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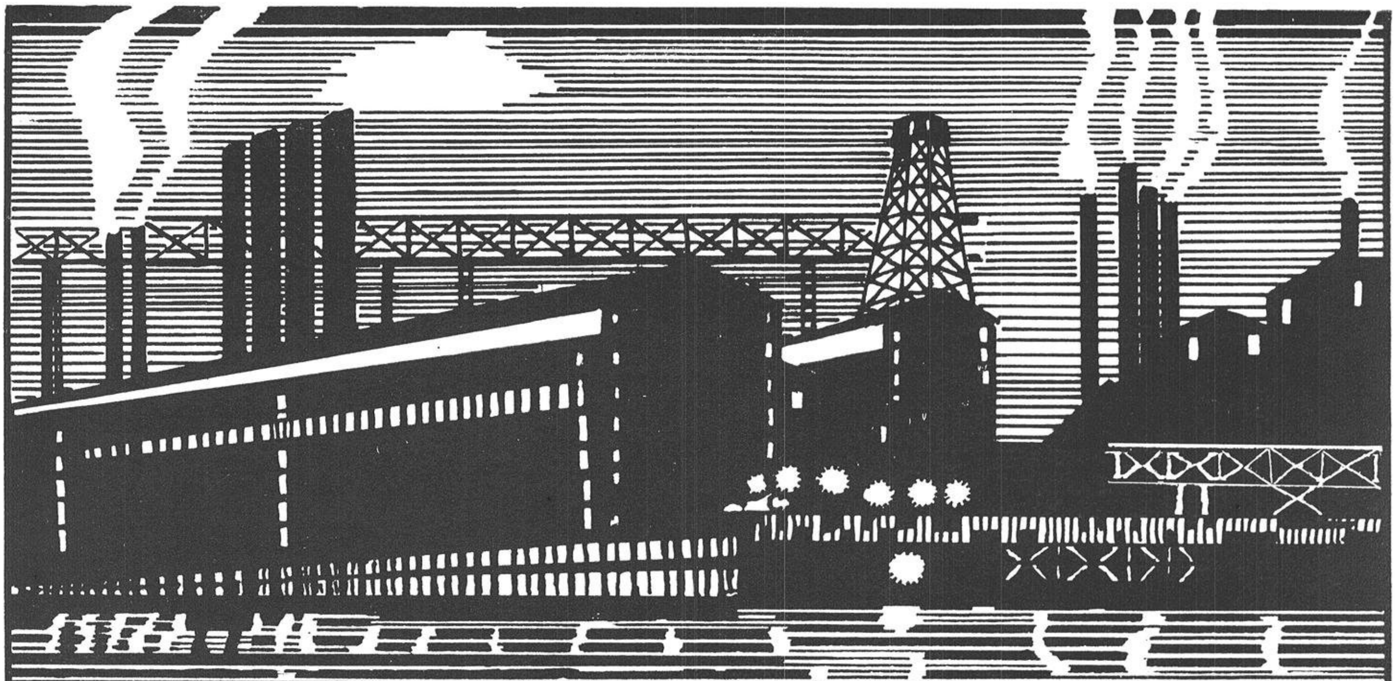
THE WISCONSIN ENGINEER



FEBRUARY 1935

MEMBER, ENGINEERING COLLEGE MAGAZINES, ASSOCIATED

The WISCONSIN ENGINEER

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With the Contributors —

- Mr. Calkins, c'31, has been working with soil erosion problems in western Wisconsin for the last three years since graduation. He presents a brief story of the technique involved in the important problem of land preservation.
- "Pouring the World's Largest Telescope Disk" was written special for the *Engineer* by the research department of the Corning Glass Works.
- In reminiscing through bygone issues we found the frontispiece, "The Engineer." As we read the tribute, our hearts beat fast, and we were astonished with the inspiration we felt. Knowing you would also appreciate the poem, we take the liberty of reprinting it.

The March Issue —

- A series of provacative articles by Professor Bennett on a possible solution to the present social predicament will begin in the next issue.
- Mr. Bogen, me'34, will discuss the present status of the applicability of the Diesel in pleasure cars.
- Mr. Hartenburg will indulge in a general discussion of something on the order of what's new in aviation.

VOLUME 39 FEBRUARY, 1935 NUMBER 5

CONTENTS

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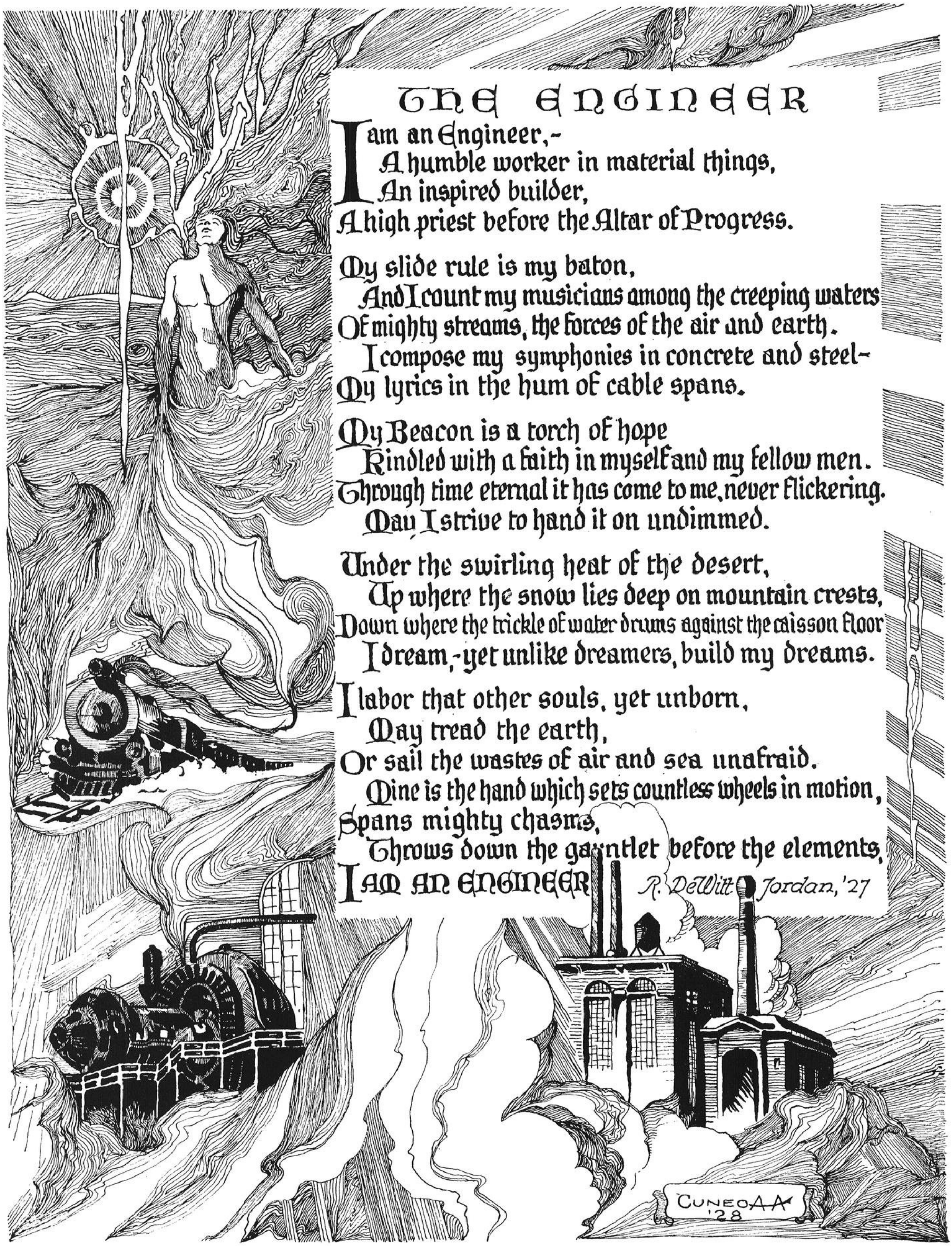


THE ENGINEER

I am an Engineer,-
  A humble worker in material things,
  An inspired builder,
A high priest before the Altar of Progress.

My slide rule is my baton,
  And I count my musicians among the creeping waters
Of mighty streams, the forces of the air and earth.
  I compose my symphonies in concrete and steel-
My lyrics in the hum of cable spans.

My Beacon is a torch of hope
  Kindled with a faith in myself and my fellow men.
Through time eternal it has come to me, never flickering.
  May I strive to hand it on undimmed.

Under the swirling heat of the desert,
  Up where the snow lies deep on mountain crests,
Down where the trickle of water drums against the caisson floor
  I dream,-yet unlike dreamers, build my dreams.

I labor that other souls, yet unborn,
  May tread the earth,
Or sail the wastes of air and sea unafraid.
  Mine is the hand which sets countless wheels in motion,
Spans mighty chasms,
  Throws down the gauntlet before the elements,
I AM AN ENGINEER

R. DeWitt Jordan, '27

The WISCONSIN ENGINEER

VOLUME 39, NO. 5 FEBRUARY, 1935

Terracing in the Coon Creek Drainage Basin

By ROBERT S. CALKINS, c'31, *Junior Agricultural Engineer, Soil Erosion Engineer, United States Department of the Interior*

President Roosevelt, in his recent message to Congress, advocated as a part of the future public works program, work in soil erosion. As more land is needed for the production of crops, it is necessary to bring that land — called sub-marginal land by the economist — into use. It is necessary to revitalize and replace the top-soil to produce any kind of vegetation. Many phases of this work are in the engineering field. This article, together with the article, "Go West, Young Civil," which appeared in the January issue, attempt to survey the present progress east and west of the Mississippi, with an eye to what must be done in the future.

THE Soil Erosion Service of the United States Department of the Interior is conducting a program of soil erosion control in the 92,000 acres that constitute the drainage basin of Coon Creek, located about fifteen miles south and east of La Crosse, Wis. The staff of this federal bureau is composed primarily of agricultural specialists, forestry specialists and engineers. Any farmer within the watershed may avail himself of the advantages of the Soil Erosion Service, on the condition that he contract to cultivate his fields and use his land for a period of five years as the agricultural specialists, forester and engineers deem best for the purposes of controlling erosion.

Generally the erosion control program follows these principles: Steep lands over 40% slope, if not already in woods, are planted with trees; and in either case are fenced off to prevent grazing on them. Land on which the slope is greater than 20% and less than 40% is taken out of cultivation, if it is being cultivated, and put into permanent pasture. Land under 20% slope is cultivated with a sound program of crop rotation and proper fertilization accompanied in most cases with either strip cropping, terracing, or both, with emphasis on contour cultivation. The steepest of the cultivated fields is seeded to alfalfa or some other crop that obviates the necessity of ploughing the land each year.

The engineering phases of this program of soil erosion control falls into two classes; namely, terracing and gully control. The body of this article shall be concerned primarily with the control of sheet erosion with terraces.

A terrace consists of a broad ridge of earth thrown up across a hillside and having a grade in the direction of the length. In forming this ridge, a broad, shallow channel is formed along the upper side of the ridge through which flows the runoff from the land above the terrace. Figure 1 shows a cross section of the type of terrace that is being built in the Coon Creek watershed. It is readily noted from the dimensions given that this size terrace permits the use of modern agricultural implements over the length of the terrace. Several terraces are constructed on a slope so spaced that the runoff from the various terraces is approximately equal per linear unit of terrace. The spacing of terraces and the grade of the terrace channels as used in the Coon Creek watershed are shown in the tables which follow on the next page.

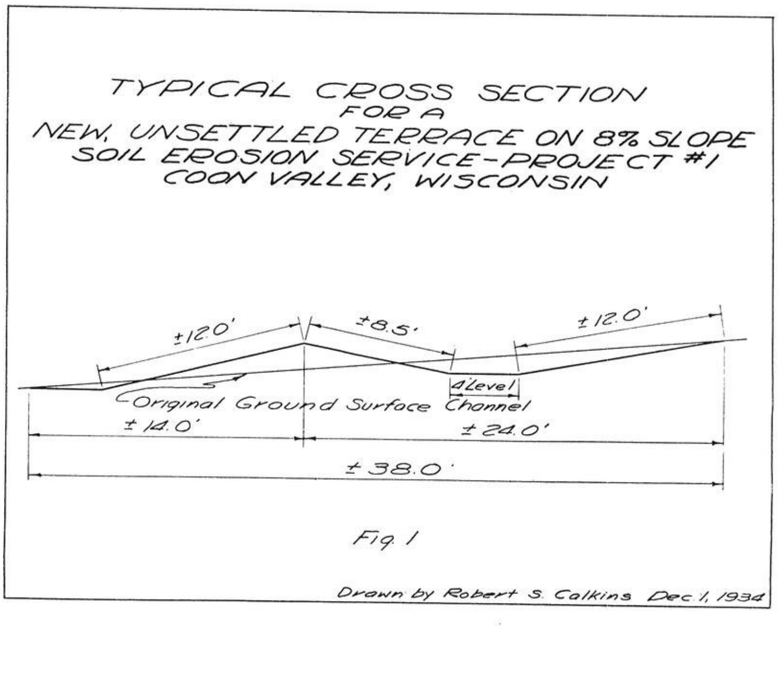


Fig. 1

TABLE SHOWING SPACING OF A BLOCK OF TERRACES

Slope of land in percentages	*Vertical distance in feet between terraces, or from top of slope to first terrace.*
4	3.5
6	4.5
8	5.5
10	6.5
12	7.5
14	8.5
15	9.0

With the possible exception of a few scattered cases, land over 15% slope is never terraced, and land over 12% slope is not terraced as a general practice.

TABLE SHOWING GRADE OF TERRACE CHANNELS

Distance along terrace in feet	*Drop in feet per 100 feet of terrace*
0 to 300	0.10
300 to 600	0.20
600 to 900	0.30
900 to 1200	0.40

In the event that a terrace is to be longer than 1200 feet, the same grades as shown in the above table are used with the exception that each individual grade is carried for a proportionately longer distance than the 300 feet shown above. In no case does the grade exceed a drop of 0.40 feet per 100 feet of terrace.

In laying out a terrace, the engineer sets a stake to the proper grade every fifty feet along the terrace. The terrace is graded with a special terracing grader powered by a crawler type tractor. The grader throws dirt from above and below the row of stakes to form the terrace, the ridge of the completed terrace approximating the location of the original line of stakes. In every case the engineer runs a profile along the channel and the ridge of the completed terrace, taking shots at fifty foot intervals to insure the proper grade in the channel and correct height of ridge above the channel.

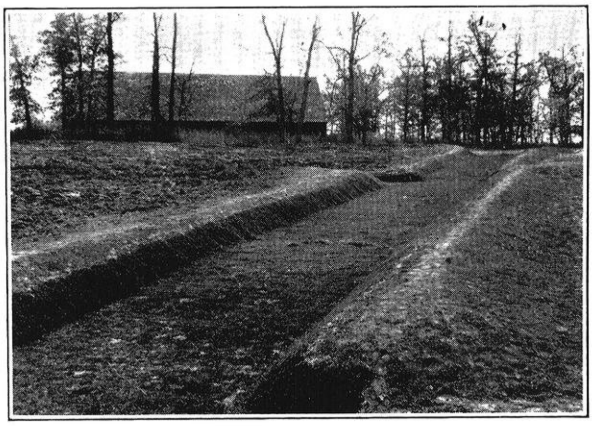
The most important consideration in determining whether or not it is practical to terrace a field is the disposal of the runoff from the terraces. The engineer is charged with this responsibility. In many cases it is possible to so locate the terraces that the runoff from them will flow into a woodlot, permanent pasture or a natural, well sodded draw, but if there is no such outlet available it is necessary to construct some form of terrace outlet that is capable of taking care of the probable runoff and yet is sufficiently inexpensive to be practical. Another consideration in determining whether or not a field is to be terraced is the manner in which the farmer is to work his terraced fields. It is essential that the farmer accomplish all his field operations along the length or parallel to the length of the terraces. If he is not willing to follow this procedure, it is of course inadvisable to construct the terraces. However, most farmers readily see the advantages of having their fields terraced, and are more than willing to cultivate the terraced field in the manner prescribed. It is necessary for the engineer to instruct the farmer in the proper methods of working the fields with the terraces.

As mentioned in the preceding paragraph, the disposal of the runoff is a vital point to consider in terracing. In the Coon Creek watershed, the engineers have used two methods of handling the water from the terraces. The first is to construct a series of notch-spillway dams to a point where a natural watercourse can be used. This method is costly and is not employed except in cases where the amount of land draining into the structures is large enough to warrant the expense, or where it is impractical to handle the water in any other manner. The second method of treating the terrace outlets is the construction of a flat bottomed channel paved with strips of sod. This type of channel is so constructed that a section transverse to the centerline of the channel has a floor made as nearly level as possible with an ordinary square end shovel, carpenter's level and straight edge. When the excavation for the channel has been prepared it is paved with strips of sod, cut from some convenient pasture, laid transverse to the length of the channel. These channels vary in width to accommodate the anticipated runoff, the widths being computed from Manning's formula for a flow of water in open channels, as follows:

$$V = \frac{1.486}{n} R^{\frac{2}{3}} S^{\frac{1}{2}} \text{ and the formula } Q = AV$$

Where the controlling velocity is set at five feet per second; $n = 0.040$; R, the hydraulic radius, is assumed to be equal to the depth of water in the channel in feet; $S =$ the slope of the channel in feet per foot; and $A =$ area of the cross section of the water in the channel in square feet. The widths of channel vary from the accepted minimum of six feet to a maximum of fifteen feet (or in rare cases twenty

This picture shows a terrace outlet before construction of sod channel.



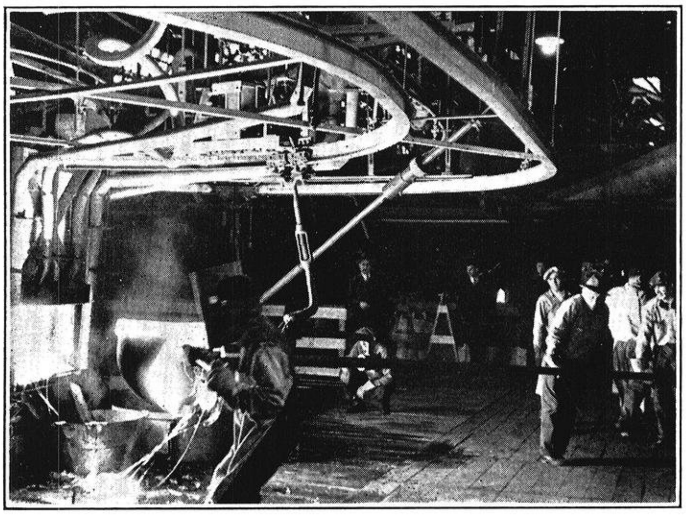
The same terrace outlet shown in above picture after sod channel has been completed.

feet), which has been accepted in the Coon Creek watershed as the maximum amount of land that may be taken out of cultivation. It is not desirable to construct such a channel more than two or three hundred feet below the lowest terrace in a given field.

Terraces have proven a practical aid in soil erosion control for the reasons that they reduce the quantity of water flowing over any portion of a field, except of course that portion above the upper terrace; they prevent concentration of water; they reduce the velocity of the water flowing over the slope; and they do not seriously impede the cultivation of the field. At the Upper Mississippi Valley Erosion Experiment Station, located near La Crosse, Wisconsin, tests taken on terraces show that the soil loss of cultivated terraced land is slightly less than two tons per acre per year. The soil loss of unterraced similar land may be from seven to forty times as great as the soil loss on terraced land.

Terraces not only decrease the soil loss resulting from sheet erosion, but stop active and potential gullies that occur where a field is stripped of its top soil. Terracing, while but a portion of the work of the Soil Erosion Service in the Coon Creek drainage basin, is yet a vital part of the erosion control program.

Pouring the World's Largest Telescope Disc



The ladle crew draws out one one-hundredth of the quota of white hot glass to make the 200-inch telescope disc.

SCIENTIFIC progress in astronomy took a long stride forward with the notable achievement of pouring the 200-inch, 20-ton glass telescope disc in the year 1934. Now close to realization are the long-cherished aspirations of astronomers throughout the world. The new telescope, when completed, will be twice the size of the great Mount Wilson Observatory instrument with its 100-inch mirror, hitherto the world's largest, and will enable man to behold universes 900,000,000 light years away — three times the furthest distance now observable.

To achieve a telescope mirror disc with a diameter of 200 inches, roughly seventeen feet, in a stable, relatively unchanging structure, dimensionally true within an accuracy of about one-millionth of an inch presupposes the casting of a large mass of glass and then bringing this, by a long period of controlled cooling, to permanent durability at room temperature. The 100-inch mirror for the Mount Wilson Observatory which was completed in 1919 had been the pre-war creation of a famous French optical works, and many astronomers doubted that the optical wizardy could be reproduced in this country. A series of attempts by outstanding scientists and research workers resulted in failure, but efforts and study continued.

The problem was finally undertaken by the Corning Glass Works, of Corning, New York, and borosilicate glass made from such materials as sand, alkali and borax, and having a coefficient of expansion only about one-fourth that of ordinary window glass, was selected for the project. Borosilicate glass is in some ways comparable to the glass used for making Pyrex glass baking dishes and for the heat resistant laboratory ware used in chemistry and physics. Experimental knowledge, likewise practical experience, were acquired by casting and successfully annealing a number of smaller disks from borosilicate glass before the 200-inch mirror was undertaken. A 30-inch disc and a 60-inch disc were first made. Then attention centered on a disc of 120 inches for use as a "trial horse" for the great mirror.

The mixture of raw materials for a glass melt of this magnitude is fed into the furnace at the rate of 400-pounds per hour, during a twenty-four hour day, and this continues for twenty-one days. Ten days plus three weeks are required to heat up the tank and to fill it with the correct charge to make the 20-ton glass disc. After this, the lake of white hot glass is observed and conditioned until it appears by test to be in just the right condition for pouring. The final temperature of the glass when ready for the pouring is 2800 degrees Fahrenheit.

The Pouring — Problem for Engineering and Science

Great ladles, something like a cannibal's cauldron, at the end of twenty foot handles are used to transfer the molten glass from tank to mold. There are three ladles, each suspended from a trolley track arrangement. The tracks run overhead in separate serpentine paths from the three tank-furnace doors and lead to three openings, 120 degrees apart, in the circular wall of the "beehive."

The ladles are ingeniously equipped, so as to be suspended with a movable fulcrum. Thus, by a shift of the ladle, horizontally, the scoop, whether full or empty, can easily be balanced and held on a level. When each ladle is withdrawn from the tank, it is pushed slowly forward, suspended from its track, until the ladle crew has inserted its scoop through one of the openings in the beehive. They then rotate the handle, inverting the scoop and pouring the contents down into the mold. About 75,000 pounds of glass are drawn out of the tank, but only about 40,000 are poured into the mold. Since part of the glass in each ladle is temporarily discarded, the total melt is several times the amount actually put into the mold. About 100 ladlesful are transported with 400 pounds of glass per ladle deliverable to the mold. The glass finally in the mold weighs approximately 20 tons.

When all of the glass has been poured and the mold is adequately full, it is kept under a temperature of about 2400 degrees Fahrenheit for from five to ten hours to remove any imperfections. Then the heat is turned off and the white hot content of the mold is allowed to cool to dull red with a temperature of about 1200 degrees Fahrenheit. The mold is then lowered from its pouring position under the "beehive" by means of synchronously operating jackscrews of a 60-ton locomotive hoist. Actually, it is caused gradually to descend from the pouring floor level, and when it is below, it is moved in its carriage on the hoist, horizontally, and on the same floor level, to a position beneath the annealer. When the mold is lowered, there must be mechanical provision for moving it with its precious cargo a distance of about fifty feet, and then raising it evenly and without distortion. Finally, when it is again raised to the original floor level, it is concentrically under and within the annealing furnace. This transfer from beehive to annealer occupies a time of about one hour. When it has entered the annealer, an insulating seal is affected to the degree required for the annealing process.

Pouring the 200-inch disc and annealing it are broadly the two fundamental divisions of the problem. Before and after and intermediate there are many side problems. First of all, of course, there has been the problem of determining how substances act under calculated conditions. Secondly, there has been the problem of handling quantities of material under changing conditions. Thirdly, there has been a problem of transporting large masses of material with minimum shock and strain. The design problem has embraced both materials and machines. In brief, the problem of casting a disc of this magnitude involves a study of making the glass ready, building a ceramic mold into which the glass can be poured, and then constructing suitable equipment in which the large mass can gradually be annealed.

The Mold

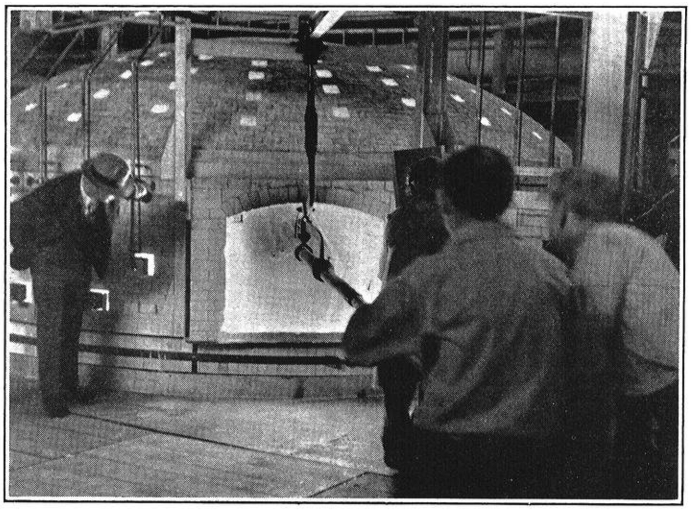
The "beehive," or pouring oven, may suggest to you an Eskimo's igloo — except for the temperature. It is a large, low dome made of white fire brick, and is the heater housing which is in place over the mold when the glass is being poured. The mold has a rim resembling a circus ring in miniature. Distributed in the base of the mold are electrical heating elements which are in operation when the mold is in the annealer. The mold is interesting because it suggests the appearance of a domed city of fairyland. The alternate heights and hollows constitute a geometric pattern. The heights, which appear like chamfered geometric blocks, are like the cores in foundry work. Into the narrow streets, symmetrically curving between them, the molten glass flows. It fills them and gradually submerges the domes. The domes form the ribs which finally will fill the back of the finished mirror. In making the mold, a period of six weeks is required. Employed, are a draftsman, two pattern makers, two laborers, five masons. The geometric units of the domed city represent a skilled job of masonry.

Disc Design

The 200-inch disc is the first very large telescope mirror disc to be made in ribbed structure. The 120-inch disc also was made with a ribbed back structure but it is a test disc or "optical flat" for the "200". Technically, a solid glass disc could be made but the ribbed structure has the advantage of cutting down the weight about one-half, and yet it provides equal rigidity. Further, the ribbed design is an aid to mounting the disc in the telescope.

According to calculations for requisite strength, a solid glass disc should have a thickness of about one-sixth its diameter. Therefore, a solid disc of glass 200 inches wide should have a thickness of 33 inches. The ribbed structures permits making a 200-inch disc, adequate in strength, with a thickness of only 26 inches, and a corresponding reduction in weight from about 40 tons to 20 tons. Then too, because of the ribbed structure, it is anticipated that there will be more rapid equalization of temperature throughout the glass.

The ideal reflector must be essentially stable, both mechanically and chemically. The borosilicate glass used for the mirror has advantages in this regard. The cores to provide the ribbed structure must be porous, non-adherent, and insulating. Hence, the domed city of the mold is made from insulating ceramic bricks composed essentially of silicates. Their porosity improves the surface structure of the glass.



Pouring a ladle of white hot molten glass into the mold.

Annealing Process

Perhaps the most difficult problem in large disc making is to bring the molten mass gradually to room temperature without causing mechanical strain to develop through too sudden thermal change or through unequal distribution of thermal and other stresses. When the mold and its disc at dull red heat, enters the annealer, the glass is held at constant temperature for a length of time which depends on its temperature in the particular experiment. In the case of the 200-inch disc, the time of this holding may be two or three months. Following this, the temperature is reduced by electrical control at a gradual rate, minimizing the possibility of strain. The rate of the decrease in temperature and the length of the total annealing operation depend on the thickness of the glass mass as a factor of its total size. The cooling rate for the 200-inch disc is approximately a degree or two per day during a period of about eleven months until it reaches room temperature.

The annealer is a short cylindrical structure located on the same floor level with the beehive. To perform the annealing operation, it is necessary to construct the annealer so that when finally reposed, the disc shall be surrounded from every direction by heating elements. Ten automatic temperature regulators are required to control the current passing through the heating elements, permitting of any desired time or rate adjustment. The electric heating elements operate on a low voltage. Provision is made for an independent power supply and, in the possible event of damage to the electric line by lightning, a substitute electrical system is always available.

In the annealing oven there are 304 heating elements, electrically supplied. In the making of these, nickel-chromium ribbon has been used; 4864 feet of it, in fact, — three-quarters of an inch wide and .052 inches thick. When the disc is in the annealer, it is insulated against uncontrolled heat loss and is subject to a controlled temperature environment during its stay there. Heating elements in top, bottom and side, are lowered in temperature gradually until the mass of glass approaches ordinary room temperature.

After eleven months, the glass and its mold are lowered from the annealer kiln, the steel rim is taken off, and the mold material is removed. A steel frame is then bolted in place so as to frame the disc. The disc is then stood up on edge and the ceramic cores are cleaned out, that is, removed. The next step is to test the disc for strain, by use of polarized light, and finally the disc is ready for final inspection and shipment.

Grinding and Polishing

Considering the size of the glass disc, it is not possible to grind it intensively because of the heat that would be generated and the stress that might result. The grinding and polishing will be done in the optical shop especially built for the purpose at the California Institute of Technology. In the "figuring" process a small amount of grinding per day will be all that can be carried out, and so the total grinding and polishing process may occupy three years. One commentator, writing recently in an air conditioning magazine, suggested that the grinding might be speeded up in an atmosphere where the temperature is controlled. The special optical shop which will be used for the 200-inch disc is temperature controlled and air conditioned.

Finally, there is the task of producing a mirror surface on the highly perfect concave reflecting surface of the disc. Indications are that it will not be "silvered" but treated with an aluminum coating instead. In the workshops of the California Institute of Technology's new astrophysical laboratories, construction work is now progressing on the framework that will hold the great mirror.

At the time of the pouring of the great disc in Corning last March, the heat of the molten glass loosened several cores of the mold, which floated up through the glass and were fished out. When the disc was inspected, two months later in May, it was found that the glass itself was in perfect condition and that the experiment was a marked success. At that time the Corning Glass Works decided to pour a second 200-inch disc. In October 1934, the first great disc was removed from the annealing oven to make way for the pouring of the second, and a new and improved mold was developed.

Location of Observatory

The most desirable location for the observatory in which the world's largest telescope is to be housed has finally been chosen by scientists who have been searching for several years for the best site. They have selected Mount Palomar which is 85 miles south of Pasadena, the site of the Mount Wilson Observatory, and 50 miles northeast of San Diego in California. Among many locations considered, Mount Palomer proved to have the greatest number of clear nights, the least atmospheric heat vibrations, less humidity and fog, clearer definition and greater distance from earthquake disturbances. The two giant 200-inch mirrors are the property of the California Institute of Technology which will build the telescope with the cooperation of the staff of the Mount Wilson Observatory of the Carnegie Institution. Most of the great advances in man's knowledge of the universe which have been made since the World War are due directly to the enormous light gathering power of the 100-inch telescope. The mighty 200-inch reflecting mirror will collect four times as much light and will increase 27 times the volume of space now within range of the 100-inch mirror. Equipped with new "eyes" the world prepares for great new scientific findings.

THE SPIRIT OF SERVICE

An interesting and amusing instance of the various ways in which the South African Railways and Harbors serve the public, particularly the farming community, is contained in the following copy of a note handed to the driver of train No. 1400 at Mevamphlope, on the North Coast Line, on August 10th, by a farmer resident at Nyoko: "Will you oblige by whistling like hell as you pass through the farm in the hope of lifting the locusts. Thanks." The driver acceded to the farmer's request and, from the latter's point of view, the ruse was quite successful. All the locusts took flight as the train roared through the farm, whistling continuously. They had their revenge on the driver, however, for the swarm settled in a railway cut a few miles ahead and the train was delayed several hours on account of the engine wheels being unable to grip the rails.

—*South African Railways and Harbors Magazine.*

THE CRITICAL ANGLE . . .

In Which Engineers Put Forth Their Comments of the Play on the Stage . .

TAKING INVENTORY Now that the first semester is over and we have received our pay for the last four and one-half months work, many will wonder whether they have been wasting their time studying engineering. A bit of reflection and self analysis may answer this question for you. In recognition of our ultimate goal as graduate engineers, we must look ahead and inspect that which is in store for us in engineering after we have ceased to work for an alphabetical symbol of our degree of perfection. Very few of the problems encountered in engineering are solved by means of an equation whether it be simple or complex; therefore it is evident that our equipment must include something more than the ability to memorize equations.

We must have an interest in and liking for building structures and machines, and solving engineering problems; a practical and theoretical technical knowledge of several branches of engineering. The faculty of appreciative observation, and the ability to analyze conditions and results is a very desirable and essential quality to help raise oneself above the level of routine work. One should be unwilling to perform tasks mechanically, copy designs, accept statements and merely be an automaton. Insist upon learning why things are done, why a certain result is obtained, why a structure or mechanism failed, and what are the good and bad features of a design.

Constantly read, observe, study, and broaden ones education in the different branches of engineering, art, literature, political economy, commerce and business. The noted and successful engineer will not be found to be a narrow minded person, versed only in his profession.

Learn to know materials and principles intimately. Acquire additional knowledge and experience by study and observation during and outside of regular hours of employment. The company or employer is not responsible for our further education, advancement and success, or failure and decay. Few are pushed up, but many are shoved out of the way because they permit themselves to remain upon an unsound foundation.

Research work must be constantly kept in mind, as well as designs and inventions. Engineers, designers and all members of the manufacturing departments should continually consider production economy, and the improving of shop methods.

Only after we have obtained employment, in the particular branch of engineering in which we have specialized, will some of these requirements become apparent. In the meantime let us examine our attitude toward engineering and our abilities. Let's take inventory.

ALL OVER AGAIN Ah, yes! A new semester. So you begin to turn over a new leaf; once more you wear your mouth in a straight line of determination; again you half squint your eyes in an attitude of resolution. Here and there are written bits of advice and encouragement. "Well, better next semester," say your profs with a smile. You hear more than one fellow assure everyone and himself that this time he will "crack 'em for sure." Soon, by George, it gets to be contagious!

By the way, though, it seems that you started out that way last semester; and the semester before that — in fact, almost every semester of school you can remember. You always begin that way! And, each time, you get so "worked up" over it all, that, those last few days of waiting for school to start, you spend trying to find something or someplace that will give you a chance to sit still for a minute. And you're always so glad you feel that way! — you just seem to *know* your next semester will be as you want it!

But how long does that fervor last? Doggone! — that's the trouble! You come back to "normal" too soon!

Well, that's why you've just done this bit of meditating. You probably see now that *you are going to make that fervor stronger and longer this semester!*

UNIFORMITY OF STANDARDS Scholastic standards if they would be worthy and meaningful should be based upon comparable records for the various schools at the University of Wisconsin. At present in the college of Letters and Science the highest scholastic honors that are awarded annually, senior high honors and senior honors, are based upon a two-year record, upon the record of the junior and senior years. Engineering college senior high honors and honors are conferred upon a basis of the four-year record.

The four-year achievement is naturally considerably more meritorious and far more difficult to accomplish. A good four-year record means that one has set a stiff pace at the beginning of his school career and that he has maintained it unflaggingly throughout the pursuit of his college education.

The thought that may have prompted the Letters and Science faculty to adopt their system is that the two-year basis of honor awards provides an incentive for junior and senior students to pursue their major studies with diligence. A bad sophomore year or a poor start in the freshman year will not remove from a Letters and Science junior the opportunity to strive with renewed effort for senior high honors or honors.

Either basis for computing senior honors is acceptable, but engineering students should be able to compete against Letters and Science students upon a similar basis. Honors should be awarded upon a four-year basis or a two-year basis but not both, especially in the same university.

« ALUMNI NOTES »

CIVILS

SHAFER, S. PARKER, '27, is employed by the Chicago, North Shore and Milwaukee Railroad Company at Highwood, Illinois.

TSCHUDY, LIONEL C., '23, who is with the U. S. Forestry Service in Milwaukee, was married on December 20th at Chicago to Margaret Lenora Beers.

JENKS, ROBERT J., '33, who is working on the Coulee Dam in Washington, writes as follows: "When I first came down in October there were three unfinished buildings here and all the luxuries of a mountain top. I have walked a mile for a hot shower and felt lucky to get one. I started by sleeping in an unfinished building; then in a bunk house with no doors or windows; now the rooms have electric heat, four walls, two beds, and a table. The completion of the wash houses and the arrival of hot water were real events. Buildings rise so rapidly that one can really get lost in his own camp. The work is new and always interesting. About everything I do is something that I have never tried before."

BERG, LOUIS L., '32, began work with the Vibrolithic Company of Ludington, Michigan, late in November.

BORKENHAGEN, E. H., '33, joined the engineering staff of the Superior Division of the Highway Commission on November 13.

McDONALD, WALTER E., '31, was married on December 22nd to Dorothy Currie of Sarnis, Ontario. They will live in Detroit where Mac is working with the U. S. Engineers on river improvement.

HOVEY, WILLIAM B., '32, sailed for Venezuela on January 9th from New York. He will be chief of a plane-table party for the Venezuela Gulf Oil Company.

WARD, GERALD C., '29, is with John Lucas & Co. of Chicago, makers of paints. His address at the present time is Madison.

LEVIN, J. D., '27, is supervising post office construction in Iowa with headquarters at Independence.

HERMANSEN, EVALD, '34, is assistant scientific aid, division of terrestrial magnetism and seismology of the U. S. Coast and Geodetic Survey since November 19th. Address: 131 — 3rd Street, N. E., Washington, D. C.

TABOR, HENRY W., '16, C. E.'21, is on the engineering staff of the Reclamation Service at Denver.

SMITH, ORRIN C., '07, is on the engineering staff of the Reclamation Service at Denver.

STAACK, JOHN G., '04, who is chief topographic engineer of the U. S. Geographical Survey, has been elected to a membership in the American Association of Geographers.

BECKER, J. WALTER, '09, who is the owner of the Ideal Commutator Dresser Company of Sycamore, Ill., has invented an artificial commutator grinding stone. He founded the company in 1916 and specializes in the manufacture of electrical specialties.

HUBER, WILLIAM G., '20, is a civil engineer with the Pennsylvania Water and Power Company in Baltimore, Md.

MARGOLES, HARRY, '21, has been with the U. S. Engineering staff since 1921. At present he is working on the huge Fort Peck Dam project in Montana as construction engineer.

SCHNEIDER, GEORGE R., '22, is working as an assistant engineer in the U. S. Engineer Office at Zanesville, Ohio.

MERZ, ROBERT C., '33, is employed in the sanitation equipment division of the Chain Belt Company as a Sanitary engineer.

MINEAR, VIRGIL, '23, is employed by the U. S. Bureau of Reclamation at Boulder City, Nevada.

MILLER, HAROLD F., '29, is employed by the Bureau of Public Roads at Pierre, South Dakota.

DITTMAN, RICHARD F., '34, who is with the Bureau of Biological Survey of the United States Department of Agriculture, has been transferred from land survey work to the examination and negotiation branch of the Bureau at St. Louis, Missouri, for the winter.

ALGEO, HAROLD L., '13, is captain of company 1673 in the CCC Camp, St. Charles, West Chicago, Illinois.

HAYDEN, LELAND H., '28, is working for the Wisconsin Highway Commission at Superior, Wisconsin.

WERNER, MAX A., '34, is working in Madison for Mead, Ward and Hunt. He is helping prepare maps for a proposed dam in Nebraska.

PERLMAN, CHARLES M., '26, who is connected with the Wisconsin Highway Commission, married Lee Lozoff, Lake Mills, on October 28. The couple are at home in Madison.

REED, JAMES, '08, is a civil engineer with the Babcock & Reed Company, Santa Cruz, California.

KAYSEN, JAMES P., '33, is camp engineer at the ECW Forestry Camp at Dunbar, Wisconsin.

DASNEY, CHARLES A., '32, is an engineer with Bailey and Sharp, construction engineers in Hamburg, New York.

ANDERSON, BERT E., '15, is general manager for the Southern California Lime & Cement Co. in Los Angeles.

BUEHLER, ROBERT J., '33, is connected with the Tennessee Valley Authority as junior hydraulic engineer.

DAMES, ERWIN, '20, is city manager for City Grove, California.

EVERY, EDWARD M., '30, has an engineering position with the Wisconsin Highway Commission.

FRICK, ORLANDO H., '02, is general manager for the Chicago Union Station.

CHEMICALS

PITZNER, A. F., '21, and **HUBBARD, H. C.**, '22, M. S.'23, are associated under the firm name of Parker, Carlson, Pitzner and Hubbard and are engaged in the practice of Patent and Trademark Law.

HEARD, GEORGE G., '34, ws married to Margaret Donnelly, '34, on January 1st at Terre Haute, Indiana. Mr. Heard is employed by the Sinclair Refining Company at East Chicago, Indiana.

ZINN, ROBERT E., '27, has been granted a patent on water treatment which has been let to the Victor Chemical Works of Chicago. The patent is for a preparation water softener.

GRENIDGE, C. T., '26, left the A. O. Smith Corporation of Milwaukee to accept a position as metallurgist with the Battelle Memorial Institute of Columbus, Ohio.

HANKS, WILLIAM V., '23, has been named chief chemist for the Standard Oil Company, New Jersey, in England. After his graduation from the university in 1923, he went to the Boston School of Technology in 1927. Since that time he had been employed at Baton Rouge, La., and Westfield, N. J., for the Oil Company. He left for his new post shortly before the holidays.

De VOS, J. W., '23, is on the engineering staff of the Kimberly Clark Corporation of Neenah.

FULKERSON, PERRY, '24, is employed by the Proctor and Gamble Manufacturing Company as superintendent at the Baltimore plant.

HIRSCH, ALLAN S., '31, is employed in the technical department of the Marathon Paper Mills, Rothschilds, Wis.

DETTNER, D. D., '34, is in the field service department of the Universal Oil Products Company, Riverside, Illinois.

FOOTE, PERRY A., '22, is a professor in the College of Pharmacy of the University of Florida located at Gainsville.

McHUGH, KEITH S., '17, works for the American Telephone & Telegraph Company as commercial engineer.

WHIPPLE, NEWTON D., '17, is associated with The Pure Carbonic, Inc., in Chicago.

BENNETT, GEORGE V., '23, lives in South Bend, Ind., where he is connected with the Northern Indiana Public Service Company.

WILLIAMS, J. WESLEY, '18, is connected with the National Carbon Company, Chicago.

MILLER, EDWARD P., '32, was married to Eleanor M. Martens, Green Bay, on October 20 at Green Bay. Mr. Miller is employed by the Hoberg Paper Mill. Address: 607 Maple Avenue.

HARDELL, CLARENCE W., '32, chemical engineer with the Sinclair Refining Company in East Chicago, Indiana, lives at 4515 Magound Ave.

AMES, KENNETH S., '23, is a technical salesman for the Carbine and Chemical Corporation of New York. His address is 217 S. Tremont Drive, Greensboro, N. C.

MECHANICALS

JOHNSON, GUY M., '06, who was formerly division manager at South Bend, Indiana, is now located at Hammond, Indiana. He has been appointed general gas superintendent of the Northern Indiana Public Service Co.

ALBERTS, HARRY C., '24, is engaged in a successful patent law practice in Chicago. Upon completing his university work he received an appointment to the U. S. Patent Office as a junior examiner. He later left this position to complete his studies at the Chicago Law school.

NIEDERMAN, PHILLIP H., '25, C'26, is assistant superintendent of the Great Lakes Dredge and Dock Company in Chicago.

JOHNSON, CLARENCE W., '27, is office manager and sales engineer with the Canadian Sirocco Manufacturing Company, Montreal.

LUCAS, JOSEPH A., '31, has been specializing in automatic heating, ventilation and air conditioning, and at present is associated with the Meyer Furnace Company as a sales engineer in his prticular field.

GIBSON, WILLIAM J., '02, has the position of apprentice supervisor for the Harnischfeger Corporation of Milwaukee.

HIPPENMEYER, IRVING R., '02, manages the Creamery Package Manufacturing Company in Lake Mills, Wisconsin.

KELLER, ARTHUR E., '07, is with the Northwestern Mutual Life Insurance Company in Indianapolis, Indiana.

MINERS AND METALLURGISTS

BUCHNER, CARL F., '23, is manager of W. C. McBride, Inc., of St. Louis, Mo.

CRAWFORD, H. DEAN, '27, who was recently employed by the Commonwealth Telephone Company at Wausau, has returned to New Mexico where he is working with the Peru Mining Company at Deming.

RAMSAY, ROBERT H., '31, M. S.'33, who is a sales representative for a Minneapolis company specializing in wood preservatives and flotation oils.

EHRLINGER, H. P., '25, manager of the Portable Power Tool Corporation, Warsaw, Ind.

GENERAL

HANKINSON, RAY L., '05, is a hydrographic engineer in the U. S. Lighthouse Service in Washington.

MUCKLESTON, RALPH W., '09, teaches in the Lincoln High School at Seattle, Washington.

ELECTRICALS

PALERMO, FRANK J., '33, is employed by the Case Company of Racine, Wis., where he has much to do with the pyrometer control of the plant's furnaces.

BURKHOLDER, CHARLES I., '96, who is an electrical engineer with the Duke Power Company, is living at 801 Ardesley Road, Charlotte, N. C.

WHITWORTH, WILLIAM E., '24, is a technical engineer with the Bell Telephone Laboratories in New York. He is married and lives at 23 Bogert St., West Englewood, N. J.

THOMAS, CLEO W., '25, is still with the Public Service Company of Northern Illinois.

WEBB, W. R., '17, is now business manager of Webb Brothers Company of Sioux City, Iowa.

ON THE CAMPUS ∾ ∾

CONFERENCE FOR FUEL USERS

With two of the series of fuel conferences completed, the program undertaken by the Mechanical Engineering department is being carried out with merited success and has already proven of invaluable service to dealers, industries and homeowners. The main lobby and heating-ventilating lab are lined with impressive booths, and the M. E. building has taken on the appearance of a veritable home show.

The trek of exhibitors, home-owners and other interested parties began on January 31st and continued throughout the week-end. The theme of the session was solid fuels, stokers, and accessories. It was estimated that approximately 450 registered for the conference and many more inspected the exhibitions and met with the authorities present. Black Diamond, official organ of the coal industry, contained an illuminating report of the conference in the February issue of the magazine.

The following week-end was devoted to fuel oils, burners, and accessories with several outstanding exhibitions of the latest engineering developments featured. Over 350 enthusiastic visitors were registered and took part in the various sessions and conferences on the extensive program.

The third conference on lubrication and fuels for motor cars is scheduled for February 27-28 and March 1-2, according to Professor G. C. Wilson, chairman of the conference committee.

LIGHTNING

Directed by V. M. Murray and R. R. Benedict of the electrical engineering department, a series of tests were performed on the effects of lightning surges on secondary distribution systems in rural districts of Wisconsin. The object of the tests was to determine the danger to which the customer is subjected due to lightning surges on the power line, the danger being judged on the basis of the magnitude of the surge voltage at the customer's end of the line. It was discovered that jeopardy of human life cannot be eliminated merely by obtaining good values of grounding resistance at the rural electric power consumer's home.

SEWAGE PLANT OPERATORS MEET

Under the auspices of the Hydraulics department, the third annual sewage plant operators course was recently conducted with lectures and demonstrations by technical experts designed to aid the operators to run community plants more effectively at lower cost. Laboratory tests beneficial in proper plant operation and demonstrations explaining the basic principles of sewage treatment were features of the course. Among the faculty taking part in the conference were Professors L. H. Kessler, F. A. Aust, F. M. Dawson, and H. W. Ruf.

FOUR LEAF CLOVERS

Four February graduates walked out of the Mechanical Engineering building with recommendations for degrees in one hand, orders to report to their jobs in the other and smiles extending from ear to ear. W. A. Pollock, one of the fortunate quartet, has accepted a position with the Milwaukee Electric Railway and Light Co. and is stationed at the Lakeside Power Plant. A. G. Foster and E. C. Helmke have begun work with the Gisholt Machine Company of Madison. In order to acquaint themselves with the functioning of the engineering division, the two men will spend considerable time in the various departments of the company. W. J. Harley joined the engineering staff of the Harley-Davidson Motorcycle Company of Milwaukee.

POLYGON CONTROVERSY

The pros and cons of the Polygon Plan are being discussed avidly about the campus, now that it has been in operation for a semester. Adverse criticism seems to center about the administrative difficulties encountered and many suggestions have been offered informally as to methods of ironing out the wrinkles. There seems to be no question as to the positive benefits made available by the success of this plan. This observer is certain that Polygon leaders will welcome constructive criticism by the student body and your approval of the plan can be best shown by cooperating in its effective administration. Let's have some comments and open letters addressed to this department, properly signed.

ECONOMICS AGAIN

One of the most enlightening analyses of the controversial question "Mechanization of Industry" has recently appeared among contemporary publications as the contribution of Professor Harry Jerome of the economics department. Prof. Jerome contends that the increase in productivity is due to new methods of production, and not the development of new machines. For those students interested in this topic, a brief summary may be prepared by Professor Volk of the Library, for a later publication of the Engineer.

FACULTY BRIEFS

Frederick A. Maxfield, instructor in the electrical engineering department, collaborated on a paper recently appearing in the January issue of "Physical Review." The title of the paper was "X-ray Levels of Radio-Active Elements with Applications to Beta and Gamma-Ray Spectra." The research was conducted while Mr. Maxfield and his colleague, Mr. Ruark, were connected with the University of Pittsburgh in 1934.

* * *

In the December 13 issue of the *Engineering News-Record* is presented a detailed report to the Highway Research Board on a series of tests conducted by Prof. H. F. Janda and Wayne N. Volk relative to the problems of roadway safety. The paper contained results of tests of highway signs to determine promptness of reaction of some 160 drivers to various types of signs. It was proved conclusively that a large arrow giving warning or direction required a shorter time of reaction than any other type of sign.

* * *

Professor G. L. Larson, chairman of the Mechanical Engineering department, has returned from the annual convention of the American Society of Heating and Ventilation Engineers held January 27 to January 30 in Buffalo, New York. Professor Larson was elected First Vice-President of the Society. Prof. Larson addressed 300 representatives in attendance at the Air Conditioning Institute of Schenectady on the subject of air conditioning.

« CAMPUS ORGANIZATIONS »

A. I. Ch. E.

One chemical engineer said to another, "Variety is the spice of life." And they got together in the Memorial Union the evening of January 18th to prove it. Business, education, and recreation were combined in just the right proportions to make a very successful meeting. After the business details had been set aside, two educational movies were shown. One was a pictorial presentation of modern methods of highway construction. Our modern highways were contrasted with the roads of Caesar's time, and in an instructive but entertaining way showed the development of highways from rock and dirt to concrete and asphalt surfacing. The other movie showed the fundamental processes in converting phenol and formaldehyde into the phenolic resin known as Bakelite. The picture illustrated Bakelite manufacture in a simple manner and gave an outline of the many and varied uses of Bakelite.

The recreational portion of the program started with a good old fashioned Harold Lloyd comedy. Refreshments were served and the evening rounded off with singing. Strains of the Song of the Vagabond, Sweet Adeline, the Man on the Flying Trapeze, and finally St. Patrick Was an Engineer concluded the evening's entertainment. A good time was had by all. And listen, you chem engineers, turn out for the first meeting of next semester!

A. S. M. E.

The society held an election of officers for the second semester of the present school year. Those elected are: Irving Kraemer, president; C. Bradford Kniskern, vice-pres.; Alex Robertson, secretary, and Roald Amundson, treasurer.

At its last meeting the chapter entertained the Marquette chapter of the society at which time Mr. R. R. Leonard, the field representative of the Chicago branch of the senior organization was a guest. In his address, Mr. Leonard outlined the functions and issues confronting the organization and pointed out the advantages of participating as members. Speakers from the Marquette Delegation included Mr. Schoen, the honorary chairman, and Mr. Krueger, the president of the Marquette Student Chapter.

Mr. Conway, of the Link-Belt Company gave an interesting talk, illustrated with movies, on the types of conveying equipment in use in the field at the present time.

After the meeting, refreshments were served and the members of the two chapters made acquaintances and exchanged ideas of mutual interest.

When engineers forget to be technical, when engineers may flit with gay abandon, when engineers open to the pleasures of comradeship — when Polygon presents its smoker. Pay your activity fee now!

A. S. C. E.

The student branch of the society were fortunate in having Mr. Earl K. Loverud as the speaker at the meeting held on January 16. Mr. Loverud is a native of Stoughton who graduated from the university in 1923 and received the degree of C. E. in 1933. He spoke of his experiences in the Far East where he has been representing various companies. His comments were well illustrated by six reels of movies which were pertinent to the work he was engaged in while abroad.

A. I. E. E.

The Madison section of the American Institute of Electrical Engineers at their dinner meeting of Thursday, February 14th, were honored in having Mr. George G. Post, the institute Vice-President of the Great Lakes District, present as their guest speaker.

Mr. Post, a graduate of the Wisconsin Engineering College in 1904, was a former resident of Dane county and felt right at home in his old stamping grounds. He is at present associated with the Milwaukee Electric Railway and Light Company in the capacity of Vice-President in charge of Power.

Mr. Post pointed out the engineers' increasing responsibility in the present social order. He emphasized the importance of applying sound engineering training and principles to social problems. With many interesting and stimulating examples, he pointed out the opportunities in store for engineers who recognize and fill public needs.

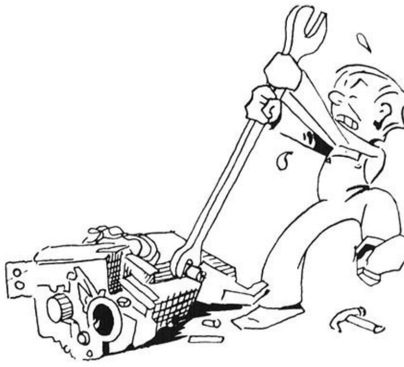
During his talk he touched upon Government, its functions and its present regulatory policies in industry especially with regards to Public Utilities. He further stressed the need for closer adherence to sound christian principles as a guide to sound government and sound industry rather than any radical changes in the existant forms.

A SLICE OF "PI"

CALL B. 3.1416

By

CEZAHL NOZNIL



A SAD EXPERIENCE

PLACE: Auditorium in any Engineering Building.

TIMS: Final exam.

PERSONAL DRAMATIS: Thirty bewildered students and ten triumphant instructors.

MAIN CHARACTER: The most bewildered of the thirty bewildered students — called Nemo.

Prologue

The final examinations have finally arrived and little Nemo is scared because he hasn't done his home work the last semester. At present he is busily listening to discussions being carried on by other members of the class hoping that he might be able to retain some of the obscure things being said.

At last the bell rings and the instructors order the students to take alternate seats in alternate rows and then they pass out the exam questions and the "blue books." Absolute silence reigns! Little Nemo looks at the questions — answer any eight out of the ten questions — little Nemo reads and rereads the questions — he looks at his "blue book." Is little Nemo blue like his "blue book?" No! No! A thousand times no! He is bluer.

Scene I

Little Nemo sits and sits and sits and nary a glimmering of knowledge comes scooting over the horizon. He omits question one, then two, finally three and when he reaches ten he begins all over again. He hears the scratch of pens around him and the unwelcome squeaks from poorly lubricated slide rules. Why can't he, little Nemo, scratch his pen and squeak his slide rule like the others do?

At last one student noisily rises and hands in his eight questions completely answered, then another follows and then another and so on. They all look tired as they leave the room, but little Nemo doesn't look tired as he sits up there in his seat all by himself — he looks sick. The last bell rings and the instructors call for the "blue books." Then and only then does little Nemo's pen scratch as he writes his name on the cover. Exit little Nemo.

Scene II

PLACE: Outside the instructor's door.

TIME: A few days after the final exam.

Little Nemo stands close to his instructor's door listening to his classmates talk about the "A's" and "B's" they received in the course. Little Nemo says nothing and thinks less. Finally his turn comes and he enters. "Well, Nemo, I couldn't find anything wrong on your paper except that your name was spelled wrong," says the instructor. A glimmering of hope struck little Nemo in the mid-section and he bent over. "But where were the answers to the eight questions? I can't give you credit for anything that wasn't there so I'll have to give you a C for your slight oversight of not placing the answers in the 'blue book'." Exit little Nemo.

Scene III

Little Nemo swimming in a glass of beer at Amber Inn. Exit little Nemo.

A Lothario in a Hysteresis Loop

Bob "Thunder" Boldt, gay young Lothario among local coeds and habitue of the "Star and Garter," recently took data for a hysteresis curve. When he had finished plotting the data he found that the points plotted formed a solid curve and did not necessitate the use of a French curve.

Incog!

What four Junior Chemicals were out celebrating incognito after the final exams?

A Stumble

When Milt Le Fevre came sneaking into lecture late, recently, Prof. Kowalke remarked that he used to come home the same way when he was a gay young blood. Immediately after saying this, Milt stumbled, thus casting a reflection upon the Professor's youthful life.

Correction

A slight error was made in the last issue in naming the four engineers who created a New Year's disturbance up in Ashland. As corrected, they are: Bob "Bottoms-up" Ritchie, George "Two-timing" Watters, "Light-house" Harry Wilson and H. Viets Fuller.

Who Is He?

Bill "Zilch" Fluck received money for his fees by telegraph. In order to obtain it, he had to offer positive identification in the form of a birth certificate or an honorable discharge from the Army or Navy. Bill couldn't prove that he was himself for three days and had to pay the three dollars fine for late payment of fees.

Slow Progress

Bob Knake, long-geared reservoir of Chemical Engineering principles, and Frank Watters set out to hitch-hike to Washburn, a small joint about 360 miles up in the wilderness. After trying for four hours they had proceeded as far as Middleton and so gave up.

According to "Bud" Tock, with a college diploma and a dime you can always get a cup of coffee and a doughnut.

Notice!

I need information on happenings in all the engineering schools. The Chemical Engineers are getting too much publicity and might resent it pretty soon.

NON-DESTRUCTIVE MATERIALS TESTING

Of the number of non-destructive testing methods that have been devised there are two which are outstanding. Two variations of each type are successfully employed:

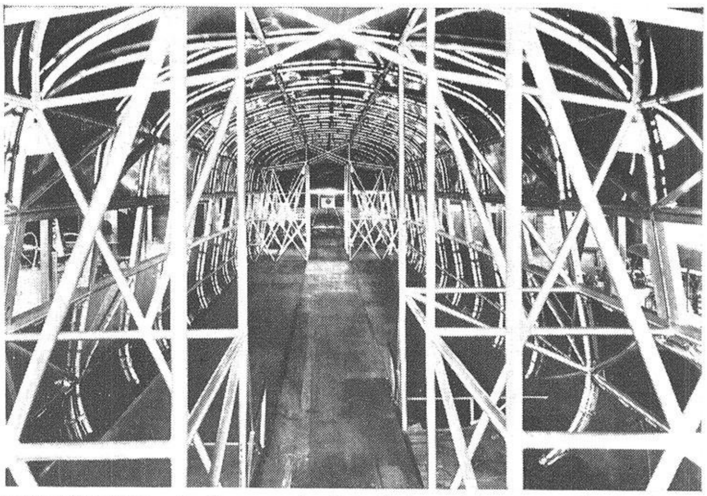
(1) Magnetic analysis by comparison with a standard material, (2) magnetic analysis by the use of metallic powder, (3) radiographic examination by means of X-rays, and (4) radiographic examination by gamma-rays.

The first method is necessarily confined to materials of simple shape, such as small diameter seamless tubing, bars and rods, etc. By comparing the magnetic properties of the material with a standard sample the metallurgist is able to check up on heat-treatment (whether the steel is properly normalized, annealed, decarbonized) and on magnetic permeability of stainless steel. Welding rods for example, have been checked for uniformity in this way.

Radiographic examination shows defects on pictures taken of the material in question. Almost any type of complicated machine part may be successfully examined by the two variations of the radiographic examination.

—*Aviation.*

Remember the last All-Engineers' Dance at the Union? Remember the last smoker? Well, Polygon is planning two similar events for Engineers only. Pay your activity fee at the Dean's office — you should not deprive yourself of a time you'll never forget.



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

Mastery over all Metals

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

By A. B. KINZEL*

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

Contributes to Home Comforts

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

Simplifies Automobile Maintenance

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

Aids Industrial Users

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

Welding Marches Ahead

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

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

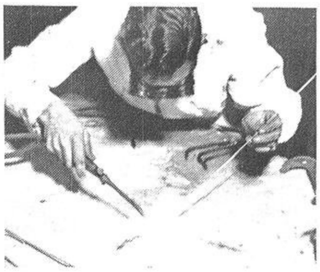
EVERY METAL—responds to the oxy-acetylene blowpipe. This stainless steel coil for cooling milk has welded joints.

Makes Modern Metal Designs Jointless

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

At Your Command

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



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

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

*Chief Metallurgist, Union Carbide and Carbon Research Laboratories, Inc., Unit of Union Carbide and Carbon Corporation.

G-E *Campus News*

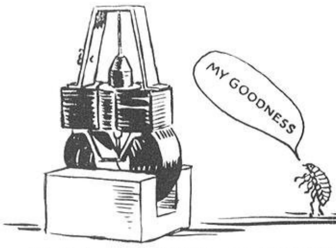
HEATING WITH COLD WATER

Reversible air-conditioning equipment, which may be adapted to either heating or cooling, depending on the season, is now in operation in a new building in Salem, N. J.

Reversing the cycle of the ordinary household refrigerator, the refrigerant absorbs heat from the water of a well which is at least 52 degrees even in coldest weather. This heat is added to that created by the work of the electrically driven compressors, and the refrigerant at 135 degrees gives up the total heat to the air of the building. Thus it is possible for an expenditure in electric energy equivalent to 100 heat units to obtain a total of 300 or 400 units for heating. Physics students will recognize this system as the heat pump.

During the summer, the process is reversed. The heat is absorbed from the air of the building. Then this heat and the heat from the compressors is dissipated in the water from the well, which then can be used for bathing, or washing dishes.

The building is completely equipped for year-round air conditioning. Besides heating and cooling, the equipment automatically controls the humidity, and cleans and circulates the air. The engineering and the planning for the installation were done by engineers of the American Gas and Electric Company and the General Electric Company, and the equipment was built and installed by General Electric.



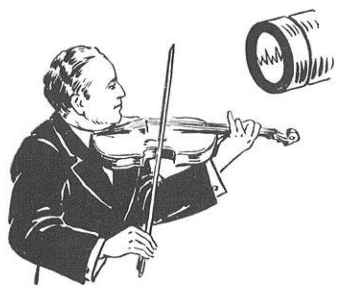
FLEA-POWER MOTOR

New photoelectric cells, recently developed in the General Electric Research Laboratory, furnish enough energy to operate a tiny electric motor rated at four ten-millionths of a horsepower.

These "cells" differ from photoelectric "tubes" in that the cells convert light energy into electric energy, whereas phototubes do not themselves generate electricity but instead control the amount of current permitted to flow through them according to the amount of light they receive. The cells are of the selenium type, the selenium being coated with a film of platinum so thin as to be semitransparent.

Four of the cells are used to operate the motor, which in direct sunlight turns at about 400 rpm. But enough light energy is converted into electricity, when a 75-watt incandescent lamp is lighted eight inches away from the cells, to turn the motor at good speed, using three ten-thousandths of an ampere. One watt of power can be obtained from about 15 square feet of cell area in direct sunlight.

Dr. C. W. Hewlett, North Carolina State, '06, Ph. D., Johns Hopkins, '12, of the Research Laboratory was in charge of investigations that led to the development of the cells and the tiny motor.



GREEN BLUES

When the G-E "House of Magic" was exhibited at the Franklin Institute in Philadelphia not long ago, the cathode-ray oscillograph was one of the most popular features. This device, as you undoubtedly know, shows the wave shape of any sound, music, speech, or just plain noise—in the form of a moving, pale greenish-blue line on the end of the tube.

Rubinoff, the well-known radio violinist and orchestra leader, came down to see how his violin notes looked in the device. He had only a few moments in between engagements. But he became so interested after watching the gyrations of the dancing green line when he played "Humoresque" that he stayed for half an hour. He played on, and found that his violin produced green notes—even when he played the blues.

R. H. Mighell, U. of Denver, '29, of the G-E Research Laboratory, was in charge of the exhibit.

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GENERAL ELECTRIC