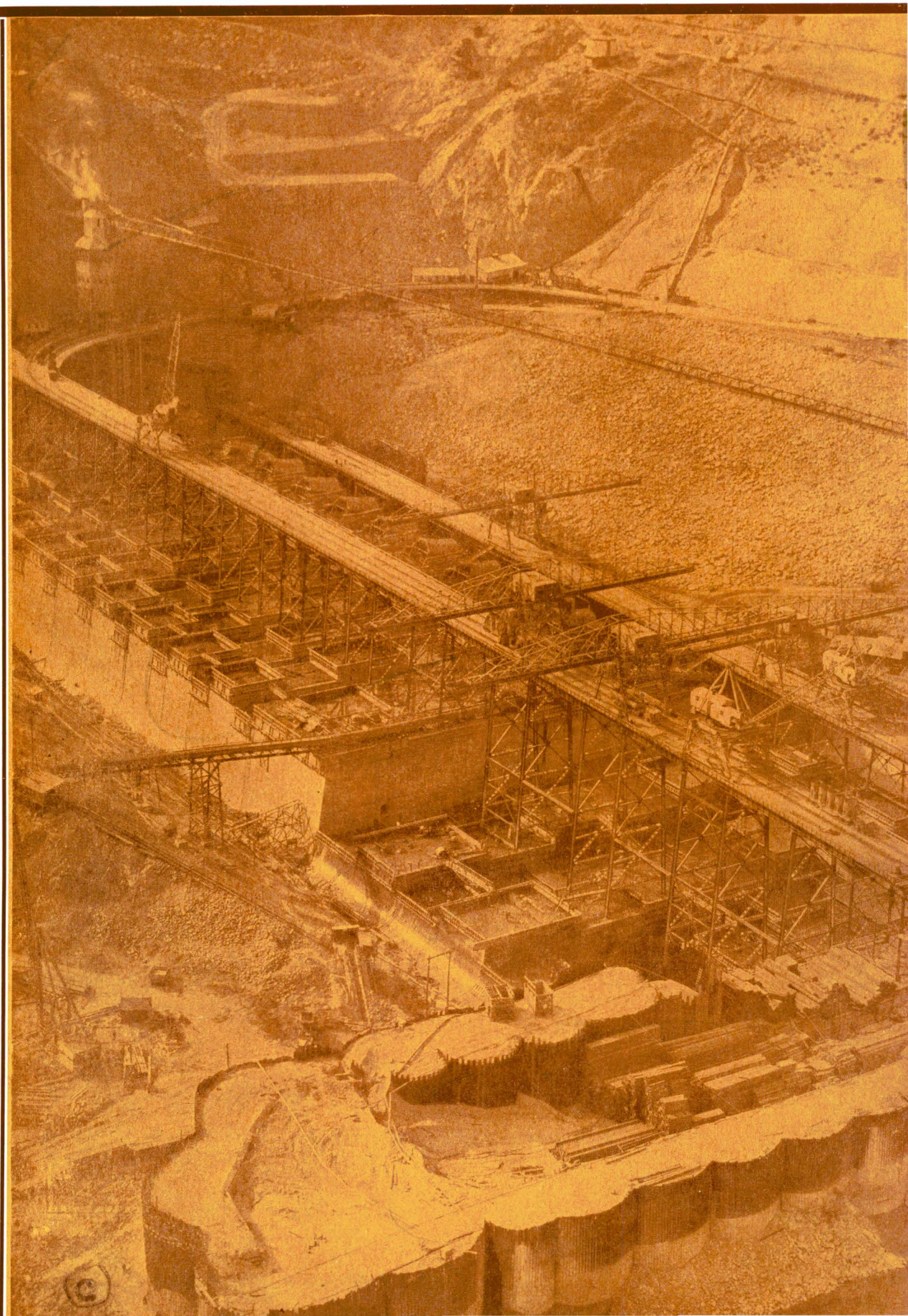
The

Vol. XVII No. 1

October 1936

MINNESOTA TECHNO-LOG

In This Issue



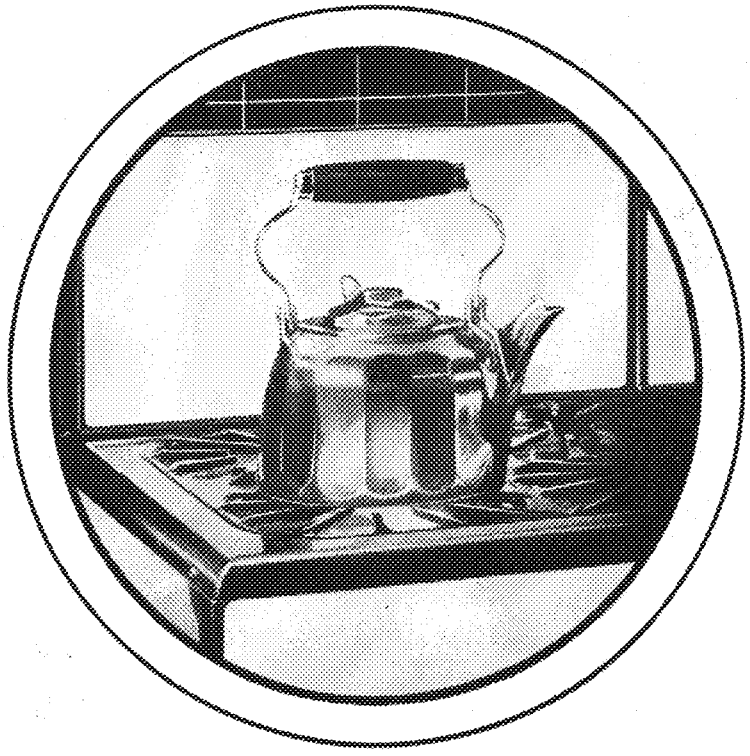
Better . . because IT'S WELDED

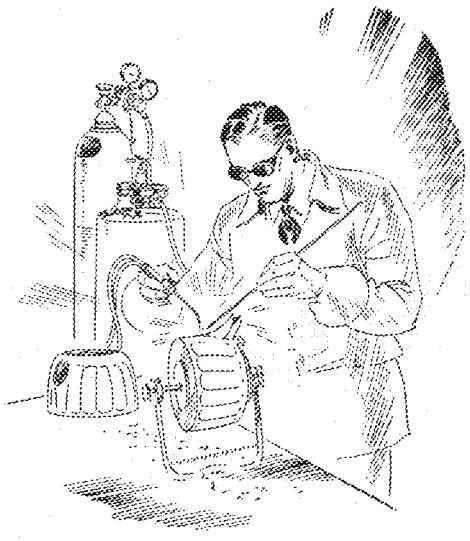
The appearance, sturdiness and cleanliness of the modern aluminum tea kettle, illustrate why many good products are better if they are welded.

The word "welded" is packed with meaning. It means light-weight without sacrifice of strength. It means sturdiness and ruggedness that can never shake loose. It means invisible joints as strong as the base metal. It means smooth surfaces with no place for corrosion to start. In short it means all that one piece construction can mean plus complete design freedom from the limitations of most other methods of metal fabrication.

Tomorrow's engineers will be expected to know how to apply this modern metal-working process to a wide range of metals—steel and iron, aluminum, copper, brass and all other alloys and metals, even platinum.

Technical booklets describing the application of the oxy-acetylene process of welding and cutting are available without obligation from any Linde Office. Write to the Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.





Everything for Oxy-Acetylene Welding and Cutting

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

FROM LINDE UNION CARBIDE

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

OCTOBER, 1936

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

This Month

VOLUME XVII NUMBER 1

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice. Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Reynold Bjerck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Randenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas.	Eta Kappa Nu
William Kaiser, Pres. John Bollihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon

Officers of the Professional Societies

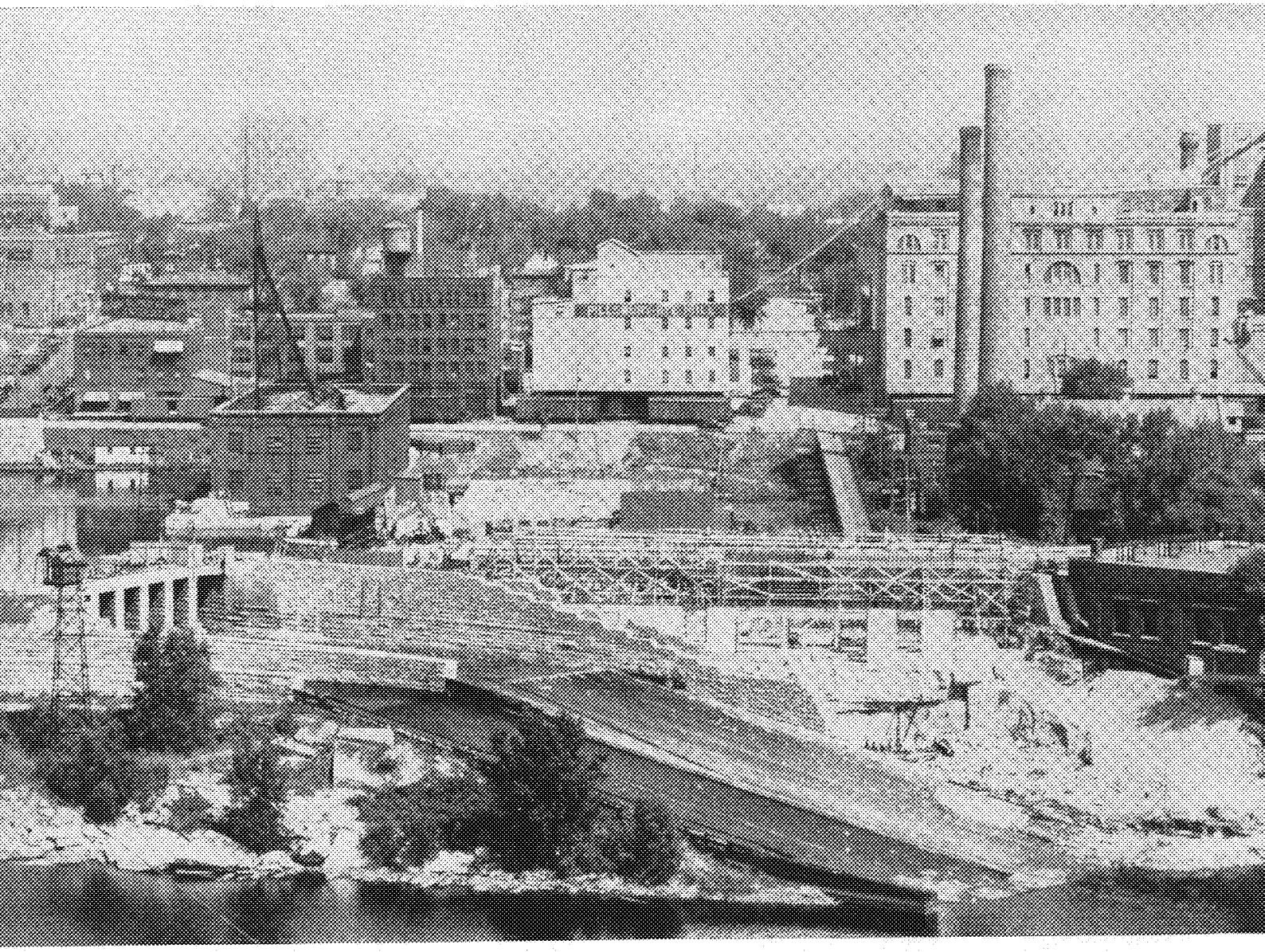
Richard Olson, Pres. Robert Ellis, Vice Pres. Walter Cutler, Rec. Sec'y Fred Rathjen, Corres. Sec'y Robert Stevens, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Ottilio Morzenti, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pieren, Pres. Richard Krahn, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. Robert Ellison, Vice Pres. Paul Thomas, Sec'y-Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Baugen, Sec'y John Peterson, Treas.	A. S. M. E.
Bernard Bein, Pres. Henry Natta, Sec'y	Commacini
Vincent Victoreen, Pres. Edmund Wodrich, Vice Pres. Robert Burns, Sec'y Leonard Sarlef, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Alkire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: LEONARD H. CHURCH
1510 Hanna Building, Cleveland, Ohio

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	Wisconsin Engineer

Entered as second-class matter April 8, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



Hydro Lab Site

Regional Planning On the Columbia

I. Grand Coulee Dam and the Basin Project

By Erling Helland, C.E. '37

DURING the past few years, the nation's attention has been turning increasingly toward a tremendous theatre of regional planning and development, the Pacific Northwest.

Here, on the turbulent Columbia, the majestic River of Kings, is set the stage of an inspiring, living drama of water and soil, steel and concrete, men and the elements; here we see the very real beginning of a far-reaching program of construction that will extend over perhaps a hundred years, and which cannot help but initiate extensive and tangible changes in the social and economic structure of the region and nation.

The Columbia River has been a challenge to the people of Oregon and Washington since the time of the earliest explorers and pioneers. Far-sighted men have dreamed for years of the day when the mighty river would be turned to useful work, of the time when it would be releasing its power to industry, its water to arid but extremely rich soil, its surface to navigation.

Now we are beginning to see the first steps in the realization of these dreams. Various agencies of the federal government, in coöperation with the state governments are engaged in constructing at two widely separated sites on the Columbia, Grand Coulee and Bonneville, the uppermost and lowermost of ten dams proposed for the ultimate development of the river within the United States.

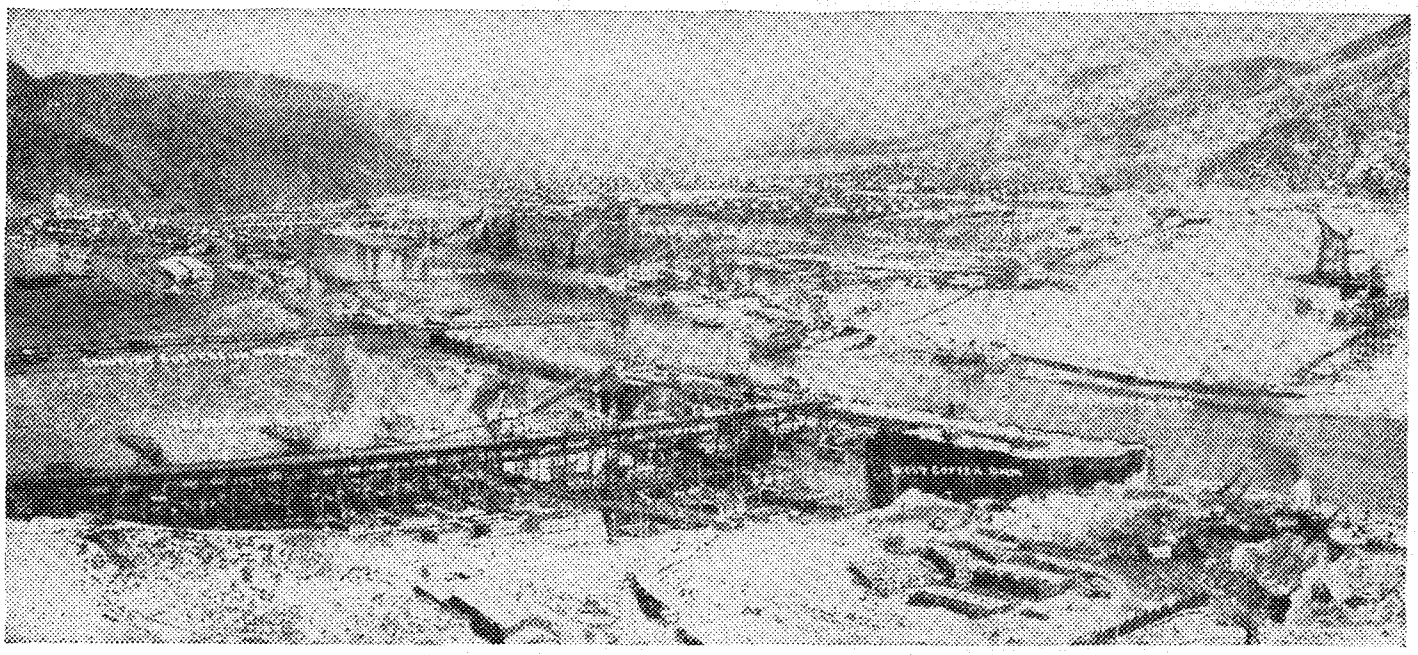
The Columbia River rises in the snows of the Canadian Rockies, enters the United States north of Spokane, and flows 750 miles through Oregon and Washington to the Pacific, falling 1,300 feet from the international boundary to the sea. In amount of run-off it is the second largest river in this country and has a discharge more continuous than any other large American river. In 1934, the discharge of the Columbia was greater than the combined discharges of all the other streams of the arid regions. The magnitude and continuity of its flow combine with its rapidity of flow and the nature of its course to make the Columbia indisputably the greatest river of the United States in point of potential economical power development.

Many centuries ago, in the prehistoric past, the channel of the Columbia, at a point about 90 miles west of the present city of Spokane, was blocked by the southward advance of an enormous glacier, a sheet of ice estimated to have been 4,000 feet thick. Halted momentarily, the river rose until it was able to flow out across the broad plateau which lies to the south and to find its way back to its channel at a point many miles downstream; the rapid waters in time gouged out of the volcanic ash a vast, mysterious canyon, the awe-inspiring Grand Coulee, which is the central topographic feature of the entire project.

The chasm is more than 50 miles long, varies in width from 2 to 5 miles, and has nearly perpendicular walls towering up from the canyon floor, from 600 to 800 feet; at the lower end of the coulee is the famed Dry Falls, where the Columbia once poured over the cliffs in a cataract 400 feet high and 5 miles long, with a volume forty times that of Niagara. Slowly the glacier retreated to the north until at last the Columbia was able to break through the barrier and once again flow in its old channel, leaving the Grand Coulee a dry chasm in the plateau.

Stretching out for a hundred miles south and east from the southern extremity of the coulee and nearly to the confluence of the Snake River with the Columbia lies a very extensive stretch of arid volcanic land, 1,200,000 acres of which has been described by the United States Commissioner of Reclamation, the late Elwood Mead, as "one of the most fertile bodies of irrigable land in this or any other country."

It is at a point on the Columbia near the upper end of the Grand Coulee that the Bureau of Reclamation is en-



Dam and west foundations rising on left around steel trestles from which the concrete is placed; in the distance the engineers' town and Mason City, the contractors' town.

gaged in the construction of Grand Coulee Dam, which will be the key structure of a development which is to bring water from the river up to the proposed irrigation district, the Columbia Basin Project. The main features of the development are Grand Coulee Dam, the reservoir behind the dam, the power plant, the pumping system, the coulee reservoir, and the irrigation system.

Grand Coulee dam is to be the most tremendous masonry structure of all time; it will contain 11,000,000 cubic yards of concrete, a volume two and one half times as great as that of Boulder Dam; it will be the first structure to exceed in bulk the Great Pyramid of Egypt. The dam will rise 550 feet above the lowest bed rock, will be 500 feet thick at the base, 36 feet thick at the top, and will stretch 4,300 feet across the canyon. The spillway is to be 1,650 feet long with a capacity of 1,000,000 cubic feet per second. The dam, which is to be of the straight-gravity type, is being built on a foundation of solid granite.

An extremely important feature of the project is the enormous amount of power which will be developed at the dam. Symmetrically placed on either side of the channel, at the base of the dam, will be two power houses which will contain turbines and generators for the production of 1,980,000 horsepower of electric current; of this amount 800,000 horsepower will be firm or year around continuous power, and will be distributed for industrial, commercial, and domestic use in the Northwest.

Behind the dam will be formed a large reservoir extending back 151 miles to the Canadian boundary, raising the normal surface of the river, at the dam, 355 feet and providing a useful storage capacity of 5,000,000 acre-feet; it will inundate the Kettle Falls site of a private power company. Since the Columbia carries very little silt, the time when the reservoir will be filled with sediment is very remote, whereas the Boulder Dam reservoir is expected to be silted over in two centuries.

Just above the dam, on the south side of the reservoir, will be a pumping station containing twenty 33,000 horsepower pumps, each with a capacity of 800 cubic feet per second. During the late spring months they will utilize 660,000 horsepower of the surplus power occasioned by the river's spring rise to raise 16,000 cubic feet of water per second, about one-seventh of the average flow of the river, over an average lift of 280 feet to the irrigation reservoir that will be formed by a part of the Grand Coulee.

This secondary reservoir, the bottom of which is approximately 600 feet above the river, will be approximately 23 miles long with a usable storage capacity of 340,000 acre-feet. South of the reservoir will be the distribution system consisting of east and west main canals, subsidiary canals and laterals, and secondary pumping stations. Water is to be withdrawn from the Coulee reservoir at the same time that it is being filled, since the Columbia is highest in June, at the time when its water is most urgently needed for irrigation and its power for pumping.

The land of the Columbia Basin Project, now unproductive, has been found to be two and one-half times as fertile as the average farm land of the United States. Dr. Mead has stated, "If these 1,200,000 acres were subdivided into farms of 10 to 80 acres, homes would be provided for 40,000 farm families with twice as many families in towns and industries which will be part of that development." He has emphasized that "to let this immense dependable water supply run unused is an economic waste, the extent of which is only realized by those who know that country." Army engineers have estimated that the Columbia Basin Project will add 1,403,000 people to the Pacific Northwest and ultimately increase by $3,000,000,000 the taxable wealth of the region.

A short distance downstream from the dam site on the southwest bank of the river the government has constructed a model town for its engineers, complete with school, administrative building, and other semi-public structures.

On the opposite side of the river, reached from the engineers' town by a new permanent highway bridge, is

one of the "world's first all-electric cities," which houses contractors, engineers and laborers, and their families. Easy access to the project from transcontinental transportation systems has been made possible by the construction of a highway (temporary) on the coulee floor and a branch railroad.

The present contract is for the completion of the foundations of dam and power houses to an elevation of about 50 feet above low water. The river has been pushed away from the southwest bank by coffer dams, one of which is larger than the dam at Muscle Shoals, and excavations for the foundations made to the granite bed-rock.

On the northeast bank of the river are stock piles of sand and gravel, undermined with a system of timber tunnels through which aggregates are withdrawn by a conveyor belt system that extends across the Columbia on a suspension bridge to a concrete plant on the southwest bank. Cement and water are led to the plant by pipe line while concrete is mixed under automatic control and loaded into buckets on flat cars which are moved out on steel trestles erected in the excavations. There they are unloaded by cranes into the block forms of the foundations; the trestles are buried in the masonry as the dam rises and become integral parts of the structure. When the southwestern portions of the foundations are completed, work can be carried ahead on the northeastern foundations.

The cost of the preparatory work and the foundations will be about $63,000,000, the sum which has been allocated by the Public Works Administration to start work on the dam. It is estimated that the total cost of the structure will be about $186,000,000; and of the irrigation development, an additional $208,000,000, bringing the total to $394,000,000. But it is estimated that the maximum direct investment in the project will be about $260,000,000, since the irrigation features will be developed progressively as the demand for irrigated land increases, and because it is believed that power revenues will become available to help pay for the cost of later construction.

The power market area of the development has been described as roughly the area within 300 miles of the dam, a region that includes part of Oregon, all of Washington, and parts of Idaho and Montana. It is stated by Frank A. Banks, engineer in charge of construction of Grand Coulee Dam, that during the years from 1920 to 1930 the demand for electric power in this area was increasing at an average rate of 9.5 per cent, compounded annually. By assuming that the rate of increase is only 8 per cent compounded annually and drops off to 4 per cent in 30 years it is found that by assigning half of the increased demand to Grand Coulee and half to Bonneville and other developments, all of the available commercial power generated at Grand Coulee will be absorbed in 15 years.

According to Mr. Banks, ". . . if the commercial power can be sold at two and one-fourth mills at Grand Coulee, equivalent to three mills on the coast, the cost of the Grand Coulee Dam and Power Plant with interest at four per cent can be liquidated in 50 years with a surplus of $144,500,000 available for the partial liquidation of the irrigation investment or other purposes, and after the fiftieth year the annual surplus would amount to $15,000,000."

Editor's note: This is the first of two articles by this author on the Columbia River Power Project. The second will appear in a later issue of the Techno-Log *and will deal with the lower dam project, Bonneville.*

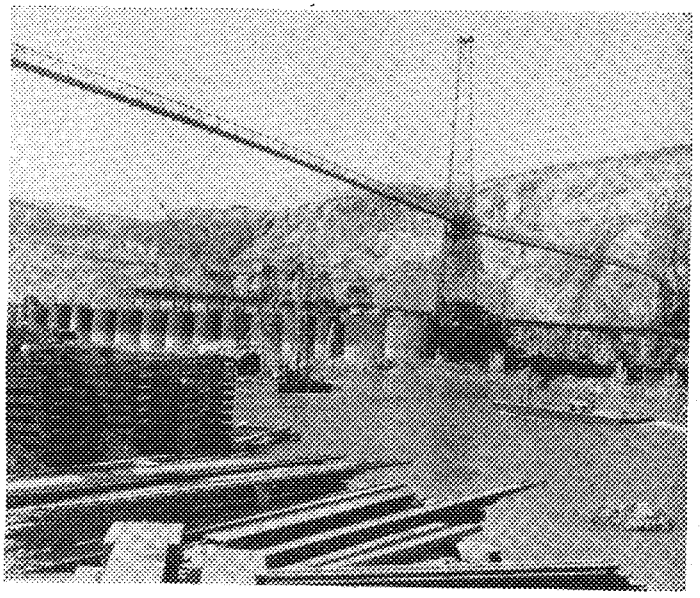
Grand Coulee Dam is a part of a comprehensive plan developed by the Army Engineers proposing the construction of 10 dams to utilize 92 per cent of the available fall of the Columbia from the Canadian line to the Pacific. Grand Coulee Dam will make use of 27 per cent, or 355 feet of this fall.

The primary purpose of the dam is to provide water and power for irrigation; in addition, besides its very important secondary purpose of commercial power production, there are the incidental purposes of reducing floods, of controlling erosion, and of improving navigation and power generation at other points on the river. Disregarding the remote possibility of extensive commercial navigation on the reservoir above the dam, there remains the improvement in low water depths on the lower river, increases that will amount to 2 feet below Bonneville (about 45 miles above Portland) and to approximately 4.5 feet below Grand Coulee Dam.

Furthermore, by increasing the uniformity of the river's flow, the huge storage capacity of the reservoir will augment by 100 per cent the amount of firm power that can be developed at six sites on the Columbia between Grand Coulee and the river's confluence with the Snake, and by about 50 per cent at the various sites below the Snake, one of which is Bonneville.

There is a considerable portion of public opinion which is strongly opposed to the investment of public money in costly irrigation, power, and navigation projects, often with good reason; but there are few that dispute the government's premise that it is better for farm families to till a small tract of rich soil with an unfailing supply of water than to struggle with the uncertainty of drouth on larger farms.

East downstream cofferdam (under construction) in foreground, west cofferdam, and aggregate belt conveyor bridge.



Largest Collegiate Hydraulics Lab Rises Near Campus

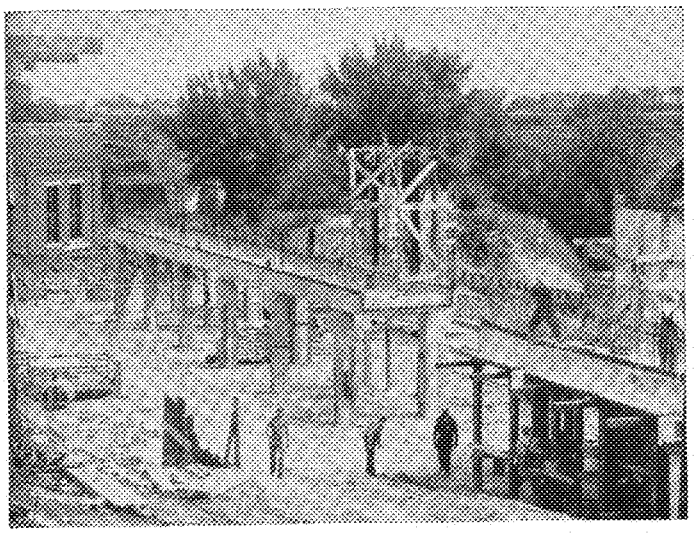
By Harry A. Larson, M '39

Work on the new hydraulics laboratory on Hennepin Island, which was started March 11, 1936, has steadily progressed during the summer under the direction of Professor Straub, assisted by Mr. Henry. Although the plant is still in the earlier stages of construction, some conception of the structure that is being erected can be had at the site.

ST. ANTHONY Falls has long been known to man. The Indians first knew it as a beauty spot where the Mississippi came tumbling over a high ledge. Later it assumed commercial importance to the Twin Cities through the electric power it provided. A tunnel was built in 1868, by W. W. Eastman, under the lip of the falls and extending back. Years later the tunnel, being built in the sandstone underlying the limestone, suddenly caved in, and in one night the river had dug a hole 100 feet wide and 30 feet deep extending for some distance back. Work was feverishly started to prevent the loss of the falls which furnished power for the cities, and over $1,000,000 was spent before the headward erosion was checked.

Later the electric project was abandoned and the old machinery was left in place. Now the excavation made for the hydraulics laboratory has uncovered old tunnels and masonry that underlie the debris and rock of the lab site. Some of the tunnels are 60 years old, and machinery uncovered has been saved, perhaps for museum pieces.

View of the second level flume under construction.



Among the finds is an old turbine that was used by the city at one time for power. It is located on the ledge below the falls in a pit twenty feet deep with the tail race going to the river. Incidentally, this tail race shows little deterioration, with part being used for the present plant. The three-inch planks on the floor of the tail race tunnel are still in good condition. The river was diverted more to the south after the water plant was abandoned, and the new lab is being built almost on the old site of the falls. The location of the plant gives enough water for large scale experiments, with the advantage of complete gravitational flow. The plant when completed will be able to use up to 300 cubic feet of water per second in one or several experiments. The laboratory will be the only one of its type in the United States that can successfully undertake large-scale experiments.

An excavation 600 feet long and parallel to the river is being made, requiring the removal of thousands of yards of material. Along this excavation the channels for carrying the water are being constructed and the laboratory will be erected over them.

There will be three channels built. A "mainstream" flume on the first level, a "discharge" flume parallel to the "mainstream" channel and on the same level, and a flume on the second level of the structure to supply water for turbines and experimental machinery.

The "mainstream" channel will be 9 feet wide and 6 feet deep with the intake on the west side of the island. This channel will be made to accommodate all the large scale experiments, especially those on model dams and

spillways. All the water running through the plant can be diverted to this one channel. Velocity of the water can be controlled by stop logs in the channel and also the height of the water thereby. On the top of the flume will run a trolley that will tow current recording instruments and model boats.

The "discharge" channel will run parallel to the "mainstream" channel and will extend 100 feet further. This channel will take care of the waste water from the "mainstream" channel and conduct it below to twin measuring tanks supplied with pneumatically operated cylinder valves centrally located, which then waste the water into the tail races. This double tank, each section 34 by 70 feet, will have two separate tail races discharging into the river below the present water level.

At the head of the three channels in the main laboratory there will be intakes with gates 9 feet on a side to let the river into the channels. The water will go through several screens, and then will reach a sluice gate that can be lowered to raise the water 22 feet higher to the channel on the second level. The depth of the water at the intake at the present time is 17 feet, enough to give any amount of water required.

The channel on the second level will be 8 feet wide and about 10 feet deep. This flume is tapped at intervals for the feeding of experimental turbines and other machinery. Tapping will take place on the bottom and sides of the flume. The waste water, after flowing through the experimental set-ups, can be diverted to the measuring tanks, or into a separate tail race that is partly constructed of the tail race of the turbine put in by the city many years ago. This tail race discharges into the lower level of the river below the spillways constructed by the Northern States Power Company.

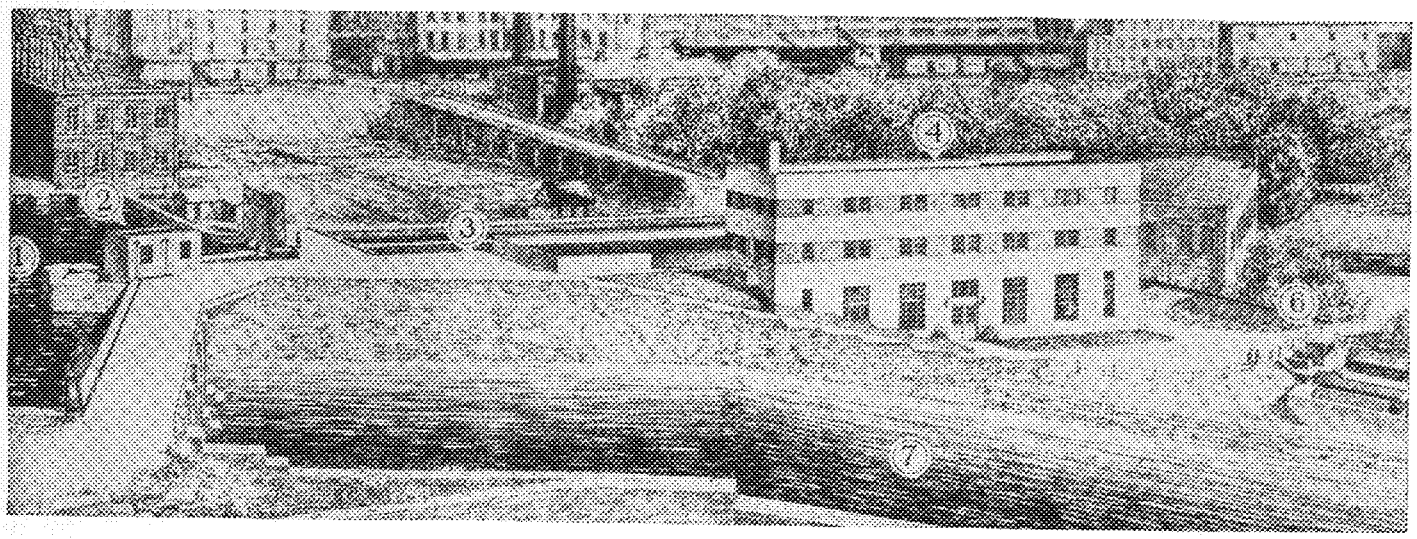
The turbines to be tested will be set below the second level flume and to the south of it. They will be practically against the old lip of the falls and there a hole 35 feet deep has been excavated. The walls of the turbine room will support a 20-ton crane that can remove and install any machinery that is desired.

The main experimental room will be approximately 300 feet by 47 feet, running west to east. The mainstream and discharge channels will be below the level of the main floor. To the south of this room will be the machinery testing laboratory equipped with a crane 24 feet above the floor for installing experimental machinery. The crane runs in the 35-foot space between the walls and east-west for 125 feet. Farther south will be the turbine testing pit with a 48-foot available head. The pit, 25 feet below the level of the main floor, will have a separate tail race. The first level will be below ground on the west side and emerge at a height of 25 feet on the east. A road is to be constructed across the second level on the west and extend down an incline to the front of the plant on the south. Parking space is directly over the turbine room. A masonry wall with a height of 30 feet on the river side encloses the road. This wall has been constructed with material excavated. The walls of the main building will be of reinforced concrete.

Eventually there are to be constructed two floors above the machinery laboratory, housing offices, smaller research laboratories, drafting rooms, and a large lecture room. It is hoped to have the building ready for occupancy this fall, although it will not be finished for several months.

This hydraulics laboratory will be used largely for graduate study and many types of research projects. Experimental work is being planned in coöperation with federal and state, as well as with commercial interests. Much of the work of the University's existing hydraulics laboratory will be transferred to the new quarters, especially that relating to river sediment transportation.

An artist's sketch of the site shows the main features of interest at the laboratory. (1) is the headwater pool where the water is let into the intake; it passes through the gate house (2) which controls amount and place to which it will be diverted. The water then passes into the main experimental laboratory (3) located below the roadway. The southern half of the plant is devoted to office space and the experimental turbines (4). The channels carrying the water discharge into the measuring basins to the right of (6), where data are gathered by the operators in the central gate house (6). The water is let out of the discharge basins into the tail races which discharge into a tailwater pool below the spillway on the west (7).



at

Civil Camp

with rod and _ _ _ _ _

By Elwood McGee
C.E.'37

WHANG! whang! whang! To the tune of claw hammer against the steel of buzz saw, 43 junior civils arose at 5:45 each morning from August 13 to September 23 to begin a day of work at the annual summer camp on Cass Lake. This summer camp is one of 54 similar camps held by the different engineering schools in the United States and Canada. The 43 boys in the Minnesota camp this summer were just 2% of the total of 2,020 that constitute the average attendance at these camps and schools.

Surveying isn't learned from a book. The work at camp gives the men perhaps three things: (1) a well rounded knowledge of the methods employed in the different types of surveying, (2) an opportunity to develop a technique in handling the surveying instruments, and (3) confidence in their own abilities.

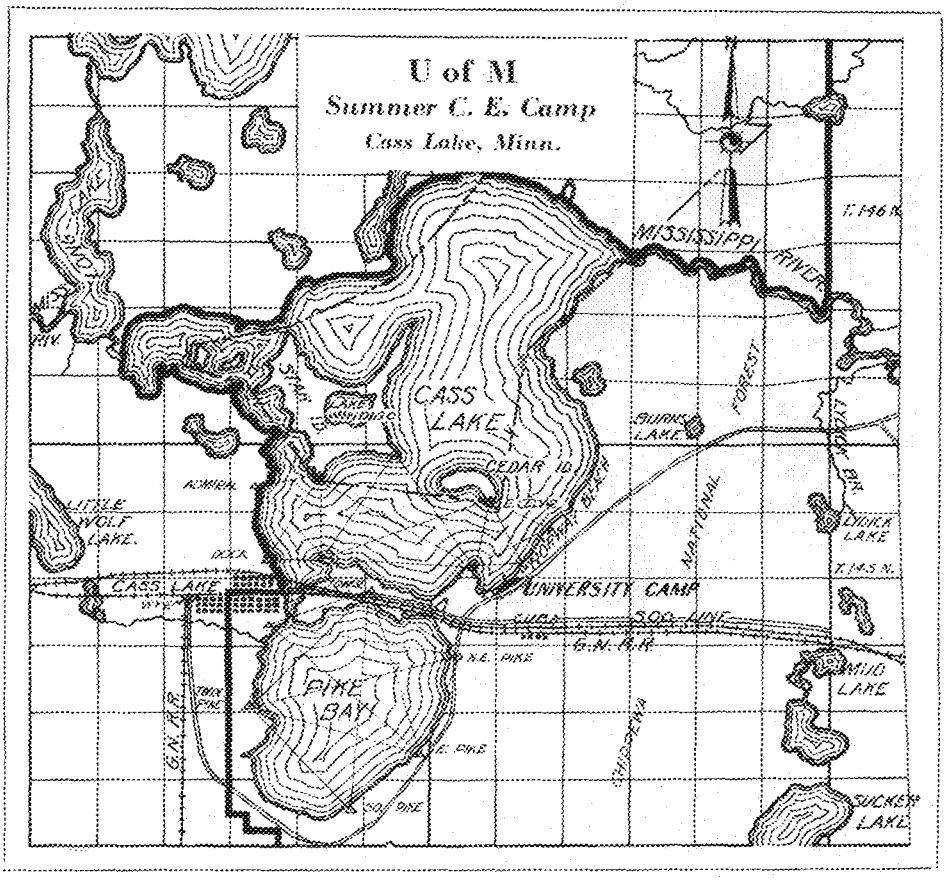
The camp is now permanently located on the south shore of Cass Lake in the Chippewa National Forest and has been made on the present site since 1920. Previous to that it was pitched among the tall pines of Norway beach, a quarter mile along the shore from the present site. Here computing rooms, mess, faculty and students were all housed in tents. On this site the wind had a 6 mile sweep across the lake and at times all four occupants of each tent were forced outside to hang onto its corners. To delve into a bit of history—the first camp was held in 1911 on Rice Lake near Eden Valley. In 1914 the location was changed to nearby Lake Koronis. There the civils did their transit-pecking until 1919. Following that, in 1920, and before becoming established at Cass Lake, the instructors and students did some railroad reconnaissance work near the international boundary.

The present camp proper contains two brown-stained wooden structures, a mess hall and a combined office and computing room. In addition, two supply tents and eleven sleeping tents are pitched on wooden floors.

The computing room is a new building available for the first time to this year's class. It is 55 feet long and 16 feet wide and houses a 16 by 28 foot computing room, an instrument room, an instructors' office and sleeping quarters for two. The computing room contains five beautifully finished maple-topped tables, two drafting tables and an air-tight stove. Light is furnished by a battery of ten Aladdin lamps.

The students live in 14-foot square tents with wooden floors. Each contains a small air-tight stove, a kerosene lantern, a good oak desk and an array of rustic furniture, bookcases, stools, clothes-trees—creations of students past and present. The tents are situated just 25 feet from the water's edge; just the right distance for a dash in for a morning dip.

First call is at 5:45. Early? Yes, but you wouldn't mind arising either if you could get in on the breakfast awaiting these boys at 6:15. Whang! Hammer vs. saw, again. 6:10 roll call. Here they come stuffing shirts into pants and yelling here! here! here! all the way down tent row. And then, breakfast.



Taking topography with a plane table among the tall pines

At 7:00 a. m. out in the field they go in parties of 2, 3, 4 or 5. Work continues until 4:30 with one-half hour off for lunch, the length of the half hour depending on the length of the party chief's snooze. Lunch, prepared by Al, is carried out in the field. Some men stay in camp and compute during the day, which is an advantage. They get soup and coffee with their lunch and get that letter from "the only one" sooner.

Mail is delivered about noon each day via water in a forty-foot cabin cruiser powered by a 105 h.p. Gray marine engine. It is quite a novelty to boat about the lake and see the mail-boxes on the ends of the docks.

The hub of the organization of work is the bulletin board on the front of the computing room. Each evening a schedule is posted showing the parties for the next day with their respective type and location of work. Here is a sample script:

Rollin Erickson Frickland Springer	Railroad location west of Wye—Tr. No. 20 See Cutler

During the day a similar schedule is posted for the night work. In the evening the men can refer to their "Manual of Instructions for Summer Camp." The following morning each party reports to the designated professor for brief directions. The manner of doing the work is the student's problem. Instructions are never too complete.

At the end of each day's work, the chief of each party turns in a report. All notes are transcribed to office records, and complete records of all the work done are kept and filed. It is a marvel how smoothly the work goes on from day to day.

The instruction at camp is purposed to provide each student with a "taste" of the many types of surveying projects. The following list gives an idea of the variety of the work actually carried on.

Control Surveying:

Base line, triangulation, observation on Polaris, differential levels, precise level, and control traverses.

Topographic Surveying:

Transit stadia topography, plane table topography, transit tape surveys.

Railroad Surveying:

Preliminary lines, ground line profile, hand level topography, railroad location, cross section, railroad track surveys, top of rail profile, cross over.

Hydrographic Surveying:

Current meter rating, stream measurement.

Mr. Zeiner deals with the control, topographic and hydrographic surveying, Mr. Cutler supervises the railroad projects and Mr. Toon has charge of the computations and office work.

The region surrounding Cass Lake is ideally suited to the needs of a surveying camp. The lake and islands form an excellent space for an extended triangulation system. The lake shore and roadways give ample opportunity for topographic surveys. The Great Northern and Soo Railways both pass within a mile of camp. The town of Cass Lake is a division point on the Great Northern and an extensive yard provides a fine place for a track survey. A rolling burnt-over section five miles south of town presents an ideal spot for the running of a four mile location line connecting the main route with the branch. A run through the establishing of this railroad would give a good cross section of the work at camp.

A party of six, say Olson, instrument; Swenson, head chainman; Asleson, rear chainman; Johnson, rear flagman; Peterson, stakeman; and Carleson, axman—(dis

---

Used in the camp this summer were 16 transits and 14 levels. Along with the tapes, rods and other minor equipment, this represents an investment of nearly $10,000.00. New additions to the instrument family present something of interest. New this summer is a precise Gurley Transit with a vernier reading to 10 seconds. Ordinary transits have verniers reading to one minute or to 30 seconds. This instrument cost $550 and is used only on triangulation work. The vernier is read with a nine power reading glass.

Another new "animal" is the semi-precise level, used to establish loops of control levels in the whole area. The department now possesses two of these. They are read in a different manner from the ordinary level, the two ends of the single bubble being reflected in a mirror when the instrument is level and a rod reading is taken when the observer sees the two ends side by side.

America, she bane a great coontry. I bane in Univoisity aboot 4 year now and preety soon I yam going to been han enchinheer) make up the preliminary party. They begin the work by running a straight line in the general direction of the desired location. When it is desirable to change direction, the deflection angle between the two tangents is measured. This preliminary line (with stakes set at every 100 feet) is run to the point of destination.

In the meantime, a party of 2 is put on this line running ground line profile levels. Their work establishes the true elevation at each of these station stakes.

Following this party come 2 men taking hand level topography. This is a rapid method of securing the elevation of the surrounding territory. The rodman goes out to 200 feet on both sides of each station stake. The other member reads the rod with a small hand level held to the eye. 200 feet out, 200 feet back, 200 feet out, 200 feet back, 100 feet up. The rodman covers 9 miles for each mile of progress, a real day of hiking for the "rodder" in this work. The above fieldwork provides data for a railroad location map with 5-foot contour intervals plotted 400 feet equal to 1 inch laterally. The location line is put on the map and field work is ready to resume.

The next job is that of the field location. The student on this job gets a real taste of outdoor work. All the turnouts, spirals and circular curves must be computed in the field. It's a real trick to hold on to a pencil, a piece of paper and an Allen Curve handbook in a zipping wind. The location party is similar in makeup to the preliminary party. It runs in the line shown on the paper location, making improvements where possible.

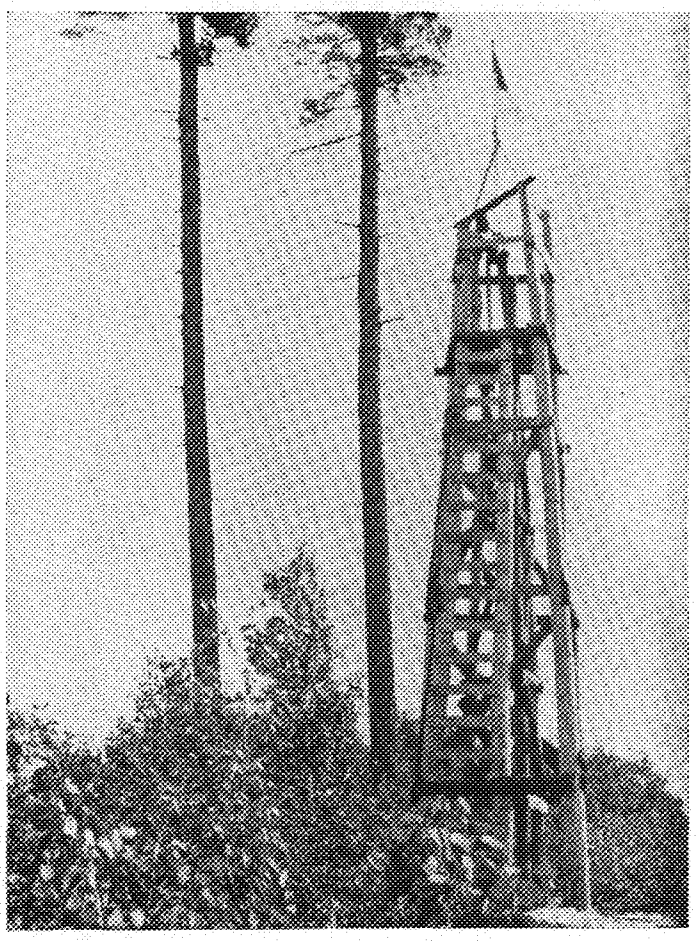
Not far behind the location party follows a cross-section party of four: levelman, rodman, tapeman and stakeman. They have as their data the rate of grade and a given elevation. This party sets slope stakes at the outer edge of the cut or fill to be. The distance these stakes are set from the centerline depends upon the depth of cut or height of fill at the point. The work requires a neat bit of mental calculation by the rodman.

From the distance these stakes are out and from the elevation of the ground at these points and at the centerstake the volume of earthwork is computed. In this work a roadway in cut of 28.0 feet, slope 1:1; and a roadway in fill of 18.0 feet, slope 1½:1 is used.

Thus a complete problem in railroad engineering covering every phase up to excavation is completed during the camp period. A student starts at the bottom of a party, works to the top, spends a day or two computing in the office and then goes into another party doing a completely different kind of work. In this way each student gets an opportunity to work with a large number of the different men in camp.

A system of triangulation stations has been set up around Cass Lake and Pike Bay. They are established by the method of quadrilaterals. The computation and adjustment of a quadrilateral is a tricky little calculation requiring a full day's work.

Several lines of bench levels have also been established. Each year these systems are re-run and extended. This year a loop of bench marks was established with the precise level all around Pike Bay. The elevations and positions are all true.



Triangulation station—note the two separate towers for instrument and observer

Observations on Polaris both by the Hour Angle method and at eastern elongation are made by each student. Their mean reading establishes the true azimuth of a line to which the triangulation system can be referred. A base line has been established between two of the triangulation stations, east and west base. Each year a number of parties measure it with an error ratio averaging 1 in 300,000. To these triangulation stations and bench marks topographic transit tape surveys, etc., are tied in. They serve as control points for less accurate work.

The interest of the student is kept up by the unity of the whole plan. It does not lack purpose, for each part of the work has a real meaning.

Interesting are two projects upon which the students worked that are to be carried out. A new saw mill in the town of Cass Lake desired a siding. A party of students ran in the turnout from the Great Northern track, computed the curve, extended the siding and cross-sectioned it.

The Forestry Department is planning a picnic grounds in a grove of beautiful 150-year-old virgin Norway pines on the highway just north of Cass Lake. A transit stadia topography survey of the proposed plot was made by a party of students.

Camp memories are many and they will last long in the minds of this group of jolly Civil Engineers. The work at camp gave each man, among other things, an opportunity to adjust himself to working with different personalities. Above all, it gave him a feeling of comradeship and cooperation with his fellow engineers.

"never-ending PROGRESS to perfection"

Light to Power

A wink of the eye by the "Man in the Moon" officially flashed the brilliance of the Cleveland Great Lakes Exposition to the watching eyes of the nation. General Electric engineers set up the equipment which changed the light vibration into mechanical energy. On the night of the opening, Professor Massau of the Case School of Applied Science trained the large telescope in the Warner-Swasey observatory of Cleveland on the moon. Special photo-electric equipment was set up at the eye-piece, and set for a definite frequency. The first variation in the light frequency threw full power on the illumination circuit by causing an electric relay to trip and throw on the power switch.

Graphite Lubrication

Pylon, a colloidal graphite friction-proof lubricant for aircraft engine use, is now being distributed by Eastern Aeronautical Supply Company. Pylon is added to fuel for lubricating the upper cylinder parts of internal combustion engines. The coefficient of friction is so reduced that revolutions per minute are well increased, and less wear occurs. Another substance, Pylon C, is added to the oil during test runs. It forms a graphite colloidal oil solution and carries the graphite particles to fissures and crevices in the bearing surfaces. An absorption process takes place due to the fact that metal has a greater affinity for graphite than oil. The thin graphite film which forms on the surfaces is nearly impossible to tear away.

Hydraulic Press

The 1,000-ton triple-acting hydraulic press supplied to the Fisher Body Corporation by the Baldwin-Southwark Corporation measures 191 inches between the side housings and 140 inches vertically. Twenty-eight feet of the press is visible while fourteen feet is beneath the floor. The press weighs approximately 650,000 pounds. Direct-acting hydraulic cylinders, a relatively new development in triple action presses, are used. Pressure at each of the four corners may be varied by screw stops on the outer slide. Each of the top four cylinders has a 42-inch stroke and 400 tons pressure, while those on the inner slide have a 20-inch stroke and total 600 tons pressure. Two cylinders of 400 tons total pressure and 10-inch stroke comprise the bottom action. Two 285-gallon pumps, run by a 400-horsepower synchronous motor, operate the press. The slides are prevented from dropping accidentally by automatic valves.

Cable Equalization

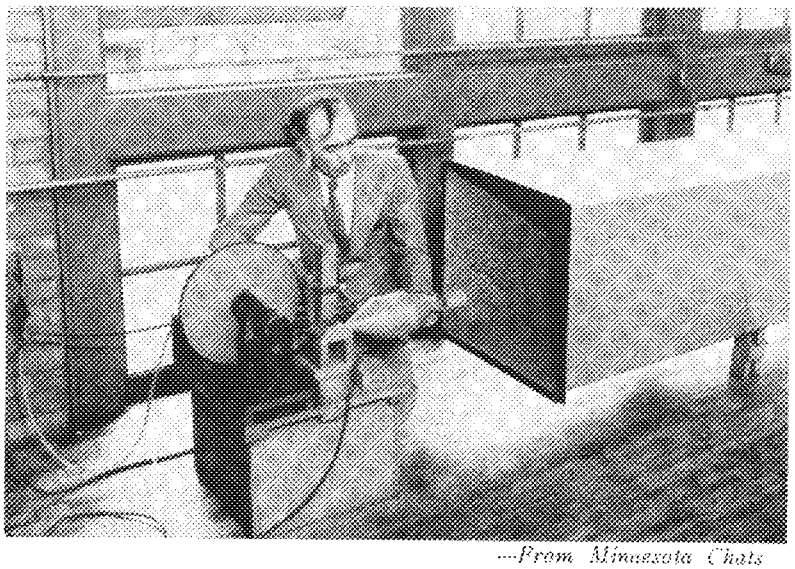
Recently perfected by the Martin-Decker corporation is an instrument for measurement and equalization of cable tension. It weighs 17 ounces, and is 3½ inches high. Army and Navy have found that it meets requirements for accuracy. The instrument is clamped on cables up to 3/16 of an inch, and 10 to 200 pound loads are measured by the deflection principle. Temperature changes are corrected for automatically.

Rowley Develops Dust-Counter

An instrument that enables him to make count of the dust particles in the atmosphere, accurate in small samples, has been developed by Professor Frank D. Rowley, head of the Engineering Experiment Laboratories.

The device forces air through a small orifice, impinging it upon a plate covered with a viscous coating in such a manner that the dust is caught as a streak or straight line rather than a cluster, making counting easier and more accurate than older methods.

An area one square millimeter is magnified 100 times for the count, while the amount of air tested varies from one-fourth of a cubic centimeter upwards. Funds for the machine were donated by the graduate school.



—From Minnesota Chats

The Minnesota Techno-Log

OCTOBER, 1936

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

Other members of the staff of the Techno-Log will be announced in the mast head next month. New applicants will be considered for all posts as well as old staff members. It is for this reason that appointments have been held up. Prospective writers and other assistants should apply now.

First Word from the Editor

In the words of the editorial I presented for the new staff last spring, students, faculty, and alumni are urged to contribute to THE MINNESOTA TECHNO-LOG. And we would like to hear criticisms by which we may govern ourselves in planning for another year.

The moment is opportune to point out that the past staff, headed by Wayne Stone, completed its year with every issue given the highest rating awarded by Engineering College Magazines Associated. Each was rated "A." Our compliments are superfluous, for their work will be rewarded with E.C.M.A. recognition at the coming convention of engineering magazine editors and business managers at Ann Arbor.

But the task before us reminds us of the need that we uphold the standard set by 43 years of engineering publication. Aided and abetted by the rest of the staff and the students and faculty of the Institute, we will try to add to the record of the magazine.

The editor has before him the problems of articles, news, columns, makeup, copy-reading, proof-reading and publication. But the editor cannot do more than edit, if he is to have any success. It is necessary to have a staff that likes the work and will help with it.

Major appointments to the staff have not been made and there is opportunity for many to join our little group in 37 Electrical Engineering. If you are interested in our work, you will be welcomed.

In future issues many items of current and local interest will be investigated. We must look into the new researches being carried on in the Institute. We must follow building and engineering structures being developed. And we must chronicle some of the advances of engineering science.

These are only a few of our problems, but they are the kind of things every engineering student could well interest himself in, not only as a reader, but as a contributor.

Your TECHNO-LOG is one of few activities easily open to you. Don't pass it up.

At the Desk

Last year this column opened with remarks that the magazine appeared with new cover and new type faces. We've not changed so much this year but we have a growth in typographical display, starting with the front cover. We feel that first impressions do count. What was yours?

Erling Helland visited Grand Coulee and Bonneville Dams this summer and has provided our first article. Pictures, including the cover, which is an aërial view of the Grand Coulee Dam showing the cofferdams, west foundations, and cement plant, were loaned the TECHNO-LOG by the Columbia Basin Commission.

Our own new hydraulics laboratory makes news for a second article. The frontispiece gives a good view of the location and progress of construction nearly up to date. Francis Meisch, architectural junior, drew up the artist's drawing.

While the lab was going up and the dams were being built, civil engineering seniors were camped on Cass lake, taking topography, running levels, and triangulating. Business Manager McGee relates their story and some student pictures illustrate it.

Mr. Siler and Mr. Haga return as the only faculty contributions this month, there being a wealth of student material. But we just had to have them in the TECHNO-LOG.

Don't pass up the Alumni page. Grads from 40 years to 1 year back have given us their whereabouts.

In the back of the book, a new columnist says "It seems that"—. He's got some timely gossip. Maybe we can exhort him to bring back the humor page to the magazine. Mental Tilts, being a trying job to prepare, will be the product of several staff members. This month's Tilts editor has one point of view.

To the Freshman

The Techno-Log

Perhaps the TECHNO-LOG is as new to you freshmen as the many intricacies of acclimation to the Institute. You support the magazine, and as employes we expect an employer's criticism from you as well as from upperclassmen. From time to time points of controversy will be presented and an opinion cast on these pages. If you agree, well and good. If you don't, let us know. Statements are made only to stimulate an improvement, and perhaps you can help bring it about.

Elsewhere on this page there is probably an editorial presenting a situation, criticising groups responsible and offering suggestions. It is included as expressing student opinion.

The TECHNO-LOG'S policy has always been to provide a supplement to the education of the engineer. By supplement is not meant an addition to his education but rather a sort of flavoring for it. The TECHNO-LOG endeavors to give the student of any one department some insight into the professional problems of the students of all the other departments. In this way we hope to keep the engineers more closely knit together and at the same time to instill a little of that "professional attitude."

Your Studies

In the little less than 3 weeks that you have been in classes, you have come a long way toward learning what is expected of you here in the Institute. Above all, the fact for the freshman to keep in mind is that, if he can bear down enough to hold his own scholastically during his first quarter, he has proven to the world, and, more important, to himself, that he can do the job. Every succeeding quarter becomes easier, though the work becomes more intense and more specialized.

Traditions

The new student doesn't meet with many institutional traditions until the spring quarter, topped by Engineers' Day and the Tech dance; but earlier there are society activities and some intra-school affairs. Enjoy them all.

Later in your collegiate life, preferably not while you are a freshman, you will want to take part in outside activities, perhaps some to a great extent. The TECHNO-LOG and the *Daily* are wonderful sources of literary experience. Music and drama find their places among some groups. And not the least important, athletics, especially intramural competition, are open to all.

'Over the Hump'

With the return to school and a glance at departmental bulletin boards, after talks with professors and last year's seniors, and especially after noting the large influx of students into the Institute, we are beginning to believe that engineers as a group have gotten "over the hump."

Students, the 1,900 strong who registered in the Institute, have tacitly expressed their faith in the stability of the engineering profession as a bread winner.

And the facility with which the class of 1936 was able to find jobs for almost every individual is an added encouragement to those of us who are still here, and will graduate next spring and the year following.

Over in mechanical engineering, every member of the class of '35 had a job within a few months after graduation and the members of the class of '36 have already reported over 85% employed.

In civil engineering, there are jobs going begging, what with signs of a building boom and government construction. Meanwhile, chemicals are taking the inevitable step toward graduate work, after which landing a position is like picking up the morning newspaper; it's there when you get up.

Of course these jobs don't come begging to anyone, but they're there for the enterprising student. And for those of us who entered the University during the lowest, darkest point of the depression there seems to be lots of hope.

Welcome Miners

Welcome, Miners, into the fold of the Institute of Technology, and more immediately into the reach of the Minnesota TECHNO-LOG. With your addition to the lists of this magazine our student subscription was expected to pass 1,600, but we have been more than rewarded with a student body over 1,900, every member of which contributes to the publication of the TECHNO-LOG.

It is the aim of the staff to present the kind of material wanted by these 1,900 students and the faculty and alumni. It is also their aim to provide a means of presenting the literary efforts of these members of the Institute.

Your Societies

To the engineer two kinds of societies are open. To the efficient, active, and for one kind, scholastically successful engineer, there are open professional societies and the honorary fraternities.

It is not necessary to here chronicle them all, but is worth while to note that both have their value and their place in the engineering student's life and in his later professional life.

The society offers every student an outlet for his personal professional abilities, and a source of orientation to his chosen field.

The honorary offers the brilliant and near-brilliant a reward for good work and an opportunity for service. Let every student choose and reap his benefits.

It is here, however, that the present editor wishes to offer a word of caution to honorary fraternities. Put less emphasis on the fee requirements and more on the personnel requirements. Put less emphasis on self perpetuation and more on service. And lastly, forget those playful, yet deprecatory, remnants of hazing, pledge-duty and other forms of personal sacrifice of self respect so often inculcated into the very ritual of joining.

This sort of thing reached a new high last spring when one of the professional groups tried to foist a publicity stunt off on one of the incoming groups of unsuspecting, sincere, and worthy students. Let's forget it this year.

Nova Scotia—

land of *fish*—— *rabbits*—— *cats*—— *elephants*——

By
Roderick Wm. Siler
Ass't Prof.
in
Mathematics

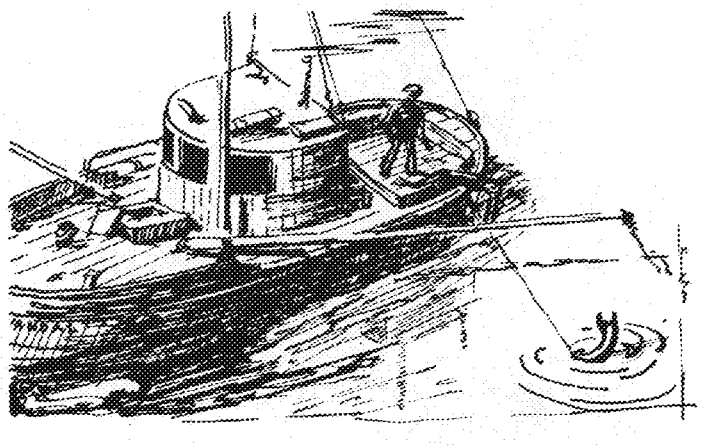
THIS summer I saw more fish than I have ever, in the same length of time, seen in my life. Cod, haddock, mackerel. Herring, halibut, tuna. Flounder, skate. Swordfish, salmon. Also eels, lobsters, shrimp, clams. All salt water products. And to these must be added fresh water trout. Specimens of these fish I saw at least once a day, usually at supper. I ate them and liked them. Excepting possibly the eels. Somehow, I don't like the look of eels.

The reason I got this way was because I spent most of the summer along the Atlantic coast of Quebec, New Brunswick, and Nova Scotia, where fish are plentiful and always fresh. And cheap. Fish in that region is what wheat is in the Northwest, a major crop. Every other man is a professional fisherman, which means that he pursues fish in cold, fog, wind, rain, and snow. In other words, he doesn't do it for the fun of it. And he gets very little in the way of cash for his efforts, I am sorry to say, there being too many fish in the sea, I suppose, and too many men pulling them out. For instance, lobster could be had at a spot where I spent several weeks, for 15 cents a pound. And this was when lobster was out of season; that is, when it was forbidden to catch it along that section of coast. The lobster I speak of had to be imported from other districts, where the season was open. Either that or it was "bootlegged." Bootlegging in lobsters there has something of the significance of what is called bootlegging in certain other lines—with this important difference, however: that though the lobsters are not quite legal they really are lobsters, not something else called by the same name.

Since I prefer fish on a plate to fish on a hook I spent more time eating than catching them. But it is a great coast for fishermen, even the amateurs. Many Americans from the Eastern states come up there to take a whirl at the sport, sometimes trying the salt water, sometimes going after the trout on the inland lakes not far from the coast. I looked at a lot of fine trout hooked this summer by the amateurs and then, to show my heart was in the right place, helped to eat them. As far as the salt water fishing is concerned, all a man needs is tackle, boat, and a stomach that can take it when the water gets rough. Also, if after tuna, it is well for the fisherman to see that there is a good motor in the boat and a pretty good supply of provisions, for tuna have a way of towing amateurs out to sea and leaving them in the fog. Tuna will run as high as six and seven hundred pounds, and take a lot of persuasion to get ashore. When an amateur catches a tuna he gives it to the professional fishermen as a rule, for it is a little large to carry on a string or throw to the cat. The professionals cut off the heads and tails of the tuna, pack the fish in ice, and ship them to the cities, where they are canned. We city folk then fish them out with a can opener, and probably imagine they were raised on a farm. Of course no fish is so good to eat as when freshly taken out of the water. Fish is easily digested. It is also said to be a great food for improving the brain. This is a result I am looking forward to.

This summer I saw in Maine, for the first time, a bobbed tail domestic cat. The owner told me this was one of a special breed of cats, the tail being natural and that the rest of it had not been artificially removed by an automobile or another cat. The owner furthermore said the breed was obtained by crossing cats with rabbits. I do not vouch for the truth of this, the wonders of Science being too numerous for me to keep track of, but this cat did have a tail like a rabbit's. Otherwise he seemed to be a perfectly good cat. Apparently he had inherited no rabbit traits but the tail, for the owner insisted he was a great fighter. Also very intelligent. Though this last, of course, may have resulted from eating a lot of fish. I do not know whether this remarkable animal should be called a cat or a rabbit or a cat-bit, but I remember the more clearly meeting him because it was August 28, and on that night I slept in a cabin, and on the following morning the temperature was 30 degrees, with a film of ice on the windshield of the car. This is the first time I ever experienced a below freezing temperature in August, and the last time, I hope, to experience it in a cabin without a stove. Under such conditions it is pretty hard to keep warm during the night, though going to bed with hat and shoes on helps.

Now to conclude with a true story of an incident occurring on this same North Atlantic coast just a hundred



years ago. It was in the fall of 1836 off the coast of Maine, winter was approaching, and winter on the Maine coast is not so very different from winter on the shores of Minnetonka. The Royal Tar, a 500 ton, sidewheel steamer of those days, was nearing the coast on her way to Portland. The ship carried two hundred passengers, including members of an American circus which had been touring eastern Canada. A considerable menagerie, belonging to the circus people, was on board, among the animals an elephant which was chained on the upper deck. As the Royal Tar reached the entrance of Penobscot Bay a stiff northeast gale was blowing, but all would have gone well enough had not the boilers become overheated and set fire to the ship.

In the driving gale there was no chance of saving the ship, but the captain hoped that by running the Royal Tar on shore he might save passengers and crew. Steamers in those days carried sails, and these were now raised. However, in spite of every effort a number of people perished. So did all the animals, excepting only the elephant. The elephant, breaking loose from his fastenings, had leaped overboard and saved himself by swimming to shore. He was seen ashore. Then completely vanished. Nothing could more clearly illustrate the changes that have taken place in this country in the last century than that an animal of this size could thus disappear and his ultimate fate to this day remain unknown.

In the solution of a mystery of this kind one man's guess is as good as another's. My guess is that the elephant, an intelligent creature who saw that winter was approaching, returned to the sea and swam back to India.

Now Here's A Book

By Clifford I. Haga

Instructor in English

WHAT do you look for in a novel when you settle down to read? Now don't become flustered in the sure foreknowledge that all you will be able to mutter are such phrases as "a good story," "lively action," "life-like characters," "excitement," "a chance to forget everyday things"—don't be ashamed of their simplicity and vagueness, and don't be sheepish about blurting out more specific demands like "a pretty girl," "strong, brave men—not too dumb," and "a lot of good fights." Don't be worried by these confessions. Worded only a little differently to emphasize certain qualitative standards, this list of specifications would serve a professor as well. All these requirements are met by the *Iliad* and the *Odyssey*, by *Don Quixote* and *Tom Jones*, by *Vanity Fair* and *War and Peace*, six books that invariably appear in every list of 100 Best Books that you can find. If you ask these things of a novel you are asking more than most novels can give. If you keep to these guides you are instinctively keeping alive the highest standards of the most popular form of literary art—the art of narration.

No wonder, then, that when a novel comes along to satisfy these and other equally legitimate demands, people by the tens and hundreds of thousands buy, read, and enjoy it. No wonder that the broad-beamed *Anthony Adverse* sold a million copies in three years. No wonder that today *Gone With the Wind*, by Margaret Mitchell, sells close to the half-million mark within *three months* of publication and is not to be had for precious love or dear money in the bookstores. Both novels have all the qualities I mentioned and both succeed in the same way and for the same reason: by telling a good story in master fashion.

An adequate synopsis of *Gone With the Wind* is impossible. It means nothing to say that in the story of Scarlett O'Hara are woven together the threads of two major human struggles—one individual and the other social-economic—in the eleven years from her seventeenth to twenty-eighth birthday, when her people were going through the disaster of the Civil War and the degradation of the Reconstruction Period, or to name her three husbands and sketch their disastrous education at her hands. These summaries would tell little of what awaits the reader of the novel. What the reader gets is the amazing story of an individual so completely identified with her class, her community, her home that what each one suffers in the war becomes a real part of her suffering and what she tries to gain, unscrupulously, willfully, even viciously, is reflected more substantially and less luridly in the slow recovery of her people. There is, consequently, a good deal of genuine history in *Gone With the Wind*, yet without any loss to the reader in the lively attraction of the characters.

In addition to this successful combination of two stories—that of a girl and that of the South—we have everything else the standard romances have taught us to recognize as the Old South: beautiful ladies, brave, gallant gentlemen who hold their liquor like—gentlemen, darkies all over the place, romantic scenery, and Damnyanks who are all hellions in blue. At the end the New South begins to emerge from the ashes of defeat—and Scarlett O'Hara is both sadder and wiser than when we first met her on the verandah of her father's house. The cleverness and dexterity necessary to make Scarlett's story part of the Confederate adventure, and the story of the Confederacy an exposition of her character, are equalled by the skill shown in linking realism and romance so shrewdly as to retain the best features of both. *Gone With the Wind* has its limitations, but a dragging style, or a confused flow of action is not one of them.

My recommendation is that you get on the handwagon by reading *Gone With the Wind* immediately. Long though it is, you will not regret the time you give to it nor will you quickly forget Scarlett O'Hara, one of the most exciting young ladies between the covers of a book since Thackeray captured Becky Sharp for us in the pages of *Vanity Fair*.

ALUMNOTES

'95 Professor Kuhlman reports to us that he had the privilege of visiting a real old timer this summer on his trip to the coast. His name, for any of you who can remember that far back, is O. F. Markhus (E. E.), assistant engineer at the Coulee Dam in Washington. Mr. Markhus showed Professor Kuhlman around the project and then bombarded him with questions about the alma mater.

'03 Mr. B. Dibble (E. E.) visited the school this summer on his return from the World Power Conference in Washington. He showed great interest in the new equipment and the experiments being carried on. He is now a consulting engineer in Los Angeles, California.

'30 George H. Shortley (E. E.) wasn't satisfied with being a student; he's now teaching other aspiring young men in Ohio State University. He's teaching physics in the Mendenhall Laboratory of Physics. Wonder what his views on football are down there.

'31 Edward S. Loyle (E. E.) is also teaching, only closer to home, over at Washburn High School.

Some of the '31 Civils who have stayed away are: E. F. Porter, Jr., engineer in the U. S. office in Duluth; S. E. Farin, junior highway engineer with the U. S. Bureau of Public Roads in South Chicago; D. N. Anderson, bridge superintendent with the W. P. Roscoe Co. in Billings, Montana.

'34 George Burch (Arch.) is Supervising Architect for university buildings out in Coyle, Oklahoma.

'34 Bob Kurtz (Arch. Eng.) is one of those who like to stay near the old homestead. He's heating and ventilating supervisor here in Minneapolis.

'34 Charles A. Martin, when last heard from, was engineer with the R. C. A. Communications, Inc., at Rocky Point, Long Island.

'34 At Langley Field, Virginia, labors Sam Davidson (Aero). He's with the NACA. For the benefit of some of you less informed students NACA stands for the National Advisory Committee for Aeronautics.

'35 John A. Boyce (E. E.) is contributing his bit for the world's good out at Los Angeles, California. He's with the Bureau of Power and Light working on the Boulder Dam Transmission Line Construction, so if the project fails to come up to expectations you can blame it on John.

'35 Leonard T. Ostergren of the '35 class (E. E.) is working with the Goodyear Tire and Rubber Co. in Akron. A classmate of Len's, Lyle Scott (E. E.) is working at the Bell Laboratories in New York.

'35 Here's one of these fellows who isn't satisfied with four years in college. He's George L. Thompson (Arch.) now doing graduate work at M.I.T.

'35 Professor Zelner passed on a letter which he received out at camp from Howard Schleiter (C. E.). Howie is working with the field records section of the air photo compilation division of the U. S. C. & G. S. out in Washington, D. C. He tells in his letters more about his job and also some of the experiences he's had out there. He's been informing the people in Washington of Bernie Bierman and our football team. Consequently he fears the day we lose a game. "They're just waiting to 'razz' me out of town," he says. He closes with an invitation to any of you who happen to come to Washington to drop in on him at room 1215, Department of Commerce Building. If any of you alums do travel to Washington, give Howie some of the news about the old school.

'36 Now for some of those '36 Grads who are probably still dreaming about the swell times they had here, or maybe about the great things they're going to accomplish.

Malcolm Lein (Arch.) is in the department of architecture of the F. W. Woolworth Co.

Garvin von Eschen (Aero.) is instructing aero engineering in Duluth Junior College.

Russel L. Nielsen (E. E.) has a teaching fellowship at Yale University.

Hugh K. Laing (E. E.) is at the Naval Reserve at Pensacola, Florida.

About half of the '36 civils are working in the state highway department. We'll give you that long list later this fall. Louis P. Merandi and Roy Lessard (Aero.) are with the Lockheed Corporation. John K. Wentz is with the G. E. Co., Schenectady, New York.

'36 Chemists and chemical engineers are also working in various parts of the country. Bob Dixon, Techno-Log business manager, 35-36, and Grant O. Sedgwick are working in the Ammonia Department of E. I. duPont deNemours & Company, at Belle, W. Va. C. Edward Ahlm is in the Institute of Paper Chemistry, Appleton, Wisconsin. With the U. S. Gypsum Company at Skaneateles Falls, N. Y., is William G. Cain, a chemical engineer doing experimental work in their paper felt mill.

Two other chemical engineers are William L. Nelson, with the Dow Chemical Company, Midland, Michigan; and Edward T. Marshall. The latter is with the Standard Oil Company of Louisiana, at Baton Rouge, doing various phases of research and development work on refinery problems.

While '17 waited, '37 talks

WHEN the class of 1917 was at college, a long distance telephone call took (on the average) more than ten minutes to be put through. ¶ This time has been whittled down gradually, so that now the connection is made in an average of 1.4 minutes—nine out of ten of them while you hold the line. ¶ But this is only one phase of the relentless effort to improve. Your service is better today because voice transmission is clearer—interruptions and errors less frequent than ever before. ¶ America demands fast but sure telephone service—and gets it.

College men and women find after 7 P. M. a convenient time for long distance calling. Moreover, most rates are lowest then.

BELL TELEPHONE SYSTEM

Mines Society Plans Freshman Reception

Bill Kaiser, president of School of Mines Society, has had Jack Melvan and Roger Lind as assistants in making plans for their freshman reception this week. The frosh will be fed and entertained by the upper classmen, according to the chairmen, in a manner unrivaled by any other engineering society. A suggestion that the upper classmen initiate the freshmen was vetoed by the faculty.

Every student in the School of Mines is a member of the society. Frequent meetings will be held, and noted mining engineers secured to speak at each meeting. Every half year the group publishes an Alumni year book. The Society has its own room in the Mines building.

Many of the miners are talking about their summer field trip. The Metallurgists visited the South Chicago, Kenosha, and Milwaukee breweries. On the summer tour, the petroleum engineers visited Oklahoma City and the Texas Centennial. The miners traveled west to Salt Lake City and on the return trip visited Deadwood, S. D., coming close to the geologists who were at Lead, S. D.

Buttonless Switch Put on Flashlight

A buttonless flashlight is now on the market. An inertia switch is built which a flick of the wrist will turn on. The flashlight, while it uses standard bulbs and batteries, is waterproof, gas tight, and will not spark. One lay 10 days under water in the Pittsburgh flood, and was not damaged. The Bureau of Mines has approved its use in methane and air mixtures.

New Eraser Made Out of Spun-Glass

A new eraser of spun-glass fibers treated with a flexible binding solution will remove ink, typewriting, and india ink, and will polish metal. It is sold in a pencil-like holder. The eraser is propelled from the holder by turning the top half. The holder is refillable.

New Auto Governor Has Lock and Key

A key operated automobile speed governor is being offered. The key is used to attack top speed of the car. The governor does not cause power loss, and the automobile retains its maximum torque.

280 Blue Prints Call A. S. M. E. to Meeting

A movie and short faculty talks were on the opening program of the A. S. M. E. October 14. Bud Wilkinson was scheduled to appear to present a door prize, and give a short talk on football highlights.

All mechanical students were notified of the meeting by the novel presentation of blue printed invitations, prepared by Gerry Mitchell, president. Refreshments were served.

New officers were presented and committees announced, after which the rest of the evening was devoted to entertainment.

Flying Club Takes 2nd in June Meet

For the second year the University flying club placed in national competition with 20 similar clubs, winning second place with 14 points, at the National Intercollegiate Flying Meet in June.

Led by Jean Barnhill, coed pilot, members of the club were edged out of first place only by a veteran Stanford University team. Bomb dropping, paper strafing, and spot landing were the special events. John Cameron, who had never tried paper strafing, took first in that event for the local squad.

All Minnesota entrant groups won points, giving Minnesota a good start toward winning for the third successive year the Loening Intercollegiate Flying trophy, awarded to the outstanding collegiate flying club.

Mercury Used in New Electric Switch

A recently developed electric switch has no moving parts and is silent. It uses the mercury break principle, and is about the size of a marble.

Two hollow chrome-nicked cups are sealed together with lead glass to form a sort of capsule. A ceramic disk with a small hole near its edge separates the cups. The mercury can flow through the hole and make contact between the cups when the switch is rotated 20°.

Stratosphere Balloon to Contain 3 New Clockwork Mechanisms

Mental Tilts

By Ward Simmons

We've found some peachy little brain dusters to help get the dust out of the crevices in the old cerebellum. The usual $1.00 prize is offered to the first student with the right answer.

If your coefficient of laziness is as large as ours you'll be interested in this one:

Three flagpoles, 60, 80 and 100 feet tall, are erected at the three corners of a triangular field, 100 feet on each side. A ladder is placed at a point in the field so that it can be leaned to the exact top of each of the three flagpoles without changing the location of the base of the ladder. How long must the ladder be and where should the base be located?

* * *

Our two cylinder mind stalled on this one, and we couldn't get a pop out of it until the next morning. We're not an example so don't say "WHO CARES!$*%√" as soon as we did.

In a certain village there are seven residents named Messrs. Bloodhound, Cocker, Pom, Peke, Pug, Mastiff, and St. Bernard. They severally, but not respectively, possess a bloodhound, cocker, pom, peke, pug, mastiff, and St. Bernard. None has a dog of a breed of the same name as himself.

Three of these villagers have dogs which are considerably larger than these villagers' canine namesakes. Only one has a dog of the same breed of which the name begins with the initial letter of his own name. Mr. Mastiff's dog's human namesake is married. The St. Bernard's owner is Mr. Pom's wife's sister's husband. The mastiff weighs the same as his owner's fiancee. Mr. St. Bernard's dog's human namesake is the owner of the peke. The cocker's owner's canine namesake is owned by the human namesake of Mr. Mastiff's dog. Of the seven villagers, Mr. Peke and Mr. Pug are the only bachelors. Who owns which dog?

* * *

The new psychopathic ward will soon be ready.

When Professor Jean Piccard's sounding balloon leaves the campus of the University of Minnesota for its trip into the upper reaches, it will be controlled by an ingenious system of clockwork mechanisms.

After it has attained its maximum altitude, and to insure its descent in daylight so that it will be found, one clock is suspended on the inside of the balloon from the top panel where it rips a three-cornered hole in that panel after a designated lapse of time.

This action releases the hydrogen, allowing air to enter the balloon from the appendix in the bottom. The air, due to the heating action of the sun and the adiabatic compression of the atmosphere, is heated to a sufficient temperature to allow the gondola, with its instruments, to sink gently to the ground.

Broadcasts Altitude

A second clock broadcasts the call letters of the balloon, the temperature and the humidity outside the gondola, and also the altitude of the balloon in every 500-ft. increment above 8 miles —one dot for every increment.

Every 8 minutes during the flight this clock also broadcasts a humming sound of known frequency to give the listener the direction in which the balloon is travelling.

The third and last clock records continuously the temperature inside the gondola by means of a bimetallic strip and a rotating drum. Some of the heat inside the gondola is derived from the discharge of the electrical energy of the batteries and the solar radiation through the Cellophane-covered, black-painted box.

Plan Ascent Soon

The ascent will be made in the near future. The Scotch Cellophane tape has already arrived and the Cellophane, from which the balloon will be made, will be here in a few days.

Student engineers working on the instruments are Harold Hatlestad, Robert Sullivan and Robert Hatch. Miss Jean Barnhill is working on the construction of the balloon.

I.A.S. to Sponsor Aviation Research

The Institute of Aeronautical Sciences this year will sponsor original student research in aviation in the form of reports to be read in meetings. Prizes will be given for the best and most original.

Effort is being made to secure speakers for each meeting, and several inspection trips are already planned. The Chairman of the club is Vincent Victoreen.

Tech Societies Begin Season With Drive For New Members

With membership drives thoughout October, societies in the Institute of Technology are launching a program of events forecasting a big year.

The A.I.E.E., under the guiding hand of Orville Beckland, expects its largest membership in years. Two meetings were on this month's schedule, one with the Minnesota Chapter October 5, and the other with students of the E.E. department. Prof. J. H. Kuhlman addressed both meetings. Plans for inspection trips and future meetings were discussed by members at the latter meeting.

To represent Minnesota at the A.I.E.E. convention at Pasadena, California, last June, Professor Kuhlman made the trip by auto, touring through seven national parks and the Boulder and Coulee dam projects en route. With the information, pictures, and material which he gained, he will pass on to the students his experiences.

* * *

Gerry Mitchell, president of the A.S.M.E., prepares to put the mechanicals on the map to stay. The opening plans were scheduled early in October. At the first meeting students were given an outline of A.S.M.E. field trips. Several prominent speakers have been booked for future meetings of the society.

* * *

Tom Klingel, A.S.C.E. president, is already dieting for the big bean feed the civils plan to have early this month. Membership committee members of the society will begin their drive at this meeting. They hope to have the largest engineering society on the campus. Several practicing civil engineers have been asked to speak at future meetings of the society.

* * *

The Glider division of the Flying Club plans to enlarge its equipment to the extent of a 2-seater glider and a new wing for the "Alexandria." Over 20 members of the Glider Club have flown the Alexandria, two of them having a "B" rating.

Most of the flying will be done at the state fair grounds where the glider is towed behind a car. Some of the students have flown the glider as high as 600 feet. All students of the university are eligible to join the club.

Zelner Completes Study on Summer Camps for Civils

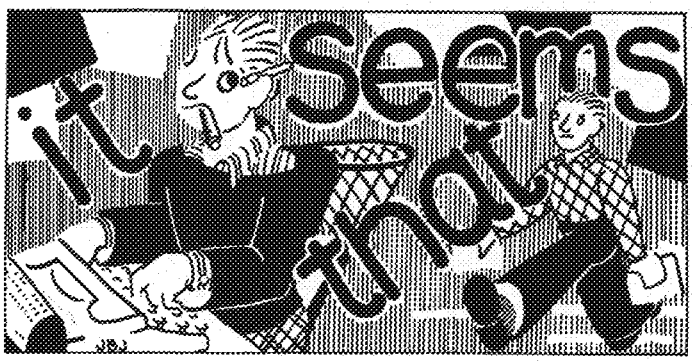
O. S. Zelner, associate professor of surveying, concluded last June a study of summer surveying camps, as a member of the committee on surveying and geodesy of the Society for the Promotion of Engineering Education.

The study, said to be one of the most complete ever made into a specific phase of civil engineering education, brings out a number of figures. He found that 2,020 students attend 54 summer surveying camps and 18 summer schools in the United States and Canada. In these camps there are 235 faculty men, or about one faculty member to every eight students. A questionnaire brought 81% replies.

His paper on the subject includes information on: name of camp or school, location, distance to camp from college, number of students attending, topography of surrounding country, method of housing, amount of tuition, amount of night work carried on, etc.

The most isolated camp is that of Iowa State college, located on Rainy Lake 35 miles by boat from Ranier, Minn. The paper is entitled, "A Study of Summer Surveying Schools and Camps in the United States and Canada." It is to appear in the *Civil Engineering Bulletin* and the *SPEE Journal*.

Index To Advertisers



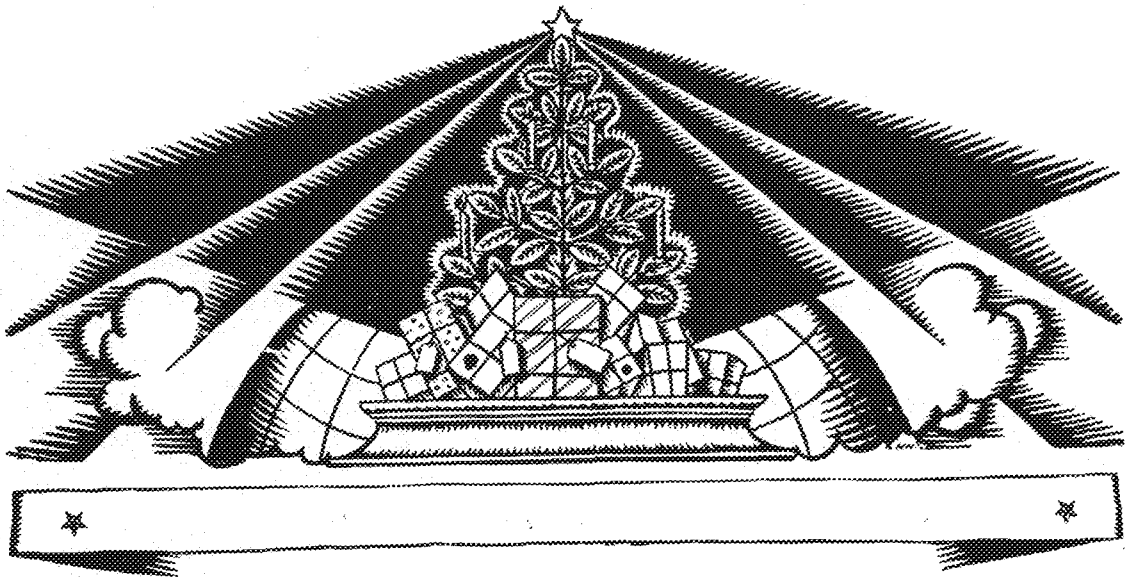
By Melvin 'Pete' Lohman

A new school year and a new columnist. We hope we can keep from boring you too much. Our good friend and instructor, Prof. Wilcox, has been up to his old tricks again. He was being unmercifully kidded about his new haircut which showed a band of white scalp above a well tanned neck. He remarked that with the beginning of school all the instructors were getting haircuts. From the back row came this: "Someone should tell Prof. - - -?! that school has started." . . . Wilcox was calling roll when he came upon the name of Leo Funke. Leo, a two-timer in his class, was asked by Wilcox whether he shouldn't spell his name with an L. . . . Might we ask where the biggest crowd was this year, in the bookstore, behind or before the counters? Is that the reason for the 13% dividend this year compared to the higher one last year? . . . I'm sure all of us wish the former Marg. Buckley, of the Dean's office, the best of luck in her new venture, marriage. . . . Looks like big times for the Tech schools with the large increase in enrollment. Might we warn the freshman as a math prof did a while back? This instructor before addressing his students about the need for intensive study said this, "look at the man to the right of you, look at the man to the left of you. Next year two of you won't be in school." . . .

Can anyone tell us why the word "Goon" is so widely used in the Tech schools? Can it be we Engineers have no appreciation for the women folk? . . . Something happened to the budding romance of last spring betyeen Jack Inklekofer and Priscilla Wrenn. The little bird has been telling that Howard Clark has been cutting in on Jack. The bird hasn't been able to keep up with Prissy lately though.

Looks like we have a successor to Glenn Seidel. His name, Francis Twedell, a sophomore civil, and they tell us he can play an hour of bang-up football. Glad to hear that the Tech school is continuing to be represented on our great teams. It shows that the Engineers have brawn as well as brains. . . . Of all the summer fishing stories that the Engineers brought back, we enjoy this one the most. Says one miner to the next as they sat throwing it one afternoon, "I went fishing this summer and caught one of those great big fish—let's see, what is it you call them?" "Oh, you mean a whale." "No, that couldn't have been it; I was using whales for bait."

Mechanicals will be glad that a certain member of their group has painted his bicycle on which he rides from main to mechanical building. We hear threats to hang it in a tree; can it be the boys don't like the new color scheme? . . . A few notes from the summer camping civils: Earl Franzen, of A grade fame, was taught to hunt snipe. His tent mates showed him how to make a large V with that which comes a thousand sheets to the roll. Earl waited at the point of the V with a light and a gunny sack. He reported hunting pretty poor although he did hear one coming once. . . . While the entire police force of Cass Lake watched the barber pole, a few of the boys who don't like publicity climbed the water tower and painted U. of M. 36 on the tank in seven foot letters. Can I tell who you are, boys?



Fall and Winter Purchases

Where Will You Make Yours?

There are 26,000 independent home-owned stores in Minnesota and surrounding states ready to serve your every need.

●

Patronize these neighborly stores . . . . see that your money goes to a home-owned institution . . it's good business all the way 'round

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis Saint Paul

"He has style—"

HE WEARS THE NEW

*BRITISH LOUNGE MODEL

The Style that Offers a New Ease, Comfort and Smartness Beyond Your Experience

The Remarkable

SAXON-WEAVE SUITS

$32.50

Resists Shine—Holds a Press
Resists Wrinkles—Long Wearing

A style that flatters so subtly that once you wear one you will find it difficult to reconcile yourself to the wearing of other models. You'll like the new breadth of shoulders, the full chest, its sweeping lapels, the tapered trousers, its uncommon ease and comfort. Pattern effects that you will find easy to like.

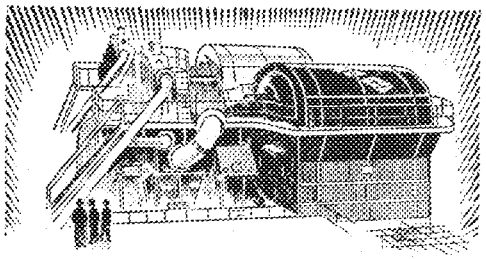
Clothiers—Tailors—Furnishers

JUSTER BROS

On Sixth Street . . . Just Off Nicollet

*Reg. U. S. Pat. Off.

G-E Campus News



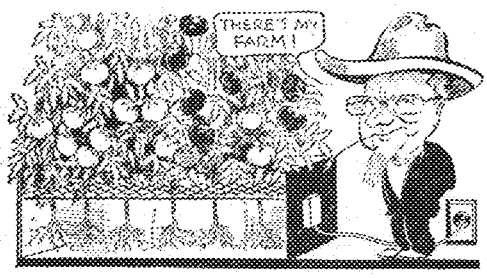
BIGGER AND BETTER TURBINES

The new 110,000-kilowatt turbine-generator, built by General Electric and recently placed in service in the River Rouge plant of the Ford Motor Company, sets several new records in turbine construction.

It is the first large unit in the world to operate at 1200 pounds pressure and at 900 Fahrenheit. Although the weight is approximately 2,000,000 pounds, it is so compact that it occupies less than a cubic foot for each kilowatt of output. Because of its extremely high efficiency, less than a pound of coal is needed to generate a kilowatt-hour of electric energy.

The new turbine is a vertical compound machine with the high-pressure turbine and generator mounted directly above the low-pressure unit. Superheated steam enters the upper unit at 12 pounds and 900 degrees. After producing 55,000 kilowatts, the steam flows directly into the low-pressure unit where it produces another 55,000 kilowatts before it is exhausted to the condenser. This is the first 1200-pound turbine in which the steam enters the low-pressure stage without reheating.

The work of designing, constructing, testing, and installing great turbines, such as this, is the accomplishment of hundreds of graduates of technical colleges and universities—men who are also graduates of the G-E Test.



ELECTRIC HEAT FOR SOILLESS GARDENS

California nurserymen are growing tomatoes, strawberries, and sweet peas in chemically treated water heated by electricity. The method, developed by Dr. W. F. Gericke, of the University of California, has been extended to commercial installations. Tomato plants, grown in this way, produced unusually high-quality tomatoes. The yield was large, and they matured ahead of tomatoes grown in soil.

Nourishment for the plants is provided by special chemicals dissolved in the water. Because the water temperature must be accurately maintained, a controllable heat source is required, and General Electric engineers have supplied heating cable and thermostats both for the experimental installation and for commercial installations which have followed.

COFFIN FELLOWSHIPS

This fall eight young men will be carrying on advanced research in seven American universities under fellowship grants from the Charles A. Coffin Foundation. The recipients and their research problems:

George E. Boyd, U. of Chicago '33. At Chicago. Study of surface energies.

Lyman R. Fink, U. of California '33. At California. Phenomena in synchronous machines. Second grant of fellowship.

Alvin H. Howell, U. of Kansas '29. At M.I.T. Insulation problems in d-c transmission.

Russell A. Nielsen, Stanford '33. At Stanford. Electron mobilities.

Richard W. Porter, U. of Kansas '34. At Yale. Transients in the monocyclic network. Second grant.

Julian S. Schwinger, Columbia '36. At Columbia. Theoretical investigations in nuclear physics.

Chauncey Starr, R.P.I. '32. At Harvard. The pressure coefficient of thermal conductivity. Second grant.

Harold G. Vogt, U. of Buffalo '31. At Harvard. The nature of the neutron.

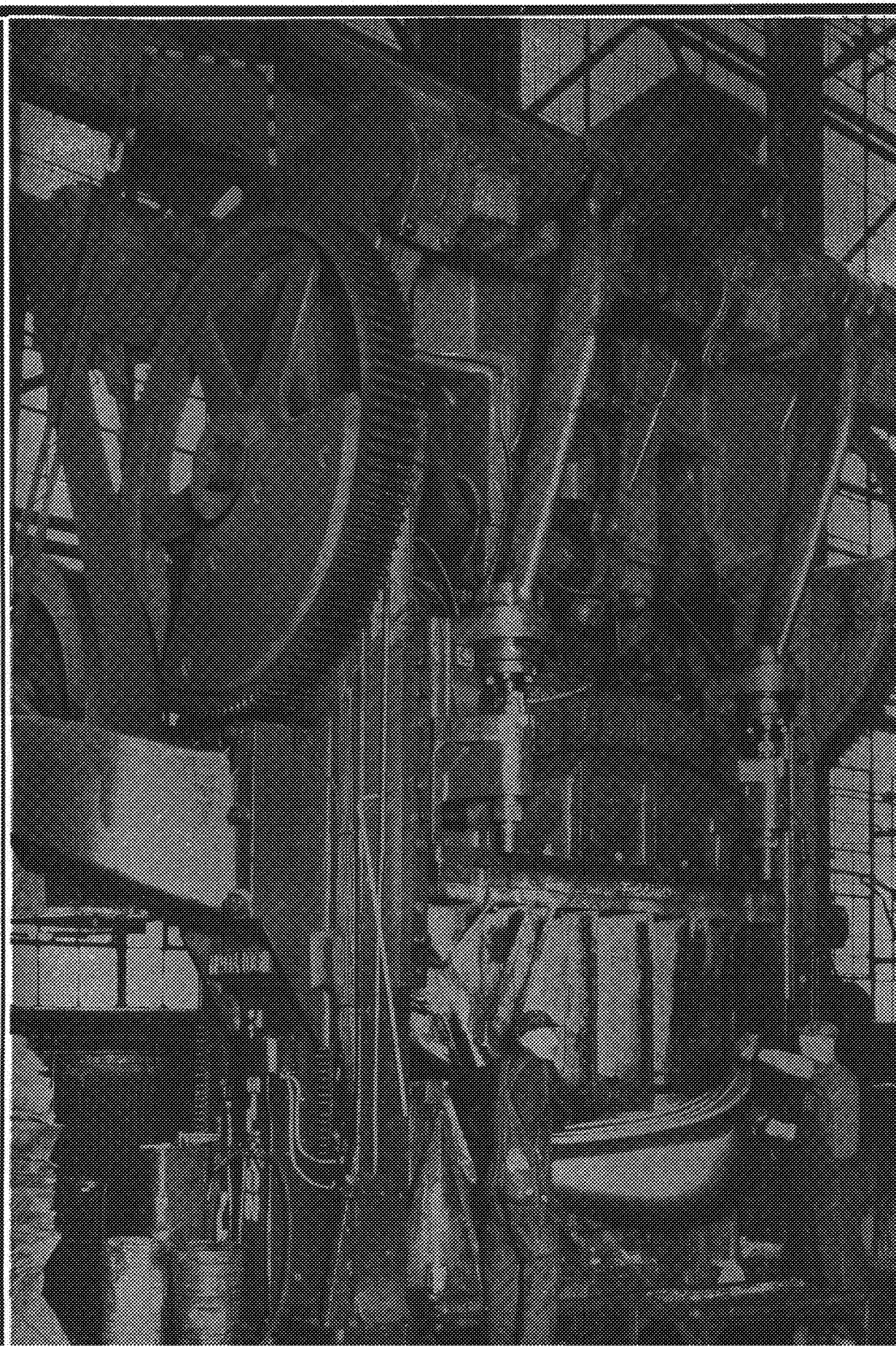
Since 1922, when the General Electric Company established the Charles A. Coffin Foundation in honor of the Company's first president, 113 fellowships have been awarded for advanced work in electricity, physics, and physical chemistry.

GENERAL ELECTRIC

'e Vol. XVII No. 2 November 193

INNESOTA TECHNO-LOG

This Issue



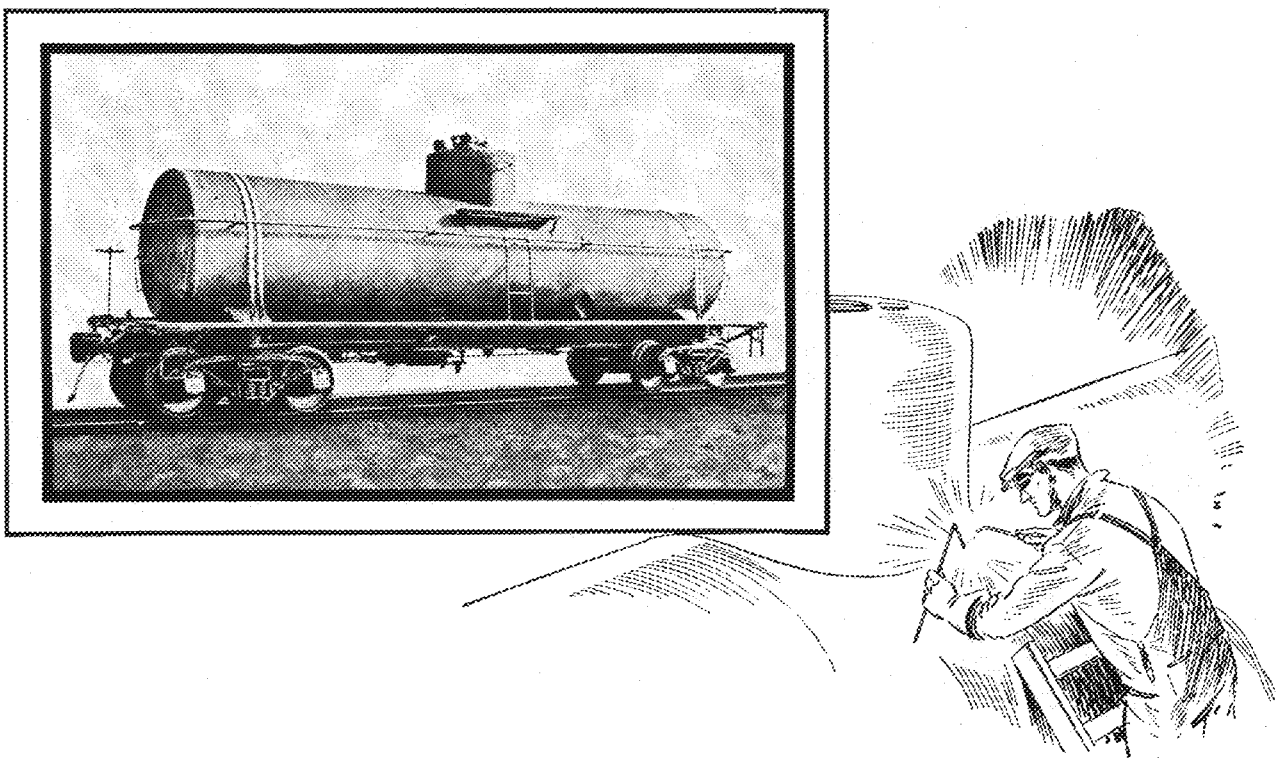
Better . . because IT'S WELDED

Welding eliminates overlapping joints in the modern tank car. This materially reduces dead weight and makes the car easier to clean and maintain. It completely prevents loss or contamination of the contents from rusted joints.

Tomorrow's engineers will be expected to know how to apply the oxy-acetylene process of welding and cutting in design, construction and fabrication to give similar sales advantages to many good products.

The word "welded" is packed with meaning. It means light-weight without sacrifice of strength. It means sturdiness and ruggedness that can never shake loose. It means invisible joints as strong as the base metal. It means smooth surfaces with no place for corrosion to start. In short it means all that one piece construction can mean plus complete design freedom from the limitations of other methods of fabrication.

Technical booklets describing the application of this modern metal-working process to a wide range of metals—steel and iron, aluminum, copper, brass and many other alloys and metals are available, without obligation, from any Linde Office. Write to the Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.



Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES — FROM LINDE — UNION CARBIDE

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

NOVEMBER, 1936

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Actg. Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Baudenbush, Vice Pres. Robert Land, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Recklund, Treas.	Eta Kappa Nu
William Kaiser, Pres. John Holliban, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Bernard Hein, Pres. Henry Mitts, Sec'y	The Commacini

This Month

VOLUME XVII NUMBER 2

Officers of the Professional Societies

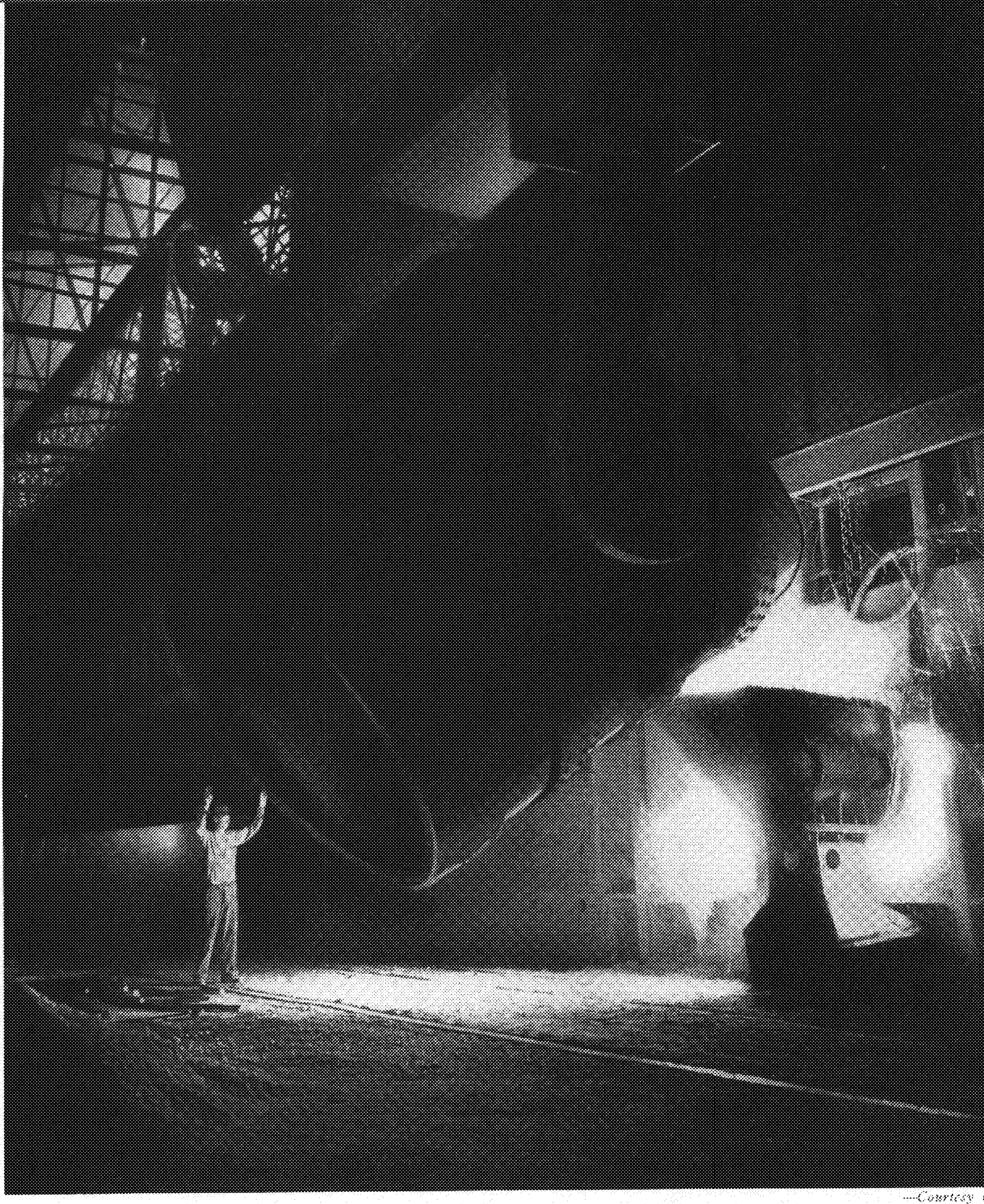
Richard Olson, Pres. Robert Ellis, Vice Pres. Walter Cutler, Rec. Sec'y Fred Rathjen, Corres. Sec'y Robert Stevens, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Parry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Frahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. Robert Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Wodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Alkire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: LEONARD H. CHURCH
1510 Hanna Building, Cleveland, Ohio

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	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, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



—Courtesy

Open Hearth

Mechanical Features of

1937 Automobiles

By Ralph Lindholm, M.E. '36

SAFETY is unquestionably the keynote in 1937 motor car design. Publicity given to automobile accidents has made it unwise for any manufacturer to publicize the top speed of his product. In fact, the board of directors of the Automobile Manufacturers Association is recommending to all members that no reference be made to vehicle top speeds in their publicity and advertising.

The safety theme is greatly bolstered by the adoption of all-steel bodies on the standard makes of the General Motors line. The article "And Sudden Death" appears to have its effect on the interior treatment in all models of the Chrysler family. In these cars there are smooth dashboards, inwardly curved tips on door handles, and softly padded rolls on the back of front seats. These features are expected to reduce injuries in event of quick stops or collisions. Frames are more rigid in most cars, the torsional strength being increased as much as 400 per cent. Lowered center of gravity, improved visibility, higher horse power to weight ratios, better shock absorbers—all are important items contributing to safer driving and maneuverability.

For the past several years, the drive shaft has interfered with the lowering of car bodies. In an effort to lower the center of gravity many manufacturers have had to contend with the floor hump. The "tunnel" problem has been overcome in many new models through the use of hypoid gearing in the differential. This form of rear end, well tested in the Packard 120, is found as a new feature on Studebaker, Cadillac 60, Chrysler, Buick 40 and 60, and others. The prime reason for adopting the hypoid differential to any pleasure vehicle is the lowering of the body floor. In this design the extended axis of the propellor shaft comes below the center line of the rear axle. An increase in the perpendicular distance between the center lines of drive shaft and axle raises the degree of hypoid treatment. Sliding action of the teeth is increased with the result that a special quality of extreme pressure lubricant is required. Gear action should be more quiet because of the lower rate at which tooth contact is made.

Riding qualities have been remarkably improved in every model. Manufacturers have found that cars are unsafe that jolt wildly on rough roads and heel over excessively on curves. Hence we find that automobiles ride better not only for comfort but largely for safety. For this reason tire pressures are lower, shock absorbers are larger, and steering mechanisms are improved. By equalizing the car weight on all four wheels and making front and rear spring rates more nearly alike, manufacturers have done more to give us a comfortable ride than ever before. A large percentage of the new automobiles use torsion bars to reduce body tilt on curves, and the popularity of independently sprung front wheels remains about the same.

Steering gear design has reached an unstable condition. More weight on front wheels has demanded a high gear ratio for easy parking, while high speeds call for good road "feel" with a low ratio for quick maneuvers. But the result has been that most cars have a high steering ratio suitable primarily for easy control at low speeds. Dodge is one automobile that has decreased the gear ratio to obtain a better road "feel." Graham Superchargers and Studebakers make use of dual-ratio steering, a gear that gives a lower ratio in the straight-a-way than it does at either extreme of turning.

Automatic controls are gaining favor. The following operations are handled automatically in many of the new automobiles: water circulation, carburetor choke, heat delivered to the incoming charge, engine idle speed, generator output, spark timing, and others. Generator output control in particular, has received special treatment this year. Control of this item is so complete that the ammeter has disappeared from dashboards of such cars as Hudson, Pontiac, and Terraplane.

Manufacturers have put special emphasis on cooling exhaust valve seats. Increased cruising speeds have resulted in high exhaust gas velocities and temperatures, and these two effects combine to have a very corrosive action on exhaust valve seats. To reduce this effect provisions are made in new engine designs to discharge cold water from special passageways in the cylinder block directly against exhaust valve seat jackets.

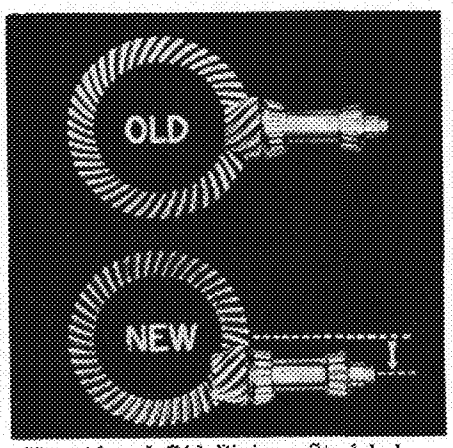
Rubber is coming to the fore as an important element of automobile construction. This substance is effective in reducing rattles, eliminating grease points, absorbing vibration, insulating sound, and is beneficial in a number of

other services. The rubber universal joint, embodied in at least one car, requires no slip joint in the drive shaft and needs no lubrication.

Special Features

Nash springs, which oscillate at the same rate front and rear, are pre-lubricated for consistent performance. Steel bows are used in the all-steel tops of the unusually wide bodies to reduce drumming. The Nash "400" has been changed to a model called Nash-La Fayette "400." The "monitor sealed motor" used in this car differs from the conventional engine in that intake, exhaust, and oil manifolds are cast in the block. Nash continues using a large number of crankshaft bearings—seven on the six cylinder motor, and nine on the eight cylinder motor.

Studebaker Dictator styles have the rubber insulated universal joints made by Thompson Products, Inc. In place of the conventional yoke there are four molded rubber spools that have enough freedom of action to permit a 15 degree joint angularity. Lubrication needs are eliminated and no slip joint is used. Road noise cannot be transmitted to the body through these joints. DeSoto, as well as other members of the Chrysler family, has the body mounted on rubber spools and biscuits. This cushioning suspension should reduce materially body drumming and the transmission of road noise to passengers. Small degrees of body weaving should be effectively absorbed thereby giving a prolonged period of body quietness.



Hypoid and Old Pinion—Studebaker

A 170 horsepower supercharged motor is made available in the 1937 Cord. Chief among the many safety items is the extremely low center of gravity, a feature made possible largely because of the front wheel drive. This, the only front wheel drive car on the U. S. market, uses constant velocity universal joints for the delivery of unvarying power at any angle. It is unique in its use of invisible door hinges and disappearing headlamps.

The floor hump was eliminated in the Oldsmobile body through the adoption of the "stabilized" propellor shaft. Three universal joints are used and the added center joint is locked in by the X-members of the frame. Only the rear section of the tubular shaft moves vertically with the axle.

LaSalle becomes another user of the V-type motor by changing from a straight 8 to a V-8. This engine develops 125 horsepower or 20 more than the straight 8 of 1936. The added power increases accelerative ability 20 per cent at low speeds and 250 per cent in the driving ranges.

For the first time, Packard has invaded the lower price field with the introduction of a six cylinder model. This new car has the traditional Packard appearance and embodies many features of the 120 line. A semi-centrifugal clutch is used to improve power transmission at high speeds.

The "Big" Three

Chevrolet continues with the valve-in-head engine. The new cast iron alloy pistons have a dome head and cut-away slipper type skirts. The cylinder bore is increased from 3 5/16 to 3½ inches, and the stroke is reduced from 4 inches to 3¾ inches. An increased displacement and a raised compression ratio combine to give greater power and torque at all engine speeds. The engine is now rated at 85 horsepower. The most important change this year is the introduction of an all-steel body. A box section frame, similar to that used on 1936 standard models, has been adopted for the two lines offered this year.

The Ford cars will be available in both the de luxe and standard body types on the single V-8, 112 inch wheelbase chassis. In the standard types, either the new 60 horsepower V-8 "economy" engine or the 85 horsepower engine is optional. Ford cars built in England and France for the European market have been powered with this smaller motor for more than a year. Steel alloy pistons, used tentatively in the 1936 engines, will be standard on all new Fords. For the first time, bodies are all steel, including a new steel top, as well as steel structure, panels and floor. The 1937 Ford is similar in streamlining to the Lincoln-Zephyr, and has the headlamps in the fenders.

Quieter action is said to result from the use of a U-slot skirt on Plymouth pistons. Reduction of the king-pin angle from nine to four degrees, combined with other improvements in the steering mechanism, has eliminated the tendency of the car to "wander." Just a few years back, it was unthought of to insulate bodies of low price cars. This year we note Plymouth engineers using five different body insulating materials—even deck lids are now sprayed with a sound deadener. The most obvious change on the new Plymouth is the larger all-steel body.

New Cars Appear

Reo will not manufacture passenger automobiles this year, but will expand commercial vehicle production. Because of continually postponed Hupp stockholder meetings, we expect no Hupmobile on the 1937 market.

A new enlarged Willys will appear this coming year. The 1937 models will have flowing lines, roominess provided by longer, wider bodies; and at the same time will afford ruggedness and economy of operation.

The American Bantam Car Co. has announced a new automobile for the domestic market, the American Bantam. The coupe weighs 1,200 pounds and has a four cylinder engine rated 20 horsepower at 4,000 revolutions per minute. With a bore of 2.2 inches and a stroke of 3 inches the engine has 45.6 cubic inches displacement. This car has a tread of 46 inches, a total length of 120 inches, an over-all height of 60 inches, and a clearance of 8 inches. Prices begin at $335 (f.o.b.) for the business coupe.

Sir Herbert Austin, the British manufacturer, has entered his product on the U. S. Market once again. He expects to sell 5,000 units in this country during 1937. The base price of these midget automobiles is about $500.

These new models will be on display in the Twin Cities the last week in the month.

Ahoy—the Pacific

From New York, on the Merchant Marine, through the Panama Canal Zone to Hawaii

By Alvin Isaacs, E. E. '40

SEAFARING is great adventure. From the very first, when I began my apprenticeship in the merchant marine by roving in the British West Indies, the tang of sea life imparted a spirit of freedom that, by a host of events, carried me up a jungle-fringed river in Dutch Guiana to an inland port; transported me to Europe to ramble through the waterfront of Le Havre, France; and permitted me to taste mellowed German "products" in Hamburg biergartens. Finally it was for even these voyages to pall into mere memories when I heard that a freighter, loaded for a long voyage to the Hawaiian Islands, was in need of another hand.

And Lady Luck beamed her regal countenance upon this vagabond for, after impressing the master that he couldn't do without me, on May 28, when two bells in the first watch struck, I was "turned to" on deck with the rest of the crew of the S. S. Anniston City. As a snorting tug boat fussed and fumed to get us from alongside our pier into the traffic of East River, it was with a feeling of satisfaction, if not actual relief, that I watched the lights of Manhattan begin to melt in the depths of the night. At last I was going to sail the Pacific!

Being a member of the watch on deck, I made my way to the foeslehead to keep lookout, while all hands were busily battening down the hatches and lowering the cargo booms as precautions against chance heavy weather outside. A short while later we dropped our pilot at Sandy Hook and all was clear. When four bells struck, after reporting the lights, I clambered up the bridge ladder to stand my trick at the wheel, relieving Jones, my watch-partner, who went on lookout for the remainder of the watch. The captain was in the chart room when I took over the wheel, so it was with an air of assumed nonchalance that I tried to appear an experienced helmsman. The third mate repeatedly made trips across the bridge to the starboard compass for bearings on lighthouses, and from the radio "shack" behind me came series of dit dat's as "Sparks" communicated with shore. As at every wheel watch that followed, there was a keen thrill to know that in my hands was the control of the ship, and with it the lives of 34 men, as well as hundreds of thousands of dollars in cargo.

Unlike the luxury liner on which I had shipped to Europe, with its gyro and magnetic compasses, its rudder angle gauge, and its wheel gauge, steering the sturdy freighter became a simplified task as all that was required was to concentrate on the gyro compass. At times, when an ambitious urge impelled me, I would line up the jackstaff with a low-hanging star, or a slow-moving cloud, and would use the compass only as a check. This system gave me a much straighter course than usual.

By midnight (eight bells), when we were relieved by the middle watch and were at last able to go aft to our bunks, we were completely out of sight of land, with our single screw churning us along southward at a full speed of 12 knots.

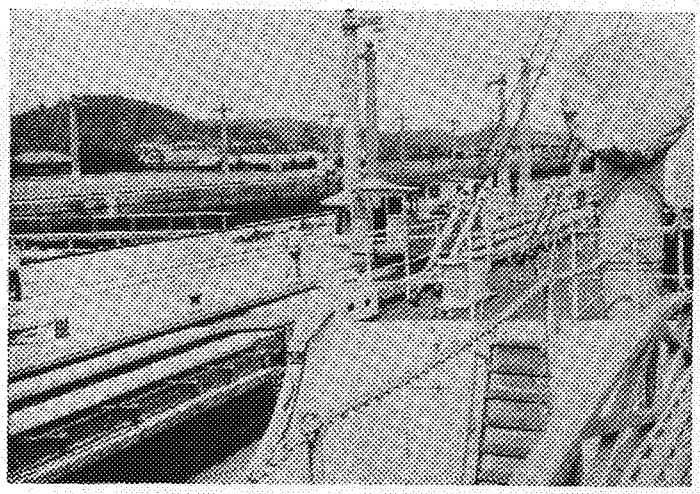
Comparable to shifts on shore, sailors work in watches, American vessels using the system of three watches in every twelve hours. That is, the crew to stand watch is divided into the 4 to 8, 8 to 12, and 12 to 4, watches, thus working four hours out of every twelve, a routine of four hours on and eight off. This enables the officers to have at hand members of the crew day and night, manipulation and safety of the vessel assured.

Morning, along with the strong right arm of an A.B., brought me from my straw mattress in double-quick time. After hasty ablutions and a snatch at the remains of breakfast in the mess room, I dashed up to the wheelhouse just as eight bells struck. Two hours later, relieved by Jones, I went on deck to work with the rest of the watch under the sharp eyes of the bos'n. The booms we lashed to the cradles, and all cargo rigging such as guys, runners, topping lifts, and slings was removed and stowed in the forepeak and fantail lazarets with the hawsers, safe from heavy seas or tropical rain and sun. Loose dunnage, which stevedores had brought up on deck from the holds, was thrown overboard, and all was made shipshape for the long voyage. When eight bells struck at noon, the watch was relieved, and after mess I turned in for my forty winks.

The afternoon, like every succeeding one, was much a repetition of personal routine. Daily, about three o'clock, after attempting to regain a little sleep in competition with a blaring radio in the next foesle or the banging of chipping hammers in the hands of the watch on deck, I would drowsily fill my tin bucket full of water, heat the contents with live steam in the washroom, scrub my clothes, and hang the result in the fidley above the engine room to dry. At five o'clock, when the mess boy rings his bell, I would immediately decide that eating had more attraction

than sleeping, and at the mess board would take advantage of each yawn by stoking in big mouthfuls.

No longer is bully beef and ship's biscuit the seaman's bill of fare, but rather your modern sailor sits down to a fair meal. It is true that the spuds might, on occasions, be rocks, or the canned milk five-hundred per cent water, but this is usually the fault of a careless cook or an indifferent steward. Sunday and Thursday lunch usually consists of chicken with either pie or ice cream for dessert. Friday always brings fish meals, and on other days meat of some kind forms the main course, with cabbage, carrots, or potatoes in support. Fresh vegetables, if there



S. S. Anniston City being lowered 32 feet at the Pedro Miguel locks

are any on board, may be added to the evening meal, while eggs and cereal with sometimes fruit make up the breakfast fare.

After supper those members of the crew who are off duty usually gather on number four hatch or the poop deck to swap yarns and tell tall stories until dark. Others may be busy mending their dungarees, listening to the radio, or reading. Books form perhaps the chief recreation on board ship, and prior to every sailing the American Merchant Marine Library Association places on board a box or so of books which are culled over almost immediately by the entire crew, sea stories rating high in popularity and forming the basis for many a discussion. Although classics were not in much demand, fiction was always sought after, with such magazines as *American* and *Cosmopolitan* in greatest favor.

At dusk some of the sailors collect in the mess room to play poker or rummy while invariably a dog-eared checkerboard made its appearance with a ring of kibitzers soon forming about the players. By ten o'clock everyone was in his bunk, leaving the deck clear except for the watch and perhaps some seaman taking a few last puffs on his pipe, dreaming a bit, before turning in.

Jones and I, being on the eight to twelve watch, went on duty at eight, one to the wheel and the other to lookout, until ten, when we exchanged places to prevent the tasks from becoming tedious. While changing, we were permitted to snatch a cup of coffee and sandwiches from the cockroaches that insisted on invading the messroom at night. On lookout we made a constant surveillance of the horizon, searching for other vessels or floating obstructions. The rigid stillness of the vigil was broken each half hour by the striking of the bell and the reporting of the running lights (the red port, the green starboard, and the fore and main masthead lights). When a vessel is sighted the lookout strikes the bell, three times for a ship dead ahead, twice for one on the port bow, and once for one to the starboard. The writer, who was on lookout when the Anniston City arrived at Panama, was kept so busy striking the bell as each lighthouse, buoy, or ship at anchor hove in sight there was little time to differentiate between navigation lights and houses on shore, and the decks fair resounded with the din. That is, until an A.B. threatened mortal destruction if "firing" didn't cease. Result: one crimson countenance.

As the distance of visibility at sea in nautical miles is about equal to eight-sevenths of the square-root of the height of the observer above sea level, a seaman in the bow say 20 feet above the water can see only 5.11 nautical miles, while an officer on the bridge 50 feet up has a range of visibility of 8.08 nautical miles radius. But even though the lookout in the bow doesn't usually see a light until well after the officers have observed it, he must report all objects in sight, as the responsibility is his.

While steaming southward, the days lengthened and the seas took on a bluer coloring as we entered the Caribbean. "Flying-fish weather!" as Big Jenssen, the mate, put it. Most of the crew were now vacating their bunks in the foesles for hammocks under the awning on the poop; and, following the sartorial example set by the third mate, many of us replaced our dungarees with khaki shorts. The bos'n sported a pith sun helmet he had obtained in India, and the whole vessel assumed a tropical atmosphere.

Breaking the regularity of sea routine were the weekly fire and boat drills which are required by the department of commerce for all merchant vessels. A continued ringing of the ship's bells and alarms would summon all hands to their emergency stations (positions which had been designated when the crew signed articles previous to sailing), and fire hoses would be stretched out and played over the gunnels. A squad known as the fire party would report 'midships with axes, chemical extinguishers, smothering blankets, and smoke masks, ready for the trouble.

Five short and one long sharp blast on the whistle was the signal for us to muster, in life jackets, to the lifeboat stations. Like most ships of our size, we had four longboats, one of which was motorized and radio equipped. At the "abandon ship" signal from the skipper, each man performed a specific duty at his own boat, or, in case of heavy weather, at the two boats on the lee side. The tarpaulins were removed, gripes loosened, and painters run out and made fast. Finally the davits were swung outboard and the falls slacked through, lowering the boats.

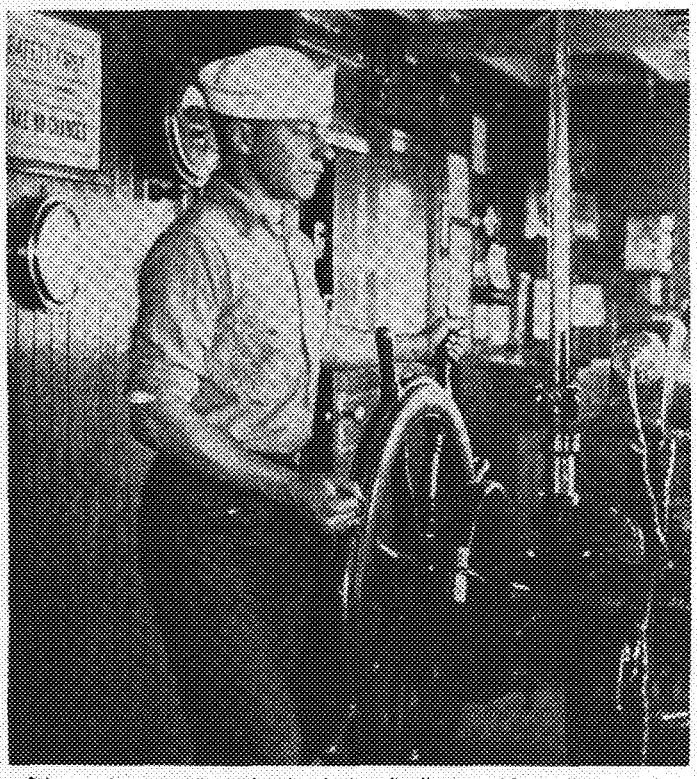
To facilitate the deck department, A.B.'s, one seaman from each watch, formed a day-gang, and the never ending scrubbing, painting, and re-rigging went on at a faster rate. The entire ship, fore to aft, was "soogeyed" (the word for scrubbing in the seaman's vernacular) with a solution of sal soda to effect the complete removal of dirt from the paint work. The next operation was to battle against rust spots, the implements of war being chipping hammers and hand scrapers. After a constant and merry fight, the spots were red-leaded, and finally painted. Much

of the rigging being of heavy wire cable, we all had great delight in taking gobs of Stockholm-tar in our lily-white hands and rubbing down the cargo gear. Following in line of duty was the very pleasant task of swabbing the steel decks with fish oil, resulting in all hands making a dash for the perfume counter of a ten cent store, upon first hitting port.

But to prove to the world that your sailor can "take it," Bos'n would drag out his heaviest holystones just when everyone was looking for a respite, and soon the men were bending their backs, wearing off the surface of the wooden decks 'midships, as well as their own surplus areas. I may explain here that holystoning is the ancient ritual handed down by generations of tars to their modern counterparts for scrubbing wooden decks. As these decks are unsurfaced, they are slushed with sea water, sprinkled with sand, and scrubbed over with the heavy sandstones to keep them worn smooth and clean.

Much as Father Neptune spouted in contempt, the raw merchant mariner found several of these occasions ripe for losing his bucket overboard. An opportune roll as the ship keeled "half seas over," and slithering across the deck would go boy and bucket, the latter ending up by going down—down to ornate the ocean bottom. And the former?—he went down too, down into his pockets for the price of a shiny new tin bucket!

It was during the evening of the eighth day out of New York that the lighthouse of Isla Grande was sighted on



The writer at the wheel of the S. S. President Roosevelt

our port bow. A few hours later we entered the breakwater and came to anchor at Cristobal, Panama Canal Zone.

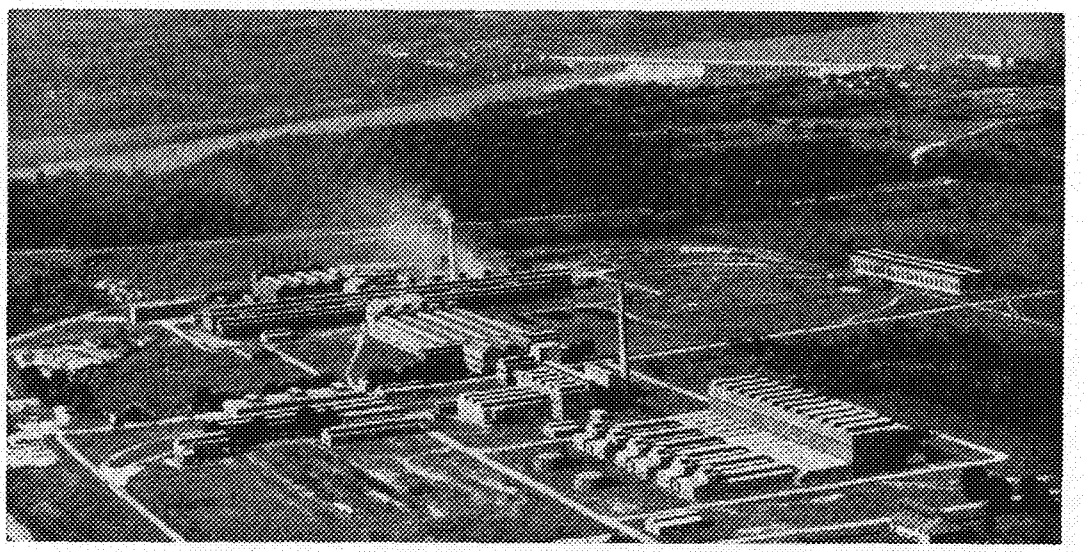
About eight o'clock in the morning when the canal was opening for shipping, a launch came out with a pilot and a crew of colored men to help work us through the locks. Following a large liner, that was given precedence in passage, we steamed slowly up the narrow channel to the entrance of Gatun, where there are three locks to go through. The canal crew made fast the lines that were passed us from electric locomotives, one on each side off our stern, and also up forward, and we were pulled into the 1,000 foot chambers. As a protective device to safeguard the 7-foot thick gates, a huge chain was extended across ahead of us to be a check in event we still had way, and we made fast our hawsers to bitts on the walls to keep us in the center.

It took about 20 minutes in each lock for the process of making fast and raising the vessel. The water comes from Gatun lake through main culverts in the walls of the locks and enters the chambers through lateral tubes opening upward through the floor. As soon as we were up, we were towed into the next chamber and the process was repeated. An hour after our arrival at the locks we were through and steaming across Gatun Lake 85 feet above sea level. Then after twisting through the canyon-like Culebra Cut and being lowered again at the Pedro Miguel and Miraflores locks we dropped our pilot and Canal crew, sailed past the huge coast artillery defenses, and out onto the heaving expanse of the Pacific, just nine hours after entering the canal.

Our master, Captain Paul Hoffman, set a great circle course for Honolulu, all hands easing into the routine of the watches, and for 17 days we rolled along, the sea and sky our only company, not once sighting so much as another freighter or bit of land. To pass the long hours of their watches below, everyone developed a hobby, some of us with braided belts and sandals, models of the ship, seabags, and hammocks as examples of handiwork. One Ordinary wrote short stories and poetry; an oiler fashioned a line and caught tuna and barracuda off our stern; the wiper developed and printed snapshots; and Jones, who had just graduated from the Pennsylvania State Nautical Academy and had his third mate's license, spent most of his time with sextant and logarithm tables, locating our position. Thus it was that two and a half weeks after leaving the Canal Zone we were glad to sight land dead ahead.

With eager arms I swung the ship to starboard at the captain's command of "right wheel." We had rounded Diamond Head, steamed parallel to Waikiki, and were now entering a channel through the coral reef that jealously guards the luring shores of Oahu. The course recorder clicked spritely as the compass needle climbed up into the second quadrant—280, 290, 300, 310—"Steady as you are!" came the order. "Three-ten it is, sir!" and I thrust the wheel 'midships. Just then four bells tinkled and Jones ambled in to take over the helm while I rove the pilot and quarantine signals to the foremast halyards, the "Stars and Stripes" already fluttering at our stern and the Isthmian Line house flag snapping above the main truck.

Although no grass-skirted maidens were on hand to deck us in leis as a welcome to Hawaii when we came alongside the dock, not one of us was disappointed. Honolulu, as well as Hilo, Kahului, and Kamapali, soon enough proved its "South Sea island magic," and two weeks later it took more than the hooting of a steam whistle and the thumping of a triple-expansion engine to arouse us for the return voyage.



Nitrate Plant No. 2—Wilson Dam in background

THE multi-purposed Tennessee Valley project in southeastern United States is one of the leading engineering developments of the decade. For sheer versatility in uses, and for future significance in almost every phase of engineering, it is the focal point of interest in every University, whether regarded from the economical, engineering, or political viewpoint.

The present set-up of half-completed structures consists of three dams—Norris on the Clinch River (see map), and Wheeler and Pickwick Landing dams on the Tennessee River. War built plants, also considered in the project, are the Wilson Dam at Muscle Shoals and supplementary power houses and nitrate plants. Major purposes of the renewed activity are three-fold: (1) control and proper use of water resources, (2) conservation and preservation of land resources, and (3) a more widespread use of electrical energy. But even these do not give the complete picture of numerous other plans which cover, and will materially affect, the fields of chemistry, forestry, agriculture, electricity, interstate transportation, flood control, and, one of the most important, government in business.

Civil Engineering

NORRIS DAM, on the Clinch River near Knoxville, Tennessee, is an upriver storage dam providing benefits to flood control, navigation, and generation of electric power. The dam when completed will be a straight-gravity mass-concrete section for the west 1,570 feet, and a rolled earth embankment 302 feet long, with a reinforced concrete core wall, connecting the concrete dam with the east hillside. The base thickness of the dam in the spillway section is 204 feet, and the height is 265 feet from the lowest point in the powerhouse foundation to the roadway across the top.

To control flood-waters, three hydraulically operated steel drum gates, each 100 feet long, will be set along the crest of the spillway, separated by 12-foot concrete piers. A concrete encased steel girder bridge for the roadway will span the three spillway openings. The powerhouse, containing two generating units served by separate penstocks, will be situated on the east side of the river, immediately downstream from the dam and adjacent to the spillway. Each generating unit will consist of a 66,000-horsepower vertical turbine directly connected to a 56,000-kilovolt-ampere, 13,800-volt generator.

Available flood-control reservoir capacity will be 2,850,000 acre-feet. This control will materially reduce flood damages caused by the Tennessee River. The annual damage, most of which occurs at Chattanooga, has been estimated at $1,000,000. Storage releases from Norris Dam will aid materially in maintaining navigable channel depth in those sections of the Tennessee River which are now difficult to navigate.

WHEELER DAM, the second major dam construction project undertaken by the Authority, is located on the Tennessee River at the head of Wilson Lake, 15½ miles above Muscle Shoals, Alabama. The construction of a dam at this site had been part of the general river improvement scheme for many years. It is primarily a navigation dam, but surplus power development and flood control will also result. The height of the dam will be 72 feet, and total length of the concrete structure will be 6,343 feet. A five story control building will contain two 45,000-horsepower turbines, each directly connected to a 36,000-kilovolt-ampere generator.

The navigation lock will be 60 feet wide and 360 feet long, with a lift of 50 feet, and will provide a 9-foot channel extending 86 miles by river to Guntersville, Alabama. Five cofferdams were built, and 500,000 cubic yards of rock removed to date.

A dam at the Pickwick site was proposed by the Corps of Engineers in their report covering the development of the Tennessee River and tributaries. The river valley there is about 1½ miles wide, with solid bedrock in a nearly level sheet across the whole valley about 10 feet below the bed of the river. The dam will consist of earth embankments across the valley on either side of the river, with concrete structures across the main channel, including navigation lock, spillway, and non-overflow section. A single lift lock of 66 feet will be built on the south side

the all-engineering project

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

A

of the river, and will have a chamber 600 feet long and 110 feet wide. The height of the dam is 110 feet. A concrete overflow spillway 1,155 feet long will extend from the lock across the channel.

The primary purpose of the PICKWICK LANDING DAM is to benefit navigation and flood control. Year around commercial navigation will be insured from the mouth of the Tennessee, on the Mississippi River at Paducah, to the head of the Wheeler Reservoir at Guntersville, Ala., a distance of 358 miles.

Three new dams recently started are: CHICKAMAUGA DAM, just above Chattanooga; GUNTERSVILLE DAM, above Wheeler; and FOWLER BEND DAM, on the Hiwassee River. These will supplement the others, and improve navigation and flood control.

Other problems which confront engineers in charge are housing, employment, land acquisition, relocation of roads and railroads, and clearing of land. Employes on Norris Dam number approximately 2,000; on Wheeler Dam 4,000, and on Pickwick Landing 1,000. Of these only about one quarter have to be cared for on the site. A typical camp is the one at Pickwick. Buildings consist of 85 temporary houses, four dormitories, cafeteria, recreation building, school, fire station, town office, store, employment office, and hospital. A separate camp is provided for negro employes. A complete water system, including a new well, a filtration plant, a system of cast-iron mains, and a 50,000 gallon tank for equalization of pressure, together with complete sanitary sewage disposal, full electric service, and oiled gravel roads, form to make almost permanent towns. The work-week is from 30 to 35 hours.

Reservoir-to-be-flooded land, approximately 215,250 acres, was purchased at an average price of $50 an acre. This includes also clearing of the land, most of which had timber on it. Some of this was burned, some cut and piled, while most was trimmed and used in construction. In the Norris area more than 100 cemeteries, involving over 4,500 graves, will be flooded. Most of these have already been moved to new locations. The waters from the three dams will also involve the moving of several miles of railroads, building of several bridges and tunnels, and relocating of several hundred miles of highways. The major bridge operation was the Clinch River Bridge, on State Highway 33, which has a span of about 1,900 feet.

Malaria control activities have received special attention in the Wheeler Reservoir area and in the adjacent Wilson Reservoir. Artificial lakes afford almost ideal breeding places for the Anopheline mosquito, especially within the latitudes of the Tennessee Valley area. Control measures consist chiefly in (1) periodic fluctuations of the water level, and (2) proper cleaning and preparation of the basin prior to impoundage.

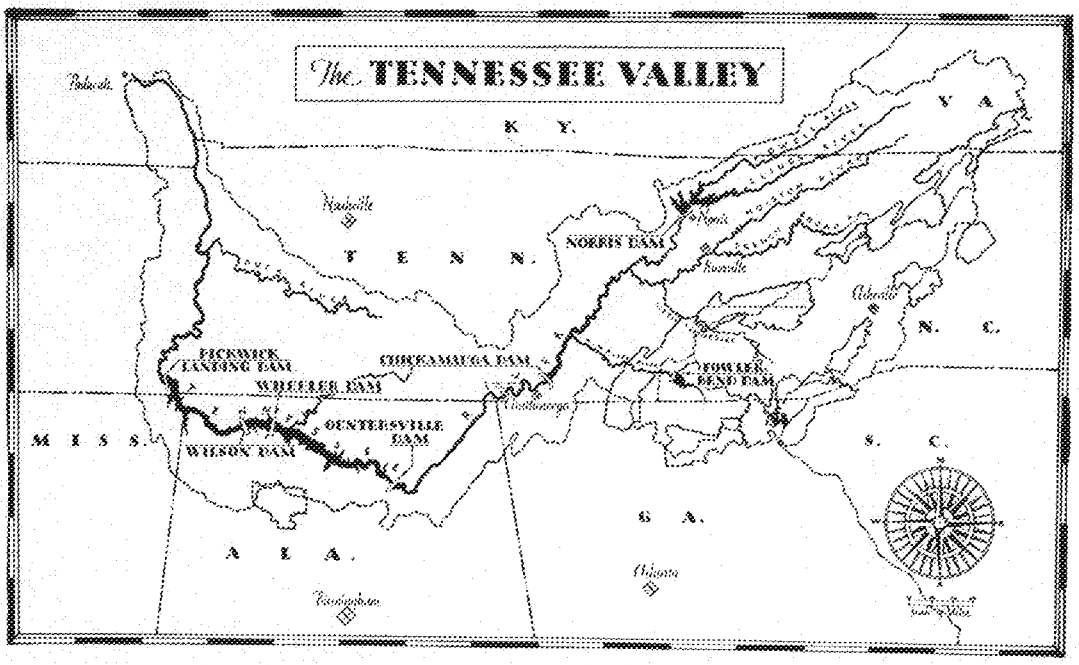
Electrical Engineering

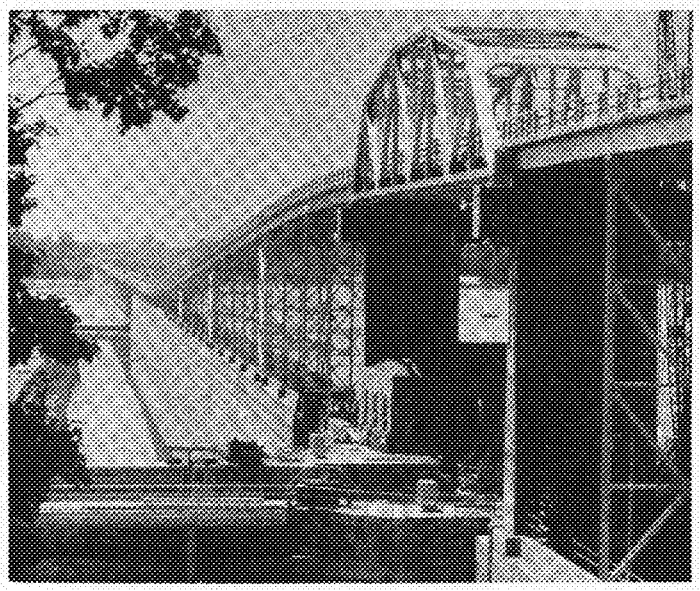
The principal transmission line in the Authority's program is a 154,000 volt line, some 230 miles long, connecting Wilson, Wheeler, and Norris Dams. Wood pole construction is used in comparatively level country, and steel towers are used in mountainous parts. Transmission lines of 44,000 volts were constructed to serve the towns of Amory, Miss., and Pulaski, Tenn., during the year; and Dayton, Tenn., was provided with power by a 22,000 volt line. Numerous other shorter branches are also being operated.

The generating power of the three afore-mentioned plants will not be needed other than to supplement Wilson plant at peak loads and low-river periods.

Special attention has been given to rural electrification, and by July, 1935, 200 miles of rural electric line had been built, and 181 additional miles were in process

Map and Illustrations courtesy T. V. A.





Road-bridge on top of Wheeler Dam

of construction. Several important advances in rural line construction also have been made. These involve economies brought about by standardization, by simplification and improvement of the conventional types of line construction, and by the use of field contracts, which give the farmers and other citizens in the areas to be served an opportunity to perform a large part of the construction work, thereby enabling them to enlarge their income and increase their interest in the program.

Chemical Engineering

After over a decade of idleness, study was started on the two nitrate plants at Muscle Shoals to determine their usability for experimental fertilizer production. Nitrate plant No. 1, completed just before the armistice, in 1918, was an unsuccessful experiment in the manufacture of ammonium nitrate by the synthetic process. Plant No. 2 was built in the same year for the production of ammonium nitrate by the cyanamid process. Up to the present it has been allowed to stand idle.

Because of the significance of phosphorus in the restoration of the soils of the nation, and in the building of a permanent agricultural program, the new deal for these plants gives major emphasis to the development of processes for the manufacture of phosphatic plant food. Steps were decided upon after conclusions were drawn that nitrogen was directly available to the farmer through leguminous plants. On the other hand, most soils in the Tennessee Valley, and elsewhere, are deficient in phosphorus, an element of the greatest concern in the program of soil economy.

More than one-half of all the fertilizer used in this country today is phosphatic in character, and the bulk of this tonnage is produced as superphosphate, containing between 16 and 20 per cent of available plant food. Research work has centered upon the problem of producing triple superphosphate by more economical and attractive methods than those already known. Experiments revealed that use of phosphoric acid having a strength of approximately 80 per cent resulted in a relatively dry product, easier to handle than the former product, and requiring no drying and practically no ageing. The process for production requires smelting phosphate rock with coke and silica in electric furnaces at a temperature of approximately 2,750° F. For this a commercial-size plant having two 6,000-kilowatt electric furnaces was built, utilizing two of the electric carbide furnaces in nitrate plant No. 2.

For national defense, nitrate plant No. 2 will remain in idleness, being kept, however, in serviceable condition. The plant will not economically produce ammonium nitrate, a munition of war, in peace time. Its capacity at peak is 110,000 tons annually. Phosphorus is also a valuable war product, inasmuch as when it is burned it has the highest total obscuring power of any smoke-screen known.

Agricultural Engineering

The agricultural program of the Authority is threefold. First is the fertilizer section, which acts in coöperation with farmers and agricultural institutions and agencies, in demonstrating the use of new forms of fertilizer and the use of fertilizer. The second section studies the control of erosion, which might result in the silting of reservoirs and in the nullification of measures for the promotion of navigation and flood control. The third section of its program is a general plan of agricultural development which takes in development of marginal land, reforestation, and well-being of the people living in the river basin.

In 1934, 188 field experiments, involving 13 crops, and eleven experiments in pots or rims, involving 4 crops, were carried on by the seven State experiment stations.

A complete soil survey of the valley is being made. Work has been done toward developing new crop products and new methods and processes of handling farm products adapted to the valley area. Research has also been carried on in the development of methods and equipment for the profitable utilization of electricity on the farm and in the rural home and community.

As regards erosion, the first step in control is the engineering phase, which consists in constructing check dams, building diversion ditches, plowing in gully banks, and mulching and matting sheet-eroded areas. The engineering structures will not bring about complete control, however, but must be supplemented by the planting of forest trees, or the reëstablishment of a vegetative cover. Reforestation work in connection with erosion control was conducted on 1,846 acres during the year, and 5,383,000 trees were planted.

* * *

Water resources data, silt and geologic investigations, and economic and social research round out most of the plans of the government in this, their first venture in this field. It is something no private company could do, regardless of the amount of money they set aside for research. Whether or not it succeeds in the financial sense; whether or not it is 30 years ahead of time, or 30 years before it will be fully utilized; and no matter whether present plans are fully completed, it is a step in the direction of America's future—full development of all natural resources, for power, power, and more power. The mechanical age is here—we must have kilowatts and ergs to make it run. Coal, oil, wood may diminish, but there will always be water. It may be our last resource. Can we engineers, as future leaders of our technological system, afford to overlook it?

"never-ending PROGRESS to perfection"

New "Orsatomat"

A new flue gas analyzer, called the "Orsatomat," will make a CO_2 analysis in 20 seconds. Results are indicated by a pointer on a large scale. The analyzing body is approximately "U" shaped. Near the bottom of one arm is the gas intake. Towards the top of the other arm is the wool which when covered with the absorbing chemical gives a large absorbing surface. The "U" has mercury in the bottom. To take a sample the analyzing body is tipped so that the gas intake is opened. Then the flue gas is aspirated into the measuring chamber. The "U" is then turned the other way which seals the gas inlet and forces the gas into the absorption chamber. The absorbing chemical floats on top of the mercury, and drops below the level of the steel wool. The shrinkage of volume of the sample due to absorption causes a metal bellows to collapse and moves the pointer indicating the per cent CO_2. The absorbing chemical retains its strength for long periods, and recharging is simple and inexpensive.

Noiseless "Auto-shift"

Production has been started on a new "auto-shift," a vacuum operated transmission for passenger cars and trucks. The unit is self-contained and control is by a finger lever mounted on the steering column below the wheel. Gear shifting is pre-selective and noiseless, being accomplished without the use of electricity.

Mechanism-less Scale

A new scale for weighing manufactured parts has no indicating mechanism. A simple shadow on the scale is substituted which eliminates parallax in readings. The scale also has twice the travel per ounce that former models have. The manufacturer claims that the scale need not be level to weigh correctly. All working parts are enclosed in a modern case which is rubber mounted.

Cu. Base Castings

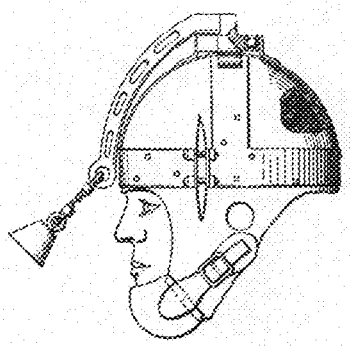
A new copper base casting alloy with a small amount of cobalt beryllium is now being marketed. Heat treatment produces high strength and hardness. The alloy has a high electrical thermal conductivity. Properties of standard test bars are: 95,000 lbs. per sq. in. tensile strength 50 per cent electrical conductivity, 85,000 lbs. per sq. in. elastic limit, 5 to 8 per cent elongation in 2 inches, 96-98 Rockwell B hardness. Heat treated castings are the only available form of the alloy.

Power at $.002 Per Kw-hr.

From information received in this country, a new type of steam plant at Leverkusen, Germany, will produce electricity at $0.002 per kilowatt hour. The plant is rated at 250,000 hp. The vertical boiler has tubes between 75 and 100 ft. long. Steam is drawn off the heads of the tubes at 1000 lbs. press and pumped to the bottom, being delivered at 2000 lbs. press. There is no water in the fire box. Powdered coal is burned in the furnace at a temperature of 500° C. The working pressure is 135 atmospheres. Cottrell precipitators are used, there is no fly ash or combustible matter given, and no conventional smoke stacks are used.

Brain Exerciser

The little device pictured here was issued patent No. 2,051,366, Aug. 18, 1936. The harness is adjusted to the head which is then shaken like a cocktail. The weight attached to the front rotates and bounces around beating the face to a pulp and exercising the neck. This is stimulating, especially to the brains, if any. However, we do not recommend its use even during finals week.



Glass Faces on Concrete

Concrete building blocks and wall tile are now available with a glass face. The concrete is coated with a metallic binder and the glass is secured to the binder with a mastic coating. It is claimed that the new product is suitable for hospitals, dairies, restaurants, bathrooms and other places where sanitary construction is necessary.

Crankcase Oil Refiner

A new development for internal combustion engines is a crankcase oil refiner that operates while the engine is running. The oil flows under pressure down through a perforated tube which is covered with a fibrous material. Surrounding the tube is a refining material contained in a perforated cylinder through which the oil flows into an outer cylindrical space. The oil then flows back to the crankcase after passing through a screen. The refiner is built in two sizes, one for 7 qt. capacity crankcases and the other for 12 qt. capacities.

The Minnesota Techno-Log

NOVEMBER, 1936

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

EDITORIAL STAFF
Donald Erickson, Copy Editor
Herbert Gaustad, Alumni Edr.

BUSINESS STAFF
Tom Jackson, - Circulation
Gordon Brierley, Adv. Rep.
Robert MacDonald, - Office

REPORTERS
Fred Warner, Charles Strom, Bertil Lindquist

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, Treas.; Professor E. H. Comstock, *Mines;* Professor R. E. Montonna, *Chemistry;* Donald Randenbush, *Electrical*, Pres.; Louis Reigert, *Architecture;* Lawrence Rollin, *Civil;* William Hanson, *Mechanical;* Elden Olson, *Aeronautical;* Edward Eidam, *Mines.*

A Place for Senior Review

IMPROVEMENT in education is always desirable. And education *is* one force that never stands still. When not improving surrounding conditions and general welfare, it is always seeking new ways to more firmly imbed in the human consciousness an ever-increasing knowledge. Some say in regard to the engineering courses that they are taught merely to show the student *where* to find things, *where* to go to get information for the solving of problems. Others and more advanced thinkers hold that the only true and useful knowledge is that stored in the conscious or subconscious mind.

But too many factors enter the case to hold either contention true. Man does not, cannot grasp and forever hold all that he has seen pass in front of him on printed page or blackboard. A genius may have an abnormal memory, but it must not be forgotten that there isn't one of them born every minute. And so it can perhaps be stated quite truthfully that without constant use, information in a certain branch of study passes into the realm of nothingness.

In our own University there has been started an institution, the Center for Continuation Study, which will keep the professional man up to the latest "tricks" of his trade, and, coincidentally, provide him with many forgotten tools of his trade.

To the seniors: we wonder how many of you remember, other than your math, your freshman subjects. Do you know how to properly address a letter; have you been keeping up with reading books, not still required other than by a personal sense of moral responsibility to keep other than cold scientific faculties going; can you still balance chemical formulas, find the number of moles in a liter; follow the correct order of inking, and so on?

Knowing many of you are hazy on these subjects, we suggest a senior year course on the order of freshman orientation, in which lectures be given in rotation by the various departments. A credit class perhaps, which will serve to fill the four-year gap, and which will bring back the essence, in a concise review, of many a course you perhaps really never understood in the hurly-burly of working problems, where the forest couldn't be seen for the trees. Very soon engineering courses may take 5 years. An even longer period, with more to forget. Adult education by all means, but senior review first.

At the Desk

A thundering giant press sets the theme this month on the cover. This press does not print, however, but stamps, molds, stretches, and cuts into shape Buick's one piece fenders. Automobiles also add to the magazine's tone in the first article, a timely one on the new safety-stressed 1937 cars. Hypoid rear-end gearing and all-steel cars are some of the features.

Through the courtesy of the United States Steel Corporation we have on the frontispiece a cut showing the open hearth furnace at their South Chicago works.

Before Al Isaacs came to the Institute this fall he took a little trip here and there to see what the world looked like away from the Minnesota prairie. Hawaii was one of the main objectives, and waving palms were not all he noticed. He writes "Ahoy—the Pacific."

Some of the latest dope on the TVA is contained in the third article this month. It really is an immense project when one considers it, and reference to it can safely be made now that the election is over. Interesting notes on latest engineering advances are contained on PROGRESS page.

Mr. Haga reviews a very fine book, *Fugue in Cycles and Bels,* that all engineers positively should read. It is as interesting as the title.

An architects' page is a new feature this month and contains valuable hints to freshmen, and a special page records organization of an Aero Alumni group. Two columnists and Mental Tilts together with Institute news complete our magazine.

Followers of the magazine will be pleased to hear that former editor Stone's magazine for last year won second place at the ECMA convention for the contest in student written articles.

Registration Figures

Institute of Technology

November, 1936 (Incomplete)

Fall Quarter

Course	1936	1935
Aeronautical Engineering	235	202
Agricultural Engineering	21	24
Architecture	99	88
Arch. Engineering (Disc.)	1	6
Civil Engineering	192	162
Chemistry	157	125
Chemical Engineering	380	269
Electrical Engineering	298	254
Interior Architecture	8	8
Mechanical Engineering	284	229
Mines*	174	190
Pre-Business	44	33
Physics (New Course)	7	0
Unclassified Freshmen	77	0
Unclassified Students**	13	0
Special Student	1	1
Total	1,991	1,591

*Registration not officially in institute in 1935.

**Classifications of 13 students were unavailable as total registration was given by registrar as 1991.

Now Here's A Book

By Clifford I. Haga

Instructor in English

WERE I asked to summarize John Mills' *A Fugue in Cycles and Bels*, a recent accession to the Engineering Library, I would merely quote from page 185: "For better or for worse, we are entering a new period in the development of music." This non-committal sentence not only sums up the content of the book, but also reflects the tone of the writing. In a way the effect of *A Fugue in Cycles and Bels* is to urge a suspension of judgment until we gain full experience of the results, both positive and negative, of the technology of sound transmission, recording, reproduction—and creation.

Mr. Mills is a physicist, the author of many textbooks and technical papers, and a research director in the Bell Telephone Laboratories. So much for his professional qualifications: they are adequate. But this book, written for laymen, needs more than a command of subject matter; it demands a skill in writing more rare and elusive than that normally required to write even a good textbook. As an example of "popular science," that difficult type of exposition which must serve two masters, Mills' book is especially notable for its ease and clarity. Too often popular science, in its feverish effort to excite and amaze, becomes a mere splurge full of "Hey, lookit! Gangway for the millennium!" There is none of that poppycock in *A Fugue in Cycles and Bels*. It wins the highest praise one can give popular science: its reading requires almost as much effort as that given to a textbook.

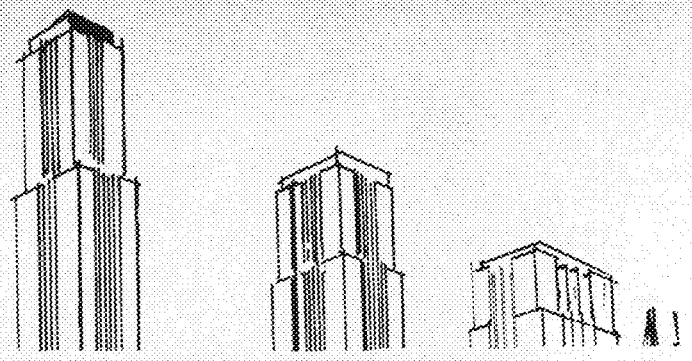
The reason why it so richly rewards the reader's effort is obvious. In a little over 250 pages, the author briefly reviews a mass of details. In four sections he gives us this: a condensed summary of acoustic theory from Pythagoras to Bell, next a rapid survey of recent laboratory investigations of sound and of electricity, then a genial and encouraging forecast of what he calls the "electrical future" of music, and last (for the picture-minded) a variety of graphs, tables, and curves. Naturally the two most interesting and profitable parts are the second and the third, the Laboratory and the Machine, one might call them.

In the first of these, the Laboratory, we learn what the physicist knows about sound; in the second, the Machine, we discover what the electrical engineer is ready to give us. The physicist, in effect, debunks many of our popular notions of sound and music. Sound is so frequently a subjective sensation that what we think we hear is not always what was actually transmitted to the ear. But when sound becomes music with all the natural appurtenances of tradition, sentiment, and feeling generally associated with art and its symbolism, that subjectivity of perception makes a simple physical phenomenon elusive and deluding. The cold fact of the physicist's conclusions is that we are not capable of hearing the music that we can produce. Yet if we could hear all of it, hear it in all its purity and power, would we enjoy such perfection? That question is one of taste, where the physicist sensibly avoids judgment and risks little more than an implied prediction that we would not like it at first. Few mortals have ears tuned to angelic choirs.

But what of the electrical engineer and his machines for bringing into our homes the perfections the laboratory theorist finds so easy to predict? Will practical probability overtake possibility? Yes, says Mr. Mills; the engineer has already won technological victories as amazing as the predictions of the scientists. He has transmitted symphony programs by radio so perfectly that the far-off audience heard richer music than did the audience before the orchestra. Better than that—more astonishing, we should say—is the engineer's *tour de force*, synthetic and mathematically perfect music created by mechanisms quite independent of any originating instruments we would call musical.

Sound is pure mathematics to the physicist, and he proves by slide rule and graph paper that music of a power and purity undreamed of can be ours. Sound is energy to the engineer, and so is electricity; with oscillators and amplifiers, tweeters and woofers, he can give us that music. In laboratory and shop waits a new glory for our most ancient art—if we make the better choice.

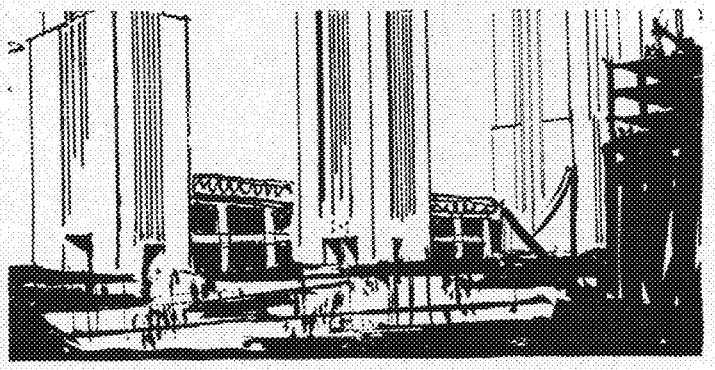
"Architecture,



the most conscious of the arts in conception and execution, is . . . the most unconscious in its sources."—M. Elie Faure.

Gerhard Brandhorst, Arch. '36,

Lets Freshman Architects have the inside on the pursuit of their Course.



FRESHMEN—I hope that your sense of taking things for granted does not so carry you away as to make you believe unconsciousness to be the best state of mind for the learning of architecture. Quite the contrary. These unconscious sources are really not many, but one—the background from which an architect derives his inspiration, if you call it that. Into this background goes everything the architect has ever seen, done, heard, read. The usefulness of this source depends, in general, upon the scope, direction, and acuteness of perception of all this seeing, doing, hearing, reading.

Architecture is an imperishable march of time, recording civilization not in cinematographic film but in sticks and stones. Its success in the recording of its time and, therefore, its greatness as architecture depends upon the designer's depth of perception and realization of all the sociological, intellectual, technological, and economic needs of that time. While it may not be immediately apparent, all these currents are reflected by buildings. The sociological form rampant in any era will determine the type of buildings to which most attention will be given. The predominating civil life in Rome resulted in great forums and basilicas for the transaction of business and politics. The religious life of the Middle Ages brought the cathedral. Intellectual currents will help shape the form, whether it be befuddled as in Victorian days or clear cut as in today's relatively few examples of modern work. Technology determines materials and their uses. Economic status tells that all-important thing, where money comes from. Architecture shows all these things. So the background from which the architect produces his architecture must contain knowledge of all these. Another part of this background of unconsciously used source material is an integrated knowledge of these currents of past eras and their recording in sticks and stones. While the entirety of this background will certainly not be obtained in school, the beginning of it just as certainly will.

This ensuing first year of the five you are about to devote to studies in architecture is the best for beginning to study this background because it has few of the minutae of actual architectural procedure in it to divert you from the greater task. By learning something of all these other things first, you can see more readily all of the parts in relation to the whole and appreciate the relatively minor parts played by the actual technique of drawing and rendering in the production of real architecture. Opportunities for the assimilation of this background are world-wide but their local manifestations are numerous. For such use as it may be to you, a few of them have been enumerated—all extra-curricular.

The intellectual activities of times past and present—literature, art, music—show how men are expressing in other media what you are attempting to express in buildings. Literature is usually the first of these to signal changing currents in the thought and habits of a people. The libraries of the two cities and the one on the campus have large and varied collections of work in this medium. The Arthur Upson Room in the University library is, incidentally, an excellent place for recreational reading—a luxurious room devoted solely to that purpose. Art and music, more closely akin to architecture, but far beyond it in abstraction, are important to the architect in a more indirect fashion. The University Gallery and Art Reading Room, both in Northrop Auditorium and the Art Institute and Walker Gallery in the city of Minneapolis, are rich in examples of the reaction of the artist to his time.

The concerts of the Minneapolis Symphony Orchestra and the Artists' Course recitals in Northrop Auditorium, a great variety of concerts of all sorts of the University music department, and the frequent and excellent gramophone programs of the University Radio Station WLB give ample opportunity to learn how the world sounds and has sounded to the composer. Sociology, Technology, Economics show what the world is doing and, to a degree, what it needs. Those things are not available in quite so concentrated a form. Books, newspapers, and some organized courses of study in the University record activities in these fields. When you have come to some realization of all these things, you are ready to begin what on the surface appears to be the main thing—the acquisition of professional technique, the procedure of designing and building the buildings which will embody these ideas.

Here in the Architectural School is an excellent professional library which should be included in these assimilation activities. Study and read about building. Familiarize yourselves with the various books and see what is in them. You will find the ability to locate a reference from

your mind rather than from awkward files a handy asset. Read as much as you can, particularly in current periodicals, whether everything is crystal-clear and obvious or not. They, too, will be an unconscious source.

The least important by itself, but of great importance as a means to an end, is the mechanical part of producing architecture, *i.e.*, drafting and rendering. Without it you produce no buildings, but with it and nothing else you produce no architecture. The school drafting rooms are always open for your inspection. The amount of information you can absorb about handling instruments by watching over someone else's shoulder is surprising. No one will mind your doing this, and you will not regret having done it when you are given your first program and told to bring forth lines on paper showing your conception of its solution. Pay also close attention to the student problems hung in the hall. These will give you some idea of the way things are done in this school.

You will probably ask sooner or later, "After I have assembled all these conscious and unconscious sources where will I get a building for which to use them?" In this connection I present a quotation from "Desperate Remedies" by the English novelist, Hardy, himself once an architect. While the thought probably needs tempering, it needs little else. "Those who get rich as architects . . . have a certain kind of energy which men with any fondness for art possess very seldom indeed, an earnestness in making acquaintances and a love of using them. They give their attention to the art of dining out after mastering a few rudimentary facts to serve up in conversation."

'M. I. T.' Under New Heads

Straub, Smith, Comstock Aid Lind

PICTURED on this page are aids to Dean Samuel C. Lind in the administration of the new Institute of Technology. Although they do not act as a group, they form the administrative board for the new Institute. Each as an individual makes decisions in connection with problems in their respective colleges.

Professor Elting H. Comstock is administrative assistant for the School of Mines and Metallurgy. In this capacity he is responsible for those problems which relate to the School of Mines. Professor Comstock has served several years in the School of Mines as professor of mine plant and mechanics.

Professor Lee I. Smith is administrative assistant for the School of Chemistry and Chemical Engineering. His responsibility is to handle those problems which specifically relate to the School of Chemistry. Professor Smith has been associated with the School of Chemistry for 16 years. He has been serving as chief of the organic chemistry division and will continue his duties in this capacity along with his new duties.

Professor Lorenz G. Straub has been appointed administrative assistant for the College of Engineering and Architecture. His responsibilities are similar to those of Professor Smith and Professor Comstock, in Chemistry and Mines, being concerned with the College of Engineering and Architecture. Professor Straub was professor of hydraulics before his appointment to his new post.

Dean Lind has been able to pass on those matters related to any of the three colleges under the Institute to these men and spend his time on problems concerning the Institute as a whole. The TECHNO-LOG takes this opportunity to introduce them to students.

—Pictures from Minn. Chats.

Professor Elting H. Comstock

Professor Lee I. Smith

Professor Lorenz G. Straub

AERONOTES

Charter Members of the California Aero Alumni

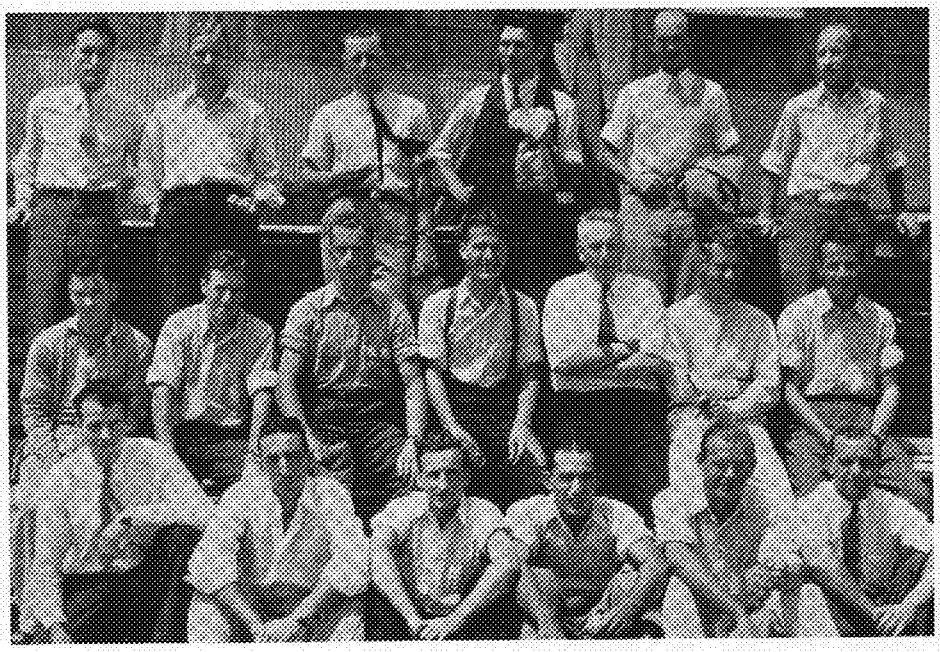
DOUGLAS			
Ralph Adams, '35	Planning	828 6th St., S. M.
Merle Beaupre, '35	Drafting	828 6th St., S. M.
Kasper Berline, '35	Drafting	501½ N. Lucerne, L. A.
John Brueckner, '33	Drafting	2505 Dewey St., S. M.
Howard Clark, '36	Shop	In school
Sanford Falbaum, '35	Drafting	871 N. Oxford, L. A.
Powell Grady, '34	Tr. Course	320 Mesa Rd., S. M.
Ernie Johnson, '36	Shop	1443 Holt Ave., L. A.
Raymond Kochevar, '35	Stress Anal.	1920 S. M. Blvd., S. M.
Alfred Lau, '35		2654 30th St., S. M.
John Mokres, '32	Draftsman	3307 Durango St., L. A.
Frank Murphy, '32	Tr. Course	1637 Greenfield, L. A.
Nicholas Napavance, '34	Weights	1045 N. Hayworth, Hollyd.
Bernhardt Petry, '36	Shop	In school
Richard Pribil, '35	Drafting	1435 26th St., S. M.
Roy Thompson, '35	Weights	1603 Brockton, L. A.
A. Weissenberger, '35	Shop	2817 3rd St., Ocean Park
William Zehnder, '35	Weights	828 6th St., S. M.
LOCKHEED		
Roy Lessard, '36	Drafting	216 N. Valencia, Burbank
Graham McVicker, '35	Drafting	216 N. Valencia, Burbank
Louis Meraudi, '36	Shop	Address unknown
Oscar Wehmanen, '35	Drafting	216 N. Valencia, Burbank
NORTHROP		
Harold Anderson, '34	Drafting	4231½ W. 28th St., L. A.
Henry Ericksen, '36	Eng. Clerk	1808 S. Hover St., L. A.
Chesley Reynolds, '34	Stress Anal.	1222½ Murfield Rd., L. A.
Herbert Swift, '34	Stress Anal.	1036 E. McGirk St., Elmonte
Stanley Vye, '33	Stress Anal.	4231½ W. 28th St., L. A.
NORTH AMERICAN		
Fred Boeke, '33	Drafting	349 Queen St., Inglewood
Walter Spivak, '33	Armament	1920 S. M. Blvd., S. M.
CAL. TECH.		
William Sears, '34	Grad. Work	196 S. Sierra Bonita, Pasa.
Homer Stewart, '36	Research	Address unknown

Aero Alums Form Club in California

Minnesota Aeronauts believe in the old adage "In union there is strength." Graduates in California have formed, under the leadership of Walter Spivak, '33, the Minnesota Aeronautical Engineering Alumni Association and hold meetings at periodic intervals.

The purpose of the organization is to help their members get better jobs as they rise in their respective companies, get jobs for new Minnesota men who come down there, and to help them get a place to stay. The club also finds that news of their alma mater and the home town gets around faster if they meet in one group. And another reason for organization lies in the promotion of good old convivialty, without which life is mere empty motion. They have discovered that the more men, the more fun, and therefore are awaiting the arrival of the rest of the boys who will get their sheep-skins this spring.

The men in the picture are members of the club who spend their days with the Douglas Aircraft Company, doing their bit to make those ships airworthy and comfortable. On the left is an almost complete list of the membership of the organization at the end of the summer. The addresses are all in California and the boys have asked to hear from the locals.



In the photo are Aeros who are working with Douglas Aircraft, some of the members of the Aero Alumni Club of California:

TOP ROW
Roy L. Thompson
Ralph D. Adams
Kasper E. Berline
John A. Mokres
John D. Brueckner
Nicholas Napavance

MIDDLE ROW
Frank W. Murphy
Ernie L. Johnson
C. Powell Grady
Alfred H. Lau
Prof. Boehnlein
Bernhardt Petry
Howard H. Clark

BOTTOM ROW
Richard F. Pribil
Merle A. Beaupre
Anthony Weissenberger
Sanford Falbaum
Raymond J. Kochevar
William R. Zehnder

Thank the G-men and the T-men, too.

BEHIND the scenes, in many a capture by G-men, will be found the service provided by T-men—telephone men (and women, too) of the Bell System. ¶ Law enforcement officers make frequent use of both local and long distance telephone service. They depend on the Teletypewriter, for quick and accurate transmission of written messages. They tighten their nets with the aid of yet another Bell System development, police car radio. ¶ And so the telephone, with products and services growing out of it, helps to make your life happier, broader and more secure.

Why not report "All's well" to the folks at home? For lowest rates to most points, call by number after 7 P. M. any day or anytime Sundays.

BELL TELEPHONE SYSTEM

Three Mining Alumni Become Executives In Major Companies

Three graduates of the School of Mines and Metallurgy have recently become general managers of major mining companies of the world.

Oliver J. Egleston, E. M. 1900, has been appointed general manager and vice president of the United States Smelting, Refining and Mining Company. Soon after graduation, Mr. Egleston entered the employ of this company as a mining engineer, and for a number of years he was manager of their Alaskan gold properties at Fairbanks. As a result of his recent promotion, he will reside in Salt Lake City, Utah.

Arno Winther, E. M. '03, has been appointed general manager of Miami Copper Company at Miami, Arizona. Since graduation, Mr. Winther has resided in Cerro de Pasco, Peru, and in various western mining camps of the United States. Several years ago he went to Africa as general manager of the Rhokana Corporation, finally leaving to take up his present work at Miami.

Guy N. Bjorge, E. M. '12, has been appointed general manager of the Homestake Mining Company gold mine at Lead, South Dakota. Mr. Bjorge spent some time after graduation in South America and then returned to Globe, Arizona, where he was chief geologist for the Old Dominion Copper Company for four years. He was associate editor of the Mining Congress Journal until 1932, when he went to the Homestake properties as Assistant General Manager.

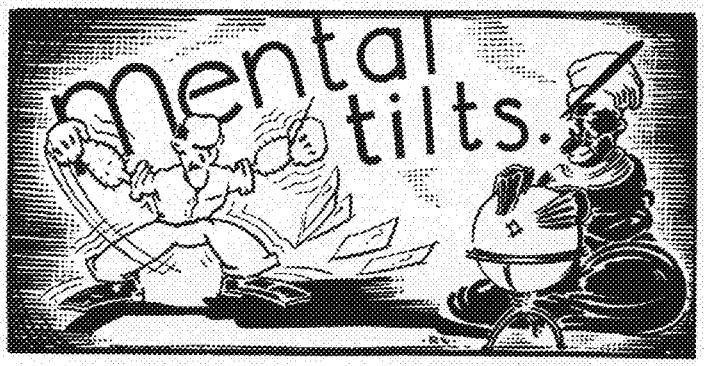
Andrew Y. Peterson, E. M. '99, general manager and vice president of the Oliver Iron Mining Company, and William A. Rose, E. M. '06, general manager of Pickands Mather and Company, are two other Mines graduates who can sign their name as "General Manager" of leading mining organizations.

Seniors To Exhibit Tri-School Design

Thirty-seven seniors in architecture have just completed their first collaborative inter-school design problem, a milk plant for a city of 500,000 population. The best plans are now being selected by faculty members for exhibition together with those from the Massachusetts Institute of Technology and the Cornell University.

Starting the first week of the quarter, students have been working on this problem for Grade III Architectural Design, planning a creamery of 175,000 lbs. daily capacity.

The best plans from the three schools will be exhibited, the display being at Minnesota sometime in December, and at the other institutions during the same month.



IN a theory propounded by some scientist or other, it was stated that if a person afflicted with stuttering walked on all fours, an improvement, or even complete recovery, was the result.

This idea started me thinking and, though I don't stutter, I thought that if some odd position could help the stutterer it might also be helpful to a poor scholar trying to get the concepts of engineering clearly in his mind. To make it really technical I shall outline the results of the test that I made.

1. **The Hands-and-Knees Position**—If it worked for stuttering, it might accelerate mental activity. My three-year-old brother thought it was swell; he climbed on my back and for the next hour I was his horse. All I got out of that was a pair of sore knees and a kink in the back.

2. **Lying Down**—This position was a partial success; all concern about this page completely vanished, as I passed into sound slumber.

3. **Sitting with Feet on a Desk**—Colgate University has found that men in this position (no ladies tested) worked 7.1% faster and were 14.1% more accurate, but I found that it was only a good position for a smoke.

4. **Standing on Head**—My watch fell out of my pocket and broke the crystal. Then I heard my sister coming and, rather than attempt to explain to her, I concluded the experiment, telling her that the boy had broken the crystal. He was taking a nap then and could not deny it.

With my experiment being brought to such an abrupt end I found myself in the usual position, sitting on a hard chair, feet twisted up under the table, elbows on table, and my poor head raw from vigorous scratching with a pencil. This is what eventually evolved:

Five engineers are respectively a Mechanical, Electrical, Civil, Chemical, and Mining Engineer. Their names, not necessarily respectively, are Blueprint, Detail, Tracing, Drawing, and Assembly. Each of them has one sister and one only, and each is married to a sister of one of the other engineers. Tracing is not a Mechanical Engineer.

The following data are available. The Chemical did not work in Cincinnati. Both brothers-in-law of Detail worked in Pittsburgh, as have both brothers-in-law of Drawing, but neither brother-in-law of the Mechanical. Drawing worked in Akron, as have both his brothers-in-law; the Mining Engineer did not. The Electrical worked in Dayton, as have both his brothers-in-law. Drawing worked in Dayton, as has his wife's brother. The Mechanical did not work in Dayton, but worked with both his brothers-in-law in Cincinnati. Assembly did not work either in Cincinnati or in Akron.

Taking all the above into consideration, we now ask you to determine the maiden names of each of the various engineers' wives. This problem is similar to one last month, but we found the last one very popular. Try again.

* * *

Now here is one for you farm campus people, Ag Engineers, or what have you.

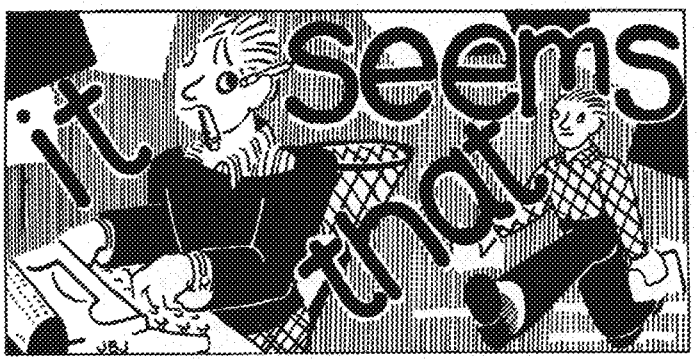
Three cows eat in two weeks all the grass on two acres of land, together with all the grass which grows there in the two weeks. Two cows eat in four weeks all the grass on two acres of land, together with all the grass which grows there in the four weeks. How many cows, then, will eat in six weeks all the grass on six acres of land together with all the grass which grows there in the six weeks?

Just to make it real easy you may assume that the quantity of grass on each acre is the same when the cows begin to graze, and also that the rate of growth is uniform during the time of grazing.

* * *

The winner of the buck last month was John G. Davies (stand up, John), who brought the answer in promptly at 8:30 a. m. the morning after the "Log" was out. The ladder is 105 feet long and its foot is 2.31 feet in on a perpendicular erected at a point 32 feet from the 100 foot pole on the edge of the field holding the 100 and 80 foot poles.

Answers to the other problem are available in the magazine's office. The $1 prize is open for the first correct solution this month.



By Melvin 'Pete' Lohman

Columning has its dangers, already a certain sophomore girl has threatened us with physical violence. We virile engineers think that the "Tech" is overrun with girls now. Have we any volunteers to take Home Ec to get even with them?

The best hunting story concerns the civil society prexy, Tom Klingel. Tom, being a man of slight physique, decided that the blunderbuss he was shooting kicked too hard, so-o-o he reasoned that if he held it a few inches from his shoulder it would lessen the impact. Evidently, Prof. Wilcox hasn't made ½Mv² clear to Tom.

Bob Kuphal reported that the military camp in Oklahoma was so dry that the trees chased the dogs around. Which reminds us of the incident at the Chicago encampment. The rifles "banged" and a surprised pretty girl stepped back into the arms of a cadet. "Oh, I beg your pardon," she explained, blushing furiously, "I was so startled by the rifles." "Oh, that's all right," said he, "Let's go over and watch the artillery."

The latest pony express dispatch from the Mines School tells us of the plight of Bill Chandler. He was arrested for speeding in St. Louis Park. When asked how fast he was going he replied that he must have been doing sixty as he passed two signs that said 30 miles per hour.

Woody Johnson, the Mines politician, found the streetcar service in Crosby, Minn., to be terrible. This summer he waited on a corner there from 2 a. m. to 6 a. m. before someone told him the nearest streetcar was in Minneapolis. We wonder if the reason for the streetcar-waiting is the same as for his sleeping in the bathtub a few nights later.

Our contribution to "mental tilts"—If the big horses say "Nay, Nay," where do all the little horses come from?

What Prof told his class he had a good cure for those who couldn't go to sleep in his class? It's a glass of whisky per hour. Won't put them to sleep but it makes it a pleasure to stay awake.

Dean Holm finds photographers' daughters very attractive at Cass Lake. Is that the cause for the luxuriant growth on his lip? . . . . The best ambition in life is that of Dick Mallander. He wants to be a philanthropist.

The senior M. E.'s are wondering when an instructor of theirs is going to change his neck-wear. After five weeks they feel they need a change of scenery.

One of the worst and most flagrant offenses of reckless driving—mixed up with a hit-and-run accident—never saw the press—it was a Minneapolis cop. . . .

And Miner (or is it Minor?) Simmons asserts that the mental tilts were too easy—he wants them printed in French to make them harder . . .

Bert Linquist, late of the U. S. Naval Air Corps, after a particularly bad flight asked his instructor whether he'd ever make a pilot. "Oh yes," the instructor replied, "If you keep this up, you'll make an ace of yourself yet." Bert is still wondering.

Bill Bannister finds that Chi Omega lass so attractive that he squired her to the Northwestern game. It's all right fellows, he was well chaperoned. Fred Comb was also upholding the dignity of the Engrs. at NW.

And to close with a rhyme,

In summer, spring and also fall
I do not like to work at all.
In winter, as you may have guessed,
My favorite indoor sport is rest.

—So it seems.

Pickle-Odes

By B. H. T. L.

The only possible excuse we can think of for this is that maybe we're pioneering—there's never been a column written on pickles before.

Personal nomination for the Champion Pickle Queen of the World: 87-year old Mrs. Louise Drake of St. Louis Park.

The fellow who mumbled, "a jug of wine, a loaf of bread, and thou," made a bad mistake when he omitted the dill pickles.

The dill pickle is the one piece de resistance which elevates a meal from the mere prosaic task of taking on more fuel (yeh, I know, there's no fuel like an old fuel, now shut up) to the epicurean rhapsody of the gourmet (yeah man) supping with the angels, if you will sir.

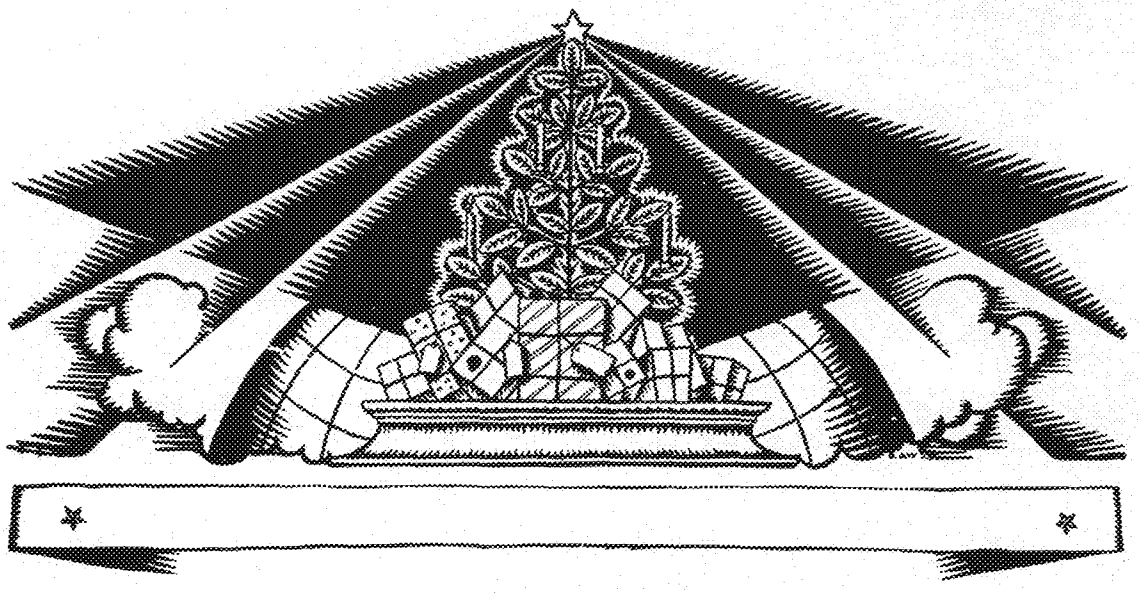
Pretty Pickles

(1) Ardently (and skillfully?) pumping the woo, via the telephone, to a newly-met wanton wench, and turning around to find the OAO applauding your efforts with fire in her eyes.

(2) It is a summer morning, you are whooping the two-wheeled peril down the avenue, late for work, rising sun in your eyes, no goggles, and an easy-working throttle in your right hand. You swing left at a stop sign, so low your spill-bars are knocking sparks out of the pavement, and your eyes suddenly, momentarily, pierce the dazzle befuddling the old optics to find another cycle right in your path! You skid your machine, pull it into a tighter turn and look up to find the other rider, back-tracking furiously to keep from being struck, is a speed cop sitting on the wrong side of the street hiding in wait for sign-jumpers!

(3) You've turned in your report on the deadline—a beautifully written, engineering masterpiece. You reach home, sit down to a wonderful dinner and then a mental thunderbolt hurls you into a full-blown panic, the realization strikes that you have turned in not only the masterpiece of which you are so proud, but with it also is last year's "A" report, the one you copied! "What's the matter, John—don't you like your dinner?"

Pass the pickles. . . .



Fall and Winter Purchases

Where Will You Make Yours?

There are 26,000 independent home-owned stores in Minnesota and surrounding states ready to serve your every need.

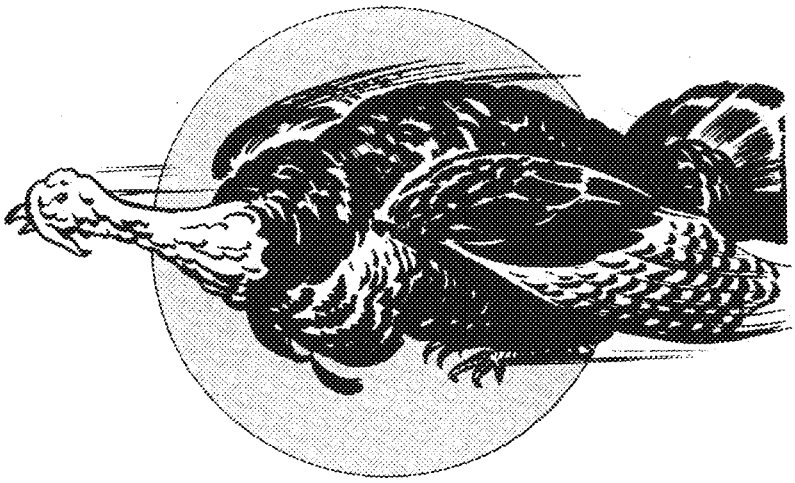
●

Patronize these neighborly stores . . . . see that your money goes to a home-owned institution . . it's good business all the way 'round

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis Saint Paul



GET YOUR TURKEY

On the Wing!

FIND YOUR HOME HERE		
EAST		
	Flying Time	Roundtrip Ticket
Chicago	2 hrs.	$ 30.00
Cleveland	3½ hrs.	62.85
Detroit	3⅝ hrs.	53.85
Buffalo	5 hrs.	76.80
Pittsburgh	6¼ hrs.	75.45
Washington	7½ hrs.	94.80
New York	6¼ hrs.	116.30
Boston	10½ hrs.	127.55
WEST		
	Flying Time	Roundtrip Ticket
Fargo	1½ hrs.	$20.00
Winnipeg	3¼ hrs.	35.00
Bismarck	3¼ hrs.	35.00
Billings	5⅞ hrs.	71.00
Butte-Helena	7⅜ hrs.	90.00
Spokane	9⅜ hrs.	114.00
Seattle	11½ hrs.	136.00
Portland	13⅜ hrs.	151.88

There's no place like Home for Thanksgiving dinner. And no way like Northwest Airlines for getting you there in a hurry.

Whether Home is New England or the Pacific Northwest . . . . you're not even a day away! As you sail smoothly along in your luxurious Northwest Airliner, you almost forget you're traveling. Before you know it you land in the bosom of your family—all set to tear into that turkey.

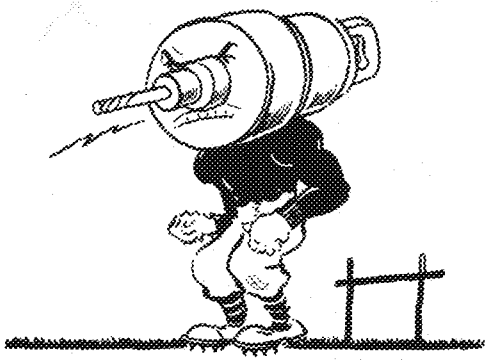
Now may we help you fly home for Thanksgiving? Our new timetable shows complete schedules and convenient through connections to most every city in the United States or Canada. Or better still, let us give you a "custom-made" itinerary, showing all departures and arrivals with total cost. Simply call—in Minneapolis: BR. 3141 or BR. 1366; in St. Paul: GA. 4881 or RI. 4500.

NORTHWEST AIRLINES

Minneapolis Ticket Office—137 South 7th Street

St. Paul Ticket Office—115 East 4th Street

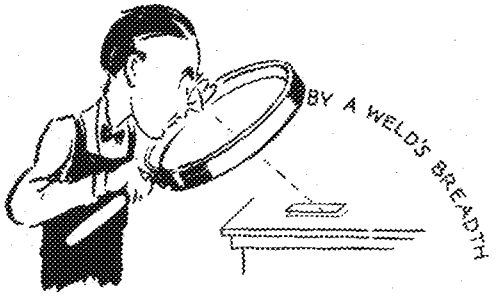
G-E *Campus News*



ALL-AMERICAN DRILL

The guards on a football team usually take a terrible beating. Coaches often pay tribute to the courage of their guards and marvel at their stamina. Wonder what they would say of one particular hard-headed drill that grinds and plugs away for General Electric in the fractional-horsepower-motor section of the Fort Wayne works. Here's the story:

A couple of years ago, this drill started buzzing around, drilling holes for motors and flanges. It was tipped with Carboloy, a development of General Electric research, and plenty tough. Result—it established a combination speed and durability record by completing 100,247 holes each 1 11/38 inches deep. During the years of its service, it penetrated approximately 2¼ miles of cast iron, at the rate of about 10 inches a minute, before wearing out!



SOMETHING REALLY THIN

Until recently, "by the skin of your teeth" was the very peak of thinness. General Electric, however, now makes a strong bid for a new figure of speech: it is "by a weld's breadth." Engineers at the Schenectady works recently welded together strips of two alloys, Copnic and Chromel, and then rolled them to a thickness of six millionths of an inch.

The material formed by this junction has a very small heat capacity and will respond rapidly to a change in temperature. Engineers estimate that a pound of this product would cost several million dollars.

Gold has been beaten to four millionths of an inch thickness, and aluminum has been thinned by the same treatment to ten millionths of an inch; but this is the first time two alloys have been reduced to such a thin section by rolling. The feat was achieved by placing the welded strips of alloy between pieces of steel and rolling the complete assembly. The product is not yet manufactured for general sale.

General Electric engineers, working with all the facilities of G-E research laboratories, are daily producing new processes and new applications that make for future progress.

HARD ON THE OX

Residents of Duanesburg in Schenectady county, New York, killed and roasted their plumpest ox recently in order properly to celebrate the opening of the world's longest stretch of sodium-lighted highway. But the ox could feed only a small part of the crowd that turned out to see the sight. Shortly, at a signal picked up by an electric eye, the road glowed out clearly in the darkness. The soft, glareless light of 391 G-E sodium lights made of it a real Golden Road, 18 miles long.

Fifteen thousand people watched the celebration and listened to New York's Commissioner of Highways, Arthur W. Brandt, point out some of the savings that good highway lighting gives. They heard the figures in the case of an early lighting installation made by General Electric—a six-mile section on the well-traveled Albany-Schenectady road. Night accidents have decreased there 40 per cent. Day accidents on the other hand have increased 13 per cent.

These stretches of lighting greatly reduce the hazard in night driving. Another major installation will be opened this fall on the San Francisco-Oakland Bay bridge where 900 units will illuminate both decks of the span. Sodium lighting has been developed to its present efficiency by General Electric engineers.

96-322DH

GENERAL ELECTRIC

The Vol. XVII No. 3 December 193

MINNESOTA TECHNO-LO

In This Issue

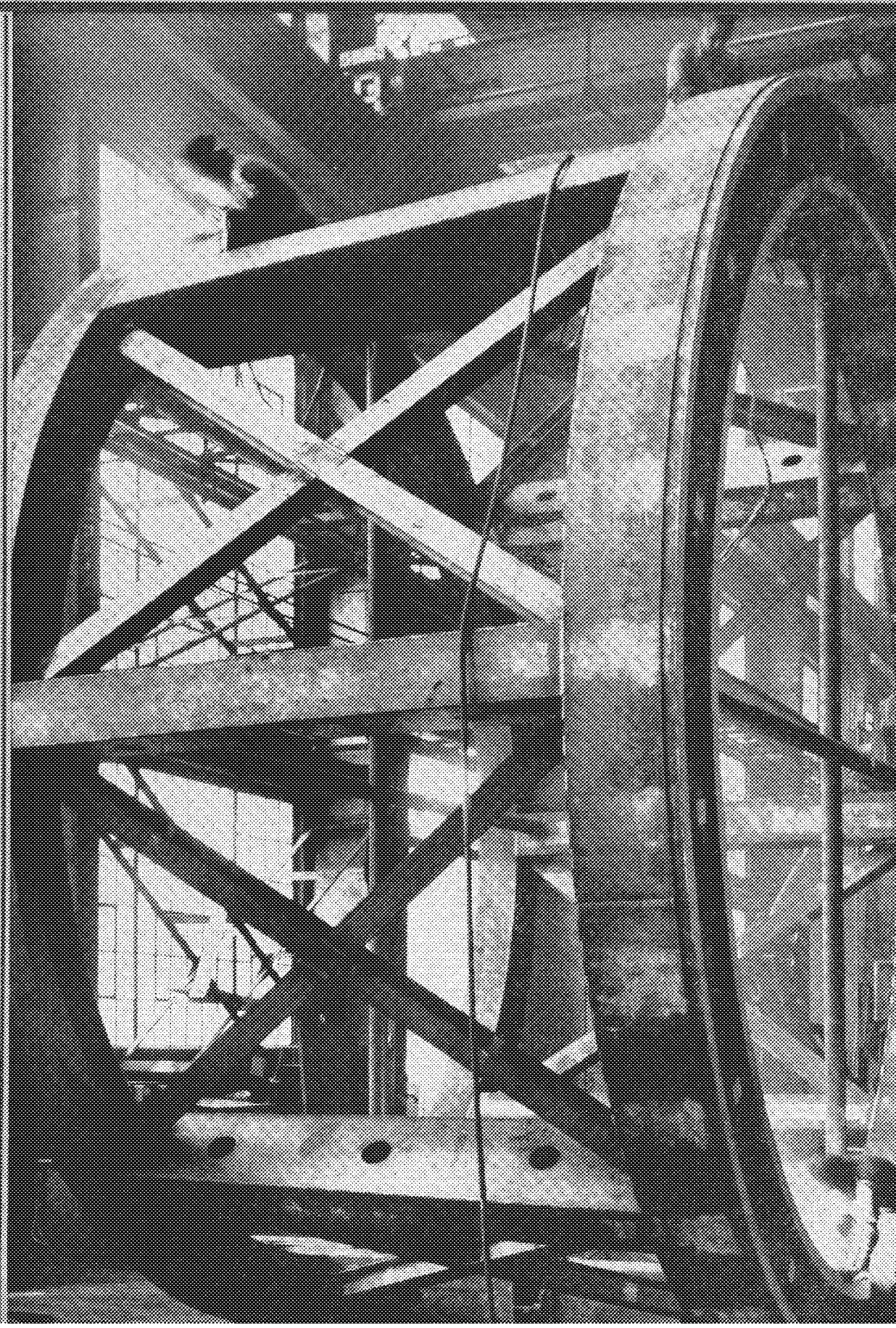
Articles On Radio

00 Inch Telescope

au Beta Pi Prize Essay

so-Topics

mploy-ment

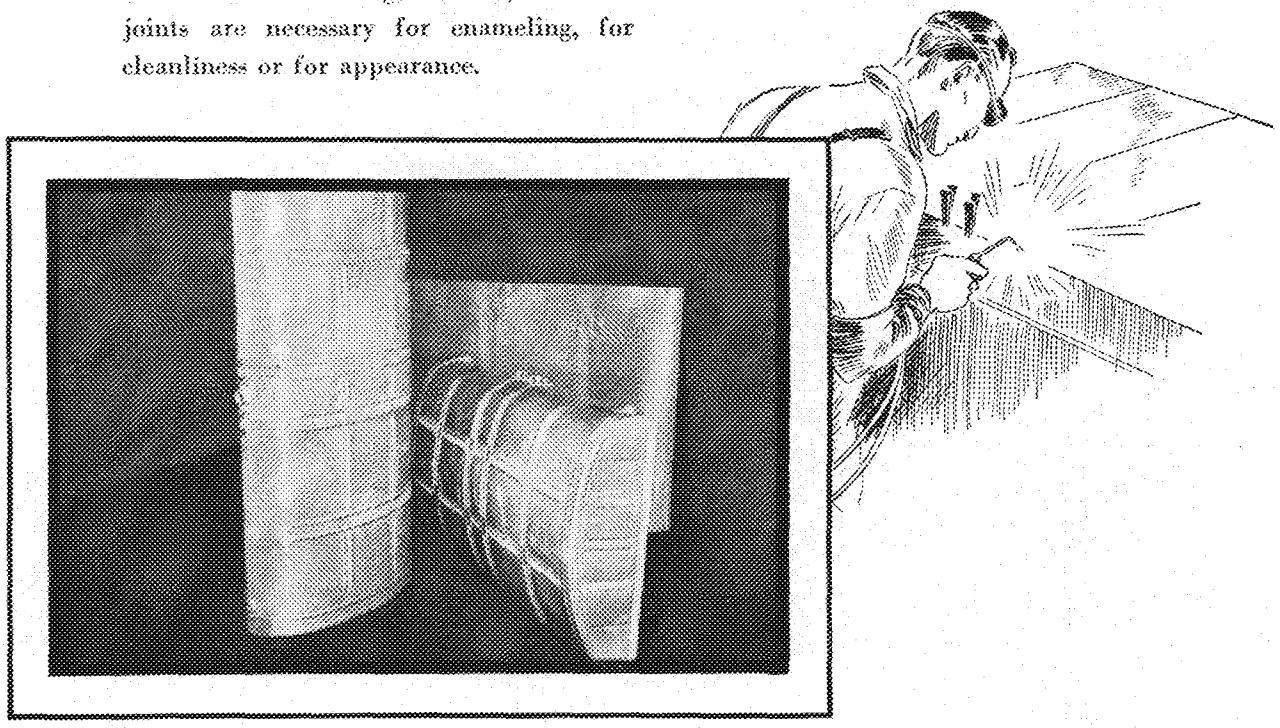


Better . . because IT'S WELDED

● Welding is essential in the modern airplane gasoline tank because high strength, lightness and freedom from leakage are paramount considerations.

Welding has made many good products better—gasoline tanks, stoves, automobiles, radios, refrigerators, streamlined trains and a thousand other things. This modern method of manufacture is applicable to the widest range of materials—steel and iron, aluminum, copper, brass and all other alloys and metals, even platinum. It is ideal for use where strong, smooth, invisible joints are necessary for enameling, for cleanliness or for appearance.

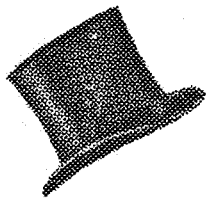
Tomorrow's engineers will be expected to know how to take advantage of this modern metal-working process. Several valuable and interesting technical booklets describing the application of the oxy-acetylene process of welding and cutting in design, construction and fabrication are available from Linde offices in principal cities. Write The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York, N. Y.



Everything for Oxy-Acetylene Welding and Cutting

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

FROM LINDE UNION CARBIDE



TOP HAT, WHITE TIE AND TAILS

Tops in Formal Smartness at a very Informal price

$35
TAILS AND TROUSERS

The New Mid-Night Blue Full Dress Lounge

Juster's Special
FORMAL ENSEMBLE
Tail coat, Tuxedo coat and 1 pair of Formal Trousers
$50

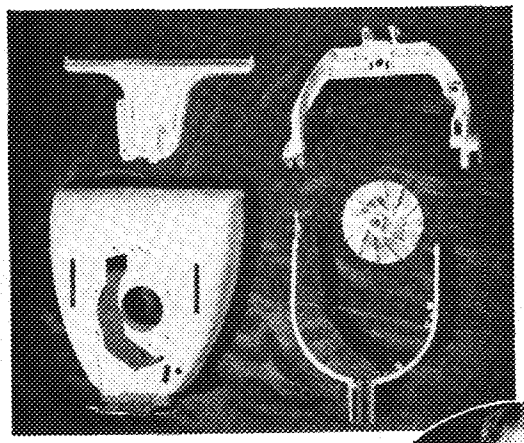
The Juster "Special"
Mid-Night Blue Tux $25

Clothiers—Tailors—Furnishers
JUSTER BROS
On Sixth Street . . . Just off Nicollet

At the right is shown the type of die-casting machines being used by The Hoover Company in producing the daily total of 5,000 Dowmetal die-castings for the new Hoover One-Fifty Electric Cleaner.

Lightness IN THE MAKING!

What DOWMETAL is doing for HOOVER



In the new Hoover One Fifty, Dowmetal is used in five different parts from the handle bail to the intricate main housing. In these five parts a total weight saving of over two pounds is achieved without the slightest sacrifice of structural strength.

The amazing lightness made possible by Dowmetal has caused thousands of women to abandon their present cleaner for the lighter, easier handled Hoover.

Lightness to the utmost limit, without sacrifice of strength or durability, was a major objective when Hoover set out to re-design its famous line of electric cleaners.

After considering every factor Hoover adopted Dowmetal.

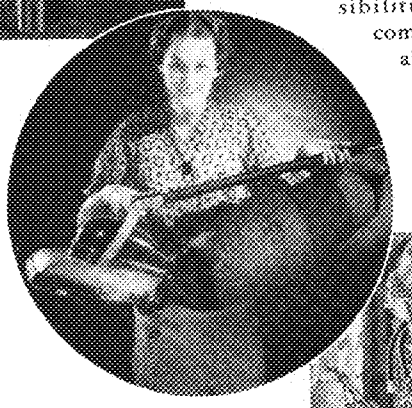
For Dowmetal is actually *a full third lighter than aluminum* yet possesses comparable strength and durability. Thus, it carries lightness of construction far beyond the possibilities of any other commercial metal or alloy.

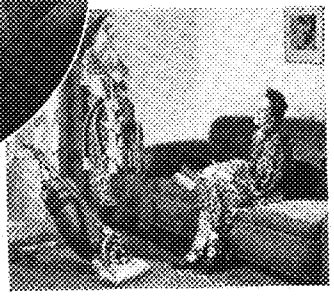
While the use of Dowmetal in the Hoover One Fifty constitutes its first appearance in a product of general public use, it has long demonstrated its value in portable power tools, trucks, machinery, foundry flasks and many other products.

Dowmetal opens the way to the complete—not partial—elimination of useless, power-consuming or sales-retarding weight.

Complete information concerning the characteristics, uses and methods of fabrication is contained in "The Dowmetal Data Book." A copy will be sent with our compliments to you.

THE DOW CHEMICAL COMPANY
Dowmetal Division • Midland, Michigan





And these women are praising the Hoover at every opportunity—and its lightness is one of the features they praise most.

DOWMETAL
MAGNESIUM ALLOYS
LIGHTEST OF ALL STRUCTURAL METALS

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

DECEMBER, 1936

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Deeh, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Actg. Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas	Eta Kappa Nu
Edward Kaiser, Pres. John Holliban, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Bernard Hein, Pres. Henry Nitta, Sec'y	The Commacini

This Month

VOLUME XVII NUMBER 3

Officers of the Professional Societies

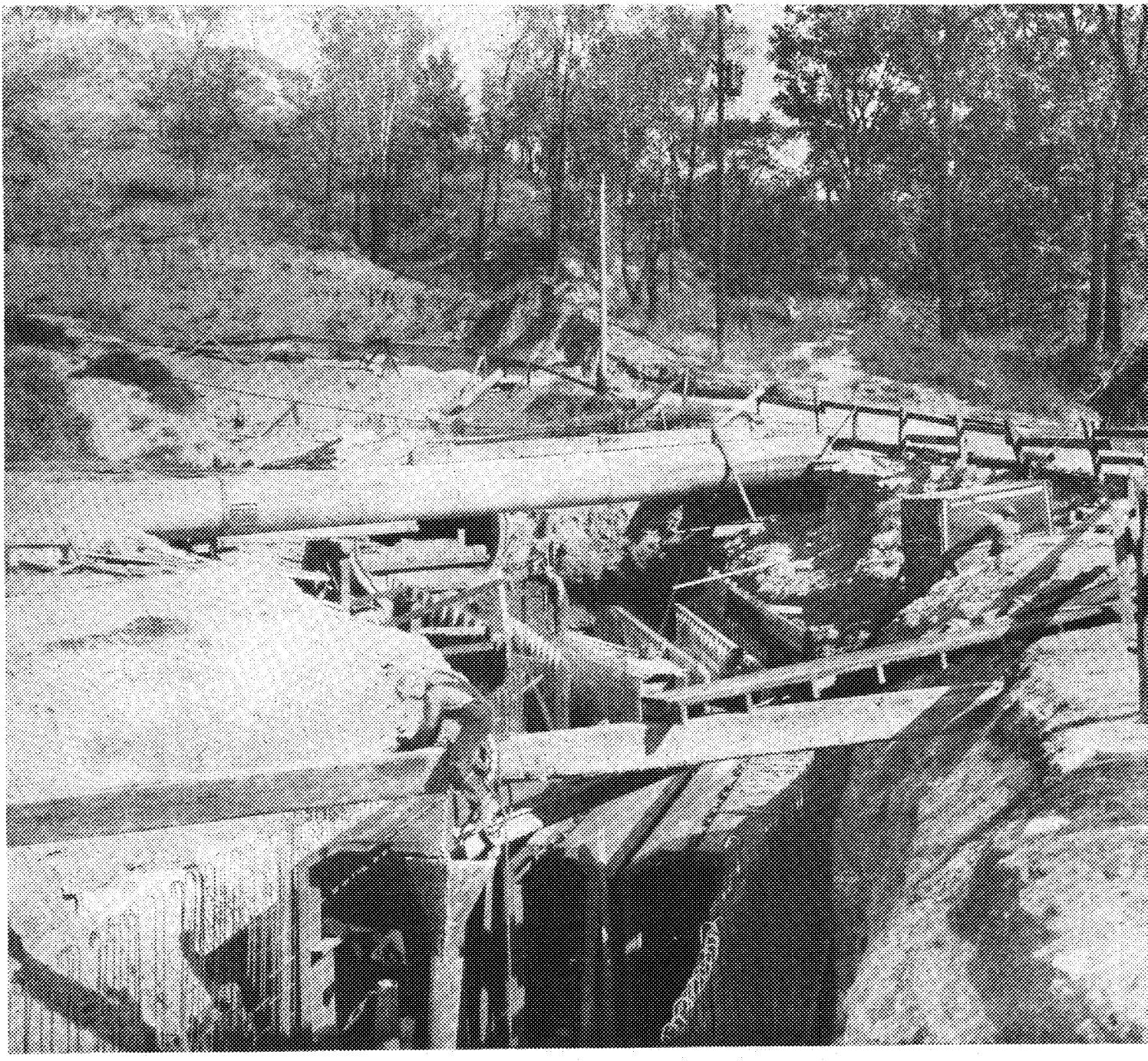
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Parry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Frahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres Robert Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Wodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Alkire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	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, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



—Improvement Bulletin

Sewer Interceptor

KSTP's Mobile Short Wave Unit

By Arthur Peck, E.E. '39

During the past few weeks special programs have been handled by KSTP's mobile short-wave unit as features of the station's "Know your University" series. These programs, made up of interviews and descriptions of classroom and laboratory work, will be continued during the winter quarter. The Electrical Engineering Laboratory, Experimental Engineering Laboratory, New Hydraulics Laboratory, Psychology Laboratory, Child Welfare Department, and University Theatre rehearsals have been mentioned as scenes for future broadcasts.

Because of the growing interest in "spot broadcasts" the engineering staff of KSTP decided that the only means to completely cover the broadcasting of field and news events at the spot where they occur was by means of a short wave unit that could be transported to any place at any time.

Their mobile short-wave unit is housed in a one and one-half ton, panel body truck. The truck is painted white and is trimmed in chromium, with the letters "KSTP" on the side and "Short-Wave Unit No. 2" on the doors. This unit replaces former Unit No. 1, which was discarded in the fall of 1934 after limited use in the field for which the present outfit was planned.

The transmitting equipment installed in the short-wave unit was designed not only to conform to the regulations of the Federal Communications Commission, but to also give a quality of broadcast equal to that of the best stationary transmitters. For ease of construction and installation, the transmitting equipment was divided into three separate units—radio frequency unit, audio frequency unit, and power supply.

The transmitter, as licensed by the Federal Communications Commission, operates under the call letters KABE on a channel of 1,622 kilocycles with 25 watts power.

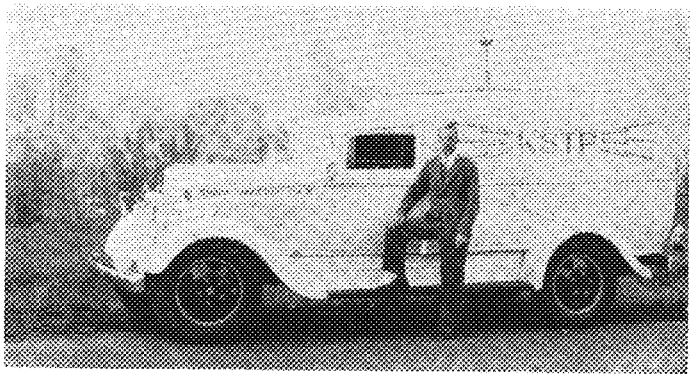
Because of the plus or minus .1% frequency toleration allowed on the 1,622 kilocycles channel, the job of constructing the carrier frequency generating unit was comparatively easy. A crystal controlled oscillator, using an AT cut quartz crystal, has a sufficiently low temperature coefficient to maintain the proper frequency of the carrier under normal temperature changes.

With assigned power of 25 watts, the tube line-up for the R.F. unit is as follows: one type 210 as a crystal oscillator, one type 865 as a buffer, and two type 210s as push-pull class C amplifiers. The 210 tube as crystal oscillator gives more than enough exciting voltage, when further amplified by the 865 tube, to excite easily the push-pull 210s in the final amplifier. The 865 was chosen as a buffer because, being a screen grid tube, it required no neutralization. The 210 tubes in the push-pull final amplifier, when 100% modulated, more than supply the 25 watts output allowed.

The R. F. unit is constructed on a black finished aluminum panel 36 by 14 inches, covered with an oak case. The complete unit is mounted in the truck on a channel iron rack. (See figure for view of mounted R. F. unit in middle of picture.) This rack insures accessibility and provides for removal of the unit for repairs.

The audio unit had to be designed to take the output of a carbon microphone and amplify it to a sufficient volume

A side view of the exterior of the mobile unit; Arthur Peck in foreground.

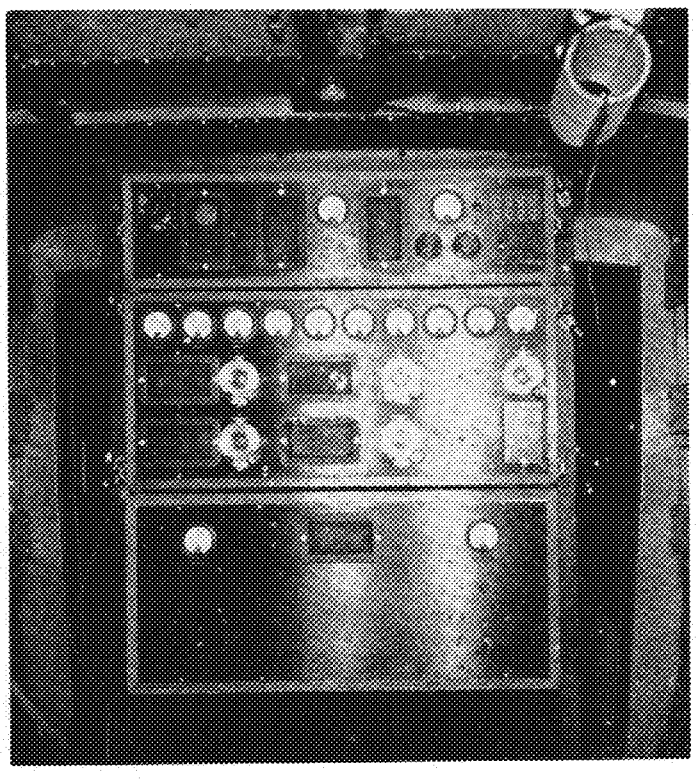


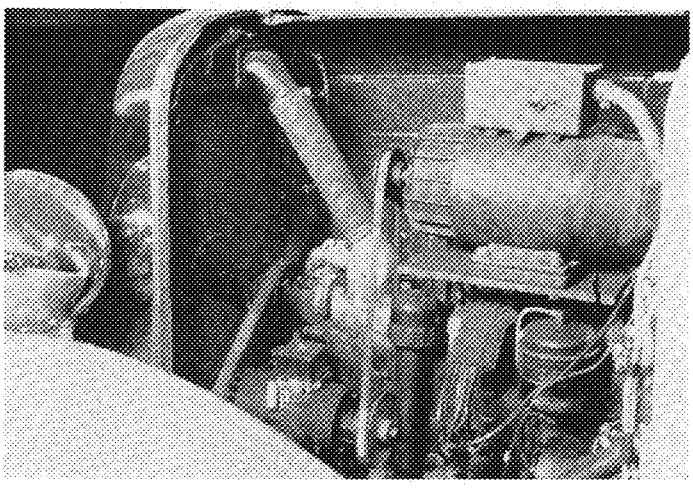
to modulate completely the radio frequency unit. After some experimentation, the following tube line-up has been found best suited: a type 75 tube as a first audio amplifier, a type 56 as a second audio amplifier, two type 45s in push-pull as drivers, and lastly, two type 46 tubes as push-pull class B modulators. The 75 and 56 tubes are used because of their large amplification factors, and the 45 tubes because of their suitability as drivers. The 46 tube in push-pull class B operation give more than enough power to modulate the radio frequency unit to a full 100% without any appreciable distortion. Throughout the whole transmitter oversized tubes are used to give "high fidelity" quality without distortion. The audio unit, as well as the radio frequency unit, is constructed on a black aluminum panel, 30 inches by 8 inches, and is covered by an oak case. This unit is provided with a volume control to regulate percentage of modulation, and a milliameter to indicate the proper volume for operation. The complete audio unit also is mounted on the iron rack in the truck directly above the radio frequency unit.

The power supply for such a mobile unit is always a problem and in this case is provided satisfactorily by using a 350 watt, 110 volt AC generator designed for operation from the truck engine. The generator is bolted to a steel plate which was drilled to fit the bolts on the engine head. The truck's own DC generator was taken apart and the drive shaft was extended out through the rear of the housing to take the drive pulley for the AC generator. (See figure for close-up of drive mechanism.) A friction clutch on the generator unit that slips at speeds above 1800 r.p.m. keeps the AC output of 110 volts fairly constant.

Since the generator supplies only 110 volts AC, a power unit was built to transform the output into proper values.

Interior of Truck. The three units, audio, radio freq., and power, are arranged on the rack top to bottom.





This picture shows the mounting of the 110 volt generator. The generator for the power supply to the transmitter is driven by the belt run from a pulley added to the extension of the 6 volt generator. It gives a nearly constant output at speeds up to 1,800 r.p.m.

This power unit delivers 2.5 and 7.5 volts AC for filament supply; and, by using two 83 tubes as rectifiers, it supplies two DC outputs of a total of 450 volts at 300 mils for the plates of the radio frequency and audio units. This power unit was constructed as a duplicate of the black panel used for the radio frequency unit and the whole unit is incased in oak and mounted at the bottom of the iron rack in the truck.

To the designers a brief survey of the antenna problem indicated the advisability of a vertical type antenna. Not only is this type non-directional, but its design facilitates its use on the truck. Four sections of pipe that telescope into each other and that can be raised to a height of twenty feet extend through a special bushing mounted on the roof of the truck. A wire "hat" was put on the top of the pipe to increase the capacity of the antenna.

A loading coil is used to increase the "electrical length" of the antenna, and the whole system is coupled to the transmitter. A series of tests soon showed that the antenna could be operated with any or all sections extended, and would easily resonate under all conditions. Even with only one section extended for use in mobile operation very satisfactory results are obtained.

A very important part of a mobile unit is the receiving equipment. The broadcast monitor, in this case, required selectivity, sensitivity, and quietness of operation. As an ordinary car radio of the superheterodyne type would fill all these requirements, an RCA model M109 has been adapted to headphone operation; it is used for cueing the announcer at the short wave unit. This set is mounted under the dash in the truck, so that it can be used at all times as either a monitor or a regular car radio; it is connected to a running board antenna and the engine is equipped with suppressors to allow quiet reception when the engine is running.

Two receiving channels are needed: one to feed the program from the main broadcast transmitter, and the other for the engineer at the truck to listen to the cue transmitter stationed at the pick-up point.

As the talk-back channel, assigned by the Federal Communications Commission, is 2,150 kilocycles, a short-wave receiver is necessary for the reception of cues. A Ham-

marlund Comet Pro short-wave superheterodyne operating on 110 volts AC is mounted on the side wall of the truck so that the engineers on duty can easily reach the controls of both the receiver and the transmitter while seated on a chair in the truck body. The set is powered by the generator unit on the engine and connected to a running board antenna. This completes the equipment for the mobile unit.

The mobile unit has been used recently for several broadcasts from the campus known as the "Know Your University" series, which is being conducted by the University in conjunction with the Minneapolis Junior Chamber of Commerce. So far there have been three broadcasts in these series: one from the speech clinic in Folwell Hall, one from the Aeronautical Experimental Laboratory in the old Armory, and one from the Manufacture Laboratory in the Chemistry building. More of these broadcasts will come in the winter quarter and the mobile short-wave unit may be inspected while it is on the campus for these broadcasts.

For these "Know your University" broadcasts, a receiving point was established in the control room of the University radio station WLB where there are direct wires maintained to KSTP. The portable field receiver and a portable cue transmitter were set up in the control room of WLB and tests were made from various points on the campus. The excellent results of these tests demonstrated that successful rebroadcasts can be made from any point on the campus.

Upon hearing the cue sentence "We take you now to the campus of the University of Minnesota" in his earphones, the announcer at the point of broadcast takes over the program. The program, as sent by the short-wave unit, is picked up at the receiving point in the control room of WLB and carried by direct line to the main control room of KSTP in the St. Paul Hotel. From this point on the program follows the conventional channels and is put on the air by KSTP's broadcast transmitter.

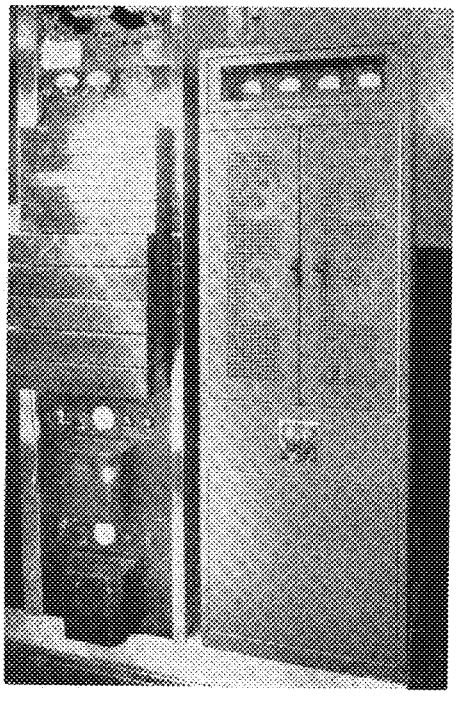
WCCO Takes up Short Wave Transmission

By Joshua Premack, E.E. '39

DURING the last few years the trend in radio has been toward high and ultra-high frequencies. Work in these frequencies was done at first by amateurs and research laboratories, but now commercial broadcasting interests are entering this field, mainly because of the possibility of new bands which will give more clarity and freedom from static. The present broadcast band is so crowded that new wavelengths are almost a necessity.

Radio station WCCO in Minneapolis has built a short wave transmitter in their control room, on the top floor of the Nicollet Hotel, for the purpose of tests in the high frequencies. This transmitter, with call letters W9XHW, was built last April and operates on a frequency of 31.6 megacycles—or about 9 meters. The equipment is built up in a steel rack about seven feet high, three feet wide, and two feet deep, and presents a very trim appearance. The circuits are adequately metered and fused and each stage is easily accessible from the rear by a steel door. These doors upon opening flip a switch which cuts off the high voltage supply, protecting the operator from any danger of shock.

Appearance of the transmitter for short-wave station W9XHW. The panel on the left is the power supply.



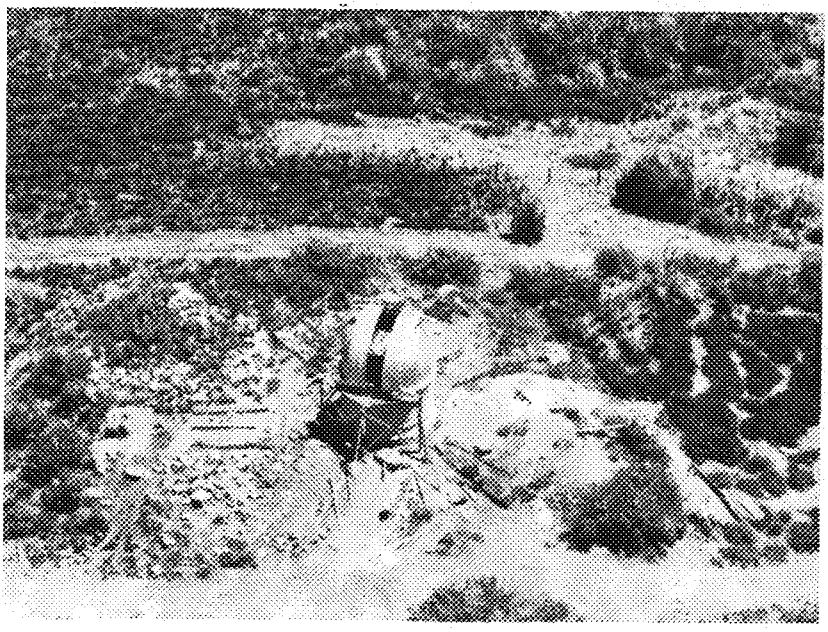
The radio frequency stages start with a type 802 tube as a crystal oscillator at 7.9 mc., and a frequency doubler at 15.8 mc. The 15.8 mc. output is fed to another 802, which doubles to 31.6 mc., the final operating frequency. This 802 excites an R.K.-25 as a straight amplifier, operating on 31.6 mc., which in turn drives the final amplifier. The tube used in the final amplifier stage is a United type 938, and is operated at an input of 100 watts. The rating of 50 watts output is rather conservative.

The program broadcast comes over the network lines, thus eliminating preamplifiers. A pair of R.K.-31's modulate the final amplifier and are excited by a pair of 10's.

The antenna is the vertical radiator type ¼-wave long and is erected atop the Nicollet Hotel. It is fed by a concentric transmission line at a point ¼-wave up from the base, which is grounded.

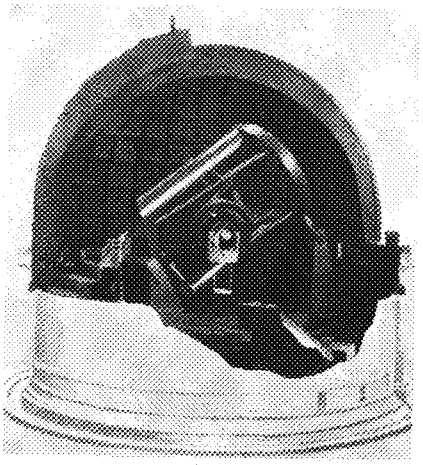
At the present time the station is in operation and results are being observed. WCCO engineers are making tests at the homes of approximately 400 of those in the Twin Cities area that have sets capable of receiving these short wave broadcasts.

Within the short duration of time the set has been operating little of determinable value from the tests has been forthcoming. The possibilities in this field, however, are very promising in that more commercial receivers put on the market today will incorporate higher frequency coverage. Future results may well open a new and better universal radio reception era.



—Scientific American

Part of the supplementary astronomical equipment consists of this 18-inch Schmidt telescope camera, being built 1000 ft. from the main dome at Mt. Palomar.



—Scientific American

An almost complete model of the 200-inch telescope showing dome.

By Donald Erickson, E.E. '38

200-Inch Telescope
A Four Year Perspective

SINCE the dawn of consciousness in the human mind, the sun, stars, and planets have ever played an important part in the progress of civilization. Strange religions have been formulated, and important incidents throughout the ages have been connected in one way or another with the actions of the heavenly bodies. An eclipse in ancient times was a period, no matter how short, of utter terror for the non-recording humanity of the time. Today General Science in grade school teaches us the truth of this spectacular occurrence.

All this has come about, however, only after these occurrences had begun to be looked at in the unemotional scientific attitude that dismisses nothing as unexplainable. Unemotional, yes—but curious to an even more marked degree. As a result of this prying into the unknown we have the first astronomers, with their crude apparatus, most of whom were usually jailed or hanged after they first attempted to reveal some of the truth. Naturally, after a discouragement of this type, scientific curiosity grew rather slowly for several centuries, until increasing social revolutions changed the old order almost completely. Weakly at first, but increasing with logarithmic rapidity, we have the present science of optics born.

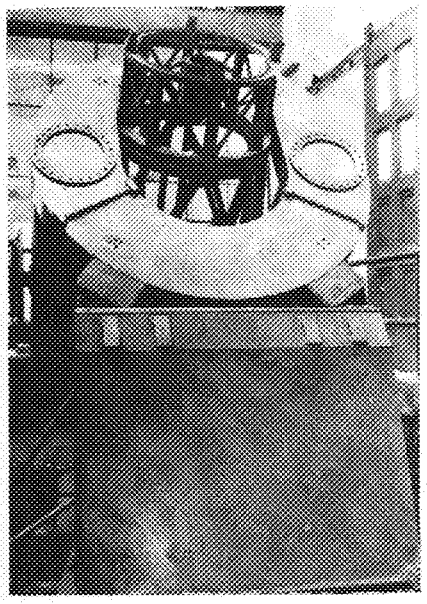
As soon as man could draw diagrams and see where his light rays were going, he no longer looked *through* a lens at which he wanted to see, but rather coated and polished to mirror brilliance the concavity of the lens, and let it look for him.

And so we have the modern telescope. Thousands of modifications and variations, of course, keeping pace with the thousands of astronomers, all contributing to the cause. And this cause? We have just traced it out for you—curiosity, almost hereditary now that our ancestors have always peered up at night, making wishes, worshipping the sun, predicting weather, and steering boats. Little wonder then that most of the civilized earth today takes more than passing note of the developments on Mt. Palomar in California.

Americans have always worked on the principle of the large building, in which one large one is better than two small ones. And the same with telescopes. One large one is not only better than two small ones—not only twice as good, but, in several cases, *four* times better. As compared to the 100-inch tube at Mt. Wilson, largest to date, the new 200-inch telescope at Mt. Palomar, California, will collect four times as much light and increase the volume that may be observed eight times, since it will permit astronomers to go twice as far into space as heretofore possible.

Fortunate indeed is the California Institute of Technology, where headquarters of the observatory will be located. Here laboratory tests and calculations will be made, and from here will come the results of painstaking effort on a project more than 20 years in the completing.

The desirable advantages of this 6,000 foot mountain for the observatory are self-evident. Ideal weather conditions, isolation, no sky glare from lights of surrounding cities, and comparatively small range of temperatures. All these are important, as shown by the fact that under ideal conditions the moon will be brought apparently to within



—*Scientific American*

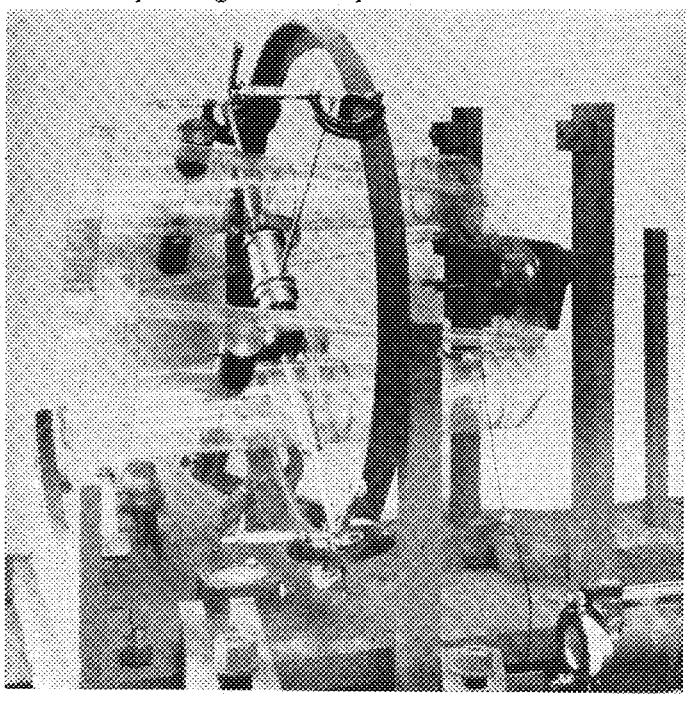
One end of a model of the 200-inch telescope, one-tenth scale development.

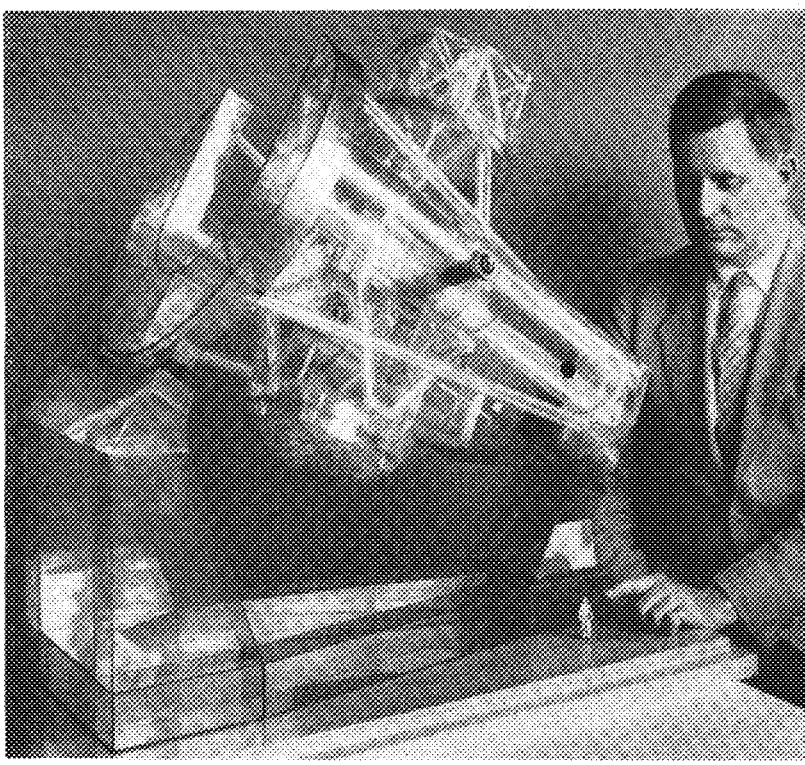
24 miles of the earth, but in practical operation will be brought only about 300 apparent miles away. History of this site dates back 30 years, when the Mt. Wilson observatory had yet to be located. The only disadvantage at that time was its isolation from community and highway.

Of interest is the fact that the observer will ride right in the tube. This is made possible by keeping him out of the beams of light reflected back from the lens to the focal point. The amount of light coming from the object to be observed will not be materially affected by this obstruction. The optical system permits light to be reflected to four main focal points as desired, including one underground air-conditioned chamber.

Structurally the mounting consists of two parts: the tube, 60 feet long and 22 feet in diameter, and made of

The glass model in the hands of the testers, micrometers and clamps being used for special tests for strains.





—*Electrical Engineering*

Glass model, 1/32 scale. Note comparative size of human to telescope as shown by the mannikin.

built up sections; and the yoke, in which the tube swings with an overall length of 60 feet. The completed unit will weigh more than a million pounds, yet must be so accurately controlled and turn so smoothly that it may be sighted with absolute accuracy. Errors in sighting must not be larger than the angle which would be made by drawing lines 3 miles long from a point to the top and bottom of a 25 cent piece. Flexible gimbals, oil pad bearings, and other modern engineering features permit a very small horsepower motor to turn the entire assembly, it having been calculated that a motor of 1/165,000 horsepower would be sufficient to turn it.

The main dome will be 135 feet in diameter and an equal number of feet high. The yoke will be hung equatorially (parallel) to the earth's axis, at an angle of 33°, 21 minutes, and 20 seconds. Part of the engineering operations involve the construction of a model, to 1/32 scale, on which tests were made of deflection.

The most important part of the whole project is the 200 inch mirror. So slowly do the experts work on this operation to achieve accuracies of a millionth of an inch that they will not have it completed before 1940.

A regular staff will be required to operate the telescope; consequently a new community is being established near the observatory. There are being built a power plant, machine shop, radio station and a million gallon water reservoir. Several smaller domes are also being built (see picture).

The 200-inch telescope was conceived by Dr. George Ellery Hale, and a grant of $6,000,000 was made for its construction by the Rockefeller Foundation. Most important of all, however, is that as a result of all this extremely accurate and painstaking work, it is hoped that 50 years from now this instrument will still be considered modern, a worthy product of the decade 1930-1940.

Engineering Efficiency For General Welfare

Prize Winning Tau Beta Pi Essay, Fall 1936

By Clark Hook, C.E. '38

THE subject of general welfare is one being discussed by men in all walks of life at the present time. To the engineer it presents an extraordinary aspect in that his product, engineering efficiency, has done much to make possible the existence of our present economic order. Engineering groups throughout the country are awakening to the fact that very little of the potential power of technological progress has been used for the common good. The engineering student cannot begin too early to recognize this fact and to devote time and study to more advantageous use of this product of his profession. Regardless of whether the student viewpoint is either over idealistic or unduly pessimistic, a student discussion of the use of engineering efficiency should at least present some interesting and pertinent, if not original, ideas.

Before any intelligent discussion of the problem can begin, certain terms should be roughly defined. Let us consider the term, engineering efficiency, as referring to the effectual energy or power placed at the disposal of society by engineering knowledge and technique. In this sense it has no little significance. Invention and scientific discovery has been gaining momentum rapidly for the past hundred years. In speaking of their effect on the general welfare, the personal viewpoint of individual benefit which has thus far developed their use must be eliminated. General welfare is the welfare of the people as a whole and not as individuals. To fully realize this significance, Stuart Chase says that if the people of this country in 1831 had awakened to find their potential productive capacity increased fortyfold, they would have immediately begun thinking in terms of luxury and leisure for all; and yet, although that is exactly what has taken place since then, a great portion of our people have a standard of living below a level of health and decency. Despite the fact that there already has been this vast increase in engineering efficiency, there is no sign that a slowing up of such progress is imminent. In fact, the opposite appears to be true.

The problem, then, is to see that this further development is used to better advantage than has been the case so far. As an example of what would happen if all the potential energy that has been created would suddenly be used, Dr. Wilcox, in his work, "Reshaping Agriculture," points out that American agriculture is only 11.3 per cent efficient on a scale of most efficient methods. "With only 50 per cent efficiency in the best farming practices, a mere fraction of our cultivated land would have to be used," he says. All this has been made possible with mechanization, transportation, and the application of chemistry to the farm. A sudden readjustment in the present scale of efficiency would mean nothing short of disaster under our present economic system. With the increase in scientific knowledge taking place at its present rate, further changes are inevitable. Taking the field of synthetic chemistry as an example of change, let us consider milk. Milk is made up of 87 per cent water plus certain converted cellulose products. One look at the present list of synthetic cellulose products makes it easy to see why some chemists are already toying with the idea of synthetic milk.

Faced with such possibilities, let us inquire into the way engineering efficiency has thus far been exploited. The technician or engineer has been content for the most part in developing and perfecting. He has left the use of his finished products to another group. This group is business with its chief tool of capital. Business, quite naturally enough, thought only in terms of personal gain, and the corporation became an easy means of avoiding responsibility and increasing profits. This is no condemnation of the corporate form of enterprise, but, since corporation laws were left to the individual states, certain states began dealing in corporations made to order on demand. The natural result has been a loose corporate economy in which waste and inefficiency are glaring defects. It must be admitted that, under the system as it operated, business has done remarkably well, but for the question at hand, the dollar sign and not the general welfare was the guiding star. Stuart Chase illustrates the contrast between the engineering system which gave business its power and business itself by the building of the Empire State Building in New York. The financial structure of this venture collapsed before the engineering structure had hardly begun to rise. Engineering exactness rebels at the lack of positive, calculated method in the exploitation of its products. Mr. Chase further goes so far as to say that, if engineering orderliness had not risen to check enterprise, the result would now be utter confusion.

Whether or not this statement is true, the fact still remains that the engineer must attempt to exercise some sort of a guiding hand in the use of his product, increased engineering efficiency. Many possible methods of approach can be suggested to alleviate the situation.

One of these remedies is suggested by the explanation of the lawyer who stated that the corporation laws of Delaware must be ideal since the legislature passed no laws that were not first approved by the bar association. Why not, if such a policy of legislation were to be used, have corporation laws also approved by a group of engineers, whose products the corporations are to use, and by a group of economists, who study and develop the theories of human welfare? Certainly such a set-up would not be less practical than to trust approval to the lawyers whose clients desire a minimum of restriction. Such a body, of course, would make necessary a closer, militant organization on the part of engineers than now exists.

Another possibility for improvement lies in the training of engineers along other lines besides their own. Tech-

nical schools, such as our own, are already offering courses in business to their students. A similar plan might embrace certain of the so-called social and political sciences. Such a broad training would better equip the engineer to plan the use of his products for the benefit of humanity as a whole.

In a final analysis, however, the only method that seems to guarantee not only to engineers but to all of the people the full use of engineering efficiency for the general welfare is a suggestion so old fashioned and yet so far ahead of its time that only writers of highly imaginative fiction have dared to present a society ruled by its laws. This idealistic answer lies in the worn out principles of service and neighborly concern, two ideas that have been made out of place in an intelligent discussion. Yet they present corners so sharp and well defined as to be rounded with difficulty. Although they are the foundation of all religion and rules of life, they seem to present no so-called practical method of attack for the engineer. Good material for an H. G. Wells but—, and yet Jules Verne once wrote, "Twenty Thousand Leagues Under the Sea."

Architecturally Speaking . . .

IN THE 5 year architectural course, there are now three grades of design, instead of four, and a thesis. A new method of advancement places emphasis on the improvement a student makes during his work in a given grade, rather than on the accumulation of points he may have.

On this page is an example of a Grade I design problem. It is a 1st mention plan for a modern beach house. It was drawn as part of the sophomore work last year and has been on exhibit, together with other Grade I renderings, on the third floor of the Main Engineering Building.

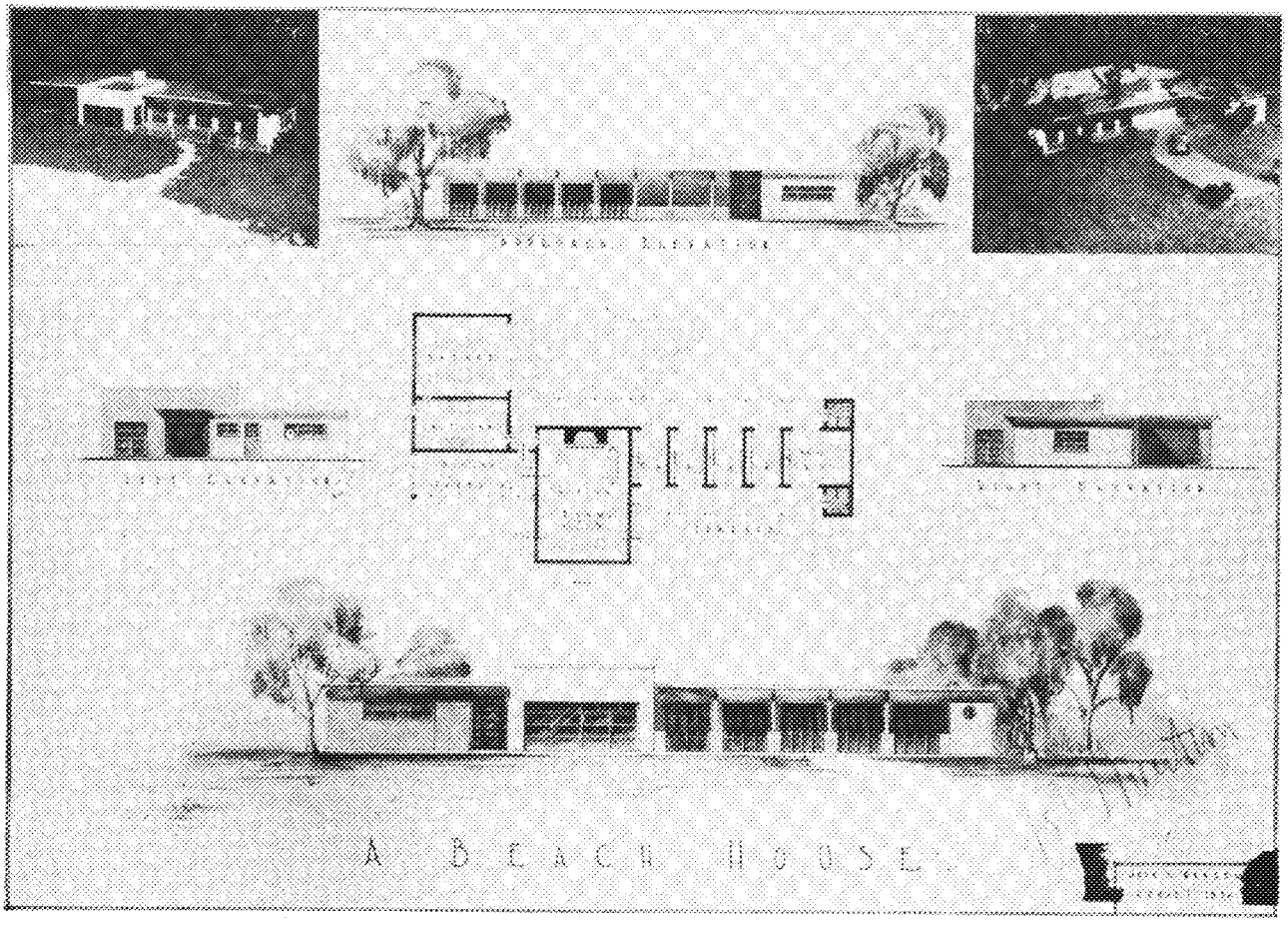
After the original orthogonal drawing was completed, a small model was made and photographed at different angles. Two of these views are included in the upper corners of the drawing to give complete pictorial representation of the design.

On exhibit these renderings may typify to the University public the design and structure of houses and buildings being built today.

For the architectural student today, at least one fourth of the total requirements for a degree consist of general courses. For students who come directly from high school, the first 5 years of their work in architecture may consist almost entirely of academic work, since many of them take 2 to 4 years of collegiate training before entering architecture.

In the light of this fact, the concentration on design that has prevailed in the past has not been remarkable. There is, however, a new tone to the present requirements.

This design is an example of Grade I problems in the School of Architecture
—Drawing by John E. Wenzel, Arch. '38.



—Northwest Architect

The Minnesota Techno-Log

DECEMBER, 1936

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

EDITORIAL STAFF
Donald Erickson, Copy Editor
Herbert Gaustad, Alumni Edr.
Erling Helland, Feature Edr.

BUSINESS STAFF
Robert McDonald, - Office
Gordon Brierley, Adv. Rep.
Wallace Wilcox, Circulation

REPORTERS
Fred Warner, Charles Strom, John Murray, Bertil Lindquist

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, TREAS.; Professor E. H. Comstock, *Mines;* Professor R. E. Montonna, *Chemistry;* Donald Raudenbush, *Electrical*, PRES.; Louis Reigert, *Architecture;* Lawrence Rollin, *Civil;* William Hanson, *Mechanical;* Elden Olson, *Aeronautical;* Edward Eidam, *Mines;* Neal Amundson, *Chemistry.*

Periodicals, Our Source Books

THAT the formal, institutional training of a professional engineer is only the beginning of his education has long been recognized; as he proceeds through various stations of responsibility he is continually acquiring new knowledge through his experience and that of his associates.

It is obvious, however, that no technical man can hope to keep himself well informed on the advancement of his profession through experience and personal contact alone and must, therefore, make use of other means to keep himself abreast of progress in his field of endeavor.

One of the most useful of these means, and one which has been brought to a high degree of development in this country, is the engineering periodical. To this means our attention turns.

Through engineering periodicals the professional man has available to him a continual stream of information well prepared and presented. Engineering societies are responsible for a large number of technical publications, so these periodicals may, as a rule, be differentiated on the basis of material and presentation into the class identified by the titles "proceedings" or "transactions" and the periodicals of a more popular appeal.

Publications of the first group are concerned principally with the organizational business of the society and with the presentation of technical reports coupled with discussions and criticisms. Through periodicals of this nature the engineer is able to obtain in a well-arranged and convenient form the most recent information on research and progress in his professional field.

The second class of society publications presents materials of a less technical nature but no less valuable to the engineer. By the aid of photographs and attractive makeup the technical reader is given an interesting presentation of trends in modern practice. Description by contemporaries of work in progress or completed, of solutions to specific problems, and information concerning new methods and materials are of invaluable aid to the engineer who wishes to keep informed.

In the furtherance of his professional knowledge the engineer will find it to his advantage to follow not only the periodicals of his own field of engineering, but also those of related branches, for the divisions of engineering are highly interdependent. In the library a wide variety of magazines is available to those who will peruse them.

At the Desk

On the cover and on two inside pages are displayed various jobs in the building of the world's largest telescope. The cover picture shows workmen welding the prime focus ring at South Philadelphia.

Neglectfully we forgot to credit the cut of the "head exerciser" last month to the *Aero Digest*. It is this magazine's policy to use a few cuts from other magazines each month and to so credit them, as you will find them in this issue.

The frontispiece shows work in progress on the Metropolitan Sewage Disposal project. The scene shown is near Dayton's Bluff, St. Paul.

For the benefit of "ham" radio fans, electricals, and all students and other readers interested in radio progress, the editorial staff has "shot the works" in two items on local radio. Arthur Peck's article on the KSTP short wave unit is first hand in many details, since he has operated and helped build the present unit. Somebody remarked, "Why not an airplane mobile unit, too?"

As part of their initiation duty, new members of Tau Beta Pi wrote essays. A gold watch chain was awarded Clark Hook for the best essay, as judged by the engineering English department. It is printed in this issue.

Mr. Siler presents "Food for Argument" and Mr. Haga suggests a book for the holidays.

Departments not seen in the magazine yet this year are "Architecturally Speaking," and "Iso-Topics."

A summary of professional society activities is a feature of the campus news pages along with a summary of employment growth in the past three years. "Pete" Lohman and Bert Lindquist "columnize," and Gordon Wickre presents some "Tilts."

Registration, Final Figures

AS already announced on this page, registration in the Institute of Technology rose to a new high this fall quarter with a total registration of 1,998 students. This figure has fallen to 1,941 at the present time because of cancellation and withdrawals. Of the present enrollment, 1,921 are men and 20 are women.

Registrations in the several departments of the Institute show that the chemical engineers lead in the total number of students registered, with 380. Not far behind are the mechanicals and the electricals, in that order, both boasting totals over the 300 mark. The other departments follow in this order: aeronautical, civil, mines, chemistry, architecture, pre-business, agricultural engineering, and interior architecture.

The physics course, originated this quarter, has seven students on its registration list.

Although the architectural engineering course is no longer offered to new students at the University, there is one student classified in that course. This student entered before the course was discontinued and has remained in this department. When he is graduated, the architectural engineering course will be only history.

This summary is presented to bring up to date full registrations in the Institute. On another page a summary of employment conditions is given.

Now Here's A Book

By Clifford I. Haga

Instructor in English

Forty years ago American journalism made one of its great contributions to social and political reform: "muckraking." From that unsavory name one may guess the parentage of the technique. It was, as the horseman would say, out of Business and Political Corruption, by Yellow Press. Most newspapers of those days were sensational, corruption was common, the reading public was eager—and the journalists thrived. It was at this time that Ida Tarbell's famous exposé of the Standard Oil trust appeared. Later came Theodore Roosevelt, fearless, noisy, apt in invective, to make political reform colloquial in a hundred ringing slogans. One journalist of that time was the leader of the muckrakers, Lincoln Steffens; and it is of his *Autobiography*, recently reissued in an inexpensive edition, that I am going to tell you.

Lincoln Steffens' *Autobiography* tells the same story that many other reformers' autobiographies tell. The game is not worth the candle—unless the rules can be changed. As the story of a man's life, the book is one thing; as the story of a man's developing mind it is another. In brief, this was the story of the man Steffens: born in Sacramento nearly 80 years ago, he had a rich and active boyhood, a happy college life, a generous allowance for leisurely study at German universities, and an exciting career as journalist, investigator, and confidant of politicians and statesmen. At the university he sought for the solution of the problem of conduct, for some body of principles by which statesmen might be guided. He did not find this code. When he drifted into journalism and found himself turning reformer, the story of his mind begins. Testing the popular assumptions of political and economic life by its actual forms among machine politicians and ward-heelers, capitalists and labor leaders, Steffens found that black was often white, and white black. Then it was that he discarded what he had learned and began to teach himself the meaning of what he had seen.

But what I have just said is too bald and colorless to serve as a real introduction to Steffens' *Autobiography*. It is the life of a man, not an exercise in geometry capped by a foreordained Q.E.D. It was a happy and exciting life, and the manner of its telling shows not only the skill of the competent journalist, but also the humor which directs our laughter at folly and spares misfortune. The first part of the book, dealing with his boyhood, has been published even separately as a book for boys, so lively and delightful is it in its similarity (yet with a difference) to *Tom Sawyer* and *Huckleberry Finn*. Then there are the almost incredible days as a police reporter in New York when the gutters ran ankle-deep with the splendid graft of complete corruption. Friendship with Theodore Roosevelt, coaching him in the practical politician's art of duplicity, acquaintance with the small fry of political and business life, national fame as a muckraker—these all followed in their turn. Then there is also the story of that sordid pilgrimage to the lesser shrines of corrupt politics, a pilgrimage out of which came his book, *The Shame of the Cities*. Minneapolis, incidentally, was in his list, and to us his chapter on our city will always be interesting. Next came his foreign adventures: visits to Mexico with our John Lind to get for President Wilson the information the State Department could not (or would not) furnish, and to Russia under Kerensky. After the war came his retirement from journalism and a gradual shifting through stage after stage on the road to the Left. In his last years he was the friend of Russia—but a dangerous friend for some Russians to claim.

Yet when you finish the book, the real value remaining will not be acquaintance with Lincoln Steffens, wise and genial though he is. What remains will be a picture of the United States through 50 years of change so violent as to be little short of revolutionary. For me the real title of Lincoln Steffens' *Autobiography* is "The United States: 1880-1930."

Food for Argument

....Statistics a Source

By Roderick W. Siler
Asst. Prof. in Mathematics

IT is a well known economic fact that college men returning home at Christmas never have any money. In their case, poverty and learning go hand in hand. Knowing from my own experience how embarrassing the possession of not more than one dime can be to a sensitive collegian, how it may not only cramp his style but also make his vacation long and lonesome, I have tried to think of something he could do during the happy holiday season that would be both enjoyable and cheap. After considerable thought I have hit on what may be a solution.

I suggest that the college man spend a certain amount of his Christmas vacation in arguing. There is much to be said in favor of such a form of recreation. First, of course, is its low cost. Equipment for arguing costs practically nothing, for all that is needed are some statistics, a few of which I will provide in this article, as well as suggest where can be found a good many more. Then there is the mental sharpening resulting from argument. After the collegian's tremendous mental efforts of the preceding three months a complete mental let-down at Christmas is not good. The shock might be too severe. Arguing off and on throughout vacation will keep the college man tuned up, as it were.

The statistics I am suggesting here are social statistics. Even for a technical student I would say these were best. When the technical man arrives at his home town he will probably find very few there acquainted with technical affairs, but almost everyone will be loaded up to the ears with social data. A certain amount of this is something in the nature of a hangover from the last presidential election, and still good for a lot of service. Now the beauty of social statistics is this: they never settle arguments. They only start them. It was the immortal Mark Twain, I believe, a very wise man, who advised, "Be sure to get your figures. Then twist 'em." But before a man can do any twisting he must have something to twist. He must have his statistics.

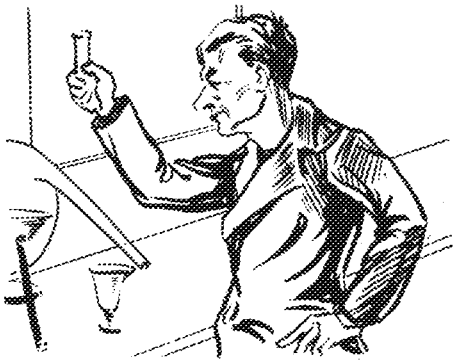
I have here beside me a thick book of social statistics brought out in this year of 1936. It cost a dollar, but as a support for debate it is worth a million. Out of it I pluck at random a statistic or two. For instance, the book gives the names of about 530 colleges and universities as existing in the United States in 1935. Attending these institutions were over a million students. I can see material for several splendid arguments here. Do a million students indicate times are better or worse? Do that many persons go to college because there is more money with which to send them, or because there is nothing else to do? And as to the great number of colleges: Are the people who create them and keep them going doing it because of a burning desire to advance higher learning? Or simply because operating a college is a good business proposition and a money maker?

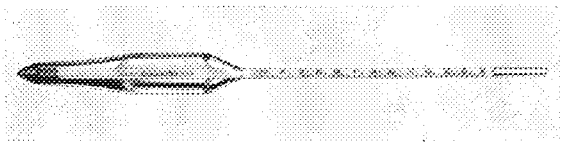
Continuing to dip into my book, I find that on Jan. 1, 1933, there were in the jails of this country 201,433 persons. This was one out of every 443 of the population over fifteen years of age. During 1933 the total commitments to jails of the United States were 693,988, most of them, of course, for brief terms. Also it is stated that one out of every 42 of our population has at one time or another served a jail sentence. Here is certainly material for argument. Do the above statistics prove Americans to be the most lawless people in the world? Or the strictest in enforcing the law? A very interesting debate can also be started as to the significance, if any, of the fact that in a country where there are more colleges than elsewhere there are more people in jail.

I find some figures on fish, giving the maximum sizes of different species caught up to date. These figures should be a check on fish stories, yet not discourage arguments. Thus the largest northern pike ever hooked was at Basswood Lake, Minnesota, in 1929, and weighed 45 lbs. and 12 ozs. The largest fish of any size ever taken was a whale shark off Florida in 1912, weighing close to 26,000 lbs. The true whales grow larger than this, but a whale is not a fish. It is a mammal, as everyone knows. The largest whale ever caught was taken out of the Antarctic in 1927, was 110 ft. long and weighed 115 tons. This is a lot of fish—or mammal, I should say—and ought to provide material for the affirmative in the argument about Jonah and the whale.

Well, I could go on indefinitely quoting this book—there are a thousand pages—but my purpose is simply to indicate the value of a good collection of statistics to a man who wishes to pass an economical as well as interesting Christmas vacation. Technical students are likely to have the impression that all things in this world are determined by facts and figures. After tossing and dodging statistics for a couple of weeks, with each man at the end believing just what he started out to prove, the impression may vanish. The beginning of a broad education is the realization that every statistic has at least two sides. And in conclusion I would suggest that statistics at Christmas time be used by college men only in combats with their own sex. Young ladies, no doubt affected by the Christmas spirit, are usually generous about overlooking a college man's financial status, but on the other hand they can stand only so much statistics. A young lady, swamped by statistics all evening, may at parting close the door on her visitor and say, "Phooey!" Or, "Hooey!"

ISO-TOPICS





—*Instruments*

Streamlined Hydrometer

A NEW hydrometer is on the market with three claims for improvement. One is that the bulb is better streamlined so that it will sink more rapidly to the floating level, and will not form air bubbles when used in highly viscous liquids. Another is that the scale is of enameled metal fused into the alloy weighting material, all of which can withstand 300 deg. F. without loosening or changing color. The third claim is that the scale is flat and graduated on both sides, which gives an angle of vision three times greater than the regular paper scale.

Monel Metal Casters

CASTERS entirely made of Monel, including shaft, spacers, and bearings, are now on the market. They are designed for use in plants where acid, alkali, or other corrosive materials are apt to spill on the floor. A recent development is a graduated pail (in 12, 14, and 16-quart sizes) made of welded Monel.

Plastics Industries

THE October issue of *Modern Plastics* is a nearly complete exposition of the plastics industries. It describes the materials themselves, their production and properties. One section deals with molding and fabrication of the materials, and discusses various molding and machining processes. Further sections explain laminations machinery and equipment, and product development. The Bureau of Standards is investigating the methods of large producers and users of plastics in determining its properties. Letters are being sent to companies asking for suggestions regarding the properties most important in performance testing. The investigation is, at present, for correlation of test procedures, and for defining properties in terms suitable for use in the industries.

Meter for pH ions

A pH meter designed to give continuous readings is now on the market. The instrument balances the electrode voltage against that of a standard cell. Balance is indicated through a vacuum tube amplifier. The glass electrode is sufficiently strong to stand insertion in refinery sludges, semisolid cheeses, and oxidizing and reducing agents. The instrument is accurate within 0.01 pH unit.

Rubber Latex, Fertilizer

AN English patent covers the use of rubber latex (the untreated sap of the rubber tree) for seed, bulb, and tuber treatment. The seeds, bulbs, or tubers are coated with a preserved latex previously treated with chemicals so that it will fertilize and protect them from fungi. Nitrogen-fixing bacteria may be added to the latex if desired.

Pigment Study on Apples

BECAUSE high color on apples stimulates their sales, and because apple growing is a large West Virginia industry, the Agricultural Experiment Station at Morgantown has investigated the pigment of apples. The color of winesap apples is due to idacin chloride, an anthocyanin in the form of a glucoside, in the skin of the apple. With the pigment isolated, its chemical structure established, and some of the properties determined, the study will be continued in the field during the growing season when the pigment is formed.

Potassium Sulphation

A NEW method of making potassium sulphate has been discovered by the Reno station of the U. S. Bureau of Mines. When alunite and borax are fused together the melt solidifies in two layers. The lower layer contains nearly 100% of the potash in the original material. The Bureau is still experimenting to find the limits of composition under which the process will function.

ALUMNOTES

ALONG with the usual locations and jobs of former students we bring you the first marriages to be reported this year. For the first time in history the Miners break into the Alumni page. Let's give them a rousing welcome.

The prize information of the month comes from Malven Olson, M.E., '36. Mal writes from Speedway, a suburb of Indianapolis, where he and six other alums are working at the present time. The other alumni are: Hugo Kojola, M.E. '30; Morris O'Brien, a classmate of Hugo's in M.E.; Herbert Sargent and William Tuel, both Chem. E.'s of '35; Everett Laitala, M.E. '34; and Rudolf Kojola, E.E. '36, brother of Hugo.

The first four together with Mal are junior engineers in the Acetylene Research Division of the Prest-O-Lite Co. Laitala is also with Prest-O-Lite as industrial engineer. Rudolf Kojola is employed by the Esterline Angus Co., producers of electrical instruments.

Mal informs us that Morris O'Brien is the only one of the group married as yet; in fact, there are three in the Morris family, but we don't know whether it's a son or a daughter. Thanks for your interesting letter, Mal. I know all your friends here and elsewhere wish you and the rest of the gang all the luck in the world.

'23 The first miner to break into print is George W. Hezzelwood, E.M. (Mining Engineer). George is the general superintendent of the Cabit Mining Assn. in Bicol, Philippine Islands.

'27 Jack C. Brightfelt, E.E., visited at school recently while on vacation from his work with G. E. at Erie, Penn. Jack is planning to organize a class reunion for next year.

'28 One of the spectators at a football game was Ed. M. Van Duzee, Chem. E. Ed is working with the Dow Chemical Co. at Midland, Mich.

Wilmer Hedlund, E.M., has been spending a vacation in the Northwest. He will return soon to South America, where he is working with the Braden Copper Co. at Rancuagua, Chile.

John Elmburg, E.E., is one of those who have recently been married. The sad part of this notice is that we were unable to get the name of the lucky girl. John is spending his time at the Fairbanks Morse Co. in St. Paul.

'31 On his way to Winnipeg Roy Kinzie, Chem. E., passed through Minneapolis recently. Roy has been transferred from the J. R. Watkins Co. in California to another branch in Winnipeg.

'32 While Prof. DuPriest was in the East this summer, he visited Maurice Norton, M.E., in Lynn, Mass. After completing a two year graduate course in business at Harvard, Maurice went to work for the G. E. Co. in the turbine department.

'33 Last reports list Charles W. Britzius, Civil, as working at the Q. A. Hall Laboratory, 356 Cedar Street, St. Paul. Britzius was captain of the tennis team in 1933 and walked off with several titles around the city.

Another Civil, J. M. Nelson, is working with the U. S. Geological Survey in Chattanooga, Tenn.

Donald Robbins, M.E., was on the campus shortly after school opened. Don spent a short time in the research laboratory of the Union Carbon and Carbide Co. in Charleston, West Virginia. He is now located in Whiting, Indiana, with the same company.

'34 Leander Fischer, M.E., visited the campus a few weeks ago. He is employed in the research laboratories of G. E. at Schenectady.

'35 At some football games cheering for Minnesota were Sylvester Laskin and Elmer O. Bernard, E.E.'s, now located at Duluth.

And now the alumni reporter presents the greatest scoop of the month, the marriage of Rohland Zinn, Aero, to Charlotte Brindore of Minneapolis. The couple were married this summer in Miami, Florida, with Jack Aiken, also Aero, as best man. Best of wishes to you and your wife, Rohland.

A. L. Craig, Arch., is doing government architectural work in Scarsdale, N. Y. A classmate of Craig's in the Architectural school, Ed Steinkellner, A.E., is teaching drawing at Vocational High School in Minneapolis.

'36 Garvin von Eschen, Aero, reported previously as teaching at Duluth Junior College, has returned from Duluth to take a position in the drawing department of the University.

Remember the Engineers' Day Queen last spring, Faith Anderson? Faith graduated last June from Chemistry and is now employed as secretary at the Dow Chemical Co. in Midland, Mich.

Charles Danchertsen, Pet. E., is doing engineering work on a salt water disposal line in the Seminole Field for the Amerada Petroleum Co.

Dr. Mann reports that John L. Mills, Chem. E., is employed as water inspector for the Northern Pacific Railway Co. in Glendale, Montana. He is checking the treatment at lime-soda and zeolite water softening plants.

Michael Tierney, another mining engineer, is safety engineer for the Anaconda Copper Co. in Butte.

Robert A. Mumm, Chem. E., is with the National Aniline and Chemical Co. at Buffalo, N. Y.

That's all for this month, we'll have more news and gossip for you next month.

His job is to look for trouble before it happens. He is one of many who inspect telephone apparatus regulary, even when nothing is wrong. His work is called "preventive maintenance." ¶ This work is of the highest importance. It helps to prevent interruptions to the service; often forestalls costly repairs, or replacements; helps keep telephone service at highest efficiency. ¶ To plan this work requires management with imaginative foresight and the ability to balance the many factors involved in the maintenance problem.

BELL TELEPHONE SYSTEM

Tonight—call up someone in the old home town—after seven, when rates to most points are lowest.

Societies Have Active Quarter; Plan More Inspections, Talks

Mines Society

Walter Olson, former Mines student, addressed the School of Mines Society late in November on "Conservation and Engineering." His talk was followed by a motion picture of the San Francisco Bridge. The "Canalization Program of the Upper Mississippi River" was the topic of a talk given to the society Dec. 10, by Dwight F. Johns, U. S. District Engineer. His talk was illustrated with slides. Ed Dobrick has been appointed chairman for the Miners annual "Shindig," which will be held in February.

George M. Sheperd, C.E. '08, now city engineer of St. Paul, spoke before the miners on the subject of "Some Municipal Engineering Problems," at their meeting December 3.

I.Ae.S.

"Behind the Weather Forecast" was the topic of a film shown to the aeros November 24. The picture showed the things that were necessary for the U. S. forecasters to do to predict the weather. The society planned an inspection trip to the Northwest Airways for the fall quarter.

A.S.A.E.

Swimming, with perhaps a sidelight on soil erosion, was on the program of a recent A.S.A.E. meeting. After a short business meeting, the society adjourned to the athletic building and spent the remainder of the meeting in the pools. There are 19 members in the society. Meetings are held the first and third Tuesday every month.

Architects Society

At a recent dinner meeting, Winston Close addressed the Architectural Society on his study of the architectural trends and developments in modern Europe. A travel film of Brittany was shown at the close of the meeting. The society has about 60 members.

A.S.C.E.

Students in the A.S.C.E. have written for slides to be used with talks later in the year. The civil bean feed has been the only large get-together all quarter. W. M. Carey was the speaker at this meeting.

A.I.Ch.E.

At a business meeting early in the quarter, the A.I.Ch.E. elected Gordon Custer as recording secretary and Eli Besser as treasurer to replace the officers that failed to return to school this fall. Mr. Lester Eck, '23, superintendent of the Minneapolis gas plant, addressed the society.

Employment on the Up-grade

According to figures released by the Employment Bureau, the employment of graduates in the engineering colleges has been steadily increasing in the last three years. The following is the employment status of the graduates of the June classes of 1934, 1935, and 1936. These figures are those which were available on November 1 of the years 1934 and 1935 and Nov. 30, 1936. Frequently graduates fail to inform the bureau of their employment and as a consequence these records are only close approximations.

	November, 1936			November, 1935			November, 1934		
	No. in Class	No. Employed	Per Cent Employed	No. in Class	No. Employed	Per Cent Employed	No. in Class	No. Employed	Per Cent Employed
Aeronautical Engineering	16	14	88	22	17	77	31	11	35
Agricultural Engineering	2	2	100	4	3	75	2	2	100
Civil Engineering	18	18	100	33	29	88	37	29	78
Electrical Engineering	42	32	76	58	41	70	54	18	33
Mechanical Engineering	43	38	88	29	24	83	42	25	59
Architectural Engineering	4	3	75	7	3	43	11	6	54
Architecture	6	6	100	14	10	71	17	10	59
Interior Architecture	1	1	100	3	2	66	2	2	100
Chemistry	16	8	50	20	6	30	16	4	25
Chemical Engineering	38	27	71	32	23	72	27	14	52
*Geology	0	..	..	3	2	67	1	1	100
*Metallurgical Engineering	8	8	100	7	7	100	12	10	83
*Mining Engineering	9	9	100	14	9	64	9	7	78
*Petroleum Engineering	2	2	100	2	1	50	3	2	67
	205	168	82	248	177	71	264	141	53

*These departments were not considered in the Engineering group during these years. The figures quoted for these years were obtained from the School of Mines office. Other figures quoted were obtained from the Employment Bureau and past records of the Techno-Log.

Honorary Groups Announce Initiates

Although three honorary societies will not formally induct new members until the winter quarter, several have already initiated their pledges and held their presentation banquets.

Pi Tau Sigma, mechanical engineering society, **Commacini**, architectural society, and **Phi Lambda Upsilon**, chemical society, will not have their lists ready till the winter quarter.

Tau Beta Pi, national honorary all-engineering fraternity, announces a list of 16 new members, 14 seniors and 2 juniors:

Juniors:
- Clark Hook
- Isadore Shapiro

Seniors:
- Reynold Bjork
- Jack Clayton
- Sherman Finger
- Donald Haight
- Erling Helland
- Dean Johnson
- William F. Kaiser
- Arvo Leppanen
- Elwood McGee
- Ottilio Morzenti
- Philip Palmquist
- Frank Parker
- Delroy Peterson
- Benjamin Polin

Eta Kappa Nu, national honorary electrical engineering society, held its biennial entrance examination on October 22, and its formal initiation on November 30. The candidates included five juniors and one senior:

Juniors:
- Gordon Brierly
- Kenneth Dunning
- Gordon Lee
- Nordahl Onstad
- Omar Patterson

Senior:
- Ottilio Morzenti

Chi Epsilon, national honorary civil engineering fraternity, on December 8 formally inducted the following initiates:

Juniors:
- Mark Olson
- Kenneth Person

Seniors:
- Milan Johnston
- Thomas MacKenzie
- John Merrell

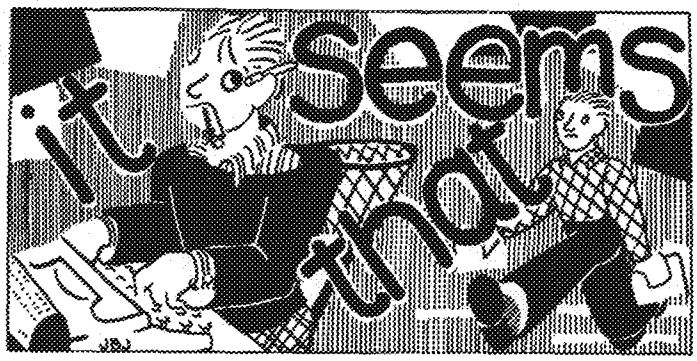
Societies . . .

A.S.M.E.

Sound pictures of the "Making of Alloy Steel" were shown at a joint meeting of the A.S.M.E. and the I.Ae.S. Recently the Mechanicals played host again, this time to the Civils. Pictures of the San Francisco Bay Bridge were shown. Prof. Schwartz, of the geology school, spoke at an early meeting. November 25 the Mechanicals inspected the U. heating plant, where a new boiler is being installed. A week later they trekked over to the Coca-Cola plant for a second inspection trip. Gerry Mitchell, president, hopes to have the society visit the medical school during the winter quarter. The society has approximately 90 members.

A.I.E.E.

The A.I.E.E., besides laying plans for the biennial Electrical Show next spring, has held two business meetings and one inspection trip. H. L. Oleson of the Western Electrical Company spoke at the first meeting, on "Electrical Measurements." Three weeks later Dr. Hartig talked on the "Future in the Field of Electrical Engineering." The one inspection trip this quarter was to the High Bridge Power plant in St. Paul. Orville Beckland, president, announced that the annual prize paper contest will be held again this year. At present there are about 70 members in the society.



By Melvin "Pete" Lohman

With the days of reckoning only a week away, your columnist's efforts are bound to be feeble. The only encouraging thing is the thought of Santa Claus and the Yule Tide Cheer.

Cecil Nelson, we hear, was getting in training for the Christmas cheer in a local grog-shop, the kind with a brass rail, when he lost his footing, slipped and fell, catching one of his gun-boats under the rail. The result, one sprained ankle and a disciple of Andrew Volstead.

And here's a hangover from last year's Claus time: Mrs. Neighbor of the Mitchells to Mr. Neighbor: "Look, dear, how picturesque; the Mitchells are bringing in a Yule log."

Mr. Neighbor: "Yule log my eye; that's Ted."

We always knew there was keen rivalry between the engineering frats, Theta Tau and Triangle, but we never suspected it would go as far as to have a member of one shooting a member of the other. For proof, ask Rawson Alkire, who was mistaken for a pheasant, and Orville Lundstrom, who didn't know the difference.

And with the seniors thinking of jobs and things, the job we'd like is stroking the Vassar crew.

Our complaint of the month concerns the M.E.s again. This time it isn't the scenery, but the climate. They tell us they have that brass monkey temperature over there every morn.

The best application of engineering theory to everyday practice is the wire in the phone booth in Main. If you know your electricity, a la Zeleny, you can save a lot of nickels. For instructions as to the method, consult any senior civil.

Overheard in the acoustics class. "Do you think a cannon shot can cause enough vibration to make it rain?" "Well, I can't say as to that but I've seen a shot-gun bring on a shower."

Those naughty civils (or do they just have knotty heads) have been making a weekly pilgrimage to the Gayety on Friday afternoons. It all started after a few of them went to see that not too clean show at the World.

What's happened to the Chems? Are they too busy making stink bombs to come out in the fresh air and enjoy life? The senior chems blame it all on to Prof. Ruth and his dad burn long assignments.

Rumor has it that the romance of Ray Bjork and the lass, for whom he left civil camp every week-end, has reached a serious stage. Someone should tell him that one can live twice as good as two.

The Aeros claim to be multi-linguistic now that they can understand the Russian and the Belgian languages also.

Bob Aslesen's mother asked him if his girl was the home loving type. "No," replied Bob, "you got to have a roadster."

Our poem of the month concerns the women-folk.

We like a drinker
Like Anne McDuff
She never no's
When she's had enough.

—So it seems.

CONVENTION-*alities*

and Personalities

By Bert Lindquist

The Pi Tau Sigmas, in addition to being able to write their own ticket as far as grades and jobs are concerned, have extended this field of endeavor to their feminine companions. Yes, they've even started writing specifications for the dates they were going to get when they hit good old Texas on their junket to the pie taw siggnaw convention. And before we go further, let us remind Mr. Bill Hansen that henceforth he will be provided with an infra-red screen to conceal that bright glow he acquires whenever he meets that "polished Southern gentleman."

And here's a brief résumé of what those guys want in their women. If they got what they wanted, they did better than we did when we tried writing made-to-order specifications on those Southern belles—of course, we're not Pi Tau Sigma; that probably explains it.

Item	Quantity	Description
Hair	500/sq. in.	Dark brown, no snarls. If dancing to be done, flavor with peppermint. No sharp points on hair pins.
Feet	two	Both pointing the same direction
Legs	two	Sturdy, good walking characteristics. No ( ). No knobs on knees.
Eyes	two	About 400 candle-power, concentrated beam. No stray glances.
Complexion	white	No polka-dots, reasonably smooth to the touch, no whiskers.
Chemical equation		Must have definite affinity for Minnesota lads. Slight rise in temperature after continued exposure to said lad.

The boys didn't complain on their return.

* * *

Little girl to her mother: "Will I walk to Heaven on a golden bridge?—the minister said so." "He's

wrong, dear, there are no bridges in Heaven—it takes engineers to build bridges."

* * *

Writing a column (?) this year has turned out to be a more arduous task than heretofore . . . You see, the editor is English, and often doesn't get the joke (if any) until after the mag has been lying around for a week after publication.

* * *

Editor's Note: The unexpurgated copy of what Bert Lindquist thought the editor was too "English" to get is available in the office. Bert had some fine ideas on what the boys should have asked for down in Texas, all drawn up in good engineering specifications. Come down and see us sometime.

* * *

The U. S. government was trying to purchase some land from a Chinese farmer on the coast of California. It was a rocky promontory and was an ideal situation for a light-house and fog-horn, badly needed in that vicinity. The Chinee was a public-spirited citizen and had the best interests of the government at heart but he refused to sell. When one of the gobs asked him why, after the officials had departed in disgust, he answered with a derisive snort, "You savvy San Diego? San Diego she have lighthouse, San Diego she have foghorn—lighthouse she shine, foghorn she blow but no good—fog she come just the same" . . .

* * *

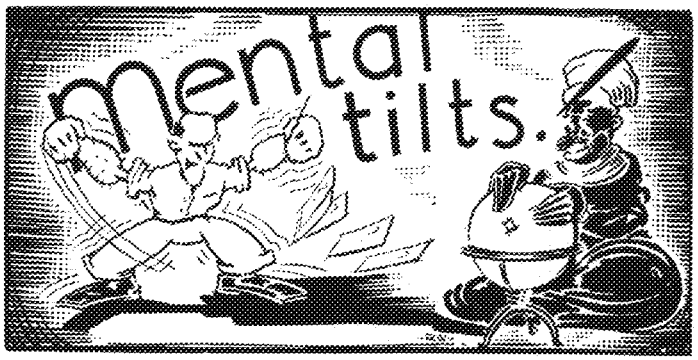
And when some of the boys began to beef about the increasing numbers of femmes in the Tech. Inst., Miner (Idiot) Simmons babbled, "Send them over to our Mines School, we can use them over there."

* * *

A couple years ago the Log office number began with 45 and we spent all our time telling Gladstone-callers to please dial nine—then we got it fixed and now the Skum office has the same difficulty. How do you suppose that happened?

* * *

A group of miners were fortunate to obtain jobs with the St. Paul Sewage Department—digging ditches. The next morning only two men reported for work.



By Gordon Wickre

THE winner of the prize for solving last month's teasers first is—believe it or not—a girl! Miss Dorothy Wishnick, Ch. '38, handed in her answers at 8:15 Monday morning following the issue of the TECHNO-LOG. *The answer to the first problem can be had by applying at the* TECHNO-LOG *office. The answer to the second problem is 5 cones. Come on, fellows, let's see you go for this month!*

Well, here we are again with a few little teasers that may help to take your mind off that pretty young blonde with whom you were out Saturday evening. Suppose you try your hand at them during those idle moments and let us hear how you come out with them.

A bright young scholar who had been guilty of breaking the school rules was in for a long period of detention. Always hanging on to that last hope, as young men will, he appealed to the dean and said, "Is there anything I can do to get off?" The wily old dean, with a deadly glint in his eye, replied, "Yes. If you can prove that 1 is equal to 2, you may go free."

The youth, being something of a shark at math, handed in the following proof, and the dean, who was not so good at solving as he was at propounding problems, could not find the fallacy in his reasoning and had to let him go even though he knew that there was a flaw concealed somewhere. Here it is:

Let $x = y$
Then $x^2 = y^2$
and $x^2 - xy = x^2 - y^2$
or $x(x - y) = (x - y)(x + y)$
Take out the common factor, $x - y$.
Then $x = x + y = 2x$, and
Therefore $1 = 2$.

Let's see who can find the fallacy first—don't all come at once!

Here's another that shouldn't take over five minutes of your time. A hymn-board in a church has four grooved rows on which the numbers of four hymns chosen for the service are placed. The hymn-book in use contains 700 hymns. What is the smallest number of plates, each carrying one digit, which must be kept in stock so that the numbers of any four different hymns selected can be displayed; and how will the result be affected if an inverted 6 can be used for a 9?

Quick, now! What is it?

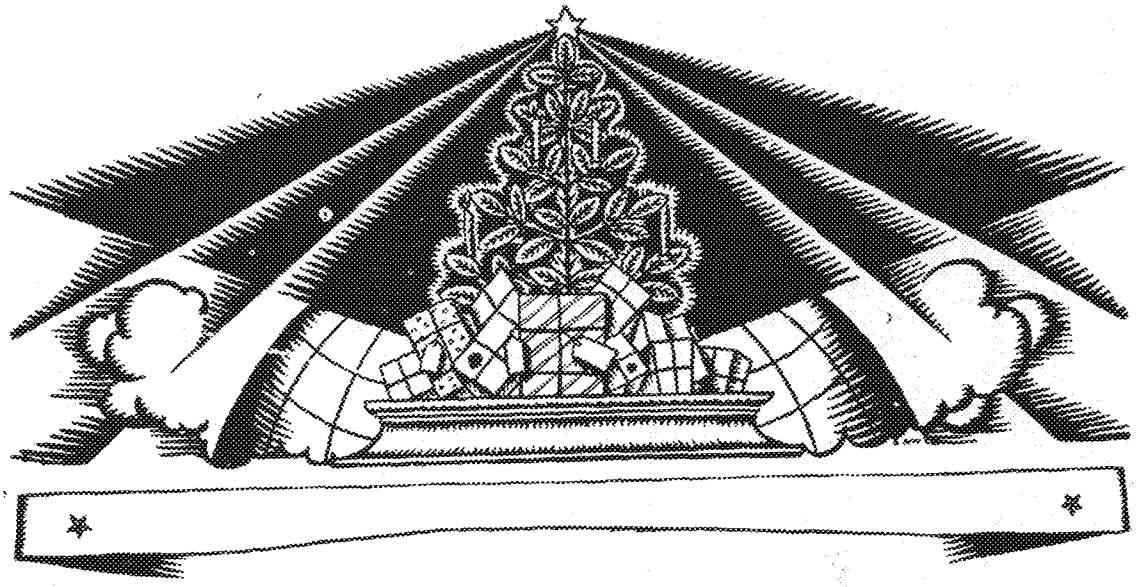
Well, well, here's the latest version of the "Cat's Pajamas." If two cats, on the opposite sides of a sharply sloping peaked roof are on the verge of slipping off, which one will hold on the longest? You are justified in believing that whichever one had the longest paws (or pause) would, naturally, hold on the longest. But you must scratch deeper than that. Come, come, now, who has it?

Shorts

Ebner Smith—Smith Welding mogul—bought an outboard motor for his employes to use on their vacations . . .

Wonder if any one ever tried Roman riding on a motorcycle? . . .

Two student aviators were watching far-off a lone airplane in the gathering twilight as he wheeled and turned, doing figure 8's and flipper turns. One said critically, "look at him! he's slipped on every one of the last three flippers that he's tried." The other student added scornfully, "Yeh, and lookit him now—skidding all over the sky. Why doesn't he come down? That guy can't fly!" Both shamefacedly walked on when, a moment later, the "plane" flew between them and a nearby tree and they found that they had been watching a bird . . .



Fall and Winter Purchases

Where Will You Make Yours?

There are 26,000 independent home-owned stores in Minnesota and surrounding states ready to serve your every need.

●

Patronize these neighborly stores . . . . see that your money goes to a home-owned institution . . it's good business all the way 'round

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis Saint Paul

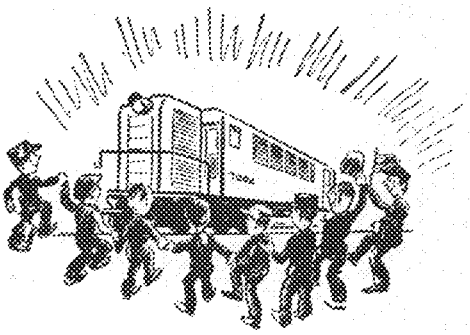
FIND YOUR HOME HERE					
EAST	Flying Time	Roundtrip Ticket	WEST	Flying Time	Roundtrip Ticket
Chicago	2 hrs.	$ 30.00	Fargo	1½ hrs.	$ 20.00
Cleveland	3¾ hrs.	62.85	Winnipeg	3¼ hrs.	35.00
Detroit	3½ hrs.	53.85	Bismarck	3½ hrs.	35.00
Buffalo	5 hrs.	76.80	Billings	5¼ hrs.	71.00
Pittsburgh	6¼ hrs.	75.45	Butte-Helena	7½ hrs.	90.00
Washington	7½ hrs.	94.80	Spokane	9¾ hrs.	114.00
New York	8½ hrs.	116.30	Seattle	11½ hrs.	136.00
Boston	10½ hrs.	127.55	Portland	13½ hrs.	151.88

SOMEBODY, somewhere, would rather have YOU for Christmas than anything else in the world. Now make that wish come true. Simply pack yourself off in a snug, warm Northwest Airliner on the 24th. Whether home is as far east as New York, or as far west as Seattle, you're there for Christmas. See how easy it is by getting a copy of Northwest Airlines' new time table. It shows convenient schedules to all important cities in the United States and Canada. Low fares include meals en route. There are no extras. In Minneapolis call BR. 3141 or BR. 1366; in St. Paul call GA. 4881 RI. 4500.

NORTHWEST AIRLINES

SEATTLE • SPOKANE • WINNIPEG • TWIN CITIES • MILWAUKEE • CHICAGO

G-E *Campus News*

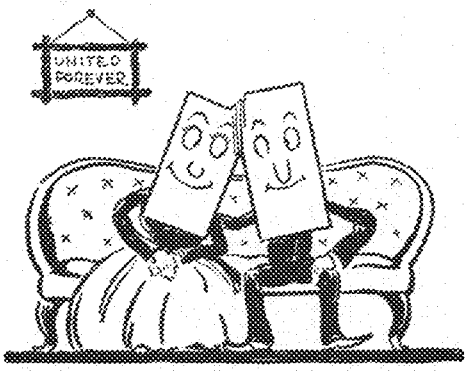


NUMBER 7000

JUST as if timed to take part in the 25th birthday celebration of the General Electric shops in Erie, Pa., Locomotive Number 7000 recently bowed its way out of its shed and took a brilliant turn on the test track.

The first of Number 7000's predecessors was begun in Erie in 1911, or just 25 years after electrical manufacture had commenced in Schenectady. Since that time locomotives weighing from 1½ to 300 tons have been turned out to improve haulage electrically. This range includes types for every sort of service—straight electric with trolley pole or third-rail shoe, battery types, internal-combustion engines, and combinations of different designs.

The Erie plant is notable for its contributions to practically every phase of modern electric transportation. The electrification of terminals and railroads has been accomplished largely with Erie equipment. Many of the new high-speed trains, which have aroused so much interest in rail travel, and many urban transit vehicles, such as street cars, trackless trolley coaches, and diesel-electric buses, likewise use Erie equipment.

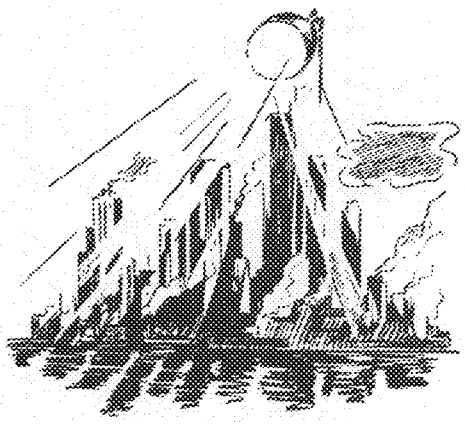


FIFTY YEARS OF WELDED BLISS

TWO pieces of metal were joined in "weldlock" fifty years ago. That was in 1886, when Professor Elihu Thomson, one of America's greatest pioneers in the field of electrical science and co-founder of the General Electric Company, invented resistance welding—fusing metals by placing them in contact and passing an electric current through them.

To mark the golden anniversary and to honor the man who officiated at the "ceremony," the Detroit Section of the American Welding Society dedicated a recent program to Professor Thomson's invention.

The years have seen resistance welding develop from its purely experimental stage into a process of metal fabrication that is wide in application. Metal radio and industrial tubes and parts, automobile bodies, the high-strength aluminum alloys used in aircraft, farm implements, the new lightweight railway equipment—all are fabricated by resistance welding.



SUNSHINE IN MANHATTAN

AT last there is sunshine—sunshine for those who spend so much of their hurried lives in the shadows of Manhattan's financial district. For in his new downtown recreation and health center—largest of its kind in the world—Artie McGovern, famous trainer and physical director, has equipped both the hot room and gymnasium with ultraviolet sunlamps.

Installed by General Electric engineers in the form of 26 ceiling units—probably the largest installation ever made in a single location—they not only afford health-giving artificial sunshine but are the sole means of illuminating the two rooms.

This installation marks another step forward in the field of lighting. The development of better lamps to sell at greatly reduced prices, the campaign for safety on the highway by means of improved highway lighting, the "Better Light—Better Sight" movement for the protection of eyesight, and the search for methods to improve general health have all been given strong impetus through the efforts of the General Electric Company.

98-340DH

GENERAL ELECTRIC

.e Vol. XVII No. 4 Jan 10 '37 E P January 193

INNESOTA TECHNO-LOG

This Issue

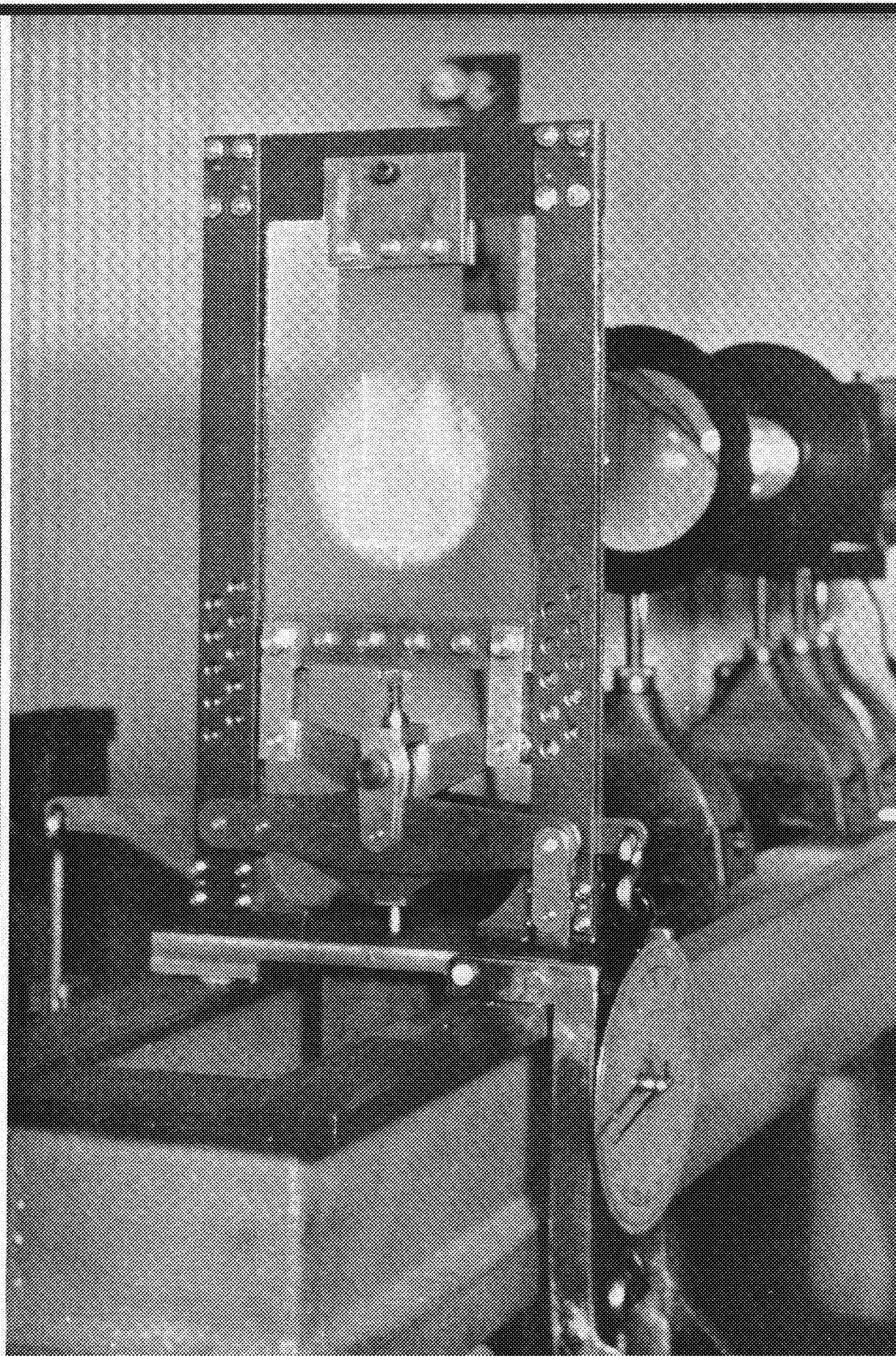
ecording
icromotion

gional
anning

Keramos"

lider Club

ipstix

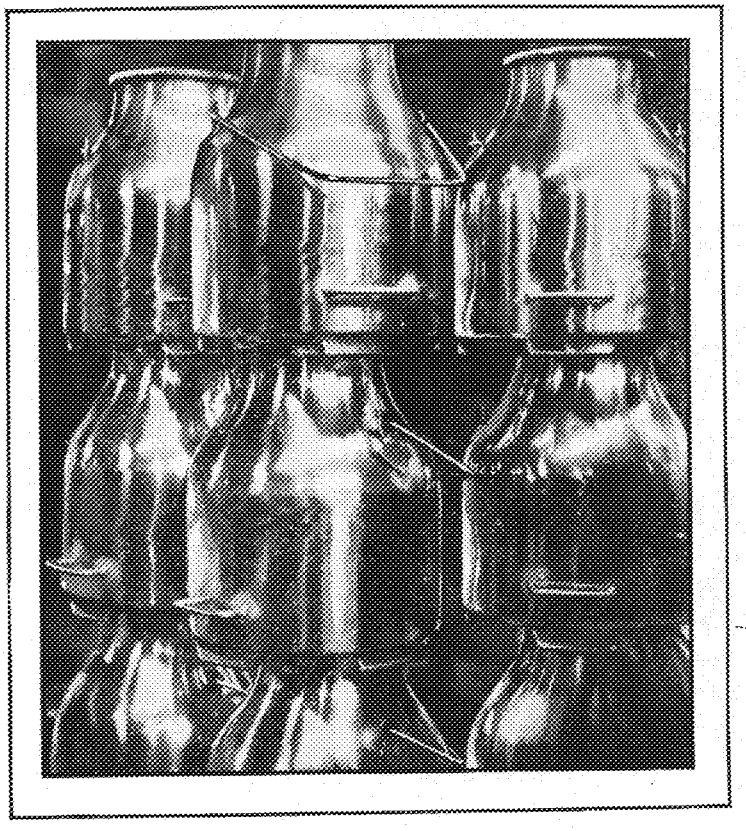


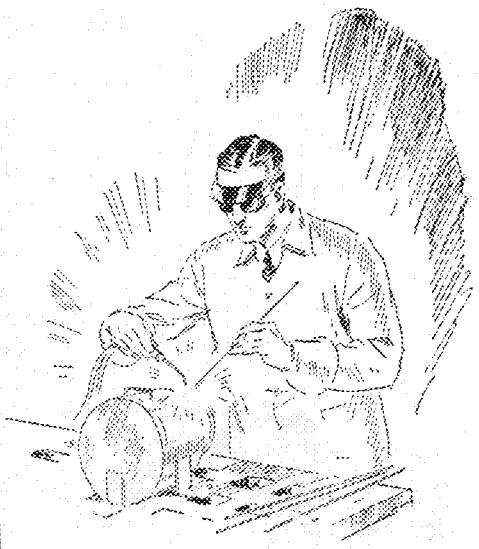
Better . . because IT'S WELDED

● The modern milk can is better because it's welded. Whether the can is made of aluminum or stainless steel—from the standpoints of cleanliness, sturdiness and serviceability—it is easy to see why the use of welded joints is beneficial.

Welding has made many good products better—milk cans, automobiles, airplanes, radios, refrigerators, streamlined trains and a thousand other things. This modern method of manufacture is applicable to the widest range of materials—steel and iron, aluminum, copper, brass and all other alloys and metals, even platinum. It is ideal for use where strong, smooth, invisible joints are necessary for enameling, for cleanliness or for appearance.

Tomorrow's engineers will be expected to know how to apply this modern metal-working process. Several valuable and interesting technical booklets describing the application of the oxy-acetylene process of welding and cutting in design, construction and fabrication are available from Linde offices in principal cities. Write The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York, N. Y.





Everything for Oxy-Acetylene Welding and Cutting

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

FROM LINDE UNION CARBIDE

SCOOP!—

We're giving you a preview of just one of the many pictures that will fill the ENGINEERS' Section of the

★ 1937 Gopher ★

This familiar scene of slide rules, brief cases, and that "head-in-the-hands" look is *part* of your school life.

BUT—

In order to Complete your Education and have a Permanent Pictorial Record of fellow engineers

get

A 1937 Gopher

It's Your Book

SENIORS—

You will be contacted soon. Be sure to sign up for your official senior picture in the 1937 GOPHER

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

JANUARY, 1937

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Elwood McGee, Transit Corres. Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas.	Eta Kappa Nu
Edward Kaiser, Pres. John Hollihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Bernard Hein, Pres. Henry Nitta, Sec'y	The Commacini

This Month

VOLUME XVII — NUMBER 4

Officers of the Professional Societies

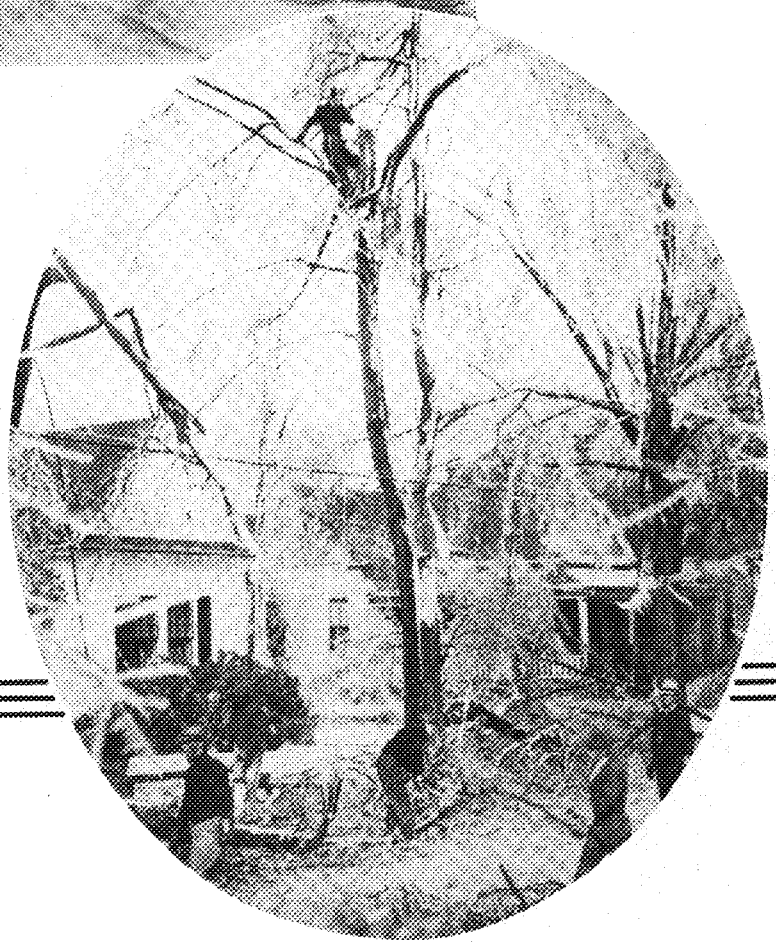
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Perry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Prahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. Robert Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Wodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Aikire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	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, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



When Winter Rain Froze on Georgia Power and Phone Lines

—Electrical World

Camera Records Micromotions

By Wayne Stone, M.E. '36

Of the Time and Motion Department of Minneapolis Honeywell Regulator Company
and former editor of the Techno-Log

THE taking of time studies with a stop watch is definitely an art. It is true that the stop watch can be read by a ten year old and that only simple addition and multiplication are necessary for the calculation of rates from time studies; but in every time study data sheet there is a little space in which a figure is to be entered that is to allow for skill, effort, and fatigue. The art consists in the determination of that figure.

There are two general methods of setting rates from time studies. In one method the superior worker is studied and allowance for skill and effort are set such as to make the rate attainable only by a super-skilled worker. In other words the rate is set for a theoretically perfect worker. However, the base wage in dollars per hour on which the rate is calculated is very high in order that the worker who attains this high rate earns a high wage, and consequently the average worker, although he does not make this rate, earns an average wage.

In the other method an attempt is made, by setting the proper allowance factors, to set the rate for an average operator working under average conditions. A base wage which the company desires that the average worker shall earn is used in the calculation of the rate. Thus the average operator who makes the rate earns an average wage and the super-skilled worker exceeds the rate and may earn even double the earnings of the average worker.

As the greatest faults of either of the two methods lie in this attempt to adjust a time study to correct for different conditions of skill, effort, and fatigue that prevail on every different job and every different worker that is studied, certain standards have been set up to guide the time study man in his decision of a proper allowance, but these at their best are rather vague.

A super-skilled worker is defined as: (1) the operator of excellent skill perfected who (2) has been at the work for years, (3) is naturally suited to the work, (4) works like a machine with (5) motions so quick and smooth that they are hard to follow, (6) does not seem to have to think about what he is doing, (7) knows and uses all the best methods and short cuts, and (8) is conspicuously the best worker of all. Such a worker may be rated from a plus seventeen per cent to as high a plus factor as the time study observer judges is correct. There are similar classifications of skill down to average, having an allowance factor of zero, and on down to poor, having an allowance factor of minus twenty-two per cent. The time study observer has a leeway of three to five per cent within each classification.

Classifications similar to these have also been set for variations in effort put forth by the operator at the time of the study. These allowances leave the time study observer a wide latitude in the setting of a rate.

One of the aims of time and motion study is the reduction to an exact science of the methods of performing an operation and the determination of the time that the operation shall consume. While all of the work that is done to determine correct methods and times is based on time studies, which may have very high accuracy, this data also include an allowance factor based on the approximate standards that have just been described which introduces an error into most conclusions in the field of time and motion study.

In recent years an attempt has been made to eliminate this error in time studies. This has mainly been accomplished in machine operations where the machine time is a relatively large part of the total time. The machine time can usually be ascertained quite accurately. For example, given the speed and feed of a drill press and the kind and thickness of the material to be drilled, the time for drilling the piece can be readily calculated. Certain average times for handling of the parts have been set up

BENCH ASSEMBLY STANDARDS SHEET

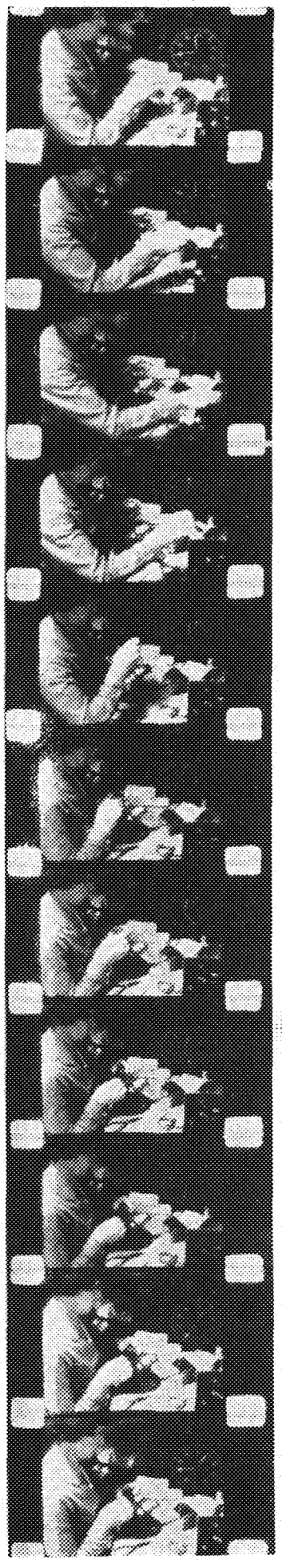
Elements	NO.	THERBLIGS	TIME	Number	Total
		(A) MOVES			
	1	MOVE 24"	10.4		
	2	MOVE 18"	9.5		
	3	MOVE 12"	6.7		
	4	MOVE 6"	6.1		
	5	CARRY 12"	13.0		
	6	MOVE H. TO H.	8.3		
	7	MOVE P. D. TO WORK	18.7		
	10	GET SOLDER ON IRON	24.1		
		(F) MISCELLANEOUS			
	1	POSITION	9.7		
	2	INSPECT BY GLANCE	16.1		
	3	STRIKE WITH HAMMER	6.4		
	4	BEND WIRE WITH PLIERS	9.4		
	5	TURN HAND OVER	3.0		
	6	TURN OBJECT OVER	13.6		

NOTES

TOTAL FACTOR | S. T. | A. T. | HRS/M

B. W. | 20.8 | A. T. | $/M

Figure 1



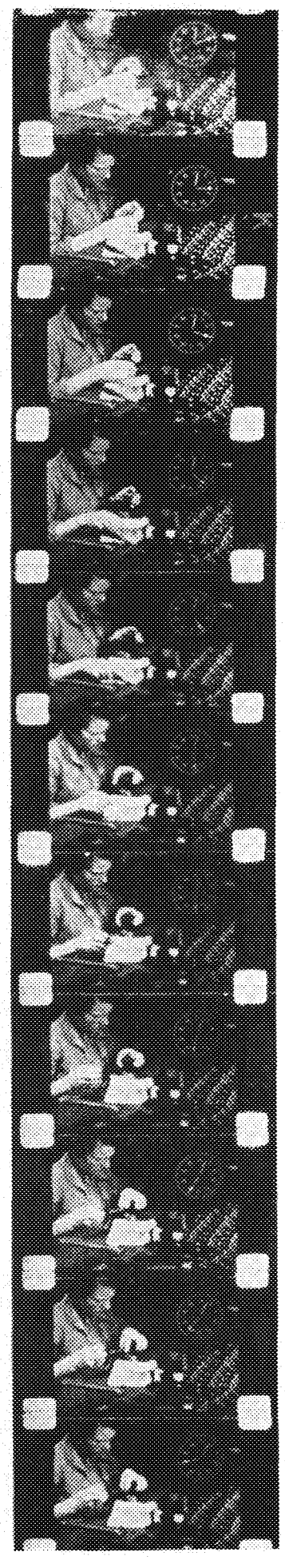
and, even though slightly inaccurate, when added to a relatively long machine time their effect on the accuracy of the total time is negligible. Furthermore, formulas for handling-time can usually be set up. In all punch press operations of a certain type the procedure for performing the operation is virtually the same. That is, the part is picked up, set in the die, the press is tripped, the piece removed from the die, and disposed of into a box or chute. Obviously a formula can be set up for all operations that have the same procedure as this, variables being size of piece, speed of press, and so forth.

Recently the Minneapolis-Honeywell Regulator Company has been attempting to eliminate time studies taken by stop watch and the error incurred in the allowance factors for skill and effort. The work in this company is peculiar in that in manufacturing controls for heating and air conditioning, every installation is different, requiring a great variety of instruments performing the same function but in a slightly different way in order that these instruments be assembled into nearly any conceivable combination. When it is considered that there are twenty-two variations of one motorized gas valve with a range of size from three-quarter inch to three inches in each type and with most any combination of voltage and frequency desired, one may understand the problem that has to be met on the assembly floor. There are many thousand different assembly operations that must be performed, some as frequently as ten times per year and others as frequently as five hundred thousand times per year. Yet proper data must be kept on the small run jobs as they are sufficiently frequent to cause trouble if inaccurate. Therefore, a method of arriving at rates for a job accurately and quickly is very desirable.

It was decided that the best way to accomplish this was to find the average time for all of the moves that might be used in any bench assembly operation. Then by selecting the moves in any one operation these average times could be added together to arrive at the total time and consequently the rate for the job.

The first step in gathering the data was to obtain a large number of micromotion studies which would include all of the moves it was judged necessary. The films were taken with a Paragon 16mm. camera equipped with an f1.5 lens. The illumination was provided by two No. 4 Photoflood lights. Time was measured with an electric clock graduated in thousandths of a minute. These films were analyzed one frame at a time, readings being taken at the beginning and end of each move. These were averaged, comparisons being made between different operators photographed to determine if any of the operators were far above or below average. These averages were tabulated and entered on a form made up for the purpose of calculating rates from these standard times. This form is shown in figure 1. The different moves are coded for easy reference.

In using this sheet for calculating rates the calculator must have a very clear conception of every move that is made in the operation. The method consists of going



These frames were taken from the micromotion study films of the Minneapolis Honeywell Regulator Company. They are not consecutive pictures but pictures clipped from strips of film to illustrate the kind of operations timed and studied.

through the operation, either mentally or actually, placing a check mark as each move is made in the column marked number opposite the move as it is made. After the study is completed the number of checks against each move are counted and multiplied by the time for that move, the result being placed in the Total column. This Total column is then added to find the total time for the operation. The squares in the lower right hand corner are for the calculation of the rate from the total time.

These standards were checked against a large number of studies taken by stop watch. It was found that the stop watch studies ran consistently higher than the standards allowed, and as the standard times are selected times rather than allowed this was expected. It was found necessary to raise these standards by twenty per cent. It was also found convenient to make certain combinations of frequently used moves. For example, time to turn down one brass nut with a power driver is composed of the following moves: Move twenty-four inches to the power driver, grasp power driver, move power driver to work, position power driver, turn down one brass nut with power driver, carry driver twelve inches, release driver. As this is a common move the time for this element was figured and placed on the tabulation sheet. Also, the time for driving two brass nuts with a power driver is the time for one nut plus the time for a move position to position, position power driver on nut, and drive nut. This time was figured and also entered on the sheet. Therefore, the time for driving any number of brass nuts is the total of the time for the first nut plus the total number of nuts minus one times the time for each additional brass nut. In such a fashion were all of the common combinations tabulated.

At the present time these bench assembly standards are being checked against all stop watch studies that are being taken. We cannot say conclusively yet that these standards will give an absolutely accurate rate for any job calculated but indications are very strong that with very slight adjustments in some of the elemental times these standards will be definitely more satisfactory than stop watch studies both from the viewpoint of accuracy and speed of calculation.

Stresses Seen by Polariscope

M.E.s Design Machines Photoelastically

ON the cover this month is a picture of the photoelastic polariscope in the machine design laboratory in the Mechanical Engineering Building. It is used for measuring stresses in transparent models of machine parts and is the largest instrument of this kind in the country, having a seven-inch diameter field and a 211-inch overall length. James J. Ryan, Assistant Professor of Mechanical Engineering, is responsible for the development and use of the machine.

Stresses induced in models are studied by means of pictures taken with polarized light. The light source is a mercury vapor lamp and its beam is sent through polarizing and analyzing prisms to an 8 by 10 inch camera.

A three-fourths scale model of a T-tail, which will hold one of the rotating field poles of a generator, is in place in the machine shown on the cover picture. On this page the photograph of stress contours made by the polariscope is shown. The stress analysis of this machine was required because of overspeed stresses in the rotating field poles of the house generator at Bonneville Dam. The propeller type water wheel used in this installation had maximum speed 50% greater than the standard Francis wheel. Installation of this new type wheel necessitated a new analysis, obtained best by the method described here.

The picture on the right shows the contours of stress. Dark areas in the body are areas of zero stress and the concentration of the light line contours at sharp corners shows points of maximum stress. Stresses become greater in proportion to the number of lines.

The stress photograph is only half the problem in these tests. The second part of the measurement is the determination of changes in thickness of the model under load by means of gages measuring to twenty-millionths of an inch. From the photoelastic pictures stress differences are found, since they are proportional to shearing stresses represented by the contours. The sum of the stresses is determined from the thickness measurements.

These measurements are converted to quantitative units by means of values obtained by known moments applied to a simple beam of the material used in these models.

Regional Planning on the Columbia

II. A Proposed Transmission System

III. The Bonneville Project

By Erling Helland, C.E. '37

IT MAY be well, at this point, to make a few distinctions concerning the use of the term, "regional planning," as applied to the work that is being done or that is planned for the development of the Columbia River; the best way, it seems, to make this usage clear is to compare the federal government's activities in the Pacific Northwest with its ambitious and much better known undertaking in the southeastern U. S., the Tennessee Valley Authority.

In the Tennessee Valley the government found a relatively stable population which had descended largely from early colonial stock and which had subsisted for many generations on semi-primitive agriculture, utilizing methods that sapped food elements from the soil and eroded it to swell the silt burden of the rivers; it found an illiterate and poverty-stricken people in close proximity to the country's populous industrial regions. It found rivers that flooded periodically to the great distress and damage of thousands who lived in the rich lower river valleys.

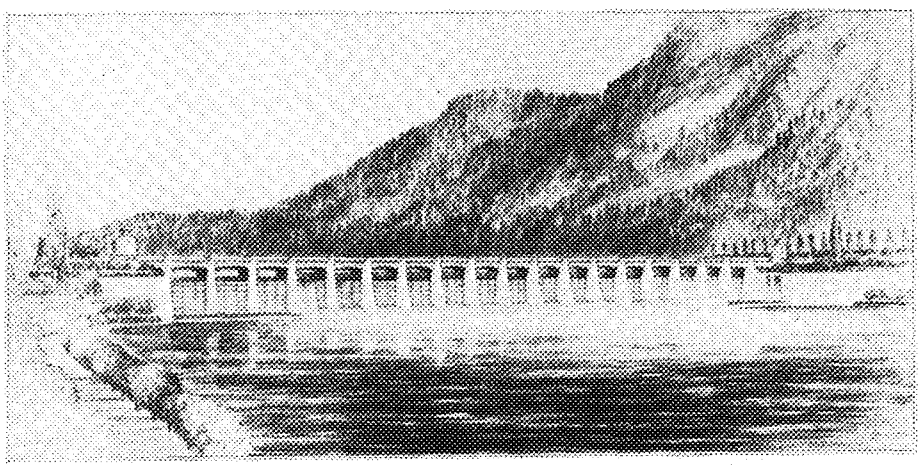
These and many other considerations were guiding factors behind the legislation that established the organization and the scope of the Tennessee Valley Authority. (See T. V. A., by Don H. Erickson, in the November, 1936, TECHNO-LOG). It should be noted that the convenience of "emergency" has not been utilized to such a great extent in the defense of the Administration for its Tennessee valley activities as it has for justification of other vast public works projects, the reason being, of course, that the populations most directly concerned are subject but little to the cyclical depressions of industry, commerce, and agriculture.

In the Pacific Northwest, however, conditions are vastly different from those of the Tennessee Valley. The states of the north Pacific coast are made up, on the one hand, of vast, sparsely settled areas, forests, mountains, semi-desert land, unused fertile arid country, and vast wheat regions; and, on the other hand, of more heavily populated regions, the larger urban areas of the lower Columbia and Puget Sound devoted to manufacturing, shipping, lumbering, and fishing, the interior cities that are supported by minerals, grain, and timber, the numerous rich irrigated areas east of the Cascades, and the hundreds of small farms on the well watered Pacific slope of this range. Here the country is newer, agriculture is more advanced, and the economic system more highly interdependent than in the Tennessee Valley.

Here is a region that felt acutely the first effects of the industrial depression; thousands were thrown out of work by the recession of the basic industries of mining and lumbering, and by the contraction of trade. These conditions made it apparent that the immediate need of the region was the restoration of employment, rather than the reordering of the social or economic structure. Accordingly, the government began, as a part of its work-relief program, the construction of two large dams on the Columbia, one at Grand Coulee on the upper Columbia (see map), and one at Bonneville on the lower river.

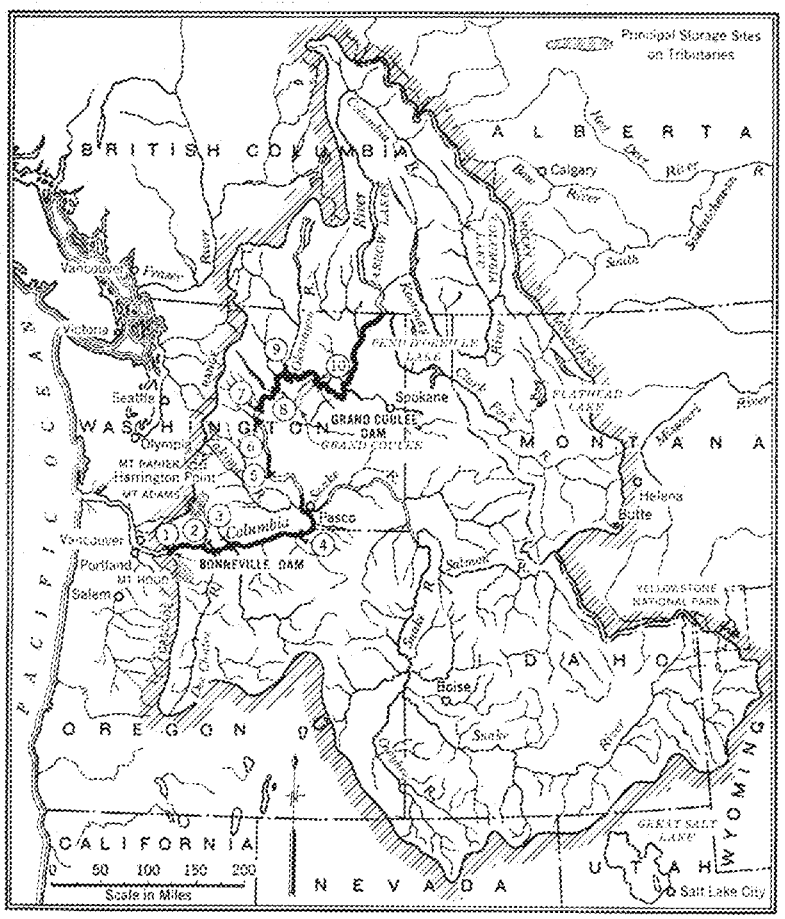
A view of the 1,250-foot spillway dam from the downstream Washington shore.

—*Compressed Air Magazine*



Planning, in the case of the Columbia, seems thus far to be an attempt to coördinate the rapidly materializing power projects which have resulted from the emergency public works program and to find a market for the forthcoming power.

Despite the emergency nature of these projects, they have behind them many years of investigation, planning, and promotion. Construction of a dam at Grand Coulee has been advocated for many years as the key structure of an irrigation and power development, whereas a dam on the lower Columbia has been suggested



—*Civil Engineering*

A map of the drainage basin of the Columbia on which are indicated the sites of Bonneville and Grand Coulee dams.

for the improvement of navigation and the incidental generation of electrical energy. In both of these projects flood control is a decidedly secondary consideration.

Now that construction is well advanced at Grand Coulee, and with the completion of Bonneville dam expected within a year, the necessity of a plan for the disposal of the power becomes more apparent; a large part of the immediate work of regional planning in the Pacific Northwest is the framing of such a plan.

The Proposed Grid

At the request of the Washington State Planning Council, Professor C. E. Magnusson, of the University of Washington has developed a plan for the integration of these new power units with the present facilities, and for the control of wholesale electricity rates. His plan, which was suggested by the British Grid System, proposes that the electric power industry be divided into three separate and independent divisions: (1) generation, (2) transmission, and (3) distribution; he holds that the transmission system should be owned and operated by an agency of the federal government, leaving the generation and distribution facilities under their present ownerships; Professor Magnusson draws a parallel between the transportation of electrical energy by transmission systems and the transportation of chemical energy in the form of coal or oil by railroad or pipeline, and holds that the conditions bringing about the legislation which separated these mineral extraction industries from the common carriers is equally applicable to electrical energy generation and transmission. His plan would include the construction of additional long distance transmission lines by the government, and their interconnection to form a statewide or regional grid, which would, by its absolute control over the transportation of electrical energy, give the U. S. agency effective control of wholesale rates, and at the same time provide means for more efficient use of generating facilities. The proposed agency would be known as the Pacific Northwest Power Board, organized as a corporation. In addition to its most important functions, which would include the operation of the grid, the sale and purchase of energy, and the establishment of rates, it would operate the federal power generating stations, such as those at Bonneville and Grand Coulee, and engage in various supplementary activities.

The Bonneville Project

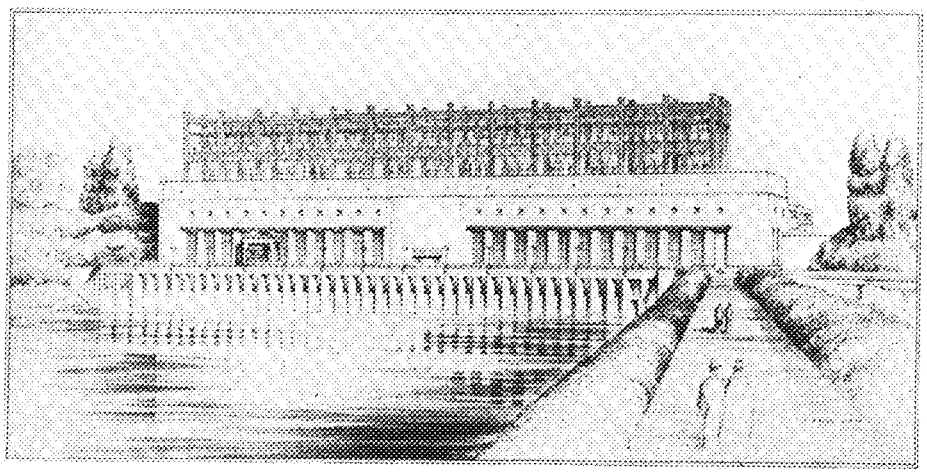
Of the two great projects under construction, the power plant at Bonneville is most propitiously located, being less than fifty miles from Portland. At Bonneville, the Columbia flows westerly through a deep cut in the Cascades, discharging an average of about 211,000 cubic feet per second, roughly twice the flow at Grand Coulee. Here, near the axis of the Cascades, the Bonneville power and navigation project is under construction by the Corps of Engineers, U. S. Army.

The main features of the project are (1) the dam, (2) the powerhouse, (3) the navigation lock, and (4) the fishways.

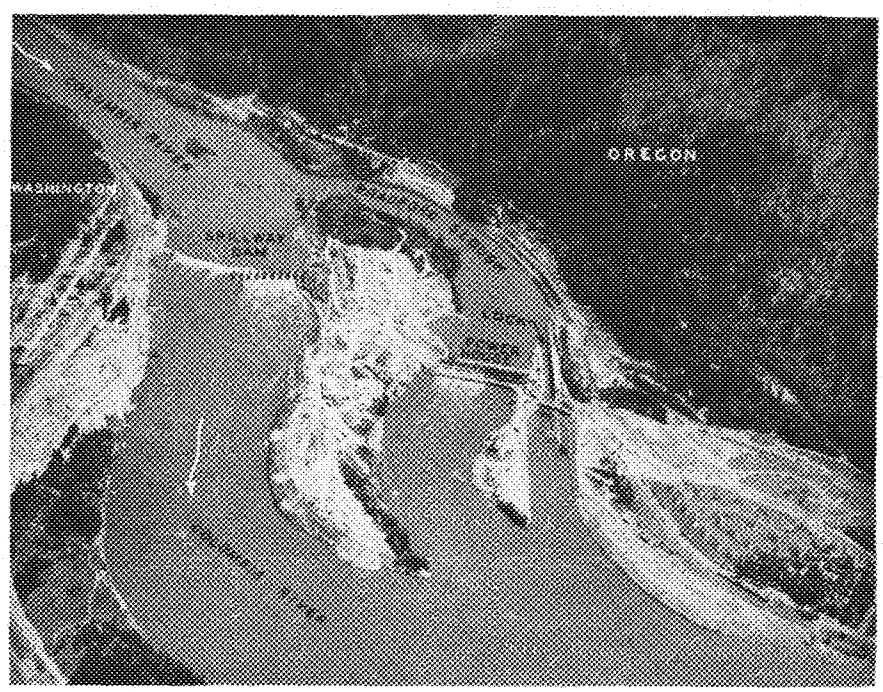
From the aerial photograph it can be seen that the Columbia at this point is divided by Bradford Island into the main or north channel on the Washington side, and Bradford Slough on the Oregon side. River flow conditions showed the necessity of a spillway with very large

The powerhouse spans the channel between Bradford Island and the Oregon shore

—*Compressed Air Magazine*



capacity, and topographic conditions indicated that the maximum head for power development could be obtained in the downstream end of Bradford Slough; for these reasons it was decided to erect a dam in the north channel with the spillway running nearly the entire length of the dam. The dam is of concrete, of the gravity type, resting on a landslide formation composed of volcanic ash mixed with rock fragments consolidated into a solid material. The dam itself is 1,250 feet long, 180 feet wide at the base, and 170 feet high above the lowest foundations. The spillway is 900 feet long, contains eighteen 200-ton vertical lift gates, operated by gantry cranes, and is surmounted by a service roadway. The maximum discharge capacity is 1,600,000 cubic feet per second, 37 per cent more than the greatest flood of record (1894) and equivalent to an estimated 1 in 10,000 year flood.



—*Civil Engineering*

An aerial view of the Bonneville project as it appeared in the early summer of 1936.

The power house, a structure planned to house six generating units, is of reinforced concrete, 608 feet long, 180 feet high, with an overall width of 207 feet; the plant extends from Bradford Island to the Oregon shore and rests on a foundation of hard andesite. Two Kaplan adjustable blade turbines, the initial installation, with a capacity of 60,000 horsepower each at a head of 50 feet, turn vertical type generators with ratings of 43,200 kw., 0.9 power factor, 13,800 volts, 3 phase, 60 cycles, and 75 r.p.m. That each generator is expected to weigh 1,400,000 pounds, and each turbine with its shaft, 2,000,000 pounds is an indication of the enormous size of the equipment. Each turbine will utilize about 12,200 cubic feet of water per second. Plans call for the ultimate installation of eight additional units to bring the capacity up to 600,000 horsepower.

The Columbia is navigable now only as far as Vancouver, Washington, a port 45 miles below Bonneville and 110 miles from the sea. With the completion of the dam and the dredging of part of this 45-mile stretch, it will be possible for ocean-going vessels to ascend the river to the Dalles, 191 miles from the Pacific. (A large, modern wharf and warehouse have been constructed high above the river's surface at the Dalles in anticipation of the advent of water transportation.) To provide passage past the dam, a large, single-lift lock is under construction; it is to be 500 feet long, 76 feet wide, with a minimum depth of 26 feet (98 per cent of the time) and, at low water, a lift of 66 feet, the highest of any lock yet constructed.

The tremendous value of the annual salmon catch to coast and inland fishermen, and the salmon's habit of ascending the Columbia to spawn have given rise to a large share of problems and expense at Bonneville; the estimated cost of facilities to enable the salmon to migrate upward past the dam has been increased from less than $1,000,000 to approximately $3,500,000 to meet the demands of fishing interests; as now planned, these fishways will be made up of three double fish locks and three sets of fish ladders; each ladder consists of a series of pools, each one foot higher than that preceding, providing the salmon with a stairway of easy cataracts. The fish locks operate in much the same manner as navigation locks, and include a rising floor to urge upward those who hesitate.

Editor's Note: This is the second of two articles by this author on the Columbia River Power Project. The first appeared in the October issue of the Techno-Loc *and dealt with the upper dam project, Grand Coulee.*

"Keramos"

By E. L. Anderson

Associate Editor, Iowa Engineer

PRICE is fixed, we are taught in economics, by two factors—supply and demand.

If, then, one offers himself on an employment market where the demand is greater than the supply, he is assured of:

(1) A good job at a higher than average beginning salary.

(2) Promotion, if he measures up to his firm's expectations, within a short time.

(3) An excellent chance of attaining an executive position.

Such a condition exists today and has been prevalent for several years, even throughout the depression, in the field of ceramic engineering. It is due to a number of causes, one being the fact that a large number of

Engineers Wanted!

Read this discussion of education for the ceramics industry to see what other students study.

industries in the widely varied lines included in the field are striving to keep up with modern industrial advancement and hence the demand for technically trained men is constantly increasing.

Most important, however, is the fact that the supply is not increasing proportionately, largely because of the fact that the word "ceramics," being unfamiliar to most prospective college students, does not attract them as do the other branches of engineering such as mechanical, chemical, and electrical.

Ceramic engineering, logically enough, has been defined as the application of science to all phases of the ceramic industries.

This definition still leaves us unenlightened until we learn that "ceramic" was derived from the Greek "keramos," which means "burned stuff," and was usually applied just to clay. "Ceramics" was, then, originally applied only to clay products, but the term has been broadened to include the mining and manufacture of all products made from non-metallic minerals. Among the raw materials mined and processed are: clay, feldspar, talc, quartzite, Fuller's earth (a clay-like substance used in making cloth thicker and more compact, as well as in removing grease and oil spots from clothing), gypsum, graphite, sand, bauxite, and the stones, among which are granite, limestone, and dolomite.

The general classifications of the finished products manufactured from these materials, and a few of the subdivisions of each, are:

Structural clay products:

Brick, structural tile, sewer pipe and drain tile, electrical conduits, architectural terra cotta.

White wares:

Dinner ware, floor and wall tile, dental porcelain, chemical porcelains, electrical insulators, art pottery.

Glass products:

Building glass, table glass, bottles and containers, light bulbs, quartz glass, chemical glass, optical glass.

Abrasives:

Carborundum and alundum, grinding wheels, abrasive papers, machine tools.

Refractories:

Fire clay refractories, silica, chrome, and magnesite refractories, crucibles and muffles, zinc and gas retorts, glass pots and tanks, insulating brick, refractory cement.

Enameled iron and steel:

Sanitary ware, cooking utensils, stoves and refrigerators, hospital ware, signs.

Cements:

Portland cement, gypsum plasters and cements, magnesium and zinc cements, lime and lime plasters, dental cements.

According to A. F. Greaves-Walker, professor of ceramic engineering at North Carolina State College, when "lumped together, the industries manufacturing these products rank next to the iron-and-steel and coal industries in value of output produced annually in the United States."

All of the ceramic processes involved are based, fundamentally, on chemistry and physics, or, being more specific, we may say, on high temperature chemistry and physical chemistry. In fact chemistry plays such an important part that ceramic engineering is considered by some to be an offshoot of chemical and mining engineering.

Hence the ceramic engineer must have a thorough knowledge of fundamental chemistry and physics and a distinct adaptability to mathematics. "Those who have no difficulty with mathematics and the sciences can be assured of success in ceramic engineering if they are willing to apply themselves closely," according to Prof. P. E. Cox, head of the department of ceramic engineering at Iowa State College.

The required technical courses in ceramic engineering at Iowa State College include: fabrication of ceramic wares, test methods, die correction, processing raw materials, ceramic calculation, refractories, kilns and dryers, plant design, special ceramic problems, and pyrometry (high temperature measurements).

These are, of course, in addition to twenty-six quarter-hours of mathematics, thirty-six hours of chemistry, twelve hours of geology, and many other courses in allied branches of engineering.

As in other lines of engineering, the graduating engineer can usually choose to enter production, design, construction, sales, or research. Ceramics is as "old as the hills," but because of the comparative recency with which educators have begun to devote their attention to it, research in its field is particularly promising.

Looking over records of ceramic engineering graduates of Iowa State College to determine how ceramic engineers are employed, we find one-fourth of the graduates in various branches of the enameling industry. They hold positions ranging from general superintendents to beginners employed in control work. Two of them are well-known research directors.

Several alumni are employed in sales work, some of these in enameling, others in fire clay products, and still others in various other branches. One of them plans all the ceramic research work of the largest grinding wheel company. Another is a mathematician in the research department of the Corning Glass Company. He works directly under the men who planned and produced the two mirrors for the great 200-inch telescope.

And so one might go on for several pages giving examples of the work done by the ceramic engineer. Those given, however, should give the reader a fair comprehension of the opportunities for men technically trained in ceramics.

The Minnesota Techno-Log

JANUARY, 1937

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

EDITORIAL STAFF
Donald Erickson, Copy Editor
Herbert Gaustad, Alumni Edr.
Erling Helland, Feature Edr.
Fred Warner, - - Reporter

BUSINESS STAFF
Robert McDonald, - Office
Gordon Brierley, - - Adv.
Wallace Wilcox, Circulation
Vernon Hoden, - Circulation

Registration Hits Some Snags

EVER since the inauguration of the new registration policy complaints and criticisms have been expected among students and instructors. Such criticism has been generated with vigor since winter quarter registration.

What are the conditions which have precipitated this criticism? Before the vacation the registration office made known that it would be open for registration on Monday, January 4, from 8:30 A. M. to 12 noon. On Monday morning there was such a crowd of students present by 10:30 A. M. that the force was unable to register them all. Although there were no students waiting when the classification offices closed at 12:30 A. M., many had gone out for lunch expecting to register in the afternoon. The enrollment department was forced to remain open till 3 p. m. to accommodate all those who had been classified in the morning. The instructors on duty here went without lunch because of the rush. From those students who came back in the afternoon to be classified the University collected the $2.00 late registration fee on Tuesday.

What was the reason for the confusion? Perhaps the most important reason was the uncertainty last fall of most students concerning their plans for the year. It has been conservatively estimated that over 50 per cent of the students wanted to change their programs for this quarter.

What is to be done to improve the new set-up? The first step toward improvement must be to familiarize the students with the object, the procedure, and the possible results of the plan. After this is accomplished it will be up to the students to make a thorough study of their courses each fall in order that they may decide definitely on a program for the year. If such results are not possible, it will be up to the administration to provide a set-up that will be able to handle registration difficulties. We might suggest that those who desire to change programs for any quarter be allowed to file such a request and, if allowed, to make that change during the preceding quarter. If this system will work out, about half of those who would be re-registering would be taken care of before the beginning of the quarter. Then the registration office would be able to estimate the number who will re-register because of failures and plan to take care of them and of new students accordingly.

At the Desk

A supplementary short paragraph elsewhere in the issue supplies the why, how, and where, of the cover this month. A familiar scene in not so cold parts of the country, and occasionally here, is the Georgia picture of power and communication interruptions of service. Wayne Stone once again writes for the magazine through the experienced eyes of a hard-working alumnus, and relates the results of time study under actual working conditions at the Honeywell Plant in Minneapolis.

The Columbia River dam series, by Erling Helland, ends this month with a description of the Bonneville Dam project, and plans for future development. Refer to the October issue of TECHNO-LOG for complete coverage. An informative article resulted from the ECMA convention this fall, where the editor met an Iowa student interested in ceramics. He spoke so convincingly on the topic, that he was asked to do an article on it for us. The title is "Keramos."

Freshman and sophomore and five year business students are asked to take cognizance of the notice of a TECHNO-LOG smoker to be held soon. Make it a point to attend, and see what your chances are. A borrowed article was printed by us this month because we enjoyed reading it, and thought perhaps you would. Gets more interesting each paragraph. Lastly, we'd like to call your attention to an ad this month—that for the Miners' Shindig. A news article in the back of the mag elaborates, and promises it to be a gala affair.

Engineers Day Appears On the Horizon

Major event of the Institutes activities for the coming season, Engineers Day, is once more appearing on the extra-curricular horizon. Notice has been received from the Tech commission that platforms will be due in about a month.

Candidates chosen from the junior class will appear before the commission to present their platforms and their themes. Written platforms are to be turned into the main engineering office. Main points to be considered in selecting the chairman are eligibility, capability, and platform theme.

The chairman will select his own committee heads and committees. Engineers Day will fall about April 15; and, as all except some freshmen know, the main features will be the parade and the open house exhibits in the various departments.

Now Here's A Book

By Clifford I. Haga

Instructor in English

MAX EASTMAN'S *Enjoyment of Laughter* may be read in two ways, either as the lively, vaguely scientific investigation of the psychology of laughter it claims to be, or as a joke book. However you read the book, as "science" or as entertainment, you will not entirely waste your time—in fact, you will wish the book longer and more ponderous in theory so that more illustrative jokes could be included.

As for Eastman's theory of the comic, his explanation of why we laugh, that is quickly disposed of. Instead of speculating aridly as other philosophers and psychologists have done with no richer clinical material than is offered by the wit and humor of philosophers, he first studies those who laugh most. Babies and children laugh most, says Eastman. After seriously tickling a multitude of babies, either by proxy or with his own philosophical finger, he discovers four principles distinguishing that which is funny. Things are funny only when we are in fun; a shift of values takes place when we are in fun; being in fun is most characteristic of childhood and the gift diminishes as we grow older; grown-ups laugh only when an apparent disappointment (if they are in fun) is sweetened by a playful satisfaction. These four principles boil down to two Laws of Laughter: First: It is necessary to be, or become, playful in order to perceive anything whatever as funny. Second: In everything that we do perceive as funny there is an element which, if we were serious and sufficiently sensitive, and *sufficiently concerned*, would be unpleasant." Eastman calls these laws "absolute." That qualification is a comfort; so often scientists state sweeping general theories without indicating the necessary limitations.

How does he prove his theory? By a jokebook barrage of such variety and charm that we laugh incessantly, and laughing so often agree in effect not only to the two absolute laws but also to the various criteria of good humour with which he concludes. Innumerable authorities are cited: Mark Twain, Groucho Marx, Freud, anonymous monkeys, Charlie Chaplin, Dorothy Parker, puppies, babies—in short, anyone who has laughed, been laughed at, or made us laugh. The result is complete conviction.

Agreeing with Eastman's theory, largely I am sure because of my enjoyment of his illustrative material, I am forced to find in the book two disappointments, one general and short-lived and the second quite specific. Lasting only so long as one remembers the serious part of *Enjoyment of Laughter*, the first disappointment comes from learning that someone has said the last word about laughter. After this, while the book is fresh in our minds, we shall laugh only uneasily, knowing that the pattern of foolishness setting off our explosive chuckles was old stuff even to Noah. (Poor Noah with his two of everything—think of his wet and weary weeks cooped up with the same two traveling-man-and-farmer's-daughter jokes!) Each of us is convinced that his sense of humor is finer than that of anyone else—yet we all laugh at the same jokes. Actually there is no disappointment of a real kind; we need only remember that even though one man has enjoyed one beefsteak, other men may find an equal satisfaction in other beefsteaks. So it is with jokes. A joke is never used up—it is used over all too frequently, say on the radio—and after lying forgotten a generation or two it can always be revived with perfect effect.

The second disappointment is more specific. Although Eastman covers his subject fairly well, he does not say anything about classroom laughter. With his experience, both as student and teacher, he should have considered that. Classroom laughter is a phenomenon which seems to go contrary to his first absolute law, since it is scarcely conceivable that anyone is or becomes legitimately playful in the classroom. If it can be demonstrated that students laugh in the classroom, contrary to the first law, it would seem that we either have a new and undefined breed of humour (sub-humour, it might be called), or that some additional absolute laws are necessary—or at least an absolute amendment or two to one of the original absolute laws. In the interest of science, I am tempted to invite an investigation in my own classes, where I have once or twice detected a tendency to merriment and have even observed actual cackles, guffaws, hee-haws, and other strange seizures quite inexplicable by the first law. I will not yield to this temptation, however, because if I see any investigators in my classes I might invalidate the data by telling the Funniest Story in the World. The possible results are too serious to contemplate.

In addition, therefore, to making a general recommendation that you read Eastman's *Enjoyment of Laughter*, I also urge the more thoughtful of you to use it as a handbook or guide in the classification and analysis of professorial humour. Fame and ill fortune await the student who will give his time in the classroom to the conscientious investigation of this problem.

"never-ending PROGRESS to perfection"

Injector Replaces Carburetor

The Department of Commerce has approved the use of a solid injection system in connection with gasoline-burning radial aircraft engines. Possibilities of carburetor icing are eliminated and the device is unaffected by maneuvering positions of the ship. Higher compression ratios, advancing octane numbers, and this new form of injection should lead to fuel efficiencies comparable to those of present day Diesels. Accordingly, it is possible that the day is very remote when the Diesel will be as practical for aircraft and private automobile use.

Fast Steam Turbine Locomotive

General Electric is building the first steam turbine locomotive in this country for the Union Pacific Railway. The new unit has two 2,500 horsepower turbines operating through an electrical transmission and it is 20 per cent lighter than the conventional locomotive of the same power. The new "iron horse" is expected to travel 110 miles per hour with 1,000 tons train burden.

Eye Blinking Eliminated

There are developments in the photographic field that indicate the future elimination of the familiar flash lamps that cause eye-blinking. A new lamp has a blue dye coating which prevents the escape of yellow light so sensitive to the human eye, but permits passage of photographically valuable light.

Rear Engine, Front Drive

Last August, Henry Ford was granted a patent bearing the title, Motor Vehicle Brake. The grant concerns more than an improved braking system, however, as it discusses an engine in the rear, front wheel drive, and, most radical of all, steering with all four wheels. By placing the engine over the rear axle proper passenger location is achieved, there being at the same time a minimum overhang behind the rear wheels. A low position of the engine in the chassis is obtained by putting a downward curve in the "dead" rear axle. Front wheel drive, theoretically better than the conventional drive, is at present difficult because of the necessity of transmitting power through large angles of the universal joints. According to the description, only 60 per cent of the steering will be done at the front, while 40 per cent will take place at the rear, consequently universal joint angularity will be materially reduced and the power transmission problem simplified. Perhaps the most important advantage of the suggested design will be improved passenger comfort.

Electric Organ

Now on the market is an organ which produces its notes electrically and which is made up of two units: a relatively small, spinet-like console and a separate tone cabinet; advantages claimed are ease of connection (merely plug into a wall outlet), and mobility of the units.

Safety Must be Taught

Lane Technical School in Chicago recently inaugurated a class in safe driving. Front compartments of old cars serve as desks for the pupils and all controls are connected electrically to a lighted panel at the front of the room. By this means the instructor can keep track of all operations performed by the students. After the preliminary training is over, pupils go out and practice with actual cars furnished for this purpose. This course is most likely the forerunner of similar forms of safe driving schooling to be instituted in all parts of the United States.

Engineering Uses of Ice

Ice recently has been used to support heavy loads temporarily and lower them slowly into position.

* * *

The inverse of the blacksmith's trick of heating iron wagon tires and shrinking them onto the rims is used in modern industry; a metal part is first shrunk by dry ice and inserted into a second part; subsequent expansion provides a tight fit.

* * *

Mud slides into the lowest Grand Coulee Dam foundations delayed concrete placing until engineers drove hundreds of pipes into the soft, wet soil, connected them to an ammonia refrigeration system, and froze the sliding banks into solid walls.

Favorite Train Whistle

The Florida East Coast Railway recently demonstrated three air whistles and three steam whistles to determine which was preferred by residents of nineteen cities along its route; most popular was one of the Zephyr type, which has a fog-horn sound.

Worry Control

Parents may now reduce by one the number of worries associated with use, by their progeny, of the family automobile: by the installation of a key-operated "dash control" auto governor the maximum speed of the automobile may be set in advance and locked; since the device is not operated by throttle opening alone, high power is possible at low speeds and there is no restricting effect until limiting car speed is reached.

Glider Club Designs Sailplane

Members Aim at Record Flights

By Marvin Walseth, Aero, '37

READERS of the *Daily* and the TECHNO-LOG are well aware of the existence of the Glider Club Section of the University of Minnesota Flying Club. Through these notes the club explains its aim and functions to draw proper credit to its activities, and to attract further talent to its membership.

The purpose of this club, a member of the Soaring Society of America, is:

(1) To instruct and to train its members in the art of glider flying,

(2) To create an opportunity for the advancement of soaring, and the promotion of glider flying in general,

(3) To promote interest in the design and construction of all types of gliders.

So far the activities of the club have necessarily been restricted to many short hops and low glides over level ground. These flights on several occasions have presented the hazard of having a fence located at the only landing spot. While fences have been very damaging to the rather fragile wings of the glider, the pilots have in no case been injured. This record indicates that because of low flying speed they are exceedingly safe for training purposes. The pilot has only one chance to make a safe landing, however, and that one has to be right if the ship is to be flown again.

Most students probably have given little thought to motorless flight and have smiled tolerantly upon the efforts of glider addicts in "kiting" to a few hundred feet on a tow rope behind someone's car, cutting loose, and daring to attempt a few turns before a rather short glide down to earth. Not until you have seen skilled glider pilots in these trim ships, soaring gracefully over America's rapidly developing soaring sites, or until you have thrilled to the experience of attending a glider contest and seen high performance ships under the operation of skilled pilots, can you appreciate the possibilities and applications of motorless flight.

Many short hops and low glides over level ground are necessary to train the beginner in the fundamentals of human flight and to familiarize him with the behavior of motorless aircraft. This preliminary training is always a lot of fun though fraught with anxiety for the instructors on the ground. It is not only good clean sport in which one must learn to coördinate the mind, eyes, and muscles; but it constitutes a very thorough training school for anyone who wants to learn to fly.

Because of the scarceness of good soaring sites and the difficulty of obtaining sufficient time and money, the club has not made great progress towards broadening its experience in soaring. However, the club has made some progress in that it has located several prospective soaring sites, and two of its members, Tom Feeney and Tom Kerker, have settled on the design of a two-piece sailplane which, according to specifications and preliminary drawings, should perform as well as or better than some of the high performance sailplanes now being flown at other places.

As a note to those who do not know the extent to which a glider may be flown, here are some statistics on the National Meet held at Elmira, New York, early last summer. During the two weeks from June 20 to July 5 there was scarcely a day when the bird-men did not soar over the hills and valleys of New York. There were 274 flights made, five of which earned for the pilots the Silver "C" certificate, the highest award in the sport of motorless flight. The Silver "C" calls for outstanding performance in that the pilot must make a cross country flight of 31 miles, an altitude of 3,260 feet above the starting point, and a flight of five hours duration. A total time of 321 hours was spent in the air with an aggregate distance covered of over 1,200 miles, which amount does not include the numerous flights that ended within 10 miles of the take-off site. Two national records were set by the new Buxton two-place sailplane from California.

The Silver "C" certificate will be each individual member's goal upon the completion of the two-place sailplane. After that the members will turn their attention toward the glider records which have been established in this country. The records upon which the club will concentrate are as follows: airline distance record of 159 miles, the duration record (with return to starting point) of 21 hours and 34 minutes, and the altitude record (above starting point) of 6,516 feet.

At present the club is endeavoring to obtain the A, B, and C certificates for each of the members. The qualifications for the "C" certificate are as follows: the candidate must make 360 degree turns both to the left and to the right with normal landings, and the candidate must make a flight above his starting point of at least five minutes.

The promotion of motorless flights in this region and other regions is slow because of the lack of suitable soaring sites, a discrepancy which often turns enthusiasm into discouragement. It is easy for some of those who are really interested to become discouraged when some inexperienced glider addict with much zeal but little respect for the trickiness of the wind and no concern for his lack of experience won't coöperate.

As a result of the activities of the Soaring Society of America the prospects for the sport of motorless flight during the coming year are exceedingly bright. Right here at the University the Glider section is looking forward to a great year of accomplishment, not only in propagating and perpetuating motorless flight in the Middle-West, but in instructing new members in the art of glider flying, in advancing the older members into soaring flight, and in building and designing new and better sailplanes.

ALUMNOTES

'19 The guest speaker at the last fall quarter Mines Society meeting was J. O. Hosted, E. M., here on furlough from his work with the Ceno de Pasca Copper Corporation, in Ceno de Pasca, Peru.

'23 One of the most energetic of Minnesota grads is Hibbert Hill, C. E. Mr Hill at one time was an instructor at the University in hydraulics. Until 1928 he was with the U. S. Engineers in the St. Paul Office; in recent years he has been Senior Engineer in charge of design of locks and dams. On November 1 of last year he reported to the Water Ways Experimental Station of the Mississippi River Commission at Vicksburg, Mississippi, there to take general charge of Hydraulic and Soils Laboratories.

'24 D. R. Ranger, C. E., visited the University this fall. He is an Engineer for the U. S. Bureau of Public Roads in Pierre, South Dakota.

'26 Accompanying Ranger was W. R. Edgington, C. E. He is State Engineer for the WPA, and also lives at Pierre.

'27 Two Chem. E's who are in the teaching business are John Beal and Lew Wallace Cornell. John is an instructor at the Montana State College in Bozeman, Montana. Cornell is closer to the cities, teaching in the Chemical Engineering Department at the University of Iowa.

'29 Another grad who has taken up teaching is M. C. Fetzer, Met. E. He's an instructor in the mining department at the State College in Pullman, Washington.

'30 R. C. Gebhart, E. M. in Geology, and his wife, were visiting in the cities recently. Mr. Gebhart is located in Albuquerque, New Mexico.

Prof. DuPriest reports that he saw Raymond Sheppard, M. E., last summer when he visited the G. E. plant in Schenectady. Ray is in the turbine control section which handles all work on bearings, governing systems, vibration troubles, etc., and says he is getting some wonderful experience.

'32 Harold E. Graves, Chem. E., is associate professor of chemical engineering at Mississippi State College, in State College, Miss.

'33 As far as records in the Mechanical office went John S. deGraaf, M. E., had been lost to the world for the past three years. Prof. DuPriest reports that he has heard from John and that he is not lost but is working with the American Can Company in Jersey City, N. J. He is now assistant foreman in charge of one of the large departments.

We wish to correct an error made in the last issue with regard to Charles Britzius, C. E. Charles has given up his job with the Q. A. Hall Laboratories to take a position in the civil department here at the U.

Roman Arnoldy, M. E., who has been operating an oil refining business of his own, has decided to go with the Linde Air Products Company. He takes up his new work in the apparatus and development laboratory at Newark, N. J., this month.

'34 Prof. Shoop has passed on to us the second issue of the *Mechanical Ballyhoo*, published annually by M. E. grads of the class of '34. The paper is edited by Grace A. Wallene, and contains short items about employment, location, marital status, etc., of every '34 graduate. We've taken some of the items that appealed to us and here give them to you with acknowledgement to the *Mechanical Ballyhoo*.

Allen S. Barnett is working with the industrial heating department of G. E. in Schenectady. He gives his address as the Mohawk Nudist Colony on the shores of Ballston Lake! If you're the least bit skeptical, he says, "Write me at this address and I'll answer your letter."

Herschell Gimpel reports that the State Highway Department is running over with Minnesota alums, especially civils. He's in the plans department.

Robert E. Yohe is working for a ship building company in Newport News, Virginia. He says the work is fascinating, that it's really thrilling to watch a huge ship take form.

Merlin F. Snyder is located in North Dakota. He was married to a Minnesota graduate in June, 1935, and now reports a new addition to the family, a son.

Of the 45 listed in the *Ballyhoo*, 23 are working in the city, 16 out of the city, and six could not be located. Only 10 of the 45 are reported as married, although many report that they are weakening.

'35 Two Aero classmates who reported this month are Bob Gilruth and Ralph E. Peterson. Bob is teaching assistant in the Aeronautical department. Ralph is with Boeing Aircraft in Seattle.

Robert E. Clifford, E. E., formerly with the Fairbanks Morse Co. in Chicago, is back in the cities at the National Institute of Technology. Bob was married only recently.

Donald Ingwoldstad, Met. E., visited in the city recently. He was here on business for Bunker Hill and Sullivan's research department of Kellogg, Idaho.

'36 Frank B. West, Chem. E., is doing graduate work in chemical engineering at the U.

W. L. Robinson, E. E., has given up his job at the Ideal Electric Company, in Manchester, Ohio, to take a job with the Carnegie Steel Company in Chicago.

James Bradford Baker, Aero., is with the Army Air Corps at Randolph Field, Texas.

Alumni, Faculty, Students!

The TECHNO-LOG is always looking for information relevant to the employment or occupation of the University's technical graduates.

If you are an alumnus or if you are an instructor or undergraduate with acquaintances among the alumni it is quite possible that you may be able to provide just the facts we want.

The magazine would like to have data on the division of Technology from which each alumnus graduated, the nature of his work, the name of his present employer, and his marital status.

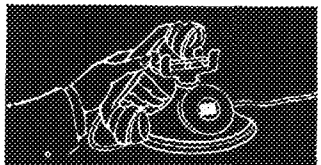
Even bare feet will never feel it!

OCCASIONALLY a telephone wire must be run under a rug or carpet. The twisted wire formerly used made an unsightly ridge.

So Western Electric—manufacturing, distributing and purchasing unit of the Bell System—produces a flat cord only one-eighth inch thick, seven-eighths of an inch wide. (Like this ). Within this tiny space are four conductors of insulated wire. Under the rug or carpet this cord is not seen, not even felt with bare feet.

Even to the smallest detail, the Bell System is constantly on the lookout for the better way to make telephone service more satisfactory to the customer.

BELL TELEPHONE SYSTEM



College men and women find after 7 P. M. a convenient time for long distance calling. Moreover, most rates are lowest then.

SLIPSTIX

Not New to Him

Local motorists who went through the drought-stricken middle west last summer brought back some prize-winning stories of incidents along the route. One told of a conversation he had with an old settler at a filling station in one of the most arid districts.

"Looks as though we might have rain," remarked the tourist.

"Well, I hope so," replied the old native, "not so much for myself as for my boy here. I've seen it rain."

—*Bagology*

Fine Points

Benny—"Pop, what is ethics?"

Mr. Isaacs—"Vell, son, I tell you. Ve say a customer comes into the shop and buys a dollar necktie. He give me a two-dollar bill and valk out vithout his change. Now this is the ethics: should I keep the extra dollar or should I tell my partner about it?"

—*Farm Journal*

The Bandwagon

A political platform is just like the one on the back of a street car—not meant to stand on, just to get on on.

—*Journal of Education*

Farewell

Three men went down to a railroad station. Arriving ahead of time, they went to a nearby bar. After several rounds, they went for some food. While eating, the train pulled in and they made a wild dash. One fellow picked up two bags that they had and the others ran unimpeded. These two made the train and it pulled out. The other chap set the two bags down and groaned. A trainman standing nearby noticed his plight and started to sympathize with him when he said: "I cannot understand it. I can't understand it. Those two fellows came down to see me off."

—*The Bridge of Eta Kappa Nu*

The Old First

Father: "John, go fetch the old horse."

John: "Why the old horse, father?"

Father: "Wear out the old one first—that's my motto."

John: "Well, father, then you go fetch the horse."

—*The Bridge of Eta Kappa Nu*

Matter of Size

"How has your potato crop turned out, old chap?" asked one ardent amateur gardener of his neighbor.

"Splendid, old man," replied the other, "some are as big as marbles, some as big as peas, and, of course, quite a lot are little ones."

—*St. Louis Globe-Democrat*

Matter of Identity

Marine Corporal (at dance): "Do you know that ugly sap of an officer standing over there? He's the meanest egg I have ever seen."

She: "Do you know who I am? I am that officer's daughter."

Corporal: "Do you know who I am?"

She: "No."

Corporal: "Thank God."

—*The Locomotive*

* * *

Experience is what one gets when looking for something else.

Was His Face Like Rouge

A certain young junior spent one particularly interesting evening during the rushing season. He got his prospect off into a corner and spent an hour telling all about the fraternity and how lousy the other houses were, etc., etc. And finally, thinking the time and rushee ripe, asked what the rushee thought of his fraternity. The supposed rushee said, "Well, I've liked it very much ever since I joined it over two years ago. You see, I'm a transfer from Colgate."

—*Cornell Widow*

State Pride

A Californian (a high-speed booster, needless to say) condescended to visit his friend in Florida, who was also something of a booster for his own state. For three days everything the Floridian showed his friend was met with a total lack of enthusiasm and the bored remark that "it wouldn't be anything out in California."

In desperation the Floridian on the third evening parked a large turtle in his neighbor's bed. Upon retiring the California man, his foot making clammy contact with the shell, shot from the bed, yanked down the coverlet and yelled, "Great snakes, what's that?"

"That? Oh, just one of our Florida bedbugs," retorted the Southerner crushingly. The Californian came close to the animal, squinted and remarked, "He's a little son-of-a-gun, ain't he?"

—*The Kablegram*

All Figured Out

By Harold J. Fitzgerald

This article is presented to Techno-Log *readers through special permission of Harper's Monthly and the author.*

OUR shoes sank into a springy network so suggestive of chicken wire that we stepped lightly in the fear of pushing our feet through it. Between its strands we saw a broad surface that seemed to have been daubed crudely with greenish paint and left full of ridges, but which we knew from having just left it was San Francisco Bay. The interval was occupied by about four hundred feet of air and an occasional sea gull.

From below, the festooned cable had looked like a slender but quite solid thing up against the sky. But as we came out onto the catwalk we discovered that it was made up of 37 smaller cables, and that each of these was a bundle of 474 wires clamped together every few yards. The bundles, or strands, as the engineer called them, ran shoulder-high beside us apparently out of and into infinity, and for no reason that we could see had the multitudinous motion of a bunched herd of galloping cattle. Later the strands would be packed tightly together to form the 28½-inch cable of the biggest bridge in the world, and the combined strength of the 17,464 pencil-like wires would support the heaviest loads ever hung from anything in history.

On our way across the anchorage the engineer had showed us how the strands were looped through 37 eye-bars embedded in thousands of tons of concrete, and then he had said a curious thing. There were not really 17,464 wires; there was one wire which ran back and forth across the three-mile reach of bay 17,464 times. This came as a shock to those of us who had supposed the cable could be pulled up or let down to the proper length before being fastened permanently, and someone remarked that it didn't leave much room for adjustment. The engineer laughed and said no, it didn't.

As we filed out along the jouncing wire netting, I thought of that single wire weaving endlessly across the bay, becoming more and more irrevocable with each loop; and of the possibility that they would have to take the bridge apart and start all over again.

"Don't worry," said the engineer when I mentioned this. "It's all figured out to a fraction of an inch."

"I shouldn't think there'd be much figuring," said a man in a gray overcoat. "Isn't it just a matter of dangling the wires to the level of the roadway?"

"Not exactly," said the engineer. "You see, that's just where we want them. You never put a cable where you want it, because then it'll go somewhere else. You put it where you don't want it."

We stared at him, and a man with a cap and a curved pipe said he thought he could do that well himself. The engineer said he was sure of it; the main thing was to know the exact length of the cable. And how, the man inquired, resting an elbow on one of the jostling strands, did one find that out?

"We took the length of the span," the engineer said. "These big ones are 2,310 feet. And the height of the roadway—216."

"And the height of the towers, of course?"

"No. We had to find that out from the cable."

"Well!" said the man. "I'd have done it just the opposite!"

"That would be all right, too," nodded the engineer, "if your bridge didn't have to hold anything. We had to consider the load. On these long spans it's about 4,500 tons for each cable. From that we had to compute the cable tension."

"That's easy. Forty-five hundred tons."

The engineer shook his head. "The cable's not only carrying the load," he explained. "It's pulling against itself." He glanced round with brisk impatience for something to illustrate his point. "Say you stretch a string across a 20-foot space and hang a ten-pound weight on it. If it can sag only an inch the tension will be about 600 pounds. Let it sag a foot and the tension will go down to 50 pounds. If it can stand a pull of only ten pounds you'll have to let it down five feet before it'll hold. It all depends on the slope."

"Well then, what's the slope of the cable?"

The engineer smiled. "Since it hangs in a curve," he said, "it has a different slope at every point. And a different tension, too." He pulled out a notebook, riffled the pages, and swiftly wrote down a series of square-root signs, parentheses, and fractions, while the impatient rattle of an air-hammer came muffled out of the distance and the cobwebby catwalk swayed under us. "If it sagged only one foot in 20," he said as his pencil flew, "its greatest tension would be nearly 13,000 tons. The cable would have to be three feet nine inches in diameter, and it would weigh 1,184 tons more than the load!"

We shook our heads, and gazed out along the uneasy silver arc, wondering at the ways of cables.

"Then why not let it sag ten or even fifteen feet in twenty?" suggested the man with the pipe.

"At fifteen in twenty," said the engineer after a few flicks of his pencil, "the sag would be 1,725 feet. Add that to the height of the span and you get nearly 2,000 feet for the height of your towers!"

"Oh!" said the man with the pipe.

"Five in twenty would still run them up to 800. So

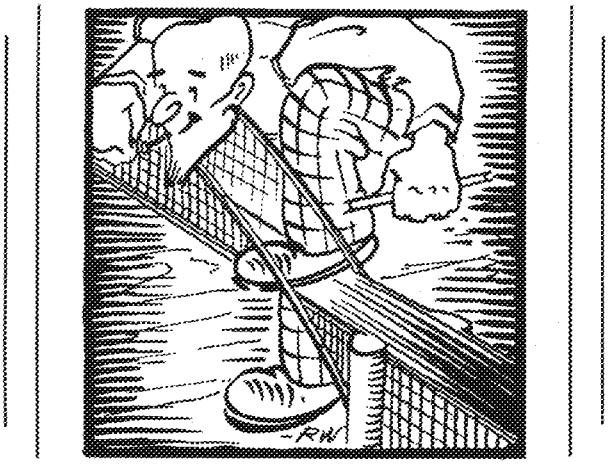
we had to find the combination of tension and sag that would be least troublesome. We finally fixed the sag at 266 feet, a little over two in 20, which gave the cable a tension of 5,200 tons. That made the towers 502 feet high."

The man in the overcoat produced a memorandum book and rested it, open, against the cable. "I used to be pretty good in trigonometry," he said. He drew a triangle, frowned, then started over by drawing a circle. He moistened his lips and tapped his automatic pencil against the dull steel. "What do I take for a radius?" he asked. "Two-sixty-two, or—"

"Neither," said the engineer.

You can't, it seems, measure cables as you do straight lines or arcs of circles. They're parabolas, and when you start measuring parabolas you leave plane geometry and most of your friends behind and get up among the spiral nebulæ of integral calculus.

The engineer made the calculation for us there on the



windy catwalk, and at last it flashed out the cable length —2,392!

The man with the pipe heaved a deep sigh. "And I thought you hung cables like clotheslines!" he said. He gazed at the glistening curve that swung like a swallow's path from tower to tower. "Just 2,392 feet from there to there!" he murmured.

"Oh, no!" corrected the engineer. "Not yet. Steel stretches. The cable won't get its full length till the load is on it. We know how far steel stretches under a given tension. So we figured the tension at each of the 70 suspender ropes."

"And subtracted the total stretchings from 2,392?"

"No," said the engineer, "there was a little more to it than that. If a 20-foot rope will stretch a foot, you can't make it 20 by starting with 19, because the 19-foot rope will stretch only nineteen-twentieths of a foot. That wouldn't be so bad, but when you shorten a cable you decrease its slope. That increases the tension and makes it stretch more. But as it stretches its slope increases, so that it stretches less and less. And of course that's going on at different rates in different parts of the cable—"

"You're not trying to tell me," broke in the man with the overcoat, "that any human being could figure that out!"

"Lots of them. We found that if we made the cable 2,388 feet long it would stretch four feet to 2,392."

The man in the overcoat murmured, "Twenty-three eighty-eight!" wonderingly, and slapped a corrugated strand. "But you haven't told us how you measured off those 2,388 feet."

"Oh, we couldn't measure them off on the cable. We gave each wire the proper sag, and that made it the right length."

"You let them sag a little less than 266—?"

"Not 266," the engineer interrupted. "You're thinking of the parabola, the shape the cable takes after it's loaded. When it's first strung up it takes a very different curve, called a catenary. So we calculated the sag of a catenary 2,388 feet long with a 2,310-foot span."

"I suppose that meant a lot more integrals?"

"Not at all. It was merely necessary to find, by successive trials, a number which, when divided by its own hyperbolic sine, would equal the cable-length divided by half the span, then multiply this by the hyperbolic cosine of half the span divided by the number. The result, when the original number was subtracted from it, yielded our answer—which was 235."

"Then," said the man with the pipe, "you gave the wires a sag of 235 feet, and that made them 2,388 feet long?" The engineer nodded. "And when the span's in place they'll stretch—"

"They'll first turn into a parabola with a sag of 256 feet. Then they'll stretch four feet, which will make them sag another ten, and just meet the bridge 216 feet above the water."

"About measuring that sag," said the man in the overcoat. "You couldn't have done it from above because there's nothing up there. Did you measure down to the water?"

"No. We set up a transit on one tower and aimed it at a point on the next. The points were calculated so that when the cable's vertex crossed the line of sight it would be 235 feet below the tower tops."

"Well, that was simple enough," said the man, with relief.

"Only," said the engineer, "that we had to allow for the shape of the earth."

"Of the *earth!*"

"Certainly. Those towers are nearly half a mile apart. If we had sighted straight across we'd have hit 1.28 inches too high."

"Well, that was the last of your problems, surely!"

"Almost. We still had to consider the temperature of the air. When the morning sun warms the east side of a tower, the steel expands and it leans to the west. In the afternoon it leans to the east, like a sunflower in reverse. The top sways six and a half inches in a day. That would throw our sights out two feet."

"But you couldn't stop the towers from bending!"

"Hardly. We pointed a collimator, or sort of telescope, straight down from the top of each tower, and when it was exactly on a mark at the bottom it meant the tower was vertical. We had telephones on the towers, and when we got word that both were vertical at the same time, we did our sighting."

Again we silently regarded the galloping strands. Somebody asked if that was why they were constantly in motion—was it that even now the tall towers were pulling at their ends?

"Partly," said the engineer. "But a good deal of it's in

themselves. When the sun warms the upper wires in a strand, and the bay air cools the lower ones, the internal strains cause a complicated set of motions. And parts of them are always being warmed or cooled at different rates. It's no wonder they're never still."

"But all those close calculations," said the man in the overcoat, "are true only once in a while then?"

"Check," said the engineer. "There are no absolute dimensions in a big bridge like this. The towers are not only swaying all the time, but they're stretching up and down. And they're being spread apart or drawn together by their bracing girders. The cable is rising and falling and shortening and lengthening, and so is the span under it, sometimes as much as nine feet in a day. Every piece of metal in the bridge is changing its size and shape every minute day and night. The whole thing is constantly squirming around."

A broad-beamed barge, looking like half of a walnut shell, came in sight through the chicken wire, inched along under our feet.

"What's the use of such fine calculations, then," the man protested, "when they aren't true the minute after you make them?"

"Oh, these squirmings and shiftings don't bother us," said the engineer. "They're all calculated in advance, too."

"You mean you can tell what this bucking steel bronco will be doing at any minute?"

"Sure," said the engineer. He dug his rubber heel into the wire netting and started down the springy catwalk. "That's all figured out."

But we didn't ask him how he did that. We were becoming a little dizzy up there among those hyperbolic cosines.

Sigma Xi Lectures Planned for Winter

"The Rock Formations of Minnesota and their Significance" will be the subject on which George M. Schwartz, associate professor in geology, will speak when he opens the Sigma Xi lectures on February 5. On successive Friday evenings following this opening lecture, three other lectures will appear.

C. O. Rosendahl, chairman of the department of botany, will speak on "The Plants of Minnesota and Their Significance"; Samuel Eddy, department of zoology, "The Animals of Minnesota and their Significance"; and D. H. Davis, department of geography, "Man and His Habitat." Slides and Motion Pictures will be used to illustrate these series of lectures.

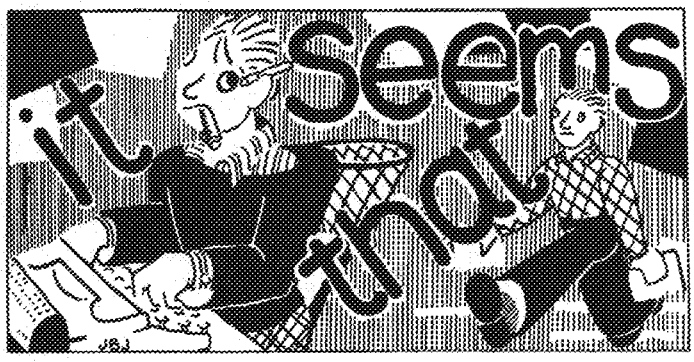
Sigma Xi is composed of scientists that have done outstanding work in natural or physical science. This series of lectures is an annual presentation of that fraternity.

Miners Will Dance February 5 in Union

A gold mining camp situated on the second floor of the Union, pardon us, in the Rockies, will be the scene of the annual Miners' Shindig, to be held February 5.

Tickets will be in the form of gold dollars(price one dollar), and dancing and entertainment by Bill Grant's orchestra will be the reward. The Shindig is the major social function of the School of Mines.

Chairman Jack Melvin assures all comers of an unusual variety of entertainment in the lounge between the dances and at intermission. The traditional Miners' refreshments will also be served. Souvenirs in the form of a small useful article manufactured in the gold assay laboratory in the School of Mines will be given away. Lots of gold-diggers are expected to be present.



By Melvin "Pete" Lohman

That was a really fine vacation, especially that extra day which eliminated that blue Monday feeling. It would be a good idea not to have school the day following vacations. Sort of an eternal vacation.

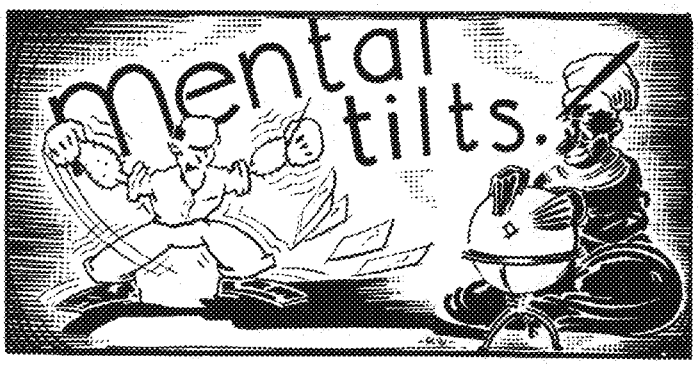
No new cases of acute alcoholism have turned up as yet so we assume everyone has started the New Year successfully. One prof is rumored to have made a New Year's resolution to give it up for the sake of his wife and kidneys.

Our esteemed vice president of Tau Beta Pi has worn the same necktie for many months. We certainly hope Santa brought him a new one to replace that shoestring-appearing one he now wears.

We're not saying Elwood McGee is Scotch but he parked one night near a popcorn stand. The wench that he was making woo to remarked, "My, that popcorn smells good." "That's right," replied McGee, "I'll drive a little closer so you can smell it better."

Our poem of the month:

I ask but little here below
A little car, a radio,
A little cash to spend at will
A little house upon a hill
A little brook where fishes lurk
And very, very little work.
—So it Seems.



By Gordon Wickre

Two antagonistic sea-farers are shipwrecked on a desert island. They are well supplied with food from the wreck; but, although they have a good balance, they have no standard weights and the marooned men do not trust each other.

A grindstone marked 40 lbs. is found, and one of the pair cuts this stone into four pieces which are used in various combinations on the two sides of the balance enabling him to weigh any amount from 1 to 40 pounds.

What is the weight of each of the pieces?

Now here is a new (?) "How Old is Anne" wrinkle:

A man is twice as old as his wife was when he was as old as she is now. When she is as old as he is now their combined ages will be 99. How old are each of them now? Quick now, what is it?

Are there any "cryptogram" experts in the crowd?

See what you can do with this one:

CTIWRES/H = AGCTRC

Each letter represents a digit from 0 to 9. When you have found the correct digit for each letter arrange the letters in sequence from 0 to 9 and you will have a term used by electrical engineers.

Last Month's Answers

Did you all figure out the "Cats' Pajamas" question in last month's issue? Just in case you didn't we'll give you the correct answer.

The question:

If two cats, on the opposite sides of a sharply sloping, peaked roof, are on the verge of slipping off, which will hold on the longest?

The Answer:

The one with the greatest "mew," of course! The Greek letter "μ" (pronounced mu) represents the coefficient of friction.

The fallacy in last month's first mental tilt is the division of the equation by the factor (x-y) which, by hypothesis, is equal to zero. The answer to the second problem is that 86 plates will be required; the number may be reduced to 81 by making the 6's and 9's interchangeable.

* * *

Ogden Prestholdt, E. E. '38, was awarded last month's crisp dollar bill for bringing in the first complete set of answers. Whose name will appear in the crystal globe this month?

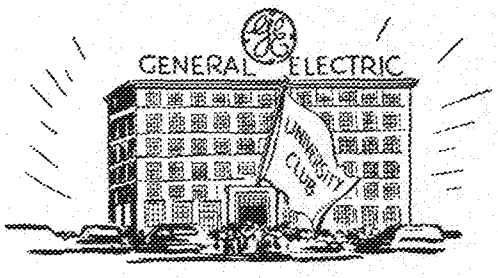
G-E *Campus News*

LIGHTNING STRIKES TWICE

LIGHTNING may strike not only twice but a dozen times in the same place over the same path within one second's time. This is one of the unusual facts that Karl B. McEachron, Research Engineer of General Electric's High-voltage Laboratory, has found out about lightning.

Even more unusual is the new theory that the brilliant lightning flash one observes during a storm is not a bolt from the sky, but a union of a cloud streamer with a similar one from the earth. The action of the air currents and of the falling drops of water separates the charges in the cloud. When the voltage in the cloud reaches a certain value, a streamer starts toward the earth, traveling in jumps at about one-tenth the speed of light. When this streamer is a few hundred feet away, streamers from four to eight feet long begin to form on the surface of the earth. When the streamer from the clouds unites with one from the earth, the flash of lightning occurs. The pressure generated during the passage of current makes the thunder.

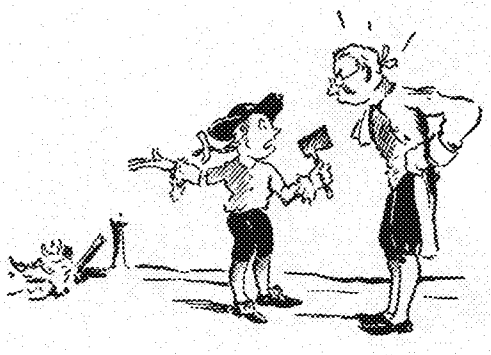
General Electric conducts research in lightning so that its engineers can design transmission lines and protective equipment which will insure better continuity of service.



UNIVERSITY CLUB

DAVE PACKARD of Stanford and Otto Schwartz of Columbia played against each other in the Rose Bowl game of 1934, but now they are working side by side in the Schenectady Works of the General Electric Company. This seems unusual until it is pointed out that in the General Electric organization is one of the largest and most cosmopolitan university clubs in the world. Approximately 4500 college graduates, representing 237 American universities, colleges, and technical schools, are employed by the Company. In addition, there are 198 graduates from universities in 22 foreign countries.

Ten educational institutions have contributed more than 100 graduates each to the General Electric family. They are: Cornell, Iowa State, M.I.T., Penn. State, Pratt Institute, Purdue, Union College, U. of Colorado, U. of Michigan, and Yale. Fifteen other schools have provided more than 50 graduates each. They are: Case School, Georgia Tech., Kansas State, U. of Maine, U. of Minnesota, Ohio State, R.P.I., Syracuse, U. of California, U. of Illinois, U. of Kansas, U. of Nebraska, U. of Wisconsin, V.P.I., and Worcester Polytechnic.



DETECTING LIES

PAPA WASHINGTON needed no lie detector; George told the truth. But as a check on less truthful persons, Northwestern University's crime-detection laboratory has developed a lie detector. It makes simultaneous measurements of respiration, blood pressure, and perspiration. Emotional disturbances are reflected in these body functions. And since extremely sensitive recording instruments are needed to record changes in perspiration, the delicate photoelectric recorder developed by General Electric engineers is put to work.

For many years General Electric has made instruments for exacting applications. This same photoelectric recorder is used to obtain a continuous record of temperature in a wire-enameling oven. Electric gauging of ball-bearing diameters, of wire diameters, and of strip thickness is accomplished in rolling mills. These operations and hundreds of others are recorded by this instrument, and with a power consumption of only one thousandth of a microwatt.

96-348DH

GENERAL ELECTRIC

The Vol. XVII No. 5 February 19

MINNESOTA TECHNO-LO

This Issue

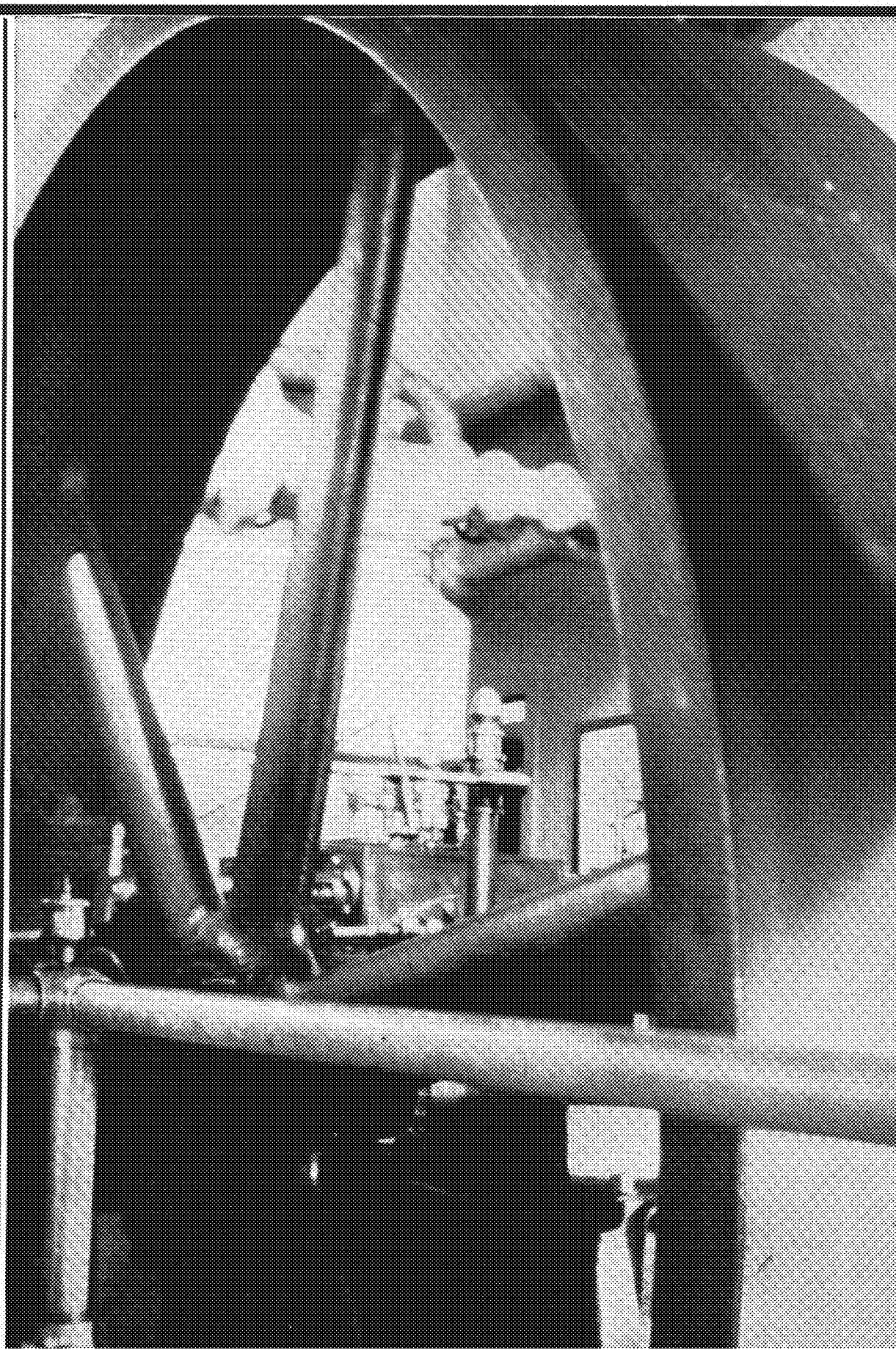
eam, Diesel
iven Trains

lucker's
aradise

nalyze This?

orse Age

ech News



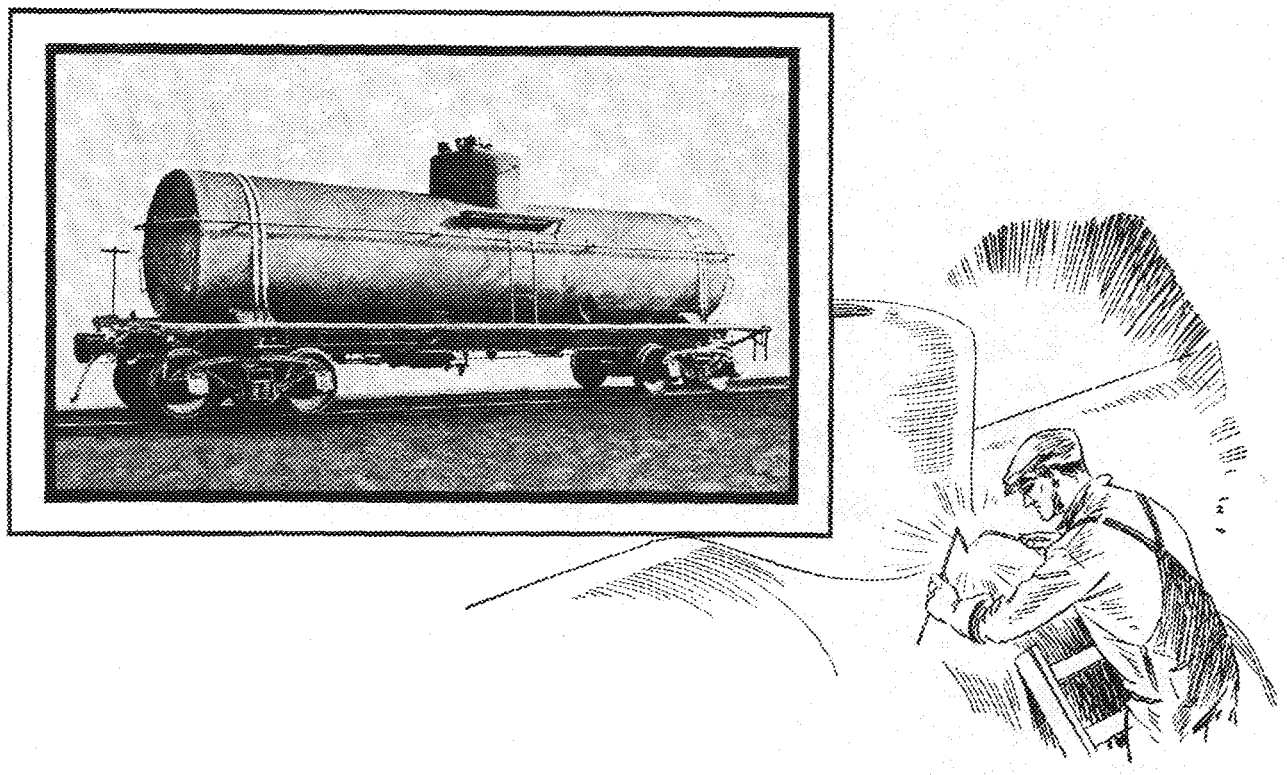
Better . . because IT'S WELDED

Welding eliminates overlapping joints in the modern tank car. This materially reduces dead weight and makes the car easier to clean and maintain. It completely prevents loss or contamination of the contents from rusted joints.

Tomorrow's engineers will be expected to know how to apply the oxy-acetylene process of welding and cutting in design, construction and fabrication to give similar sales advantages to many good products.

The word "welded" is packed with meaning. It means light-weight without sacrifice of strength. It means sturdiness and ruggedness that can never shake loose. It means invisible joints as strong as the base metal. It means smooth surfaces with no place for corrosion to start. In short it means all that one piece construction can mean plus complete design freedom from the limitations of other methods of fabrication.

Technical booklets describing the application of this modern metal-working process to a wide range of metals—steel and iron, aluminum, copper, brass and many other alloys and metals are available, without obligation, from any Linde Office. Write to The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.



Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES — FROM LINDE — UNION CARBIDE

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

FEBRUARY, 1937

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Elwood McGee, Transit Corres. Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas.	Eta Kappa Nu
Edward Kaiser, Pres. John Hallihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Bernard Hein, Pres. Henry Nitta, Sec'y	The Commacini

This Month

VOLUME XVII NUMBER 5

Officers of the Professional Societies

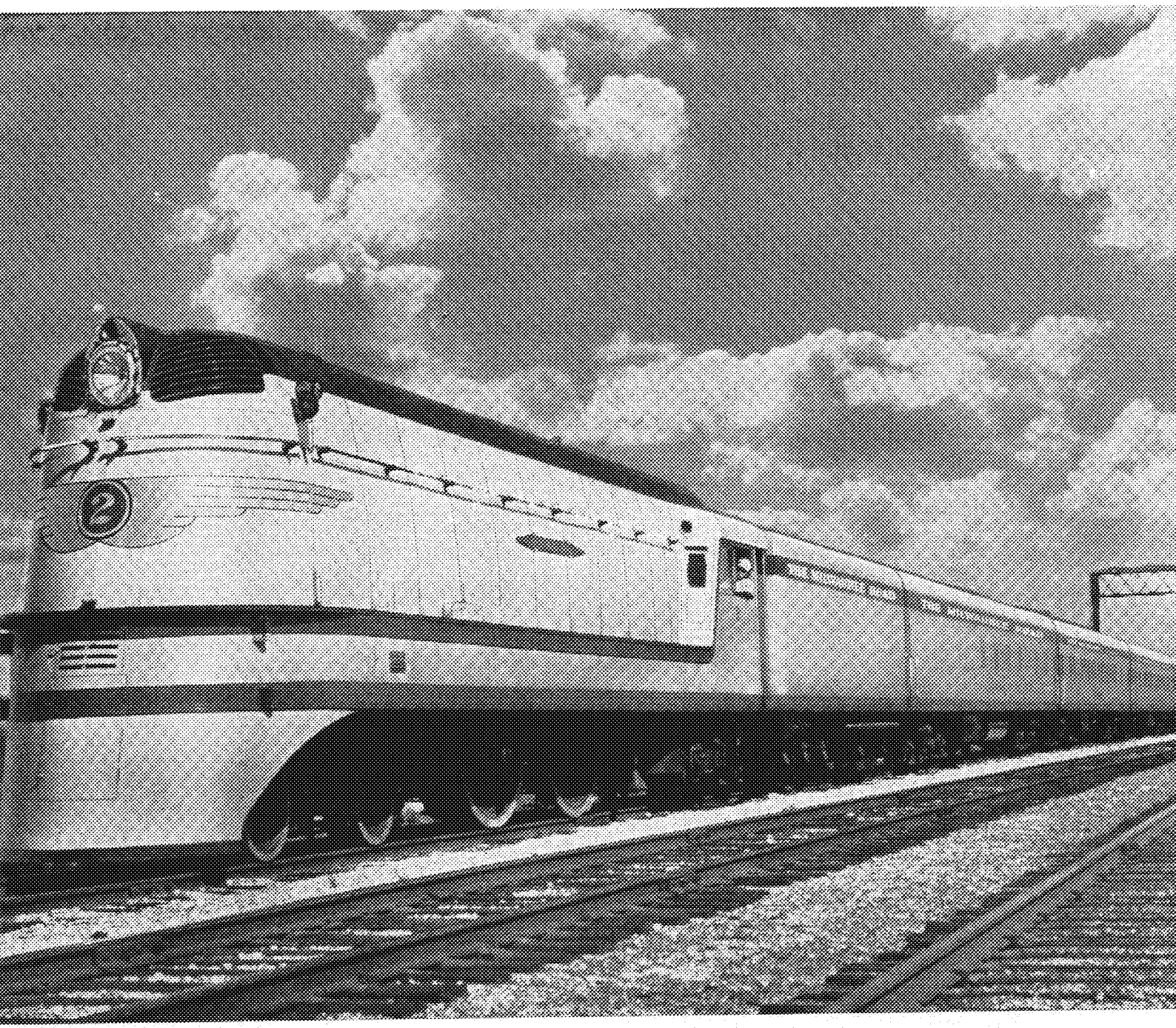
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Parry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Prahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. Robert Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Wodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Aikire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	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, Main 8177, Extension 314. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



New Cow-catcher—Old Trucks

Twin Citians See

Steam, Diesel Driven Trains

On Fast Schedules

By Harry A. Larson, M '39

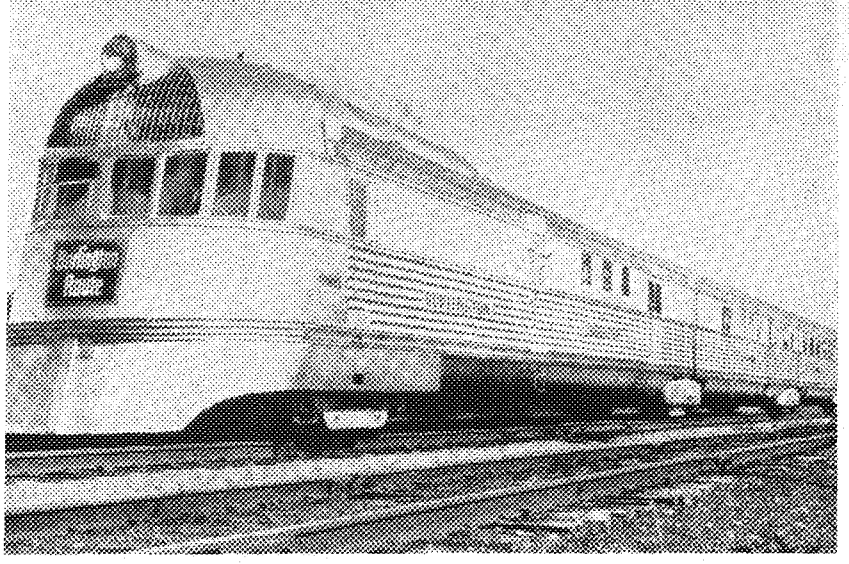
POWER! Speed! Beauty! Safety! These words form the background for modern mobile transportation of all kinds. First the airplane, then the automobile, and now the railroads have turned to a phase of development unheard of a few years ago. Passenger service on railroads recently dropped so much that most of them operated at a loss for several years, slow freight being the main recurring source of revenue. Engineers diagnosed the trouble, designing trains that embodied comfort, beauty, and luxury in a new type of train that has been in service the last few years. An unprecedented rise in passenger traffic gave further impetus to the movement. Of especial interest is the run made by train between the Twin Cities and Chicago. Where recently it took 10½ hours by the fastest train, it now takes only 7½ hours to complete the journey of 420 miles or more. Improvements throughout make the passage on these trains more enjoyable.

Streamlining is a word that is bandied about in almost every conversation about modern trains. Technically, it means designing to facilitate the slipping of a body through air with the least amount of resistance. Intensive study on streamlining has shown that a blunt nosed object with the shape of a raindrop gives the ideal result. All protuberances on the train are, therefore, necessarily eliminated and the passenger train produced is a thing of symmetrical beauty that slips or, rather, glides through the air with a minimum of resistance. Decreasing air resistance increases the velocity of a body enormously at the higher speeds, as much as 50% at 95 m.p.h. The Zephyr, Hiawatha, and 400 trains are all capable of traveling well over 100 miles per hour. The Hiawatha is a good example of car construction utilizing better streamlining. All its cars are semitubular in shape with turtle back roofs and the sides curved inwardly at the bottom. This construction gives a flush surface over the outside. Space between cars is enclosed by a full width diaphragm with rubber shroud, giving the appearance of a unit train. The Zephyr does not use vestibules, but has the ends of two cars riding on the same truck. These changes in construction interfere in no way with the interchangeability of cars to meet traffic requirements. Equipment carried underneath, such as water tanks, electrical apparatus, and braking drums, are enclosed in a rounded and tapered shell. The steps used when taking on or leaving off passengers are folded away or drawn up when not in use.

The Burlington Zephyr is a Diesel propelled train. The power plant develops 1800 h.p. with a V-type, 2-cycle Diesel-electric powered engine. The first car of the train is the locomotive proper and houses the 1800 h.p. engine. The second holds a 1200 h.p. Diesel booster. The first half of the third car contains auxiliary generators and air-conditioning apparatus for miscellaneous electric loads. The cost of operating the Zephyr is 31c per train-mile, as against 69c per train-mile for a comparable train of standard equipment. This saving is effected through the light-weight construction of the train, total weight 1,314,600 lbs. Welded, high-tensile, stainless steel is used in general construction with special metals being used for individual pieces that stand unusual stresses and strains. The train has a normal running speed of 80 to 90 m.p.h, but the train is built to exceed 100 m.p.h. Each train travels 882 miles per day with 3 stops between the Twin Cities and Chicago. All lubrication is Alemite as time cannot be wasted in stops for servicing working parts.

A new Zephyr being put into service will be a 12-car train, overall length 884 feet. Passenger cars are articulated and "tight lock" couplings are used to prevent slack between the power car and train; couplings are mounted on truck frames of cast nickel steel. The braking system is the electro-pneumatic type which prevents wheel-locking at stops. The maximum height above rail of the power car is 13 ft. 10⅜ inches; outside width, 10 ft. ⅛ inch. The truck wheel base for tractors is 8 feet 6 inches with tractors 36 inches in diameter used. The wheel base at the cars is 8 feet. Axles for all trucks vary from 5 to 10 inches and run on roller bearings. The outside of the engine is completely encased in a steel covering. The engineer rides at the forward part of the train and is in communication by telephone with others parts of the unit.

The Hiawatha is a good example of a train that has been built up from the rails. A "Milwaukee" type, it has 4 driving wheels, 84 inches in diameter, with a load on driving wheels of 142,000 lbs. and maximum tractive power of 30,785 lbs. The power is a crude-oil-burning steam engine. The steam pressure is 300 lbs. as compared to 150 to 200 lbs. in the normal train. The length of the



The Zephyr of the Burlington Route.

engine is 51 ft. 3 inches, and that of the fuel tender 37 ft. 5 inches, making the total wheel base of 78 ft. 10½ inches. The maximum height is 14 ft. 4 inches, and width 10 ft. 2⅜ inches. The tender weighs 247,500 lbs.; water capacity, 13,000 gallons; and crude oil displacement, 4,000 gallons. Clasp brakes are provided on both sides of all wheels to permit quick stopping. All axles and other movable parts are encased in grease or oil or operate on Timken roller bearings. Thousands of bolts formerly used in securing the different parts of the locomotive were eliminated by casting parts in large pieces. This step precludes the possibility of wearing or loosening of these parts. The engine is encased in a smooth shell and has a headlight in front of the smokestack. The Tyfon whistles are above the headlight and the bell is located under the grating in front of headlight. A "smoke elevator" lifts the smoke away from the cars in the train. A standard coupler is hidden in the front end in case it is necessary to carry a car on the front. The medium-light weight construction of the train enables the carrying of an extra car in the train without subsequent loss in the time schedule.

In comparison to the type of engine on the Pioneer Limited, which operates on a slower schedule of 10½ hours, it is noted that some dimensions have been decreased. The grate area of the Hiawatha is 69 sq. ft. instead of 80 sq. ft. The heating surface of tubes has been increased from 645 sq. ft. to 1,781 sq. ft., the superheater flues have been decreased from 3,149 sq. ft. to 1,170 sq. ft., superheater tube surfaces have been decreased from 1,815 sq. ft. to 1,029 sq. ft., the total evaporating heating surface has been decreased 960 sq. ft., and the number of tubes has been increased from 58 to 160.

The tender in the Pioneer Limited holds 15,000 gals. of water as against 13,000 gals. in the Hiawatha. Coal space on the Pioneer is 20 tons, but the Hiawatha needs space for 4,000 gals. of crude oil. Overall length of locomotive and tender on the Hiawatha is 83 ft. 7-13/16 inches, and the Pioneer has a length of 94 ft. 3½ inches, measured from the pulling face of the engine to the pulling face of the tender. The weights are also comparable; the tender on the Hiawatha weighs 262,400 lbs., the Pioneer, 287,780 lbs. The total weight of the locomotive and tender has been decreased 119,600 lbs. in the new Hiawatha. It is constructed of high-tensile, light steel or alloy against the heavy steel of the Limited.

The 400 is the other fast train that is operating on the 7½ hour schedule. It is a standard train that has been renovated. The locomotive is a Western Pacific type of the E-2 class that was taken into the shops and altered. A new type of superheater unit was installed and boiler pressure put at 225 lbs. The driving wheel diameter was increased 4 inches to 79 inches. Valve gears were adjusted for more power and smoother running at high speeds. The main driving wheels were carefully cross counter-balanced to assure smooth operation at higher speeds and reduce stress in track structure. It was converted from coal to oil burning to avoid stops en route for fuel. Fuel capacity is 5,000 gals. and water capacity is 15,000 gals. The total consumption of water is 32,000 gals. a trip. The train is capable of making 100 m.p.h. and averages 58.4 m.p.h. between Chicago and Minneapolis including three 5 minute stops. Careful roadbed preparation for high speed operation such as reballasting and curve elevation were made, and rails tested with a Sperry rail testing car. The engine and tender are heavier than those of the Zephyr and Hiawatha.

The passenger cars of the Zephyr and the engine make up a unit 884 feet long. The first 2½ cars are taken up by equipment, but the last half of the third car is used for mail. The rest of the cars with the exception of baggage cars are used for the accommodation of passengers.

The inside width of cars is 9 ft. 3¼ inches. The car is sealed against all air currents, dirt, and smoke. Windows are hermetically sealed, shatter-proof glass in stainless window frames. All cars are air-conditioned by electro-mechanical means with temperature control in each car. The heating apparatus consists of steam radiators concealed overhead and under the floor. The floor itself is a corrigated stainless steel in which the corrigations have been filled with cork strips and covered with cork tile. Floor coverings are carpets laid over sponge rubber padding and having colors harmonizing with the pastel shades of the interior walls. Window frames and mouldings are of bright metal. The seats in the cars harmonize with the car purpose and decorative treatment in the color, but all are furnished with sponge rubber cushions and are upholstered in fabric or leather.

On the Hiawatha the coaches are of the double truck type and using cast steel truck frames. The coaches have vestibules in but one end. Vestibules and steps are exceptionally wide to permit easy entrance. The steps fold back in the car when not in use. The capacity of the coaches is 52; ten can be accommodated in the men's lounge, and 4 in the women's. There are lavatory facilities in each car, having hot and cold water. Seats are in pairs, separately reclining, and having more leg room than the ordinary coach. Windows in the coach are set slightly forward of the seats to give the optical illusion of less speed. Luggage is stored in overhead racks, under seats, and at one end of the coach is a compartment for the storage of hand baggage. The 82 foot car is illuminated by electrical focused lighting.

In the forward part of the 9 car train a baggage car has been half converted into a tap room seating 40 people. This car has no windows except for 2 portholes located near the bar. Furnishings are modernistic with the use of mirrors, chromium plate trimmings, red leather covered chairs with polished aluminum frames, and pastel shaded walls with orange decorative moulding. Ten tables are

located along the walls and have regular seating for four at each table, although six may be accommodated.

The dining car, located between the coaches and the parlor car has been built without vestibules for greater room and seats 48 in the 40-foot dining compartment. Kitchens and pantries are located in the car with special cooling and ventilating systems installed. Fuel oil is used in the ranges and the kitchen carries automatic refrigeration.

Parlor cars are classed as straight, drawing room, and beaver tail. The straight has a length of 76 ft. plus 3 ft. 6 inches included in a vestibule. The car contains 28 swivel chairs. A men's and a women's lounge slightly over 6 ft. long and seating 4 each, 2 lavatories, a baggage locker, and a clothes locker. Distance between swivel chair center is 3 ft. 5½ inches. Alongside each chair is a recessing folding table that may be used for writing or holding reading material. The ceiling of the car is bone white; walls, veneer with walnut wainscoating; windows, hermetically sealed and having aluminum window frames. The floor is covered with blue carpet except in the men's lounge where it is gray rubber. Seats in the car are covered with a dark blue purple velour.

The beaver car, the last on the train, has not the usual rear platform and instead the end of the car is rounded. The front end of the car, specifically 12 ft., has a vestibule, toilet rooms, clothes lockers, and baggage lockers. The passenger compartment seats 26 in a space of 47 ft. 10 inches. An observation lounge in the back seats 12 passengers. Due to the elimination of a rear platform the body of this car has been lengthened one foot and permits the placement of an additional window between the emergency side door and the rear end. The number of windows in the curved section has been increased from two to four. No buffer protrudes at the end of the car. The tap room and the beaver tail have radio-phonographs installed, which are operated by the crew. The radio is of the automotive type with antennæ being mounted on the roof. Speakers in the cars are concealed; in the tap room it is in the ceiling cove, and in the beaver tail there are two—one for the rear compartment concealed in the ceiling cove and the other in the body of the car.

The exterior of the 737 foot train has the tops of the cars painted silver. The top border of the cars is maroon with a silver stripe. Housing is brown underneath and includes the trucks.

The 400 is a six car train that uses standard Northwestern Car equipment. The cars were renovated and air conditioning equipment, modern drinking fountains, radio equipment, etc., were installed. The air conditioner is an ice-activated type consisting of two ice bunkers of 1,600 lbs. each, located in front of trucks underneath each car. It has a 30-gal. sump located between them for receiving chilled water after passage over ice. A Chicago water pump, driven by a ½ h.p. Baldor electric motor delivers the chilled water through copper pipe to fin type cooling coils in the clerestory at one end of the car. Cooling effect is varied by the rate of motor pump speed and is regulated by a thermostatic vapor control panel located at the opposite end of the car. Air circulation is provided by means of a direct-connected electric driven double blower unit of 2,000 cu. ft. per min. capacity which forces air through grills conveniently located on the sides of the car body. About 75 per cent of the air is recirculated and 25 per cent is introduced fresh.

The editors wish to acknowledge pictures and material furnished by the Chicago, Milwaukee, St. Paul, and Pacific Rr. Co.; Chicago, St. Paul, Minneapolis, and Omaha Ry. Co.; Chicago, Burlington, and Quincy Ry. Co.; and Edw. G. Budd Mfg. Co.

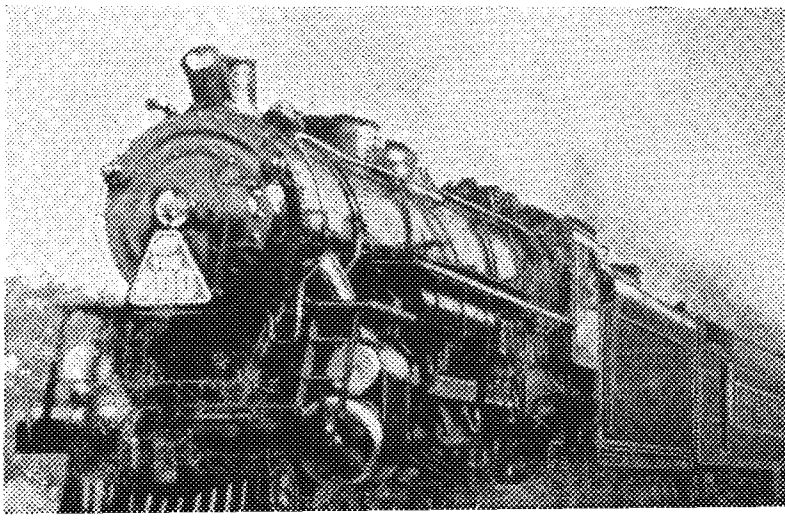
The passenger-baggage car is 70 ft. 3 in. in length over the end sills; additional space is taken by double vestibules that are carried as standard equipment. Cars seat 50 in the passenger compartment and also have 29 ft. space for baggage. The car interior is in three shades of gray with black trimmings, and the lighting system is the sort found on other trains of older vintage.

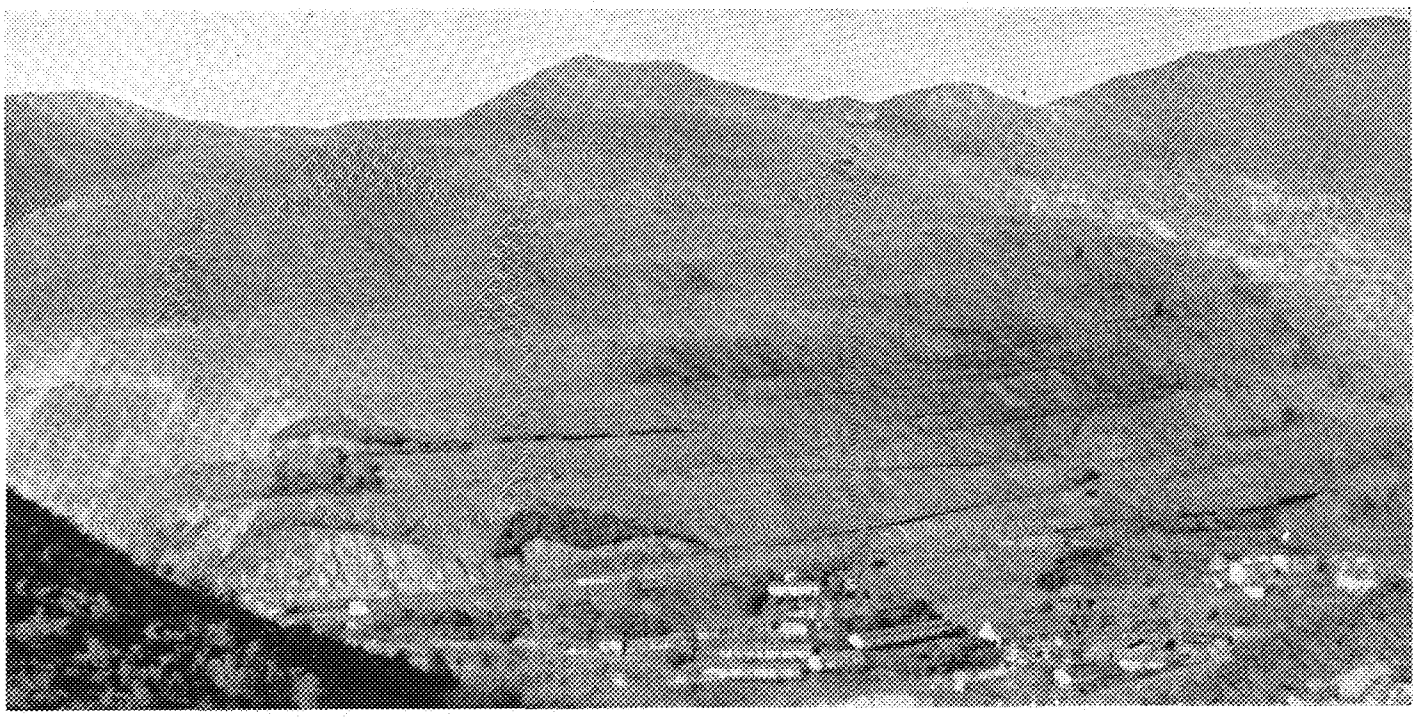
The lounge coach is 73 ft. 4½ in. long and seats 38, a men's lounge seats 7, and a women's lounge seats 6. Seats are rotating, individual type, with adjustable back. All chairs are upholstered in an old rose flowered design, except in the men's lounge where they are upholstered in green leather. Floor covering is alternate squares of black and green marbleized tile. The lighting system is indirect, and uses 120 15-watt bulbs. Light is supplemented by 6 overhead hallway lights and 3 side-wall lights of the bracket type being used in the lavatories. Trimmings throughout the car are chrome-plated.

The dining car is 73 ft. long, 15 ft. 11 in. being devoted to the kitchen, 6 ft. 3 in. to the pantry, 5 ft. to the stewards section, and 38 ft. 7 in. for the main dining room which has a seating capacity of 36. A parlor car embodies the same color scheme as the others with the exception of brown trimmings being used. The car has seating arrangements for 42, using 23 individual chairs in the main section, 2 sofas in the men's room, and 11 seats in the smoking room.

All the improvements that have been cited in the Zephyr, the Hiawatha, and the 400 have contributed to a steady increase in the passenger service of the railroads. Such things as air conditioning, better roadbeds (oiled), light colored interiors, pneumatic brakes, radio, comfortable seats, etc., were unknown a few years ago. The shorter time schedule appeals to everyone who needs transportation. New trains in all parts of the country are being made to be put into service as soon as possible for the accommodation of the increasing passenger traffic.

The 400 of the Chicago, St. Paul, Minneapolis, and Omaha Ry.





Utah Copper Company's Terraced Mine at Bingham Canyon, Utah

Mucker's Paradise

By Virgil Frank, M '37

FOLLOWING 2 weeks of instruction in First Aid and Mine Rescue under the direct supervision of engineers from the United States Bureau of Mines, the junior class of the School of Mines and Metallurgy last summer visited various parts of the United States on field and inspection work. Those class members specializing in Metallography traveled to Milwaukee, Chicago and other points east; the Petroleum Engineers went to the Oklahoma and Texas oil fields; the Miners and Metallurgists left for the so-called Western trip, which included the Black Hills, Colorado, and Utah; the Geologists left prior to May 1 for six weeks of field observation and geologic mapping in the Black Hills.

Now for impressions of the Western trip—we had arrived at Lead, South Dakota, and were about to go through the Homestake Mining Company's famous South mill, where almost 4,000 tons of gold ore is crushed, reduced, and the precious metal extracted every day. The low, almost ominous, rumble that issued from the mill enveloped one as it was approached. Around the noisy stamp mill crushing machinery it was impossible to make yourself heard, even by shouting as loudly as possible into the ear of the person next to you. Then came the underground workings with the accompanying rattle of the drills, the boom of dynamite blasts, and the deafening toot of the compressed air locomotive whistles. Other mines and mills were visited in regular succession. Always it was gold, gold, but no gold bars. Our patience was rewarded when we observed a bullion shipment being loaded on the same train on which we left the Black Hills. We didn't see the gold bars, but we knew they were there. Romantic? Well, weren't there almost two dozen guards around with sawed-off shotguns, rifles, and submachine guns, and didn't we ride on the same train?

The itinerary included a stop in Denver before reaching Salt Lake City, Utah. The Salt Lake region presented numerous other mines, mills and smelters. It was here that we saw the world's largest open-cut copper mine of the Utah Copper Company at Bingham Canyon. The daily tonnage mined at present is 45,000 tons averaging about 1 per cent copper. Too soon the trip ended and a quick dispersion of the fellows took place. Several continued on to the California gold mines where jobs awaited them, a couple went to Montana for work, a few took an additional trip by themselves, and most returned home.

Juniors before us had endeavored and succeeded, and those after us will try and, no doubt, succeed equally well in getting a mining job at the close of the field trip. So previous to the end of the trip, Glenn Helps and I had decided to flirt with Lady Luck and test the possibilities. With considerable trepidation and uncertainty, we ventured forth late on the day following the close of the trip, via the short line bus (locally called stage) toward Bingham Canyon. It was raining and it continued steadily for several days. (What is the psychology of hunting a job in adverse weather conditions?) With the Lark mine camp as our destination, we arrived the same night after a four mile hike from the main highway. The

last bed in the camp's boarding house was ours. Early the next morning we eagerly rushed down to the mine office and stated our purpose, only to be just as quickly rushed out and told that "rustlers" should see the foreman at a place near the "dry." Step number one in the practical education of uninitiated miners. "Rustlers" are mine job hunters, and the "dry" is the miners' clothes changing building with showers, etc. We did as told for two shift changes a day for several days, spending our spare time exploring the countryside and wondering why it had to rain. After a few days of this, we awoke one morning to see the sun shining. We felt better. That noon we were signed up. Lady Luck played a good hand and smiled. A quick trip to Salt Lake City was now imperative. To adequately present a recital of the series of events, maddening delays and split-second connections that were ours from the time of being signed up until going to work the next morning, would require the atmosphere of a radio broadcasting studio with the distinct ticking of a time clock for background, accompanied by the deep-throated, staccato, rapid fire Floyd Gibbons description.

The really high point probably was the physical examination at the Bingham hospital six miles from Lark. We seemed to have come on an off-day. Of the usual three doctors in attendance at the hospital, only one was on duty, the waiting room was full of people, and it seemed to be official baby inspection day; as a result about twenty anxious mothers with their off-spring preceded us. Of course, we had almost immediately been ushered into a small adjoining room by the nurse and told to disrobe and await the doctor. The room was quite cool and the rapidly increasing number and size of "goose pimples" told us during the long delay that something peculiar was being enacted. It was very necessary to get back to Salt Lake, thirty-five miles away, before the stores closed so that necessary purchases could be made and our baggage reclaimed. We fervently wooed Lady Luck and won, catching the Salt Lake stage with a few seconds to spare. Our Salt Lake transactions were accomplished with the same scant margin. These included buying the necessary "hard hat" and "pie can" (lunch box).

The return to Lark was eventually made and we obtained forty winks before the new morning sun peeped over the horizon. With our "diggers" (old working clothes) on and the "pie can" heavy with nutritional substance, two new "muckers" reported to the foreman for work. He looked us over and decided that Glenn looked capable enough to handle a pick, shovel, and wheelbarrow, and because of my long legs I could doubtless tram. Tramming is pushing a loaded ore car on a track and dumping its contents down a chute or into a hoisting skip. The loading of the "buggy" was done by yours truly, with a shovel at the working place, or, when more fortunate, by a powered scraper. These ore cars were about 1½ ton capacity. The following days saw a gradual orientation as we became inured to the vagaries of the shovel. Sore muscles were replaced by callouses on the hands. We had become one of that fraternity of mining life called "muckers."

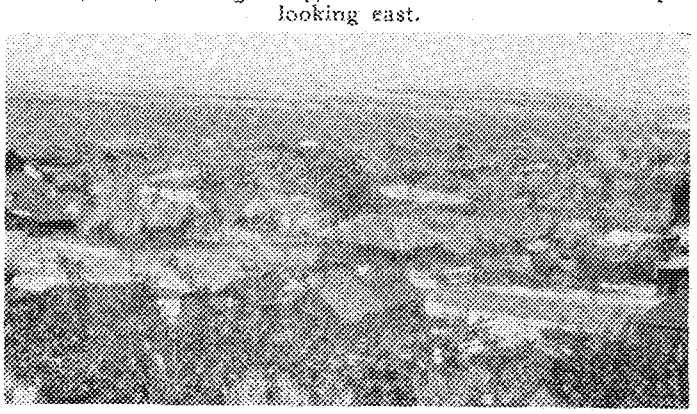
The Lark mining camp adjacent to the famous Bingham district has a long history, and has been worked with more or less regularity for over 40 years. The ore mined contains lead, silver, and copper. In the early part of its career, many of the present properties were exploited by shafts from the surface, but now these have been abandoned and all ore deposits are connected underground by the three-mile-long Mascotte tunnel. The workings extend vertically below the tunnel level for 500 feet or more with depth increasing as extraction proceeds. All supplies, ore, and men are transported through this tunnel. Lark has a population of around 400. The mine employs over 300 men, but many of them live in Salt Lake City and the smaller towns in the intervening valley.

Sharing our "paradise" with us during the summer were a number of other college fellows. These included a civil, an electrical, and a chemical engineer; also a doctor, dentist, business student, a political science major, and even a graduate education student. (Did you say mining was for miners only?) However, we came for experience and got plenty of it. There was quite often opportunity presented to try one's hand at drilling, running a scraper, loading blasting holes with dynamite, and picking up a practical trick or two. We were very well treated and even enjoyed the promotion to timberman's helper for the last few weeks. Is there romance in mining? Yes, I would say so. There is something distinctly fascinating about the eerie underground sounds of activity, the rumble of the ore cars, the din of the drills, and the churn of the scrapers. Raw materials! They are the basic elements of industry.

The essentials for a true "muckers paradise" are a new pick and shovel, an easy running "buggy," a short down grade tramming distance, good air, plenty of water to drink, and lots of ore. For best results the ore must have a sufficient quantity of good sized chunks to facilitate quick loading. Are these always to be had? Well—not quite! Anyway, it will be necessary to "take five" (resting time) periodically because lead ore does get heavy. The story goes that a new, young, unitiated mucker came into a mine and was told to work with an old timer carrying lagging (usually some sort of board lumber) from one place to another. After a period of rather constant application in transporting three lagging each per trip, the young fellow began to tire so the old Cousin Jack suggested, "Let's take five." "——No," was the quick reply, "three are enough for me!"

"Spitters" (blasting) time has arrived, so let's drop the shovel and get our "pie can" at the shaft station and be hoisted. Then we can board the man-train and relax during our ride to the tunnel portal where the sunshine will make us blink our eyes. Our carbide lamps are out and it's a shift!

Lark, Utah, mining camp, and view of Salt Lake valley looking east.



Will You Please Analyze This?

By H. H. Barber
Asst. Prof. of Inorg. Chem.

A CONTINUOUS stream of requests for analysis of all sorts of products pour daily by mail, by telephone, by messenger, and by personal calls into the office of the School of Chemistry. Most of these requests come from individuals who have purchased some commercial product and, having found it satisfactory or unsatisfactory, wish to know the composition of the material. Or there may be trouble—the goldfish may have died; the dickey bird may have been poisoned; the husband or wife may be suspicious of some white substance found in the bottom of the morning cup of coffee. Mrs. Jones wants to know if we will analyze the water in her fish bowl and determine what killed her very valuable guppy; and dickey, a prized canary, died during the night. Will you please analyze the bird seed, or the canary? She feels sure the seed poisoned the bird. And just some time ago a very nervous and hen-pecked looking man came into my office with a cup of coffee. He wanted to know if I would determine if the coffee contained any poison. Upon inquiry I learned that he was suspicious of his wife, and that this morning she seemed to have a peculiar mood, which he did not like. He became concerned on tasting the coffee which she had prepared for him. He said it had a queer taste and that there was some white material in the bottom of the cup. Examination showed the white substance to be sugar. And then there was a woman who came in with some white tablets which she believed were poison tablets. Her husband had bought them for her. She had asked him to get her some aspirin, but she was certain these tablets were not aspirin. Would I please examine them? Her husband had said he was going to poison her. The tablets were the common mint—sodium bicarbonate kind. Both of my clients were satisfied that life was not as bad as it had appeared to be.

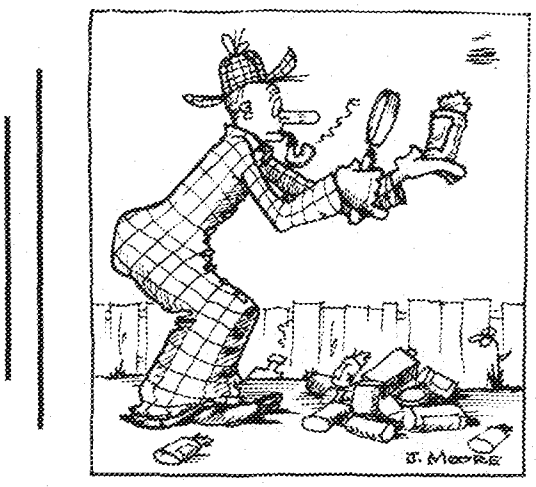
During the days of prohibition, many people were concerned with the quality of the liquor they were about to purchase or consume. Constant reports in the newspapers of poisoning and death of people from drinking everything from varnish to Minnesota 13, made many customers of bootleggers wary. They seemed to think that it was one of the functions of the University to certify to the purity of their liquor supply. Many cases came to us. They were referred to the Dairy and Food Commissioner. We assumed the Commissioner was a better judge of liquor than a sober minded professor with only a theoretical knowledge of drinks.

Outside the law

On the other hand, the bootlegger wished to furnish a certified product to his customers. One day a well built, dark eyed, black haired, swarthy complexioned man came to see us. He was dressed in the height of fashion, and had the air and bearing of a very successful business man. He closed the door to my office, introduced himself, and informed me that he was a bootlegger and had been referred to me by a friend. He had a straightforward business proposition. He wished to take denatured alcohol and, by chemical means, remove the denaturant. I was told that thousands of extra gallons of bootleg whisky could be sold if the odor of the denaturant could be removed from the product. His proposition was a good one.

He offered to give me $5,000.00 if I could produce from 50c denatured alcohol a pure product which would not cost over $2.00 a gallon. He offered to set up a private laboratory and furnish all equipment necessary to develop the technique to remove the denaturant. The offer was tempting, but I feared the administrative authorities of the University would not issue the necessary permit for this kind of outside work. We shook hands and parted the best of friends, but for several days I felt a certain pride in having met a real bootlegger.

"I am sending you by parcel post two kinds of wine. One is red and the other is white, one sweet, the other dry. The red wine is a commercial product and the white wine is home-made. I would like you to say which of the two wines you would rather assert to be pure and



valid, and safe for sacramental purposes." The request of the writer of the above letter was found, on consulting an authority on sacramental wine, to be entirely reasonable, and did not involve testing for evil spirits. Analytical work showed that the red wine was not a natural fermentation product, but that the white wine contained only innate alcohol. Our client was advised to use the white wine for sacramental purposes and to send us the red wine for scientific purposes.

Sacramental wine

Many persons gain avoirdupois by an over-fed system and lose adipose by the use of salts or vicarious exercise. Mr. Epsom had a bottle of solution which had been sunkist. He had just received it from California, and for a gallon of this salt solution, he had paid $30.24, C. O. D., and $3.47 express charges. He said his wife used this material as a massaging solution on ladies with an over-fed system. By this vicarious exercise the adipose ladies gained poise. Mrs. Epsom had tasted this solution and noticed a familiar flavor. A few laboratory tests showed the solute to be magnesium sulfate. Mr. Epsom was advised to buy 10c worth of the salt, add it to a gallon of water, and proceed with the massage. Later, Mr. Epsom informed me that the sunkist salt of Minnesota was just as effective as the California variety. This information was not surprising to me, but I told him to always keep the solution in the California bottle.

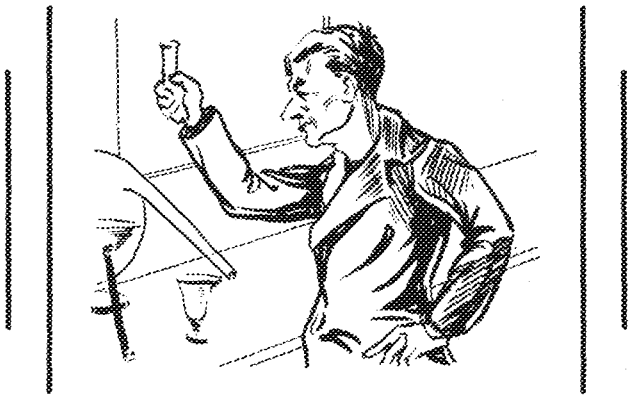
The Sunkist salt

A persistent search for the ideal radiator anti-freeze solution is carried on by a great number of people. The majority of these persons are without chemical knowledge, and consequently any solution which does not freeze may be, to them, an ideal anti-freeze for automobile radiators. And while it is known to chemists that practically all anti-freezes on the market at the present time consist of methyl alcohol, denatured ethyl alcohol, glycerine, ethylene glycol, or mixtures of these chemicals, there are always new substances trying to find their way into radiators. Solutions of common salt are not an uncommon product. Calcium chloride and magnesium chloride, with and without a small amount of chromate, are persistent comers. Solutions of honey, of sugar, of glucose, either by themselves or admixed with alcohols, find their way to market. Kerosene is another anti-freeze which circulates. And tomorrow the ideal anti-freeze may come on the market, and analysis will probably show that it is the same old stuff under a new and fancier name.

Pep-tablets and mileage producers for gasoline are constantly in the dreams of those who would get lots of energy from a pill or a few drops of some mysterious liquid. Tall tales are told regarding these marvelous substances. The poorer grades of gasoline become better than the best gasoline. Many extra miles per gallon of gasoline are obtained from a pill the size of a pea. The engine no longer knocks, gets hot, or refuses to start. Examination usually reveals that these marvelous pills are mothballs. Some are colored red, some are purple, some are pure white, and all are pure bunk. And the super-power liquid is acetone or just a lubricating oil perfumed.

Anti- and super auto products

And the old battery has to be doctored. If you put in some of this wonderful material, the old run-down battery becomes fully charged, and the new battery will never run down, so says the fellow with secondhand knowledge. Chemical analysis of the material shows the "wonder battery rejuvenator" to be a mixture of aluminum sulfate, iron sulfate, and copper sulfate. And you wonder why battery manufacturers go to trouble and expense in removing iron and copper from the lead before they make up their battery plates.



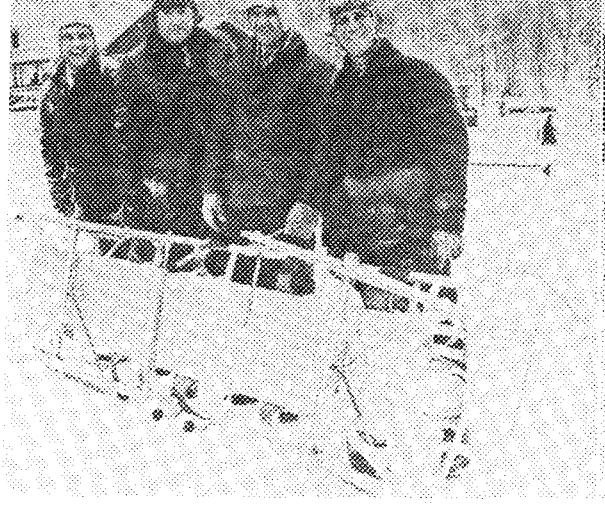
Johnny Chasem had had his day, or night. Johnny came to me with a story that touched my heart. Johnny and his pals had played tit-tat-toe, three-in-a-row with mercurochrome on the backboard of a dancer. The mercurochrome had blushed redder than usual and being a product of an organic chemist and, having inherited some of the chemist's characteristics, it clung tenaciously to the soft white skin of the dancer. Johnny and his pals had tried to remove the stain. Soap had been used in quantities; ammonia solution had been tried, and whisky had been applied. All to no avail. The scarlet marks still remained to plague and embarrass. The lady in distress was due to appear on the stage of a downtown theatre in a few hours, and everyone knows that a fan dancer cannot dance if her back is covered. The mercurochrome had to come off, and come off soon, or the dancer would lose her job, and Johnny would be disgraced. Search in the field of applied chemistry gave the desired information. The embarrassment was removed in time, so Johnny said

In the realm of serious comedy

Commercial concerns are ever alert to the possibilities of chemistry. They may wish to manufacture certain products which they are now buying. They want to have their own products analyzed for purity, or have the purity of products they are now buying certified, or they may wish to develop a new material for manufacture and sale. Most of these requests fall purely in the field of extended research and development, and cannot be solved by a few laboratory tests.

In the field of enterprise

From the many requests that come, many may be answered from the storehouse of knowledge in the field of chemistry and from our own investigation of certain subjects. Thus members of the School of Chemistry help the citizens of Minnesota and surrounding states in solving problems which are perplexing to them. Oftentimes, however, the requests extend beyond the bounds of present knowledge. "Will you please tell me how to synthesize chlorophyll, the green coloring substance of plants?" was one of our latest requests in the realm of the unknown.



—*The Foundry*

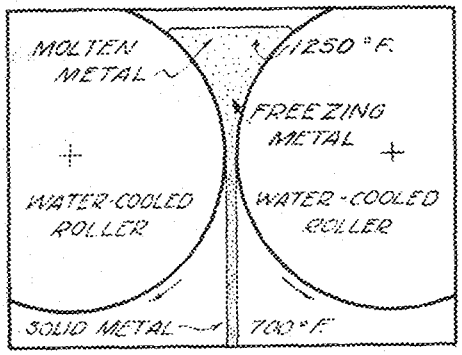
Progress

Efficiency Typewriter

A TYPEWRITER with a built-in fractional horse power motor is now on the market. When a special key is pressed the motor shoots the carriage back automatically.

Direct Rolling of Aluminum

ALUMINUM is now being converted directly from the molten state into sheet metal without first being poured into ingots. The fluid aluminum is poured continuously into the trough formed between horizontal water-cooled rollers; the metal freezes to the sides of the rollers and is rolled solid; it emerges under a tension of 25,000 lbs. over 24 inches in length, as a smooth uniform strip with its temperature reduced from 1250° to 700° F. Advantages claimed for the process are reduction in the number of operations, in power required, and in waste. Brass and steel are also being direct rolled.



Pipe Clamps

PIPE clamps to be used for permanently stopping leaks in pipes have been recently redesigned. The clamps may be used on all types and sizes of carriers, and may be installed while the pipe is in service except for certain high pressure failures. The devices are of malleable iron hinged on one side and held together by two steel bolts on the other.

Cast Iron Bob-Sled

THE National A.A.U. junior 4-man bobsled championship was won last year on a cast iron sled. The runners were cast as a unit to see if they would have less friction than steel runners. The sled, named "Ironshoes," is several inches lower than the ordinary type, and is finished in silver bronze. It weighs two pounds less than the 485 pound limit. The sled cut an average of more than two seconds from the best time of each heat. The four mile heats were run in a total time of 4 minutes, 42 seconds.

New Use of Aluminum

AT Gallipolis, Ohio, aluminum was used in the construction of an emergency bulkhead on a rollergate dam; the bulkhead is made of seven units each 129 feet long, 13 feet wide, and 4.25 feet high; in spite of their great size they can be placed in position by a maneuver boat, obviating the necessity of the customary crane and runway bridge.

Sound Mixes Ice Cream

THE use of high intensity sound in manufacturing is one of the most recent industrial applications of pure science; sound is being used to beat wood pulp for paper-making, to produce ice cream of a smoother consistency, to make artificial curd milk, to pasteurize without heat, to age wines, and to form homogeneous pigment suspensions. The beating effect results from the alternate compression and expansion of the material through which the sound waves pass.

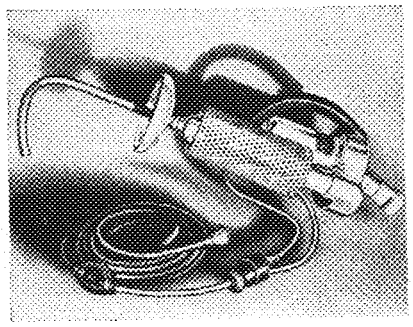
'Tuned' Pavement

E. W. DAVIES, superintendent of the Minnesota Mines Experiment station, has found in the course of his experimentation with cast iron paving that various types of non-skid paving give forth a variety of sounds when passed over by automobile tires. The discovery has given rise to a novel idea for increasing motoring safety by paving highways with strips of iron blocks whose configurations are such that there would be very little sound when the vehicle was in the center of the lane and that it would increase in intensity to warn the motorist as he veered toward the inner lane or curb.

At Other Colleges

Vacuum Cleaner and Heat Gun

A COMBINED vacuum cleaner and heat gun has recently been designed. A 1,000 watt heating element surrounds the vacuum cleaner exhaust and provides a large volume of warm air for thawing and other industrial maintenance operations. A detachable nozzle is provided for transmissions and other places difficult to reach. The heater may be detached from the vacuum cleaner by means of a bayonet lock and thumb screw.



—General Electric

Atom Smasher

THE Physics Department of Purdue university is taking an active part in the development of high voltages by the construction of a cyclotron, or what is now more commonly called an "atom smasher." When this machine is completed it will be capable of emitting the strongest beam ever made by man, being able to melt metals, disintegrate any known substance, penetrate three feet of lead, or make ordinary table salt radioactive.

The fundamental operation of the cyclotron is as follows: positive charged ions (protrons or deutrons) are formed at the center of a large pan cake vacuum chamber which lies between the poles of a powerful electromagnet. These ions are accelerated periodically by a very high frequency field so that they travel in an ever widening spiral path parallel to the faces of the magnetic pole pieces. During every revolution the ions receive an impulse of electrical voltage which drives them faster and faster. This continues until the ions reach the periphery of the vacuum chamber at which time they will have attained a velocity equivalent to 20,000,000 volts.

When they have attained this very high energy, they are pulled out by an electrostatic deflecting electrode and directed against the desired target which undergoes a variety of peculiar effects.

The Purdue cyclotron was designed by Dr. H. J. Yearian and John D. Howe. The magnet weighs 48 tons and measures 113 inches long, 82½ inches high, and 41 inches wide. The poles of the huge magnet are 35 inches in diameter and 3¾ inches apart. Heretofore, the shape of the poles was given very little consideration in the construction of the magnet. However, a great deal of attention has been given the poles on the Purdue magnet. Dr. Yearian and Mr. Howe have designed curved poles according to a theoretical calculation made by Dr. H. A. Bethe of Cornell University. By shaping the poles in this new and unique way it is hoped to increase the magnetic field strength.

—The Purdue Engineer

Drafting Machine

A NEW type of drafting machine, designed by Prof. L. E. Finney of Iowa State College and built by the college instrument shop, is being tried out by students in engineering drawing who are familiar with the "universal" drafting machine. Many of the students who have already had a chance to get the "feel" of both outfits express a preference for Professor Finney's creation. It is estimated that the machine could be marketed at about $35, as compared with the $60 to $75 demanded for drafting machines now on the market.

The drafting machine is a gadget which replaces the tee-square, triangles, scale, and protractor ordinarily used by the draftsman. It consists of a graduated steel square fastened to the end of a long metal arm reaching down from the top of the drawing board. This arm is secured at the top in such a way as to insure that the blades of the square will always make the same respective angles with the edges of the board, no matter where they are moved over the surface of the board.

—The Iowa Engineer

All-purpose Autogyro

THE Aeros at Wayne University are building a vehicle which they think is the type which will best answer the individual need for private transportation. They are building into it properties which will enable it to perform as an automobile, heliocopter, and autogyro.

In outward appearance the job will resemble somewhat, the latest roadable autogyros built by Pitcairn. That is, it has no fixed wings but a two-blade rotor to provide lift. Forward motion is accomplished by means of a pusher-propeller mounted just ahead of, and swinging with, the rudder. The overall dimensions of the ship are somewhat smaller than the Pitcairn; in fact it is only a single-place ship. There are two wheels forward and one in the rear. For ground travel, power and steering control are applied through the rear wheel.

—The Wayne Engineer

'Descrip' Made Easy

THE department of engineering drawing at Iowa State College is in the process of developing a new technique in the way of handling that old bug-bear, descriptive geometry. Loose-leaf mimeographed booklets are being made up in which each lesson will be introduced by an isometric and orthographic projection of the problem accompanied by from six to fifteen simple leading questions which are written in such a way as to aid the student in visualizing the different phases of the problem at hand. Upon completion of these exercises, the student summarizes what he considers to be the general principle brought out by the day's work.

—The Iowa Engineer

The Minnesota Techno-Log

FEBRUARY, 1937

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

DONALD ERICKSON, Issue Editor

EDITORIAL STAFF

Herbert Gaustad, Alumni Edr.
Erling Helland, Feature Edr.
John Murray, - News Editor
Fred Warner, - - Reporter

BUSINESS STAFF

Robert McDonald, - Office
Gordon Brierley, - - Adv.
Wallace Wilcox, Circulation
Vernon Hoden, - Circulation

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, Treas.; Professor E. H. Comstock, *Mines*; Professor R. E. Montonna, *Chemistry*; Donald Randenbush, *Electrical*, Pres.; Louis Reigert, *Architecture*; Lawrence Rollin, *Civil*; William Hanson, *Mechanical*; Elden Olson, *Aeronautical*; Edward Eidam, *Mines*; Neal Amundson, *Chemistry*.

St. Pat By Merit?

THE combination of the University's technical schools into the Institute of Technology has brought about many fundamental changes in the organization and policy of the engineering schools, and we are led to expect even greater changes in the not too distant future.

It is undoubtedly true, also, that a majority of student activities are now functioning very efficiently. One, however, has for many years been administered in such a manner that it has promoted jealousy, bitterness, and antipathy.

That function is the annual selection of student St. Pat and Queen, representatives of the legendary Hibernian patrons of engineering, to reign over the greatest event of the Institute's school year—Engineers' Day.

As far back as extends the memory of the most senior of our seniors, the engineering college's king-for-a-day has been chosen by election from a list of candidates made up of seniors who have met certain eligibility requirements and who have presented petitions bearing the signatures of twenty-five senior students. While the nominating system is outwardly democratic, in practice the candidates are selected by the student professional societies. It has been customary for the newly elected St. Pat to make a choice for his queen from among the women students.

Smaller classes have become discouraged by the weight of their rival's numbers and have come to look on the election with pardonable apathy. They are justified in showing little interest in a function that has been ruled by one class for seven of the past eight years.

What can be done to eliminate or at least minimize this unfairness? How can we put the election of St. Pat on a basis that will restore the interest of senior students in the Institute as a whole?

An answer to these questions, and a solution that merits the consideration of all technical students, was suggested at a recent round-table discussion of an engineering organization:

> **That a committee of students and faculty select three candidates on the basis of service and scholarship, using a point-rating system, without regard to classification by school or division, and that the names be held secret until the hour of election so that electioneering might be reduced to a minimum.**

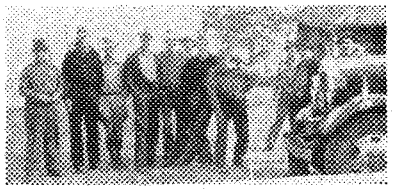
By this arrangement it is believed that merit and ability would be recognized and rewarded, while at the same time students would be enabled to express individual preferences.

At the Desk

THE cover this month is a familiar picture to many mechanicals, inasmuch as it was taken in their building. The three types of trains running between the Twin Cities and Chicago form the basis for the first article this month. Some interesting comparisons can be made with a little study of the statistics.

The function of the university as a state institution is shown by Prof. Barber's write-up illustrating some of the requests and jobs performed by the Chem. dept. without recompense. Progress is a varied page this time, notes being made of research and experiments and new products not only in commercial companies, but in other colleges and here in the Institute.

The miners are heard from through Virgil Frank, in a synopsis of the field trip last summer, and his own adventures in garnering practical experience.



Pictured Here Are Some of the Members Who Took the Mines Trip.

Institute activities and experiments are stressed in this issue, as can be noted by the new Tech news page, and short articles on Prof. Piccard's work in the Aero department, and the testing of model motors by the Aeros in the experimental engineering building. Two contests are being started this month—one by the Tech Glee Club for words for an Institute song—and one by the columnists. The latter's rules and regulations head B. H. T. L.'s column, and have something to do with a beer can, but empty.

ATTENTION JUNIORS

Candidates for **Engineers' Day Chairmanship**, here is what you must do:

(1) Submit your plan (you may see old plans in Dean Leland's office).

(2) Include plan for open house.

(3) Be a regular junior in the Institute of Technology.

(4) Present 25 Junior signatures and 25c.

(5) Bring plan, fee, and signatures to room 127 Chemistry by 5 P. M., February 15, 1937.

Engineers' Day is April 16

Now Here's A Book

By Clifford I. Haga

Instructor in English

THE first draft of this review had to be thrown out after the introductory paragraph ran away with me. In it I related a fable or parable about a little boy who played with spools and left one where his uncle stepped on it, broke his neck, and set fire to the house by dropping his lighted cigar in a waste basket. Rapidly I traced the chain of events that succeeded until everyone in the United States and even abroad had been affected. It was a pretty parable and a very reasonable one, but it was too long for my purpose. Even though I thought it was very funny, I gave it up willingly to get to work telling you about Paul Sears' *Deserts On the March* and how this book will help us to understand the flood now roaring down the Ohio River valley.

This flood is a terrible thing to read about in our newspapers and to look at in the news reels. It is especially terrible because we have learned in the last few years that the devastation caused by floods is made possible largely by man's interference with nature. A surprisingly effective, concentrated propaganda has given meaning to the dust storms and floods of the last five years and most of us read in them the moral to that historical anecdote called "Civilizing the Wilderness." True, there were flood and drought before man gutted the forests, plowed the prairies, and over-grazed the uplands. But these floods and droughts, as far as any records can be depended on, were not quite as bad as those of today. It is that extra twenty-five per cent spelling devastation and terror for which man is responsible. In other words, most of what we have done up to the present has had as its chief practical effect the magnification of the less amiable forces of nature.

And how have we caused this final, destructive twenty-five per cent increase? By doing only that which is natural and proper to human life in its search for food and shelter, just as little Oscar rocked the United States to its foundations by doing something quite natural and proper to infants. And just as the moral to the parable of little Oscar, "Children should not play with spools," was both logical and silly, equally logical and silly would be this moral to the flood and drought tale, "Men should not interfere with Nature." The true moral is, "Men can interfere with nature only on her own terms."

Let us see what Professor Sears says in *Deserts On the March*. He is an ecologist, or a plant and animal biologist who is also a specialist in geography, economics, sociology, geology, mineralogy, meterology, chemistry, bacteriology, history, and everything else that may be of use in explaining how and why the economic strata of the earth's surface and its atmosphere maintain the functional interdependence of their parts that we call the Balance of Nature. Darwin's story of how the old maids of England won the Battle of Waterloo is a homely example of a simplified aspect of ecology. Darwin demonstrated that the spinsters all kept cats, the cats caught mice that otherwise would have destroyed the bumble bees, the bumble bees pollinated the clover blossoms, the clover luxuriated, the beeves of England thrived on the clover, the English soldiers waxed mighty on the beef, the mighty English won the Battle of Waterloo. Q.E.D. What Sears does is to show with equal vividness, though on a larger scale and in a more complex and detailed pattern, that a land area whose character is the sum of, let us say, *n* variables will in a few short years change completely (and generally for the worse) if any of the variables are made inoperative or if some are encouraged to play an exaggerated rôle in the system.

He does it simply and logically. Starting with America as it must have been before the white men came, he shows that there was in existence a beneficent equilibrium little affected by the acts of the few Indians living here. Then came the white man—and civilization. Forest and plain, mountain and valley, each was plundered recklessly or thoughtlessly perverted. But it was not necessarily the more scandalous forms of this plundering and interference that spelled destruction and poverty; it was the persistent, widespread, small-scale operation of man's proper and necessary efforts to house and feed himself that has brought us to the evil cycle of drought and flood.

All that and more Sears shows us. But he is not too pessimistic of the future. In a way, *Deserts On the March* is one of the most optimistic books I have read, even though it shows how deplorable has been man's foolish and selfish "victory" in the wilderness. It is optimistic because it represents knowledge and is animated by a faith that this knowledge will be used by men of good will. If we will be reasonable and sacrifice immediate, temporary advantage for ourselves, our grandchildren and great grandchildren will not be entirely impoverished. The book is indeed optimistic.

I need not add that for engineers, the technologists in general, Sears' *Deserts On the March* will be profitable reading. It is partly because we recklessly hired so many reckless engineers to do our work that we will soon thoughtfully hire statesman-like engineers to help undo the work of their predecessors. I am also happy to add that there are six copies of the book in the University Library.

The Horse Age

Versus

The Machine Age

By Roderick Wm. Siler
Asst. Prof. Mathematics

A REALLY remarkable fact about the present college era, it seems to me, is that there are represented in the colleges today two great ages in the history of mankind. I refer to representatives of the horse age and the machine age. This calls for some explanation, and I gladly give it.

When I speak of horse age and machine age I refer to the standard methods of transportation in those ages. Of course machinery there was prior to 1900, and even some mile-a-minute railroad trains, but ordinary transportation was dependent upon horses, and while one could go from one city to another at a pretty good pace, the general and local transportation moved more sedately. There were horses, horses everywhere, but except for an occasional runaway or the fire department doing its duty, nothing moved on the streets at more than six miles an hour. For centuries before 1900 the world had moved just so.

I am, of course, a horse age man. Anyone born before 1900 has at least his roots in the horse age, whether he admits it or not. Thus college faculties today are composed in large part of horse age men. Ignoring the suggestion of some of you machine age boys that that is what ails the faculties, I may say that what I am trying to do just now is bring out the point that when you boys reach that time at which offspring dangle about your knees you will surely be asked the question, "Grandpaw, did you ever see a horse age man?" While there will then probably be horses in zoos, not a horse age man will be left on earth. For this reason it will mean something to the little ones to have a grandpaw who has actually seen a horse age man, actually talked with one, actually observed one trying to keep his hat on while dodging traffic propelled by gas instead of by horses.

College has so many advantages today compared with what it had when I went to school. The cave man age, that dark period in world history when all the horses were wild and young men were confronted with the hard choice of either walking to school or staying at home and doing the chores, preceded the horse age on earth. Yet when I was young there were no cave men still in existence. Perhaps that is where we horse age men lack: we never had a chance to meet our predecessors on this earth. The only cave man I have ever seen was a stuffed one, in a museum of natural history in Chicago. Fifty years from now there may be a stuffed horse age man beside this cave man, and I repeat that it will mean something to the kiddies, when you machine age boys take them down to the museum in your rocket ships, for you to be able to say, "Yes, I knew some of those dodos when I was young. They were like this—," and from there on you can enlighten and amuse, and perhaps frighten, the little ones with anecdotes of the past.

It is, of course, my wish to be of help to you machine age boys, even up to that happy time when you become grandpaws, and as one who has emerged from the horse age and remembers something of it I may be able to offer a suggestion or two. Many questions will undoubtedly be asked you, but limitations of space prevent me helping you here with answers to more than, say, two. Thus a question very likely to be asked is, "What was the difference between the horse age men and the machine age men?" And a second question may be, "Which age is the better?"

It may surprise you to learn that the more I consider Question No. 1 the less seems to me the differences between horse age and machine age people. If there are differences they are superficial ones; they are more apparent than real. An observer of today suddenly transplanted to a city thoroughfare of forty years ago would note, it is true, a difference between the 1897 and 1937 populations. A second look, however, would show these differences to be superficial and chiefly due to the styles in dress of that period. For instance, it is a fact that gentlemen in 1897 went in for whiskers, but behind these screens they were much the same men as today. I have already said that traffic of the horse age moved more slowly. And as a result there was less noise. Also, a dollar may have bought more in those days. The bad feature of which was that a dollar was just that much harder to get.

I repeat that, as far as I am able to judge, people have not changed much. The chief topics of conversation formerly, as today, were the weather, the price of beefsteak, the latest murder, the best show, even the fearful speed with which traffic moved on the streets. So I would say that a good answer to No. 1 fifty years from now would be that, though the appearance of life changes, men do not.

As to question No. 2, I do not feel capable, on second thought, of answering it. Because I remember that the last time I saw the cave man in the Chicago museum his face, though not exactly handsome, had an expression of great contentment on it. His countenance did not show the least longing to have himself moved up to the machine age, or even the horse age. In other words, he seemed satisfied that the age and environment in which he found himself was the best of all. What struck me most about this remarkable expression of his, so indicative of satisfaction with himself and his times, is the way he has managed to transmit it through the ages to his descendants, even down to 1937. Of course this is no answer to No. 2. I don't know that it is an answer to anything. Though possibly it might be used in support of Answer No. 1, already given: that the appearance of life changes, but men do not.

First Sounding *Now* Ascension

By Bertil Lindquist, Aero '38

ONE phase of the research in the upper strata of the atmosphere that is being carried on by Professor Jean Piccard at the present time is the task of determining the diameter a sounding balloon attains in the stratosphere before bursting.

When the balloon, with its minimum barometer, leaves the earth it has a diameter of about 3½ or 4 feet; but at the time that it bursts its diameter is approximately 15 feet. This enlargement occurs as a result of decreased air pressure at high altitude, the atmospheric pressure at the time of bursting being about one fortieth of the pressure at the ground.

The diameter of the balloon at bursting could be determined in the laboratory were it not for the presence of other conditions in the stratosphere which have an adverse effect on the rubber material. The extremely low temperature stiffens the rubber and therefore causes it to fracture sooner than it otherwise would. The much greater amount of ultra-violet light has a markedly deteriorating effect and the unusually high percentage of ozone present at the high altitudes attacks the tightly-stretched rubber, contributing to its failure.

A minimum barometer encased in a black aluminum foil tube, which in turn is shielded by a cellulose acetate case with a half inch dead air space, is attached to a parachute which goes up with the balloon. By an ingenious hook arrangement the balloon, after bursting, is released from the parachute and the parachute lowers the barometer gently to the ground.

Professor Piccard is vitally interested in knowing the altitude reached by and the diameter attained by these sounding balloons since he is now investigating and planning an arrangement whereby he will use 2,000 of these balloons to provide the lifting power to carry him into the stratosphere. By overinflating some of the balloons which will break sooner than the rest, he expects to reach an equilibrium point in the stratosphere where no more balloons will fracture; since the bursting of the first balloons reduces the lifting power, no additional increase in altitude will result. An ascent by this means will provide ample time for scientific investigation of ultra-violet light, cosmic rays, ozone, dust, organisms, and the other as yet unknown phenomenon present in the outer fringe of the earth's atmosphere.

Testing 'Lilliputs'

By Robert Moore, Aero '37

IN ALL probability most of the men in the engineering college have seen one of their fellow students working with what might appear to be a dime store version of an aircooled airplane engine. The truth of the matter is that these are actually airplane motors, designed to power model airplanes.

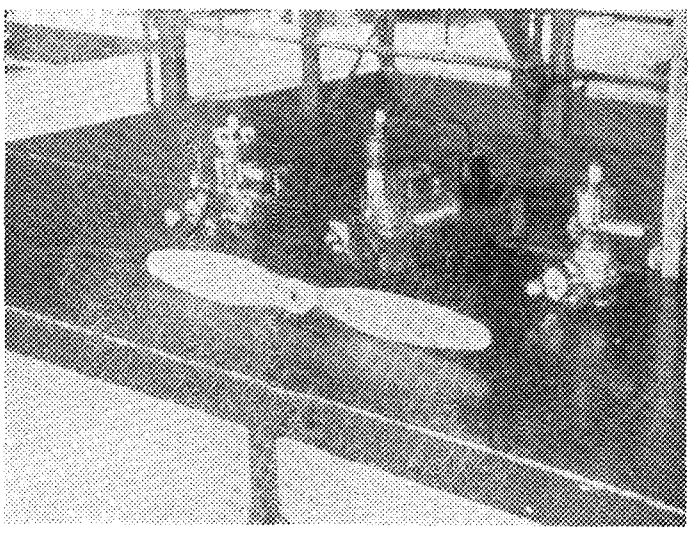
These motors are aircooled, two cycle, one cylinder, internal combustion engines. They burn any good grade of gasoline. The fuel is ignited by means of a tiny spark plug in the cylinder head. The electric spark is furnished by a flashlight battery, a spark coil and a condenser. The spark timing is accomplished by a cam on the crankshaft. Adjustments can be made to advance and retard the spark. The engines are, in fact, miniature airplane power units, complete in every detail, so diminutive that the complete unit, including gas tank and coils, is only about four inches high and eight inches long. The lightest of these motors, without accessories, weighs only 6.8 ounces. The bore is only about ¾ in. and the stroke about one inch. These engines are expected to develop about one-fifth h. p. at five or six thousand r. p. m.

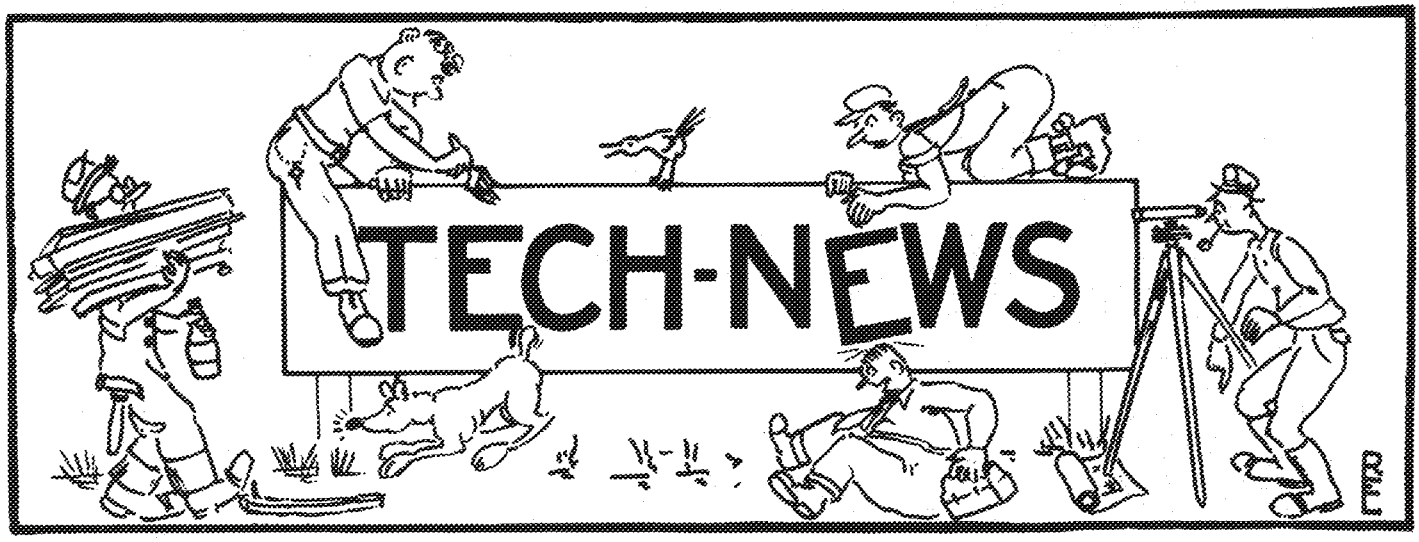
These engines will be tested according to the United States Army engine test procedure and will include fuel consumption, horsepower output, thrust (using the propellor supplied by the engine companies), torque, and speed.

The idea of testing these engines as a class project was promoted by a senior aeronautical engineer. The Minnesota branch of the Institute of Aeronautical Sciences obtained three different types of these motors under the condition that the manufacturers will receive a report of the results of the tests on their respective motors. Prof. B. J. Robertson consented to instruct the class and help the men where they encountered difficulty. The class will build all the necessary equipment, such as torque stand and the delicate instruments for measuring fuel consumption, thrust, torque, and power output.

The principal objective of this course is to instruct the students in the methods used in commercial tests on aircraft engines. If the work is carried out as it is planned now, the course will achieve its prime objective in an admirable manner. Also the manufacturers of these engines will be given considerable knowledge of their motors.

Three of the small model engines being tested by the senior Aero's.





Miss Bauer to Talk To Architects Group

The Architectural Society, an organization of student architects, has been active this year with a special series of lectures on "Modern Problems of Architecture." During the fall quarter, Mr. Winston Close, '27, was entertained by the society at a dinner meeting where he spoke on "Housing in Europe." Mr. Close has been studying abroad.

Eugene Schoen, of New York, interior decorator of the French liner, the Normandie, and the Lounge Pierre in the Radisson Hotel in Minneapolis, spoke to the group on "Modernistic Design in Interior Architecture." Mr. Schoen illustrated his talk with slides showing many of his original designs in homes, department stores, and offices.

February 11, Miss Katherine Bauer, convocation speaker, addresses the organization at a special luncheon meeting in the Minnesota Union where she will discuss several of her recently published books on "Architecture and its Problems."

Social activities for the season include the most prominent event on the architectural social calendar, the twenty-second annual Beaux Arts Ball, which will be given early in the spring quarter. Patterned after the original and famous Beaux Arts Ball in Paris, this year's theme will be centered on "Masks." In charge of preliminary plans are: Ralph Zauder chairman, Clinton Hegg, Alice Youngquist, and Martha Granger.

Chems to Hear Luyten

A joint meeting with the A. S. M. E.'s in January for the showing of the 1936 Gopher football pictures started off the 1937 activities of the *A. I. Ch. E.* A talk by George Mitchel on Rubber provided the entertainment for the meeting held on February 2. A faculty-student dinner for all the chemists and chemical engineers is scheduled for February 15 with Professor W. D. Luyten's talk on Astronomy as the main feature of the evening.

At present, members are working on the solution of a problem sent out by the National A. I. Ch. E. The award for the best solution is $100.

Aeros Plan Trip

Saturday night, February 20, is the date set for the Annual Aeronautical Ball which is held jointly by the aeronautical engineers and the flying club in the Minnesota Union. Jack Mace, as chairman of the dance, has promised many surprises.

Seniors in aeronautical engineering are planning a visit to the Institute of Aeronautical Sciences Headquarters in New York this spring. The trip includes inspection of all the outstanding aircraft factories and airports in the East. A number of the members will attend the National Intercollegiate Flying Conference which will be held in Washington, D. C.

Juniors Take Charge Of A.I.E.E. Meeting

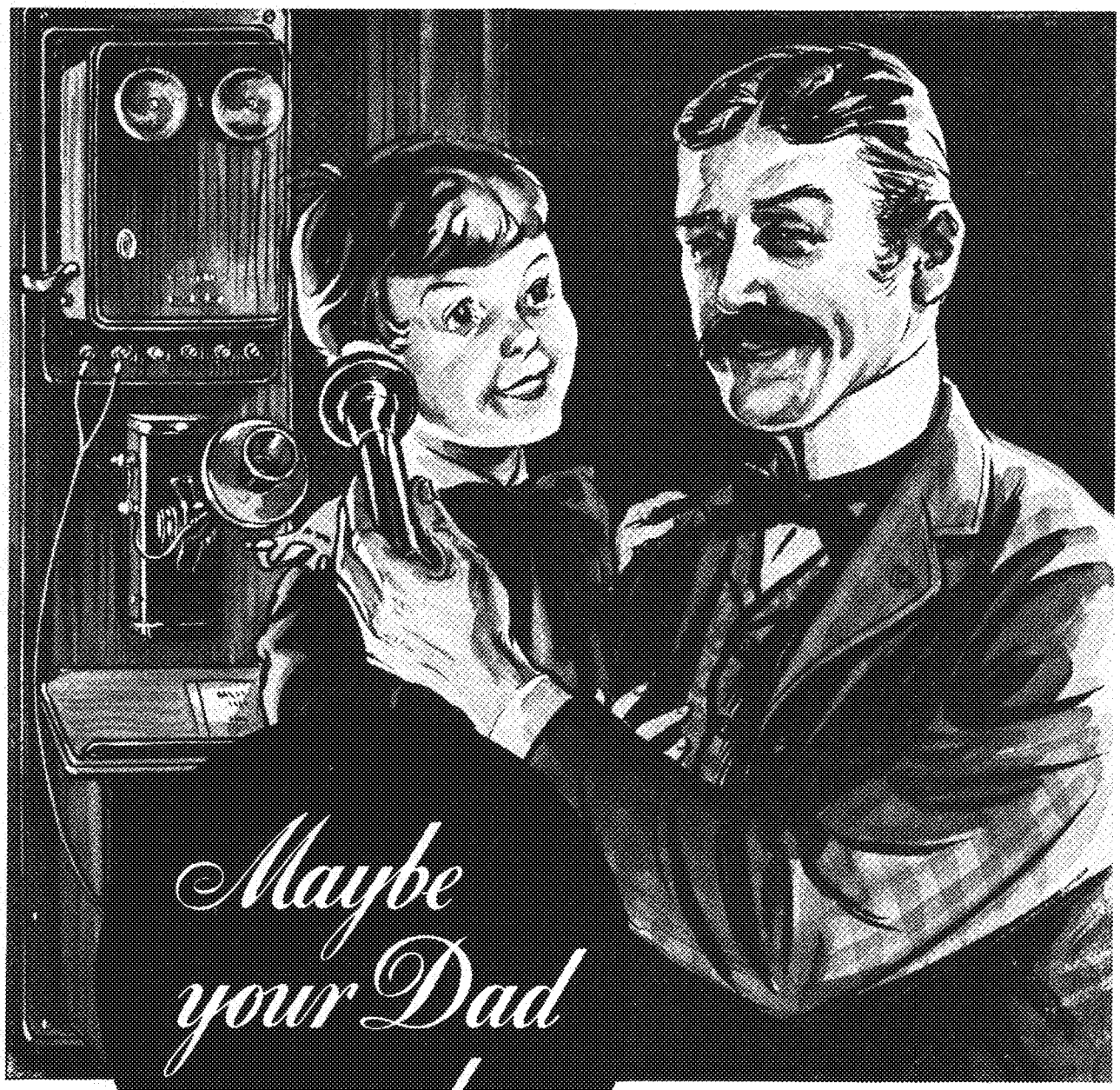
The A. I. E. E. held their monthly meeting on Wednesday, January 27, in the auditorium of the Main Engineering Building with the juniors in charge. Freshmen were sent special invitations and responded with a very good turn-out. Mr. Fader, of the Northwestern Bell Telephone Co., presented three one-reel films, "Sea Going Telephones," "Hello Around the World," and "Sky Harbor." Following the movies, Mr. H. C. Richardson, of the Engineering English staff, gave a very interesting talk on his trip through Mexico last summer. Plans for the Electrical Show to be held in the Spring Quarter were discussed by Ottilio Morzenti, chairman for the show. After the meeting, refreshments were served.

Miners Hold Series Of Thursday Lectures

Such subjects as A Vacation in Europe, A Practical Demonstration of a New Method of Dust Precipitation, and a talking picture on the Federal Reserve System indicate the broad field from which Fred Speers and his Speakers Committee have been building up a winter lecture series for the School of Mines.

The fourth Thursday lecture, Feb. 7th, dealt with the Lumber Industry of the U. S. and some special wood preservation processes. Lectures on taxation, business administration, and possibly a final survey lecture on the field of law are being considered to round out the quarter's program.

Because of the varied nature of this program, *The Mines Society* feels that students in all branches of college work will be interested in hearing the Thursday lectures and extends its invitation to all to attend them.



Maybe your Dad remembers ...WHEN HE WAS VERY YOUNG

As small boys, many fathers now living knew the telephone only as a little used curiosity. It grew into today's constantly used necessity largely because the Bell System never ceased looking for the new and better way. It stayed *young* in its thinking.

Young ideas developed "conference service", enabling several nearby or widely separated persons to talk on one telephone connection. Young ideas steadily made Long Distance service better, quicker, yet cheaper.

Young ideas are at work day and night to make sure America continues to get more and better service for its telephone dollar.

Why not call Mother or Dad tonight? Rates to most points are lowest after 7 P. M.

BELL TELEPHONE SYSTEM

New Experimental Engineering Laboratories Start Activity

To provide for facilities in experimentation, an association of rock wool manufacturers have appropriated approximately $20,000 toward research in the rock wool industry, which will be conducted in part of the new experimental building now under construction.

The new building is to supplement the experimental engineering laboratories, and to house advanced and graduate research experiments in real industrial problems. It is located on University Avenue beyond Oak street and will be a part of the Institute of Technology. It has been acquired from the Caterpillar Tractor Company, and is being reconditioned by WPA funds. Work is well along on the tunnel to connect with the campus heating system and reconditioning of the interior has started. By spring, Professor Frank B. Rowley expects to have all extensive experiments transferred to these new headquarters.

Features of these buildings that can be used to advantage are: The large elevator capable of lifting heavy trucks, a traveling crane, and the railway tracks which enter the structure. Over the latter a "cold room" will be erected, affording a long sought after place for testing air conditioning and insulation of freight and passenger trains. A 25-ton compressor will be installed for controlling, by circulated air, the temperatures from —35° F to 125° F. It will have floor dimensions of 20 ft. by 90 ft. and will be 20 ft. high. A room of this size will provide ample space for experimental purposes.

A second room for carrying on the rock wool research will be provided. It will be thirty feet square and twenty feet high and will be used for testing properties of insulations. Inside this will be constructed smaller rooms which will represent small buildings, to aid in an accurate research of rock wool properties and also other insulating materials.

Controlled by a 15-ton compressor, temperatures of —35° F. may be attained. The object of the research program for the rock wool industry is to find properties of it, when used as building insulations, and for the study of condensation properties.

The building program also emphasizes a new wind tunnel unit with a 7 by 10 throat and a controlled velocity up to 150 mph. Much of the internal combustion engine experimentation, both by mechanical and aeronautical engineering departments, under the direction of Professor Burton J. Robertson, will be transferred to the new research laboratories upon their completion. The chemistry department, being a part of the experimental group, is now conducting their experiments in the manufacture of water gas from North Dakota lignite and those upon cellulose materials, under the supervision of Professors Lloyd H. Reyerson and Ralph E. Montonna. The experiments on behalf of the Northwest Research Foundation have already been taken to the new location; as will be those in the setting of cements and concrete at low temperatures, which have been carried forward for several years by Professor Chester A. Hughes.

The new research group will require more men. Clarence Lund, a graduate in Mechanical Engineering, will be employed full time and some part time assistants will be taken on. Outstanding students in Engineering may have a chance to participate in the experimental activities later on. The work will be largely self-financing, as many of the problems are to be submitted by industrial groups.

Hose Elected Commacini Prexy

On January 28 at 510 Groveland, the *Commacini*, honorary architectural society, held its winter quarter initiation with president Bernard J. Hein presiding. The newly initiated members are:

Oswald Thorson '37
John Kellam '38
Stanley Markey '38
Gordon Schlichting '38

Those present at the ceremony included Prof. R. C. Jones, Acting Head of the School of Architecture, S. Charwood Burton, and Robert Cerny, faculty members, and Bernard J. Hein, Henry S. Nitta and Robert H. Hose, active members.

Robert H. Hose was elected to serve as president to fill the vacancy caused by the graduation of Bernard J. Hein.

Pi Tau Sigma Initiates Members

Seven new members were initiated into **Pi Tau Sigma**, national honorary mechanical engineering fraternity, at formal ceremonies held in the Nicollet Hotel on January 15, 1937.

New members are:
Honorary:
Axel Algren
Seniors:
Vincent Busian
Wesley Matey
Juniors:
William Andres
John Davies
Edwin Hage
Rowland Retrum

Following the initiation ceremonies a banquet in honor of the new initiates was given with Professor Wilcox presiding as toastmaster. Arnold Matthies, president of the local chapter, extended a welcome to the new men with Rowland Retrum responding. Professor LeFort followed with an interesting talk on "The Pan American Conference." The program closed with Professor Marteois, national president of Pi Tau Sigma, presenting keys to the new members.

Aeronauts Take Off On Ballroom Hop

The Aeronautical Engineers will soon be warming up their motors, and listening (and looking) for misses preparatory for their annual take-off from the union ballroom. The engineers will practice tail-spins, spot-landings, and long glides, all under the critical eye of their own private check-pilots.

Chief Pilot Jimmy Pidgeon is bringing his squadron of the best swing-time pilots to the campus and will saturate the air with lovely melody. It is expected that all the guests will be "flying high" when the evening is over, with excellent prospects of shattering some local altitude records.

Civils Plan Outdoor Party This Month

A sleigh ride or toboggan party is on the schedule of that "husky outdoor group," A. S. C. E., for the latter part of February. The sleigh ride is favored by the members but no one who can drive a team of horses has been discovered to date.

A series of lectures by men from the State Highway Department is being planned by Paul Thomas, secretary.

Mines Prof Gets R. W. Hunt Award

T. L. Joseph, Professor of Metallurgy in the School of Mines and Metallurgy, has been granted the Hunt Award by the Committee on Awards of the American Institute of Mining and Metallurgical Engineers. This award will be presented at the annual dinner held on February 17 in connection with the annual meeting held in New York City from the 15th to the 18th.

The terms of the Robert W. Hunt Award are as follows: "The award shall be made each year to the person or persons contributing to the Institute the best original paper or papers on iron and steel, but when in the opinion of the committee of award none of the papers is worthy, no award shall be made."

Glee Club Wants Tech "Rouser"

The Tech Glee Club is sponsoring a contest which is open to the students and faculty of all colleges for the purpose of securing words for a song for the Institute of Technology. The contestant may be in any college or class.

There are to be three prizes offered for the songs accepted.

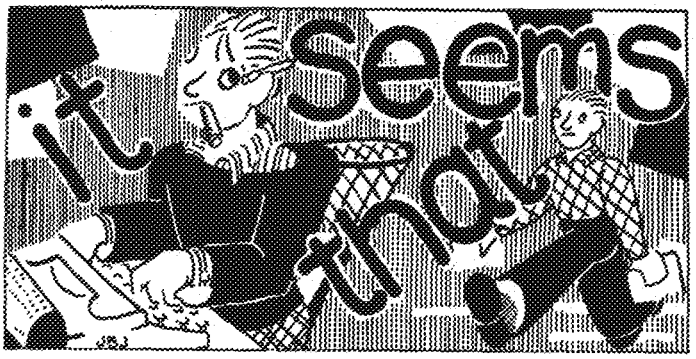
1st prize. . $15.00 cash.
2nd prize. . $10.00 merchandise at Engineers' Book Store.
3rd prize. . $ 5.00 cash.

Rules for the contest are:

1. The contest is open to any student or faculty member regardless of school or class.
2. The words need not be written for any particular tune but must be words for which a spirited melody may be written. The words must have direct bearing on the I. of T. and students from that college.
3. The words must consist of at least one verse and a chorus.
4. Those desiring to submit words must have their manuscripts in the Techno-Log office, Room 37, Electrical Engineering, by midnight March 15, 1937. Entries arriving later than that date, unless they arrive by mail postmarked before midnight March 15, 1937, will not be considered eligible for prizes in this contest.
5. All manuscripts submitted become the property of the Tech Glee Club, sponsors of this contest.
6. The decision of the judges shall be final.
7. Contributors may submit as many manuscripts as they wish but only one prize will be awarded to any one contributor.

The judges of the contest are: J. C. Sanderson, School of Mines, Chairman; A. O'Steen, Music; O. S. Zelner, Engineering; H. C. Richardson, Engineering English; C. A. Mann, Chemical Engineering.

Aluminum is being substituted for tin as a coating for sheet steel containers; the innovation is the result of the perfection of a new process for the aluminum dipping of steel.



By Melvin "Pete" Lohman

NONE less than our esteemed math profs (including Head of Dept. Brooks) have gone slightly mad over a puzzle. It seems they are trying to evolve different combinations of four fours (multiplying, dividing, adding, etc.) so that they will make any number from one to fifty. Evvy is the scorekeeper and she reports the profs still have a few numbers to go.

Gerry (busy) Mitchell had so many things on his mind that he scheduled a dinner meeting for the Tech Commission of which he is president and then forgot to show up. Gerry has confided to us that his dog's (mascot of the A. S. M. E.) favorite movie actress is Helen Twelvetrees.

Al Jacobs, of the KHK house is the lad who advertised via the Daily for a girl for their party. He's saying "it pays to advertise."

Once upon a time there were three co-eds who were very tired and wished to go to bed. So they went into their rooms.

Suddenly:

"Someone's been sleeping in my bed," said the great big girl in a great big voice.

"Someone's been sleeping in my bed," said the medium sized co-ed in a medium sized voice.

"Good night, girls," said the little co-ed in a little bit of a voice.

Tom Klingel had to move on to the campus for the winter quarter because his girl's car was hard to start.

We wonder why Paul Thomas and Don Mark both have pipes in their vest pockets but neither ever smoke. Bet they're trying to appear virile.

Bob Ellison came back from vacation and informed the senior civils that he had taken the big step. He spent the best part of his vacation down in the little Iowa town. It hardly seems possible that such a thing could happen but still that small spot under his nose is gone and he has been wearing his best suit everyday.

Miner Ed Dobrick's definition of home: The place where you can scratch any place that itches. Can it be those Miner cooties?

Wonder why all the seniors were so anxious to get a job with the Kimberly Clark Company. Could it be the product they make?

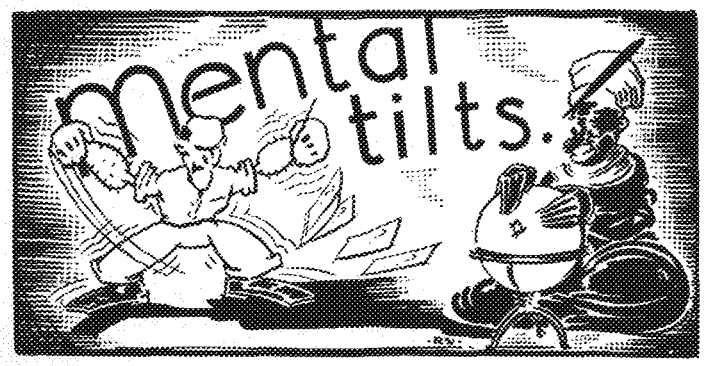
One of the local hash houses had a sign up which read, "Turkey, 75c." At the bottom was "NRA Turkey, 35c." A customer called a waitress over to explain and he quoted her as saying:

"The 75c turkey is white meat and drumsticks. The 'N' in the NRA turkey stands for 'Neck,' the 'R' for 'Ribs' and if I told you what the 'A' stands for, you wouldn't think of me as a lady."

Our poem of the month:

The pharmacy blush so often seen
On the girl who has danced till dawn
Is the same as painting the bare ground green
And saying you have a lawn.

—*So It Seems*



By Gordon Wickre

WE HAVE a nice little problem this month that we'd like to have you figure out for us on paper—we won't advise anyone to try figuring it out by actual experiment! Briefly, the problem is this: From what height must a man fall from an airplane, yelling as he leaves the ship, so that he will reach the earth before the sound he made when he yelled? In this problem you must disregard the resistance offered to the fall by the air, and also the fact that the sound would probably never reach the earth. Remember that the velocity of sound is constant at a given temperature (say 0° C.) and that a falling body constantly accelerates at the rate of 32 feet per second.

We've had monkeys and most everything else in this column so why not cockroaches? Two very live cockroaches were lying on their backs on the number 12 on the face of a clock, and lying about their respective merits as long-distance runners. To settle the argument they decided to run a race around the face of the clock on the line inclosing the numerals. Immediately, they started off as fast as their six individual, articulate legs could carry them, the first cockroach completing the circuit in 224 seconds, the second in 364 seconds. They each ran till they were again together at the number 12. How many times did each cockroach run around the face of the clock? Have you got it?

We're not so sure that you readers are going to stand for our getting poetic, but we'll try anything once.

A country spark addressed a charming she,
In whom all lovely features did agree;
But being void of numbers as doth show,
Desirous was the lady's age to know.
"My age is such that if multiplied by three,
Two-sevenths of the triple product be;
The √ of 2/9 of that is four.
Tell me my age or never see me more."

Last Month

Last month two students submitted their answers to the problems issued, simultaneously. Each received one half the dollar prize as no duplicate prizes can be awarded. The winners were Erhard Prill and Rawson Alkire.

The answers to the problems offered last month are:

1. The grindstone must be divided into four pieces, the weights being 1, 3, 9, and 27 pounds.
2. The man's age is 44 years and the wife's age is 33 years.
3. The electrical term was SWITCHGEAR

The Taurus

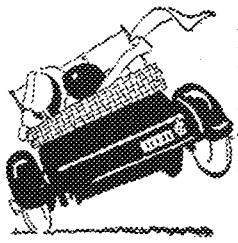
By B. H. T. L.

Taurus-tossing Competition

SILAS Q. WHISTLEBOTTOM, the old spook of the mountains, lumbered out of the heat tunnels, raised his ugly physiognomy to query, "Say! whose's this guy Munchausen? His brand of ox-tossing is like the white lies of a child compared to the artistry of the Institute Engineers. Did you ever hear the alibis offered for not having their reports in on time? Or explaining 50% errors by blaming their slide-rules? The idea seems to be—'Nothin's perfect—what do you expect?'"

Silas Q. is obsessed with the idea that the Baron should be shown his place and in the furtherance of this idea has appointed your old chronicler chairman of the Taurus Board consisting of Johnny Murray and Don Erickson to judge all entries in the forth-coming contest. Johnny has been closeted with Mr. Q. to design and build an appropriate trophy which will be awarded each month to the versatile engineer who turns in the most plausible line of guff—in the opinion of the aforementioned judges. So wind up the one-lunger and get your stories written up—no word of mouth stuff, please, because that seems to be going on all the time.

The three top tales will be posted—if. . . .



It must be that Priscilla (Tweeps) Wrenn, Soph. Aero., simply dotes on Pontiacs; and Jack Intlekofer, leaving for New York, sold his brand new Pontiac to "Prof." Von Eschen, former classmate and now instructor in drawing. . . . So now "Tweeps"—J. Clark I's. former monkey-wench—is seen at the hockey games with Von—and the Pontiac, of course.

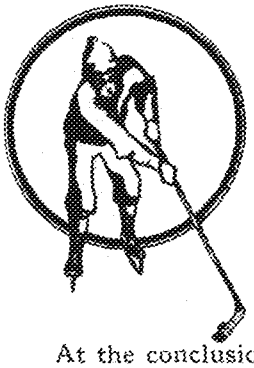
Your blind date comes tripping back to your table, with a most gorgeous female in tow. "Want you to meet my girl friend, Mr. er, er—what was your name again?" You rise in gleeful anticipation and then stand there in mouth-open stupidity—you can't think of the damn thing!

TWO flight students, with their instructors, hopped off for a dog-fight in the upper reaches. They went through their aerial gymnastics, getting on each other's tail and meticulously noting at which time they would press the triggers to send their opponent crashing to earth. At the end of their time, they spiralled down to the field and noticed an excited crowd of students waving wildly and running in circles. As they taxied up to the line and cut their guns the gunnery officer strode over to them and in measured tones rasped, "Gentlemen, I am attempting to teach a gunnery class here, but it seems that you are not aware of it. You have interrupted my lecture by removing my instruction material—the guns in both of those ships are loaded to capacity!"

Ups and Downs Dept. . . .

Remember the fellow who, just a short time ago, was admiral on the British Navy and now is only the third mate on an American tramp?

Let me hasten to add that the Aeronautical ball is tossed in the laps of you fellows February 20. Having attended several of these "Take-Offs," I can truthfully (for once) state that a finer party has never been thrown—with innumerable diversions for those who find the Light Fantastic growing a bit weighty. . . .

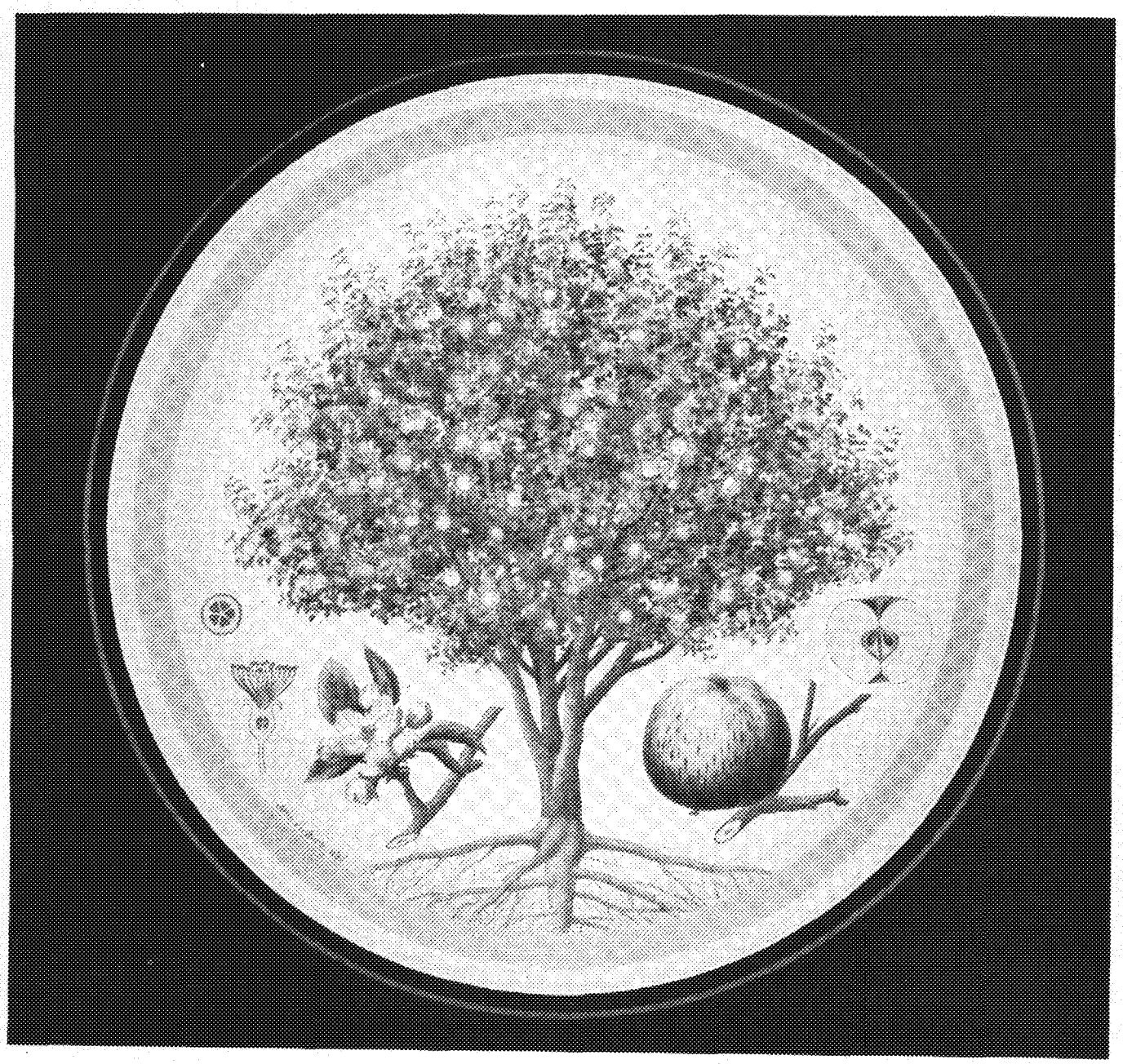


For those fellows who love to bounce dynamite, may we suggest a full evening by going to a Minnesota hockey meet and then concentrating on bringing Battling Captain Senior Civil Ray Bjorck's Wolfe-blood to a boil? . . . or you might hand him a box of raisins.

At the conclusion of a banquet, which only men attended, the usual long line formed at the check room. An old gentleman in butler's livery was on hand, who took the overcoats from the check room lass as they were handed out and assisted the owners in getting into them. The usual procedure was to hoist the coat high on the neck and then let it hang there while he reached up beneath to pull down the suit coat. The old duffer was weary and seemed to be having difficulty keeping his eyes open and his mind on the job. . . . Then an extremely comely young lady stepped up and demanded her coat and the fellow took it, never noticing that the sex had changed. He hoisted the coat up and groped around in the nether regions for the customary perfunctory jerk to the suit coat . . . and apparently encountered only frills and—well, just frills, I guess. The young lady emitted a super-Indian war-whoop and raised quite a "rumpus."

A noted mechanical engineer researcher and time-studier has just announced that the results of his last brainstorm show that the efficiency of factory workers stays at a much higher level if permitted to eat a bite at periodic intervals throughout the day. Undoubtedly true, but then why not come out and honestly state that the basic rea-

(This may be continued on page 122)



Beauty Treatments FOR FINER FRUIT

IN THE growing of crops, man can rarely leave nature to her own devices. On one hand she is bountiful—on the other destructive.

No one is more conscious of this dual capacity than are those whose business it is to supply the tables of American homes with fruit and vegetables.

When, for instance, the apple tree puts forth its best efforts to produce fruit of faultless quality, there is a host of pestiferous insects and sundry diseases constantly out to defeat that purpose.

Should they succeed, they rob the apple of its beauty and quality—the fruit grower of his profits. And, this danger extends to the peach, pear, cherry and to countless vegetables as well.

Protecting crops against the ravages of insects and disease is one of the most urgent tasks of the fruit and vegetable grower.

Aiding him in his fight are such organizations as The Dow Chemical Company. Well in the forefront of Dow's research program is the development of better insecticides and fungicides.

In 1936, Dow was able to bring to fruit growers two new developments in spray materials. One, a superior wettable sulfur that possesses a particle size of such microscopic fineness that, when sprayed in solution, it literally envelops fruit and foliage in a fog-like blanket. Thus, it provides protection more positive than has been possible heretofore. The second is a better dormant type spray that goes further in its protective power yet avoids danger to the operator or his equipment and offers in addition, several important technical advantages.

When you next pause to admire the smooth, unblemished texture of an apple, the perfection of a peach, or the excellence of many vegetables, remember that day in and day out laboratory technicians, experimental stations and, above all, the grower have striven hard to attain such perfection.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Branch Sales Offices: 30 Rockefeller Plaza, New York City
Second and Madison Streets, St. Louis • 135 S. La Salle St., Chicago

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY

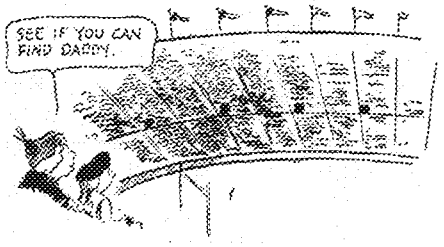
G-E *Campus News*

LOSE A NEEDLE?

Not a needle in a haystack, but perhaps a needle in a rug. During the manufacture of rugs, needles may become broken and embedded in the finished product. Former methods of inspection were tedious and time-wasting, but a new magnetic device indicates the exact location of the steel fragment.

This iron detector, developed in the General Engineering Laboratory of the General Electric Company, consists of a test coil, a motor-generator set, and an amplifier. The rug is passed through the magnetic field twice in directions at right angles. The presence of a broken needle causes a distortion in the magnetic field and consequently an unbalanced voltage in the secondary coil. This unbalance is amplified, and the relays cause signal lights to glow.

Detectors of similar principle have previously been developed for such uses as detecting scrap iron in sugar cane and in scrap cellophane. The General Engineering Laboratory is constantly receiving problems from industrial concerns and is developing equipment or giving suggestions to solve these problems.

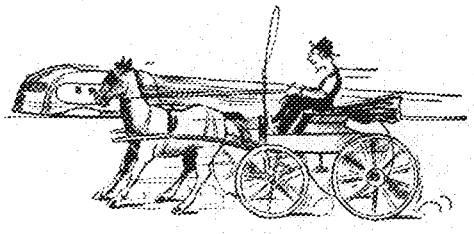


MICROANALYSIS

Two millionths of a gram of material present in a 25-cubic-centimeter sample is almost as inconspicuous as one man in a group composed of the combined populations of New York City, Chicago, and Detroit gathered in one huge stadium, yet the phototube and the recently developed spectrophotometer can accurately determine such microscopic quantities. This detector has been commercially developed in the laboratories of the General Electric Company from the original design by Professor A. C. Hardy of M. I. T.

In medical science, the spectrophotometer should prove very useful. The presence and amount of almost any element which will form a colored compound when combined with some reagent can be determined. In the industrial field, paints have been studied and the effects of heat, light, ultraviolet radiation, humidity, and surface greases have been measured. This has proved a reliable guide to purchase of these materials.

The spectrophotometer is admirably adapted to the study of problems involving colored substances. Its scope extends far beyond chemistry, physics, or industry. In fact, it is in the biological sciences that the instrument will probably find its most important applications.



BY A NOSE

A century ago there was a race between a horse and a locomotive. No such race will be necessary to determine the supremacy of the steam-electric locomotive being built for the Union Pacific Railroad by the General Electric Company. This new unit will get its first trial run on the test tracks at the Erie, Pa., Works early this year.

This new passenger unit will carry a steam-turbine electric generating plant to feed power to the traction motors. The turbine will exhaust through condensers, using the same water over and over with small additions to make up for leakage. A new, highly efficient type of steam boiler has been built, and heavy fuel oil similar to that used in present-day locomotives will be used.

The new unit will be a double-cab locomotive, streamlined, practically smokeless, and provided with power equipment for air-conditioning the trailing passenger cars. It is rated at 5000 horse-power and is capable of hauling 1000-ton trains at a speed of 110 miles an hour. The efficient fuel consumption will allow runs of hundreds of miles at top speed without a stop.

The many desirable constructional features of the modern high-speed electric locomotive will be incorporated in the design as a result of General Electric's many years of experience in building and equipping electric locomotives.

96-353DH

GENERAL ELECTRIC

he Vol. XVII No. 6 March 19

INNESOTA TECHNO-LO

This Issue

ew Art
ethods

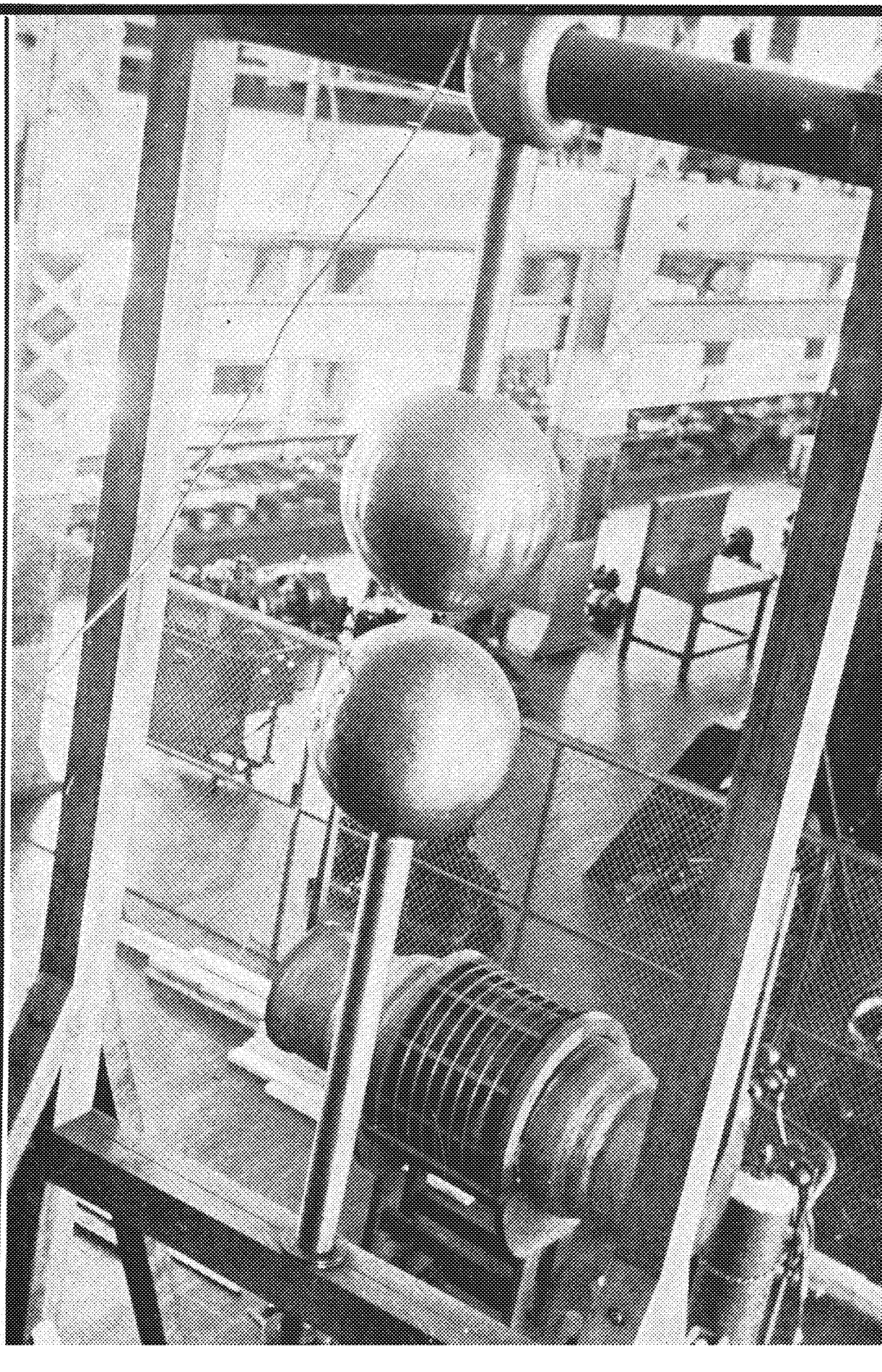
ngineers'
ay

arm Power
ontracting

enegoid
old Scare

lectrical
how

lumnotes



Wearproof by Welding

Thus engineers obtain the service of the best alloys at the cost of ordinary steel

THROUGHOUT industry, wear on metals is an important cost factor. Until recently, most wearing parts had to be made entirely of special high-cost materials. Now, by welding, rapidly wearing surfaces can be covered with a wear-resistant alloy. Welded additions of bronze or Haynes Stellite—a wear-resisting alloy of cobalt, chromium and tungsten—create excellent wear resistance at low cost.

Long Life at Low Cost

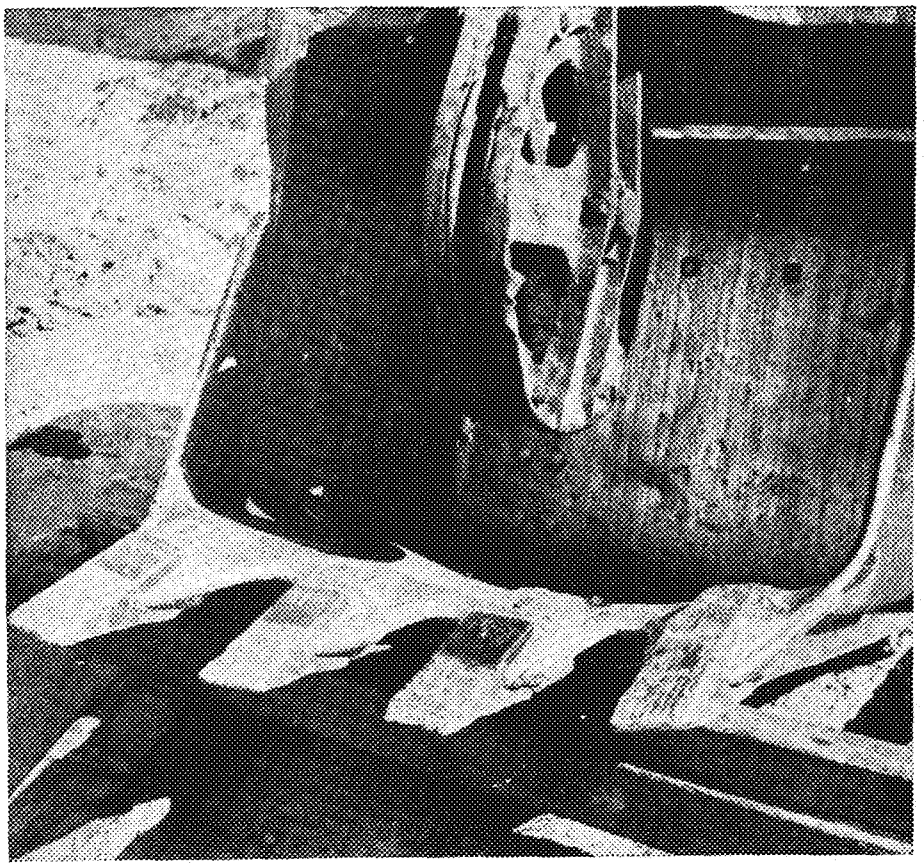
Wherever metal has hard work to do, wearproofing by welding plays an important part. Under the toughest conditions, in mines and mills, in factories and on farms, in construction and oil-drilling, it is saving money and time.

Wearproofed parts will last many times as long as those made of unprotected iron or steel. Welding cost, including the necessary alloy, is only a fraction of the total cost of a new part. Then, after long, hard service, the part can be re-covered—another wear-resisting surface can be welded on at small cost, and the part is again as good as new.

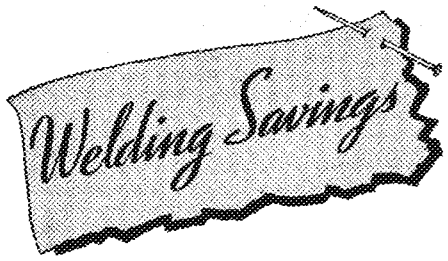
Extensive Savings

Savings through the application of wear-resistant alloys are not confined to the lower cost of the part involved. Less power is used. Inventories are cut due to the consequently lowered investment and simplified control. Machine shutdowns for replacement are fewer. Maintenance costs are decreased, and a smaller crew can handle the necessary repairs. Further, the plant, without added equipment, can turn out a greater volume of production.

Figures drawn from case-histories where wearproofing is used are often surprising. A glance at the adjoining column will indicate many of the possibilities inherent in this process.



INTO THIS YAWNING CAVITY goes the dirt to make Grand Coulee Dam. Bucket front and teeth were hard-faced by welding. The result of this wearproofing was six months' service on Bonneville Dam, and many more months of trouble-free, repairless service on Grand Coulee.



Welding makes automotive exhaust valve seats good for 150,000 miles and more, with no regrinding in truck and bus motors, the toughest kind of service. These valve seats are wearproofed by welding Haynes Stellite to the contact surface. Ordinary cast-iron seats need regrinding every ten thousand miles.

* * *

Welding saved $2200 in one year for an Ohio pulp mill. Haynes Stellite was welded to the wearing surfaces of shredder knives. This work cost $90; knives, from the scrap heap, cost nothing. Hard-faced knives lasted for six months, and were again refaced by welding. New knives cost $200, last one month.

* * *

Welding a wear-resistant facing on the cutting edges of boiler-tube cleaners yields a twenty-fold saving—each cleaner will clean twenty times as many tubes as an ordinary cutter. When worn, hard-faced cutters are rebuilt for another long service.

* * *

Welding cured pump troubles in a pulp mill. Shafting on a sludge pump was wearing rapidly. Packing glands had to be tightened every hour, completely repacked once a week. The shaft was fast disappearing. Hard-faced by welding with wear-resistant metal, the shaft ran for three months with no attention, no appreciable wear.

* * *

Welding lengthens the life of blooming-mill shear clutches three times. Clutches previously ran 49 days, then went to the scrap pile. Now, wearproofed by welding, these clutches average 217 days before any attention is necessary. The same clutches are then refaced and used again.

* * *

Welding has solved an impossible lubricating problem. At a Southern mill where heater furnaces are fed by internal conveyor, rolls and bearings operate at 750 degrees Fahrenheit. Lubrication is impossible. A wear-resistant coating, built up on the rolls and bearings by welding, makes the conveyor last indefinitely, eliminates *need* for lubrication.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable and interesting technical booklets describing the application of the oxy-acetylene process are available without obligation. For further information write any Linde office.

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

New York and Principal Cities

In Canada:

Dominion Oxygen Company, Limited, Toronto

Again . . . for Spring

THE BRITISH LOUNGE* MODEL

is the Standout University Fashion

SAXON WEAVE SUITS *for* SPRING

$35

The pattern illustrated is the new oversized window pane square. While it is unusual and different, it is so subtly colored as to be quiet and in the best of taste.

*REG. APP. FOR

Clothiers — Tailors — Furnishers

JUSTER BROS

On Sixth Street . . . Just Off Nicollet

Hurroo! Hurroo!

Have ye not heard?

on APRIL 16th

all Loyal Sons of St. Pat will celebrate

th' 24th Annual

ENGINEERS' DAY

- OPEN HOUSE in all of St. Pat's workshops
  April 15th, starting at 7:30 p. m.
- GIGANTIC PARADE of St. Pat's Sons at 10:30
  Knighting on th' Knoll.

★ ★ ★ ★ ★ ★ ★ ★ ★

BRAWL • Hotel Nicollet

'T will be a wise son of St. Patrick who'll be datin' his foine Colleen or Noireen or Rosaleen now.—Ah me, what a party it was last St. Patrick's celebration. Th' largest University social function of th' year 'twas, too. A' and it'll be better and livelier this year.

GRAND BALLROOM

. . . ONE DOLLAR PER COUPLE

★ ★ ★ ★ ★ ★ ★ ★ ★

- A' and a FIELD MEET and Diamondball Tourney.
  The Prize . . . a gigantic cup of many gallons capacity.
- GREEN TEA DANSANT—St. Pat's Queen will pour ye a cup of th' refreshing drink of her fatherland.

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

MARCH, 1937

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Bech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Elwood McGee, Transit Corres. Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas.	Eta Kappa Nu
Edward Kaiser, Pres. John Hollihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Robert Hose, Pres. Henry Nitta, Sec'y	The Commacini

This Month

VOLUME XVII NUMBER 6

Officers of the Professional Societies

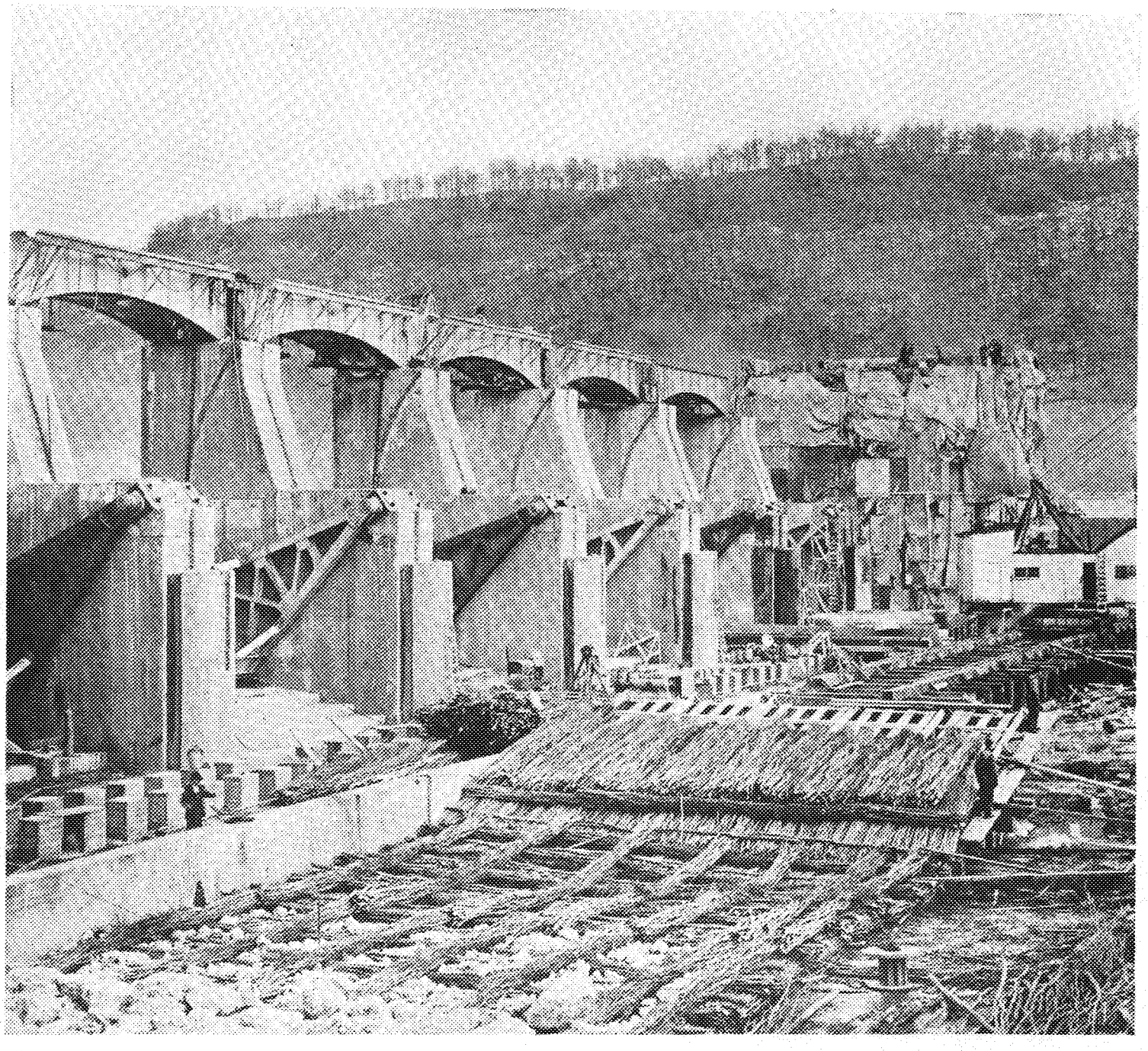
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Parry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Fralinn, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. John Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Woodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Aikire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer	New York Univ. Quadrangle
Colorado Engineer	North Dakota State Engineer
Cornell Engineer	Ohio State Engineer
Illinois Technograph	Oregon State Technical Record
Iowa Engineer	Penn State Engineer
Iowa Transit	Pennsylvania Triangle
Kansas Engineer	Purdue Engineer
Kansas State Engineer	Rose Technic
Marquette Engineer	Tech Engineering News
Michigan Technic	Villanova Engineer
Minnesota Techno-Log	Washington State Engineer
Nebraska Blue Print	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, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



—Improvement Bulletin

Lynxville Dam

New Art Methods For Institute Architects

By Elaine Hanson, A. '39

IN KEEPING with the new methods of teaching the drawing classes in the School of Architecture, an exhibition of the first quarter work has been put on display in the third floor corridor of the Main Engineering building.

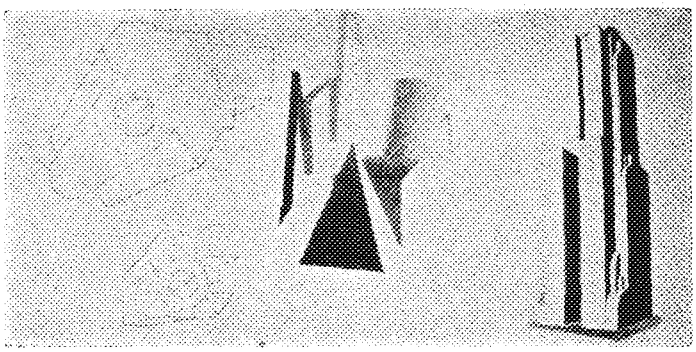
The plates here shown illustrate the principle of encouraging the student to interpret the form and movement of models placed before him, rather than to portray them photographically.

In thus helping a student feel the solidity and volume of objects, a new and greater emphasis has been placed on what may be termed the three essential elements in the creation of any great art form: namely a sense of time, space and force. By "time" is meant the rhythm sensed as the eye passes over the forms; "space" involves the development of a composition in the third dimension; while "force" is the use of the sense of time and space to display the dynamic qualities of objects.

The first step in learning to use these fundamental principles is to develop a consciousness of the mass and movement of forms. Some of the early drawings are done with this in mind. Punctures are made in the surface of a cube in order that a student may feel the volume of the object which he is sketching. Again, projections are made on the outside of the cube to suggest the force of internal energy.

The exercises done during the beginning of the quarter deal with geometric objects in their simplest form. Later these same forms are used but now are arranged in a manner that will express movement and the transmitting of energy from one to another. It is of tremendous importance that a student quickly gain a conception of movement and form. In order to help develop this consciousness, several types of exercise are done. In some of these, the student is given a mere silhouette from which he must create a composition involving the third dimension, or he is given a plan from which he must project forms.

Some of the later drawings, as the display shows, are done in a manner to suggest space relationship. Then in others, the idea is to represent transparency, the weight and density of materials, or compactness of form. Later



An example of the development of a student's work in the beginning drawing classes.

in the quarter as the work progresses, geometric forms are used to represent animate objects in a definite movement. These same drawings then are done in two colors to express a greater movement and a more pronounced degree of energy. Other examples of work done during the first quarter show the perspective solidity of geometric objects, memory sketches, imaginery arrangements of objects, solids drawn in outline, and the use of graduated color values to create a very definite third dimensional form.

The plates, representing the work of second year students, are executed with water colors as a medium. The sheets are charts of color arrangement, including the important schemes of color combinations. These exercises are done to develop in the student a color consciousness and a more thorough understanding of color arrangement.

After the various charts of color schemes have been made, specific examples of the application of these color combinations to actual work are done in the form of renderings of geometric objects against a colored background. These renderings are not necessarily architectural in nature, but are abstract in their general character. The knowledge gained, however, in the use of pleasing color arrangements can be used for the basis of any architectural rendering.

Another and entirely different type of water color done during the second year of work is the painting of still life. Here a student is allowed absolute freedom in the execution of his work and may do it in any manner he desires. The paintings on display in this section represent clearly the student's ability to express color and form when given this freedom. This practice of allowing individual development of technique in the portrayal of models and the

An illustration of portrait drawing. A splendid conception of form and movement.

expression of color, teaches, more subconsciously than consciously, color and its association.

The third section of the display represents the work done by the third year class in portrait and life drawings. In these sketches the student embodies all the principles of design he has learned during the previous years.

For this work the creation of the dynamic contents of form is very important. Lines become significant, not in themselves, but in the movement and forces they convey. Here the energies suggested by the lines are of more importance than the line that can actually be seen. Again in this work, emphasis is placed upon the interpretation of form and movement and force, rather than on the copying of models. The creation of forms and energy and the expression of dynamic movement are given primary consideration and are of considerable importance.

A fifth and last section of the exhibition shows the drawing of stage designs as done by the students. This type of work, however, differs widely from the others in the exhibition, for more emphasis is placed on the psychological effects produced. Here too, as in all the drawings the sense of time, space, and force are absolutely essential for a good composition.

The application by the students of the knowledge acquired during their three years of drawing to actual architectural use is evident. The fundamental principles learned are necessary for the creation of good design and may be applied to any form of architectural work.

This application, to actual architectural use, of the many principles learned by the student during three years of drawing, is manifested in many ways. First and foremost he learns to express himself on paper. This is of primary importance to the student architect, for drawing is the language of his profession.

In his early work he develops the ability to visualize objects in his mind. By constant practice and by doing many exercises he becomes acquainted with the details of objects in any position or form. From this he acquires the ability to express the forms he creates in his mind without having to place a model for them.

It is almost impossible to realize the great value of these years of drawing, for many intangible forms integrate themselves in a student's work and mind, the foremost of these being the development of a sensitiveness to observe and retain an impression of everything observed.

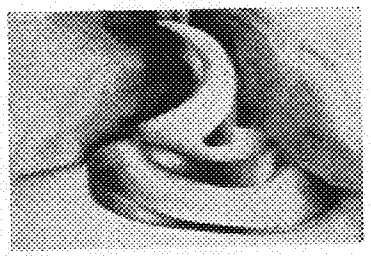
A sense of proportion, of space relationship—all of which are taught in the three year course—are essential for the establishment of a sound foundation upon which to build an architectural career.

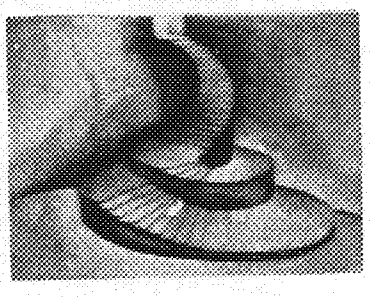
The ability to handle mediums, such as pencil, ink, water colors, and the like, are invaluable to the architect. Talent in handling these mediums and the knowledge of the effects they will produce are useful, if not absolutely essential, in all architectural renderings.

In life drawing the ability to interpret clearly, and to sketch rapidly, develops an artistic incentive. Rough sketches of the human figure, for example, can with few alterations be turned into mural decorations.

In countless ways these classes aid the student for they teach the foundations upon which most of the architectural fundamentals are based, and that the principles of time, space, and force are absolutely indispensable for the creation of a good design in any form.

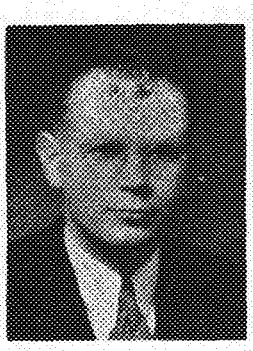
This drawing shows the principle of interpreting mass and movement suggested by a model.



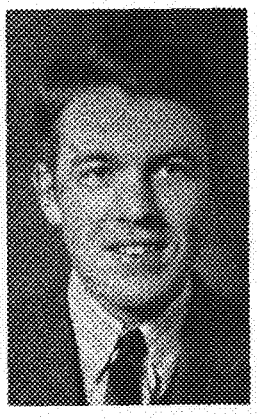


An example of stage design. In the first a rapid, in the second a greatly slowed up expression of time.

St. Pat 1903-1937 Engineers' Day Plans



Sherman Finger



Clifford Ryan

Leo Funke

William Lowe

Jack Mace

By Leo Funke, M. E. '38

THIRTY-FOUR years ago the discovery of a stone marked the founding of the finest of all Minnesota traditions—the celebration of St. Patrick's Day by the engineering students. The "old timers" of the class of '03 proudly relate how one of their group was casually watching a workman loading stones uncovered during the excavation for the Engineering Annex, when one of the stones rolled from the load and fell on his foot. Strangely the student felt no pain. He was dumbfounded momentarily but regained his composure and picked up the stone; it was inscribed with five words in a strange language. The inscription proved to be in a dialect peculiar to Old Erin; translated it means "Saint Patrick was an engineer."

The next day, March 16, 1903, a senior meeting was called to attempt to interpret this strange omen. It was decided that St. Patrick had used this means to express his desire that all senior engineers dedicate themselves unflinchingly to the service of their patron saint. To this end the following resolution was passed:

Whereas in the ranks of the Engineering College there are many of noble birth and Irish blood, and

Whereas the ancestors of many of our illustrious students came from Erin Isle, and

Whereas St. Patrick was an engineer

Therefore be it resolved that the Engineering Department take a holiday and celebrate in a body.

On the next morning, St. Patrick's Day, 1903, the students introduced the spirit of St. Pat to the Minnesota campus by a dedication to their patron and a day of "Irish Jubilee."

The following year a similar celebration was held with the additional feature of a senior banquet. In 1907 the banquet was supplanted by the St. Patrick's Dance at the Armory.

The year 1910 marked a major change in the St. Patrick's celebration. It was in that year that Prof. George C. Priester, then teaching his first year at the University, initiated Engineers' Day as it is today. Since that memorable year there have been no major changes in Engineers' Day. To be sure women have been admitted to the Order of St. Pat, and the St. Pat's dance has moved up from the Armory, through the Union to become "The Engineers' Brawl," a colorful social event at a downtown hotel.

The true spirit of Engineers' Day certainly has not changed since its inception. The changing times have restrained the manifestation of that spirit in that they have required the supercession of the old time whirlwind and sometimes riotous celebration by one befitting the prominent position of engineers in the present day. The 1937 Engineers' Day will follow this trend toward a more social and educational program.

Plans This Year

Tentative plans for this year's celebration call for "Open House" on Thursday evening, April 15, to make it more convenient for parents to visit the school.

On the following day all engineering classes will be excused and students will concentrate their efforts on putting the finishing touches on the floats to be in readiness at 10:30 a. m., when the twenty-seventh annual Engineers' Parade leads the seniors in triumphant march to the throne of St. Pat, there, by the touch of his sword, to receive that most coveted of honors, knighthood in the "Order of St. Pat."

Shortly after 2 p. m. teams sponsored by the various engineering societies will respond to the beat of the drum and compete in a series of athletic contests for a trophy signifying championship of the Institute of Technology.

The traditional Dansant and Green Tea will be run simultaneously with the athletic meet. The celebration will culminate in the gala "Engineers' Brawl" at the Nicollet Hotel.

Arrangements for the day are being made by Leo Funke with the assistance of William Lowe, Sherman Finger, Jr., Clifford Ryan, Jack Mace, and many other members of the student body.

Contracting for Farm Power Brings Economy

By Eugene Hesli, Ag. E. '38

FARM power contracting is the business of supplying farm power and the operating of farm machinery on a company business basis. The use of mechanical power in this manner on farms is now said to have gained universal acceptance. It leads to a more complete motorization of farms and thus enables the farmer to take on added acreage. It encourages more thorough methods of soil preparation and crop handling calling progressively for more and more power.

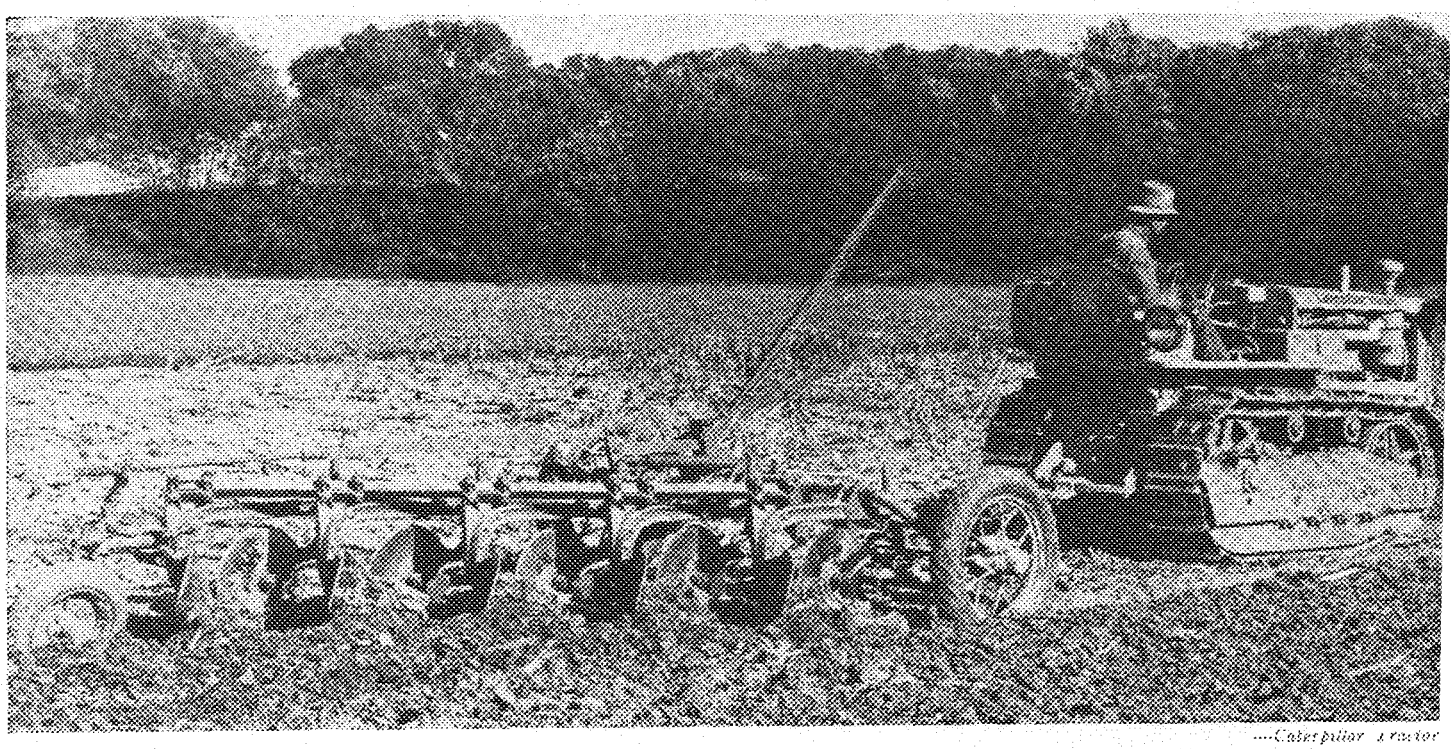
One fact to take into consideration is that the motorized farm in most cases still has "peak periods" in its program, when power available at home is insufficient to do the work as promptly, thoroughly, or cheaply as it can be done by an outside contractor with specialized equipment of adequate size.

This idea of power contracting is not a new one in that it has been used a long time in performing such work as threshing, silo filling, and other heavy jobs. Old time threshing crews probably didn't call it by that name but it did embody the power contracting principle. However, the equipment used cost too much for every farmer to own; and, therefore, the man who did own an outfit usually made it pay by making a practice of renting it, thus decreasing his overhead costs.

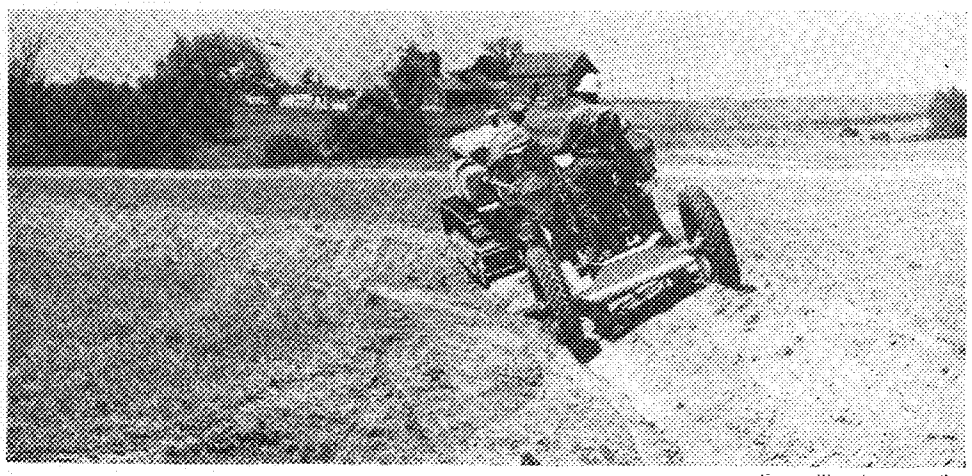
When the first threshing machines came out they used horses as power. As a large number of horses were needed for the power, a group of farmers usually owned one machine coöperatively. Later, when the steam engine came into use, it was the practice for one farmer to own the machine and do others' threshing on a contract basis. When the gas tractor came into more general utilization about 15 years ago, a demand was made for small threshing outfits. These machines were mostly owned coöperatively by two or three farmers, one of whom had a tractor. Silo filling has been another power job but most of the silage cutters are now owned coöperatively.

Some farmers are not mechanically inclined, do not like to handle machines or be responsible for them and are

With his Diesel tractor and 5-bottom plow the farm power contractor reduces the cost of soil preparation.



—Caterpillar tractor



—Caterpillar Tractor Co.

Terracing with Diesel tractor and terracer to check soil erosion is an important part of farm power contracting.

willing to have their heavy farm work done by outsiders provided they can obtain dependable service, and assurance that the work will be done on time.

Lately the idea of farm power contracting has been entering other fields of farming. Most farmers are not now able to handle their peak loads, nor were many of the farmers with horses or small general purpose tractors able to handle, on time, all of their work. These factors and the availability of a Diesel tractor in a comparatively small size have opened up both the necessity and the opportunity for the establishment of a farm power contract service in these communities.

On many farms where the farmer hasn't the power to finish some job on time it pays him to hire someone to do part of the work for him. This is especially true on farms of smaller acreage.

The following figures will give one an idea of the costs of plowing with horses, a 2-plow rubber-tired tractor and a 5-plow Diesel tractor. Total cost of operating the three units, including overhead, fuel oils, repairs, labor, team feed and expense are based on figures submitted by the University of Illinois College of Agriculture and from farm power contractors' records. Each unit had plowed on its own strip for 9 hours.

A 2-horse team plowed 1.9 acres at a cost of $2.50 per acre.

A 2-plow tractor plowed 7.1 acres at $1.20 per acre.

A 5-plow Diesel plowed 7.9 acres at 66 cents per acre.

The farm power contractor usually gets from $1.00 to $1.25 per acre for plowing. When it becomes apparent that he can plow an acre for $0.66 against the farmers' cost of $1.20, it can be seen what such a service and business means.

Terracing is another job which fits into a contractor's program. In a test on a 21-acre field it took a contractor and his helper 13 hours to build 5,130 feet of terraces. The cost of this job to the farmer was $43.55, or $2.10 per acre, as compared to the old costs, using horses, of around $5.00 per acre.

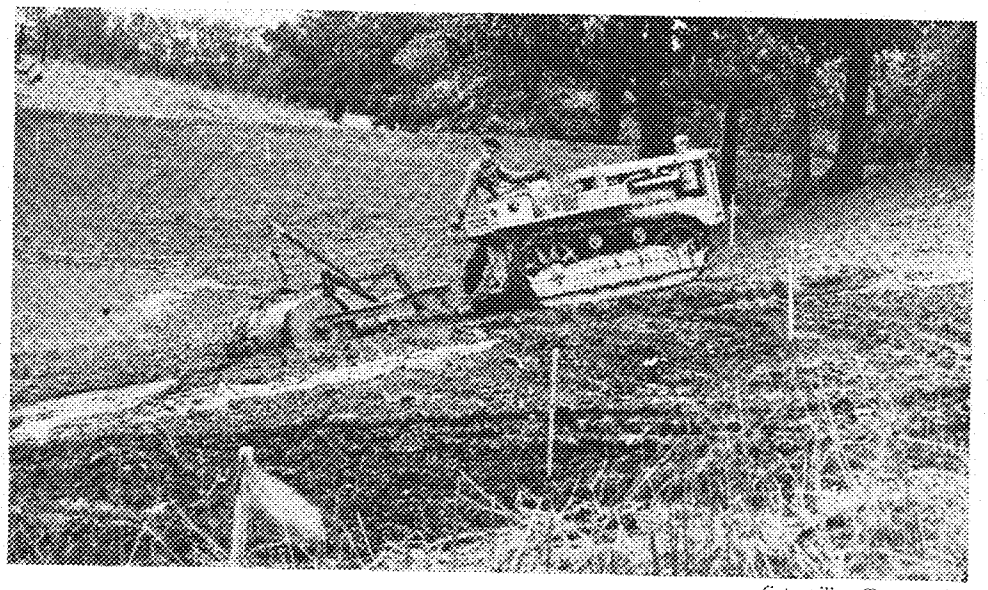
The farm power contractor's cost, including labor, fuel, lubrication and grease, was $15.18. This left the contractor $28.37 to provide for overhead, repairs, and profit.

There are many other jobs about a farm which can be done at a saving to the farmer and still pay a profit to the contractor. Some of these are digging trench silos, hauling logs, and disc harrowing.

In many parts of the country, farmers associate themselves to own, coöperatively, farm machines. This is true of machines which take more labor than the farmer can supply himself. One of the most important factors which induces farmers to own machines jointly is that it enables them to do their own work at any time they desire. If, for example, three or four farmers own a threshing machine, one of the farmers probably wants to thresh early and another later in the season. If dependent on a custom run, they must thresh when the machine gets to their place, whether it is early or late for the crop. In the case of coöperative ownership, when the farmer who likes to thresh early gets ready, he is assisted by the other members of the group, and so on until everybody is done.

With a coöperatively owned machine, the investment is divided between the farmers, thus reducing the overhead cost to each. The machine is also used more days a year, thus giving a lower cost per unit of work. From observations it appears doubtful that a coöperatively owned machine lasts as long as a privately owned one, mainly because it isn't cared for as well as a privately owned machine. Each farmer leaves it up to the next one to repair and rapid deterioration is the result. Consequently the machine cost per unit of work is greater with

Destructive gully erosion is checked by building small dams with tractor and roll-over scraper.



—Caterpillar Tractor Co.

coöperative ownership than it is if the machine is owned by one man doing custom work.

The quality of the work done by a power contractor can be of a higher standard because of the amount of specialized work which he does. While doing this work, the contractor learns how to adjust his machine for optimum results and therefore is able to get the best quality of work possible out of the machine.

The cost of operating a machine in the field is made up of labor, power, and machine costs. We are interested especially in the machine costs. They are made up of the depreciation, interest, repairs, and housing charges.

Using a binder as an example, costs have been computed for a year of use. This material is taken from J. B. Davidson's report on "Life, Service, and Cost of Service of Farm Machinery." The average cost of a binder is found to be $240, with an average life of 16 years. The depreciation on this machine is $15 a year. The interest on the money at 6 per cent would bring in an average of $7.20 per year for the 16 years. Repair costs per year are estimated at 1 per cent of its original value, or $2.40. Two per cent of the original value per year for housing is $4.80. The total costs are thus $29.40 per year. The average period of use for binders is six days per year. The resultant cost of service that the farmer pays for the binder per day is $4.90. Within certain limits, no matter how much work a farmer does, his total annual cost will remain the same but his cost per unit of work will decrease with each extra day he uses his machine. If he works for his neighbor for an additional six days, it will bring his cost per unit of work down to half of what it was before, or $2.45 per day. Therefore, the contractor would be able to put his machine into the field cheaper than the farmer would be able to use his own machine and still make a profit for himself.

The following figures are from tables published recently by the State College of Agriculture of Cornell University. The area plowed on an experimental tract is around 60 acres and only about half of this is cultivated. These figures would probably be changed somewhat on larger farms, although the size and cost of machines in proportion to the units of work to be done would scarcely be greatly different. These figures indicate the effect of part ownership of ensilage cutter on costs.

Effect of Part Ownership of Ensilage Cutter on Cost:

	No. of Farms	Ave. Tons	Ave. Investment	Ave. Annual Cost	Ave. Cost Per Ton
Owned ensilage cutter	29	112	$107	$24	$ .22
One-half interest owned in ensilage cutter	7	118	46	15	.13
One-thiru interest owned in ensilage cutter	3	107	32	9	.08

Now if a farmer solely owned an ensilage cutter and did the work on three farms, he would have a cost per ton of $0.08. If he contracted to do the work for $0.10 a ton he would still be making money and at the same time saving money for the others.

To make good in farm power contracting, one must be careful to always get the work done on time and see that it is of a high standard, at least of that standard which the farmer would do himself. Equipment used should be more efficient than that of the farmer. This means greater power and bigger machine units. In providing these the contractor not only makes extra money but provides adequate power for his own farm work and at a much lower cost than it would otherwise be done.

Considered from all aspects it seems reasonable to expect that farm power contracting will be of great importance in the general improvement of agricultural efficiency.

The Gold Scare At Senegoid

By Elting H. Comstock

Prof. of Mine Plant and Mechanics

SENEGOID is a prosperous town not over a three or four hours' drive from Minneapolis. It is called Senegoid for two reasons: first, that is not the real name of the town and, second, so far as I know no town by that name exists on the globe. The names of individuals used in the story are not their true names. Many of the actors in the gold scare were personal friends of mine and I would not have any of them feel that they had been inadvertently left out of the story. Senegoid is situated in an old broad valley and far to the East and North and West are low hills. A small river runs through the heart of the town. The bed of the river and the banks of the stream for miles north of the town are composed of gravel deposited there by the glaciers ages ago.

A number of years ago, shortly after the canning factory at Senegoid had opened for the season, Jim Ogilvy, a grizzled prospector from the Klondike, appeared in town. As no one was able to prove that he was not a prospector from the Klondike, he was accepted as such. He applied for work at the canning factory and, as he appeared husky and times were good and help was scarce, he was given a job.

Jim set out to find a boarding house. There were many in town but, as he was a sentimental man, he wanted one on the northern edge of town. He also wanted a room overlooking the valley and the hills beyond which re-

minded him so much of the Klondike. At last he found just what he was looking for and settled down. In due time he became acquainted with his fellow boarders and entertained them with tales of his experiences in the far North.

On a beautiful Sunday afternoon, when everyone was sitting down with nothing much to do, he decided, for old time's sake, to unpack his gold pan, go up into the valley, and pan some of the gravel. He invited those of his fellow boarders who were interested in seeing the process of panning to go with him and quite a group started out. He selected a likely looking spot, put some gravel and water in his pan, and showed them how to manipulate it. Finally to everyone's astonishment "colors," the miners' term for small gold flakes, were discovered in the bottom of the pan and the gold scare at Senegoid was on. The news spread like wildfire and early next morning the hardware store was swamped with requests for pans. They were ordered by wire from Minneapolis and after their arrival nearly everyone in town was up in the valley panning for gold.

Jim proved to be a wonderful help in teaching the novices how to shake the pan and throw out the gravel and a surprising number found "colors" in their pans. Business was nearly at a standstill. Dr. Cutler left word at his office that he could be found up on the river. He had unusual success. Tom Walbridge, the butcher, left the shop in the care of his wife and he too was able to pan quite a number of small nuggets which he carefully stored in a small glass bottle. A crippled boy learned the knack better than the others and had more to show for his efforts than anyone else, but no one went home empty handed. Clarence Barnhart, a young business man from Chicago, was stopping at the hotel. He tried his hand at panning and was soon proficient. He had wonderful luck and became enthused over the possibilities of putting Senegoid on the map as the center of placer mining in Minnesota. He drew plans for a mill and worked out schemes for transporting the gravel to the mill. He called a meeting of those interested to organize a company so that mining could be carried on on a scientific and businesslike basis. With one exception, everyone was enthusiastic, and had it not been for the presence of Angus McDonald a company would have been started then and there. Angus was very proud of his town and was fearful lest they rush into something which might be the cause of regret later on. He argued that there was no need for haste and urged that a mining engineer of unquestioned ability and integrity be secured to investigate the possibilities and make a complete report.

Prof. Comstock

Barnhart retorted that they knew what they had, that a mining engineer brought in from outside would sell them out to some big mining company and they would be left holding the sack. Angus clinched the argument for the time by hoping that nothing be done whereby "the fair name of Senegoid might be besmirched."

About three o'clock the next morning a form could be seen in the valley near the river, gathering samples of gravel from the spots where the greatest amount of gold dust had been found. With the sacks filled, Angus—for it was he—carried them to the depot where he boarded the early train for the cities. A taxi brought him to the School of Mines and Metallurgy with his samples. He told his story, whereupon the dean and the professor who taught assaying took the samples to the laboratory. Tests failed to produce any gold; the samples were barren. The question to be answered was: how did the colors get into the pans in the valley north of Senegoid? Various possible methods of "salting," the miners' term for adding values for the purpose of deception, were discussed. Among them the trick of placing gold dust in cigarettes and, at the proper time, flicking the ashes into someone's pan was mentioned. The ashes would float but the gold dust would sink to the bottom and remain to be discovered, much to the elation of the manipulator of the pan.

Angus McDonald returned to Senegoid doubtful of the presence of gold in the valley. He openly expressed his doubts but could gain few supporters. The gold panned by his fellow citizens had them convinced. Barnhart offered to pan gold from any samples taken from the valley. They could test him any way they chose. Dr. Cutler cleaned out his garage. Samples were carefully collected. Barnhart was dressed in a pair of trunks. The barber hunted for gold in his hair and ears. The dentist went through his mouth. He merely laughed at them. Angus gathered up the packages of cigarettes Barnhart had brought with him and announced that during the test he could not smoke. With this announcement Barnhart lost his good nature and complained that they wouldn't believe him even if he did pan gold. He demanded the return of his cigarettes but Angus had them safely in his pocket. Barnhart dressed and he and Ogilvy quietly slipped out of town. The cigarettes were panned and produced a fine showing of colors, but the gold scare at Senegoid was at an end.

Senegoid was an actual town, but it might have been any one of a dozen or more within the state of Minnesota. The details in the various gold scares have differed somewhat from those recounted. In many, no Angus McDonald was so concerned over the good name of his town that he was able to prevent the organization of a company, the selling of thousands of dollars of stock to people of that and neighboring communities and the ultimate disappearance of the promotors with the cash, when they left for Denver, or some other place to buy machinery. With all the excitement in various communities, no gold mine, or for that matter no producing oil well, exists in our state at the present time. Would that every town might have an Angus McDonald worried for fear that "the fair name of Senegoid might be besmirched."

The Minnesota Techno-Log

MARCH, 1937

ROBERT TEETER, Managing Editor
ELWOOD McGEE, Business Manager

ERLING HELLAND, Issue Editor

EDITORIAL STAFF

Donald Erickson, Copy Editor
Herbert Gaustad, Alumni Edr.
Erling Helland, Feature Edr.
John Murray, - News Editor
Richard Stone, Harry Larson,
Fred Warner, - - Reporters

BUSINESS STAFF

Robert McDonald, - Office
Gordon Brierley, - Adv. Rep.
Warren Waleen, - Adv. Rep.
Wallace Wilcox, Circulation
Vernon Hoden, - Circulation
Dan Doyle, - - - - Circulation

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, Treas.; Professor E. H. Comstock, *Mines;* Professor R. E. Montonna, *Chemistry;* Donald Randenbush, *Electrical*, Pres.; Louis Reigert, *Architecture;* Lawrence Rollin, *Civil;* William Hanson, *Mechanical;* Elden Olson, *Aeronautical;* Edward Eidam, *Mines;* Neal Amundson, *Chemistry.*

Education in the Institute

NOW that the furor raised by President Roosevelt's letter on engineering education has subsided and in view of the rumors of impending changes in the curricula of the Minnesota Institute of Technology, it seems appropriate that we, the students, begin to take an active, critical view of the system through which we are trying to gain an education.

To justify its existence an educational institution must be able to provide an affirmative answer to the question: are its graduates educated men? To answer, merely, that they are good chemists or electrical engineers or technicians of any sort is insufficient and secondary. To us, lay observers of the educational scene, it appears that the primary purpose of education is not to enable us to earn a living but to show us how to live in harmony with our fellowmen and with our social institutions, how to think clearly and properly express ourselves, how to understand our own minds and bodies, and how to best appreciate our cultural heritage.

That the Institute accomplishes the secondary purpose—that of teaching us a profession—cannot be denied, but even there its methods and perspective are being questioned. In its primary function, however, we will attempt to measure its success.

We find that students nearing graduation realize with feelings akin to shock and disillusionment that after 4 years in the University they are not really educated. Even their technical training, they find, has been so highly specialized that they find it difficult to adapt themselves to any type of engineering save the one they selected 3 years previously; they find that they have spent much of their junior and senior years striving to master the technical details of "practical courses."

That the Institute of Technology does not, save through its English courses, provide for what we have called the primary function of education is too obvious for argument. It cannot be that the doctor, or dentist, or lawyer has greater need for knowledge of the fundamentals of our society and culture than has the engineer, or chemist, or miner.

One answer to our problem would be the establishment of a 2-year pre-engineering course in the Arts college followed by an intensive 3-year engineering course, and postponement of fine specialization to a graduate year preceded by a year or more of professional employment. We look forward to the next step to be taken by the administration.

At the Desk

THE sphere gap in the electrical engineering laboratory is shown on this month's cover, while steel erection on the tainter gate section of Upper Mississippi River Dam No. 9 at Lynxville, Wisconsin, is depicted on the frontispiece.

In the first article is a description and explanation by Elaine Hanson of art instruction methods that are being used for the first time by the University's architectural school; it is illustrated by photographs of students' work selected from the display that has been exhibited on the third floor of main engineering.

Professor Comstock tells us this month of the methods of unscrupulous mining promoters and how they nearly succeeded in swindling the citizenry of a Minnesota town.

How farm cost may be reduced and a new vocation established by the introduction of power contracting to agriculture is described by Eugene Hesli in the second article in which he compares the advantages of individual, coöperative, and contractual performance of farm tasks which require considerable power or costly machinery.

St. Pat's history is reviewed and plans for the greatest event on the 1937 calendar of the Institute—Engineers' Day—are discussed by general arrangements committee chairman, Leo Fouke, who promises us a celebration we should long remember; the Electrical Show and party, which are to be held April 30 and May 1, are described by Tom West.

Mr. Haga's book review for this month concerns *Your Wings*, a book of especial interest to those of us who are air-minded.

The Alumnotes page carries a message from Hibbert Hill, well-known alumnus, who makes some valuable suggestions on engineering education.

News of the professional societies will be found on the Tech News page.

This Test Baffles Even Psychologists

PSYCHOLOGISTS and educators throughout the country have exhibited an unusual interest in the following test which gives a person a chance to test the sharpness of his vision.

Scrutinize carefully the following sentence and state how many F's, either large or small, it contains.

> **"The Famous Valspar finish is the result of scientific study combined with the experience of years."**

Referring to the test *The Outlook* states:

"Out of twenty people of intelligence not more than two will get it right the first time, and a large proportion will not find more than three after being told there are more. Professor Walker, of M. I. T., submitted it to seventeen trained scientists used to looking for small things, and sixteen failed. My secretary, immediately after typing it, found only three. Stanley Cobb (Professor of Neurology, Harvard Medical School), who fell, was much interested in it and its bearing on mental matters and intelligence tests. I showed it to a man trained in reading proof, who could only find four. It's not a fool stunt, but very interesting as showing how little we see of what we look at."

Now Here's A Book

By Clifford I. Haga

Instructor in English

SO EXCITING are most things connected with flying that even a queer, elementary sort of book apparently written for bright boys in junior high school can be worth a few hours. Assen Jordanoff's *Your Wings* is such a book. In a simple, colloquial style enlivened by frequent spurts of Boy Scout humor, Mr. Jordanoff takes you by the hand, tells you what an airplane is, why it flies instead of walking, what its gadgets are, how to fly it—in short, he turns you out as a fully-qualified, correspondence school Lindbergh.

To be sure, much of what appears in *Your Wings* is already common knowledge to most bright boys of college age—not to say kindergarten stuff to the drawing board hell-divers over in the old Armory swimming pool. But few books I have seen come as close to telling about everything in such great detail or so clearly as *Your Wings* does, nor are any other books of this kind so crammed with pictures vividly supplementing with their graphic clarity an already lucid text. Few of even the best informed undergraduates know everything found in the book, and even aeronauticals will gladly condescend to peek into it "—just to see if the guys knows anything."

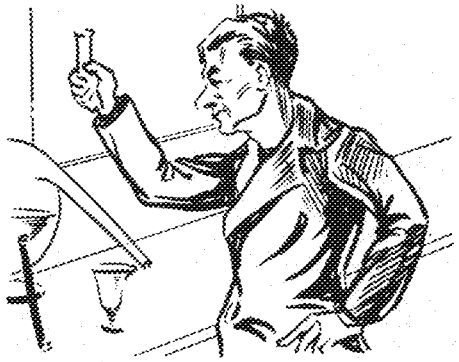
Who is this Assen Jordanoff that he should be so reliably encyclopedic? I gather from the book that at the age of 15 he was a corporal in what I suppose must have been called the Royal (or, since the Ferdinand running things was styled Tsar, perhaps Imperial) Bulgarian Flying Corps. At any rate it was the air force—"one lone airplane and three fliers"—of the Bulgarian army in that prelude to the World War, the Balkan War of 1912, when airplanes were first used for military purposes. Two years later, at 17, he built his first military airplane. With such a start, his continuous flying in the succeeding 25 years without getting killed would prepare him, you assume, to write 273 quarto pages of instruction for bright boys in the ninth grade. Limiting my opinion to my own experience with aeronautics and estimating myself as a bit more advanced than 9A (and bright to boot), I can say quite confidently that *Your Wings* is a good book.

For these reasons, the obvious completeness of the discussion and the apparent authority of the writer, *Your Wings* is certainly profitable reading. A third reason (really two reasons in one) suggests itself: the manner of organizing the material and the style in which it is written. Step by step the author takes the reader through the standardized training routine from ground school to pilot's license, all the while with a cheerful, chatty "you-ing" of the reader quite scandalizing to those of us who know how process exposition should be written and believe "Pro 4" one of the gospels. The effect of this colloquially simple style I poke fun at is to make the more susceptible readers imagine themselves helmeted and strapped into the seat, one hand on the stick and the other on the throttle, ready to give her the gun, easy now, all right, level off, now throttle her down, check the tachometer—. I think I had better get back to what I started out to say: that you yield gradually but completely to Jordanoff's spell and feel, as you look up from the book, that though you are not actually flying, you *have* been flying.

Most of us, whatever our ages, are sufficiently childish to appreciate the possibility of this kind of hypnotism. The very thought of flying is supremely thrilling and when we get as close to it as we seem to in *Your Wings*, it is not strange that we should be affected in somewhat the same way as was one of my schoolmates on a drowsy spring day almost a generation ago. This boy, Louis by name, was supposed to be drawing a map for his geography lesson, but one thing led to another and one line to another until he was absorbed in a grand drawing of the one great love of his life—a locomotive. Slowly it took shape and reality from tender to cowcatcher, smoke of rich black poured from the stack, the engineer had his hand on the whistle cord—and Louis's voice split the sleepy air with an ecstatic "Toot-toot-tooooooot!" as he sketched the escaping steam around the whistle. There was, of course, h—— to pay. The drawing was villainously confiscated, and Louis spent the rest of the afternoon "standing in the corner" and spitting with surreptitious contempt and complacence into the chalk trough.

You need not wonder, then, that I urge those of you most tenderly susceptible to suggestion to read Jordanoff's *Your Wings* in private. If you try for a three-point landing from an altitude no greater than that of a living room chair, you very likely will be sent to bed without your supper.

ISO-TOPICS



New Color Film

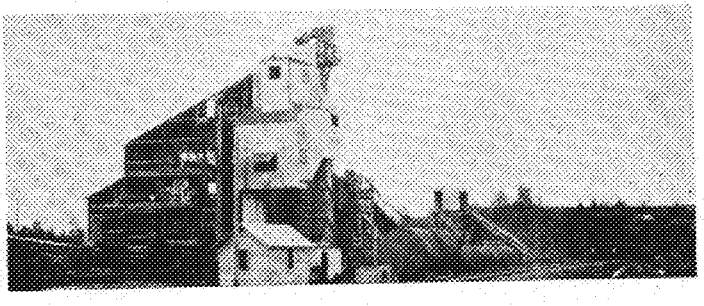
A new color film, based upon the "additive" as well as the "subtractive" color process, has been recently marketed. It reproduces color without the use of a coarse grain film or color screen, and no color filter is necessary for the lens. Three emulsion layers from .002 to .005 mm. thick are used to make up the film. Each layer absorbs one of the primary colors. The film is no thicker than normal.

Magnetic Ore Roasting

A PROCESS making useful iron ore from tailings that were previously discarded has recently proven its worth as a possible method for the concentration of low grade hematite ores such as are found in the Lake Superior Region. It consists of heating low grade hematite to 1100° F. by oil burning in a reducing atmosphere. The hematite changes to magnetite upon contact with vaporized fuel oil at a temperature of 900° F. After cooling, the magnetite particles are separated from the rest by magnets. Recovery is about 50 per cent, with the product a high grade, desirable ore.

A few years ago, the Mines Experimental Station undertook the designing and development of a furnace that would be commercially suitable for this process. A single unit plant was constructed at Cooley, Minn., and operated experimentally during 1934 and 1935. In 1936 the plant was taken over for commercial operation and it was found that this process can not be used indiscriminately for the concentration of all low grade ore, because the variability of the factors involved means the difference between operating at a profit and suffering loss. The plant at Cooley can be operated at a small profit only because the ore being treated is waste material from existing concentration operations.

Cooley ore plant.



Coaxial Cable

Electrical Engineering

(Watch this column from month to month for latest news in your field of engineering.)

THE American Telephone and Telegraph Company and the General Electric Company have put into experimental service a new type of cable which is expected to give better service than the present cable containing many wires.

The coaxial cable has been installed between New York and Philadelphia, a distance of 94.5 miles. It is equipped with repeaters or amplifiers every 10 miles, enabling it to handle a band of about 1,000,000 cycles. This coaxial system is able to handle 240 simultaneous two-way telephone conversations. The experiments so far have been very successful and no technical difficulties have arisen although much work remains to be done before such a system can be used for general commercial service.

The new cable contains two coaxial units, each having a 0.265 in. inside diameter, and four pairs of 19-gauge paper insulated wire. The whole is enclosed in a ⅛ in. lead sheath. The central conductor of the coaxial units is a 13-gauge copper wire insulated with hard rubber at intervals of ¾ in. The outer conductor is composed of nine overlapping copper tapes forming a 0.02 in. thick tube, and is held together with a double wrapping of iron tape.

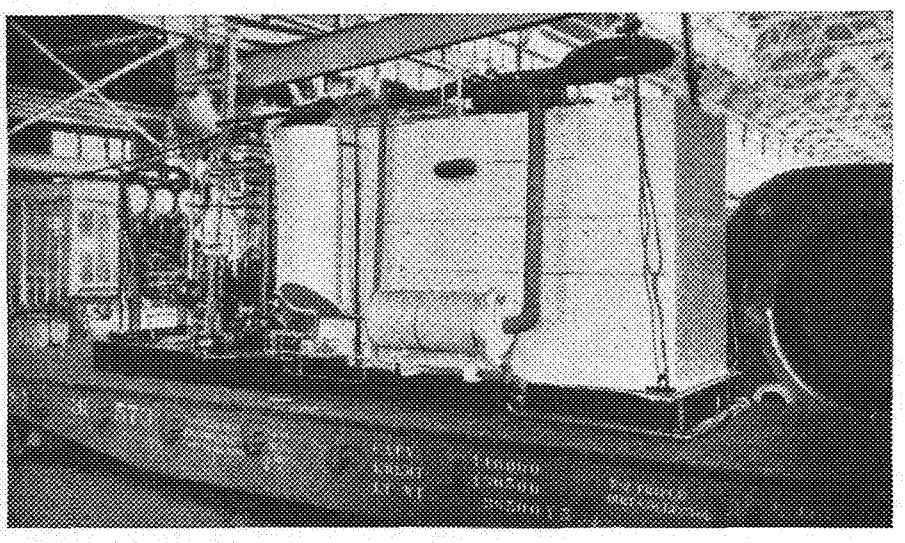
The attenuation of this cable is about four per cent higher than is calculated for a solid copper tube of the same dimensions and material. However the shielding obtained from one conductor to the other or to outside interference is considerably more. A severe requirement is the elimination of cross talk, and this condition has been achieved to a considerable extent.

The amplifiers used in the test system between New York and Philadelphia were designed for about 10 mile spacing and frequencies ranging from 60 to 1,024 kilocycles. Ten complete two-way repeaters have been provided including those at the terminals. Six of these repeaters are unattended stations in manholes or in small buildings erected for that purpose. The repeaters are designed to compensate for power losses over the distance already covered by the voice. Three stages of pentodes are used with negative feed back around the last two stages. Attenuation changes due to temperature of the line are compensated automatically by a pilot channel device which has been installed at every second or third repeater. The regulating mechanism uses four small tubes and is added to the repeater when desired.

The idea employed involves two steps of modulation. The first sets up a 12-channel group in the frequency range from 60 to 108 kilocycles and the second step of modulation is used to step the entire 12-channel group to the desired frequency location by a "group" modulator.

By means of the coaxial cable a step towards television will have been reached. Much of the experimentation on television is carried on by the American Telephone and Telegraph Company and it claims that a complete television program may be transmitted over one coaxial cable, although this cable has not been perfected to the extent that it can be used for commercial television.

"never-ending PROGRESS to perfection"



—*General Electric*

Steamotive

A RECENTLY developed type of steam generating equipment is called *Steamotive*, designed for compactness and rapid response to load changes. Capacities of 2,000 to 10,000 horsepower are possible with them; and, while the units are very compact, they are not as efficient as equipment designed for larger space. Two units have been built and more are under construction. The outstanding characteristics are no water storage necessary and pressure draft through the burner and boiler. The auxiliaries, consisting of a feed pump, blower, fuel oil pump, and lubricating oil pump, are all geared to one turbine. The water is pumped through the furnace in several circuits where all of the steam is generated.

The conventional refactory furnace walls have been replaced with water walls and insulating block. This results in quick response to load variations. Safety valves and other protective devices on natural circulation boilers have been replaced with devices which shut off the oil fire.

Combustion rates up to 400,000 b.t.u. per cubic foot per hour have been reached. The two completed units have outputs of 21,000 and 10,000 pounds of steam per hour, at pressures of 1,500 and 1,200 pounds per square inch at 950° F.

Dust Counter

A RECENTLY developed dust counter, requiring no laboratory training for its use, is now being sold. A hand pump draws 1/1000 cu. ft. of air through a moistening chamber and impinges it in a ribbon upon a glass slide. One slide will care for 12 different samples.

Vibrationless Grinder

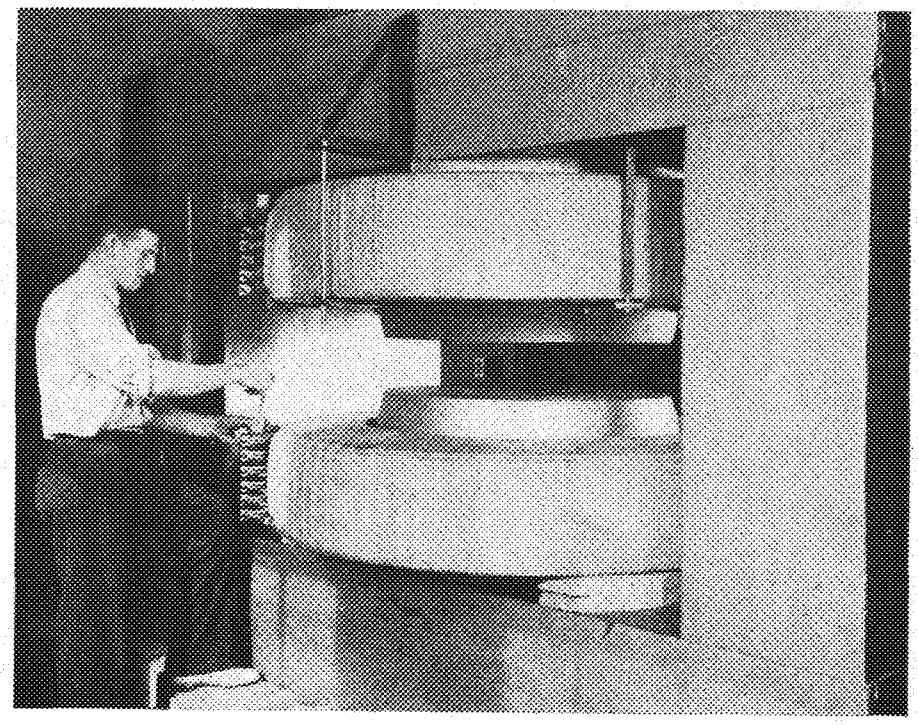
TO INSURE better finish and less grinding time, a large roll-grinding machine recently designed, has a four-step reduction multiple V-belt drive eliminating vibration and chatter-marks. This machine will handle units as large as 60 inches diameter, and 24 feet long. The 25 hp. motor is of the constant power type, with the speed adjustable from 1200 to 300 r.p.m. A reduction of 50 to 1 is possible. A total of 65 belts are in the machine, either 54 or 45 of which are in use at one time depending upon the reduction required.

Dual Life Bulb

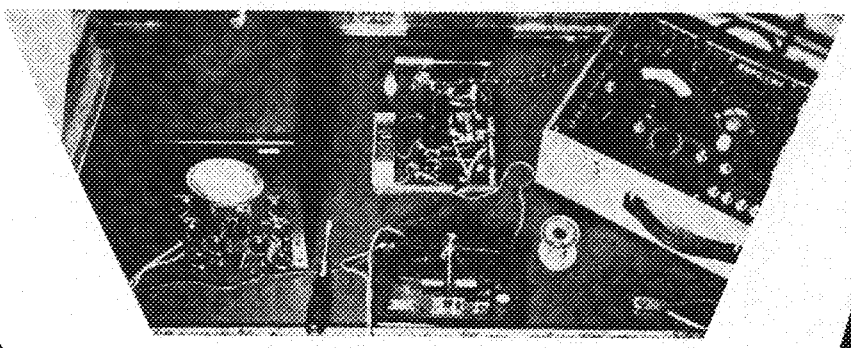
AN AUTOMATIC switch in a new light bulb automatically sends the current through a spare filament when the original one fails, thus doubling the life of the bulb.

Purdue University's Cyclotron, or "Atom Smasher," capable of emitting the strongest beam ever made by man, and able to melt metals, disintegrate any known substance, penetrate three feet of lead, or make ordinary table salt radioactive.

—*Purdue Engineer*



ELECTRICAL SHOW 1937



The capacity detector shown in this picture is one of the many exhibits being constructed by Electricals for the Electrical Show. This particular instrument has the mystifying property of detecting the presence of human beings without the aid of light beams or photo electric cells.

IN THE E. E. building there lately has been intense activity in the way of committee meetings for the forthcoming Electrical Show. Ottilio Morzenti, chairman of the party, is already beginning to get gray hairs although the opening date isn't 'til the 30th of April.

We've been snooping around the various conferences and meetings in order to give our readers some inside dope on the startling things to come, even though only a sketchy preview of the hundreds of exhibits can be given.

One of the things you'll first see is an electric doorman. He will be operated, so we are told, by an interrupted light source focused upon a photocell. Of course, I presume that all of you know what a photocell is. For those who don't, I may describe it as an electric switch which is operated by light beams. Is that clearer? I thought so. For those of youse guys who are too lazy to open the door for your best girl, this will be a blessing. Then, too, this is one doorman with which your girl friend can't flirt.

* * *

You've heard the saying: "He who builds a better mouse trap will find a beaten path to his door"—well, it seems that there will be a better mouse trap at the show and those in charge hope there won't be too much of a stampede to see it. We have the word of Bob Olson that, to help in explaining the operation of the device during the show, he will bring in real live mice. You know the kind—pure white mice that do such a great job in explaining human behaviorisms.

* * *

Those who like to talk big will want to see the man in charge of the "Seeing Your Voice" exhibit. According to Myron Leslie, the senior supervising construction of the display, an oscilloscope will be used which, with associated apparatus, will project a picture of the voice upon a huge screen. I am sure that after seeing this the loud fellow will realize just how his voice sounds to others.

To prove that the male is not the stronger sex, at least when it comes to having a lot of self-generated electricity in the body, there will be an exhibit which should be very interesting. By rubbing a cat's fur with the hand and holding it over an ordinary light bulb, the lamp can be made to glow with a certain amount of brilliance. The brilliancy of the lamp is determined by how much electricity a person can store in his body. The committee in charge of this display is looking for a cat so we're warning, in advance, the old maids around the campus to keep a close watch on their Tabbies.

* * *

All of you wise engineers must have heard of that Indian Fakir stunt where a rope is made to stand up in the air all by itself. The electricals will have their version of this trick at the show. Only, there, a huge logging chain will be used instead of a rope. However, the rest of the stunt where a boy is killed and then brought back alive, the committee can't promise to have.

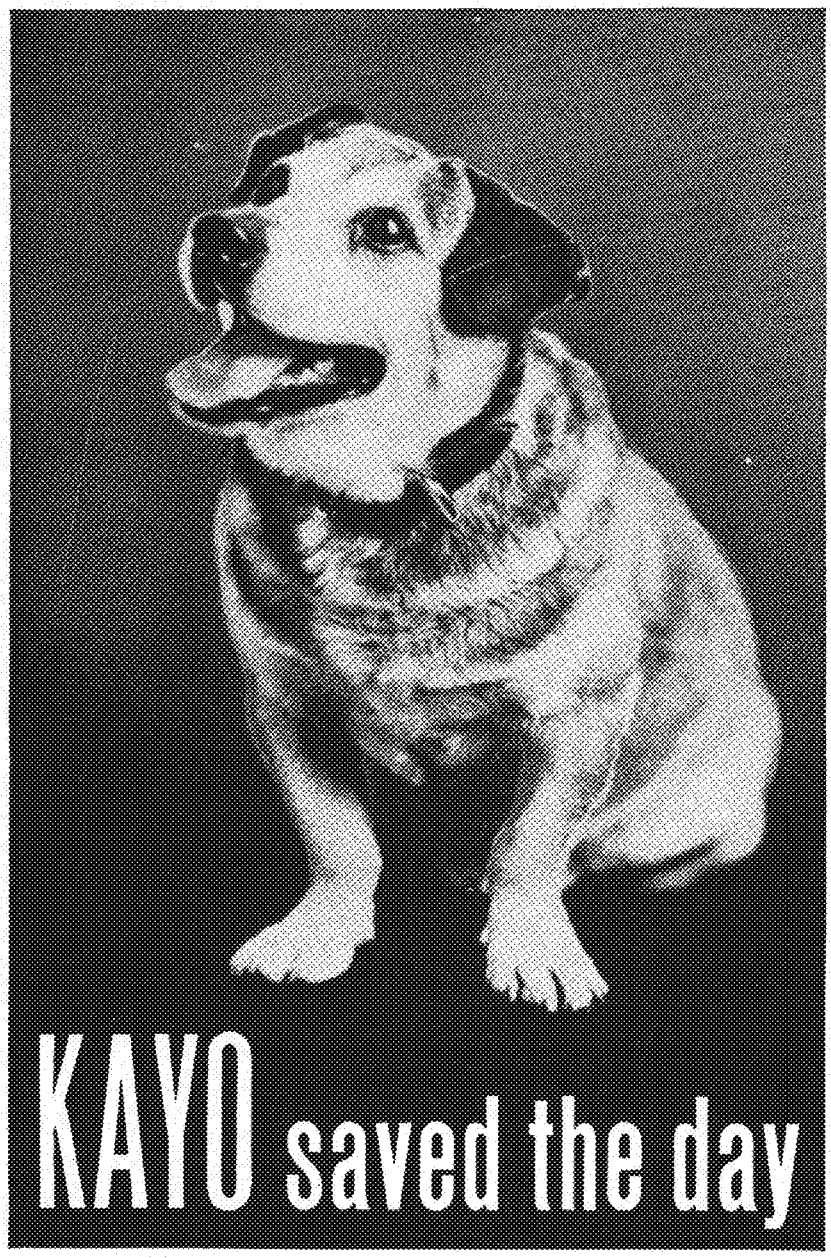
* * *

I imagine you bashful engineers at some time or another have tried to find out in your subtle way just what it was that attracted you to some girl. The electricals have something which may be of great assistance to you, and that is the "Personality Tester." It indicates on a scale just how much personality she has. So bring your girl friend around to the show and really find out the cold, scientific facts.

* * *

Then, of course, no show is complete without a lie detector. There will be several at this year's exhibition so that every one will have a chance to see how they operate. This would be a good time to find out if your flame was really telling the truth the last time you asked her for a date and she had some excuse to offer.

—*Tom West.*



A CHURNING flood had taken out the telephone line across a Colorado stream. Repairmen couldn't wade it because of quicksand—couldn't cross elsewhere and bring back the line because of obstructions.

Then Kayo's master had an idea. He went upstream, crossed, came back and whistled. Kayo jumped in—swam across with a cord tied to his collar. With this cord, the wire was soon pulled over—communication was restored.

A small incident. But it typifies the ingenuity which helps Bell System men and women to give you the world's most dependable telephone service.

BELL TELEPHONE SYSTEM

Why not telephone home more often? Rates to most points are lowest after 7 P.M. and all day Sunday.

ALUMNOTES

With An Alumnus

FIRST in a series of interviews with prominent Minnesota graduates in the various Engineering fields, this department presents Hibbert Hill, C. E., '23. Mr. Hill is General Superintendent of the St. Anthony Falls Water Power Co. He has been prominent in engineering circles for several years and his opinions are well worth considering.

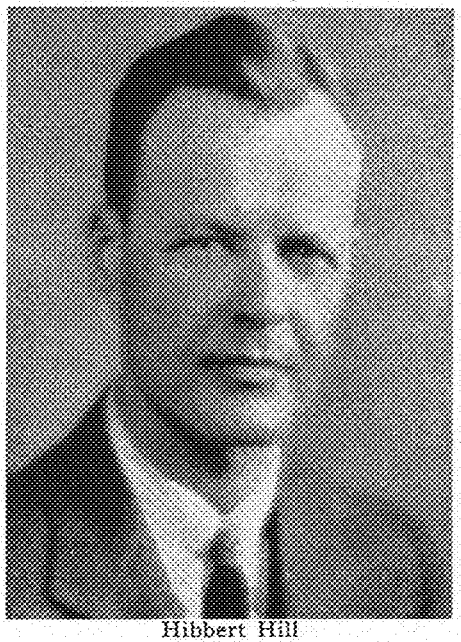
Mr. Hill's first statement concerns the technical college's curriculum. He is a firm believer in the basic subjects such as math, English, chemistry, and physics. "These subjects offer the best training for prospective Engineers," he says. "In addition there is a need for the inclusion of basic economics and business practices in the curriculum. The Engineer is finding more and more that a thorough knowledge of business practices is just as important as the technical knowledge."

For those who aspire to executive positions Mr. Hill says, "Although executives are usually 'born and not made,' there are two things which a fellow may develop in striving towards that end. These are the ability to write well and the ability to speak intelligently in public. These two traits are the most important assets of a successful executive."

Concerning Civil Engineering in the future, Mr. Hill has an optimistic outlook. He sees the largest portion of Civil grads going into governmental work, especially in flood control. He predicts the continuance if not expansion of this phase of governmental work. To meet this demand Mr. Hill suggests the possibility of a special course with the sole purpose of preparing men for this field.

'09 Professor Kuhlman reports a very interesting meeting this fall with a real old timer—J. A. Fitts, E.E.—at the district meeting of the executive committee of the A. I. E. E. in Chicago. Prof. Kuhlman and Mr. Fitts talked over lunch about Minnesota, trading experiences. Mr. Fitts is secretary-treasurer of the Chicago section of A. I. E. E. He works at the Electric Storage Battery Co. in Chicago.

'30 Two Mechanical classmates spending their time for the benefit of General Electric, are Richard Guppy and C. M. Cederstrom. Guppy is manufacturing foreman of



Hibbert Hill

the Small Oil Circuit Breaker Division at the Philadelphia Plant. Dick reports that business is fine but that he can't find enough good men. Cederstrom is assistant to the superintendent of the Power Transformer Division of the Pittsfield Works.

Mr. L. R. Shellenbarger, C. E., has been promoted to the operating department of the Chicago, Milwaukee, St. Paul & Pacific R. R. He is train master of the Iowa Division at Marion, Iowa. Mr. Shellenbarger has been with the company since graduation except for one year spent at Yale University on a Strathcona Fellowship in Transportation. During that year he obtained his master's degree from Yale.

'31 R. C. Jordan, Aero (Master in Mech. in 1933), has turned to teaching to pass the time. At present he is teaching college algebra, drawing, air conditioning, and trig. at Texas A. and M.

Russell M. Thayer, Mech., who has been employed by the Minnesota Mining and Manufacturing Co. in St. Paul for several years, has accepted employment with the Linde Air Products Co. at Buffalo, N. Y. He will work in their research laboratory.

'33 Delbert A. Severance, Aero, is now located at Washington, D. C., with the Department of Air Commerce.

'34 Working on a Battelle Memorial Institute fellowship at Ohio State is Francis W. Boulger, Met.E. Mr. Boulger does his research work at the institute and his educational work at the University.

Another miner to be heard from this month is Kenneth R. Johnson, E.M. He is employed by the Weepah Nevada Mining Co. at Toopah, Nev.

Bob Marshall, E.E., a member of the TECHNO-LOG staff in 1932-33, has been on a graduate fellowship at Columbia for the last 2 years. This fall he accepted an offer to work with the American Telephone and Telegraph in New York City.

'35 Another former TECHNO-LOG man to report this month is Richard Pederson, Chem.E. Dick was on the staff during the year 1932-33. He writes that he is planning to take graduate work at Yale in the near future. At present he is with Swift and Company in Chicago.

It has been reported that Arthur B. Hallaway, E.E., has been recently married. We're sorry we can't give any particulars but we would welcome any information about the event. Art is located in the Lighting Sales Department of the Northern States Power Co.

Bob Gilruth, Aero., has left his assistantship in the Aero. department for Langley Field, where he will join Sam Davidsen, an aero classmate.

Edward Silberman, Civil, employed by the Minneapolis Dredging Co., has recently been in Kansas City doing general engineering work on a sheet steel piling wharf and dock.

'36 Prof. Roy Jones passed on this information concerning two architecture men. Leonard Carrie and Robert Anvinen are working on graduate fellowships at Harvard.

Perry Larson, E.M. (Pet.), visited friends in the Twin Cities recently. While he was here he stopped in long enough to tell us that he's working for the Shell Petroleum Co. in Lyons, Kansas.

THE IDES OF MARCH

By BERTIL LINDQUIST

The Taurus Trophy is completed and on display at the Engineers' Bookstore. The trophy will be entrusted to the loving hands of him who submits the best tall tale during the next month and his name will be engraved on the cup (can). The lies (stories) must be written since the verbal tale would entail the engagement of a stenographer—and most of this unexpurgated verbal stuff is unfit for feminine consumption. So get your pens rolling, you Institooters.

It was Saturday morning and the little town of Cass Lake drew its first untroubled breath in a week—the civils had left town over the weekend. But it immediately rubbed the sleep from its bleary eyes and gazed with wonder at its auspicious water tank—for painted on it in dazzling white were "U of M, '37"—ten feet high. When confronted by the irate citizenry, Prof. Carl Swanson (who got so he used to shout "not guilty" for his boys in his sleep) offered the explanation that CCC boys must have done it to get back at his well-bred peace-loving students. "CCC boys!!!" the natives roared, "you know darn well the CCC boys can't print that good."

Brother "Connie" J. Bevier strode into the office the other day muttering imprecations and threats . . . "Don't you call me any more of your two-bit names—I just bought me a dictionary . . . Sycophant, ephermeral claustrophobiac—humph!"

And the kid sister tells me that a cracked chair is like a cop because it'll pinch you if you don't park right . . .

Boy! It must be a long time since one dean took—that is, wore a bathing suit. Her sense of morals seems to fluctuate with the seasons. A three-months swimming suit preview in the enlightened Eastern centers of civilization bring hazzahs and dry-goods business stimulus, while here in the mid-victorian Minnesota Backwoods a mild edition of what the news-reels have been portraying in dignified Northrop Auditorium all winter rumoredly brings a penalty of eight credits per damsel.—Another convincing argument for compulsory retirement, although we must admit that not *all* University deans lose their sense of judgment (and humor, Madam?) in proportion to their increasing number of encroaching years.

Not reported in the downtown rumor was the removal of the boarding house, in which the girls lived, from the approved list. * * * Perhaps the dean is still in a huff as a result of that incident at the Nurses' Home a short time ago—she went to attend a meeting that she had been invited to and then sat downstairs all the time it was going on because no one came down and asked her up.

Our Dr. Piccard, at the conclusion of a stratosphere lecture on cosmic rays, was confronted by a fluttery young matron who gushed, "Oh, Doctor! Do tell us more about those fascinating COSMETIC rays."

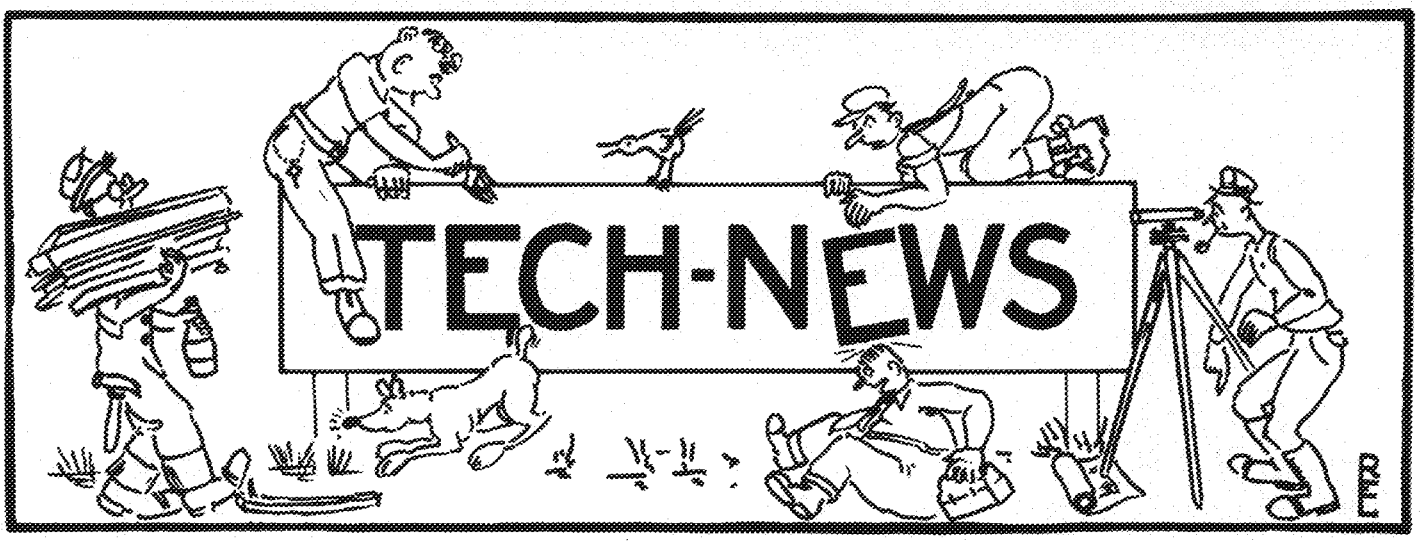
Famous last words—Naw, I don't need a parachute . . .

Co-columnar Pete, in perpetual perspiration fearing eruption of prospective mother-in-lawental wrath, bends his every feeble effort toward keeping his stint clean and hoity-toity—and then writes things like that "Good night, girls," stuff.

ANACREONTIQUE

Friend of my soul! this goblet sip,
'Twill chase away that pensive tear,
'Tis not as sweet as woman's lip,
But Ah! 'Tis more sincere!

Suggested name for a Chemistry Student Organization—"Catalyst Club" . . .



Miners Planning Spring Field Trip

Miners were given some useful and interesting points in Engineering Law by Mr. Ray Allerd when he spoke to the School of Mines Society at their February 25 meeting. Mr. Allerd, although a Metallurgical Engineer of the Class of '18, is now a practicing Lawyer. A discussion of gems by Dr. Gruner of the geology department featured the March 4 meeting of the Society.

Senior Miners are busy rushing to completion their models of mines and mills for their thesis work while the sophomores and juniors are making plans for their field trips spring quarter to Northern Minnesota, to Chicago and points south, and out west.

Honeywell--Machinery Co.'s Visited by A. I. E. E.

A.I.E.E. members were shown many interesting production methods when they inspected the Minneapolis Honeywell plant on February 10. Another trip especially interesting to the members taking machine design was the inspection trip through the Electric Machinery Manufacturing Company on March 3.

April 30 and May 1 have been designated as the days when the Electrical Engineers will demonstrate what they have learned in the laboratory and classroom. On these two days will be held the Fifteenth Biennial Electrical Show.

Lecture Series Feature A. S. C. E. Meetings

The first of a series of speakers from the Minnesota State Highway Department was W. J. Titus of the U. S. Bureau of Public Roads who spoke on "Highway Planning Survey" at the March 2 meeting of the A.S.C.E. Following Mr. Titus' talk, the Tech Glee Club sang several songs.

Mr. J. T. Ellison of the Minnesota Highway Department is slated to speak March 31 to the civils in the Minnesota Union on "Highway Development and Construction in Minnesota." Scheduled for a later date is Mr. L. Yager, assistant Chief Engineer from the St. Paul office of the Northern Pacific Railroad, who will talk about problems dealing with present conditions in the railroad field. Mr. Yager is a graduate of Minnesota.

Plans for spring quarter activities include three inspection trips and a new series of lectures. One of the field trips will be through the new Hydraulics Laboratory with the A.S.M.E.'s as guests. Later the civils will inspect the new sewage disposal plant being constructed for Minneapolis and St. Paul and the third will be to one of the dam sights being constructed on the Mississippi river near Red Wing. The lecture series for the springquarter are under the directorship of Professor H. S. Levens and are sponsored by the student society.

Plans are also under way for a joint meeting of the Northwest Senior section and the student branch of the A.S.C.E.

Convention on A.S.M.E. Spring Activity List

A. S. M. E. members were kept busy the night of February 19, trying to attend a lecture titled "L o x o l o g y" by Mr. Maxwell of the Yale and Towne Lock Co. and a movie starring Joe E. Brown in "Earthworm Tractors," both programs being presented at the same time at different places on the campus.

The whole senior class plans to desert the campus the week of April 19 to attend the A.S.M.E. Student Convention and to inspect several large industrial plants in the Chicago area.

Professors J. J. Ryan and C. A. Koepke, in cooperation with the student chairmen for the trip, are planning various inspection trips through industrial plants in Milwaukee, South Bend and Chicago.

A. S. A. E. Designs New Engineers Day Float

The most important Ag social event of the year was the A.S.A.E. Student-Faculty Party which took place on the evening of February 6. The party was sponsored and financed by the student branch, the faculty being invited to attend free of charge. Space was provided for by reserving the entire Ag Union. Entertainment consisted of dancing and movies, besides the guests' choice of games.

A.S.A.E. members are busy at present with plans for their contribution to Engineers' Day. They promise to have an entirely new float design.

Chemists Hear Piccard On 'Strato' Chemistry

Fifteen new members were initiated into Phi Lambda Upsilon, honorary chemical fraternity, at a banquet held in the Curtis Hotel with Dr. R. E. Montonna of the Chemical Engineering Department presiding as toastmaster. Among the speakers was Dr. E. L. Piret, who has returned from a year's study at the University of Lyons; he spoke on University Life in France. The principal address of the evening was given by Dr. Jean Piccard who gave the group an extremely interesting discussion of the chemical aspects of stratosphere work.

The following men from chemistry and related fields were initiated:

Neal Amundson
Don Aubretcht
Lyell Behr
Carl Dahlquist
Frank Eggertsen
James Guertin
Alex Keyl
Charles Quest
Richard Olson
John Painter
George Piercy
John Ridgway, Jr.
John Vincent
Emil Wiest
Hilmer Winberg

Glider Club

The Glider Club has their regular scheduled meetings on the first and third Thursday of each school month. In addition to their regular meetings, they have been having "work nights" on every other Friday night for the purpose of working on the gliders and planes.

By Melvin "Pete" Lohman

IT'S that dad barn time again; seems like we just got thru with exams, including condition exams. Courage, seniors, these are the last exams you'll take for your college career.

We suppose everybody is beginning to think about Engineers' Day already. Leo Funke, the general arrangements big shot, doesn't throw out his chest over getting the job. Reason is his pals shaved it nice and clean the other night. Makes him look sort of nude.

Two Chems met the other day. Said one, "Where you been?" To which the other replied, "Lookin' for work." "Man! your curiosity is going to get you into trouble yet," replied the first.

Some people throw away their junk but civil Bill Lowe bought another license for it.

Seems that instructor Jensen of the bridge analysis course doesn't care much for the senior civils if the giving of fourteen flunk slips at mid-quarter is any criterion.

The retort proper for some of our profs who ask if you're learning anything. Tell him no, you were listening to him.

Jim Savage, the miner adonis, joins the "Men Who Have Gone Out with the Big Ten Beauty Queen" Club. In fact he should be made prexy, as rumor has it that he even went down to Chicago to see her win the crown.

The sequel to the book **Live Alone and Like It** is **Wake Up Alone and Like it.**

And then there was the guy who spent so much of his time looking thru Venetian blinds at cocktail lounges that he thought pink elephants came in layers.

Our idea of nothing to do: washing miner Roger Lynn's hair.

This might have happened in a well known prof's electricity class but it didn't. Nevertheless, it illustrates the point. A certain lecturer was talking on the drink question. "Now, supposing I had a pail of water and a pail of beer on this platform, and then brought on a donkey: which of the two would he take?" "He'd take the water," came a voice from the gallery. "And why should he take the water?" asked the lecturer. "Because he's an ass," came the reply.

A freshman wondered why there was so much electricity in his hair. Frank Parker said it was because its connected to a dry cell. Frank should know.

And then there was the engineer who after surveying the ham in the ham sandwich he had just ordered in a local beanery asked the waiter, "Did you slice that ham?" "Yes," said the waiter. "Boy, you almost missed it," commented the eng.

B.H.T.L. told one of his famous yarns when a listener remarked that he reminded him of a chap who dyes lambs wool only he's a lamb dyer and that B.H.T.L. was something that sounds very similar.

Famous last words in the civil lab classes. "Whose going out for Gobs?"

In the face of such impeccable and unimpeachable information as that of the MINNESOTA TECHNO-LOG, *The Scientific American*, and other of the country's leading scientific periodicals, the *Minnesota Daily* strives manfully to garner a little notoriety by telling us that the new 200-inch telescope won't be ready until 1945 when they know very well that THE TECHNO-LOG's Dec. issue gave the date as 1940.

Our editor explained to the cub reporter about newsgathering and used the classic example "dog bites man and man bites dog." A few days later the lad came back with a scoop titled, "Hydrant Sprays Dog."

Wonder why all the lads on one of Koepke's inspection trips wanted to date a certain girl who does an interesting piece of work at the Zinsmaster Baking Co. Anyone interested see the senior M. E.s for details (they can't be printed).

And the poem for this month:

The morning after the night before
Our cat came home at the hour of four;
The innocent look in her eyes had went,
But the smile on her face was a smile of content.

—So It Seems.

Points

By Richard Henning

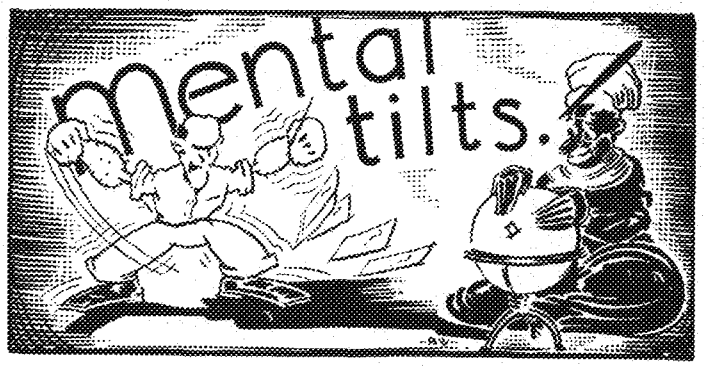
In Professor Wilcox' class in dynamics, the students get so enthusiastic over their ability to follow the prof that they sometimes forget themselves. The other day during a quiz, one student shouted "Glory Hallelujah" as he hit upon the solution to a particularly difficult problem. From the other side of the room came "Amen, Brothers, Sign the Pledge," and, lo and behold, there was the good professor standing with his face in the corner trying to suppress one of those mirth-provoking smiles that only a professor in mathematics knows how to make.

* * *

There is a story concerning the ancient but worthy schools, Cambridge and Oxford, which I would like to pass onto you. It seems that once a year each school tries to put a swift one over and the winner is treated by the loser to a dinner. One year the Cambridge boys (gentlemen, every one) collected a fairly large sum of money and sallied forth to a local merchant to purchase a goodly number of country receptacles. The boys then hired a cart and in the early hours of the morning they went forth to do their bit. Now, as you know, Oxford University is made up of rather old buildings some of which have a great number of sharp-pointed spires.

The following morning, the college youths of Oxford walked down the tree-lined walks and stared in amazement for atop each one of those spires there glimmered one of those household necessities.

The Oxford boys thought that was a pretty fair piece of skulduggery but they were not to be outdone. In the early hours of morning, as workers hurried along the streets to their places of occupation, they saw several large trucks roll into one of the town squares. A mob of ragged and dirty workmen (the same who a few hours before were good college boys) alighted and with picks, shovels, bars, and hammers set about to tear up the square. The police, thinking that they were street department men, gave them every right of way even to blocking off the streets. After a few hours of hard labor the boys calmly picked up their tools and departed. The pay-off came that evening when the local papers carried a very interesting story of how the college boys had in the midst of a great population carried out such a risky job.



By Gordon Wickre

THIS month we have a man riding on the cowcatcher of a locomotive. The train is 352 yards long, and is approaching the mouth of a dark tunnel at a speed of 40 miles per hour. Now, just as the nose of the engine enters the tunnel, the man crawls up onto the "catwalk" of the engine, along toward the cab, and then runs through the cars to the back platform of the rear coach where he stands till the car emerges from the other end of the tunnel. The total time elapsing from the time that he began his journey to the rear of the train until he again saw the light of day was 100 seconds. How long was the tunnel?

It seems that there was a man who had to work late at the office (at least that's what he told his wife), and it also happens that the electric lights in the building went out. A clerk brought him two candles, both of the same length, and he explained as he lighted them that one would burn for five hours and the other for five hours. Our late-working man finished his work and started for home. As he blew out the candles he noticed that one was exactly four times as long as the other. Now, he had to charge the office for overtime, and he had forgotten to look at his watch. However, from the length of the remaining candles he was able to figure out exactly how long he had been working. Could you do as well?

A contractor has to remove 2,000 tons of rock in 22 days. His steam shovel can remove 63 tons a day. He can rent for $50 per day another shovel which can remove 126 tons a day, but the excavation is narrow so that he can use only one shovel at a time. How much must he pay in rent for the larger shovel if he uses his own machine as much as possible?

Do you like "cryptograms"? See what you can do with this one:

FLISDY HIS AJKIN PLUF TOPNJ QNJUG XSUBBUGR ATJPSNT UG VUFPTN WIGGTW-PUIGF CIET YTZJNPVTGP MIGP HIS DTP PLT TYUPIN EGIM.

Each letter represents some other letter in the alphabet. All that is necessary to make it appear more like English is to substitute the correct letters.

Last Month

Correct answers for the February teasers were received before 8:30 a. m. Thursday from two students, Erhard Prill and Harold Ellis, who share the prize of one dollar.

The answers for February are:

1. He must fall from a height of 74,114.61 ft.
2. Faster cockroach, 13 times; slower cockroach, 8 times.
3. The country maiden's age was 28 years. Some gave an answer of 84; but, after all!

Spring . . .

. . . this Season of Rejuvenation brings to us the need of new merchandising effort . . . the necessity of improving and perfecting our selling plans.

IF you have a sales problem, perhaps we may be of assistance in its solution.

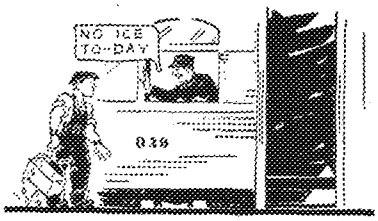
Why not contact us?

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis Saint Paul

G-E Campus News

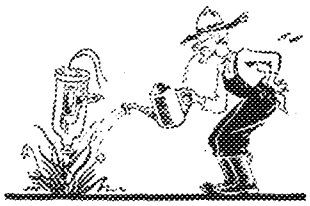


ICE WATER

New electric drinking-water coolers introduced by General Electric have replaced the antiquated ice-cooled type on several prominent Midwestern railroads. This is another step in the modernization program being carried on by railroads to increase passenger traffic.

The new coolers are designed to overcome many disadvantages of the ice-cooled units. With foot operation of the self-contained units, only one hand need be used to get a drink. Cleanliness is promoted because of the absence of ice-filling operations, and the expense for maintenance and service is reduced to a minimum.

The water is automatically maintained at a healthful and refreshing temperature through thermostatic control. Coolers are designed either as self-contained units or as separate cooling and refrigerant condensing units for remote installations in the car.

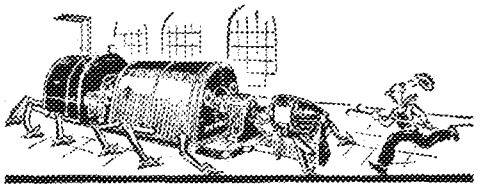


AS VACUUM TUBES GREW UP

As the vacuum tubes grew, they found their style cramped because metal could be sealed to glass only in thin strips. Research took up the problem, and it is now possible to fabricate glass and metal together, in any size or shape, very much as two metals are fabricated.

In a successful glass-to-metal seal, the temperature coefficients of expansion of the glass and the metal must agree exactly over a wide range of temperature. Painstaking investigation—much of it in the General Electric Research Laboratory, at Schenectady—developed new alloys and new glasses, which could be used for this application.

The first application of this new knowledge has been in metal radio tubes, now standard in almost all radio receivers. Power thyratrons, switches, capacitor bushings—all these follow along the new trail. We cannot predict how far this new technique will go, but the possibilities are numerous and inviting.



TURBINE STEEL CREEPS

If the wrong kind of steels were used in turbine construction, the machine would not go creeping across the floor with the operator in hot pursuit, but the results might be even more disastrous.

Part of the increase in efficiency that has come about in the power-generating field in the last few years has been due to increased steam temperatures and pressures. As a result, the modern turbine shell runs, almost literally, red hot. This shell must withstand pressures such as exist half a mile down in the ocean and must keep a 20-ton rotor spinning perfectly in line. Heat softens metal, just as it softens candy, and permits it to stretch. This stretch, however, must be kept to the merest creep—about one part in 1000, if the changes are uniform.

In the Schenectady Works turbine shop, automatic electric furnaces hold samples of turbine steel at the temperature which will occur in the turbine. Gauges, which indicate changes of one part in a million, measure the creep as the pieces are exposed to heat for years at a time. From these tests, the best steel is selected.

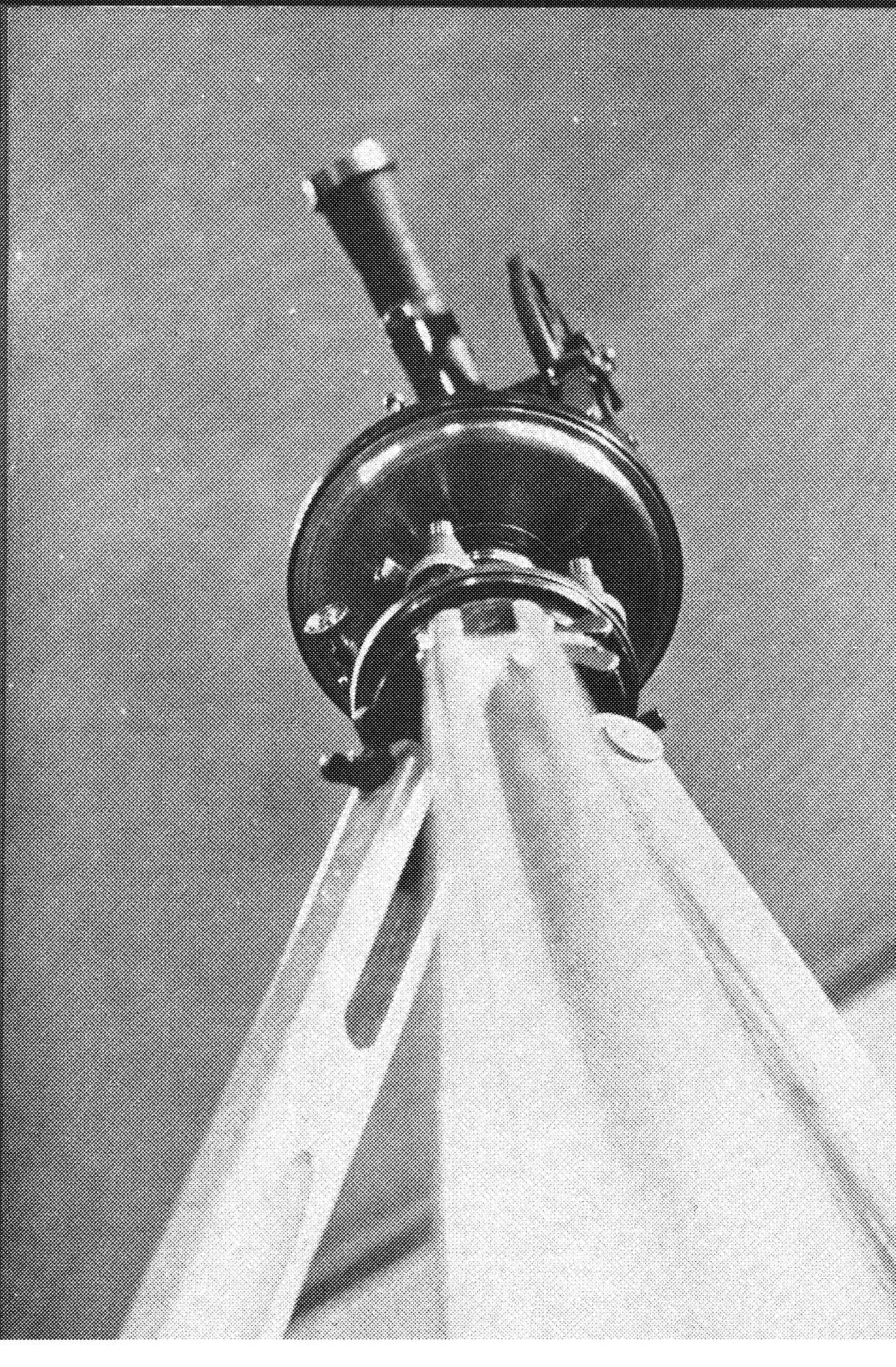
It has been largely due to this research carried on by General Electric that the temperature and pressure of steam used in power generation have been raised to unexpected highs in the last few years.

98-363DH

GENERAL ELECTRIC

Vol. XVII No. 7 April 19

MINNESOTA TECHNO-LO



ngineers
ay Issue

rogram

hings
o See

ighway
oils

Modern
uilding

arriage
rade

roup
ictures

Checkmates Corrosion

Welding aids modern metallurgy to produce completely corrosion-proof assemblies

EQUIPMENT is subject to corrosive attack and consequent deterioration by three forces: chemical attack, electrolysis and erosion. Chemically active gases, liquids, pastes, or solids eat away the more easily attacked portion. Dissimilar metals often set up galvanic currents, which cause pitting and corrosion. High-velocity steam or solid particles in a slurry add mechanical abrasion to the ravages of chemical and galvanic attack.

Welding Prevents Deterioration

Welding is a valuable aid to users and fabricators of equipment for corrosive service. By welding, equipment can be made smooth, jointless—one-piece. Valves and necessary fittings can be faced with corrosion-resistant metal welded in place. Chemical attack can be further prevented by making welds of material similar to the body metal.

Welded assemblies present a smooth, unbroken internal surface. No pockets are formed in which concentration and consequent deterioration can occur.

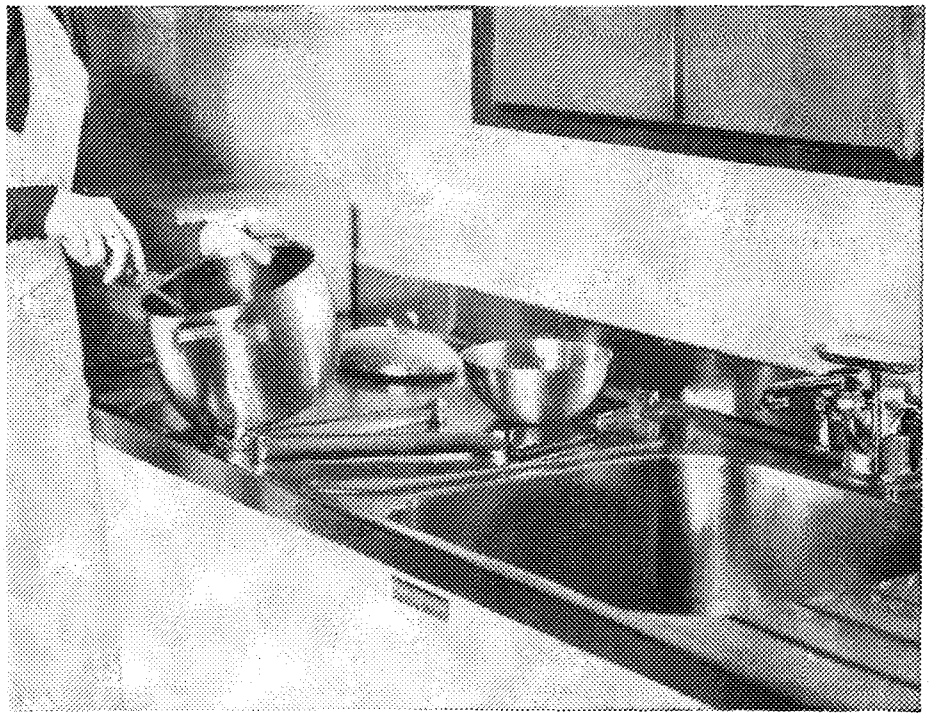
Galvanic attack, which occurs with other types of assembly, ceases to be a factor in welded equipment. In a welded assembly, the same or similar metals are fused together. Perfect electrical contact prevents the damage due to galvanic action. Abrasion by steam, water, or solids is prevented by welding on hard alloys at constrictions and bends.

Welding Stops Corrosion Losses

Abrasion, chemical attack, electrolysis, are defeated on a thousand fronts by welding. New equipment, designed to resist corrosive conditions and fabricated by welding to assure satisfactory performance, is achieving enviable records in service. Equipment which would otherwise be scrapped is renovated and protected against further deterioration. Many corrosion problems, localized in extent, are conquered through the application of resistant materials to the affected parts by welding.

As a result of the successful application of welding to check corrosion losses, industry is saving money. Repair and replacement bills are cut. New machinery and supplies have a longer life, and thus amortization charges are lowered. Less valuable production time is lost through shutdown and accident.

A few of the many ways by which welding checkmates corrosion, selected from actual case histories, appear in the column at the right. These and many other similar welding applications may be utilized in your future business.



THIS ALL-WELDED KITCHEN UNIT includes sink, dishwasher, drainboard, working space, and closets. It is made of stainless steel, welded into a jointless unit which is strong, easy to clean, and resistant to corrosion. Many of the utensils also are of stainless steel.

Welding Savings

In the textile industry, stainless steel is used for dye-vats, tanks, buckets, dippers, and many other purposes. The equipment, welded throughout, resists chemical action, is smooth inside and therefore easily cleaned, and is strong and durable.

* * *

Wear by sandy water had pitted the surfaces of two 42-inch diameter balance needle valves so seriously that the valves would no longer operate efficiently. Twenty-two hours of welding saved these expensive semi-steel castings, which otherwise would have been scrapped.

* * *

In redesigning several 700-gallon tanks for food storage, it was necessary to eliminate an unsanitary and corrosion-ridden condition. The tanks were redesigned to be made from stainless steel with welded joints. The inside and outside are now permanently free from undesirable laps where germs might lodge or corrosion might start.

* * *

Sea water had seriously corroded the impellers of cargo pumps on an oil tanker. Five hours of welding repaired this damage at a fraction of the cost of new parts. Resistant metal used for the repair will prevent recurrence of trouble.

* * *

Welded piping in the floor of a skating rink successfully resists severe corrosion in addition to mechanical stress. No mechanical joint could withstand this service. The piping carries alternately refrigerating brine for freezing the skating surface and steam for melting it.

* * *

Milk storage tanks for a chocolate manufacturer were welded to prevent corrosion and unsanitary conditions. These tanks were fabricated entirely of stainless steel. They were welded to prevent corrosion at the seams as well as off-taste in the milk. The smooth, flush, inside surface left no pockets for chemical and bacterial action to produce spoilage.

* * *

A container for caustic soda solutions, made of Monel metal to resist corrosion, had a cast iron plug in the base. Corrosion troubles were imminent. By welding this and all other joints, corrosion was successfully prevented.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable booklets describing the oxy-acetylene process are available without obligation. For further information write any Linde office.

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

UCC

New York and Principal Cities

In Canada:

Dominion Oxygen Company, Limited, Toronto

Silk-Aire Gabardines

Star in the University Style Picture!

A suit picture of perfection . . . Rated five (*****) stars by college style critics. A suit story full of swaggy smartness and long wear . . . lustrous, supple, trim, tightly woven . . . Silk-Aire holds a press and drapes as does no other fabric. Sparkling new patterns . . . and colors! The most beautiful soft-toned shades of blue, grey, brown, sand and green we've ever seen.

$35

Sport and Lounge Models

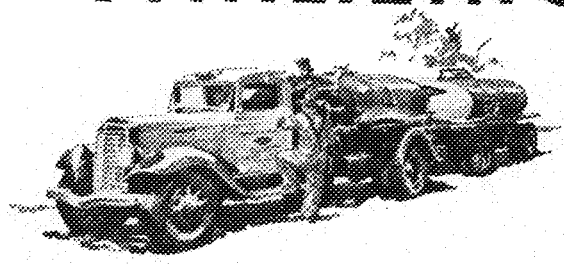
STYLE NOTE—To make additional ensembles, wear the coat with odd slacks. Priced from $4.85 up.

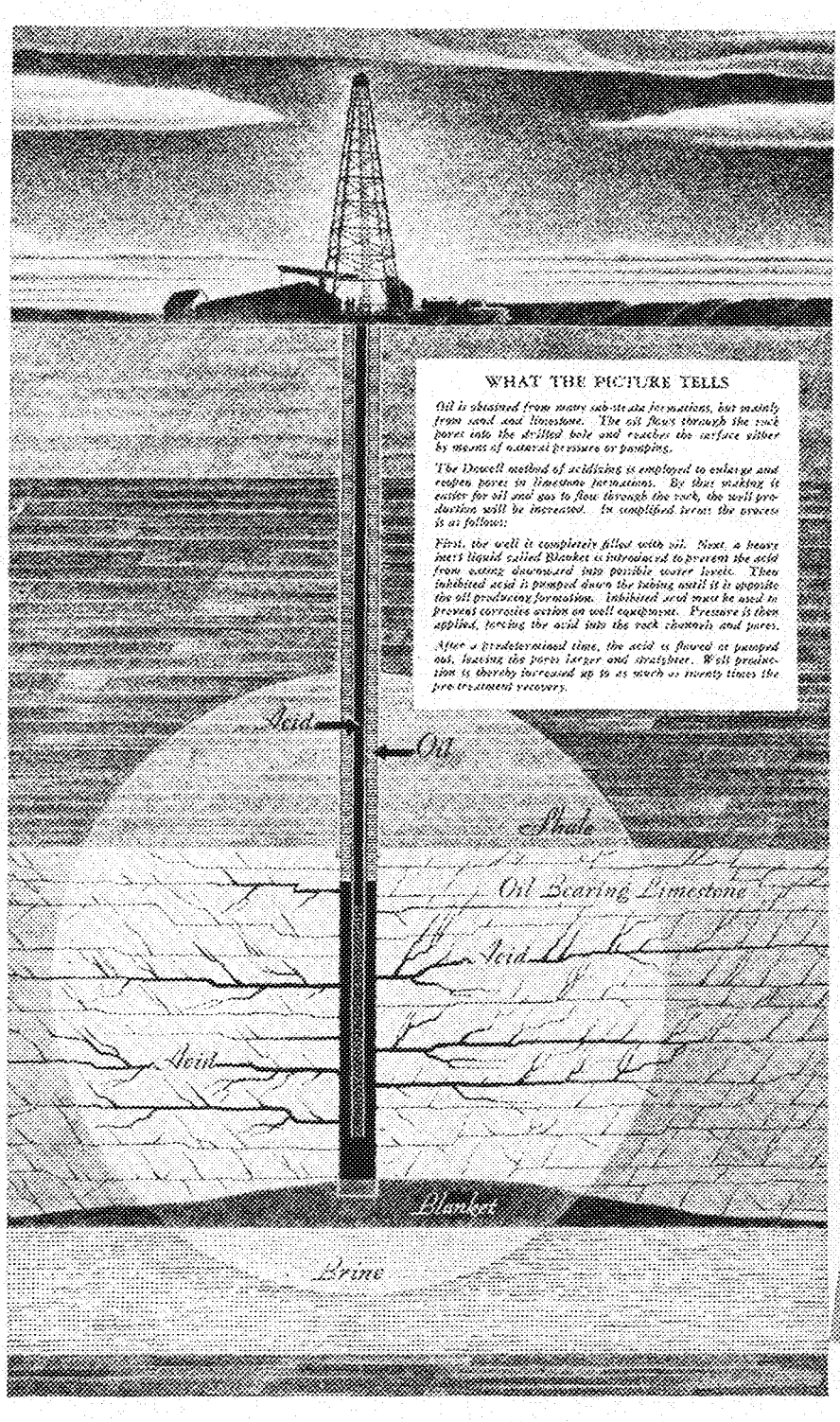
Clothiers — Tailors — Furnishers

JUSTER BROS

On Sixth Street . . . Just Off Nicollet

VITALIZING OIL WELLS VIA *Chemistry*





WHAT THE PICTURE TELLS

Oil is obtained from many sub-strata formations, but mainly from sand and limestone. The oil flows through the rock pores into the drilled hole and reaches the surface either by means of natural pressure or pumping.

The Dowell method of acidizing is employed to enlarge and reopen pores in limestone formations. By thus making it easier for oil and gas to flow through the rock, the well production will be increased. In simplified terms the process is as follows:

First, the well is completely filled with oil. Next, a heavy inert liquid called Blanket is introduced to prevent the acid from eating downward into possible water levels. Then inhibited acid is pumped down the tubing until it is opposite the oil producing formation. Inhibited acid must be used to prevent corrosive action on well equipment. Pressure is then applied, forcing the acid into the rock channels and pores.

After a predetermined time, the acid is flowed or pumped out, leaving the pores larger and straighter. Well production is thereby increased up to as much as twenty times the pre-treatment recovery.

SO VITAL is petroleum in our highly mechanistic age, that it might be said a nation's sword of Damocles is no longer suspended by a thread but by a drop of oil.

Since the days of Colonel Drake who gave America its first commercial oil well in 1859, the discovery and production of petroleum has constituted one of the most vivid chapters in our national development.

Billions of barrels have flowed from the earth's depths in close to one-half of our states—and there is little question that this abundant resource has literally oiled the wheels of American progress.

But, despite our apparently bountiful supply, both known and yet to be discovered, the need for more efficient and conservative production of petroleum has been long regarded as essential.

A sizable stride in this direction was taken when, five years ago, Dow brought to the oil-producing industry through its subsidiary, Dowell Incorporated, a specialized chemical service for oil wells.

Whereas formerly, through natural and mechanical means, oil producers extracted approximately twenty per cent of the potential petroleum accumulation, by putting chemistry to work they stepped recovery up to double, and even triple this amount.

Stripped of technicalities, Dowell undertakes through special acids and chemicals to overcome natural barriers to greater oil production in areas where oil is produced from limestone or dolomitic formations. To render this service, Dowell maintains headquarters at Tulsa, Oklahoma, and a complete field organization located in the principal oil fields.

To date is has treated over 9,000 wells, resulting in approximately $50,000,000 gain to the oil industry. In servicing these wells, Dowell trucks and cars have traveled 4,500,000 miles and its treating engineers have handled over 15,000,000 gallons of special acid.

Thus, Dow research and chemical application reaches out into another channel of usefulness—promoting and developing the value of a great national resource.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

Branch Sales Offices: 30 Rockefeller Plaza, New York City
Second & Madison Sts., St. Louis • 135 S. LaSalle, Chicago

Are You A

CANDID CAMERA

Enthusiast?

PICTURES are wanted! TECHNO-LOG *is sponsoring a snapshot contest in order to replenish its files for future reference for Engineers Day Issues, covers, etc. Submit all pictures with description and name on back to* TECHNO-LOG *office.*

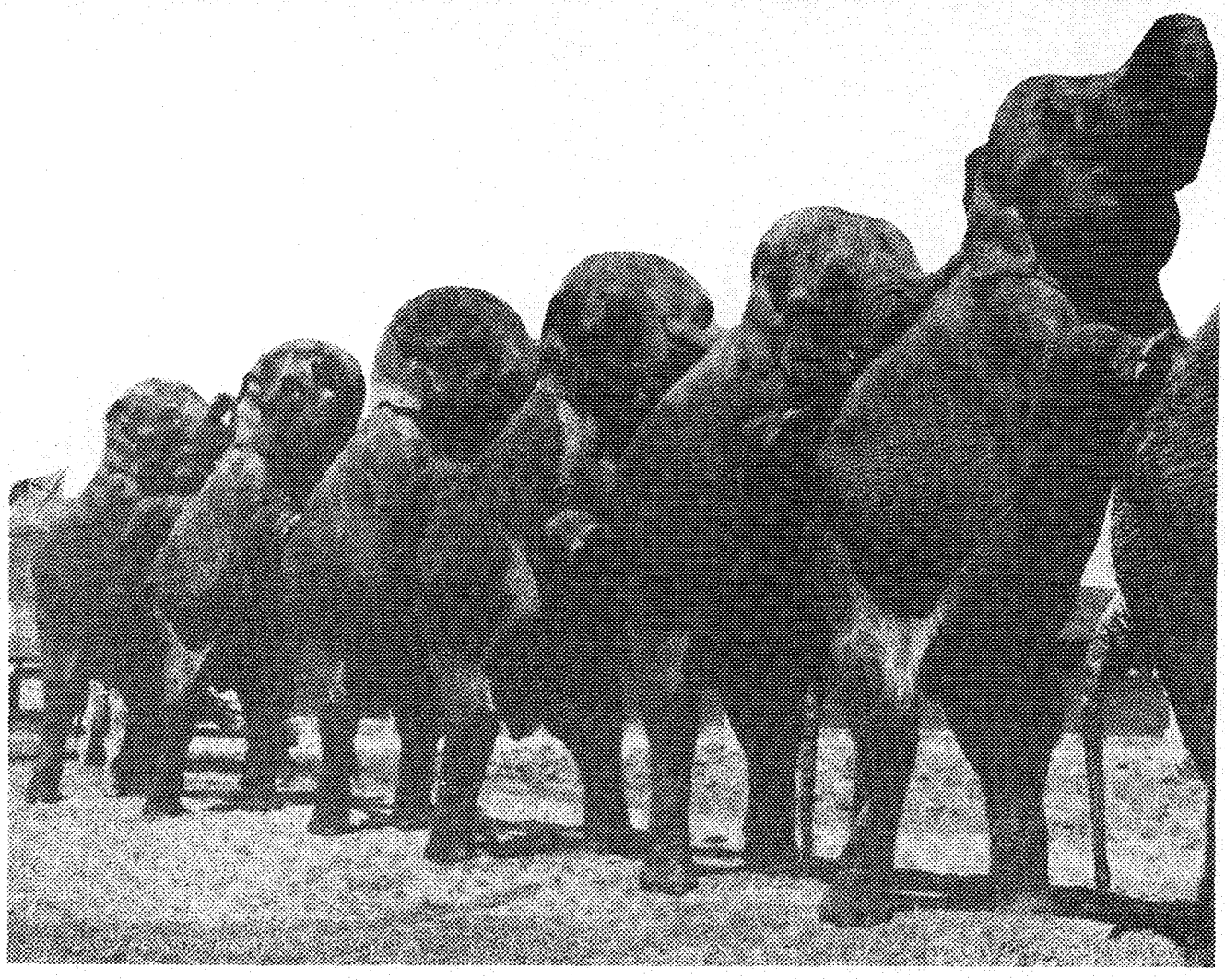
Engineers Day offers one of the finest chances of the year to get pictures of the biggest of all Tech activities. The various open-houses will give all the interesting aspects of the different branches in all of the finery. And the parade, with its many humorous and excellent exhibits, will offer many an opportunity to get first prize (special consideration will be given snaps of the prize winning floats).

Classes at work, pictures of the profs (especially of that "Wilcox Smile"), all of these offer interesting subject material, and these sunny spring days should lend themselves to some sharp, clear pictures.

Drop around to the office for some more ideas.

Rules

1. All pictures submitted will become the property of the Techno-Log.
2. The contest opens April 9, and will continue through May 4.
3. First prize will be $2.50, second prize $1.50, and third prize $1.00.
4. All students submitting pictures must be registered in I. of T.
5. Members of the Techno-Log staff will not be eligible for any of the prize money.
6. Judges will be the editors of Techno-Log, and their decision will be final.
7. Pictures will be judged on subject material and excellence of photography.
8. The area of the print must be at least 9 square inches.



Two Million Americans NEVER SAW AN ELEPHANT

THAT'S why the circus will come back this year. "Same old stuff," you say — same stunts, same clowns, same animals, same ballyhoo you saw when you were a kid. Yes, largely true of course; but since that same old elephant stalked through the streets a year ago, two million new Americans will have arrived in this country—two million *more* people who have never seen an elephant.

And in that same interval, a million boys will reach the girl-crazy stage and start shaving the fuzz off their chins for the benefit of another million young women suddenly become acutely clothes and cosmetic conscious. Another two million folks will up and get married—start new homes, buy new furniture, new dishes, new lines. Yesterday they "weren't interested," today they are—and tomorrow other people will be.

That's why the same old elephant walks around serenely confident that among every bored group of people who say, "That's just an elephant," some eager voice will shout, "Oh—*that's* an elephant!"

When you advertise your product, you are not talking to a *grandstand*, but rather to a *parade* that is constantly on the move with new faces—new buyers—coming into the picture every day.—*Anon.*

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

APRIL, 1937

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Franzen, Pres. Erling Helland, Vice Pres. Loren Frickland, Sec'y Elwood McGee, Transit Corres. Reynold Bjorck, Treas.	Chi Epsilon
Richard Longiellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Beckland, Treas.	Eta Kappa Nu
Edward Kaiser, Pres. John Hollihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Robert Hose, Pres. Henry Ritta, Sec'y	The Commacini

This Month

VOLUME XVII NUMBER 7

Officers of the Professional Societies

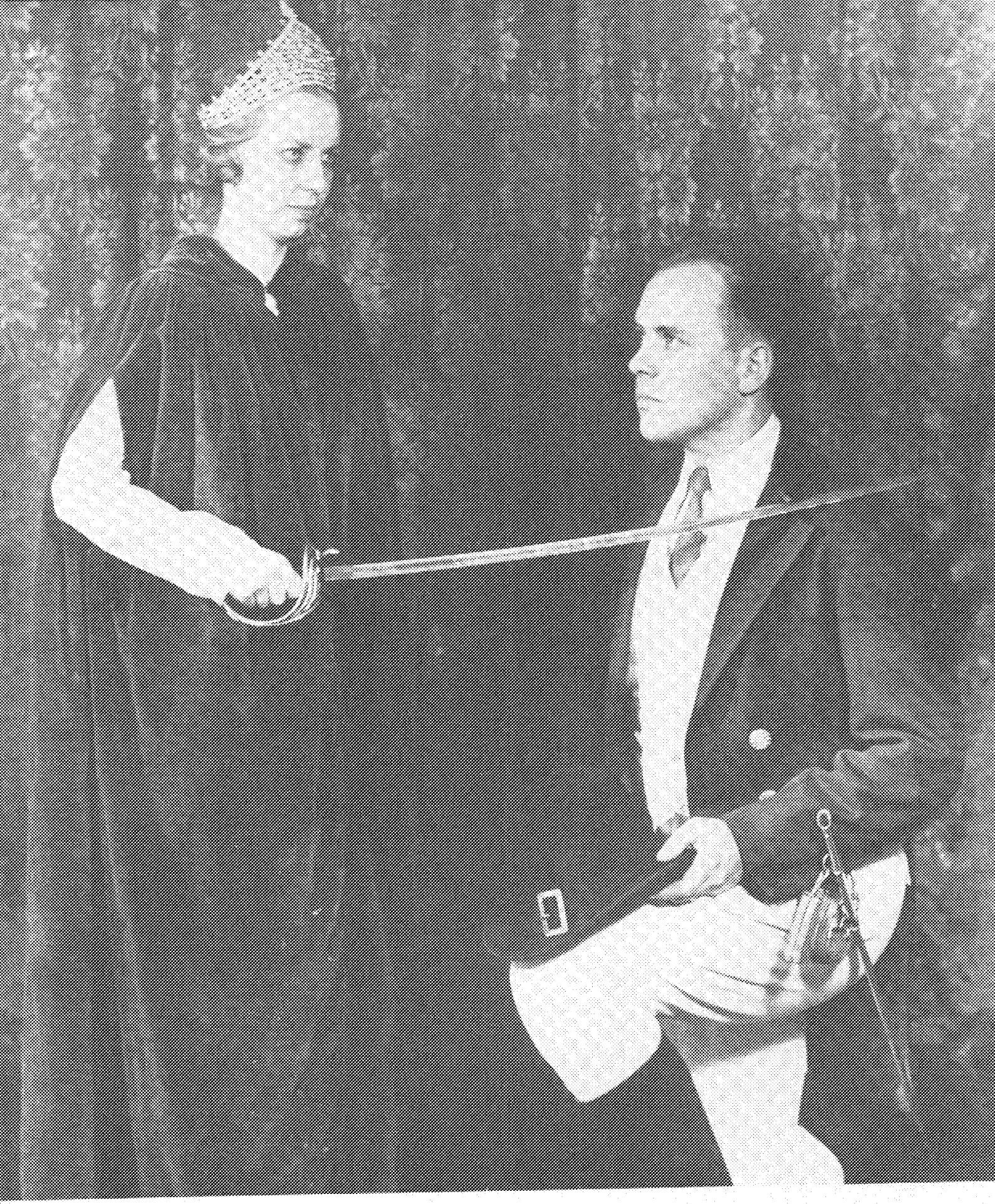
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Beckland, Pres. Farry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Prahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. John Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Woodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Alkire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
New York Univ. Quadrangle
North Dakota State Engineer
Ohio State Engineer
Oregon State Technical Record
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Villanova Engineer
Washington State Engineer
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, Main 8177, Extension 314. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



The Queen — **St. Pat**

Betty Vincent, Int. Arch. '37

Thomas Klingel, C. E. '37

ENGINEERS DAY 1937

Program of the Day

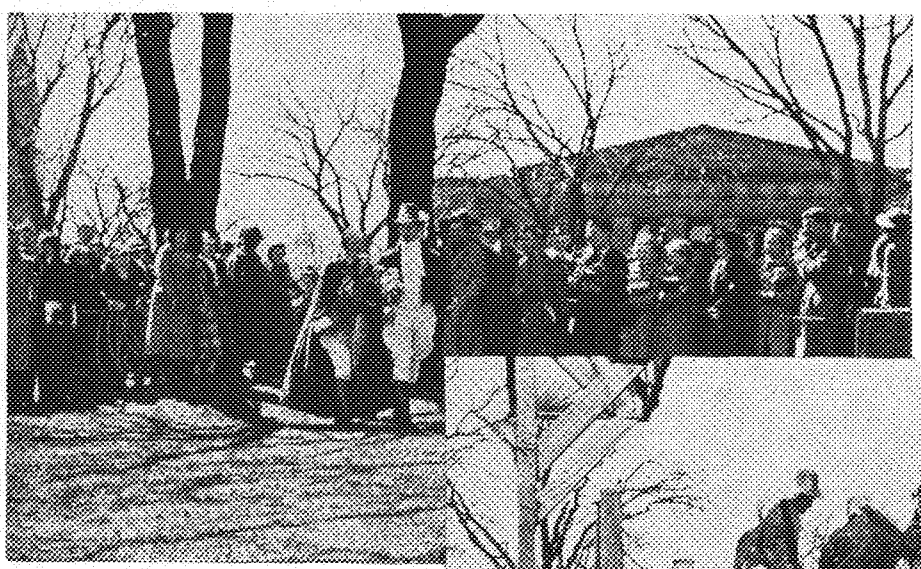
Thursday

7:30- 9:30 P. M.—Open House at all buildings

Friday

10:30-11:30 A. M.—Parade
11:30-12:30 P. M.—Knighting
12:30- 2:00 P. M.—Luncheons
(1) St. Pat and Queen
(2) Alumni at clubs and fraternities
1:30- 3:30 P. M.—Athletic Contests
3:30- 5:30 P. M.—Dansant
9:00- 1:00 P. M.—Engineers Brawl

Leo Funke has been general arrangements chairman for Engineers Day.



Knighting ceremonies of last year.

1936

Exhibits

Aeronautical Open House

David Weeks, Chairman

Armory

Different types of airplanes on display	Basketball floor
Motors on display	Basement
Constructional parts of planes and gliders	North wing

Experimental Engineering

Wind tunnel mounted airplane model
Motor running on test stand

Ag. Eng. Open House

Eugene Hesli, Chairman

Main Engineering

Showing of motion pictures	First Floor

Chemistry Open House

Elias Amdur, Chairman

Chemistry Building

Complete biennial show put on by the school of Chemistry. See the article in this issue for complete details

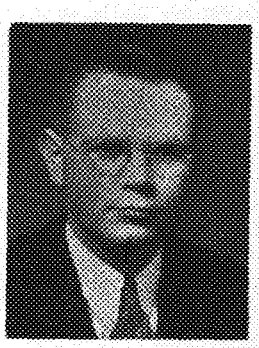
Mines Open House

Rawson Aikire, Chairman

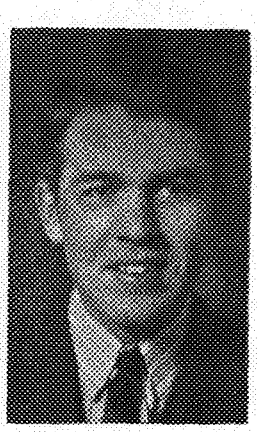
Mines Building

Registration of visitors and model exhibits	Library
Blueprinted souvenir programs	
Exhibits and demonstrations	Metallography lab.
Drawings and model mines	Junior drafting room
Exhibits and demonstrations	Ore dressing lab.
Moving pictures from the Bureau of Mines	
Petroleum exhibits	
Exhibits and demonstrations	Assay lab.
Miscellaneous exhibits	

Student



Sherman Finger, Jr.



Clifford Ryan

General

Aero Open House
David Weeks, chmn.
Lloyd Nelson
Bob Burns
Don Benson
Harold Schmidt
Goodwin Luck

Ag. Open House
Eugene Hesli, chmn.
Ray McVeety
Gordon Moore
Charles Snyder

Arch. Open House
Verner Johnson, chmn.
Laurence Haugen
John Wenzel

Chem. Open House
Elias Amdur, chmn.
Charles Berger
Burnell Carlin
Maurice Jusier
Fred Geiger

Civil Open House
Robert Baker, chmn.
Ken O'Brien
Wilson Brown
Richard Carlson

Elec. Open House
Hugo Hesse, chmn.
Perry Morris
Ogden Prestholdt
Lyle Hanson

Mech. Open House
Edwin Hage, chmn.
Arnold Matthies
William Hanson

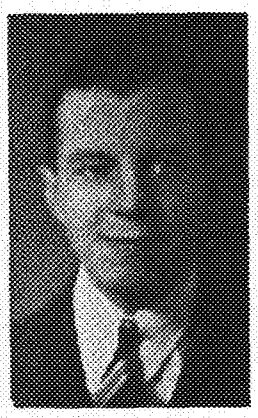
Mines Open House
Rawson Aikire, chmn.
Harry A. Larson
Donald Scott
Howard Nordquist

Brawl
Merle Wiltrout, chmn.
M. C. Rudawsky
Joe Tucker
Robert Nichols

Broadcast
Bertil Lindquist, chmn.
Robert Moore
Don Erickson

Buttons
Jane Bossen, co-chmn.
Mary Lindsey, co-chmn.
Priscilla Wrenn
Doris Eckman
Martha Bates
Betsey Ann Nuessle
Jean Westlake

Committees



William Lowe

Jack Mace

Arrangements

Dansant
Dorothy Ebel, chmn.
Phyllis Borger
Martha Granger
Amy Gene Kilpatrick
John Pitblado
Thomas Jackson

Field Meet
Edward Pierson, chmn.
Henry Lykken
Alfred Anderson
Don Reed
Norman Serigstad

Green Tea
Dorothy Kipp, chmn.
Helen Miller
Elaine Hanson
Idell Hillman
Martha Holt

Knighting
John Gerstenmaier, chmn.
Franklin Renstrom
Alfred Dreher
Asbjorn Severson
Jim Kemper

Office
Ronald Pfleider, chmn.
Jack Junghauer
Merlin Pugh
Paul Feyereisen
Howard Baer

Parade
Clement Scully, chmn.
Fred Anderly
Fred Rule
Raymond Day
Jack Richmond

Posters
Richard Johnson, chmn.
Don Lanipland
Donald Garrison
James Cooper
John Liggett

Printing
Donald Brewer, chmn.
Clayton Johnson
Kay Huebscher
Wallace Lien

Tickets
John Arnot, chmn.
William Benn
Donald Sutcliffe
Donald Knight
Edwin De Werff

Campus Publicity
Robert McDonald, chmn.
Eldred Nelson
Frank Larson
Jack Nickols

Off-Campus Publicity
John Murray, chmn.
Charles Colby
Richard Pratt
Edwin Seder

Exhibits

Civil Open House

Robert Bazer, Chairman

Main Engineering

Blueprint souvenirs	
Instrument display	Room 217
Map exhibit	Room 229
Moving pictures	Room 106

Electrical Open House

Hugo Hesse, Chairman

Electrical Building

High tension	Main lab.
Signal corps exhibit	Left lab. balcony
Electrical stunts	Main lab.
Oscilloscope	Third floor
Instrument display	Sophomore lab.
Illumination display	
Commercial display	
Radio station WLP	Third floor

Mechanical Open House

Edwin Hack, Chairman

Mechanical Building

Machine design models	Room 50
Making ash trays	Foundry shop
Walking sticks	Forge shop
Paper weights	Machine shop
Candlesticks	Machine shop

Experimental Engineering
Hot air engine

Architecture Open House

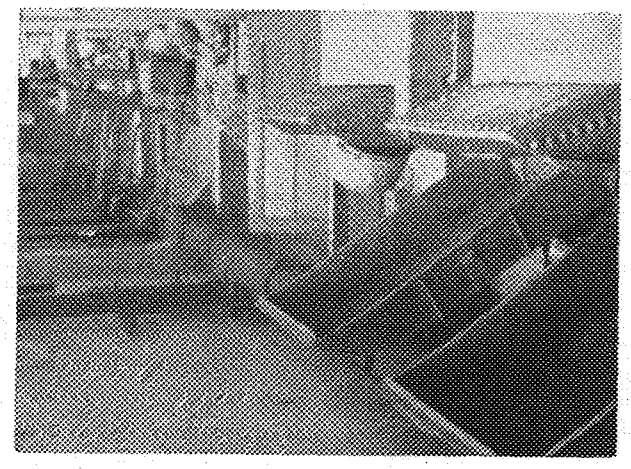
Vernes Johnson, Chairman

Main Eng. Auditorium
Green Tea, 3:00 to 5:00 p. m.

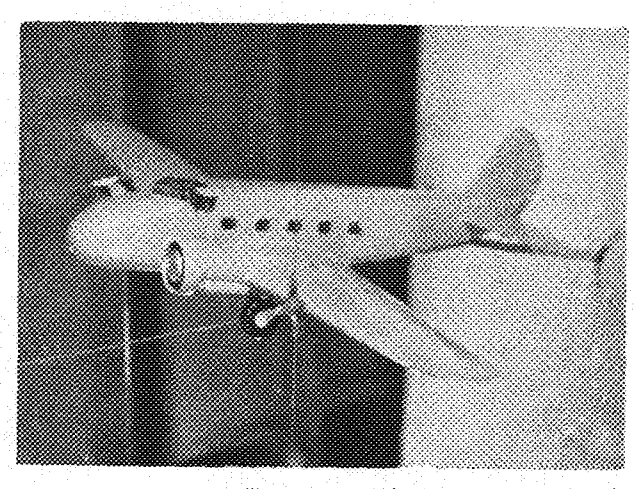
Main Eng. Third Floor
Water colors
Charcoal and pencil life drawings
Architectural design problems
Interior design problems
Murals

Things to See

In the Buildings of the Institute

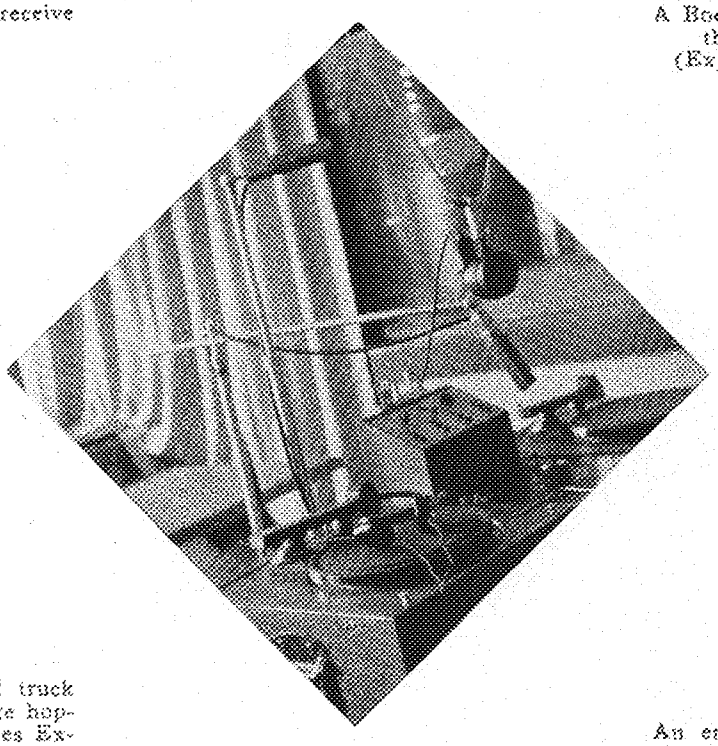


Drying ovens gape widely to receive their ore. (Mines.)



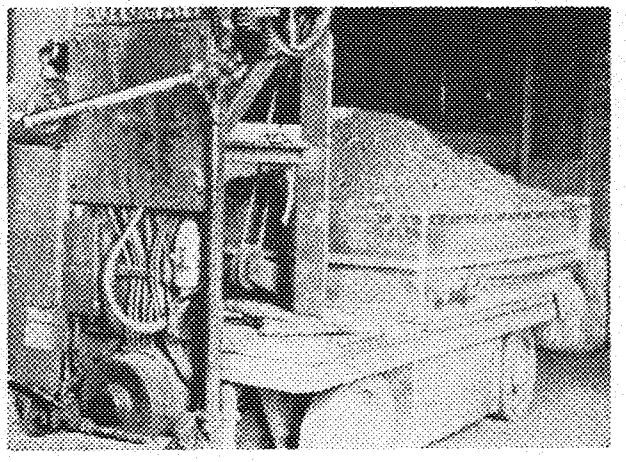
A Boeing model set up for testing in the Göttengen Wind Tunnel. (Experimental Engineering Bldg.)

WLB

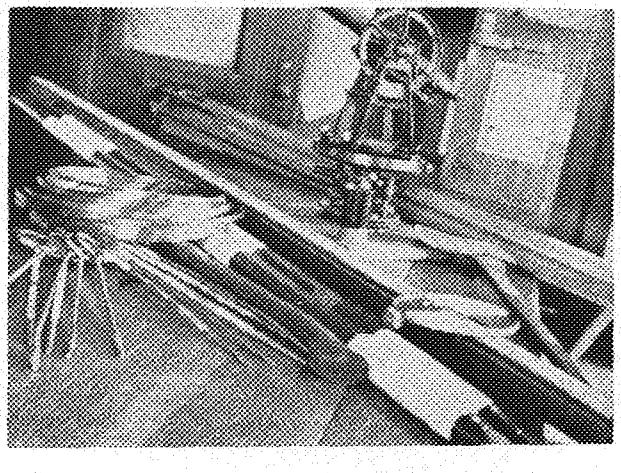


STUDIO

This storage battery powered truck brings the ore from the storage hoppers to the log-washers. (Mines Experiment Station.)



An embryo Civil's equipment for a day in the field.



Things to See

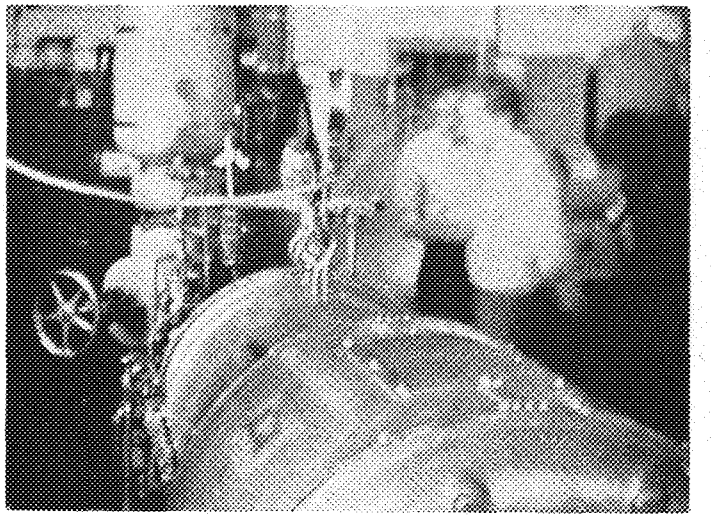
With the Engineers of the Institute

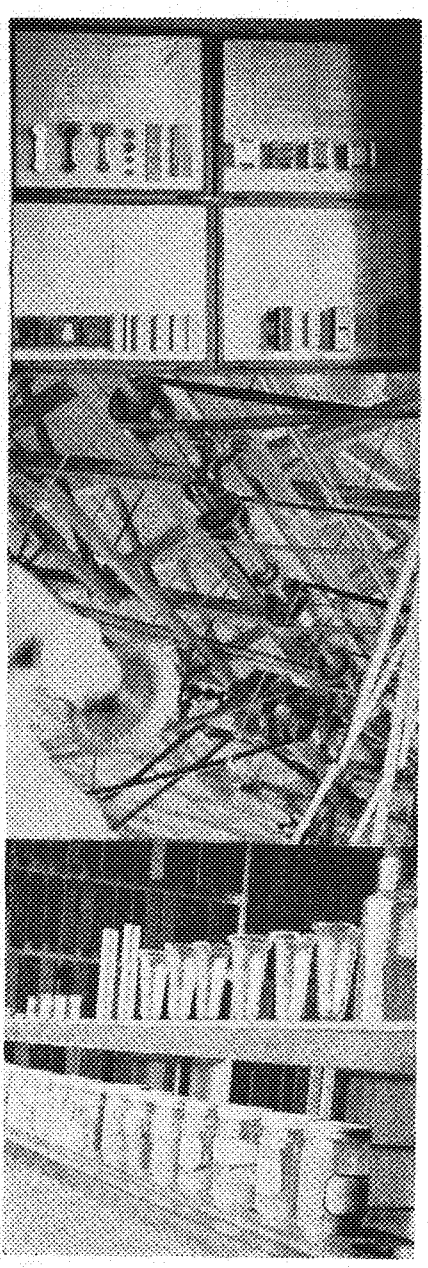
"No leisure time for technical students" might epitomize the adjacent picture of senior ME's testing a steam turbine on a Saturday afternoon in the steam division of the Institute.

Engineering courses have never been known as pipes for easy credits, but these students are foregoing their Saturday afternoon diversions in the midst of sitdown strikes and demands for shorter hours in industry.

Only recently one professor in engineering commented upon a drawing for the new Union which was entitled, "Where students will spend their leisure time," with a sly grin, "My students don't have any leisure time; they work all the time."

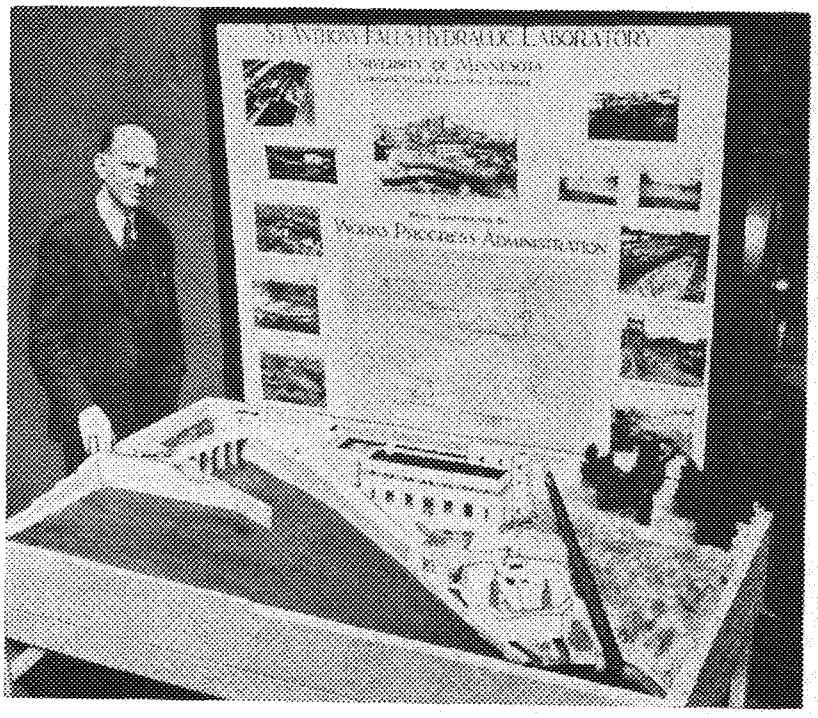
However, the students who carried out this test, like many others, did not feel that any hardship had been imposed upon them; but instead were anxious to conduct the test on the steam turbine in the Mechanical Engineering building on a Saturday afternoon to avoid conflict with other students using the laboratory equipment and to obtain suitable load conditions under which to run the test.





At the left is what the cameraman saw in the pattern shop on the second floor of the Mechanical Engineering Building. The top picture in the panel shows the various stages in the making of patterns; the center section is a view of the maze of power distribution belting and pulleys in the pattern lab; the lower view was taken in the lacquering room, and wood panels in the background are samples for a color system.

Dr. Straub exhibits a model of the New Hydraulics Laboratory located on Hennepin Island, north of the University Campus.



122 Holes at Once

Multiple drilling not only speeds up production but also assures uniform accuracy. On this multiple driller, 122 holes are drilled at once on four faces. Cut courtesy of International Harvester Company

Soils Control For Highways

Vertical Surveys of Roadbeds

By Eugene Woodfill, C.E. '37

HIGHWAY soils engineer? Perhaps you say, what are they, or, I've never seen that course offered in the University curriculum. Well, a highway soil engineer is a civil engineer gone specialist. He has chosen to make his extensive study on the soil problems that confront the construction and maintenance highway engineer.

Before 1925, little was understood regarding soils and their relationship to construction and maintenance highway problems. Very few students will remember the early days of our automobile and highway development, but the professors will more vividly remember those aggravating and distressing afternoons spent in the early spring pushing their "horseless carriages" out of the local mud when the spring breakup took place. These days are fast disappearing with the more recent developments in highway construction. It was about this time that various States, as well as our National Government, concluded that it was about time that some investigations should be made, and some departments set up to carry on these investigations of soils and soil stability.

Many studies were made more closely to determine the relationship between the soil and its various field properties, such as drainage, frost heaves and frost boils, sliding, swelling during wet weather and conversely shrinking during dry seasons, and the ability of the soil to support heavy loads and the effect when the load passed. From these studies, it was determined that not all soil difficulties could be remedied by the old "cure-all" of applying drainage for almost any difficulty that arose on the road surface or in the subgrade. It was found that drainage was effective only in soils of a certain texture. At this point perhaps we should define the term texture, which refers to the size of the individual soil particles and the proportion of material of each size, and may be illustrated by the common terms in texture such as sand, clay, loam, etc. In Minnesota there may be a wide variation in soil textures in the soil profile. The soil profile is defined as a vertical cross section through the soil to the unaltered parent material. This difference in texture may be caused by various natural effects: namely, the effect of the parent material from which the soils were formed and soil forming processes; and, more likely in Minnesota, glacial outwashes and deposits that have invaded Minnesota in prehistoric times. Each of these glaciers moved with it different materials, thus it is not unusual to find pockets of soil whose texture greatly differs from the surrounding soils.

Frost heaves and frost boils could not wholly be remedied by drainage treatments; but, due to the properties of the soil and the surrounding characteristics of the topography, it was found that it was often necessary to remove the soil that was effecting the undesirable road conditions and to replace it with a more suitable soil. It was found, through field examinations and laboratory tests, that the soils causing undesirable road conditions displayed such characteristics in their mechanical composition that the action of these soils could be predetermined by laboratory tests. It was through these extensive studies that various highway departments all over the country found it extremely profitable to establish a division of soils with men specially trained to study the soils on the right-of-way of new highway construction as well as to suggest corrective methods for recurring annual maintenance problems. The solving of these construction and maintenance problems led to the development of a routine method

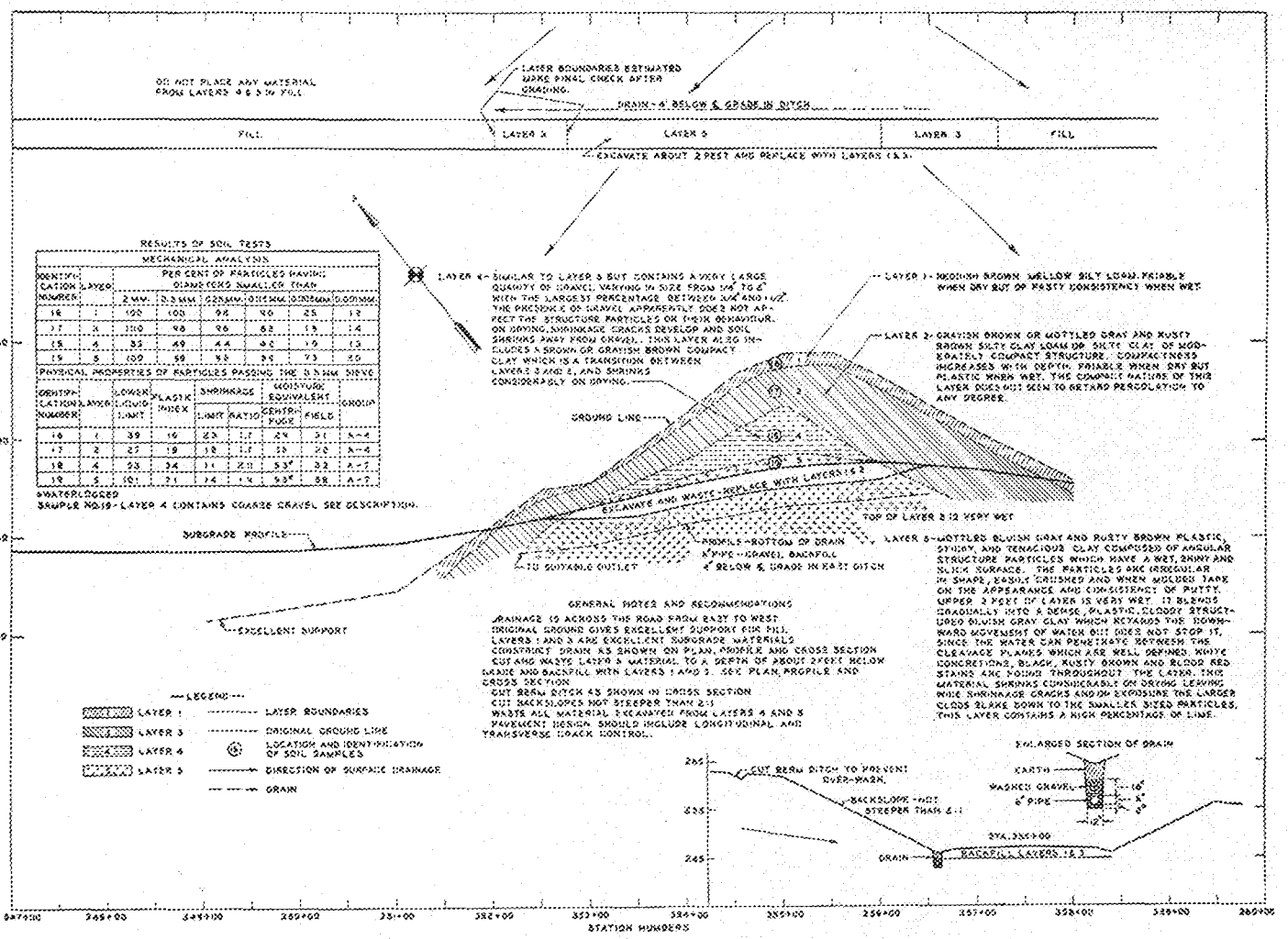


FIGURE 8.—SUBGRADE SURVEY SHEET FOR THE DESIGN OF NEW ROAD

Typical subgrade survey sheet for the design of a new road showing the soil profile and the recommendations as made by the soils engineer. *From Public Roads*

of attack. This method incorporates a soils subgrade survey and soil profile studies and should not be confused with the type of survey carried on for agricultural purposes by the Department of Agriculture. The Department of Agriculture makes soil surveys to determine the soil characteristics and texture of the uppermost portion of the earth's mantle; these different soil characteristics and textures are plotted as areas on a map, but highway soils surveys are straight line surveys which determine the texture of the soil down into the ground many feet. Highway subgrade surveys consist of a determination of the various types and texture of soils existing on the center line of a proposed road for new construction, and the determination of the type and texture of the soil in troublesome sections of existing roads. In this paper, subgrade surveys will be detailed from the point of surveys run for new construction.

The soils engineer makes the subgrade survey to obtain the necessary data to make a comprehensive study, so that recommendations may be made regarding desirable movements of the center line of the road, both horizontally and vertically, in order to avoid undesirable subgrade conditions. The engineer must make a selection of suitable fill material, and also determine the location of borrow pits, if necessary. The design of the wearing surface may be greatly influenced by results obtained in the soils survey. The thickness of the wearing surface is dependent upon the type of subsoil and the situation of the soil. The soils engineer may select and conserve the desirable soils so that they may be used to the best advantage. When desirable soils are not plentiful, the engineer may conserve the good soil that does exist; and, by using the poor soils in places where they will have no effect on the road and placing the good soils directly under the wearing surface, it is possible to design a more economical wearing surface. When this method is used, it is often necessary to stock pile good soil and to cut below the grade line in the poor soil; the extra cost of excavation is usually surpassed by the savings in the cost of the wearing surface. The engineer, in his determinations and studies, may also furnish valuable data regarding the condition of drainage, as affected by ground water, capillary water, and degree of percolation.

The subgrade survey starts as soon as the locating parties determine the proposed best center line and the plans department determine a tentative grade line. The soils engineer receives a ground line profile of the proposed center line with the tentative grade line on it. The soil engineer then enters the field with a one and one-half inch soil auger, which may be extended in three foot lengths to any desirable total length; this tool is used to investigate potential subgrade soils and to take soil samples. The engineer also has a pick and shovel to obtain surface samples, and necessary bags to be used as contain-

ers and labels to identify the samples that are sent to the laboratory for a more complete examination. Holes are to be drilled along the center line of the proposed road at intervals of about 50 feet where no changes seem to be taking place in the various layers of soil. These borings are taken to a depth of at least three feet below the proposed grade line. This 50 feet interval for sampling is not by any means rigid, but rather is offered for normal conditions. When there is little change in the topography there is usually little change in the soil profile, and it is not necessary to limit the distance between borings to 50 feet; they may even be extended to 100 feet. Borings are only taken in proposed cuts. While in fills, a determination usually is made in the field regarding the ability of the ground to support the fill that is to be made. When the topography is very rolling and consequently the grade changes are often, the engineer may likewise find rapid changes taking place in the soil profile, thus making it necessary for him often to take borings more frequently than the 50 foot interval.

When the point of sampling is determined, the auger is started into the soil, and at each pull out the engineer examines the soil that clings to the auger. At this time the specially trained engineer determines the texture, color, consistency, and relative compaction; this may take one or two minutes. This sampling is continued to a depth as before stated. When the engineer examines the soil at the pull out, he is able to determine the depth at which there is a change in texture. It is the depth of the regular layers of soil of a given texture, and the depth of the introduction of new layers of unknown soil texture that the engineer is interested in. For each different type and texture that is encountered on the survey, a sizeable representative sample of three to five pounds is placed in a bag and properly labeled. This is sent to a laboratory to make a complete determination of the physical properties and the mechanical analysis of the soil.

After all the field data has been assembled and the soil reports on the physical properties and the mechanical analysis from the laboratories has been gathered together, the soils profiles are plotted. This makes it possible to review all the data and study the conditions, so the soils engineer may make suggestions and recommendations to the construction engineer. These recommendations may include suggestions for movement of the center line, a detail of the drainage facilities, the location of borrow pits, the condition of subgrade, the condition of the ground where fills are to be made, and the necessary back fills and the location of the material to be used in back filling so that the best soil may be conserved and some of the soil hazards that exist in nature may be corrected.

It may seem that such details that may be corrected by the soils engineer are trivial, but this is not the case when these details are converted to costs. The soil engineers have saved large amounts of money that before was charged to annual maintenance costs, which in reality could be traced to undesirable subgrade condition. Most all of us have ridden over wavy pavements which were caused by large cracks or warped slabs. In most cases, these undesirable features may be traced directly to unstable subgrades, or to improper subgrade treatment before applying concrete surfaces. After a period of years, far short of the normal life of concrete pavements, these road surfaces must be replaced. The work of the soils engineer has been a great factor in the development of stable fills, that is, fills which are not subject to sliding and swelling and shrinkage under different weather conditions. We, in Minnesota, have had a great many unfortunate experiences with frost heaves and frost boils, which result in sections of our roads being bumpy during the winter season and impassable during the spring breakups. It is very well known to highway engineers that in most cases the trouble may be traced directly to the texture of the subsoil. Vast sums of money have been expended to remove these sections that are effected by frost heaves and frost boils by excavating the undesirable soil, and replacing it with a soil having the proper texture that is not subject to this common fault. It is through the work of the soils engineer in the past, and his savings of money that may be spent for other purposes, that he has justified his existence. This type of work has a much broader field, other than the work of the highway soils engineer in the field; the soils engineer has been instrumental in the development of low cost stabilized roads.

It was through constant experimenting by the soils engineer to develop a low cost stabilized road that we now have methods available to stabilize the gravel roads of the past. Stabilizing affects the road by making a more dense and compact surface which is, to a great extent, dust free and does not soften in wet or ravel and become rough in dry weather. The work of the soils engineer does not stop with the development of stabilizing and stabilized roads, but on each job the soils engineer locates the stabilizing materials which will include binder, or clay, and sand and gravel. He not only locates the material but supervises the mixing and adding of salts as well as the placing of the stabilized mix on a suitable subgrade.

The stabilizing field has taken on a new value during recent years because of the necessity of developing a low cost road that may literally "get the farmer out of the mud." The soils engineer has not completely solved all of the problems that have developed in the stabilizing of low cost roads, but the highway soils engineer is constantly experimenting and doing research work to make new developments in all types of highway soils engineering, as well as correct the defects that have developed in the past.

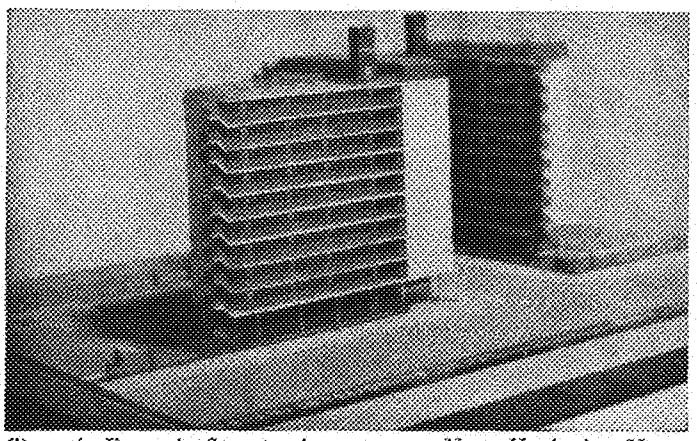
ISO-TOPICS

Chemical metal coloring is now possible without the use of chemical processes. A new enamel, when mixed with clear lacquer, is semi-transparent and produces a colored effect that is fast to light as well as durable. Suggested applications are compacts, lighting fixtures, and articles where a colored metallic finish is wanted.

Manufacturers of DuPrene have announced that the product will henceforth be called neoprene. The new name will not be trademarked and it is intended that it be adopted as a generic term for chloroprene polymers. Neoprene is used where rubber-like properties as well as resistance to deterioration by oils, gasoline, solvents, refrigerants, ozone, and sunlight are required.

MODERN ARCHITECTURE

Little Gallery Exhibit Shows New Methods In Building



Chrystie-Forsyth Streets Apartments, New York, by Howe and Lescaze, show development of mass housing.

By Idell Hillman, A '39

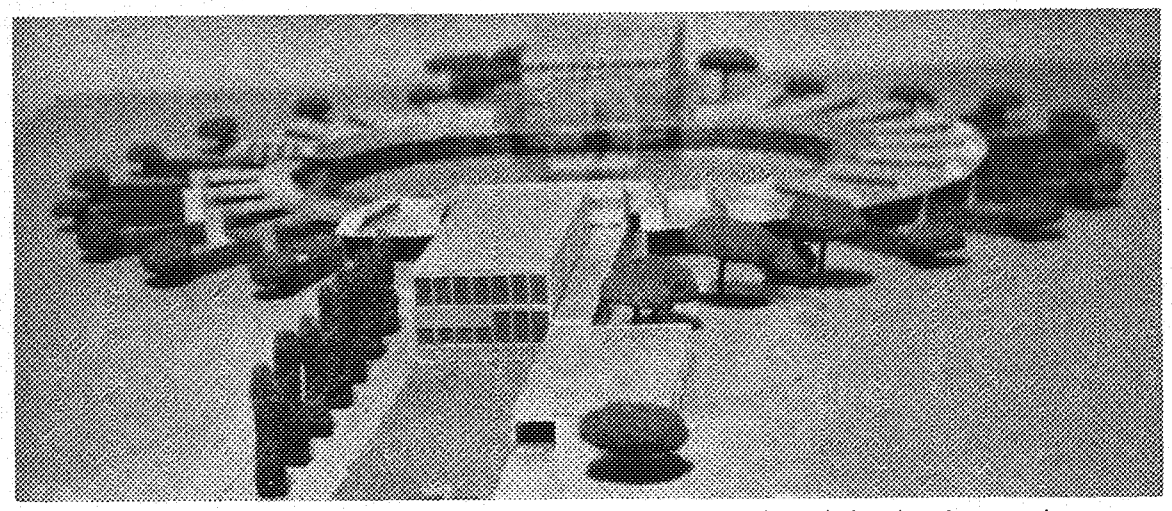
WITH the present showing of the Modern Architecture Exhibit in the Little Art Gallery on the top floor of the Northrop Memorial Auditorium, April 3 to May 1, it is of interest to learn something of the recent half-million dollar exhibition from which the Gallery's collection is a small part. Just a mere sight-seeing tour through the rooms will mean little to the average observer; therefore, to aid in the appreciation of an ever-growing and important part of our modern life, the following explanation of modern architecture is presented, with highlights on its present day leaders and their methods of developing all that architecture can boast of today. Pictures of the original models, as shown in the East, are here with some of the original models themselves. Many projects and designs not discussed are shown, but it is felt that with these explanations the remaining portion of the exhibit is attractive and interesting enough to be self-explanatory.

It is a general belief that exhibitions, expositions, and competitions are the primary factors in developing new trends in modern living. This especially holds true in the fields of architecture. With the Columbia Exposition of 1893 in Chicago, a taste for the Classic Revival was definitely established. In 1922, the *Chicago Tribune* Competition, although it brought forth a variety of Gothic Renaissance and Roman influence, re-established Sullivan's ideal for an original and modern style through Saarinen's inspiring project. In 1925 the Exposition of Decorative Arts in Paris opened the eyes of American architects to a modern form of decoration to be used with modern construction. And with the Exhibition of Modern Architecture in 1932, the progress of a new and modern architecture was shown. The development and use of the International style was displayed in models by recognized practicing authorities of the day, and principles of new construction were exhibited. In all, it was a climax to the past, and a challenge to the future.

The International Exposition of Modern Architecture was held in the Museum of Modern Art in New York from February 10 to March 23, 1932. Twelve different institutions located throughout the United States subscribed to the exhibition; and fifty-two patrons contributed to the showing with models, pictures, information, time, or suggestions. The exhibiting architects were Frank Lloyd Wright, Walter Gropius, Le Corbusier, J. J. P. Oud, Miës Van Der Rohe, Raymond Hood, Howe and Lescaze, Richard J. Neutra, and the Bowman Brothers. A special portion of the exhibition recognized the ever-growing problems of housing with models of proposed plans by Otto Haesler and others.

The most interesting and probably the most important feature of the exhibition was the development to date of the International Style which originated as a post-war style in Europe. It is a style typical of the twentieth century in appearance and structure and has been developing in several different countries at the same time. Because of its world-wide distribution, it became known by its present name. The International Style is based upon three outstanding characteristics:

1. It emphasizes volume of space rather than volume of mass as a basic principle of design. Such emphasis is based upon the use of still frameworks supporting expansive sheets of glass or curtained



Model of Richard J. Neutra's proposed Ring Plan School indicating layout of buildings to obtain maximum amount of natural light.

walls of some opaque substance whose function is the delineation of space.

2. It emphasizes regularity in spacing the elements of design rather than disposing them symmetrically on either side of a principle axis as done heretofore in historical styles. This feature is the result of using a still frame in construction—that is, vertical supports—and horizontal girders that connect them, spaced at equal intervals to distribute strains. This functional principle used esthetically makes for a basic and rhythmic element which finds expression in the design of the protective outer sheath, the exterior wall.

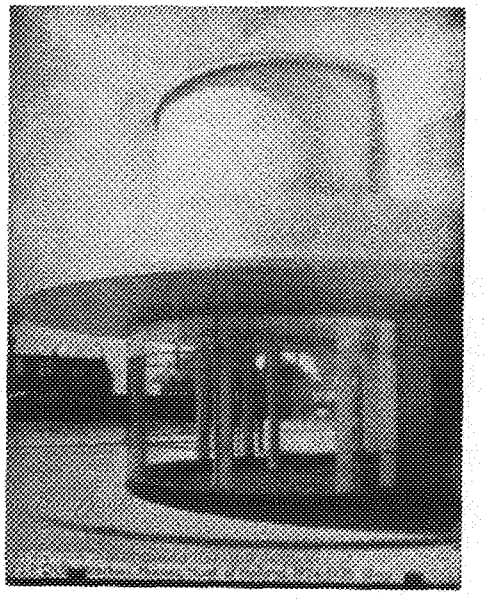
3. The esthetic characteristic of this style depends also upon the good proportions and intrinsic qualities of materials employed. The result of this characteristic is dependent upon the first two as added decoration would give the appearance of masses and obscure the original rhythm of design.

There are four men closely associated with the International Style, each of whom is individual in his development of it. They are Walter Gropius, a German whose main idea was to suit his designs to the efficiency of the Machine Age; Le Corbusier (nee Pierre Edouard Jeanneret) a French-Swiss, who is recognized as a great theorist, and who is concerned mainly with esthetic architecture, not its problematical construction; J. J. P. Oud, a Dutchman, who gained fame with his plans for minimum cost housing; and Miës Van Der Rohe, also a Dutchman, who is recognized for his interest in detail and esthetic problems for which he seems to find solutions by the use of costly materials.

Walter Gropius is generally associated with the Bouhaus in Dessau, Germany, which is considered the climax of his style. He built it in 1926 as a school where every form of modern art and design was to be taught, and manufactured for actual use. The building is thoroughly modern in construction and design; and consists of a group of buildings including dormitories, classrooms, laboratories, and the workshop, all related in their fine proportion and appropriate treatment of constructive materials.

The work which has brought Le Corbusier fame is The Savoye House at Poissy-sur-Seine near Paris which was built in 1929. It is made of concrete with cantilevered floors, a favorite feature of Le Corbusier's work. The plan is symmetrical in form with the rooms arranged in

Row of houses built by J. J. P. Oud in Weissenhof Housing Exposition. Corner shop from houses in Hook of Holland showing interior skeleton supports.



relation to the open terrace of the living floor on the second story much as if it were actually the first.

The windows are banded, and from a distance, appear in strong dark contrast with the light walls. The roof shelter is entirely functional and structural, but it is treated with color and adjusted with curved and straight planes as a background for planting. (An actual miniature model in color may be seen in the Little Gallery Exhibition.)

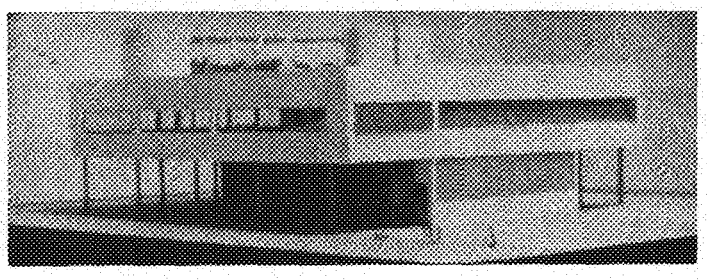
J. J. P. Oud's architecture is not recognized for its mechanical organization nor technical and decorative refinements, but for its esthetic appeal impressed by the function and form of the building. His work may not be as stimulating as that of others, but it is readily conceded that it will no doubt be invaluable to support future architecture.

In the designs for the rows of workers' houses in the Hook of Holland in 1926, we find the new trends in building developed to new heights through modern methods of construction and material. The plan has a regularity of design in each block of buildings, the two main ones being symmetrically disposed. The buildings have flat roofs, long horizontally banded windows flush with wall surfaces, projecting balconies, and entire walls of glass revealing the interior skeleton supports. Van Der Miës' subtleties of design may be seen in his use of curves, details of doors and windows, and various interior fixtures.

Van Der Miës is a decorator, designer, and architect; and, in his most famous piece of the Tugendhat House in Brno, Czechoslovakia, built in 1930, he displayed all of his talents. This house features movable glass walls on the exterior, and velvet curtain panels on the interior. All the furniture is designed in metal by Miës himself. Everywhere is a luxurious display of the costly. One interior wall consists entirely of a huge slab of onyx, and one curtain is seventy-five feet long, of the finest silk obtainable, the pattern of which he designed.

In the development of American Twentieth Century Architecture Frank Lloyd Wright stands out as a leader, for he was one of the first to bring about a change from traditional concepts of design. His greatest achievement thus far is his "Prairie Architecture" which came into existence in 1900. This particular type of architecture grew from Wright's desire to build homes suited to an environment, that is, bearing in its design all the characteristics of the country where it stands. The Prairie House is a low-lying building, arranged horizontally in a compact mass fitting into the typical spreading prairie of the middlewest. An excellent example of this style is the Robie House in Chicago built in 1908. It is an extreme example of the horizontal accent with cantilevered roofs and banded windows. The interior and exterior are closely related in being handled as a single unit, one space leading into another by unobstructed walls and doors. Of particular interest to Minnesota students is the home which Frank Lloyd Wright designed for Dean Willey in Minneapolis.

Savoye House, Poissy-Sur-Seine, France, by Le Corieusier, features use of isolated pier construction.



Richard J. Neutra, at present in California, is another leader in modern American Architecture. Coming from Europe to America, he has brought with him a wealth of information on European developments in building. He has prepared many consequential projects, and has also designed several homes. Of special interest is his proposed Ring Plan School which he designed in his plans for "Rush City Reformed," a general project which has held his attention for some years. (The original model is now on exhibit in the Little Gallery.)

The school is built in ring plan and is designed to be located outside a residential area. The project assumes that it could be built in series, perhaps as part of housing plans; it is designed, therefore, to be made of standardized pre-fabricated parts. Each classroom has an outdoor terrace with large glass wall to provide natural light. Within the ring is an enclosed playground, and an open air swimming pool. Such a structure is new and different, and an interesting possibility in a warm climate state.

Representing a typical product of American architecture is the combination of two architects, George Howe and William E. Lescaze of New York. Together they have designed many buildings in and about New York. Of special importance is the Philadelphia Savings Fund Building which was done in 1932. It is one of the first attempts to apply a consistent horizontal scheme of design to the skyscraper; and, without a doubt, it is very successful.

An interesting and important housing project which Howe and Lescaze designed is the Chrystie-Forsyth Housing Development. The building is designed to be high and placed on a small site. The buildings are arranged in such a way that the important living exposure of each block is as distant from other blocks as possible. Stairways on each block lead from the street to the outside corridor. The construction consists of a steel skeleton with concrete floors exposed on the facade. Much of the exterior walk is of glass, the remaining portions are of brick. The first floor contains store or shop space, and the plans of the apartments vary in size and layout. This project is a typical one of the many being planned in cities throughout the United States.

The work of the Bowman Brothers, Monroe and Irving, since 1928 has been a development of their ideas on prefabricated mass production in housing. Their project for the Lux apartment is worked out in terms of such standardized construction as adding two-inch partitions to built-up steel framework.

The Modern Architecture Exhibition was a collective method of showing America and the world what the architect has been doing while busy in his studio, behind drawing boards heavy with paper and instrument.

It was an introduction of modern trends in architecture for both the architect and the layman. Since the original showing the architects have returned to their studios to work some more with the newly gained ideas. Soon again we may hope to see the fruit of these last few years as we anticipate the next exhibition, perhaps another milestone in architecture, the New York World's Fair in 1939.

THE CARRIAGE TRADE

By Roderick Wm. Siler,
Asst. Prof. in Mathematics

THE average person of today, asked to name a few types of wheeled vehicles once drawn by horses, would have to scratch his head a bit, I imagine. About the only things still visible along this line are milk wagons, and it is necessary to get up very early in the morning to see one of them. And, of course, there are the stage coaches, the covered wagons and the buggies which appear in the movies. Outside of these few examples the knowledge of most people is strictly zero when names of horse drawn vehicles are called for. Yet I think one is safe in saying that, as far as types of pleasure vehicles are concerned, the carriage trade of old presented a far greater number of types than do the autos of today.

The greatest days of the carriage trade were probably in the last years of the century preceding this. By 1875 stage coaches and covered wagons had pretty well vanished from the scene, but the buggy remained, a light, four-wheeled affair, much favored in the cities for business and in the country by hired hands taking their girls to church. But besides buggies there were in existence gigs, phaetons, cabriolets, Concord wagons and buckboards, all light and economical of horse flesh. When a man's family grew—and his income grew with it—he possibly drove a chariotee or a Rockaway or a Germantown. If the income continued to increase, though not necessarily the family, he might ride in a landau, a barouche or a caleche, with two horses, and a coachman on the box.

But the English of that time seemed to have gone far beyond the variations I have mentioned. They had such things as curricles, whiskies (yes, that was the name), telegraphs, Clarences, Stanhopes, Tilburies, Broughams, sovereigns, dogcarts and Victorias. These Victorias seem to have been swanky, very swanky, with seat for coachman in front, another seat for footman behind. Yet the dogcart appeals most to me. It was two-wheeled, seat open to the view and high in the air, and drawn by two horses in tandem, one behind the other. The owner sat facing forward, driving, the groom sat back to back with him, and besides wearing a high hat had to keep his arms folded. Imagine rolling up to class in an outfit like this, and compare it with the present practice of arriving in a battered can of a car. I have read somewhere that the Oxford and Cambridge boys of that time went in for dogcarts in a big way.

Americans roved around to some extent in those days but not in the hordes that they do at present. The only thing then that I have heard of comparable to the present trailer life was on the European continent, and indulged in by wealthy Englishmen. This was in the first half of the 19th century, before there was much of railroading. A conveyance I have read of, and intended for this Continental touring, had a box seat for the coachman, a rumble seat behind for a couple of servants, while inside the coach were not only seats for the owner but an extension under the seats whereby he could lie down and stretch out at full length if he was not over four feet tall. It took only four horses to keep this bus moving downhill.

That the manufacture of carriages of all sorts was once a tremendous business in the United States can be gathered from the words of a speaker who addressed the Carriage Builders National Association in November, 1872. He said, in part, "In 1870 there were 11,944 establishments in the United States, employing 65,294 persons, paying out $22,000,000 for labor, producing 800,000 carriages, amounting to $67,000,000. This year (1872) it is estimated we have built one million carriages, employing 75,000 persons, with total production of $100,000,000. This makes one carriage to every forty persons in the country, to say nothing of sleighs, of which there are tens of thousands. . . . There can be no doubt there is danger of over producing. New labor saving machines of all kinds have been introduced. . . . The labor of days is crowded into hours. . . . There is a possibility of producing more than we can consume. . . . There are many shops that produce in seven or eight months all they can sell in the year, leaving men, during four or five months, out of employment and out of money. This state of things cannot continue long without serious disaster to the trade."

This sounds very familiar and modern. Yet the address was delivered sixty-five years ago.

If the old timers could flood the country with carriages it was not simply because they could make them. They knew something about selling them. Here is an extract taken from a New York paper of that time telling of a carriage exposition in progress: "A square fronted landau Clarence, trimmed in rich brown, with seats that can be raised at pleasure, is a marvel of fine finish and strength. As a closed carriage, with its square foot of beveled glass plates, it looks a fairy palace on wheels. A double suspension vis-a-vis is a miracle of grace and sober elegance. It is painted in dark imperial green, with black stripes and a yellow hair line, cushioned in dark green morocco, and trimmed with dark green cloth. An eight spring duc, with a rumble, is a very elegant and stylish park carriage. The driver's seat is renovable, so that the ribbons can be handled from the inside. . . . A nylord cabriolet, in brown and black, is a charming light, open carriage. It possesses a novel feature in a sliding cane seat for children, or, at a pinch, those of larger growth. The gem of the exhibition, certainly for ladies, is a coupe brougham in black, with a narrow yellow stripe, trimmed in Havana brown satin. . . . The drag, or mail-coach, exhibited . . . is as staunch, massive and firm as the best English work. . . . The body is black, and the wheels and running gear a brilliant red. . . . Every space available for stowage has been made use of, and so artistically has it been done that the drag might be provisioned for a three days' cruise without showing a basket. Brakes before and behind. Even the lamps are marvels of good workmanship."

It is no wonder that our ancestors feared to stick their heads into an exhibit of up-to-date transportation as much as do we. It wasn't the carriages they couldn't resist. It was the sales talk.

The Minnesota Techno-Log

APRIL, 1937

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

EDITORIAL STAFF

Donald Erickson, Copy Editor
Erling Helland, Feature Edr.
Herbert Gaustad, Alumni Edr.
John Murray, - News Editor
Richard Stone, - - Reporter
Fred Warner, - - Reporter
Harry Larson, - - Reporter

BUSINESS STAFF

Robert McDonald, - Office
Clayton Kendall, - - Office
Gordon Brierley, - Adv. Rep.
Warren Waleen, - Adv. Rep.
Wallace Wilcox, Circulation
Vernon Hoden, - Circulation
Dan Doyle, - - - - Circulation

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, Texas.; Professor E. H. Comstock, *Mines;* Professor R. E. Montonna, *Chemistry;* Donald Raudenbush, *Electrical*, Penn.; Louis Reigert, *Architecture;* Lawrence Rollin, *Civil;* William Hanson, *Mechanical;* Elden Olson, *Aeronautical;* Edward Eidam, *Mines;* Neal Amundson, *Chemistry.*

Consider Graduate Study

THIS year, graduating seniors in the Institute of Technology are finding that the opportunity for finding employment in their chosen fields is greater than it has been for many years. Already many have been offered work, and of these many have accepted positions. Still others are being interviewed and will continue to be interviewed during the spring quarter as industry attempts to rebuild its personnel after the ravages of the depression.

Enlarged government activities call others who are interested in making a career of public service.

Now that the prospects for employment are becoming increasingly favorable there is a tendency for graduating students to overlook the advantages of graduate training. This tendency is quite understandable in the light of the senior student's impatient desire to get out in the world, to put to work some of the things he has learned and to exchange the expense of formal education for the income of employment.

The values of graduate study, despite the distracting influence of recovery, are worthy of careful consideration, even by those who have been offered attractive terms of employment.

In the first place, there is the value of increased knowledge and greater familiarity with the particular aspect of engineering in which the student is enterested. He is able to devote his energies more fully to specialized aspect of his own particular field, if he so desires. There is increasing recognition by employers of the value of this additional training, in all branches of engineering.

Then there should be considered the opportunity to improve one's experimental and research methods and the value of experience in preparing a thesis in good technical, grammatical, and literary form.

A third incentive is the availability of teaching fellowships, assistantships, and scholarships, which offer the additional advantages of experience in teaching and in organizing work and judging people.

Lastly, the advanced work may be used to fulfill the graduate study requirement for the various Engineer degrees (which require also four years of experience in responsible engineering positions.)

It should be to the advantage of every graduating technical student to consider carefully the value of work toward advanced degrees.

At the Desk

AS you thumb through this extra-large, super feature issue, you may notice we have divided it more or less into three portions. In the first is contained programs and committees, and all relating to the cause for celebration, St. Pat's Day at the Institute of Technology.

With regard to St. Pat, and his Queen, we want to warn this year's duo to wear smoked glasses. For a vague rumor recently filtered into the office that the two so chosen about two years ago are looking at furniture together.

We have been having lots of fun running around the campus lately getting (scientifically, of course) pictures in the different buildings which we hope will help the visitors, not Tech graduates, to understand what they're seeing. Our favorite faculty tale relater is with us again this month, this time barking back to "motorless" cars, but we suspect, not "sparkless," buggies!

Thumbing our way along, we run into an article on "Soils," contributed by Gene Woodfill. All about the humpings and cracks of the earth, which in turn add to our highway bill. Miss Idell Hillman, sophomore in Architecture, discusses modern architecture, and the leading artists in the field. Most of the rest of the regular features are incorporated, with addition of a page each for the two biennial shows, electrical and chemistry. The latter is to be held in conjunction with Engineers Day, and the former will be a two day show, two weeks later. It's a circus and fair and carnival in itself, all wrapped up in one, and always extremely popular.

The last section contains 24 pictures, of all the prominent societies and fraternities. This was more fun in the picture taking line; and, along with editorialists and salesmen, we are rapidly developing a photography school.

We hope you like this issue; with favorable comment, a bigger one may be forthcoming next year!

Architect's Specifications for a Wife

Bids: The Architect reserves the right to reject any and all applicants.

Maintenance: The applicant will be held responsible and shall make good all her own expenses and all damages done to Owner's heart during the period of courtship; and, if awarded contract, must guarantee to keep owner well fed and satisfied for the rest of his natural life.

General Conditions: Must be blond or equal. Must be five foot two with eyes of blue or other approved model. Elevation must be in keeping with other like parts, and shall not overbalance the rest of her structure. Must have brains as well as beauty; this fact must be certified to by the latest certificate of a national correspondence school.

Paint: Only a first class paint job will be accepted. Paint must be applied in a neat and workmanlike manner, with no streaks, smears, wrinkles, or other blemishes.

Fees and Permits: All minister's fees and permits to be married will be taken care of by the Owner (otherwise known herein as Architect).

Heating: Must maintain a uniform temper and not first be hot and then be cold, or vice versa. Must guarantee a back that will keep Owner's feet warm when temperature outside stands at 30 below zero.

Payment: Accepted applicant will receive Owner's hand at altar, and 85 per cent of his kisses every two weeks or oftener, if cause can be shown that payment is due.

—*Pencil Points.*

Now Here's A Book

By Clifford I. Haga

Instructor in English

MINNEAPOLIS has again made the headlines, this time as the subject of a book. But just as a few years ago, when we and our twin down the river won fame as "the sore spot of the nation" (or was it "a hotbed of crime"?), the new renown is not the most pleasing, nor will the book be quoted by our local trade associations. The book is *American City: the Biography of a City*, and the author is Charles Rumford Walker. Perhaps you have heard of it, or have even read it. Even so let me tell you what I think about it.

To begin with, I think it is a somewhat foolish sort of book, hastily assembled out of odds and ends and slammed together with a good deal of quick, cheap journalistic slap-dash. The point it tries to make is not clearly established, partly, I guess, because of the muddled thinking of the author and partly because of the haste with which it appears to have been written. To a considerable extent the book parallels the famous article in *Fortune* of several years ago and it has, consequently, most of the same faults as that bit of fancy. My opinion of the book is based largely on a feeling that it is weak, rather than on definite proof of error. Long experience with theme-reading has sharpened my wits and I sometimes believe I have developed a dependable sixth sense by which I can *feel* the competence of a writer. So remember this explanation of my criticism and also give me credit for frankness in stating the true basis of my judgment of the book. Few critics are that honest with their readers.

American City hurries us through a swift review of history from the years when our city was St. Anthony to those brisk days when Local 574 was in the saddle. Walker seeks to show that those 75 years have swept us through an era of fabulously rewarded exploitation when the city grew rich and its chief families powerful on the returns of their mining the northwest—for what else was the removal of ore, forest, and wheat but mining?—and depreciated our only true capital, our natural resources. Now, says Walker, commerce in this region can no longer depend on these three resources, and like them our fourth ace, transportation, also fails to win high stakes. Of late, his argument runs, this wealth and power has been forced, if it would maintain itself, to exploit people instead of nature. But you can exploit human beings only so long—until things go bang! Then when the dust settles you have the people in the saddle, there is a new deal, everyone signs a forty-hour-a-week contract with time and a half for overtime, and the world again takes up the painful and tedious process of redistributing wealth.

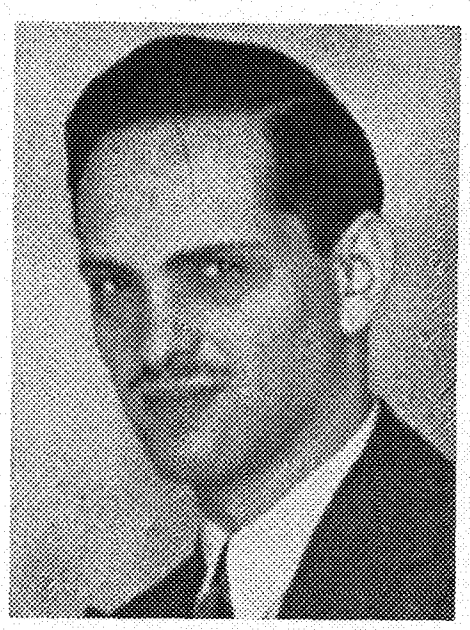
So hasty a summary of the book does not substantiate my reason for feeling that it is not all gospel truth. To be specific, in two places the author is guilty of boners, both little errors to be sure, but still offensive to my delicate schoolmarmish nostrils. In one place he speaks of the "broad levees" at our harbor. If you can see a levee below the Washington Avenue bridge, I'll eat it. In another place, he describes one of the officers of Local 574 as a Swedish immigrant whose father was a "serf." If you can find any serfs in Nineteenth Century Sweden, I'll eat them too. Moreover, the sources he gives are often second hand. For example, as authority for his history of our empire-builders fifty years ago, he cites Josephson's *The Robber Barons*, a book that is little more than a watery emulsion of Meyers' *History of the Great American Fortunes*. I quibble, to be sure, and fall back on a pedantic dogmatism by insisting on pure source material, but please remember I am not defending a rational critical opinion—only a *feeling*.

If Minneapolis is to be smeared, let the muckraker learn from the master. Some thirty years ago the late Lincoln Steffens gave us a chapter in his *The Shame of the Cities*. If you want to see how the job should be done, read that and read also his *Autobiography* in which he does even better than in his earlier book. Or if you want a factual, objective analysis of a city (if well done, it will be the more devastating kind of criticism), read *Middletown* by the Lynds. Or if you want a philosopher's peep into the mystery, read Ortega y Gasset's *The Revolt of the Masses*. In other words, if you want to learn more about our real problems that can be gained from a news reel view of the Battle of Deputy Run, read any one of these books—read all of them—before you read *American City*.

1937 CHEM SHOW

This year's show to combine best of old, many new exhibits

By Elias Amdur, Chem.'38
Warren Hanson, Chem.'38



Elias Amdur

TODAY marks the opening of the third and largest Chemistry Show ever given on our campus. Nothing has been spared in an effort to create suitable entertainment of such a caliber to be deserving of the blessing of our revered patron, Saint Pat. Dormant ideas, simmering in the heads of chemistry upperclassmen, have been teased out that we may satisfy the man on the street, as well as the pseudo-scientists rampant on the campus. Verily it may be said that the brilliance of the spectacle devised for the entertainment of the public is such as to cause the scintillating carbon arc to appear as dark as the familiar "black body" by comparison.

By way of retrospection let us revert for a moment to that history-making presentation, the first Chemistry Show, staged in 1932. In that year the students of the school of chemistry went into action about a month before Engineers Day and produced a show which has served as a pattern for those given since. The show given that year was financed by contributions from the A.I.Ch.E., the Engineers Day Committee, and the professional and honorary fraternities of the school of chemistry. It was a two-day affair, and extremely successful, in spite of the fact that the Engineers Day chairman of that year was a chemist, which resulted in the available material for committees being cut down considerably.

Three years later the A.I.Ch.E., under Harry Cottingham, put on the second Chemistry Show. Engineers who were on the campus that year (1935) should remember this exhibition. The entire field of chemistry was laid bare to the public gaze, and for two days crowds estimated at as high as 3,500 per day streamed through the Chemistry building. This show was pronounced a success by all concerned.

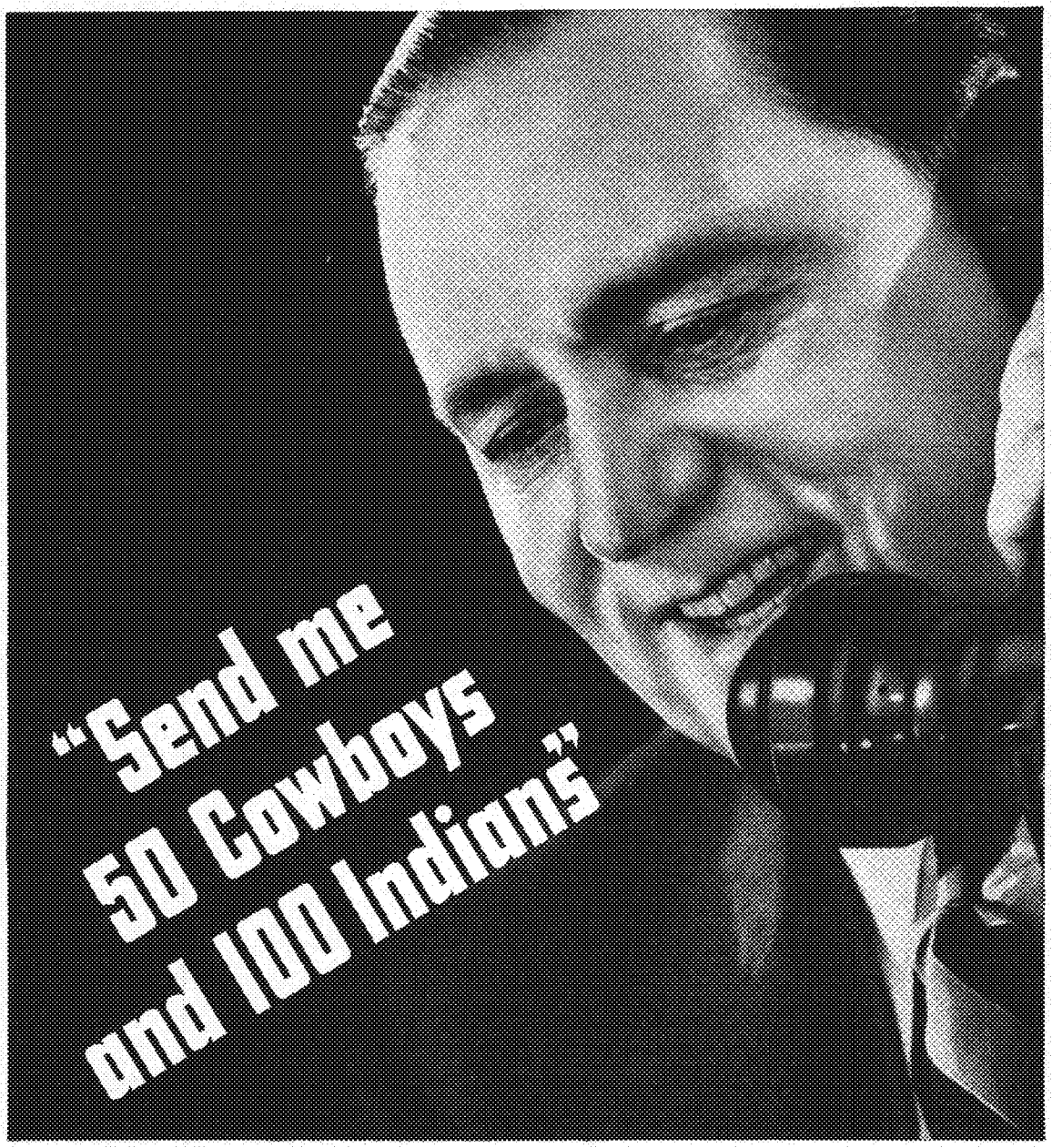
This year the features of those two shows have been combined with new material, after the elimination of those exhibits which had previously been unsuccessful, to give an entirely new show. An attempt to describe the various departments of the show will not be made here since they are listed in the souvenir program which is given out at the door.

The show this year is being financed by the student chapter of the A.I.Ch.E. and the Engineers Day committee. Since no admission charge is made the program booklet is being financed by advertisements from local and national concerns.

This year Dean Lind has consented to a two-day show, conforming to the custom of previous years. In order to facilitate the operation of the show, he appointed a faculty committee to assist in working out details, and to assume responsibility for material used in publicity and demonstrations. This committee consists of Dr. C. A. Mann, head of the department of chemical engineering, and advisor of the student branch of the A.I.Ch.E.; Dr. W. M. Lauer, professor of Organic Chemistry, and Dr. H. H. Barber, superintendent of supply and assistant professor of Inorganic Chemistry, who is taking the place of Dr. M. C. Sneed, originally appointed to the committee, now on a trip east. Dr. G. R. Heisig assisted the students in the preparation and handling of the more dangerous materials.

Students who are managing the show this year are Elias Amdur, junior in Chemistry, who is general arrangements chairman, and Charles V. Berger, junior in Chemical Engineering, who is acting as business manager.

So, engineers, make it a point to come over to the building where you spent lots of hours as a freshman, either Friday or Saturday, and see what the witty (or fraction thereof) chemists have prepared for you. Mere words inadequately describe this zenith of achievement, and the optimum degree of satisfaction can be obtained only by personal attendance. Certainly no one should intentionally forego the pleasure of observing the reaction of Miss Nellie NaOH (the girl with the powerful base), or of feeling the frigidities of Miss Le Quad Aire and Miss Drye Eyce, said to be cold enough to freeze mercury. Come one, come all; a big show, and all free!



WHEN Hollywood wants to film a scene requiring hundreds of "extras," it makes a telephone call—and gets them. ¶ This is made possible by a central casting bureau, whose amazingly fast service is based on systematic use of the telephone. This organization has a telephone switchboard where as many as 30,000 calls a day are handled in bringing actors and producers together. ¶ Another example of the value of telephone service to business and social America. It is the constant aim of Bell System men and women to make it ever more useful—constantly better.

BELL TELEPHONE SYSTEM

Keep in closer touch with home—by telephone. Rates to most points are lowest after 7 P. M. and all day Sunday.

FLASH!

Electrical show to accompany novel and startling stunts with lectures and educational exhibits April 30, May 1.

Color organ

The radio "kaleidochrome" is a unit which is designed to convert sound frequencies into a varicolored array of lights. It is a sort of "color organ." The audible sound frequencies from a radio, phonograph, or microphone are amplified and converted into various color combinations by means of several special lamps connected to filters resonant to various bands of frequencies in the audio spectrum.

Novel effects and color combinations are obtainable from radio programs, phonograph records, or voice. Loud speakers will be used in conjunction with the unit so that visitors will be able to hear as well as see the sound in color. An opportunity will be presented to everyone to see and hear his own voice, as well as many other sounds.

"See your voice"

Would you recognize your voice if you saw it? Come to our show and see.

The loud-speaker oscilloscope used for demonstration is an arrangement for changing sounds into light. The observer speaks into a microphone, his voice is amplified, and fed into the loud-speaker. The speaker then moves a tiny mirror upon which is trained an intense beam of light. The beam of light is reflected from the mirror to a set of revolving mirrors, and from these mirrors to a screen. As the mirror jiggles to the tune of the speaker, the light beam dances, giving a picture of what is spoken into the microphone.

Light beams run exhibits

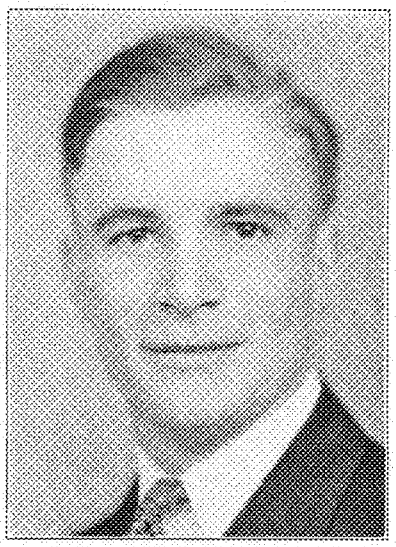
This exhibit transmits sound on a beam of light. Two sending stations will be used, each sending a different-colored beam of light to a common receiving station. The receiving station can thus make its own program by color filters, with analogous operation to our own radio sets.

Photocell exhibits

Featured among the exhibits will be the photocell display of Talking Beams of Light wherein electrical impulses are converted to light impulses, transmitted, and then reconverted to electric impulses. All guests will be counted when they enter the electrical engineering building by means of the Photoelectric Attendance counter. Electric lights and motors will be controlled by the light of a match or a flashlite. Automatic Water Fountains which turn on when one wishes a drink will be in operation. A Color Discriminator will audibly discriminate between the depth or shade of colors. Among the interesting commercial exhibits will be a complete theatre vitaphone projector.

ELECTRICAL SHOW CHAIRMEN

Committee	Chairman
Student's Exhibits	Robert Olson
Manufacturer's Exhibits	L. W. Phinney
Power	R. Lind
Communications	O. Becklund
Radio	F. Hager
Illuminations	L. La Patka
Electro-chemistry	W. Weist
Signal Corps	R. Christofk
Photocells	S. Goffstein
Meters	D. C. Peterson
Transients	M. Leslie
A.I.E.E. Representative	P. Morris
Senior Representative	J. Jordan
Junior Representative	O. Presdtholt
Sophomore Representative	E. Hagen
Freshman Representative	L. Tokar
Publicity	T. West
Finance	F. Parker
Dance	C. Henrici
Programs	D. Raudenbush
Tickets	A. Jacobs
Photography	E. Williams



Otulio Morzenti, Chairman

A "Jeep" in cat's clothing

This exhibit employs a delicately balanced electrical circuit set up in such a manner as to utilize the static electricity generated by rubbing a cat's fur to make a tube glow. Although most of the electrical energy used is obtained from another source, that obtained from the cat actually sets off the phenomenon.

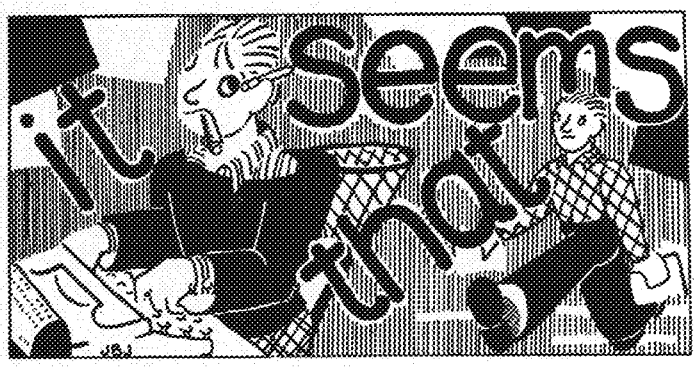
Plating on wood and paper

The exhibits on electrochemistry will demonstrate some of the more important industrial processes such as welding, electroplating, and the electrolytic manufacture of caustic soda and white lead. The welding exhibit will show how both arc welds and spot welds are made. The manufacturer of a souvenir will also demonstrate the electroplating of nickle and copper.

Inverted speech

Speech inverters or "scramblers" are used on transatlantic and other radio telephone services where privacy is desired or necessary.

This is possibly the most interesting exhibit of the communications group. Normal speech spoken into its microphone will be transformed into entirely meaningless sounds. On the other hand, certain meaningless words arrived at by practice can be transformed into something understandable.



By Melvin "Pete" Lohman

ENGINEERS DAY is with us again this early April day, but rejoice you lovers of spring because next year it will be again moved to May. Reason: The miners aren't going camping next year until June.

It is queer that the same engineers who are able to bow down and kiss the blarney stone in the morning are not able to chin themselves on the curbstone by evening.

We wonder why a member of the civil faculty started an aggressive campaign to clean up the parade? Is it because he thought the people would imagine a house five by five by eight feet was the only thing a civil could construct?

The heating and ventilating lads agree that the greatest "sun effect" occurs in the late afternoon when the co-eds are passing by main on their way to the medical buildings. They also coined this definition: "A fan dancer is just a nudist with a cooling system."

We don't like to criticize our instructors but we do think the instructor in civil who flunked thirteen graduating seniors deserves something. It was necessary for the guys to go to the head of the department who fixed it so they only received conditions. Is it the instructor's fault or is it the students' when only about half of the class gets through a course? We are of the opinion that it's the former.

From the Aero trip comes this tale of a lad, now known as "Fecnecymint," whose diaestion was quite upset by the rather long bus ride. During the height of a snow storm near Chicago, the three doses of concentrated T.N.T. began to go into action. This necessitated a quick stop by the bus. A traffic jam consisting of several more busses soon formed because in the hurry to stop the bus driver had neglected to pull off the highway. But, it is reported, everyone enjoyed waiting and the trip was shortly resumed.

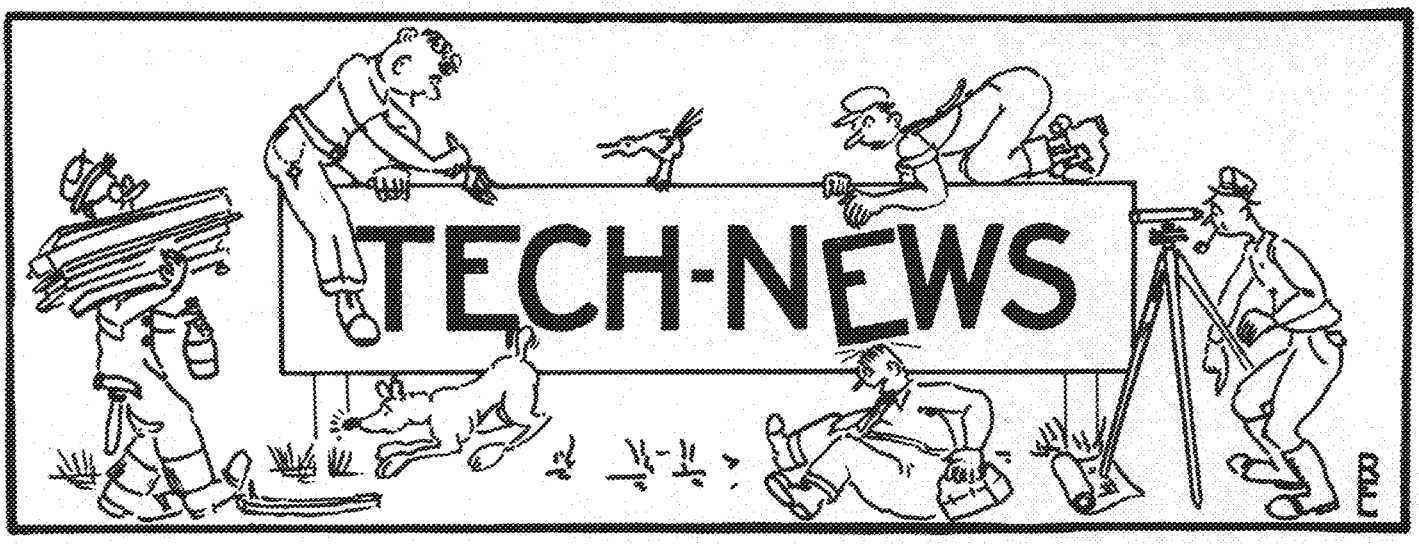
Who was it that said, "Rivers can't have much fun because only one river can get into a bed."

We didn't think the Chems had it in them but rumor has it that they established headquarters in Chicago at Kitty Davis', but why did they pick Appleton to throw their big party?

The poem of the month is dedicated to spring:

Rose's are red
Violet's are white.
I saw them on the clothes line
Last Monday night.

—So It Seems.



40 M. E.'s to Visit Chicago On A.S.M.E. Field Trip

Plans have been completed for the senior mechanical engineers' trip to the student convention to be held in Chicago under the auspices of the Northwestern University Chapter of the A.S.M.E. Forty M.E.'s will attend the convention and the inspection trips that will follow.

Convention activities include: two technical sessions at which the best theses from the Mid-Western schools represented will be read, a business meeting, a social banquet, and inspection trips to the Crane Company and the Western Electric Company.

In addition to these activities, Marvin Lee, chairman of the convention committee, has arranged trips to 10 other plants. Class headquarters during the week will be at the Allerton Hotel in Chicago.

The A.S.M.E. meeting of March 10 combined business and pleasure, consisting of technical and comical moving pictures and Amos' German Band.

13 Initiates Make Tau Bete Placques

At an informal initiation held April 5 in the Mechanical Engineering Building, Tau Beta Pi candidates constructed wooden plaques showing the design of the Tau Beta Pi emblem. These men were then formally initiated into the society at a banquet held in the Curtis Hotel on April 14.

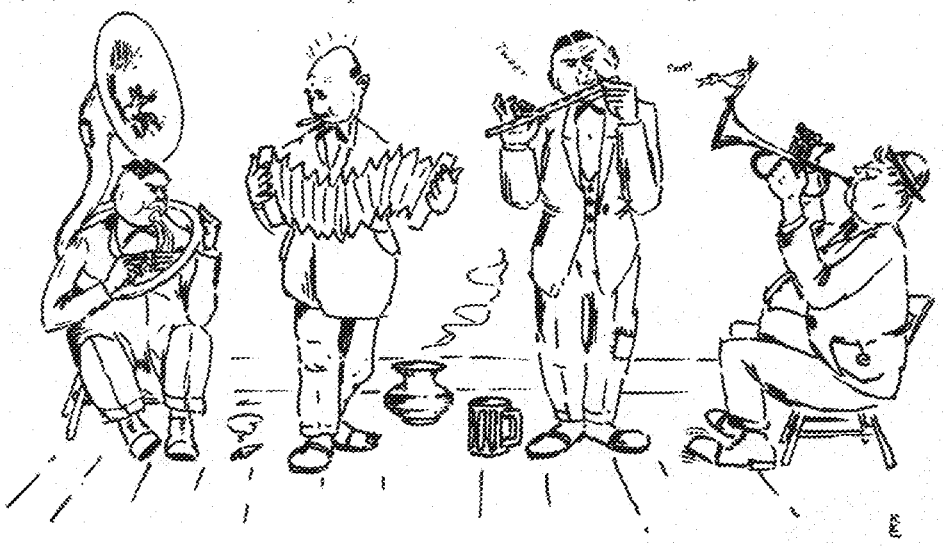
The new members are:

Alfred Anderson
Wilfred Cardwell
Howard Daniels
Carroll Dobratz
Edwin Hage
Harley Hughes
Gordon Lee
Ray Goodwin Luck
Mark Olson
Nordahl Onstad
Kenneth Person
Aldrich Syverson
Robert Wagner

Aero's to "Shoot" Engineers Parade

Besides their other activities on Engineers Day, members of the A.S.A.E. will shoot several motion pictures of the parade. These are to be included in a three-hundred foot film of the society's activities during the spring quarter, which film will be shown before branches throughout the country.

On the second Wednesday of each month during ninth hour, the Ag. Engineers seminar meets. At each of these sessions a student presents some topic of interest to engineers. Gordon Moore, Sr., Ag. E., will speak at the first meeting, April 14th, explaining the operations in a canning factory with the aid of motion pictures. At the second on May 12th, Nelson Dingle, Jr., Ag. E., will present the subject, "Good Farm Structures as an Investment." Anyone interested is cordially invited to attend. The place: Room 107, Ag. Engineering Bldg., U. Farm.



Hage Chairman of Mech. Open House Planning

Pi Tau Sigma has taken charge of mechanical engineering open house for Engineers Day. Edwin Hage is chairman of the group, assisted by Arnold Matthies and William Hauson. At luncheon meetings several men were appointed to be responsible for the exhibits in the various departments.

C. E. Engineer Lecturer Speaks to A.I.E.E.

A joint meeting of the Minnesota section of the A.I.E.E. and the student branch was held on Wednesday, April 7. Mr. D. K. Blake, Engineer, Distribution systems, Central Station Engineering Department, General Electric Company, Schenectady, New York, gave a talk on "Operating Records as a Basis of System Design for Future Extension and Improvements in Service."

Plumb Bob Formally Announces Initiates

Each year on Engineers Day the members of Plumb Bob, senior honorary society in Technology, are formally announced. Plumb Bob consists of twelve men chosen on a basis of character, scholarship, and service to the institute.

The men honored this year are:

Orville Becklund
Reynold Ejorck
Carl Dech
Edward Dobrick
Lloyd English
Hugh Gage
William Kaiser
Thomas Klingel
Fredrick Mann
Elwood McGee
Gerald Mitchell
Richard Olson

I.Ae.S. Hears Marine

At the March 5 meeting of the I. Ae. S. a talk was given by Captain Charles J. Schlapkohl of the U. S. Marine Corps on the flight training course offered by the U. S. He told of the qualifications of an Aviation Cadet and of the types of training received at the Naval Air Station in Pensacola, Florida. Captain Schlapkohl explained that in the one year training course and the three years of active duty following graduation it was possible to obtain 1,000 to 1,500 hours of flying.

The Taurus

By Bertil Lindquist

Did you ever get "Mike Fright"? The baleful glare of the little KSTP microphone during the Engineers Day broadcasts developed a more severe case of the jitters in your old chronicler than anything he had previously experienced.

Just about the toughest blow that the returning Engineer grads encounter is the discovery that "Engineers Day" has grown up and has become a citadel of contemporary engineering knowledge and education. Judging from the present rate of progress, by 1940 the tail end of the parade will feature full-grown trees by the foresters and full-blown theories by the arts college.

We like—

—Prof. Hugh B. W.'s lively method of keeping dull math courses interesting—

—Prof. Harlowe C. R.'s cheery, instantaneous, first-name greetings to all his former students—

—Prof. Burton J. B.'s painless injection of infernal combustion into unwilling and resisting craniums—

—The comraderie and cohesiveness of the Civils—

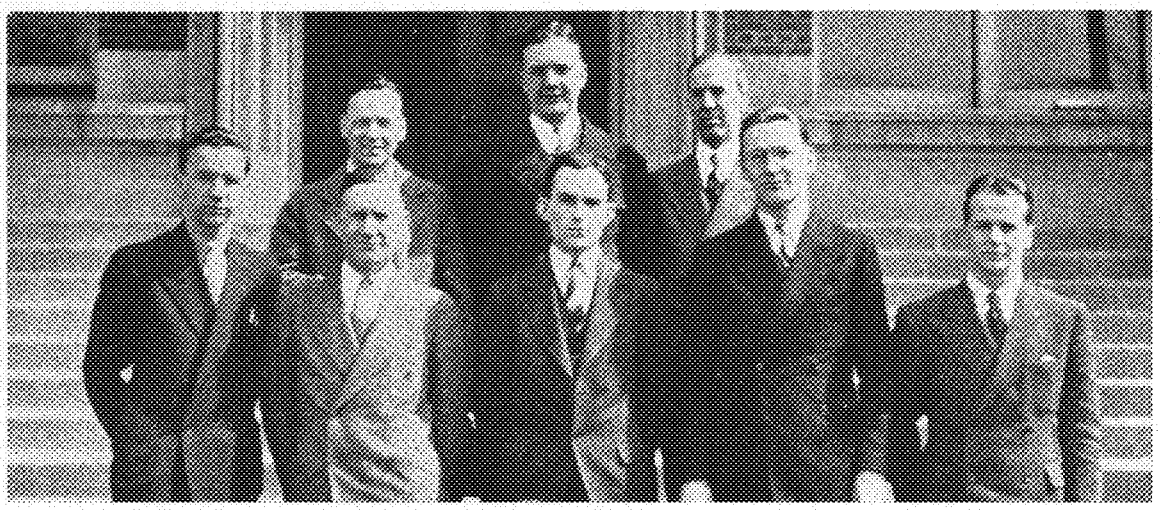
—Those lassies who cavort about the propitty in either robin's-egg blue or dove-grey outfits—

—Prof. Charles T. B.'s scrupulous punctuation of involved (to me) equations and his accompanying unostentatious solutions of said equations—

That guy Lohman and his snide insinuations about the veracity of your old scriver's tales—him and his poetry—phooey! Here's a rhyme or two to pin Pete's ears back for a spell:

Little Jack Horner is not in his corner
The reason he's gone is quite plain.
He's just taken a pill
And cannot sit still.
Is it clear, or must we explain?

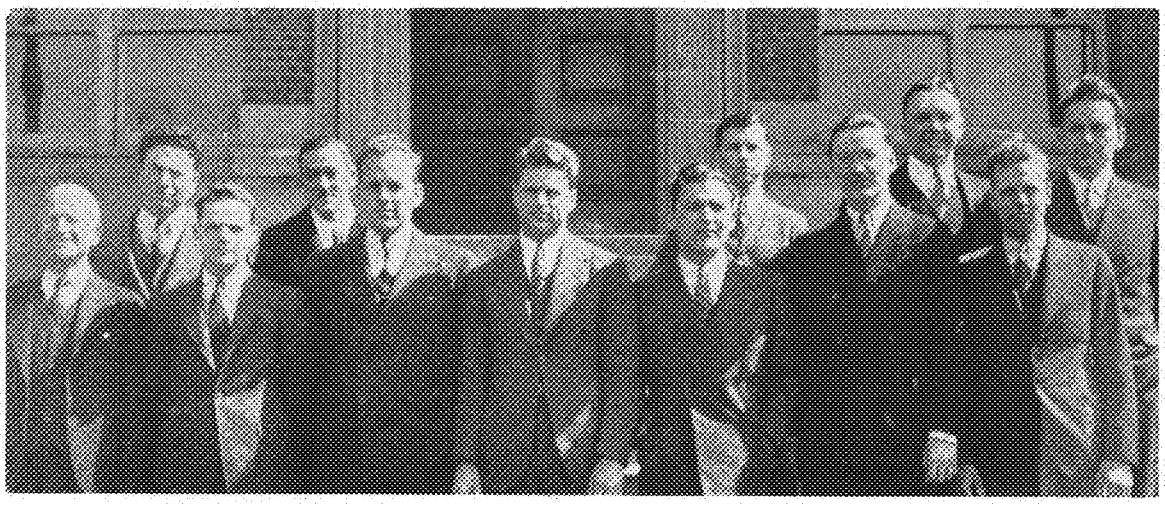
Speaking of St. Patsy, the Aero's have never contributed a queen to the festivities. Wonder if (and when) our female Aero "Tweepsy" Wrenn reaches the Senior Class she will have developed long enough legs—and enough of the necessary poise—to stick on a horse.



Tech. Comm.

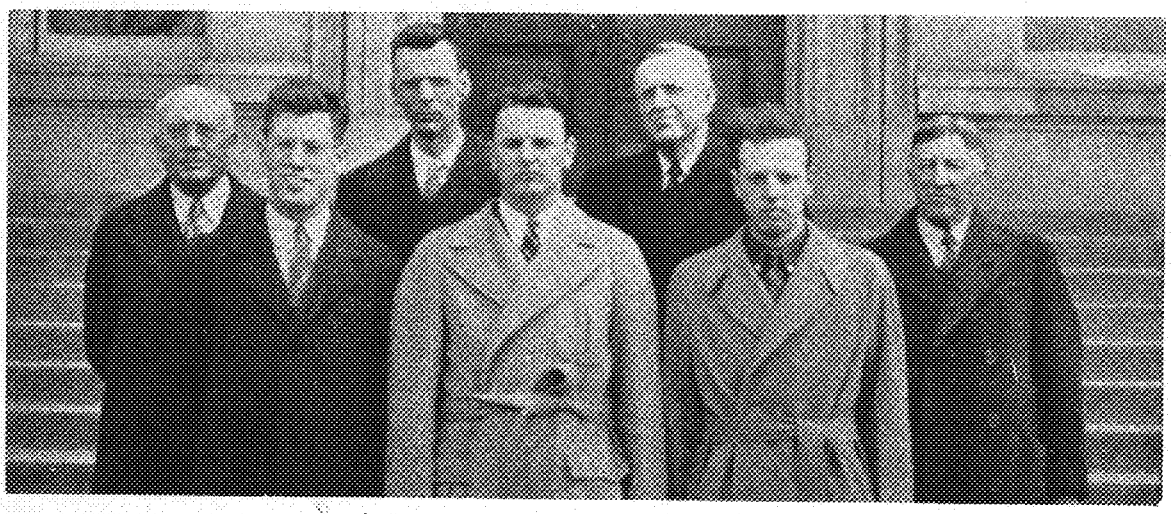
* Row 1. Nordquist, Joseph, Mitchell, Olson, Pierce
Row 2. Lauer, Becklund, Todd

Plumb Bob



Honorary Senior Fraternity

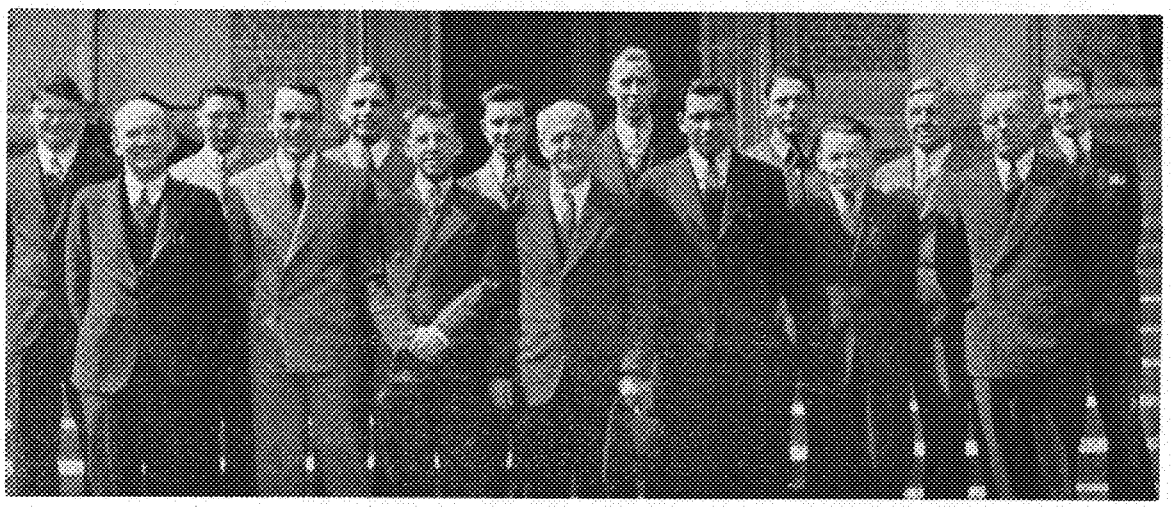
* Row 1. Richardson, Gage, Klingel, Bjorck, Deck, Olson, Dobrick
Row 2. Kaiser, Kuhlman, English, Becklund, Mann



Bookstore Board

* Row 1. Campbell, Kleinman, Dobrick
Row 2. Comstock, Smith, Zeiner, Kirchner

Pi Tau Sigma



Honorary Mechanical Engineering Fraternity

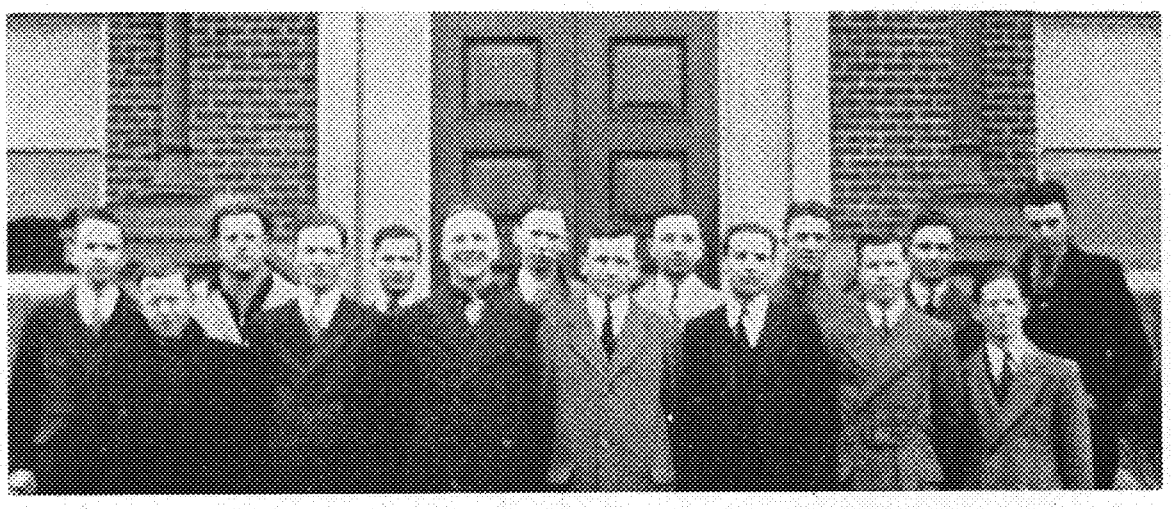
* Row 1. Robertson, Hanson, Matthies, Martenis, Hughes, Johnson, Algren
Row 2. Bussan, Davies, Hage, Matey, Haugen, Andres, Shoop, Teeter

Chi Epsilon

Honorary Civil Engineering Fraternity

* Row 1. McGee, MacKenzie, Bjork, Franzen, Helland, Frickland
Row 2. Johnston, Peterson, Cutler, Merrell, Olson, Person

Eta Kappa Nu



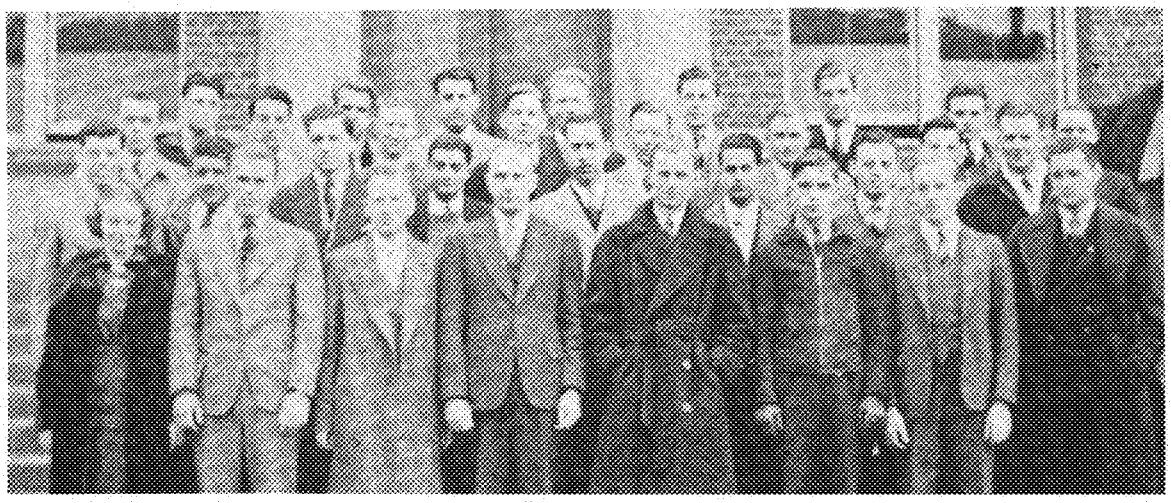
Honorary Electrical Engineering Fraternity

* Row 1. Lind, Stewart, Becklund, Longfellow, Haight, English, Patterson
Row 2. Raudenbush, Parker, Morzenti, Lee, Weist, Johnson, Brierly, Dunning

Tau Beta Pi

Honorary Engineering Fraternity

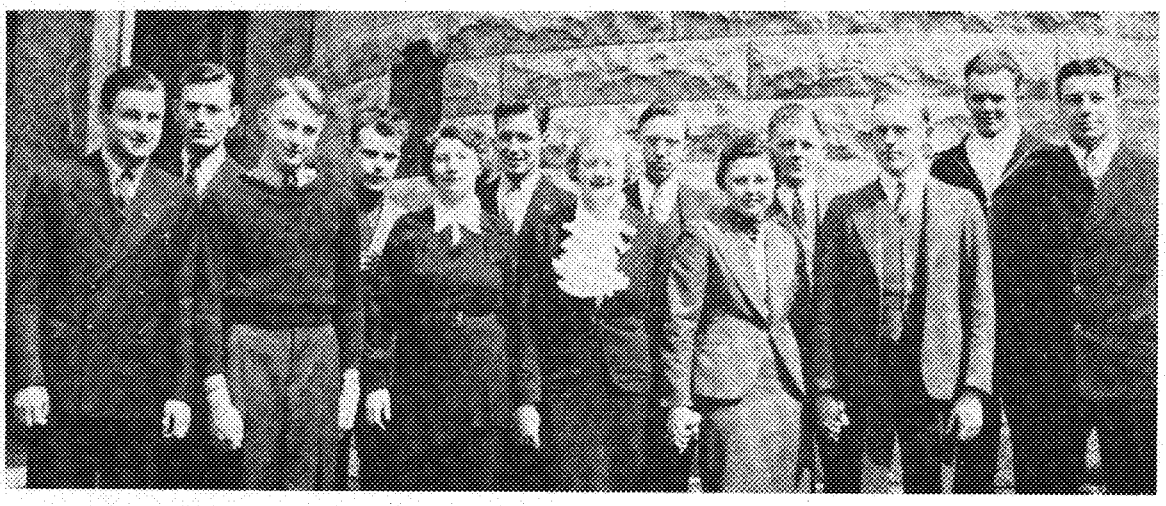
* Row 1. Amundson, Bjerck, English, K. Olson, Dech, Piercy, Beckland, Hughes
Row 2. Mattheis, Gage, Morsenti, Peterson, McGee, Kaiser, Franzen
Row 3. Palmquist, Aubrecht, Parker, Haight, Longfellow, Helland
Row 4. Teeter, Montillon, Shapiro, Appert, Lind, Frickland, Hage
Row 5. Dobratz, Robertson, Hook, Person, M. Olson, Syverson, Dobrick, Hanson



I. Ae. S.

Institute of Aeronautical Sciences

* Row 1. Wrenn, Starlof, Wodrich, Victoreen, Akerman, Burns, Walseth, Kerker
Row 2. Bodey, Micka, Schoonmaker, Flushman, Barlow, Hagger, Larsen, Lindquist, Karpen
Row 3. Brush, McElroy, Wilkes, Baseler, Carlson, Strom, Lang, Huseby
Row 4. Gaskell, Moore, Bloch, Hellman, Spoor, Seeger, Smith



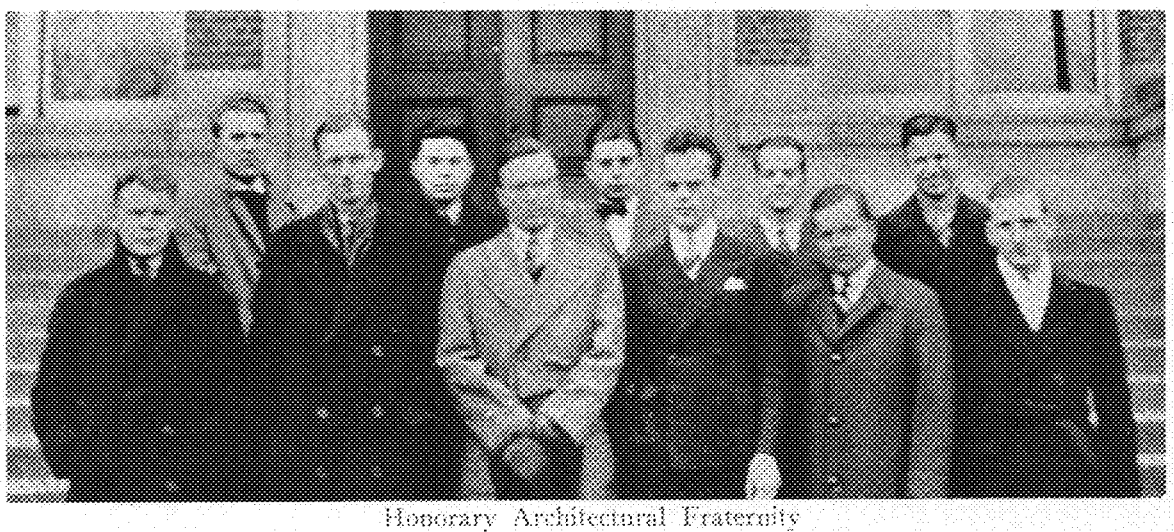
Glider Club

* Row 1. Kerker, Karpen, Hostetter, Haas, Peterson, Walseth, Dye
Row 2. Enderson, Stiles, Hoffman, Feeney, Johnson, Lindquist

Arch. Society

* Row 1. Chapin, Butzig, Granger, Brandhorst, Vincent, Pierce, Prahm, Haarstick
Row 2. W. Johnson, L. Borget, Kyle, Zander, P. Borget, K. Johnson, MacManus, Magney, Manion
Row 3. Lie, Morley, Hanson, Bergland, Hanley, Youngquist, E. Johnson, G. Matson
Row 4. Abbot, Hillman, Wenzel, Voosen, Riegert, Folsom

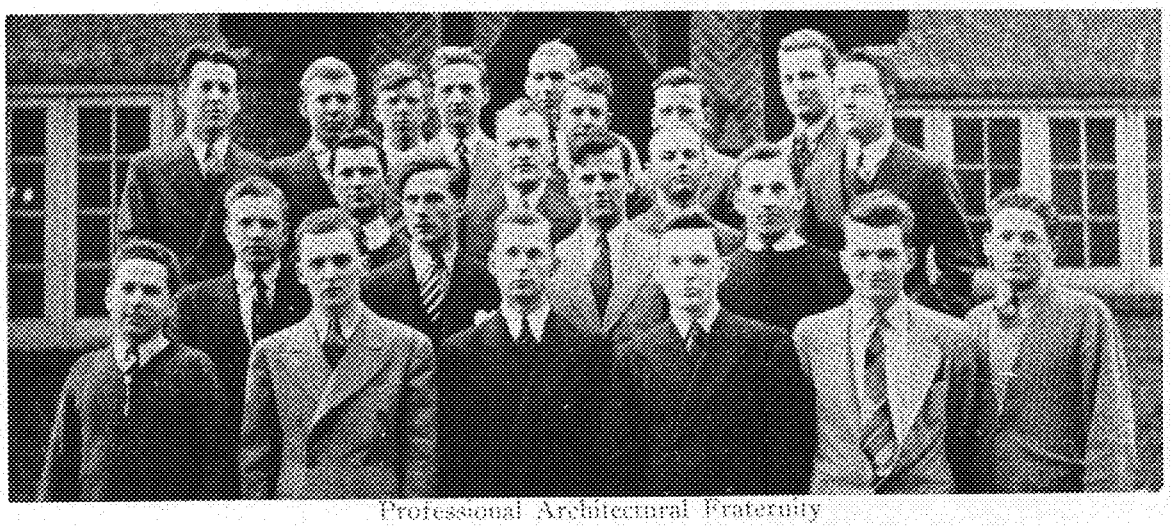
Scarab



Honorary Architectural Fraternity

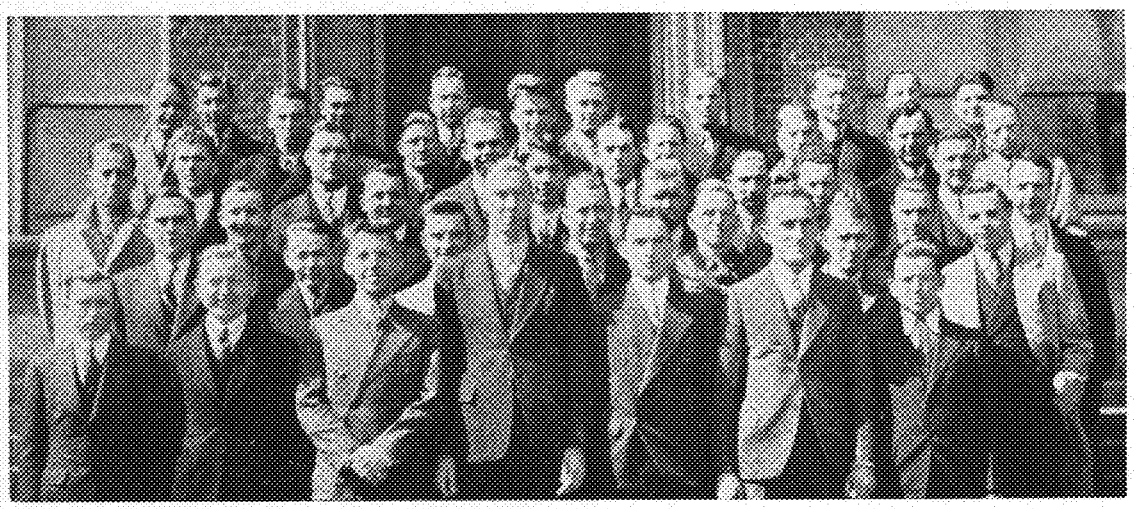
* Row 1. Chapin, Abbott, Voosen, Prahm, Magney, Johnson
Row 2. Wenzel, Borget, Baldwin, Pierce, Zander

Alpha Rho Chi



Professional Architectural Fraternity

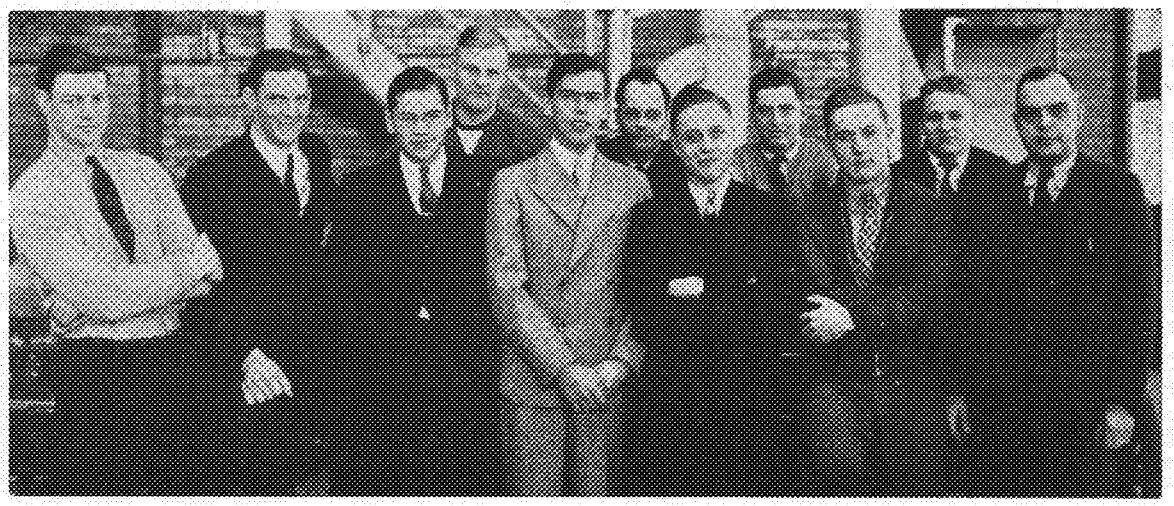
* Row 1. Parmelee, Coffman, Rogness, Cairow, Kehne, Roth
Row 2. Matson, M. Johnson, Flynn, Fredrickson
Row 3. Arneson, Haarstick, Wilmsen, Folsom
Row 4. Morley, Bergmann, Lee, Wiley, Kremer, Kromhout, W. Johnson, Hegg



A. S. M. E.

American Society of Mechanical Engineers

Row 1. Heer, Faith, Matthies, Haugen, Mitchell, Peterson, Gendein
Row 2. Mooney, Johnson, Matey, Jordan, Lightowler, Slocum, Haglund
Row 3. Warner, Horgberg, Winn, Pittelkow, Rintala, Romanchuk, Doxey, Smith
Row 4. Nelson, Scrigstad, Kreitinger, Benson, W. Wolfe, Swanson, Lee
Row 5. Swanstrom, Freberg, Shotwell, A. Anderson, Pitts, Filbert, Swanson, I. Anderson
Row 6. Hankee, Snyder, Schad, Lykken, Comb, Lorentzen, Ecklund, R. Wolfe



A. S. A. E.

American Society of Agricultural Engineers

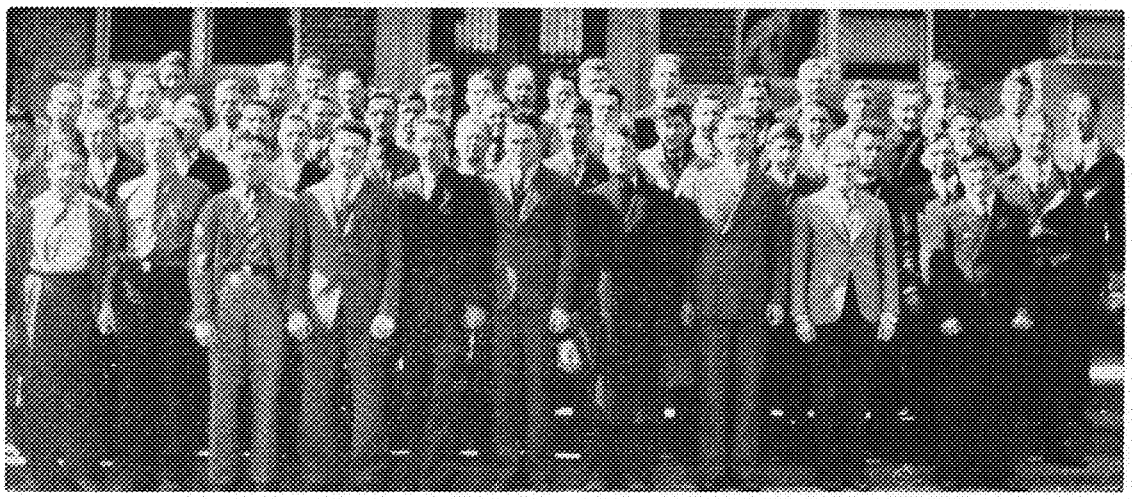
Row 1. Larson, Snyder, Besli, Kenjoski, Dingle, Moore, Erlandson, Bostager, Ridings, Peterson, Schwantes

A. S. C. E.

American Society of Civil Engineers

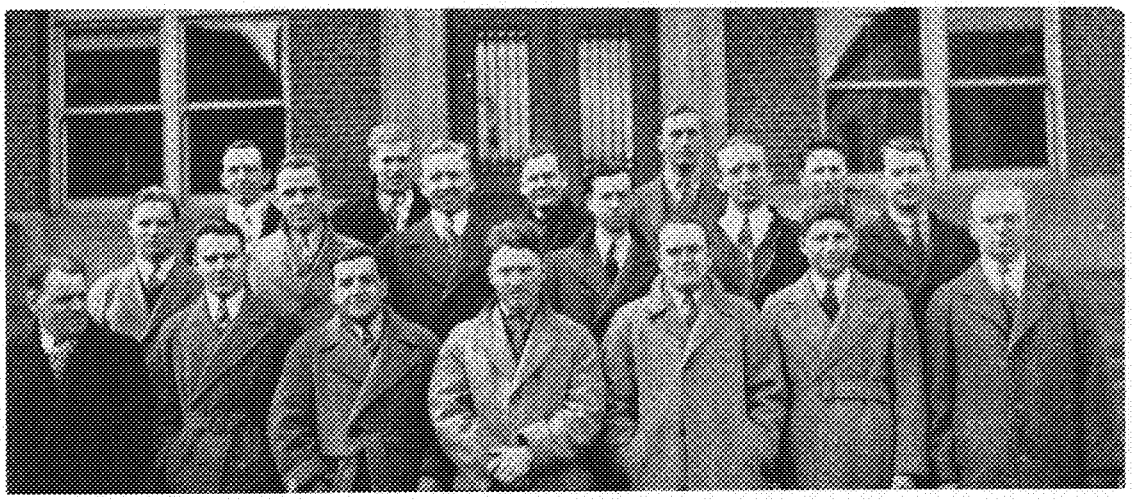
Row 1. R. Carlson, McGee, Rhode, Cutler, J. Ellison, Thomas, Klingel, Levins, Kishel, G. Carlson, Rollin, MacKenzie
Row 2. Scully, Naevik, C. Pearson, Johnston, D. Peterson, Childs, Thorstenson, Mowry, Swedberg, Bjorck, Merrell, Franzen
Row 3. Soderberg, Leonard, Butcher, Richmond, G. Johnson, H. Olson, Swenson, Mark, Erickson, MacDonald, Nelson, Frickland
Row 4. Cornell, D. Hook, Lindsey, Postels, Smithman, Clapper, C. Hook, Titus, Mickelsen, Carey, Heiland, La Fountaine, R. Ellison
Row 5. Bennets, Kellum, Huebscher, Appert, Andres, G. Pearson, Nichols, Olson, Boehlke, Holm

Mines Society



Row 1. Wexler, Harrison, Eidam, Kaiser, Nordquist, Aikire, Krefting, Sherman, Kugler, G. Nelson
Row 2. Tweelings, Robinson, McMullen, Walton, Olmstad, Halgeson, Fine, Fontaine, Beckford, Grock, Troxell
Row 3. Kania, Johnson, Melvin, Lewis, Purcell, Christianson, Linsley, Ronicker, Zuppan, Smith, Jones.
Row 4. Larson, Simmons, Sundquist, Quigley, Lauderdale, Lynn, E. Johnson, Miller, M. Johnson, Thronson, Robertson, Ryan
Row 5. Felt, Newberry, Lundquist, Hodgman

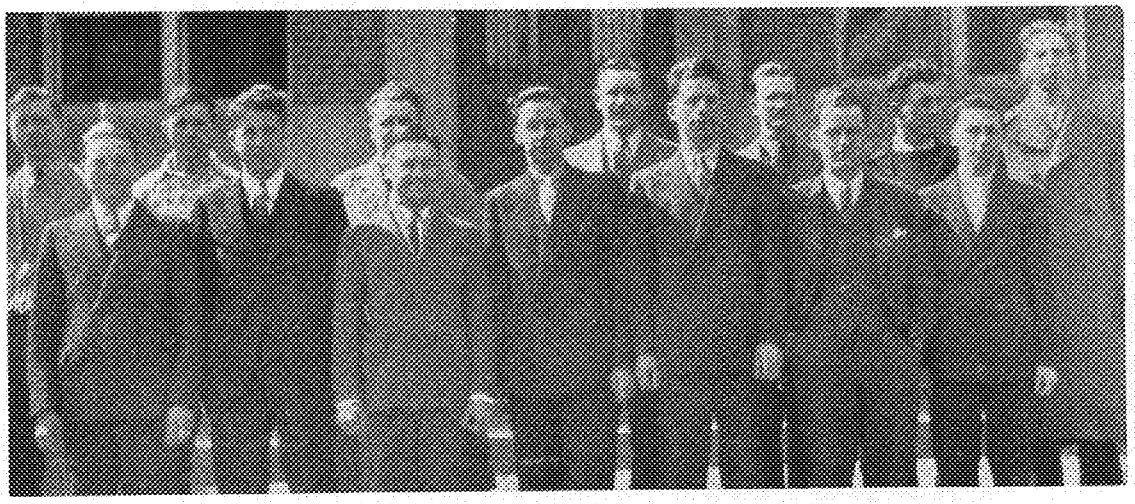
Sigma Gamma Epsilon



Professional Mines and Geology Fraternity

Row 1. Wright, Thompson, Alvarado, Hewett, Kugler, Fontaine, Dennis
Row 2. Kendall, Sherman, Thronson, Brown, Frank, Crowley
Row 3. Swanson, Bergquist, Maxwell, Sundeen, Kaiser

Sigma Rho



Professional Mines Fraternity

Row 1. Tweelings, Newberry, Lacy, Nordquist, DuFour, Dobie, McMann
Row 2. Nichols, Purcell, Christenson, Wilson, Sundquist, Beckford, Miller

A. I. E. E.

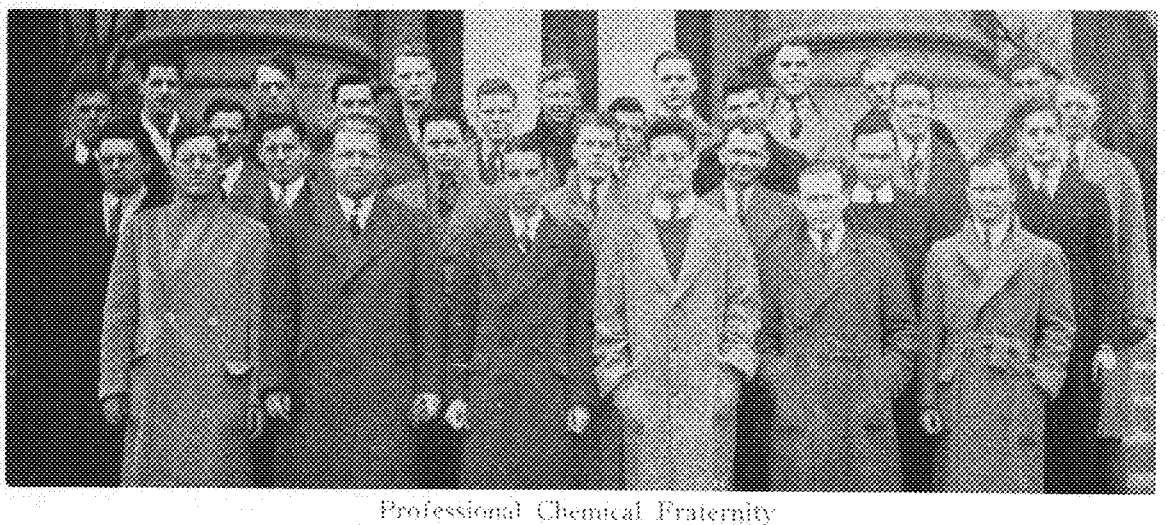
American Institute of Electrical Engineers

* Row 1. Albert Hendry, Morzenti, Parker, Becklund, Morris, Sachter, G. Johnson, Dokas
Row 2. Fox, Baudenbush, Hay, Christoff, D. Peterson, Thomson, Hawks
Row 3. Boutin, Phinney, Jordan, Downey, Goffstein, Smith, Spethmann
Row 4. McDonald, Korbone, R. Olson, Lind, English, Wagner, Titus, La Potka
Row 5. Leslie, Walleen, Sandburg, V. Olson, D. Johnson, W. Peterson, Yokich
Row 6. Dunning, Longfellow, Mikkali, Stewart, Hagen, Larson, Lilygren
Row 7. Haswell, Bager, Haight, Weist, Walstrom, Saunders, Wiener, Wall, Wyman
Row 8. Anderson, Lee, Brierley, Coffin, Murray, A. Johnson, Fiohil, West

A. I. Ch. E.

American Institute of Chemical Engineers

* Row 1. Ross, Amdur, Rashka, R. Olson, Mann, Besser, H. Van Hoven, Streiow, Lundy
Row 2. Videen, Dobratz, Conklin, Bergvall, Stoltz, Berger, Lund, Frederickson, Anderson, Piercy
Row 3. Patton, Erickson, Wiesner, Stevens, O'Donnel, Johnson, Mickelson, R. Van Hoven, Rathjen
Row 4. Cromer, Wall, Rogers, Ellis, Campaign, Halverson, Thompson, Schilt, Ritchell, Hurd
Row 5. Motl, Schutz, Playman, Johnson, Custer, Aubrecht, Liedl

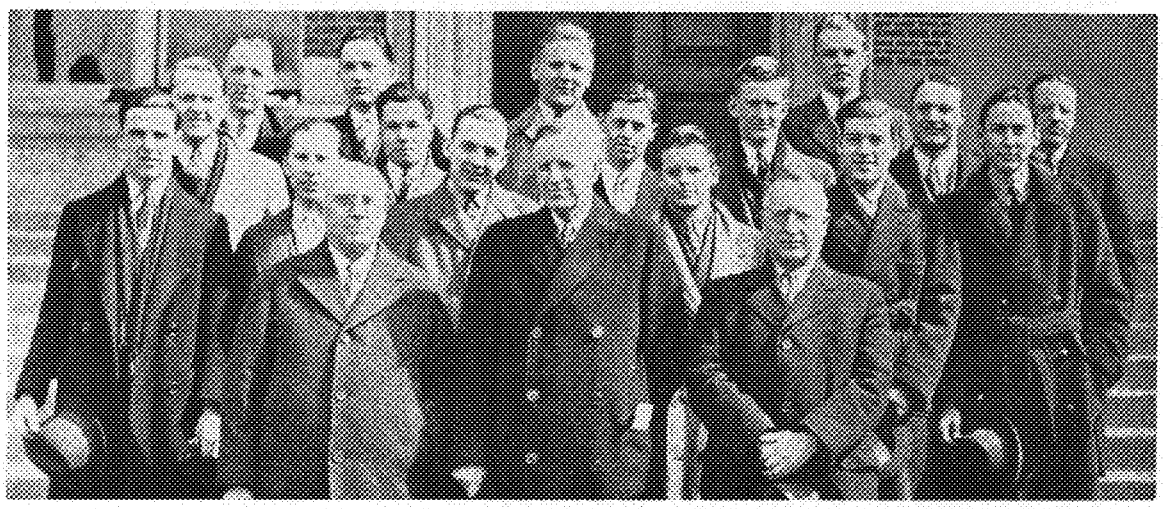


Alpha Chi Sigma

Professional Chemical Fraternity

* Row 1. D. Johnson, Erickson, Carlin, McDonald, Custer, Arper
Row 2. Moth, Vezina, Stevens, Lahort, Grove, Schneider, Turner
Row 3. Opri, Tyler, McKusick, Chamberlain, Mitchell, Culbertson, Wiest, Smith
Row 4. Griffith, Behr, Fadden, Anderson, Berg, Carlson, Merman, R. Johnson

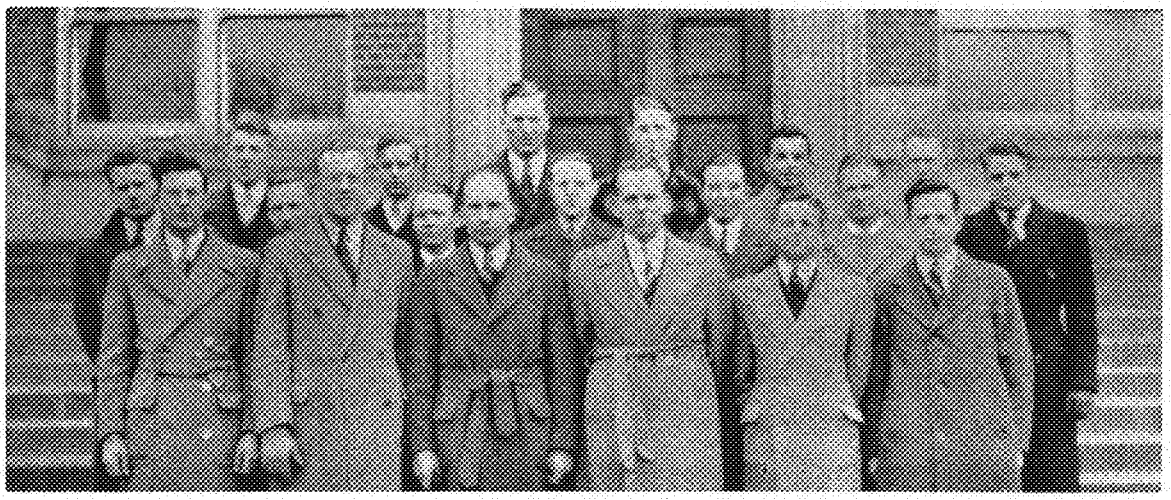
Theta Tau



Professional Engineering Fraternity

Row 1. Comstock, Zelner, Parker
Row 2. O'Keefe, Ranta, Aslesen, Larson, Ohman, Bass
Row 3. Swanson, Lewis, Brirzius, Hodgman, Troxell
Row 4. Rogers, Johnson, Ronbeck, Robertson, Haley

Triangle



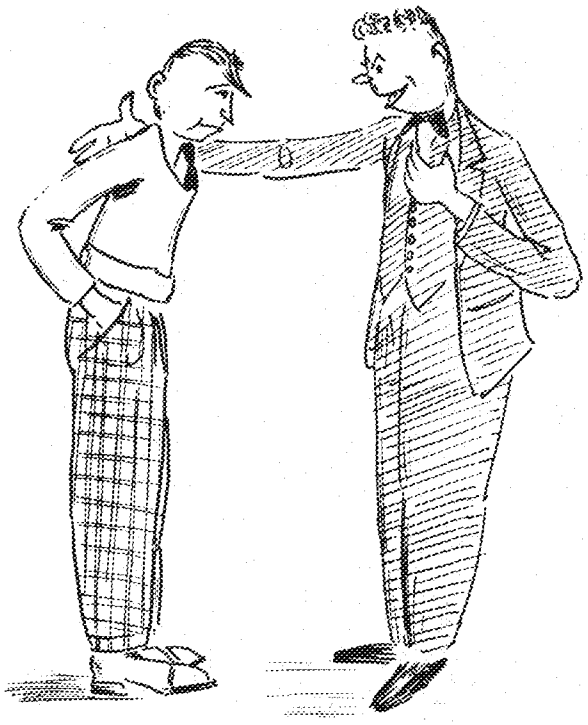
Professional Engineering Fraternity

Row 1. Senn, Hesse, Lynn, Klingel, Lohmann, Funke
Row 2. Wiltrout, C. Johnson, Brewer, Smith, Lowe, Barber, Moore
Row 3. Ryan, Ulrich, Wahlsten, Pfleider, Larson, Wodrich

Kappa Eta Kappa

Professional Electrical Engineering Fraternity

Row 1. Parker, West, Cartwright, Williams, Hewici
Row 2. Molenson, Stenderson, Fiohil, Strand, Wagner, Jordan
Row 3. Koerner, Morris, Haswell, Sabine, Wilcox, Broding



"What, no job in sight yet? Not even a nibble? Gee, that's tough pal. You should have ordered personnel leaflets."

SENIORS. Better pass the word on to the Juniors to get busy next fall and order personnel sheets early.

Company scouts find them convenient for reference in making interviews.

The faculty find them convenient for making recommendations.

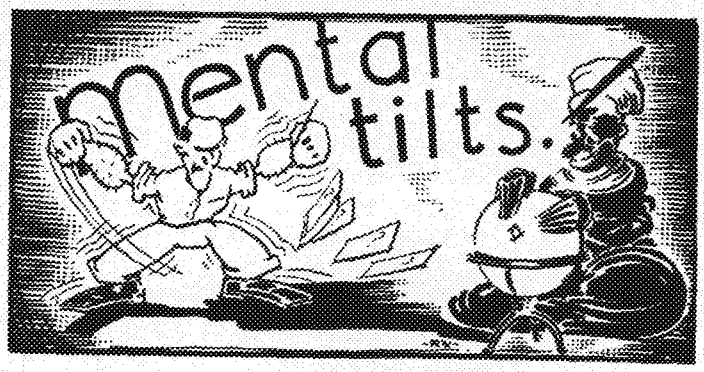
You have 100 copies for your own use in contacting companies.

The Institute mails 75 copies to prospective employers.

This year over 55% of the graduating seniors ordered leaflets.

The cost is only 2c each

Next Year's Seniors! Order Early!



By Gordon Wickre

WE ARE going to assume that the old brain had a good rest during vacation and that the new quarter isn't far enough along to have helped it much, and give you some easy "teasers" to aid in bringing the "old thinker" back to par again.

NOT long ago, a venerable old professor of mathematics got onto a train in one of our larger cities, and as he took his place in the Pullman, he noticed that the tall chimney of a factory, located due S. W. of the train, coincided exactly with the vertical edge of the window. The chimney remained in this position on the window till the train reached the next stop, 5½ miles from the starting point, but the factory was now due N. W. of the station. Mr. Professor, using only a stub of pencil, and a calling card for paper, immediately calculated the distance from the factory to the starting point of the train. How far was it?

* * *

Tommy Green had a giant glass marble. His big brother, who was somewhat of a physicist, decided to work out a few experiments with it: whereupon he weighed it in air and found its weight to be 90 gm. He then weighed it in a liquid, the temperature of which was 12° C., and found that the balance showed 49.6 gm. He next heated the liquid to a temperature of 97° C. and found that the marble weighed 51.9 gm. With this data, and assuming that the coefficient of cubical expansion of the glass was .000024, "big brother" found the coefficient of expansion of the liquid. Can you?

On a certain farm in North Dakota there is a conical shaped reservoir for rain water (if it rains). Why it is conical we don't know, unless the farmer thought he was saving concrete when he built it. The reservoir is 20 ft. deep, 10 ft. wide across the top, and it was found that the maximum capacity of the pipes leading into the reservoir is 15 cu. ft. per min. How fast is the level of the water rising when the cone is filled to a depth of 8 ft., assuming maximum flow?

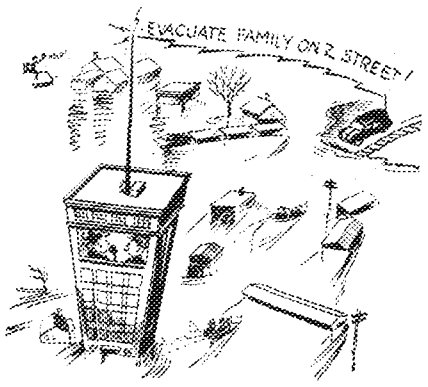
* * *

Are there any boat race fans in the crowd? Try this one: In a boat race between Harvard and Yale, the crew of Harvard rowed over the course at an average speed of 4 yards per second. Yale covered the first half of the course at 3½ yards per second and the last half at 4½ yards per second. They reached the end of the course 15 seconds later than the Harvard crew. What was the time of each crew?

Last Month's Contest

Due to the editor's laxity in correcting a manuscript error, the second problem in last month's Mental Tilts was rendered insoluble. The candles should have been capable of burning four and five hours respectively, rather than as given. For this reason no prize has yet been awarded for answers last month. The contest for March is, therefore, hereby reopened. The above simple problems will be considered separately for the April contest.

G-E Campus News

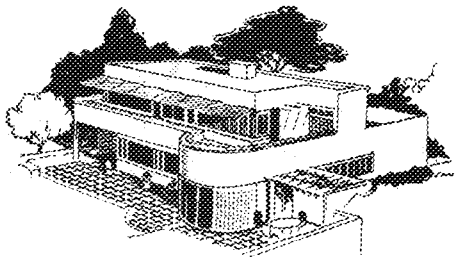


IN EVANSVILLE

Into the flood zone several General Electric engineers—among them Henry Duval of Washington University, Eugene Darlington of Oregon State, and Harold Towlson of Clarkson Tech—took two radio-equipped police cars and played an important part in the relief activities along the Ohio Valley. The equipment included a two-way ultra-short-wave police radio set in each car, a 50-watt headquarters transmitter, and a 150-meter transmitter having its own gas-engine-driven electric generator—in reserve in case of power failure.

One of the engineers reported, "We arrived in Evansville and erected our antenna on the 75-foot tower of a bank building. We were on the air continually, rendering service to the flooded area."

In a further effort to aid flood victims, General Electric sent extra men to the G-E Service Shops in the affected area to speed repair work.



IT'S "NEW AMERICAN"

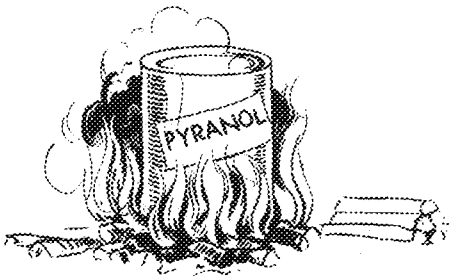
Conceived by General Electric, the "New American" home promises to influence profoundly the trend in American building. The program is sponsored in co-operation with all those professionally interested in building new and better homes.

The modern kitchen is one of the results of this work. It has been changed from just a room where a variety of tasks must be performed to a scientifically planned workshop. It is equipped with electric appliances which do the drudgery of kitchen work silently and easily. The electric range, refrigerator, dishwasher, Disposall unit, and modern lighting are but examples of the improvements which have been made in the home workshop.

The radial wiring system used in the "New American" home was designed for safety and convenience. Plenty of outlets for lights and for appliances are the outstanding features of this system.

The home is thoroughly air conditioned. Conditioned air is not only more comfortable but also more healthful, and the G-E air-conditioning units have been designed to promote such conditions.

With the elimination of wasted space, steps, and time throughout the entire dwelling—with the maximum in health, comfort, and economy—the "New American" home is building a brighter future for the cottage and the mansion.



IT WON'T BURN

Noninflammable and nonexplosive, this new cooling and insulating liquid, Pyranol, was developed by General Electric for use in transformers, capacitors, and cable. Its unusual characteristics have been recognized by the National Electrical Code, making it possible to install transformers indoors and at the load centers, without fireproof vaults. This results in savings in secondary copper and installation costs.

Pyranol is chemically stable and does not sludge, a feature which minimizes maintenance. Experience to date has showed that the materials used in Pyranol transformers have a longer life than under oil. The result—longer transformer life.

Pyranol transformers were first used in 1932, and now more than 700 units, totaling more than 200,000 kva of transformer capacity, have been installed, all giving excellent service.

96-375DH

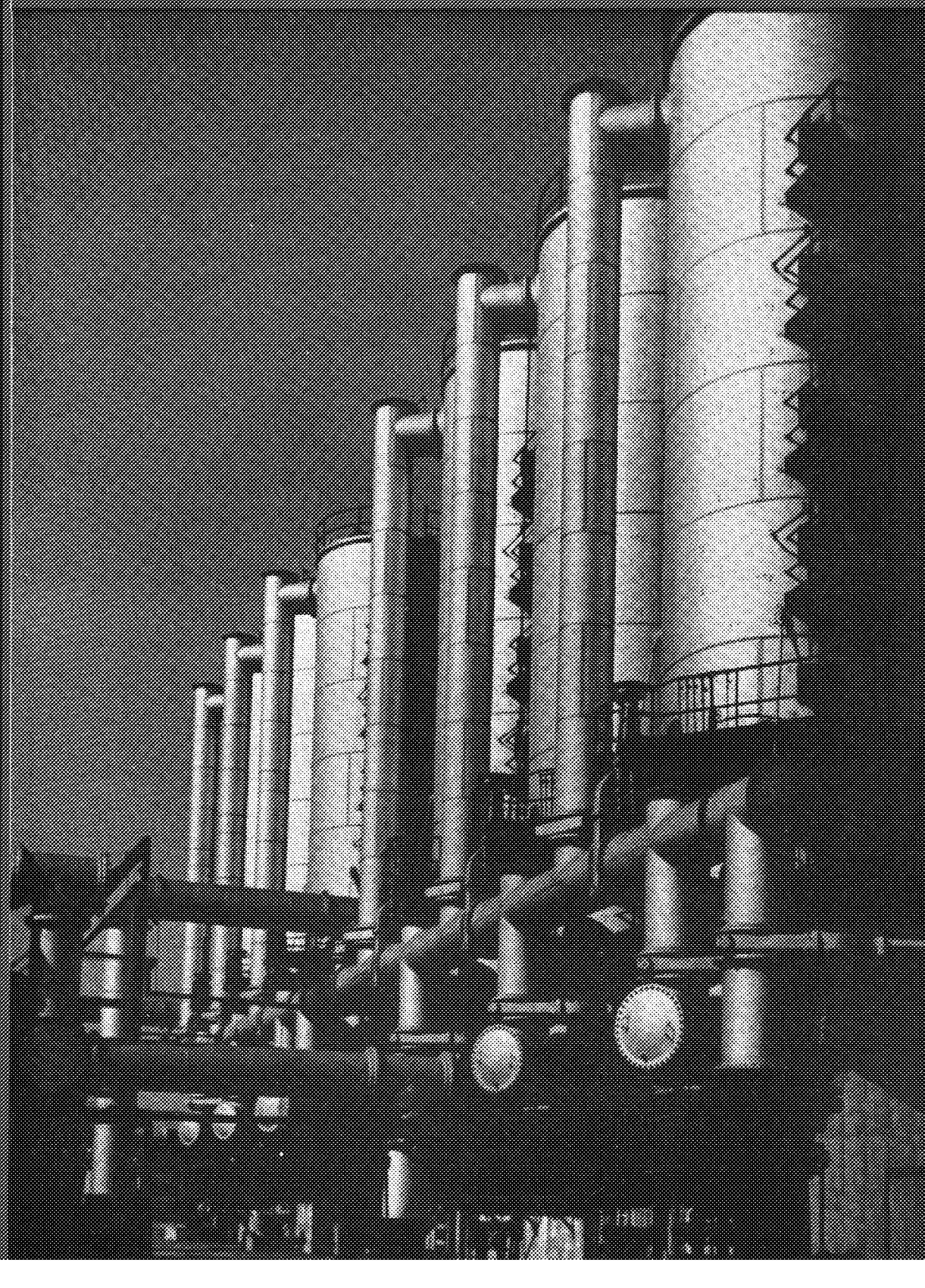
GENERAL ELECTRIC

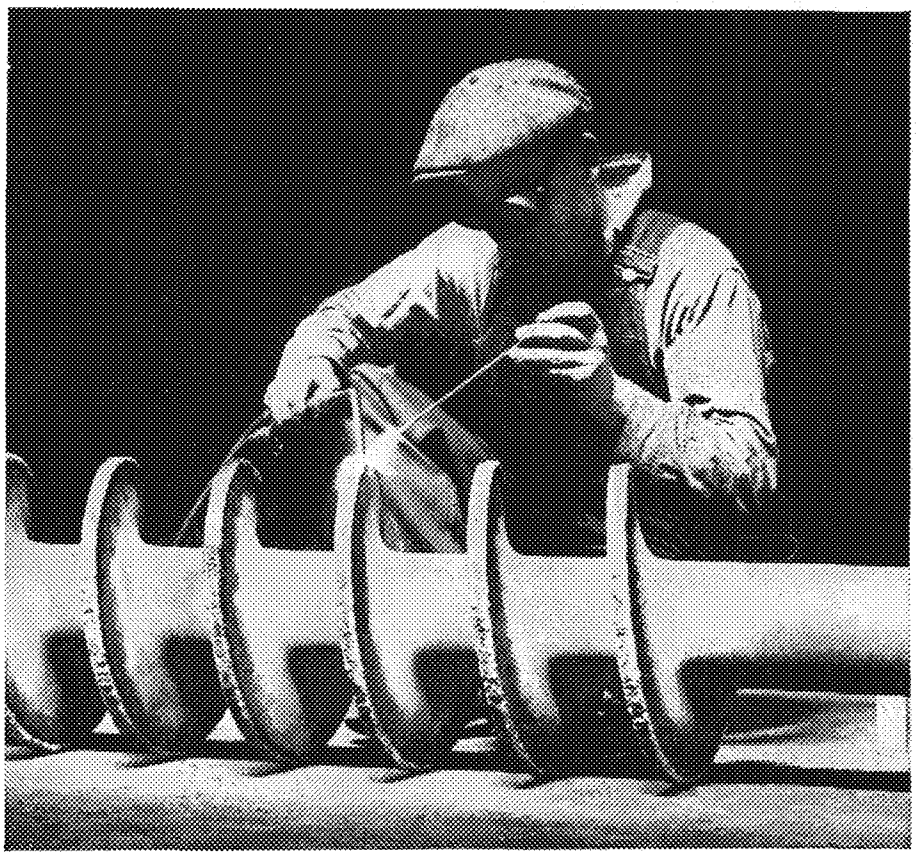
Vol. XVII No 8 May 19

MINNESOTA TECHNO-LO

In This Issue

- ...ate Water ...onserva- ...on
- ...u Beta Pi ...ze Essay
- ...rgoyle ...lub
- ...reparation ...r Service
- ...ogress
- ...lumnotes





WORN SCREW-CONVEYOR flights rebuilt by bronze-welding save replacement costs.

Build up the worn down . . .

Previous habits in the metals field reversed by new welding technique

UNTIL a comparatively short time ago, when metal parts were worn below the limit of toletance, they were discarded. Further cutting down could not make them fit the job again. This method wasted both time and money.

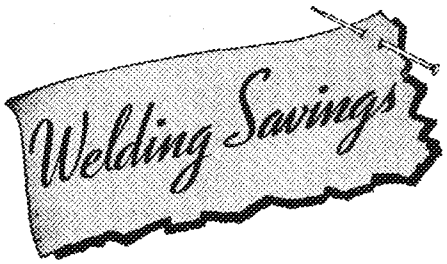
With the introduction of welding, this picture has been entirely changed. It is easy now to build up metal at low cost. Parts, worn too small to be useful, can be returned to original size and shape. By the oxy-acetylene welding process, new metal is put on where the old has been worn away. The original investment may thus be salvaged by a small additional investment in repair by welding.

Welding Means Low-Cost Repairs

Welding has made rapid strides in the repair and rebuilding of worn parts. In every industry where metal is used and wear occurs, welding methods are saving money. Oil-well drills can now be kept in cutting shape long after their normal life span is past. Railroad shops repair and rebuild worn parts of rolling stock and track by welding as a regular procedure. Factory tools and machinery are kept in shape through welding as one of the surest ways to low-cost, profitable operation. Contractors and engineers rely on welding to rebuild worn drill bits, picks, shafting and wearing parts on shovels and digging equipment. The list of repairs made by welding is growing rapidly.

A Friend in Need

Welding is indeed a friend in need. For example, when work is being done on time contracts, it is of vital importance that worn or damaged equipment can be repaired quickly on the job. Suspension of operations until new parts could be obtained would be fatal to speed and profit. With welding, such interruptions are prevented since machinery and equipment are kept continually in operating trim. The scrap piles are kept at a low ebb. Worn metal parts, from shovel dipper teeth to truck axles, are reclaimed by welding. It can be depended upon to give satisfactory results in repair, maintenance and fabrication.



$2,000 budgeted for new saws was saved by welding. Before any money was spent, the company checked into the possibilities of welding. Saw-repair by welding was developed, and now saws with broken teeth, cracks or other damage are restored at a fraction of the cost of new saws.

* * *

Welding of the copper kettles used for boiling wax in chemical and dye manufacture has become a regular routine that saves a chemical company many hundreds of dollars. After being in service for some time, the bottoms of these kettles become very thin. As the kettles have both an inner and outer shell, it was found best to weld in two new bottoms.

* * *

Welding was used by a midwestern creamery to rebuild the teeth on a large gear. The gear was worth $600, and the rebuilding work cost less than $50. This one job alone far more than paid for all necessary welding equipment.

* * *

Welding saves thousands of dollars each year for a large western railroad. Battered rail ends, caused by constant hammering of the car wheels at the joints, are rebuilt by welding. The rail ends are welded in place without traffic interruption. This saves taking up the rails, sawing off the ends, redrilling and relaying.

* * *

Welding is used to reclaim worn and broken reamers from automobile shops. The reamers, which cost from $2.50 to $16 each, reclaimed by welding are as good as new, at an average cost of 40 cents. Breakage and loss of teeth on this type of tool are extremely high. The tooth bill in these shops has shown a healthy reduction since welding methods have been used.

* * *

In a wood-products mill, welding is used to rebuild the steel shafts in pulp grinders. These shafts, originally a foot in diameter, wear rapidly and continually at the collars holding the stone. A small amount of play makes it difficult to keep the collars drawn up right. Under these conditions, wear happens fast. Common practice, before the advent of welding, was to change the collars and bearing four to eight times as the shaft wore down and was remachined. When the shaft was too small, about eight inches in diameter, it was discarded. Now by welding, the shaft is built up to original size as soon as it wears. Many thousands of dollars in new shafts, collars and bearings are saved annually.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable booklets describing the oxy-acetylene process are available without obligation. For further information write any Linde office.

The Linde Air Products Company

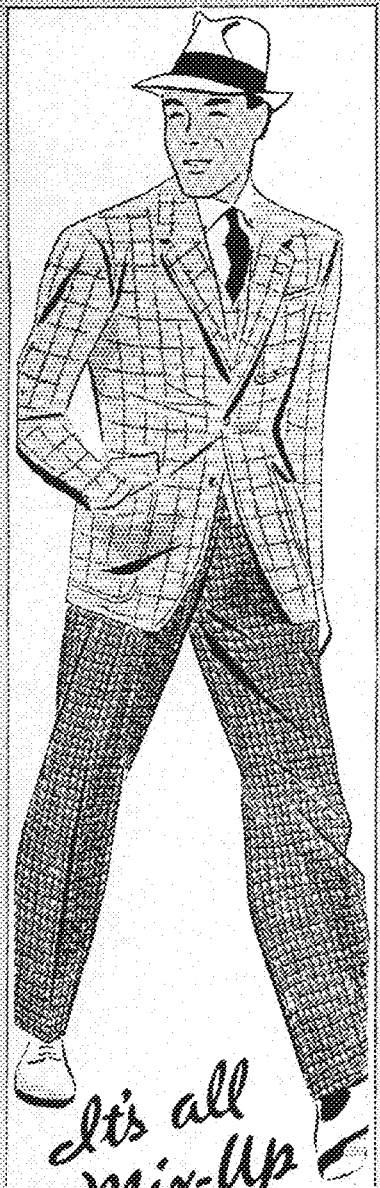
Unit of Union Carbide and Carbon Corporation

UCC

New York and Principal Cities

In Canada:

Dominion Oxygen Company, Limited, Toronto



It's all a Mix-Up

Yes, we're a bit dizzy . . . just finished making up some new Juster "mixed fabric" sport ensembles . . color blends heretofore unknown in men's clothing. There are checked blouse jackets with darker slacks, with an over-square pattern, glen plaid high rise, pleated slacks with belt to match, with a cross bar herringbone jacket . . . blends that are out of the ordinary — exclusive, but not expensive.

SPORT JACKETS . . $12-95

"ALL WOOL" SLACKS $5.95

Jack up your appearance

with a

JUSTER *Sport* JACKET and "TUG" *Slacks*

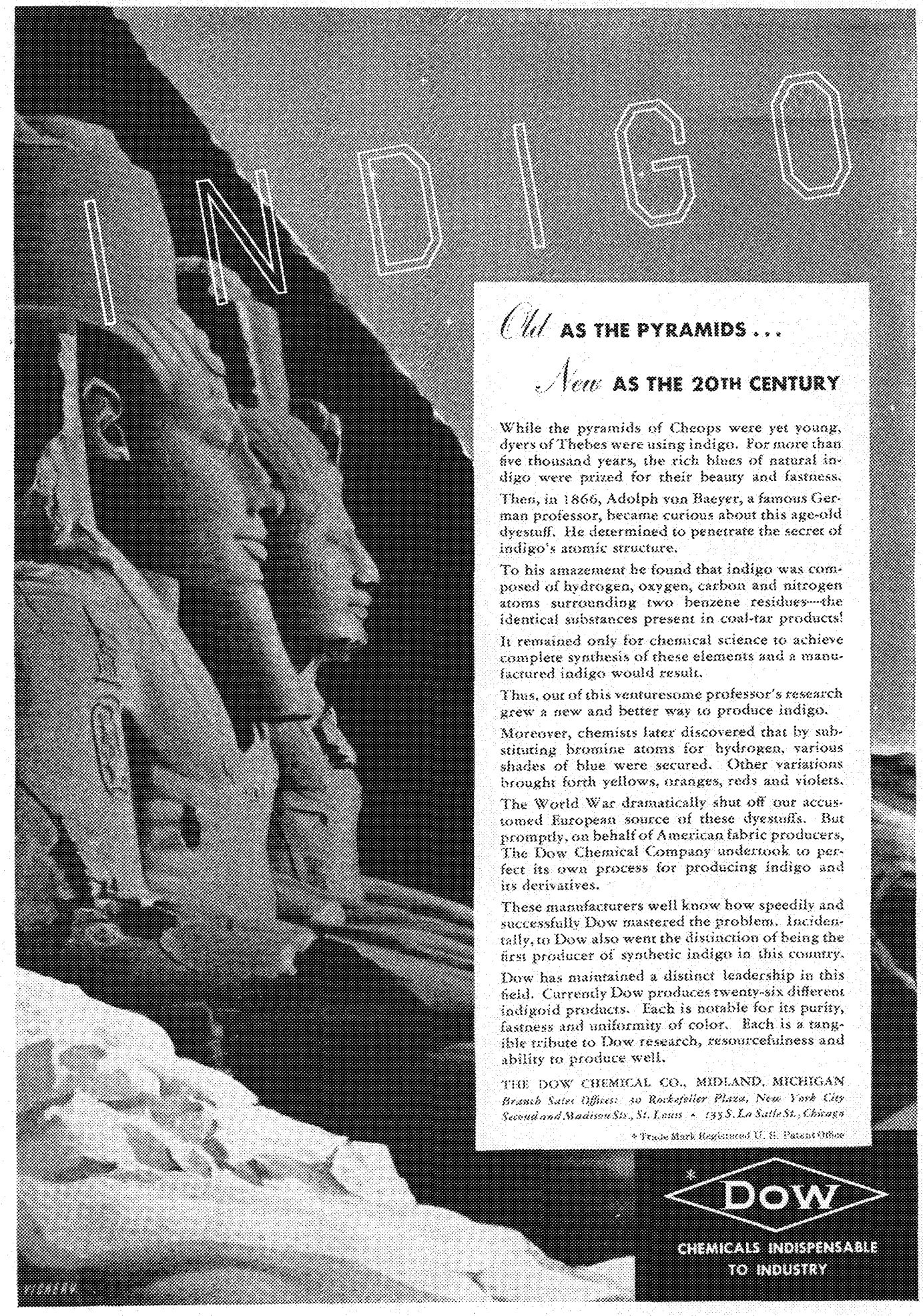
Blouse Back
SPORT JACKET
$12.95

All Wool
SLACKS
$5.95

Clothiers — Tailors — Furnishers

JUSTER BROS

On Sixth Street . . . Just Off Nicollet



Old **AS THE PYRAMIDS . . .**

New **AS THE 20TH CENTURY**

While the pyramids of Cheops were yet young, dyers of Thebes were using indigo. For more than five thousand years, the rich blues of natural indigo were prized for their beauty and fastness.

Then, in 1866, Adolph von Baeyer, a famous German professor, became curious about this age-old dyestuff. He determined to penetrate the secret of indigo's atomic structure.

To his amazement he found that indigo was composed of hydrogen, oxygen, carbon and nitrogen atoms surrounding two benzene residues—the identical substances present in coal-tar products!

It remained only for chemical science to achieve complete synthesis of these elements and a manufactured indigo would result.

Thus, out of this venturesome professor's research grew a new and better way to produce indigo.

Moreover, chemists later discovered that by substituting bromine atoms for hydrogen, various shades of blue were secured. Other variations brought forth yellows, oranges, reds and violets.

The World War dramatically shut off our accustomed European source of these dyestuffs. But promptly, on behalf of American fabric producers, The Dow Chemical Company undertook to perfect its own process for producing indigo and its derivatives.

These manufacturers well know how speedily and successfully Dow mastered the problem. Incidentally, to Dow also went the distinction of being the first producer of synthetic indigo in this country.

Dow has maintained a distinct leadership in this field. Currently Dow produces twenty-six different indigoid products. Each is notable for its purity, fastness and uniformity of color. Each is a tangible tribute to Dow research, resourcefulness and ability to produce well.

THE DOW CHEMICAL CO., MIDLAND, MICHIGAN

Branch Sales Offices: 10 Rockefeller Plaza, New York City
Second and Madison Sts., St. Louis • 1535 S. La Salle St., Chicago

* Trade Mark Registered U. S. Patent Office

* DOW

CHEMICALS INDISPENSABLE TO INDUSTRY

The Minnesota Techno-Log

Member of Engineering College Magazines Associated

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

MAY, 1937

ROBERT TEETER
MANAGING EDITOR

ELWOOD McGEE
BUSINESS MANAGER

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

Officers of the Honorary Societies

Carl Dech, Pres. William Mather, Vice Pres. Richard Olson, Rec. Sec'y George Piercy, Corres. Sec'y Prof. E. W. Johnson, Treas.	Tau Beta Pi
Arnold Matthies, Pres. William Hansen, Vice Pres. Karl Haugen, Rec. Sec'y Vincent Johnson, Corres. Sec'y Harley Hughes, Treas.	Pi Tau Sigma
Earl Fransen, Pres. Erling Helland, Vice Pres. Loren Prickland, Sec'y Elwood McGee, Transit Corres. Reynold Bjorck, Treas.	Chi Epsilon
Richard Longfellow, Pres. Donald Raudenbush, Vice Pres. Robert Lind, Rec. Sec'y Lloyd English, Corres. Sec'y Orville Becklund, Treas.	Eta Kappa Nu
Edward Kaiser, Pres. John Hollihan, Vice Pres. Bruce Gillespie, Sec'y Ralph Frederickson, Treas.	Phi Lambda Upsilon
Robert Hose, Pres. Henry Nitta, Sec'y	The Commacini

This Month

VOLUME XVII — NUMBER 8

Officers of the Professional Societies

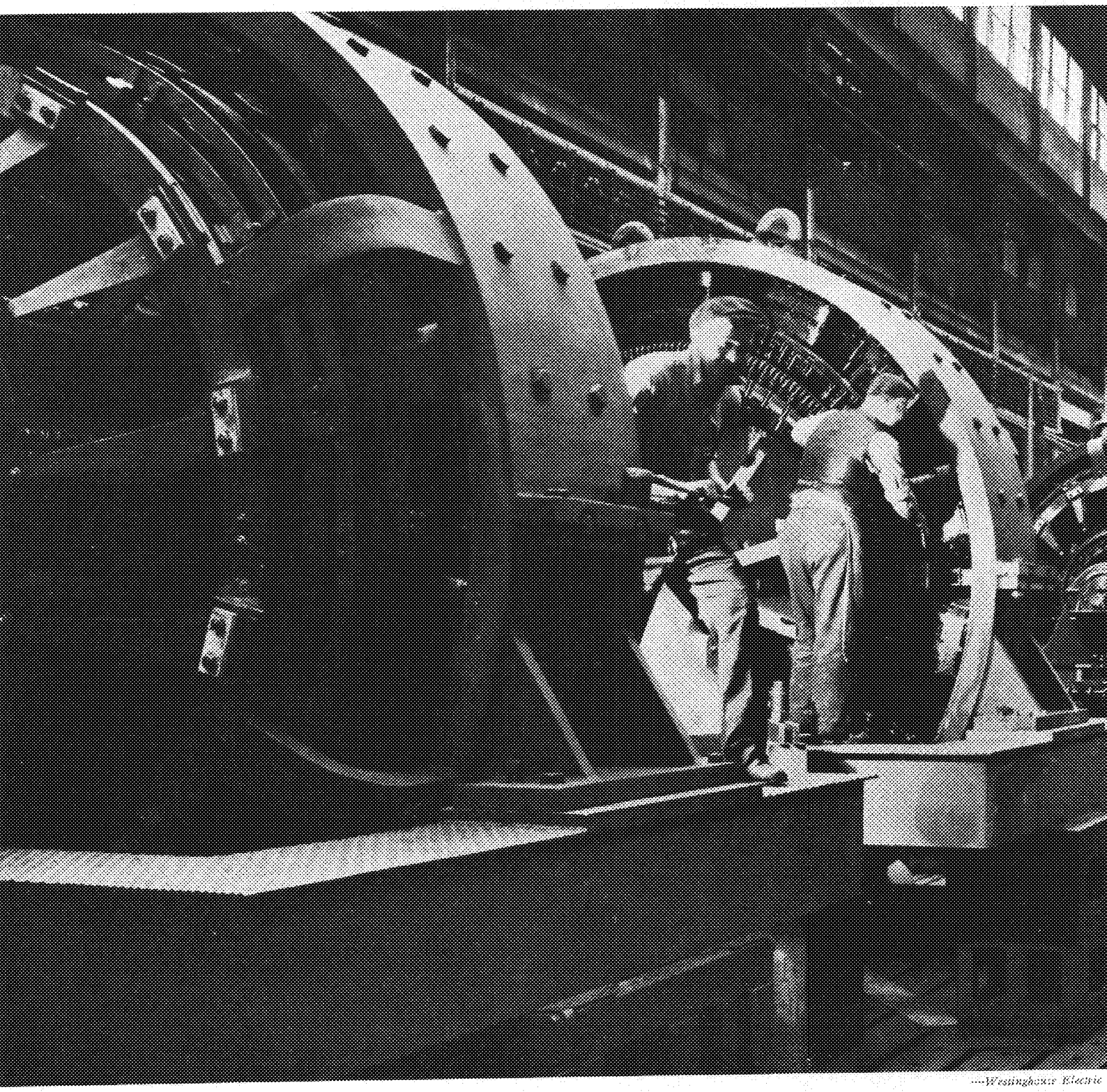
Richard Olson, Pres. Robert Ellis, Vice Pres. Gordon Custer, Rec. Sec'y Fred Rathjen, Corres. Sec'y Eli Besser, Treas.	A. I. Ch. E.
Orville Becklund, Pres. Parry Morris, Vice Pres. Frank Parker, Sec'y-Treas.	A. I. E. E
Robert Pierce, Pres. Richard Prahm, Vice Pres. Stuart Chapin, Treas. Martha Granger, Sec'y	Architectural Society
Charles Snyder, Pres. Stanley Balik, Vice Pres. Nelson Dingle, Sec'y-Treas.	A. S. A. E.
Thomas Klingel, Pres. John Ellison, Sec'y Paul Thomas, Treas.	A. S. C. E.
Gerry Mitchell, Pres. Arnold Matthies, Vice Pres. Karl Haugen, Sec'y John Peterson, Treas.	A. S. M. E.
Vincent Victoreen, Pres. Edmund Woodrich, Vice Pres. Robert Burns, Sec'y Leonard Starlof, Treas.	I. Ae. S.
William Kaiser, Pres. Rawson Aikire, Vice Pres. Howard Nordquist, Sec'y-Treas.	School of Mines

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
New York Univ. Quadrangle
North Dakota State Engineer
Ohio State Engineer
Oregon State Technical Record
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Villanova Engineer
Washington State Engineer
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, Main 8177, Extension 514. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application.



—Westinghouse Electric

Motor Assembly

Development of Water Conservation in Minnesota

By Paul Thomas, C.E. '38

PROBLEMS dealing with water control projects in the United States have been under consideration for many years. They are concerned with control for particular usage, such as navigation, flood control, irrigation, recreation, water supply, or power development. Only in the last few years however, has any study been made of this problem in our own state, Minnesota. General property owners, city dwellers, and residents of the state are becoming conscious of today's acute moisture situation.

Minnesota has suffered many ill effects of an economic and social nature because of drouth of the last few years. The drouth is the result of a record deficiency in precipitation which has accumulated almost without a break for sixteen years. This condition has in some way, either directly or indirectly, affected the life and interest of every citizen of the state. Many emergency methods have been employed in the supply of water for cities and villages for sanitary and domestic purposes. The towns and villages in the Red River Valley are now confronted with serious water shortages, but probably will be greatly aided within the next decade.

The possibility of recurring water shortages is a disturbing factor in the development of industries in most of these cities. Unless a constant and dependable source of water is assured, new industries, including the fast growing beet sugar industry, will be forced to move their present plants to other locations. The summer supply of water is usually adequate for these communities, but, as winter approaches, they find the supply diminishing. The immediate problem becomes that of bringing down supplies from distant lakes or water reservoirs.

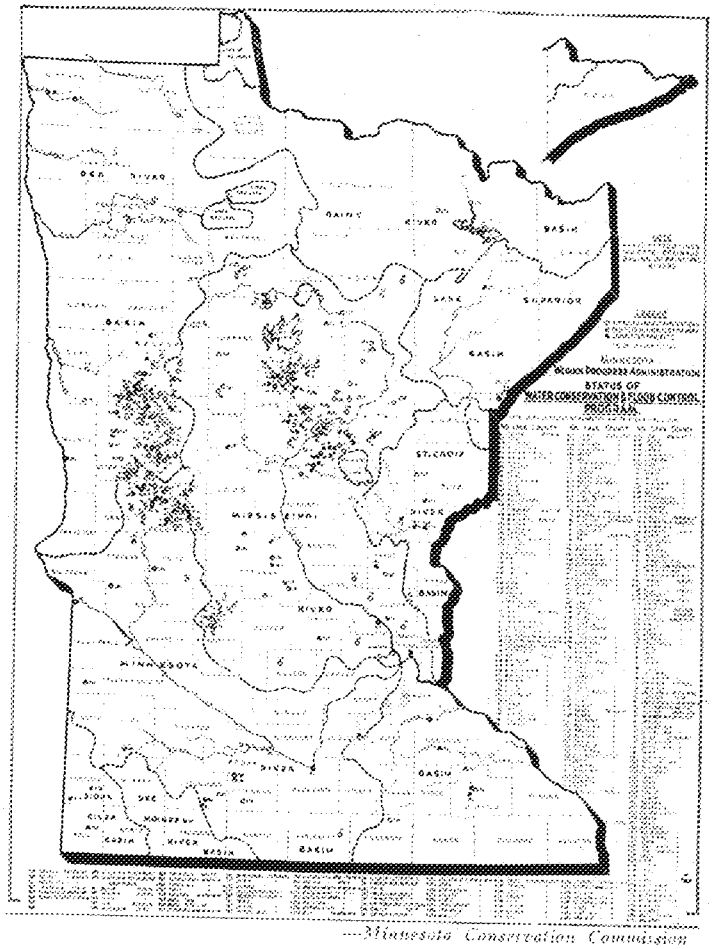
The lowering of the lake level which has resulted from the drouth of the past years has greatly affected the tourist industry. The lowering of lake elevations has caused lake shorelines to recede from the cottages and resorts, thereby making many summer homes and business establishments practically valueless. Minnesota has long been noted for its one great natural resource—water—which has contributed to its reputation of being the most attractive and popular tourist state in the union. If the levels of its lakes are allowed to fall, the state will find it difficult to retain its good name as being the summer resort of the nation. If lake levels are not restored, the property value and the incomes of the communities will continue to fall as tourist trade diminishes. The lowering of lake levels by draining their breeding places, tends to decrease the supply of fish. Lakes also have become too shallow in the winter to allow fish to thrive below the crust of ice.

The drouth has had its effect upon the welfare of the farmers of Minnesota by causing a depletion of ground water and soil moisture. Parts of the state have suffered three years of crop failure by drouth. Minnesota, being mainly an agricultural state, depends on a constant supply of water. The farmer is directly dependent upon an adequate supply of moisture to raise his products and promote his general welfare. The moisture which is maintained from the winter supply or early spring rains determines, to a certain extent, the crop outlook for each year. Also, enough moisture must be supplied to continue crop growth throughout the summer months.

Minnesota is one of the few states in which all of its rivers drain out of the state with no river draining in. Minnesota's continental divide has proportioned the state into areas which drain away in all directions into the four major basins as outlined on the map. Each part of the state drains toward one of these large basins. Minnesota boasts of containing the largest water surface area of any of the 48 states, but, because of its geological divisions, it is faced with the continuous problem of scarcity of water. The water area of the state receives its supply from precipitation—that is, rain and snowfall. The catchment areas lie within the state itself with very little water being supplied by any other means.

The problem is not how to change the supply of rainfall and snowfall for Minnesota, but how to better control or

Drainage basins of Minnesota; location of conservation projects is shown by circles.



—Minnesota Conservation Commission

make use of the water which does exist before it escapes from the state. It is necessary to develop a means of so controlling the supply on hand that it will be properly stored and used to accomplish the greatest amount of good for all purposes within the state.

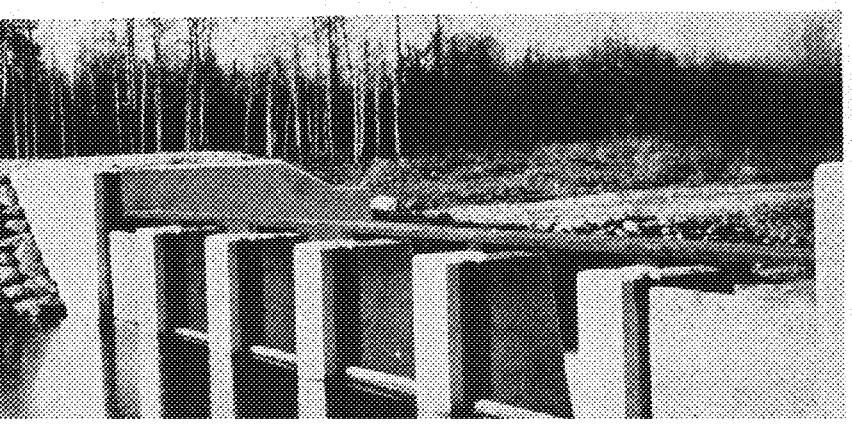
Nature has provided two means of storing water. The first and most important is storage in natural reservoirs which includes lakes, marshes, ponds, and streams. This supply of water is constantly subject to demands of nature and these demands far exceed the part taken by man. Nature's demand is in the form of evaporation from open water and soil surfaces, transpiration (that part demanded by vegetation in its growing process) and seepage. The total of the three make up 80 per cent of the demands on normal precipitation supplies. When a period of exceptionally dry years is encountered the demand upon water supply is very heavy, and the amount which is available disappears rapidly leaving little or none for human needs.

The second method is known as ground water storage. The water seeps into the ground and percolates into various geological formations. This process of distribution is governed by the characteristics of the ground in question which are determining factors as to the rate and amount of seepage and percolation. The rate is affected by geology of underlying strata, topography of ground surface and the rate of sub-surface water movement. The quality of ground water is affected by the salts and minerals which it gathers as it passes through the ground. Before this water can be used, chemical treatment must be given to remove the harmful materials.

The cities in the Red River Valley have been trying to obtain supplies of water from underground sources, but they have found only water which is unfit for domestic consumption. This region is dependent upon the rainfall in the catchment areas to supply the water for the towns. The drouth has practically shut off the supply of water for these cities and has created a serious problem. Cities which are included in this area are Breckenridge, Moorhead, Fargo and Thief River Falls.

Since rainfall is Minnesota's main source of water supply and since hydrologists have no formulas to predict future supplies with any degree of accuracy, our only means to secure an adequate water accumulation is to build reservoirs and store as much rainfall as possible. To establish a basis for such a program, fundamental data must be gathered. Time is the essential element in the preparation and actual construction of water conservation projects. The structures which are designed must be able to withstand natural forces such as those resulting from high volume, frequency, intensity, and duration of water flows. The fundamental knowledge necessary is the behavior of surface water to be dealt with in time of flood as well as in time of drouth. The collection of data pertaining to each run-off area or basin requires many years of tabulation and interpretation. When data regarding stream flow become available, much more time must be spent in the analysis than is given to the location and construction of the control itself. All-in all, the data gathered must be compiled and analyzed so as to approach a program adequate for future needs—one which will serve as a check during floods and as a prevention of extreme drouths.

The standard type "C" dam used in Minnesota's water conservation development.



It became imperative within the last few years for the people of Minnesota to take into consideration the problem of quantity as well as quality. Since the water which we receive is derived almost exclusively from within the state itself, it is essential to devise methods which will retain as much of it as possible and put it to the most beneficial use before it passes out of the state. Proper allocation for use and storage should be made only after a thorough recognition and understanding of the rights and privileges of all who are concerned have been reached.

The conservation department of our state, although handicapped by the decided hesitance on the part of the federal agencies to allot special funds for water conservation projects to our state, has persistently pleaded for the cause of Minnesota's lakes, rivers and streams until, finally, a water conservation program, which is, without question, the most comprehensive and extensive of any ever undertaken, has been approved. At the present time 800 projects, affecting as many lakes and artificial reservoirs, have been handled by the department. On April 1, 1937, 124 projects had been completed, 52 were under construction, 38 were ready for construction, and 118 projects were awaiting land clearance, sponsor's commitments, etc. The rest were either under consideration or are temporarily suspended.

The general water conservation program was started by the Conservation Commission early in 1933. This program is second in point of capacity, the upper Mississippi River navigation reservoirs being first in the country. The system includes projects in the Lac Qui Parle, Whetstone River Diversion, Big Stone Lake, Lake Traverse, Red Lakes and Red Lake River, and Roseau River reservoirs. This program of projects is intended to furnish a much needed, dependable source of water supply and also provide for the control of damaging floods such as were encountered in April in the western and southwestern part of the state. The dams which are completed in this area performed their duty by preventing severe damage to any particular part of the state; when they are completed it is hoped to have a means of completely checking such disasters. The Whetstone River Diversion Project aided in controlling the flood this spring.

The chief need on the Minnesota River is to correct stream flow by main stems and tributary storage, protect agricultural lands subject to overflows, improve sanitation, and provide reliable surface sources of water supply. The larger projects, such as the Whetstone River Diversion which includes the Big Stone Lake and Lac Qui Parle reservoirs, are designed to aid in flood control as well as to provide for low water needs. The plan provides for the upper portion of the storage space to be kept avail-

able for flood storage during the entire year when the flow into the reservoir exceeds the bank-full capacity of the channel below the reservoir; the middle section is to be used for primary storage, and the lower section is to provide water supply during drouth.

The big Lac Qui Parle flood project is about 80 per cent completed, some water already being held by the dam. This project is located about eight miles north of Montevideo and is designed to supply water for Montevideo and to increase the flow in the Minnesota River during the drouth periods. The reservoir is about 23 miles long and one-half mile or more in width, adding one more lake to Minnesota's much-vaunted 10,000.

A diversion channel is being cut from the Chippewa river through the Watson sag into Lac Qui Parle. It is hoped that the directing of the spring flood will raise the lake's level from last year's figure of 926 feet above sea level to 936 feet. The excess flow over bank-full capacity will be stored in the reservoir until it can be safely released. The reservoir will be ready to impound water from the possible floods of June and July. The dam control is designed to keep the level of the lake above 936 feet. The dam will dole out water to correct existing sewage disposal situations and provide water for the cities directly below.

The conservation program includes the construction of several hundred type "C" dams as shown in the photographs. Storage of water in the smaller lakes is brought about by the erection of these small dams which are used as control units at the outlets. The word "dam" is not properly used in describing these structures. They are built of reinforced concrete in such a way as to place the elevation of the sill or low water control at the same elevation as the bed of the natural outlet. The width of the dam depends on the topography of the outlet and may be varied to meet local conditions by varying the number of standardized weir sections. The elevation is controlled by the removable stop logs. The water levels of the lakes will be raised during the spring and an attempt made to keep this elevation. Each "dam" is made up of 5 ft. weir

A dam erected to save a stand of trees by raising the ground-water level.

sections with a 2, 4 or 6 foot control. When all the logs are in place the lake will retain the water from the entire water shed. Much attention was given to the special design of the type "C" dams. Each particular section is given special consideration as to spillway section and channel development.

The cost of each project is dependent upon many factors such as design, location, development, and labor. Works Progress Administration labor has been used on the 124 that have been built to date. The average cost of each project has been $2,000 without labor.

The entire program developed by the conservation department deserves continued support. Public reaction towards water conservation is swayed by the conditions as they exist from time to time. The present drouth has given rise to the present construction projects which are part of a program so comprehensive that it will necessitate the extension of the work over a considerable number of years. If interest is kept up in the future there is no doubt but that the elevation of the lakes can be restored and a greater supply of usable water stored up. Also, water conservation can be made to furnish wholesome, interesting, and educational employment for relief purposes with permanent results comparable in value to other types of conservation and requiring a minimum of maintenance costs.

Tau Beta Pi Prize Winning Essay

"The Story of Clerk Maxwell"

By **Howard Daniels, E.E. '38**

THE middle portion of the last century was remarkable as an age of rapid advancement in all branches of science, and particularly in that branch known as Theoretical Physics. During these prolific years, a multitude of classic concepts and theories which, having outlived their usefulness, were acting as obstacles to the further progress of science, gradually collapsed under the rapidly accumulating pressure of new scientific fact and thought; and those inherited concepts and theories which survived emerged in new forms, modified, reënforced, and supplemented by the efforts of many brilliant physicists, to be gradually fused into the foundation upon which rests most of what is now known of the science of physics. That these tremendous advances were possible was due in no small measure to the work of James Clerk Maxwell, whom Sir James Jeans describes as "the greatest mathematical physicist the world has seen since Newton."

In the course of his lifetime, Clerk Maxwell offered a large number of significant contributions to many domains of physical science, any one of which might have established him as one of the foremost physicists of his day. Two of his accomplishments, however, his contribution to the Kinetic Theory of Gases and his development of the Electromagnetic Theory—are so important as almost to obscure his other work; and a brief consideration of his investigations in these two fields may furnish both an in-

dex to the man and his method and a clue to the real basis of his fame.

The Kinetic Theory of Gases, which attributes the heat and the pressure of a gas to the rapid, erratic motion of swarms of molecules of which it is presumed to be composed, had been well developed by such workers as Bernoulli, Clausius, and Joule. On the basis of this theory, it had been possible to explain mathematically some of the simpler relations between the properties of gases; but the propounders of the theory made the considerable error of assuming the speeds of all the molecules in a given gas under fixed conditions to be the same, and their mathematical analyses of many of the more complex phenomena consequently failed to agree with experimental results. Maxwell, recognizing that the speeds of such molecules could not be equal—that, in fact, the speed of each molecule must suffer a change in magnitude with each collision of the molecule with another—interested himself in the question of the distribution of the molecular velocities with the aim of extending the application of the existing hypothesis. The result of his efforts was the Maxwell Distribution Law, a mathematical formula giving the fraction of a large number of molecules selected at random from a gas which might be expected to possess a given velocity.

Develops Statistical Mechanics

The Distribution Law, augmented by the work of Maxwell himself and a number of later investigators, proved to be of immense value in the correct solution of many fundamentally important problems which had previously resisted analysis, including those relating to the viscosity of a gas and its properties of diffusion and conduction of heat. Hence Maxwell's investigations, by furnishing powerful corroborative evidence for the Kinetic Theory of Gases, were instrumental in securing the general acceptance of the principles which remain today as the main supports of the science of Thermodynamics. But of even greater significance is the fact that his solution of this problem marked the beginning of the study of Statistical Mechanics, a realm of scientific investigation which becomes more fruitful with each passing year. Here, for the first time, was a demonstration that the mathematical principles of probability constitute a useful—indeed, a necessary—means of physical investigation.

Important as was Maxwell's work on the theory of gases, however, its significance is small as compared with the consequences of his Electrodynamic Theory, whose momentous implications definitely altered the course of scientific history, and which, in the word of Max Planck, "must remain for all time one of the greatest triumphs of human intellectual endeavor."

When Maxwell first turned his attention to the study of electrical phenomena, physicists were divided in their opinions as to the proper mode of attack on the problems of electricity. Some among them accepted the theories of Faraday, who, in order to explain the mechanism of electric and magnetic forces, conceived of the space surrounding electric charges and magnetic poles as existing in a peculiar state of strain, representable by lines of force radiating in all directions from the charges and the poles; others, regarding Faraday's lines of force as trivial inventions, preferred to rely on Newton's theory of action at a distance, which implied that the space around a charge or a pole is in no respect different from any other portion of space. For Maxwell, the concept of lines of force, supported as it was by a mathematical expression for the force exerted on electric charges by magnetic flux in motion, had a strong appeal, and early in his career he began to apply his extraordinary physical intuition to the extension and generalization of that concept. His speculations led him to a significant conclusion; that just as moving magnetic flux exerts forces on electric charges, so moving electric flux exerts forces on magnetic poles. These two interrelated postulates he expressed mathematically in the form of a double system of partial differential equations describing the relationship between the electric and the magnetic fields.

Discovers Electromagnetic Theory

It is impossible to overestimate the far-reaching influence of Maxwell's conclusions upon subsequent trends in experimental and theoretical physics. Not only did his theory, with its clearly suggested corollary that electrical disturbances are transmitted through space in the form of electromagnetic vibrations, render the study of electricity an exact science, establish the basis for the eventual discovery and perfection of radio communication, and successfully solve the major problems of optics, which had resisted all previous attempts at accurate solution; it also supplemented the established Newtonian physics of discrete particles and action at a distance by a new, more versatile physics of continuous fields. Doctor Einstein remarks, "This change in the conception of Reality is the most profound and the most fruitful that physics had experienced since the time of Newton." By his development of the Kinetic Theory of Gases, Maxwell created a tool with the aid of which much of the present science of Thermodynamics was fashioned; but by his discovery of the Electromagnetic Theory, he provided material for the reconstruction of the universe.

Experimentation Left to Successors

It was characteristic of nearly all of Maxwell's work that, after arriving at a scientifically important conclusion by a path of pure reasoning guided and controlled by that profound physical and mathematical intuition which was his greatest strength, he made no serious attempt to verify that conclusion by experiment; never an experimenter himself, he preferred to deliver this important task into the hands of those whose talents peculiarly qualified them for it. His Electrodynamic Theory, for example, was not corroborated experimentally until nearly ten years after his death, when Hertz succeeded in demonstrating the existence of electromagnetic waves; similarly, the work necessary to establish the validity of his amendment to the Kinetic Theory of Gases and to develop its many useful consequences was left to a number of skilled experimenters, who worked independently of one another at widely separated places and times. Maxwell was by nature a pioneer; having penetrated into previously unexplored territory, he left its exploitation to others who followed him, and himself moved on to still untouched domains. In the words of Sir James Jeans: "It was not in keeping with Maxwell's methods that he should finish off a piece of work so completely that nothing could be added to it; his plan was rather to open up wide vistas which would provide work in their detailed exploration for whole generations yet to come."

1937 Gargoyle Club Competition

and

Scarab Medal
Alpha Alpha Gamma Award
Northern States Power Prize

WINNERS of the Gargoyle Club Competition in architectural design for 1937, Richard N. Frahm, '38, and J. Lawrence Haugen, '38, will receive prizes of $35 and $15 respectively in books of their own selection. The *project* offered this year in the annual competition was the architectural and decorative treatment of a State Supreme Court and adjacent rooms, and the sixteen designs were considered by a jury consisting of seven faculty critics and one Gargoyle Club representative.

The Gargoyle Club is an organization of St. Paul architects and draftsmen, established about twenty years ago and for some years owner of the little Cass Gilbert church at the foot of Ramsey Street hill; its competition, offered for some years in the junior design course, purposed to encourage students by material reward for excellence in design.

Because of the nature of the competition, the problem offered is always of a special nature, not primarily a "plan" problem but one of the character of which must be at once relatively simple and monumental and which requires considerable skill in presentation.

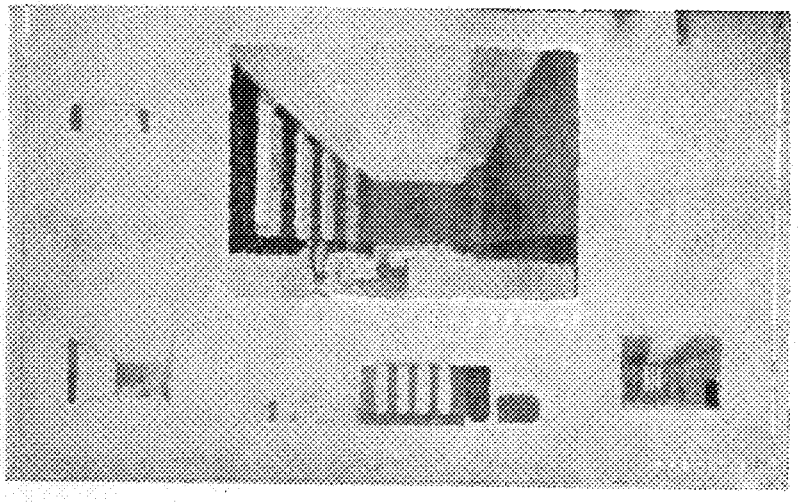
The competing students are furnished with printed sheets listing the requirements of the problem and specifying final sheet sizes and scale of drawings. In this particular *project*, it was required to present a large perspective view of the main court chamber and smaller explanatory sections of the chamber, of the large and impressive vestibule, and of the judges' consultation room. Two days were allowed for a preliminary study intended to provide a clarifying basis for study. Then, for the remainder of the month, additional informal studies were prepared, progressing from plan functions through proportions and materials into rendering.

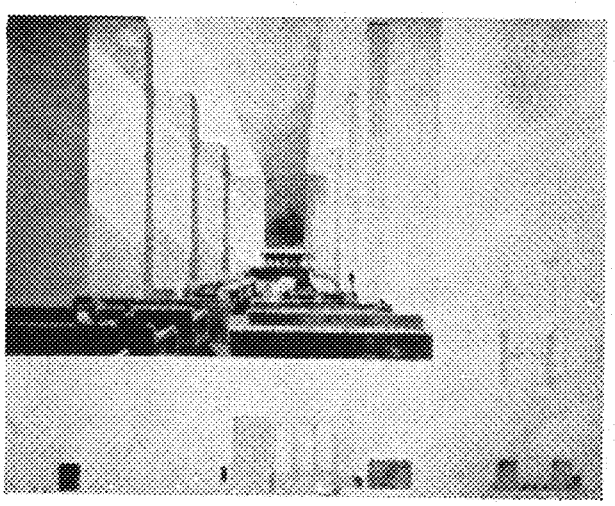
The final drawings were more carefully delineated than the ordinary architectural problems, which are not intended for exhibition but merely as expressions of the all-important *ideas*.

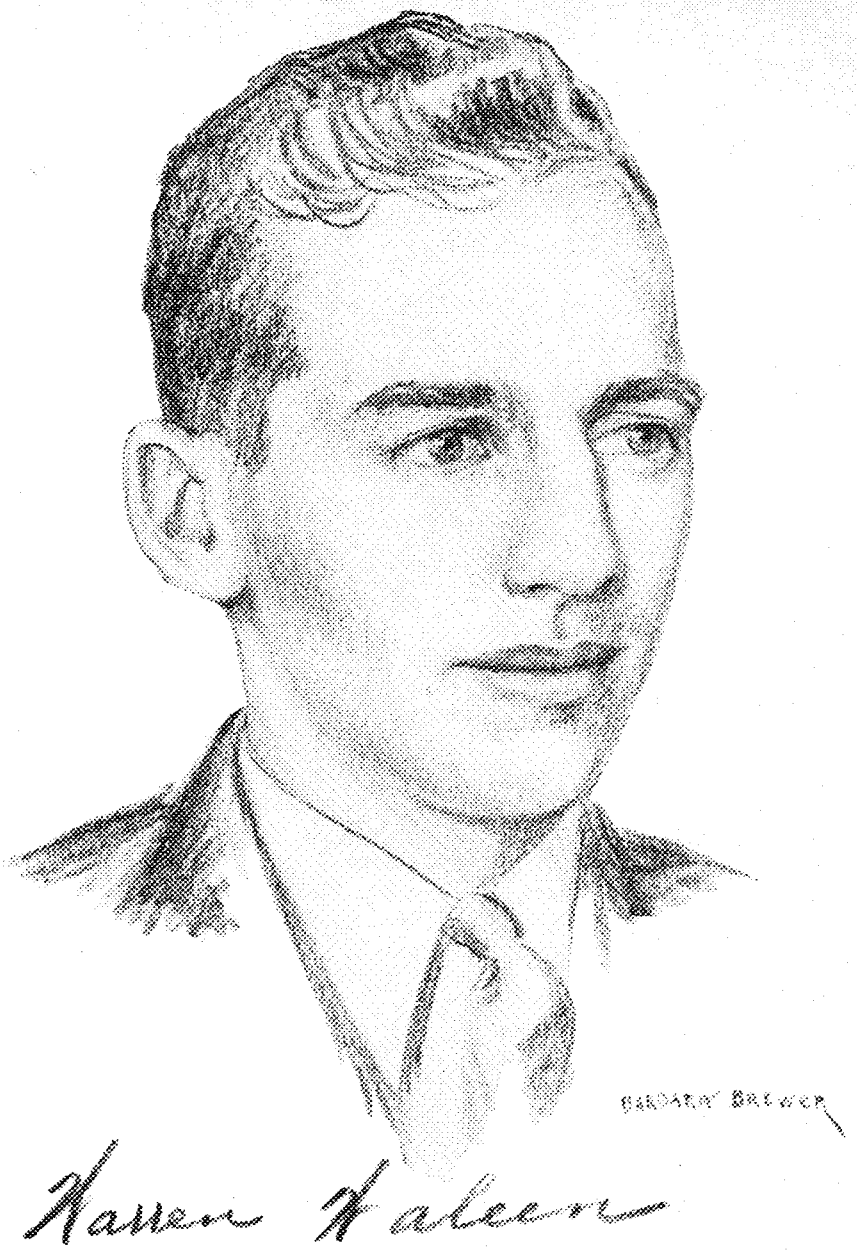
In judging the designs, the jury gave particular regard to plan arrangements, proportions, character, color and materials, and presentation. Mr. Frahm's solution was praised for its bold and original handling of large masses and simple surfaces, but some doubt was expressed as to the character produced by the use of immense pylons at the side of the main room. In Mr. Haugen's design, the jury liked the unmistakable "court" character, the excellent choice and indication of materials and the general expertness of the drawing but felt a certain "usual" quality.

Other prizes have been offered this year by Scarab Fraternity, Alpha Alpha Gamma Sorority, and the Northern States Power Company. The Scarab Medal was won by John W. Folsom for his solo design of a Junior College. The Alpha Alpha Gamma competition, in the design of an entrance to an exposition, resulted in the award of $15 in books to Martha Holt. The Northern States Power Company prizes of $25 and $15 went to Marvin Johnson and Robert Calrow for their designs of a small cinema.

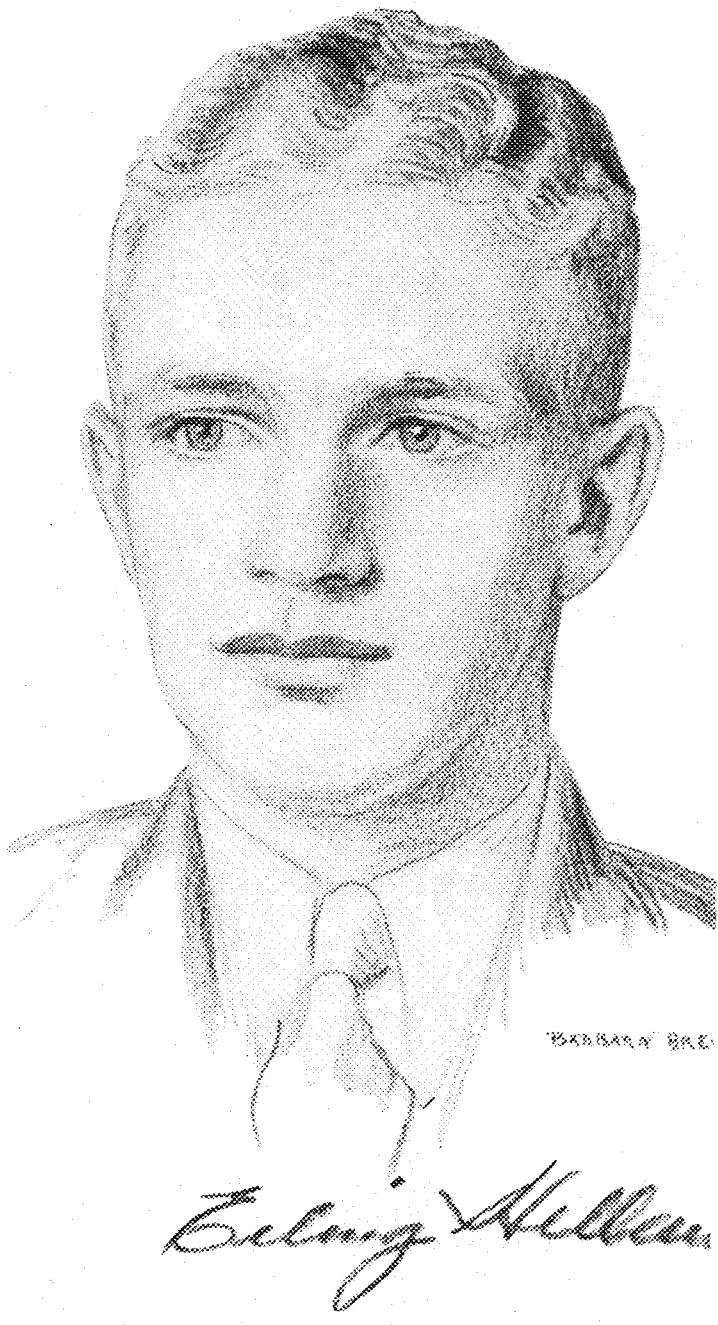
On the left is the State Supreme Court Room design drawn by Lawrence Haugen, mention placed second; on the right is Richard Frahm's design, mention placed first.







PRESENTING the new officers of the TECHNO-LOG in "Campus Sketches" by Barbara Brewer—At the crucial meeting of the board on April 27, Erling Helland was chosen to take over the editorship of the magazine for the year 1937-1938. Erling is a hard working civil taking the 5 year course with business. He is 21 years old and a member of Delta Kappa Epsilon. His other societies are Tau Beta Pi, Chi Epsilon, and A.S.C.E. He will replace Robert Teeter, who will return to finish his 5 year course in mechanical engineering and business, along with keeping a guiding hand through the TECHNO-LOG board.



ON the other side of the office, Warren Waleen will reign supreme over ad salesmen, circulation boys, and office assistants. His big job will be to prepare to entertain the E.C.M.A. convention in the fall, when business managers and editors of 23 college technical magazines make a second trip to Minnesota for a convention. Besides his work on the magazine Warren has been active in the advanced drill corps, and in Pi Tau Pi Sigma. He is 21 and a junior in electrical engineering. He will replace Elwood McGee, who will also return to finish a five year course in business and civil engineering.

The Engineer Prepares for Service

THE engineer's position in the world today is somewhat anomalous and has every prospect of becoming more so. On the one hand he is credited with most of the material advances of modern civilization; on the other he is held responsible for many of its maladjustments, is exhorted to correct them, and frequently is accused of an indifference toward them.

Last year President Roosevelt addressed an open letter to engineers advising them to prepare themselves by a broader training to help meet the social exigencies with which we are confronted in a machine age. President Compton of the Massachusetts Institute of Technology and others have replied that it is futile for the engineer to advise or attempt to direct when his advice is neglected

and when he has no means of applying the same methods in social adjustments or control that have proved effective when applied to invention and production.

Without entering into the question of the inventor's responsibility for the uses to which society puts his inven-

By Dr. S. C. Lind, Dean
The Institute of Technology

tions or in what unthought of or unintended way they may be abused, it must be admitted that the world is involved in a situation of such increasing complexity and perplexity as to threaten civilization. Aside from the misapplication and abuses, which are all too apparent, of the gifts of modern science to mankind there is the further danger that lies in the inability of society to evaluate or adjust itself to the external changes that are forced upon it with devastating acceleration. It welcomes the novel and agreeable without realizing the implications and inevitable consequences. Society is eager to accept the mechanically new, but lags in the adoption of safety measures or of legal restrictions.

Dr. Lind

What can the engineer do to render to society that assistance of which the need is so obvious? Or, to limit the question to what concerns us more closely, what can the college or engineering school do to equip the future engineer to aid in solving the social and mechanical problems that are thrusting themselves upon an unprepared and somewhat bewildered world?

If we dismiss at the outset the idea, which has sometimes been advanced, that the engineer is essentially different in makeup, has a different type of mind, is not socially minded, then the question simply remains what change in or addition to his training must be made?

The first step in this direction at the University of Minnesota took the form of a combined course of engineering and business, the first two years including mainly engineering subjects of general non-specialized character and the last two years devoted to economics and business courses. This beginning later led to a five-year combination of the essentials of the undergraduate course in business administration with the requirements of each of the engineering curricula, leading to the bachelor's degree both in business administration and in the respective branch of engineering. This arrangement appears to care satisfactorily for the economic training of each type of engineer and should make him a more valuable employee and useful citizen. It will naturally take a number of years to evaluate the advantages of such a combination, but the results will be the subject of great interest and study.

Beyond the economic training of the engineer there lies a yet broader field in social sciences, history, language, and the other humanities. The most satisfactory way to fill this serious gap in the engineer's training would undoubtedly be a four-year's arts college course prior to entering engineering. During this time enough of mathematics, language, and social sciences could be included so as to insure completion of the engineering course in two to three more years.

Doubtless, however, a full academic course exceeds the time and finances available to most engineering students. The next best compromise would be one or two years of arts college work before or during the engineering courses. And for the student who can take only the four-year engineering curriculum there remains only the opportunity offered by electives. Unfortunately, these have already been encroached on in various ways.

A close scrutiny of undergraduate curricula in the Institute of Technology is planned for the near future with the purpose of eliminating requirements which represent the introduction of too much routine practice which might better be omitted and of subjects of fine specialization that might well be reserved for graduate instruction.

The importance of graduate work for engineers was emphasized in a recent editorial in The Minnesota Techno-Log (April, 1937). Means should be sought which will help to further graduate work in engineering and to stimulate the prosecution of research work by the staff. The establishment of industrial fellowships, the reorganization and increase in the number of available assistantships, with a reduction in service hours to allow more time for graduate work are some of the more apparent means that would help accomplish these objectives. Applicants for these positions should be sought from a wider field.

The facilities for carrying on investigations and research work both in the departmental laboratories and in the experiment stations should be increased and made readily available to both students and staff.

Finally it would appear that the engineer is obligated to take a renewed and broader view of his responsibilities to society. He alone can introduce those methods of study and exact investigation into our social economy which have been so eminently successful in the creation of our modern world of science and invention. It will not be enough for him to refrain from shunning these responsibilities. He must not only welcome them but seek them with a well thought out plan. But above all he must prepare himself for them socially as well as scientifically. In making this preparation for service or in its performance the engineer will not only contribute to the public welfare, but he will broaden his own social and cultural horizon while expanding his sphere of usefulness.

The Minnesota Techno-Log

MAY, 1937

ROBERT TEETER
Managing Editor

ELWOOD McGEE
Business Manager

EDITORIAL STAFF

Erling Helland, Feature Edr.
Donald Erickson, Copy Editor
Herbert Gaustad, Alumni Edr.
John Murray, - News Editor
Bertil Lindquist, - Photo Edr.
Richard Stone, - - Reporter

BUSINESS STAFF

Warren Waleen, - Adv. Rep.
Robert McDonald, - Office
Clayton Kendall, - - Office
Gordon Brierley, - Adv. Rep.
Wallace Wilcox, Circulation
Vernon Hoden, - Circulation
Dan Doyle, - - - - Circulation

THE MINNESOTA TECHNO-LOG BOARD

Professor Lorenz G. Straub, *Engineering and Architecture*, TREAS.; Professor E. H. Comstock, *Mines;* Professor R. E. Montonna, *Chemistry;* Donald Randenbush, *Electrical*, PRES.; Louis Reigert, *Architecture;* Lawrence Rollin, *Civil;* William Hanson, *Mechanical;* Elden Olson, *Aeronautical;* Edward Eidam, *Mines;* Neal Amundson, *Chemistry.*

YOU are reading the final issue of the TECHNO-LOG for this school year and the last to be published under the leadership of the retiring Editor and Business Manager. We who are to carry on in 1937-1938 hope that in our hands the TECHNO-LOG will fare as well as it did under the direction of our predecessors.

The publication of a magazine, like most human activities, is a compounding of the labors of many individuals working in coöperation. Supporting the efforts of the staff has been the assistance ungrudgingly given by the faculty, departmental contributors, and feature writers. Deserving also of thanks are the printers, whose cheerful helpfulness has lightened the task of bringing out the magazine each month.

Before many more weeks have passed most of you will have left the campus, some as graduates, the great majority as undergraduates. To those of you who are finishing your final year at the University we wish the best of success and happiness in whatever you undertake. We hope you will remember that there will remain among the readers of the TECHNO-LOG many who will be interested in the work you may obtain and the places your employment may bring you. Will you write us from time to time so that we may pass on the information to them?

To you who are not graduating we wish an enjoyable and profitable summer. Your classmates will want to read of your vacation experiences —where you have gone, what you have done; the TECHNO-LOG will be glad to publish stories of this nature.

In the fall there will be many opportunities for students in all classes and divisions of the Institute to begin working on the TECHNO-LOG. Whatever your interests may be, it is likely that you may find enjoyable and useful expression for them as a staff member or contributor. The TECHNO-LOG will have use for many of you as advertising salesmen, reporters, bookkeepers, copy- and proof-readers, office assistants, editorial writers, columnists, art advisors, and many others.

Major appointments to editorial and business staff positions will be made in the fall. We would like to emphasize that there is opportunity for rapid advancement of new staff members and that the business manager and editor for the following year may possibly be chosen from those new members.

Perhaps the most important among the advantages of work on the TECHNO-LOG is the wealth of friendships made with students from all corners of the Institute.

We will be looking for you next October; until then—the best of vacation wishes.

—E. H.

At the Desk

WE'RE just a trifle proud of our cover illustration this month; it is a good example of what can be done with a camera and an eye for the unusual. We are indebted to Eastman Kodak Company for the cut.

Minnesota's experience with the drouth, and the preventative and curative measures which are being undertaken by the State to remedy drouth conditions are described by Paul Thomas, senior civil, in the first article.

High speed continuous strip mills to produce steel for Ford cars will soon be operated by the motors depicted on the frontispiece.

Dr. Lind has graciously consented to put on paper some of his views on the future of our profession and the efforts being made here at the Institute to "prepare the engineer for service."

The series of short chats with well-known alumni is continued this week on the Alumnotes pages by an interview with Harry Gerrish. The life and scientific contributions of Clerk Maxwell, outstanding pioneer in theoretical physics, are described by Howard Daniels, junior electrical, in the spring, 1937, prize winning Tau Beta Pi essay.

Men of Mathematics is the title of the book Mr. Haga reviews for us this month on the opposite page. We were once rather surprised to find that mathematics could be made the subject of recreational reading but we know now that we were mistaken. By the way, if you think you will have the time and opportunity to catch up a little on your reading this summer, it might be of considerable help to thumb through your back numbers of the TECHNO-LOG and find Mr. Haga's reviews of other books on science, engineering, and industry.

The columnists come through with much new Technology gossip plus everything they've been saving for the last issue; you'll find the columns on the last few pages.

Candid Camera Contest

APPARENTLY as a result of the rain and cloudiness that marred the Engineers' Day parade, the number of entries in the Candid Camera Contest announced last month was very low.

In view of the scarcity of entries and the difficulty of obtaining good photographs under adverse weather conditions, the contest has been held open until November 1. The rules will remain the same with the exception of the changed closing date.

It is suggested that the entrants strive for greater "candidness" in their work.

Those who have left prints at the TECHNO-LOG office may either leave them there over the summer or call for them before the end of the spring quarter and reënter them in the fall.

Readers are urged to take advantage of the many opportunities for candid and pictorial photography on and near the campus: classes and laboratories, individual students and instructors, campus buildings and equipment, and scenes from the river flats and barge terminal.

As before, photographic excellence and interest to the readers of the TECHNO-LOG will be the basis of judgment.

Now Here's A Book

By Clifford I. Haga

Instructor in English

WHENEVER I see displayed the work of mathematicians, I can sympathize with the amazement of the Russian peasant at a fair long years before the war. In those days Germany had the popular reputation of being the nation most highly endowed with inventive talent and mechanical ingenuity. Consequently when the Russian came to a baboon in a cage, it was only natural that he should explode with "What won't these Germans invent!" I am, I hope, more fortunate than the Russian; I have some vague notion that these equations and theorems and laws invented by mathematicians have great utility—but there still hangs over them a sort of baboonish glory and mystery.

So much for the layman in his worst innocence and his response to E. T. Bell's *Men of Mathematics*. What of the mathematician, that is, the engineer? I am more generous in my definition of "mathematician" than Lord Kelvin was. Said Lord Kelvin, "If the equation, integral between plus and minus infinity of $e^{-x^2}dx = \sqrt{\pi}$, is as obvious to you as $2 + 2 = 4$, you are a mathematician." To answer my question, I take the second equation as the one qualifying mathematical understanding and say that even I am a mathematician. *Men of Mathematics* is a good book. I give this cheerfully confident answer merely because of my faith in the general proposition that any authoritative biographical-historical review of a science or an art is most worthwhile to its practitioners.

Professor Bell can be accepted as an authority on the history of mathematics. In addition, he has a lively, witty style so well controlled as to subtract nothing from the essential dignity of his subject. The result is a swift and animated survey of modern mathematics from Descartes to Cantor, three centuries of extraordinary development without which modern science and technology would be bleakly impossible. So impressive has been this progress, so sure and satisfying its products, that all our modes of thought have been altered; even the man on the street, though he can not solve $x^2 + 2ax + a^2 = 0$, enjoys many of its benefits in his thinking. In fact, modern mathematics has grown so lush and fruitful that anarchy now faces it, and the prayer goes up for a new Newton to organize it and save it from itself.

It is not only sound mathematics to know some of its history. It is also good, sound common sense. Engineers, for example, frequently grow moody and with a deep melancholy confess they lack "culture." Though they seldom define "culture," except by a catalogue of "books and art and history—and things," they seem to mean a smattering of the humanities in general. Now such a profitable smattering can be gained most easily and quickly by any person trained in any technique. All he needs to read is the history of that technique. In other words, the human side of his art is the "cultural" side, and that is what history gives. Therefore Bell's *Men of Mathematics* should be required reading for all science and engineering students. Q. E. D.

Besides urging you to read *Men of Mathematics*, I must seize the opportunity to mention a number of other books out of which you can piece together some notion of the human (cultural) significance of one of your principal tools. Bell has another book, very brief and lively, called *The Queen of the Sciences*, and a third, even shorter and more lively, *Numerology*. If you like Bell's style, read them all. Then there is Tobias Dantzig's *Number, the Language of Science*, a most interesting and illuminating book. Heavier going, but quite necessary in such a reading program as I discover I am working up, is Smith's *Source Book in Mathematics*. Another good book, though a bit old, is Bertrand Russell's *Mathematics*. Then for those of you for whom philosophy has a strong attraction, I recommend Keyser's *Mathematical Philosophy*, and his essays in *Pastures of Wonder*. For those who wish to wander farther and see to what extent enthusiasm can carry a man, get Reuff's *From the Physical to the Social Sciences*, where the attempt is made to deal with politics and economics as an engineer would deal with his materials. Or take Lancelot Hogben's *Nature and Nurture*, and *The Nature of Living Matter*, and learn how even protoplasm plays the game of mathematics. Hogben, incidentally, has a new book, *Mathematics for the Million*, which I risk recommending unread. Having read all these books and a few dozen others culled from their bibliographies, and having learned your higher mathematics thoroughly, you will be ready to tackle the heavy volumes of Whitehead and Russell's *Principia Mathematica*. After that you won't need my help to continue your reading.

This list I have just given is another proof of the excellence of Bell's *Men of Mathematics*. *Men of Mathematics* is a good book because it suggests so many other good books: "it makes one want to read more."

ALUMNOTES

Interviewing Our Alumni

YOU and I are sitting in an office in the Essex building talking with Harry E. Gerrish, '05, M.E., of the Morgan-Gerrish Co., sales engineers in heating, ventilating, and air-conditioning.

Mr. Gerrish turns to us and says, "The great deficiency of the engineering graduate is his inability to take his place in the community as a man of broad and cultured education. The cause of this condition is the overemphasis both by professors and students on practical engineering questions."

"In our company," says Mr. Gerrish, "we will pay any amount for fellows with the personality to sell our services. The neglect in technical schools of personality development made it difficult to find such men. Although you may not be required to sell goods, all of you will have to sell yourselves to a prospective employer in the near future. Your personality will play a bigger part in that sale than your knowledge of engineering facts."

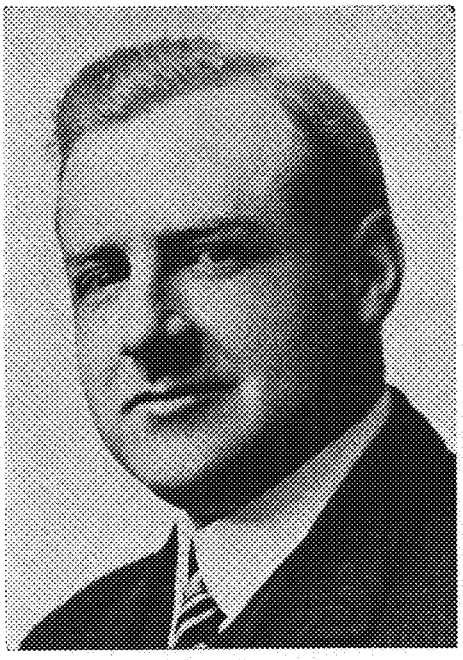
Mr. Gerrish affirms by comparison with other graduates our belief that Minnesota graduates rank at the top. "This state should be attributed to fine staff and equipment," he says. "However, increased freedom for professors to conduct research will enable them to keep up with modern trends and thus to improve courses."

Concerning mechanical engineering Mr. Gerrish has this to say, "The field of mechanical engineering is the most general of all the engineering courses. For that reason I think it is most valuable to engineering students. Mechanical graduates get a broad education which enables them to go into various fields according to their preference."

'21 Sam Aronovsky, Chem.E. (Ph. D. in 1929), working on a fellowship at the Institute of Paper Chemistry for a number of years, has accepted a research position with the U. S. Farm Wastes laboratory at Ames, Iowa.

'26 We received a letter this month from Gunaker Dewaji, M.E., of Veravel, Kathiawar, India. He informs us that he is working as Electrical Supervisor for the Junagad State Electrical Supply Works. Mr. Dewaji would probably appreciate communications from former classmates and friends.

'27 Recently in Minneapolis after a business trip to Eau Claire was Harry Dubois, E.E. Harry was formerly in the Plastic Sales department of G. E. but resigned that job to take a better position as Sales Manager of the Plastics Division of the Gorham Co. in Providence, R. I.



Harry Gerrish

'30 In answer to alumni questionnaires, come replies from two civil classmates, Robert K. Zeese and Erwin G. Hill. Bob is Junior Highway Engineer, Division control, for the U. S. Bureau of Public Roads in Washington. He is temporarily in St. Paul on a planning survey. Erwin is with E. J. Phelps, landscape architect in Wayzata, Minn. He says that he plans to marry in May.

Prof. Martenis gives us a report on his son, William, M.E. Bill is with the Minneapolis Honeywell, and has recently been sent out to check heat control performance under wide ranges of applications. He is at present in Toledo.

'33 Karl Hehl, E.M., has returned from his work in the Denver City Engineering department to take the position of Dredge Inspector with the U. S. Engineers in St. Paul.

Marshall Ruley, Chem.E., has accepted a position with the Flax Co. of Minneapolis, dealing with water treatment. He reports four unnamed Minnesota Chem.E's working with the company.

'34 From an unknown source we received the information that H. D. Middel, E.E., is with the General Electric Company research laboratory. Several days ago he gave a talk on the "electric eye" at a Parent-Teacher Meeting of the Sacandaga School in Scotia.

Minnesota can boast of at least one expert in the rating business. Dr. E. E. Litkenhous, Ph.D. in Chem.E., has been computing ratings, for both football and basketball and syndicating them to various newspapers. His system is based on integral calculus. He rated Minnesota's basketball champions third behind Stanford and Notre Dame. He rated the football team champions by 0.1 per cent over Pittsburgh! When he is not busy with computation he is at the U. of Louisville where he is assistant professor of Chem. E.

George A. Russel, E.M. (Geology), is located at Red Lake, Ontario, Canada, as a geologist for Mines Selections, Ltd.

'36 Richard Poucher, M.E., visited the campus recently to inform us, through Prof. DuPriest, that he is located in the sales department of the Pittsburgh office of American Blower Co.

W. P. Blake and W. F. Arksey, civils, have both taken over new positions in the last month. Blake has taken a position in the office of the Division Manager of the Chicago, Milwaukee, St. Paul, and Pacific Railway at Miles City, Montana. Arksey has resigned his U. teaching fellowship to go with the Great Northern Railway at Superior, Wis.

Word comes to us rather late, that Bob Newman, E.E., was married during the last of January. He married Dorothy Hanson, formerly of Dean Nicholson's office. The marriage took place in New Orleans where Bob is a representative of Minneapolis Honeywell.

Progress

Domestic Solar Water Heater

FROM CALIFORNIA comes a bulletin on "Solar Energy and its Use for Heating Water." Enclosed 30 gallon hot-water boilers with glass covers can be used as solar heaters and will furnish two or three hot showers per tank in the late afternoon on bright sunshiny days. They do not maintain overnight the high temperatures attained, but the users may be assured of a continuous supply of hot water by attaching an insulated storage tank. To assure constant supply regardless of weather, an automatic auxiliary heater can be connected. Then, when the temperature is not up to the temperature set on a thermostatic control, the solar heater will operate while the sun shines—with the auxiliary heater automatically going into action when the sunlight fails. Thus the housewife is never bothered with lukewarm water, yet she saves fuel expense while the sun shines.

—*Mechanical Engineering*

Respirator for Dust Protection

THE U. S. BUREAU OF MINES has recently approved a new respirator for use as protection against those dusts tending to produce silicosis. This respirator contains a filtering element which removes all dust, even of microscopic fineness, yet allows free passage of air. A supersensitive outlet valve allows no inside air pressure, a condition which previously made breathing difficult. Users have reported no apparent resistance to easy breathing in this model. Of equal importance in this new development is a seal at the facial contour. It is effected with the aid of a soft metal band which reduces the headband pressure until it is no longer noticeable.

—*Concrete*

Glass Substitutes

CHEMISTRY has developed various types of transparent plastics to take the place of glass for many uses. One type known as "Perspec" is used for optical lenses in binoculars, cameras and spectacles. It can be pressed into shape and needs no grinding or polishing. It is non-breakable and about one-half as heavy as the usual silicon glass. Because there is no laborious grinding and polishing, the expense of manufacturing optical instruments is considerably reduced. Another type known as "Plexiglas" is used in construction work. It is especially suitable for airplane windows because of its lightness and strength. The shapes used for the transparent curved hoods on the newer airplanes to give unimpaired vision to the pilot are made very easily and cheaply from "Plexiglas." Because it is a plastic and can be pressed into shape there are no strains or differences of thickness to distort the vision. It is claimed by the manufacturers that ultraviolet light rays are transmitted through it and that sun and weather have no effect on its transparency.

—*Architectural Record, Modern Plastics, Chemical Age*

Air Conditioning Goes to Sea

THE NEW transatlantic liner *Nieuw Amsterdam*, Holland's recently launched "ship of peace," is equipped with the largest air-conditioning system afloat. The 300 ton cooling system was designed by the same American company which installed the air conditioning plant on the *Queen Mary* and the *Normandie*. The centrifugal refrigerating machines are of special construction to assure efficient operation despite the roll of the ship in the worst weather.

—*Steel*

Hospital Sunlight

AN UNUSUAL design in building is being utilized in New York in an effort to obtain the maximum amount of sunlight during the day. A group of hospital buildings are being built with the southern half of the building in the shape of a V. By this arrangement the designers claim that 240 degrees of sunlight will be available instead of the usual 180 degrees. The site of this new development is on Welfare Island on the East River of New York. Six buildings are now in the process of completion. In the center of the buildings are towers which will be occupied by elevators and stairwells. The north side of the buildings will contain all the service facilities and the south side of the buildings will contain the rooms. The cost of the completed buildings together with special power plant will be approximately $7,000,000.

—*Engineering News-Record*

New Portable Room Cooler

RECENTLY put on the market is a new model of a portable room cooler. This model is described as being able to clean, cool, dehumidify, filter, and deodorize the air in the room. It is designed so that no drain connections are necessary. Connection to supply outdoor air is made through an adjustable window damper which combines the inlet and outlet air ducts. This unit operates with a minimum of noise and requires only an electric current to operate. There are two models of this device on the market at the present time, having capacities of ¾ and 1½ tons of refrigeration. The ¾ ton model has a B.T.U. capacity of 10,000, and the 1½ ton model has a B.T.U. capacity of 20,000. The cooler is enclosed in a walnut-finished, insulated cabinet.

—*Domestic Engineering*

Lacquer Thickness Gage

RECENTLY invented is an electrical lacquer thickness gage which is used to test paint thickness on new cars as they come off the line at an Indiana automobile plant. The dial registers the difference in resistance between an established thickness of paint and that of the surface under test.

—*Steel*

SLIPSTIX

The Slide Rule

Prof. Noah Webster defines the slide rule as follows:

Slide—derived from the Egyptian Cleopatra—to slip—to glide, to pass smoothly.

Rule—(Ancient Hebrew) an instrument, a rude process of operation. Hence, slide rule, an instrument used to pass a course smoothly by a rude process.

A slide rule is something like a woman. It is slippery and no one ever learns to manage one. It has a variety of figures which are more or less true. Its beauty is only skin deep, but, like the girls at a dance, it has sines on its back. Men are crazy until they get one, and after they get it they wish they had saved their money.

—*Iowa Engineer*

Haven for Neckties

A man looking at some neckties tossed one or two aside rather contemptuously. Lingering after having made his purchase, he noticed that the clerk had put those he had so positively rejected into a separate box.

"What becomes of those?" he inquired.

"We save them for the women who come in here to buy ties for men," was the reply.

—*Purdue Engineer*

Fly In It?

Joe: I can't eat this soup.

Waiter: Sorry, I'll call the manager.

Joe: (To the manager): This soup, I can't eat it.

Manager: I'll call the chef at once.

Joe (To chef): Dammit, I can't eat this soup.

Chef: What's the matter with it?

Joe: Nothing, only I ain't got a spoon.

—*Cornell Widow*

Worldly Frosh

Worldly: How long have you been shaving?

Frosh: Four years now.

Worldly: G'wan.

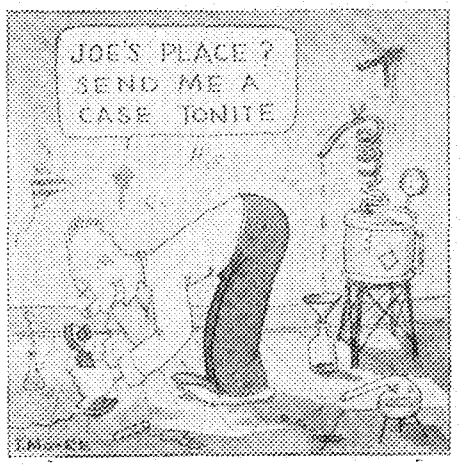
Frosh: Yes, sir. Cut myself both times.

—*Yellow Jacket*

Moral: Drink Whiskey

Temperance lecturer: And in conclusion, my dear fellow citizens, I will give you a demonstration of the evils of the Demon Rum.

"I have two glasses here on the table: One is filled with water and the other with whiskey. I will now place an angle worm in the glass of



water. See how it lives, squirms, vibrates with the very spark of life."

"Now I will place a worm in the glass of whiskey. See how it curls up, writhes in agony and then dies. Now, young man, what moral do you get from this story?"

Delt: "If you don't want worms, drink whiskey."

—*Rose Technic*

Conceited Man

Add to the Hall of Conceited Men the engineer who wouldn't take an eraser to a calculus exam.

—*Exchange*

We Need Bread

It has been noticed recently that a certain fastidious young lady kneaded bread with her gloves on. This may seem odd, but the editor of this "Old Rag of Freedom" needs bread with his shoes on, he needs bread with his pants on, and, unless some of the delinquent adventurers pony up before long, he'll need bread without a damn thing on—and Wisconsin is no garden of Eden in the wintertime.

—Editorial—*Podunk News*

Breakfast Club

Radio stations should start off the morning broadcast with, "Who the hell left the radio on all night?"

—*Red Cat*

Indicator With Bell?

He was in the Chem. lab., and the prof. was explaining certain reactions.

"This liquid turns blue if your unknown is basic, and it turns red if the unknown is acid."

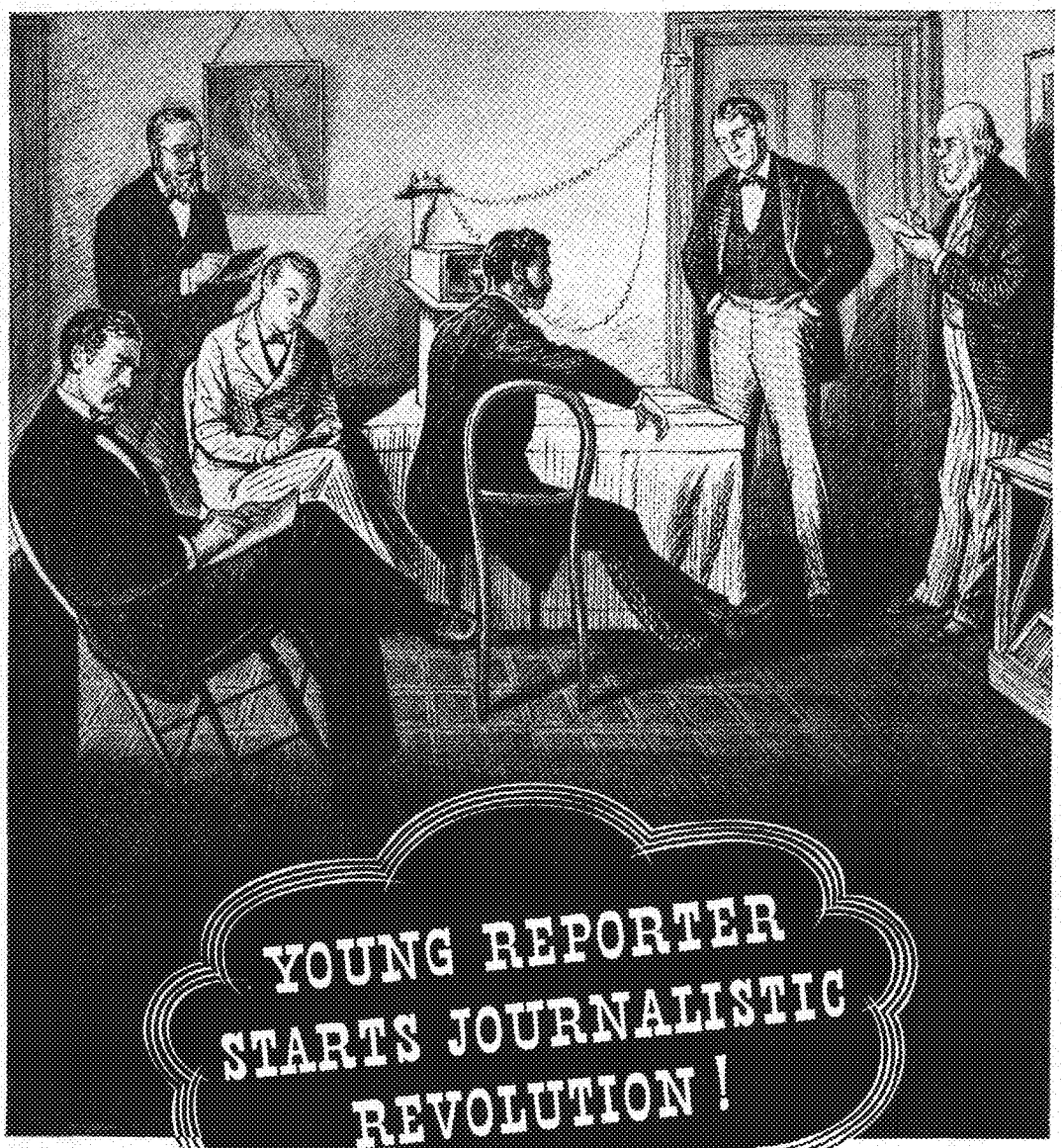
"Sorry, but I'm color blind," apologized the brain trust, "have you anything with a bell on it?"

—*Kansas Engineer*

Tragedy of Humor

The day was warm, the hour was late,
But the editor's work all had to wait.
With nervous steps he paced the floor
And looked askance at the card he bore. . . .
Then suddenly, quickly—a timorous rap!
With puzzled expression he answered the tap.
It was a frosh, with face scared and wet;
"I—sent you a joke—did you get it yet?"
The editor groaned, as he looked at the card. . . .
"Not yet," he shrieked . . . "but I'm trying hard!"

—*N. Y. U. Varieties*



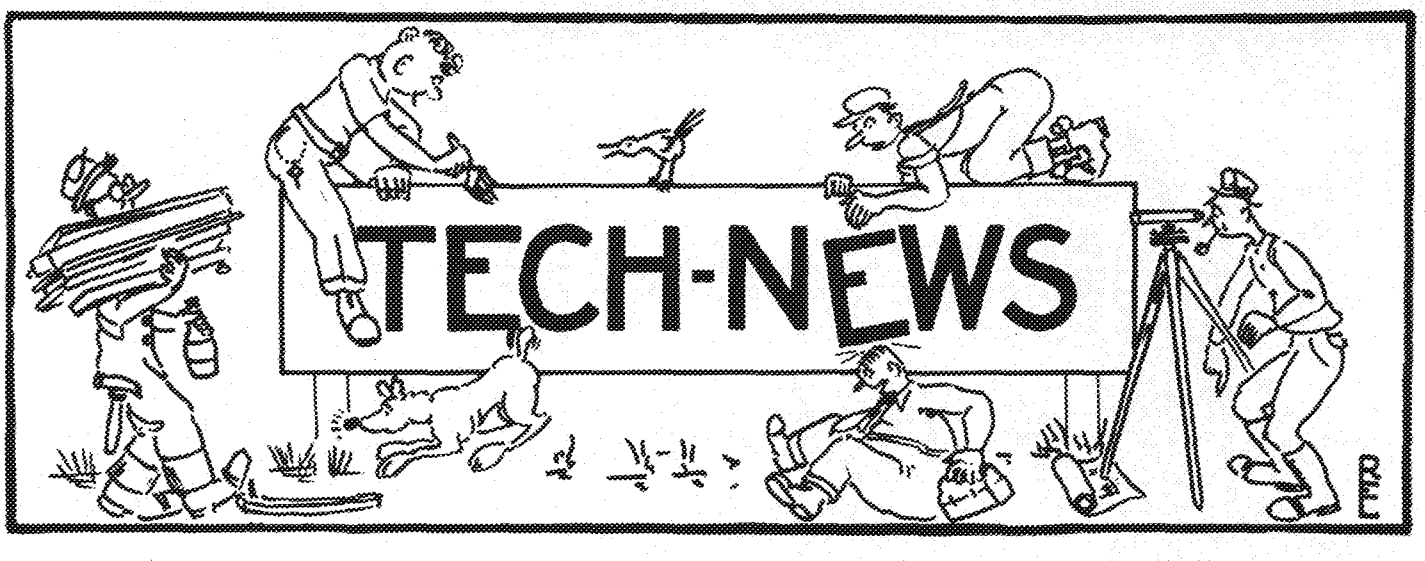
It happened in Salem, Mass., on February 12, 1877. The young reporter attended a demonstration of inventor Bell's new telephone—then "talked" his story to his paper in Boston *by telephone!*

Though he didn't realize it, he was inaugurating a new era in journalism. For today's newspapers could hardly exist without the telephone.

Gathering and spreading news with lightning speed is just one of the telephone's countless contributions to modern life. And 300,000 Bell System people strive constantly to make the service still better, still more useful.

BELL TELEPHONE SYSTEM

Why not telephone home oftener? Rates to most points are lowest after 7 P. M. and all day Sunday.



Institute Accepts Extension Credits

The Administrative Board and the General Faculty of the Institute of Technology announce the following recommendations regarding credits earned in the Extension Division of the University of Minnesota:

First, the acceptance of credits in non-technical courses earned in extension classes, which are residence classes according to the University Senate Ruling.

Second, the acceptance of credits in such other residence courses as have been approved, by the departments and instructors concerned and the Dean of the Institute, but that this action be contingent upon the Extension Division differentiating, in its announcements, between credit and non-credit courses.

Third, the acceptance of correspondence credits in academic subjects, but not to exceed 9 credits.

Aero's See Movies of Eastern Trip

Two well-attended meetings were held by the Minnesota Student Branch of the Institute of Aeronautical Sciences during the month of April.

On Friday, April 23rd, a series of motion pictures showing the aeronautical and hydrodynamical research institutions of Italy, Germany and England were presented in the Physics Auditorium on the campus. The pictures included demonstrations of equipment and performance of tests on full size as well as scale model planes. These pictures were originally prepared for the annual I. Ae. S. meeting in New York and were shown here through the courtesy of the Institute.

Motion pictures taken by one of the group of senior students, who recently made an inspection trip to the various aircraft companies in the East under the direction of Professors John D. Akerman and Howard W. Barlow, were shown at the meeting on April 28th. The pictures showed most of the points of interest visited by the touring students. Another reel of pictures showing the attempted ascent of one of Dr. Picard's cellophane stratosphere balloons was also shown on May 4th.

A.S.A.E. Challenged to Faculty Ball Game

Ag. Engineering students enjoyed a first class supper on the invitation of and at the expense of the Ag. E. faculty on April 23rd. The supper, which was given in the Men's Union, was followed by games of all sorts for which each student had a faculty member for a partner. Scores were kept, and comic prizes were awarded the "best" players.

On May 1st, the A.S.A.E. was guided through the coke plant in St. Paul by Lawrence Lindahl, General Foreman of the plant. At the present, this group of Ag. E.'s is working on a float and a demonstration for the annual Ag. Royal on May 15th.

Recently Mr. C. H. Christopherson, representing the faculty, challenged the students on behalf of the professors to a K-Ball game to take place at a student-sponsored student-faculty outing.

Montillon Awarded Tau Beta Pi Freshman Prize

New officers of Tau Beta Pi, honorary engineering fraternity, are:

Sherman Finger, Jr.—President
Clark Hook—Vice President
Alfred A. Anderson—Recording Secretary
Gordon Lee—Corresponding Secretary
Harley Hughes—Cataloger
Professor Elmer Johnson—Treasurer.

Professor Lorenz Straub was re-elected to the Advisory Council.

Tau Beta Pi's Freshman Award was presented to George Montillon, M.E. '40. This award is made on the basis of the scholarship in the Freshman Class in the Institute.

Pi Tau Sigma to Present Keys to Initiates

Three new members have been added to the Pi Tau Sigma rolls. Ralph Heer, senior, and Alfred A. Anderson and Wallace Lien, juniors, were formally initiated on May 7. Keys will be presented to them at the annual tri-honorary banquet.

Commacini Names Four New Pledges

The Commacini, honorary architectural society, has pledged the following men:

Frederick M. Mann, Jr. '37
Robert R. Pierce, '38
Francis R. Meisch, '38
Verner Johnson, '38

Tech Glee Club Completes Third Year on Campus

The *Tech Glee Club*, composed of students of the Institute of Technology, had its beginning early in 1934 when Professor O. S. Zelner sponsored a group of 20 men under the directorship of Earl Killeen of the music department faculty. The first appearance of this group was over radio station KSTP when they sang a group of songs for Engineers Day. Since then they have appeared at numerous functions. The officers of the present group are: Richard Wagner, EE '38, President; James Thompson, '39, Secretary; Robert Sheeks, Ch. E. '40, Business Manager; Professor O. S. Zelner, Faculty Advisor; and Alton O'Steen, Director. Miss Margaret Steenson, Music '37, is the accompanist for the Glee Club which today numbers 25 members.

The group has sung for the Engineers Club of Minneapolis and for the TECHNO-LOG smoker last quarter and is scheduled to sing at the Student Forums in the Minnesota Union. Plans are being formulated for a concert to be held some time in the spring quarter.

Director O'Steen is looking for a first tenor and second bass to complete the group. Any student in the institute is eligible to try out for the Glee Club.

Phi Lambda Upsilon Will Initiate 12

Phi Lambda Upsilon, honorary chemical fraternity, will hold its final initiation of the year with a dinner meeting on May 27. The following men from chemistry and related fields will be initiated:

Henry W. Anderson
Edward C. Ballard
Norman H. Cromwell
Hugh B. Gage
James J. Lingane
Carl S. Miller
Henry C. Miller
Paul A. Sanders
Louis S. Savage
Isadore Shapiro
Stanley Wawzonek
Ralph V. White

At the meeting, the officers for next year will be elected, and plans for the Chapter activities discussed. The retiring officers are Edward W. Kaiser, president; John P. Hollihan, vice president; Bruce G. Gillespie, secretary; and Ralph Fredrickson, treasurer. All members who may not receive notices of the meeting are urged to communicate with the secretary.

A.S.C.E. Plans Lectures, Two Inspection Trips

Two more lectures on the outlook for employment in the engineering field will be given before the student chapter of the A.S.C.E. The first lecture will be on hydraulic engineering and will be given Thursday, May 20, during 4th hour. The second lecture, to be given on Thursday, May 27, 4th hour, will be on public utilities.

Arrangements are being made through Hibbert Hill for an inspection trip through one of the Northern States Power Company's steam-electric plants on Saturday, May 22. Dr. Straub is planning a field trip through the University's new hydraulic laboratory on the Mississippi River. This trip is planned for May 22 also.

Tentative arrangements are being made for an outing for the Civils on May 26. Kittenball and other sports are on the program. There will be plenty to eat and drink.

The annual election of officers will be held May 19.

A.S.M.E. Plans Picnic for Students, Profs

With the National A.S.M.E. convention at Chicago over, the local student branch of A.S.M.E. has resumed activities with the showing of a motion picture on "Combustion Engineering" at their May 5 meeting. The picture was shown through the courtesy of Babcock and Wilcox Company.

The senior Twin Cities section of A.S.M.E. was the host to the student chapter at a banquet on May 7 in honor of Mr. C. E. Davies, National A.S.M.E. Secretary.

An inspection trip through the Coca-Cola plant on May 13 was well attended by the thirsty mechanicals.

The annual A.S.M.E. picnic is being planned with one of the interesting events to be a diamond-ball game between the students and the faculty. The date for the picnic will be announced soon.

The Taurus

By Bertil Lindquist

GEORGE (Pretty Boy) Hagger has felt the call of spring and certainly gets into the swing of things. When testing the Buick the other day, the circuit breaker blew (doesn't it always?) and Handsome Hagger, aghast at the thought of losing all that fine data, wrapped his lily-whites around the breaker handle and did the flying trapeze act on it trying to hold it shut. The sparks and flame flashing about George's head made him look more like an angel than ever . . . . . .

SPRING SIGNS

Profs gazing absently out the windows—leaving half-finished sentences hanging in mid-air . . . Coeds soaking up insolation (that means sunshine) in gym pants on roof tops . . . More coeds wildly waving tennis racquets at little white balls . . . McCormick bragging about his baseball team . . . Engineers lunching and sleeping on the south sides of Main—while their consciences prod them unpleasantly to go in and get to work . . . . "Haven't cracked a book this quarter" . . . More femmes—exchanging the case-hardened look that they've worn all winter for a smooth, soft, and yielding one that is infinitely more attractive . . . . Green grass stains on the knees of white flannels . . . . S.R.O. on the knoll . . .

Ye Olde Ed tells me the lid's off for this issue—so here's a few I've been saving since fall (chorus: which fall?):

He: How many beers does it take to make you dizzy?
She: Oh, four or five—but don't call me Dizzy!

The civils have developed that permanent droop in the left eye again peeking through transits at those coeds sitting on Northrop steps hugging their knees . . . . or watching the "flat-land furriners" toss woo daown by th' houseboats . . . .

CRACKS

Mother—Mary, why did it take you so long to say goodbye to that boy?

Mary—But, Mother, if a fellow takes you to a movie, the least you can do is kiss him goodnight.

Mother—I thought you went to the Cocoanut Grove.

Mary—Yes, Mother.—

Buying a car is just like getting married:
Once you get the license you can go as far as you like . . .

We sort of wish the Daily would restrict its "humor" to its humor columns—instead of putting it on the front page and foisting it off on the studes as news . . . .

And that when Skum wants to indulge in a bit of half-witted leers at the Aeros they would at least take their own pictures . . . .

And friend Gaustad says that his tennis would improve immeasurably if those amorous couples on blankets down below the courts would only wait until it got a little darker . . . "But that's Life." says Herb . . .

"I never give a kiss," says Prue,
"To naughty man, for I abhor it."
She will not give a kiss, 'Tis true—
She'll take one though, and thank you for it.

Here's a little dirge that will help you put Pete Lohman away with the rest of the snow shovels, overshoes, coal shovels, and ash baskets that have been pestering you all winter . . . .

SHELVIN' MELVIN
Petrarch's sanctimonious,
But not very euphonious.
His poetry's junk,
His column's punk
It's all a lot of balonious!

If Pete's brains were replaced by dynamite, he couldn't blow his nose. . . . Or if hot air were music, he would be a whole band.

The calculus prof finished a long theoretical discussion and concluded with the usual, "Any questions? Anything that you don't understand?" There was a heavy silence as the mutton-headed students groped feebly, contemplated the enormity of this thing that had been so precipitately dumped into their laps. The prof broke in on the reveries: "No questions, you know all about it then—well, we'll just have a little quiz."

I'd hate to be a flier
Without a place to land,
For that is worse than a statue
Without a place to stand;

Worse than a home-coming hero
Without a big brass band,
O poor lonely flier!
Without a place to land!

But if I cannot find a field,
Why I don't give a "hoot";
I'll calmly step off into space—
Don't scream! I've a parachute.

H. L. B.

I suppose you all remember that dumpy little dewy-eyed damsel who was barging hereabout on roller skates (and a good skate she is, too) prying you reluctant engineers loose from your two-bitzes for Engineer's Day buttons. Being slightly underdeveloped—in a business sense, that is—she very generously overlooked collecting from certain of her Engineer pals and just now discovered that the romance-barren Engineer's Day Committee demands financial remuneration for said buttons. And at this writing she is skittering about frantically searching for some slightly used buttons to make up the deficit. . . .

And Jo Woodward, reactive chemical lass, cornered Prof. Koelsch (the big one) a whole week after Engineer's Day was over and, he marveling at the stamina rampant in the so-called feebler sex, fished up a quarter for the charming Josephine and a button. . . . Thanks, Prof. . . .

Fatherly advice to my flighty Aeronautical buddies: Keep your nose down—if you let it get too high, you'll stall. . . .

To the graduating Seniors, pulling up their stakes this spring: let me stick out my mitt and wish you the best of luck—and that elusive Fame and Fortune that is the heritage of every Minnesota Engineer. . . . It's been swell knowin' yuh. . . . So long. . . .

By Melvin "Pete" Lohman

IN winding up this uneventful year, we'd like to settle an old score with that monger of false tales, B.H.T. It is not our habit to criticize but he will notice that this month's poem is dedicated solely to him. And as a final dart, we might add that the distance between his ears is one block.

Scoop! Flash! The president of the A.S.M.E. has the smell of orange blossoms in his nostrils. He's taking that last fatal step into the deadlock of matrimony this spring. We wonder if he'll continue motion study in this new field.

The reason St. Pat. rode last in the parade instead of first was because he couldn't get his pants on and he objected to riding Lady Godiva style.

A sure sign of spring: the civils hooting at every girl that passes. They say that these new spring clothes the goons are wearing remind them of a barbwire fence—They protect the property without obstructing the view.

And with the coming of spring, let us all be warned that: "It's fine to have fun but don't let the fine cost you more than the fun."

It is rumored that Morzenti, the Electrical Show Shot, is so bashful that he blushes everytime he steps on a girl's shadow.

It was a wise man that recommended that men each day do two things they dislike very much. And it is a precept that we have followed scrupulously; for every day we have got up and we have gone to bed.

Engineers take heed to the statement of our math. prof. philosopher who says, "This may be the machine age, but love is still made by hand."

Our astute business manager, Elwood Mug-gee, finds that his associations with the good old T-Log leave him with lessons which can be used very handily in his outside contacts. Recently, in quest of a topcoat, he wandered into the Standard, and, in the course of being subjected to their super-sales staff he found himself inside of a nice gray creation. Said creation didn't look so coy with his old brown chapeau so the salesman put a new gray hat on his head to make the coat look good. McGee bought a *brown* coat and was several blocks from the store when he was overtaken by the breathless salesman—he still had that new gray hat on his head.

Seniors! Let's rally around the standard of "No Finals This Quarter." There have been a few offenders among the profs in past years so let's glare them down this time. Graduation time is no time for exams, it's time we got a rest.

Bob Aslesen is seeing entirely too much (don't get us wrong) of a gal by name of B. Beach. Would you call him a "Beach-Comber"?

The civils in the person of Clem Scully pulled a gooder on Ralph McDonald. It seems that Clem mailed a note in a U of M envelope to Ralph calling him to the Health Service for the first treatment of an infectious malady quite common this time of the year. Ralph, amid the jeers of the rest of the junior civils in railroads, tried to excuse himself from the class by saying he was cutting class to go river banking but he didn't get further than the Health Service, where he found, much to his peace of mind, that he was germ-free.

Smile: Busy as the electricals running back and forth in front of their electric eye counter so it would show they had 10,000 visitors.

Carl Swanson, the frosh arithmetic teacher, is a candidate for the world's biggest pessimist. He wears both suspenders and a belt to support one pair of pants. Wonder why?

It might be said that the girl in the library the other a.m. was the sexation of the day to most of the boys.

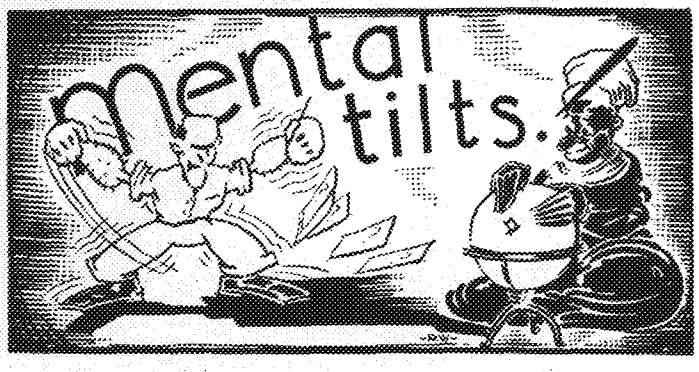
We hate to say this but it is true that an Aero Tau Beta had to be helped out of a grog shop in Chicago by his two instructors, who incidentally stood the expense of the party.

Don Raudenbush is the candidate for the school's amateur politician. Never was there a man so busy with nothing to do. It is rumored he instigated the Electrical, Miner, Aero hookup for the St. Pat election which promptly pooched out.

And so to close the desk on this year, we'd like to say it's been fun and if we've made you smile, then we're happy for it is our belief that laughter is the world's greatest cure-all. The poem of the month, as stated before, is dedicated to B. H. T. L.

Better try to do something
And fail in the deed.
Then try to do nothing
And always succeed.

—*So it seems.*



By Gordon Wickre

WE are very happy to note that we have at least two faithful "Tilts" readers as shown by the fact that two men have won five out of the seven contests staged this year. Erhard Prill, '37, who won the March contest, is three times a winner; and Harold Ellis, '38, won in April for his second "hit" of the year.

It might be interesting to look at the solutions of some of the "teasers" of the last two months.

The first thing that catches our eye is the man on the locomotive going through a tunnel. The time required for the *entire* train to pass through the tunnel is given as 100 sec.; the length of the train is 352 yards. Find the length of the tunnel. The distance traveled in 100 sec. is of course the length of the tunnel plus the length of the train. Since distance is equal to rate times time, we have

$$40 \text{ m.p.h.} \times 1/36 \text{ hr.} = X + 0.2 \text{ mi.}$$

Therefore X, or the length of the tunnel, is 0.9 mi.

Now we come to those candles—they must have burned for 3¾ hrs. for at the end of that time the 4 hr. candle had 1/16 of its length left, and the 5 hr. candle had 4/16 left.

The steam shovel problem was quite simple for the civils! They say that the contractor would use the hired shovel, capacity of 126 tons daily, for X days; his own shovel would be used 22–X days at a rate of 63 tons per day. Then the equation

$$126 \times 63\ (22 - X) = 2000$$

$$X = 9.745 \text{ days}$$

At $50 per day, he would pay $487.30 in rent.

Now for April and the professor in the pullman. Since the smokestack remained in exactly the same position on the window for 5½ mi., it is quite evident that the train must have been traveling on the arc of a circle with the chimney at its center. The problem consists of finding the radius of that arc. From S.W. to N.W. is one quarter of a circle, so the circumference of the complete circle must be 22 mi.

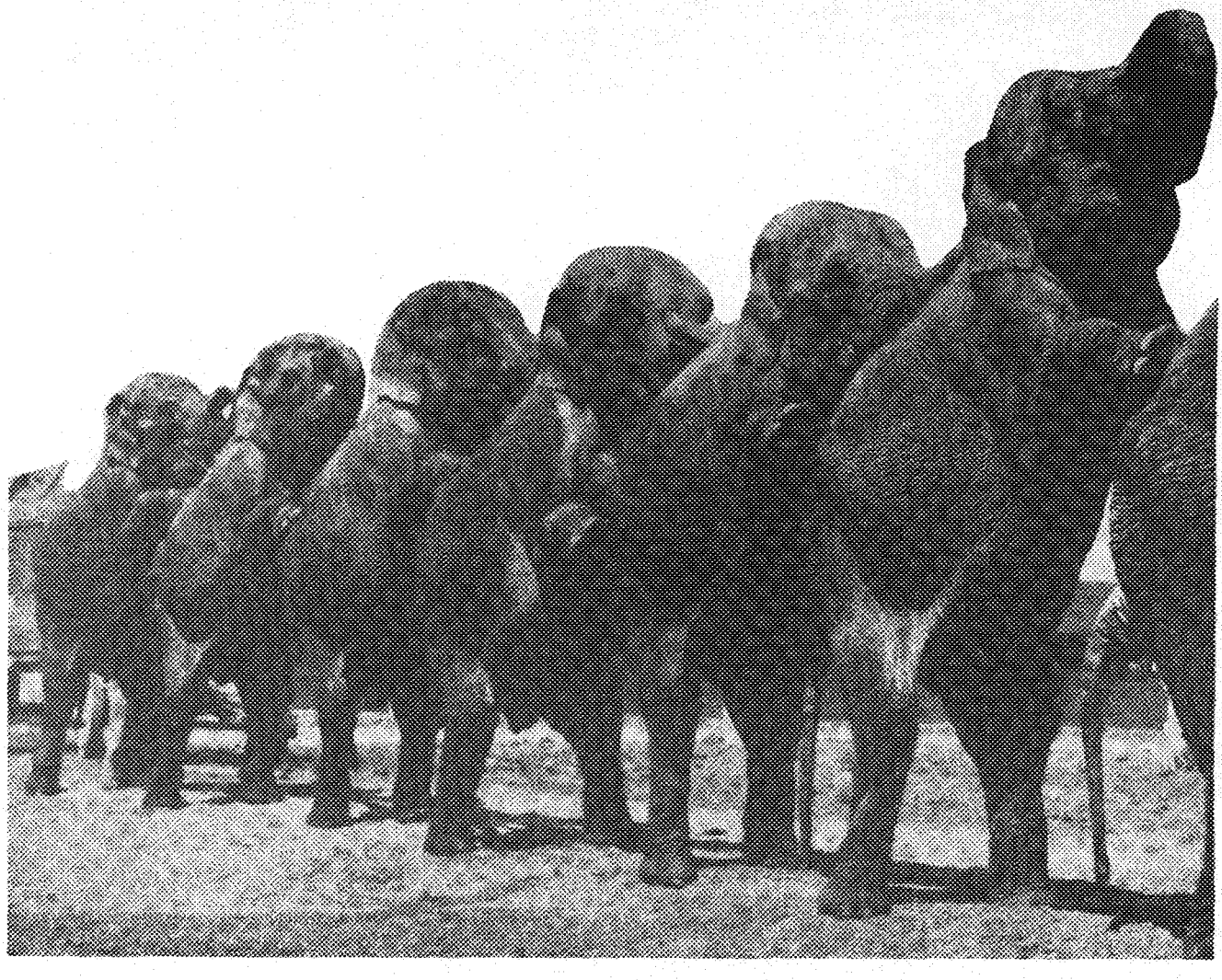
$$22 = 2\Pi r$$

$$r = 3.5 \text{ mi.}$$

The coefficient of expansion of the liquid in which Tommy Green's marble was placed is (believe it or not) 0.0007418.

The surface of the water in the conical cistern would rise at the rate of 15/4Π ft. per min. when the water is 8 ft. deep.

Flash!!!! The Harvard crew came in 15 seconds ahead of Yale, making the course in 15 min. and 45 sec. That finishes things for the year and we'll leave you with this little riddle to keep you busy till next fall. A man is eating where he would not be eating if he had what he is eating. What is he? What is he eating? Where is he?



Two Million Americans

NEVER SAW AN ELEPHANT

THAT'S why the circus will come back this year. "Same old stuff," you say — same stunts, same clowns, same animals, same ballyhoo you saw when you were a kid. Yes, largely true of course, but since that same old elephant stalked through the streets a year ago, two million new Americans will have arrived in this country—two million *more* people who have never seen an elephant.

And in that same interval, a million boys will reach the girl-crazy stage and start shaving the fuzz off their chins for the benefit of another million young women suddenly become acutely clothes and cosmetic conscious. Another two million folks will up and get married—start new homes, buy new furniture, new dishes, new lines. Yesterday they "weren't interested," today they are—and tomorrow other people will be.

That's why the same old elephant walks around serenely confident that among every bored group of people who say, "That's just an elephant," some eager voice will shout, "Oh—*that's* an elephant!"

When you advertise your product, you are not talking to a *grandstand*, but rather to a *parade* that is constantly on the move with new faces—new buyers—coming into the picture every day.—*Anon.*

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis **Saint Paul**

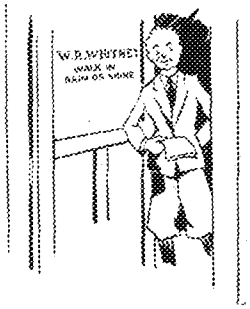
G-E *Campus News*

FOR OUTSTANDING ACHIEVEMENT

February 26 was a big day in the lives of thirty-three G-E employees. These thirty-three were selected from the 60,000 persons in the Company's employ to receive the Charles A. Coffin Awards. There were fifteen factory men, twelve engineers, two commercial men, and four administrative and clerical employees. Twelve of the group are college graduates:

Roy T. Adolphson, University of Washington, '34; Eugene W. Boehne, Texas A & M, '26, and M. I. T., '28; Claude P. Hamilton, University of Nevada, '14; George H. Jump, Syracuse U., '10; Jack R. Meador, Texas A & M, '27 and '28; Harry E. Scarbrough, Georgia Tech., '19; Edward J. Schaefer, Johns Hopkins, '23; Alfred A. Thompson, University of California, '05; Carl Thumin, College of City of New York, '17, and M. I. T., '20; Harold E. Trekell, Kansas State, '31; Elmer J. Wade, University of Maine, '19; and Leo F. Worden, West Virginia University, '25.

Each year General Electric makes these awards to employees who have done outstanding work, as provided in the Charles A. Coffin Foundation established in 1922. Charles A. Coffin was organizer and first president of General Electric.

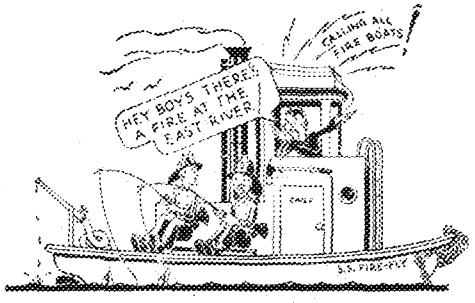


"EXPERIMENTALLY—NOT ON PAPER"

Sixteen years or so ago, Dr. Willis R. Whitney, now Vice President in charge of General Electric research, sent a note to a research worker, suggesting experiments with a motor-generator set sealed gastight and filled with hydrogen to see if the machine ran cooler, and more efficiently. The results of those experiments promoted the use of hydrogen in synchronous condensers and established the present trend toward the use of hydrogen in turbine-generators.

Windage loss in a rotating machine is reduced about 90 per cent and noise is greatly decreased because of the low density of hydrogen. Heat is carried away much more rapidly through the higher thermal conductivity of hydrogen. Resistance to damage due to corona within the machine is increased. These characteristics increase the electrical output for a given core size and reduce inspection and maintenance expense.

The construction of several hydrogen-cooled turbine-generating units is now going on in the Schenectady turbine shop—perhaps all because of that note written by Dr. Whitney so many years ago.



CALLING ALL FIREBOATS

Fireboats are often away from their docks for several days at a time—not on a fishing trip, but fighting severe marine fires. The communication problem has been solved, however, for the fire-fighting sailors on the nine New York fireboats. General Electric engineers have installed a two-way radio system which will be in operation when the boats are out of telephonic contact with shore. This system will be an invaluable aid in expediting the handling of injured persons or those suffering from exposure.

In size, this system will be second only to the police-car system used in Boston. Two-way conversation will be possible, with no switching operations necessary to change from talking to listening. The equipment will include a remote-control, 500-watt, medium-frequency central transmitter for direct radio communication to all fireboats. The return part of the conversation from the boats will be transmitted by ultra-high-frequency radio to pickup receivers located at strategic points on the shore.

98-376DB

GENERAL ELECTRIC