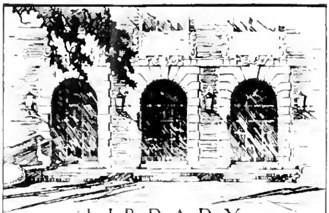

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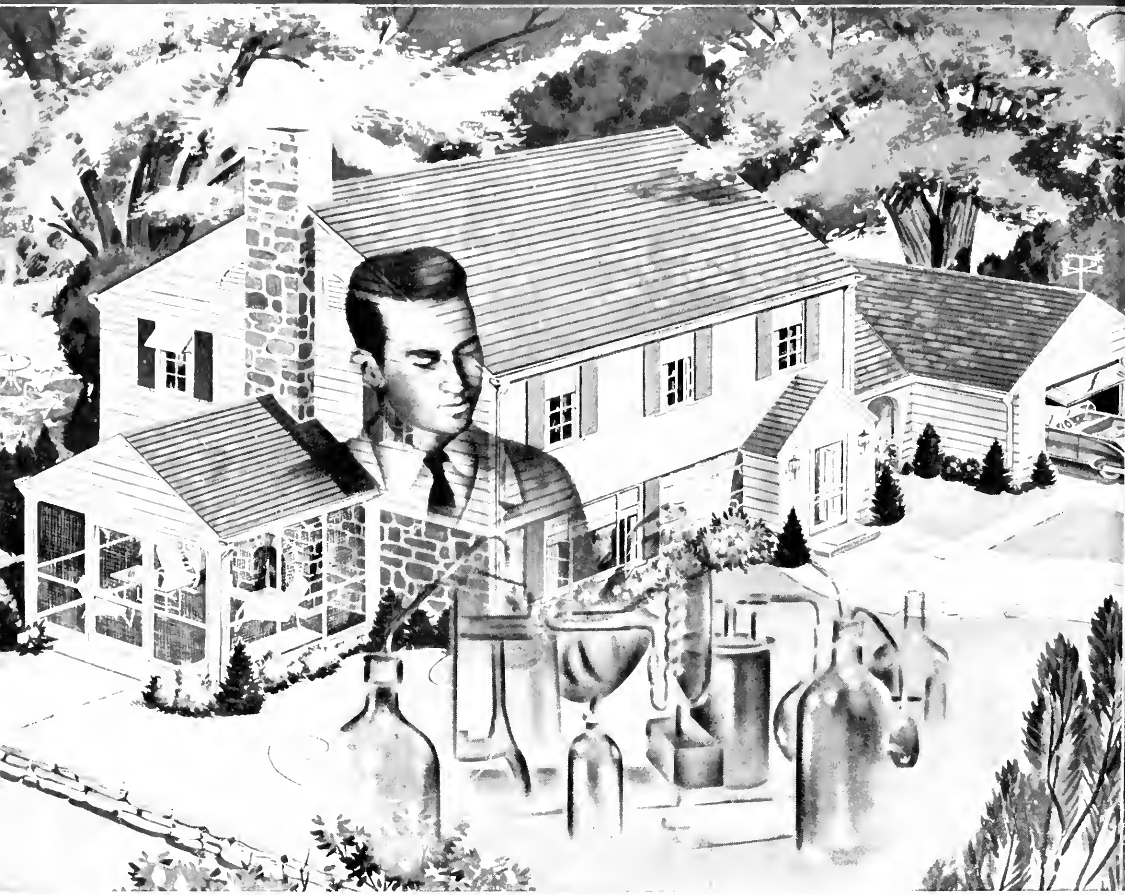

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This advertisement appears in College Engineering Publications during October, November and December, 1947

New Developments

By John Dick, E.E. '49

Weld Engineering Cuts 33 Operations to 5

A simple design and process change can sometimes produce important savings in production costs, while increasing output and improving quality.

This is demonstrated in the case of a reinforced bus pillar, fabricated from 13 separate stampings by Hawthorne Metal Products company, Detroit, and designed originally for single spot welding. This in itself resulted in a rather low fabricating cost. When the job was released for production, however, the supplier of the welding equipment—Progressive Welder company of Detroit—recommended the forming of a series of projections in five of the stampings at the time that these were produced.

The new stampings were then attached to the pillars by projection welding, using a press type welder. As a result, only one operation was required to join each of these five stampings to the pillar proper instead of 33 individual spot welds.

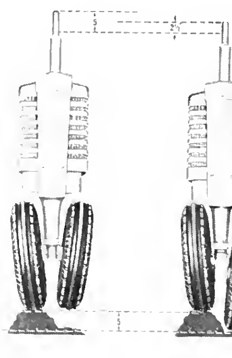
Moreover, by using simple locating dies in the press welder it was possible to get accurate locating and alignment without clamping of the parts prior to welding. The net result of the changes was to double the productivity of the welding equipment, 100 completed assemblies being produced per hour in comparison to 50 per hour by straight spot welding, and at the same time cut the fabricating cost in half.

"Knee-Action" Front Wheels

The latest innovation in tractor design was announced recently by the John Deere Tractor company, of Moline, Illinois. The idea consists of adapting the knee-action wheel idea to farm tractors. Manufactured under the trade name of "Roll-O-Matic," the knee-action principle applied only to the front wheels results in increased smoothness and safety of operation along with longer tire life.

As shown in the accompanying illustration, the fundamental principle of operation of the "Roll-O-Matic" knee-action front wheels is readily seen. Mechanically, a gearing system is included so that the slightest up or down movement of one wheel is instantly transferred to the other which automatically equalizes the load. At the same time the up and down movement of the front end of the tractor as it goes over bumps and clods is reduced to 50 per cent that of the conventional wheel arrangement.

By minimizing this up and down movement of the front end, and by automatically equalizing the load on each tire, the "Roll-O-Matic" front wheels promise a safer, more comfortable ride and greatly increased front tire life.



Diagramatic sketch showing how "knee-action" limits the front end motion by 50 per cent.

The lotest addition to the "flying laboratories" is the B-29 whose space permits engineers and designers to study the gas turbine in actual use

Flying Test Stands

Working on a flight testing project sponsored jointly by the Army Air Forces and the General Electric company, engineers and designers have been able to gain invaluable assistance in the design of aircraft gas turbines through utilizing army bombers which have been converted into flying laboratories.

Inaugurated in 1942 when the Flight Test Division obtained a B-23 for flight investigations of the turbo-supercharger, the division has since used many different types of army aircraft to serve in the role of "papa" to experimental equipment. The most recent and largest of the planes to be used for this purpose is the B-29, shown in the accompanying illustration as it is being equipped for service.

Since the jet power plants are installed as auxiliary equipment rather than substitute engine, the method has proved to be a safe and expedient way of conducting the tests under altitude conditions. Although used at the present time mostly for tests on the powerful TG-180 gas turbine, the flying laboratories have proved quite successful in the testing of new gas turbine units prior to actual installation aboard aircraft.

In addition to these advantages the method has also enabled important components to be tested with older engines before the completed unit is ready.

If the devil drank tea he could use this cup...

NO, this picture isn't faked. It shows white-hot molten metal being poured into a little glass dish resting on ice.

This is Corning's "Vycor" brand 96% silica glass, a result of the first really new glassmaking process in over 2000 years. It can withstand sudden extremes of hot and cold without breaking, and temperatures up to 2000° F. without melting. It is one of the hardest, most acid-resistant, and electrically-resistant glasses known. And it has already opened up new fields in many industries.

Now it is ready to go to work to make cooking easier, cleaner, and safer for millions of women . . . as a burner plate on a modern gas range, soon to be announced. The smooth glass plates will distribute heat more evenly and give firm support to even smallest utensils. And they will keep spilled food from clogging burners.

Corning began its search for heat-resistant glasses years ago when it was asked by railroads to supply a glass for brakemen's lanterns that wouldn't shatter when a gust of cold rain hit it. This was the forerunner of the famous Pyrex brand glasses which have since found their way into thousands of industries in such diverse form as glass piping, laboratory ware, and ex-ray tubes, and into millions of homes as Pyrex Ovenware and Flameware cooking utensils.

Corning not only knows glass, but knows how to make it work. It has the finest glass research organization and the finest group of skilled workers in the world . . . a hard-to-beat combination that will be at your service whatever career you choose. In the meantime, learn all you can about glass and if we can help answer any questions, call on us. Corning Glass Works, Corning, N. Y.

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the Illinois Technograph

Volume 63 **No. 1**

The Tech Presents

ARTICLES

DEPARTMENTS

OUR COVER

Typical of the problems faced by many veteran students is this picture of "Study Hour." Dont laugh, it could happen to you.

FRONTISPIECE

Shown assembling a new television antenna, these two workmen are perched high on the Empire State building. (Courtesy of General Electric company).

Look Before You Leap

By Carl Sonnenschein, M.E. '48

Some people are adaptable to any situation or job, but most are not. All too often a man, or woman, finds out, too late, that he has accepted a position which does not appeal to him and for which he is unable to show the proper interest. Are you going to be one of this misplaced and misled group?

It is a generally accepted fact that one reason people go to school is to increase their ultimate earning power. As a group, engineers are not the highest paid of the professional men and women, although there are exceptions. However, in order for a person to be able to accept greater responsibilities and hence a larger remuneration, he must have a real and vital interest in the work which he is doing.

There are several basic considerations which enter into the acceptance or rejection of a job offer, and for the most part they are predicated upon personal desires, likes, and dislikes.

Let us now consider the average student as he approaches the ultimate goal, graduation.

Needed—A Job

Having completed almost four years of constant and intensive study he finds that very shortly his period of incubation, as an engineer, will end. It is usually at this time that the prospect of having to choose a job is first brought forcibly to his attention. There are a few persons who already have a course of action laid out for themselves, but they are the lucky few.

Now that the realization of the necessity of getting a job has become manifest, the student arranges, through the college office, to have several interviews.

The number of interviews the student has will vary according to the indivdual. Some persons may need only one or two in order to make their decision, while others will require a half dozen or more.

Advice from the Dean's office indicates, that the greatest difficulty that the interviewers find with the students is that they do not know what they want, nor do they come to the interviews equipped to ask intelligent questions.

All too often, due to this unpreparedness and indecision, a man may either pass up a good offer, or he may accept a job for which he is mentally unqualified. This can only lead to a condition of unhappiness and discontent with his work.

The purpose of this article is not to try to tell anybody which job they should or should not accept, but rather it is an attempt to point out a few of the factors which should be considered by all persons seeking employment. Neither is the article intended only for those seniors who expect to graduate in the near future but is applicable to freshmen and sophomores as well. This will become more evident as we proceed.

This article is the first of a series designed to impress upon the student the realization that the ultimate goal of all education lies in the proper selection of a job in which he can best utilize his talents and training. Although space does not permit a complete discussion on the subject of selecting a job, the article at least suggests many lines of investigation that may be followed by the student who is truly interested in fitting himself into a more than just adequate job. In attempting to help open up one line of investigation, the subsequent articles in this series will deal with specific descriptions of several small industrial organizations located in the State of Illinois. They have been chosen because they are also representative of a group of employers with whom the engineering student has had little direct contact.

Most of the engineering curricula in the junior and senior years provide opportunity for the student to take options which give him a chance to develop any special interests he may have.

This line of attack is of utmost importance but its significance is completely lost to the student who has not put forth any effort toward developing specialized interests.

We must accept the fact that engineering today is such a broad and comprehensive field that no one man can possibly be accomplished in all of its ramifications. As a result of this condition, engineers have become a group of specialists. When a man decides to become a specialist, he automatically narrows his future into a well defined path; and, once having made the choice, it will be very sad and disillusioning for the person who then finds that he does not like and enjoy the work he is doing.

For the most part, freshmen are excluded from extra-curricular activities until they have qualified themselves scholastically. For those who are qualified the numerous engineering societies and other school activities are a deep well for the accumulation of an insight into the various phases of engineering. The student should take full advantage of these opportunities that are offered to him to learn about his and other professions.

Summer Jobs Valuable

The accumulation of practical experience of various types, through the medium of summer jobs, is another fine way of acquiring this diverse knowledge.

Unfortunately for the student, most of the trade publications are far too technical for all but the seniors and some juniors to be able to read and understand. However, mere perusal of these publications is, or should be, of interest to all engineering students.

All of these things which have been mentioned will help to prepare a person to make up his mind when the time comes.

In the final analysis, the true proof of the pudding is in the eating, so it is impossible to be absolutely sure that your choice is the right one until after you have worked at the job for a while. Nevertheless, prior to employment, an honest consideration of all factors should greatly increase the chances of making the correct choice.

Now let us consider the senior who has accomplished his formal educational program and is about to set forth on the real business of living. Let us assume that this particular individual has thought over the prospects and has decided upon what type of work he wants to do. The only question he has yet to answer is, "Whom shall I work for?"

As we have already mentioned, the college office arranges for interviews between representatives of industry and the students. This is one of the finest services, of many, that the office does provide.

Analyze the Problem

When our student approaches his interview, there are a number of important questions to which he should desire the answers.

The locale of the employment is always an important consideration, especially in these days of housing shortages. Should it not be possible to obtain adequate housing it would be absolutely foolish for a person to try to accept a

(Continued on Page 22)

The Gyro Compass

By Herbert Mazer

Even though the principle of operation of the Sperry gyro-compass may be well known to the reader, you will find in this article a clear description of not only how it functions but also some of the problems encountered in its design.

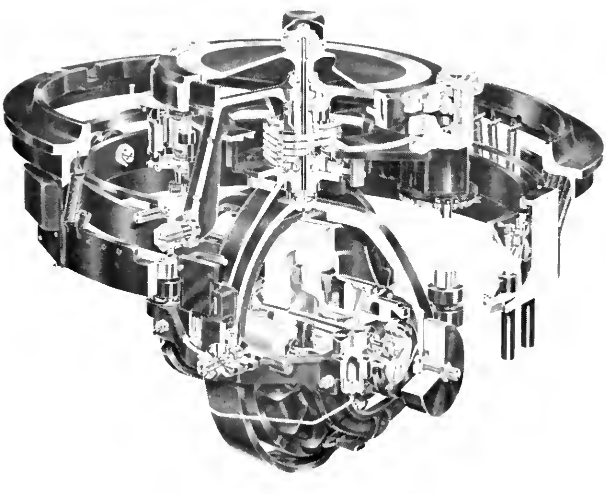
As late as the middle of the 19th century, there were people that still clung to the belief that the universe rotated around a stationary earth. Scientists had attempted to disprove this fallacy as early as the 17th century, but could not decisively do so. In 1851, Jean Bernard Leon Foucault, a prominent French scientist of the period, threw some light on the situation by showing that the earth was actually rotating on its axis.

Incorporating theories developed by Galeleo, Newton, and Kepler, he mounted a wheel in a frame on very delicate bearings so that it could maintain its spinning axis in a fixed direction. By conducting a series of experiments with this apparatus, he proved that the earth turned relative to the stationary direction of the spinning axis of the wheel. Foucault called his delicate apparatus a gyroscope from the Greek word "gyros" (revolution), and "skopien," (to view), and he predicted that some day it would be used to navigate ships.

At the turn of the 20th century, Dr. Elmer A. Sperry, founder of the Sperry Gyroscope company, became intrigued with the many possibilities of mechanical applications of the gyroscope and dedicated himself to the development of gyro-statics.

Before going into the problem confronting Dr. Sperry in the development of the gyro-compass, it would be best to define the gyroscope and briefly state its properties.

A gyroscope consists of a solid wheel with its mass concentrated about the rim. It is so suspended that it may rotate about its spinning axis and turn about its vertical and horizontal axes. These axes are mutually perpendicular and coincide with the center of mass at the geometric center of the wheel. Its physical properties are: (1) the ability to hold its position in space unless acted upon by an external torque, and (2) if such a torque were applied, action would take place about an axis 90 degrees from the applied torque. In other words, if a torque were placed on the vertical axis, the gyroscope would turn about its horizontal axis. This peculiar property is known as "precession."



A cut-away view of the Sperry gyro-compass showing details of the internal assembly

Dr. Sperry had a series of obstacles to hurdle before he could build his first gyro-compass. The first, the problem of a continuously spinning rotor, was easily overcome by evacuating the center of the gyro-wheel and installing a set of induction windings; thus making the gyro-wheel the rotor of an induction motor. Rotors in the most commonly used Sperry compasses weigh 55 lbs. and develop a speed of approximately 6,000 r.p.m. They are driven by induction windings supplied with 50 volt, 3 phase, 210 cycle alternating current.

The problem of making a gyroscope north-seeking and north-remaining was more complex. Dr. Sperry knew that if the plane of rotation of a gyroscope were parallel to the earth's plane of rotatin, their spinning axes would point to the true geographic north and south. The rotation of the earth would cause no deviation from the true north and, by definition, the gyroscope would become a compass. For all practical purposes, however, it would be impossible to set the plane of rotation of a gyroscope parallel to the earth's plane of rotation unless a mechanical setup was used. Dr. Sperry conceived an ingenious method. Utilizing the gyroscopic property of precession and the apparent tilting of the gyro-rotor because of the rotation of the earth, he placed a tank of mercury on each side of the rotor and connected them with a unrestricted pipe; thus allowing mercury to flow freely from one tank to the other. He attached these to the bottom of the rotor case by means of a connection arm and an eccentric pin, (called "eccentric" because it is attached approximately 1° from the perpendicular).

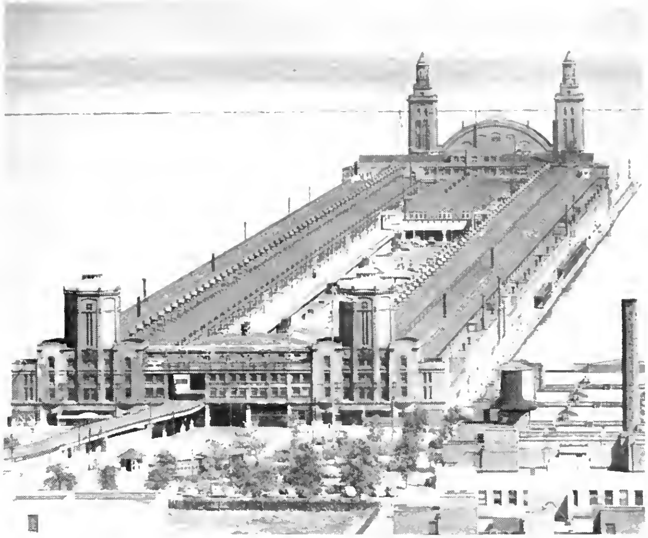
Let us see what effect the addition of mercury ballistic tanks had on the gyro-scope. Assume the rotor to be level and pointing east and west. As the earth rotates from west to east, the east end of the gyro-scope will appear to tilt up. This apparent tilting will cause mercury to flow from the east to the west ballistic tank and, in effect, place a torque on the horizontal axis. Following the rule of precession previously stated, the rotor will commence to turn about its vertical axis.

Due to the unrestricted flow of mercury, the rate of precession is directly proportional to the angle of tilt and, since the earth rotates continually, the amount of tilt will gradually increase until the spinning axis of the rotor moves into the plane of a meridian. At this point, the angle of tilt, the amount

(Continued on Page 36)

The Pier Branch

By Francis Green, E.E. '48



A familiar sight to "Pier Branch" students is Navy pier, the home of the University's undergraduate division at Chicago

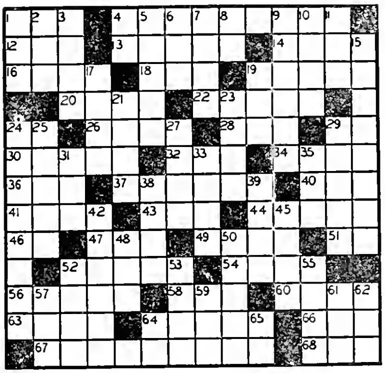
Welcome to the College of Engineering, freshmen and sophomores of the undergraduate division at Navy Pier! Your student engineering magazine wants to acquaint you and the rest of our reading public with our engineering college and the Pier branch, its teaching personnel, and student personalities and 'characters,' if any. In one year the Pier has been built up to one of the 50 largest centers of secondary education in the United States with an enrollment of 4,000 students, and 276 faculty members. Most students come from within the city of Chicago and the faculty—far from being unknown and without reputation—include such men as Dr. Charles C. Caveny, dean of the undergraduate division, from Penn State, Dean Randolph P. Hoelscher, associate dean of engineering sciences, from the Urbana faculty, and several men from Northwestern university.

With the exception of a dozen or so engineering sophomores and a proportionate amount of men in other divisions of the University, all students of last year are coming back to the Pier to embark on their second year of college. Several new instructors and 24 new courses on the sophomore level are now available.

This year the expansive opportunities of technical and non-technical extra-curricular activities will go into full swing—a theatrical group, the "Pier Illini Productions," a student newspaper, the "Pier Illini," intramural athletics, and numerous activities for individual participation; such as, reading in the 10,000 volume embryo library, study of the indefinite loan of sculpture from the Art Institute, special exhibits at the Museum of Science and Industry, and most important of all a chance to join the student branch of the particular engineering society of your field. To those men and women who are interested in writing or applied business training, as well as a number of good times with a group of active engineering students, we extend our invitation to you to contact Mr. Ogden Livermore and initiate a branch of the "*Illinois Technograph*," engineering student publication on campus, there at your division of the University of Illinois.

Among the Pier men who have come south to Urbana, are such GMOCs (growing men on campus) as the first editor of the "*Pier Illini*" newspaper, Bernard Weinstein, a new writer on the *Technograph*, Donald Johnson, and from what we hear 'Muriel Locke,' diminuitive, typical Navy Pier coed who announced her arrival at Urbana 'due to the adversity of the male Pier population'!

Crossword Puzzle



ACROSS

1. Spider's trap
4. He advanced a theory of electrochemical decomposition in 1805
12. In past time
13. American painter, invented the telegraph
14. German who produced his first telephone in 1861
16. Washing material, still scarce
18. Social gathering
19. Stain of disgrace
20. Freezing point of water, in the Centigrade scale
22. Motion picture actor, in "Caesar and Cleopatra"
24. Exclamation of triumph
26. Irrational number
28. Rumanian monetary unit
29. Keep in motion said of a machine
30. Free negative atom
32. Monotonous routine
34. Irish dramatist, once employed in first English telephone exchange
36. Conquered
37. "The Wizard of Menlo Park"
40. Summer month: abbr.
41. First radio station to broadcast regularly scheduled programs, opened in 1920
43. Large simian
44. Stout, as one needing an electrical reducing machine
46. Mineral used in photoelectric cells: chem. symbol
47. Injure the ... face of
49. Estimate
51. Junior's father abbr
52. Parts of churches
54. Electric amplifiers often help these people
56. Edges of a roof
58. Wing
60. Important part of a radio set
63. For all time
64. Floats, as on a liquid
66. Bean sauce
67. State of being upright
68. Female sheep

DOWN

1. Existed
2. Self
3. Ruth's second husband: Bible
4. Metric weight: abbr.
5. Moving part of a dynamo or motor
6. Source of a metal
7. Former Russian autocrat
8. Tellurium: chem. symbol
9. Planet for which the heaviest metal is named
10. Six: Spanish
11. Moral transgression
15. He patented an automatic telephone exchange in 1891
17. South American coin
19. Support for railroad tracks
21. Letter of old Norse alphabet
23. High voice
24. Englishman who devised an electric light in 1709
25. Positive electrode
27. Fall in drops
29. German who founded the mathematical theory of electricity
31. Important printing material
33. Consumer
35. Have: Scot
38. Defy
39. Memorandum
42. French physicist, developed the solenoid
45. Regular pulsation
48. Donkey
50. He produced the first electrotypes in 1839
52. State
53. Cut with a saw
55. This protects a circuit from overloading
57. Hail!
59. Falsehood
61. Arch of refracted light
62. Ample light prevents strain on this
64. City thoroughfare: abbr
65. Kind of ship: abbr

Industrial Ceramics Grows Up

By Karl Hilgendorf, E.E. '48

Ceramics is one of the oldest arts in the history of mankind. Although some phases have been shifting from the arts into industry, the war created one of the largest industrial applications yet found. This article deals with the application of ceramics to some of these war-created problems.

The ceramics industry has made astonishing advances in the past few years. The glass industry in 1939 was worth 1 3 billion dollars. Glass products are as vital as any products the country produces — millions of light bulbs, X-ray tubes, lenses for microscopes, make glass important to scientific progress and industrial development.

Glass can withstand abrasion better than any metal. A colliery in Pennsylvania uses thick plate glass coal chutes in mines. Glass aircraft windows replaced plastics since pressure differential at high altitudes made plastic materials bend and pop out of their frames. Plastics offer no protection against ultraviolet rays.

The manufacture of glass is as ancient as civilization. The Egyptians, thousands of years ago, knew the secret of making emerald and cobalt glass, the Phoenicians were adept at blowing glass, and the Romans made the discovery of transparent glass. In 1900 an industrialist predicted that glass, as much as steel, would revolutionize the 20th century.

Foam glass—glass baked with carbon dust—is buoyant in water and can be used for life rafts. Fibrous glass in the form of glass wool insulation, continuous fibres for textiles, and non-inflammable drapes, were used by the Army and Navy.

Jet planes operate at temperatures of 2000° F and rise off the ground in 30 seconds. Special ceramic coatings make parts heat resistant. In planes, uncoated materials must be replaced in 50 hours. With ceramic coatings the lifetime of the metal was over 100 hours. Ceramic coatings are useful in coating turbo-supercharger parts.

Glass is unaffected by moisture and most acids. It can be made heavier than iron and lighter than aluminum. It was used in making the 200-inch reflector at Mt. Palomar observatory and has been drawn into fibres .023 inch thick. It can be as unbreakable as quartz and fragile as a Christmas tree ornament. There are 300,000 different ways of making it.

During the war the treasury department seriously considered making pennies of glass instead of hard-to-get copper.

The United States is today the leader in the quality and quantity of glassware and in the variety produced. With new uses of ceramics being discovered daily—from the textile industry to the building trades—the ceramics industry promises to grow by leaps and bounds.

Wartime Needs

Early in the war in Europe our intelligence department reported that flight paths of American bombers sweeping into Germany were being plotted by means of infra-red radiation detectors and anti-aircraft fire was being directed by similar apparatus. The infra-red rays emitted by the hot engines of our bomb laden Flying Fortresses and Liberators were a dead give-away as to the position of flying squadrons.

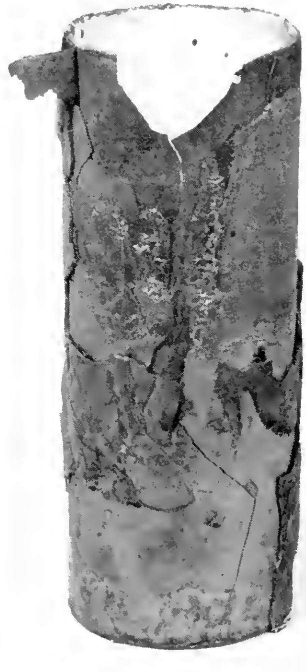
In July, 1943, Army Air corps officials from Wright field, Dayton, representing the Air Materiel command, dropped into the Ceramics building at the University of Illinois and asked Dr. A. I. Andrews: "Can you develop a ceramic material which will suppress infra-red radiation from the hot metal parts of our planes? Every plane gives away its location long before it reaches its target." Dr. Andrews' response was in the affirmative. He felt that ceramic materials could be found to solve this critical problem.

The laboratory investigation for special ceramic coatings which were to be applied to aircraft parts, such as collector rings and exhaust stacks, actually had a double purpose. The first was, of course, to suppress infra-red radiation. The second, equally important, was to unearth ceramic coatings which would protect metals from the rapid deterioration that they undergo in extremes of temperature.

During the following year, a critical review was made of ceramic materials available and tests were made on them continually. The tests determined heat resistance, thermal shock resistance, strength, radiation-suppressing qualities, and other factors.

It was found that any metal with a ceramic coating of the proper kind can be operated at temperatures higher than normal. In the tests on coatings placed between the flame and metal in exhaust stacks and jet engine flame tubes, it was found that the useful operating life of the metal part was increased several times. One specimen of steel was heated 450 hours at 1500° F. with no visible sign of corrosion.

Dr. R. D. Bennett, director of research in the ceramics department, was placed in charge of the project. Under him, R. K. Jursh planned and developed procedures and apparatus and, with the cooperation of the physics department, prepared test specimens.



Typical heat-corrosion in an unprotected pipe

The immediate result of the research was that metals had increased operating life, and due to this protection by a coat of ceramic material, cheaper metals could be substituted for more expensive metals. High grade steels were in demand by every branch of the armed forces; substitution of less critical materials proved a boon at a time when war production was at its peak.

Dr. Bennett says in a report: "With dense, relatively glassy coats serving to seal off metal from high temperature corrosion, the additional application of the more porous, relatively crystalline top coatings served to provide thermal insulation, radiation reflection, and radiation suppression. The net result was either a metal operating at a lower temperature or, often more important, a higher combustion temperature with the metal temperature no higher than before.

The approach was to heat the specimen coated with various kinds of ceramic material and then evaluate the results through graphs. The Stefan-Boltzmann law shows how radiation and temperature are related. It is:

$$P = KET^4$$

where P is power radiated per unit area, T is the temperature in degrees Kelvin, E is the total radiation emissivity, and K is the Stefan-Boltzmann constant in watts per degree Kelvin per unit area. Planck's radiation formula gives the distribution of energy among the various wavelengths. It is:

$$J\lambda = (2hc^2\ \lambda^5)\ (hc\ \varepsilon^{k\lambda}T^{-1})^{-1}$$

where $J\lambda$ is the radiation intensity at wavelength λ
h is Planck's constant
c is the velocity of light
k is Boltzmann's constant
and T is the temperature in degrees Kelvin.

The Bouquer-Lambert law of absorption demonstrates that the ability of a body to transmit radiation is independent of the intensity of the radiation. It is:

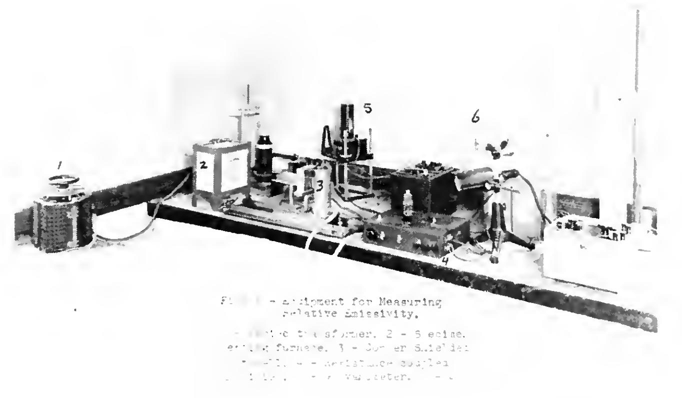
$$J\lambda = J\lambda_0 \varepsilon^{-kx}$$

where $J\lambda_0$ is the radiation intensity at surface toward the source
$J\lambda$ is the radiation intensity at a distance x
x is the distance from the surface toward the source along the radiation path
and k is the absorption coefficient of the transmitting medium

As a direct corollary of the Bouquer-Lambert law, it can be seen that each unit thickness of a homogenous medium reduces the intensity of the beam in the same ratio.

The Test Equipment

A tiny, specimen furnace, large enough to hold a 4 by 4 inch metal plate had a pyrex glass window to keep out convective air and was operated in connection with a variac which regulated the energy output. A Chromel-alumel thermometer was imbedded in the specimen metal and connected to a potentiometer.



The laboratory arrangement of the equipment used to measure the relative emissivity of coated materials

A photoelectric cell, sensitive to radiation up to 1.2 microns, changed radiation to electrical energy which was measured through a reflecting galvanometer. Deflections on an attached focused scale gave a direct measure of radiant energy.

Two types of filters were used. A Corning, black glass filter, which cut off infra-red emission wave lengths below 0.75 micron, and a glass filter cell (with $CuCl_2.2H_2O$), which was open to radiation below .7 micron, were satisfactory.

Preliminary tests indicated that all grades of steel showed the same absolute emissivity over a given temperature scale. As the temperature is raised, oxidized steel reaches a total emissivity of 95%. Stainless steel was selected as the test specimen in all remaining work of the investigation. Readings of the radiant energy from the coated steel were taken at 50° intervals over two main temperature ranges—800-1000° F. in the infra-red band and 1100-1800° F. in the visible and invisible radiation bands.

A number of variables were considered: particle size, coat thickness, firing time, temperature, and types of bonding glasses. Bonding glasses with different capacity to transmit radiations were correlated to the other variables. The per cent of bonding glass was kept low to keep the coat thickness down as much as possible. Each first coating 14 mils thick was fired on the steel plates before the test metal received its coating of the ceramic material tested.

Nineteen representative materials, among which were diaspore, uverite, feldspar, lepidolite, cobalt dioxide, manganese dioxide, and olivine were tested with filters over the 800-1600° F. range to determine the amount of emissivity.

The following is the formulation for base coat No. 32-16 at 4 mils thickness:

Quartz	24.3%
Potash feldspar	34.8
Borax	23.8
Sodium carbonate	6.5
Sodium nitrate	4.2
Fluospar	3.7
Cobalt dioxide	0.5
Nickel oxide	0.5
Manganese dioxide	1.5

A mill batch of the above frit number 32 was made up as follows:

Frit number 32	65
First grade diaspore	35
Borax	0.75
Water	50.00

The frit materials were mixed and melted to quiet fusion and the melt was then quenched in water and dried. After the mill batch was ground, a 100 gram slip sample was passed through a 200 mesh screen and 4 grams of residue remained. The remaining slip was applied to the annealed metal specimen by dipping, and then fired for 10 minutes at 1750° F.

Testing Procedure

The specimen was placed in the furnace with a top coating facing the photoelectric cell, and the temperature was raised gradually to 1600° F., slowly lowered to 800° F., and then raised again at the rate of 10° a minute to 1100° F. with readings taken every 50°. At 1100° the sensitivity of the galvanometer was reduced to keep the deflection on scale and filters were changed. Additional readings were taken up to 1600° F.

Analysis revealed that in the low tem-

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Quality Control . . .

Industry's Watch Dog

by Jerry Mathews, M.E. '47

The progress of accuracy in machining has increased geometrically in importance since the beginning of the machine age and along with it has grown the responsibility of making machines which can produce parts within very narrow limits. It is not uncommon to see manufactured parts with a tolerance of .000006 in. It would be economically impossible to discard machines which, after normal wear, fail to produce the accuracy demanded. Consequently, the practical method is to measure the parts as they come off the machine, discard those beyond the limits, and if necessary, shut down the machine for readjustments when it consistently fails to produce parts within the specified limit. At best this system, if not wasteful of material, slows down production—a violation of one of the ten commandments of a business enterprise.

It took two world wars and a University of Illinois graduate to partially solve this problem through "quality control." At least a good attempt is being made by many companies to utilize the method of quality control to cope with the dilemma posed by the need for rapid production along with accuracy.

A relative newcomer to industry, the field of quality control is the subject of this article. Developed by means of statistical mathematics, quality control is proving itself to be as effective as 100 per cent inspection and yet is much less expensive and troublesome.

rinciples Explained

The Federal Products corporation, a manufacturer of precision measuring instruments, has published a "primer" explaining the theory of quality control in the layman's language. The following is a condensation of this explanation of the principles of quality control.

"If 50 pieces are taken from the work of a machine where the o.d. has been turned and if the pieces are measured individually with an indicating gage for this outside diameter and then classified by actual dimension (a sort of selective assembly operation), in other words laid out in rows by actual dimension, a result similar to that shown in Fig. 1 will be obtained.

"A group of pieces dimensionally classified in this manner make what is known as a Frequency Distribution, illustrating the frequency of occurrence of certain dimensions and their distribution among the whole. The curve itself is called a Frequency Distribution curve.

"It is characteristic of pieces classified and distributed according to their dimensions that the largest group would fall close to the mathematical average of the entire assembly.

"Furthermore, it has been found that a Frequency Distribution can be divided into six zones mathematically equal in width. Thus a practical use of the Frequency Distribution becomes available because it has been determined that the number of pieces ordinarily lodging within each of the strips represents percentages of the total. Carried to an extreme, the Frequency Distribution procedure could resemble or equal 100% inspection.

"In the actual application a sampling procedure is adopted and a chart system replaces the frequency distribution. Rather than sort over the entire 50 pieces, small samples, such as five pieces at a time, are taken more or less regularly from the work as it progresses, and certain resulting observations are plotted on a control chart, as shown in Figs. 2 and 3.

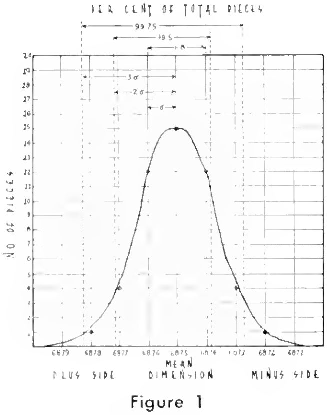

Figure 1
A Frequency Distribution Curve

"In order to determine the value of 3σ, mathematicians have developed formulae by which the 3σ value can be calculated from a quantity known as "range" is the difference between the greatest and smallest dimensions observed in each sample taken. Fig. 3 shows a chart on which the 5 readings from each of the samples are plotted in proper position. It illustrates for each sample taken the highest and lowest reading and the spread, or range, between them, as well as the variation in range from sample to sample."

The Application of Theory

From the foregoing principles quality control has come into existence. To see how these principles are put into actual practice, consider the following example.

Usually five pieces are selected at random during definite intervals by an inspector or operator right at the machine. Each piece is measured and the measured value recorded. An average of the five readings, called $\bar{X}$, is recorded along with the largest and smallest readings. The difference between the largest and smallest readings is called the range and represented by $\bar{R}$. Generally between 10 and 25 such samples are taken from which the overall averages of $\bar{X}$ and $\bar{R}$ are obtained. From these values it is then possible to calculate the control limits by means of the following formula:

$$c.l. = \bar{X} - A_2\bar{R} \text{ and } \bar{X} + A_2\bar{R}$$

where A_2 is obtained from the table below

No. Pieces	5	8	10	12	15
A_2	.577	.373	.308	.266	.223

To obtain the control limits for the range, the following formula is used:

$$\text{Upper } c.l. = D_4\bar{R} \quad \text{Lower } c.l. = D_3\bar{R}$$

where D_3 and D_4 are found from the table below:

No. Pieces	5	8	10	12	15
D_4	2.114	1.864	1.777	1.717	1.652
D_3	0	.136	.223	.284	.348

With the control limits set up then, the process of measuring five pieces of work periodically is continued and the averages of X and R are plotted on a control chart. When either of these averages falls outside the established limit, it means that that particular sub-group of five has gone "out of control"; and either a readjustment of the machine or a recalibration of the measuring instrument is necessary. At least it is known that something has gone "haywire" with the process and that it's time to make a check. It also means that a 100% inspection of all the parts produced after the preceding sub-group is necessary.

That the speed and quality of production is directly dependent upon the method of inspection is not difficult to see. It should also be apparent that the quality control method of inspection based on the principles of Frequency Distribution permits a considerably greater production speed than the 100% inspection method. In actual practise the inspection method adopted is a compromise between the required accuracy and economical operating speed. For example, in a process with fairly large limits a 10 or 15% inspection method may be adopted with reasonable accuracy which

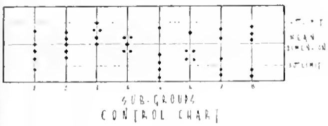

Figure 2

also permits the process to be operated at a speed consistent with economy. As the limits of the process become smaller, the method of inspection must, of necessity, become correspondingly larger to insure the quality of the product. For limits smaller than a certain value a 100% inspection method is mandatory, because the increased production speed gained by any lesser method is more than offset by the number of defective parts which are undetected. By the use of the principles of quality control the necessity for 100% inspection is eliminated and at the same time the accuracy of the work is maintained. Of course this is the big selling point of quality control—"accurate guess work." With the formulae and constants developed by mathematicians for the quality control method, however, the guess work is reduced to about a 99.99% calculated risk.

Mathematical Angle

One of the more prominent mathematicians responsible for the development of quality control is Dr. Walter A. Shwart of the Bell Telephone Laboratories. Mr. Shwart was graduated from the University of Illinois in 1913 and received his Master's degree here in 1914. He completed his work for a Ph.D. at the University of California in 1917.

It is very likely that Mr. Shwart became interested in the subject of quality control through his work with Bell Telephone, for in 1918 it became his duty to establish head sizes for aviation radio helmets. In 1924 he actually began studying sampling plans to be used in the inspection of quality. His problem then was—how large a sample should be taken in order to justify the acceptance or rejection of a given production lot on the basis of these samples? The statistical control chart, described previously, was introduced for this determination and is now used both here and abroad by many corporations.

The British have added a new section to the Royal Statistical society concerned entirely with quality control. In the United States the war department during World War II requested the American Standards association to organize a committee for the purpose of sponsoring the application of statistics to quality control. It was this action that has been largely responsible for the present day interest and popularity. As a further supplement to the original training offered by the war production board, a series of papers called "Quality Control Reports" were also published in which were shown many illustrations of the application of quality control.

Quality Control Succeeds

In one report the John Deere company published an interesting account of the direct application of quality control to a production problem arising in their shops. In the manufacture of piston pins the three final operations in the production procedure consisted of:

1. rough centerless grinding
2. plunge (or stop) centerless grinding and lap
3. polishing.

It was found that after leaving the rough centerless grinding operation considerable trouble had arisen with uneven flow of parts and scrap work. To correct this trouble, it was decided to utilize the principles of quality control; and to do this, necessitated a conference with the superintendent and supervisors.

Next it was necessary to select and train individuals for patrol inspection and thoroughly acquaint everyone involved with the procedure required to carry out the quality control method. This preliminary preparation was considered absolutely necessary because of the inertia in getting the operators to change over from the old procedure to the new one.

After the system had been set up, it was found that the plunge centerless grinder was turning out the pins on the high side of the tolerance; and as a result a number of them were oversize. By proper adjustment of the machine the average size was brought down closer to the mean dimension, but the range still continued at an unsatisfactory level. A control chart placed on the preceding, rough centerless grinders indicated that this operation was not functioning properly, and a check-up revealed that the operator was not making the prescribed number of passes through the grinder. After correcting this condition and making a few machine adjustments, the operator was then able to easily turn out the pins according to specifications with only sub-group checking.

As a check on the accuracy of the quality control method, 1800 pieces were given 100% inspection and found to all fall within the specified tolerance. The control charts, however, showed that four points fell below the lower control limit for averages. This downward trend in the averages indicated that even though all of the pieces were within the tolerance, some operation was still "out of control." When that particular trouble was located and corrected, complete control was maintained for the rest of the run; and all of the pieces produced were found to fall more closely to the mean specification.

From the foregoing discussion it can readily be seen that the advantage of

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Figure 3
A sub-group control chart shown in actual use on the machine floor

Illini in Action . . .

THE STORY OF CARL MENZEL

by Florian Kaitis

Do you know that the number of small air bubbles in concrete determines the durability of that concrete? Concrete with less than a certain amount of air weathers badly. Concrete with greater amounts of air resists frost action, but its strength is decreased. A problem is raised—how to get enough air into the concrete without getting too much. Putting the air into the concrete is simple. Controlling the amount of air is tricky. Before you can control it, you have to measure it. That is the assignment Mr. Carl Menzel, research engineer of the Portland Cement Association, received.

After my discharge from the Army, I went to work for the Portland Cement Association. That was when I met Mr. Menzel—I became his assistant. In the next few days I learned a great deal about air-entrained concrete. I learned that between three and five per cent of air is best for durability and strength. I learned that it is easy to adjust the amount of air in concrete by adjusting the mix. I also learned to qualify that last sentence—it's easy to adjust the amount of air in concrete, if we know how much air was in the last batch mixed. Then I learned that measuring the amount of air in the concrete was hard, and that our job was to devise a "Practical Field Method for the Determination of the Air Content of Fresh Concrete."

Initial Difficulties

There were three general methods in use a year ago for measuring the air content of fresh concrete. In one, the "gravimetric" method, the weight of a cubic foot of the fresh concrete was obtained and compared with the theoretical air-free unit weight of the same concrete. This comparison gave an "air content." In another method the air was removed from the concrete by "washing," and the loss of volume in the process represented the air content. In the third method the concrete was put under pressure, and through measurement of the volume change under that pressure, the air content of the concrete could be found.

Serious objections to each method were made, the most serious of these being inaccuracy. An experienced man could judge air content more accurately "by guess and by gosh" than by any of the three.

For instance, with the most highly approved method, the most "exact" method—the gravimetric—the weight of an accurately measured volume of fresh concrete was needed. To be fairly certain of the amount fair, an accuracy of about 3 in 10,000 was needed — an accuracy common in the laboratory, but impossible in the field where the test was to be used.

Mr. Menzel sat down and did some thinking. First he listed the disadvantages of each method (at that time there were few advantages for any of them). Then he started devising ways of removing the faults.

The almuni department, Illini in Action, has been devoted this time to the story of one man, Carl Menzel '17. This story deals with the problems he encountered in handling an assignment he received as a research engineer for the Portland Cement Association. The outcome of his work—a pressure testing unit for determining the air content of concrete—was reported in the May 1947 issue of the Technograph. This story is the saga of headwork, elbow-grease, and grief behind its development.

The gravimetric method was discarded at the start. The composition of each tested batch had to be known—the exact amounts of water, sand, cement and gravel in the batch had to be known with an accuracy that is impossible on a road job where conditions seem to change without apparent reason. The gravimetric method also involves computations which are too lengthy for the field, where test results are needed "immediately" if not sooner.

'Washing' Method Cumbersome

Now let's follow his reasoning with one of the other methods, the "washing" method. The accepted technique of the washing type of test was devised by Mr. Benham of the Indiana Highway department. It consisted of measuring the weight of a cubic foot of fresh concrete and then immersing the sample in a large amount of water. The concrete was stirred around until the mortar from the fresh concrete became so thin and diluted with water that it couldn't hold any of the air, and the air escaped. Since the air was released, the volume of water and concrete decreased. With a careful volume measurement and another weighing, sufficient data had been gathered to determine the air content. After about fifteen or twenty minutes of pencil work (slide rule isn't accurate enough), the inspector might be able to calculate the air content.

In all, three weighings and three volume measurements are needed with the "Indiana" method. The scales must be rugged enough to take the abuse found on a construction job. Scales rugged enough to withstand the hard usage are not accurate enough to be used with this test. Two of the volume measurements are on a water surface with a hook-gage. The last of these measurements is always confused by the presence of a thick scummy foam composed of cement particles and the air-entraining agent used. Combining the inherent inaccuracies of the hook-gage and the scales with the probable errors in calculations, the Indiana method was little better than guess work.

The Plot Thickens

Carl Menzel considered the difficulties and their solution. The scales led to inaccuracies. Discard it. The hook-gage gave incorrect answers. Discard it. The scum caused difficulties. Remove it. Mixing the concrete and water was hard physical labor—labor the average inspector might shirk. Lessen it. Computations were difficult. Eliminate them.

The general solutions of the problems were easy. The details of the problems were not. Easy to say "remove the scum." But how? Well, the thing that held the scum and foam together was the air-entraining agent. There must be something to dissolve it. Scores of solvents were tried. Finally one was found that almost "ate it up." There was a problem solved after only a month or so. At the same time others were being investigated and whipped. Finally the "rolling method" was evolved. There was little resemblance left between the rolling method and the Indiana method.

While research was proceeding on the "washing" type of test, the "pressure" method was taking shape. Boyle's law gave a relation which should easily tell the air content of the fresh concrete if its change in volume under a pressure change was measured. Boyle's law seemed to be incorrect in this case—at least there seemed to be no correlation. The sand and gravel used in making concrete is full of small pores. These pores are usually filled with air—air which has no affect on the durability, but which has a varying affect upon the indicated air content of the concrete. After a "porosity correction" factor was determined and applied, the pressure method became a possibility.

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The Engineering Honoraries and Societies

I.A.S.

The annual spring picnic was held on May 16 at Hessel park in Champaign. Rain kept the attendance down to 40 members, wives and girl-friends, but failed to dampen the spirits and appetites. Baseball was the main form of recreation. Following the game, a picnic supper was served.

The officers elected for the summer semester were: Jack McGuire, president; Louis Glover, vice-president; and Paul Klevatt, secretary-treasurer. Prof. R. W. McCloy is the faculty adviser.

The first meeting of the summer was held July 2 on Diamond No. 3. A baseball game was the main topic and Paul Klevatt's team outpointed Prof. McCloy's team. Refreshments were served following the game and a short business meeting was held. The following men were named to the meetings committee: Louis Glover, chairman; Ralph Fidler, R. S. Chubb, and Robert Kelly.

The second meeting was held August 6. Prof. H. S. Stillwell, head of the department of aeronautical engineering, spoke on the topic, "The Aircraft Industry." He pointed out that the aircraft industry reached the low point of employment in 1947 due to cut backs on government appropriations and small commercial requirements. Even so, there will be enough jobs for all who want them. Next year points to an increase in employment. He also discussed the new training facilities to be inaugurated at the U. of I. These include a supersonic wind tunnel, an engines lab, a structures lab, and a graduate program, all to be in operation soon.

The third meeting was held August 20 on Diamond No. 3. The sole object was baseball. Ed Spuhler's team downed Paul Klevatt's team by a score of 11 to 10—the game ending in darkness.

The last meeting of the summer was held Sept. 10 with movies and election of officers for the fall semester. At that time the points of the proposed Engineering Council was brought out.

M.I.S.

With plans under way to hold a membership drive right after registration, the Mineral Industry Society will have their first meeting for this purpose during the first week of school. Although inactive during the summer, the society plans to start off the fall program at the first meeting with a discussion of plans to send as many members as desire to the National Metals Exhibition and Congress in Chicago on October 22 and 23.

The activities of the society will be guided by the following officers who were elected at the last meeting of the spring: Leland House, president; Lynn Rowells, vice president; Margaret O'Donnell, secretary; and W. W. Berkey, treasurer.

A.S.C.E.

"The Golden Gate Bridge" was the title of the movie shown on June 19, at the first meeting of the summer term. The film portrayed some of the construction and maintenance problems of the bridge.

A smoker was held at Latzer Hall on July 17. Prof. Babbitt gave a short talk and introduced the faculty. Jim Keith, president, then introduced our guest speaker, Frank M. Amsbary, who spoke on the advantages of belonging to a professional society.

Prof. Shedd gave an explanatory lecture in connection with the film "The Tacoma Narrows Bridge," at a meeting in Gregory Hall on August 7. The movie was very spectacular and almost unbelievable. As Prof. Shedd commented at the beginning of the meeting, "I've seen this film over 50 times and I still can't believe it possible."

On September 17, the student chapter and the central section of the A.S.C.E. held a joint meeting at a dinner banquet in Latzer Hall. Mr. Hastings, president of the parent society, was the guest speaker.

The officers for the summer term were James M. Keith, president; James M. Wolfe, vice president; Barbara Schmidt, secretary; and Robert E. Kronst, treasurer.

A.I.E.E.-I.R.E.

The combined student branches of the American Institute of Electrical Engineers and the Institute of Radio Engineers will open the fall activities with an orientation program. All sophomore, junior, and senior electrical engineers are cordially invited to attend this meeting to familiarize themselves with these organizations. Dr. William L. Everitt, head of the electrical engineering department, will address this meeting on the importance and advantages of membership in technical societies.

Past experience has shown that electrical engineering students often have not become active in the A.I.E.E.-I.R.E. until late in their junior or senior year. This orientation program will attempt to stimulate interest at an earlier time so that underclassmen will avail themselves of the opportunities offered by an extra-curricular engineering activity.

Eta Kappa Nu, electrical engineering honorary fraternity, will participate in the program by presenting an award for scholastic achievement to the highest ranking, first-semester junior in the department. The purpose and function of Eta Kappa Nu will also be explained to acquaint students with the opportunities of association with this group.

During this past summer the combined A.I.E.E.-I.R.E. sponsored several events. A pre-war custom was revived when over two hundred students and faculty attended a department picnic. Highlighting the afternoon's activities was the traditional student-faculty softball game. The winner was awarded the A.I.E.E.-I.R.E. trophy which is now on display in the electrical engineering laboratory. The awarding of this trophy will be an annual event at the department picnic each spring.

Another open program sponsored by the A.I.E.E.-I.R.E. was the "Previews of Progress" demonstration given by General Motors corporation in the Gregory hall theater on July 24. Over four hundred students, faculty, and guests attended the show which demonstrated examples of current scientific research.

Programs planned for the fall semester include speakers from technical organizations such as the General Electric company, Bell Telephone company, and others. In addition A.I.E.E.-I.R.E. members will travel to Chicago early in November to attend the A.I.E.E. and electronics conferences. Several social activities have also been proposed for the semester but are not yet scheduled.

A.I.Ch.E.

Since the summer enrollment did not warrant any meetings, the student branch of the American Institute of Chemical Engineers remained inactive. The final meeting last spring was the annual picnic held on May 10 at the County Fair grounds. At this meeting the officers elected for the 1947-48 school year were Donald Hornbeck, president; John R. Mitchell, vice president; Dale Glass, secretary; and Edwin F. Dyer, treasurer.

During registration a membership drive will be conducted among the stu-

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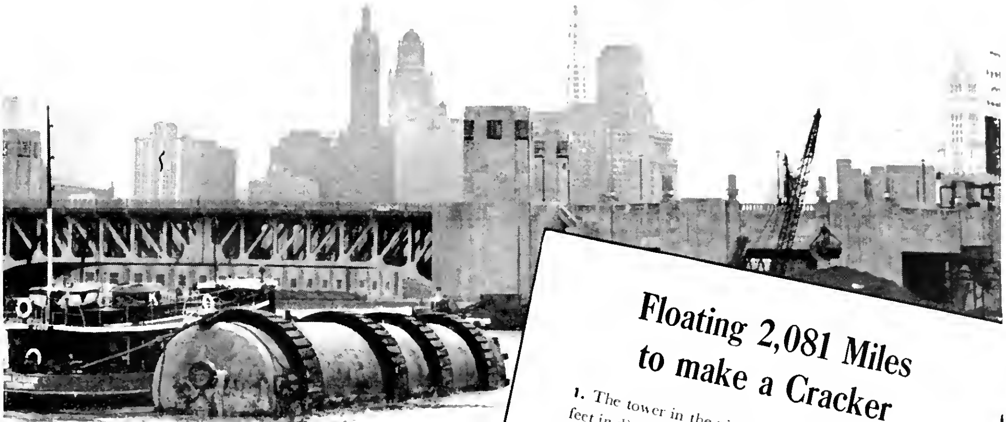
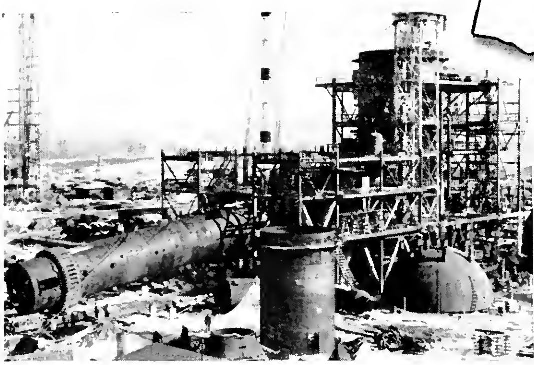




Introducing . . .

by John Shurtleff

WILL J. WORLEY

Up three flights of stairs in Talbot laboratory, the name Worley can be found on the door of room 321a. Inside sits quiet, sandy-haired Will J. Worley, an instructor of T.A.M. 1, 2, 3, and 63. He seems to be right at home with a testing lab down the hall, a slide rule in his hand, and the sound of machines at work.

Mr. Worley is a native of Illinois, being born in Gibson City, August 2, 1919. After spending eight years in a country school and one year at Drummer Township High School in Gibson City, he came to Champaign. Finishing high school here, he enrolled in the University in mechanical engineering and graduated in 1943. He received his M.S. in Theoretical and Applied Mechanics in 1945. At the present he is working for his doctor's degree in engineering while teaching.

Outside of his regular work, he is interested in radio circuits and also in the application of electrical and electronic equipment to industrial control. He devotes the rest of his spare time to hunting and a stamp collection.

Mr. Worley is now helping with tests of plastics and plastic laminated material. He has spent the last two years on steel, making tests of static tension, high velocity impact, impact tension, etc. The purpose of these tests is to determine the effects of temperature, rate of straining, strain aging, stress concentration, and state of stress in producing brittle fracture of steel.

His most recent development in the field of testing devices is an adoption of the Baldwin Southwark portable strain indicator to dynamic tests. Mr. Worley explains: "This adaptation was developed to obtain an easily available commercial unit for repeated dynamic strain measurements. The procedure involves the use of a standard Baldwin Southwark portable strain indicator and a cathode-ray oscilloscope. The oscilloscope is used in the circuit as a null balance indicating device."

Mr. Worley is a member of Pi Tau Sigma, Sigma Xi, Pi Mu Epsilon, the American Society of Mechanical Engineers, the American Society for Testing Materials, the Society for Experimental Stress Analysis, and the American Society for Engineering Education.

When asked for some comment on his teaching, he replied, "I always recommend to my students that they read an article called 'The Unwritten Laws of Engineering' by W. J. King. Every prospective engineer will get something out of it." He also stated that his favorite subject from the standpoint of teaching is T.A.M. 2.

Well liked by his students and fellow engineers, Mr. Worley is making some really fine contributions to the field of engineering.

MARY E. WELCH

There is probably not a single student in the College of Engineering who has not looked many times across the desk in 300 Engineering hall at Mrs. Welch's smiling face. And across this desk she is asked any conceivable question on engineering.

While waiting just a few minutes to see her, we heard a student ask whether he had enough hours to register with sophomores or juniors; another needed her help in making out his study list for the following term; yes, even a telephone caller wanted to know if he was still on probation. Only part of the inquiries, however, need the use of her complete files on each student's scholastic record.

Graduated from New Canton High School, Mrs. Welch spent most of her married life in Rockport near New Canton. After the death of her husband, she attended the Illinois Business College at Springfield and worked a little in Springfield after graduating.

Coming to Champaign-Urbana in December, 1940, Mrs. Welch worked in Dr. Bailar's office until August, 1943, on the records of freshmen chemistry students. She then began her present position as senior record clerk for the College of Engineering. Although an occasional engineer uses "damn" or "hell," they impress her as being well-mannered and knowing what they want out of school.

Mrs. Welch has played quite a bit of bridge, but for relaxation she enjoys reading most of all, with gardening running a close second. But we are sure if you ever go into 300 Engineering hall, you will agree that Mrs. Welch's graciousness shows an intense interest in people too.

WILBUR TUGGLE

"When the other boys wanted to be firemen, I wanted to be an engineer . . . always did," quietly stated Wilbur Tuggle. As a junior in civil engineering, Wilbur is rapidly approaching his boyhood goal.

He came to the University of Illinois because he believes that it is one of the finest engineering schools in the country and because it is far enough away and still close enough to his home town, Chicago.

After graduating from Wendell Phillips High School in February of 1941, Wilbur worked for a year to finance his education. However, Uncle Sam had other ideas for him, and after completing his freshman year, he left for service. The next thirty-one months found Wilbur in the Pacific Transportation Corps, stationed in New Guinea, the Philippines, and Japan. After his re-

(Continued on Page 32)

WILBER TUGGLE

Ultrasensitive RCA Television camera tube cuts studio light requirements 90%

Television finds drama in the dark — with new RCA studio camera

Now television becomes even more exciting as lights are dimmed, and the camera reaches deep inside studio shadows to capture action as dramatic as any on stage or screen . . .

A new studio television camera—developed by RCA scientists and engineers—needs only 1/10th the usual amount of light.

The super-sensitive eye of the new camera is an improved Image Orthicon Tube . . . of the type once used only outdoors. With it, studio broadcasts are sharper, clearer—and since so little illumination is needed, heat in the studio is sharply reduced. No more blazing lights!

Such improvements come regularly from research at RCA Laboratories, and apply to all branches of radio, television, electronics, and recording. These improvements are part of any product bearing the name RCA or RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio and electronic wonders at RCA Exhibition Hall, 36 West 49th St. Free admission. *Radio Corporation of America, RCA Building, Radio City, New York 20.*

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

GEORGE R. FOSTER
Editor

FRANCIS P. GREEN
Ass't Editor

EDWIN A. WITORT
Ass't Editor

the Illinois Technograph

STOP! LOOK! THINK!

Do you remember how many laborious hours you have spent from time to time trying to decide on what kind of a job you want? The process started 'way back when you were in knee pants and insisted that the life of the corner policeman directing traffic was the one for you. Since then it probably has run through quite a gammut of jobs until, as you grew older, your taste in type of work finally settled into a more practical field.

Of course, some people never reach a final decision, and others do not decide definitely until after they graduate and start hunting for jobs, but in any event most people have at least a general idea as to the type of work they want. Having made this momentous decision the average person then sits back with a self-administered pat on the back and begins to prepare himself for the job by going to school. Since the item of deciding on the appropriate technical preparation has already been considered in planning the various curricula, the average student is fortunately spared the necessity of deciding what technical courses his education should include. Instead, most people promptly pitch into four years of hard work and equally promptly become lost in a maze of details relating to their particular line of study. An occasional few may even be far-sighted enough to realize the value of the experience to be gained from participation in extra-curricular activities.

In any event it is indeed rare that a student will have even considered—let alone reached a decision—on the third great problem which usually rears its surprising head about the last half of the senior year; i. e., "Whom shall I go to work for when I've finished school?"

Whether the student decides that he wants to work for himself or someone else is, in itself, unimportant. What *is* important is that the student should not leave this problem for a last-minute decision based solely on the consideration of remuneration. The answer to the question is, of course, up to each individual, but happiness and satisfactory performance in one's job is not achieved unless all the factors affecting the choice are considered.

To try to cover all the phases of future job prospects and point out all of the criteria used in making a sensible selection of employer is a pretty tough order, but the *Technograph* is going to attempt to tackle part of it. Since the larger, nation-wide companies are not only well known to most students, but also well publicized in our pages, it is going to be our additional aim in this year's issues to publicize a hitherto little-used and less well-known field of employers—the local manufacturers located throughout the State of Illinois.

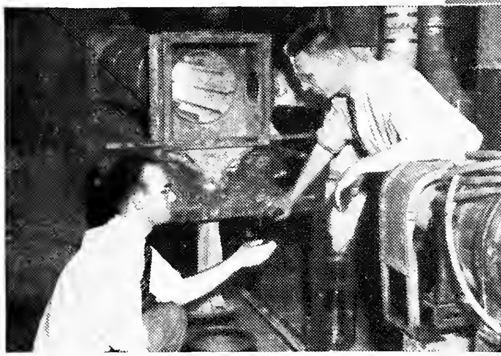
It is true that many men eventually work into these smaller industries, but as yet, very little has been done to establish contact between them and the graduating engineer. It is felt that the student, in considering all the possibilities in selecting a suitable employer, is overlooking a fairly large, potential field just through lack of knowledge and publicity. To accomplish this purpose, the *Technograph* is planning a series of articles about several representative industries designed to acquaint the student with the type of work found in smaller organizations.

It is sincerely hoped that this series will not only open up a new field to you, but will also help to overcome mental inertia so that you will begin to consider this subject with more than just a passing thought and will be able to walk into an interview with other questions on your tongue than "How much will you pay me?"

Du Pont *Digest*

Items of Interest to Students of Science and Engineering

Fundamental Engineering Studies



Studying product development in an experimental rotary dryer. H. J. Kamack, B. S. Chemical Engineering, Georgia Tech. '41; F. A. Gluckert, B. S. Chemical Engineering, Penn State '40.

Inspecting the interior of experimental spray dryer after a run. W. R. Marshall, Jr., Ph.D. Chemical Engineering, Wisconsin '41; R. L. Pigford, Ph.D. Chemical Engineering, Illinois '41.

In a company like Du Pont the diversity of chemical operations is great and the investment in equipment is high. In addition to the engineering work done in the ten industrial departments, the responsibility for design and construction of manufacturing plants is undertaken by the central engineering department, which also maintains an engineering research laboratory. This laboratory is staffed by chemical, metallurgical and mechanical engineers, and physicists, whose function is to carry on fundamental and pioneering-applied research to develop new methods of processing and equipment designs; improve equipment, materials of construction, and methods of measurement and control; and establish fundamental relationships in unit operations and unit processes.

For example, a broad project was undertaken to study the fundamentals of rotary drying. A principal objective of the study was to learn the effect of the operating variables on the volumetric heat transfer coefficient. Of the numerous variables that affect the drying rate of such a dryer, the more important ones studied were: (1) feed rate, (2) dryer rotation rate, (3) air rate, (4) air temperature, (5) number of flights, (6) direction of air flow, and (7) dryer slope.

Studies on a Laboratory Scale

Fundamental studies of heat transfer and mass transfer were made in a laboratory scale rotary dryer, 1 ft. in diameter by 6 ft. long. To determine the true heat transfer coefficient, special methods were devised to measure the material temperature along the length of the dryer and to measure continuously the temperature of the rotating shell. These determinations permitted an analysis of all the heat transfer effects in the dryer; namely, from air to solid, from shell to solid, and from air to shell.

From a knowledge of the material temperature along the dryer, it was possible to calculate the air temperature at each point in the dryer and thereby to determine point values of the heat transfer coefficient. This procedure permits the calculation of a more accurate average temperature difference, which gives more accurate heat transfer coefficients than can be obtained from terminal conditions only.

During the course of the study, every opportunity was taken to obtain heat transfer data on large-scale plant dryers in order to establish scale-up factors. This procedure permitted the correlation of heat transfer coefficients from a 1 ft. diameter dryer with those of full plant size.

Paralleling the work on the fundamentals of rotary drying operation, problems involved in product and process development received continuous attention. These usually require an investigation of the important auxiliary problems of: (1) material handling to and from the dryer, (2) removal of dust from the air, (3) sealing the space between the rotating shell and stationary breeching, and (4) corrosion of the dryer shell.

How the Results are Applied

The findings of the effect of holdup on dryer capacity were applied to an 8 ft. standard rotary dryer producing 300 lb./hr. of granulated material. The information obtained on this factor alone permitted an increase in capacity of 75 to 100%. This meant an increase of over a million pounds annually. Further, one dryer could now handle the load of two, releasing second dryer for other work.

The information developed in such fundamental studies permits more accurate design of equipment for future operations resulting in lower cost of manufacture and lower investment.

Questions College Men ask about working with Du Pont

WHAT KIND OF TRAINING WILL I GET?

All new employees receive on-the-job training. Men who are engaged in research, development or engineering have the opportunity to add continually to their knowledge and experience in specific fields. This practical training is supplemented at many Du Pont plants and laboratories by training courses and lectures. Write for booklet, "The Du Pont Company and the College Graduate," 2521 Nemours Building, Wilmington 98, Delaware.

DU PONT

REG. U. S. PAT. OFF.

More facts about Du Pont—Listen to "Cavalcade of America," Mondays, 8 P.M. EST, on NBC

LOOK . . .

(Continued from Page 7)

job in the locality where his services are wanted.

Of course, the question of remuneration is an important one at all times. It would be advisable for the student to consider this in its broadest aspect.

In its truest sense, remuneration means more than just a pay check. With our present advances in group insurance and health benefits it would be well to have an understanding of these matters. Many companies, through the group insurance policy, provide health, accident, and life insurance. This should certainly be of interest to any prospective employe.

Do you, the employe, expect to have a vacation with pay? If so, it would be a good idea to inquire as to the company's policy regarding vacations and also overtime work. These are both important questions and the student would do well to get a clear cut answer to both of them.

Whenever it becomes necessary to work closely with other persons, the problem of personnel relations is sure to crop up. What, if any, social obligations will fall to the new employe? If there are any, will they be an added financial burden upon that person's individual income or will the company provide an expense account? To what extent will the work itself require contact with different people and different situations? These questions should all be answered to the satisfaction of the individual seeking employment. Some people enjoy traveling and entertaining, others do not. Some people are good salesmen, and again, others are not. Therefore, failure to get these answers at the interview may lead to an unpleasant or difficult situation after employment.

It is not the purpose of this article to attempt to discuss the pros and cons of labor unions. However, since almost everybody has his own opinions on this matter, it would be a very wise thing to become acquainted with the union and labor policy of the company.

Every company, with a few exceptions, has a very definite policy regarding advancements of position and increases of salary. A knowledge of these facts should be a good indicator to the prospective employe of what his future should hold. Not that he can necessarily better himself otherwise, but when a definite plan of advancement is followed, it affords a partial basis for planning his life.

Lastly, and most important, is the type of work that will be required of the employe. Some persons want to do design work, others production management, and still others desire outside contact work such as selling or maintenance. For the neophyte engineer the opportunities are somewhat limited in so far as original design work is concerned. The great majority of work is merely the re-design of proven items or the making of detailed drawings that the older engineers have already sketched out. This system of apprenticeship is an old and well established custom; and there are few men who can circumvent it.

In the field of production management there is also an apprentice period in which the engineer works in the plant. Usually this process takes several years and carries to all parts, departments, and phases of the work of the organization.

Selling and maintenance require training which is provided by the company. Sometimes this requires six to twelve months after which the employe is assigned to a territory of his own or one with another more experienced man.

Unfortunately, too few persons are able to decide beforehand, exactly what kind of work they desire.

Due to their financial resources, the large, well established companies, and the governmental agencies, have, up to

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LOOK . . .

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the present time, been the only employers who have provided personal interviewing service for the students.

It is true that these large organizations have heavy requirements and that they go to a great expense and trouble to get high caliber personnel, but they do not employ a majority of engineers when one bases the figures upon the total numbers of employes of all grades, skills, and classes.

For the most part, the smaller business organizations do not have any direct contact with the students. The college office receives many letters of job requirements from the smaller organizations but the written word can hardly supplant an oral interview.

There are a great many men who would be able to find the type of work they desire with smaller companies were they given the opportunity to find out more about them.

Personal Interviews Encouraged

It is for this reason, and in the interests of the students of the College of Engineering, that the *Technograph* is this year conducting a campaign among the small industrial organizations of the state to interest them in the opportunities that would accrue to them, as well as to the students, if they would provide personal interview service in the same manner that the large organizations do.

The smaller businesses have organized themselves along the lines of their particular interests, so that if they were to provide interviewers, they would represent particular types of work. This would be a great aid to the student who is looking for the right job.

Along with publishing the latest technical developments from the large and well-publicized companies, the *Technograph* is going to run a series of articles about the smaller, less well-known industries; so that the students may know something of the kinds of engineers they employ and the kind of work required for the job.

At the present time, the engineering schools of the United States and Canada are heavily overcrowded. Naturally this tremendous influx of men and women into the various fields of engineering is going to affect the employment situation.

The American Society for Engineering Education, has seen fit to make a survey of the supply and demand situation in the near future.

With the assistance of Mr. H. H. Jordan, associate dean of the College of Engineering, the following material from the "Interim Report by the Manpower Committee of the A.S.E.E." was

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LOOK . . .

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made available. The survey was made and the material was accumulated through the cooperation of the various colleges of engineering, the U. S. Office of Education, and various cooperating industries.

The breakdown into six major groups was made on a basis of the comparison of present supply and demand and an educated guess as to when the supply would catch up with the demand.

Aeronautical Engineering: This is a relatively small group which is now overproducing at the rate of 400 graduates per year.

Chemical Engineering: In this field there is a very heavy demand. In prospect, there will be no surplus of manpower until about 1950.

Civil Engineering: At the present there is a very slight overproduction in this field but not of serious size. The demand should remain steady until about 1950 when there will be a surplus.

Electrical Engineering: The supply should catch up with the demand in about 1949. After that, there will be heavy overproduction and surplus.

Mechanical Engineering: At present this is the largest group of students but also the group with the largest demand. By 1950 there should be some surplus.

Mining and Metallurgical Engineering: This is always a relatively small group and never seems to show any overproduction.

The Time Is Now

At the present time, it seems as though every school of engineering in the country has started out upon an expansion program, but there will be a gradual decline in the number of engineering students, the same as in other fields in a few years.

Now, let us assume that we have accomplished our objective and that the interviewers have arrived from both the large and small organizations. Our student must now make his choice of jobs.

It is not wise to try to speak to too many interviewers because this will only lead to great mental confusion. Rather, having decided upon the kind of work desired, arrange to be interviewed by men from both the large and small businesses, that can offer the desired work.

Remember, do not waste the interviewer's time. Have all pertinent questions in mind beforehand. If necessary, write them down, and ask them clearly and concisely. When you are asked questions by the interviewer, try to answer them in the same manner.

Having once made up your mind, stick to it and go through with your agreed program. Nothing looks worse than a man who cannot make up his mind.

So, if you look before you leap, the chances are that you will wind up with the job you wanted and planned on getting.

QUALITY CONTROL . . .

(Continued from Page 13)

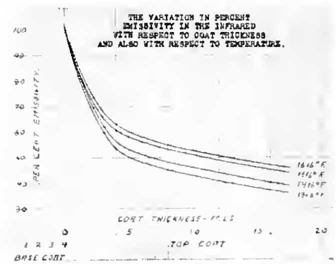
the quality control system over the 100% inspection method is not only to speed up production, in itself a great improvement, but also by maintaining continuous control right at the operation to increase the number of pieces falling on or near the specified dimension. Although most manufacturers will tend to hesitate about adopting the quality control methods simply because of the difficulty in making the transition from one system to another, the superiority of the quality control system will more than economically justify the cost and problems of transition.

CERAMICS . . .

(Continued from Page 11)

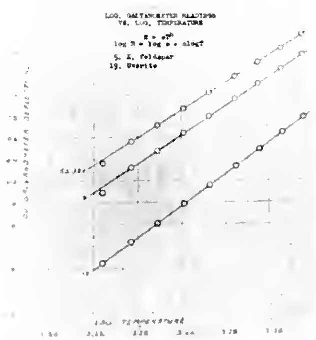
perature range, lepidolite had greater emissivity than stainless steel while uverite showed least emissivity. In the visible range (800°-1100°) uverite, which is closer to a true black body than any of the ceramic materials, showed less than 10% of the emissivity of stainless steel.

In the group consisting of lepidolite, olivine, quartz, and kyanite, their high relative emissivity indicated that they were desirable for coating metals for protection only. They were excellent where uninterrupted heat flow was desired. In the group showing lowest curves of emissivity, uverite, manganese oxide, and zirconium oxide indicated that such coatings would retain heat and cut off radiation.



In analyzing coat thickness, graphs clearly demonstrated that first elements of coating produce rapid decrease in radiation, but the curve of coat thickness versus radiation quickly levels off. The sharp bend in the curve was in the region of 5 mils thickness.

Any small amount of zirconium oxide added to the ceramic mixture decreased radiation by 11%, whereas a chromic oxide film enhanced emission of radiation by 29% (from 43 to 72%).



Bonding glasses were important factors in suppressing heat energy. Just 5% of vanadium oxide (V_2O_5), when substituted for NiO, decreases emissivity by 32%. The property of coatings which seals in heat, slows metal corrosion, and doubles useful operating life of metal parts is that of inhibiting fatigue cracks and offering protection against decarborization. Dr. Bennett said that a certain amount of metal oxide is necessary to promote a good coating bond, but that must be noted so that further oxide the time at which coating was applied formation is prevented.

Knowledge from the tests was quickly put into practice. During the fighting in the Pacific, our pilots reported that Jap suicide pilots could spot our night flying squadrons by the reddish glow from overheated exhaust pipes and collector rings and would simply aim their planes at the glow. A black paint which cut off all visible rays regardless of the temperature and which would not crack was quickly developed before V-J day. Paint was sprayed on the plane before takeoff time and was dried by engine heat.

Since engines, particularly jet engines, operate efficiently at higher temperatures, use of ceramic coatings is now known to be indispensable to our faster-than-sound, jet-propelled planes which will operate at temperatures greater than 2000° F. Techniques learned in the laboratory will be applied to commercial and military uses, since high speed planes and rockets will develop temperatures approaching the melting point of steel.

The research program included these universities and colleges: Rutgers, Armour, Penn State, Alfred university (N.Y.), and Battelle State college.

During the joint Army-Navy symposium held last February in Washington to discuss the future of heat resistant ceramics for the armed forces, it was decided that ceramic research should be speeded in view of the rapid development of jet propulsion.

ILLINI IN ACTION . . .

(Continued from Page 14)

The pressure change to use was important. Pressures from 0.5 p.s.i.g. to thirty tried. With the low pressures undesirable "hydration" effects were noticed—the chemical action between the cement and water caused minute unpredictable changes in volume, serious enough to disturb the extremely precise readings needed. This hydration effect became less noticeable as the pressure used was increased and volume changes became greater. The porosity correction remained constant over the whole range and did not influence the choice of pressure. As the pressure used increased, more work was involved (a hand air pump is used). To decrease distortion of the equipment itself meant thicker, heavier, and more expensive parts. A moderate pressure change was indicated and used.

The two pieces of equipment—rolling and pressure—were ready to be calibrated. Most data on air-entrained concrete, so far, had been obtained with the gravimetric method. Several states were using the Indiana method. Carl Menzel had developed a stirring method—a cross between the rolling and Indiana methods. He had also devised a "modified rolling method"—same theory as the rolling method but with slightly different equipment and technique. A testing schedule was drafted. All of the methods were to be tested simultaneously on identical samples. Six times a day, five or six separate tests were performed. Those people using the Indiana method could adjust their data to compare with any of the others. All of the methods could be correlated with the gravimetric method.

Is It Practical?

These tests went on for weeks. We reached the point where we could look at the concrete as it came from the mixer, smell it, and guess its air content closely. The tests still went on. Finally everyone was satisfied. Both the pressure method and the rolling method gave results, and the results correlated much more closely than we had dared hope.

Still, all of this work had been done in the laboratory. These tests were supposed to be practical field tests. They had to be tried under the same conditions in which they would be used.

The pressure method and the modified rolling method were apparently the two best qualified for field use. In the laboratory they would give results checking each other within a few hundredths of a per cent. For various reasons, the other methods were out of the running.

We visited one road-paving job after another. Every part of the equipment was checked and checked again to make

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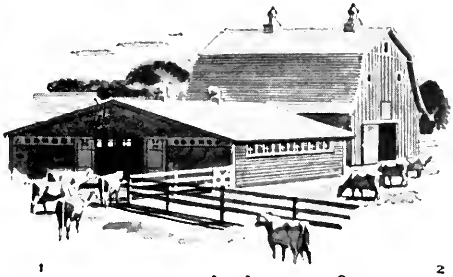
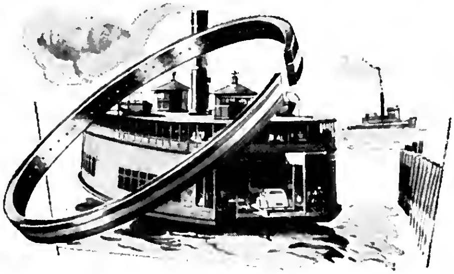


When you admire a beauty[1] . . . or visit a farm[2] . . .



ride on a ferry[3] . . . . or order some coke[4] . . .

swallow an aspirin[5] . . . . or turn on the light[6] . . .

the chances are, you are coming in contact with Koppers engineering or chemical skills.

1. Koppers chemicals for use in cosmetics. **2.** Farm structures made of lumber pressure-treated by Koppers for long life. **3.** Koppers American Hammered Piston Rings for marine engines. **4.** Coke from Koppers-built ovens. **5.** Koppers chemicals for use in medicines. **6.** Koppers Fast's self-aligning couplings, widely used in power plants. All these are Koppers products . . . as well as scores of others that help to increase our comfort, guard our health, enrich our lives. All bear the Koppers trade-mark, the symbol of a many-sided service . . . and of high quality. Koppers Company, Inc., Pittsburgh 19, Pa.

K

KOPPERS

ILLINI IN ACTION . . .

(Continued from Page 30)

it as efficient as possible. Everyone — laborers, engineers, truck-drivers — suggested modifications. The pressure method proved most adaptable to field conditions.

The construction season passed. The pressure method was chosen as the easiest, most reliable, and most accurate method of determining the air content of fresh concrete in the field. A big mixer would place a batch of more than two tons of concrete on the road bed. Five minutes later an inspector could say, "The air content of this concrete is within specifications," or he could say, "This concrete doesn't have enough air." A few minutes later the inspector could be testing another batch. It was now possible to maintain a continuous accurate control over the concrete that went into the road. Now there would be no more long sections of concrete without the proper amount of air. An error in proportions could be corrected almost immediately.

All of this was possible except for one thing, there was only one piece of equipment for the pressure method available.

It was a wierd-looking apparatus. As improvements had been made, they had been added any place they would fit. The equipment had to be redesigned. Clamps held the equipment together. Were they of the best design possible? Would another design be better? A different type of closure might cut seconds from the testing time. Books on artillery were consulted — some type of quick-acting breech lock might be adapted to the purpose. Cutlery departments of stores were visited—the clamping action of a pressure cooker might yield an idea. A pump is used—what size should it be? Where could the pump be placed when not in use? Many questions were asked. Many weeks were spent in getting the answers.

This spring the job was finished; over a year had been spent, but a simple, reliable, speedy test was evolved. That is the story behind the paper "Determination of Air Content," published by Mr. C. A. Menzel in the May, 1947, issue of the Journal of the American Concrete Institute.

A local option election was being held in a county inhabited by sturdy Germans, who loved the foaming brew. The teller called out,

"Vet, vet, vet, vet," then he frowned and said, "Dry-y-y." Continuing he called, "Vet, vet, vet, vet," and frowning again, he exclaimed, "Some son of a gun voted twice."

INTRODUCING . . .

(Continued from Page 18)

lease from service, he returned to Illinois to continue with the aid of the GI Bill.

Wilbur's hobbies include hunting and fishing, but in his words, "An engineering curriculum doesn't give much time for outside activities." Although he does most of his hunting in Michigan, he found time for some novel game shooting while stationed in Hollandia, New Guinea.

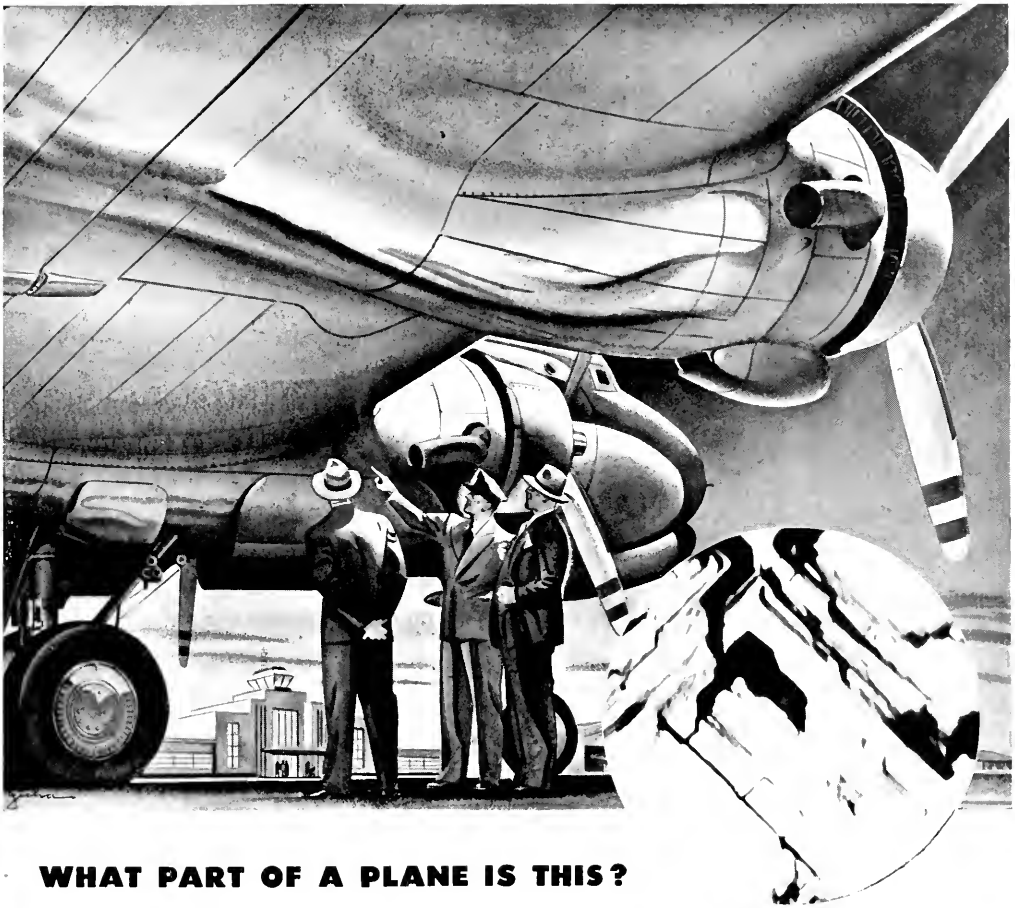
He also enjoys swimming and was a member of various swimming teams in Chicago during high school.

Football takes first place for his entertainment as a spectator. His favorite team is, naturally, Illinois, and he believes that the Fighting Illini are right in line for another championship this year.

As for the future, he hopes to specialize in bridge construction and design, spending a year in South America after graduating. Then it's a case of "California, here I come," since Wilbur likes the spaciousness and opportunities offered by the west coast.

Lawyer: "Now if you want my honest opinion—."

Client: "I don't. I want your professional advice."



WHAT PART OF A PLANE IS THIS?

Clue: 31,700 would cover a pinhead

It is part of the wing surface . . . an area so microscopic that 31,700 spots like this would barely cover a pinhead.

You are looking at aluminum through an electron microscope, the way Alcoa Research scientists look at aluminum alloys in our laboratories. They get down to aluminum's *really* fine points . . . explore among the atoms.

Studying structures like this is one of the ways Alcoa metallurgists learn how to improve aluminum alloys and how to make new ones. By scientific experimentation they combine with aluminum the *right* amounts of the *right* metals to produce the results they want . . . alloys as strong or stronger than structural steel, at one-third the weight . . . alloys that make better castings, forgings, extrusions . . . alloys for innumerable uses

You wouldn't hear half, *not even a hundredth* as much about aluminum today if it weren't for these alloys that Alcoa Research has produced. Aluminum's great and growing usefulness springs directly from their development. Nature made aluminum light. Alcoa has made it strong and versatile and low in cost. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

MORE people want **MORE** aluminum for **MORE** uses than ever

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

GYRO-COMPASS . . .

(Continued from Page 8)

of torque, and the rate of precession are all at their maximums; therefore precession will continue about the vertical axis. However, as the rotor crosses the meridian, the rotation of the earth will cause a gradual decrease of the angle of tilt until the rotor reaches a level position again.

The eccentric pin is offset 1" for a specific purpose. If it were placed directly in line with the perpendicular, the consequent torque would act on the horizontal axis of the rotor only, and the rotor axis would oscillate from east to west to east continually. By offsetting the pin 1" in the proper direction, an unbalanced condition of the mercury tanks would cause a slight torque to act about the vertical axis; the resultant action about the horizontal axis opposing the tilting effect caused by the earth's rotation. From this, it can be seen that the amount of tilt will be dampened with each oscillation of the rotor wheel and eventually the rotor will, for all practical purposes, come to rest in the plane of a meridian. This takes about 2½ oscillations or 3½ hours at the most.

It can be seen that if the weight of the mercury ballistic tanks rested on the rotor case, movement about the horizontal axis would be restricted. Since Dr. Sperry depended on complete freedom of the rotor for the desired results, he had to devise a way to support the mercury tanks and yet keep them in the proper position relative to the rotor. He accomplished this by designing what he called the "phantom element." This consists of a metallic, circular ring that is kept in line with the movements of the rotor about its vertical axis by means of a 3 coil transformer, and electronic follow-up system, a little direct current motor, and appropriate gearing. Roughly, the system operates in this manner. The 3 coil transformer, consisting of a primary, energized by single phase, 210 cycle alternating current, and a secondary on either side, is mounted on the phantom ring and a little armature is attached to the rotor case. If the rotor moves relative to the phantom ring, a signal is sent from one of the secondary coils to the electronic follow-up system. This system consists of an amplifier tube and two rectifier tubes 90 degrees out of phase with each other. The signal is amplified, rectified to direct current, and piped to the little d.c. motor which, through proper gearing, turns the phantom ring back in line with the rotor case. Because it is always in step with the rotor case, the phantom ring is an ideal location for mounting the compass card, and is used as such.

Because it is necessary to have accurate compass readings at various sections of a ship, a system of repeater compasses is used. The compass cards on the repeaters are kept in synchronism with the master gyro-readings by either a d.c. step-by-step system or an a.c. selsyn system. Using either of these methods, any desired number of remote bearing indicators may be operated.

Somewhat after the installation of the first Sperry gyro-compass, (U. S. S. Delaware, 1911), a different type of gyro-compass was developed by the Arma Engineering company. Utilizing two, non-parallel rotors for stabilization, its overall efficiency is comparable to the Sperry product. Arma compasses employ a pendulum and oil tank system for their north-seeking and north-remaining properties.

During the recent war, gyro-compasses were indispensable to fighting ships. They were essential, not only for taking bearings and keeping ships on course, but to automatic course recorders, automatic steering, (Gyro-Pilot), radar, and fire control.

Special compact types of gyro-compasses have been developed for use in

(Continued on Page 38)

He Can Be a Valuable Player On Your Cost-Reduction Team

● Your head electrical man—don't overlook his counsel in your cost-reduction huddles. Here's why—

During recent years, thousands of electrical systems have been operating under abnormal stress. They have become overloaded and unreliable . . . poorly located or improperly applied in relation to present needs. They have increased production costs—plenty.

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GYRO-COMPASS . . .

(Continued from Page 36)

airplanes and small, speedy ships and boats. The most commonly used of these is called the Gyro-Flux Gate System and was developed recently by the Bendix Aviation corporation. This system consists of an earth inductor compass stabilized beneath a gyro-scope and contains a transmitting unit, a remote manual caging unit, an amplifier, a master indicator, and a repeater indicator. The power supply (115 volts, 400 cycle a.c.), is provided by an inverter, operating from a 24 volt d.c. input. The gyro-wheel is the rotor of a 2 phase induction motor supplied by single phase, 115 volt, 400 cycle a.c. The 90 degree phase shift for the motor's second phase is provided by a series of condensers. The rotor develops a speed of approximately 10,500 r.p.m.

Mechanical uses for the gyro-scope, other than employment in compasses, are too numerous to mention here. Gyrostatics has taken great strides forward since Foucault built his classic gyroscope in 1851, and with private capital exploiting its possibilities, the applications promise to become even more varied than now.

He: "Do you believe in free love?"
She: "I haven't sent you a bill, have I?"

SOCIETIES . . .

(Continued from Page 16)

dents in chemical engineering, and as soon thereafter as possible a meeting will be held for the same purpose.

S.B.A.C.S.

The student branch of the American Ceramic Society has been inactive during the summer session, but has a full program laid out for the fall term. This program is to be started off by an intense drive for 100 per cent student membership.

At the final meeting last spring an election of society officers for the fall semester was held. The men elected were Walter F. Stuenkel, president; Floyd M. Maupin, vice president; Allen P. Wherry, secretary; and Arthur C. Bouenkerk, treasurer.

A.S.M.E.

Due to the accelerated program, the A.S.M.E. chapter has been inactive during this summer. The first meeting of the fall term will be devoted to a membership drive. The exact date of this meeting will be announced later and all students in the mechanical engineering curriculum are cordially invited and encouraged to attend this meeting. The new officers for the fall semester will also be elected at this meeting.

Blonde chorus girl: "Congratulate me, girls, I've just made a fortune."

Brunette chorus girl: "Yes, whose was it?"

* * *

A collegiate chap asks: "If all the coeds in the world that didn't neck were crowded into one room, what would we do with her?"

* * *

Simp: "If it wasn't for one of my father's discoveries I wouldn't be here today."

Glimp: "What was that?"

Simp: "My mother."

* * *

Jack: "Say, do you know that your wife is telling everyone that you can't keep her in clothes?"

Geo.: "That's nothing. I bought her a home and I can't keep her in that either."

* * *

Sergeant: "What'd you get drunk for, in the first place?"

Private: "It wasn't the first place, Sarge, it was the last."

* * *

Claude: "My brother-in-law swallowed a box of fire crackers."

Maude: "Is he all right now?"

Claude: "I don't know. I haven't heard the last report."

* * *

A diplomat is a man who can make his wife believe that she looks fat in a mink coat.

* * *

Mrs. A: "My daughter is takin' a course in domestic science."

Mrs. B: "How is she makin' out?"

Mrs. A: "OK, I guess. She writes that she has made the scrub team."

* * *

Kitty: "Whenever I'm down in the dumps, I get a new hat."

Katty: "So that's where you got them."

New Bride: "Honey, I've a confession to make, I've got a cedar chest."

Groom: "I'm glad to hear that—I was wondering what you would say when you learned that I have a wooden leg."

* * *

Biology teacher: "Tell me, Jimmie, why do women live longer than men?"

Jimmie: "I don't know, teacher, unless it's because paint is such a good preservative."

* * *

Absent-minded professor: "Lady, what are you doing in my bed?"

She: "Well, I like your bed, I like your neighborhood, and I like your house. And furthermore, it's about time that you remember that I'm your wife."

"And now, with Mr. Riley's permission, we'll return to the anatomy of a frog."

Crossword Answer

W	E	B		G	R	O	T	T	H	U	S	S	
A	G	O		M	O	R	S	E		R	E	I	S
S	O	A	P		T	E	A		T	A	I	N	T
		Z	E	R	O		R	A	I	N	S		R
H	A		S	U	R	D		L	E	U		G	O
A	N	I	O	N		R	U	T		S	H	A	W
W	O	N		E	D	I	S	O	N		A	U	G
K	D	K	A		A	P	E		O	B	E	S	E
S	E		M	A	R		R	A	T	E		S	R
B		A	P	S	E	S		D	E	A	F		
E	A	V	E	S		A	L	A		T	U	B	E
E	V	E	R		S	W	I	M	S		S	O	Y
	E	R	E	C	T	N	E	S	S		E	W	E

The awkward age: Too old to cry, and too young to swear.

* * *

LAS student: "Going around with girls keeps me young."

E.E.: "How?"

LAS student: "I started going around with them four years ago when I was a freshman, and I'm still a freshman."

* * *

Mama mosquito: "If you children are good, I'll take you to the nudist camp tonite."

* * *

Mrs. A: "Oh! I'm so happy. My husband is taking up anthropology."

Mrs. B: "How did you find out?"

Mrs. A: "Oh, I found some little red tickets in his pocket saying—Mud—horse 15 to 1. When I asked him about them, he said they were the relics of a lost race."

* * *

Johnny: "Mr. Jones, daddy wants to borrow your cork screw."

Mr. Jones: "All right sonny," said Jones reaching for his coat. "Run along home—I'll bring it over."

* * *

Son: "Dad, when you were a kid, what was your greatest ambition?"

Father: "To wear long pants. I've had my wish. I haven't met anyone who wears his pants longer than I do."

* * *

Teacher: "George, your theme, entitled 'My Mother', is just the same as your brother's."

George: "I know. We have the same mother."

* * *

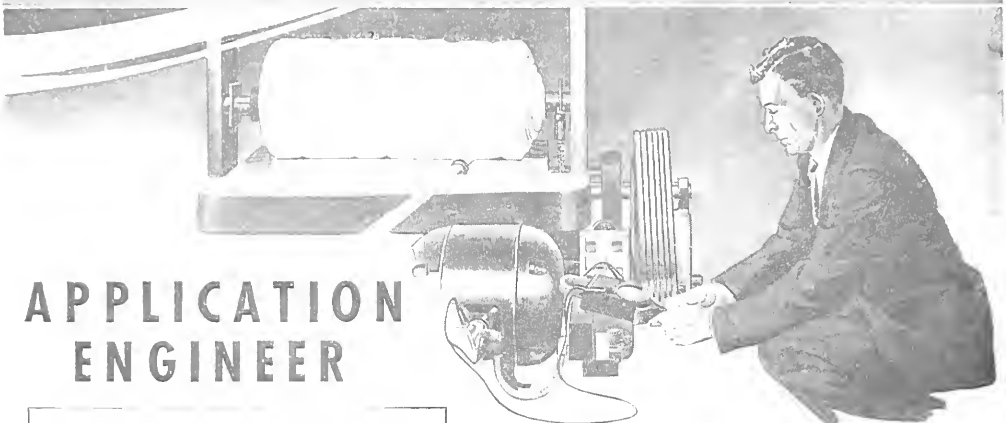
You can't tell—maybe a fish goes home and lies about the size of the bait that got away.

* * *

At breakfast one morning I was reading in the paper that a couple in North Dakota were buried in a snow drift for 18 hours, and I said to the waitress: "How would you like to be buried in a snow drift for 18 hours with your sweetie."

"Say," she replied, "If me and my sweetie was buried in a snow drift, we'd be swimmin' in 15 minutes."

GENERAL ELECTRIC



APPLICATION ENGINEER

War took a six-year cut out of Frank Lewis' career plans. He's making a new start with G.E.

Struggling to become airborne in the teeth of an Aleutian gale, the B-25 in which Frank Lewis was serving as co-pilot spun down into a fiery crash. Frank took the long way home. Badly burned about the face and shoulders, he spent two years in Army hospitals.

When he came back to work at General Electric this spring he had been away exactly six years. He had forgotten a lot, changed a lot since the days when, fresh out of the State College of Washington, he had worked on "Test" with G.E.

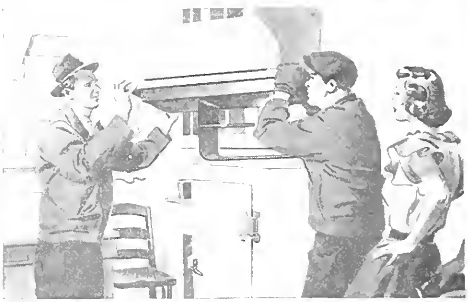
He took naturally, therefore, to the G-E Rotating Engineering Plan especially set up to give the veteran a period of familiarization and general orientation.

"The idea worked fine," Frank says. "Any department I was interested in was ready to open its doors for me so I could come in and look it over. When I found a groove that suited me, that's where I would stick."

Frank stayed in the orientation program from March till August, considering what type of engineering assignments most interested him and best suited his abilities. For his actual work during this period he went back to something familiar industrial control. He had worked in control before the war had, in fact, become head of the Control Test group. Now, in the circuit development laboratory of the Control Divisions, he renewed old memories.

He decided he wanted to be an application engineer. His work proved he was capable of it. On August 1, Frank Lewis took over a desk in G.E.'s big, brick office building in Schenectady and drew the first important assignment of his new career.

For your copy of "Careers in the Electrical Industry," write to Department 237-6, General Electric Company, Schenectady, N. Y.



To help pay his way through college, Frank worked summers installing G-E refrigerators in Spokane, Washington. He graduated in electrical engineering in 1939.

Critically injured in a plane crash, Frank spent two years in Army hospitals. He's now back with G.E., shaping up a career as an application engineer.

GENERAL ELECTRIC

the Illinois Technograph

November, 1947 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

There's a future for you in *Manufacturing* at Westinghouse

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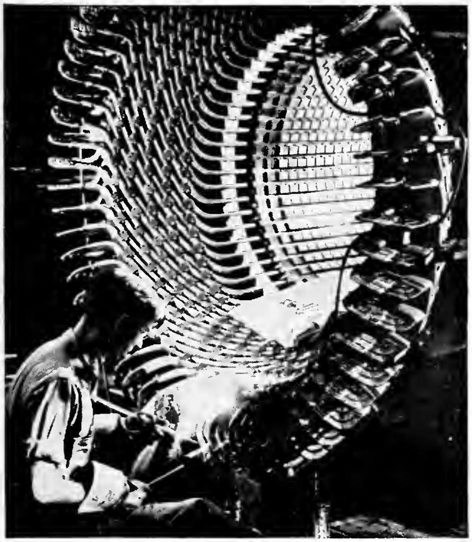

MANUFACTURING ENGINEERS . . .
to show production people how to turn out the product after it has been designed.

METHODS ENGINEERS . . .
to improve efficiency in methods of production.

PRODUCTION CONTROL ENGINEERS . . .
to get the right materials at the right place at the right time.

QUALITY CONTROL ENGINEERS . . .
to supervise inspection of materials and workmanship at every step in the process of manufacture, and help develop the highest standards.

TEST ENGINEERS . . .
to see that correct and uniform methods are applied in testing apparatus to assure compliance with the customer's specifications.

PLANT LAYOUT ENGINEERS . . .
to plan installation of new manufacturing facilities or revamping of the old.

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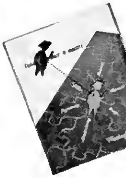

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New Developments

By John Dick, E.E. '49

New Vacuum Tube for High Altitudes

A new vacuum tube designed for use at altitudes up to 60,000 feet has been announced by Amperex Electronic Corporation. The development work was sponsored by the Air Material Command of the U. S. Army Air forces. The tube is especially important in control circuits of guided missiles.

The base of the tube, of glass, is tapered and ground to fit the socket like a glass bottle stopper. This construction keeps the air around the socket terminals at atmospheric pressure, even when it is used at high altitudes — an operating condition which frequently results in flash-over between the terminals.

The tube socket is the exact counterpart of the tubes, insofar as the taper is concerned. The taper angle is chosen large enough to avoid trapping of air when the tube is plugged into the socket. The socket is made of Mycalex, a bonded glass-mica composition, which will not carbonize in the event of an electrical breakdown. Mycalex is also impervious to moisture, retains its dimensions under extreme conditions of temperature, and can be molded to very close tolerances.

The original tube designed for the U. S. Army Air forces is a high-vacuum, half-wave rectifier rated at 14,000 volts peak inverse. It can deliver an average plate current of 125 ma and a peak plate current of 750 ma. Although rated at only 14,000 volts peak, this tube and socket combination will handle voltages as high as 35,000 volts peak.

This new design is applicable to all types of high-voltage vacuum tubes which may be subjected to similar high-altitude conditions. When used in areas which are strongly radioactive, tubes of this type will not break down externally due to ionizing action.

In addition it can be used in equipment which must be used in areas subject to strong radioactivity. Normally, the ionizing action caused by such radioactivity would limit the permissible operating voltage to a relatively low value — something less than the flash-over potential. With this glass-seal construction, however, the full rating of the tube may be safely used.

Chimes Without Bells

A new method of producing the sound of church bells by the use of a two-ounce Alnico permanent magnet made by General Electric company, has been devised by Liberty Carillons, Inc., of New York.

Designed to capture the inaudible vibration of the bell tones when they are created by the blow of a small metal

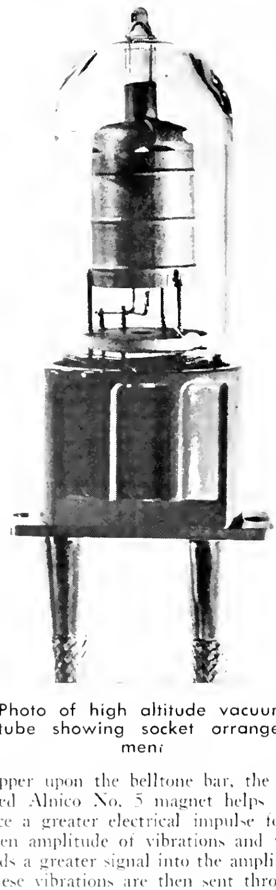


Photo of high altitude vacuum tube showing socket arrangement

clapper upon the belltone bar, the sintered Alnico No. 5 magnet helps produce a greater electrical impulse for a given amplitude of vibrations and thus feeds a greater signal into the amplifier. These vibrations are then sent through an extra high fidelity amplifier system from which they are transmitted to super-powered beltry stentors and then exploded with the realism of a great bell being struck.

The General Electric sub-assembly used, consists of an Alnico No. 5 permanent magnet one-eighth of an inch in diameter and five-eighths of an inch long, magnetized by approximately 50 turns of copper wire. This magnet is inserted in a nickel-plated brass tube and the tube filled with a plastic compound.

This sub-assembly, located just below the point of the blow of the metal clapper, lifts the initially inaudible vibrations from the tone bars and passes the electrical impulses along to the amplifiers. From 12 to 60 of these sub-assemblies are used, depending on the size of the instrument.

Ultra-High Speed Camera

A camera with a speed of one-millionth of a second, which produces a finished photographic projection within thirty seconds after the picture has been taken, has been developed by General Electric's General Engineering and Consulting laboratory at Schenectady, N. Y.

The camera, being two feet in length and one foot in height and depth, is not portable and is not intended for use by the camera fan. Fully automatic with the press of a button, it is part of equipment developed for the rapid testing, by means of electric power surges, of apparatus used in the generation and transmission of electric power. Such tests are made to determine insulation characteristics of new designs, and to make sure that equipment under production meets performance specifications.

Used in combination with a cathode-ray oscilloscope, the camera photographs the visual indication which appears on the screen when a surge of high voltage electric power is applied to the equipment under test. Since the total duration of the recorded voltage wave may be as short as one-millionth of a second, the camera speed must be equally fast.

As soon as the photograph is taken, the operator pushes a button, thereby setting into action the automatic developing equipment built into the camera. The development cycle is finished in 24 seconds, and the film is moved into another compartment in which a projector reproduces the negative, enlarged about ten times, upon a ground glass screen at one side of the camera. This picture gives the operator an accurate record of the performance of the equipment during the application of the surge.

It is pointed out that the time saved by the high speed camera is significant because of the large investment involved in the equipment being tested, the oscillograph, and the associated test set—a generator which produces surges up to 3,000,000 volts. With this new equipment, testing of electrical apparatus will be speeded up as much as ten times.

Photographic Film Shows Atomic Fission

The Eastman Kodak company announces that special photographic plates made in its laboratories are being used by scientists to picture actual atomic fission and to study action of highly charged nuclear particles.

These plates, recognized as valuable new tools for research in nuclear physics, are known as "nuclear track" plates from their special use in recording the paths of the particles.

The characteristics of the new plates are markedly different from those of ordinary photographic materials. The plates are super-sensitive to the electrical charges carried by atomic particles. At the same time they are relatively insensitive to light—which affects ordinary film—and to X-rays. The silver grains in the emulsions of the nuclear track plates are unusually close-packed. It is these silver grains, suspended in the gelatin emulsion, that are particularly sensitive to the charged particles.

When a highly charged particle speeds into the emulsion, a dotted line of affected silver grains is produced. These grains, when the plate is developed, make an identifiable track. From the length and curvature of the track and the grain spacing along it, information is obtained of the particles' speed, energy, and other characteristics. Thus it can be identified as a proton, alpha particle, or heavily charged nucleus.

Actual fission was recorded when one of the plates, first bathed in uranium nitrate, was exposed to slow neutrons from a radium-beryllium source. A neutron, striking a uranium atom in the emulsion, brought about the fission which was recorded on the plate as the track of two new atoms.

The new plates are designed to record tracks of individual nuclear particles, rather than to record density due to overall exposure to radioactivity. For this reason the especially fine grained emulsions not only give the characteristic track of a particle, but also make little record of the "background" radioactivity. Thus the track stands out clearly in the emulsion.

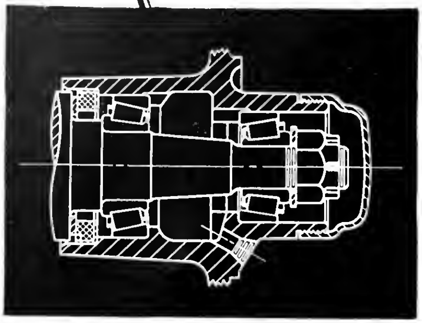
Special advantages of the nuclear track plates are that they are continuously sensitive and can record permanently isolated acts of particles over a period of time. They also provide for recording of a great deal of scientific data with a simple, inexpensive apparatus.

It is believed that a photographic plate that could perform all the functions of a cloud chamber, in addition to having the higher stopping power and the permanent record of the photographic emulsion, would make one of the most valuable aids to work of nuclear physicist.

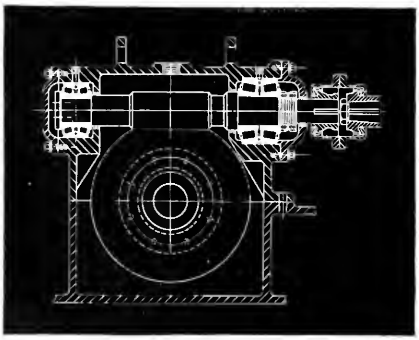
A wolf lounging in a New York hotel lobby perked up when an attractive young lady passed by. When his standard come-on, "how-de-do," brought nothing more than a frigid glance, he sarcasmed, "Pardon me, I thought you were my mother."

"I couldn't be," she iced. "I'm married."

What Every Student Engineer Should Know About Bearing Functions



TRACTOR FRONT WHEEL in which both thrust and radial loads are carried on single row Timken Bearings. From whichever way the load may come, it will be handled with minimum friction and wear.



APPLICATION of Timken Bearings on the worm shaft of a worm gear drive. The load on the worm shaft bearings, due to the operation of the worm, is primarily thrust. There is considerable radial load however, arising from the separating force of the gears and also possibly from overhung driving loads. This is another application for which the tapered roller bearing is ideal.

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Practically every bearing application in equipment of all kinds involves the carrying of radial and thrust loads in varying degrees. These drawings show how Timken Tapered Roller Bearings effectively perform both functions.

Because it is a *roller* bearing, the Timken Bearing can carry the heaviest loads. Because it is a *tapered* roller bearing it can carry both radial and thrust loads — separately or in any combination.

From whichever direction loads may come, its tapered design enables the Timken Bearing to carry them all with full efficiency and safety. The cost and complication of a separate type of bearing for each kind of load are eliminated. Bearing housings and mountings are simplified — with savings in cost, weight and space.

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THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

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The Illinois Technograph

Volume 63 **No. 2**

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

And still the construction continues. This time it's the new mechanical engineering laboratory on the corner of Green and Mathews streets.—Gene Robinson.

FRONTISPIECE

This startling edifice is the home of A. O. Smith's engineering and research departments at Milwaukee. Built over fifteen years ago, its ultra-modern lines defy time. (Courtesy of A. O. Smith Co.)

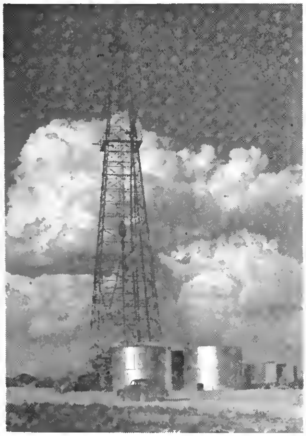
Vanishing Resources

By Don Hornbeck, Ch.E. '48

In this article will be found some rather startling revelations on the limitations of our supposedly unlimited natural resources. Easily read in a short time, the article points out several interesting facts with which every engineer, present and future, should bestir himself to become acquainted.

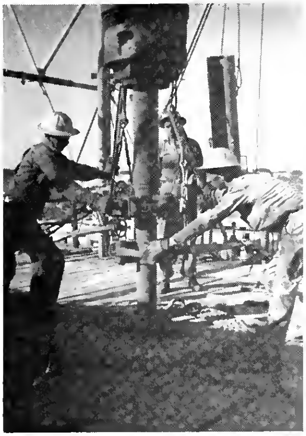
Our natural resources, once thought to be virtually inexhaustible, have become depleted to the extent that some of our most common metals, metals for which we may never find satisfactory substitutes, will run out within the lifetime of today's college student. The United States, great as was its pioneer mineral wealth, has had to import the bulk of its manganese, chromium, nickel, and tin supplies for years. Now, since the end of the recent war, we note with due concern that this war cost us large percentages of our waning mineral wealth, e.g., during the years of 1941-45, one-fourth of our present proved petroleum reserves, 20% of our commercial copper reserves, and more than one-fourth of the nation's lead and zinc were consumed. A total of five billion tons of American-mined minerals were thrown into the war effort.

Although a small fraction of the commercial iron reserve was consumed during the war years, we are now faced with having to mine ore of lesser quality; for experts are predicting that the Mesabi range, noted for its high-grade, low-cost ore, may begin to play out in another ten years—others predict that the red hematite of those mammoth surface mines of Duluth will be exhausted within 17 years. However, we have ample iron ore in other localities, probably more than enough for our needs. The total proved reserves will last through the year 2050, with an additional amount of lower-grade, but usable, ore sufficient to last 400 years beyond that date. Further, there are vast amounts of nearby Canadian ores which lie buried rather deep beneath the the ground, too deep for economical recovery at the present time.



This Shell Oil company derrick is the tallest in the world

Native copper supplies have been inadequate for several years, necessitating importation of one-half of the required ore. The Anaconda mines, mainstay of the home copper mining industry, are nearing the outer limits of their copper-producing veins; and no large discoveries are expected by the geologists. At the present rate of consumption of a million tons annually, our resources may last 33 years, or until about 1980. Since the U. S. has the greatest production and reserves of copper, lead, and zinc, it appears that our foreign sources may not be able to support American industry for any extended period of time.



Two "tong men" breaking the drill-stem joint to add another section on the stem

Lead and zinc mines have been worked quite completely—our remaining native supply being enough to last only about 11 and 18 years, respectively. As it is, the mines are down to producing about one-half of the quantity of ore that was produced twenty years ago. The most noticeable effect of the lead scarcity will be in the scarcity of good paint, lower quality gasoline, and in the higher prices of household goods.

Many metals have been largely imported for many years. U. S. mines furnish only slightly more than one-half of our aluminum, cadmium, mercury, and potash, and somewhat less than half of our antimony, manganese, asbestos, mica, platinum, and tungsten needs. For years we have imported nearly all of our tin, nickel, chromium, graphite, industrial diamonds, and quartz. In less than 20 years, our native supplies of nearly 20 essential minerals will be exhausted.

Since sulfur is one of the most abundant of our adequate non-metallic resources, agriculture will not want for sulfate fertilizers. The agricultural wealth is probably the only resource of a nation capable of being increased. With sulfate and phosphate fertilizers available, a vast supply of potash available in New Mexico, nitrates being made synthetically, and with improved erosion control methods and greater knowledge concerning optimum care of soil through crop rotation and fertilizer application, the overall fertility of the nation's food-producing medium is slowly increasing.

In the days of the early pioneer settlers, 800 million acres of this country's 1,903 million acres were covered by forests, containing 4,760 billion board feet of lumber. Today, 630 million acres of woodlands remain, 460 million acres being of a commercial nature. At present there is an annual cut of 48 billion board feet, this amount exceeding the annual growth by 16 billion. Most of this depletion is in the Northwest forests of softwoods. In the Northeast, the growth equals the small annual cut. With efficient management, this country could have lumber sufficient to meet its needs.

The future of our natural fuel supply is somewhat brighter. While our 20 billion barrels of petroleum may not last much beyond 1975, we will not want for gasolines and oils since we have ample coal, from which they can be made synthetically. Last December, the U.S. Bureau of Mines predicted an average daily consumption of 5,500,000 barrels of petroleum products. In April, the

(Continued on Page 22)

Mining and Metallurgy Opportunities Unlimited

By Ralph Lending, E.E. '48 and Francis Green, E.E. '48

In the far northeastern part of our campus lies the department of mining and metallurgical engineering. The department was originally created in 1867 and consequently is one of the oldest departments in the University. It was discontinued in 1893 due to lack of interest among the student body, but was re-created in 1908 because of the necessity for having a scientific study of mining and men able to conduct this study. Although originally only mining was taught, in 1934 metallurgy became a part of the department, and eventually the major part of it.

Perhaps because you tinkered with old automobiles, you decided to become a mechanical engineer; or perhaps you built radios and decided to become an electrical engineer, but there is no such attraction to the field of metallurgy. You see a cake pan or perhaps a car gear and accept them. The composition of the material, its hardness, and other properties are extremely important to our present day civilization and our progress, and yet we have too few men entering this very important field.

The present head of the department, Professor H. L. Walker, has been very active in this field and has a nationwide reputation. At the moment he is the active head of the Illinois State Department of Mines.

During the war many firms had contracts with the government for armor piercing projectiles. The specifications required that so many inches of steel of a certain grade be pierced by these projectiles. Several of the firms had difficulty in filling the specifications required by the government. In order to obtain the required quality of production, Professor Walker was called in as a consultant by these firms; and with his aid and advice they were able to pass the war department specifications for armor piercing projectiles that they were manufacturing. The job of the metallurgist during the war was extremely important in enabling our government to outproduce and outfight the enemy. Professor Walker went to Germany in 1945 to evaluate the German metallurgical research and developments for our government. He reported that the visit was most disappointing in that the Germans had produced nothing which could be of value to American industry, and as a whole they seemed to be far behind us in their metallurgical work.

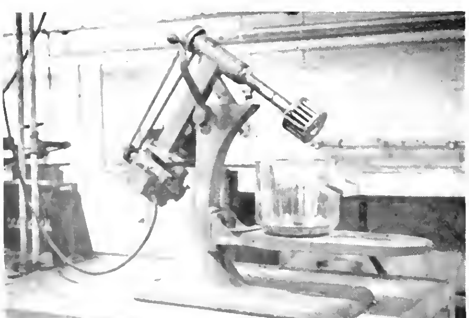
Research on Quenching Agents

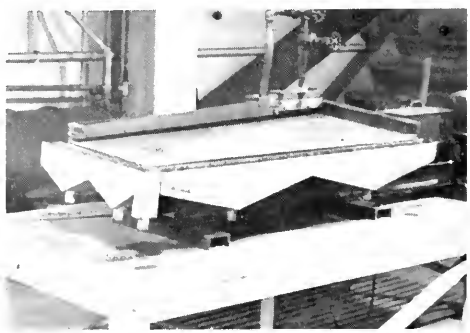
The metallurgical department is now working on a study of quenching agents for steels. When metals are heated to a high temperature and then cooled abruptly, their outer surface is hardened. The department is now studying the differences among oils, and the effects of the different oils on the hardenability of steel. The study of why brine cools faster than water, and other similar effects observed in the quenchant test could be of great importance to the field of metallurgy as well as to the entire field of engineering. The department hopes that from their work they will gain a better understanding of quenchants and that they will be able to use them more effectively.

Among the projects of the department is the determination of the Austenite grain size of steel, as it fixes the physical tire steel industry and thus the entire Austenite grains are formed when the

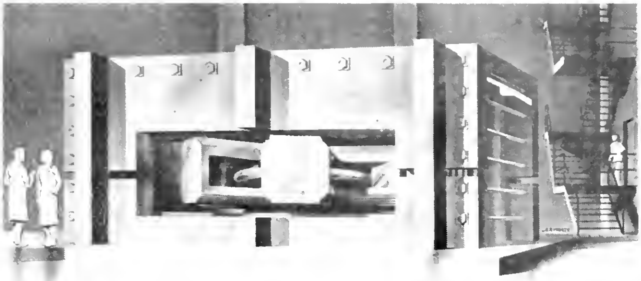
(Continued on Page 34)

In this day and age of high-powered electronics and atomic bombs the average student regards the subjects of mining and metallurgy with something only slightly more than disinterest. For those students, and also students who are as yet undecided on the type of work they want, this article is strongly recommended. It deals with several of the more salient features in the two fields of work and clearly points out that the romance of research and development is by no means restricted to nuclear fission.





Left: Flotation separator used to segregate ore by agitation. Right: Wilfley shaker table used for gravitational separation of ores



THE BETATRON *Reviews and Previews*

From A. R. Wildhagen

Although the betatron and its inventor, Professor Donald Kerst of the University of Illinois, have been given much space in these pages, the Technograph presents this article on the new 300,000,000 volt betatron which will be housed in the recently completed betatron laboratory on the south campus. Along with a description of the new machine, the article also includes a resume of what has been accomplished to date as well as a discussion on future prospects.

Professor Donald W. Kerst of the University of Illinois built and put the world's first betatron into operation at the University July 15, 1940. Since that time rapid progress in design and development and extensive application has been made of the machine that accelerates electrons by use of a magnetic field.

In making the betatron, Professor Kerst succeeded where scientists of both America and Europe had failed. He conceived his successful idea when only 27 years old. A commercial laboratory turned it down.

The University of Illinois gave its young physicist encouragement and support. He spent one year designing the instrument; and a second year building it. It worked at the first application of power.

From the beginning, Dr. Kerst foresaw three uses for the betatron:

1—For industry, a powerful source of x-rays of 20- to 30-million volts energy.

2—For medicine, a source of x-rays or of a beam of free electrons at 20- to 35-million volts energy to be used against cancer.

3—For science, a powerful source of x-rays or of free electrons, with precision control, and with energies going well beyond the 250-million volts range necessary to produce cosmic ray phenomena.

The industrial promise of the betatron was brought to success during the war, in the secret development by scientists of the University and engineers of the Allis-Chalmers Manufacturing company of a 20-million volt industrial betatron used for x-ray purposes in arsenals.

The medical application, held up by war work, came closer to realization in July, 1946, when University of Illinois scientists brought a beam of free electrons out of the University's 22-million volt betatron. This promises spectacular value for cancer treatment but the forces involved are so powerful and little-known that three to five years of careful laboratory study must precede any clinical use of this device on patients.

The scientific application is the greatest of all, giving opportunity to study the inside of the atom, the behavior of electrons, artificial radioactivity, and the mysteries of the cosmic ray.

New Betatron Laboratory

The University of Illinois is now building a betatron of 300-million volts energy which will open entirely new doors to science by producing cosmic rays in the laboratory. The new betatron will be 23 feet long, 13 feet high, and 6½ feet thick. The hollow "donut" vacuum tube in which electrons will be accelerated to the speed of light will be 9 feet in diameter. The instrument will weigh more than 400 tons.

A new research laboratory in which it and the University's other smaller betatrons are housed has been built on south campus. A special appropriation of $1,500,000 was provided for the building, the new instrument, and associated equipment.

Professor Kerst is heading work on the new 300-million volt machine. His first betatron had an output of 2½-million volts. A second betatron, having an output of 20-million volts, was completed in 1941. Now increased to 22-million volts, it is the prototype of commercial betatrons being built for industrial x-ray use.

A 70-million volt betatron is under construction as "pilot model" to try out new ideas for the big machine. The University also was the scene of wartime development of a 4-million volt, portable "baby betatron."

All of these instruments are housed in

(Continued on Page 28)

Development of the Betatron

Year Developed	1940	1944	1947
Power in volts	2½-million	22-million	300-million
Size: Length	19 inches	5 feet	23 feet
Height	10 inches	3 feet	13 feet
Thickness	8 inches	2 feet	6¼ feet
Weight	200 pounds	4 tons	400 tons
Diameter of vacuum tube	8 inches	19 inches	9 feet
Electrons travel	60 miles	250 miles	700 miles
Power consumption	5 kw	30 kw	150 kw

Industrial Sightseeing . . . A. O. Smith Company

From GIBB ALLEN, Publicity Director

In this article the Technograph presents the second in a series designed to stimulate in the student an active thinking on the subject of employment and work. Although last month's article dealt quantitatively with the subject of job-seeking, this is the first to cover a specific company. The companies which have been selected for this series were picked with a view towards variety not only in location throughout the state, but also in type of work offered.

A $5,000,000 postwar industrial plant is in full swing these days at Kankakee, Ill., turning out approximately 1,500 water heaters daily and giving employment to more than 1,500 persons. Less than two years ago the site of this new industry was a cornfield a mile south of the city on Highway 49.

The heaters are one of the postwar products of the A. O. Smith Corp., of Milwaukee, Wis. They are distinguished from other water heaters by an inner lining of tough glass which is fused to steel. A container is thus formed which is practically impervious to the corrosive effect of hot water and in which the water cannot be contaminated by rust or any other impurity.

The company is nearly 75 years old. It has branch plants in Houston, Texas, and Los Angeles, Calif., and it has district administrators in New York, Chicago, Atlanta, Houston, Los Angeles and Seattle. It also has an International division which supervises foreign sales.

A. O. Smith's primary functions are the fabricating and welding of steel products. The latter include pressed steel automobile frames, of which the company was the pioneer manufacturer; large diameter welded steel pipe for the transmission of petroleum products and natural gas; pressure vessels for the oil refining, chemical and paper industries; domestic coal stokers; glass-lined beverage storage tanks; and welding electrodes and equipment. The company did about $60,000,000 of business in 1946.

Growth of an Idea

The story of how the company got into the water heater business will be of particular interest to students of the University of Illinois. In the late 1920's A. O. Smith was seeking a new way to protect steel pipe against corrosion. The search led into the field of ceramics and a method was evolved of literally fusing a very thin coating of true glass onto steel. It was not worked out, however, until much consulting had been done with Dr. Andrew I. Andrews, head of the ceramics department at the College of Engineering, University of Illinois. Dr. Andrews' assistance was of incalculable value and he is still active in the work which the company's Ceramics Research department is doing. The ceramics department is now headed by Wayne A. Deringer, who graduated from Illinois in 1932. Other Illinois men who are on his staff include A. C. Barzdukas '40; M. K. Blanchard '38 (Ph.D. in 1942); L. K. Breeze '40; O. E. Mulvane '28; E. P. Murphy, jr. '44.

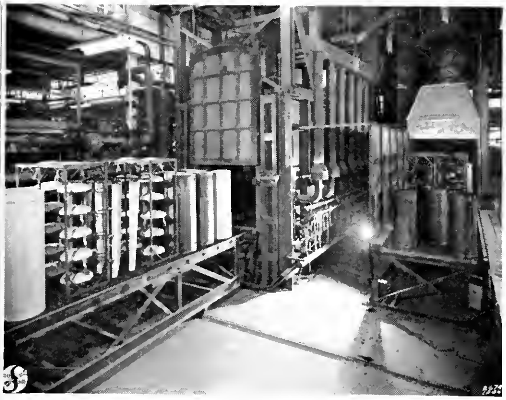
After the glass-fused-to-steel method was perfected, the company began to seek other uses for it. One of the first successful applications was the glass-lining of large steel tanks for storing beer. In the late 30's the company's research engineers turned their attention to domestic water heaters and by 1940 the company was ready to enter the field on an extensive basis. The plans were interrupted by the war, although the government asked the company to manufacture a limited number through the war years. When V-J day came, however, plans were already well formulated for an intensive effort in the water heater field.

A water heater has been described laconically as one tin can inside another with insulation between the two. And that described with some accuracy the methods used by a good many small manufacturers of heaters. It is a far cry, however, from the research, engineering and quality control that has gone into the making of the heaters in the new Kankakee plant.

A steel especially adapted to the glass-fusing process is used for the inner tank of the heater. It is rolled into a cylinder and automatically flash welded. The cylinder, and the stamped out top and bottom heads and flues, are sprayed or slushed with finely ground glass mixed in water and clay. The parts go into a furnace especially designed for the job. These furnaces are the result of the combined work of mechanical, ceramics, electrical and metallurgical engineers. The furnaces combine such features as roller hearth, radiant heating and atmosphere control and, through an intricate electrical control system, are virtually automatic in operation.

After going through the furnace, the inner cylinder and parts move to an automatic welding operation where top and bottom heads and flues are welded

Kankakee Plant of A. O. Smith Company



Left: Heat treating furnace used for sealing glass liners to the metal case. Right: View of the overhead conveyor system for moving parts through the plant

into position. The resulting assembly is then tested under 300 pounds air pressure and is then ready for final assembly.

Meanwhile the other parts of the heater, outer shell, skirts, tops, etc., have gone through a bonderising operation and spray painting, and move to the assembly line on overhead conveyors. Final assembly consists of six lines which give flexibility in assembling various types and sizes of heaters at the same time. All unloading of raw materials and loading of finished heaters is done inside the plant.

Plant Located for Efficiency

So much for the process. Why did A. O. Smith pick Kankakee? The company approached that problem from an engineering standpoint. Every move was directed toward the most efficient plant of its kind in the world. When the plant was thrown open for inspection early in 1947, the event was covered by Life magazine. In its issue of last Feb. 3, Life described the plant as "the most efficient factory of its kind in the world.

But the manufacture and sale of water heaters entail more than an efficient plant and process. The flow of raw materials to the plant must be constant and as economical as possible. Shipment of finished heaters must be flexible and fast. So the company sought a location which would be as close as feasible to the principle raw material, steel. Kankakakee satisfied that requirement. Rail facilities were important. Kankakee is served by both the Illinois Central and the Big Four. Good highways would mean the opportunity of using trucks. Kankakee is on Highways 45, 49 and 54. The State of Illinois has developed plans for a superhighway which will run within 800 yards of the plant.

Efficient operation would depend also on a labor market of sufficient size and stability. This tended to rule out large cities where the demand for labor was high. Kankakee, however, is in the center of a large farming community. It is at least 50 miles from a city of any size. The area is stable and well equipped with good roads, so that the plant would be able to draw on a wide area for employes. The problem of so-called "transient" labor would be reduced to a minimum in such an area.

Stable Area Promotes Opportunity

In considering the stability of Kankakee, A. O. Smith engineers took a long look at the character of the city itself. What did they find? Here was a community of 22,000 people, the great majority of whom owned their own homes. The engineers noted the neatness of the homes and the way yards and shrubbery were tended. They found a very low crime rate. They counted the number of churches and took a look at the Kankakee country club. They visited other manufacturing plants in the city—Florence Stove Co., Bear Brand Hosiery, Bradley Manufacturing Co., and others. They found an alert Chamber of Commerce whose members were actively promoting the welfare of Kankakee. The city has a daily newspaper and its own radio station. Here was a community that was alert. The judgment of the engineers was vindicated recently by figures showing that there is more home building per capita in Kankakee right now than in any other city in Illinois.

To the young engineer this new plant offers many interesting opportunities and challenges. It is a new staff of young men that has put together the present organization and that is engaged now in perfecting all its details. It offers opportunities to the chemical engineer and to the engineer in the fields of electricity, mechanics, metallurgy and welding. Its present engineering staff number about 30 people. There are also opportunities for the engineer in the various manufacturing departments themselves, and in the elaborate quality control organization that has been set up. Incidentally, quality control at the plant is under the direction of another University of Illinois engineering graduate, Waldo W. Higgins '30. The manager of the plant is Harold F. Detrick.

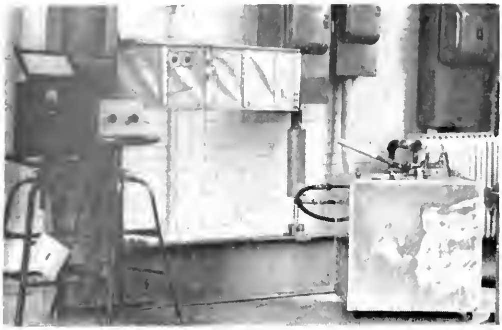
Of further interest, perhaps, is the fact that back of this plant is an organization with a profound conviction that the principles of engineering provide the most intelligent approach to the solution of any problem, mechanical or human. Indeed, it was once said of A. O. Smith that its principle "product" was engineering. Automobile frames, steel pipe, pressure vessels, water heaters, these were simply by-products. It was not by chance that A. O. Smith, when it built a "home" for its engineering staff in Milwaukee, spent more than $2,000,000 on a glass and steel seven-story structure that has no counterpart anywhere. It was built more than 15 years ago, but the startling beauty of its clean straight lines still evokes expressions of awe and admiration from visitors.

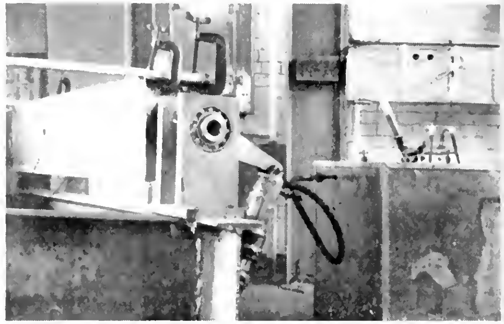
Upper-classmen may not be distinguishable from each other, that is, sophomores, juniors, and seniors all fill the same mold—but you can always tell a freshman. (Although you can't tell him much).

* * *

Mother (After delivering a long talk on waywardness to her daughter): "Now tell me, Mary, where do bad little girls go?"

Mary (Winsomely): "Everywhere."





Left: Tension beam under stress showing electrical strain indicating potches in position. Right: Torque box showing hydraulic pump and jack used to apply stress

New Laboratories for the . . .

Aeronautical Engineering Department

By Don Johnson, E.E. '49

Housed in the old railroad shops just north of the Mining and Metallurgy building is the new Aeronautical Engineering Laboratory which is the topic of this article. Besides discussing several types of experiments handled in this laboratory, the article also deals with the prospective modifications for the aircraft engines laboratory which is located at the University airport.

The aeronautical engineering department has, figuratively speaking, found its "sugar daddy." With the surplus aircraft equipment offered at bargain basement prices by the War Assets Administration, the department, under the direction of Professor Stillwell, has set out on a large program of improvements.

In the structures laboratory with Professor F. R. Steinbacher in charge, the most striking addition is a large piece of equipment which resembles a structural steel guillotine. It is a drop-test rig for the dynamic testing of landing gears. It consists of a large frame on which the landing gears with attached weights may be raised for a drop of about five feet. To accurately determine the position of the landing gear at any instant of time during the drop, a motion picture is taken of its fall. This camera, which is now being constructed in the laboratory, consists essentially of a rotating drum around which is attached the film. A timed shutter permits light to enter the camera and thereby expose the film at predetermined time intervals. Small lights attached to the landing gear provide the necessary light source to expose the film. The exposed film then provides a space-time record of the drop test from which velocities and accelerations which occurred during the drop may be determined graphically. A dark room has been constructed in the structures laboratory to process the film.

Although the drop test rig and most of the camera parts have been constructed in the laboratory from new materials, the landing gear, the quick release mechanism on the drop test rig, and the device for hoisting the gear and its attached weights were all obtained from surplus property.

In the structures laboratory there are several test beams designed to provide laboratory demonstration of lecture courses. One example of these test units is a cantilever aluminum tension-field beam. The load is applied to the free end of the beam by means of a hydraulic cylinder. Strains at various points on the beam are determined by means of electric strain gages. From these strains the stresses in the beam may be calculated.

Another example of these sample test structures is represented by a torque box constructed of various thicknesses of aluminum alloy sheet. The box is rectangular in cross section and each one of the four sides has a different thickness of aluminum sheet. A hydraulic cylinder applies a torsional load to the box and strains in the box are obtained through the use of electric strain gages. Last semester, in an experiment conducted by members of one of the classes, it was found that the torque box with cross sectional dimensions of 8 7/16" by 11" was thirty times as strong in torsion as a 12" structural steel I-beam, even though the weight of the torque box is only a fraction of that of the I-beam. The students could hardly believe that the torque box was not filled with steel reinforcing.

Electronic Test Apparatus

Electronic equipment for the measurement of vibration in aircraft structures has recently been purchased by the aeronautical department. This equipment provides for picking up vibrations by means of a piezoelectric crystal pickup. The excitation is amplified and finally recorded on cathode-ray oscilloscope where it can either be photographed with a high speed motion picture camera or read directly from the oscilloscope screen.

This same apparatus, with only minor modifications, may be adapted for the purpose of determining pressures in internal combustion engine cylinders or the combustion chambers of various jet engines. Consequently, the equipment will be used for both the structures and power plant laboratories.

A new test designed to apply a large number of concentrated loads along the span and across the chord of the stabilizer is being prepared for student laboratory instruction, using the stabilizer and elevator assembly of a Japanese fighter airplane. These loads are produced by a lever system which is actuated by a hydraulic cylinder. Since the loads must be applied to an aluminum skin covering the stabilizer, a tension patch which is glued to the skin has been developed. This tension patch consists of a thick rubber plate glued to the skin on one side and to a steel plate on the other side. A bicycle spoke is attached to the steel plate on one end and to the load applying lever system on the other end.

Aircraft Engines

In the power plant laboratory, under the direction of Prof. R. W. McCloy, several new facilities are being constructed. A torque type test stand for reciprocating engines is being installed at the University Airport. This type of test stand is to be used for both performance testing of complete aircraft engines and for research on individual components of reciprocating engines.

In order to study the design and operational characteristics of jet engine combustion chambers, a boot-strap unit is being constructed in the laboratory. It consists essentially of a General Electric CH-5 turbo supercharger which supplies the compressed air to support combustion in the combustion chamber. This unit provides only sufficient power to run itself. A duct system from the supercharger leads into the combustion chamber and the exhaust gases are then returned to the turbine side of the turbo-supercharger thus driving the turbine and thereby turning the centrifugal supercharger to provide the compressed air required for combustion. The unit is designed so that various sizes and types of combustion chambers may be installed and tests may be run under controlled conditions.

The New Airport Wind Tunnel

The largest laboratory development project in the department at the present time is the planning of an airflow laboratory at the University Airport. A 40′ by 120′ building has been erected at the airport for the purpose of housing the equipment for this laboratory.

Although all plans for the equipment are still in the tentative stage, the units will consist of essentially the following items:

A supersonic wind tunnel is to be constructed which will have a velocity in the test section of approximately four times the speed of sound. At sea level atmospheric conditions, this is approximately 3000 miles per hour as contrasted with a velocity of 130 miles per hour in the present subsonic wind tunnel. The cross-sectional area of the test section of the supersonic wind tunnel will be approximately one-half a square foot. Optical methods for studying the flow of air over models are being planned.

In addition to the wind tunnel test section the high-velocity supply can be diverted to provide for testing combustion chambers for turbo and ram jets. Compressed air to start the models will be provided through a supply line running the length of the building. The combustion chamber inlets branch from this supply line and the outlets are connected to an exhaust line which will run the full length of the opposite side of the building. Thus the products of combustion are vented from the combustion chamber through an exhaust line where they are cooled and expelled from the building. In addition to tests of combustion chambers under controlled conditions, these facilities will provide hot exhaust gases which may be used for turbine testing and for thermal shock tests.

According to present calculations approximately 20 pounds of air per second at a pressure of 140 pounds per square inch will be required from the compressors. A number of different methods for developing compressors which will provide this performance is being considered. One system, which has met the interest of both military and civilian groups, consists of compressors and driving engines which may be constructed entirely from surplus aircraft equipment. This system makes use of a surplus Pratt & Whitney R-2800 aircraft engine. The engine could be converted from a four-stroke cycle to a two-stroke cycle engine by means of changing the valve timing. This engine would then act as a compressor and power would be provided by a surplus Allison V-1710 or a Rolls Royce Merlin. Air at atmospheric pressure would be taken into the gear-driven supercharger of the R-2800 where the pressure would be increased to two atmospheres. It then enters the cylinders of the R-2800 engine where it would be further compressed to 10 atmospheres. Three such units of this type when paralleled into one system will provide the quantity and pressure of air required.

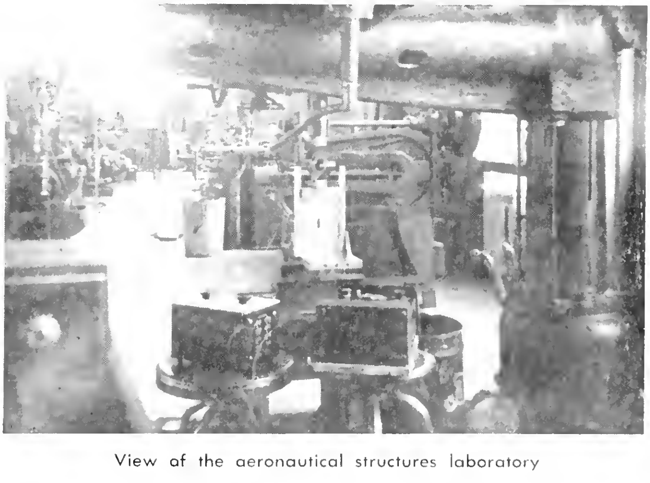
Due to the complexity of the mechanical conversion of the engines, studies are now being made to convert the centrifugal compressors from surplus General Electric I-16 turbo-jet engines to provide the air required. However, in the present stage of the design studies, the R-2800 conversions appear the most promising.

The purpose of this new laboratory is three-fold. It is primarily for educational use in undergraduate and graduate courses. However, since the main items of equipment will be developed from surplus property and the cost will be held to a minimum, it is considered that the laboratory may provide for a pattern for the development of low cost laboratories for other universities requiring relatively large quantities of compressed air. A third purpose of the laboratory will be to conduct experimental investigations relating to research projects being undertaken by the department.

A portion of the building will be occupied by the chemical engineering department for projects they are undertaking in fields which are related to fluid mechanics. It is Professor Stillwell's opinion that if the laboratory can be developed along the lines now planned, there will be several departments in the College of Engineering which will find use for the facilities.

DAFFYNITION

A burlesque show—a stage production in which the actresses assume that everybody is from Missouri.



View of the aeronautical structures laboratory

Grandad of Powder Metallurgy . . . Cemented Carbides

from James R. Longwell

Director of Research and Engineering, Carboloy Co.

Although "synthetic" metals have played an important part in engineering in the past, there is one particular group which promises to play an increasingly important role in the future. This group, unique in many ways, is the super-hard "carbide metals." They are true synthetic metals, being unlike anything that occurs in nature. They are twice as stiff as steel, nearly as hard as the diamond, and under ordinary conditions it is almost impossible to wear them out. Some of them are also heavier than lead.

In addition, these carbide metals, being produced by powder metallurgy, possess all the advantages to be derived from this form of fabrication. They have an unusual degree of purity, there is little waste in their manufacture, and their composition of different grades can easily be controlled.

Even though most of their uses are new, metal carbides, of course, are not. In fact it was in 1896 that a French chemist — Henri Moissan — quite accidentally produced particles of hard tungsten carbide while trying to create a temperature equal to that of the sun in his newly invented electric furnace. Moissan tossed aside the hard carbide particles as worthless and grieved because he had not equalled the temperature of the sun.

The first commercial use of tungsten carbide came during World War I when the hard-pressed German industry hit upon the idea of "cementing" together the individual particles. The resultant blocks of solid metal were used as substitutes for the diamond dies so badly needed at that time for drawing filament wire to be used in electric lights.

About a decade after World War I large bars of solid cemented carbide were imported into the United States. A few manufacturers tried to make cutting tools out of the metal, but the carbide was so hard and difficult to work that applications were extremely limited. In fact, the results were heart-breaking to those who had expected much from these super-hard metals. It was not until 1928 when the engineers of the Carboloy company hit upon the idea of forming the metal in smaller pieces, close to the exact shape required, that carbides became commercially practical in the cutting tool field. Today it is estimated that carbide tools are used for substantial part of all metal removal.

Process of Manufacture

The basic ingredient of "cemented" carbide is tungsten carbide. Supplementary ingredients, titanium and tantalum, are added when it is desired to provide additional basic properties. The tungsten carbide is prepared by firing a mixture of pure tungsten powder and lampblack

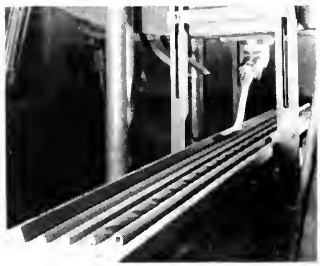


Photo showing the different shapes of cemented carbide parts produced by extrusion

at a temperature of 2500° to 2700° F. Tantalum and titanium carbides are prepared by heating the oxides of those elements with carbon at even higher temperatures. These carbides are then mixed with a relatively soft binder material which is usually cobalt. The resultant powder may then be formed into the desired shape by either cold pressing, hot pressing, or extrusion.

In the cold pressing process, the powder is packed into a mold and "pre-shaped" pieces of flat, round, or cylindrical shape are formed on automatic pill presses. In this same way flat, round, and cylindrical "ingots" are also formed. These ingots can later be converted into their final shapes.

The pre-shaped pieces of carbide are pre-heated at a relatively low temperature and then given a final heat treatment (sintered) at 2650° F. A neutral or reducing atmosphere, usually hydrogen, is used in this process to prevent decarborization. Sintering causes the product to become a coherent, solid mass although the temperature used is below the actual fusion point of the material. The cobalt, however, flows to fill in the cavities between the carbide particles; and when the piece cools, the cobalt freezes in this new position and cements the hard tungsten carbide particles together. Blanks will shrink as much as 40% in volume during sintering. The density of pre-sintered material is about 9; that of the finished product runs as high as 15.

Ingots and slabs of carbide from which special shapes will later be formed are pre-sintered to give the ingots sufficient strength to be machined. The special, machined shapes are then finish-hardened by sintering.

In recent years there has been steady progress towards hot-pressing the powder compacts to replace the cold-pressing and sintering operations. Hot-pressing incorporates into one, single operation the three separate operations of cold-pressing-pressing, pre-sintering, and sintering.

The hot-pressing method is used for long, thin, or hollow pieces and also for pieces which are too large to be accommodated in existing sintering furnaces. In the hot-pressing process the powder is placed in an enclosed mold which is usually made of graphite-base composition. The mold and its contents are heated to sintering temperature while sufficient pressure is exerted simultaneously to properly form the piece.

Finally, the extrusion method is used mainly for forming standard round, square, or special shaped rods. Several varieties of rod and tubular section can and have been made in this way. Extruded, solid rods are used extensively for small, solid, precision boring tools and "wear" parts.

Structure and Grades of Carbides

The hard carbide metal produced by any of these processes is a "cemented" material in the strictest sense of the word. Its composition is characterized by a granular structure in which the finely divided particles of carbide are held in a matrix of the relatively softer and less refractory binder material. The structure of the material, therefore, is somewhat comparable to that of a brick wall. The particles of tungsten, tantalum and titanium carbide comprise the bricks while the cobalt, or other binder material, can be compared to the cement which holds the bricks firmly in place.

To best meet the widely varying conditions under which carbides are being employed, the cemented carbide is manufactured by the Carboloy company in variety of different "grades." Each of these grades possesses a distinctive combination of hardness, toughness, abrasion resistance, and other characteristics.

Properties of Cemented Carbides

Although powder metals as a class usually suffer from such disadvantages as relatively low tensile and impact strength, this is not true of the carbide powder metals. Carbide powder metals offer physical properties—such as high hardness at elevated temperatures and high mechanical strength—that are in many ways superior to those obtainable from any other materials regardless of the method of its manufacture.

The hardness of the carbide metals at room temperature makes them stand apart from all other currently available engineering metals, since carbides are the hardest metals commercially available. The hardness of carbide metals surpasses that of such abrasive grains as aluminum oxide, and in some cases may even equal the hardness of silicon carbide.

As a result, the carbides possess extreme resistance to penetration and scratching. Commercial grades of Carboloy cemented carbide have a Rockwell hardness (read on the "C" scale with a lighter load) of 85-93. The material retains a high degree of its hardness when at red heat. When cooled again, the material should be just as hard as before heating. Carbides are far superior to any other known metal in these respects. They may be heated and cooled repeatedly without any appreciable loss in hardness. When heated to 1550° F., carbides are still as hard as high carbon tool steel is at 650° F., and as high speed steel is at only 825° F. These characteristics are largely responsible for the effectiveness with which carbide tools cut metals at high speeds.

Cemented tungsten carbides possess a modulus of elasticity more than double that of steel, ranging upwards from about 73,000,000 psi. This compares with a modulus of around 30,000,000 psi for tool steel. The strength of tungsten carbide depends to quite an extent on the amount of cobalt used as a binder. The average grade of carbide metal, however, has a tensile strength which is in excess of that required for most normal operations, being about one-half that possessed by tempered tool steel. In addition, the carbides have a compressive strength which is materially greater than the compressive strength of a good grade of heat treated alloy steel.

Dealing with one of the most important applications of powder metallurgy, this article on cemented carbides is so interesting and timely that the Technograph has departed from its usual custom of student written articles to include it in this month's presentation. The editor wishes to thank the Carboloy company for the material and illustrations for this article.

Despite the fact that the structure of the hard metal carbides is that of powder metals, parts made of this material easily can be ground and lapped to a surface smoothness of 1/2 micro-inch (1/80,000 of an inch).

Extreme degree of resistance to wear is possessed by cemented carbides whether the wear is caused by rubbing or friction or by the abrading and gouging action of grit and other abrasives. This quality is indicated by the comparative shot blast tests in which steel shot No. 72 at 100 pounds pressure was directed at five test bars of different materials.

Inasmuch as great hardness is generally associated with weakness and brittleness, it is not unnatural to assume that cemented carbides might possibly have a relatively low impact resistance. Repeated tests and applications have demonstrated, however, that the impact resistance of carbides is higher than is commonly believed. The highly successful use of carbides for blanking and punching dies and punches attests to their ability to resist impact.

The rate of thermal expansion of carbide metal averages about one-half the amount of the expansion of steel in the range of 20° C. to 700° C.

The density of a cemented carbide varies with its composition inasmuch as both tungsten and tantalum carbides are much heavier than the binders generally used. This a typical cemented carbide containing 20% of cobalt binder and the remainder tungsten carbide shows an average density of 13.55. A carbide having, say, 3% cobalt binder and 97% tungsten carbide has an average density of 15.25.

All magnetic properties possessed by carbides are due entirely to the presence of the cobalt binder, hence carbides are magnetic to only a very slight degree.

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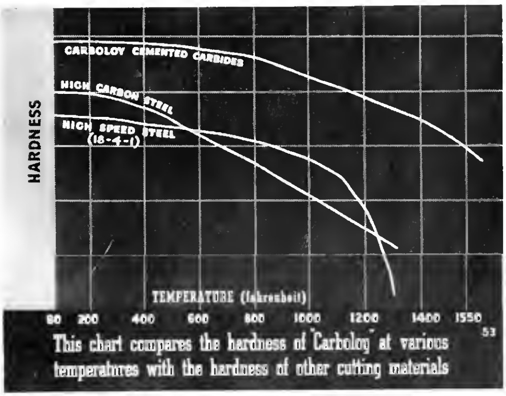

Left: Formation of carbide parts by hot pressing, a single operation which combines the three distinct processes of pressing, pre-sintering, and sintering. Right: A chart showing the relative hardness of three common tool materials as a function of temperature

Introducing . . .

By John Shurtleff

JACQUE HAUSER

A newcomer in the aeronautical engineering department is Professor Jacque Hauser, who arrived at the University of Illinois this summer. Introductions are in order, and perhaps this interview will serve the purpose.

"I received my B.S. from the Alabama Polytechnic Institute in 1941," he began with an unmistakeable drawl. In fact, during the interview he was called to the telephone and did not appear again for some length of time. Finally returning, he explained that his relatives had called from Alabama to inform him that they had weathered the hurricane without too much trouble. "It was necessary to talk to all of my relatives from the biggest to the smallest; and since I have quite a few, it required a little time," he apologized.

After graduating from A.P.I., he went on to the University of Michigan to receive his M.S. in 1943. He stayed at Michigan for two more years in a teaching position.

For the next two years he was employed by the Boeing Aircraft company in Seattle, Washington. The first fifteen months were spent as an assistant group leader. His job was to do the paper work and write reports on the performance tests of such planes as the stratocruiser, the B-50, the B-29, and the C-97. He worked for the other nine months in aerodynamics research on boundary air control and supersonics.

He then accepted his present position at the University of Illinois. Aero. E. 1,

(Continued on Page 26)

JACQUE HAUSER

JIM MATT

Jim Matt, senior in E.E., has his eyes set on next February. That's the date when he hopes to have his degree. A little older than most students, Jim long ago recognized the value of a college education and is looking forward to his work after graduating.

But let's start at the beginning. As Jim puts it, "I was born back in the stone ages . . . October 10, 1915, to be exact." Until he was nine years old he lived in La Crosse, Wisconsin, and then moved to Chicago, which he names as his official home town.

He attended Morton high school in Cicero, Illinois. After school hours he worked as a printer's devil and spent the rest of his time with dramatics, football, and radio club.

Graduating from high school, Jim went into the radio business. He was married in September, 1940, and then deciding upon a college education, he entered the University of Chicago in October of 1941.

Then in May, 1942, he enlisted in the Signal Corps and went into an electronics training group at Northwestern university. His training continued at Camp Crowder and was finished in O.C.S. at Fort Monmouth, N. J., where he received his commission.

Released from service on June 14, 1946, he was back in school again two weeks later, this time at the University of Illinois, to continue his course in electrical engineering. At the present time he is engaged in work on research of high frequency equipment under the guidance of Doctor Samuel of the electrical engineering department.

Jim is a member of Sigma Tau and

(Continued on Page 26)

STANLEY H. PIERCE

A man with whom engineers become acquainted at some time in their college career is the assistant dean of the College of Engineering, Stanley H. Pierce. He handles everything from students on probation to the placement of seniors; not to mention a heavy load of paper work in between.

After receiving his B.S. degree in railway electrical engineering at the University of Illinois in 1932, he was employed as an engineer in the shop department of the Chicago Rapid Transit company, testing equipment and doing design work. Then in September of 1936, he returned to the University as an instructor in general engineering drawing and obtained his M.S. degree in electrical engineering in June of 1939.

He remained at the University until May of 1944 when he enlisted in the navy. After attending radar schools at the Princeton Institute of Technology and the Massachusetts Institute of Technology, he was commissioned as a radar officer on an electronic repair ship. His overseas duty was spent in the Pacific and in Japan.

Among his unforgettable experiences in the navy, he recalled the ducking he received on the way home. "I was on the weather deck during some rough weather when a wave caught me by surprise. Luckily, I was close enough to the safety rail so that I could hold on to it instead of going overboard."

During his term in the service, his wife and daughter remained at their residence, 1307 South Race street, Urbana.

(Continued on Page 28)

STANLEY PIERCE

Illini in Action . . .

by Don Johnson, E.E. '49

JAMES ELMO SMITH, C.E. '09, has many accomplishments to his credit: two inventions, long service as a U. of I. civil engineering instructor, several terms as mayor of Urbana, when he helped to build up the southeast section of the town. He came to the University in 1907, after being assistant and resident engineer with three different railroads. In 1919, he became the second facultyman to be elected mayor of Urbana. Earlier, he had assisted in the engineering work of the construction of Chanute field and designed the sewage disposal plant there. He invented a new protractor of benefit to civil engineers, mathematicians, and landscape gardeners, and a paring knife which saved its owners money by turning out a uniform sized peel. After retiring from politics, Mr. Smith became a civil engineer for the University physical plant. He still holds the position, although he is past the retirement age.

Prof. E. F. BRUHN '23 has been named head of the School of Aeronautics at Purdue. He taught at Colorado School of Mines for five years and worked with leading airplane companies for 11 years before joining the Purdue faculty in 1941.

Prof. NILES H. BARNARD '28, M.S. '30, became acting chairman of the University of Nebraska mechanical engineering department September 1. For the past year he has been associate director of lay activities for the Methodist Church of America, a job he took when he resigned from the Nebraska faculty after 10 years of service.

One of the speakers at the summer Flying Farmers' field day at the University was FRED E. WEICK '22, vice president of the Engineering and Research corporation, Riverside, Md. Born in Chicago at the time the Wright brothers were inventing the airplane, Weick has grown up with American aviation, devoting his life to aeronautical research and development of a plane safe enough for novice aviators to fly without experiencing the two chief dangers, spinning and stalling. His spin-proof, light plane is better known as the Ercoupe.

Col. DWIGHT L. SMITH '11, widely known electrical engineer and veteran of both wars, has been appointed general manager of the Chicago North Shore and Milwaukee Railway company. Immediately after his graduation, Smith started work for the Chicago Rapid Transit company as a lineman helper, and later became a lineman, draftsman, power supervisor and assistant electrical engineer. He was chief electrical engineer from 1926 to 1937 and was assistant to the executive officer when he entered service in World War II. At the end of the war, he became assistant to the executive officer of the North Shore Line, later was assistant to the president. He was made acting general manager when the late Samuel A. Harrison, who died in April, became ill.

A recent speaker on campus before the Urbana division of the American Institute of Electrical Engineers and the Institute of Radio Engineers was EVERETT S. LEE '13, engineer in charge of the G.E. consulting laboratory at Schenectady. He talked on "European Improvements in New Developments in Engineering and Science." He visited Europe in 1939, and had an opportunity to observe the post-war scene last year when he was in Paris as an A.I.E.E. representative at the sixth international congress. WILLIAM A. MAN '23 and WILLIAM BOWERSOCK '19 of the Chicago office were among other G.E. men who joined him on campus to discuss job opportunities with seniors in electrical engineering.

R. E. GOULD '23, M.S. '29, chief engineer for the Aeroproducts division of General Motors, has been advanced to factory manager. He joined the Aeroproducts organization January 1, 1945, after 15 years in various engineering capacities with the Frigidaire division of G.E.

At one time the commander of a chemical mortar battalion with the 5th Army in Italy, Lt. Col. RUSSEL E. McMURRAY '26 now is military governor of Kagoshima Ken on the Japanese island of Kyushu. A chemical engineer as a civilian, Colonel McMurray entered service in August, 1942, at Edgewood Arsenal, Md. He participated in the Salerno and Anzio landings, was awarded the Purple Heart and Silver Star.

ROBERT BURNS '37, who was a major in the Engineering corps during the war, has been made sales manager in the St. Louis area for the Bethlehem Steel corporation. He is a graduate in civil engineering, and formerly lived in Galena.

After a brilliant career, much of it on the editorial staff of Railway Engineering Maintenance, GEORGE E. BOYD '96 has retired. Famous for his "What's the Answer?," he started his career with the Illinois Central and then went to Lackawanna and Western.

JOHN H. MILLER '15 has been made vice-president and chief engineer for the Western Electric Instrument corporation. He has had broad experience as an engineer, holds 30 important patents, is chairman of the committee drafting revisions of the present measuring instrument standard of American Standards Association.

A ceramic engineer, WILLIAM H. FELLOWS '41, has been named an

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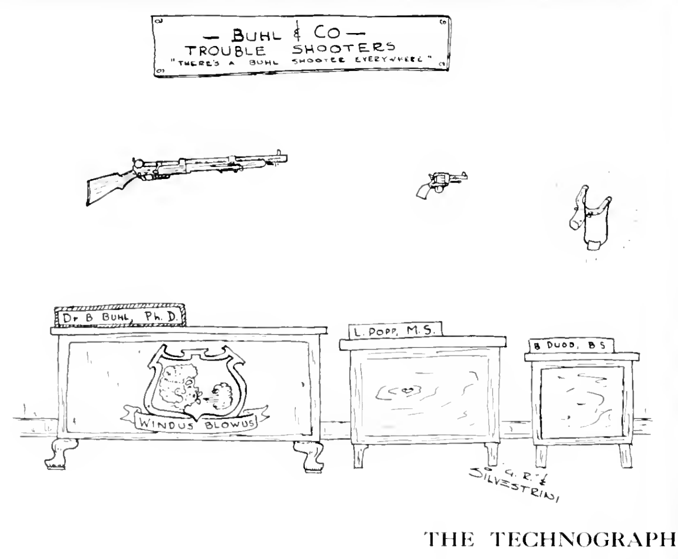

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the Illinois Technograph

My word . . .

Being able to handle the "Kings" English" is a subject which can never be overstressed nor regarded too seriously by either the prospective or incumbent engineer, business tycoon, or what have you.

The business man or sales engineer soon learns, through the necessity of constantly dealing with a variety of people, that a good, more-than-adequate vocabulary is his most valuable asset. The research or design engineer, on the other hand, too frequently completely overlooks the value of interesting speech because the people he works with every day, learn how to interpret what he says. Where this lack of clear expression may not necessarily cause a man to lose his job, it is frequently the answer to the age old question, "I wonder why Bill got that promotion instead of me?"

In addition to furthering a man in his line of work, a good, working vocabulary is largely responsible for getting him into the job in the first place. If you were sitting on the employer's side of the table at a job interview, it's a sure bet that the student who stammers and verbally falls all over himself wouldn't even get your second thought. The man who would get your job would be the fellow who can say exactly what he means in a clear and interesting manner.

The reason for this choice lies in the fact that a person's vocabulary constitutes a part of that intangible quality known as personality. It's quite true that the personality of an individual also includes such important items as: the manner of presentation, and alert and wide-awake attitude, and a natural or cultivated—but at least sincere—interest in the things other people are doing. Without a vocabulary to go along with the above items the individual has absolutely no means of expressing himself and is really worse off than a ship without a rudder.

Although the subject of how to build a vocabulary has been sufficiently publicized, the problem of maintaining and expanding that vocabulary has not been stressed so much. A professor once said that words can be divided roughly into three classes: A, B, and C. Class A words are those with which the person is familiar and uses all the time. Class B words are those with which the person is acquainted but is not on speaking terms. Class C words are those he's never even heard. The process of expanding the vocabulary consists of moving Class B into Class A and at least part of Class C into Class B. Unfortunately the process, like some chemical equations, is reversible. This frequently comes about through lack of interest and disuse and must be constantly guarded against.

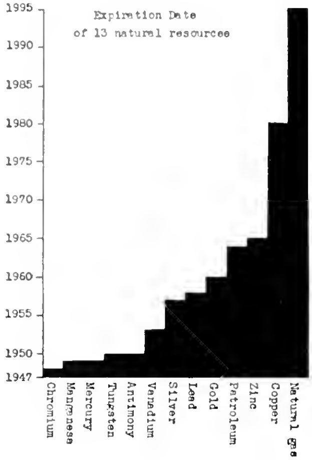
As a parting shot, it should be pointed out that a super-vocabulary all by itself is just as detrimental to the individual as none at all. A lack of knowledge on how to use the words effectively too often backfires like a charge of uncontrolled gunpowder. The speaker must learn how to gauge the audience or person with whom he's talking, and select his words accordingly. An unbridled vocabulary does not result so much in the incorrect use of words as it does in the improper choice of words. This phase of harnessing the vocabulary and choosing the proper words is especially important to engineers who have a special vocabulary peculiar to their profession, and who, in order to give clear explanations, must constantly be on their guard to select words which are appropriate to the occasion. If you don't believe this statement, just think back to that classroom in which the instructor, momentarily forgetting that he was talking to students not so familiar with the terms as he, launched into a beautiful technical explanation—for someone on his own level.

VANISHING RESOURCES . . .

(Continued from Page 7)

Industrial Petroleum Association viewed the unprecedented rate at which these fuels were being used and revised the estimate upward 5%. This figure is 26% above the 1941 consumption level. Reasons for this unprecedented consumption rate appear to be (1) more cars on the road than were foreseen from pre-war travel, (2) the 1,545,000 tractors on farms prior to the war now number 2,422,000, an increase of 57%, (3) homebuilders prefer oil heat—475,000 oil-burners were installed last year and they are continuing to be installed at the rate of 50,000 per month, and (4) many industries have found that shutdowns caused by coal strikes are too expensive, and so are switching to liquid fuels to protect themselves. Railroads are rapidly changing to more efficient Diesel locomotion. Ninety-five per cent of the railroads' recent locomotive orders have been for the Diesel-powered type. Tractors, home oil-burners, and Diesel engines all require a specific cut from the petroleum oil, thereby leaving a smaller portion to be processed into high-octane gasoline.

At the present time a 92 billion barrel "oil shale" source of oil is being investigated at Rifle, Colorado. If pilot plant operations indicate that the extraction of this crude, called kerogen, from the shale proves economically feasible a supply equal to 4.5 times our present reserves will be available.



The strain on petroleum supplies will be relieved greatly by the advent of synthetic fuels. The raw materials necessary for synthesizing liquid hydrocarbon fuels, namely natural gas and coal, respectively, are to be found in abundance. Recent estimates place the natural gas reserve at 161 trillion cubic feet, enough to produce 18.5 billion barrels of liquid fuels. Two plants for the conversion of natural gas to oil are now being built, one in the Hugoton gas field in western Kansas, the other at Brownsville, Texas. The latter will process 64,000,000 cubic feet of gas daily to produce 7,000 barrels of oil per day by the Fisher-Tropsch process, which was named after the two German chemists who discovered it. By building the plant near gas fields where gas can be obtained for as little as 5c per 1000 cubic feet, it is thought that gasoline can be produced for 5c per gallon, thereby competing favorably with the present cost of producing and refining petroleum.

Coal is by far the most abundant of our expendable resources. The depths beneath continental United States hold an estimated 3.2 trillion tons, thought to be about one-half of the world's reserve of all ranks of coal. This would be sufficient to last 6,000 years if we were to continue use at our present rate of consumption of 500,000,000 tons annually. However, with the approaching depletion of our petroleum reserve, and with the increased use of coal as a raw material for certain synthetic polymers, this black gold will be used at a greater rate.

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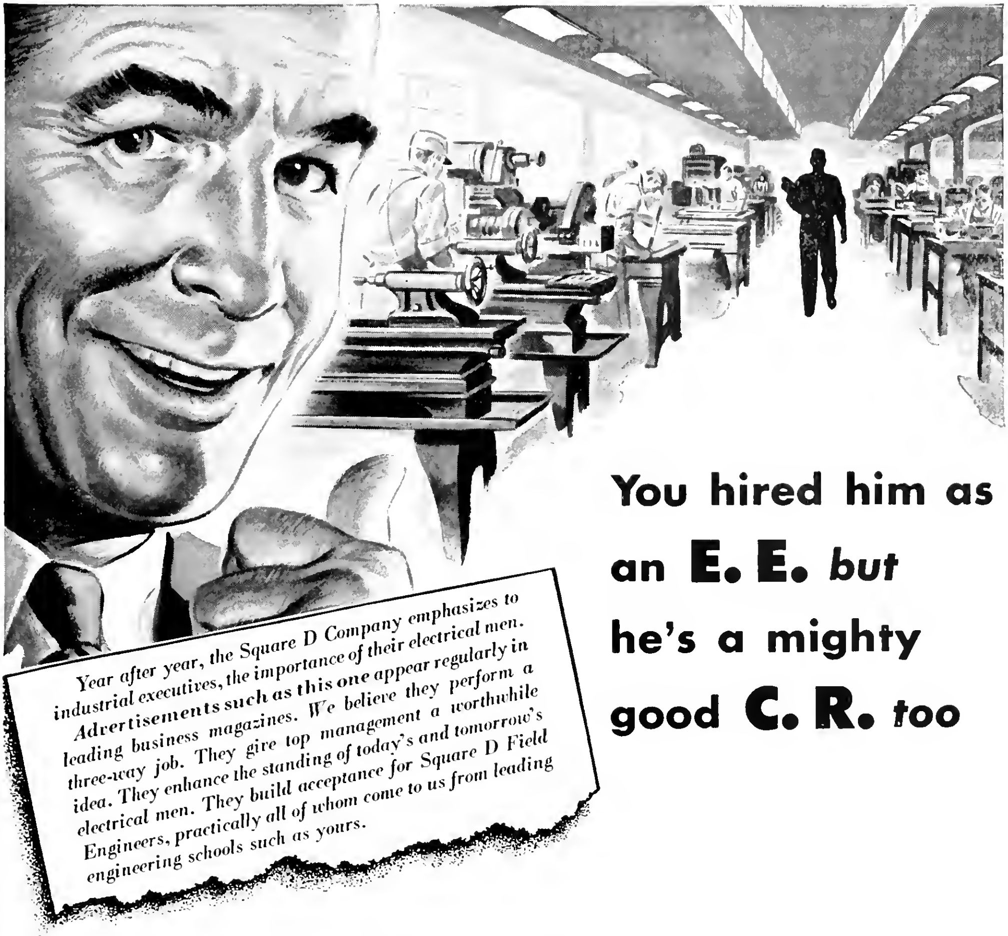

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VANISHING RESOURCES . . .

(Continued from Page 22)

The major portion of the fuel that the Nazis used to energize their implements of air, land, and sea warfare was produced synthetically from coal by the well-known Bergius process, likewise, a German innovation. During the year 1944, they made 27,000,000 barrels of oil by this process and a lesser 4 million barrels by the Fisher-Tropsch synthesis. The former process, requiring pressures approaching 10,000 pounds will probably not become as common in this country as the Fisher-Tropsch process. Many of the minor coal seams of either insufficient purity or quantity will be exploited by burning the underground seam with insufficient oxygen, admitted to the seam through a controlling device, thereby controlling the composition of the combustion products. Some of these gases can then be used in the synthetic production of liquid fuels, all of this being accomplished without the high cost of mining the coal. Further, the great expense of shipment will be reduced since 4.4 barrels (1360 pounds) of oil is equivalent in heating value to one ton of coal. Railroads now consume nearly one-quarter of the nation's entire coal production, one-fourth of this being used to haul coal itself. With the advent of the 25% efficient Diesel locomotive pulling fewer trains of synthetic fuel (much will be sent by pipelines) it is possible that our required coal production will not be greatly increased over the present, in which we have steam locomotives a quarter of a century old with a grate to driver efficiency of about 5% pulling longer trains of coal.

In summary, it appears that there are no grounds for fears that we shall run out of fuel for heat or power for many generations to come. However, there is cause for concern of the longevity of our metallic resources, many of which will expire in this century. Secretary of Interior Krug has suggested a billion dollar survey to determine the exact extent of our resources. This could be a very reasonable price for policies aiding the conservation and reclamation of our rapidly disappearing resources, resources which may be the very life-blood of coming generations.

Frosh: "I hear you've given that girl a wonderful present."

Senior: "You're wrong. I've given her a wonderful past."

* * *

1st drunk: "Let's sleep in the gutter."

2nd drunk: "Why?"

1st drunk: "There's plenty of room and runnin' water."

Airborne Radar

Radar for planes will soon become even more practical with the production of a new, lightweight radar in General Electric's Electronics Department. Weighing about 100 lbs., this small, simplified radar will be compact enough for the average commercial or military transport plane.

An outstanding feature of this new airborne radar is its gyroscopically stabilized antenna. The device allows presentation to the pilot of the radar picture unaffected by banking, climbing, or diving of the plane.

This new radar is designed to help remove some of the hazards of flying in darkness, fog, or storm, and to increase the efficiency of "all-weather" airlines operations. It is not expected to be a cure-all for visibility hazards, but it is another step forward in the national air safety program.

Stout woman: "Do these slacks come in odd sizes?"

Clerk: "No, madam, they get that way after they've been worn."

* * *

A hiccough is a message from departed spirits.

* * *

The most eloquent lines are not written or spoken—they're worn.

JACQUE HAUSER . . .

(Continued from Page 16)

11, and 62 are the courses which Professor Hauser is teaching, and in addition he is engaged in research on a supersonic propeller. So far, the propeller is still in the theoretical stage so that no further comment could be made.

Following his chosen field, he picks flying and model airplanes as hobbies. However, he also likes to repair and reactivate old watches, a hobby that should require a great amount of patience. "The older the watch, the better," he says. "The greatest difficulty is in obtaining parts."

He is a member of the Institute of Aeronautical Sciences and the Society for Experimental Stress Analysis.

When asked how long he expected to remain at the University, he replied, "I hope to make my permanent home here. After roaming around quite a bit, I'm ready to settle down." The aero engineers will certainly benefit from his training and experience.

"Do you really expect to find the perfect girl?"

"Gosh no, but it's a lot of fun finding the ones that aren't."

* * *

Two pints makes on cavort.

JIM MATT . . .

(Continued from Page 16)

Eta Kappa Nu, in which he held the office of secretary-treasurer. He is also chairman of A.I.E.E.-I.R.E. which occupies most of his spare time. For sports Jim likes horseback riding, bowling, golf, and tennis.

After graduating he hopes to go into the electronics industry and the development and distribution of electronic equipment.

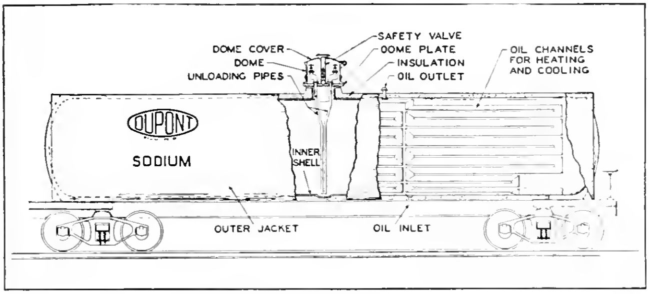
Professor, during a quiz: "Were you copying his answer?"

Bright student: "No, sir, I was only looking to see if he had mine right."

Du Pont *Digest*

Items of Interest to Students of Science and Engineering

Industrial Organic Applications of Metallic Sodium



Sodium for organic reactions is shipped in 80,000-lb. quantities. It is pumped into the car, solidified by cooling and melted by hot oil for removal.

There would seem to be a considerable gap between the electrolysis of salt to make sodium, and research in the field of organic chemistry. However, at Du Pont as much emphasis is placed on organic research to develop outlets for sodium as on its inorganic uses.

For more than 15 years, intensive work on industrial uses for sodium has been carried on in Du Pont laboratories and plants by chemists, physicists, chemical, mechanical and electrical engineers.

In the organic field, this research has contributed a number of important uses for sodium such as the reduction of fatty esters, particularly of natural glycerides, to alcohols.

$$C_{15}H_{31}\overset{O}{\overset{\|}{C}}-OR+4Na\xrightarrow[\text{solution}]{\text{alcohol}}C_{15}H_{31}CH_2OH+4RONa$$

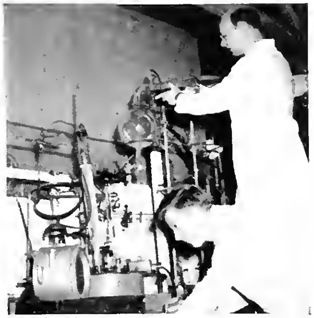
Du Pont organic chemists have found that sodium with selected secondary alcohols, such as methyl amyl alcohol, in the presence of toluene or xylene, eliminates shortcomings of the classical method involving ethyl alcohol and sodium. Practically quantitative yields of the higher molecular weight alcohols are obtained.

This new method is especially useful in preparing unsaturated alcohols not easily made by catalytic hydrogenation. The process can be carried out at atmospheric pressure and compares favorably with catalytic hydrogenation of saturated, higher fatty esters because of the simplicity of operation and equipment.

The discovery of the new reaction conditions has led to the use of millions of pounds of sodium annually for manufacture of long-chain alcohols for wetting and emulsifying agents and synthetic detergents.

Other important processes developed by Du Pont organic research include the use of sodium for reduction of fatty esters to corresponding long-chain acyloins, and reduction of nitriles to primary amines.

Du Pont has also contributed to the development of many other uses for sodium and its simple derivatives, such as in the manufacture of tetraethyllead, used in high-grade motor fuels, dyestuffs synthesis, and descaling of alloy steels. In the form of sodium hydride or sodium alkoxides, sodium is a catalyst for many Claisen condensations, useful in the manufacture of barbiturates, sulfa drugs, vitamins, keto-acids and diketones.



Preparing to carry out an organic condensation reaction involving the use of sodium, R. B. Clark, B.S., West Virginia University '42, and W. J. Hilts, M.S., Syracuse '36.

Questions College Men ask about working with Du Pont

WILL AN ADVANCED DEGREE HELP ME?

For certain types of work, particularly research and development, a higher degree is a distinct advantage and about a third of the men engaged in this work are Ph.D's. However, the majority of our technically trained men are Bachelors or Masters. Every effort is made to recognize a man's training as well as his special experience and aptitudes. Write for a copy of the new booklet, "The Du Pont Company and the College Graduate," 2521 Nemours Building, Wilmington 98, Delaware.

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BETATRON . . .

(Continued from Page 9)

the new laboratory. The original betatron is a scientific exhibit. The 4-, 22-, and 70-million volt instruments will be used for research along with the 200-million volt betatron. The smaller instruments are useful for many projects not requiring the great energy of the large machine.

A betatron can not only produce great energies, but also provide precise control of them, an important feature. The energy output can be controlled by steps of less than 1-million volts. A betatron can produce either a high-energy beam of free electrons or an equally high-energy x-ray beam.

But the most spectacular scientific possibilities lie in great energies such as the 300-million volts to be produced by the new Illinois machine. The energy imparted to each electron by it will be greater than that resulting from splitting a uranium atom.

Cosmic ray production in the laboratory will enable scientists to make fundamental studies which may provide clues to the nature of nuclear energy and nuclear forces, and actually to learn what holds the atom together. The big machine is expected to produce mesotrons, a little-known and mysterious part of cosmis rays.

DEAN PIERCE . . .

(Continued from Page 16)

He was released to inactive duty in March of 1946 and was appointed by the University as assistant professor in general engineering drawing and assistant dean of the College of Engineering in September, a year ago this fall.

Dean Pierce is an amateur radio operator and held a class A license in Chicago and Champaign for some time.

Another of his hobbies is sailing, about which he reminisced, "I can remember when I put a Ford motor into a salvaged hull and had a boat that actually ran." While convalescing from rheumatic fever this last summer, he extended his hobbies to the field of model airplanes.

He is a member of Phi Eta Sigma, Tau Beta Pi, Phi Kappa Phi, Sigma Tau, A.I.E.E., and Synton, and an associate member of Sigma Xi. For seven years he was president of the board of trustees of Alpha Kappa Lambda fraternity.

His knowledge of engineering and his likeable personality together with an understanding of student problems make him the ideal man for being in direct contact with the students. For an engineer with a problem, Dean Pierce is the man to see.

CEMENTED CARBIDES . . .

(Continued from Page 15)

Carbide Cutting Tools

Cutting tools are still, at present, the greatest single use of carbides. Tools for cutting are generally made with the cemented carbide portion in the form of a cutting "tip" brazed to a soft steel shank or cutter body. Besides conserving material, a tipped tool has the advantage of extra strength since the tough steel portion of the tool backs up the carbide by absorbing any shocks incident to machining. Because of the construction, carbide tools cost just about the same as steel tools.

Carbide tools are being used commercially to cut the entire range of steels, cast irons, and malleable irons up to 550 Brinell hardness. In addition, they are used for practically all of the commonly used non-ferrous metals and such non-metallic and abrasive materials as hard rubber, "Bakelite," celluloid, "Lucite," and other plastics. They will cut metals that are so hard that steel tools will not touch them.

Carbide tools by their nature can remove more cubic inches of metal per minute than other tools. They can hold closer tolerances over long production runs. They give longer tool life and produce a better finish on the work piece. Thus, they greatly speed production while relieving the machine operator of the necessity of continually having to re-sharpen and re-set this tool.

Carbide tools may be run at cutting speeds considerably in excess of the best speeds obtainable with high speed steel cutting tools. Aluminum, for instance, is being carbide milled at speeds as high as 8,000 and 15,000 surface feet per minute. Higher cutting speeds mean tremendous increases in productivity of labor with a resultant lowering of manufacturing costs—an even more important consideration today than usual.

Since carbide tools cut so much faster, they generate more heat than do other types of tools. Coolants are therefore used frequently with carbides to remove this heat and keep the work cool so that it will not distort. When cutting steel, the coolant also quenches the hot chip, stiffening it and making it easier to break. Chip-breaking is more important when using carbide tools due to the increased speed at which the chips leave the work. When coolants are used with carbides, they must be applied in large volume, at a fairly high velocity, and directly to the cutting edge of the tool so to carry away the heat fast enough to keep the temperature from becoming excessive.

When milling with carbide tipped cutters, it is frequently found advantageous to have a negative rake angle on the cutting tips. This puts the engagement of the tool with the work just slightly behind the cutting edge where the tip is better supported and stronger than it is right on the cutting edge. In some applications it has been found that milling machines equipped with carbide tools may require a flywheel to be mounted on the spindle. The flywheel thus mounted helps to give a smooth, flat cut; adds to the cutter life; and greatly helps to reduce the effect of shock loads.

Carbide Dies

The original use of carbide metal, as a die metal for drawing round wire, continues to be such an important application that today carbide dies are standard equipment throughout the entire wire drawing industry. Carbide dies last many times longer than did the formerly-used cast iron and steel dies, permit working to closer tolerances, give a better finish on the wire, and have made possible greatly increased speeds of wire drawing. In addition, bars, tubing, and many special shapes which previously had to be machined are now drawn to size through carbide dies.

Of greater importance, perhaps, is the

(Continued on Page 32)

CEMENTED CARBIDES . . .

(Continued from Page 30)

ever-increasing use of carbide dies for the blanking, piercing, forming, and deep drawing of many kinds of sheet metals. Plain steels, alloy steels, stainless steels, brasses bronzes, aluminum, and tin are all being deep-drawn on a production basis in carbide dies. Such dies will frequently outlast from 20 to 100 similar dies made of hardened tool steel. In size modern carbide dies range up to 13½ in. inside diameter and are capable of handling sheet steel up to 3/32 in. Some of the typical parts which are being produced by carbide dies include lipstick cases, coffee pots, pressure cookers, steel cylinders for high pressure gas storage, and various automotive and radio parts.

The field of application for carbide punches and dies for blanking is also steadily increasing. To date, excellent performance has been obtained on the blanking of steels and other metals. Development work is also progressing on the punching and blanking of more and more complicated shapes. On present punching and blanking jobs, averages of 1½ to 2 million punches are being obtained with carbide punches between regrinds, as compared to an average of 50,000 operations for steel punches and dies of a similar design. A typical job on which carbide punches and dies have proved their worth is in punching laminations out of abrasive silicon steel sheet in the manufacture of stators for electric motors.

Use of a coolant with corbide cutting tools requires high pressure and direct flow onto the cutting edge

Carbide Wear-Resisting Parts

Predictions by the manufacturer and users indicate that the use of cemented carbide for wear-resisting parts will eventually exceed even the tremendous volume now consumed for tools and dies. When it is realized that carbides, even under conditions of extreme abrasive wear, often stand up 100 or more times longer than other metals, the reason for this prediction becomes clear.

Today, carbides are already being used—both in the form of shaped inserts and complete parts—where undue wear by rubbing and abrasion is a problem. Some of the more typical applications of cemented carbide parts for this purpose are liners for molds making drugs, powder metals, and bricks; for fish rod guides; in the form of guide rings, bushings, etc.; for lathe and grinder rests and other machine parts; for ring and plug gages; for nozzles for fire hoses, de-hydrating, or spray painting and for machine ways and gibs.

THE DEVIL NAMED NICKEL

The devil was responsible for the naming of nickel. The Saxon miners of the 18th century blamed him for casting a spell over their ores. When they attempted to smelt an ore resembling one of copper, they obtained a white metal too hard and tough for them to work, due to its nickel content. In christening the metal "Kupfer-Nickel," or "Old Nick's Copper," they gave the minerologist, Cronstedt, a precedent for calling it "Nickel" when he discovered the element.

MINING, METALLURGY . . .

(Continued from Page 8)

steel is at a very high temperature. If it were possible to determine the Austenite grain size of steel before purchase this would be a fool-proof method of buying the proper type. It is believed that the presence of copper inhibits, somewhat, the grain growth.

Much of the research done by the department is done by graduate students. In addition to contributing to the knowledge in the field of metallurgy, these men gain valuable experience. Because the field of metallurgy is relatively unexplored, the contributions of any one man could revolutionize the entire steel industry and this the entire industrial economy of the country. Although the study of metals is one of the oldest phases of engineering, because of constant discoveries and the many new paths that each discovery brings forth, this field represents one of the best opportunities for the engineer who wishes to explore the unknown. A former University of Illinois instructor got his start by investigating processes for the selective floatation of zinc and lead. He now heads a company that is engaged in that work.

The method of teaching students in the department of metallurgy differs from that in the other departments due to the fact that metallurgy is a constantly changing science, there are fewer students in this work, and there are not many textbooks covering metallurgy. The student must get much of his information from periodicals and bulletins. Because of the great number of variables in any metallurgical process and the fact that the field is to a great extent unexplored, mathematical treatment is extremely difficult. In addition a knowledge of chemistry is one of the important basic parts of the field of metallurgy.

Graduates of the department usually work for the large companies in the metals industry. They can work in research, or they may be in charge of foundry. In general, the field of metallurgy is one of the few pioneering fields left in engineering. They may work for a company that is a large consumer of metallic products, such as the automobile industry. While working for a consumer industry they may investigate defects or failures in metallic parts.

A Golden Opportunity—Mining

Public consensus of opinion seems to be that all prospective students of mining engineering will fare best by going to such schools as Missouri School of Mines, or Colorado School of Mines; and therefore, many young men interested in this field head there either di-

(Continued on Page 36)

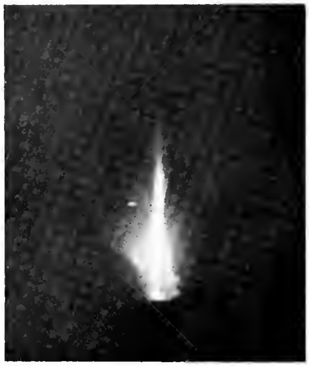
MINING, METALLURGY . . .

(Continued from Page 34)

rectly or immediately following a primary year at their state university. It is not realized by many people that first-rate training under the best teaching staff available is offered in all courses of study right here at the University of Illinois. Many U. of I. graduates of the past have achieved top rank in the mining engineering world. All too often a man goes to a school of mines and acquires a trade education, whereas he could profit most by attending such a school as the U. of I. and obtain a liberal research or administrative education. Mining companies are now in great need of graduate engineers with just this background.

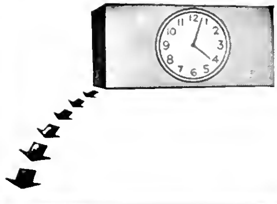
Judging from the employment-demand figures, described in the *Technograph* last month, a student in the engineering college would do well to investigate the opportunities offered in mining or metallurgy—greater employment demand, less competition, rapid advancement to higher than average salaries for engineers in general, unlimited opportunity for research and development, and work in a vital industry which is becoming more and more a key to our national economy.

Let us glance at some of the many positions available for which the basic work is covered in the mining department. The industry resolves itself principally into two divisions, metal mining and coal mining. In the first division, there is a dire need for engineering and development in prospecting methods for the location of deep-seated deposits of copper, manganese, and other metals whose reserve supply have become critically small. Also both types of industry have felt the acute need for more trained technical men, because industrial leaders realize that a college graduate is a more valuable addition to their technical staff than an untrained worker from the ranks. So many demands were made of the mining department last year that several positions open for mining engineers at very good starting salaries had to be referred to other departments in the school of engineering to be filled. For the student interested in research, this is the fulfillment of his life ambition: the fields of development in explosives, ventilation, extraction methods, and possible future underground living in this atomic age are but a few of the subjects no more than touched by research.

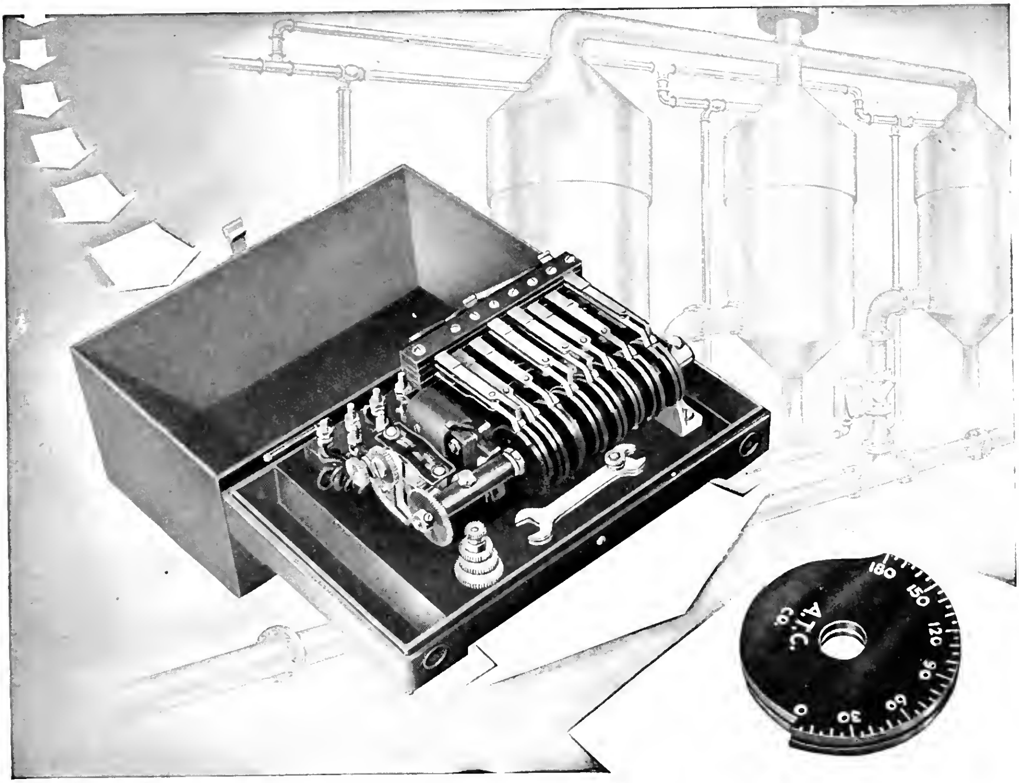


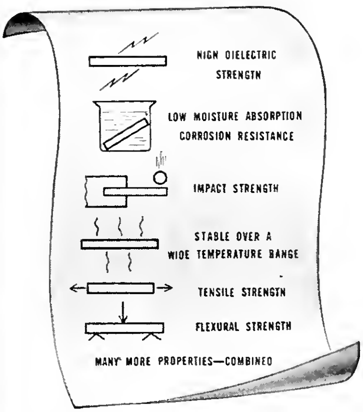
Night photo of a 50-foot oil well blast produced by a shaped charge of explosive

Well versed and well known men in the fields of mathematics, chemistry, metallurgy, and mining are here awaiting your signal to share the wealth of basic knowledge prerequisite to your future success. Such men as Professor H. L. Walker, already mentioned, and Professor William R. Chedsey are internationally known for their work in the fields of metallurgy and mining. In choosing mining or metallurgical engineering as your profession, there are few better places in the world to acquire the education upon which to build your future than the University of Illinois.



Plastics where plastics belong— using insulating and printing qualities





OUR TYPE of plastics, Synthane, has a combination of mechanical, chemical, and electrical properties that fit it for a host of useful applications. It is corrosion and moisture resistant, dense, structurally strong, and may be easily worked. An excellent electrical insulator, Synthane is extremely light (about $\frac{1}{2}$ the weight of aluminum).

A good example of the use of laminated plastics is this timing device which uses Synthane for the cams in the timer. Heart of an automatic system, the Cam Timer is designed to control the flow of exhaust gases to a stack.

Aside from its outstanding insulating qualities, letters, numerals, and symbols may be easily and clearly printed on Synthane by our Synthographic process. Synthane Corporation, Oaks, Pennsylvania.

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ILLINI IN ACTION . . .

(Continued from Page 18)

abrasive engineer for the Bay State Abrasive company of Westhoro, Mass. He will serve Chicago and the midwest. After graduation he went with the Phoenix Glass company, then became assistant ceramic engineer in the clay and silicate division of the National Bureau of Standards in Washington. Most recently he has been connected with the sale and manufacture of foundry snagging wheels.

At a recent family night party at Western Electric's Hawthorne plant, LOUIS A. STAFF '42, a W.E. engineer, received the Distinguished Service Cross for his heroism in battle against the Germans.

Mr. Staff's heroism was exhibited between April 7 and 9, 1945, while serving as a forward observer for a platoon of chemical mortars. When his party was pinned down by heavy enemy fire, Staff, a lieutenant, waited until dark, and then evacuated his men to a nearby wood where he evaded enemy patrols all night. The following morning, he re-established radio contact with the supporting artillery and at great personal risk, adjusted artillery fire on vital enemy emplacements. He then brought his men back through enemy lines, capturing numerous prisoners on the way.

JEROME E. MACHAMER '22, assistant general superintendent of the Hibbing-Chisholm (Minnesota) district of the Oliver Iron Mining company, has been elected a vice president in the firm. He joined the Oliver organization soon after graduation, working first as a mining engineer in the Canisteo district. In 1930, he was transferred to the Virginia district. He was made general crusher plant foreman at the Virginia-Eveleth crushing plant in 1934, was promoted to assistant superintendent of the Hibbing-Chisholm district in 1942, became superintendent of the Hartley-Frazer mine in 1943, and in September, 1946, was appointed assistant general superintendent of the Hibbing-Chisholm area. A native of Chicago, Machamer attended Oberlin college from 1912 to 1914. After serving in the Air corps during World War I, he entered the U. of I. to study mining engineering.

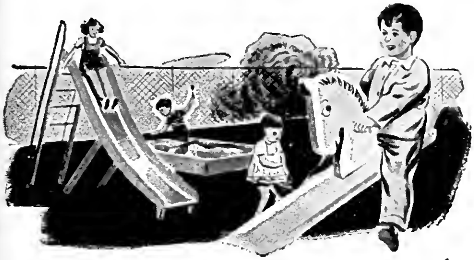
THOMAS A. MURRELL '33, Washington, D. C., an expert consultant in the field of radar for the War department, has been named an assistant professor of electrical engineering in the University of Illinois.

Born in Lebanon, Kentucky, he attended the University of Louisville, graduating in electrical engineering in

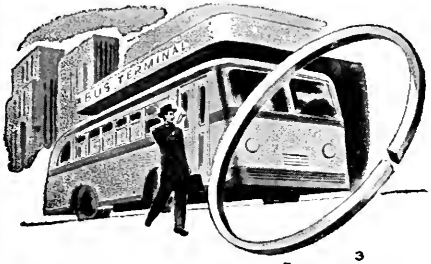
(Continued on Page 40)

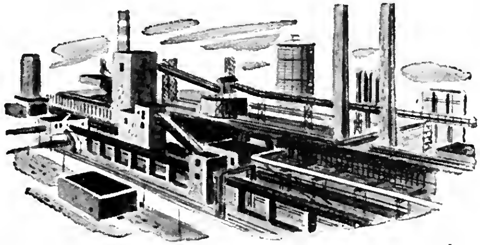
QUESTION:

What do these things have in common?

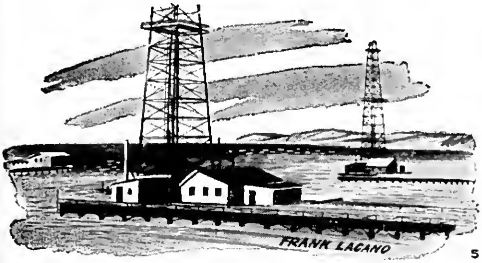


A children's playground[1] .... a private pleasure plane[2] ...





An interurban bus[3] .... a battery of coke ovens[4] ...



An oil well in the ocean[5] .... and a deadly insecticide[6]?

ANSWER:

They've all been made more efficient by the engineering or chemical skill of Koppers

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KOPPERS

ILLINI IN ACTION . . .

(Continued from Page 38)

1936, and the University of Wisconsin, where he received the doctorate degree in physics in 1941. Before going to Wisconsin he had spent a year as engineer with the Louisville Gas and Electric company. He taught as an undergraduate assistant at Louisville and as a graduate assistant at Wisconsin.

In 1941, he became a member of the radiation laboratory at Massachusetts Institute of Technology, aiding the development of radar systems, and being project engineer for the production of airborne radar. In 1944, he became an expert consultant in the office of the secretary, being sent with special groups to England and to the Philippines.

At MIT, he was a member of a radar development group headed by Professor LOUIS N. RIDENOUR, now dean of the Graduate school at the University of Illinois.

Professor JULIAN R. FELLOWS, M.S. '34, and JOHN C. MILES, M.S. '40, both of the mechanical engineering staff, have invented the Illini down-draft furnace, which burns coal smokelessly. The U. of I. Foundation holds furnace patent. A model is being manufactured by the Lennox Furnace company and will be ready for general sale before next year.

The first draft of "A History of the College of Engineering of the University of Illinois, 1868-1945," by IRA O. BAKER '74 and EVERETT E. KING of the civil engineering department is ready for revision. The late Professor Baker was one of the college's best known men and was in the field of civil engineering. Professor Emeritus King retired two years ago and has done a great deal of work on the book since then. Professor Baker carried forward to 1920. Not a great many copies will be printed, since the main purpose, as Mr. King describes it, will be to have a college reference book for engineering faculty men. A limited number of copies will be available for alumni and others.

More than 40 new faculty members have been appointed to the College of Engineering, including one of the scientists who helped establish radar contact with the moon. He is HAROLD D. WEBB who will be an assistant professor of electrical engineering. A new professor in theoretical and applied mechanics is NELS O. MIKLESTAD, who, during the war, served as consultant for the California Institute of Technology on research problems in dynamics, vibration and stress analysis. ALFRED M. FREUDENTHAL of the University of Haifa, Palestine, will be visiting professor of T. and A. M. for 1947-48 and will devote part of his time to research projects on the fatigue of metals.

This year DR. RAY L. SWEIGERT '20 took over his new work as dean of the Division of Graduate Studies at Georgia School of Technology, Atlanta. He has been on the staff there since 1929, serving as professor of mechanical engineering, director of engineering, science and management, war training and co-director of the Institute of Citizenship. He did special work for the Navy on its turbine design and for Pratt & Whitney and United Aircraft during the war.

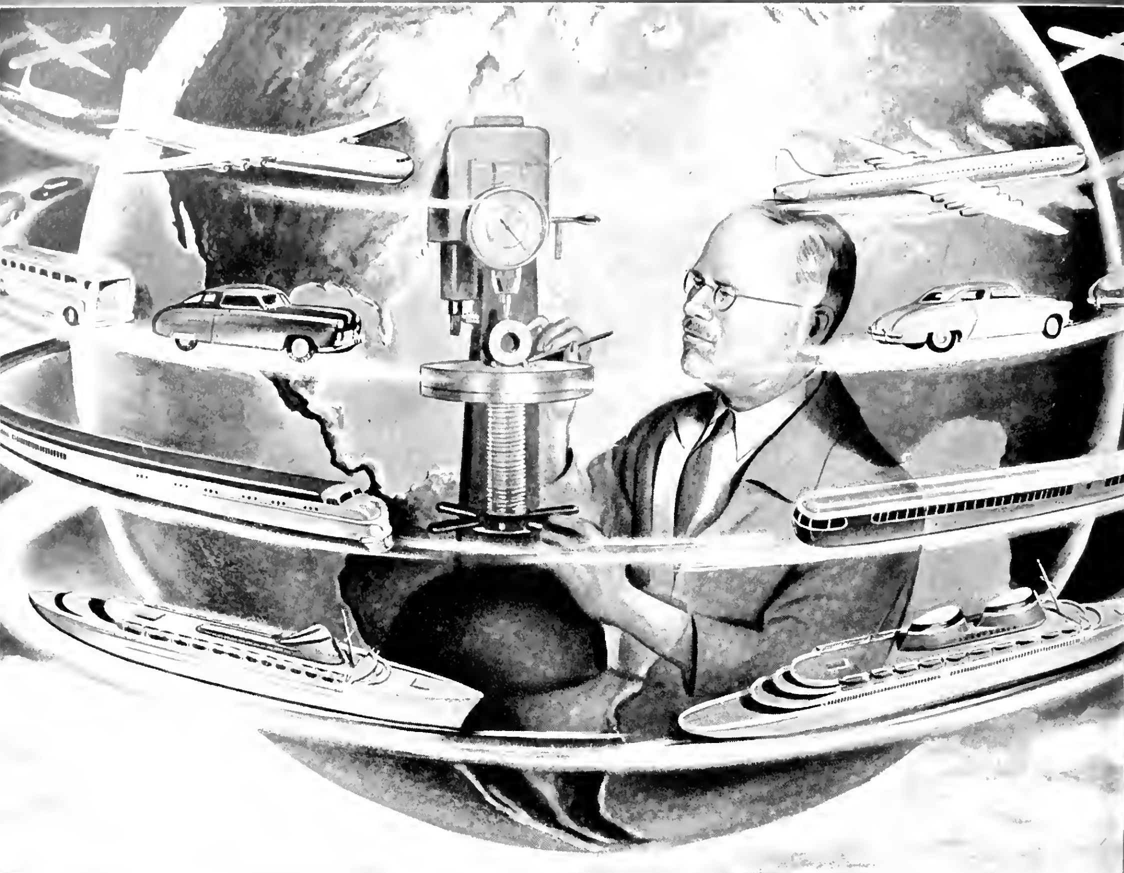
When CURT TALBOT '36 went to General Electric right after graduation, he kept on studying electrical engineering, this time in the company's general and commercial courses. Between hours of work and study he went out to the Schenectady airport to practic flying, piling up 500 hours and getting his commercial license. By studying in both these fields, Curt was, unknowingly, giving himself the best possible preparation for his present job—that of manager of the new General Electric Flight Test laboratory.

The Illinois Technograph

December, 1947 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

"—Many shall run to and fro, and knowledge will be increased" —DANIEL XII, 4.



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New Developments

By John Dick, E.E. '49
and Herb Mazer, E.E. '50

Micro-Wave Spectroscope

Identification of whole molecules of chemical substances may be made with a micro-wave spectroscope, using radar waves from 1.2 to 1.6 centimeters in length. In this way complicated molecules such as the hydrocarbons can be analyzed. When micro-waves are beamed through the vapor of the substance to be analyzed, certain wave lengths are absorbed by the molecules. Thus, for each substance, there is a characteristic pattern of absorption lines which, when projected electronically on a screen, are easily identified.

Basic elements of the spectroscope developed at the Westinghouse Research Laboratories are an oscillator (reflex klystron) wave guide, crystal detector, oscilloscope, and sweep generator as shown in the photograph. Micro-waves emitted by the oscillator are directed through the wave guide which contains the sample vapor to be analyzed. The waves are picked up at the other end by the detector which transmits the impulse to the oscilloscope. The wave guide is the long slender tube extending out at the lower left side of the photograph. Compounds which have been identified are ammonia, water vapor, acetone, cyanogen bromide, and carbonyl sulfide. The instrument promises to be a valuable tool in the study of molecular and atomic nuclei.

An electronic spectroscope for identifying molecules of gases

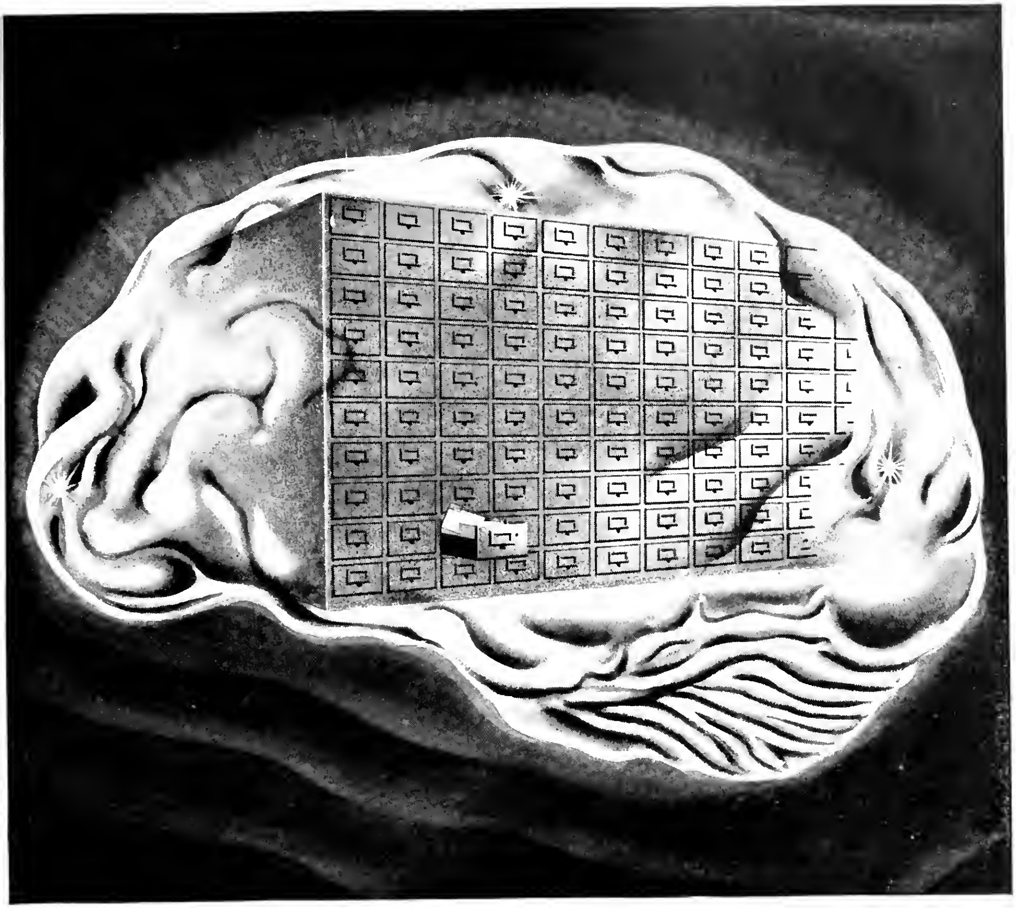
This 6-inch long cathode ray tube is designed for small, lightweight equipment.

Miniature CR Tube For Small Testers

A newly developed NORELCO cathode ray tube (type 3QP1) for oscilloscope use is very short, has a flat face, and provides improved electron-optical characteristics, particularly at the screen edge. The tube has improved cross-talk characteristics between deflection-plate pairs and is especially suited to the design of the unusually small, lightweight service equipment needed in television installation and maintenance work. (Cross-talk is the distortion on one set of deflection plates caused by the action of a signal on the other set.)

The overall length of the 3QP1 is only 6 1/8 inches and the face diameter is 2 3/4 inches. The tube utilizes P1 (green) phosphor and has electrostatic focus and deflection. Rated heater drain is 0.3 amps. at 6.3 volts. Capacity between terminals varies from 2 to 9 $\mu\mu F$.

Under typical conditions, operating potentials compare favorably with those of the usual cathode ray tube; second anode voltage E_{b_2} is 800 volts DC, anode E_{b_1} is 300 VDC, grid cut off voltage is -35 VDC. A voltage of 168 volts between deflection plates D_1 and D_2 produces a beam deflection of one inch while 105 volts between plates D_3 and D_4 produce a deflection of one inch.



ALUMINUM BRAINS FOR THE ASKING

Some day you are going to want to know something that you won't have learned in college. And won't find in books.

You are going to consider using aluminum for some purpose where the engineering isn't all spelled out for you. You'll want facts about aluminum that you can apply to your problem; and guidance in using them.

When that happens, remember to call on the brains that have stored up more knowledge of aluminum than you can find anywhere else. For 59 years this brain has been gathering facts and experience in making aluminum useful in thousands of ways.

We are talking about the cumulative corporate brain of ALCOA . . . Aluminum Company of America. When it goes to work on your problem, the particular kind of knowledge needed is sure to be found in one or more of this brain's many parts . . . in the minds of the scientists, engineers, plant men and salesmen who make up this corporate brain of ours.

Their metallurgical experience, their counsel on design, their intimate knowledge of aluminum fabrication and finishes . . . all yours for the asking. Aluminum Company of America, Gulf Bldg., Pittsburgh 19, Pa.

MORE people want MORE aluminum for MORE uses than ever

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the Illinois Technograph

Volume 63 **Number 3**

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

This hole in the ground at the southeast corner of California street and Mathews avenue is the first phase in the construction of the new chemistry building. (Gene Robinson).

FRONTISPIECE

The stethoscope, believe it or not, is not limited to the medical profession. Here it is shown being used for the inspection of time switches. (Courtesy of Sangamo Electric company).

Problems Affecting the . . .

Design of Agricultural Machinery

By Al Rust, Ag.E. '48

"Weed-tamer," "plow-jockey," hay-shaker" or whatever you prefer to call him, the farmer is one of the largest users of the steel output from the foundries in this country today. According to the 1945 census report by the U. S. Department of Agriculture, there were 5,800,000 farm operators utilizing $5,150,000,000 worth of farm implements and machinery. This means that nearly one-third of the total income of the farmer has been invested in farm machinery, excluding automobiles. The farm equipment industry then is definitely not in its infancy and its size indicates that employment for many an aspiring agricultural engineer can be assured in this occupation.

The urbanite needs to go no further than his own city limits before he visualizes the farmer in action surrounded by a group of implements which have been designed and produced after several decades of modification and refinements. He might exclaim "Farming is really a soft life with all these new modern labor-saving devices," and "push-button farming is practically here!" Needless to say, both statements are rather inaccurate. However, it is true that the design and production of farm machinery has kept pace and will continue to keep pace with rapid advances in other industries.

What is the basis for farm machine design? How is an implement designed and built? For the answers to these questions the engineer must go through a logical thought process before he can establish an idea on paper.

What job must the machine do? How must it perform under various field conditions? What must be its capacity? How much can the company afford to spend on the machine in design and engineering? For the answers to some of these questions the farm implement designer must be a combination engineer, agriculturist and prophet. What he must keep in mind is that there may be anywhere from 5 to 50 other manufacturers working on a design for the same type of implement. The field is highly competitive. If the designer comes through with an idea that is patentable, there is always the necessity of checking through files for infringement on someone else's patent rights. A system of cross license of patents is used in the farm equipment industry. For example, this makes it possible for the John Deere Company to use International Harvester Company patents for the price that International asks. These prices are usually not excessive since there may be a mutual proposition between companies for use of other patents. Once the manufacturer sees a clear course outlined he turns his engineering "blood-hounds" loose on turning out an experimental machine.

Concurrent with the record output of foodstuffs in this country is the approaching maturity of the farm machinery industry. Sparked with an expanding outlook toward the information gained by recent research and development engineering, the industry is rapidly working toward the ultimate goal of functional design. This article deals with a few of these design problems of which many have been demonstrated by the experience of the farmers themselves.

Designing and building a modern farm machine goes through somewhat the same procedure before production that an automobile might. Ideas for a new machine or an improvement in an existing design may be conceived almost anywhere—agricultural experiment stations, the U. S. D. A., and the farmers themselves. The latter is probably the most prolific source since one farmer or a group of farmers often experiment with an idea and use their own machine shops. The manufacturer receives the idea from the farmer through the local farm imple-

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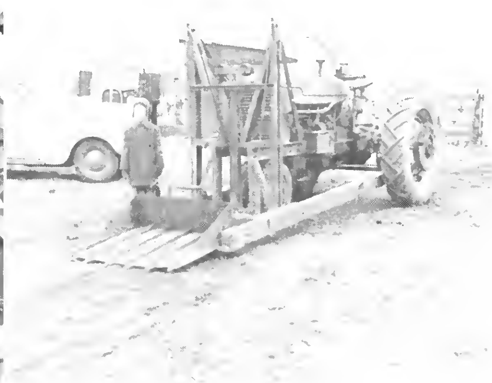


Of the agricultural design features adopted by industry, many originate with the farmer, himself. Shown here are (left) a homemade power take-off and (right) a hoist attachment for loading dirt, manure, and limestone.

LOOKING AHEAD . . . Machine Tool Developments

By Ronald Johnson, Comm. '48

At the Machine Tool Conference held in Chicago this fall, the exhibitions were keynoted with machinery which was designed to revolutionize methods and accelerate the production of parts. Exemplifying this type of machine are the horizontal lathe and the gear and worm shaper which are the subjects of this article.

Constant new designs and improvements in machinery and machine tools in modern industry are the basis for America's high level of production. Through these improvements we are able to "out do" the rest of the world in producing superior equipment.

An entirely new concept in the field of horizontal engine lathes has been developed. It is designed primarily for between center work on shaft and chucking jobs where turning, grooving, facing and angle turning operations are required. This machine, having three spindles with identical tooling for each spindle, produces three pieces of finished work for each complete cycle of functions. This lathe makes possible rough and finish cuts with single point tooling for the majority of machining operations with attendant savings in tooling costs. However when operations such as grooving or nicking for grinding are required, a multiple-tool block is used which works in conjunction with single point tools and is controlled and operated by an automatic control unit as a single function in the machining cycle.

Departing from the usual engine lathe design, this new horizontal lathe offers the following advantages never before incorporated in horizontal lathes:

1. An innovation for greater operator's convenience is the location of the head stock and the Man-Au-Control Unit with all the machine operating controls on the right-hand side of the operator.

2. Three spindles produce three pieces in less time than normally required for one.

3. All three spindles are equipped with hydraulically - operated centering type lever gripping chucks. These chucks perform two functions: first, to extend the center which picks up the work, and second, two hydraulically-operated levers grip the work, thereby eliminating the use of driving dogs.

4. Each hydraulic chuck is individually foot treadle operated. This gives the operator unrestricted use of both hands.

5. Both saddle and tool slide are mounted in the vertical plane, and travel horizontally on vertical bearing ways. Because of this vertical construction, chips fall freely into the chip receiver without any accumulation around the work or the machine operating parts.

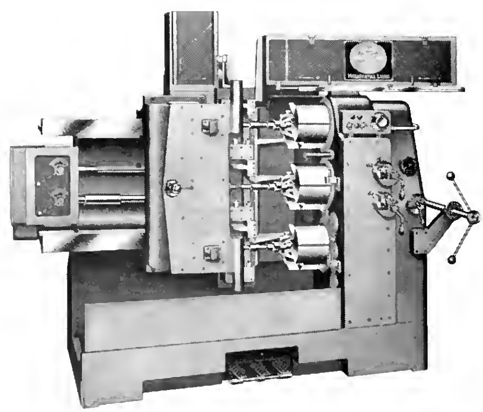
6. An automatic feed interrupter breaks the chips to convenient lengths for removal from the chip receiver.

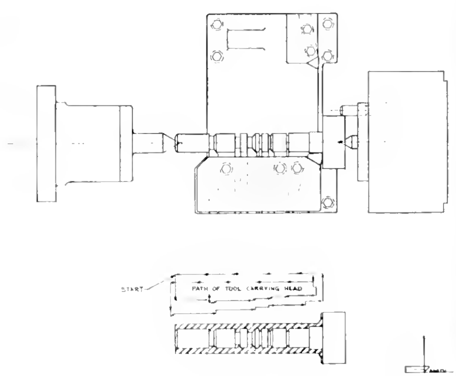
7. The work and tools are always visible and easily accessible to the operator without reaching across the tools the tool slide.

Any setup is easily and quickly changed to meet requirements of another job. Since it is not cam operated, its versatility in change over from one job to another makes it practical and efficient on short or long runs. The availability of either manual or automatic operation to suit conditions makes it a practical machine for extremely short runs. In manual operations, functions are performed faster than with most types of manually-operated engine lathes. After speeds and feeds are once set for a given job, these are automatically selected at the proper time, even when in manual operation.

The control and feed unit will control the head through 39 different and entirely unrelated functions in any sequence. With this unit the machine is cutting almost continuously. There are no stops while the operator measures the piece or changes the feeds or speeds and other customary operations. The machine is set up for a fixed maximum production. There is no loss of time due to the operators indecisions or the element of fatigue.

The automatic control unit returns the tool carrying head to the starting position by the shortest path. Since it is not necessary to retrace the cutting path, scoring the work is eliminated. It also eliminates trial cuts on each piece, re-





Left: A Bullard horizontal engine lathe equipped to handle three pieces of work simultaneously. Right: Diagram of a typical piece of work handled by the lathe.

sulting in a greater degree of accuracy and uniformity of finished work.

The control and feed unit is flexible—it has no predetermined sequence of operating functions, except when it is not set for a given job. Any of the 39 functions may be quickly changed without disturbing other settings. This is invaluable where change of work design affects a few dimensions of the total setup.

Flexibility of control permits the operator during the machine's automatic cycle to instantly change from automatic to manual operations by simply moving one lever. When this is done, the head is controlled manually and can be moved to any position desired by the operator. The machine may be restarted in any position of the automatic cycle by moving the same lever back to the automatic position. This is a tremendous advantage in the event of tool breakage during a cut or for the removal of a part before it is completely finished.

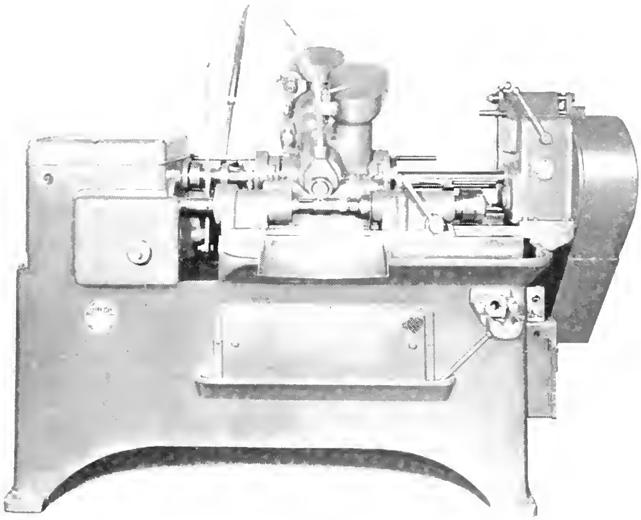
Flexibility of feed and traverse strokes from .005 in. to the capacity of the machine greatly reduces the machine setup time and minimizes setup operations.

Automatic changes of feeds and speeds while the machine is cutting enables the machine to use modern cutting tools to their maximum capacity and provides a high degree of production efficiency.

Figure 1 is an example of the high level production methods used by this machine.

Thread Generator

Another advancement in the field of machine tools is the Fellows 4-T thread generator. This machine works on the molding-generating principle and uses a helical-type gear shaper cutter. The principle of operation can be clearly visualized if one considers threads as rack teeth that are wrapped around a cylinder in a helical path. In generating these threads the work rotates upon its axis at right angles to the axis of the cutter. The cutter also rotates in harmony with the work—that is, cutter and work are geared together in relation to their respective numbers of teeth and threads.



Front view of the Fellows 4T thread generator

The cutter is carried on a spindle rotatively mounted in a head, the latter being held on a slide that is moved along a parallel to the axis of the work. It produces threads by molding-generating process. Figure 2 shows a close view of the cutter at work cutting a double-threaded worm, and illustrates the principle of operation of this machine.

Nature of the Cutting Action

Some idea of the production possibilities of this method of cutting worms and threads can be obtained from a study of the cutting action illustrated diagramatically in Fig. 2. The cutting action is analogous to that of using a rotary circular cutting tool in the lathe, with the exception that instead of the cutting edge becoming a continuous circle, it is interrupted by teeth. The tooth spaces prevent the transmission of heat, and act as chip breakers. With the circular cutting tool, the action is that of turning, whereas, with the gear shaper cutter it is turning and shaving combined.

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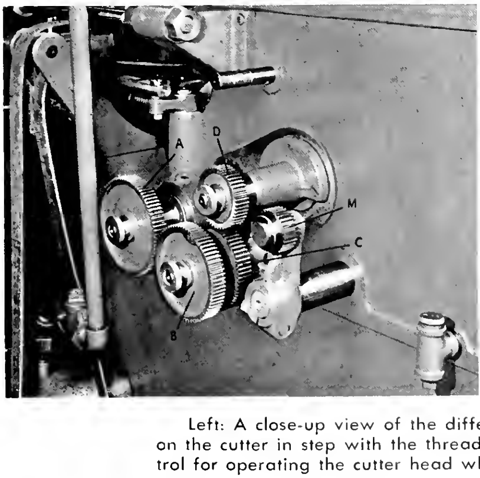
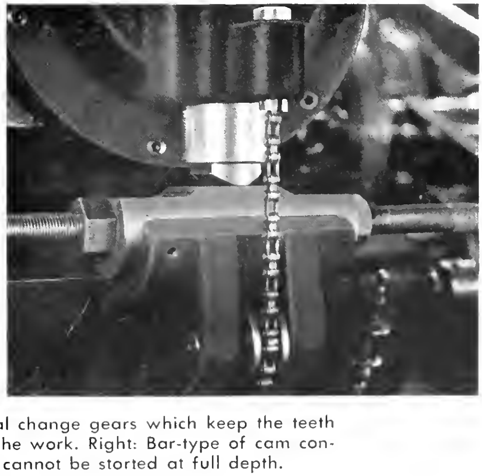




Left: A close-up view of the differential change gears which keep the teeth on the cutter in step with the threads on the work. Right: Bar-type of cam control for operating the cutter head when it cannot be started at full depth.

Industrial Sightseeing . . . *Sangamo Electric Co.*

From Publicity Department, Sangamo Electric Company

In the attempt to bring to the attention of the engineering student the field of small businesses as an additional possibility to consider when he is job hunting, the Technograph presents in this, the third article, the story behind the nationally-known Sangamo Electric Company of Springfield, Illinois.

The Sangamo Electric Company, with its main offices and factory located in Springfield, Illinois, has established a world-wide reputation for the manufacture of electrical meters and other related products. The history of the company dates back almost fifty years to the period during which the first crude designs of the induction type watthour meter were being originally developed. The long, painstaking research in which the company shared during the evolution of modern watthour meters has provided a rich background of electrical engineering experience and scientific advancement. The significant contributions which the Sangamo Electric Company has made to the basic progress of electric metering have gained universal recognition throughout the electric power industry. Today, more than ever, the company's emphasis is on engineered designs and methods.

Executives

The high standards of scientific development work, the precision manufacturing methods and the exceptional record of industrial relations at Sangamo Electric Company have attracted executive and professional personnel of unusual ability and character. A brief summary of the backgrounds of the company's executives is given in the outline which follows:

President
- Graduate of Yale University (1917)
- Accepted position with Sangamo Electric Company as secretary to the President.
- Directs company finances and investments; coordinates the activities of the vice-presidents.

Vice-President (In charge of manufacturing and employee relations).
- Graduate of Sheffield School of Electrical Engineering at Yale University (1927).
- First position with Sangamo Electric in office of Factory Superintendent.
- Appointed director of company in charge of manufacturing at the British Sangamo plant in Enfield, England.
- Returned to Springfield in 1939 as Vice-President.

Vice-President (In charge of development and sales)
- Graduate (cum laude) of Sheffield School of Electrical Engineering at Yale University (1931).
- Began work with Sangamo in the Engineering Department. Became assistant to the General Superintendent and later assistant to the President.
- Elected Vice-President in 1946.
- Active in Navy development work undertaken by the company.

Vice-President (In charge of Enineering)
- Graduate Electrical Engineer of the University of Nebraska (1913).
- First job with the General Electric Company. Later returned to the University of Nebraska as associate professor of electrical engineering. Entered employment of Sangamo Electric as chief engineer (1919). Recently received doctor's degree from his university.
- Coordinates the work of the various branches of the engineering department.

Vice President (In charge of Production)
- Employed by the Racine-Sattley Company before coming to Sangamo (1918).
- Exceptional ability in pioneering modern production methods in the manufacture of electrical instruments.

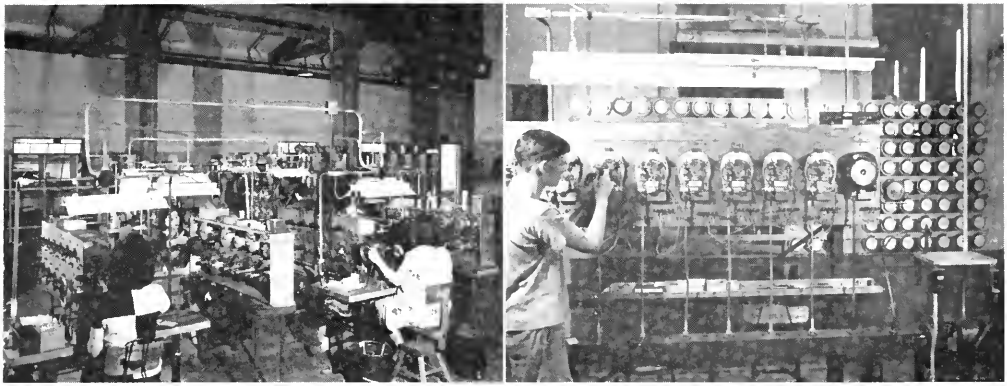
Secretary-Treasurer
- Graduate of the University of Illinois with B.A. in Accounting (1931).
- Received C. P. A. rating in 1935; began work with Sangamo the same year.
- Elected controller of the company in 1942 and Secretary-Treasurer in 1946.

An aerial view of the Sangamo Electric company plant at Springfield, Illinois

Engineering Department

The functions and responsibilities of the engineering department extend throughout the Sangamo plant organization. The more important activities can, however, be divided into three general categories: research, design development and quality control. The details in each section are supervised by senior engineers and their staffs.

The research section works closely with the company's sales division in anticipating the requirements of the elec-



Left: Machines for winding paper tubular capacitors. Right: A test bench for the Tachographs

tric industry. New uses for electricity and ever-increasing loads create problems with respect to their effect upon distribution systems and the cost of supplying electric energy. The functions of the research section are to develop means of metering factors entering into the cost of service, so that such costs may be most equitably allocated among the customers, and to simplify and improve existing instruments through the application of new and improved materials. Patent investigations are conducted, as well as study of domestic and foreign competitive developments.

The design development section works out the actual details of projects instituted by the research engineers. This work progresses to the point at which complete working models can be assembled and subjected to test. From the experimental tests specific information is obtained which can be compared with the requirements established by the research group.

The third general section of the engineering department is devoted to quality control and is in reality an engineering testing laboratory. Part of its duties involve the checking of accuracy and performance of production line samples, selected at random each day. Other functions are the testing of purchased materials and parts, the establishment of inspection standards for the manufacturing process, the field testing of Sangamo products, and the investigation of unusual service difficulties.

Operation Department

The primary function of this department is to coordinate into a master pattern a great number of individual machining operations, assembly operations and supplementary activities contributing to the effectiveness of factory production.

When a model of a new product is completed by the engineering department, it is turned over to the operating department for study as to manufacturing possibilities. Alterations are made, if necessary, to the satisfaction of all concerned and the model is sent to the drafting room, where a complete set of tracings is made. When these drawings are returned to the operating department, a complete breakdown of the project is made in relation to the machines, operations and materials required. The various parts are assigned to specific departments for fabrication, or specifications are given the purchasing department in order to obtain the items from an outside source. Quantities are estimated and time studies made so that data can be compiled on manufacturing capacity and costs. The inspection department is informed of the standards which have been established by the engineering department, so that accuracy can be checked at each step in the manufacturing process.

Sangamo Products

The Sangamo Electric Company is engaged in the manufacture of an extensive line of meters for integrating electric energy for use on both alternating and direct current systems. Other products of the company are time switches, capacitors and tachographs.

Alternating current watthour meters are made for use on all types of distribution circuits, single or polyphase. Demand meters of the block interval and thermal type are included in the line of alternating current meters, the latter available in both the indicating and graphic forms. As an accessory to the alternating current meters, the company produces instrument transformers for loads too large to be metered on self-contained units.

While direct current distribution systems have become nearly extinct, there are numerous industrial applications, such as the production of aluminum and magnesium, which require direct current watthour meters. In these industries, large currents are often employed, and metering shunts up to 60,000 amperes (and one for 70,000 amperes) have been built. Direct current amperehour meters are built for the control of batteries, showing the state of charge or discharge at all times. These meters are compensated for the inherent losses in battery operation. A special application of this type of meter is in the electroplating industry, where it is used to indicate the quantity of metal deposited during the plating operation.

Sangamo electrically - operated time switches are made for use on both direct and alternating current. Three general types are included in the line: the electrically-wound clock type, the synchronous motor type with electrically-wound clock which functions during current interruptions, and the synchronous motor type.

Specially-designed time switches are used by utility companies to turn off electric water heaters and other loads during on-peak hours. The remainder of the time switch market lies in the automatic operation of electrical signs, floodlights, window lights, and in the heating and air-conditioning fields.

In 1924 Sangamo introduced the first bakelite model mica capacitator, entering this specialized field only to a limited extent. During the recent war, increased activity in this line of manufacturing resulted in the decision to expand the capacitator division to the extent that it has now become a competitive force in the industry. Plastic-molded paper type capacitors have been added to the line, and production has already begun on capacitors of the electrolytic type, giving the company a complete range of coverage.

To secure adequate space for the manufacture of the capacitor line, the entire capacitor division was recently moved to a new plant in Marion, Illinois.

Probably one of the most unusual and interesting instruments manufactured by the Sangamo Electric Company is the

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The Engineering Honoraries and Societies

By John Shurtleff, Ch.E. '50 and Dick Hammack, G.E. '48

A.I.E.E.-I.R.E.

The first meeting of the school year was held on October 23, 1947. The meeting was called to order by the chairman, James G. Matt, who introduced Murray L. Babcock. Mr. Babcock discussed the entrance requirements and functions of Eta Kappa Nu, the honorary electrical engineering fraternity. He presented an engraved handbook and a national membership to Richard Johnston for being the junior electrical engineer with the best scholastic average. This is to be an annual presentation.

Harry Robbins, instructor in the illumination department, discussed the Illumination Engineering Society. He is working to organize the first student branch of the I.E.S.

Dr. William Everitt, head of the electrical engineering department, who was the main speaker for the evening, welcomed all of the fellows to the first meeting of the school year. He pointed out that the engineering school's function is not to fill the student's head full of facts, but to develop the ability to learn and reason for one's self after leaving school. He stated that it is important to develop self assurance when entering the big world of industry.

Dr. Everitt considers the engineering societies as a fundamental medium for both the student and the professional men. He suggested that the student branch take a poll of all the electrical engineering students as to complaints, suggestions, and recommendations to the faculty.

The student officers for this year were presented to the assembly. They are the following: James G. Matt, chairman; Edwin C. Edwards, vice chairman; Donald E. Steeper, secretary; Kenneth E. Gerler, treasurer; Harry A. Davis, corresponding secretary for the A.I.E.E.; and Charles W. Steele, corresponding secretary for the I.R.E.

A senior job placement meeting was conducted by Professor Faucett on October 30. The annual senior-faculty banquet of electrical engineers was discussed at that time and it will be held some time in January.

On November 4, about 100 electrical engineers attended the national conference of A.I.E.E., I.R.E., and I.E.S. in Chicago. Many interesting speeches were given and demonstrations and exhibits were observed. Those who attended had an interesting and educational time.

The Bell Telephone laboratories sent men to give a talk and demonstration on "Mobile Telephone Systems" for the meeting of November 13. An automobile transmitter in Chicago was picked up from the receiver on the stage in Gregory Hall.

As of October 24, there are 213 members in the combined student branch of the A.I.E.E.-I.R.E. The goal is to make the membership 100 per cent of the sophomores, juniors, and seniors.

A.S.C.E.

To date the Illinois student chapter of the A.S.C.E. is the only society to have a local division. A subsidiary chapter has been started at Navy Pier, and it now has 75 members.

On October 22, a smoker was held at which George A. Ekblow, geologist with the State Geological Survey, delivered an address on the "Services Rendered by the State Geological Survey."

The following are the new officers of the A.S.C.E.: Robert Wright, president; Frank Anderson, vice president; Charles L. Jansen, secretary; and John O. Lewis, treasurer.

I.T.E.

Recognizing that traffic is a major problem throughout the country today and will become an even greater problem in the future, 21 University students have organized the "University of Illinois Society of Traffic Engineers."

Upon official recognition by the Institute of Traffic Engineers, this organization will become the second student chapter in the country. The first chapter was organized by the Bureau of Traffic Research at Yale University early this year.

This chapter hopes to promote the advancement of traffic engineering: by fostering the closer association of students with the traffic engineering profession; by studying local traffic problems and cooperating with interested agencies in their solution; by encouraging the expansion of facilities for traffic engineering study at the University; and by stimulating general interest in traffic engineering.

Membership is open to all students with a sincere interest in traffic engineering. All persons interested in the solution of local traffic problems are cordially invited to participate in any meetings of the organization.

The following officers were elected at the first meeting on October 28: Thomas A. Wiley, president; James B. Runyens, vice president; Robert J. Allen, secretary-treasurer. The faculty adviser is C. C. Wiley, professor of civil engineering at the University.

After accepting the constitution and by-laws of the Institute of Traffic Engineers, it was decided to apply for official recognition as a student branch of that organization. Plans were made to hold meetings at 7 p. m. in Engineering Hall in the first and third Wednesdays of each month.

Professor Wiley gave a short talk on the general aspects of traffic engineering at the meeting held on November 5. Several of the graduate members then gave summaries of the individual traffic problems which they are investigating, and the meeting was opened for discussion on the problems mentioned.

By meetings such as these, it is hoped that graduate and undergraduate members will find a common level for discussions. Most of the meetings will be held along the line of an open discussion of traffic engineering and its problems rather than confining the activities solely to lectures.

CHI EPSILON

Although not active during the summer, Chi Epsilon, civil engineering honorary, started a busy fall semester with an officer's meeting on October 14 to discuss plans and activities. This was followed by a meeting of actives on November 3 to vote on eligible candidates, who were later entertained at a "get acquainted" smoker.

Officers of the organization, which was founded in 1922 to further the profession of civil engineering as an instrument of social betterment, are Ray Wente, president; Bob Wright, vice president; Ken McGann, recording secretary; Wayne Welge, corresponding secretary; and Ernie Kuncicky, treasurer. The faculty adviser is Professor M. A. Oliver.

A.I.Ch.E.

The Illinois student chapter of the American Institute of Chemical Engineers opened the 1947-48 year with a smoker held in the faculty lounge of the Union Building on Wednesday evening, October 8. Fall membership indicates that this will be a banner year for the Ch.E.s.

After the preliminary bull sessions, intermixed with the nibbling of the cookie-coke-nuts refreshments, an informal meeting was opened by Don Hornbeck, president, who outlined the extensive plans for the coming term.

The four chapter meetings of the fall term will feature such prominent speakers as Gustav Egloff, author and director of research for Universal Oil Products; V. C. Williams, head of the chemical engineering department at Northwestern University; S. D. Kirkpatrick, editor of the McGraw-Hill chemical engineering magazine; and J. Henry Rushton, head of the Illinois Institute of Technology.

Inasmuch as several of these meetings will be of general interest to all engineers, other societies may be invited.

The president then introduced Professor H. F. Johnstone and the other faculty members of the chemical engineering department. John Mitchell, vice president, and Edwin Dyer, treasurer, who were elected last May, were also introduced.

Herb Schultz, of Evanston, was elected secretary of the organization, and Robert Chilenskas, of Chicago, was elected chemical engineering representative to the Engineering Council. John Mitchell as vice president is an ex officio representative.

Prior to the election, George Foster had outlined the principles of the Engineering Council and had outlined the main points of the new constitution of the organization. Without further discussion, the group ratified the constitution as proposed.

Eighty-five members of the A.I.Ch.E. assembled in front of the Illini Union a half hour before the Army-Illinois football game to pose for a picture suitable for publication in the Illio of 1948.

The society met on October 30 in room 112 of Chemistry Annex to hear Dr. Bailar discuss the facilities of the chemistry department for job placement and summer employment. The meeting was of special interest to those graduating in February or June of this school year.

More than 300 persons, chapter members, faculty, and members of fellow professional organizations, attended the meeting of November 19. V. C. Williams, professor and chairman of the chemical engineering department at Northwestern University, presented a most interesting and informative discussion of "Liquid Air Production and Air Separation." Mr. Williams has done consultant and engineering work for Linde Air Products, incorporated. Since many heavy industries are considering the use of 90 per cent pure oxygen instead of less reactive and more voluminous air, the topic was one of current technical interest.

PI TAU SIGMA

In 1915, a group of upperclassmen in mechanical engineering at the University of Illinois formed the first chapter of Pi Tau Sigma, now a national honorary fraternity for mechanical engineers, "To foster the high ideals of the engineering profession, to stimulate interest in co-ordinating departmental activities, and to promote the welfare of its members." (The Story of Pi Tau Sigma). The chapter has proven its worth over the years by encouraging high scholastic ideals, and cooperating with the department in student activities.

At the first meeting of the group on October 22, Joe Mazer was elected president, Charles Spaeth, vice president, Martin Sabath, corresponding secretary, Gerald Geraldson, recording secretary, and Jerome Fox, treasurer.

Activities for November included attendance at the national convention held at Purdue University from November 20 to November 22. Delegates from here were Bryce Alberty, Martin Sabath, and Lee Sullivan.

A.S.M.E.

The 1947-48 edition of the student branch of the American Society of Mechanical Engineers got off to a flying start with an open house and business meeting on the evening of October 16. outgoing honorary chairman; and Prof. N. A. Parker, head of the department of engineering; Prof. K. J. Trigger, outgoing honorary chairman; and Prof. Francis Seyfarth, incoming honorary chairman.

Elections were held for the society's officers and the men elected are as follows: Robert S. Smith, chairman; William E. McCarthy, vice chairman; William M. Alexander, secretary; and Carl W. Falk, assistant treasurer. Richard G. Love, the incumbent treasurer, is now serving his second year in that position.

A strictly business meeting was held on October 30, for the purpose of voting upon the ratification of the proposed Engineering Council. The council was approved unanimously. Prior to adjournment, two committees were set up for the duration of the first semester. These were the publicity and program committees.

On Tuesday, November 11, Professor Hull, a newcomer to the department of engineering, addressed the society on the subject of "Tomorrow in Automotive Engineering." Professor Hull's principal interests lie in the field of internal combustion engines and his talk was very illuminating and interesting. The principal points of interest were those which dealt with the Tucker car and the plans for three-wheeled cars of the future.

The program committee has only been able to schedule one meeting for December due to the beginning of Christmas vacation. The meeting will be held on December 9 in room 319 Engineering Hall. The speaker at that time will be Mr. James W. May, head of the research department of the American Air Filter company. Mr. May, who formerly was a member of the faculty of the University of Kentucky, will have for his subject, "Electric Precipitation and Dry Filters in Heating, Ventilating, and Air Conditioning."

M.I.S.

Plans for the junior and senior students of the metallurgy department to attend the National Metals Congress and Exposition in Chicago were discussed at the meeting of October 13. Juniors and seniors were excused from classes on October 22 and October 23 in order to attend the congress.

Approximately 35 students and all of the faculty went to Chicago to spend an informative two days.

Over 350 exhibits were on display by companies of the metal industries at the International Amphitheater. At these exhibits the students were able to witness actual demonstrations of some of the latest developments in equipment for the processing of metallic materials.

The biggest attractions were the Tucker automobile and the beautiful girls employed by the various exhibitors to hand out free souvenirs or literature. (Their attire was exceedingly attractive even though the skirts were long).

The exhibits gave the student an excellent idea as to what the outstanding companies of the metal industry actually produce for the commercial market. The exhibits also gave the student a chance to see what field of metallurgical engineering he might wish to enter after completing his undergraduate or graduate studies. Some of the senior students made contacts at the convention which will lead to interviews concerning their employment after graduation.

"Current Research Developments in the Steel Industry" was the topic talked on by Dr. E. I. Martin at the meeting of November 21 at 7 p. m. in room 218 of the Ceramics building. Dr. Mar-

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West Meets East...

by Carl Sonnenschein, M.E. '18

The persons used to a high standard of living in the western world will find in this article a description of the strange contrasts to be found in the recently reopened countries of Korea and Japan. The engineering viewpoint is applied to this first-hand account of the customs and pattern of life in the Far East.

If this were a travelogue, the Orient would be beautiful, glamorous, and mysterious. Unfortunately, to my knowledge, it is seldom if ever any of these things. I greatly doubt if I shall ever get the "smell" of the Orient out of my nostrils, or forget the squalor and filth in which the great majority of people live.

It seems strange that a place which offers so little in the way of a standard of living to its people could at the same time be capable of great engineering accomplishments, yet that is the case in Korea and particularly in Japan.

Electric Power

The American people, as a whole, take the existence of electric power pretty much for granted. However, there are large regions of this country in which there are no public service companies and others in which the only source of power are small, privately owned, gasoline engine generator sets.

It is said of Japan that every home and hovel has an electric light. True, there is only one fixture and a 15 watt bulb, but it is there. It is my personal experience in both the large cities and rural areas to have never seen anything to disprove the above statement.

Wherever one travels in Japan, or Korea, the high-lines are always much in evidence. The lines are much the same as those in this country and the occasional sub-stations are also quite similar.

Japan has always been very short of coal, and this is responsible for the high percentage of potential water power which has been developed.

The Japanese Imperial Railroads operate all over the three main islands of Kyushu, Honshu, and Hokkaido. If possible, the trains on some of the divisions operate at greater speeds than do American trains.

Almost all of the Japanese railways are electrified, to some extent, if not wholly, and many of them maintain operating speeds of 60 miles per hour or more.

A note of interest is the ages of many of the operating personnel of these trains. I once rode several hundred miles at a very high speed and found out later that the engineer was only 15 years old, an unheard of thing in this country.

A person need only see what is left of the Mitsubishi shipyards at Yokohama to realize that the Japanese are fully capable of building ocean going vessels of all sorts. It was at these yards that one of the two giant 50,000 ton Japanese battleships was built.

Japan possessed, prior to and during the war, a highly dispersed manufacturing system. Hiroshima and Nagasaki illustrate the claim that every home in those cities was in reality a war plant. This claim was later fully substantiated and I have seen homes in which the full equipment, such as it was, for the manufacture of various war materials had been installed.

The great majority of the manufacturing in Japan is crude by American standards. Due to the tremendous supply of very cheap labor, very few machines have been installed unless they were absolutely necessary.

True, there are large plants which have some very fine machine tools, most of which were imported from the U. S. These plants are the ones which are being used for war reparations. Many have already been disassembled and shipped to China, Java, the Philippines and other areas which were ravaged by the Japanese.

Antiquated Roads

Highways are practically non-existant in either Japan or Korea. True there are many dirt roads but I refer specifically to either concrete or asphalt surfaces. Whether this condition was due to shortage of material and manpower during the war I do not know.

In the larger cities, such as Seoul, the capital of Korea, Tokyo, Yokohama, Osaka, etc., many of the streets are four and six lanes wide and are surfaced with either concrete or asphalt.

However, when one enters the ordinary residential districts of these cities the streets are either cobble stones or good old fashioned dirt.

The contrasts between the age-old and the modern are startling. I recall one dirt road, dusty and deeply rutted which suddenly turned a corner and there was a multiple span, four lane bridge with a concrete roadway. The over-all length of the bridge and its approaches must have been better than a mile. After crossing the bridge, I was again almost blinded by the dust.

I wondered then and still do, why they built a bridge of those proportions on a road which was not important enough to even be graded occasionally.

When our outfit first went into Korea we were quartered in a part of a wire-rope factory. We were informed that this was the largest plant of its kind in either Japan or Korea and during the war had had top priorities on materials from the Japanese government.

With all of this very impressive information in mind I was quite anxious to have a look at the inside of the shop. The main building was, in itself, quite impressive being over two city blocks long. I've never been so disappointed in my life.

The materials were all manually moved about and the equipment was of the vintage of about 1910. I do not recall what the rate of production was but I'm sure that it could not have compared favorably with any American plant manufacturing the same item.

Poor Sanitation

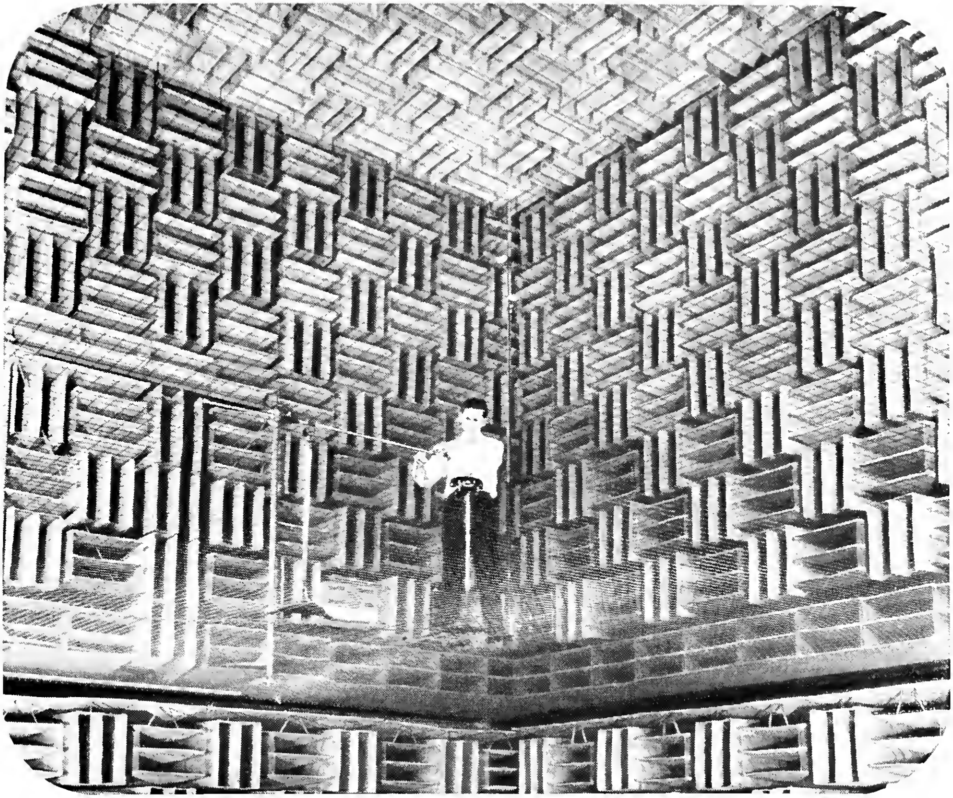
Most American communities take great pride in their municipal water and sewage disposal facilities. This does not only apply to the large metropolitan areas but also to the smaller towns and villages.

In Japan, with the exception of a very few of the largest cities, sanitary facilities are an unknown thing. In Seoul human excrement as well as all garbage was thrown into a two or three foot deep ditch along the street. In some of the better class of homes, there were cesspools which were cleaned out about once a month by the city department of sanitation.

In the Orient, human fecal matter is of great commercial value because of the scarcity of fertilizers. Chemical fertilizers are unknown and there are not enough animals to provide manure. Hence, the sewage is hauled directly from the city out to the farmer where it is spread in the fields.

The water supply is inadequate and definitely impure. No facilities are provided for chlorinating or aerating the water supply. The pressure maintained in the mains is always very low and often fails completely. As a result of this condition, when a fire starts the fire department can seldom extinguish it because of failure of the water supply. As a result of the poor sanitation, typhoid

(Continued on Page 16)



WEST MEETS EAST . . .

(Continued from Page 14)

and other such diseases are very prevalent.

So far as was apparent, automotive transportation was more of a public hazard than a blessing. The average oriental seems to go quite berserk as soon as he gets his hands on a steering wheel.

The cars and trucks, which formerly had been army or navy property, used gasoline as a fuel, but the vehicles that were civilian owned were another story.

Due to the shortage of gasoline, the natives had been forced to use various substitutes such as charcoal burners in their trucks and cars. Naturally, these vehicles had very little power and it was the usual thing to see everybody disembark to push whenever a hill was encountered.

Crowded Transportation

Any vehicle which would normally carry, let us say, five passengers, was not considered properly loaded until there were at least a dozen persons crammed into and hanging on the outside of it.

The Japs had some three wheeled motorcycles which were quite fast, but even these used to be loaded with as many as six or seven persons hanging on to one another.

After being around for a short while, it became quite commonplace to see a vehicle come to an abrupt stop with a consequent spraying of the landscape of its unseated occupants.

The Japs have a small automobile which in appearance and performance compares very favorably with the Austins which were being sold in this country a few years ago. This car seems to have been the favorite of the few people who could afford to own one. The only people who rode around in large cars were government officials and members of the ruling classes.

As an illustration of crowded conditions, the New York subways have for years been considered to be the acme of compressed living conditions. I believe that there exists a worthy contender for that questionable distinction.

The street cars of the Orient are for the most part narrow gauge and very unstable. Again the question of safe operating speeds does not enter into the picture. The people in Japan and Korea seem to swarm, not only into, but all over the cars and although threatened with sudden death at any instant, they are very calm about the whole thing.

There are many western style buildings in the larger cities of the Orient. In Tokyo, General MacArthur's headquarters is one of the finest looking buildings that I saw. There are many other such structures but they were mostly built with foreign capital and designed by foreign architects.

The most notable example of the foreign influence is probably the Imperial Hotel which was built after the great earthquake in the '20s. This building was supposed to be earthquake proof and was designed by the famous American architect, Mr. Frank Lloyd Wright.

The Japanese Imperial Palace and other governmental edifices, both in Japan proper and Korea, are magnificent structures which were built by the natives. These are usually massive stone structures and are very ornate.

Anybody who would deny the architectural beauty or the fine craftsmanship of the many temples would be foolish. These structures are built without the use of nails or glue. The entire fastening together of the component parts of the structures is done by careful fitting and dowelling of the pieces.

The engineering methods by which the ancient Egyptians raised the Obelisks is no more of a mystery than how the ancestral Japs erected many of their famous Buddhas.

Many of these tremendous figures are made of different types of stone so cleverly fitted together that only very close inspection will disclose the joints.

Many times the statement has been made that Japs are the greatest copiers in the world, and I believe it.

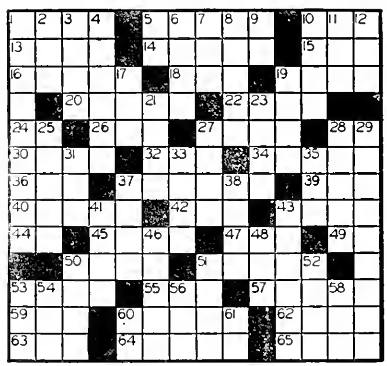
In various shopping streets, in the various cities, I was offered German cameras, Swiss watches, genuine imported Scotch, Irish lacework, and innumerable other items. All of the above mentioned pieces of merchandise were in reality, very clever copies made and produced in Japan with absolutely no regard for international patent agreements or misrepresentation of merchandise. However, this is not a new story.

Little Ingenuity

Apparently, due to a great shortage of imagination and inventive genius of their own, the Japs were forced to take other people's inventiveness and steal it for their own gains. Undoubtedly the Orient has produced many fine engineers but their existence was hardly noticeable in either Japan or Korea.

Perhaps some day the peoples of the East will enjoy the same standard of living that we do, but it will take a lot of work and will require a great deal of money, time, and well-educated engineering and scientific personnel.

Crossword Puzzle



ACROSS

1. Corridor
5. Chief Justice of California, sent first transcontinental telegraph message to President Lincoln in 1861
10. Joker
13. Great Lake
14. —— Allan Poe great American writer
15. Epoch
16. Depart
18. Parcel of land
19. Group of electrons, protons and neutrons
20. Electrical multiplier
22. Search
24. Exclamation of triumph
26. Box cover
27. Branch wires in telephone exchanges
28. Musical note
30. Individuals
32. Produced by most electric refrigerators
34. At a subsequent time
36. Edge
37. Irish physicist who gave the electron its name, in 1891
39. Amateur radio fan: slang
40. Kind of sheer linen fabric
42. Lightning protector
43. Citizens of the U. S. S. R.
44. Metal used in dry cells: chem symbol
45. 4,840 square yards
47. Wrath
49. City thorough fare: abbr.
50. Preposition
51. Philatelist's delight
53. Uninsulated, as wire
55. Consume, as electric power
57. Victor Borge plays it, among others
59. Artificial language
60. Relating to the largest continent
62. Whirled
63. Unit of weight
64. Inventor of the alternating-current induction motor
65. Warbled

DOWN

1. German scientist, one of the founders of the law of the conservation of energy
2. Metric surface unit
3. Fibber
4. Makes horizontal
5. Metal used in electromagnets: chem. symbol
6. Indolently
7. Self
8. Turning machine
9. Physician's title: abbr.
10. A unit of electrical power
11. In the past
12. Precious stone
17. First name of the inventor of the cotton gin
19. Handle of a vase
21. Mine entrance
23. Hideous
25. Free negative atom, in an electrolyte
27. Kind of cotton gauze
28. Wires connecting a motor, etc., to the current source
29. Inventor of the superheterodyne radio circuit
31. Finial atop a spire
33. Center of a solenoid
35. Article
37. Religious group
38. Prepare for publication
41. American mathematician, inventor of a visual telegraph system
43. Negligent
46. An electric alarm clock will —— you
48. Knock
50. Easily magnetized metal
51. Lead wafer used to protect a meter against tampering
52. Parent
53. Drill used with a brace
54. Fuss
56. Sister's nickname
58. Member of a religious sisterhood
60. By
61. Continent having the most telephones: abbr

Introducing by Mel Reiter, Arch.E. '49

Ken McOwan, M.E. '49 and Connie Minnich, C.E. '51

ROBERT M. STEPHENS

Robert (Bob) Stephens will be the only graduate of the mining school this semester. This will mark the end of a very long trail for him dating back to his high school days when he thought that he might like to be an electrical engineer.

Bob had just graduated from high school and was playing his clarinet with local dance bands around his home town when he got an opportunity to enter the University of Illinois under a scholarship from the Illinois Mining Institute. It might be said at this point that his grades in high school were of a type that made people want to offer him scholarships in almost anything that he might have chosen. This was not a case of choosing, however, for Bob had been noticed by the head of our mining and metallurgical department, Professor Harold L. Walker, and offered this aid because it appeared as if he might be well suited to the profession.

Bob appeared on campus in the fall of 1942 and began his studies. He had the usual amount of trouble getting started but by the beginning of his second year he was really starting to hit his stride. (He could be found at a certain sorority house almost any week night.) The Army stepped in at this point and claimed him for two long years. His travels carried him to the North Carolina State College in Raleigh, North Carolina. He studied civil engineering and after graduation was assigned to the 18th Combat Battalion of the Army Engineers.

Bob was back on campus in 1946 to continue his studies. This he has done with more than the usual amount of success.

Being the only graduate this semester in the mining curriculum is a great mystery to Bob. He says that there is a backlog of about eight years for graduate mining engineers. This has caused the rate of pay for such men to levels far above the average for both beginners and experienced men.

The University of Illinois has the best mining curriculum available, according

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HENRY F. JOHNSTONE

Directing hand of one of the finest chemical engineering departments in the country is Dr. Henry F. Johnstone, nationally known for his extensive research and developments in the chemical engineering field.

Dr. Johnstone's research and developments have all been along the line of gases, aerosols and fumes. As a matter of fact, he holds many patents and has published numerous articles in technical magazines on these subjects. In 1943 his published articles for that year won him the annual Walker medal, given by the American Institute of Chemical Engineers.

When Dr. Johnstone came to the University of Illinois in 1928 to take the job as research assistant in the Engineering Experiment station, he worked on sulfur compounds in stack gases and their effect on health and vegetation. He also worked on the corrosion caused by these gaseous sulfur compounds.

After two years on this project he began a study of the methods of elimination of these sulfur compounds from stack gases. Almost $200,000 was spent on this project from 1930 to 1942 by the University and cooperating industries.

Just before Pearl Harbor, Dr. Johnstone and others began working on gas masks under a contract with the National Research Committee in charge of another contract on the development of munitions for the Chemical Warfare Service. New devises for dispersing smakes, gases and insecticides were in-

(Continued on Page 24)

HENRY F. JOHNSTONE

MARCIA PETERMAN

Having her office right over Boneyard Creek is a unique, but not too pleasant proposition in the eyes of Mrs. Marcia Peterman, secretary of the electrical engineering department. Although room 212 in the E. E. Lab is the only office on the campus that can boast this "distinction," Mrs. Peterman will be very happy and proud next summer when she can move her files and secretarial pos-

MARCIA PETERMAN

sessions into the more spacious rooms in the new electrical engineering building now under construction. Although the view from her window is nice, she says that this does not compensate for the odors and mosquitoes that trooped in for regular visits last summer.

However, one glance into her small, neat office will tell anyone that neither the Boneyard nor an atomic explosion can interrupt her work. Mrs. Peterman's duties include everything from filing student and Alumni records and segregating reports of the E. E. Research Division to giving directions and information to new students and attempting to keep up with all business affairs connected with her rapidly expanding department.

A native of Harvard, Illinois, Mrs. Peterman graduated from Capron High School in 1928 and then enrolled at

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GEORGE R. FOSTER
Editor

FRANCIS P. GREEN
Ass't Editor

EDWIN A. WITORT
Ass't Editor

the Illinois Technograph

The "Buck" Knight Trophy

Why do the students of the various departments of engineering, so meticulously avoid one another? Is it a disgrace for an electrical engineer to be caught reading or discussing a subject pertaining to mechanical or chemical engineering? Must the student of mining and metallurgy refuse to look at the new construction, which is going up on the campus, because that type of work lies in the province of the civil engineer? Now you may say that this attitude is ridiculous and doesn't exist here, but such is the case.

Surely it would be for the greater good if the men interested in the various fields were to associate with one another and thus be able to exchange information and ideas.

Let us consider the purely social aspects of the situation. The social life in and about the engineering campus is about as spectacular as a fountain pen that has just run out of ink. However, there was a time when things were somewhat different.

It would indeed be a great surprise if more than five per cent of the student body of the College of Engineering had ever heard of the "Buck" Knight Trophy. At one time the Trophy was the center of a really important social event in the college—important because it brought together the two largest groups in engineering, the mechanical and electrical engineers.

A "Battle of Wits" was fought annually to see whether the American Institute of Electrical Engineers or the American Society of Mechanical Engineers would have possession of the trophy for the following year. The trophy was originally made and presented to the two societies by Professor A. R. Knight of the department of electrical engineering.

The trophy itself is quite significant and typifies several well chosen qualities. Made in the form of a loving cup, little more than an inch high, the component parts are as follows: the base is a collar button which symbolizes the eternal search for knowledge, the bowl is a sewing thimble which denotes industry, and the handles are fully annealed 14 gage copper wire which connotes adaptability. All of the above are fundamental and important qualities in the make-up of anybody, whether he is an engineer or not.

To get back to the "Battle of Wits," the last meeting was held in February of 1946, when the A.S.M.E. retained the cup for the third successive year. Since then nothing more has been heard of the contest. An activity of this type is essential to the social intermingling of the students, and all that is required will be for the EEs to issue a challenge to the MEs.

There you have a very real example of what can go on in this college. For the good of the school, but especially for the betterment of the individual student, it is about time that the students of the College of Engineering quit their moaning and griping about anything and everything and begin to do something constructive to better themselves and the communities in which they will someday live.

MACHINE TOOL . . .

(Continued from Page 9)

The following example will serve to illustrate the high-production possibilities of this method of cutting worm threads. Assume that the worm to be cut has a triple thread of 0.525 inch linear pitch, and is 2.100 inches outside diameter; that the cutter is approximately 3.5 inches pitch diameter, 21 teeth; that the worm is rotated at 600 R.P.M. and the cutter at 85.7 R.P.M. At a work speed of 600 R.P.M., the cutter would be operating at 330 feet per minute at the outside diameter of the work. No portion of the cutter teeth would remain continuously in contact with the work for more than 1/30 second, and 1800 cutting teeth would be presented to the work every minute.

If one compares these cutting speeds with those used for milling and turning, it will be seen that speeds from three to five times as great can be employed, with a corresponding increase in production.

Change and Feed Gears

The principle of thread generation, as briefly outlined, indicates that a harmonious relation must be maintained between the cutter and work. In addition to keeping the cutter and work in step with each other, the cutter is also traversed across the work. This motion is effected by a lead screw and feed gears. These gears are so compounded as to advance the cutter a definite rate of feed cutter across the work.

The axial travel of the cutter upsets the harmonious relation effected by the work change gears, and necessitates the introduction of a differential mechanism. The gears A, B, C, and D, shown in Fig. 3, increase or decrease, as necessity demands, the relative speeds of the cutter and work, and thus compensates for the axial movement of the thread generating cutter across the work.

In some cases, it may be necessary to change the traverse of the slide from the conventional direction for the "hand" in question, and cut in the opposite direction without changing the direction of rotation of the cutter. When this is done it is necessary to insert idler gear M between differential gears C and D, shown in Fig. 3.

Quick-Return Mechanism

The thread generator is arranged so that it will cut both right and left-hand threads, and the cutter-slide can be traversed by power feed in either direction. In practice, this is effected as follows: in cutting a right-hand thread, the cutter travels from right to left under power feed, and when it reaches the end of the cut, the machine stops automatically. The operator then removes the work and engages the clutch operating the quick-return mechanism, which returns the cutter slide to the starting point at high speed. An uncut piece of work is then inserted, the feed engaged and the cutter again brought into operation.

Depth of Cut Controls

The head that carries the generating cutter is provided with trunions, which are mounted in suitable bearings on the cutter-slide. The head can be swivelled on these trunions to raise and lower the cutter relative to the work. The operation of the head is effected by a cam located at the rear of the slide where it is held in a semi-circular seat. The conventional type of cam is shown in Fig. 4. This type of cam is made with different lengths of "dwell" to suit the length of thread to be cut, and with different angles of "rise" to lower and withdraw the cutter at the required rate of feed.

This cam can be used in two different ways: when the cutter is to be held at full depth of thread for the required length, the plunger is located on the "dwell" portion of the cam, and the nuts are released so that the cam will travel with the slide.

When a thread must be cut in the center of a bar requiring that the cutter be fed to depth as the slide travels, the nuts are tightened against the ends of the cam as shown in Fig. 4. In this case,

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HENRY F. JOHNSTONE . . .

(Continued from Page 18)

vented. One of these was for dispersing DDT over beach-heads and camps. At present the Navy has a contract in the Engineering Experiment station under the direction of Dr. Johnstone and others for the investigation of the mixing of fluid steams. This work is of importance for the development of jet engines. Several of the graduate research theses in the department are on investigations of smokes and fumes.

Dr. Johnstone doesn't spend all his time on research. He said that "about one third of his time is spent in teaching, one third in administration of the chemical engineering division, and the remaining one third on research, both in chemical engineering and the Engineering Experiment station."

One naturally wonders how a man who is foremost in his field as Dr. Johnstone is, got started in it. He was born in South Carolina in 1902, and grew up on a farm near Lexington, Kentucky. And we bet the farm gave him his six-foot, 210-pound stature. Any of you raised on a farm know that it doesn't leave much time for other activities in high school. Nevertheless this Phi Beta Kappa member found time to be editor of the school paper and to play football in his senior year, but according to him "They aren't worth mentioning." Dr. Johnstone majored in chemistry at the University of the South in Sewanee, Tennessee, because he found he could finish in three years. After graduation there in 1923, he proceeded to the University of Iowa to receive his Ph.D. in 1926 at the age of twenty-three.

When asked what his plans were for the future, Dr. Johnstone laughed and said, "There's no place better than Illinois. It's like working with a manufacturer in that one can develop new processes and materials. Here one can develop things from the fundamentals on to the finished product, rather than just one phase of a research project. Furthermore, here one works with young men, which is always an inspiration." He feels that his teaching entails much more work and requires more time than work in industry, but far more interesting.

Diner: "Do you serve crabs here?"

Waiter: "We s e r v e anyone, sit down."

* * *

"Do gentlemen prefer blondes?" asks a writer.

That's what many a girl is dye-ing to find out.

MACHINE TOOL . . .

(Continued from Page 22)

the cam does not travel with the slide, but is held in a fixed position. Hence, when the plunger proceeds up the "incline" the cutter is fed to the required depth of thread, then "dwells" at depth until the plunger reaches the end of the "dwell" portion of the cam. When the plunger moves down the incline, the head is raised by a weight, removing the cutter from the completed thread.

Psychologist: "Are you troubled with improper thoughts?"

M. E.: "Why no, I rather like them."

* * *

Many a young engineer is spending a lot of time tinkering with the misses in their motors.

CROSSWORD ANSWERS

H	A	L	L		F	I	E	L	D		W	A	G
E	R	I	E		E	D	G	A	R		A	G	E
L	E	A	V	E		L	O	T		A	T	O	M
M		R	E	L	A	Y		H	U	N	T		
H	A		L	I	D		L	E	G	S		L	A
O	N	E	S		I	C	E		L	A	T	E	R
L	I	P		S	T	O	N	E	Y		H	A	M
T	O	I	L	E		R	O	D		R	E	D	S
Z	N		A	C	R	E		I	R	E		S	T
		I	N	T	O		S	T	A	M	P		R
B	A	R	E		U	S	E		P	I	A	N	O
I	D	O		A	S	I	A	N		S	P	U	N
T	O	N		T	E	S	L	A		S	A	N	G

DU PONT Digest

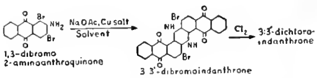
For Students of Science and Engineering

Development of dyes requires both physical and organic chemistry

The synthesis of a new dye in the laboratory or even the development of a manufacturing process from that synthesis may still be a long way from the realization of the full potentialities of the new compound as a coloring material. This is illustrated by the commercial history of the exceedingly fast bright blue dye indanthrone and its halogen derivatives.

Indanthrone was the first known anthraquinone vat dye and has led tonnage sales of vat dyes in the U.S. since its introduction, despite the commercial use of well over 200 types. In 1901, Bohn first synthesized indanthrone by KOH fusion of 2-aminoanthraquinone, but the yields obtained were in the range of only 25-30 per cent. Because of the industrial importance of indanthrone, and the low commercial yields obtained by the original fusion procedure, a great deal of research time has been spent in its study.

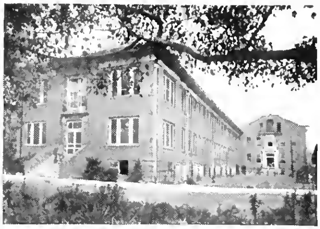
Several U.S. patents record the fact that Du Pont organic chemists have made outstanding contributions in this field, particularly by developing the intercondensation of 2 moles of 1,3-dibromo-2-aminoanthraquinone and replacing the bromine by chlorination to give 3:3′-dichloroindanthrone ("Ponsol" Blue).



This fixes the chlorine in the desired positions to give a product with greater bleach-fastness than indanthrone and minimizes extraneous substitution that always accompanies direct chlorination of indanthrone. The commercial yields of 3:3′-dichloroindanthrone now being obtained by Du Pont are markedly greater than those obtained by Bohn and his workers.

It is just as important, however, that a water-soluble dye be made in a physical form that gives optimum shade and working qualities, such as perfect dispersion, freedom from specks, rapid reducibility and storage stability. A significant Du Pont contribution to the production of vat dyes in optimum physical form is called "turbulent flow drowning." In this procedure, the color is dissolved in strong H_2SO_4 and then diluted by a large volume of water in a constricted tube. High turbulence is maintained during dilution and produces uniform dye particles.

In this development the work of physical chemists and physicists, aided by electron microscopy, ultra-centrifuging, infrared and ultra-violet spectrometry and other modern techniques, was of major importance.



One of the three wings of the Jackson Laboratory, where a large portion of the basic research on dyes is carried on. The new $1,000,000 addition on the right is nearing completion.

The conversion of laboratory findings to a plant operation often presents unique and difficult problems that require unusual ingenuity on the part of chemists, chemical, mechanical and electrical engineers. The work on the indanthrones was no exception. The outstanding commercial success of "Ponsol" vat colors, typified by "Ponsol" Blue is one example of the results achieved through cooperation of Du Pont scientists.

★ ★ ★

Questions College Men ask about working with Du Pont

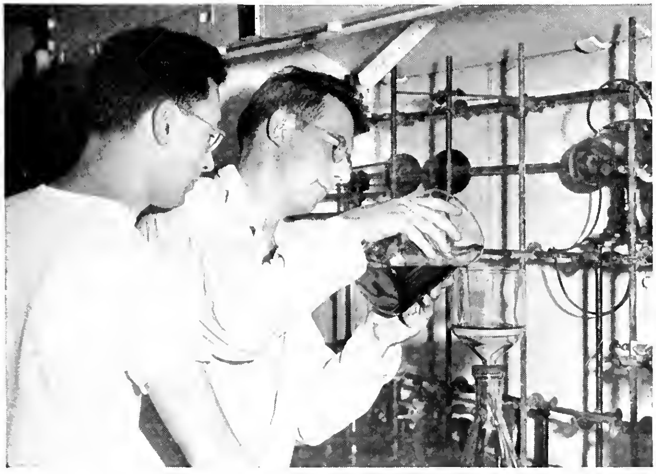
WILL I GET LOST IN A BIG COMPANY?

The organization of Du Pont is unique in that each of its ten manufacturing departments and two technical staff departments is responsible for its own operation. Furthermore, new chemists and engineers work in small groups under experienced supervisors. Du Pont's group system assures men of interesting and friendly working conditions plus the broad avenues of promotion that go with size. Write for the new booklet, "The Du Pont Company and the College Graduate," 2521 Nemours Building, Wilmington 98, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



W. R. Remington, Ph.D., University of Chicago, 1944, and S. N. Boyd, Ph.D., University of Illinois, 1945, working on a dye research problem.

MARCIA PETERMAN . . .

(Continued from Page 18)

Rockford College to major in music. Arrival here in Chambana resulted in her marriage and her present position which she has held for the past sixteen years. Her favorite amusements include all kinds of sports, listening to music, or playing her favorite instrument, the saxophone. The "woman's touch" is apparent in her office with a small China dog sitting on the files, a vase of flowers on her desk and bright calendars on the walls.

Proud of the rapid growth of the electrical engineering department, its staff and students, Mrs. Peterman states that, "The U. I. engineers are more well-rounded individuals and on a higher level than those of ten or twelve years ago." She attributes this to the stimulus brought on by the war.

Traffic cop bawling out an unassuming lady motorist: "Don't you know what I mean when I hold up my hand?"

She, meekly: "I ought to. I've been a school teacher for 25 years."

* * *

He: "Every time I kiss you it makes me a better man."

She: "Well you don't have to try to get to heaven in one night."

A divinity student named Tweedle
Once wouldn't accept a degree—
'Cause it's tough enough to be Tweedle,
Without being Tweedle D. D.

* * *

Small boy (looking at elephant): "Gee, Ma, ain't that a hell of a big animal?"

Proud Mama: "How many times must I tell you not to say 'ain't'?"

* * *

Unlike other wild animals, coeds can be tamed by petting.

AG MACHINERY . . .

(Continued from Page 7)

ment dealers. A farmer might approach his dealer with a question like "Why doesn't my new forage harvester require less power? I only have a two plow tractor and with most of the power required in the power take-off shaft (referred to as the PTO), there isn't enough left to move the tractor unless I travel in low gear." The local dealer transfers the ideas or suggestions directly to the manufacturer who at this point compiles any other suggestions and delivers them to his engineering department.

The design of farm machinery is controlled first by economic considerations. Farm machinery must be produced at low cost since the actual service life or time in operation is usually very low in comparison with industrial machinery. Farm machinery becomes out moded more quickly. New ideas and new crop handling methods demand new machines so that even though a machine can be designed to last a life time, it often becomes outdated and worthless in several years time, even though its component parts might still contain many years of service. An 8 to 10 year service life is usually used for a design basis. A minimum of 400 hours in a corn planter to 8,000 hours for a farm tractor shows a

This device made with old parts and ingenuity, trims weeds close to fences.

wide variation in design life and of course directly affects the cost and selling price. Repair costs are not considered in the design life.

Of the two types of costs, engineering and production costs, engineering costs represent from 3 to 4% of the finished product selling price. Engineering costs involve all development costs from design through construction and acceptance of an experimental machine, which, for a new type of machine such as an automatic wire-tying hay baler, might approach a $50,000 figure. To show how important cost is to the implement manufacturer, we have only to look at his "dead blueprint" files and the machinery "grave yard". The "grave yard" is that area within the close confines of the manufacturing plan which contains all the finished experimental machines which have never been placed into production because they were either not economical to produce or they were outmoded before production even got under way.

Even though the cost of the machine is low, it must be dependable during its designed life. Bearings must be designed to give dependable service during the design life and the frame must be built to withstand repeated vibrations, not only from moving parts but from the constant jarring over rough terrain. Rubber tired implements have done much to reduce frame size by absorbing more of the shock of impact when wheels strike rocks, clods, and ditches.

The machine must be designed for maximum possible safety. Equipment manufacturers have tackled the problem of making present machines safer but there is still a lot to be done. There is a movement on foot at present to design

(Continued on Page 30)

AG MACHINERY . . .

(Continued from Page 28)

safety shields on new machines integral with the machine so that they cannot be removed by careless farmers. As yet, however, there are still too many uncovered chains and shafts.

Having determined that an idea has some merit and might be adopted into a production machine, a sales survey is made. By analyzing farmers' desires and purchasing power, it is determined if there is a sufficient market for production. The volume of production, being a variable factor, is directly related to the future potential market. If a proposed machine still passes all financial estimates, a program for development is started.

Functional Specifications

The engineer for a particular farm implement receives a set of functional specifications which are requirements that the machine must possess in order to make it perform at a certain rate under certain working conditions. Three factors influence these working conditions under which a machine will operate and their effect on design can be summed up as follows:

1. The soil: Sand to clay conditions, dry to wet types. Soil conditions determine the speed at which the implement can be towed through the field and power required. Frame design is also affected by soil conditions to a certain extent.

2. The crop: High or low in physical height, standing or badly beaten down by the elements. Physical dimensions of the crop determine the intake or amount of crop which can be processed per hour. The amount of crop which can be processed is closely related with the economics of owning the machine by the farmer in his crop management plan.

3. The weather: Hot or cold climates, winds, and humidity. Climatic conditions directly affect design in that provisions for enclosed lubrication are necessary in windy, dust-blown areas. It is true, however, that in hot, dry areas lubrication of moving parts is very important, whereas in dusty areas non-lubrication means longer wear, less abrasion. In addition to provision for lubrication, special adaptations must be designed for special conditions. A particular example is that of a self-propelled combine where track laying wheels have replaced rubber tired wheels for harvesting of rice under the swampy conditions encountered in Louisiana.

Mechanical Specifications

In addition to functional specifications, the engineer determines certain mechanical specifications. He estimates the approximate loadings on the main working parts of the machine. If a machine is completely new, the engineer uses "scien-

(Continued on Page 32)

AG MACHINERY . . .

(Continued from Page 30)

tific guess work" to determine sizes of some parts. From the outset, however, it is to be noted that *an experimental machine is usually designed for failure at some critical section.* The loads on farm machine parts are unknown and variable so that theoretical design is seldom satisfactory. In contrast, a steam turbine which is very expensive to build and test, must be designed to closer limits and with more complete stress analysis. After failure in trial runs, this critical section is built up to the point where the section does not yield after strenuous tests. Necessity may dictate that a heat treating process be introduced on a higher strength steel be used but in the majority of cases the original steel as it came from the mill will be strengthened by an appreciable change in or building up the original section.

A wide variety of steels may be used in agricultural machinery from low carbon 1025 steels to higher carbon or alloy steels. The most common plain carbon steels used are those of the 1045 variety while most alloy steels are of approximately 2345 composition. Unless the volume of production warrants, the tendency in present day farm machine design points to the elimination of as many castings as possible and substitution of more electric arc welded construction. Arc welding makes possible the use of lower carbon steels.

Frame Design

Some of the biggest problems the engineer encounters in a particular machine occur in frame design. If there are many rotating parts, they may throw an excessive strain on the frame which will affect misalignment of gears and sprockets. V-belts and V-belt pulleys are used in some cases where this occurs. The recent introduction of stress coat paints and strain gages has eliminated much of the guesswork in frame design. Since most moving parts are mounted on the frame, part failures are often difficult to analyze and here again the element of "scientific guesswork" may play a major role. With the introduction of the oscilloscope and strain gauges, stresses in shafts, universal joints and other moving parts can now be determined fairly accurately.

After an experimental machine has been built from detail drawings it still contains many "bugs" which must be removed by a combination of old fashioned horse sense and ingenuity. The shop mechanic very often has the answer to a certain problem, but where the trouble cannot visibly be detected, high speed movies and stroboscopes are a helpful aid to the engineer and designer.

General Conclusions

The problem of applying the principles of mechanics and machine design

(Continued on Page 34)

AG MACHINERY . . .

(Continued from Page 32)

take on a new light when applied to farm machine design. The ability to apply the formulae for beam strength, and to use equations for torsion, bending, tension and compression, all might be used in any one machine but it is said that the "horse sense" factor weighs heavily in any computation. It should be noted that only about 5 to 10% of the ideas which are investigated for new types of machines ever reach the final production stage.

At the present time, the farmer is still demanding machinery at almost any cost which means that in spite of labor strife, the manufacturer, if he is to remain in the field, must produce equipment. Since design, building, and testing of an experimental machine requires almost two years time prior to production, many of the new machines promised for post war production are just beginning to appear. Many are still being tested in the field. However, many of those promised machines may never be produced because of an expected beginning of the "buyer's market" in 1948.

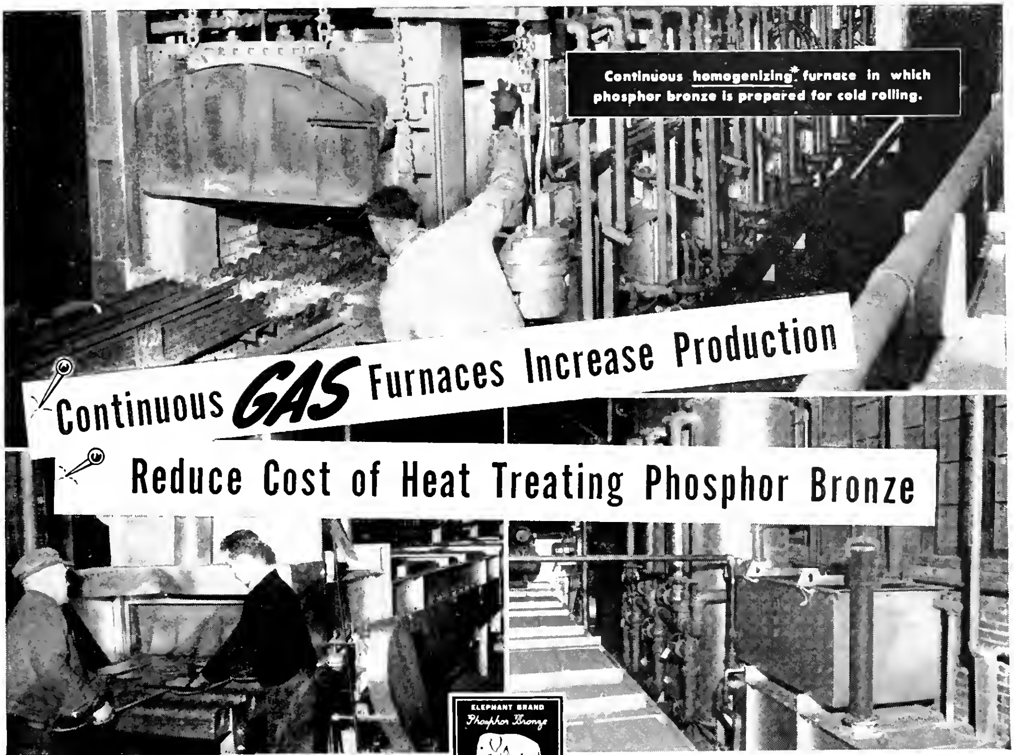
Time is the thing that keeps all things from happening at once.

ROBERT STEPHENS . . .

(Continued from Page 18)

to Bob's way of thinking. This opinion has sound reason behind it. In contrast to most mining schools which lay emphasis on teaching the technological phases, the department here at the University stresses the economic and engineering aspects of mining. It is believed by some that this latter method of teaching better trains young engineers for work in the industry.

Bob is a member of A.I.M.E., M.I.S. and Sigma Phi Delta, professional and social fraternity.



Continuous GAS Furnaces Increase Production

Reduce Cost of Heat Treating Phosphor Bronze

Roller hearth radiant tube heated furnace using prepared atmosphere for bright annealing.

Elephant Brand Phosphor Bronze — Phosphor Bronze Reg. U. S. Pat. Off.

Atmosphere generating equipment used with bright annealing furnace.

Customers of Phosphor Bronze Smelting Company, 2200 Washington Ave., Philadelphia, started the whole thing—they demanded more Elephant Brand Phosphor Bronze products than the company could produce by former methods of heat treating.

So company production engineers, already familiar with GAS and Gas Equipment, specified the modern method of heat treating—with continuous, automatically-controlled, Gas Furnaces, with integral prepared atmospheres.

Here are the processes . . .

Process—*Homogenizing—a method of heat treating to develop uniform grain structure in phosphor bronze billets prior to rolling, while relieving casting strains.

Temperature—1200° F.

Cycle—6 hours

Furnace Capacity—2000 lbs. per hour

Process—Annealing of bars and sheets in a prepared-atmosphere furnace to retain brightness while relieving stresses set up during rolling or drawing operations.

Temperature—1200° F.

Cycle—40 minutes to 3 hours, varying with stock size

Furnace Capacity—5000 lbs. per hour

Here are the results . . . .

1. Pickling process eliminated
2. Production increased 80%
3. Uniformity of heat treatment assured by automatic control
4. Annealing and homogenizing costs reduced over 50%
5. Working conditions improved

Throughout industry modern Gas Equipment has established cost-cutting and time-saving records wherever GAS heat treating methods and machinery have been integrated in production-line processes.

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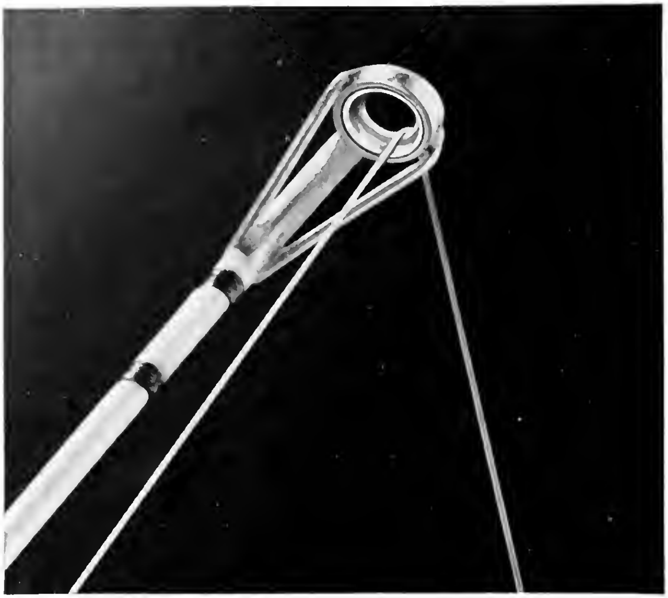


SANGAMO ELECTRIC . . .

(Continued from Page 11)

Tachograph. This device is a recording speedometer for automobiles and trucks, which provides the driver with a visual speed indicator, a total mileage indicator, a time clock, and a red warning light which flashes when safe driving speeds are being exceeded. In addition to the visual functions, all movements of the vehicle are recorded on a chart which is locked inside the instrument. This chart shows graphically when the engine is started, the time idled, the time moving, the speed moving, and when stopped. These features help drivers eliminate costly driving habits, lost time, excessive fuel consumption, the necessity of frequent repairs, and tire and brake replacement.

The Tachograph has won wide acceptance and acclaim from fleet owners, truck operators, bus transportation companies, drivers of trucks, insurance companies and many others, who have learned that they can depend fully on the record as provided by the instrument, and that this record can help them in the promotion of safety and more economical operation of their vehicles.

Personnel Management

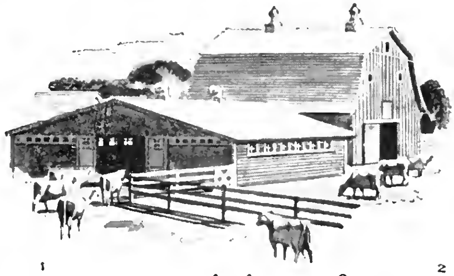
A formalized industrial and labor relations department is an important part of the company organization. Following through an employee relations program instituted by its founder, the company was one of the pioneers in the establishment of improved working conditions. Details of the program in brief, are as follows:

Modern facilities are provided for the employees, such as a modern, well-equipped medical department, two cafeteria, smoking areas, ladies' lounges, refreshment dispensers. Rest periods total 30 minutes per day. Plant-wide music is provided on the public address system 15 minutes out of each hour. An exceptionally active athletic program has been in effect for a number of years. There are also numerous inter-factory clubs, such as the camera club, the supervisors' club and others. The 35 year service club has 37 members, the 25 year club has 194 members and the 15 year club has 230 members.

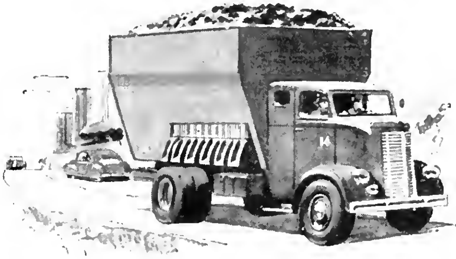
A complete welfare program is also in operation with a retirement plan, hospitalization plan, credit union, and a vacation with pay plan.

An active safety committee has been effective in establishing high standards of safety throughout the plant; the excellent records attained have been awarded national recognition.

The company maintains an open shop contract with independent organizations for hourly workers.



When you admire a beauty[1] . . . or visit a farm[2] . . .



ride on a ferry[3] . . . . or order some coke[4] . . .

swallow an aspirin[5] . . . . or turn on the light[6] . . .

the chances are, you are coming in contact with Koppers engineering or chemical skills.

1. Koppers chemicals for use in cosmetics. **2.** Farm structures made of lumber pressure-treated by Koppers for long life. **3.** Koppers American Hammered Piston Rings for marine engines. **4.** Coke from Koppers-built ovens. **5.** Koppers chemicals for use in medicines. **6.** Koppers Fast's self-aligning couplings, widely used in power plants. All these are Koppers products . . . as well as scores of others that help to increase our comfort, guard our health, enrich our lives. All bear the Koppers trade-mark, the symbol of a many-sided service . . . and of high quality. Koppers Company, Inc., Pittsburgh 19, Pa.

K
KOPPERS

SOCIETIES . . .

(Continued from Page 13)

tin is assistant manager of metallurgical research for the Inland Steel company of East Chicago, Ind.

I.A.S.

New members of the student branch were acquainted with the purposes, aims, and functions of the organization at the meeting of October 15.

In addition to this orientation, various members of the faculty in the college of engineering and the department of aeronautical engineering explained the machinations of the college and the department and their endeavors in supplying the aeronautical engineering student with a sound, academic, technical foundation on which he will be able to build his professional career.

Close co-ordination between faculty and students was stressed, and all new freshmen were urged to seek the advice of the faculty and the senior engineering students.

The speakers were the following: H. H. Jordan, associate dean of the College of Engineering; Jesse W. Stonecipher of the University of Illinois Institute of Aeronautics; Henry S. Stilwell, head of the aeronautical engineering department; Robert W. McCloy, professor in the aeronautical engineering department.

At the next meeting on October 29, M. Zbigniew Krzyblocki, associate professor of aeronautical engineering, gave an interesting talk on the technical history and development of the rocket, stressing the necessity of rocket research.

A short business meeting directed by Robert S. Chubb, student chairman, followed the talk by Mr. Krzyblocki. The proposed constitution of the Engineering Council was read by Jack McGuire and was ratified by the assembly. A date was set aside for the taking of the organization's Illio picture.

"Your Job Opportunities in Aviation" was the title of the talk given by R. J. Anderson at the meeting of November 19. Mr. Anderson is assistant district sales manager for Capitol Air Lines, and his advice for the graduating student seeking a job in aviation was greatly appreciated.

S.B.A.C.S.

The student branch of the American Ceramic Society held its first business meeting on Thursday evening, October 16. The main topic of discussion was the Engineering Council, which was ratified by a unanimous vote. Frank Reckny and Floyd Maupin will represent the S.B.A.C.S. on the council.

Dr. Cook, faculty adviser for the society, was present. He announced part of the organization's fall schedule which includes a lecture by Robert Twelves, a graduate of the University of Illinois and a representative of Auto Light. The time of this lecture is December 19.

The second meeting of the fall term was held in the Ceramics Building at 7 p. m. November 13. John D. Sullivan of the Battelle Memorial Institute, Columbus, Ohio, and national president of the American Ceramic Society, was the speaker.

Walter Stuenkel, president of the student branch, presided at a short business meeting immediately following Mr. Sullivan's talk. It was decided to have the annual Pig Roast in May at the Urbana-Lincoln hotel. It was also decided to reserve a half-page in the Illio for the group picture and general information concerning the organization and its activities.

"Raw Materials," the student publication, is in the making. Roger Westlake and James Young will be the ones responsible for its composition and distribution. Its purpose is to furnish members of the ceramics department, or any others who are interested, with current information concerning the doings of various ceramists. Any slip, by word of mouth or by action, will be duly recorded therein; and the editors reserve the right to make any distortions in the facts if they so see fit. It should prove to be quite interesting to most readers.

. . . a great name in research with a big future in METALLURGY

[illegible] Super-Fortresses have [illegible] its their use of [illegible] permanent magnets. [illegible] steels or other mod[illegible] industries [illegible] these remarkable magnets [illegible] advantage.

What is it that makes G-E permanent magnets [illegible] adaptable to the [illegible] motors and generators, control [illegible], games and novelties, radio and communication equipment, meters and [illegible], and mechanical appli[illegible]? The answer is G-E Alnico, one of the most powerful magnet materials in the world! Special Alnico assemblies have been designed to lift as much as

[illegible] casting G-E Alnico

[illegible] times the weight of the Alnico [illegible] magnet.

[illegible] originally discovered [illegible] of an alloy designed [illegible] high temperatures. [illegible] aluminum, nickel, and [illegible] of this [illegible] than [illegible]. Re[illegible] probable

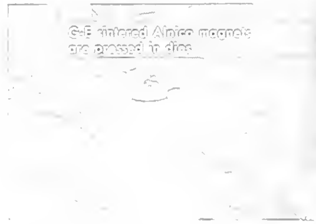
[illegible] and pre[illegible] in iron, [illegible] treated [illegible] of [illegible] are now [illegible] Alnico.

G-E Alnico permanent magnets are [illegible] sand casting, precision-casting and sintering. Sand-cast Alnico is most [illegible] and is generally used for magnets weighing over [illegible] grams, unless [illegible] physical properties of sintered Alnico are required.

Heat-resisting cast G-E Alnico

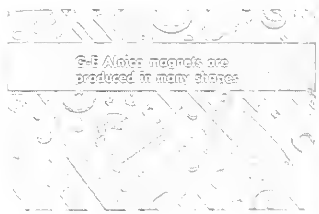
Sintered Alnico is best adapted for mass production of smaller magnets, or for special applications needing more uniform flux distribution and higher physical strength. For shapes that are impractical or impossible to sand-cast or sinter, the precision-casting method may be used to advantage.

But regardless of the method of production, the end is the same . . . shaped pieces of ferromagnetic material which once having been magnetized, show definite resistance to external demagnetizing forces. Unlike quenched steel magnets, G-E Alnico permanent magnets will retain their magnetizing force for very long periods of time . . . actually for centuries with normal use! Truly G-E Alnico magnets are *permanent* magnets.



G-E sintered Alnico magnets are pressed in dies

In the comparatively short time that these powerful G-E magnets have been available, an ever-increasing field for their use has opened up. Today the total production of Alnico in this country surpasses 6,000,000 pounds annually. Tomorrow this figure may be greatly increased as young engineers of vision proceed in research and development of this family of alloys.



G-E Alnico magnets are produced in many shapes

A message to students of metallurgy and metallurgical engineering, from

DR. ZAY JEFFRIES

Vice President of the General Electric Company and General Manager of the Chemical Department

There are many opportunities for further metallurgical research in the highly important field of permanent magnets. We are engaged in the development of better and less costly permanent magnet materials. You who plan a career in metallurgy or chemistry will find the possibilities at General Electric unusual and enticing.

GENERAL ELECTRIC

[illegible]

[illegible] ○ INSULATING MATERIALS ○ GLYPTAL ALKYD RESINS ○ PERMANENT MAGNETS

the Illinois Technograph

January, 1948 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Why housekeeping gets "lighter" all the time

". . . Woman's work is never done."

True enough. But today's homemaker — aided by her modern refrigerator, range, water heater, vacuum cleaner and other appliances finds more time for family and for leisure.

And what helps these "automatic servants" operate so dependably? *Better materials* for one thing.

Materials on the inside — the unseen working parts of household standbys. Such as alloy steels, new plastics, carbon brushes in motors . . . lighter, more compact materials that make appliances stand up longer and handle with ease.

Materials, too, that you can see . . . as those stainless steel surfaces so easy to clean. Or the chemicals in more enduring waxes and polishes, varnishes and plastic finishes.

Yes, today's housewife enjoys new leisure, new freedom from drudgery . . . thanks to better materials.

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New Developments

By John Dick, E.E. '49
Herb Mazer, E.E. '50
Ken McOwan, M.E. '51

Electron Diffraction Analysis

The General Electric company took a step forward in the field of structural analysis by developing an electron diffraction instrument. The theory of operation of this instrument is relatively simple. An electron "gun" fires a beam of electrons in a high vacuum compartment. These electrons are accelerated by an electrostatic field of 40,000 volts and focused by a magnetic field. Hitting the specimen being examined, they rebound and form a diffraction pattern that is characteristic of the crystalline structure of the material under examination. The pattern is recorded on a photographic plate after a 5 second exposure and provides information which is not available with the use of the conventional x-ray and electron microscope.

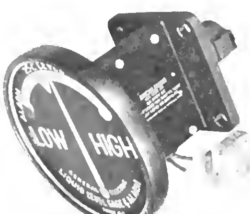
The commercial possibilities of the electron diffraction instrument are numerous, since it can detect chemical changes before they are detectable by any other method. This property can be utilized for combating corrosion in various alloys besides use in the study of catalysts, surface deposits, graphite, pigments for paints, inks, dyes, and in metallurgical investigations.

Electron diffraction instrument has innumerable possibilities

Liquid Level Gage

An improved liquid level gage was recently produced by the Boston Auto Gage company of Pittsfield, Mass. Designed to accurately indicate the level of the insulating fluid in transformers, the gage utilizes a float inside the transformer tank to transmit the motion of the liquid to one of two similar alnico permanent magnets. The motion causes a flux variation in the magnet which is in turn transmitted to the second magnet. The second magnet is attached to a dial indicator needle which, with a properly calibrated scale, gives highly accurate readings.

It can be seen that leak-proof, magnetic coupling is necessary for accurate indication. This is obtained with use of two General Electric sintered, alnico permanent magnets separated by an aluminum diaphragm. The aluminum diaphragm is pressure tight to a minimum of 30 P.S.I., effecting a permanent seal between the liquid and the gage proper. The gage flange is mounted with four studs to the side of the tank, (usually below the maximum oil level), and is then sealed with a "hy-car" gasket.



Special gage designed to indicate level of insulating fluid in transformers.

Sonigage Detects Flaws in Metals

Sounds pitched too high for the human ear to hear have been put to work to improve motor vehicles. Harnessed in an inspection device, called an automatic sonigage, such sounds give automotive engineers new knowledge for control of materials that go into cars and trucks.

Similar to wartime radar where distances were measured by the bounce of radio waves, ultra-sound waves travel through metals and reverberate to measure thicknesses and detect structural flaws.

Elapsed time for sounds to echo from interior surfaces provides a measure of thickness. Variable tones reveal air pockets, cracks and other flaws. Sound frequencies of over a megacycle must be used since sound travels through steel at about 250,000 inches per second and some sections of steel to be measured are only an eighth of an inch thick.

The field of ultrasonics is comparatively new and virtually unexplored. But experiments thus far indicate there may be many practical applications. Ultrasonic experiments in automotive research laboratories began during the war when measurements of wall thicknesses of hollow airplane propeller blades were needed. The improved sonigage is one result of continuous experiments in peacetime. The device provides engineers with much improved controls of materials.

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The Illinois Technograph

Volume 63 Number 4

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

Introducing this month's modification in the cover design is a picture of the plane, shown returning with the football team from the Army game this fall.

FRONTISPIECE

This picture of the main machine shop floor of Woodward Governor company shows the large area covered by the individually powered equipment.

Construction Practices Used on the . . .

Mechanical Engineering Laboratory

by Barbara Schmidt, C.E. '48 and Charles Jansen, C.E. '48

Designed to show the relationship between theory and practice, this article describes some of the practices used in the construction of the new mechanical engineering laboratory and, more important, some of the reasons behind these practices.

The authors wish ot thank Mr. F. J. Wilcox, the architect's representative, for his time and patience in answering the many "whys" that were presented to him.

Many questions which arise in the classroom about various construction details can best be answered by an on-the-spot investigation of any one of the buildings being constructed on campus. Although these buildings are all being erected within a half-mile of the Administration building, the foundations of each vary considerably.

The Electrical Engineering laboratory is constructed entirely on pile footings driven to an average depth of 18 feet; whereas the Mechanical Engineering laboratory utilizes pile, cantilever, continuous, and single footings of varying dimensions. Both buildings used shell piles filled with concrete and were driven according to the Engineering News formula. The E. E. laboratory piles rest upon a gravel strata and were given 54 blows for the last 3 inches while the M. E. laboratory piles are supported by a strata of blue clay and were given 48 blows for the last 3 inches.

The footings at the north end of the M. E. laboratory are poured on top of piles, while the south end of the building is supported by individual spread footings. For this reason there might be a difference in settlement between the north and south ends; therefore the building is divided into two sections and connected by an expansion joint. The columns along the expansion joint are placed on cantilever footings so that the two sections can act as individual units and settle independently of each other. The purpose of the large steel girder in the M. E. laboratory, which has undoubtedly caused comment among the student engineers, is to provide a connection for further building additions.

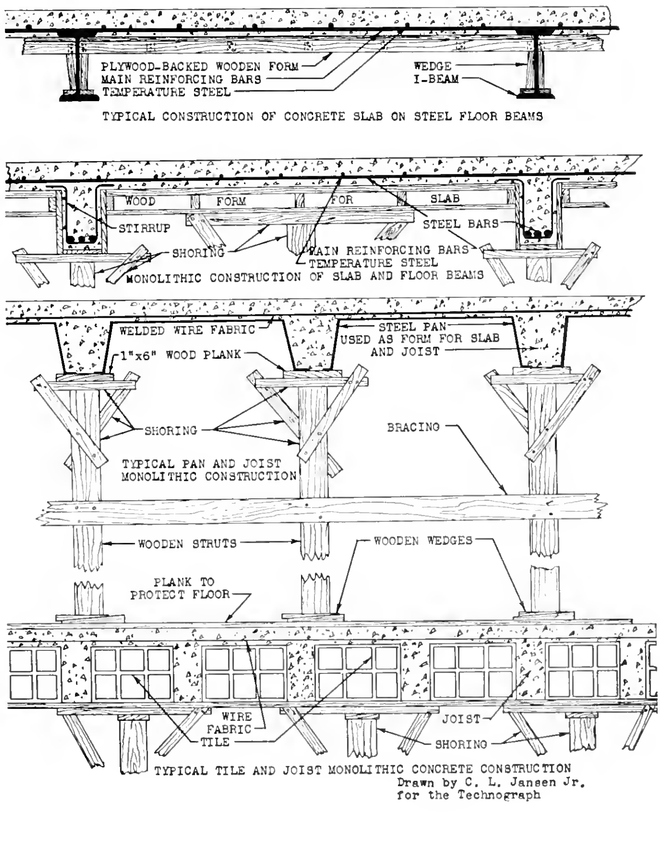
Steel pans, nailed to 1" x 6" wooden planks, constitute the form work for the joists and floor slabs of the M. E. laboratory. Wooden shoring supports the forms (see fig. 1). The joist elevation is obtained by driving wooden wedges under the shoring until all the joists are level. This procedure also facilitates the removal of the shoring. A plank placed between the floor and the shoring struts prevents any possible damage to the wearing surface that might be caused when driving the wedges.

After the forms have been erected, the temperature steel and reinforcing bars are laid in place. The temperature steel is laid at right angles to the reinforcing steel and takes the stresses introduced by the contraction and expansion of the slab due to temperature changes.

Other construction features, such as using reinforced concrete instead of steel, and joist pans instead of joist tiles, were simply designer's choice influenced by frugality. Although standard sized reinforcing bars are emphasized in design courses, on the actual job a round bar may replace one of the specified square bars as the steel company might not have had any square bars in stock. The computed bending moment will be safely resisted by the steel as long as the area

(Continued on Page 18)

FIG. 1



Woodward Governor Company plant at Rockford, Illinois

Industrial Sightseeing . . . *Woodward Governor Co.*

By Don Johnson, E.E. '49

An airplane is in level flight with the control set for an engine speed of 2000 revolutions per minute. The pilot pulls the plane into a climb, forcing the engine speed to momentarily decrease, but almost instantaneously the constant speed control reduces the pitch of the propellers, the engine speed returns to normal, and the plane continues to climb at a reduced airspeed due to the power required to increase the altitude.

In the same way, then the pilot levels off, the engine load will be momentarily decreased, causing the engine speed to tend to increase, but again, almost instantaneously, the blade pitch is increased automatically to that position necessary to absorb the engine power output at that engine speed and throttle setting, and the plane proceeds in level flight at an increased airspeed.

If while in level flight the pilot desires to increase the speed of his plane, he has only to increase the throttle opening. As the engine momentarily accelerates, the governor increases the blade pitch, absorbing the increased power and returning the engine speed to normal. Thus, the engine speed remains constant, while the forward speed of the plane is increased because of the engine's greater power output.

Airplane governors providing automatically controlled adjustable pitch propellers are essential for satisfactory performance of modern aircraft.

The first company to develop a practical airplane governor was the Woodward Governor company of Rockford, Illinois. Its governing devices have been installed in the majority of America's great dams, and in installations throughout the world, including the Soviet Union's historic Dnieprostroy Dam, which was destroyed in the face of Nazi invasion. Its Diesel governors are found aboard submarines, patrol-torpedo boats, sub chasers, destroyers, cruisers, battleships, tugs, merchantmen, streamlined trains, and in stationary electric plants. These governors range in work capacity from 6 inch pounds to 60,000 foot pounds and in weight from the 2½ pounds airplane governor to the 75,000 pound twin cabinet actuator for the U. S. War Department's Bonneville Dam.

Amos Woodward, a Rockford machinist, received on May 31, 1870, a patent on the first practical friction-type waterwheel governor and, in 1872, opened up his own general pattern and machine shop in a small two story frame building. In 1899, two years before the Woodward Governor company was incorporated, his son, Elmer Woodward, developed the first mechanical compensating-type governor which decreased the time required to operate the gates over full travel. After assuming the presidency in 1919, Elmer Woodward developed the first successful hydraulic Diesel engine governor and, in 1934, the first satisfactory governor for controlling the pitch of airplane propellers.

During this time the company's physical plant had also been growing. Leaving their original two story frame building in 1893, the Woodward Governor company remodeled and occupied the N. C. Thompson's Reaper Works building, and a five story steel and concrete structure was completed for them in 1909.

During the lifetime of the two Woodwards, their company became the oldest and largest manufacturers of hydraulic governors for prime movers.

Devoted to the manufacture of precision governing equipment and associated auxiliary devices for all prime movers exclusively, the company has never expanded except where absolutely necessary. However, shortly after Pearl Harbor, it completed and occupied a new and beautiful plant, which they said was "probably the most completely equipped industrial plant in the world." Although conservative in expansion, the company showed unusual progressiveness in the design of their plant.

The exterior of this building is buff brick and Lannon stone with Bedford trim, and is entirely windowless except for three small areas of glass block. Basic construction is reenforced concrete and steel. All ceilings are acoustically treated so that even in the machine shop the sound level is such that conversation in normal tones is easily heard and all lighting is white fluorescent with fixtures flush mounted. The entire building, including the shop, is air conditioned. All incoming air is heated or cooled, humidified or dehumidified as required and filtered through self-cleaning electric precipitation type filters. Because of low building losses, cooling is required under normal load conditions for outside temperatures as low as 3° to 6° below zero for the office area and 45° below for the shop. Contrast this with so many plants today where the workers must work in T-shirts all summer and in jackets all winter. Throughout the building are flush mounted ceiling loudspeakers carrying general paging, announcements, and music during rest periods.

At the time of completion, the main machine shop in the Woodward Governor company's modern plant ranked second to none in the world. Comprising a floor area of approximately 35,000 square feet devoted to machining operations, the entire area is clear from floor to ceiling except for ceramic tile enclosed steel columns for roof support. All machines, 98% of which were less than five years old at the time of dedication of the new building, are equipped with individual drives, eliminating line shafting and belts, and all electrical and compressed air services to the machines are brought up through the floor.

Above the suspended shop ceiling is all necessary wiring and ventilating ductwork, making it possible to service the lighting and air conditioning from above without disrupting shop operation.

The shop floor is terrazo with alundum chips in the filler to prevent slipping, the ceiling is perforated metal acoustic tile, and the walls are ceramic tile in restful colors of green and buff. The fluorescent lights flushed into the ceiling provide approximately 50 foot-candles at the work level.

In this shop are performed all machine operations on airplane, Diesel, and water-wheel governors. Parts produced range from a few ounces to several thousand pounds and tolerances of two ten-thousandths are not unusual.

The engineering department is soundproofed with rubber floor and acoustic ceiling, and lighted by flush mounted fluorescent lights which provide approximately 140 foot-candles on the drawing boards.

The subject of the fourth article on local industries is the Woodward Governor company of Rockford, Illinois. Getting its start over 75 years ago, this company is typical of the many businesses which were started modestly by one man, developed into successful concerns by himself and his family, and finally, by incorporation, were transformed into large organizations without loss of purpose or principles upon which they were founded.

The experimental department consists of the general laboratory, the chemistry laboratory, the engine test room, the hydraulic laboratory, the photographic laboratory, and the model shop where first models for experimental units are constructed. The stratosphere chamber, also a part of the experimental laboratory, one of the largest units of its type ever built, duplicates conditions of temperature and pressure encountered by aircraft at altitudes up to 70,000 feet. Temperature within the chamber can be controlled from —95 F. to +175 F., and pressure ranging from atmosphere to one inch of mercury.

Probably the most outstanding of all this plant's construction is its facilities for its employees.

The cafeteria, in the basement of the office section, is operated on a non-profit basis by the Primary committee of Multiple Management. (More will be told about Multiple Management later.)

The auditorium seats over 500 people, in chairs which can be removed for dances and similar gatherings, and is available to all members for meetings and social functions. It is used for general meetings, schools of instruction for members, and the biennial Woodward Governor schools, at which purchasers and users of Woodward governors exchange information and receive instruction in governor theory, operation, and maintenance. It is equipped with sound-movie equipment and a parabolic reflector microphone to pick up audience questions.

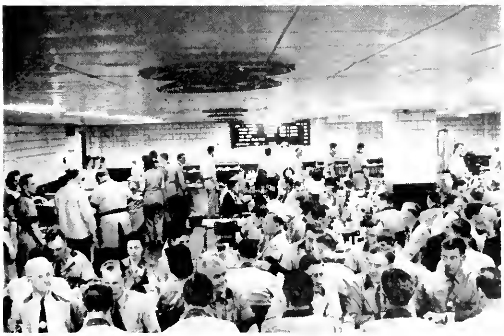
The personnel department gives each prospective employee written general and specific intelligence examinations and manual dexterity test designed to determine their qualifications for various jobs in the organization. The vocational test room is equipped with booths for the tests requiring concentration and suitable apparatus for measuring the applicant's mechanical aptitudes and dexterity. Many people assign this rigid employment selection as one of the main reasons for the company's success.

Provided for the employees is a parking lot which is patrolled by guards and floodlighted at night; twenty-two showers; and locker rooms in which each locker is ventilated to keep clothing fresh.

Open constantly is the shop hospital. In addition to the available first aid service, each member is given complete physical, foot, and dental X-ray examinations once each year, the results of which are given to a physician and dentist of his choice. Since the purpose of these examinations is to maintain proper physical fitness, it is obligatory that corrective measures be taken.

The plant boasts a treatment room

(Continued on Page 28)



Left: View of the shop cafeteria during noon lunch. Right: Shown being used for a meeting, the auditorium is also available for dances and recreation

Something New . . .

By Martin Sabath, M.E. '48

All engineering students might well examine this liberal metamorphosis of the study program for the prospective mechanical engineering student. The changes in existing courses and the addition of many new courses described in this article have been made with the idea of helping the student in the choice and expansion of his education.

A new curriculum in mechanical engineering went into effect in October.

Only freshmen and first semester sophomores are affected by it. The curriculum will be activated semester by semester as these sophomores progress through their four years. Other students in mechanical engineering will continue to follow the old curriculum, but will benefit by having a wider selection of electives to choose from.

Mechanical engineering has the widest application of any branch of engineering. It can be roughly divided into three main fields, each of which can be further divided into specialized branches. These fields are heat power, mechanical engineering design, and production. The curriculum has been designed to give the student a working knowledge in all these fields, and in addition he can concentrate on subjects in his chosen field of specialization, if he has one.

The new curriculum was presented before a meeting of the ASME last spring by Professor N. A. Parker, head of the department of Mechanical Engineering, after considerable study and discussion by members of the department.

A total of nine options are offered in the department. These options, and the percentage of enrollment expected in each are as follows:

1. Design option, 24%: This option provides for specialization in mechanical engineering design.

1. Design option, 24%: The option is for those students whose interests lie in the field of steam and gas power.

3. Production option, 26%: This option provides emphasis on the production engineering aspects of mechanical engineering to meet the needs of those students planning on a career in the manufacturing industry.

4. Research option, 3%: A highly technical course for students interested in research and development.

5. Aeronautical option, 3%: This option is designed for those mechanical engineering students who may be interested in the aircraft industry. This option is given with the cooperation of the Department of Aeronautical Engineering.

6. Air conditioning and refrigeration option, 14%: This option provides for those interested in heating, ventilating, air conditioning, and refrigeration.

7. Petroleum production option, 6%: This option is designed for those students interested in the mechanical engineering aspects of petroleum production.

8. Railway option, 1%: This option permits specialization in railway mechanical engineering.

9. General option, 13%: This option permits selection of courses to meet the needs of students whose interests differ from those who choose special options.

The basic differences between the new curriculum and the old one may be said to be:

1. Credit is cut from certain technical courses required for all. Additional special courses are provided in the options. Some of the new courses now offered or to be offered in the near future are:

Combustion engines and turbines laboratory.

Heat transfer.

Gas turbines.

Advanced heating and ventilating design.

Production control.

Industrial quality control.

Tool engineering.

Motion and time study.

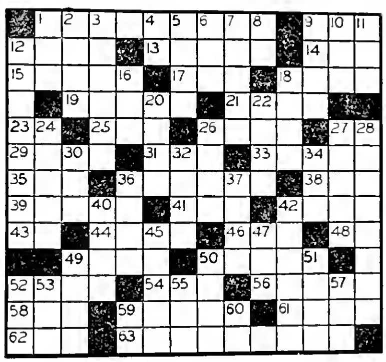
Experimental investigations.

2. Several options are listed which show how a sequence of courses may be selected to effect an emphasis on one or another phase of mechanical engineering. A student may thus have an incentive to do a better job in his particular field of interest.

3. A general option is included which permits a selection of courses which cut across the other options, or which may

(Continued on Page 20)

Crossword Puzzle



ACROSS

1. He gave his name to an induction coil
9. Health resort
12. Early form of electric battery
13. Grave robber
14. Turn to the left
15. Moves a switch to interrupt a current
17. Chess pieces
18. Inventor of the automatic block system for railroads
19. Openings for insertion of coins in coin telephones
21. What the use of electricity continues to do
23. Unit of germ plasm
25. Organ helped by proper use of light
26. Old name for Thailand
27. Scandium: chem. symbol
29. Easter flower
31. Likely
33. Inventor of 12 Across
35. Card game
36. Inventor of neon lights
38. Conger
39. Tool for straightening borders
41. Well known South African antelope
42. Not electrified, as a circuit
43. Tellurium: chem. symbol
44. Be foolishly fond
46. Essay
48. Common unit of electricity: abbr.
49. Popular radio comedian
50. Situated
52. Metric unit of weight
54. Crafty
56. Trite
58. Belonging to us
59. Watchful
61. Limy clay deposit
62. Kind of pipe connection
63. Vermont inventor, produced the first commercially successful electric motor

DOWN

1. Tear
2. Mexican rubber trees
3. English electrician, devised an electroscnpe in 1771
4. Metric weight, about 2.2 lbs.
5. Units of electrical resistance
6. Fish eggs
7. Some of these plants are destructive to wonden poles
8. Gas allied to chlorine: abbr.
9. Famous dramatist, once worked in first London telephone exchange
10. Chum
11. Shoemaker's boring tool
12. Introduced his sine galvanometer in 1837
16. Kind of Chinese bean, now grown here
18. Genus of human beings
20. Small short-necked river duck
22. Talk deliriously
24. Two element vacuum tube
26. Knock out
27. Cut of meat
28. Member of first Federal Radio Commission, 1927
30. Ship's record book
32. American physicist, invented a "galvanic multiplier" in 1837
34. Dr. DeForest's first name
36. Cut short
37. Obligation
40. Ancient country SE of Palestine
42. Electric generator
45. Inventor of the modern alternating current induction motor
47. Curved bone
49. Designed a copper and zinc battery in 1821
50. Ancient musical instrument
51. Growl, as a dog
52. Obtained
53. Regret
55. Bulgarian coin
57. Skill
59. Our present era: abbr.
60. Thoron: chem symbol

Introducing by Art Welcher, E.E. '49

Shirley Smith, E.P. '50 and Connie Minnich, C.E. '51

DICK FOLEY

"Starting at right guard for Illinois, Dick Foley, number 9." These words will echo throughout Huff gym in a few weeks as the Illini open another campaign in quest of the Big Nine basketball title. One of the stalwarts upon whom Illinois is depending to again bring home the glory won by the renowned Whiz Kids, is Dick Foley who was sidelined a whole season in the shadow of these same Whiz Kids.

Leading Illinois scorers in his freshman year, Foley, along with a host of other potential first string men, was relegated to the bench to watch the returning Whiz Kids—Menke, Phillip, Vance and Smiley—carry the brunt of the Illinois attack. Despite a mediocre performance all season, former coach, Doug Mills, perhaps influenced more by experimental reasons than by good hard basketball sese, let the Whiz Kids corner the spotlight and allowed a possibly better combination sit out most of the games.

This year, however, the Whiz Kids are gone and stellar performers like Jack Burmaster, Dwight Humphrey and especially Dick Foley will be given the chance to again prove themselves worthy of the Orange and Blue.

Dick Foley, who started his basketball career in Paris, Illinois, high school, began working toward an engineering degree at the same time. He decided to become a chemical engineer, but, after 28 months in the Signal Corps, he decided to change his major to covil engineering.

Dick is now a junior in civil engineer-

(Continued on Page 24)

DICK FOLEY

WHEELER LOOMIS

In 1929 when professor Wheeler Loomis came to Illinois as the newly appointed head of the physics department, the research divisions of universities and colleges throughout the United States were beginning to make important discoveries in some comparatively new fields

PROFESSOR LOOMIS

of physics that have now introduced us to a new era which we call the Atomic Age. Under his direction, the University has today become one of the leading institutions in the world of physics with a tremendous amount of fundamental physics, war-time research, and the invention and development of the now-famous betatron to its credit.

Dr. Loomis has behind him a long record of research, teaching, and administration in physics. Born at Parkersburg, West Virginia, he determined to be a physicist when a senior in high school. He graduated from Harvard university in 1910 with a bachelor of arts degree and continued there with his graduate work, taking a master's in 1913 and a doctorate of philosophy in 1917. During World War I, he served as a captain in the ordnance department in charge of anti-aircraft ballistics at the Aberdeen proving ground in Maryland. Resuming his career, he held the position of research physicist with the Westinghouse Lamp company until 1920 when he became successively assistant professor and associate professor in the physics depart-

(Continued on Page 24)

WILTON McDEVITT

For 22 years Mr. W. B. McDevitt has worked at the University amid the white clay dust and intricate halls of the Ceramics building. "Mac" is a potter, an expert in his trade.

Mr. McDevitt was born on a farm near Hamilton, Missouri, but in 1896 his family moved to East Liverpool, Ohio, where he began his five year apprenticeship in ceramics. Then, as a journeyman, he continued to work in East Liverpool for 8 years. Part of this time was spent in sanitary work. From there, Mr. McDevitt went to Mannigton, West Virginia, where he was employed for two and a half years by the Bowers Pottery company.

In 1925, "Mac" joined the University staff as general utility man and storekeeper for the ceramics department. He also supervised "a class in pottery from raw clay to finished products consisting of bowls, vases, ash trays, and lamp vases."

In the past he has made many ceramics pieces of special shapes and uses for other departments of the University. These included crucibles, molds, and cases for a variety of objects.

In 1941 Mr. McDevitt began working with the physics department in the development of porcelain tubes for the betatron. At present, he is retired from his job in the ceramics department, but he is continuing to work part-time with the physics department to complete the latest betatron accessory, a doughnut-shaped tube made in sections and measuring ninety inches in diameter. In addition, he continues to supervise the instruction of a few classes.

Besides being an expert in the field of ceramics, "Mac" has another passion. As he says, "I'm nuts about fishing!" He makes a point of fishing at Danville whenever he has time, and in the sum-

(Continued on Page 30)

"MAC"

In This Corner... NAVY PIER

Just Between Us

by Siegmund Deutscher, A.E. '50

Since this is the first issue in which the Navy Pier branch of the University is represented, we would like to acquaint the reader with the *TECHNOGRAPH*.

The *TECHNOGRAPH* is published 8 times during the year (October through May) at Urbana, Illinois, by students in the College of Engineering.

The undergraduate division will be represented by two pages in every issue and a number of feature articles throughout the issues. In cooperation with the downstate staff, we shall try our best to present the reader with the newest developments in the engineering industries, the latest news of our engineering departments and to acquaint our subscribers with the engineering field in general.

In our two assigned pages we shall attempt to acquaint you with the College of Engineering at Navy Pier. This is to be accomplished by an interview with a staff member, an interview with a student, an article on our equipment and a report on the local engineering societies.

It is also fitting, at this time, to express our thanks and appreciation to Professor Randolph P. Hoelsher, associate dean of engineering science at Navy Pier, for his valuable help and effort in organizing the *TECHNOGRAPH* staff here and in securing our office (room 354-I) and equipment.

By no means can our appreciation stop at this point, for Mr. Ogden Livermore, instructor in the department of physics and our faculty adviser, has given us much of his time and effort in advising and organizing our present staff.

In addition to the above, we wish to extend our thanks to George R. Foster and Robert A. Johnson, editor and business manager of the *TECHNOGRAPH*, respectively. Both have come to Navy Pier to give us their personal guidance and instructions and have given us all the help they could at our inception. We are proud to be members of the same publication staff.

PIER CLOSE-UPS

The Technograph Staff

by Richard Choronzy, M.E. '51

On November 3, 1947, ten applicants were chosen and assigned to their respective positions on the newly formed *TECHNOGRAPH* staff at Navy Pier. The following is a brief sketch of each member of our staff.

Up in room 354-I, you can locate Siegmund Deutscher every day between two and five in the afternoon. Siegmund, by virtue of his past experience in writing and editing in various school newspapers, was appointed assistant editor of our branch staff. His life story reads like a fiction novel. In 1939, at the age of 10, he arrived in the United States from a trip abroad in which he visited many countries. He was born in Austria and still remembers the schools at which he studied in Vienna. All told, he has attended 27 schools including those in the United States and Austria. Siegmund is a sophomore in aeronautical engineering and his chief hobbies are photography and writing.

Our assistant business manager is Joan Burns who has the distinction of being the only girl on our staff. Joan graduated from Lakeview high school, Chicago, in 1945. Like Siegmund, she is a sophomore in aeronautical engineering. Her major recreation is golf.

Four young men comprise our reporting staff. The first, John Fijolek, spent over five years in the army signal corps, from which he drew his present knowledge of electricity. He belongs to the A.I.E.E. and various other organizations on the Pier campus. John is a freshman in electrical engineering.

Our second writer is Norbert Ellman, who graduated from Schurz high school, Chicago, in 1944. After 26 months in the navy, he enrolled at Navy Pier and is now a freshman. Norbert belongs to the A.S.M.E. and his favorite pastime is basketball.

Our third member of the reporting

Standing, left to right: Norbert Ellman, John Kaufman, John Fijolek, John Cedarholm, Clarence Niebow, Leonard Cohen, Richard Choronzy. Seated: Joan Burns, Siegmund Deutscher. Not present: Ronald Wessel.

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EDITORIAL STAFF

Siegmund Deutscher............*Asst. Editor*

Reporting

John Fijolek — Norbert Ellman
Richard Choronzy

Photography

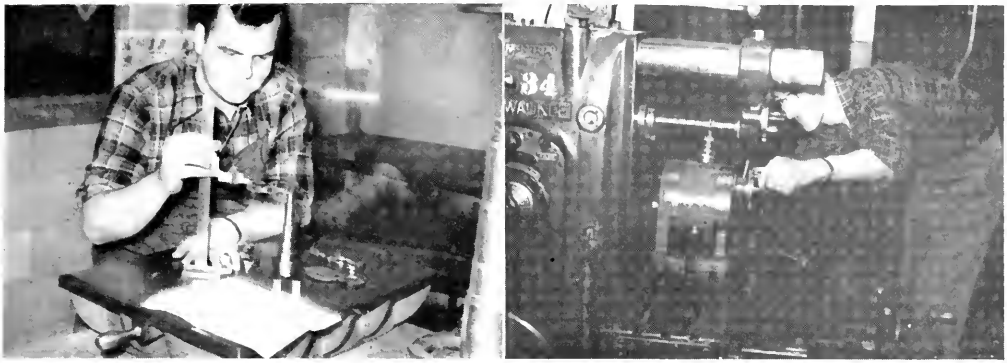
Clarence Niebow

•

BUSINESS STAFF

Joan Burns.................*Asst. Bus. Mgr.*

John Cedarholm — Leonard Cohen
John Kaufman — Ronald Wessel



Left: Unidentified student checks a piece of finished work with a dial indicator from the inspection department of the machine shop. Right: Another student, also unidentified, operates a Milwaukee milling machine which is a part of the shop equipment

staff is Clarence Niebow, who also handles the photography. Clarence is a freshman in chemical engineering, having just graduated from Lane Technical high school last June. His hobby, obviously, is photography.

The other writer on this staff is yours truly, Richard Choronzy. I graduated from Harrison high school, Chicago, in June, 1947, and am now a freshman in mechanical engineering. I belong to the A.S.M.E. and the Classics club.

The remaining four members make up our business staff. John Cedarholm, the lad with the boyish grin, is a sophomore in engineering physics. After graduating from York high school, Elmhurst, in 1945, he served in the navy for one year. John is a member of the honorary fraternity, Phi Eta Sigma.

John Kaufman, sidekick of Cedarholm, is a sophomore in engineering physics and is also a member of Phi Eta Sigma. John served two years in the navy and is a graduate of Lane Technical high school in Chicago.

Leonard Cohen hails from Philadelphia, Pennsylvania. In 1946, he left that city to come here to Chicago's Navy Pier. He was in the navy for two years and is now a sophomore in electrical engineering.

Last and certainly not least is Ronald Wessel, who is majoring in metallurgical engineering. Ronald graduated from Palatine Township high school and served in the army for 30 months. His fraternity is also Phi Eta Sigma.

Under the heading "Gas Overcomes Girl While Taking Bath," the following appears in a local paper:

"Miss Cecelia M. Jones owes her life to the watchfulness of Joel Colley, elevator boy, and Rufus Bacon, janitor."

* * *

She was only a T.A.M. instructor's daughter, but she had her moments.

Shop Talk

by John Fijolek, E.E. '51

In the center of Navy Pier's long jutting arm, 264 students of aeronautical and mechanical engineering are enjoying practice with the tools of their sciences this semester under the dierction of Professor J. S. Kozacka and his staff. New equipment installed by the University has made available four new shop courses at the Chicago branch.

In one of the most completely equipped shops of its kind in this section

With this issue the Illinois Technograph takes great pride in announcing to its readers the addition of this department prepared by our branch staff at Navy Pier. We would also like to welcome our new staff and readers at the pier.

of the country, students in M.E. 87 (machine tool laboratory—three hour course) are given experience in operating many and varied types of machines of latest make and model. For example, the equipment of the shop includes: 19 lathes—precision machines by Pratt-Whitney, Monarch, and Handy; 2 turret lathes; 10 milling machines—horizontal and vertical types; 4 shapers; 1 planer—hydraulically operated; 2 gear shapers for cutting internal and external gears; 7 drill presses; 9 grinding machines of different types; 5 tool grinders and various other machines.

On this page is a photograph showing some of the equipment in use by the students. Also shown is a well-equipped inspection department maintained for checking the work of the students. Here are found fine measuring instruments, gauges and gauge blocks, comparators, a projecting comparator, hardness testing machines, and optical flats for measuring to millionths of an inch.

In addition to the above there is a large tool crib which contains a great variety of tools for the operation of all the machines and for use in metal cutting. Not for want of a nail can a grade be lost!

Demonstrations are given in M.E. 82 (machine tool production methods—one hour) in the use of machines, tools, jigs, and fixtures. Students operate various machines and make simple jobs on milling, regular gear cutting, and special gear cutting machines. Occasionally movies are shown of current industrial practice.

To assist the students in their work and answer their questions, the machine shop has four staff personnel. Of these, two are instructors, one is a senior mechanic and the other is a junior mechanic.

The other two new shops will be covered on these pages in a later issue.

Personable George, "What d'ya wanna buy, I'll sell it to ya cheaper than you can get it anywhere else," Zanotti can, without a doubt, claim undisputed possession of the BMOC (busiest) title this semester. In addition to teaching classes in G.E.D., sitting in on a T.A.M. 2 class to help prepare him for his teaching position at the Navy Pier branch next spring, tutoring in M.E., math., physics, aerodynamics, G.E.D., T.A.M., and other subjects relative to engineering, (see his secretary for appointments) counsel in personal problems, and lastly, trying to get his degree in aeronautical engineering, is a weekly commutor to Chicago. His wife, Theresa, was expecting about Christmas time and this issue went to press before the happy event. You can contact him for latest results and cigars.

The Engineering Honoraries and Societies

By John Shurtleff, Ch.E. '50 and Dick Hammack, G.E. '48

ENGINEERING COUNCIL

The first official meeting of the Engineering Council was called to order by George Foster, temporary chairman, on December 2, 1947, at 7:00 p. m. in 207 E. H. I.A.S. had ratified the constitution on condition that the limit on the treasury be increased. The opening discussion was one of attempting to effect a compromise on that point. According to the constitution, I.A.S. could prevent the distribution of the money in the treasury by one vote. The other alternative would be for the society to keep any money received from the Council in a separate account. The I.A.S. representative felt that a solution agreeable to all would be worked out by the time of the next meeting of the Council on December 16.

Before the Council could elect officers for the year, it had to be decided how long the representatives would remain on the Council. Vice-presidents elected on a semester basis would be replaced in February. The elected delegates are supposed to serve a year starting with the spring semester. This will result in a large turnover in the middle of the school year. It was tentatively decided that the present elected representatives on the council would serve until June, 1948, and gradually turn over their duties to the representatives to be elected next year.

The new officers are Murray Forth, A.S.A.E., president; Floyd Maupin, S.B.A.C.S., vice-president; Barbara Schmidt, A.S.C.E., secretary; and Allen Benson, I.A.S., treasurer.

By unanimous vote, it was decided to have two standing committees. Murray Forth appointed Keith Goodwin, A.I.E.E.-I.R.E., chairman of the Steering and Program committee. The purpose of this committee will be to direct and arrange business to be brought before the Council. Floyd Maupin was appointed chairman of the Coordinating and Publicity committee. This committee will keep the societies informed on events of interest and will arrange for publication of news to the public. In order to make the work of the Publicity committee effective, it was strongly recommended that every society appoint a publicity chairman and or committee who will be specifically responsible for preparing news releases on all activities, meetings, etc., of the society and who will work in close contact with the Publicity committee of the Council.

The St. Patrick's ball committee will be headed by Robert Chilenskas, A.S.Ch.E., and John Prodan, I.A.S. This committee will make all the necessary arrangements for the ball such as tickets, publicity, arrangements for the band and location, decorations, etc. They will submit a budget at the next meeting and will have made all the preliminary arrangements before Christmas vacation.

"BUCK" KNIGHT TROPHY

The evening of January 13, 1948, will mark the renewal of the "Buck" Knight Trophy competition. The student branch of the American Society of Mechanical Engineers, the present holders of the trophy, have received and accepted a challenge from the student branch of the American Institute of Electrical Engineers.

The subject matter of the competition is limited to non-engineering subjects and only those which are regularly discussed in newspapers and radio broadcasts.

Each of the competing societies will be represented by a panel of four men. The judging will be handled by men who are in no way connected with the College of Engineering.

The winner of this contest will be obligated to accept challenges from any and all of the other seven student branch societies, or else forfeit the trophy.

The contest will be held in room 112, Gregory hall, at 7:30 p. m. Everybody is invited including the wives and girl friends. This should prove to be one of the most enjoyable social events of the school year, and it is hoped that an enthusiastic audience will be present.

A.S.C.E.

Following a study of the Engineering Council's constitution by James Chandler, Barbara Schmidt, Charles L. Jansen Jr., Bill Miller, and Frank Anderson, the Engineering Council was adopted by the A.S.C.E. at a short business meeting held in room 319, Engineering Hall, on October 29.

"Special Problems in Drainage on the Congress Street Superhighway" was presented by Mr. John C. Guillou, special research associate in the CE department, who illustrated his talk with slides showing the location and details of the superhighway at the November 18 meeting of the chapter.

The Illinois division of highways has allocated $25,000 per year to the Civil Engineering department which is conducting all research for the state and federal government. The money will be well spent since the cost of drainage for the completed highway will be $500,000 per mile of road. The highway is designed for 2,000 cars per hour per lane at a speed of 60 m.p.h. The 300-foot right of way is made up of eight 12-foot highway lanes, four in each direction; four train tracks, two in each direction; road shoulders; and drainage ditches.

At a combined A.S.C.E. meeting and CE 93 lecture on November 19, Mr. Craig P. Hazelet, consulting engineer from Louisville, Kentucky, spoke on the general subject, "Aspects of a Professional Career." He urged that student engineers become proficient as public speakers at A.S.C.E. meetings and at every other possible opportunity. Mr. Hazelet, who is on the administrative committee for student chapters, also emphasized the importance of writing for technical publications as a means of developing the engineers literary skill.

A.S.A.E.

On October 20, the Illinois student branch called its first meeting of the semester with approximately 50 old and new prospective members in attendance.

President A. E. Rust introduced Professor E. W. Lehmann, head of the department of agricultural engineering, who delivered an enthusiastic welcome to all and introduced other members of the faculty.

The first meeting was characterized by the presentation of an ambitious program of branch activities for the coming year. A lengthy report was given by each Illinois delegate to the national convention of the A.S.A.E. in June.

On November 3, the machinery began rolling for the development of the branch's activities, and committees were set up to plan programs for each meeting, publicize meetings, secure refreshments, and take care of the journalistic work in connection with the society and individual members.

The annual fall picnic was held Sunday afternoon, November 9, in an atmosphere familiar to all agricultural engineers. In the tractor and farm machinery lab, some 40 students and faculty members gathered to cook weiners, eat apples, drink cider, play badminton and touch football. Originally scheduled for the city park, the weather man forced the use of the tractor lab as the alternate scene of action.

On November 24, a meeting was devoted to the technical problems involved in agricultural engineering. Mr. T. R. Wire and Mr. D. O. Keairn, agricultural engineers employed in the Soil Conservation service working out of Milwaukee, presented an hour's discussion on "Soil Conservation as It Affects the Agricultural Engineer." It was stated that soil runoff, the impact of rain drops on the soil, and mechanical practices in erosion control are all problems confronting the agricultural engineer; and therefore, an engineering background is almost mandatory to solve many soil conservation problems.

A.I.Ch.E.

Six student members attended the fortieth annual convention of the American Institute of Chemical Engineers in Detroit, Michigan, at the Statler hotel. They were Don Hornbeck, Jack Besperka, Bob Chilenskas, Ernest Waggoner, Karl Franson, Robert Toomey, and Tom Baron. The students attended the regular programs of the institute and also an inspection trip through the development laboratories of the Chrysler corporation.

The student meetings were held on November 12 and 13 at the Rackham Memorial Institute. Dr. Comings, professor of chemical engineering at the University of Illinois and national chairman of the committee on student chapters, presided. Several talks were given at this symposium.

On Wednesday evening, November 12, a student banquet was held at the Prince Edward hotel in Windsor, Canada. Mr. Sidney D. Kirkpatrick, editor of Chemical Engineering magazine and an Illinois alumnus, gave the principal address of the evening, entitled "Chemical Engineering Opportunities and Achievements." He was introduced by Albert B. Newman, vice-president of the A. I. Ch. E.

The winning solution of the student contest problem was also on display. The problem is sponsored by A. I. Ch. E. and is given in the spring of each year.

Attending these meetings affords the student chemical engineer the opportunity of meeting successful and progressive men in the field, making valuable contacts, developing a "feeling" for the profession, meeting students from other universities, and obtaining and sharing experiences and information with other engineers. In addition, it gives him a feeling of "belonging to the profession," and puts him in a more receptive frame of mind toward developments in his profession.

I.T.E.

The University of Illinois student chapter of the Institute of Traffic Engineers is now the second student chapter in the nation, having received official approval of the Institute on November 7. They have been holding meetings every two weeks and have begun work on their first major project.

This project involves the study of the immediate campus area in an attempt to find solutions to some of the traffic congestion problems. Traffic surveys were conducted on November 12 and 19, from 7:45 a. m. to 10:45 a. m., in the area bounded by Springfield avenue on the north, Gregory drive on the south, Sixth street on the west, and Mathews avenue on the east. All intersections along the bounding streets and within the area were checked, making a total of 24 stations. The actual field work was done by members of the chapter and by students in the C. E. 20 and 23 classes.

On the first Wednesday, a count was made of all vehicles entering and leaving the area and their movement within the area. A survey of all cars parked within the area was made the same day by checking cars by location and license numbers in the morning and again in the afternoon to determine the use made of the present parking capacity and the number of all day parkers.

On the following Wednesday, a count was made of all pedestrians crossing the most congested streets within the area. Another parking survey was also made, this time checking the cars at twenty minute intervals to determine the length of time parked.

It is hoped that upon analysis of the compiled field data, the I. T. E. will be able to find some of the answers to present traffic problems. There may be a need for the development of more adequate off-street parking facilities, a change in present time limits on parking, a system of one way streets, retiming of the present traffic signals, special pedestrian control signals or the use of some painted lines on the streets to guide the movement of both vehicles and pedestrians, and better enforcement of the existing traffic ordinances.

Whatever may be the solutions reached, they will be presented to local agencies interested in these problems; and, with their cooperation, to the proper authorities for study.

KERAMOS

At the first meeting of Keramos, the national professional ceramic engineering society, the following officers were elected: James F. Essenpreiss, president; H. G. Sowman, vice-president; C. Roger Westlake, treasurer; James F. Young, secretary; Roger F. Fellows, herald.

A short business meeting was then held to outline plans for the semester.

After the business session two movies were shown to the group. The first movie dealt with the manufacture of a structural clay product, and the second showed performances of the University band during the 1946 football season.

The non-business portion of the November meeting was devoted to a discussion of the problems confronting the young engineer.

PI TAU SIGMA

At a recent meeting of Pi Tau Sigma, Lee Sullivan and Martin Sabath reported on the national convention which they attended at Purdue on November 20, 21, and 22. At the convention, Sullivan served on the finance committee, and Sabath worked on the committee for expansion.

New pledges met the actives at a smoker held shortly before Christmas vacation. These men will be initiated at a banquet to be held soon after the return to classes.

CHI EPSILON

Thirty-five men were selected as pledges by the active members of Chi Epsilon, civil engineering honorary, at the meeting held on November 5. These men met the members at a rushing smoker held on November 12, and were initiated during the week of December 12, which was climaxed by an initiation banquet. Dr. Nathan M. Newmark, research professor in civil engineering, was made an honorary member at that time.

Following is a list of the new pledges: R. A. Anderson, F. A. Bassett, C. W. Browning, H. H. Connolly, E. Cabezas,

(Continued on Page 26)

GEORGE R. FOSTER
Editor

FRANCIS P. GREEN
Asst. Editor

EDWIN A. WITORT
Asst. Editor

the Illinois Technograph

We HAVE an Engineering Council

Last summer on the 28th of June and every Monday night thereafter throughout the entire 16 weeks of summer school a committee of ten people met to draft a constitution for the Engineering Council. The committee consisted of at least one representative from each of the eight professional engineering societies and the editor and business manager of the *Illinois Technograph.* The work of the committee, needless to say, was laborious and finally resulted in the finished constitution which was acted upon during the first few weeks of this semester and ratified by each of the eight participating societies.

This action authorized the organization of the Engineering Council which consists of two representatives from each of the professional societies and the editor and business manager of the *Technograph.* In the words of the constitution: "The purpose of the Engineering Council is:

1. "To bring about closer relationship and cooperation among the various professional societies.

2. "To stimulate the interest of the engineering student in all engineering activities on campus.

3. "To be responsible for the planning and carrying-out of combined activities of the engineering societies: e.g., St. Pat's Ball and the Engineering Show."

These statements of purpose are merely that, but do not indicate in any way the reasons for their inclusion in the constitution.

Certainly, the practicing engineer knows, or soon finds out, that his everyday work frequently brings him in contact with engineering fields by no means restricted to his own. He continually meets and works with men in other engineering lines and usually becomes associated with several professional societies related to his work. As a means of impressing this fact upon the student engineer, it is felt that the Engineering Council can foster a closer relationship among the members of the societies.

The intermingling of ideas brought about by this closer relationship was not considered sufficient; however, unless these ideas were attracted to maturity by an active cooperation among the societies. In the past the eight societies have been less effective than the lowly octopus, because this creature does have, at least, a brain with which to occasionally direct its eight legs towards a common goal. With the formation of the Engineering Council there exists the agency which can help to plan and coordinate the activities of the societies to prevent overlapping and, in general, increase the benefits offered by these activities. Although it is not in any sense the intent nor, since the Council derives its authority only from the consent of participating societies, is it possible for the Council to interfere with the existing functions and aims of the individual societies. It is certainly to be hoped that the truly active cooperation on the part of the societies will manifest itself in very serious consideration of all Council actions and recommendations.

By this cooperative action it is felt that the activities offered and sponsored by the Council will greatly benefit the individual society member since it will be he who is taking the active part in carrying out these functions. That all the engineering students should receive the benefits of the Council's services is a foregone conclusion, but the mere fact that the societies, through the Council, have made these activities available should do much to stimulate their interest and encourage them to affiliate themselves with the professional society in their field.

Finally, the means by which the Council can provide these benefits to all engineering students is to plan and execute a variety of functions in which the student can actively participate. Passive participation, such as listening to speakers, has its place in any organizational program but should be complemented by activities in which the participants can really "pitch in." The Engineering Council can and will sponsor these and other functions. At the present time it has already gone to work on St. Pat's Ball, and the possibilities for the future are practically unlimited. It remains now only for every student to contribute his ideas through his Council representative to form the blueprint of a better and more interesting campus life and later to devote his energies to make that blueprint a reality.

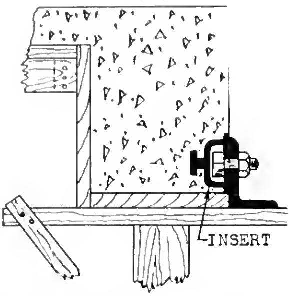
CONSTRUCTION . . .

(Continued from Page 7)

furnished is equal to, or greater than, the area of the specified square bars.

Fastened to the inside of the forms for the wall beams is a spandrel angle insert which is held fast by the finished concrete beam. This insert provides a means of attaching angles which support the outer masonry construction, allowing the load of the wall itself to be transferred to the wall beams.

FIG. 2



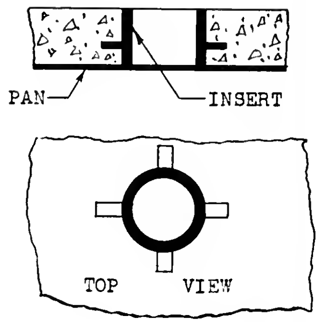
SPANDREL ANGLE INSERT DETAIL WITH WALL BEAM FORM REMOVED TO SHOW METHOD OF ATTACHING ANGLE

High temperatures, resulting from fire, would weaken the reinforcing steel and cause the structure to fail; therefore it is standard practice to enclose all reinforcing bars with a layer of concrete. A concrete cover of $1\frac{1}{2}$ inches is used on beams and girders to resist a fire of four hours duration, while floor slabs utilize a ¾ inch covering for a fire of the same duration. The device which provides the proper amount of fire cover for the reinforcing bars is known as a chair. These chairs are usually gage wire or small bars bent into shape. The chairs are placed on the forms and the reinforcing bars rest upon them, allowing the concrete to completely encase the bars. The estimator does not include these chairs in his estimate because it is standard practice for the steel company to furnish the proper number needed when filling an order for the reinforcing bars.

The structural designer usually does not take into account the ordinary openings for plumbing and ventilating pipes and electrical conduits in the design of the floor construction because his architectural plans are not complete. Where these openings are comparatively small, their final location is decided by the contractors on the job. The actual location of plumbing and heating inserts must be accurately determined because of the difficulty and extra expense that would result in placing bends in the pipes. The insert mentioned above is a section of steel pipe with welded lugs which is placed on the pans in the desired location, and is held in place by the finished slab. This results in an opening through which the sub-contractor may run his pipe or conduit. Because the electrical conduits are easier to bend for relocation, the heating and plumbing contractors are usually given preference over the electri-

(Continued on Page 20)

FIG. 3



HEATING AND PLUMBING INSERT WITH WELDED LUGS

CONSTRUCTION . . .

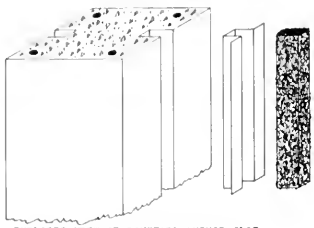
(Continued from Page 18)

cal contractors when both parties desire the same location for inserts.

When an electrical junction box, which is desired for the room below is deeper than the floor slab, but is not located at a joist, it is necessary to provide a greater depth of concrete than is furnished by the slab. To accomplish this the pans are telescoped a few inches in the direction of the joists and fitted with ends which permit the formation of an auxiliary joist at right angles to the regular joist.

Dovetail anchor slots are channel sections of sheet iron which are nailed in place vertically to the column forms and which are filled with felt in order to keep the concrete out during pouring. These anchor slots are approximately ¾ inch wide and 1½ inches deep. When the forms are taken from the columns, the felt is removed and these slots are utilized in anchoring the walls to the columns. When all chairs, stirrups (U-shaped bars used to take the shear in beams), reinforcing bars, spandrel angle inserts, plumbing, heating inserts, and dovetail anchor slots have been placed, the steel mesh is then laid. After all debris has been blown off the section by compressed air, the ready-mixed concrete is poured and vibrated into place. The

FIG. 4



EXPLODED VIEW OF DOVETAIL ANCHOR SLOT SHOWING COLUMN, CHANNEL, AND FELT INSERT

M. E. laboratory specifications call for 2500 p.s.i. concrete, and samples are sent to an independent laboratory in Chicago for analysis. As a rule all form work is kept in place at least 7 to 10 days, or longer as needed. With the coming of cold weather, tarpaulins and salamanders are being used to raise the temperature to insure proper curing.

"Rats!" said the contractor as the building collapsed, "I told those carpenters not to take down the shoring until the walls were plastered."

"Now that I've told you my past, do you still want to marry me?"

"Yes, beloved."

"I suppose you will expect me to live it down."

"No, I expect you to live up to it."

SOMETHING NEW . . .

(Continued from Page 10)

be in non-technical subjects or in commerce.

4. A minimum of nine credit hours of non-technical subjects are required in every option. If Rhetoric is included, this becomes fifteen credit hours. As many as thirty hours of non-technical courses may be taken in the general option.

The reason for the gradual transition to the new curriculum is the limited capacity of the physical plant and staff. Some courses have been shifted to a different semester in the curriculum. To have a complete change at once would overtax the capacities of the electrical engineering department and of the T. & A. M. department.

The staff is being enlarged to bring in some outstanding men. This is a process which takes considerable time.

Some of the new courses cannot be offered until facilities are completed in the new Mechanical Engineering building, now under construction.

The new curriculum is part of the overall improvement program which will make it possible for a student to select any specialized field of mechanical engineering at the University of Illinois, and have the finest facilities and faculty possible.

WHEELER LOOMIS . . .

(Continued from Page 11)

ment of New York university. In 1928-29, Dr. Loomis held a Guggenheim Memorial fellowship to study at Göttingen, Germany, and at Zürich, Switzerland. It was following his return that he accepted his present position here at the University.

A year before Pearl Harbor, Dr. Loomis took a leave of absence to serve as the associate director of the radiation laboratory at the Massachusetts Institute of Technology from which he returned to Illinois in 1946. The microwave radar which this laboratory developed for our army, navy, and air forces was the decisive factor in the defeat of German submarines, brought down 95% of the V-1 rockets, guided our air forces in the bombing of Europe through overcast, and affected the outcome of naval battles. The laboratory employed nearly 4000 people and spent about $50,000,000.

His small office in 203 Physics building is generally a hubbub of business throughout the day. Dr. Loomis' many duties include directing the large department staff of 165, and giving demonstration lectures to large sophomore classes in physics. His specialty is the study of molecular spectra, in which field he is known for his discovery of the isotope effect and for his work on absorption and fluorescence spectra of molecules.

At that time of the year when the majority of faculty and students are finding some relief from the past year's work, the sea holds a strong attraction for Dr. Loomis, and any visitors to his summer home in Massachusetts would probably find him sailing in his boat on the waters of Martha's Vineyard.

Besides his work here at the University, Dr. Loomis is also active as a Fellow of the American Physical society, the Optical society, the Association of Physics Teachers, and the American Association for the Advancement of Science. He is also a member of the board of governors and of the council of the Argonne National laboratory and a consultant to the U. S. Atomic Energy commission.

Voice from passing auto: "Engine trouble, bud?"

Voice from parked car: "Nope."

First voice: "Tire down?"

Second voice: "Didn't have to."

* * *

She: "Can you direct me to the ladies' room?"

Bellhop: "It's just around the corner."

She: "I'm looking for relief, not prosperity."

DICK FOLEY . . .

(Continued from Page 11)

ing and carries 18 semester hours including three laboratory courses. A schedule like that is tough on anyone, but besides that, he attends basketball practice from 4 to 6 every afternoon. He explains that very few people get any serious work done in the late a fternoon hours, so when other fellows are loafing around, he practices his basketball. He admits that "Many evenings after practice I've felt like throwing the books out the window and just taking it easy. Then I remember that I simply can't afford to get behind. You've got to stay on the ball!" Dick's study habits must be good because he has better than a 4 point, all-university average.

A reducing exercise—move the head slowly from side to side when offered a second helping.

* * *

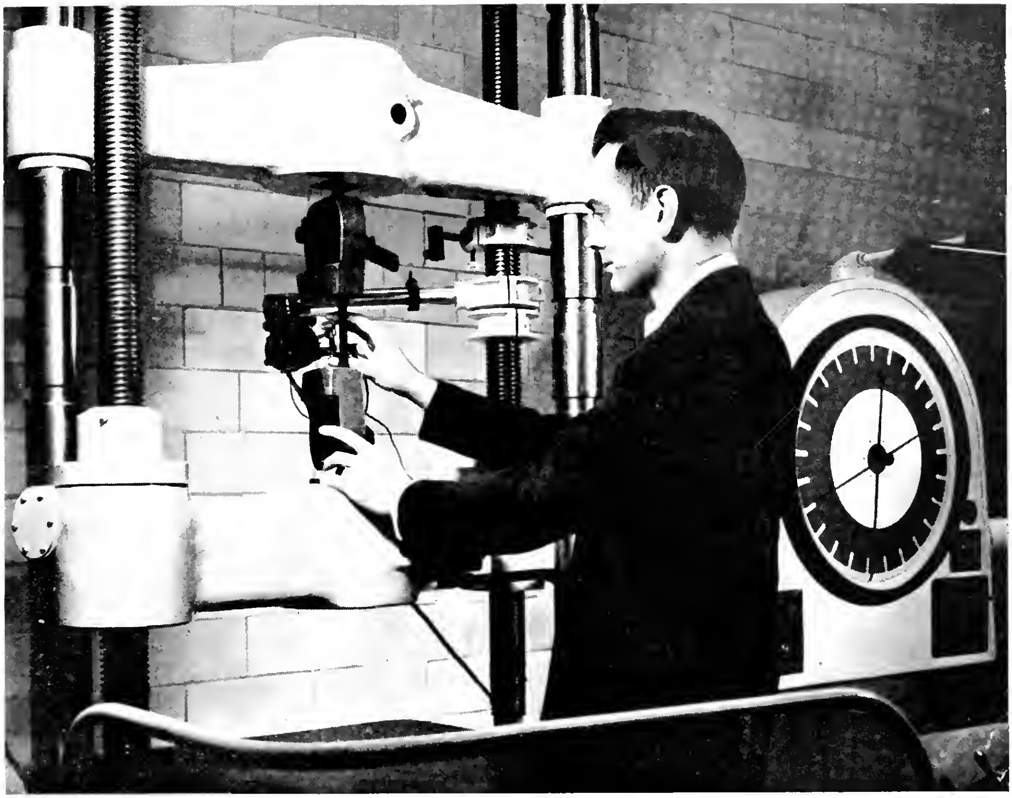
She: "Now what are we stopping for?"

He: "I've lost my bearings."

She: "Well, at least that's original. Most fellows run out of gas."

* * *

Wife: "Now that I have an electric ice box dear, I expect you to get a mechanical stenographer."



Working in a Dow physical research laboratory, this young man is operating a machine to test plastic materials.

SOCIETIES . . .

(Continued from Page 15)

J. H. Gallivan, E. W. Habricht, W. D. Hays, R. H. Inman, H. G. Cagges, C. H. Coontz, J. O. Lewis, E. L. Mollman, W. C. Reed, D. J. Schertz, C. F. Zirzow, L. A. Cunz, C. E. Anderson, R. A. Briscoe, D. Q. Brown, R. H. Brown, M. H. Fisher, A. R. Goodman, L. M. Gulledge, E. R. Healy, G. A. Kouros, G. E. Neher, C. R. Nowacki, E. W. Passow, E. Ozgor, H. J. Pelc, J. W. Powers, D. Principali, D. V. Sartore, and J. G. Roberts.

SIGMA TAU

This year's officers of Sigma Tau, all-engineering honorary, are: Philip A. De Camp, president; Thomas E. Kurtzer, vice-president; Stuart J. Johnson, treasurer; Burton L. Cordry, recording secretary; Charles W. Studt, corresponding secretary; Professor J. S. Crandell, faculty advisor. Sigma Tau has thirty active members this semester, and plans to initiate several new pledges soon. A smoker was held for these men shortly before Christmas vacation. Pledges are selected on the basis of scholarship, ability to apply knowledge to a practical problem, and socialibility.

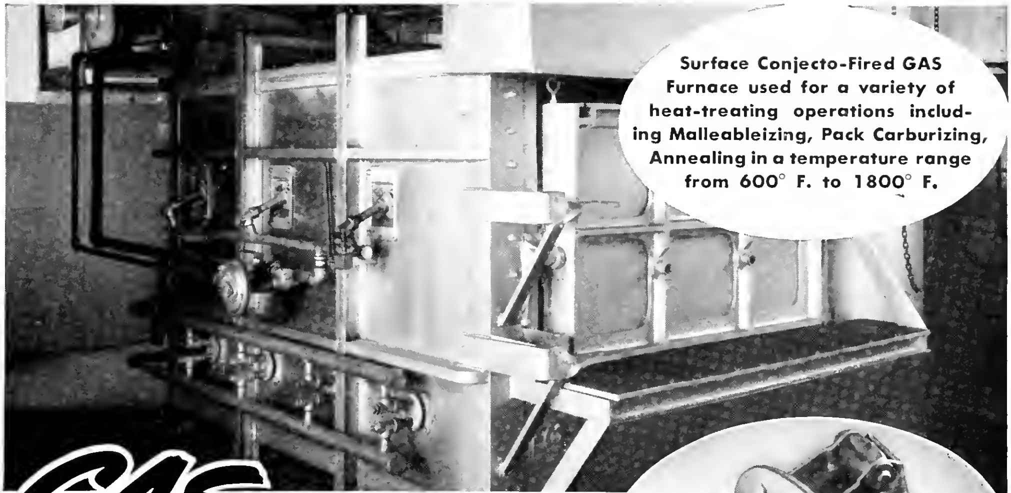
TAU BETA PI

Tau Beta Pi, the Phi Beta Kappa of the engineers, held its first meeting on October 21. The main topic of the meeting was a report by president E. P. Shapland on the national convention, to which he was a delegate. The convention was held at the Hotel New Yorker, New York, on October 9, 10, and 11. On December 9, a meeting was held, and new pledges were elected. These men met the actives at a smoker held December 16, to discuss pledging.

ETA KAPPA NU

Eta Kappa Nu is the electrical engineering honorary on the campus. The Alpha chapter, founded here in 1904, is the parent chapter of the national organization. At present there are 20 members in the Alpha chapter. The officers are: Murray L. Babcock, president; Edward C. Fensholt, vice-president; Orville R. Pomeroy, treasurer; Charles W. Studt, corresponding secretary; Harold D. Guy, recording secretary.

The first meeting of the semester was held November 11, at the Chi Phi house. At this meeting plans were formulated for a pledge smoker and an initiation banquet. Since there are 73 men eligible for pledging this semester, membership is expected to hit an all-time high.



GAS FURNACE PERFORMS MULTIPLE HEAT-TREATING FUNCTIONS UNDER VARIED CONDITIONS

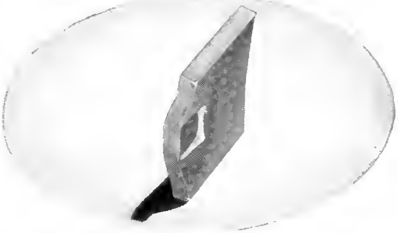
In modern heat-treating, adaptability of equipment and flexibility of fuel are primary influences in any cost-per-piece analysis. As a typical example of the flexibility of the productive flames of GAS, this Conjecto-Fired GAS Furnace is used for a variety of operations without any change other than regulation of the fuel-mix and temperature controls.

Atwood Vacuum Machine Company, Rockford, Illinois, is equipped to heat-treat pieces ranging from 1 ounce to 1000 pounds, in volume up to 15,000 pounds daily. Their modern Gas-fired Equipment is adapted for annealing, carburizing, drawing, hardening, normalizing, malleableizing, stress relieving, under rigid metallurgical specifications.

Experienced heat-treating specialists like Atwood Vacuum Machine Company use GAS because this flexible, controllable, rapid-heating fuel is so readily adaptable to all types of processing at any required temperature. The productive flames of GAS are so flexible that they can be used for any production-line heating operation, under the most exacting conditions.

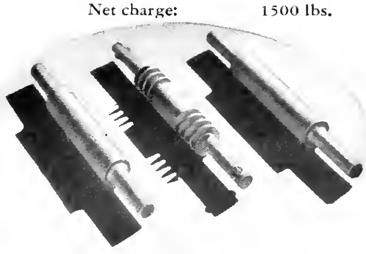
***ANNEALING*—Station wagon body hinge**

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.



***PACK CARBURIZING*—Brake Trunnions**

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.



***MALLEABLEIZING*—Trailer Jack Screws**

Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

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MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

WOODWARD GOVERNOR . . .

(Continued from Page 9)

and a solarium. The facilities of the treatment room, including a treatment table and intra-red heat cabinet, are available to all members as required to alleviate minor aches and pains. In operation during the winter months to replace the beneficial effects of the summer sun, the eight ultra-violet ray lamps in the solarium, or "sun-room," provide in one minute the same benefits as one hour's summer exposure. Each member is urged to take three one-minute treatments per week.

Equipment in the public-address control room broadcasts music at intervals, reaches every part of the plant with paging and general announcements, and can be set to bring all members radio programs of general interest or importance at the time of actual broadcast or at any time thereafter. For dances and social gatherings in the auditorium this equipment is equally well suited.

Also available for members' use are a pistol and rifle range where the pistol and rifle clubs meet in regular practice and competition, two concrete tennis courts which are designed for flooding for ice-skating in the winter, and ample space for gardening flowers and vegetables.

Largely responsible for the exemplary personnel policy in the Woodward Governor company is a plan, known formally as Multiple Management, which was placed in operation in 1939. Mr. Irl C. Martin, president and general manager, believes the company, in reality, is a business organization of men and women who have freely associated themselves to accomplish collectively what it would be impossible to accomplish individually. He believes the business is made up of three groups: the stock-holders, the management, and the workers; *all* of which are responsible for the success of the company and all of which should share in its management, hence, the name, Multiple Management. That is the reason why, in the course of this article, the employees have been referred to as members. Every employee is actually considered as a member of the firm.

Mechanical aptitude test shown here is a part of the examination given to applicants for employment.

As practiced in this company, Multiple Management is composed of three committees; the Senior committee made up of the officers and seniors supervisors (representing the stockholder members); the Junior committee, made up of 15 members of the junior executive and supervisory personnel (representing the management members); and the Primary committee, made up of 25 members not included in the above two classifications (representing the worker members).

Membership in the Primary and Junior committees is elective and rotative to provide as many members as possible with experience in company management.

Each committee has the power, and in fact, the responsibility of recommending beneficial policies, but the Senior committee has the final responsibility of acceptance or rejection.

Any member of the company may have

(Continued on Page 30)

WOODWARD GOVERNOR . . .

(Continued from Page 28)

a voice in the management through the form of a suggestion to the Primary committee, and each member is encouraged to do so.

A good example of Multiple Management is the fact that the employees, as well as the stockholders and the management, were consulted before the decision to erect the present plant was made. The operation of plant protection and the plant cafeteria are a few other examples. Multiple Management has fostered employer-employee relationships to such an extent that there has never been the necessity for forming a union in the company.

WILTON McDEVITT . . .

(Continued from Page 11)

mer, he takes more extensive trips north.

While his fishing may benefit by his approaching retirement from the University, the ceramics department will miss the atmosphere of friendliness around "Mac"—the slight figure with white hair, a quick smile, blue work clothes, and a white apron. "Mac"—whose hands and shoes show the whiteness of clay dust—while being interviewed, looked perfectly at home sitting on an up-turned "flower pot."

A good place to get Cost-Reducing Ideas

Your head electrical man is a good source of workable, cost-reducing suggestions. And right now is a particularly good time to let him prove it.

During the tremendously increased production of recent years, there has been a sharp increase in the amount of power used per employee. Most electrical systems have been operating under abnormal stress. Many are overloaded, unreliable and poorly located or inflexible with respect to present machine locations. Excessive "down time" and higher production costs are certainties.

Check with your head electrical man for possible cost-reducing opportunities in your plant. A Square D Field Engineer will be glad to work with him in analyzing any electrical problem and selecting corrective power distribution and electric motor control equipment.

Field Engineering Counsel is available, without obligation, through Square D offices located in 50 principal U. S., Canadian and Mexican cities.

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Bill Gail and Miss Jean Lemmon of Chicago were married on December 27. The lucky man graduates in Mechanical Engineering in February.

* * *

A wealthy client insured her valuable wardrobe while traveling in Europe. Upon reaching Paris she found an article missing and immediately called her broker in New York: "Gown lifted in Paris." Her broker replied, after due deliberation: "What do you think your policy covers?"

* * *

"Who you shovin?"
"Dunno, what's your name?"

CROSSWORD ANSWER

■	R	U	H	M	K	O	R	F	F	■	S	P	A
P	I	L	E	■	G	H	O	U	L	■	H	A	W
O	P	E	N	S	■	M	E	N	■	H	A	L	L
U	■	S	L	O	T	S	■	G	R	O	W	■	■
I	D	■	E	Y	E	■	S	I	A	M	■	S	C
L	I	L	Y	■	A	P	T	■	V	O	L	T	A
L	O	O	■	C	L	A	U	D	E	■	E	E	L
E	D	G	E	R	■	G	N	U	■	D	E	A	D
T	E	■	D	O	T	E	■	T	R	Y	■	K	W
■	■	H	O	P	E	■	L	Y	I	N	G	■	E
G	R	A	M	■	S	L	Y	■	B	A	N	A	L
O	U	R	■	A	L	E	R	T	■	M	A	R	L
T	E	E	■	D	A	V	E	N	P	O	R	T	■

Then there's the story about the freshman who was told that T.A.M. 5 was a pipe course.

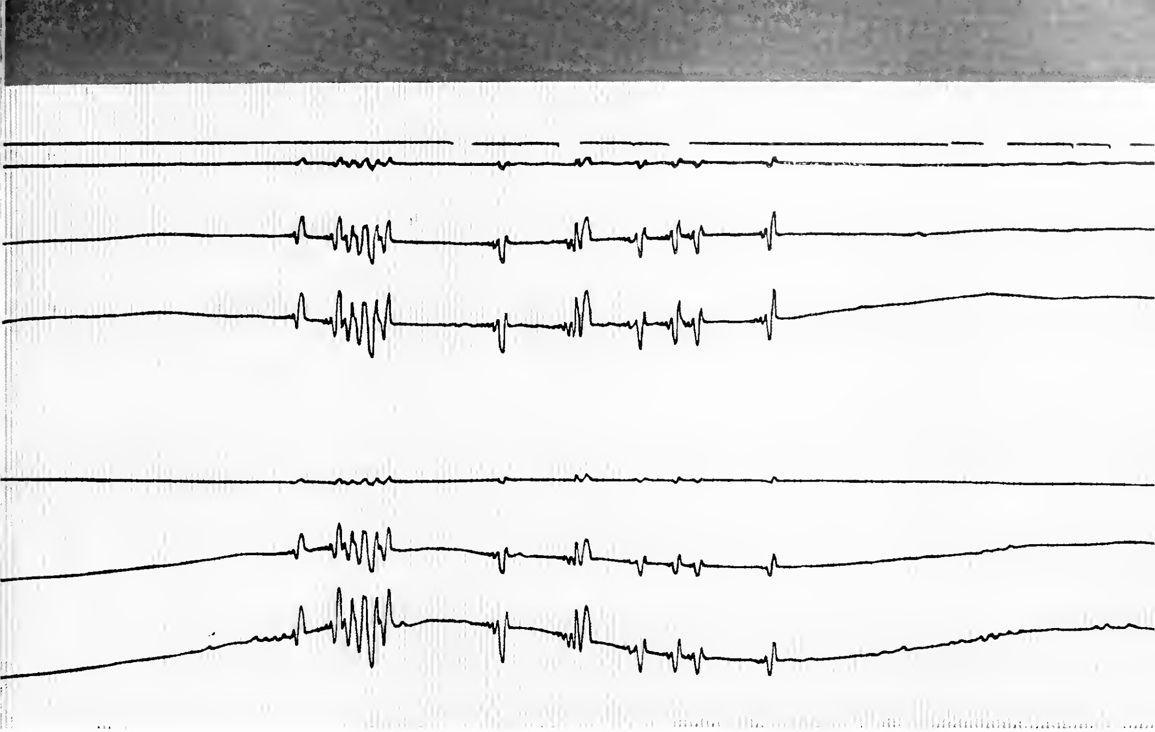
The difference between a pretty girl and an old maid is that the pretty girl always has a lot of handsome men in her wake while the old maid only has them in her sleep.

* * *

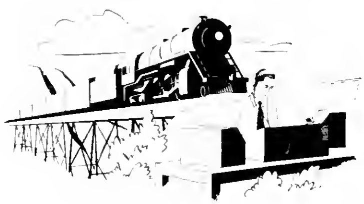
The sailor boy had missed his ship. It was majestically steaming through the Golden Gate. With his arms about his girl's waist and a gloomy look on his face he muttered: "Now, honey, we're both in trouble!"

* * *

Some girls are like roads, lots of curves, soft shoulders, and you can't tell where they lead you.



Picture of a bridge groaning under load...



. . . photographic stress analysis is one of many industrial uses for light-sensitive Kodak recording materials.

By cementing strain gauges smaller than postage stamps to external surfaces, test engineers can find out about structural behavior deep inside the material under stress . . . so sensitive is the response of these little devices to vibration and strain.

An important contribution to such sensitivity in instruments of this type is the wide latitude of Kodak photographic recording materials that are available. These may be had in all sizes and speeds for nearly every type of instrument.

Kodak is continually developing new recording products, and is glad to discuss them with you—so your new instruments may take full advantage of the finest in photographic recording.

Why not utilize the greater sensitivity and speed of photographic recording for your instruments? Why not find out how well the new Kodak high speed recording papers will work in your equipment? Just write to

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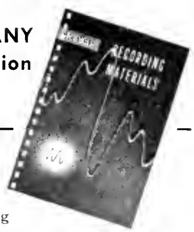
Rochester 4, N. Y.



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☐ Please send information on your new high speed recording papers.

Name____________________

Company____________________

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State____________________

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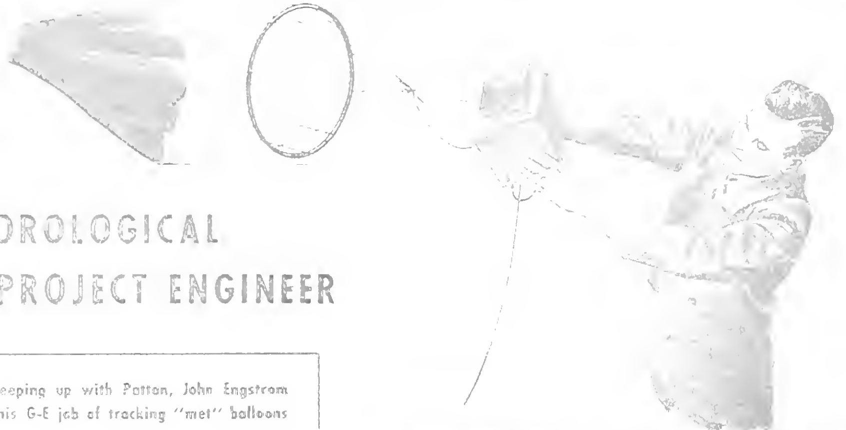
GENERAL ELECTRIC



METEOROLOGICAL PROJECT ENGINEER

After keeping up with Patton, John Engstrom enjoys his G-E job of tracking "met" balloons

[illegible] 1946, after he had happily [illegible] himself [illegible] "inactive" in the files of the Reserve Army [illegible] Corps, John Engstrom—a family man with two [illegible] looking for his first career-size job.

[illegible] able to rely on the help of an old friend—his [illegible] electronics.

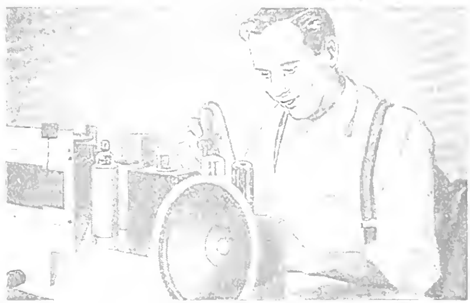
[illegible] since he started tinkering with radio sets in his [illegible] had been doing things in electronics—and [illegible] had been doing things for him.

[illegible] of Minnesota he had earned part of [illegible] servicing radios between hours of studying [illegible] engineering.

[illegible] his graduation [illegible] training in electronics at [illegible] New Jersey, he had been sent on a [illegible] assignment to South America. [illegible] been assigned to a Signal Corps communica[illegible] that helped provide General George Patton's [illegible] communication during the final [illegible] Germany. And after V-E Day he had [illegible] States to head up an investigation [illegible] microwaves in low le[illegible]

[illegible]

[illegible] Electrical Industry, [illegible] Electric Company.



John Engstrom admits that his attention perks up when he begins to think about electronics. He paid part of his college expenses at Minnesota servicing radios.

In the Army Signal Corps he continued his work in electronics. His radio communications team helped keep channels open to Patton during the [illegible]

GENERAL ELECTRIC

the Illinois Technograph

February, 1948 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

New Developments

By John Dick, E.E. '49
Herb Mazer, E.E. '50
Ken McOwan, M.E. '49

The Heat Pump

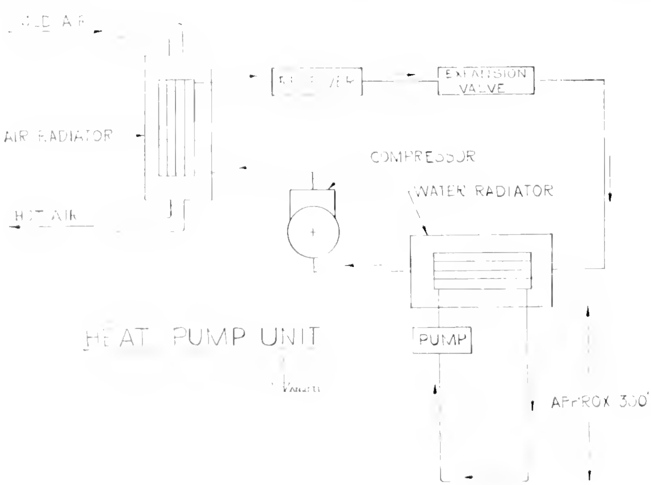
The heat pump is in the public eye today more than ever as a possible source of heat for dwellings. Contrary to the opinion of many, the heat pump or "the Kelvin heating engine" was first conceived in 1852 by Lord Kelvin.

At present this process is being used as a heating and cooling device in a few office buildings. Home use has been impractical up to now because of low efficiency. In the last few years three companies have been experimenting with this process with home use as an objective. Two of these companies are offering ready-built units at present.

Much work is being done to increase the efficiency of these machines. At present, these units are capable of producing heat at a c.o.p. of about 2.5; that is, the ratio of heat absorbed to the work needed to absorb it was 2.5. The heat rejected would be equal to one plus this number. Thus, if one unit of electrical energy was used over a certain period, the system would eject 3.5 units in the form of heat. This is a very small number in the light of present-day fuels, provided one remembers that when electrical energy is generated only one-fourth of the chemical energy is utlized. Since these units depend upon electrical energy for their operation, the original loss in the generation of the power must be considered along with the losses of the system itself.

For operation, these machines utilize the surrounding air for a source of heat in mild climates and the constant temperature below the surface of the earth in the less temperature regions. In the latter case, the unit consists of a long pipe which has water flowing through it, imbedded in the ground to a depth of about 300 feet. The heat from the ground is transferred to the cooler medium of the water in the pipe. The water carries the heat up to the compressor where it is transferred to a still cooler fluid in the compressor. From this point the unit operates like a home refrigerator in reverse. In the summertime, the machine may be reversed to provide cooling.

A simplified drawing of the unit is shown in the accompanying figure.



Automatic Rectifier For Photo Mapping

An automatic focus rectifier for mosaic map making, the first to be produced in America, has been delivered to the army corps of engineers by the Bausch and Lomb Optical company. The new photogrammetric instrument will be of paramount significance in planning national highways, soil erosion studies, flood control, and aerial reconnaissance work.

Resembling an ordinary photo-enlarger, this instrument simultaneously

The rectifier corrects distortion in aerial photos

enlarges, prints, and automatically reduces aerial photographs to a common scale and level, correcting the tilt encountered as a result of the plane's variation in angle and level at the time the photographs are taken. Planes equipped with the most modern stabilizers can maintain a constant level only to within one-quarter degree accuracy, making the rectifier vitally necessary in the production of precise aerial photo maps.

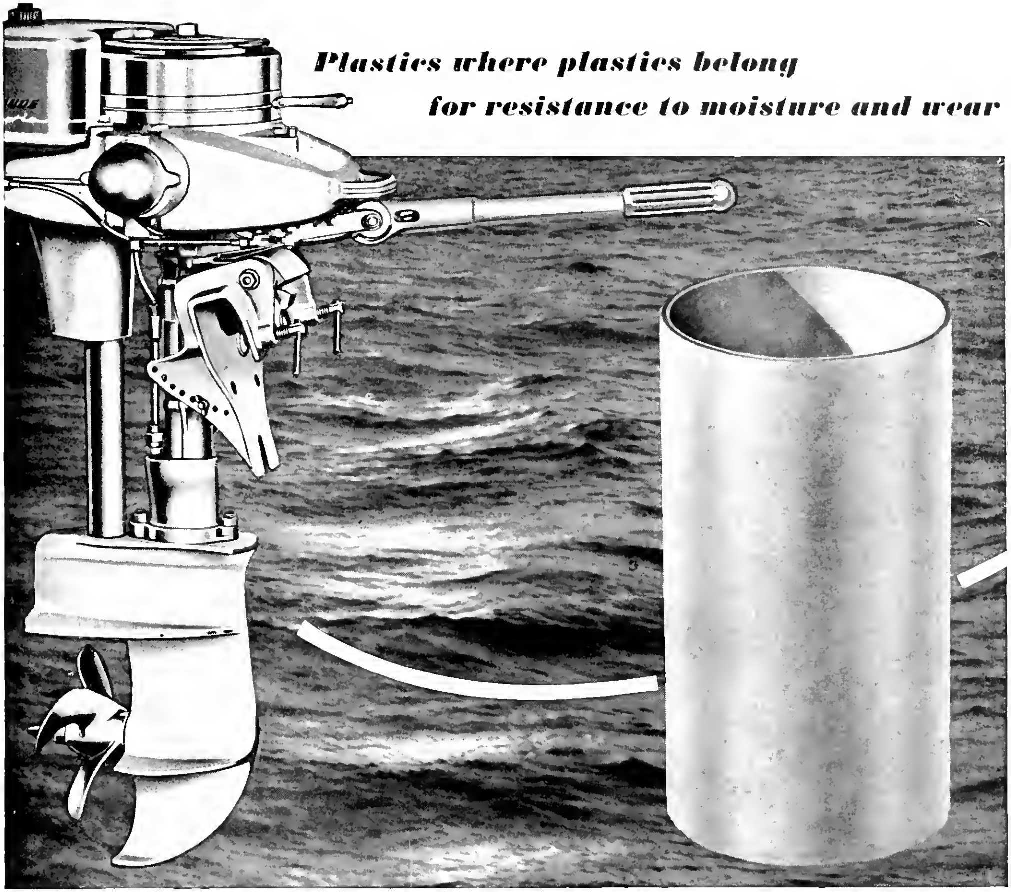
The automatic instrument, equipped with push button controls, can be operated by a photographer to turn out rectified prints on a production line basis at the rate of one every five minutes. Previous non-automatic rectifiers required tedious, involved mathematical calculations for each individual photograph.

Mathematics, mechanical design, and many features of the new engineering instrument were worked out by John V. Sharp and Olin W. Boughton, Bausch and Lomb scientists, while optical solutions were contributed by Dr. Konstantin Pestrecov and Harry G. Ott, also of the firm's research and engineering staff.

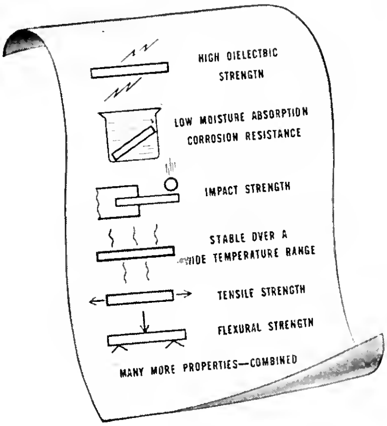
This instrument will be available for commercial use this year. It is small enough to be mounted on a trailer truck for use in field work. It also has fluorescent illumination, an enlarging lens of high optical resolution, and is constructed to maintain constantly the proper alignment between the negatives and printing easel.

(Continued on Page 38)

Plastics where plastics belong for resistance to moisture and wear



Synthane where Synthane belongs



IT'S SYNTHANE—this outboard motor pivot bearing . . . requires no lubrication . . . resists both salt and fresh water, wears long and well. It's a good example of the use of plastics where plastics belong and Synthane where Synthane belongs.

Synthane (our type of plastics) is also light, dense, strong, easily and quickly machined, an excellent insulator, a material for fighting corrosion.

These and many other properties—combined—make Synthane adaptable to countless applications. Synthane Corporation, Oaks, Pennsylvania.

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The Illinois Technograph

Volume 63 **Number 5**

The Tech Presents

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ARTICLES

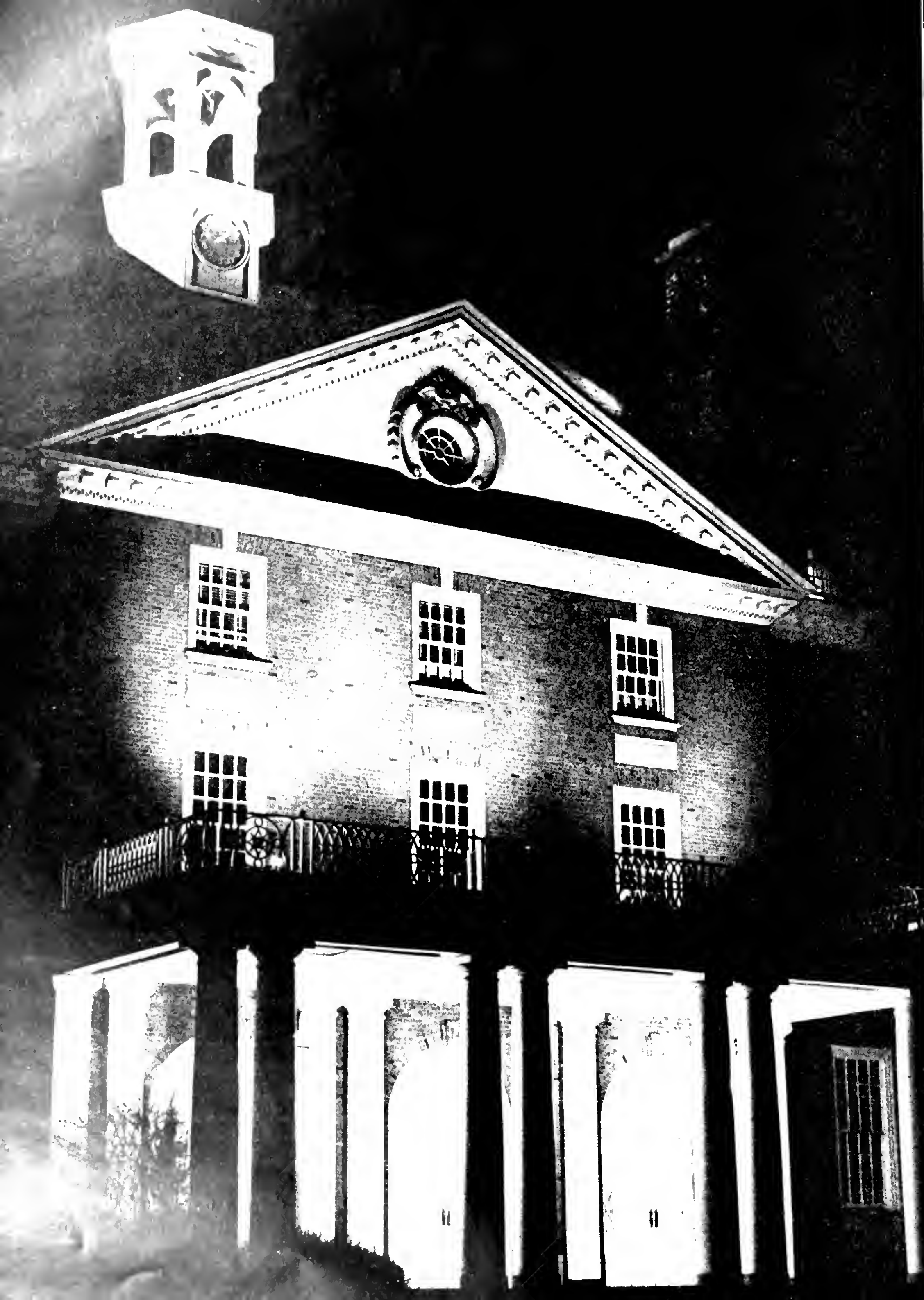
DEPARTMENTS

OUR COVER

This night scene of the Illini Union building is typical of whot the omateur photographer can do if he sets his mind to it.—(Ted Sohn).

FRONTISPIECE

A scene neor White Heath, Illinois, showing the method of contour plowing ond terrocing to prevent erosion.



In the Dark? . . . See the Light

By Ted Sohn, E. '48

To the majority of camera enthusiasts their hobby subjects begin and set with the sun. However, at dusk millions of lights appear one by one to illuminate the scene. Each one renders to nearby objects a particular kind of glamour that was missing during the day. Whether the downtown shopping district, one's neighborhood, or a college campus, the complexion of all things is changed. The distracting details that had earlier been so noticeable are now hidden in deep rich shadows.

For once, the photographer can approach his subject material with a minimum of equipment, the rudiments of which are any camera, a watch with a second hand, a lens shade, a tripod, and perhaps an exposure meter. Whether or not it will be possible to use a meter will depend upon the intensity of illumination. A flashlight is an aid in setting the shutter and diaphram, but it will do little better than a few matches. The tripod could be dispensed with provided a substitute is used. For exposures of more than one-fiftieth of a second, it is generally recommended that the camera be supported solidly instead of held in one's hands. The lens shade should be considered as a necessity since it will minimize the streaks caused by light striking the lens.

The illustrations accompanying this article were made on panchromatic film with exposures ranging from 10 to 120 seconds near f-16. This diaphram opening represents a compromise between what would mean an excessive exposure and a loss in the depth of focus. Since the depth of focus and to a varying degree the clarity of the subject is determined by the diaphram opening, it is to the advantage of the photographer to stop down to at least f-11 or f-16. This increases the length of exposure but the extension of patience in one's endeavors will be rewarded accordingly. Select film for these shots that is fairly fast. Panchromatic films are preferable since they have the greatest latitude and also reduce the exposure considerably. Artificial light consists principally of the longer wave lengths of light, that is, near the red and yellow light bands to which pan film is almost equally sensative.

Side entrance of Union building

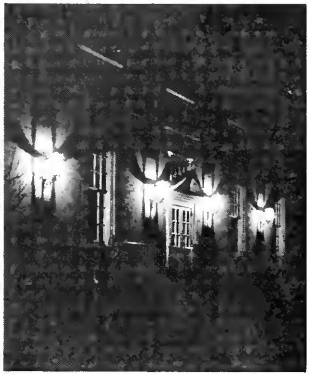
The real problem in night photography is in exposure. At best, a meter will only duplicate what a good calculated guess would do. To arrive at an exposure, the type of light, film, subject, and so forth must be considered. The exposures appear to have three ranges and the first step is to determine in which one

Some helpful hints on type of film, time of exposure, lens openings, and other suggestions for night photography are included in this article. Easily accomplished, these suggestions should greatly improve the quality of pictures taken at night by amateur photographers.

your subject is 10. They are one-tenth to one second, 10 to 30 seconds, and exposures from 45 to 120 seconds, using pan film with the diaphram at f-16. It is best for the beginner to find this range by use of a photographic exposure meter, but if one is not available the exposure selections made by others for similar subjects will have to be used. After some experience has been gained one can rely on this for the so-called calculated guess. At best, there does not seem to be any simple solution for an accurate determination.

Once the range has been selected, either extreme. To illustrate, if the center of the range and two others at either extreme. To illustrate it, the meter indicates an exposure of seventy seconds at f-16, take the first picture at this, and two others at 50 and 90 seconds.

Because films have a limited latitude much smaller than that of human vision,



Terrace entrance of Union building

a compromise must be made with every subject. It is not enough that the material being photographed is interesting, but the print must be of high quality. It is difficult to keep all the highlights and still keep some of the objects from becoming hidden in thee shadows. The solution is in selecting that part of the scene most important and exposing for it.

After mastering simple scenes and acquiring a fair degree in the judgment of exposure, a few tricks can be tried. One is a purposeful double exposure which is accomplished by photographing the subject at dusk and again when it is lighted by artificial light. The first time, deliberately underexpose, and lighted, rephotograph it at normal exposure, being sure that the camera is rigidly held so it will not move. The effect is to bring out some of the detail of the building that would ordinarily be lost and at the same time keeping to a minimum the effect of halation. These results can be duplicated in part by using a small flash bulb covered with a handkerchief so that some of the detail can be saved by the supplementary light. Reflection in water puddles or just the fact that it has rained previously will aid in making many pictures additionally interesting, each reflection adding to the effect. This is especially true of wet pavements. It should not be forgotten that under these conditions that a reduction in exposure should be made because of the reflections.

Not all night shots are enhanced by

(Continued on Page 36)

Argonne National Laboratories

By Francis Green, E.E. '18

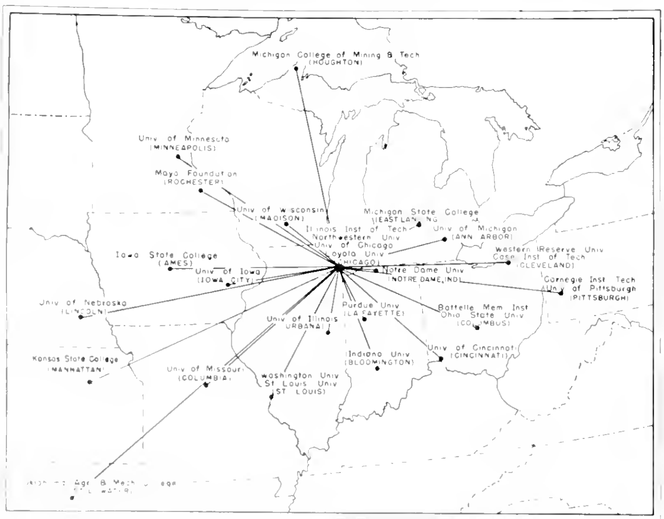
Until this moment, the Technograph has been unusually silent on the new and fascinating subject of the most prophetic invention in recent history—atomic energy. Initiated here is a series of articles designed to cover the more exciting and interesting aspects of the development, application, and cultural consequences of peacetime atomic energy research in the United States. First, read the conception and development of the Argonne National Laboratory, an organization hailing you from our very doorstep to show you dreams come true and advancements soon to gain fruition.

Under the terms of the Atomic Energy Act the U. S. Atomic Energy Commission is charged with keeping America on top in the field of atomic weapons. But its work in making available to the nation as a whole the benefits of atomic energy—thereby adding to the country's economic and industrial potential — is sometimes obscured by the technicality of these benefits and by the secrecy attending progress of a military nature.

Significant events leading up to the conception of the Argonne National Laboratory occurred in 1939 when Dr. Einstein wrote a letter to the President which resulted in the appointment of a liaison officer and a committee. No satisfactory results were achieved until Dr. Einstein wrote a second letter in the spring of 1940. In May, President Roosevelt created the Office of Scientific Research and Development under Dr. Vannevar Bush, which took over the atomic project. At this point was founded the research project which ultimately became the parent organization of the Argonne National Laboratories.

The research and development work done in connection with the first successful atomic pile or reactor and the plutonium production problem was carried out largely at the University of Chicago in the cryptically named "Metallurgical Laboratory." Growth of the research facilities sponsored by the University of Chicago, and responsible to the Manhattan District during the war, produced offices in Ryerson Physics laboratory, Eckhard Mathematics building, Rosenwald Museum, and part of the Chemistry laboratory on the campus, and offices in the new building set up for special purposes on the Ingleside avenue tennis courts, and in the Cottage Grove avenue Armory. Research areas off campus were given 'site' designations. Site A was the Argonne Forest section out in Palos Park, Illinois, and Site B was a brewery and ice house near 63rd street, Chicago, used for biological studies associated with the project.

The most important spot in the dramatic wartime development of atomic energy has not yet been mentioned — namely, the squash courts under the west stands of the University of Chicago stadium! It was here that on December 2, 1942 Dr. Fermi and a number of scientists gathered to witness the first daring demonstration of an atomic chain reaction, releasing atomic power in an amount limited only by the controlling hand of the operator. Most of these buildings and areas eventually became a part of the present Argonne National Laboratory physical plant.



Research institutions working with Argonne National Laboratories

The U. of C. Laboratories Get a New Name

On July 1, 1946, the name of the Metallurgical laboratory was changed to Argonne National Laboratory, after the Cook County forest preserve in which one branch of the laboratory has been located since 1943. The idea of a regional national laboratory operated by the University of Chicago for the Atomic Energy Commission was first proposed by an advisory committee on research and development appointed by Major General Leslie R. Groves, commanding general, Manhattan Engineer district, late in 1945. Dr. Arthur Compton, who was in charge of the development of the first successful chain reactor, was chairman of this committee.

The purpose of the national laboratory program is to provide for the research institutions of the country the costly facilities for atomic research, facilities too costly for any single institution to provide for itself. Tools of modern nuclear work — piles, accelerators, and the like — are far beyond the resources of most colleges. In the last year or two, it has become the fashion for any school which wants to build a strong physics department to dream up an appealing research program, sell it to the Army, Navy, or Manhattan district, and get government financing.

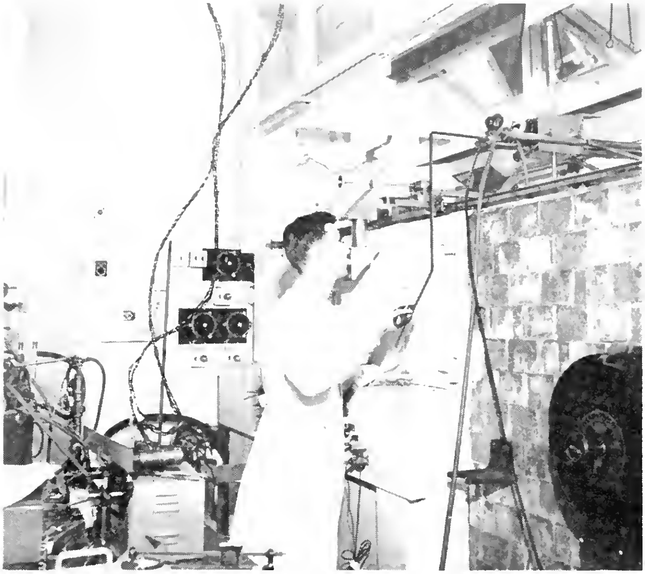
Negotiations are now in progress between A.E.C. and the military services to change that. A.E.C. wants future government-owned equipment centralized at the laboratories, where it will be widely available, rather than at individual institutions.

Because of the vital role played by

the Metallurgical laboratory in the development of atomic energy, because a highly qualified and experienced staff was already at work in Chicago, and because Chicago is the logical center for bringing together the research talents of the entire midwest, the decision was made to build one of the laboratories here.

Two other laboratories have been organized and are working along similar lines — Brookhaven laboratories at Camp Upton, Long Island, and Clinton laboratories, at Oak Ridge, Tennessee. Each laboratory has been assigned problems in special fields in atomic energy engineering.

The Argonne National Laboratory at present occupies several locations other than those at the University of Chicago and at Palos Park. Included are a 39th street, Chicago, warehouse and a new six-square-mile area in the southeast corner of DuPage county, just north of the town of Lemont. This latter area offers a number of advantages. Its underlying strata of rock is good, its drainage is good, its accessibility is good, and it does not contain extensive land improvements. It is only five-minutes distance from the Palos Park pile facilities, making possible continued operation while the new facilities are under construction.



Working with radioactive materials without getting any nearer than the six-inch-thick lead-brick wall of the "Hot Room" allows

Layout of Laboratory

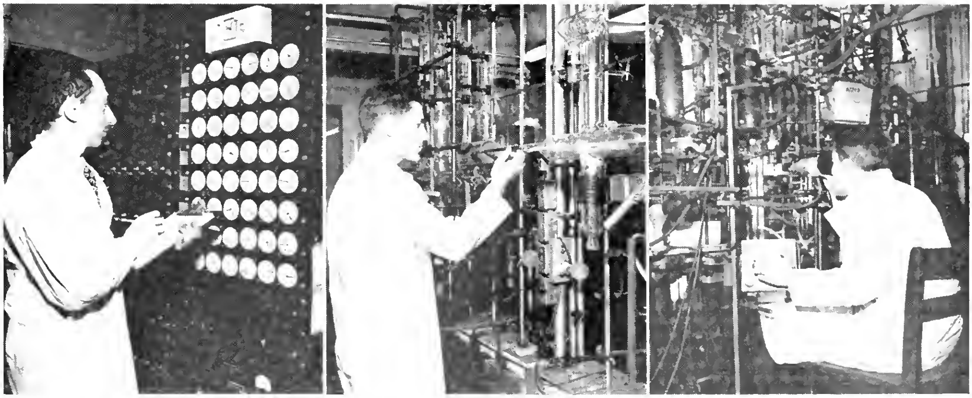
The new facilities just mentioned will be divided into two areas, one, the public area consisting of auditorium, guest, and medical buildings, and two, the larger restricted area which at present stage of planning consists of six major research buildings. On June 23, 1947, the University of Chicago announced retention of Ford, Bacon and Davis, Inc. of Chicago and New York, as architect-engineer-construction manager of the proposed new home of the Argonne National Laboratory.

Dr. Walter H. Zinn had been director of the Palos Park Argonne laboratory and with the inception of the new national laboratory, became director of that organization. In addition to the director, administrative organs are a Council of Participating Institutions, representatives of 29 universities and technical schools, and a board of governors. Other institutions which, because of research interests, qualified personnel and geographical location, find it possible and to their advantage to participate in the cooperative program of the Laboratory may be considered as possible future participants.

The board of governors is elected by the Council. The first board of governors consisted of:

Professor Farrington Daniels, chairman—University of Wisconsin

(Continued on Page 22)



Left: The instrument panel of the pulse analyzer which determines the amount of radiation from different materials which may be in a mixture. Center: The elaborate vacuum system used to measure the vapor pressure of the radioactive materials. Right: Making precise temperature measurements of the crucible used to evaporate various new elements

Post - War Japan . . .

By Phil Doll, M.E. '49

Last summer during July and August the National Academy of Sciences, Washington, D. C., at the request of the war department, sponsored a six-man committee on a trip to Japan. The members of the committee included: chairman, Dr. Roger Adams, head of the department of chemistry, University of Illinois; Dr. William D. Coolidge, director of research (Emeritus), General Electric company; Dr. Royal W. Sorensen, professor of electrical engineering, California Institute of Technology; Dr. William V. Houston, president, Rice institute; Dr. Merrill K. Bennett, executive director, Food Research institute and dean of the social sciences at Stanford university; and Dr. William J. Robbins, director, New York Botanical Gardens. The purposes of the trip, as stated by Dr. Frank B. Jewett, president of the National Academy of Science, were as follows: "(1) To review with the American Military Government and the Japanese the plans which have been formulated for the peacetime organization and development of Japanese science and technology along democratic lines; (2) to give such aid to the American Military Government and the Japanese as the experience of the committee may suggest; and (3) by your presence as representatives of the Academy to show the Japanese that American scientists are interested in the re-establishment of their science along lines which will be permanently beneficial both to them and to the world at large."

During its forty-day mission to Japan to accomplish these purposes, the Advisory Group visited industries in the principal cities of Japan, discussed problems with the Military Government and the Japanese, and visited several prominent Japanese universities.

Japanese Universities

Many interesting sidelights on university life and teaching methods in Japan were observed. A complete university has seven "faculties," including law, literature, economics, science, engineering, agriculture, and medicine. Not all faculties are represented in all universities, but one university may have more than one faculty of the same kind. There are both government and private universities. The private universities on the average are older, account for about half of the university graduates, and have specialized more in the cultural sciences.

Dr. Adams says about the government, or Imperial, universities: "In external form the Imperial universities are similar to American and European institutions. The emphasis on the scholarly activity of the faculty and on graduate work, and the nature of the work required suggest a strong German influence." The unit of the Imperial universities appears to be the "chair," consisting of a professor, an assistant professor, and one or more assistants. All members of the staff of any Imperial university are government employees. However, the internal administration appears to be quite democratic. The deans are elected by the professors, and the president either by all the professors or by representatives of the various faculties. This democracy is probably more apparent than real, since the government Ministry of Education has the final word on everything.

Herein you can read of the first-hand experiences and observations of Dr. Roger Adams, head of the department of chemistry, set down during his recent travels through Japan. He and his committee made a survey and study of education conditions and practice and research facilities in order to advise the reconstruction program for that country. See for yourself some of the amazing forces and effects which shape the oriental mind and his actions.

The Ministry of Education also establishes regulations concerning private universities; hence they may be called private largely because they are self-financed. Dr. Adams says of the private universities: "They seem to represent a more liberal and democratic spirit than do the Imperial universities."

Following the German tradition, there is a high degree of specialization in a Japanese university. A student is confined to a single faculty, and all general education is obtained before entering. A graduate student is attached to one professor and works under his guidance. Being in such close contact, there is a strong transfer of loyalty to the professor. This probably exerts an undue influence on the thinking and activities of many scientific men, leading to concentration of activity in very narrow fields and a lack of breadth in training and interest. It also leads to competition among scientists and scientific institutions rather than cooperation, and probably hinders the general development and spread of scientific attitudes.

On the whole, all salaries are low, and members of the teaching staff must supplement their incomes in any way possible, such as teaching in other institutions and doing consultant work.

Scientific Research

Scientific research in Japan today is carried out in three ways; by university professors, by government and independent research institutions, and by research laboratories closely associated with industrial organizations.

Every university professor is expected to carry on research in his field; however, as Dr. Adams points out, "Much university research is somewhat esoteric in character. Mathematicians prefer such things as number theory to analysis or to work in applied mathematics." The idea of proving to the rest of the world that Japan has a superior culture is the dominating idea in too many university minds, and sometimes blots out research of a practical nature. The research equipment seems fairly good, but much of it is not in use at present. Also, the equipment is rather poorly maintained which is probably partly due to the mental preoccupation of the reseach assistants with supplementing their low wages.

There is also a number of research institutions which are either supported by the government or supported independently. The Ministry of Agriculture supervises a laboratory which, on the whole, does worth-while work and makes the results available to farmers. The Ministry of Communications has a laboratory for electrical standards. A number of other laboratories working on specific problems related to industry are maintained by the Ministry of Commerce and Industry. The problems include work in such industries as ceramics, mining, and textiles.

The self-supporting laboratories are few in number and quite large. They are skillfully managed, however, and even develop their own products and manufacture them. Few research laboratories run by industrial organizations attempt any pilot-plant operations in developing new processes as is done in this country. The staffs in these laboratories often devote much of their time and energy to testing and control.

The government and independent laboratories work in close contact with the university laboratories. Indeed, they are staffed by a large percentage of university graduates, and employ professors as part-time research men. On the other hand, the industrial laboratories have

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Protect Yourself

by Carl Sonnenschein, M.E. '48

What engineering student has not at some time dreamed of producing a world shaking invention? The answer is, obviously, that there are quite a few. How many inventors have lost the economic privileges which should have accrued to them from their inventions? Here, unfortunately, the answer is that there have been many.

The purpose of this article is not to outline a plan for a potential inventor to follow for production of an invention which will earn for him a million dollars. Rather, our purpose shall be to outline the type of procedure which should be followed so that the inventor may be sure to reserve to himself the benefits and earnings from his invention.

Most people are acquainted with the fact that there exists at Washington, D. C., an organization known as the United States patent office. The patent office is a part of the United States department of commerce and is housed in a building known as the United States Patent Office building.

History of Patent Office

The present United States patent system came into existence as the result of an act of Congress which was passed in 1834. The first patents were granted in 1836, and since then there have been 2,400,000 patents granted by the patent office.

To go back just a little farther in our national history, we can call to mind article I, section 8 of the Constitution which says:

> "The Congress shall have power . . . to promote the Progress of Science and useful Arts by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."

It was on the strength of this Constitutional authorization that the act of 1834 was legal. Clearly, the men who wrote the Constitution realized the importance of inventors and their work in the national economy.

Now, you may ask, what does the act of 1834 guarantee to the inventor and in what ways does it protect him? The act provided for the granting of patents for a period of seventeen years, with the provision that renewal could only be accomplished by an act of Congress.

The inventor is guaranteed the full control over his invention; he can prevent anyone from making, using, or selling his invention. On the other hand, the inventor can lease manufacturing rights or may do his own manufacturing of the item on which he holds a patent.

The government reserves the right to refuse patents if the item in question can be considered deleterious to the public welfare, or if it appears to infringe upon the prior patent rights of another inventor. By the same standards, it must be a useful item and must be a novelty.

Supposing that you have, or think you have invented an item that is worth being patented. There are several very essential and important steps which must be taken in order that you may obtain your legal rights regarding your brainchild.

Were a business man to attempt to run his business without keeping proper records he would be regarded very poorly by the people associated with him. Such is also the case with inventors. The inventor should be just as systematic about his business as is the successful businessman.

All engineers, as potential inventors, will be interested in this straightforward article which contains valuable data about patents. Certain procedures and records are mandatory in realizing the worth of your idea or invention.

Complete records of all correspondence, notes, and experimental data should be kept and carefully dated. Wherever possible, important dates should be attested to by the signature or knowledge of a responsible party. This will become more apparent as we proceed.

Back-tracking a bit, we recall that there must have been a time when a realization of a need for the item was first conceived. Possibly not at this date but at a subsequent one, an idea was forthcoming as to the means of fulfilling this need. Perhaps preliminary sketches were made and miscellaneous notes scribbled on scratch paper; all of these papers should have been kept and carefully dated for further reference.

As soon as the fundamental ideas had crystallized, a set of working drawings should have been made up, with accompanying descriptive material. These drawings need not have been to an accurate scale, but they should have possessed all of the necessary dimensions. The drawings should have been clearly explained with numbers referring to the specific parts of the mechanism. At such a time, it would have been a good idea to write down what the invention was supposed to accomplish and what bad features of other machines or mechanisms it would overcome.

Briefly, and in summary, these preliminary drawings should have told what the invention was related to, what its object was, what the various drawings were intended to show, how the mechanism would be constructed, and lastly and most important how it was expected to work.

For our purposes, we will assume that you have successfully fulfilled all of these preliminary requirements and that now you want to proceed with the formal part of obtaining your patent.

The first step would be to take the preliminary drawings and statements, which you have made, to a notary public and have him attest them and attach his seal to them. Of course, there are other ways of establishing the date of inception; such as having the papers signed, each one individually, by at least two qualified witnesses, or by mailing the papers to oneself through the government mails. If the latter mentioned system is used, the seal on the envelope should not be broken unless the papers are needed at some later date as evidence in court due to litigation arising from your patent claims. This action will definitely establish your claims as to chronological inception of the ideas pertinent to your invention.

Obtaining a Patent

In addition to the notarizing of the papers themselves, the following information should be attached to the technical papers and should also be notarized.

(a) The original date when you first thought of this invention.

(b) The date when you first told anybody else about your ideas or invention.

(c) The date when you first started to work out the practical considerations subsequent to being able to construct a working model.

Having proceeded this far, it is now wise to obtain the services of a good patent attorney. Only certain men are allowed by the patent office to practice patent law. Strange as it may seem, a patent attorney need not be an attorney-at-law. Many of the successful patent attorneys are engineers who have been able to satisfy the patent office as to their qualifications and have thus been permitted to practice patent law.

After you have contacted your attorney, you must then be ready to put full trust and confidence in him. The reason

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In This Corner... NAVY PIER

SHOP TALK

By John Fijolek, E.E. '51

In addition to the machine shop courses described in a previous issue, two other shops have been in operation at the Chicago branch since September, 1947. These shops have been a welcome addition to the engineering students of sophomore standing for whom the courses are limited.

Aeronautical engineering students in M.E. 81 (foundry and welding laboratory—two hour course) are divided into two groups at the beginning of the semester. One group begins the study of molding principles while the other is trained in light welding principles. The two groups change their study of each subject around the middle of the semester.

In the welding laboratory seven asbestos-lined booths each contain a welding bench and an a.c. welding machine. These booths occupy one side of a large room which also contains a spot welder and seven gas welding stations. Light welding with ferrous and aluminum materials is emphasized. Practice makes the study more interesting as can be evidenced from the photographs showing some of the equipment being operated by the students.

The foundry group is given practice as well as theory in melting of metals, testing of castings, and testing of sand so that a good knowledge of the processes involved is obtained.

More time is spent on foundry principles in M.E. 85 (pattern and foundry laboratory—two hour course). Pattern design is taught, and, as in all of the courses described above, the emphasis is placed not so much on manual work skill as on the knowledge of the processes involved and the testing of the product and materials used.

Movies and slides supplement the laboratory work which is carried on in a shop well-equipped with benches, conveyor, molding machines, a core room, a sand testing laboratory, and melting equipment including an electric arc furnace.

Professor Kozacka's staff in the foundry consists of one supervising instructor, two instructors and one mechanic. The welding shop, which has the smallest number of students at one time, has one instructor to supervise all operations.

Engineering Societies

By Clarence Niebow, Ch.E. '51

Although the Navy Pier branch is only a little over a year old, its engineering societies are well organized. They are sponsored by competent men with good engineering background. All the societies here at Navy Pier function through the College of Engineering except the Chemical Engineering society which is activated through the College of Liberal Arts and Sciences. The following items will give you a summary of the progress and future plans of the societies.

A.S.M.E.

The Mechanical Engineering society is sponsored by Mr. C. T. McDonald of the general engineering drawing department. The society has affiliated itself with the student chapter of the A.S.M.E. So far the group has had quite a few speakers, the first one being Dr. Norman Parker, head of the mechanical engineering department at Urbana. He spoke on the subject, "Curricula of the Junior and Senior Year in Mechanical Engineering." They have had one field trip to the Carnegie Mill of the United States Steel corporation. An all-day field trip is now being planned to the tractor works of the International Harvester company, where the group will be especially interested in the forge shop, the die-casting shop, and the machine shop. The officers are Joe L. McCaffery, president; Gerald Lerman, vice president; Edward Harper, treasurer; and Lambert Kilboy, secretary.

A.I.E.E.

The sponsor of the Electrical Engineering society is Mr. W. K. LeBold. They have affiliated themselves with the student chapter of the A.I.E.E. and have had Dr. J. E. Hobson, director of the Armour Research foundation, talk to them on, "The A.I.E.E. and the Professional Registration of Electrical Engineers." Also Dr. W. L. Everitt, head of the electrical engineering department, at the University of Illinois spoke on "Electrical Engineering and Options." Mr. LeBold hopes to get speakers on communications, radio, and illumination. The group has not elected its officers as yet; but the acting secretary is R. Petersen who is also chairman of the nominating committee.

A.S.C.E.

The civil engineers are headed by Mr. J. C. Chaderton of the mechanical engineering department. This group has

Left: Students applying their knowledge of welding principles
Right: Pouring a casting in the foundry laboratory

affiliated itself with the student chapter of the A.S.C.E. Mr. George Salter, midwest representative of the A.S.C.E., addressed the group on, "The Functions of the A.S.C.E." The society hopes to have a speaker every month. The officers of the club are: William Lingo, president; Gary Cass, secretary; and James Swendsen, treasurer.

Ch.E.

This group is sponsored by Dr. Meloy who is also head of the chemistry department here at the Pier. This group has not affiliated itself yet, but is now negotiating with the chapter downstate for membership into the A.I.Ch.E. Mr. Wassel of the American Can company recently addressed the group on the, "Thermal Processing of Food." The next speaker is going to be Mr. A. I. Kegan, a lawyer, who will speak on some interesting facts about patents. Recently the chemical engineers went on a field trip to the Standard Oil company where they inspected the research laboratories. The recently elected officers of the group are: Claude Lucchesi, president; George Duwel, vice president; Neal Smith, secretary; and Herman Petsch, treasurer.

FACULTY IN REVIEW

By Norbert W. Ellmann, M.E. '51

RUPERT M. PRICE

In passing through the lounge adjacent to the lunchroom, one may happen to glance in a southerly direction and notice a white sign just above an office door. The sign reads "Associate Dean of Engineering Sciences." This is the office in which Rupert M. Price, M.A., assistant to the associate dean of engineering, conducts some of the many duties falling to him in the post. Mr. Price is also an assistant professor of physics, and a staff counselor in the student personnel bureau.

Born in 1906 at Waynesville, Illinois, Mr. Price completed grade school and high school in Waynesville and went on to Eureka college at Eureka, Illinois. Later he received his master's degree at the University of Illinois.

For twelve years Mr. Price coached basketball, baseball, and track for the Atlanta, Illinois, high school. He then became the high school principal at New Holland, Illinois, a position which he held for five years. For two more years he held the position of principal at the Washburn, Illinois, high school, during which time he spent the summers teaching mathematics at the University of Illinois.

Mr. Price's hobbies are hunting and fishing. That he is a true sportsman is evidenced by the fact that he uses archery equipment instead of a gun to do his hunting. This is far from being a handicap, however, because Mr. Price usually returns from his hunting trips with a fine catch of rabbits and pheasants.

Mr. Price married a school teacher and has three children, two girls 7 and 13, and a boy 9 years old.

RUPERT M. PRICE

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•

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Rhet Instructor: "John, take this sentence: 'I led a cow from the pasture.' What mood?"

P.E.: "The cow, sir."

* * *

Last year's graduating electrical engineers have learned how to apply their knowledge in a practical way. They are now using the "right hand rule" to obtain transportation.

* * *

POME

Mary bought a "New-Look" dress,
The style was very dare-y.
The dress, it doesn't show the dirt,
But WOW! It sure shows Mary . . .

* * *

Dorothy Plummer . . . Here's your name in print. NOW will you buy a subscription?

PIER CLOSE-UPS

By Richard Choronzy, M.E. '51

TAYLOR BROWN

Twenty-five miles is a long way for a person to go to and from school each day. That is the distance Taylor Brown travels from his suburban home to Navy Pier, and furthermore, he likes it. "Education is worth its time in travel and study. If I had to travel 100 miles, I'd stil do it." These words were stated by the quiet, unassuming freshman at his drawing desk in room 135.

Taylor, a civil engineering student, hopes to continue with his education until he receives his Ph.D. Apparently, he is trying to folow in his dad's footsteps because the elder Brown is chief engineer of the highway and bridge construction division of the state in the Chicago area.

Taylor Duane Brown was born in Kankakee, Illinois, on May 28, 1929. When he was 6 years old, his family moved to Downers Grove, Illinois, where he lives at present. During his high school years he played the clarinet in the school band and was graduated from Downers Grove high school last June. The few months between high school and college life he spent with his father studying the various kinds of jobs performed by a civil engineer. His choice of civil engineering as a career resulted largely from his liking for the work his father does.

His chief hobby is hunting and his favorite sport is boxing, at which he is quite adept. Taylor has a girl friend, Helen Smith, with whom he has made future engagement plans. He plans to specialize in bridge construction work after graduation.

TAYLOR BROWN

ILLINI IN ACTION . . .

By Herbert Jacobson, M.E. '50

Two more graduates of the engineering department of the University of Illinois were awarded honors, when WALLACE A. DEPP and EDGAR A. POST, both of the class of '36, were presented the Eta Kappa Nu award by the American Institute of Electrical Engineers at its winter meeting January 26. This award is presented annually to the engineer selected as the most outstanding young electrical engineer on the basis of his technical achievements and on his civic, social, and cultural activities. These two men were both given honorary mention citations for the year 1945.

Starting to work with United Air Lines in 1936 as a radio engineer for the design and supervision of construction of aircraft radio equipment, Mr. Post was soon promoted to the position of assistant supervisor and acting radio engineer, a position he still holds today along with that of superintendent of navigation aids. During the war he attained the rank of lieutenant colonel and was chief of systems at the Aircraft Radio laboratory at Wright field where he had direction of the installation and flight testing of all prototype radio, radar, and counter measure equipment in army air force aircraft. A member of A.I.E.E., I.R.E., and Tau Beta Pi, Edgar Post is a member of the VHF Radio Ranges and Radio Instrumentation committee of the Radio Technical Commission for Aeronautics. At present, he is a recognized authority on automatic flight control, airways traffic control, and aircraft instrumentation.

The other alumnus presented the Eta Kappa Nu award, Wallace A. Depp, B. S. '36, M.S. '37, is a graduate with high honors. He is a member of A.I.E.E., Tau Beta Pi, Sigma Xi, and the American Federation of Scientists. After graduation, he was employed by the Bell Telephone laboratories in New York where he designed cold-cathode tubes, thyratrons and spark gap tubes for radar, and thyratrons for the proximity fuze. At the present time he is in charge of basic development of gas-filled tubes for Bell Telephone laboratories. Wallace Depp has been granted several patents and has a few pending now. The author of several publications, he is very active today in radar and cold-cathode tube research.

The Eta Kappa Nu award, suspended during the war, was resumed by the A.I.E.E. at its winter meeing in Pittsburgh. An award was presented for each of the years from 1942 to 1947. Out of ninety-five candidates, two of the winners were University of Illinois alumni. The award is only given to engineers less than thirty-five years of age who have been graduates for not more than ten years.

ERNEST E. CHARLTON, X-ray section head of the General Electric research laboratory, has been appointed chairman of the American Institute of Electrical Engineers' therapeutics committee for 1947-48. Born on December 17, 1890, at Meriden, Iowa, Mr. Charlton received his bachelor of arts degree in 1913 from Grinnell college. He obtained his master of science and doctor of philosophy degrees in 1915 and 1916, respectively, from the Univecsity of Illinois, and was awarded a doctor of science degree in 1945 by Grinnell college. He has been employed by General Electric company since 1920 during which time he has engaged in research activity. Mr. Charlton served on the therapeutics committee during 1946-47.

HUBERT MICHAEL TURNER, associate professor of electrical engineering, Yale university, has been appointed 1947-48 chairman of the American Institute of Electrical Engineers' committee on award of institute prizes and of the technical program committee. Born in Hillsboro, Illinois, July 20, 1882, Mr. Turner received the degrees of bachelor of science (1910) and master of science (1915) from the University of Illinois, and was instructor here from 1910 to 1912. He joined the faculty of the University of Michigan as instructor in electrical engineering in 1912 and in 1918 became assistant professor of Yale university. He was appointed associate professor in 1926. Mr. Turner has been chairman of the institute committee on communication and has served on the committee on instruments and measurements. He holds a number of patents and is the author of numerous technical papers. He also is a member of the Institute of Radio Engineers, International Scientific Union, the American Association for the Advancement of Science, Franklin Institute, American Society for Engineering Education, Eta Kappa Nu, and Sigma Xi.

In 1944, CHARLES E. RAMSER '09, received the John Deere medal of the American Society of Agricultural Engineers for special investigation and drainage research conducted for the Soil Conservation Service of the U. S. Department of Agriculture. Recently, the U.S.D.A. engineer was honored again when his bulletin, "Prevention of Erosion of Farm Lands by Terracing," first issued in 1917, was listed as one of the outstanding scientific publications by U.S.D.A. research workers.

E. T. BLIX '20, who was chief engineer on the project to build the Sky-Ride for the 1933 World's Fair, now is manager of the Melrose Park plant of the Mississippi Valley Structural Steel company, a firm he has been with since graduation. He started as a detailer in the Decatur plant, worked into sales, and was in the Kansas City and Chicago offices. In 1929, he was made chief engineer of the Melrose Park plant, a position he held until his promotion.

ROBERT C. LEWIS '36 has joined the staff of the Aero-Elastic Research laboratory, Massachusetts Institute of Technology. Formerly chief engineer of the vibration division of M.B. Manufacturing company, he will continue to serve M.B. as a technical consultant and will practice as a consulting engineer. He previously was associated with the Crane company research laboratories and later was head of the vibration department of Vega Airplane company.

PHILIP STEELE, M.E. '89, Chicago, secretary of his class and one of the most noted of the older Illini (older in point of years only), recently was the guest of honor at a dinner celebrating his 50 years of service with the Municipal Employes Insurance association of which he is president.

Guests included many old friends and members of various unions, representing some 20,000 employes. Former mayor of Chicago, Edward J. Kelly sent a personal letter commending and thanking Mr. Steele for his "long years of faithful and capable public service and for the contributions made to the welfare of . . . fellow employes . . ."

The monthly bulletin of the Municipal Employes society carries a summary of his career of duty: 1. Entered the Civil Service of Chicago in 1895; was later promoted to chief engineer of the Springfield Avenue Pumping station, and now is rounding out fifty years in the service. 2. Was one of the founders of the Chicago Civil Service league, which was organized in 1901 to protect and promote the interests of civil service employes of the City of Chicago. 3. Was instrumental, along with Bernard McMahon, John P. Dillon, and others, in the founding of the Municipal Employes Pension fund. 4. One of the organizers and first president of the Municipal Employes society, which has protected and promoted the interests of contributors to the Pension fund since 1912. 5. One of the organizers of Local 556-556A, International Union of Operating

(Continued on Page 40)

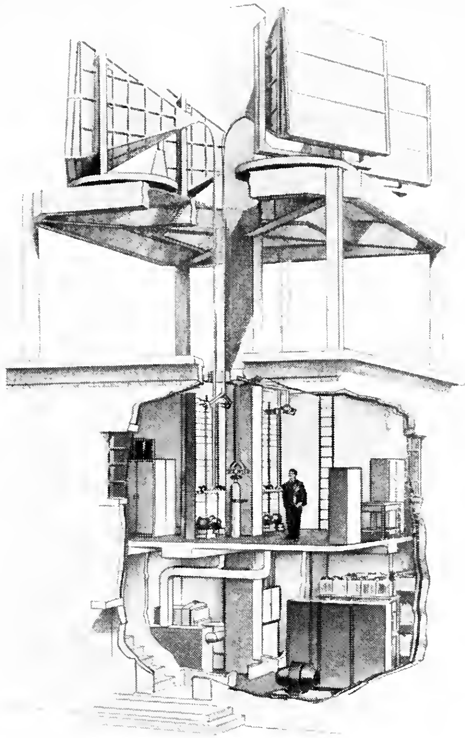
TELEPHONY'S SEVEN LEAGUE BOOTS...

THIS tower reflects great strides in communications. It's one of the seven new radio relay towers that link New York City and Boston.

This new path for Long Distance communication uses microwaves . . . free from static and most man-made interference. But, because microwaves shoot off into space instead of hugging the earth's curve, we've had to build relay stations within line of sight to guide the waves between the two cities. Atop each tower, metal lenses gather these waves and, after amplification, relay them to the next tower. The lenses focus and direct the radio waves like a searchlight beam.

This new system for transmitting Long Distance telephone calls, radio and television programs is but one phase in the Bell System's program for improving this country's communication service; a never ending program of growth and development in which many telephone engineers will participate, and whose careers will develop with it. *There's a future in telephony.*

BELL TELEPHONE SYSTEM



A cut-away view of a typical radio relay station. Emergency power equipment and storage batteries are on the first floor, radio equipment on the second floor, and the special microwave antennas which receive and beam the communication signals are on the roof.

Introducing

by Tom Moore, C.E. '50

Shirley Smith, E.P. '50 and Connie Minnich, C.E. '51

JAMISON VAWTER

In 1937 the College of Engineering added another full professor to its staff—Jamison Vawter, professor of civil engineering.

Mr. Vawter, the son of a doctor, was born April 21, 1889, in Arkansas City, Kansas. His family moved at various times to Kentucky, Oklahoma, and Missouri, but they returned to Arkansas City, where Mr. Vawter spent the last three years of his high school career and graduated in 1908. In 1916 he received his B. S. and C.E. degrees from the University of Kansas. Mr. Vawter commented with a smile, "It didn't take me those eight intervening years just to go through college." He later received his M.S. from Illinois.

In World War I, Mr. Vawter spent two and a half years with the army in France, and then served in the army of occupation in Germany in 1918 and 1919. Before joining the University staff, he worked six years for the Santa Fe railroad and instructed at the University of Kansas another two years.

Then, in the fall of 1922, Mr. Vawter accepted the position of assistant professor at Illinois. In 1931, he became an associate professor.

Now, at Illinois, Mr. Vawter instructs graduates and advanced undergraduates in civil engineering, but his principal problem is taking care of irregular engineering students and keeping C.E.s properly registered. He remarked that since the beginning of the war he has had little time for vacationing or his favorite sport, fishing.

Mr. Vawter is one of the joint authors of the book, "Theory of Simple Structures," and he is, of course, a member of the American Society of Civil Engineers. Along with the A.S.C.E., he holds membership in several other honoraries and societies: Theta Tau, Sigma Psi, Tau Beta Pi, Chi Epsilon, Tau Nu Tau, American Railroad Enginesre association, American Society for Engineering Education, and Scabbard and Blade.

When asked if he had any particular inspiration or guidance toward a civil engineering career, he thought a bit and then, smiling, said, "No, I did what the YMCA says not to do. I just drifted in."

If you engineers who have no direct contact with Professor Vawter will pass room 307 Engineering hall a little slower than usual, you will probably see him at the opposite end of the room turning between a table and roll-top desk by means of a swivel chair. If he isn't in, you'll recognize his office by the work piled around his secretary and the volumes of the "Transactions of American Society of Civil Engineers" which line the north wall.

ELMER F. HEATER

Sitting astride his high drawing stool and comfortably propping one elbow on the drafting board, Elmer F. Heater, research assistant professor for the Engineering Experiment station, summed up his interest in his work in four short words, "I'm cracked on drawings."

For nearly thirty years he has worked with all kinds of drawings in his leisure time as well as in his regular work. A native of this community, he was

ELMER F. HEATER

born near Thomasboro, Illinois, and attended Champaign high school. During his college career as an electrical engineering student, he became a member of Eta Kappa Nu. After graduating from the University with a B.S. degree in 1911, he was employed by the General Electric company in Harrison, New Jersey. This job was succeeded by a position with the Public Service Company of Northern Illinois from 1912 to 1915. The next two years found him with the Westinghouse company, and then he returned to Urbana to become a draftsman with the University Engineering Experiment station. This finally resulted in his present position as research assistant professor.

Producing a number of gray-bound publications which read, "The University of Illinois Engineering Experiment Station Bulletin," he thumbed through one of them, displaying a few of the many diagrams, illustrations, and charts. He explained that the report on any one of the many station research projects is first submitted to the station staff. If accepted for publication as a bulletin, it is given to the editorial offices to be prepared for the printer. The editor and Mr. Heater first make a preliminary estimate of illustration sizes and arrangements. Mr. Heater then checks the drawings with the manuscript for notes, captions, and references. Finally he prepares the drawings so that cuts, at the size desired, may be made by the engraver. Photographs for half-tones are marked for size, screen, and finish. After a final check by the author, the "copy" is ready for the engraver and Mr. Heater's work on another bulletin is finished. These station bulletins are usually published at the rate of one a month and deal with everything from domestic heating to many industrial problems. One of the publication's main tasks, he stated, "Is to keep scientific research down to human appeal."

Reminiscing over his past work, he recalled one incident in which the director of the station came into his office to discuss the reproduction of a portion of a geological map. The director was sure that the only safe method was by a half-tone and refused to believe that it could be done by a line-etching, as Mr. Heater had suggested. To prove his point, Mr. Heater had both the half-tone and the line-etching made. After he had examined the results, the director admitted the line-etching was the better of the two.

In his hobby of stamp collecting, Mr. Heater has gone beyond the "ordinary squirrel stage of collecting" and has written papers on his latest specialization, the classification of some of the United States envelopes. Another one of his favorite pastimes, fishing trips in Wisconsin, was interreupted by the war.

Readers of the station bulletins can appreciate the work and detailed checking done by Mr. Heater, who is to be commended for his fine record.

JOSEPH M. COOK

In June, 1946, Joe Cook set a record at the University by completing his undergraduate requirements in five and one-half semesters. As an undergraduate, Joe was enrolled in engineering physics, but to get into graduate school early, he transferred to the Division of Special Services for War Veterans.

(Continued on Page 26)

The Engineering Honoraries and Societies

By John Shurtleff, Ch.E. '50 and Dick Hammack, G.E. '48

ETA KAPPA NU

Alpha chapter of Eta Kappa Nu association, the honorary society for electrical engineers, began its fall activities with the presentation of its annual award to Richard A. Campbell of Mt. Sterling, Illinois, for achieving the highest scholastic average in electrical engineering at the end of the sophomore year. Murray L. Babcock, Alpha chapter president, made the presentation at an I.R.E.-A.I.E.E. meeting held October 23, 1947.

January 7, 1948, was the date of initiation for twenty-four seniors and fifteen juniors. Seniors were Lawrence E. Brennan, George L. Clark, Burton L. Cordry, John M. Del Vento, Joseph J. Du Rapau, Richard J. Fahnestock, John E. Farley, Francis P. Green, Howard L. Johnson, Robert G. Knowles, Robert L. Jones, Thomas E. Kurtzer, Robert G. Lakin, Robert E. Lepic, Edward Lovick, John R. Massey, Maurice R. McCrary, A. G. Peifer, William E. Powers, Charles M. Rieckter, Joseph A. Saloom, Robert C. Schneider, Lenix H. Swango, and Norman H. Tarnoff.

Juniors who were initiated are Delmond C. Bangert, Kenneth R. Brunn, Robert H. Brunner, Glenn M. Burgwald, Edmond E. Connor, Frank J. Dill, Floyd Dunn, Milton L. Embree, Edward W. Ernst, Frank J. Oenaschek, Willard A. Schaaf, Donald K. Schaeve, James H. Schussele, Harold B. Scott, and Lynn E. Wolaver.

A.I.E.E.-I.R.E.

Mr. Slinger of General Electric was the speaker for the meeting of Dec. 12. Speaking on the subject of power transmission, he discussed the electrical, mechanical, financial, legal, and economical aspects of power distribution lines. He stated that for every dollar spent for power generation, fifty cents is spent for transmission. It is estimated that the amount of power generation will increase 300 percent in the next fifteen years.

At this meeting, the St. Patrick's Ball, to be held in March, was voted upon and approved.

The A.I.E.E.-I.R.E. is at the present time distributing questionnaires to all engineers in the electrical engineering department to obtain the students' reactions to present teaching practices and policies. It is hoped that many constructive criticisms, comments, and approvals will be made. The program has the full cooperation of the electrical engineering department, and is conducted under the policy to make the University of Illinois the best school in the country.

The annual electrical engineering senior-faculty banquet was held at the Urbana-Lincoln hotel on Jan. 15, 1948. This is the students' chance to poke fun at the instructors, and a very good time was enjoyed by all.

The Buck Knight trophy contest between the A.S.M.E. and this society was held on Jan. 13. Four contestants from each group met and had a quiz program on non-engineering problems.

R.C.A. furnished the program for the meeting of Jan. 22. The topic was, "How to Get a Job in Industry." Many helpful hints were given on how to get the most out of job opportunities, and the desirable features of a company were discussed.

I.T.E.

The student chapter of the Institute of Traffic Engineers has been hard at work lately. The results of the recent campus traffic studies have been compiled and are in the process of being analyzed in an attempt to reach solutions to some of the traffic problems.

A resolution was sent to the Champaign city council recommending that it enforce the present traffic ordinances, paying particular attention to the sections on the traffic commission and its assigned duties. It was suggested that other articles be revised to meet present-day conditions. It was also recommended that the commission establish a program of traffic improvements, to provide for correction of traffic hazards, as well as to review the street construction program for traffic design and coordination with city planning. It was also recommended that a definite traffic financing plan, utilizing parking meters and other forms of revenue, be formulated. A suggested list of major items to be considered in this plan was included.

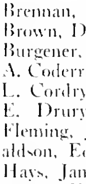
A letter was received by the chapter from the Champaign city engineer on behalf of the traffic commission, thanking it for its recommendation and saying that any further suggestions would be kindly received.

A resolution to University officials is now being drawn up by the chapter to give its recommendation on the need for more adequate parking facilities in the campus area. This problem has been under study by the chapter with several parking studies having been made. These studies showed that a great portion of the available parking spaces are being occupied by all-day parkers. This reduces the facilities available to the "short-time" parker, for whom street parking is theoretically planned.

The last meeting of the semester was held January 21. Everyone is welcome at any of the regular meetings held every second Wednesday in the evening. The meetings are normally round-table discussions by the members on local traffic problems and their solutions. Any new ideas are always welcomed, so watch for the red flag outside Professor Wiley's office announcing a meeting.

TAU BETA PI

On Wednesday, December 18, Tau Beta Pi, all-engineering honorary, entertained at an informal meeting, fifty-seven men selected from all phases of engineering on the basis of distinguished scholarship and exemplary character. These men were introduced to the history and purposes of Tau Beta Pi by Professor W. N. Espy of the department of mechanical engineering.



Those invited to pledgeship are Bryce E. Alberty, Henry O. Barton, Ralph W. Behler, Albert W. Berg, Lawrence E. Brennan, Robert H. Brunner, Edmond Brown, Donald Q. Brown, Maurice L. Burgener, Roger W. Caputo, Richard A. Coderre, Edmond E. Connor, Burton L. Cordry, George T. Dellert, Charles E. Drury, Floyd Dunn, Arthur N. Fleming, Jerome L. Fox, Gerald Geraldson, Edward W. Ernst, Walter D. Hays, James L. Honnold, William G. James, Harry G. Kabbes, Alfred W. Kellington, Otho Kile, Robert G. Knowles, Stafford W. Kulcinski, Richard G. Love, Joe L. Mazer, Kenneth F. McGann, and Don C. Miller.

Also invited were Joseph B. Morrison, Frank Oenaschek, John J. Perry, Joseph Pechloff, Orville R. Pomeroy,

(Continued on Page 28)

GEORGE R. FOSTER
Editor

EDWIN A. WITORT
Assoc. Editor

the Illinois Technograph

OFF and ON . . .

This editorial is designed to jar you out of an attitude of complacent ignorance. It isn't going to be pretty; so if you are easily offended, quit reading it now.

Deviating from my usual practice of writing in an impersonal manner, I intend to discuss the subject of living, in such a way that there will be no doubt as to whose opinion is being expressed. That it is high time to talk about this subject is evidenced by the fact that in the course of my few years of experience around this campus, I have been appaled by the "don't-give-a-damn" attitude of the average student who calls himself an educated human being. Although it is true that he is receiving training in a certain field, he certainly has no right to consider himself educated until he has learned—and practiced—at least some of the rudimentary principles of decent living.

Believe it or not, gentlemen, whether your specific endeavor is conducted in the business world, in the game of politics, or in the field of engineering, you are still mainly concerned with the business of living. Now this term is admittedly broad, but in my own definition it means that if you consider yourself a Christian—if your philosophy embraces a continuity or divine purpose of all life—you can't possibly sit through your life in the apathetic fashion of the average student here and feel that you are contributing anything worth while to anyone, least of all yourself.

It certainly looks to me as if there is a crying need for each of us to devote a portion of our lives to the improvement and benefit of other people. When we fail in this task, we not only become hypocrites in the eyes of our own philosophy, but also contribute to a world seemingly bent on self-destruction.

Many of you will temporarily ease your conscience by rationalizing that you are too busy studying right now to divert any of your energy into other channels. After spending three or four years in procrastination, you will educate yourself negatively to the extent that when you graduate and go to work you will argue that you are still too busy to help anyone else. Only by positive action started right now in school can you become positively educated. It is probably a little redundant to add here, a frequently expressed idea, that only by contributing unselfishly of your own efforts are you able to educate and improve yourself.

In the last issue of the *Technograph* was printed an announcement of the "Buck" Knight Trophy competition which was to be held on January 13. Less than two weeks before the event, designed to provide an entertaining and relaxing evening, the men who had devoted their efforts towards its reactivation were forced to cancel the affair just because of lack of interest.

The Illinois *Technograph*, the one extracurricular activity designed specifically for engineers, has an amazingly low percentage of subscribers among the student engineers. In addition, it has frequently been forced to operate with a skeleton staff simply because the student was not interested.

Gentlemen, I believe the time has arrived for a sharp word of caution. In order to maintain the proper perspective towards life it is absolutely essential to lean back in your chair, take ten slow breaths, and re-evaluate your own philosophy. If, after you've done this, you still aren't interested in helping to participate in those activities which make campus life a little more enjoyable and pleasant for everyone, then you may as well go home; you're wasting your money. If enough engineering students come up with the same disinterest, then we may as well quit publishing the *Technograph*, fold up the Engineering Council, and disband the societies. Before you decide too conclusively in favor of the selfish, complacent attitude, however, I should like to remind you, as if anyone needed reminding, that "War is Hell!"

ARGONNE . . .

(Continued from Page 9)

Dean O. W. Eshbach—Northwestern university

Chancellor R. G. Gustavson—University of Nebraska

Chancellor A. H. Compton—Washington university

Professor F. W. Loomis—University of Illinois

Dean J. A. Tate—University of Minnesota.

Professor F. H. Spedding—Iowa State college

Dr. Paul Klopsteg of Northwestern university and Dr. L. A. Turner of the University of Iowa were selected to replace Dean Eshbach and Chancellor Compton on July 1, 1947. The director is assisted by Dr. Norman Hilberry and Dr. Harvard L. Hull, associate directors. Dr. W. M. Manning is director of the chemistry division. The director and the scientific staff of the Laboratory have full responsibility for the formulation of the research program.

The scientific staff is made up of regular and temporary staff members. Temporary members fall into two categories; the first includes those who are on leave of absence from their institutions and are on the full-time staff of the Laboratory for the duration of their leave. These members will be engaged upon research programs sponsored by the Laboratory or being carried out at the suggestion of the government. The second category includes those members who are carrying on research programs for their own institutions but make effective use of the facilities available at the Laboratory.

Temporary staff membership is not limited to the staff members of the participating institutions. The director may appoint any qualified scientist to this position. The Laboratory may cooperate with other institutions by making special facilities available for investigations at the Argonne National Laboratory, by providing special materials for use at the participating institutions, by advice and assistance in the construction of special apparatus, or occasionally by the loan of special materials authorized by the government.

Security requirements at the Laboratory are in accord with government policy. Reports detailing the results of research investigations are made available to other government laboratories and contractors working under its sponsorship in the same field. Any member of the staff is at liberty to publish results properly certified by the A.E.C. as unclassified in any accepted scientific journal and in such form as such journals may require.

Rather than the usual Civil Service wage scale on projects under government sponsorship, industrial wage scales are followed thereby making some positions open to research men unusually attractive.

ANL Research Projects

The research programs of the Laboratory include both fundamental research and development work. Work in nuclear physics and chemistry and in related phases of the physical, biological and engineering sciences is stressed.

It is intended that the research program emphasize the training of scientific personnel. Botanists, biologists, chemists, engineers, physicians, and physicists work independently and in groups. In many cases, training there will constitute principally a stepping-stone from college to industry. Aside from on-the-spot training there are already being given lecture classes on underlying phases of both the research and applications elements of many departments. University graduates who have shown promise of finding or actually have found methods of approach to problems that are not easily solved by conventional methods are in great demand by the Laboratory.

The research program includes study of the properties of elements and of atomic nuclei and radiations; of fission products and their separation; of the

(Continued on Page 24)

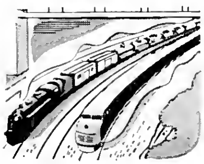
We're not so hot on POGO STICKS

Lots of people like to play jack rabbit. Still, as a way of going to work every morning, we don't see much of a future for Pogo Sticks. Not even *aluminum* Pogo Sticks.

But mention any other means of locomotion or transportation and our aluminum "Imagineers" get a gleam in their eyes. After all, what is more logical than vehicles made of aluminum? Less weight to move. More payload.

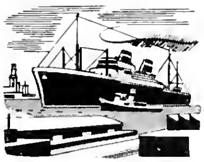
We turned our imagination loose on that idea years ago . . . then engineered our thinking into trains, trucks, planes, ships. Alcoa's Development Division has a staff of "Imagineers" who think of nothing else but better ways to transport people, products, and materials by using aluminum. Actually, we have *four separate* staffs of transportation engineers, one each on railroads, highway vehicles, ships and aircraft.

Whatever you do after college, you'll benefit from that. If you go into transportation, these Alcoa engineers will be working with you to cut costs, speed schedules, improve facilities. Or if you choose some field of production, they'll be helping to transport your materials and finished goods cheaper and faster. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

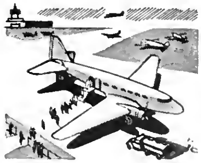


Passenger streamliners, refrigerator cars, hopper cars and tank cars built of Alcoa Aluminum are serving American railroads.

Alcoa Aluminum is finding more and more uses in buses, trucks and trailers. Yes, in passenger car manufacture, too.



Newest thing in shipbuilding is the aluminum superstructure, developed by Alcoa with marine architects and engineers.



Ever since Kitty Hawk, Alcoa has worked with the aircraft industry in developing better aluminum for better planes.

ALCOA FIRST IN ALUMINUM

ARGONNE . . .

(Continued from Page 22)

effects of neutrons and radiations on the properties of material and of living organisms; of the application of radioactive isotopes and tracer techniques to the study of biological processes, of chemical reactions, of metallurgical phenomena, and industrial processes. The metallurgy of uranium itself, so little studied before the war that not even the melting point of metallic uranium was known with any precision, is now well understood and its constants precisely found.

The use of tracers are now being used in the study of photosynthesis for the ultimate goal of actual food synthesis by laboratory methods, and of cancer for the eventual control of malignant diseases. Specifically, good results have already been obtained by using newly-discovered materials which are sold by the Isotopes Branch of the Atomic Energy Commission at Oak Ridge, Tennessee. Two materials in addition to the radioisotopes are being allocated under stringent rules to research laboratories: Heavy water — also a tracer but more useful in regard to organic matter; and boron 10 — used in the manufacture of radiation detection instruments. These are not radioactive.

University of Illinois personnel active in Argonne National Laboratory work are Dr. Moritz Goldhaber, of the physics department, who is in charge of the neutron physics research group, Professor Eugene Rabinowitch, of the botany department, who is an expert in the field of photosynthesis and now is editor of the "Bulletin of the Atomic Scientists", and Harry Palevsky of the physics department, associated with instrument development.

An example of a recent press release to industry on an advance in basic research illustrates the cooperative trend actively employed among all the national laboratories. "Dr. Inghram, Mr. Hess and Mr. Hayden of the Argonne National Laboratory have discovered that a faint isotope of an unusual type occurs naturally in the rare earth element lanthanum. Its nucleus contains 57 protons and 81 neutrons, both odd numbers. Only two such stable nuclei are known, in lithium and nitrogen; two others occur in nature but are radioactive. The new isotope appears to be stable. About one-tenth of one percent of the nuclei of lanthanum are of this type, the great majority having 57 protons and 82 neutrons."

Another central theme at Argonne is the design of atomic piles — at a level somewhat more fundamental than the engineering approach involved in G. E.'s power-production program at Knolls laboratory in Schenectady, New York. A staff of about 25 scientists here and over 30 scientists and engineers at Clinton laboratory are at present engaged in this study.

The big problem today is to work out the features of piles which run hot enough to produce electric power economically. That calls for temperatures in the neighborhood of the 900-degree level of modern steam plants. This is a considerable jump from the six now in existence which run hardly more than warm, either because, like the two research piles at Chicago, they have low energy output; or because, as at Hanford, Washington, they are elaborately cooled. Along with this program Argonne has done considerable work on the design of electronic counters, so necessary at every stage of the synthesis and transformation of radioactive materials.

As now conceived, atomic energy merely substitutes an atomic pile for a conventional steam plant in developing heat required to generate power. But atomic energy itself is an electrical force. Some day a means may be found to harness this force directly, instead of using it to generate heat which must be reconverted into power.

Before the conclusion of this article, the newly formed Atomic Club should

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ARGONNE . . .

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be mentioned. It is undoubtedly the most expensive and most exclusive club in the world. The idea was inaugurated by Chancellor Robert M. Hutchins last year and approved by the University of Chicago board of trustees. Membership is limited to 50 industrial organizations interested in research in atomic power. The dues? They are $50,000 a year. To date, five members have joined, all oil companies.

This is the saga of ANL. Some of the results will be significant and valuable to the military, some of value in connection with national defense, but no weapon development work will be carried on at the Argonne National Laboratory. If a satisfactory control of atomic energy can be achieved, unprecedented constructive advance in biology, chemistry, physics, and medicine will eventually be credited to the Argonne National Laboratory.

Daffynition: An electron is a dot of electricity that speeds very fast backwards from the direction that electricity actually goes.

* * *

Webster says taut means tight. There are plenty of people who have been taut quite a bit in college.

JOE COOK . . .

(Continued from Page 16)

Let us start with Joe's freshman year on campus, 1941. At that time Joe co-captained the freshman wrestling team and won his numerals. To prove untrue the old adage about athletes not being scholars, wrestler Cook made the Honors day celebration with his 4.5 average.

During his sophomore year Joe received one hour of B. This has been the only grade below A that he has ever received since.

Joe's college career was interrupted in February of 1943 when he enlisted in the army air corps. One incident that stands out in his memory is the celebration of the Fourth of July on a ship just off the coast of England. On October 7, 1944, Joe was shot down over Kassel, Germany, and spent the remainder of the war in a prison camp a little north of Berlin.

While in camp he won a $100 bet by walking 100 miles in five days, on a tract he laid off in the enclosure.

January of 1946 found Joe back on the Illinois campus, again bringing down top grades. This fall Joe was presented with the Interfraternity Scholarship cup which is awarded each semester to the fraternity man who turns in the greatest number of A's.

As an extracurricular activity he spends a considerable amount of his time with the University chess club. "To improve game techniques," he is playing twelve correspondence games at once.

Joe is an active member of Acacia fraternity, and for several semesters he served as chapter reporter for Acacia's national magazine. The 1946 Bronze Tablet contains Joe's name and he also holds the scholarship key given for making Honors day for three consecutive years.

In June, Joe will receive his master's degree in mathematics. For the reason that he needs "the tools of the trade."

After completing his education, Joe plans to devote his time to pure research. He is not interested in industrial research, but would be interested in aligning himself with a university.

And then there was the girl who was so lazy she wouldn't even exercise discretion.

* * *

Barrister (for motor accident victim): Gentlemen of the jury, the driver of the car stated he was going only four miles an hour. Think of it! The long agony of my poor, unfortunate client, the victim, as the car drove slowly over his body.

SOCIETIES . . .

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John Prodan, Robert N. Rasmus, Billy C. Reed, John G. Replinger, Leslie E. Roby, Earl G. Ruesch, Donald K. Schaeve, Robert K. Scharmer, Robert C. Schneider, Fred L. Siegrist, Charles W. Studt, Robert J. Wagner, Harlan V. White, William C. Wiley, Richard D. Williamson, Robert S. Wiseman, and George S. Ziles.

William A. Brooks, Gilbert G. Kamm, and Jack L. Pihl were elected as honor students.

PI TAU SIGMA

On Thursday evening, December 19, Alpha chapter of Pi Tau Sigma entertained prospective pledges at a smoker held at Hillel foundation. Professor D. G. Ryan outlined the early history of the organization, which was founded at Illinois in 1915.

President Joe Mazer was in charge of the meeting.

SIGMA TAU

Sigma Tau held a pledge smoker on Thursday, January 9. Initiation was held during the week preceding finals and was climaxed by an initiation banquet held at the Inman hotel.

PATENTS . . .

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for this is that only he can gain entry to the records of the patent office and thus verify whether or not there are already prior claims registered which would prevent your being granted a patent.

In order for the attorney to do this background work, he will have to go to Washington, and you will be paying the bill. This is a good thing to remember so that you will not be bothering either the patent office or an attorney unless you honestly believe that you have something worthwhile.

After your attorney has returned from Washington and reported to you that he believes that there is a very good chance that the patent can be obtained, your work will really begin.

The patent application must be submitted upon special patent paper which can be obtained from the patent office or the government printing office. There is also a particular technique by which the drawings must be made. Usually it will be wisest to let the attorney take care of the drawings as they usually have in their employ men who have been making patent application drawings for years.

Twenty Claims Free

When you submit your application you will have to make certain claims for your invention. The patent office will allow you to make twenty claims free. If you wish to make more than twenty claims, it will cost you $1 per claim.

These claims must be very carefully drawn and must be worded in the peculiar language which is a part of the standardized p a t e n t procedure. Here again the attorney, whom you have retained, will prove his worth.

Any series of claims must be, ultimately, the basis upon which the patent will be granted. Let us suppose that you fail to recognize one very valuable ability of your invention. Under these circumstances, another person can enter a claim on your patent and thereby make use of your patented invention due to your own carelessness or negligence. At the time when the claims are being prepared, the very greatest care should be taken to make sure that all of the possible applications of the invention have been investigated and fully discussed.

In your patent application you must state who you are, your age, place of birth, and nationality. Failure to give complete and truthful answers to these questions will ultimately result in revocation of your patent rights.

At the time that the application is filed, it is sometimes necessary to submit either a full sized specimen of the

(Continued on Page 32)


It's a good thing he doesn't dress for every industry he serves
He's a Square D Field Engineer. There are others like him in Square D branches in more than 50 principal cities of the United States, Canada and Mexico. These men are liaison between Square D and industrial America. Their full-time job is contacting industries of every type and size. It is through them that we are able to do our job effectively. That job is three-fold: To design and build electrical distribution and control equipment in pace with present needs—to provide sound counsel in the selection of the right equipment for any given application—to anticipate trends and new methods and speed their development.
If you have a problem in electrical distribution or control, call in the nearby Square D Field Engineer. He makes a lot of sense in finding "a better way to do it."
For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.
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PATENTS . . .

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item or, in the event that this is inadvisable due to size, a working model. Great care should be exercised in the construction of the model so that it will exactly conform to the specifications as set forth in the patent application.

Many an inventor has been able to bring his invention up to the point where he needs financial backing in order to be able to pay attorney fees and finally to start manufacturing the item. This is always a difficult problem as the people who are willing to give financial backing to inventors are few and far between. Usually, the person with money must first be convinced of the worth of the invention and then he will usually want to obtain a controlling interest in the invention in return for his financial aid. This seems rather unfair but it is the usual practice. The only thing that can be said is that it very definitely behooves the inventor to attempt to do business, if at all possible, with a man whose integrity is beyond question.

Following are a few of the standard fees which are charged by the patent office and which are payable in advance:

On filing each original application	$30.00
Each claim over 20	1.00
On issuing each original patent	30.00
On issuing each claim over 20	1.00

These are the most important and most often encountered fees but there are many more ranging from 10 cents for certified copies of patents to $1.50 per hour for assistance to attorneys on the examination of publications and materials in the scientific library of the patent office.

After all of the necessary papers and drawings have been prepared they are sent to the commissioner of patents, at the patent office. This is known as filing an application for patent.

Sometime following the receipt of the application, the patent office will make an examination of the prior patent grants and will decide whether or not, in its opinion, the inventor is entitled to a patent.

Should the patent office decide that your invention is not patentable, they will inform you of their reasons for so believing. Following receipt of this letter, you, the inventor, or your attorney have six months in which to ask for a hearing at which time you or he can personally argue the case.

The average length of time required to procure a patent runs well over two years, and therefore it is advisable that the inventor have some other means of support in the interim. The cause for this delay is the tremendous amount of research work which must be done by the staff of the patent office in connection with each and every patent application.

The manner in which the application is examined is quite thorough. The application division determines: a) whether or not the application is complete; b) whether or not the proper patent office procedure has been folowed; and c) to which class of inventions the application belongs. The examination division reviews the application to determine: a) whether the subject of the application is patentable under the laws of the United States; b) whether the item meets the basic requirements of eligibility; and c) whether the application conflicts with any patent that has already been granted or is pending.

It might be well, in passing, to note that the patent office receives on an average about 1,200 patent applications per week. Under these circumstances it is easy to understand why there is such a great delay in the processing and granting of patents.

If, and when your patent has been granted, you will be so notified by the commissioner of patents. Upon receipt

(Continued on Page 34)

PATENTS . . .

(Continued from Page 32)

of this information, you will possess certain rights as to tax exemptions upon your invention, and other legal items, which will not be discussed here. However, it would be a very wise move for you to make yourself acquainted with the purely legal aspects of your rights and obligations as owner of a patent. At such a time, unless your patent attorney is also an attorney-at-law, it would be adviseable to avail yourself of the services of a good lawyer so that you may enjoy the rewards of your inventive ability.

"An engineer got pretty fresh with me last night."

"Did you get the upper hand?"

"Yes, but I couldn't do a thing with the one on my knee."

* * *

Patient (Coming out from under the ether): "Doctor! Why are the blinds drawn?"

Doctor: "There is a big fire next door, and I didn't want you to come to and think that the operation wasn't successful!"

* * *

Barmaid: "Oh yes, I married a man in the village fire department."

Soldier: "A volunteer?"

Barmaid: "Nope, shotgun."

JAPAN . . .

(Continued from Page 10)

little contact with the universities, in direct contrast to American organizations of a similar nature, few of the Japanese industrial research men have advanced degrees. The students with advanced training seem to feel there is a stigma attached to this type of work. The situation resembles that which existed in the United States prior to 1918. In addition to this handicap, most of the industrial laboratories operate in secrecy because the present patent laws do not guarantee them control over the fruits of their labors.

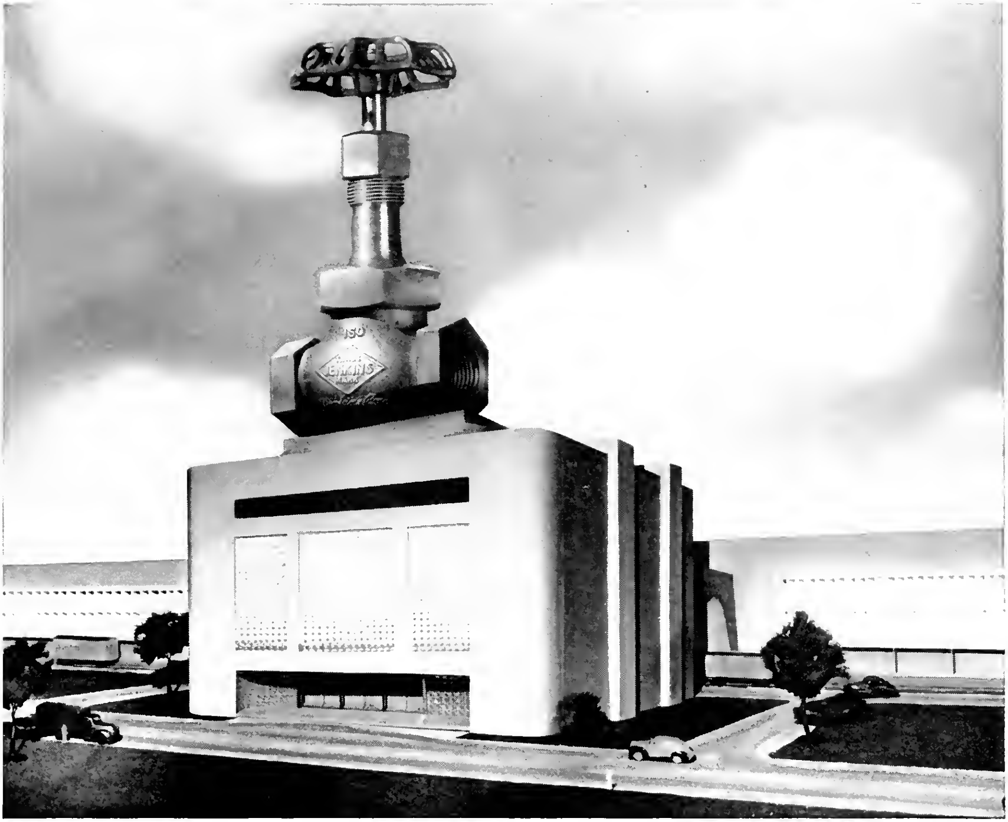
With regard to world trade, Japan at present is in no condition to resume immediately her former place. Her exports and imports are far below those of prewar years. Manufacturing establishments of all kinds have been damaged to varying degrees. Imports of food, fuel, fertilizer, and raw materials have shrunk extensively, and exports of manufactured goods have declined proportionately. Agriculture alone remains substantially intact, but is seriously handicapped by a shortage of fertilizer. These conditions have brought about the inevitable result, a lower standard of living in terms of food, clothing, shelter, and inflation.

Elevation of this standard of living will be the result of recovery and reconstruction. Possibly this may be brought about by increase in farm output, yield from available fisheries, and mine and forest output. However, before the war these home-island resources had been so skillfully exploited that a further increase in output could come only very slowly. The only way to appreciably increase the general level of living (the forcible conquest of territory failed in this respect, as it always does) will be through the development of manufacturing industries for export and through the sales of services, as in the tourist trade and shipping.

Dr. Adams goes on to say, "It is with reference to the recovery, reconstruction, and development of the export trade in manufactured goods, and in a very wide range of these, that the progress of science and technology in Japan (using the word "science" with emphasis upon the natural sciences) assumes particular importance. The products of industry competitively salable by any country on the world market are constantly changing both in character and in unit cost. The most efficient nations must and do invent new products, creating new markets, and at the same time they devise cost-reducing processes applicable to older products."

In comparison with the products of United States and European industries, the manufactured products of Japan

(Continued on Page 36)



There's Truth in this "Tall Story"

If you think of *all valves* in this plant as *one valve*, you'll see the truth in this trick photo. Valves, collectively, represent one of the biggest investments in equipment in any plant.

With wages and material costs highest ever, it is just as important for management to keep a sharp eye on valve maintenance as it is on operating costs of larger plant units.

Excessive maintenance of one inferior valve is insignificant, but, multiplied by thousands, it is a serious drain on operating budgets.

Jenkins Bros. helps management meet this problem two ways. First, by building extra endurance into Jenkins Valves, making them the longest-lasting, lowest-upkeep valves that money can buy. Second, with advice from Jenkins Engineers on any question of proper selection, installation, or maintenance.

That's why, for all new installations, for all replacements, alert management relies on Jenkins quality and engineering service for lowest valve costs in the long run. *Sold through leading Industrial Distributors everywhere.*

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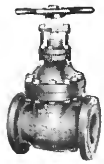

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JAPAN . . .

(Continued from Page 34)

have, in general, come to be regarded as of poor quality. The application of scientific research to their development and manufacture would bring about a better product and remove this stigma. This has not been done for several reasons. In addition to the fact that few Japanese scientists are willing to accept positions in commercial laboratories and that the patent laws contain loopholes as mentioned above, constant betterment of product was always retarded by artificial price fixing by trade associations. However, these price fixing groups have now been dissolved.

A renewal committee composed of Japanese scientists is at present working on this problem of the reorganization of Japanese administration of science and technology. The committee, composed of 108 scientists elected by scientific societies throughout Japan, was just getting under way as the Scientific Advisory Group left Japan, and it is to be hoped that an intelligent, effective reorganization on Japanese initiative will result.

The formation of more nation-wide professional or scientific societies would also aid the development of science and technology, and indeed higher education generally, in Japan. The main aim of such a society is to further the science which it represents, and does so through published matter, by bringing together for discussion different groups of scientists, and by encouraging research and thought. It gives experienced men a chance to pass on their knowledge to the inexperienced.

However, reorganization of the natural sciences should not proceed down a narrow alley at the expense of the social sciences. As Dr. Adams points out: "The reconstruction of Japan and her rehabilitation in the eyes of the world call equally for leadership and advancement of thought in the social, economic, and cultural fields, and for change in the attitude of the people as well. Material and spiritual reconstruction must move forward on a common front. Progress depends not alone upon the scientists but upon the collaboration of scientific and political leaders. Their joint efforts to visualize the new Constitution and to restore the economy of Japan will be watched throughout the world."

"Certainly I respect your advice, Mr. Bell, but what good is alimony on a cold night?"

* * *

Sign in Library: "Thinking allowed — but not aloud!"

SEE THE LIGHT . . .

(Continued from Page 7)

the addition of the human figure, but in the majority of cases more interest will usually be secured. There is something to this, perhaps because human interest arouses the curiosity of those viewing the picture. Slight movements of the model or models used in the picture will register as a blur so that it is best to place them leaning comfortably against a building or rail.

The greatest dilemma occurs in night photography when people walk into the scene or cars drive by. Should a person appear or an auto drive by, simply cover the lens with a dark card until the intruder is past and continue the exposure. This can be done as often as necessary, but with short exposures some difficulty is encountered in the timing. If the camera shutter is closed at these times there is a good chance that it may be moved. If the setting is made at "B," or Bulb, and the shutter does not have to be cocked it may be opened and closed safely by a cable release.

The results of a successful evening will be manifest in a negative that is of normal range that can be printed on No. 2 paper. The pleasing response of those seeing the print is the reward.

NEW DEVELOPMENTS . . .

(Continued from Page 2)

The first push-button operates a device which compensates for the tilt of the plane, and can correct for tilts as high as twenty degrees.

A second button regulates magnification, automatically bringing photos taken at varying elevations to the desired map scale. The remaining button controls swing, re-establishing in the instrument the plane's angle of deviation from its true course.

Photographs of terrain printed with the new rectifier are so sharply defined they give an almost three-dimensional effect.

Fluorescence Analysis Of Minerals

A Norelco fluorescence analysis unit which utilizes a new X-ray diffraction technique and makes possible rapid quantitative metal analysis has been announced by the North American Philips company.

It was exhibited and demonstrated for the first time at the National Metals Exposition in Chicago on October 18-24. The new unit determines quantitatively the purity of metals or the percentages of alloying components, and the quantities of metallic elements dispersed in non-metallic carriers.

Fluorescent analysis unit used for metal analysis and control

The fluorescence analysis unit consists of an x-ray generator, a rotating indexing holder for four specimens, a special collimating system, a crystal (usually sodium chloride), a goniometer having a scale graduated from 0° to 90°, and a Geiger counter. The crystal and Geiger counter are mounted on, and positioned by, arms which traverse the goniometer arc.

The apparatus serves for determinations on elements ranging from atomic numbers 20 to 41 when a rock salt crystal is employed. For the elements 42 to 50, a calcium fluoride crystal may be used.

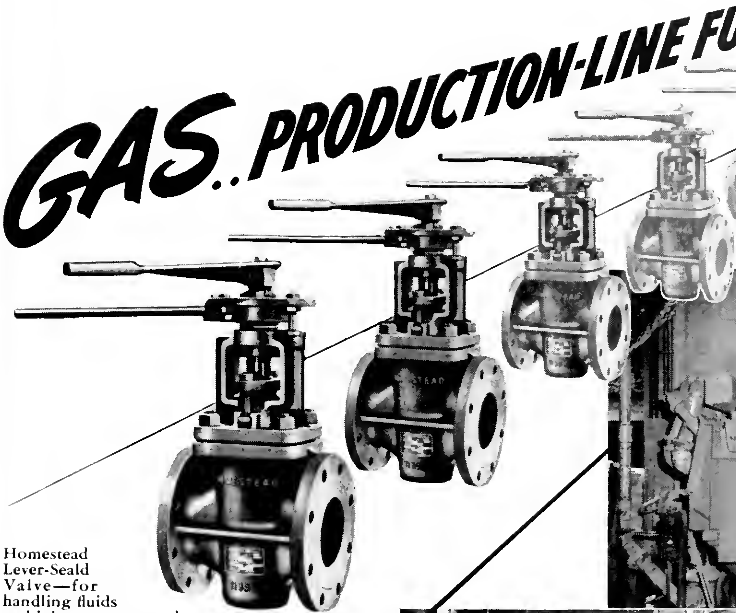
The use of the apparatus is best explained by discussing a typical problem. To determine the cobalt, nickel, and chromium content of an unknown alloy, a specimen of the alloy is placed in the four-unit holder along with the standardizing specimens containing known percentages of the alloying elements.

Assume that the cobalt content of the unknown alloy is to be determined first. From tables of reflection angles in which settings for various metals are listed, we find that for cobalt the Geiger counter should be set at the 36.8° mark on the goniometer scale. Next, the sodium chloride crystal position is adjusted to one-half the Geiger counter angle or 18.4°. By rotating the specimen holder, readings are taken first on one or more of the cobalt standardizing samples and then on the unknown. By comparing the readings and referring to a calibration chart, the percentages of cobalt may be determined.

The technique employed with the new

(Continued on Page 40)

GAS..PRODUCTION-LINE FUEL



Homestead Lever-Seald Valve—for handling fluids at high pressures and temperatures—one of the multitude of Homestead Valves for all types of applications.

Gas-fired "SKLENAR" Furnace for high-speed melting of ferrous metals.

Sectional Gas-fired core-drying oven.

for FOUNDRY MODERNIZATION

Foundry modernization is a continuing project at Homestead Valve Manufacturing Company, Inc., Coraopolis, Pa., because Homestead engineers have since 1892 kept their sights set on modern productioneering equipment and methods.

And, in their research, these engineers have investigated fuels and combustion techniques as they apply to foundry practice. As a result the productive flames of GAS are increasingly important and more extensively used in Homestead's production lines.

Modern Gas-fired Foundry Equipment, such as the "SKLENAR" furnaces for ferrous metal-melting, utilize the special characteristics of GAS—flexibility, controllability, speed. This saves equipment space, melting time, and lining maintenance. Operating at 2700° F. these furnaces have a capacity of one ton heat per hour, and 160 heats per lining—evidence that modern Gas Equipment is really productioneering equipment.

But this is not the only GAS application in the manufacture of Homestead valves. Core ovens, annealing furnaces, and non-ferrous crucible furnaces are all heated by the productive flames of GAS. In modern foundry practice GAS is the logical fuel for all heating and heat-treating operations.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

NEW DEVELOPMENTS . . .

(Continued from Page 38)

fluorescence analysis unit makes available an entirely new approach to many of industry's problems of metal analysis and control. The x-ray method permits analyses to be made without destroying the specimens used for the purpose. This method also permits a rapid determination of the percentage of a component present in large or small proportions.

Gas Turbine

A British concern is now building two ships with closed cycle gas turbines as power units. This will be a new thing in the field of marine power plants. The units used will develop 6,000 shaft horsepower. Future plans call for building some units with a shaft horsepower of 50,000. These installations will take only about one-fifth as much space as equivalent steam or diesel propelling units. By using the closed cycle type of turbines, the blades and other parts will come into contact with pure air only and thereby prevent impurities from fouling the fine blades and other parts. It is expected that the units will have a life of around 100,000 hours.

Variable pitch blades will also be used, thereby eliminating the need for gear reducers and increasing the general efficiency of these plants.

ILLINI IN ACTION . . .

(Continued from Page 14)

Engineers, and now is serving as chairman of the Executive Committee of this local. 6. Engaged in fraternal activities quite widely and for many years was president of the Chicago Fraternal Life association. 7. Participated in instituting the insurance activity of the Municipal Employes society in 1927. 8. Was one of the organizers and first vice president of the Municipal Employes Insurance association founded in 1937. 9. Succeeded to the presidency of the Insurance association in 1943.

Beginning September 1, hunting and fishing became the principal interests of CLEVES H. HOWELL '05, Longmont, Colorado, who has announced his retirement from a distinguished engineering career. He has been engaged for the past 10 years as project engineer of the Colorado-Big Thompson project, U. S. Bureau of Reclamation, one of the monumental feats of American engineering, and construction engineer of the Continental Divide (Alva B. Adams) tunnel. This 13-mile tunnel, the longest in the world to be built from two headings, will divert water from the western slope of the Continental Divide and Rocky Mountain National Park to the eastern slope. The Big Thompson project provides for the diversion of surplus water from headwaters of the Colorado river on the western slope of the Continental Divide to lands on the eastern slope in northeastern Colorado to supplement present inadequate irrigation supply and provide opportunities for development of hydroelectric power.

At Kagoshima on Japan's Kyushu island, Lt.-Col. RUSSELL E. McMURRAY '26 serves as military governor. A chemical engineer in civilian life, he was commander of a chemical mortar battalion on the Fifth army front in Italy, fought at Salerno and Anzio and won the Purple Heart and Silver Star. He is a native of Peoria, is married and has a daughter and two sons.

FENG C. LING '21 states: "My M. E., E.E. and C.E. courses are still most useful to me." Since the end of the war he has had charge of two railway lines in his province. He is repairing the war-damaged section of one which connects Indochina with the south.

In the reorganization of the General Electric company into integrated departments October 1, W. C. HECKMAN '20, M.E. '26, was appointed manager of the aeronautic and ordinance systems division. In his new position he will have entire charge and direction of manufacture, design, and commercial activity in this class and field of products.

the Illinois Technograph

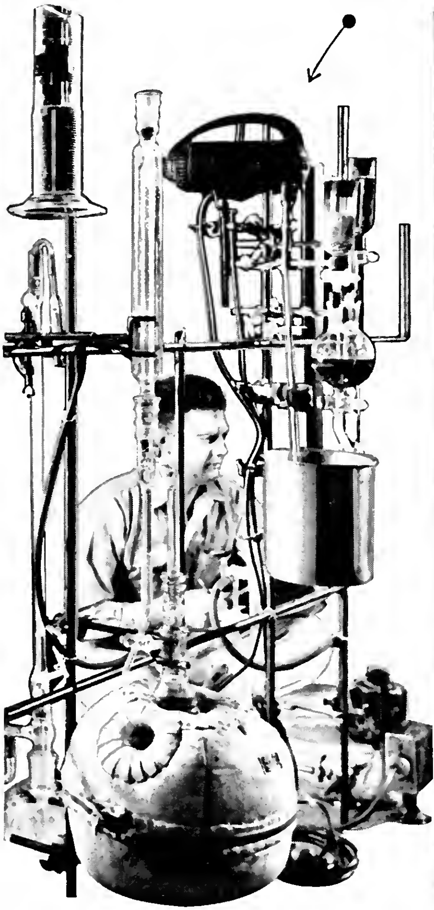
March, 1948 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Plant

Laboratory

Purchasing

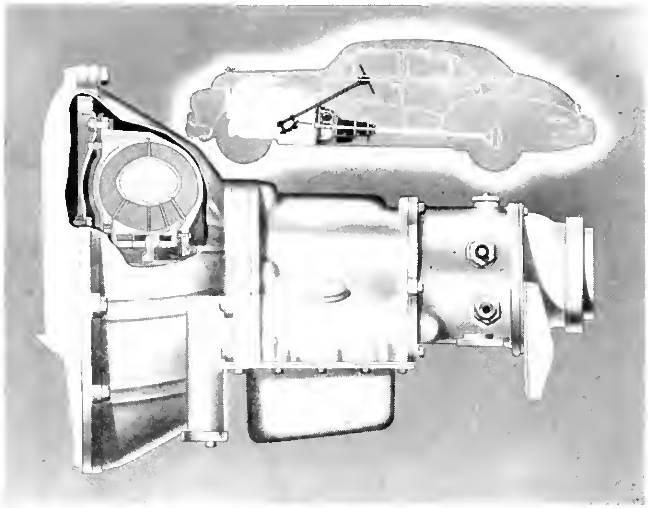


New Developments

By John Dick, E.E. '49
Herb Mazer, E.E. '50
Ken McOwan, M.E. '49

Torque Converter

Considered one of the outstanding automotive engineering developments since the war, Buick's new Dynaflow transmission, introduced for 1948 on Roadmaster cars, multiplies engine torque and transmits power to the rear wheels through an oil pump turbine and stator combination instead of through conventional gears. This combination is called a torque converter. The clutch pedal and conventional clutch are eliminated as are all sliding gears. Instead, the power plant, through the torque converter, does what gears used to do, transmitting a smooth flow of oil cushioned power as needed from a standing start to cruising speeds. Planetary gears, operated by the converter are provided for reverse and extreme load conditions and extreme grades, or for "rocking" the car. Only accelerator and brake pedal are needed in the driver's compartment. A selector lever mounted under the steering wheel chooses the driving range and direction and provides for parking and neutral positions. Shown above is a cutaway view of the Dynaflow.



Dynaflow transmission replaces conventional gears

Man-Made Rain

The dry-ice or silver iodide methods of producing rain from super-cooled clouds have been supplemented and perhaps by-passed by a new method for producing "man-made" rain. Recently disclosed by Dr. Irving Langmuir, associate director of the General Electric company's research laboratory, the method consists of dispensing small quantities of ordinary water into actively growing cumulus clouds. These clouds must have certain characteristics including an upward wind current of at least five miles per hour, fully grown cloud water droplets, a high cloud water content, and a cloud thickness of several thousand feet. These characteristics are evident in most of the active cumulus cloud formations.

According to the theory behind the method, the small quantity of water injected into the cumulus cloud will begin to fall in the form of ordinary water drops. As they fall, they will collect the tiny cloud water droplets in their paths. Thus, the drops will be continuously growing as they fall.

When the water droplets reach their critical size, (about 3/16 of an inch in diameter), they will begin to shed water particles. These particles, too little in weight to resist the upward wind currents in the cloud, will be driven upward. However, they too, will collect the smaller cloud droplets in their paths until a weight is accumulated that is sufficient to overcome the upward force of the wind; thus the drops will begin to fall. In this manner, according to Dr. Langmuir, a chain reaction will progress throughout the cloud.

By use of this method, a self-propagating rainstorm may be stimulated. Since the loss of cloud droplets lowers the density of the cloud, the upward wind currents could cause the cloud to grow to much greater heights. If this occurs, the cloud will probably draw in additional moisture from the atmosphere and thus continue the chain reaction rainfall.

Operating Costs Reduced

A long standing cause of increased operating costs is finally on the way out thanks to the Illinois Central Railroad.

This railroad has just completed construction of five new hopper cars that weigh only four-fifths as much as cars now used for similar work.

The use of such equipment means more pay load for the railroads. The savings that could be realized by a widespread development and use of lightweight cars might well be the long sought-after means of actively competing with the truck lines that have caused the railroads much concern in recent years due to their lower operating costs and resultant lower tariffs.

Temperature Control

A new development of an old idea has resulted in the manufacture of a set of controls that insure uniform temperature through the entire area of furnaces where variations are not allowable. This device is coupled both with the heat-producing elements and a recording thermometer. Readings of temperature are possible over a large area within the furnace and adjustments are possible over any part of this area. It is possible also to keep one part of the furnace at a slightly lower temperature than that of the surrounding areas. This device has filled a great need in the pottery industry where temperature control is of prime importance for the production of a uniform product.

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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the Illinois Technograph

Volume 63 — **Number 6**

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

A familiar sight wherever structural steel framing is used in building is the man who heats the rivets and tosses them up to the riveting crew. In this case, the picture was taken on the site of the new chemical engineering building on the University of Illinois campus.

FRONTISPIECE

One of the many well designed and engineered buildings constructed by John J. Felmley Company is the United States Tobacco Company factory in Richmond, Va.


MODEL
TOBACCO

Industrial Sightseeing . . . *John J. Felmley Co.*

By Ronald Johnson, Comm. '48

The John Felmley company, with its main offices in Bloomington, Illinois, has established a high reputation in Illinois, Tennessee, and Virginia for its general and heavy construction work. The history of the company dates back almost thirteen years, at which time a small group of men under the direction of John Felmley made plans for organizing a heavy construction company. During the years that followed, the company did most of its work in Central Illinois. The company is licensed in both the states of Tennessee and Virginia and has operated there in the past.

The high standards of construction work performed is the responsibility of highly trained and highly experienced executives and professional men. A brief summary of the backgrounds of the company's executives is given in the outline which follows:

President: John Felmley, graduate of the University of Illinois (1925) in architectural engineering. He has had thirty years of experience in the general building construction and contracting business.

Vice-president and General Superintendent: R. C. Dickerson, graduate of Purdue University in civil engineering, has had twenty years' experience in construction work, most of this time as a superintendent. He is in charge of the two buildings being constructed here on campus.

Vice-president and General Superintendent: O. R. Callbeck, originally a carpenter, served his apprenticeship from 1914 to 1917. He has had thirty years of experience, twenty-five of which were in the capacity of carpenter foreman and general superintendent in charge of large construction projects.

Secretary and Auditor: C. V. Quiett has been in the accounting end of the construction business for twenty years.

Treasurer and Estimator: A. M. Allyn attended the University of Illinois three years in architectural engineering. He has had thirty years' experience in estimating.

This article about the John J. Felmley Co. of Bloomington, Illinois, is the sixth in a series on local industries. The purpose of the series is to stimulate thinking on the part of prospective engineers on the subject of employment and work. Numbering several Illinois men among its executives, this company is an excellent example of opportunity in the construction business.

Chief Engineer: T. S. Blackman, graduate of the University of Georgia (1925) in civil engineering, has had twenty-two years of experience in engineering and construction work.

General Superintendent: D. L. Gard, graduate of the University of Minnesota (1924) in civil engineering has had twenty-three years' experience in general construction and engineering.

Assistant Superintendent and Engineer: James B. Meek, graduate of the University of Illinois (1942) in civil engineering. Mr. Meek is in charge of construction on the Chemistry and Chemical Engineering building on campus.

The company, employing 100% union mechanics and laborers, handles all types of general and heavy construction including school buildings, office buildings, hotels, apartment buildings, banks, factories, power houses, sewage disposal plants, water works, etc. Some of the principal projects that were constructed in the past twelve years consist of:

State Farm Insurance company office building in Bloomington, Illinois.

Dormitories and Union building, Illinois Wesleyan university, Bloomington, Illinois.

Library, Illinois State Normal university, Normal, Illinois.

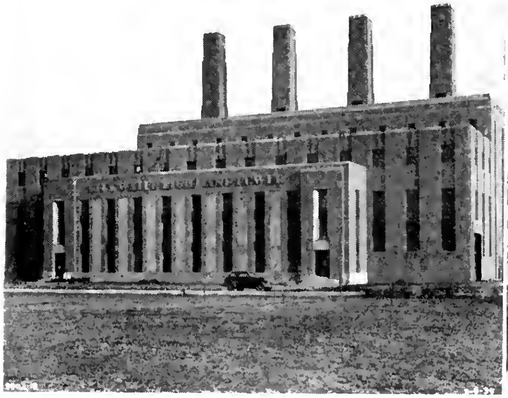
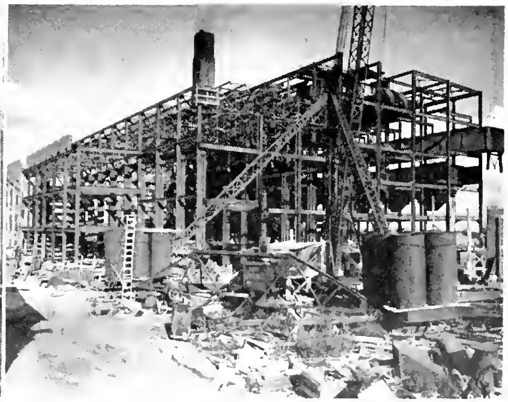
Factory for Sylvania Electric company, Bloomington, Illinois.

Memorial hospital, Springfield, Illinois.

Power plant for the city of Springfield, Illinois.

Terminal buildings and hangars at the Springfield Public airport, Springfield, Illinois.

(Continued on page 24)

At left is the municipal power plant for Springfield, Ill., built by the John J. Felmley Company. At right is the same building during construction

Protected by Plastics

By Don Hornbeck, Ch.E. '48

Dealing with one of the lesser-known applications of plastics, this article covers the use of plastics for protective coatings on finished metal parts, and some of the problems involved in this field.

Although today's plastics were pioneered over 100 years ago, they remained merely the interest of the small number of men working on the crude resins which appeared, usually unintentionally, in the test tubes of research chemists. Three of our most useful synthetic resins, polystyrene, polyvinyl chloride, and polyvinylidene chloride had been prepared before 1840. These curious resins were reported in the literature as they were discovered, but little thought was given to them as a material for the manufacture of the myriad of household and industrial items we now enjoy.

While the 19th century literature contains frequent reports of studies made of the phenomena of polymerization and condensation of these resinous materials, it remained for Dr. L. H. Baekeland, a young Belgian chemist at work in an American laboratory in 1909, to recognize the merits of a phenol-aldehyde resin which he had prepared and to apply industrial practices to the commercial production of this early plastic. The original Bakelite company was organized in 1910, and it is at present a part of the Carbide and Carbon Chemicals corporation. As the opportunities in this field of manufacture of organic resins became known, other enterprising gentlemen organized similar companies.

Since an adequate coverage of the field of plastics would require several volumes, we shall limit ourselves here to the single sub-division concerning the use of plastic coatings on the surface of metals. Certain resins have been found to be particularly adaptable to use in covering metallic surfaces. The particular properties required are largely dependent upon the service in which the material will be used. A listing of some of these properties would include inertness to the action of heat, light or various solvents, ease of fabrication, hardness, transparency, adhesive qualities, and non-inflammability.

The two general objectives for the application of organic coatings on metal are to protect the metal from corrosion and to provide a pleasing appearance. These coatings may take the various forms of lacquers, varnishes, paints, or enamels to be applied by brush, spray, or dip. Many special finishes, such as wrinkle coating, may be used for decorative effects. The constant aim of the plastics industry is to develop materials that will permit greater ease of application and wider fields of usage. Further, these coatings shall be more resistant to solvents, chemicals, water, weather, and other factors which cause premature failure of present-day protective coatings.

Temporary protection of mechanical equipment while being transported to various theaters of war demanded the development of a coating resistant to mild abrasion and to corrosive atmospheres. This temporary surface had to be readily strippable from the metal to facilitate on-the-spot replacement of, for example, truck parts. Researchers developed a plastic containing 25% ethyl cellulose, 25% resin plasticizer, 50% mineral oil and wax, and 1% stabilizer and inhibitor to insure the stability of the plastic to effects of light, heat, and oxygen. Ethyl cellulose is the ether of cellulose and ethyl alcohol, made by the reaction of ethyl chloride upon alkali cellulose, which is prepared from wood pulp. The plasticizer imparts the controllable properties of flexibility, toughness, and impact strength.

The metal to be coated was dipped into a kettle containing this ethyl cellulose mixture at a temperature of 350—375° F. A "double-dipping" procedure has been recommended. The combined thickness of the two dips should be between 60 and 100 thousandths of an inch in thickness. The material upon cooling, forms a tough skin-tight protective layer which thoroughly protects the metal and at the same time is easily removed by simply slitting and peeling off. It is abrasion-resistant to a marked degree. The protective qualities of this material called "Stripcoat" are retained from —30° to 150° F., and it will withstand 100% relative humidity at 120° F. It is water- and corrosion-proof, and also bigly resistant to salt solutions. Aside from the protection which this package gives, manufacturers using it report a saving of from 60 to 95% in packaging time depending upon the type of part being dipped.

Various lacquers were formulated for brushing and spraying in addition to the above-mentioned dipping process, whichever process appeared to be most practical for the individual application.

Certain types of parts: e.g., bearing assemblies, were packed with the grease required in operation and then given their overall coating. Recent industrial applications have included the use of this temporary coating to protect metal parts while in the course of inter-plant shipment, in transit to sub-contractors, and in protecting export products being shipped to or through zones of unfavorable climatic conditions.

(Continued on page 20)

A wartime packaging development is the use of certain resins to preserve and protect metal parts in storage or shipment.

Here are the changes inaugurated in the electrical engineering curriculum. They will eliminate overlapping, but will mostly introduce new material, especially in illumination, where a new option has been added.

E. E. CURRICULUM

By Glenn Massie, E.E. '49

The electrical engineering department put into effect a new curriculum last spring, after having waited until most of the students whose education was interrupted by the war had returned to the campus. Even as early as 1940, department committees were making a thorough study of the curriculum for means of improving the course offerings from the point of view of the student. It was felt that it was necessary to eliminate overlapping of some courses and to introduce new material where a need had been indicated. However, the activation of the new curriculum had to be postponed during the war years.

The electrical engineering curriculum starts with the sophomore year. Several major changes were made in this and the junior year. A course in Effective Speaking was added to help the engineer learn how to present his ideas in a clear and forceful manner. Two courses, Pattern and Foundry Laboratory, and Hydraulics, were taken from the required list, but may still be taken as electives. The study of Statics and Dynamics, which previously required five hours, is now covered in a combined four-hour course. Basic electrical theory, previously included in Introduction to Circuit Analysis during the first half of the junior year, is now incorporated in Introduction to Electrodynamics and is taken during the last semester of the sophomore year. The great importance of a thorough mathematical background to the electrical engineer was indicated by the additional hour given to Differential Equations and Orthogonal Functions, now a three- instead of a two-hour course.

Prior to the change of curriculum, all electrical engineering students, whether interested primarily in communications, power, or illumination, had taken the same courses through to the end of the junior year. However, specialization now starts with the second semester of the junior year. This has made it possible to give separate introductory courses in electronics and electrical machines and illumination, with the theory and problems being directed toward the particular option. A new course, Measurements in Electrical Engineering, taught by the electrical engineering staff, has been substituted for Electrical and Magnetic Measurements, which was taught by the physics department.

A large portion of the electrical engineering advances made during the last war was in the communications field, and this has been recognized by the reorganization of the various communication courses. The major difference is the renumbering of courses and the inclusion of new material. The same is true to a lesser degree of the power option, where the reorganization of course material had already been accomplished.

The importance of making the engineering curriculum as broad as possible, in order to graduate a good citizen as well as a good engineer, was acknowledged by the addition of six hours to the previous allowance of six non-technical elective credit hours. These twelve hours are included in the junior and senior years, for it was felt that the junior or senior, having attended the University for several years, would have decided which course in other colleges would best help him.

Illumination Option Added

The importance of illumination as an engineering problem was recognized by the addition of illumination to communications and power as an electrical engineering option. At the present time the University of Illinois is the only institution in the country offering such an option. Courses in illumination and photometry have been offered here and elsewhere for over fifty years, but the new option is designed to develop lighting engineers for manufacturing concerns, scientific and research laboratories, and the utilities. A new pamphlet titled "To The Prospective Electrical Engineer," soon to be released by the electrical engineering department, describes the work of the illumination engineer in these terms:

"In this profession the individual will find positions ranging from abstract research into the behavior of human beings under the influence of light, to positions in the sales divisions of jobbers and manufacturers of lighting equipment. In the utilities the illumination engineer acts either as a consultant or an application engineer, specifying the required illumination and designing both commercial and industrial lighting systems. In the development laboratories, the requirements may range from research in fundamental principles to the development of new sources and the investigation of lighting applications. The manufacturer requires an engineer who can design equipment, test it, and follow through to the actual application in the field."

As with communications and power, the illuminating option begins with the second semester of the junior year. The illuminating engineer takes the electronic courses required for the power group and the electrical machine courses required for the communications group. Other technical courses include Illumination Engineering, Measurement in Electrical Engineering, and Illumination Design Economics. Physiology of Vision and Psychology of Vision are included in the illumination curriculum in order that the physical function of the eye and the behavior of the human being toward light may be better understood. Inasmuch as lighting and architectural design are closely allied, two courses in History of Architecture are also provided. Several credit hours are devoted to Salesmanship and Sales Administration, for the illumination engineer must also be an effective salesman.

It is not expected that the illumination branch will graduate more than twenty to twenty-five men a year for some time to come as the value of technically-trained men is not yet fully appreciated by the illumination industry. It should be noted, though, that the illumination engineer is still primarily an electrical engineer and can compete in either the communication or power fields.

The new curriculum is less elective than the old, but the alert student still has an opportunity to receive a broad electrical engineering education. The new plan guarantees that the student takes the courses in which he has "to dig in and then work himself out." As in the past, it is the department's aim that each electrical engineering graduate shall be first a good, well-rounded citizen, a capable electrical engineer in any option, and a specialist in one option.

"Pardon me, Mrs. Astor, but that would never have happened if you hadn't stepped between me and that spittoon."

* * *

Dean (to coed)—"Are you writing that letter to a man?"

Co-ed—"It's to a former roommate of mine."

Dean—"Answer my question."

* * *

It's all right to compliment her on her ankles but don't compliment her too highly.

The Engineering Honoraries and Societies

By John Shurtleff, Ch.E. '50 and Tom Moore, E.E. '50

ENGINEERING COUNCIL

St. Pat's Ball will be held on March 12, 1948. This was the decision of the Engineering Council members at their second meeting, called to order by Floyd Maupin on December 16 in Room 215 Illini Union.

Candidates for the queen of the ball may be entered by any engineer by submitting pictures to the Technograph office. The Queen must be the date of an engineer at the dance. Wives of engineers are, of course, eligible to compete. The deadline for submitting pictures will be February 20. Soon after this date the candidates will be eliminated to nine girls by a committee of faculty members or professional photographers. The Queen will be elected at the dance, the other girls being her court and representing the eight societies.

In entering candidates for St. Patrick, each society will choose one engineer to represent the society. This choice must also be turned in to the Technograph office by February 20. St. Pat will be selected at the dance by an applause meter.

The meeting of January 6 was called to order by Murray Forth.

Bob Chilenskas, co-chairman of the St. Pat's Ball committee, reported on the progress of the committee. Bob Scharmer, A.I.Ch.E., was appointed to head the contest arrangements. Frank Recny, S.B.A.C.S., was named ticket chairman; he will work out the method of ticket distribution and make up the list of people who are to receive complimentary tickets. It was recommended that ticket sales be restricted to society members for the first week that they are on sale.

The Buck Knight Trophy contest was postponed. The council was asked to take over and sponsor the contest in the future.

A suggestion was made to invite several representatives from the International Harvester company to the University to meet with an eight society panel. All societies are to let the council know, through their representatives, how they would like such a meeting.

The St. Pat's Ball committee reported at the meeting of January 20 that the dance and the contests for St. Patrick and St. Patricia had been approved. Frank Recny gave a report on the list of patrons and those who would receive complimentary tickets. The elected delegates on the council will receive the allotted number of tickets for their society. Fifty per cent of the profits from the dance will be distributed equally among the societies and the rest according to the membership of each society. John Prodan resigned as co-chairman and will be replaced by Keith Goodwin.

Mr. S. T. Waidelich of the Austin company will be her on March 10 to talk on "Industrial Plants—Who Designs Them?" All societies are urged to publicize this program to their members because it should be of interest to all students.

Henceforth, men who are working with the two standing committees and are not official representatives of their respective societies will be known as non-voting members of the council.

A.I.E.E-I.R.E.

An election of officers at the meeting of January 22 produced the following result: Orville R. Pomeroy, president; Robert O. Duncan, vice-president; Arthur R. Jones, secretary; and James Stewart, treasurer. Don Richardson and John Farley were appointed corresponding secretaries.

George D. Lobinier, superintendent of the student recruitment department of Westinghouse, addressed the members on the proper technique for a student to use when being interviewed for a job. His advice was to examine the resources and background of a company before applying for a job.

A report on the latest plans for the St. Pat's Ball was given by Keith Goodwin, one of the Institute's representatives on the Engineering Council.

A.I.CH.E

The members of the American Institute of Chemical Engineers met on January 7 to hear a talk given by Professor W. E. Chalmers of the Institute of Labor and Industrial Relations. Nominations were made at this meeting for the selection of a candidate to represent the chapter in the election of St. Patrick at the annual St. Pat's Ball.

A business meeting was held on January 27, at which time officers were elected for the second semester. Don Hornbeck was re-elected president of the chapter by the unanimous consent of those present. Also re-elected was Herb Schultz, secretary. The other officers elected were the following: Bob Chilenskas, vice-president; R. W. Fisher, treasurer; and Richard A. Coderre, representative to the engineering council. Coderre also received the honor of being elected as the chapter's nominee for St. Patrick.

Appointments made were Jack Rose as chairman of the social committee and Ray Harris as chairman of the program committee.

Dr. L. F. Audrieth, professor of inorganic chemistry was elected an honorary member of the chapter in recognition of his interest in chemical engineering.

The revised constitution was ratified at this meeting, and one of the amendments will allow students of the University branches at Navy Pier and Galesburg to become members of a sub-chapter.

A.S.A.E.

The student branch of the American Society of Agricultural Engineers elected officers for the second semester at a meeting held on Monday, January 27, 1948. They are as follows: president Harlan Baker, Mt. Morris, Illinois; vice-president, William Fletcher, Kingston, Illinois; secretary, Earl Moss, McLeansboro, Illinois; scribe, Lawrence Bitterman, Wilmington, Illinois.

I.T.E.

The student chapter of the Institute of Traffic Engineers completed their first semester since being activated with the publishing of a report on the campus area's traffic problems and some possible solutions. This report was based on actual facts obtained in several large scale traffic surveys taken by the group in November, 1947. The recommendations called for an immediate and a long range plan of action to be taken by the University and the twin communities.

This report was sent to President Stoddard and other University and city officials. It is hoped that some consideration will be given to these recommendations by the officials concerned.

Several recommendations were given for the immediate program of action. One was the establishment of a system of one-way streets with the following streets being set up for one-way traffic in the direction indicated: Daniel, west; Chalmers, east; Illinois, east; California, west; Oregon, east; Nevada, west; Sixth, south; and Fifth, north. This action would permit parking on both sides of the street. Also recommended was the restriction of parking to one side only along the east side of Mathews, the east side of Romine from Springfield to Main, and the south side of Springfield from Wright to Mathews. Other suggestions for the immediate program were as follows: The restriction of parking along the streets within twenty feet of all cross-walks; the changing of the position of the stop signs at Wright and Springfield, making Springfield the through street; and the establishment of more off-street parking facilities.

The long range program contained the following suggestions: widen Green street to a four-lane divided thoroughfare from Wright to Goodwin; widen Gregory drive; widen Springfield from Wright to Goodwin; and the establishment of still more off-street parking facilities.

An interesting talk on Traffic Safety and Education was given to the chapter on January 28 by Mr. Mathew Sielski, director of the Safety and Traffic Engineering department of the Chicago Motor club. A dinner was held in the Illini Union for Mr. Sielski and those members who were able to attend.

U. OF I. ELECTRONIC CLUB

The University of Illinois Electronics club is the newest technical organization on the campus. It was formed last spring by a group of students and faculty members who are interested in the practical side of electrical engineering and electronics. The purpose of the club is to provide power, laboratory space and instruments for the use of any interested student or faculty member of any department of any college in the University. Work on personal projects is encouraged and, whenever possible, technical assistance is supplied. Occasionally, program meetings are presented which feature one or more speakers who talk about subjects not ordinarily taught in the regular classes.

The originators of the idea were Mr. Milton R. Crothers, an instructor in electrical engineering, and Mr. Ernest E. Overby, a senior in the communication option of electrical engineering. Mr. Crother is the faculty sponsor and adviser. Mr. Overby was the first president of the club.

The club has met several times during the summer session and the fall semester of 1947 on a trial basis to determine the interest of the student body. Since interest has been sustained and attendance has increased, a petition for recognition and approval has been submitted.

Anyone, student or faculty member, who has an amateur interest in things electric or electronic is welcome to attend. There are no dues, involuntary assessments or expenses except for hand tools, parts and supplies which each person must supply for his own use. Meetings are planned for Tuesday evenings from 7:00 p. m. to 10:00 p. m.

ETA KAPPA NU

The semi-annual initiation and banquet of Eta Kappa Nu, electrical engineering honorary, was held on the evening of January 7, 1948. The following thirty-nine men were admitted to membership: D. G. Bangert, L. E. Brennan, K. R. Brunn, R. H. Brunner, G. M. Burgwald, G. L. Clark, E. E. Conner, B. L. Cordry, J. M. Del Vento, F. J. Dill, F. Dunn, J. J. Du Rapau, M. L. Embree, E. W. Ernst, R. J. Fahnestock, J. E. Farley, F. P. Green, H. L. Johnson, R. L. Jones, R. G. Knowles, T. E. Kurtzer, R. G. Lakin, R. E. Lepic, Ed Lovick, J. R. Massey, M. R. McCrary, F. J. Oenaschek, A. G. Peifer, W. E. Powers, C. M. Rieker, J. A. Saloom, W. A. Schaaf, D. K. Schaeve, R. C. Schneider, J. H. Schussele, H. B. Scott, L. H. Swange, N. H. Tarnoff, and L. E. Wolaver.

The guest speaker at the banquet was Paul N. Landis, professor of English, who discussed his views of the "Humanities" in an engineering education. Following the speech, the next semester's officers were elected and installed.

The new officers are: Granville G. Kemp, president; James H. Schussele, vice-president; Edward W. Ernst, recording secretary; Charles W. Studt, treasurer; Edward Lovick, Jr., "Bridge" correspondent.

PI TAU SIGMA

Twenty-nine seniors and twenty-eight juniors were initiated into Pi Tau Sigma, national honorary fraternity for mechanical engineers. They were honored at a banquet at the University club following the initiation, January 21, 1948.

Seniors initiated were: James C. Adair, Henry S. Bieniecki, Roy K. Cannon, Richard L. Davis, Kenneth A. Ebi, Harold J. Farrar, Charles F. Fry, William K. Haebich, James G. Haller, Thomas B. Harker, Carl P. Hendrickson, Richard F. Johnson, Alfred L. Kellington, Ivan J. Law, Gordon E. Martin, Robert C. Menken, Walter H. Merker, Lawrence S. Monroe, Robert S. Plumb, Daniel W. Porter, Homer R. Rizner, John O. Roeser, Earl G. Ruesch, Robert S. Smith, Elmer R. Steiner, Walter R. Stiles, Marvin L. Tratner, Robert E. Wilson, and Erwin E. Ziemann.

Juniors initiated were: George A. Becker, William A. Berg, Harold I. Blotner, Clarence L. Brown, Charles L. Carll, John R. Cushman, Frederic T. Fariss, Joseph A. Grimmer, Morris Henderson, Leon R. Henry, John C. Hug, Richard R. Hunter, Robert L. Hunter, Stuart J. Johnson, Charles A. Lessing, Richard Ling, Lloyd M. Lundquist, Wilbert H. Morgan, John J. Parry, Bernard A. Peskin, Chester M. Peterson, Joe J. Poczatek, Leslie E. Roby, Donald E. Taylor, George P. Taylor, James R. Tucker, Renso J. Vannelli, and Robert J. Wagner.

Officers elected for the spring semester are: Gerald Geraldson, Jr., president; Robert C. Menken, vice-president; Charles A. Lessing, corresponding secretary; Robert S. Plumb, recording secretary; Jerome L. Fox, treasurer.

Following the banquet, Dr. Harry J. Fuller of the University botany department gave a talk on Peru and Bolivia. He illustrated his talk with colored slides.

SIGMA TAU

On the evening of January 13, 1948, the University chapter of Sigma Tau, all-engineering honorary, held a smoker at McKinley foundation to which forty-six prospective pledges were invited.

John S. Crandell, professor of highway engineering and faculty adviser of Sigma Tau, told the rushees some interesting facts about the history of the organization. The initiation banquet was held on the evening of January 27, 1948, in the Inman hotel. H. E. Babbitt, professor of sanitary engineering, was the guest speaker.

A VOLATILE QUESTION

Have you seen alcohol?
Kerosene him last night,
But he ain't benezene since.
Gasolined against a lamp post and took
a naptha.

FASHION NOTES

Another item for the "Time Brings All Things" department: For the information of all concerned, word got around that The Illinois Technograph had a Women's Page Fashion News Editor. It was news to us, too, but for the benefit of all our married readers and women engineers who are interested we will keep on file the news release about modern knitting, that our "Women's Page Fashion News Editor" received.

In This Corner... NAVY PIER

Electric arc furnace just installed at Navy Pier

SHOP TALK

by John Fijolek, E.E. '51

Modern industry in the shape of molten metal being poured from an electric arc furnace has invaded the Pier campus. Engineering students in the foundry laboratories have welcomed the invasion and now regard the newly installed Pittsburgh Lectromelt furnace as one of their prize possessions.

The furnace in question is pictured on this page and is one of the three-phase arc type with each arc being individually controlled. The furnace has a melting capacity of 250-300 pounds for each melt and has an acid lining. The walls are of high-refractory silica brick. It is used for pouring acid steel products and to cast iron. Another furnace, which is gas-fired, is used for non-ferrous metals.

Shown in the illustrations are the three electrodes each of which is connected to one phase of a three-phase current and lowered into the bath in such a manner that an arc is formed between the slag and each electrode. The heat is generated by electric current passing through the air separating the electrodes from the bath. Automatic control of this air distance is provided for with the new furnace.

A separate room houses the eleven-ton transformer which has a maximum capacity of 300 KVA. Normal operation is at 55 volts and 800 amperes. Iron is poured at temperatures ranging from 2500 to 2700° F. with steel temperatures going higher to about 2800°.

The outside furnace wall is water cooled. Another safety device is a mercury control for tripping the circuit breaker when the furnace is tilted for pouring.

The furnace may start with a cold charge requiring one to two hours for melting, and the steel made in this way is spoken of as cold-melt electric-furnace steel to distinguish it from that resulting from the practice of using a hot or molten charge previously melted in an open hearth furnace and transferred to the electric furnace. In the manufacture of high-grade steel for tools, the slower and more expensive cold-melt method is almost always used.

Instructors R. E. Kennedy, secretary emeritus of the American Foundrymen's association, and R. W. Schroeder, supervise the various engineering groups who use the furnace in their studies of control of materials and processes in making castings for construction purposes.

Let's Do Our Share

By Siegmund Deutscher, A.E. '50

Last week one of the *Technograph* reporters approached the officers of the various engineering societies for news items. The only reply he received was that there was no news. Yes, for a whole month none of the societies had any news. The following month was taken up by final examinations and registration which in all probability will prohibit any further meetings. The beginning of the new semester will no doubt draw out the unactivity period for a few more weeks.

Is this how we want to operate at the Pier? To start organizations and then forget about them? I doubt very much if that was the idea of those who started them.

Does lack of student interest cause this situation? If so, why? During the past semester a number of students, who showed considerable interest, approached me and asked me how they could join their various organizations. The only advice I could give them was to see the various officers.

The advice was next to impossible to follow. None of the organizations have even attempted to use the office space appropriated for them. Yes, they do have office space. In fact, they are supposed to share the *Technograph* office with us.

I still remember the many difficulties Dean Hoelsher went through to get this space for us. The executive faculty only wanted to allow us to use one-half of the space we asked for but Dean Hoelsher pressed for more space, explaining that all the engineering societies would be using the office. But now that we do have the space, the *Technograph* is the only organization that has used the office. In fact, the other organizations

(Continued on puage 28)

EDITORIAL STAFF

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Naomi Suloway, *Asst. Bus. Mgr.*

Reporting

John Fijolek — Norbert Ellman
Richard Choronzy — Leonard Cohen

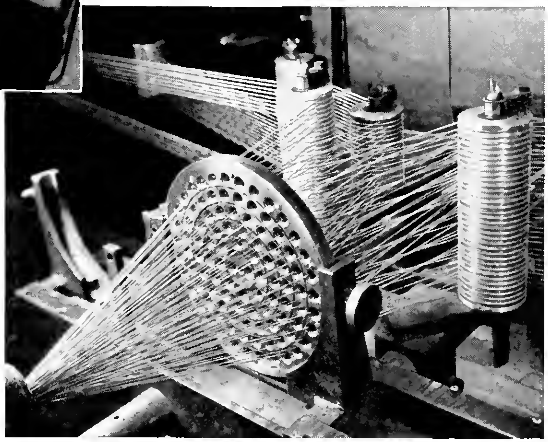
Ogden Livermore........*Faculty Adviser*

NUMBER 10 OF A SERIES

Newsworthy Notes for Engineers

"Merry - go - round" speeds telephone dial governors

Most production lines in Western Electric plants follow standard practices, but often it is advantageous to custom-tailor an assembly line to do a specific job better. To control the mass production of delicate telephone dial governors to exacting standards, Western Electric engineers designed this "merry-go-round" conveyor with its ingenious assembly fixtures. It both simplifies the operation and reduces the time of assembly.



Cable at the "Cross Roads"

This "Cross Roads" guide plate through which pulp-insulated wires are rushing, keeps the wires in their proper relative position while being twisted into units of 101 pairs before being fashioned into a telephone cable. The wires passing through the guide plate to the flyer strander are kept at a uniform tension by means of a torque motor and a very sensitive control device at each of the 101 supply reels. Designed by Western Electric engineers, this mechanism prevents defects by keeping the wires from being stretched as they move along.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Introducing

by Dick Hammack, C.E. '48

Shirley Smith, E.P. '50 and Herb Jacobson, M.E. '50

RAYMOND N. McDONALD

Since practically all engineering students sooner or later find the letters "M.E." followed by an appropriate number, on their schedule, it seems wise to introduce at this time one of the newcomers to the department of mechanical engineering. Professor Raymond Neill McDonald is the man.

"Born in Denver, Colorado, in . . . well, maybe we'd better not mention just when," he began in modest tones. "I graduated from the University of Colorado in 1936, with a B.S. in mechanical engineering."

After graduation he applied his knowledge for the Gates Rubber company, in their Denver office. The work consisted of designing V-belt drives.

Then, in September of 1936, he went to work for the Gulf Oil corporation at Port Arthur, Texas. After a year in the Lone Star state, he was transferred to the company's Cincinnati, Ohio, plant, where he was assistant to the plant engineer for four and one-half years. His work there was in the maintenance and construction division of the refinery.

In 1941 he went back to Denver to work in the mechanical engineering design department of the United States Bureau of Reclamation. Through this department passed the designs for the piping and other mechanical equipment which went into such projects as the Parker dam, and the Colorado Big Thompson dam.

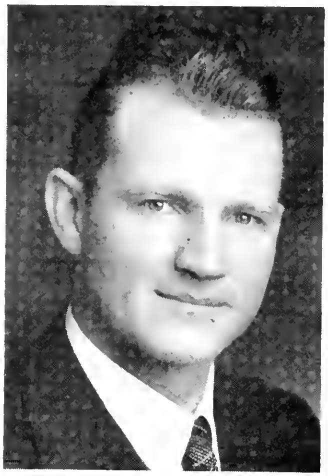
When September of 1941 rolled around, professor McDonald went back to school, but this time on the other side of the desk, at Vanderbilt university in

(Continued on page 18)

RAYMOND McDONALD

FRANK ANDREW

Out on the south end of the campus amidst the scattered buildings stands the Agriculture Engineering Building. Not a large percentage of the students have ever seen it and fewer yet have ever been inside. This building, where "ag" engineers study how to increase farm production and improve farm life, also houses the extension agriculture engineers of the University of Illinois Engineering Department. At the mention of the extension engineers most "ag" engineers think



FRANK ANDREW

of one of the busiest and most well-known extension workers, Frank Andrew. Seldom found in his office, he spends most of his time flying over the state giving lectures and demonstrations to Illinois farmers. A graduate of the College of Agriculture in 1938 and the College of Agricultural Engineering in 1947, he is a recognized authority on rural electrification besides being well versed on farm equipment.

Born in 1914, Frank was brought up in Palmyra, Illinois, graduated from the Palmyra Community High School, attended Blackburn College in Carlinville, and returned to his home after graduating from the University of Illinois in 1938. It was during his high school days thta he acquired his interest in equipment and electrification when he used to hook up a gasoline engine so that it would run the washing machine, but-

(Continued on page 18)

JAMES HONNOLD

"Well, yes, somewhere in the back of my mind I always have hoped to get my doctor's degree." And right now, Jim has a pretty fair start.

"Jim" is James Honnold, 24 years old, senior, chem engineering. He will graduate in June and then begin the real drive toward the fulfillment of his ambition at the Massachusetts Institute of Technology. He hopes to acquire an assistantship for part-time teaching beginning next fall.

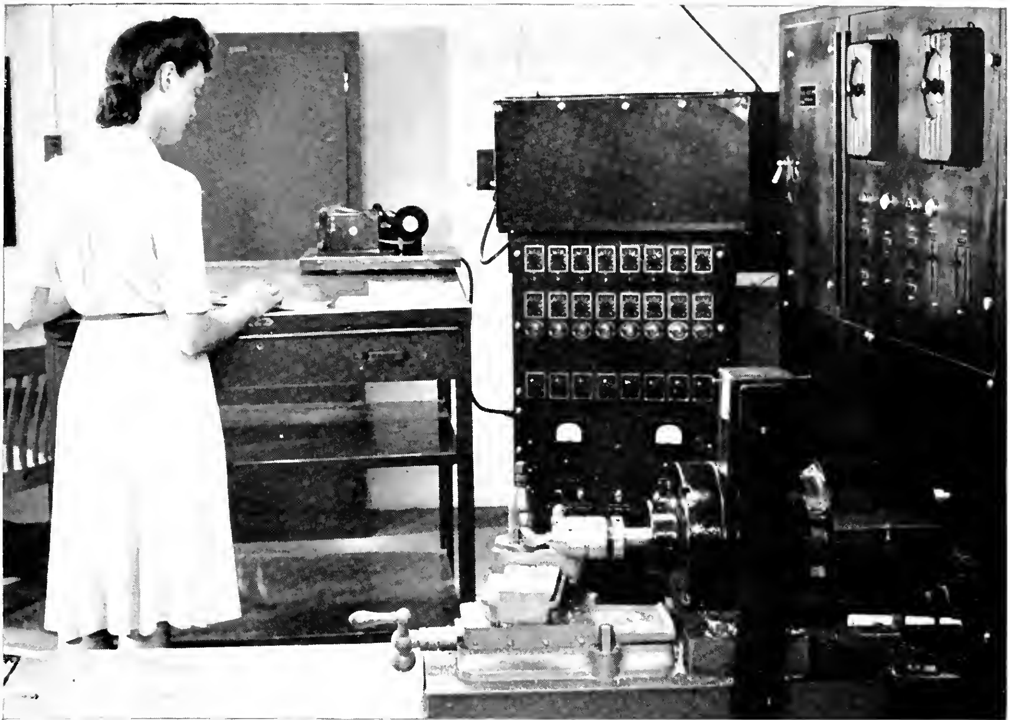
From his all-University average of 4.7, one could justly accuse Jim of much hard study, but, somewhere between pages of flow sheets and hours of lab, he manages an active membership in the A. I. Ch. E. Along with that, he belongs to the Y. M. C. A., University band, and Wesley foundation.

Such industry might well be just a natural continuation of his busy high school days. His full four years of high school were spent at Kansas, Illinois, where he was a member of the track team and played the sousaphone in the band. This is in addition to helping around the family grain and livestock farm and belonging to the 4-H and Future Farmers of America.

During the war, Jim was enrolled in the University of Pennsylvania (which, incidentally, he didn't like as well as Illinois) under the A. S. T. P. He served nearly three years as a T 5 in Europe and was awarded the Bronze Star as well as the Combat Infantryman's award.

He said he doesn't have much time for hobbies—that is, except to go home and see "the best little brunette that ever was." She is herself a home economics graduate from Illinois, and they intend to be married during the summer.

To the wedding, then, we send our congratulations; to the coming Ph.D., our high esteem; and to his success in finding an apartment in Massachusetts, our rabbit's foot.



Typical of its laboratory activities, Dow recently developed this direct-reading spectrometer that electronically measures concentration of elements in alloys—automatically records analyses in 10 seconds.

GEORGE R. FOSTER
Editor

EDWIN A. WITORT
Assoc. Editor

the Illinois Technograph

LET'S ALL DO IT!

One of the greatest advancements towards making the College of Engineering at the University of Illinois one of the finest in the country was put into effect recently. I'm referring, of course, to the questionnaire filled out last semester by all engineers enrolled in electrical enginneering courses. Oddly enough, the system was devised solely by electrical engineering students, and after several revisions by the head of the electrical engineering department, professors, and students in electrical engineering, it was given the stamp of approval and put into use last semester.

The purpose of the questionnaire was to improve the teaching methods used by the departments, and to make the methods efficient and efficacious. This was accomplished by asking questions concerning the ability of the professor; asking for comments on text used; and various other questions.

Professors' and students' attitudes towards the questionnaire were very favorable. The students had a chance to really blow their top at the professor, text, laboratory procedure and assignments. Many professors took a great personal interest by tabulating the comments into favorable and unfavorable categories and proceeded to give the results to their present-semester students. It might be looked upon as a game with all participants emerging as winners.

The great need for such a system is proven by the fact that results of last semester's survey, which were probably compiled no more than three weeks ago, were directly responsible for many improvements, already noticeable, in electrical engineering courses. The attitude of the instructor has changed; courses have been set up with a definite aim in view; and, in general, the courses are better organized.

The survey's *first* opportunity has brought about these improvements. It might be well to bring to the surface the fact that there are bound to be a few inherent flaws in the questionnaire. It is, no doubt, not as efficient as it could be; some students, when filling it out, thought it was a farce and, not realizing its value, proceeded to be facetious in their answers. However, suceeding surveys will undoubtedly have cast out many of these evils and, as a result, the plan will be running smoothing and effectively. Regardless of the weaknesses of the questionnaire, the fact remains that it has brought about improvements in the electrical engineering department after its first chance.

Now, if the EE's can do it, why can't the ME's, CE's, etc.? There is no reason why they can't! The system has shown its worth, and as can be seen, its potentialities are almost unlimited. All that remains to be done is for the remainder of the engineering student societies to organize, do a little research, and promulgate one of their own questionnaires to be used by the respective departments.

At present, there are a great number of veterans in the College of Engineering. As a result, the average age of the engineering student is somewhat higher than at normal times. This fact should not be overlooked by the individual societies contemplating putting the plan into effect. The comments and suggestions received will be those of a more mature individual. Generally speaking, the average student is earnestly seeking an education. Comments from students with this attitude are invaluable. You will probably find that a greater number of students have this perspective now, than in normal times. This means the plan should be put into effect by all the engineering departments as soon as possible.

The worth of the survey has been proven. A gold medal and our hats off to the foresighted students of the AIEE-IRE, for this was the society that sponsored the first survey. To the other societies that as yet have not installed the plan in their respective departments, we say: "Do it *now* John Dickerson!"

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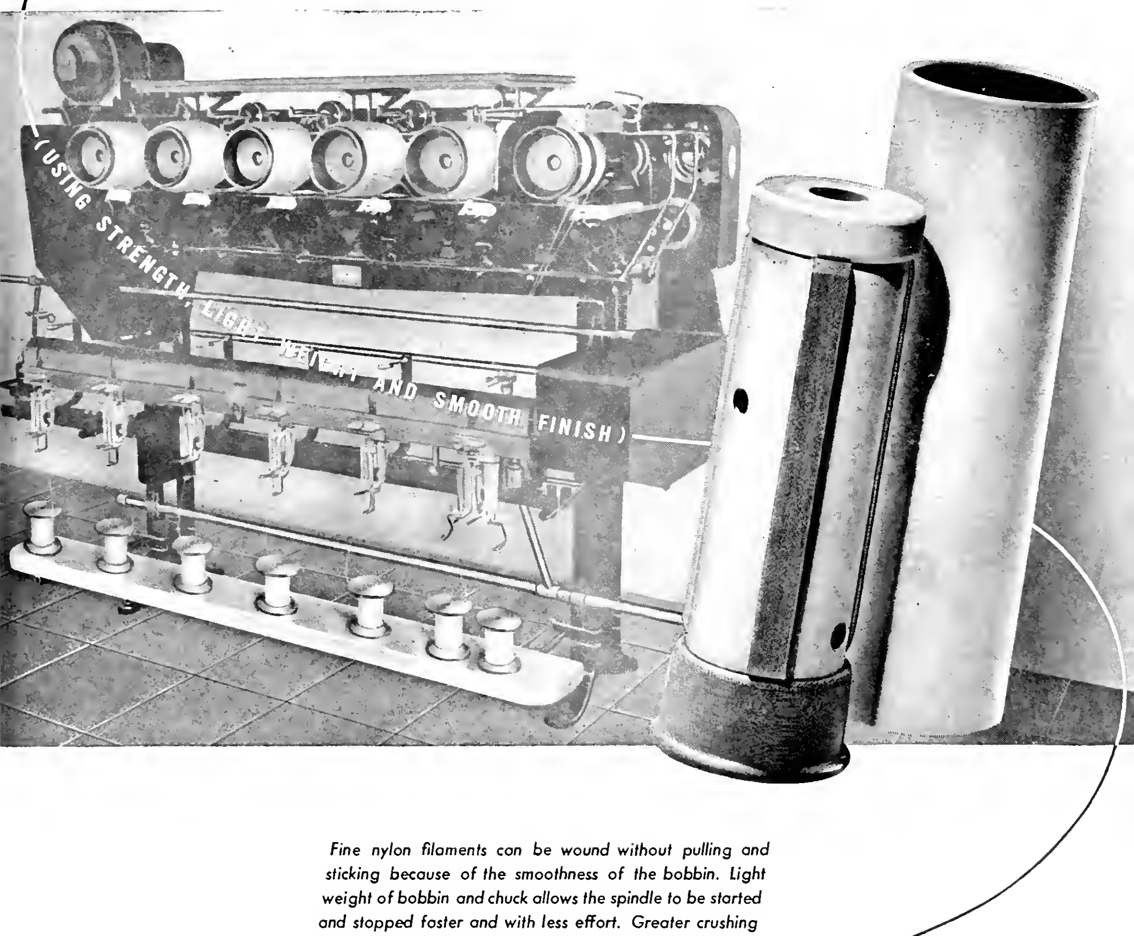
Among the interesting occupations of our type of technical plastics are the redraw bobbin and chuck (below) used in winding fine denier nylon for women's hosiery.



Fine nylon filaments can be wound without pulling and sticking because of the smoothness of the bobbin. Light weight of bobbin and chuck allows the spindle to be started and stopped faster and with less effort. Greater crushing strength of tube permits larger amounts of nylon to be wound. This is an appropriate job for Synthane, an interesting example of using plastics where plastics belong.

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FRANK ANDREW . . .

(Continued from page 14)

ter churn, feed grinder, and grindstone.

In 1940, the farmers of the midwest were talking about the spiral farmer of Palmyra, Illinois. That was Frank Andrew. The automatic tractor and controls on which Frank holds patents farmed the old home farm in circles. The sight of the tractor operating day and night without a driver as the 0.034 inch stainless steel control wire guided it around the field was commonplace to his neighbors. The fact that his spiral corn rows were 40 miles long always gave room for neighborly comment. Frank operated the 330-acre configuration grain and livestock farm until his return to university work in the fall of 1946.

Recently active in promoting the mow curing of hay, mechanical drying of corn in cribs, and the use of the silo unloader, he was the first extension worker to use the airplane for traveling between his lectures. In the past year he has traveled about 400 hours by private plane. He is a member of the American Society of Agricultural Engineers.

Before I could tell him I wasn't that sort of a girl, I was.

RAY McDONALD . . .

(Continued from page 14)

Nashville, Tennessee. During his stay there he was kept rather busy. He taught courses in physics, mathematics, and engineering drawing for the A.S.T.P.; thermodynamics, machine design, kinematics, kinetics, internal combustion engines, and aircraft engines to civilian and V-12 students. In addition, he taught basic engineering courses to civilians in essential industries in and near Nashville, and was head of the mechanical engineering laboratory for three years.

In June of 1947, he resigned as associate professor of mechanical engineering at Vanderbilt to come to the heat-power division of the mechanical engineering department here.

Professor McDonald is a member of the A.S.M.E., the American Society for Engineering Education, and Pi Tau Sigma.

"I used to like to hunt," he said, "but there hasn't been enough time for that for quite a while."

LEAP YEAR

I waited for this year
My heart was filled with fear
I chose my words, rehearsed
And then he asked me first.
—from S. G. Moore.

PLASTICS . . .

(Continued from page 8)

The desire for a completely expendable beer can has presented several problems. First, the metal that would be in contact with the beer must be surfaced with some material that would prevent rusting of the metal. The beverage, to be sure, had the properties that would favor metallic oxidation—moisture and absorbed oxygen. Secondly, the metal would corrupt the distinguishing flavor that was so essential to the continued sale of the product. The desired coating must have the properties of low water absorption, non-combustibility, non-toxicity, stability under the action of a 3.2% alcohol solution, and still remain odorless and tasteless. Polyvinyl chloride, one of the earliest plastic materials observed, was found to possess these required physical and chemical properties.

A thin layer of a glyptal alkyd resin (made from glycerine and phthalic anhydride) is applied to the plane surface of the steel which will be used to form the cylindrical container. This resin forms a base to which the vinyl chloride resin will adhere. The plastic layer is then painted on over the base coat and baked at an elevated temperature. The coated metal sheet is then rolled into cylindrical shape and the seams soldered.

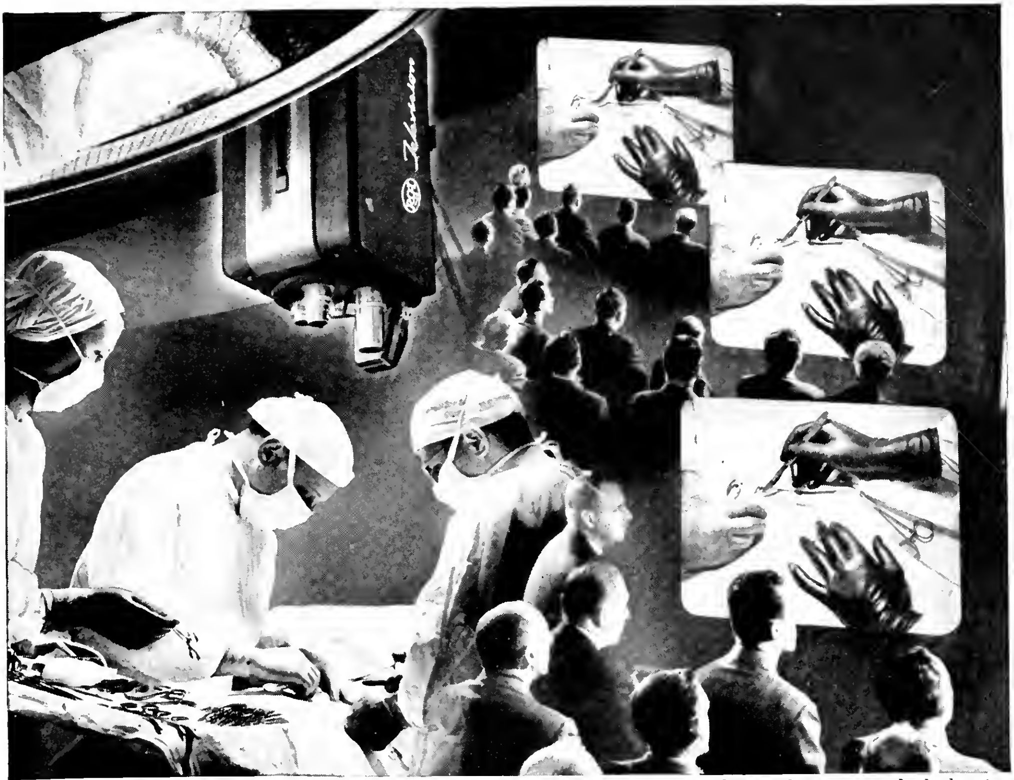
The coating can easily be removed by slitting and stripping the part.

The metal then withstands the hard knocks of handling while the polyvinyl chloride plastic coating (called Keg-lining) assures the enduring quality of the beverage.

Polyvinyl chloride is prepared from the raw materials of acetylene and hydrochloric acid (HCl). An elevated temperature in the presence of a catalyst is required for the first part of the reaction. An equal number of molecules of acetylene and hydrochloric acid are reacted to produce the desired vinyl chloride. If excess acid were present, this excess would react with the vinyl chloride, adding another molecule of HCl to form vinylidene chloride, CH_2—$CHCl_2$, which is unreactive and will not polymerize. The vinyl chloride however, will polymerize in the presence of a catalyst. The number of molecules which will enter into the chain, depends upon the concentration and temperature of the reaction, and is variable. The polyvinyl chloride molecule has a molecular weight of approximately 12,000—25,000.

Plastics have found another use in the protection of the ice tray of modern refrigerators. Since the air inside of a refrigerator is always saturated with water vapor and the inner surfaces of the trays are in contact with water the metal is subjected to conditions highly favorable to corrosion. This was formerly overcome by plating the iron frame by dipping it in a hot tin solution. This old tray has long been unsatisfactory due to the development of cracks and scratches, which, combined with the inherent pores and pits of the tin coating, permitted the steel framework to rust through the coating. Zinc covered the foundation more completely, but the dull finish was unattractive.

(Continued on page 22)



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- Design of receiving, power, cathode ray, gas and photo tubes.

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Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

PLASTICS . . .

(Continued from page 20)

One manufacturer devoted five years of research to the development of a plastic coating which would adhere to the metallic frame and give long corrosionless service. His recently developed product is also resistant to abrasion and at the same time embodies a neater appearance in the ice-tray compartment. By applying two coats of this resin over a bonderite film (which prepares the 0.4—0.8 mil thickness zinc initial coat for adhesion to the resin) the manufacturer is assured that no moisture will reach the welded steel frame to cause unsightly and unsanitary corrosion.

One of the most recent and most interesting additions to the plastic coating family is a polymer that is completely unaffected by any known acid, base or metal (except molten metal and chlorine under special conditions). Du Pont has given this product the trade name of Teflon, a contraction of the chemical name tetrafluoroethylene. Instead of the usual carbon-hydrogen bond, Teflon is built of carbon-flourine linkages. The polymer never becomes sticky when heated to temperatures as high as 700 degrees Fahrenheit, at which temperature the polymer breaks down to the monomer.

First operation of double dipping process is to immerse half of the part.

This inert plastic found wartime application as material for gaskets and corrosion-proof valves. Difficulty has been encountered in attempting to bond Teflon to metal. Since the material now costs $15 per pound, and is estimated to drop to one-third of this cost in two years, it is obvious that some means of making the plastic adhere to metals must be discovered. The expense of constructing an entire reaction vessel out of Teflon is entirely prohibitive.

One of its uses as a coating has been reported. In this application the plastic was used as a dielectric for electric cables exposed to corrosive conditions. A glass jacket was applied to the cable to form a base to which Teflon has been found to adhere. This application is limited to service in which the product will not be subjected to any rough handling.

In view of the approaching shortage of most of our common metals, the future use of plastics appears very great indeed. Already they are able to use plastics in many of the services once thought to require only the best of metals.

A LARGE EDITION

"May I print a kiss on your lips?" I asked.
She nodded her sweet permission.
So we went to press and I rather guess
We printed a large edition!

* * *

She: When we get married I'm going to cook, sew, darn your socks and lay out your pipe and slippers. What more can any man ask than that?

He: Nothing, unless he is evil minded.

"GLASS SURE MAKES BETTER COFFEE!"

Thousands of families say their next coffee-maker will be glass. Why? Because they like their coffee just right! Glass lets you *see* and control the strength of the brew. Glass never alters flavor, even when coffee stands and is reheated throughout the day in your home or in a restaurant. And you can see at a glance when a glass coffee-maker is clean...so your next brew will be as rich and amber-clear as the first.

There are five excellent glass coffee-makers on the market today. And everyone of them uses Pyrex brand glass parts made by Corning. The reason? Because Corning makes these glass parts to close tolerances, with proper sidewall thickness, of uniform high quality. And Corning makes glass that can stand heat and cold without breaking.

Everybody benefits today from Corning's knowledge of glass. You get a better cup of coffee. Better food cooked in Pyrex ware. Better soup processed in Corning glass piping. Better vitamins extracted with Corning laboratory ware. Better light from bulbs and luminous tubes made from Corning's glass.

In all, Corning makes about 37,000 items in glass. Many of them have been applied in fields once held by other materials. Glass gets into new jobs because Corning uses it as a material of unbounded possibilities. Perhaps some day, in the business you select, glass will be able to cut costs, improve processes, or add to the salability of your product. That's the time to remember us. Corning Glass Works, Corning, N. Y.

IN PYREX WARE AND OTHER CONSUMER, TECHNICAL AND ELECTRICAL PRODUCTS ▸

CORNING
means
Research in Glass

JOHN FELMLEY COMPANY

(Continued from page 7)

Library, MacMurray college, Jacksonville, Illinois.

Power house, U. S. Tobacco company, Nashville, Tennessee.

Factory building and power house, U. S. Tobacco company, Richmond, Virginia.

During the war, the company constructed numerous buildings at the Oak Ordnance plant in Illiopolis, Illinois; at Camp Ellis, and at the Granite City engineering depot. The carpenter work at the Victory Ordnance plant in Decatur, Illinois, was also handled by the company.

Up until the war, the company had an average annual volume of business of approximately two million dollars, and since 1942 it has averaged from three to four million dollars annual volume of contracts, all in Central Illinois. Approximately 90% of all their work during the past twelve years has been on a firm contract bid basis.

At the present time the John Felmley company is responsible for two of the three new additions to our campus, namely the construction of the Electrical Engineering building and the Chemistry and Chemical Engineering building. Both of these buildings are of steel frame construction with reinforced slabs and exterior face brick walls, with mostly exposed Haydite partitions. They perform almost all of the items classed as "general work" with their own forces, including excavation, forms, concrete, masonry, structural steel, and carpentry work. Such special skills as plastering, terrazzo, glazing, painting, and mechanical trades are sublet to firms specializing in this type of work.

The company's standard practice is to carry about one young graduate engineer for development into a job engineer or superintendent; a new man is employed usually about every two to three years.

ENGINEER'S TEST OF GOOD WHISKY

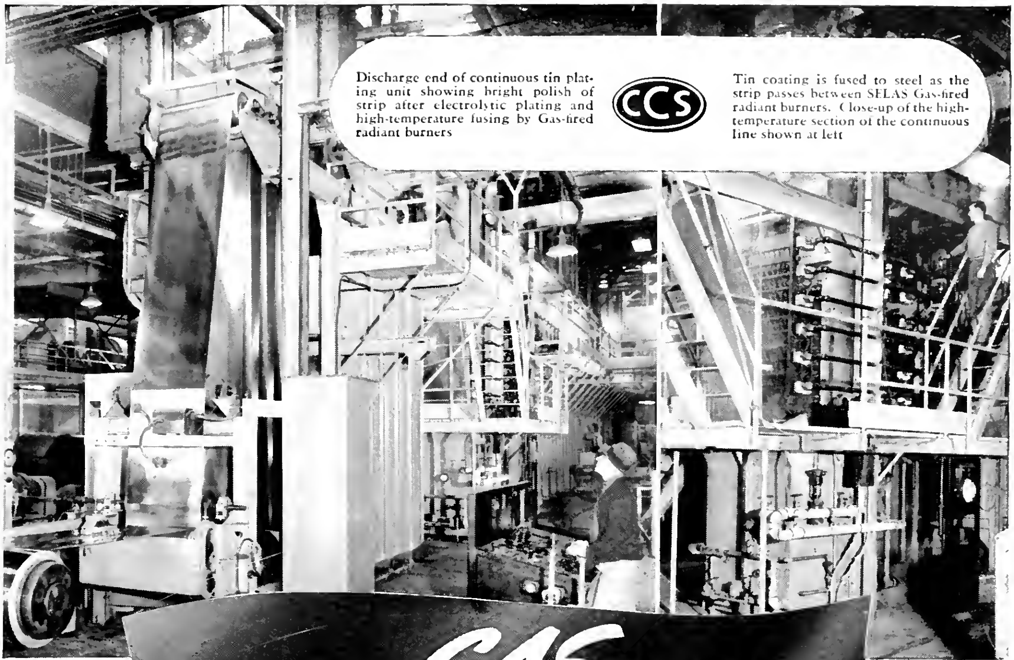
Connect 20,000 volts across a pint. If the current jumps it, the whiskey is poor.

If the current causes a precipitate of lye, tin, arsenic, iron slag, and alum, the whiskey is fair.

If the liquor chases the current back to the generator, you've got Good Whiskey.

* * *

"How did you puncture that tire?"
"Ran over a milk bottle."
"Couldn't you see it?"
"No, the little runt had it under his coat."



Discharge end of continuous tin plating unit showing bright polish of strip after electrolytic plating and high-temperature fusing by Gas-fired radiant burners

CCS

Tin coating is fused to steel as the strip passes between SELAS Gas-fired radiant burners. Close-up of the high-temperature section of the continuous line shown at left

RADIANT *GAS* BURNERS *create high-temperature* tin-coat fusing zone

BRIGHT FINISHING was the problem—and engineers of Crown Cork and Seal Company, Inc., Baltimore, adopted a high-temperature method for fusing tin to low-carbon strip, with resultant high-polish surface, in a continuous production mill.

Then, to obtain the high temperatures necessary for heat-processing, these engineers selected GAS and modern Gas Equipment. By directing the heat of radiant GAS burners over a concentrated area of the freshly-plated strip it was readily possible to coordinate the fusing action with the plating process to accomplish continuous high-speed production of bright finished strip.

This typical installation demonstrates the flexibility of GAS and the applicability of modern Gas Equipment for continuous, production-line heat processing. Compared with available fuels GAS is most readily controlled by simple automatic devices; Gas Equipment can be adapted for use with existing machinery or incorporated in new machinery without radical design changes, or expensive supplemental apparatus.

Manufacturers of Gas Equipment and the American Gas Association support continuing programs of research designed to assure the most efficient use of GAS for every heat-processing requirement.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

Chemical Analysis of Woman

SYMBOL—Woe.

ATOMIC WEIGHT — 120 (approximately).

OCCURRENCE

1. Can be found wherever man exists.
2. Seldom found in free and natural state.

PHYSICAL PROPERTIES

1. All colors and sizes.
2. Always appears in a disguised form.
3. Boils at nothing, freezes at any point.
4. Melts when properly heated.
5. Very bitter if not used correctly.

CHEMICAL PROPERTIES

1. Extremely active in the presence of man.
2. Great affinity for gold, silver, and other precious metals and precious stones.
3. Able to absorb expensive food at any time.
4. Undissolved by liquids, but activity is greatly increased with a spirit solution.
5. Sometimes yields to pressure.
6. Turns green when replaced by a better specimen.
7. Ages rapidly—the fresher variety has a greater attraction.
8. Highly dangerous and explosive in inexperienced hands.

DU PONT Digest

For Students of Science and Engineering

Research simplifies print making with development of "Varigam" Paper

Chemists and physicists make important contributions

Photographic film that has been overexposed or overdeveloped usually means a "hard" or "contrasty" negative—too much silver is deposited on the highlights in comparison with that in the shadows. The opposite effect, a "soft" or "thin" negative, results from underexposure or underdevelopment. At one time photographers had to stock four or five grades of enlarging paper to correct for these conditions and get the right degree of contrast.

To eliminate this expensive, unwieldy situation, scientists developed "Varigam" variable contrast photographic paper. With "Varigam," the whole procedure of getting different degrees of contrast is reversed. Instead of using several grades of paper, the photographer uses only one. He gets variation in contrast by use of filters that control the wave lengths of light reaching the paper, thereby getting finer degrees of contrast than are otherwise possible.

The action of "Varigam" depends on the ability of certain dyes to extend the sensitivity of silver halide emulsions beyond the blue and blue-green regions. This effect was well known to scientists. But "Varigam" has an added feature—it gives high contrast in the blue portion of the spectrum and is also sensitive to light in the green region, *with low contrast.*

"Varigam" the work of many men

The first job was one for the physical chemists. Silver halide emulsions, normally sensitive to blue light, had to be made to give maximum contrast when exposed to light in this region.

It was known that certain dyes would extend the sensitivity of the emulsion over as far as the infra-red. But they were not practical for photographic paper, being affected by the red safety light used in the darkroom. Research by chemists showed that certain dyes such as 1:1′-diethylthiopseudocyanine iodide extended the light sensitivity only to the green region. And, most important, they produced low contrast when used in lower-than-normal concentrations. When such a dye was combined with high-contrast silver halide emulsion, the result was an emulsion that gave high-contrast prints when exposed to blue light, and low-contrast prints when exposed to green light.

Physicists Develop Filters

Physicists made this contrast control a reality by preparing sharp-cutting filters that allow the user to control his printing light selectively. These filters, which are attached to the lens of the enlarger, range from blue for high contrast to yellow, which cuts out the blue almost entirely and gives low contrast. In between are eight grades of filters with intermediate degrees of blue and yellow light transmission. All of the filters are made in such a way that neither light nor printing time needs to be varied as filters are changed, except the last two on the blue end. These require approximately twice the time of the others.

In "Varigam," made by Du Pont, chemical science has given the photographer new economy and convenience in printing, and a degree of contrast control more precise than is possible with any combination of commercial papers.

Questions College Men ask about working with Du Pont

What types of training are needed?

The majority of openings for college graduates at Du Pont are in technical work and are usually in chemical, physical, or biological research; chemical, mechanical, civil, electrical, or industrial engineering. Openings are available from time to time in other fields, including architecture, ceramics, metallurgy, mining, petroleum and textile engineering, geology, mathematics, accounting, law, economics, and journalism. Write for booklet, "The Du Pont Company and the College Graduate," 2521-C Nemours Building, Wilmington 98, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

More facts about Du Pont — Listen to "Cavalcade of America," Mondays, 8 P.M., EST on NBC

Normal print (center) can be obtained from either a "soft" negative (left) or a "hard" negative (right), using "Varigam" variable contrast paper.

NAVY PIER . . .

(Continued from page 12)

have not even bothered to pick up their assigned keys.

The preceeding paragraph brings out the fact that the unactivity is by no means caused by uncooperation of the faculty. It is useless and unnecessary to try and put the blame on anyone. Instead, let us try to remedy the situation.

In my opinion the best way of doing the latter is to form an engineering council similar to that now in progress at the Urbana campus. This will not only help to organize the individual organizations, but also bring them closer to each other. To do this I suggest that the officers of the various organizations come up to our office (Room 354-1) and make up a time of meeting.

Let us not rely entirely on the faculty for our organization. Let us do our share.

A flea and a fly in a flue were caught.
Said the flea: "Let us fly."
Said the fly: "Let us flee."
So they flew through a flaw in the flue.

* * *

"What kind of noise annoys an oyster?"
"A noisy noise annoys an oyster."

FACULTY in REVIEW

OGDEN LIVERMORE

by Norbert W. Ellmann, M.E. '51

The Pier staff of The Illinois Technograph is just growing out of its infancy. We celebrate our third issue by introducing a man whom we think should be mentioned at this time. Because of his splendid efforts in our behalf we were able to form a working organization and thus begin what we hope will be an interesting and instructive section of The Illinois Technograph. This man is Mr. Ogden Livermore, M.A., faculty adviser to the Pier branch of The Illinois Technograph. Mr. Livermore was born in Wellesley Hills, Massachusetts. He finished grade school and first year high school in Wellesley Hills. His last three years of high school were spent at Nicholes Senn high school in Chicago. While at Senn, Mr. Livermore won first prize for having the best garden of the year. He was also assistant business manager of the Senn News. Mr. Livermore then went to the University of Illinois, where he received his B.S. degree. After this, Mr. Livermore attended evening school at Armour Institute (now Illinois Institute of Technology) where he took a course in welding. He then enrolled in a business course at Northwestern University, also in the evening. After completing evening school, he enrolled in day school at Northwestern and received his M.A. degree.

The first position Mr. Livermore held was in the field of chemistry. He then worked in real estate management with the Chicago Title and Trust company. After that he went on to teaching at Francis W. Parker school, where he taught mathematics, drawing, and general shop.

During the war Mr. Livermore went back to chemical work. He worked on fluxes for war alloys. He then became business manager and instructor at North Shore County Dewey school after which he accepted his present position at Navy Pier as an instructor in the department of physics.

Mr. Livermore's most loved hobby is working in his garden. He also likes to work on machinery and fix odds and ends around the house.

There are no children in the Livermore family although Mr. and Mrs. Livermore would like to have about three sets of triplets.

(Continued on page 30)

He's a Square D Field Engineer . . . his full-time job is working with industries of every kind and size in finding "a better way to do it." He talks less about theory, more about proven practice. He has a tremendous amount of actual experience to back him up.

Through a staff of such Field Engineers located in more than 50 offices in the United States, Canada and Mexico, Square D does this three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends, speeds development of new methods and equipment.

If you have a problem in electrical distribution or control, call in the nearby Square D Field Engineer. He makes a lot of sense in finding **"a better way to do it."**

For many years ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

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NAVY PIER . . .

(Continued from page 28)

The Pier staff members of the Technograph have come to know Mr. Livermore as a personal friend. We have found him willing to help whenever help was needed. At this time we would like to express our gratitude and appreciation to Mr. Livermore for his invaluable counsel and assistance in helping us get started.

PIER CLOSE-UPS

RUSSELL PABST

by Richard Choronzy, M.E. '51

Take it from Russell Pabst, there's no place like good old Chicago. Russ can testify to that, as he spent a year overseas in Japan while in the Army Air Corps.

"The thing I missed most of all was the sight of our beautiful Chicago women. Japan just can't compare with Chicago." That was all he would say on the subject of Japan. From there on, it was all engineering.

Russ first began to think of engineering as a career in his freshman year at Harrison high school. After graduating in January, 1944, he decided to go to work, meanwhile going to school during evenings. He attended Illinois Institute of Technology for a short period of time; however, the Army had other plans for him. He entered the Army early in 1945, and after his basic training, left the states for Japan. Russ was discharged in December, 1946, after spending twenty months in the Army.

In February, 1947, just two months after his discharge, he enrolled in general engineering at Navy Pier. Currently he is a sophomore in mechanical engineering, having changed his course this semester. He is very much interested in designing and intends to work in that field after he graduates.

Russ has many outside interests in addition to his school work. His outstanding hobbies are stamp collecting, photography, and writing poetry. He enjoys listening to classical music and has a large collection of Wagner recordings. He also is an avid baseball fan, football expert, and boxing authority (all this and engineering, too!). If worse comes to worse, Russ can always write poetry.

Father—"When I was your age I used to go to bed with the chickens."

Son—"Well, dad, t i m e s haven't changed much."

* * *

Here's to the girl who gives,
And does not sell.
Here's to the boy who takes,
And does not tell.

Silent Switches—No More Clicks

To cool and quench the arc of a new 10-ampere, silent light switch, there is hydrogen gas in the "button." This also prevents oxidation of the mercury when the circuit is broken.

The mercury in these switches is contained in a metal enclosure, which consists of mercury to mercury contacts enclosed in two special metal alloy disks that are glass-sealed on a ceramic barrier.

The new mercury switch recently developed by the General Electric Company, assures its users of silent, smooth operation for an extremely long time. It has been tested for a half-million "makes and breaks."

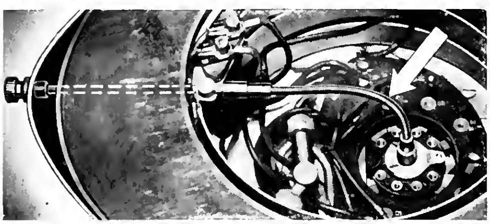
The little child was sitting demurely on the couch, watching her mother smoking a cigarette. Her little nose was wrinkled and in her pale blue eyes there was an expression of childish disillusionment. Finally unable to stand it any longer, she burst out in her quavering falsetto, "Mother, when in hell are you going to learn to inhale?"

"Thish match won't light."
"Washa matter with it?"
"I don't know. It lit all right a minute ago."

—Jester

PROBLEM — You are designing a machine which includes a number of electrical accessories any one of which can be turned on by means of a rotary switch. For reasons of assembly and wiring this switch has to be centrally located inside the machine. Your problem is to provide a means of operating the switch from a convenient outside point. How would you do it?

THE SIMPLE ANSWER — Use an S.S.White remote control type flexible shaft to connect the switch to its control knob. This arrangement gives you complete freedom in placing both the switch and the control knob anywhere you want them. That's the way one manufacturer does it in the view below of part of the equipment with cover removed.



This is just one of hundreds of remote control and power drive problems to which S.S.White flexible shafts provide a simple answer. That's why every engineer should be familiar with these "Metal Muscles"* for mechanical bodies.

*Trademark Reg. U. S. Pat. Off. and elsewhere

WRITE FOR BULLETIN 4501

It gives essential facts and engineering data about flexible shafts and their application. A copy is yours free for asking. Write today.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933.

Of the Illinois Technograph published eight times a year (Oct., Nov., Dec., Jan., Feb., Mar., Apr., and May) at Urbana, Illinois for October 1, 1947.

State of Illinois } ss.
County of Champaign }

Before me, a notary public in and for the State and County aforesaid, personally appeared Robert Johnson, who, having been duly sworn according to law, deposes and says that he is the business manager of the Illinois Technograph, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management and the circulation, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Illini Publishing Company, 725 South Wright Street, Champaign, Illinois:

Editor, George Foster, Urbana, Illinois.

Business Manager, Robert Johnson, Urbana, Illinois.

2. That the owner is the Illini Publishing Company, a non-profit corporation, whose president is C. A. Moyer of Urbana, Illinois, and whose secretary is Manning D. Seil of Champaign, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are none.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

ROBERT A. JOHNSON, Business Manager.

Sworn to and subscribed before me this 30th day of January, 1948.

(SEAL)

MARGARET E. CAIN, Notary Public.

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•

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the Illinois Technograph

213 ENGINEERING HALL
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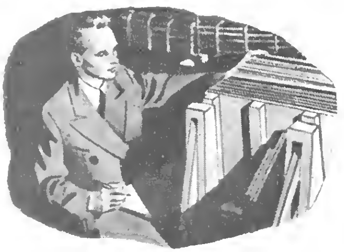
GENERAL ELECTRIC

PHYSICIST . . . CHEMIST . . . ENGINEER

for each, General Electric has assignments to his liking

General Electric is not one business, but an organization of many businesses, ranging from the building of giant turbines at Schenectady to the molding of plastics in Pittsfield. The 165,000 people of General Electric work in 93 plants in 16 states. Graduates of American colleges and universities are finding that General Electric offers opportunities to all degrees of specialists, all sorts of enthusiasms, all kinds of careers.

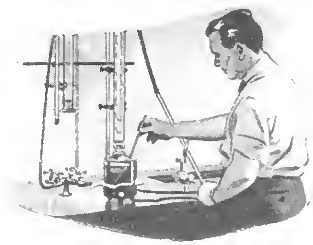
ATOMIC PHYSICIST



As the result of its research in nucleonics, General Electric was asked by the Government in 1946 to take over operation of the giant Hanford Works, one of the major units of the Manhattan Project. With this development, and with the construction of both a new Atomic Power Laboratory and a new Research Laboratory at Schenectady, opportunities in all phases of nuclear research have increased enormously. Herbert C. Pollock (left), one of the first scientists to isolate U-235, works now with such electron accelerators as the Betatron and Synchrotron.

CHEMIST

General Electric is the largest molder of finished plastics parts in the world. It has also played a large part in the development of silicones, new chemical compounds from which a whole new industry is springing. Developments like these have meant unprecedented opportunities for chemists and chemical engineers at General Electric. Dr. J. J. Pyle, graduate in chemistry at British Columbia and McGill, became director of the G-E Plastics Laboratories at the age of 29.



ELECTRONICS SPECIALIST

For good reason, General Electric Electronics Park has been called the "Greatest Electronics Center in the World." Its 155 acres look like a campus. Its laboratories, shops and production lines are the most modern of their kind. It's a Mecca for men whose attentions perk up at the sight of a circuit diagram—men like Dick Longfellow, who has worked his way up through television and high-frequency assignments and is today section engineer in charge of ground radar equipment.

FOR YOUR COPY OF "CAREERS IN THE ELECTRICAL INDUSTRY," WRITE TO DEPT. 237-6, GENERAL ELECTRIC CO., SCHENECTADY, N. Y

GENERAL ELECTRIC

the Illinois Technograph

April, 1948 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

New Developments

By John Dick, E.E. '49
Herb Mazer, E.E. '50
Ken McOwan, M.E. '49

Tape Recorder

The development and perfection of a voice-activated instantaneous start-stop clutch mechanism, now available as optional equipment on any Magnetape Recorder*, has been announced by the Magnephone Division of Amplifier Corporation of America.

Activated by the voice of the speaker, singer, or other preselected sounds, the voice-clutch equipped Magnetape Recorder continues to record as long as the sound is maintained, and for approximately five seconds thereafter—to compensate for any pause. Actually, the time the recorder will operate after the sound has ceased depends on the length of time the speech or music has been going on, and on its volume. Thus, the instrument's period of expectation increases with the increased possibility of additional sounds following.

Operating on the principle of sound being converted into electrical impulses through the microphone, which is then amplified and fed into a rectifier, the voice activated a special control circuit which operates through a special clutch arrangement to provide instantaneous control of tape movement.

The sensitivity of the voice-clutch may be manually regulated by manipulation of the instrument's recording volume control to match the normal volume of any voice. This also serves to prevent activation of the Magnetape Recorder by extraneous room noises.

Tape recorders can be equipped with sound-activated start-stop mechanisms.

The addition of the clutch mechanism on a Magnetape Recorder results in a highly convenient automatic dictating machine. It tremendously increases the recording period of a reel of magnetic tape, since the recorder operates only while the sound continues. And reels of magnetic tape may be used over and over through a unique erasing process which completely erases previously recorded material while the new recording is being made. Transcribing of dictated material by a typist is simplified by a remote control switch for instantaneous start and stop.

Instantaneous voice activation of the Magnetape Recorder makes the instrument ideally suited for any regular, occasional, or intermittent sound recording requirement. Application as widely diversified as telephone monitoring, confession recording, studies of animal and nature sounds, etc., will find this voice-activated start-stop recorder the perfect answer.

*Trademark.

Air Fuel Ratio Controller

Complete temperature and combustion control systems for large industrial furnaces now include a new air-fuel ratio controller. This device can control air-fuel ratios to any pre-set proportions. The main new feature of this device is that it operates through electronic circuits and thereby eliminates the use of costly hydraulic pipe systems. The ratio may be pre-set to vary with volume or any other standard such as time, pressure, etc.

Phase Contrast Microscopy

A new, simplified method of phase contrast microscopy was recently demonstrated at the National Cancer Institute in Washinngtonu, D. C., where it was generally agreed to be one of the most important developments in the field of microscopy in over 50 years. Developed by the Bausch and Lomb Optical company, Rochester, New York, it consists of optical and mechanical accessories that can be fitted to the standard laboratory microscope as well as to the more complex models.

Contrast microscopy in itself is not new but previous methods of application necessitated either killing or distorting the action of the specimen with stain or having only black and white contrast. The phase contrast method, however, eliminates any treatment that may hinder the action of the specimen and provides all of the tone graduation in the contrast range.

Phase contrast microscopy optically utilizes the differences in speed at which light travels through substances of various densities in the specimen by transforming the resulting phase shifts in the light wave fronts into differences of brightness. The various tone graduations of the structure are brought to focus by a lens system which produces a sharply defined magnified image that can be reproduced on a photographic plate.

The new accessories used consist of a special condenser assembly, a series of objective lenses ranging from 10 to 97 power magnification, and a miniature auxiliary telescope. The condenser assembly contains a rotary mechanism housing several annular stops that control illumination on the specimen. The objectives are mounted in a rotatable turret to provide rapid change from lowest to highest magnification power and are fitted with a ring-like elevation that correspond to the diaphragm stops in the condenser. This eliminates partially disassembling the microscope to increase or decrease magnification power.

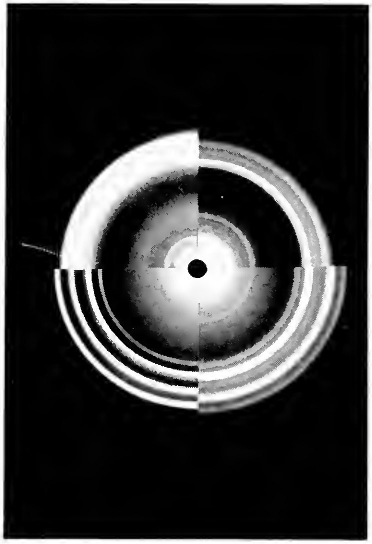
For centering the patterns, a small auxiliary microscope is used in the microscope's draw tube in place of the regular eye piece.

The development of phase contrast microscopy is a definite step forward in the field of microscopy. According to Dr. Kurt J. Heinicke, Bausch and Lomb scientists, its scope and probable effect on health, nutrition and industrial processes is practically unlimited for it will prove of distinct value in microscopic studies ranging from sewage disposal to atomic radiation research.

Spectrophotometer Aids Police

The recording spectrophotometer has been put to use as an aid in locating hit and run drivers. It can easily distinguish 2,000,000 different colors. Examination of a suspect's car and comparison with paint spots left on the scene lead to positive identification of the guilty party.

The FBI maintains a standard file to aid in identification of the make of car involved. Weathering and other corrosive factors also determine the final answer.



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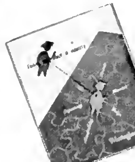

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the Illinois Technograph

Volume 63 **Number 7**

The Tech Presents

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ARTICLES

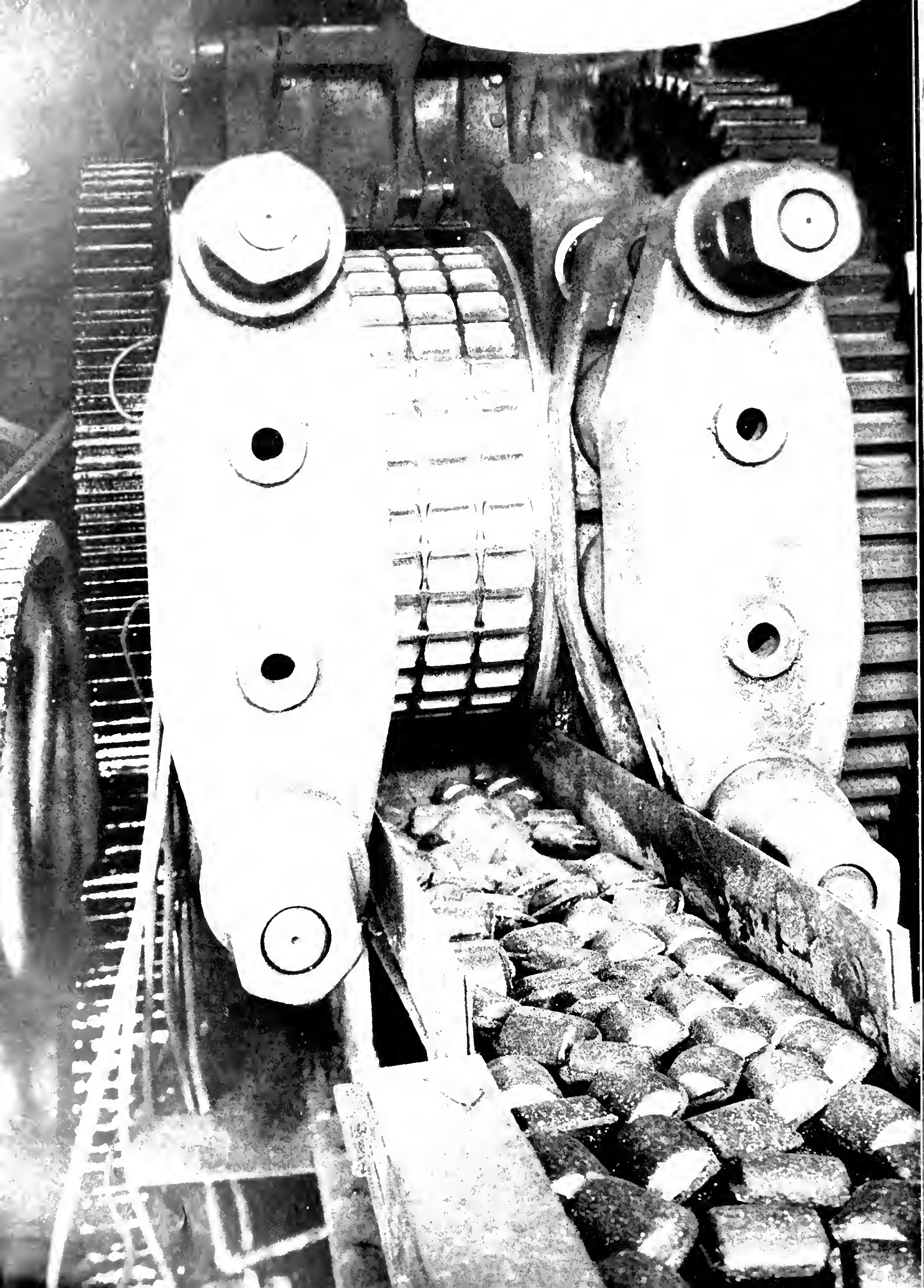
DEPARTMENTS

OUR COVER

Alvina Sorzickas is crowned queen of the St. Pat's Ball, given by the Engineering Council. (Photo by Jack Stumpf, M. E. '50.)

FRONTISPIECE

Cool briquettes are moulded in these "waffle iron" rolls by the Old Ben Coal company.



Revolution in . . .

Water Filtration

By Connie Minnich, C.E. '51

A few sanitary engineers in the United States do not need a crystal ball to visualize a revolutionary method of water treatment that may be installed in many purification plants in the world of tomorrow. If experimentation with this new process proves successful, the engineering world will soon find reposing in its lap a little gadget called the diatomite filter. This newly-developed filtration system may prove to be the aspirin for many industrial headaches caused by bottlenecks in existing water purification systems.

Although still in the experimental stage, the potential qualities of the diatomite filter have already been recognized by many of the country's leading industries. It is, for example, a type of filter that can be installed in small compact units that occupy less space and weigh far less than rapid sand filters with the same capacity; it has proven successful in the complete elimination of some bacteria and organisms and the partial elimination of others that cannot be wholly controlled by the use of chlorine and other chemical purifying means; it is superior to other methods in faster filtration, more effective removal of tastes and odors, and a lower installation cost.

Although recognized as a capable filter for many years, the actual story of the diatomite filter in the field of water treatment began with Army research in 1938. The underlying principle is based upon the remarkable filtering properties of diatomaceous earth. This diatomaceous earth, also known as *kieselguhr*, diatomaceous silicia, or simply diatomite, is a fine white powder composed of billions of tiny skeletons of diatoms, minute acquatic plants. During their brief lives, these small pre-historic organisms formed shells or skeletons around themselves through the absorption of silica from the surrounding water. Upon death all that remained was oil and these shells which settled in abundant deposits principally in California and Oregon. These particles are so tiny that one cubic inch may contain as many as 50,000,000 skeletons of more than 10,000 known species, which vary in size from microscopic conical cylinders and frustules to the barely-visible discs and boat-shaped particles.

The raw powder is mined in a black-streaked impure state. This is refined and processed by various methods which generally include calcining (removal of the water by heating), sizing, and the addition of small amounts of alkaline flux, which causes an increase in porosity by the agglomeration of larger particles. The finished product is very light, weighing from 7 to 13 pounds per cubic foot. It is soft, friable, amorphous in character and extremely porous. Its chemical composition of silica, clay, sand and other impurities, remains neutral and has no effect on the pH of the filtered water.

Need for Development

These remarkable properties of diatomite had been known for some time, but the Army began actual experimentation only when pressed by the necessity of inventing a new filter. The existing conditions in the field and on the battleground called for a system of water purification that could remove the cysta of water-borne dysentery, a particularly virulent strain of amoeba found among the natives in the Pacific and India-Burma-China theaters as well as in the United States. Chlorine used in the customary rapid sand filters failed to kill these organisms whereas the use of diatomite resulted in the almost perfect removal of them, according to studies conducted through the combined efforts of the Engineer Board, the Surgeon General's office, and the National Institute of Public Health. Further studies showed that diatomite also removed chlorine-resistant *Chironomus*, a blood-worm larvae, and the cercarie of *Schistosoma* blood-fluke.

Diagram of a simple diatomite filter.

In addition to the removal of such scourges, the Army also needed a light, portable unit of water purification that could supplant the heavy and rather cumbersome sand filters. Here again diatomite came to the rescue, since it could easily be used in a small unit. Army field tests showed that of various types of filter-aid, diatomite had the least bulk and the least weight of filter-media per square foot of filter area. Other advantages, not, however, as important as those before mentioned, were

A discussion of the present state of development of a filter more effective than the rapid sand filter, this article deseribes the uses, advantages, and disadvantages of diatomite. Although the remarkable properties of diatomite had been known for some time, aetual experimentation was started only when the Army needed a filter eapable of removing eertain organisms eneountered prineipally in the Pacifie and China-Burma-India theaters.

a marked absorption of oil from condensate and a reduction in tastes and odors.

In collaborative studies with various manufacturing concerns, the Army finally developed two filter units: one, a small pack filter with a capacity of 15 g.p.m. and a larger motor-transported filter with a capacity of 50 g.p.m. These mobile units have only between 5% and 18% of the weight of sand filters with corresponding capacities. The units each consist of a gasoline-driven pump, a diatomite feeder, a filter shell with attached porous filter elements and all necessary connecting hose and piping. A calcium hypo-chlorite feeder is also included in each apparatus and serves as a double-check on the filtered water, removing chemically any matter that finds passage through the diatomite cake. This, however, will be omitted from the following discussion, since it is not connected with the actual diatomite filtration process.

Flow Diagram

The accompanying diagram of a filter developed by the Refinite company of Omaha, Nebraska, shows a relatively simple system. Assuming that the filter is in steady operation, one finds that there is a cycle of three processes: pre-coating, filtering and backwash. In the pre-coat process, diatomite powder is released in a suspension of water from

(Continued on page 38)

St. Pat's Ball Tops Them All

By Shirley Smith, E.P. '50

And so, St. Pat, I give you now
This radiant halo for your brow.
'Twill light the pathway of our School,
That Engineers may brightly rule.

This is a part of the original poem with which Professor J. S. Crandell crowned the first St. Pat on March 17, 1934. The dance was established as an annual affair for the engineers, and revived last year after the war's interruption.

And so, on March 12, 1948, in the Illini Union ballroom, another St. Pat was chosen by popular applause. In keeping with the times, the setting was changed slightly and the candidates were introduced with Dick Cisne and his orchestra singing a novelty, "St. Patrick Was An Engineer."

No one could have disputed the results of the audiometer when it registered high for Bob Plumb. "St. Pat" Plumb is a senior in mechanical engineering and represented the A. S. M. E.

Miss Alvina Sorzickas was chosen St. Patricia by ballot from the nine finalists in the queen contest, and was crowned by St. Pat. Miss Sorzickas is a sophomore in pre-journalism. She was escorted by Albert Chilenskas, a chemical engineer.

The crown was, as always, something that could have come only from north campus. It's brighter features included two light bulbs which guided St. Patricia around the ballroom throughout the latter half of the dance. The programs featured the traditional green shamrock on white. Exhibits sponsored by the various engineering societies were set up in a side room near the main ballroom. Each exhibit attempted to show some phase of the studies undertaken by the societies. The civil engineers' well-trained transit seemed to draw the largest crowd.

The ball was sponsored by the Engineering Council and the Engineering societies. Bob Chilenskas and Keith Goodwin were general chairmen, and George Becker made the crown.

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The Ceramic society exhibited samples of various ceramic products and materials.

Photos of St. Pat's Ball
by Jack Stumpf, M.E. '50

The civil engineers transit is momentarily diverted from the "paper doll across the street to a "real live girl," while on the right the agricultural engineers exhibit absorbs quite a bit of interest.

Miss Sorzickas is about to be crowned queen by Bob Plumb. Miss Marilyn Fiedler is in the background.

About 400 couples danced from 9 o'clock to midnight to the music of Dick Cisne and his orchestra.

Industrial Sightseeing . . . *Old Ben Coal Co.*

By Glenn Massie, E.E. '49

Interested in mining or machinery? Here is another in the series of articles designed to present job opportunities for engineers in industries in the state of Illinois. The Old Ben Coal company, largest independent coal company in Illinois, is proof of the success of mechanized coal mines. Each mine is completely electrified and employs mechanical cutting and loading devices, some of which have been built in the Old Ben shops. A pioneer in the use of safety devices, the company uses compressed air for blasting.

A mining company of progressive thinking and action is the Old Ben Coal company, of southern Illinois. It is proof of the success of mechanized coal mines.

Of the 129 companies which operate 166 mines in Illinois and employ 33,000 persons, by far the largest independent company is the Old Ben Coal company, which owns 54,300 acres of coal lands, besides 12,000 acres of timber and farm lands.

The company's five mines are located in Franklin county in southern Illinois. Although Illinois has 77% of its area underlaid by one or more of six known layers of coal, the Herrin, or No. 6 bed, is the most important. The Herrin bed has its greatest purity, as well as its greatest thickness, in the counties of Franklin and Williamson. Twenty-five per cent of the state's total production is mined in Franklin county. An average analysis of Franklin county coal taken from 23 mines showed these characteristics:

Moisture	9.3%
Volatile matter	33.7%
Fixed carbon	48.4%
Ash	8.6%
Sulphur	1.5%
Btu per pound	11,830
Fusion temp. of ash in °F	1920-2650

Coal from No. 6 bed is bright and shiny in appearance and is harder than most Midwestern coals; hence, it will stand handling, sizing, and storage better. These qualities, the free-burning, relatively-high ash-fusion temperature, and the relatively-low sulphur content have caused wide usage—not only in locomotives and electric-power generation, but also for metallurgical and domestic coke, water-gas generation, the making of brick, tile and cement, and for conditions where there is need to avoid soot.

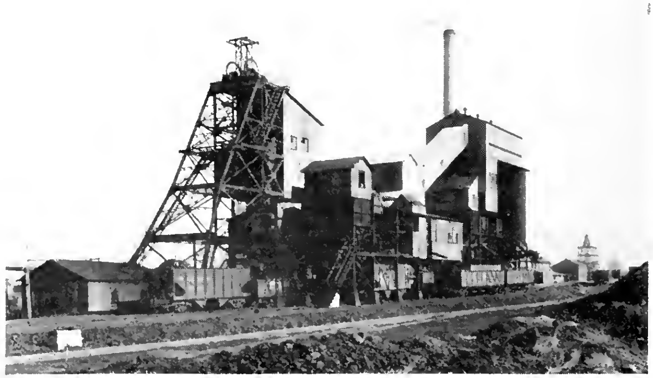
The Old Ben Coal company, named after Benjamin Franklin, is by far the largest producer of coal in Franklin county. Headquarters for the organization are located at 230 South Clark street in Chicago, center of the southern Illinois coal marketing area and in itself the world's greatest coal-consuming metropolis. The operation of the company's mines in southern Illinois, as well as those of allied companies in southern West Virginia, Virginia, and eastern Kentucky, are directed by means of a teletype network. Teletype is also used to connect sales offices and field staff, scattered from the Atlantic seaboard to Omaha, Neb., with the home office.

The original forerunner of the company was the Wilmington Star Mining company, operating in the vicinity of Coal City, Grundy county, Illinois. The vast Old Ben operations of today are a far cry from the "longwall" mines of northern Illinois of the 1870's, in which the pick miner lay on his side to hew coal from a 24- to 36-inch seam. The five southern Illinois mines now operating (formerly there were twelve, but the others have been worked out or consolidated as mechanization increased) are all shaft mines ranging in depth from 400 to 750 feet. Daily production at the various mines ranges from 4,000 to 6,000 tons, for a combined total of about 25,000 tons. Over 5,000,000 tons of coal were produced in 1947.

Mechanized Methods

Each mine is completely electrified, from the coal "face" to the railroad car, and employs mechanical cutting and loading. Typical of the present trend in mining practice is No. 9 mine at West Frankfort, Ill. Old No. 9 was shut down in the depression years of the late 1920's but the wartime need for coal caused its reopening in a spectacular fashion. A pair of new shafts was sunk in a virgin area over a mile south of the old main shaft, and the new workings connected to the old workings to the north. The mine is laid out on the "panel" system, development being driven ahead by a system of main, cross, and panel entries. From the latter, rooms are driven through to the next panel, pillars being robbed to the greatest degree consistent with safe roof control before abandonment of the individual panels.

The first step in the actual mining is undercutting. This is accomplished with universal shortwall mining machines, which are self-propelled and mounted on rubber tires. These use rotating toothed chains to undermine the seam so that the force of the blast can be directed both downwards and outwards; this insures larger chunks of coal and less coal dust



Here's a view of the topside of a typical Old Ben mine after blasting. Next a "drill-mobile" electrically drills the necessary holes in the "face" of the coal seam to be worked, for blasting the coal down for loading. This "drill-mobile," created in the Old Ben shops on a standard Chevrolet chassis, is a jeeplike car, also self-propelled and rubber-tire mounted.

After drilling, the coal is blasted with Airdox. The company is pioneering this new method of blasting. It previously used Cardox, which involved placing a tank containing carbon dioxide at very high pressure, in the hole drilled in the "face," and releasing the gas by remote electrical control. This method had the great advantage of increased safety for the miners and so could be used "on the shift"—that is, while the miners are in the mine. Conventional explosives can be touched off only when the miners are out of the workings and is generally done during the night. Airdox substitutes compressed air for the carbon dioxide. The air is compressed aboveground, then led down into the mine through heavy rubber hose to a valve at the "face." A thick copper tube is fixed into the hole drilled in the "face," with the other end of the tube connected to the valve. When the valve is opened, the compressed air at 5,000-10,000 psi effectively blasts down the coal.

The loosened coal is loaded mechanically by crawler-mounted mobile loading machines into one of the newer "Rube Goldberg" mechanical mining monsters—the shuttle car. This, too, rolls on rubber, being a self-propelled, seven-ton, conveyor-bottom buggy. Two of these shuttle back and forth from each loading machine to the "parting," that is, the closest mine sidetrack on the mine haulage system. When the shuttle car arrives at the parting, the clutch is thrown in on the conveyor bottom and the load is automatically transferred to a waiting seven-ton, all steel, roller-bearing mine car. Eight-ton electric locomotives haul trips of these loaded cars to the shaft bottom where the cars are dumped by a rotary car dump into vast underground bins. The secret of success in this mechanized cycle—from the blasting to bringing the coal to the shaft bottom—is careful timing; the same clockwork precision is employed as is required in a factory and for the same reason: the tremendous investment in machinery which must not stand idle.

The coal is drawn off by gravity from the underground bins and hoisted by 14-ton capacity skips or buckets working in pairs. And so, the coal arrives at the surface. The coal is screened, picked, and broken to sizes less than six inches and then transported over a company highway by 35-ton, high speed, trailer bottom-dump diesel trucks, to the main preparation plant for processing.

Marketing

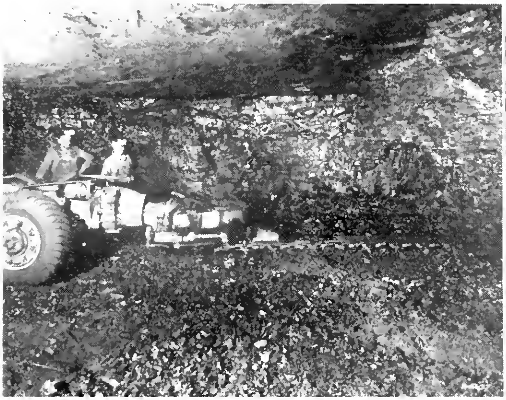
At the preparation plant, the coal is sized by great shaking screens, washed in either water or calcium chloride jigs or dry cleaned on pneumatic tables, blended or mixed with other types of coals if so desired, oil treated, and lowered gently into waiting railroad cars for the trip to market.

The adoption of new mechanized mining techniques by this company and other leaders in the coal industry has meant that the percentage price increase of coal in the last two years has been less than for most other items. Mechanization has also meant that Old Ben mine employes are younger, mechanically-trained specialists—each an expert in his own field, carefully selected and thoroughly trained for his position in a mass-production team.

The principal marketing innovation introduced by the company is the positive identification of its product by color-marking it with a special green pigment. The Old Ben slogan is "A glance identifies Green Marked Coal." The consumer is guided in his purchases, just as packaged, branded merchandise guides the housewife in her grocery purchases. Over 1800 retail coal merchants handle Green Marked coal.

An allied company, Coal Processing corporation, operates a briquetting plant in conjunction with Old Ben No. 14 mine, producing smokeless-burning briquettes known as "Fireballs," which are marketed in communities such as St. Louis where rigid smoke ordinances are in force.

The Old Ben Coal company is proud of its record of pioneering in safety progress. Its mines were among the first to employ exclusively electric safety cap-lamps. It was first in Illinois to employ Cardox shooting and to discard dangerous conventional explosives. It now uses Airdox, an even safer blasting method. Rockdusting for the prevention and control of mine explosions was first extensively used in the United States by Old Ben, which developed and patented the first machine for the application of rockdust. The patent rights were dedicated to the people of the United States so that they could be used without payment of royalty. A bag-type rockdust installation is tripped by the shock wave of a mine explosion, the cloud of inert dust released helps snuff out the explosion. Bags of rockdust are scattered at many points in the mines to help control the headline-making, disastrous mine explosions, which although often the outgrowth of a local gas explosion, are invariably propagated by coal dust rather than gas.



On the left is an undercutting machine. A "trip" coming into the bottom of Old Ben No. 9 is on the right; the pre-cast concrete lagging of the ceiling is an Old Ben invention.

Modern Design Reaches the Farm

By George Ricker, Aero.E. '49

A new type of farmhouse developed by the Small Homes council and the College of Agriculture is described in this article. The basic design consists of two rectangular sections, the arrangement of which may be varied to suit the owner and the site conditions. Additional units may be added as desired. The design is specifically adapted to farm houses, but may also be used for small homes generally.

Old meets new on the campus again! Mumford house, erected as a model farmhouse in 1870, now houses its successor, the Small Homes council, which is an agency created to study low-cost homes. The council, working with the College of Agriculture, has recently developed a new type of farmhouse that is built in units.

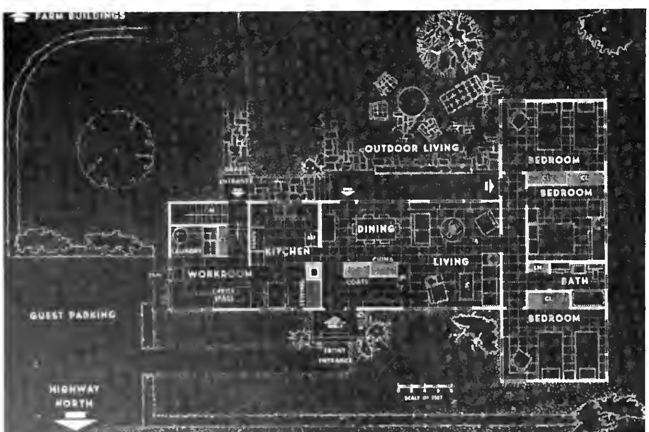
Mumford house when first erected was occupied by the University's "head farmer," who was in charge of the field and farm work connected with the house. It is named after Dean Mumford, professor of agriculture, whose family was the last to occupy the house. In 1939, it became the studio of Dale Nichols, first Carnegie visiting professor of art, and was the home of his successors. In 1944 Mumford house was turned over to the newly organized Small Homes council.

At the time Mumford house was built, a revolutionary idea was incorporated into it. This idea was the addition of a business office for the farmer. The room that was set aside for this purpose in Mumford house is now the library of the Small Homes council.

The purpose of the council is threefold: to spread information, conduct education, and do research on the construction, equipment, and maintenance of low-cost houses. It is a coordinating agency working with all the University departments that do research relating to housing: architecture, economics, engineering, home economics, and sociology. The most important informational activities of the council are the non-technical circulars that are distributed to home owners and professional people of the building industry. These circulars are well illustrated and easy to read and understand. The subjects covered all phases of home construction and maintenance.

The educational program is comprised of three series of short courses. One of the series is a course designed to bring contractors and builders up to date on the latest construction practices. Another of the series is a 30-day session conducted for lumber yards and building material personnel. The third of the series, instituted on campus last July,, is a course for mortgage officers.

Although the educational and informational activities have been far-reaching and very effective, it is the research program which promises to contribute the most to the improvement of the low-cost house. The Home Research center, established by the council, occupies a four-block site on the campus. A demonstration center, a produceiton yard, and three blocks of research homes will eventually be built upon this site. Four buildings, including two research residences, have already been constructed.



Especially adapted to conditions and requirements of farms in the North Central States is this house plan.

Development of Design

One of the projects which the council and the College of Agriculture have just completed is the development of a new farmhouse plan. The problem, as it was presented, was to design a farmhouse which would be adaptable to the typical requirements and living conditions on owner-operated farms in the North Central States. Because surveys showed that the farmers prefer a one-story house with a partial basement, this type of plan was chosen. It is well suited to the generous house sites available on farms. The house was also required to be flexible in size and in cost of the initial building, because many builders wish to start out with one bedroom and add others as desired.

Most of the planning for this farmhouse was based on five factors distinctive to farms and farm life. The first consideration was the farmstead and the arrangement of the farmhouse with respect to the other farm buildings. The house has to be properly related to the other buildings both in location and room arrangement. The arrangement of the rooms is also determined by the direction of the sunlight and the prevailing winds. The second consideration was the natural assets of the site. The farmhouse should be planned to take advantage of the generous home sites offered in the country.

Another thing distinctive to farm life is the work room. A well-planned work room should be built in a convenient location to be used for activities too often restricted to the basement or the woodshed. The fourth on the list is a farmer's office. The business dealings of farmers requires a place to file records and business letters. The fifth major

(Continued on page 24)

A Mechanized Farmstead

By Randall Beasley, Ag.E. '48

A drag line runs the entire length of the gutter.

The advancement in farm mechanization in the past thirty years has reduced the labor requirement in field crop production to about one-third of that required at the end of World War I. Rural electrification now promises to do for farmstead chores what tractors and power machinery have done for field work.

One of the newest developments for saving time and labor is the mechanical dairy barn cleaner. By the mere flip of a switch this mechanism can do, in only a few minutes, the farmer's most disagreeable job. This is in contrast to the conventional shovel method requiring an hour or more of hard work for a twenty cow herd.

A description of a motor-driven dairy barn cleaner is included in this article, with a first-hand account of the problems involved in its installation in a University of Illinois dairy barn.

One of these machines has been installed in a twenty cow barn on a University of Illinois farm for experimental purposes. Its operating characteristics are being studied and its efficiency and power consumption are being determined. Studies are also being made to determine the effect of the use of rust inhibitors on the drag chain.

It has been discovered that after remaining stationary for only a few hours, enough rust will have formed to hinder the starting of the machine. Since most dairymen keep their cows in the barn a large per cent of the time, it has been thought that running the machine intermittently by use of a time clock switch about five minutes out of every half hour will keep rust from forming and will thus increase the life of the machine.

It must be realized that the barns into which these cleaners are to be installed are already laid out and, therefore, the type of cleaner used must be specially designed for the barn. In the University of Illinois barn, a continuous chain type cleaner is being used.

With this type of cleaner, a continuous gutter is necessary so that the chain drag will always move in the same direction of rotation. Accurate concrete construction is a necessity, especially at the corners where sprockets must be installed to change the direction of travel of the chain.

Creosoted wood slats are attached to the drag chain to form a continuous conveyor. From the method of attachment of these slats to the drag chain and the way in which the load acts on them, they may be considered as uniformly loaded cantilever beams. The conveyor is powered by a one horsepower, 220 volt single-phase, 1750 r.p.m., capacity motor. The ratio of the motor speed to the conveyor sprocket speed is 400 to 1. To appreciate the magnitude of the load developed on the conveyor by the motor use, use the h.p. equation and solve for the load P, thus:

$h.p. = P \times D\ 33000EP = 33000 \times 1 \times .800\ 10 = 2640$ lbs.

Where P = load on the conveyor chain, D = distance traveled by the conveyor per minute, h.p. = horsepower of the motor, and E = efficiency of gear transmission.

At one end of the barn is an elevator into which the manure drops as the conveyor passes over it. This elevator extends through the end of the barn and drops the manure into a wagon or spreader where it can be hauled directly to the field. The drag in the elevator travels at a speed of 50 feet per minute, this speed being necessary to elevate the liquid manure.

The drag of the elevator is powered by the same type and size motor as is used on the conveyor. Even though the load travels a shorter distance, it must move up an incline in the same length of time.

The problem of corrosion of the chain and rivets, alignment, chain tension, and cleaning of the wood slats, are yet to be satisfactorily solved.

Other cleaners besides the continuous chain type in use today are the reciprocating type with a hinged paddle to move the manure and a drag and cable type. The latter two do not require a continuous gutter and may be preferred where there is only one row of cows. Since these gutter cleaners are still in the early stages of development, the cost, as may be surmised, is still quite

(Continued on page 32)

The driving mechanism of the gutter drag line.

In This Corner... NAVY PIER

PIER CLOSE-UPS

WILLIAM GILLESPIE

By Richard Choronzy, M.E. '51

"Why anyone from the *Technograph* would want to interview me is a mystery," said Bill Gillespie when we approached him, intent on getting his life history. Yet, out of a number of prospective interviewees, he had the most interesting story to offer.

He was born in Chicago, August 6, 1926. He went through grammar school graduating with the highest honors. "I still didn't know what I wanted to be, even after graduating from high school," he said, when we asked if he had already decided on his future plans then. He graduated from St. Patrick academy in June, 1944. Five months later, he was inducted into the Army. Bill spent 14 months in the Philippine Islands as a staff sergeant in the infantry. After he was honorably discharged in December, 1946, he began attending DePaul university in the evenings. During the day he worked at the Inland Steel company in the accounting department. It was there that he decided to study engineering. He transferred his credits to the University of Illinois and entered Navy Pier in September, 1947. Undoubtedly he chose the curricula most suited for him because he received grades of A in all his subjects except drawing (in which his mark was a B).

He is an excellent dancer and is frequently seen at all his favorite dance spots. His favorite past-times are fishing and horseback riding. His chief hobbies are stamp-collecting and numismatics, but other minor ones are photography, model airplane-making, and collecting and reading good books. Bill's favorite haunt is the University library where he can usually be found every late afternoon reading reference material or something by Shakespeare.

WILLIAM GILLESPIE

FACULTY in REVIEW

PROF. CLARENCE I. CARLSON

By Norbert W. Ellmann, M.E. '51

The staff of the Engineering Drawing department is a well organized group of men who are qualified for the positions which they hold. To augment this statement I would like to introduce Mr. Clarence Carlson, B.S., associate professor of general engineering drawing and chairman of the General Engineering Drawing department. Through a brief review of his life it may well be seen that Mr. Carlson has the experience and knowledge to justify the position which he holds.

Mr. Carlson was born on Chicago's far south side on December 21, 1897. His education was extensive. After first attending Madison and Paul Revier grade school Mr. Carlson was ready to choose the profession for which he was best suited. Deciding upon engineering he attended Armour Institute of Technology (now Illinois Institute of Technology). Here Mr. Carlson received his B.S. degree in mechanical engineering. Northwestern university was the school which Mr. Carlson next attended. He also atended Iowa State, the University of Illinois and Indiana university.

As one would suspect, the vast store of knowledge which Mr. Carlson achieved during his long years of study put him in demand by a great many industries and the experience gained by practicing engineering in these industries certainly qualifies him as an educator of the men who are to follow his chosen profession.

Mr. Carlson first accepted a position with the Pullman Car Works as testing engineer. He then took a position with the Howe Scale company as designing engineer. After this he went to the American Well Works and was engaged in the designing department. The Love Brothers foundry department was the next firm with which Mr. Carlson was associated, and here he was connected with the drafting department. The Batavian Metal Products company then engaged Mr. Carlson as chief draftsman.

In turning to the field of teaching experience we find that Mr. Carlson also qualifies here. The first teaching position which Mr. Carlson held was at East high school of Aurora where he taught drafting. Pullman high school was his next teaching position and he also taught drafting there. Mr. Carlson then went back to Armour Institute, where he first began his engineering career. Finally coming to the University of Illinois, Mr. Carlson taught extension work in engineering drawing and then took over his present position at the Pier.

One would hardly overlook the stately appearance which Mr. Carlson presents. It is our pride to have such a distinguished man among the faculty of our school.

SHOP TALK

By John Fijolek, E.E. '51

Almost as much the trademark of an engineer as a T-square or triangle is the sight of a blueprint. Wherever you find an engineer, there you will find blueprints. And so, since we have engineers and would-be engineers at the Pier, we have not only blueprints but the means for making them.

In Professor Carlson's G.E.D. department various reproduction processes are coordinated and put into use by Mr. J. E. Findlay. The reproduction equip-

(Continued on page 28)

CLARENCE I. CARLSON

Introducing the University Galesburg Division

by Robert Jackman, E.P. '50

A famous man once said: "These are the times that try men's souls." If he could visit the universities of this country today he would probably conclude that these were the times that try students' souls because of the miles of walking through rain and snow storms required on most campuses. It is a rare occasion when a student will enroll in a university and find not only dormitories, study halls, classrooms and laboratories but also a hospital, bookstore, dining rooms, barber shop and all the other necessities of life, all under one roof. Such a students' utopia is the Galesburg Undergraduates Division of the University of Illinois.

Originally the army's Mayo General hospital, these red brick buildings and grounds, covering an area of 156 acres and costing over $5,000,000, were, in 1945, declared as war surplus and taken over by the State of Illinois. In September, 1946, it was turned over to the University of Illinois for conversion into an undergraduate school to meet the educational demand caused by new students and the return of veterans. The old army hospital received its honorable discharge, and on October 21, just 30 days after being acquired from the state, it donned its civilian clothes and became a college. Since its establishment, this "30-day university" has seen its enrollment soar from 432 studfents to the near-capacity registration of 1702. To keep pace, the instructional staff has been increased from 34 faculty members to the 106 now handling teaching assignments.

Advantageously situated 103 miles from Chicago and 45 miles from Peoria, the Galesburg Division offers its students many convenient facilities to insure that their stay will be not only educational but also enjoyable. The university itself is a mile and a half from the center of town and is readily served by a city bus line. Athletic facilities include a large swimming pool that becomes very popular during the warm months, a gymnasium with basketball and handball courts, four football fields and five baseball diamonds. Recreational and social activities consist of frequent dormitory parties, dances, and the various meetings of the 20 or more clubs and organizations on the campus. The movie going student can enjoy the latest films at the University theater three times a week. Because these facilities are all under one roof the school is occasionally referred to as the "University City."

The engineering department is headed by Mr. Fredrick W. Trezise who worked for six years on the TVA project. He has proven to be very capable in this position and also as a counselor and friend of the engineering students. Mr. Trezise heads a staff of instructors who have had considerable experience in the various fields of engineering endeavor. Notable among these is Mr. Shrode, an instructor in engineering physics, who participated in the activities concerning the atomic bomb experiment at Bikini and also accompanied Admiral Byrd as a member of his recent Antarctic expedition.

Within our "University City" are three laboratories which are available to all engineers. They are the engineering geology laboratory, the physics laboratory and the chemistry laboratory. The geology laboratory, which contains numerous exhibits such as various rocks and their formations, has a maximum capacity of 30 students.

This laboratory is open evenings for the convenience of those who are interested in further study. The physics department has two laboratories which are capable of holding 20 students each. The equipment contained in these two laboratories is sufficient to suit the demands of undergraduate study. The department has just recently obtained some new war surplus equipment such as an oscilloscope and other electronic devices, which will prove beneficial for demonstration purposes. The two chemistry laboratories are possibly the greatest asset to the engineering students. They are capable of serving 160 students at one time. Both contain AC and DC power facilities and also a considerable amount of new equipment which will aid the student in his study of chemistry.

The combination of these three laboratories and the excellent faculty in the engineering department proves to be an unbeatable team for the instruction of the students of engineering.

Dopey Porter: "Did you miss your train, sir?"

Enraged Traveler: "No, I didn't like its looks, so I chased it out of the station."

Aerial view of the Galesburg branch of the University of Illinois.

Introducing

by Dick Hammack, C.E. '48

Herb Jacobson, M.E. '50 and Connie Minnich, C.E. '51

THOMAS A. MURRELL

Many of the electrical engineers on the campus, especially those taking Electronics 40a and 62a, have become acquainted with one of the newer members of the electrical engineering department staff, Assistant Professor T. A. Murrell. Mr. Murrell joined the staff last fall after working on radar for the war department.

During the war Mr. Murrell held several very interesting and important positions. In 1941 he became associated with the Office of Scientific Research and Development and, as a member of the Radiations laboratory at Massachusetts Institute of Technology, began research on the development of radar. He was soon promoted to production engineer for all air-borne radar systems. While at M. I. T. he worked under Louis Ridenour, now dean of the Graduate school at the University of Illinois. In 1944 he became an expert consultant in the office of the secretary of war and was sent to England as the technical adviser on radar operations with the Eighth Air Force under General Doolittle. He was concerned principally with briefing operations preparatory to blind bombing by radar. After V day he was sent to the Pacific where he became a member of the three-man Advisory Specialists group while on the staff of the Far Eastern Air Force under General Kenney. The group was concerned with all new scientific de-

(Continued on page 32)

THOMAS A. MURRELL

HARRY KABBES

Leaning back in his chair, Harry Kabbes modestly explained his college career. "I didn't do much. My favorite pastime is the sack, you know."

But let the record speak for itself. Harry was born in Mattoon, Illinois, back in September of 1924. He attended grade and high schools in Mattoon, then came to the University of Illinois in the fall of 1942. After a short stay of one semester, the air corps called in February, 1943. In fact it called Harry right to the University of Chicago to study meteorology for a year.

When orders came for Harry to go to Alaska, the University of Chicago asked him to come back for a year some other time, by means of a scholarship.

But after a year and a half in Alaska as a weather observer, he decided that Illinois was the place for him. The Army let go its hold in March of 1946, and Harry returned to the books the following September.

Since then he has been going to school full time. In June he will receive his bachelor's degree in civil engineering, with a structures option. "My father is a contractor, and I've been around buildings all my life."

Harry is a member of the student branch of A. S. C. E., and a member of Tau Beta Pi, and Sigma Tau, engineering honoraries, and Chi Epsilon, civil engineering honorary.

"I used to do a bit of photography, but most of the fun was in developing the films, and the men's residence hall doesn't have a darkroom. Lately I seem to like the sack best of all."

Looking at Harry's record, it seems as though more rest might be a good idea for quite a few engineering students.

MRS. KATHRYN C. JORDON

All was quiet on the northern front of room 201, Engineering hall. Ha! Now was the time—a quiet and peaceful time—to capture Mrs. Kathryn C. Jordon, secretary of the civil engineering department for an interview with *Technograph*. The trip from the Tech office across the hall was uneventful, for the time was exactly 1:20 p. m., one of the rare minutes at which the halls of Illinois U. sleep peacefully from the rush and bustle that occur every ten minutes to the hour.

All remained tranquil while Mrs. Jordon answered a bombardment of the usual questions. Born on October 20, 1910, she grew up in Mount Carmel, Illinois, and attended the high school there, taking a commercial course and outside activities such as Glee club, senior plays and the school operetta. She attended Chillicothe Business college in Chillicothe, Missouri, and then worked for a short time for a bonding house in Chicago. Her return home resulted in a position with a ———

Did we say it was peaceful? Did we say it was quiet? A moment ago the office had been vacant, but now people seemed to be swarming in and out of the door like ants. Mrs. Jordon smiled her nicest, and quietly and efficiently assumed command in the sudden onslaught of people. "Yes, you can pick up a C.E. 60 notebook in the office," to an inquiring student; "Isn't this grand weather we've been having?" to the mailman; "Yes, go right in," to a person who wanted to see Professor Huntington; "Hi, Bill, can I help you?" to another inspecting the bulletin board; "Colonel Hiatt, here is your letter that Jean typed for you," handing a page to one man;

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MRS. KATHRYN C. JORDAN

Broadening the Engineering Outlook

by Robert Rasmus, Gen.E. '48

Much has been said recently about the need for the engineering profession to take a broader and more responsible part in the world of human affairs, both political and social. It is said that engineers, as a professional group, have been short-sighted and narrow in their interests and activities and have been reluctant to emerge from the technical realm of machines and materials into the great arena of world and national affairs where the problems of international relations and the atomic bomb, of national politics and social justice, are being decided. It is said that of all the professions, engineering has the least social and political consciousness; statistics are presented to show, for example, that in the local, state, and national legislative bodies the legal profession has wide representation while the engineering profession has almost none. It is not my purpose to go into a thorough and intensive discussion on this matter except to say, that to my mind, it is wrong to expect the engineering profession, as a profession, to enter into fields for which it has neither the professional concern nor the professional competence. This is not to say that engineers, as individuals and citizens, are to isolate themselves from these affairs; nor is it to say that there is anything wrong with engineers leaving the profession entirely and entering into these fields if, as individuals, they have the desire and the proper abilities. However, I believe it is folly for the profession, as such, to attempt to become articulate in, and identify itself with, fields which are properly the domain of the politician, the lawyer, the economist, or the social scientists. Ultimately, the question resolves itself into distinguishing between the profession and the individual; once this is clearly understood it becomes evident where the profession should stand.

Most engineers understand this instinctively, but what they forget, many times, is that it is one thing for the profession to remain objectively within its proper boundaries and it is another for its members, as private individuals, to remain parochial and short-sighted in their attitudes. So to the claim that engineers, as individuals, are narrow and limited in their undertaking and activities, I think there is sometimes much justification, and I think it is with this that the profession should rightly concern itself. It is one thing, for instance, for the profession to provide leadership in national politics and it is quite another that individual engineers should be able to think and speak and act intelligently as citizens in connection with national politics. Certainly a good part of the standing of a profession in the eyes of the public depends on the intelligent attitudes which its members would take as citizens and members of society in virtually every field of human interest.

But of even more importance than these general aspects in connection with engineers as citizens and members of society, is the problem of engineers often times being seriously limited in their understanding and ability in matters which,

Engineers! Here is an article of vital importance—read it and take heed. Arise from your soft easy chairs of procrastination and step from behind your walls of lethargy.

while not strictly technical in nature, are continually being met in the day to day course of a professional career. It is here where the profession has some of its most serious shortcomings. I speak now of such matters as engineers commonly being unable to speak lucidly and articulately before individuals or groups, professional or non-professional; of being unable to write reports that are clear and understandable and are adapted to the particular groups that will read them. I speak of too many engineers being unable to understand the business or economic considerations which must be made in connection with engineering or productive enterprises; and of the failure of many engineers in industry to understand fully all the ramifications of labor-management relations, thereby losing great opportunities to benefit both groups and society. I am thinking of the naivete with which some engineers look on business and financial procedures which management must follow for the successful execution of business. I think of the lack of knowledge which many engineers have concerning the legal and political implications of the industrial or public enterprises for which they are laboring. It is shortcomings of this kind that many times continue to keep the engineer in a position of a mere technical servant rather than a full-fledged partner in enterprises,, both public and private. Sooner or later engineers have got to realize that unless they supplement their technical knowledge and ability with greater competence in self-expression and broader and more intelligent understanding and attitudes toward other groups and fields with which they are constantly in contact throughout their professional careers, the engineering profession will never achieve the standing which it should have.

Much improvement can be made along these lines by supplementing the present engineering curriculum in the colleges and universities with more courses in English and composition, effective speaking, business law, economics, psychology, labor problems, and government. If this means adding another year to the usual four-year program it will be well worth it. But equally important with broadened education is broadened attitude; it is here that the greatest and most lasting gains can be made. Engineers have got to get over the attitude that there is some special virtue in engineering merely because it deals with tangibles instead of intangibles. The feeling that accountants and lawyers, business executives and politicians because they are not "productive," are therefore not valuable, has got to go. No longer should we hear some engineers speak of the liberal arts and the humanities as being worthless. No one expects that engineers should become scholars in Elizabethan drama or the philosophy of Descartes, but it may be justifiably expected that engineers will at least not maintain intolerant and scoffing attitudes toward the fields of culture and liberal learning. Engineers have got to realize the importance of, and be able to cope with, human relationships as well as mechanical relationships; engineers must reach out beyond their technical provincialism and understand that in this modern society there are a multitude of facets, of which engineering is only one.

Thus far in its history the engineering profession has gained the grateful respect of society, and rightly so. But once the membership of the profession has acquired the attitude of looking and thinking beyond the confines of that which is purely technical in engineering, the profession will reach even greater heights of prestige and service.

THIS IS Bendix

GEORGE R. FOSTER
Editor

EDWIN A. WITORT
Assoc. Editor

the Illinois Technograph

Better Years Ahead . . .

The huge success of this year's St. Pat's Ball was readily apparent minutes after the dance ended. Practically every one present agreed that, truly, it was one of the finest affairs ever presented to the students. The success was largely due to the fact that there was a variety of entertainment: The displays featured by each of the engineering societies; the danceable music; and the climax of the evening's enjoyment, the selection of St. Pat and crowning of St. Patricia.

There is just one sad part about the whole story. The demand for tickets to the ball was much greater than the supply. There are approximately 3,000 engineers on the campus. There were exactly 400 tickets available. These were distributed *pro rata* to the various societies. After the mad rush for tickets was over, it was estimated that at least twice this number of tickets could have been sold. This means that there were a large number of disappointed engineers.

Did the Engineering Council, when planning the dance, mean it to be for a select few? Not exactly. At most, the Council could be accused of venial negligence. As you probably know, this is the Council's first year of operation after six years of inactivity due to the war. The plans for the dance were started very shortly after the Council, and its new constitution, received its official recognition from the College of Engineering and the engineering societies. An attempt was made to procure Huff gymnasium for the dance, but at this late date, the Union ballroom, with a maximum capacity of 400 couples, was all that was available.

Looking again at the outcome of the dance, it can be seen that the Council did a commendable job in presenting it to the engineering students. It was ideal except for the one unavoidable error mentioned above.

With the facts before you, it is hardly conceivable that you can look with disapproval at the Council. Rather, you should give the Council a hearty slap on the back for the admirable work it has performed so far this year, for, again, it was the Council that arranged for the representatives of the Austin company to give the enlightening talk on "Industrial Plants."

Next year should be a banner year for the engineering students. Most of the new engineering buildings should be completed by that time. The Council will be well established, and with a group of men as capable as the present representatives of the Council, plans for St. Pat's Ball will be started early enough to obtain accommodations for as many as want to attend. Mention should be given to the fact that an Engineering show, normally given on odd numbered years, and various other important items, should be on the agenda of the Council.

For these reasons you should be unanimous in your voice of approval of, and encouragement to, the Council. Let the members of the Council know you are behind them. When, as a member of an engineering society, you are called upon to cast your ballot for a Council representative, keep in mind the responsibilities that the man elected will have. Give a little forethought to the matter and make certain that the honor of representing your society goes to the most capable man. Then, and only then, will the Council be able to work and plan as effectively, efficiently, and on as big a plane as it should.

Engineering Societies

By Ray Hauser, Ch.E. '50

ETA KAPPA NU

Alpha chapter, the parent organization of Eta Kappa Nu, electrical engineering honorary fraternity, granted a charter to a new chapter at the University of Kentucky, on February 24, 1948.

At the installation and initiation of Beta Tau chapter at Northwestern Technological Institute the local chapter was represented by John E. Farley. Mr. Zerby, executive secretary, Mr. Hibshman, national president, and Mr. Williams, national vice-president, were present at this installation, which took place January 24. Dr. Jesse Hobson, director of research, Armour research foundation, was the principal speaker.

KERAMOS

Preparations are now being made to initiate 13 new Ceramic engineers into Keramos. The initiation will be followed by a banquet to be held at the McKinley YMCA on the evening of March 11.

Guests at a get-acquainted smoker and movie at the Illini Union, January 15, were: H. L. Anderson, E. K. Jensen, F. M. Maupin, J. Wuellner, R. N. Ames, R. S. Degenkolb, R. D. Fenity, J. E. Griffin, Jr., C. E. Janke, R. G. Kraft, Chun Lee, R. E. Bickelhaupt, D. D. Rassner, and L. H. Schneider.

SIGMA TAU

The campus chapter of Sigma Tau held a formal initiation at the Inman Hotel January 27. Forty men joined this all-engineering honorary fraternity at that time. Pledges honored were: W. A. Brooks, Jr., R. H. Chilenskas, R. A. Coderre, J. R. Cushman, Floyd Dunn, N. J. Elliott, M. L. Embree, G. L. Engelhart, J. W. Ericson, E. W. Ernst, G. J. Gore, R. W. Harris, J. L. Honnold, R. R. Hunter, H. G. Kahbes, Otho Kile, B. D. Kirkwood, R. G. Kraft, A. S. Levine, Richard Ling, R. G. Love.

R. E. Lovett, J. L. Mazer, J. B. Morrison, J. J. Parry, B. A. Peskin, John Prodan, O. T. Purl, L. E. Roby, J. H. Schussele, C. H. Sechrest, L. H. Shanin, H. D. Smith, Jr., J. M. Vene, R. J. Wagner, R. B. Weil, W. C. Wiley, R. D. Williamson, R. B. Wiseman, and F. L. Zeisler were also initiated at this time.

TAU BETA PI

Main event of the recent Tau Beta Pi activities on campus was the formal initiation and banquet on January 22. The pledge group consisted of 52 men, the largest number ever to be taken into the campus chapter of this all-engineering honorary.

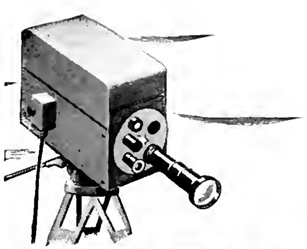
Banquet toastmaster for this event, held at the Hotel Tilden Hall, was Professor A. R. "Buck" Knight. Chapter president, Earl Shapland, Jr., welcomed all newcomers and Richard Williamson replied for the pledges.

Leslie A. Bryan, director of the local Institute of Aeronautics, delivered the address for the evening, reflecting his own genuine interest in aeronautics.

A.I.Ch.E.

The chemical engineers held a smoker, their first social function of the second semester, on Monday evening, January

(Continued on page 34)



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MODERN DESIGN . . .

(Continued from page 12)

factor considered as vital to the farmhouse was the clean-up facilities. To avoid bringing dirt and mud into the house, a place should be provided near the rear entrance for workers to clean up as they come in from the fields.

The basic house plan consists of two rectangular units which can be arranged in a number of ways. The flexibility of the arrangement of the rectangular unit and the variability of the length of the unit make it possible to meet the requirements of many families and their farmstead arrangements. One of the rectangular units includes the living, dining, and homemaking areas, plus the storage space which should go with these rooms; the other unit contains the bedroom and the bathroom. Each unit is 16 feet wide; the length of the unit depends upon the size and number of rooms desired. The location of the entrance has been thoughtfully arranged so that no guest will enter through the back door and no worker will track through the front door. This will do away with the housewife's complaint that workers walk through the living room and visitors enter through the kitchen.

The driveway widens near the house to provide a small parking space for guests. There is a walk leading from the parking space to the front entrance; the front door opens into an entryway in which there is a small closet to hang coats. The entryway leads into the living and dining areas. The back door opens into the work room. The stairs to the basement are located just inside the door, making it convenient for the farmer to get to his office space or for the workers to get to the basement to discard muddy clothes and clean up. Other entrances can be made where desired but two recommended doorways

(Continued on page 26)

Models of the farmstead in various orientations were constructed. Here the house is parallel to the rood.

AFTER April 16, Standard Oil's great new research laboratory at Whiting, Indiana, will be open to the public. Technical men will be especially interested in these splendid new buildings and their equipment. Most interested of all will probably be young men like yourselves, for here at Whiting you can see facilities so modern in every respect that they are likely to serve as a model for similar industrial developments for many years to come.

It may well be that you will spend part of your professional career in surroundings patterned after these well-planned new buildings at Whiting. In any case, you cannot fail to find the new Standard Oil laboratory a present accomplishment and a promise for the future. Here is one of the places where the world of tomorrow will be shaped by the skill of men trained, as you are, to the exacting, rewarding tasks of scientific research.

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STANDARD

STANDARD SERVICE

MODERN DESIGN . . .

(Continued from page 24)

are those leading from the dining room and bedroom sections onto the back terrace.

Since the homecoming area is the "control center of the farm," the kitchen and workroom should be placed so as to give a view of the approach from the highway and of the farm yard itself.. The workroom division of the homemaking area is directly connected to the kitchen. The farmer's office, with space for a desk and file, is located in one corner of the workroom. Provisions for washing machines and movable laundry trays are located in the laundry alcove diagonally across the room from the office. A wash-up space is located in a third corner. The work room may also be used to process food and prepare produce for the market.

The modern, compact kitchen has refrigerator, sink, range, cabinet, and work counters in a U-shaped placement to insure greater efficiency. A breakfast table is located across the room from the sink. Just a few feet from the breakfast table in the eating nook is a sewing cabinet which provides space for a sewing machine and a full-length mirror.

The plan makes provisions for three bedrooms, but more can be added as desired. Each bedroom is separated from the other by closet space. The bathroom is located between two of the bedrooms. Together the bedrooms and bathroom form a self-contained unit, making up one of the two rectangles.

The stairs to the basement are located just inside the grade entrance. The basement contains a heating unit, storage place for the fuel, and a shower. The basement also contains an all-purpose room which can be used for such things as storage and a place to hand clothes on a rainy day.

The construction of the house achieves simplicity by use of the modular plan. All of the dimensions are divisible by four, which leads to a minimum of cutting and waste of material. The house can be built of a wide variety of materials. The exterior can be easily finished with stone, brick, shingles, or plywood and with any approved method of applying that material.

The house is designed with the first floor level several steps above the ground line to provide ample space for basement windows and to reduce the depth of excavation and simplify the drainage. The gable roof is built with overhanging eaves, which provide shade from the sun and shelter the windows from rain and snow. Since there is a trend toward more glass area today, the windows are larger than usual. For comfort and to save fuel, the large windows are double glazed.

The farmhouse plan is the first completed research project that has directly resulted in a circular. However, it is not to be the last. The Small Homes council now has many low-cost housing projects under way. Research is being carried out on baseboard radiation for basement-less houses, the planning of houses to be heated with solid fuel, a kitchen-laundry project, site fabrication, and concrete slab floors.

The problem of low-cost housing has become a very serious problem of this era. The research and experiments of the Small Homes council will be of great service in helping Illinoisans and others obtain their "Home Sweet Homes."

"Where'd y'all git thet derby?"
"It's a sooprise fum mah wife."
"A sooprise?"
"Ah cums home de odder night, unexpected like, an' foun' it on de table."

If it's funny enough to tell, it's been told; if it hasn't been told, it's too clean; and if it's dirty enough to interest an engineer, the editor gets kicked out of school.

IF HE COLLECTED SAMPLES

as he made his rounds

A sample from every industry served by Square D Field Engineers would make quite a load, indeed. For these men serve as liaison between Square D and every segment of industrial America. Their full-time job is working with industries of every kind and size—helping find that "**better way to do it.**"

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NAVY PIER . . .

(Continued from page 14)

ment is so modern and complete that it is doubted that more than a few of the schools in the country can match the Pier in the quality and capability of its facilities in this respect.

The equipment selected was installed with not only the idea of reproduction in mind, but the demonstration of procedures involved, so that, in effect, utility and instruction are conveniently combined. Because of the variety of equipment on hand, reproduction is achieved by the blueprint process, by the Ozalid method, by photostating, and by use of a vacuum printer.

For blueprint work, the department has a three carbon arc Pease "11" Printer. This 42-inch printer directs printing in both the blueprint and Ozalid processes. Four large vats used for developing the blueprint while a 42-inch Pease Senior Dryer turns out the finished product.

Reproduction by the Ozalid process involves the use of the Pease printer already mentioned and a 54-inch Ozacoupler in which ammonia fumes develop the print in a dry process that avoids paper shrinking. In this manner, one can make prints which have black, blue, red, or sepia lines on either a white paper background or on cloth, foil, or film.

The Number 1 photostat is made by a subsidiary of Kodak. This photostat machine takes pictures up to 11 inches by 14 inches. Photostats can be obtained in any size between 40 per cent and 200 per cent of the original size. The machine includes an engineering board, a book holder, a filter for color work, and has its developing tank and fixer directly attached. Two mercury vapor lamps are used for lighting the object to be photostated.

In the adjacent dark room is a Remington Rand vacuum printer called a Portagraph. This is a contact printer for general photostatic work but has in addition a vacuum pump which is very beneficial for reflex work. The printer is capable of handling work up to 30 inches by 40 inches. By using photact papers and cloth on this machine, the originals may be preserved, restored, and duplicated.

One of the chief advantages of the vacuum printer is its ability to make transparencies. Irrespective of the kind of paper on which the original drawing is made, a negative can be made from which a positive transparency is made on either paper or cloth which is a visible improvement over any pencil original. Finally, the photact print now serves as the master from which further reproductions may be made on the Pease printer.

In straight photographic work, a 35 millimeter camera is used for the making of film strips and slides which are used as visual aids to education. A four by five press camera and a four by five view camera belonging to the physics department supplement the above equipment. In addition, there is in the dark room a DeJur Professional four by five enlarger.

Although this equipment was set up primarily for the Engineering colleges, it is used for University work such as developing registration photos and in supplying reproductions for use by instructors and departments in the other colleges.

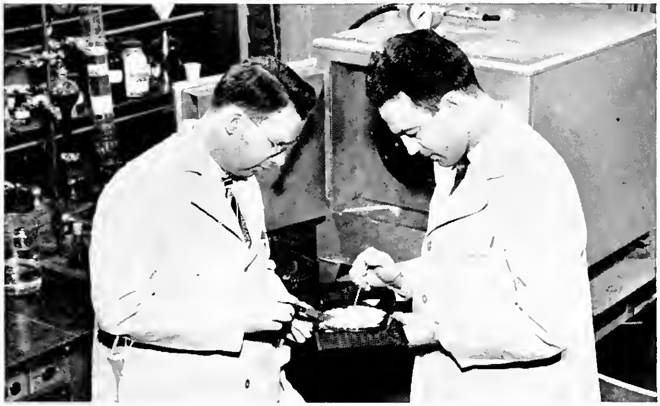
DU PONT *Digest*

For Students of Science and Engineering

Experimental research results in better Vitamin D source for poultry industry

Fifteen years of work by Du Pont chemists, biochemists, physicists, and engineers behind development of "DELSTEROL"

In 1922, it was shown that vitamin D controls the utilization of calcium and phosphorus in the body, especially in the bones of growing animals. This led to the discovery that leg weakness in chicks, poor production, low hatchability of eggs, and other disturbances were caused by a deficiency of this vitamin.



L. Fullhart, Ph.D. 1946 in organic chemistry, Iowa State College and W. F. Marlow, chemist, B.S. 1941, George Washington University, preparing to examine a sterol product for quality and yield.

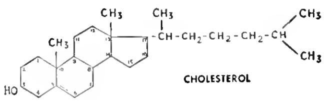
Scientists subsequently discovered that vitamin D could be made by irradiating plant or animal tissues with ultraviolet light. This reaction has since been shown to consist of transforming certain provitamins from the group known as sterols, into vitamin D. The final result of these discoveries was the present large-scale commercial production of the vitamin by a series of complex chemical and photo-chemical reactions which require careful control by chemists, biochemists, physicists, and engineers. In this development, Du Pont scientists played an important part.

Ergosterol once the only source

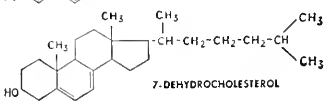
For years before 1934 it was assumed that ergosterol, a sterol first isolated from vegetable sources, was the only provitamin that yielded vitamin D. In that year, Du Pont research men—who had been studying the chemistry and biochemistry of vitamin D for almost four years—announced that the provitamin in animal cholesterol was *not* ergosterol. They showed that the activated provitamin in cholesterol gave a vitamin D much more effective for chicks than that of irradiated ergosterol. This fact was based on many comparative assays of irradiated cholesterol, irradiated ergosterol, and irradiated mixtures of these substances on rats and chicks.

Synthesis from Cholesterol developed

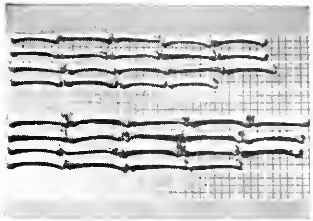
Other investigators showed that the provitamin in cholesterol was 7-dehydrocholesterol by developing its synthesis from cholesterol. The relationship between cholesterol, 7-dehydrocholesterol, and vitamin D_3 is shown by the following formulas:



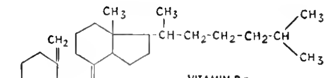
CHOLESTEROL



7-DEHYDROCHOLESTEROL



Bones at top, from birds fed no vitamin D, are shorter, poorly developed, and fragile, compared with bones at bottom from birds fed Du Pont "Delsterol."



VITAMIN D_3

Du Pont chemists and engineers carried this forward by devising a successful commercial process for making 7-dehydrocholesterol and irradiating it to vitamin D_3. Several forms of vitamin D are now manufactured by Du Pont, ranging from oil and dry powder concentrates—used by the poultry trade under the trademark "Delsterol"—to vitamin D_3 crystals of the highest purity.

Today's chickens are healthier, and the average annual egg yield over the last eight years has increased from 134 to 159 per bird. To a considerable degree, this is a result of the fifteen years of research devoted by Du Pont scientists to the development of "Delsterol" "D"-activated animal sterol.

Questions College Men ask about working with Du Pont

What are the opportunities in sales?

Separate sales staffs are maintained by each of Du Pont's ten manufacturing departments. Training in chemistry or chemical engineering is a prerequisite for some sales positions, which may be in one of three fields: technical sales, sales development, or direct selling. New employees usually acquire technical background by first working in a control laboratory or in production. Write for booklet, "The Du Pont Company and the College Graduate," 2518 Nemours Building, Wilmington 98, Delaware.

DU PONT

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BETTER THINGS FOR BETTER LIVING ...*THROUGH CHEMISTRY*

More facts about Du Pont — Listen to "Cavalcade of America," Mondays, 8 P.M., EST on NBC

MRS. JORDAN . . .

(Continued from page 16)

"Yes, write your present address here," to a bewildered student.

So it was for the rest of the hour. For a few moments the office would be as silent as a morgue except for the solitary tick-ticking of the office typewriters and the far-away drone of a professor's voice. Then the room would suddenly become alive with people and Mrs. Jordon would quickly be prepared to answer all sorts of questions and give instructions and directions. In between rushes she gave the rest of the account of her life. As we had started to say—

Her return from Chicago resulted in a position with a town lawyer and her marriage in 1934. In 1936 she and her husband came to Chambana, and two years later she accepted a secretarial job here on campus. The last six and one-half years have been spent in secretarial work for Professor W. C. Huntington, head of the civil engineering department, and supervision of department work which she passes on to the desks of the other girls: Jeanne Pancoast, her "right-hand man"; Patricia Peterson and Doyne Proudfit.

Her outside interests include golf "in golfing weather, of course," movies, her home, and her dog Ginger, a special breed called a Skipperke, a sort of "fox-faced terrier with the body of a black spitz dog." She also said that she loves to go fishing with her husband up in Wisconsin during the summer.

At 1:56 p. m. when we left, Mrs. Jordon was still fresh and smiling, gladly helping all and sundry who came into her office, and still prepared for any emergency. We, meanwhile, tired and worn from the barrages of visitors, scratched our heads and wondered, "How does she do it?"

Judge: "Who was driving when you collided with that car?"

Drunk (triumphantly): "None of us. We were in the back seat."

* * *

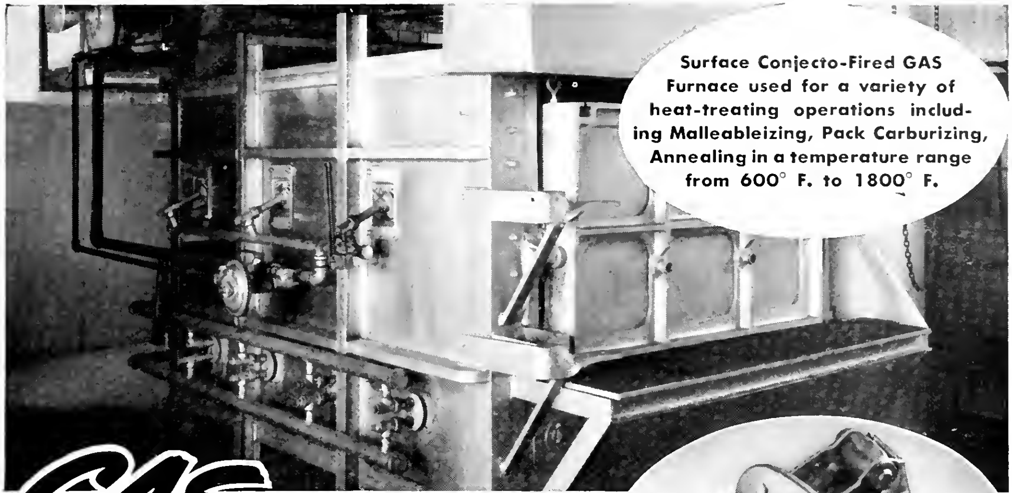
A certain brewer sent a sample of his beer to a lab to be analyzed. A few days later he received this report from the chemist:

"Dear Sir: Your horse has diabetes."

* * *

EE: "Could I try on that blue tweed suit in the window?"

Clerk: "We'd rather you'd use the dressing room."



GAS FURNACE PERFORMS MULTIPLE HEAT-TREATING FUNCTIONS UNDER VARIED CONDITIONS

In modern heat-treating, adaptability of equipment and flexibility of fuel are primary influences in any cost-per-piece analysis. As a typical example of the flexibility of the productive flames of GAS, this Conjecto-Fired GAS Furnace is used for a variety of operations without any change other than regulation of the fuel-mix and temperature controls.

Atwood Vacuum Machine Company, Rockford, Illinois, is equipped to heat-treat pieces ranging from 1 ounce to 1000 pounds, in volume up to 15,000 pounds daily. Their modern Gas-fired Equipment is adapted for annealing, carburizing, drawing, hardening, normalizing, malleableizing, stress relieving, under rigid metallurgical specifications.

Experienced heat-treating specialists like Atwood Vacuum Machine Company use GAS because this flexible, controllable, rapid-heating fuel is so readily adaptable to all types of processing at any required temperature. The productive flames of GAS are so flexible that they can be used for any production-line heating operation, under the most exacting conditions.

AMERICAN GAS ASSOCIATION

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Data and Photos by SURFACE COMBUSTION CORPORATION, Toledo, Ohio, Manufacturers of Gas Heat-Treating equipment

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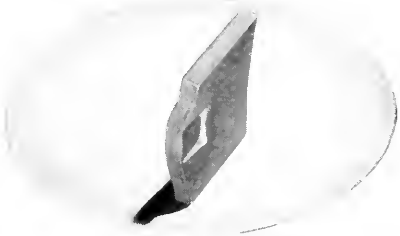
FOR ALL INDUSTRIAL HEATING

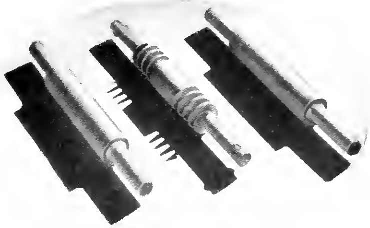
ANNEALING—Station wagon body hinge

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.



PACK CARBURIZING—Brake Trunnions

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.



MALLEABLEIZING—Trailer Jack Screws

Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

MECHANIZED FARM . . .

(Continued from page 13)

high. A number of farmers have made units of their own in order to reduce the investment. However, several companies are now in the field and as operating difficulties are worked out, the barn cleaner may become as standard a

For ease in loading spreaders, the end of the conveyor is elevated.

piece of dairy barn equipment as the milking machine.

The Agricultural Engineering department at the University of Illinois is presently studying efficiency of design and power requirements for several other new dairy production machines. All these studies have as their ultimate objective the reduction of time and labor consumed by the farmer in the dairy enterprise.

PROF. MURRELL . . .

(Continued from page 16)

vices, including radar. Mr. Murrell returned to the United States in October, 1945, and worked in Washington for the war department on problems of air navigation and traffic control until he came to the University last fall.

Born in Lebanon, Kentucky, on February 18, 1914, he was educated in Louisville, Kentucky. He received his Bachelor of Science degree in electrical engineering from the University of Louisville in 1936. Mr. Murrell worked for some time as an engineer for the Louisville Gas and Electric company. He went to the University of Wisconsin in 1937 as a graduate research assistant for the Physics department. He received his

(Continued on page 36)

SOCIETIES . . .

(Continued from page 22)

23rd. It was held in the Illini Union in an attempt to remove it from the aroma ala organic chemistry, thereby establishing an environment conducive to better socializing.

The climax of the evening's entertainment was the presentation of an honorary membership to one of the most popular professors of the chemistry department, Dr. L. F. Audrieth. He was also made an honorary life member of the Illinois student chapter of the A. I. Ch. E., all "in recognition of his continued interest in the profession and social training of chemical engineering students."

Dr. Comings introduced the Ch. E. faculty and spoke at length on the "new building" being constructed immediately east of the chemistry annex. The society officers were introduced by the president.

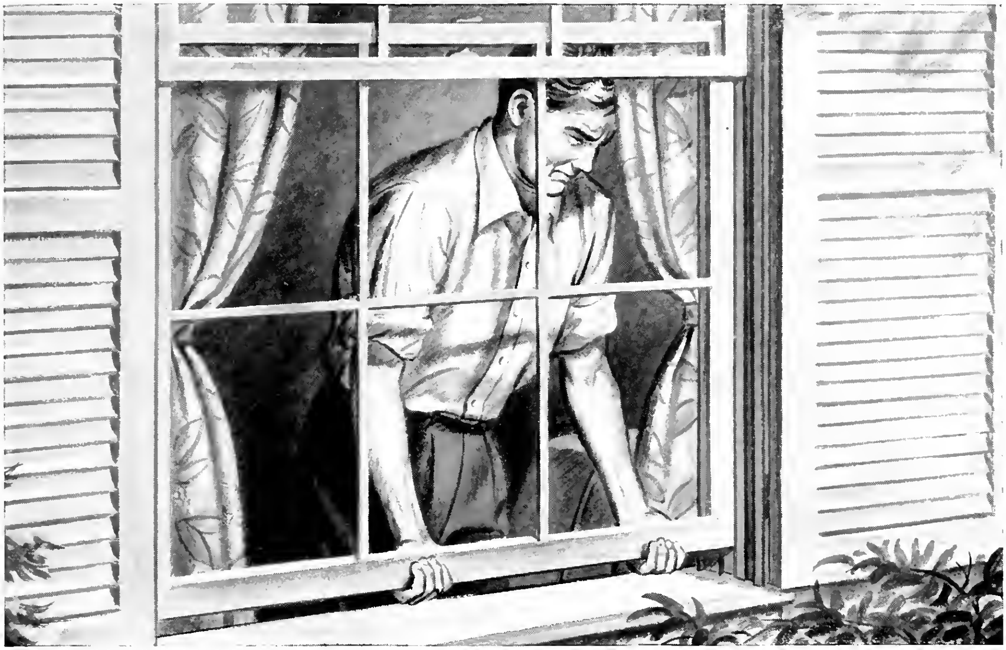
Approximately 100 chemical engineers and chemists assembled on the evening of March 1st to hear Dr. Bailar, professor of inorganic chemistry and secretary of the chemistry department, discuss the relationship between a student's aptitudes and the type of job that he was best fitted for. He mentioned the "job interview" and what to expect from an industrial organization.

The office of the secretary is very active in assisting Noyes laboratory graduates in the procurement of the right job. Any chemical engineer or chemist should talk to Dr. Bailar and fill out an application blank to be placed in Dr. Bailar's permanent file.

"So you deceived your husband," said the judge gravely.

"On the contrary, your honor, he deceived me. He said he was going out of town, and he didn't go."

The man who cooled a million hotheads



Some women can fix anything with a bent hairpin. But it took a man to solve a problem that had stumped the hairpin experts for generations.

He solved the irritating problem of opening and shutting stubborn windows without benefit of crow-bars, by means of an ingenious, automatic sash-balance, which enables you to perform that operation with one finger.

The principal member of this new temper-saver is a length of high carbon, sash-balance spring steel made by Roebling. The manufacturers have such confidence in this Roebling product that they guarantee their sash balance for the entire life of the building in which it is installed.

Roebling flat spring steel is one of the most widely used of the hundreds of Roebling products, yet it is the least known. Few men think of umbrella stays, clock springs, feeler gauges, measuring rules and tapes, and thousands of other articles, in terms of flat spring steel.

On the other hand, when enterprising inventors create knotty design problems, when competition dictates re-design of a product in order to lower costs, engineers invariably look to these Roebling products for at least part of the solution.

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A CENTURY OF CONFIDENCE ROEBLING

PROF. MURRELL . . .

(Continued from page 32)

Ph.D. degree in physics there in 1941.

While instructing in electrical engineering Mr. Murrell still maintains an active interest in the field of physics. Although not actively engaged in any specific research at the present time, he is planning to enter part time research in the near future.

Mrs. Murrell is the former Miss Clare Hall, also a graduate of the University of Illinois. She received her degree from the College of Liberal Arts in 1941. Mr. and Mrs. Murrell met in England in 1944 where she was an officer in the WAC. They met again in the Philippine Islands for a few months after the war. They were married in January, 1947, after both had returned to the United tSates. Mrs. Murrell is now in graduate school working on her master's degree in English Literature.

A member of IRE, the Physical society, and Sigma Xi, Mr. Murrell is at present on special call with the Research and Development board in Washington.

I crept upstairs, my shoes in hand,
Just as the night took wing
And saw my wife, four steps above
Doing the same damned thing.

DIATOMITE FILTRATION . . .

(Continued from page 7)

the slurry tank (15). The mixture circulates through the connecting piping and valves (as indicated by arrow direction) to the lower compartment of the filter (6) where it passes out the top through a number of elements (7). These elements consist of cylindrical septums of porous refractory materials or septums of helically-wound wire upon which the diatomite gathers in a uniform pre-coat, .06 to .09 inches in thickness. The water then passes through the filter effluent line (9) and valve (4). At valve (10), however, it does not follow the route shown but is diverted down to (12) and back to its origin in (15). In test filter runs, the best initial pre-coat of this kind was formed by the addition of 10 to 15 pounds of filter-aid per 100 square feet of surface area on the filter elements.

In the second process, the actual filtering, the water, usually pre-treated by coagulation and settling, enters the influent line (1) and follows the same route as the pre-coat slurry. While passing through the septums (7), the diatomite coats filter out the suspended matter, slag, and bacteria of the water which accumulates in additional layers around them. The filtered water then continues through the effluent line (9) and (11) and out of the apparatus. During this filtering operation there is a continual feed of diatomite slurry from the body feeder (not shown) which mixes with the water to be filtered and builds up a growing coat on the already pre-coated filter elements. This maintains the coat's porosity for a longer period by retarding the loss of head pressure that draws the water through the apparatus. However, this body feed is not to be confused with the initial pre-coat of diatomite; this slurry fed in during the filtering process is an additional amount.

(Continued on page 40)

Mr. Bowman of the Sanitary Engineering laboratory displays a model of the 15 g.p.m. diotomite filter pack unit developed by the Army.

DIATOMITE FILTRATION . . .

(Continued from page 38)

The suspended matter and slag before mentioned soon accumulates to form a thick coating that is removed by a backwash process, which lasts about 30 seconds. The water flow is reversed at valve (4) and passes up (9) and down through the top of the filter (8) and its elements. This discharge, carrying away the coat of sludge and diatomite, is then diverted through (5) and valves (4), (10), and (12) to the waste tank or sump.

Research in Progress

Field filters of the kind described were used successfully during the war, although it is agreed that the possibilities of the diatomite filter have not yet been entirely developed. For this reason, present research in this type of filtration is being conducted at five American institutions: New York, Harvard, Johns Hopkins, California, and Illinois universities. The five factors involved in this investigation are filter septums, filter-aid, pre-treatment of water, corrosion of filter units, and various methods of sterilization. The University research conducted at the Sanitary Engineering laboratory deals for the greater part with the first of these, the testing of about 30 kinds of different septums. This research program, sponsored by a governmental appropriation of $50,000, began June 1, 1947, for the designated length of a year and will be continued if further experimentation is thought necessary.

About the only disadvantage of the diatomite filter is its cost. The filter-aid varies from three to five cents per pound, and the amount used varies for waters of different characteristics. In this respect diatomite filtration is more expensive than the rapid sand filters despite the lower installation cost of the former.

In practical application the diatomite filter has found a definite niche in the purification processes used in the treatment of swimming-pool water. The usual swimming-pool turbidity (occurrence of sediment and other foreign matter) is in the ratio of two or three parts per million. This requires a comparatively low consumption of filter-aid, about .04 pounds per 1000 gallons of filtered water. Financially speaking, this filtration would then cost one-fifth of a cent per 1000 gallons, if the cost of the diatomite is figured at 5 cents per pound.

Another application of the filter would be for temporary water treatment by campers. Due to its ability to produce a filtrate of very low turbidity it could also be used in industrial mechanisms which require water free from suspended solids. To date, no information is available concerning the possible large-scale treatment of municipal water supplies.

The future of the diatomite filter holds unlimited horizons, but until further studies and statistics are compiled, it cannot be used in wide industrial application.

Why didn't the ram turn before he ran off the cliff?

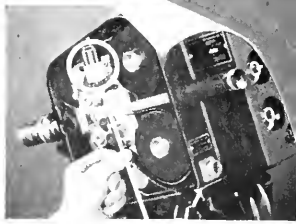
He didn't see the ewe turn.

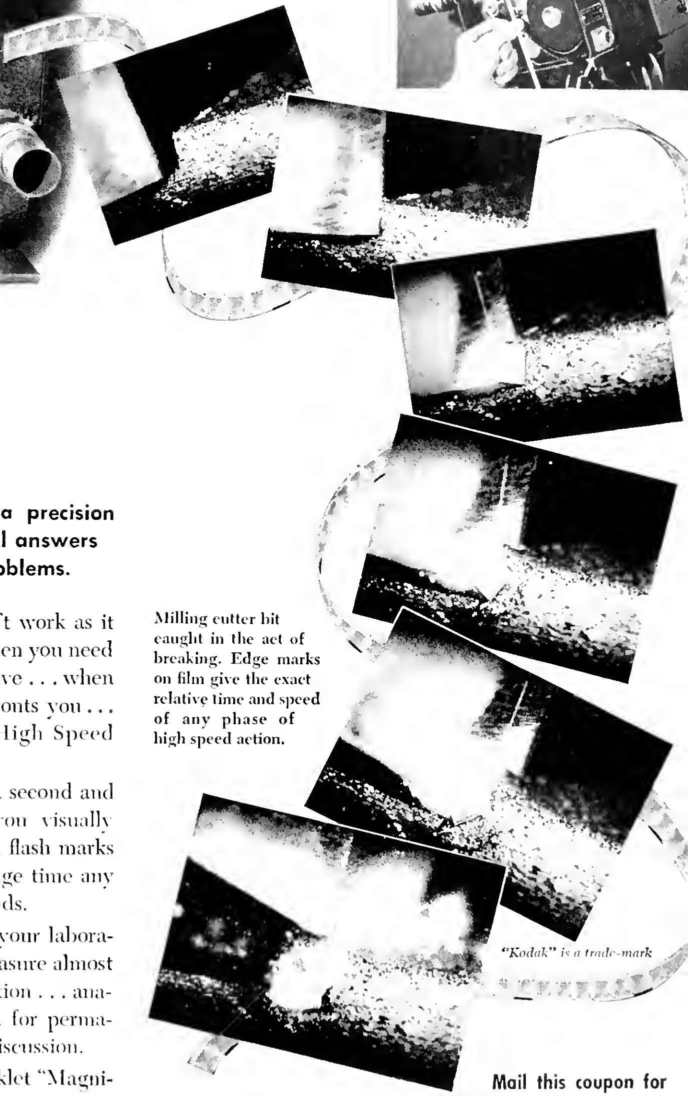
* * *

I stood on the bridge at midnight,
A simple Pratts-truss span.
And my fingers were held fixed ended
In the clasp of my love . . . dear Ann.
And I sighed as I there surveyed her,
My love passing fair.
While a sportive wind load sudden
Caused tensile stress in her hair.
"Ann, wilt thou walk beside me
Along life's hard surfaced road?"
On my ribs spiral reinforcement
My heart set up an impact load.
"Oh, Ann, beam thou upon my life;
I pray thee do not dim it."
And my joy, when she softly whispered,
"Yes,"
Exceeded the elastic limit.

Kodak

Argon "timer" on Kodak High Speed Camera puts edge marks on film, as shown below, for externally fed rectangular pulses.





Milling cutter bit caught in the act of breaking. Edge marks on film give the exact relative time and speed of any phase of high speed action.

"Kodak" is a trade-mark

The Kodak High Speed Camera . . . a precision instrument that gives you exact visual answers to complex industrial time-motion problems.

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. . . a great name in research with a big future in CHEMISTRY

PLASTICS—INFANT INDUSTRY THAT GREW UP FAST

Ten years ago the infant plastics industry was teething. It has since rushed through a precocious childhood and grown to a vigorous and impressive maturity. Today the plastics industry is a multimillion dollar business. Two thirds of all American factories use plastics materials in their manufacturing operations.

Of course, plastics were not new ten years ago. In fact, back in 1894 General Electric was making lamp carbons out of an early plastic lampblack-impregnated potter's clay.

New Materials Encourage Growth

But the rapid growth of the plastics industry came in the late 1930's when new materials and improved molding techniques encouraged its expansion. Then, with World War II, plastics manufacturing accelerated tremendously.

Synchrotron ring, molded by G. E. for Univ. of California's new betatron atom-smasher.

General Electric's position in the plastics field is unique in that G. E. is the world's largest manufacturer of finished plastics products and also a manufacturer of molding powders.

General Electric offers a complete plastics service. It has facilities for developing special compounds and for designing, engineering, and molding plastics products to meet individual customers' requirements.

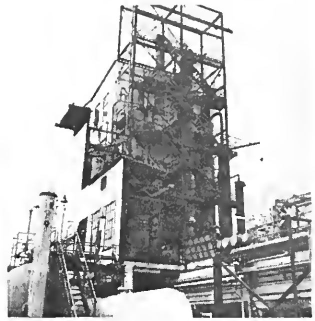
The variety of parts and products turned out by General Electric's Plastics Division is startling—and it illustrates the diversity of applications that are being found for plastics in the postwar world.

For Rowboats and Radios

Take, for example, the plastics dinghy. This is a four-passenger boat molded of laminated plastics by General Electric for a New England boat manufacturer. Then there is the synchrotron ring for the University of California's new betatron atom-smasher. It's the largest single part ever molded by G. E. Less spectacular, perhaps, but still important, are the hundreds of more familiar plastics products like clock cases, compacts, radio cabinets, camera cases, packages of all sorts, Textolite surfacing material, plastics parts for automobiles, refrigerators, and other appliances—even plastics cups for milking machines.

This plastics dinghy was molded by General Electric for the Beetle Boat Company.

Since 1920, General Electric has manufactured molding powders for its own use. Recently, a synthetic phenol plant was completed in Pittsfield. As a result of this increased production capacity, G. E. can now provide high quality phenolic compounds to other molders.



New G-E Phenol plant at Pittsfield, Mass., showing fractionating towers on distillation building.

General Electric's plastics activities are just one phase of the operations of the Chemical Department, where research is opening new doors to progress. In the fascinating new field of silicone chemistry, in resins, in insulating varnishes, in permanent magnets, General Electric is making contributions to chemical knowledge. For more information on any of these activities, write *Chemical Department, General Electric Company, Pittsfield, Massachusetts.*

A message to students of chemistry from

DR. J. J. PYLE

Director, General Electric Plastics Laboratory

The field of plastics is surely a stimulating one—and one that offers many opportunities and the utmost in challenge to graduate chemists and chemical engineers. At General Electric, plastics research is presenting new possibilities in this fascinating field that should prove exceptionally interesting to young technical men.

GENERAL ELECTRIC

PLASTICS • SILICONES • INSULATING MATERIALS • GLYPTAL ALKYD RESINS • PERMANENT MAGNETS

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MAY, 1948 • 25 Cents

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This "magic lamp" makes Aladdin's look lazy

You will remember the fabulous lamp—and how it served its master, Aladdin. Serving you, today, is a real "magic lamp" . . . the electron tube.

You are familiar with these tubes in your radio, Victrola radio-phonograph or television set . . but that is only a small part of the work they do. Using radio tubes, RCA Laboratories have helped to develop many new servants for man.

A partial list includes: all-electronic television, FM radio, portable radios, the electron microscope, radio-heat, radar, Shoran, Teleran, and countless special "tools" for science, communications and commerce.

[illegible] tron microscope, helping in the [illegible] disease, magnifies bacteria more than 100,000 diameters, radar sees through fog and darkness, all-electronic television shows events taking place at a distance, radio-heat "glues" wood or plastics, Shoran locates points on the earth's surface with unbelievable accuracy, Teleran adds to the safety of air travel.

Constant advances in radio-electronics are a major objective at RCA Laboratories. Fully developed, these progressive developments are part of the instruments bearing the name RCA, or RCA Victor.

• • •

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- Design of component parts such as coils, loudspeakers, capacitors.
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- Design of receiving, power, cathode ray, gas and photo tubes.

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New Developments

By John Dick, E.E. '49
Ken McOwan, M.E. '49

Gas, Key to Progress in Research and Manufacture

Gas, as we all too often think of it, is not an "it:" it is a "them." There are many gases used in industry and research. The more important ones include hydrogen, oxygen, nitrogen, illuminating, acetylene, helium, argon, krypton, neon, ammonia, and chlorine. These are not mere laboratory curios but are piped into many buildings and laboratories much as one would pipe water into his home.

The uses of gas are varied. It is employed in furnaces, glass blowing, copper brazing, annealing, sintering, welding, cutting steel, as a refrigerant, as a pressurizing agent, as a filling for vacuum tubes and light bulbs, and for many other purposes.

Among the most interesting uses of gas is that of glass blowing. A mixture of various gases is used to obtain the proper size and shape of flame for each operation. One of the new machines for this highly interesting work is shown in the included picture.

New Core Binder

The General Electric company has developed a variation of the mass spec- nolic resin to bind sand cores used in the casting of metals.

The new core binder imparts enough dry strength to the core material to allow the core to be handled while still warm. With a minimum of baking time and temperature, it imparts sufficient strength to the core to withstand pouring temperatures of 2750° F. It possesses a low hot strength, and excellent green strength. The phenolic resin evolves very little gas during pouring and will not injure the properties of the core material after shake-down.

New Standards Adopted By ASTM

The ASTM has adopted a number of new standards that are unique. One of these standards is a method of testing steel for sulfur content by direct combustion. The use of this method will cut down testing time as well as costs.

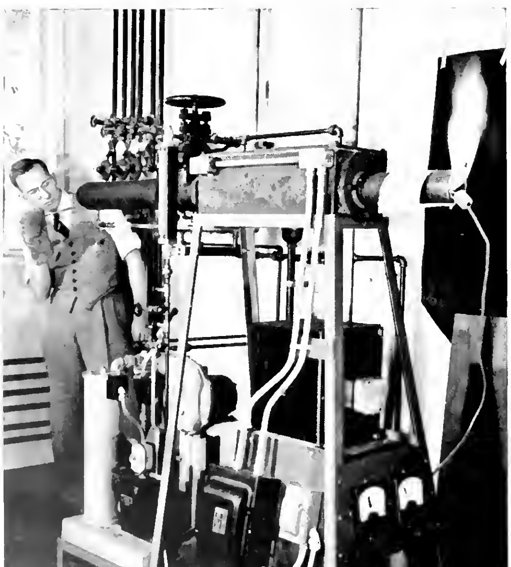
Mass Spectrometer

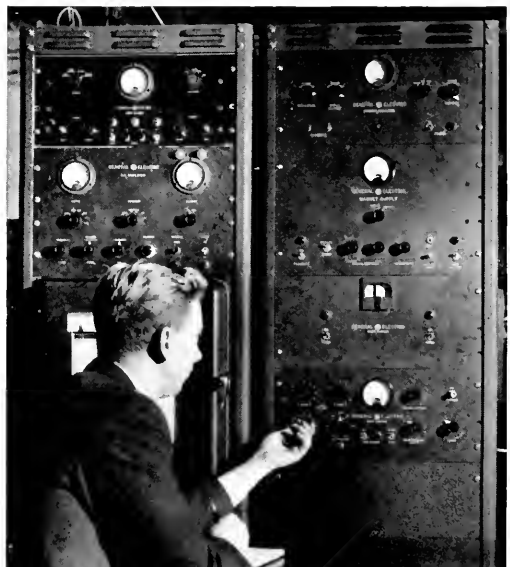
The general Electric company has developed a variation of the mass spectrometer to make gas analysis easier and more accurate.

The new machine will seek out and record traces of a gas even if it be present in as small a quantity as one part in 100,000 parts of other gases.

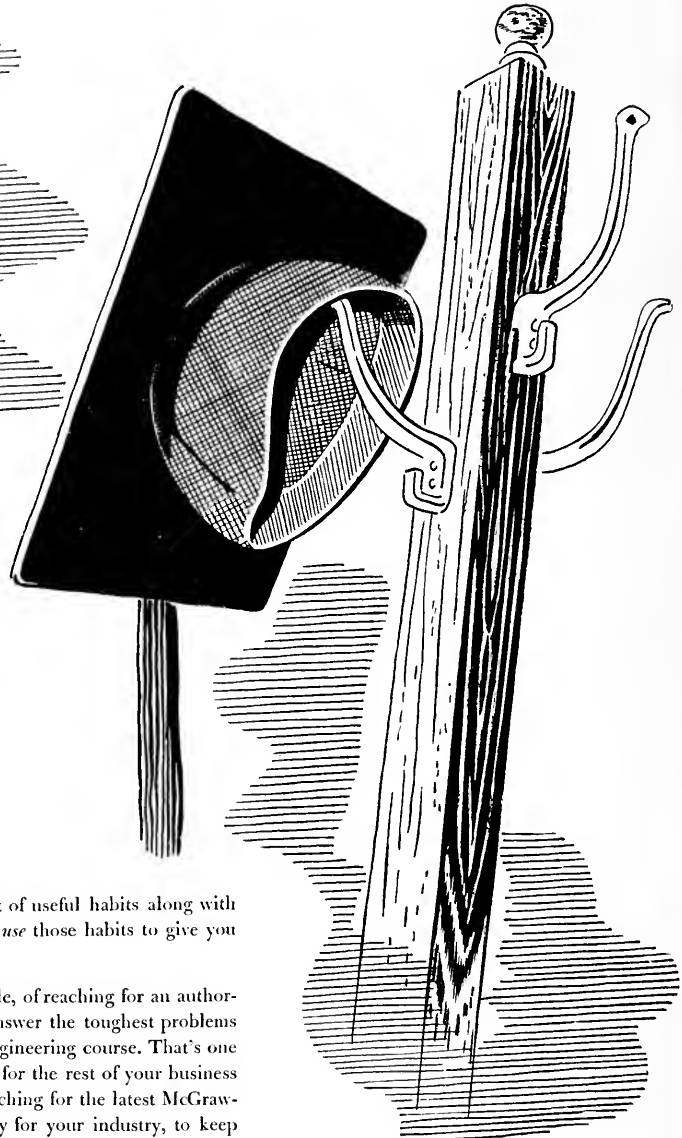
To quote its creator: "For hydrocarbon analysis of synthetic rubber, gasoline, and other petroleum products, the analytical mass spectrometer requires but one-tenth the time needed by ordinary methods of chemical analysis." These were the words of Mr. C. M. Foust, the engineer in charge of developing the new machine. It seems that he is not stretching the point if one can remember the time spent in a chemical laboratory in search of just one element.

The new machine is constructed so that an inexperienced and untrained person can operate it after an original analysis has been made by a technically trained supervisor.





A glass blowing machine is on the left. On the right is a mass spectrometer used in gas analysis.



Published Eight Times Yearly by the Students of the College of Engineering, University of Illinois

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The Illinois Technograph

Volume 63 — **Number 8**

The Tech Presents

ARTICLES

DEPARTMENTS

OUR COVER

This recent picture of Engineering Hall shows the new, improved landscaping, just after the job was completed. (Photo by Russ Sanden)

FRONTISPIECE

Molten iron, produced in Inland blast furnaces, is being poured into an open hearth furnace.

Opportunities in Mining Engineering

By George Clark
Assistant Professor of Mining Engineering

Today, more than at any other time in the history of the profession, there is great need for more technically trained men of high caliber in mining engineering. If you feel that your capabilities and desires equip you to work in any of the branches of mining described below, you would do yourself and the mining industry a service by investigating the possibility of entering this very essential branch of engineering.

Before describing the various careers in mining we might discuss some of the fallacies concerning the dangers connected with underground mining, particularly underground coal mining. A recent issue of Mechanization carried an article which showed that there were 1.3 fatalities per million man-hours worked in coal mines in one year. During that same period the rate for persons riding in automobiles was 1.0 fatalities per million man-hours of riding time. It is only slightly more dangerous for a man to work day after day in a coal mine than it is for you or me to drive day after day in an automobile.

Several branches of mining offer extensive opportunities to graduate engineers. They might well be divided into the following categories.

Coal Mining

Coal is one of the most important of our natural resources. Its production has a profound effect upon the national economy. Though some might be inclined to steer clear of mining due to its slightly higher accident rate, to the clear-thinking person it offers a challenge. The relatively greater number of hazards which are present in this most vital of industries show clearly the great need for research into the cause and prevention of accidents. Most of the factors which cause explosions are already known. It has been well established that mixtures of methane (the explosive gas found in some coal mines) and air are explosive only in certain well defined ratios; what is needed is to apply the knowledge that we possess. Contrary to a common belief, however, explosions cause only a small part of the total accidents which occur each year. "Fall of roof and face" are responsible for three to four times as many fatalities as explosions. Here, too, is an acute problem that will require real energy, initiative and ingenuity to solve.

An interesting sidelight is the puzzle of appraising the human element in any formula for safety in underground production of coal. Can you solve it?

Salaries for graduate engineers in coal mining vary at present from about $250 to $350 per month. The University of Illinois has not been able to fill even a small part of the requests that have been made for mining engineers in this field since the war.

Metallics and Non-Metallics

Within a radius of 500 miles of the University we find a large number of this type of mines. Many of them have engineering and operating problems which, like a number in coal mining, have not been satisfactorily solved. In the mines of a large Missouri company we find an excellent example: The mining of flat, underground, bedded deposits of lead ore has required the leaving of large pillars of ore to support the roof of the excavations. There are many millions of pounds of valuable lead in the pillars of these mines. Yet it is impossible at the present time to know which pillars may be extracted, how many may be removed with safety, and how long the remainder will support the roof. Here is a challenge to the alert engineer.

There is also the very urgent problem of finding new ore bodies. Many of our vital reserves of metals and non-metals are becoming depleted at an alarming rate. No completely satisfactory method has yet been devised to "see" into the earth in order to locate new ore bodies. Geophysical prospecting in its present stage is only a minor part of the answer to the problem. It needs much more development.

Research

Mining has been perhaps one of the slowest of all industries in developing and applying scientific principles to its use. Consequently, many of the broad fields of research have just been scratched on the surface. We have a tremendous amount yet to learn about explosives, the physical properties of rocks, the reason for "rock bursts" in some mines and, as mentioned above, safety problems in underground coal mining. There are many others; these will serve to illustrate.

The U. S. Bureau of Mines offers good starting salaries for junior engineers. Many universities, including our own, have openings for part-time assistants in research. The new Illinois State Department of Mines and Minerals Analytical laboratory in the Mining laboratory building on our campus is directly concerned with analytical work which employs results of extensive research done by the U. S. Bureau of Mines and other agencies.

Teaching

Closely akin to research is the teaching of principles of mining engineering. Instructors in this profession are in very high demand. Opportunities for graduates vary from part-time assistantships to full-time instructorships. Salaries for beginning instructors range from $3,000 and up for nine to ten months of teaching at various mining schools in this country.

Here is a field with a great need for technically trained men—mining engineering. As described in this article, there are great opportunities for accomplishing worthwhile things and getting ahead in the mining industry.

Salaries for part time, which permits work toward advanced degrees, are $1,200 at the University of Illinois. Scholarships of $200 per year are offered for undergraduates and $750 per year for graduate students by the Department of Mining and Metallurgical Engineering on our campus.

For those students, then, who have not definitely decided which branch of engineering they want, mining offers many advantages. The state, the nation, and the world needs mining engineers. Production, consulting, teaching, research—all have openings for trained men. Pay is good. Initiative is rewarded. Professional advancement and a satisfying career await those men who like to face the challenge and stimulus of practical problems.

Industrial Sightseeing . . . *Inland Steel Co.*

By Sam Jefferies, E.E. '48

Steel making is one of the largest industries in the world and probably the most important manufacturing process ever created. Without steel in the vast quantities in which it is produced, modern civilization would not have been built. Few, if any, modern industries could exist without steel. Yet, despite its importance, steel is the world's cheapest metal. You can buy finished steel for about three cents a pound.

In 1947 the American steel industry produced over 84,000,000 tons. That is more than all of the rest of the nations of the world produce even in normal times. It is estimated that more than a billion tons of steel are currently in use in the United States. That amounts to about 17,500 pounds for every man, woman and child in the country—nearly seven times as much as in 1900.

The Inland Steel company started business in 1893 as a re-rolling mill for steel rails. Since then the company has continued to expand, and today it is the seventh largest steel producer in the country and a prime supplier of steel for the Midwest. In the first year of its operation, the company produced 6,000 tons of steel. By 1910 it was producing 300,000 tons of steel a year; and by 1947, 3,300,000 tons a year. The operations of the concern have been expanded to include iron ore mines, coal mines, fluorespar mines, limestone quarries, and a fleet of boats. The company strengthened its marketing position by acquiring the Milcor Steel company (now called the Inland Steel Products company), the Wilson and Bennett Manufacturing company (now known as Inland Steel Container company) and Joseph T. Ryerson and Son, Inc., the largest steel jobber in the country. There are 22,000 men and women working with this concern and its subsidiaries.

The history of this company shows a policy of careful planning and expansion with new and modern equipment. Particular emphasis is placed on metallurgical research and continuous improvement in steel making and processing methods.

Production

Principal raw materials used in steel making are iron ore, coal, and limestone. A large portion of these raw materials is carried from the subsidiary mines and quarries by the company's lake vessels. The steelmaking plant is located at Indiana Harbor at the southern tip of Lake Michigan. This location offers cheap transportation of raw materials and a central location in the middle western market for steel products.

The size of a steel plant is tremendous. Even with careful planning and

Another in the series on job opportunities for engineering graduates in nearby industries, this article tells about the Inland Steel company, located at the southern tip of Lake Michigan. Steel is a vital part of our civilization, and hence production facilities are constantly being expanded. Emphasis is placed on research and continuous improvement.

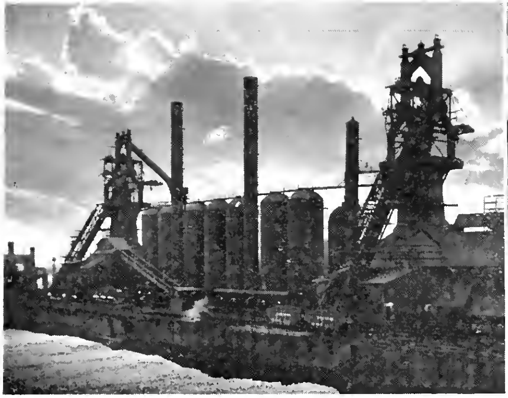
economic utilization of space, the blast furnaces, coke ovens, open hearths, and rolling mills of the Indiana Harbor plant occupy an area of 630 acres. A complete railroad system with over 150 miles of track and 45 locomotives is required just for operations within the plant. Every month about 18,500 railroad cars move into or out of the plant.

The eight blast furnaces and 36 open hearth furnaces of this plant operate 24 hours a day, turning out thousands of tons of high quality steel. The plant is so well integrated that molten iron from the blast furnaces may be processed through the open hearths and the rolling mills without ever cooling. Cold rolling mills which put special temper and finish on the steel operate almost continuously to supply the tremendous middle western demand for cold rolled steel products. At every step in the steelmaking and rolling operations metallurgical laboratories maintain a continuous check on the quality of the steel. The specifications for steel are so rigid that if housewives had to make cakes with the same relative care which the steelmen must use, they would have to measure the ingredients of their cakes not by teaspoonfulls, but by ten-thousandths of an ounce. In addition to maintaining careful control over the quality of steel, the metallurgical laboratories are continuously searching for and producing better steel and steelmaking processes.

Almost all of this steel is produced for middle western customers. Sheet steel goes into automobiles, refrigerators, washing machines, and thousands of other manufactured items. The company produces large quantities of both electrolytic and hot dipped tin plate for manufacturers of tin cans. Large tonnages of bars, structural shapes, sheet piling, reinforcing bars, and floor plates are sold to the construction industry. This company is one of the major suppliers of heavy steel rails for American railroads. The metallurgists have developed many new alloys to meet special maching, drawing, and other technical problems of customers.

A portion of the steel produced goes to the subsidiaries. The Inland Steel Products company manufactures a wide variety of sheet metal products in its plants in Milwaukee, Cleveland, and Baltimore. These products are used in the building industry, and include such items as expanded metal lath, interior metal trim, steel roofing, and ventilators. This subsidiary also makes such products as furnace pipes and fittings, stove pipe, and airtight wood-burning heaters. The Inland Steel Container company, with plants in Chicago, Jersey City, and New Orleans, makes steel pails and drums in all sizes and shapes

A steel sample is being given an impact test in the laboratory.



On the left is seen two of Inland's eight blast furnaces. Right: Inland's fleet of ore boats haul raw materials to the Indiana Harbor works from the company-owned mining and quarrying operations in the Great Lakes area.

and for all purposes. Joseph T. Ryerson and Son, Inc., the company's largest subsidiary and America's largest steel jobber, handles thousands of sizes, shapes, and descriptions of steel in its many warehouses located throughout the United States. The Inland Lime and Stone company produces metallurgical stone for companies in the steel industry and provides a considerable quantity of sized and crushed stone for construction and agricultural purposes.

Industrial Relations

Industrial relations policies have always been advanced and far-sighted. Throughout the years great emphasis has been placed on the individual worker, his right of self-determination, and his right to get ahead. Union membership has always been a matter of free choice for the individual worker. About 50 per cent of the employes in the company and its subsidiaries are members of unions. The company deals with 10 unions and 26 bargaining units in its various operations. For the most part labor relations are peaceful, but the company has never been willing to give way to coercion in the face of unsound or unreasonable demands. Job evaluation plans have been installed in many operations with considerable success. Such job evaluation programs are aimed in establishing wage rates on every job which are fair and correct in relation to every other job. The average pay for this company's steelworkers for 1947 was $1.64 per hour. Wage earners in the steel industry as a whole made an average of $1.51 per hour during 1947 and workers in all manufacturing industries as a whole received an average of only $1.22 an hour. Incentives for extra production are provided on all jobs whenever possible so that extra effort and initiative will be rewarded with extra pay.

Personnel policies have always been progressive. For example, as long ago as 1919 this company pioneered the eight-hour day in the steel industry. Vacations with pay have long been a tradition at Inland. All employes with at least one year of service are entitled to a vacation with pay. The company has one of the most complete low cost group insurance plans in American industry. In 1947 about 91 per cent of all eligible employes subscribed to the plan. The company pays part of the cost of this insurance. The insurance plan covers life, accidental death and dismemberment, accident and sickness, hospital expense insurance, and surgical benefits for employes and their dependents.

Retirement income is important to employes because many of those who come into the steel business as young men find steady jobs and lifetime careers in the industry. The retirement plan is on a voluntary basis with both the company and the individual employe contributing to the retirement fund.

The company is particularly proud of its medical and health program, and demonstrates that it is one of the finest in American industry. This program provides for physical examinations, consultation service, health education, health information, and medical research. In addition, the Department of Industrial Hygiene spends its full time searching for and correcting health hazards on every job and in every corner of the plants. The safety department dates back to 1911. According to accident statistics, employes are twice as safe inside the plant gates as they are in their own homes.

Employment has always been stable, in good times and bad. This has been true primarily because this company is a prosperous and efficient steel producer. The company is strong financially and turns in a healthy profit from its large volume of sales.

Opportunities for young men for careers in steel-making are excellent. This is true both for engineers and non-engineers. Because of the nature of the business, there are many opportunities for men with technical training. More opportunities are available today than at any time in the past. The company today has a backlog shortage of technically trained young men because of expansion during the war and the fact that sufficient trained engineers were not available.

Training Programs

There are currently a number of training programs which are designed for graduate engineers or men with similar technical training. Graduate training programs are divided into four major groups. There is a program for those interested in sales, one for those interested in mill operation, and another for those interested in general administration. Each training program extends over a period of nine months.

For men who are interested in steelmaking, the metallurgical department has set up a rather elaborate program in which trainees have an opportunity to observe and work under expert guidance in the various divisions of the steel plant and the metallurgical department. At the end of his training period the trainee has the opportunity to go into either research work or into control work in the various operating departments. Trainees who go into control

(Continued on page 24)

Production of . . .

THE ILLINOIS TECHNOGRAPH

By George Ricker, Aero.E. '49 and Sam Jefferies, E.E. '48

Photos by Jack Stumpf, M.E. '50

Ever wonder what had to be done in order to publish a magazine. This article will give you a clear-cut picture of how the Technograph is put together each month, from the day the assignments are made to the day the finished magazine reaches the readers' hands.

This article, like all other articles in this magazine, was in its first stage of preparation twelve weeks ago. Since then, it has seen all the different phases of editing by students; composition of the complete magazine from the articles, short items, illustrations, and advertisements; printing by the Illini Publishing company; and distribution by the business staff, composed entirely of students. In fact, that is what this article is about — its own preparation.

The Technograph staff is composed of engineering students who are interested in writing and editing or in the business procedures of publishing and distributing a magazine. These activities are an absorbing hobby to the student, and the student gains valuable experience by his participation.

The preparation and writing of an article, and the development to its final form are the duties of the editorial staff, which is directed by the editor. The editor and the assistant editors decide upon the articles and illustrations which will appear in each issue.

After the articles and illustrations for the issue have been chosen, the assistant editors make the assignments to the reporters. Usually one or sometimes two reporters are assigned to a feature or department, and generally have about four weeks to meet the deadline.

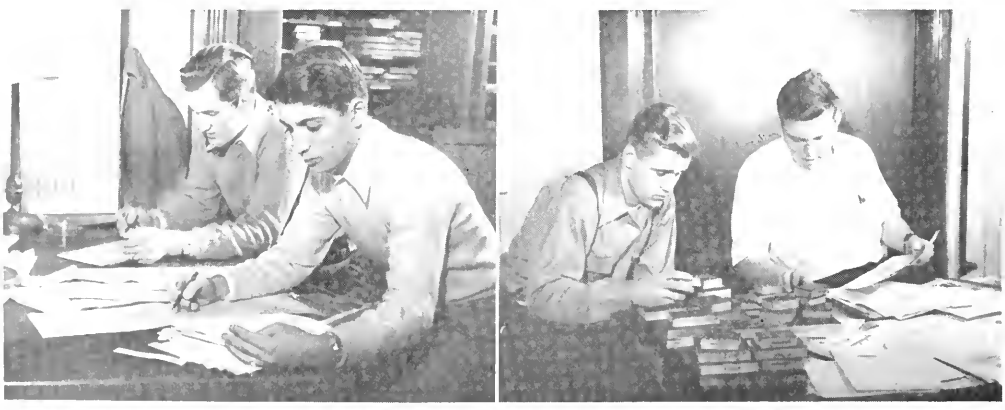
For the initial preparation the reporter determines the scope of his subject and gathers general information. He then makes a rough outline of the subject and selects the material that will be covered. He investigates all sources of information. The business of getting first-hand and up-to-date news on the subject is an interesting part of the reporter's work. This includes interviewing, investigation, and obtaining contemporary literature on the subject. All this work is preliminary to the actual writing of the article.

While the reporters are gathering information and writing the articles, the make-up editor determines the types of pictures to accommodate the articles and makes assignments to the staff of photographers. The photographers have the job of getting pictures that are not only technically illustrative, but that also show good photographic composition. Photography is an art in itself, and is a hobby to these men. Certain types of pictures, like commercial products, are obtained directly from their source. The make-up editor must meet the same deadline as the reporters.

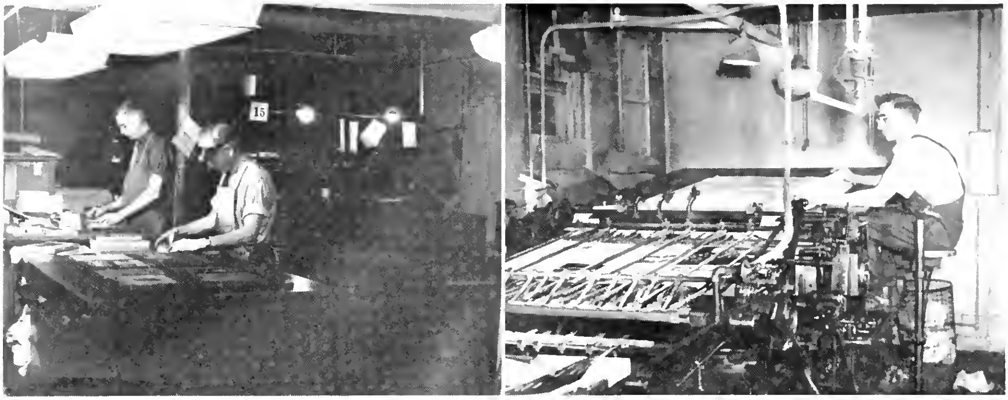
After all copy has been turned into the office by the reporters, the articles are edited. They are reviewed and revised, and necessary changes are made to improve the form and composition and to conform to the particular style used by the magazine. Each assistant editor checks over the material turned in by the reporters under his supervision, and the editor then reviews all the copy. The edited copy is then taken by the editor to the Illini Publishing company for processing.

At the same time that the copy is being edited in the office of the Technograph, the make-up editor and the editor are marking up the illustrations for size. These photographs are then taken to G. R. Grubb and Company to be engraved. The production of a metal plate suitable for printing the varying tones of a photograph is an interesting process.

The first step in engraving is the production of a "half-tone" negative. The illustration is "shot" through a half-tone screen by taking a photograph of the illustration with a half-tone screen



Staff members performing a few of the many small tasks necessary to put out the magazine. Left: Herb Jacobson and Ed Witort work together to check galley proof against the original copy for typographical errors. Right: Dick Leek sorts advertising cuts while George Kvitek checks advertising page proof.



In the basement of Illini Hall. Left: Two printers, Ralph Broderick and Clyde Hall assemble the body type, headlines, and cuts into page forms. Right: The printing press in action, operated by Leo Klackner. At this stage, the magazine is near completion. After the press run the sheets are cut and bound into magazine form and are then ready to be mailed.

placed upon the negative. The half-tone screen consists of two plates of glass, each striated by a diamond cutter, placed one upon the other so that the unit is cross-hatched. The striations are very fine grooves which are filled with a black pigment. The half-tone screens used in making plates for this magazine have 120 grooves to the inch, and therefore 120 times 120 squares to the square inch. When the light from the picture passes through this screen to the negative in the camera, the light is refracted so that the square is reduced in size on the negative. These squares on the negative are larger for greater intensity of light, which corresponds to a lighter tone of gray. The resultant negative of minute squares is called a half-tone negative.

The half-tone negative is next printed onto a metal plate covered with a photosensitive enamel. This plate is developed, and a half-tone print of enamel is left on the metal. The plate is now etched, so that the parts not coated with enamel become the depressed portion of the engraved plate, or cut. The metal plate from which the cut is made is usually a zinc or copper plate, and brass is sometimes used to produce a tough plate. Copper is etched with hydrochloric acid, zinc is etched with perchloride of iron, and brass is usually electrically etched. From G. R. Grubb's finishing department the cuts go to the Illini Publishing company.

The Illini Publishing company is a non-profit organization which was established in 1911 to print and distribute The Daily Illini and other student publications of the University of Illinois, and to do a general printing and publication business. All proceeds from the business of this non-profit organization go back into the reserves of the company and are used to further improve the publications. This company is subject to the general authority of the president of the University. The Technograph, The Daily Illini, the Illio, the Agriculturist and the Tempo are all published by the Illini Publishing company.

At this point, the edited copy is ready to be marked up in the printing shop of the Illini Publishing company. In the margins of the copy are marked the type face, size of type, and measure of the width of the column to guide the setting of the copy by the operator of the line casting machine. The line casting machines used by the Illini Publishing company are Intertypes.

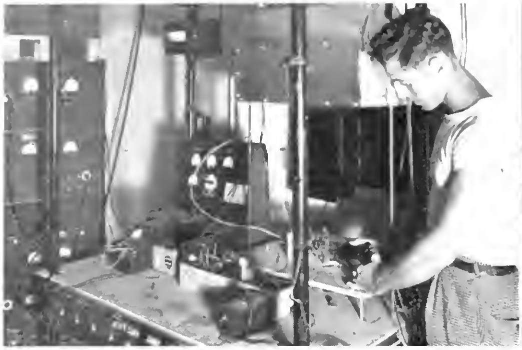
There are two main steps in composition, or setting copy. The first is the line casting on the Intertype. When the operator presses a key on the keyboard of the Intertype, a mold for casting a letter, called a matrix or "mat," is released and drops into line. The type metal, which is a mixture of zinc, tin, lead, copper, and antimony, is kept in a molten state, ready to be cast into a line of type, or slug. When a line of mats is ready for the casting of the slug, the molten type metal is forced against the mats and into the depressed letters in the face of the mats. When it cools, a line of type, or slug, is ejected from the machine. The second step in setting copy is the assembling of the slugs into columns of type. Such a column of type is called a galley.

Proofs must now be pulled from the galleys on a proof press. To do this the galley of type is placed on the proof press, the type is inked, the paper placed directly on the type, and a roller moved over the paper. Two proofs of each galley are pulled and sent to the Technograph office for correction and for making up the magazine dummy.

One copy of each galley proof is checked and corrected first by a member of the editorial staff, then by an assistant editor, and then by the editor. This proof reading requires approximately three days after which the proofs are sent back to the typesetter for correction. At the same time, the other set of galley proofs is being used to make up the magazine dummy. The dummy is a rough assembly of the entire magazine, formed by cutting parts from the galley proofs and pasting them along with the illustrations and headlines on the pages of an old magazine. This work, which requires approximately a week, is done by the make-up editor, assisted by the editor. The completed dummy is then turned over to the printer for make-up of the pages of type.

After the typesetter has corrected the galleys, and the headlines have been set either on a Ludlow line casting machine or by hand, the printer assembles the body type, headlines, and cuts (engraved illustrations) into page forms, according to the pages of the magazine dummy. In the printing shop this operation is called make-up. One proof of each page is then pulled and returned to the Technograph office for correction. These proofs are checked and corrected first by the editorial staff and then by the editor assisted by the make-up editor, and are then returned to the printing shop. In the printing shop, corrections are made on the page by substitution and by resetting type. The pages are then locked up in forms, or chases, of eight pages each, constituting what is known as a printing signature. There are forty-four pages in this mag-

(Continued on page 34)



Left: This research man is evacuating a klystron tube. The pressure inside the tube will be about .001 mm. of mercury when he is finished. Right: Inside view of the circuit laboratory. Note modernistic ceiling lights and orderly arrangement of apparatus.

New Vacuum Tube Laboratory

By Phil Doll, M.E. '49

The vacuum tube research group of the department of electrical engineering has moved into the new laboratories which have recently been completed. The new laboratories occupy 4,800 square feet in the south wing of the present Electrical Engineering laboratory, supplemented by 4,000 square feet below the main rooms. Completed at a cost of $142,000, the facilities are among the best in the United States.

Research in vacuum tubes is an important part of the University's $500,000-a-year electrical engineering investigation program. Present sponsorship includes nine contracts with the Army, three with the Navy, two commercial ones, and three projects sponsored by the Graduate school. In addition, five new Army contracts are pending.

Working conditions in the larobatory are excellent. Half the main tube area is air conditioned, and the entire laboratory is flourescent-lighted. The flourescent tubes are sunk into long ceiling trotters and the light is diffused through frosted glass. The air conditioning equipment includes a 30-ton air compressor complete with precipitron and humidity control. The walls of all the rooms are painted a restful green, and the floors covered with asphalt tile. Acoustical ceiling tile is used throughout. Exhaust hoods are located wherever necessary. An interesting feature of the tube assembly benches is the interchangeability of the tops. The tops are removable, so that different colored working surfaces may be used, depending on the job.

Familiar in radio and television sets, vacuum tubes also find many other important uses. They are vital parts of telephone systems and radar, and are used in airplane navigation. Vacuum tubes are finding increasing utility in the operation of machine tools as well as in the transmission of electrical power.

The recently completed vacuum tube research laboratory here is among the best in the United States. In this article are described the scope of its work and some of its new and unusual facilities.

The author wishes to thank Dr. H. L. Van Velzer for his help in preparing this article.

The trend of developments in the field of vacuum tubes has been toward higher and higher frequencies, through short waves, high frequency, very high frequency, ultra-high frequency, micro-waves, and centimeter waves. The most important types of micro-wave tubes, the klystron, magnetron, and the traveling-wave tube, are now under investigation. Each is represented by a project in the vacuum tube laboratories. It is to the development of new tube types that the work of the laboratory is specifically directed. Most of the work which is being done in the field of vacuum tube research is in the design of circuits for their operation rather than the design of new tube types, as is done here.

Precision work is a necessity, both in forming and assembling the parts, which may be as small as a match head or as large as a half-dollar. The thousands of items of materials and equipment include a great variety—metals from fine wire to four-inch billets, special glasses, chemicals, machine tools, and costly testing apparatus.

Different operations are segregated into different rooms to avoid confusion and interference. Located next to the director's office, near the entrance, is the grinding room. It is farthest from the clean air conditioned assembly and glass-blowing rooms because of the metal dust produced in grinding. The machines include a power saw, universal grinder, and surface grinder.

Next to the grinding room is the parts preparation room. Precision lathes, milling machines, shapers, drill presses, and an hydraulic press are used here. The machines are of all sizes, from a big toolroom lathe to a tiny watchmaker's lathe which could be put in a coat pocket.

Several interesting methods of stamping and forming sheet metal parts are used with the hydraulic press, which has a 20-ton capacity. The form of the part to be made, say a shallow cup, is first machined in a block of brass or steel. On the block is built a sandwich —first, the sheet metal to be formed, then a thick sheet of rubber, and lastly, a second block of metal. The sandwich is then placed in the press, and pressure is applied to make the metal sheet conform to the shape in the metal block. This method eliminates expensive, hardened dies.

Another process employing the hydraulic press is used with soft materials like copper, where sections are to be made up with odd, often intricately shaped, holes. A stem of hardened steel having the shape of the required hole is pressed into the copper block. After removal of the stem, sections of the block may be sliced off to any desired thickness.

The next room, the heat-treating room, contains several furnaces. Some of these furnaces are used for hardening such tools as steel punches and dies. The hydrogen furnace is the largest; in its interior an atmosphere of hydrogen is maintained. Parts are placed inside and heated to bright redness by globar elements; the hydrogen reduces the oxides and the parts emerge clean and bright. When used for brazing with silver solders, no flux is necessary.

Beyond the heat treating room is the cleaning room. Here all traces of grease are removed by exposing the tube parts to boiling cleaning fluid. In addition to the de-greaser, facilities are provided for electroplating tube parts and other objects with copper, silver, gold, or chromium as may be required. Electroplating techniques may be extended to electroforming, the building up of metal tube parts and waveguide junctions, making possible a high degree of accuracy.

In the coating room special coatings of oxides are applied to cathodes to increase the electron emission. The oxides are powdered in ball mills(rotating jars containing marbles), mixed with liquid binder, and sprayed on to the surface like paint with an air gun. The thickness of the coating is controlled by means of sensitive balances. Traces of impurities will ruin the properties of the coating; an air conditioned atmosphere is essential.

The assembly room and glass-working room are located in the heart of the air conditioned region. Here the tube parts are put together. Metal parts which have been formed, cleaned, and plated or coated are joined to each other, to glass, or ceramic. The metal to which the glass is to be joined is first carefully heated to give a coating of oxide around the contact area. This oxide must be of just the right thickness to diffuse into the glass when the two are heated and brought together. The metal and glass are sealed together by the diffusion of the oxide.

In the assembly room small brazing operations are performed in a hydrogen-filled glass bell. The parts are clamped together and heat is supplied by an induction coil.

A small precision spot-welder is also used. Two pieces to be joined are placed together between two pencil-like metal jaws. A surge of accurately controlled current heats the parts, which are forced together by the pressure of the jaws. The tiny parts are inspected in an optical comparator. Two micrometer heads permit accurate measurement of size and alignment.

Eight different kinds of glass are stocked, as well as a great variety of glass tubing sizes. Each tube is carefully marked with a label for identification. Joining two different kinds of glass together will result in breakage upon cooling, due to different coefficients of expansion. In assembling the parts, metal and glass of similar coefficients of expansion are joined, reducing the stresses set up by temperature variations.

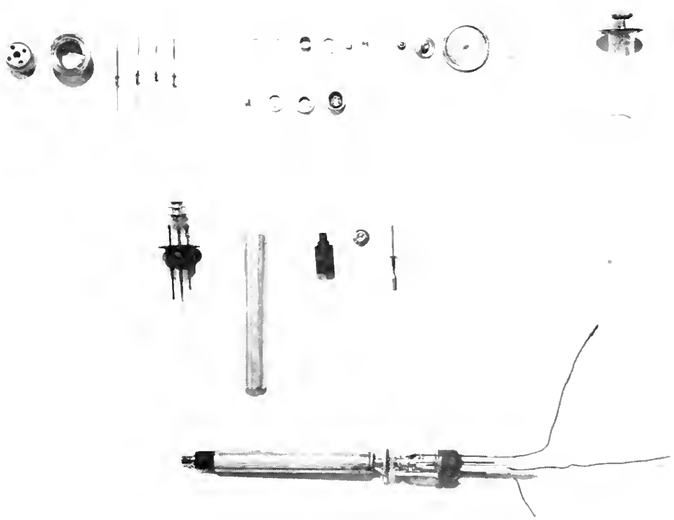
The glass-working room is equipped for both hand and machine fabrication of glass parts. Intricate shapes, requiring a lot of skill and patience, are made here. Glass lathes are used whenever possible for working glass or joining two pieces of tubing. One piece is held in a chuck or wooden collet in the headstock, and the other is similarly held in the tailstock. Both headstock and tailstock spindles revolve at the same speed; the tubing is heated at the proper sections by a set of movable gas jets. When the ends of the two tubes are hot, the tailstock tube is moved up and joined with the headstock tube. Blowing may be done by compressed air introduced through a hollow spindle, and the work may be pushed to shape by paddles. The type of flame, area heated, and the air pressure are controlled by levers, knobs, and foot-pedals.

When the glass parts cool, stresses are set up. The stress distribution is studied by means of polarized light, under which the stress distribution shows up as vivid bands of color. The bands are examined to determine the magnitude of the stresses.

Emerging from the assembly and glass-working rooms, the vacuum tubes must still be evacuated. In the pump room, a vacuum of .000001 mm. of mercury is produced, which leaves only one out of every ten billion air molecules in the tube. During the evacuation, the glass is heated almost to its softening temperature, and the metal parts are heated by an induction furnace to an even higher temperature; this brings out any gas molecules hidden in the pores of the material. Most of the air, down to about .001 mm. of mercury, is removed by a rotary vacuum pump. Beyond this, a diffusion pump is operated with the rotary pump. After the tube has been sealed and cooled, other operations are necessary to activate the sprayed cathode.

The result of all these operations, the finished tube, is now sent to the testing laboratory. Here the experimental

(Continued on page 26)



A detailed view of the numerous parts needed to assemble a K-1 klystron.

Undercover at... GALESBURG

ENGINEERING PROJECTS

By Robert Jackman, E.P. '50

Because this is the first issue in which the Galesburg Division of the University is formally represented, and the final issue for this school year, we hope that these pages will help to familiarize the Technograph reader with some of the engineering activities going on here, and with a few of the people that make these activities possible.

During the early weeks of this semester the Division of Engineering Sciences, headed by Prof. F. W. Trezise, sponsored two important programs.

The first was the Home Planning Institute, which lasted from February 10 to March 6, and consisted of six lectures on the various phases of home building and planning. The speakers were from the Small Homes Council of the University of Illinois, and created so much interest that over 450 people from the campus and the city of Galesburg attended the final lecture.

The second project was the formation of the Engineering Council made up of members of the faculty and prominent engineering students. The purpose of the council is to bring about closer understanding among the students and faculty, to stimulate the interest of the engineering student in all engineering activities on the campus; and to sponsor activities of a professional and social nature. Plans are being made to provide students with periodic movies and talks on various phases of engineering, conduct field trips to seevral industrial plants in Illinois, and maintain an engineering lounge supplied with current publications. When this council begins to function, it will become a great asset to the engineering student, so we of the Technograph staff want to wish them the best of luck in their enterprise.

Next September many of the engineering programs that are now on the drafting board will be put into operation and should provide a source of interesting articles. We hope that the reader will find this to be true.

THE TECHNOGRAPH STAFF

By Ray Johnson, C.E. '51

A good example of the cooperation and interest shown by the students of engineering and their faculty is the formation of the Technograph staff here at Galesburg. Shortly before the close of last semester, a group of students selected by the faculty, met to discuss the formation of the Galesburg staff.

EDITORIAL STAFF

Robert W. Jackman, Asst. Editor

Reporting

Luther Peterson, Elmer Lochow
Dean R. Felton, Edward A. Brooks
Stanley Runyon, Homer Kipling
H. Roy Johnson

Photography

Herbert Moore, John L. Mize

BUSINESS STAFF

Billy E. Marr, ...Assistant Manager
Carol Johnson, Jack Parlier
Ted Boblak, Dwight R. Beard
Larry Green, Bill Carr
Daryl B. Gaumer

Eighteen of these students showed active interest, and although this number exceeded the requirements, they were retained to serve as a nucleus for future engineering activities. Because space does not permit an introduction of each member, a discussion of each division of the staff will be made.

The editorial staff is headed by Robert W. Jackman, who has contributed much of his spare time in organizing the staff and aiding in the preparation of articles submitted thus far. He was a member of the Army Air Forces for two years and was active overseas in the formation of the German Youth Activities program. Another phase of his work in the ETO was the preparation of base histories which has aided him in his journalistic attempts here at Galesburg. The staff is presently engaged in interviewing the engineering faculty and prominent students whose personal experiences are of particular interest to the engineer. It is also interested in the activities of the newly created Engineering Council and will report on their progress in future issues.

The first function of the business staff was the selling of subscriptions during registration. Under the leadership of the assistant business manager, Billy E. Marr, the drive was a complete success. Bill, who served with the Army in Manila, has proven to be competent in this position, and with the assistance of his staff, also assumes the responsibility of publicizing the magazine on this campus.

We would like to take this opportunity to thank George R. Foster and Robert A. Johnson for their valuable assistance in eliminating many of the problems that confronted us in our first stages of organization. We would also like to thank our sponsor, Mr. Omar C. Estes, and Professor Trezise for their

Standing left to right: Stanley Runyon, Bayard L. Wright, William J. Carr, Billy E. Marr, Daryl Gaumer, Dean R. Felton, Lowell J. Green, Jack Parlier, Luther S. Peterson, Herbert Moore, Dwight R. Beard, and Ted Boblak. Sitting, left to right: H. Roy Johnson, Elmer Lochow, Carol Johnson, Edward A. Brooks, Homer Kipling, and Robert W. Jackman. Not present is John L. Mize.

efforts in obtaining our offices and other facilities that we now enjoy.

It is the sincere hope of the Technograph staff that the articles appearing on these pages and in future issues will be acceptable to the reader and that we may continue to serve as a regular part of the Illinois Technograph.

INTRODUCING . . .

PROF. FREDRICK W. TREZISE

By Dean Felton, C.E. '51 and Luther Peterson, E.E. '51

Probably one of the most outstanding impressions one gets when visiting the Galesburg Division is the close relationship existing between the students and faculty. This is especially true in the division of engineering sciences, where its chairman, Professor F. W. Trezise, has, since his arrival here in September, 1947, gained the respect of the engineering students, not only as a capable instructor and practical engineer, but also as a good friend and counselor.

Mr. Trezise's career in engineering may be compared to a novel by Jack London, for his travels have taken him across the North American continent from Mexico to the Arctic Circle. His study of engineering began at Michigan State College where he received a B.S. in civil engineering and later the professional C.E. degree. He also obtained an M.S. degree at the University of Wisconsin, majoring in hydraulics and business administration, and in 1919 he attended the University of Bonne, Germany. His interests in education led him to Lawrence College, where he taught for 15 years. During this time he supervised construction of a number of concrete mill buildings and obtained material as basis for a thesis on "Unit Costs and Time Labor Units."

PROF. FREDERICK W. TREZISE

Also while at Lawrence, Mr. Trezise gained a practical knowledge of engineering geology by investigating and tracing mineral claims in the Black Hills region of South Daokta and Wyoming. His other investigations of mineral deposits included work in the Sierra Madre Mountains of Mexico, and in the Great Bear Lake region beyond the Arctic Circle where lies one of our largest sources of uranium-yielding pitchblende.

Perhaps the engineering project with which Mr. Trezise is most commonly associated is the Tennessee Valley Authority. In 1936, along with a number of other hydraulic engineers, he was appointed to set up preliminary plans and make investigations of flood control factors in the construction of the various dams in the Tennessee River Basin. He spent four summers and one year's leave of absence from Lawrence College on this work. When the war broke out, and the TVA was called upon for more power, Mr. Trezise was offered the position of personnel officer for all management services at Knoxville, Tennessee. The pressure of the emergency raised the employment to over 42,000 and the agency was soon on a 24-hour basis. All available man power was put

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In This Corner... NAVY PIER

PIER CLOSE-UPS

By Richard Choronzy, M.E. '51

NAOMI SIDNEY SULOWAY

It is seldom that you find a girl enrolled in the engineering college. Our newly appointed assistant business manager is one of only ten girls enjoying that unique position here at Navy Pier. She is Naomi Sidney Suloway, better known to her friends as "Sully."

"Sully" was born on October 24, 1927. From the beginning, she took an interest in anything that pertained to flying. She began flying at the early age of 13, when she joined the Civil Air Patrol in 1941. For two years practically all of her time was occupied with high school and flying. Finally, deciding that she was more interested in the latter, she left high school at the age of 15.

She went to work during the war at Wright Field, Dayton, Ohio. It was there that she began receiving the practical experience and knowledge of airplanes, which was wanted. Her position was that of an engineering aid. The various jobs "Sully" had were "taking planes up," testing hydraulic equipment, wind tunnel maintenance, and working mathematical computations. In short, she learned everything about aircraft from props to bolts. At Wright Field she also learned the essentials of mathematics, drawing, and physics.

NAOMI SULOWAY

After the war "Sully" decided to study aeronautical engineering. She crammed and studied day and night, and finally completed entrance examinations in every high school course in 15 months.

"Sully" entered Navy Pier in February, 1947, and is now the only girl enrolled in her chosen curriculum. As a means of better recognition, the ten girls in the engineering college, with the help of Mrs. Holladay, G.E.D. instructor, have formed the "Technae Illinae," a club for girl engineers at Navy Pier. "Sully" is pres-

(Continued on page 32)

The Engineering Honoraries and Societies

By Ray Hauser, Ch.E. '50, Almar Widiger, Ch.E. '48 and John Shurtleff, Ch.E. '50

SIGMA TAU

Sigma Tau held its first scheduled meeting of the spring semester on the evening of March 11, 1948, in the E. E. Illumination laboratory. Highlighting the business taken up was the distribution of keys and shingles to the new members. Sigma Tau is proud of its 41 new members, one of the largest groups ever initiated into the organization at one time.

After necessary business was completed the meeting was turned over to the program committee which presented two films of engineering interest, "Exploring with X-Rays," and "Diesels for Modern Power." The films were very interesting and were well received by all present. President Phil De Camp discussed some of the activities coming up during the rest of the semester before closing the meeting.

ETA KAPPA NU

A business meeting of the Electrical Engineering honorary, Eta Kappa Nu, was held in the Illini Union on March 24. It was decided to inaugurate periodic luncheon meetings for the purpose of promoting interest and closer contact between the members. There is a short, informal program at each meeting. The first of these luncheons was held on Thursday, April 8, in the University Y. M. C. A.

All faculty, graduate and student members of Eta Kappa Nu are urged to attend these functions which will be announced by notices on the bulletin board in the Electrical Engineering laboratory.

U. OF I. ELECTRONIC CLUB

New officers elected at the second meeting of the Electronics club were I. G. Evans, president; M. L. Embree, vice-president; and G. M. Boyd, secretary-treasurer.

The aim of the Electronics club is to provide technical practice, instruction, and facilities for students and faculty members of the University who are interested in electronics and allied fields. University facilities and equipment will be available for the use of members interested in construction of electronic equipment.

Meetings are held on alternate Saturdays in room 306 Electrical Engineering laboratory from 1 to 5 p. m. Meeting notices are posted on the bulletin board next to room 212. Interested students and faculty members are invited to attend the meetings of the club. Further information may be obtained from the secretary, G. M. Boyd, 1341-2 South Third street, Parade Ground Units, Champaign.

KERAMOS

Noteworthy event of this semester's activities by Keramos was the initiation banquet held at McKinley Y. M. C. A. on March 11. In a short but impressive ceremony Dr. Ralph Early Grim, petrographer, Illinois State Geological Survey, was made an honorary member of the fraternity. Initiated at this time were 13 undergraduate ceramic engineers: H. L. Anderson, E. K. Jensen, F. M. Maupin, J. F. Wuellner, R. N. Ames, R. S. Degenkolb, R. D. Fenity, J. E. Griffin, C. E. Janke, R. G. Kratt, Chun Lee, D. D. Rassner, and L. H. Schneider.

After the banquet the aforementioned Dr. Grim spoke on "Non-Ceramic Uses of Clays." President James F. Essenpreis closed the ceremony in a gay manner by leading the group in a medley of "Oskee - wow - wow," "Remember Pearl Harbor," and "Come on and Knock Me a Kiss."

A.I.E.E.-I.R.E.

The officers elected for the spring semester were O. R. Pomeroy, chairman; R. O. Duncan, vice-chairman; A. R. Jones, secretary; J. E. Farley, corresponding secretary for the I. R. E.; and D. D. Richardson, corresponding secretary for the A. I. E. E.

At the regular monthly meeting on February 26, Dean M. L. Enger spoke on "The Power Age," in which he gave the history of some of the early methods of producing power.

A special meeting was held March 8 at which Mr. Meacham of Bell laboratories gave a lecture and demonstration on pulse code modulation, the newest method for the transmission of intelligence. In fact, it is still in the development stage and the society was very fortunate in having Mr. Meacham, who is directing the development work, speak to them on the subject.

Mr. Brooks H. Short, director of research at the Delco-Remy division of General Motors spoke on "Recent Developments in Automotive Electrical Equipment" on March 12. He gave a brief summary of new electrical equipment to be expected on the new automobiles and explained why certain items, about which there have been rumors, will not appear on the new cars. Mr. Short stated that safety devices operating on radar principles probably will not appear on automobiles for some time, since it costs about 50 cents more to equip the car with this device than the cost of the car itself.

On March 30 Mr. Blake D. Hull, chief engineer of Southwestern Bell Telephone company and national president of A. I. E. E., addressed the student branch and the Urbana section of the A. I. E. E. His subject was "Ceiling Unlimited," in which he discussed the future of electrical engineering.

Mr. F. A. Faville, who is chairman of the civic responsibilities committee of the A. S. M. E., president of the Faville LeVally corporation, and president of the Lincoln Engineering company, spoke on "The Part of Engineers in Bettering Community Understanding," at the April 12 meeting.

M.I.S.

The first meeting of the second semester was held February 24. The speaker for the evening was Mr. M. F. Yarotosky, division superintendent of steel production, Carnegie-Illinois Steel corporation. Mr. Yarotsky's splendid talk on "Developments in the Use of Basic Refractories in an Open-Hearth Furnace was illustrated by slides.

The next meeting of M. I. S. was held on April 6, 1948. Officers for the school year 1948-1949 were elected. Plans for the Chicago section of A. I. M. E. field trip to the University of Illinois were discussed. The main events of the evening were movies entitled "Dislocation Movement in Lattice-Soap Bubble Analogy" and "Metal Crystals."

On April 24 the Chicago section of the A. I. M. E. made a field trip to the University of Illinois under the auspices of the M. I. S. Welcomed by Professor H. L. Walker and Dean M.

L. Enger, the visitors were invited to view a Rockwell Kent painting symbolizing the "Lincolns of Tomorrow." The painting was presented to the University of Illinois by the Bituminous Coal association. The day was concluded by inspection trips to the mining and Metallurgy laboratory, the geological survey, and the betatron.

The final social event of the year for the M. I. S. will be their annual picnic held near the end of May.

A.I.Ch.E.

At the A.I.Ch.E. meeting March 22 a short business session was conducted by Donald Hornbeck, president; and then Mr. S. D. Kirkpatrick, editor of "Chemical Engineering," was introduced as guest speaker for the evening. Mr. Kirkpatrick presented a very interesting and entertaining talk on "The New Look in Chemical Engineering." According to Mr. Kirkpatrick, a definition of chemical engineering given in the 16th century is not greatly different from our modern definition. His liberal definition of chemical engineering defines it as a mathematical application of chemistry and physics with an eye on the almighty dollar sign. Further highlights in his talk were the new industrial fields which are now offering increased oportunities to the chemical engineer.

The newly organized A.I.Ch.E. bowling team has already "plowed under" the Ag.E.'s, but were unable to see the king pin which, unfortunately, was clouded by steam emitted from the leaky seams of the M.E.'s, leaving the team with a .500 average for their first outing.

The outstanding feature of the exhibits at the St. Pat's Ball was a mystifying bit of plumbing displayed by the chemical engineers. A stream of dark liquid was seen to jet continuously from a water faucet suspended in mid-air with no visible water connections. The more clever of the engineers, those who were able to detect the fraud, devised innumerable explanations of the phenomena to further bewilder their respective dates. For a complete thermodynamic explanation reference is made to a yet to be published volume, "Violations of the Law of Conservation of Mass," by Chilenskas, Schultz, and Vance.

Included in the plans for the remainder of the semester are a talk by Dr. Gustav Egloff, director of research, Universal Oil Products, and social activities comprised of a banquet and the annual A.I.Ch.E.

I.A.S.

The first meeting of the semester, an informal affair, was arranged primarily to acquaint the new students with the organization and with one another. The general plan of the meeting is to have a focal point of interest, usually available films on the latest developments in the aircraft field and, when possible, a speaker active in the industry to talk on developments and opportunities in the field.

Two films were shown at the first meeting, one showing the preparation and execution of a typical airline flight, and the other giving an interesting insight into the methods used during the last war to teach aircraft identification.

Plans for the future? They're big, as befits an up-and-coming organization, but help is needed to make them materialize. Aero engineers, it's up to you!

S.B.A.C.S.

The Student Branch of the American Ceramic Society held a meeting on Wednesday, March 3. Thomas C. Shedd, professor in structural engineering, was the guest speaker. He spoke on the need for engineers to take the necessary examinations to become registered professional engineers in their state.

President Walter Stuenkel presided at a short business meeting immediately following the talk. Plans were made for the annual Pig Roast to be held in May, and committees were appointed to make final arrangements. Dick Ames was elected to succeed Art Bovenkerk as treasurer and was also elected as representative to the Engineering Council.

I.E.S.

The charter members of the Illuminating Engineering club recently gained recognition as the newest engineering society on campus. The first open meeting of the I.E.C. introduced the students and faculty members present to the local organization and to the national Illuminating Engineering Society.

The program was opened with an amusing demonstration of "black light" conducted by Professor Horn of the illumination department. The audience, consisting chiefly of men interested in the lighting field, was then given the story of the development of the I.E.C. by G.T. Nelson. An invitation was extended to those interested in the organization to become members. The speaker for the evening was Professor J. D. Kraehenbuehl, who talked on the national I.E.S. and the illumination option.

The idea of organizing the I.E.C. came with the first group of men to pursue the illumination curriculum of electrical engineering. A committee of three began studying the problems of organization and writing a constitution. With University approval the Illuminating Engineering club became an official society in February, 1948.

The purposes of the I.E.C. are threefold. The organization is founded first, to promote fellowship among the illumination option and the faculty; second, to bring together men in training for the same profession for the exchange of information, new ideas, and to learn of new developments in the lighting field; and finally, the I.E.C. is founded in cooperation with the national I.E.S. for the promotion of better lighting in the commercial, industrial and domestic fields in America. It is the sincere hope of the I.E.C. that in the near future this campus society will affiliate with the I.E.S. as the first student branch of that organization.

Those interested in this new field of engineering should contact Professor Kraehenbuehl or any members of the I.E.C. for information on the club and the illumination option.

A.S.A.E.

The activities of the Student Branch of the Agricultural Engineers were limited to an exhibit at the St. Pat's Ball arranged under the supervision of William J. Fletcher, and the regular meeting on March 22. The speakers at the meeting were Mr. Thayer Cleaver, who spoke on the opportunities in the U. S. Department of Agriculture, and Mr. Leo Holman, who presented a talk with slides on a typical engineering project that was carried out by the U. S. Department of Agriculture.

A.S.M.E.

The Student Branch of the American Society of Mechanical Engineers has had two very interesting meetings during the month of March. On March 10, Mr. V. G. Swanson, education and training director for the Industrial Power Division of International Harvester company, spoke on the possibilities that men with engineering backgrounds have in other fields than engineering. Mr. Swanson also gave some valuable suggestions for interviewing.

A short business meeting was held on March 24 at which interesting activities were discussed. A kodochrome movie, "Steam Progress," sponsored by "Combustion Engineering" magazine, was shown. Announcement was made of the annual student regional conferences of the A.S.M.E. soon to be held. Each university in a region is usually represented by a student who reads a paper. The papers are written on any subject of interest to the author or a group of fellow engineers. On April 7 the papers were presented to the local branch from which the best paper will be sent on to the regional conference at the University of Iowa. Besides glory for the University of Illinois and the winner, there is also a fifty dollar prize. Plans were made for a picnic to be held later in the spring after the rains abate.

Introducing

by Don Johnson, E.E. '49
Jim Iocca, C.E. '50
Herb Jacobson, M.E. '50 and Connie Minnich, C.E. '51

ALAN KEMP LAING

A pleasant voice with a slight English accent said, "Hello, won't you come in?" as we entered 119 Architecture building.

Alan Kemp Laing, professor of Architecture, is a tall, neatly-dressed man with blue eyes and sandy hair and mustache the type of person with whom you might discuss Parliament's labor policies over a cup of tea in some select London coffee house. We sat down—fully prepared to hear about his life in England.

But no—contrary to what we had expected—he was born, not in England, but in Gladstone, Michigan. He spent his boyhood in Denver, Colorado, and attended the Manual Training high school there. He entered the University of Denver as a chemical engineering student, but, as he expressed it, "chemistry didn't live up to my expectations," with the result that he changed to L.A.S., majoring in history and sociology. In 1923, following his graduation from there with a B.A. degree, he worked for a short time in an architectural office and became a member of the Denver Atelier, a studio group of artists and interior decorators affiliated with the Beaux Institute of Design in New York.

Professor Laing then attended Massachusetts Institute of Technology and took courses at Harvard during the intervening summers. He graduated from M.I.T. in 1926 with a B.S. degree in architecture and was a co-winner of the Desloge Prize in senior design. He held positions with the University of Cincinnati as assistant, associate professor, and professor of the

(Continued on Page 34)

ALAN KEMP LAING

WILLIAM E. McCARTHY

If, as they say, hard work is the secret of success, Bill McCarthy, president of the student branch of the American Society of Mechanical Engineers, is sure to get ahead in the engineering world.

"Mac," now 23, graduated from Amundsen high school in Chicago, his birthplace, six years ago, where he acquired letters in wrestling and soccer.

Working for the Crane Packing company, he advanced from machinist, to draftsman, to testing engineer. He also played on the company's bowling league and industrial league baseball team.

It was during this time that he became interested in engineering and, in October of 1944, he matriculated at the University. Although he had had no physics, chemistry, mechanical drawing, geometry, or trigonometry in high school, he plunged right in with 20 hours his first semester. To get back to his study habits, he began writing 50 page reports for his laboratory courses. "Some of the fellows thought I was eager when I started handing in those reports," Bill says, "but I don't like a teacher unless he assigns a lot of homework." To catch up with those who had a better technical background than he did, he began to do a tremendous amount of reading. He reads about 10 books a semester, such as "Inside U. S.A.," "The Male Hormone," "Microbe Hunters," "Surgeons' World," "Devils, Drugs, and Doctors," "The Roosevelt I Knew," Fundamentals of

(Continued on page 28)

R. J. HALES

"Hey, Prof! I'm conducting experiment nine, and I need one of those 'gimmicks' that are used to distil water." Seconds later a tall, portly man appears at the dispensing window with the desired "gimmick." "Hey, Prof! Do you have change for a dime. I need some nickels for the candy machine."

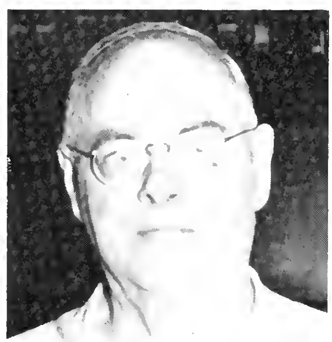
If you should ever have the occasion to wander over to the Chemistry Annex and pass by Room 4, you are more than likely to see Mr. R. J. Hales busily doling out "gimmicks" to Chemistry 1, 2, and 3 students.

Mr. Hales was born in Prophetstown, Illinois, on September 14, 1883. He set some sort of record by attending thirteen different elementary schools before graduating. Not that he was a dull boy, but his father was a minister, and the family traveled extensively throughout the midwest.

After he graduated from high school, his family moved to Minnesota where he began teaching in the rural schools. It was while teaching in the rural schools that he acquired the nickname of "Prof!" and the name remained with him to this day. In 1906 Prof entered the College of Law at the University of Illinois. He remained at the University until 1907, after which he returned to his former profession—teaching. Prof recalled the times he played tennis with Professor Thatcher Guild, then an instructor in the English department, but now well remembered by all Illini as the composer of the "Illinois Loyalty Song."

In 1922 Mr. Hales accepted the position of principal of Sadorus high school. In addition to running the affairs of the school, he was an instructor, a coach, and the director of athletics. While at Sadorus, he introduced the sport of basket-

(Continued on Page 30)



R. J. HALES

NUMBER 11 OF A SERIES

Newsworthy Notes for Engineers

How to make handset handles twice as fast!

To meet the tremendous postwar demand for telephones, Western Electric engineers were faced with the problem of molding 50% more plastic handset handles per day than ever before. Calling on their wartime experience, the engineers turned to electronic pre-heating, which raises the temperature of the phenol plastic from room temperature to 275 degrees Fahrenheit in just 30 seconds. In this way they cut press time in half, doubled production, improved the finish and increased the strength of the handset handles through more uniform heating.

Laboratory precision in mass production

This line amplifier looks like something made in a laboratory—and destined to spend its life there. Actually, the amplifiers are mass-produced to lead rugged lives up poles, down manholes, or in remote repeater stations along coaxial telephone cable routes. Each amplifier must boost the volume of as many as 600 voice channels, ranging from 64 kc to 3,096 kc, with closely controlled characteristics over long periods without attention. Working out manufacturing methods and controls that assure uniform performance of laboratory precision in telephone equipment is always an interesting project to Western Electric engineers.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

GEORGE R. FOSTER
Editor

EDWIN A. WITORT
Assoc. Editor

The Illinois Technograph

Information Please . . .

"There's always some 'dunnigan' who doesn't get the word. Who doesn't remember this familiar phrase which was too frequently applied to the hapless "swab jockey" who just happened to be getting in a little "sack time" when the P.A. system blasted out its raucous "Now hear this?" Used also in the plural, little concern was expressed about whether the individuals or the system was at fault, because the "word" got around fairly well by the "scuttlebutt" route and resulted in the appearance of a successful system. In fact, it was so "reliable" that a vast number of men became "Missourians" overnight.

Fundamentally, the problem of communications arises from the fact that men must work together. In any situation where one man must work with another, the need immediately arises for a means of communicating ideas between the two. Basically, this transfer of thoughts is carried out through the senses of sight and hearing, although the skunk imparts information quite effectively through the olfactory nerve. For small groups verbal communication is adequate, but as the group increases in size, so does the need for extending the media employed.

The increase in size of the group to be reached also increases the problem of designing an *effective* communication system. With a large group the greatest effectiveness can be realized when the information is repeated several times. To analyze the effectiveness of the system, however, the criterion should not be the percentage of the total group receiving the information but the number of individuals who did not receive the information.

All this leads up to the fact that the communications system here at Illinois, as applied directly to the dissemination of information to the students, is badly in need of analysis and re-design. Whether this information be of a current nature applying to college activities and official information, or whether it applies to longer range information regarding scholastic advisorship and information about such advisory system, is immaterial from the standpoint of designing an effective means of communicating this news to *all* students.

Operation on the present theory that the student should have sufficient interest in his own welfare to seek the needed information is a fine theoretical idea if he knows who to contact, but completely misses the more practical, human approach. Consider, for example, the extreme case of the new student who, in his lack of experience with the existing system and his attempt to obtain information, contacts people with no more idea of what he is hunting for than he has. In an organization of this size, that is quite easy to do, and it leads to utter confusion and discouragement. Later, as the individual becomes more experienced, but equally uninformed, the situation breeds anything but respect.

The finding of a complete answer to the problem is not an easy task, but certainly it should not be too much to expect at least a step or two towards improvement. A system could hardly be called *effective* that relies on passing out important information only on an easily overlooked notice on a stuffed bulletin board or on a notice read in one class. If every student knew positively what was going on, it's a safe bet that the gain in everyone's opinion would be evidenced by an improved "esprit de corps."

Although the engineer's viewpoint is too often based on percentage of hits, how about seeking a partial answer from the student's viewpoint, through the Engineering Council, on the basis of the individuals missed? It's certainly worth a try to see how many "dunnigans" there really are.

A new doorway to Petroleum Progress

No illustrations can do more than suggest the wealth of facilities at Standard Oil's new research laboratory at Whiting, Indiana. Here, in one of the largest projects of its kind in the world, there are provided the many types of equipment needed and desired for up-to-the minute petroleum research.

The caliber of the men who work here is high. For many years, Standard Oil has looked for and has found researchers and engineers of high professional competence. Further, the company has created for these men an intellectual climate which stimulates them to do their finest work.

And there is nothing new about the idea that motivates Standard Oil research. It is simply that our responsibility to the public and to ourselves makes it imperative to keep moving steadily forward. Standard Oil has always been a leader in the field of industrial research; the new Whiting laboratory is proof of our intention to remain in the front rank.

STANDARD

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Standard Oil Company

(INDIANA)

910 S. Michigan Avenue, Chicago, Illinois

GALESBURG . . .

(Continued from page 15)

to work on the production of electric energy required in the manufacturing of aluminum, phosphates, nitrates and other necessities of war.

One of the more interesting phases of his work with the TVA was his assistance in the original purchase of the "Kingston Demolition Range," later to be known as Oak Ridge, Tennessee, "the atomic center of the world." When this area was taken over by the Manhattan District of the Army Engineers, it was developed from one of the poorest regions of run-down farms in the South, into the fourth largest city in Tennessee, and the hub of atomic research. This task required the tremendous power that only the TVA could furnish.

Mr. Trezise's work in the personnel field gave him an opportunity to learn just what industry is looking for when hiring college graduates. He discovered that certain elements of leadership, cooperativeness, character, and common sense were wanted as well as high scholastic achievement. Here at Galesburg he is using his knowledge and practical engineering experience to give the students a better understanding of the profession they wish to enter, and to aid them as they pass through their green years.

W9RCM

By Elmer Lochow, E.E. '51, and Stanley Runvon, E.E. '51

One of the most interesting extracurricular activities at the Galesburg division is the operation and maintenance of the radio transmitter, property of the radio club.

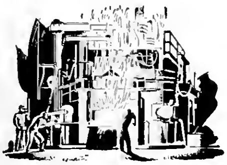
This club had a very humble beginning; Joe Saugier invited all fellow students with "ham" licenses to a meeting in March, 1947. They collectively decided to "get something on the air," so each brought his own amateur radio equipment to the campus. Shortly after this, these pioneers (W9KSQ, W9TLY, W9FSP, W6HYD) became

(Continued on page 24)

Ham shack at the Galesburg branch of the University of Illinois.

How ELECTROMET Serves the Steel Industry

IN addition to providing a full line of high-quality ferro-alloys and alloying metals, Electro Metallurgical Company serves steelmakers in other important ways:



Field Metallurgists — You can obtain the help of our trained metallurgists who render on-the-job assistance in the use of ferro-alloys. These men are qualified to suggest the grades and sizes of alloys best suited for your particular steel and practice.

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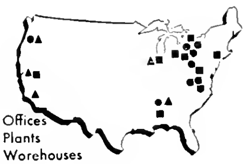
Technical Booklets—You will find helpful information about ferro-alloys and metals in ELECTROMET'S free technical booklets and reprints. Among these are "ELECTROMET Products and Service" and "ELECTROMET Ferro-Alloys and Metals." Write to our Technical Service Department to obtain copies of these booklets.

Convenient Stocks — You can count on prompt deliveries of ferro-alloys from ELECTROMET, since our offices, plants, and warehouses are conveniently located to insure efficient service.



ELECTROMET Ferro-Alloys and Metals

Information about these and other alloys and metals produced by ELECTROMET is contained in the booklet, "ELECTROMET Products and Service." Write for a copy.

CHROMIUM . . . Low-Carbon Ferrochrome (in all grades from 0.03% maximum to 2.00% maximum Carbon), Nitrogen-Bearing Low-Carbon Ferrochrome, High-Carbon Ferrochrome, SM Ferrochrome, Chromium Metal, CMSZ Mix, and other Chromium Alloys.

VANADIUM . . . Ferrovanadium in all grades and Vanadium Oxide.

COLUMBIUM . . . Ferrocolumbium.

MANGANESE . . . Standard Ferromanganese, Low-Carbon and Medium-Carbon Ferromanganese, Low-Iron Ferromanganese, Manganese Metal, and other Manganese Alloys.

SILICOMANGANESE . . . Max. 1.50 and 2.00% Carbon Grades.

TUNGSTEN . . . Ferrotungsten, Tungsten Powder, and Calcium Tungstate Nuggets.

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SILICON . . . Ferrosilicon in all grades including both regular and low-aluminum material, Silicon Metal, SMZ Alloy, and other Silicon Alloys.

TITANIUM . . . Ferrotitanium, Silicon-Titanium, and Manganese-Nickel-Titanium.

CALCIUM . . . Calcium-Silicon, Calcium-Manganese-Silicon, and Calcium Metal.

"EM" BRIQUETS . . . Silicon, Silicomanganese, Ferromanganese, and Chromium Briquets.

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GALESBURG . . .

(Continued from page 22)

a recognized club. Dr. Snader, dean of mathematics, was chosen as sponsor of the club and two rooms were soon secured in which to house its valuable radio equipment. The organization expanded from four to twenty-six members, and through the assistance of three staff members, Mr. Galbraith, Mr. English, and Mr. Mills, they obtained a new transmitter and receiver for the exclusive use of this club.

The communication receiver is an eleven-tube Hammerlund HQ129X. It covers, in six bands, a continuous range from 540 kilocycles to 31 megacycles, which includes all the major frequencies used by amateurs. It has excellent sensitivity and incorporates a very effective crystal filter circuit, which eliminates most interference. It also has a noise limiter, which overcomes auto ignition and pulse type interference.

The transmitter is a Supreme model AF100 and is a complete, self-contained unit, embodying all types of emission permitted amateurs. It is designed to operate from a 110-120 volt power line at 50 to 60 cycles. It covers all amateur bands from 3.5 to 30 megacycles with a stability of .02% or better over the entire range.

The transmitter provides a carrier of at least a hundred watts throughout the complete frequency spectrum which it is designed to cover, and may be 100% voice modulated. It may be tone and frequency modulated with either narrow, medium, or wide band F.M. Tone modulation is also provided for I.C.W. operation, which is permissible on certain amateur bands.

Three eighteen foot doublets (one for each of the lowest frequency bands) make up the present antenna system. This arrangement has a tendency to limit the range of the equipment; however, our "hams" claim DX (long distance), C. W. operations with Europe, Africa, and the West Indies. Plans are being made to erect a ten-meter ground plane vertical antenna this spring.

On January 5, 1948, the station received its call letters, W9RCM, and is now an active member of the intercollegiate network.

Senior girl to freshman after being asked for a date: "No, I couldn't go out with a baby."

Freshman: "Oh, sorry; I didn't know."

* * *

Nothing robs a man of his good looks like a hurriedly drawn shade.

INLAND STEEL . . .

(Continued from page 9)

work have the opportunity of moving directly into management positions in the various steel handling operations.

A separate training program is set up for pre-sales trainees. This program parallels the metallurgical training program except that it places more emphasis on order handling and customers' problems. Selling steel has become so much a matter of helping the customer work out the answers to his particular needs that this is an unusually fine field for engineers with an interest in manufacturing problems.

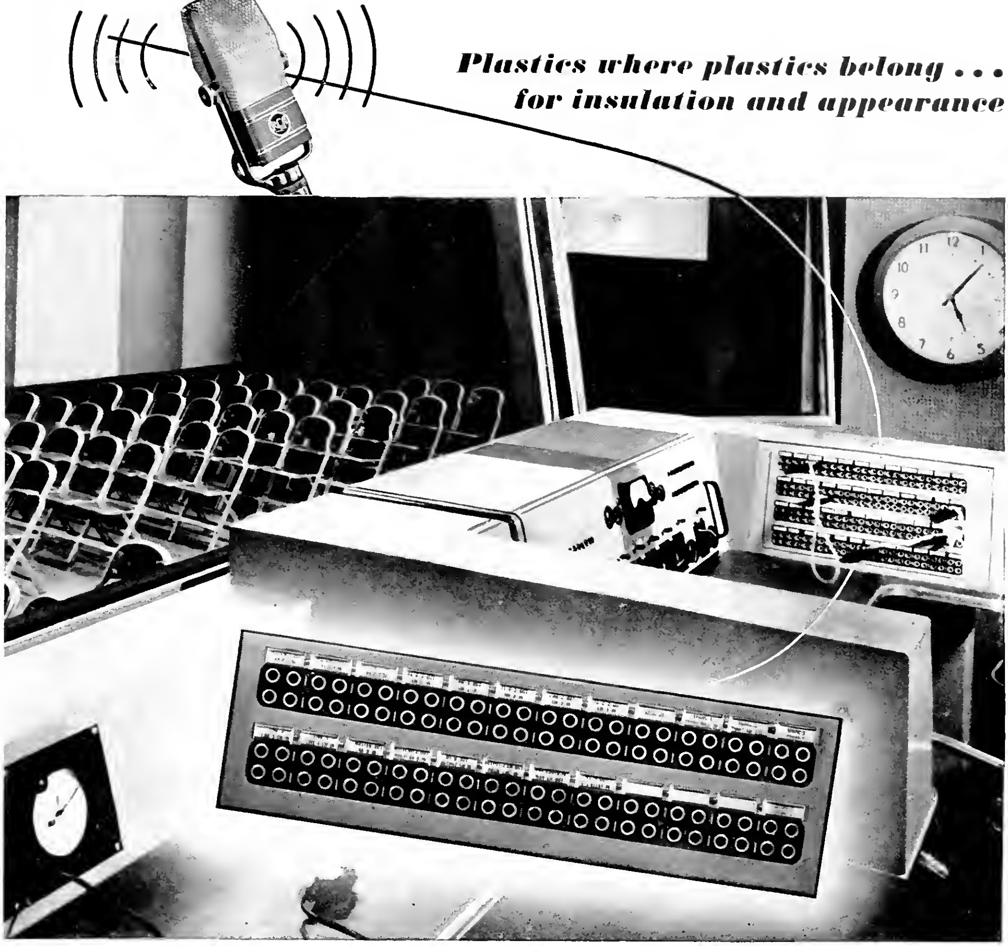
Another training group is concerned directly with mill operations. These trainees get the same over-all picture as those in the other training programs except that blast furnace, coke plant and open hearth operation are emphasized. Men in this training program are in a position to move into jobs of responsibility in basic iron and steel production.

A similar training program which includes both technical and non-technical men prepares men for general administrative positions. The training of these men includes raw materials as well as steel-making operations.

In addition to the formal training

(Continued on page 26)

Plastics where plastics belong . . .
for insulation and appearance



Photograph Courtesy of Station WNEW, N.Y.C.

Synthane . . . where synthane belongs

USES for Synthane laminated plastics are almost unlimited because of their combination of chemical, electrical and mechanical properties. Synthane is corrosion and moisture resistant, light in weight, quickly and easily machined. It is also hard, dense, strong, one of the best electrical insulators known. The "set" plastic, Synthane is stable over a wide range of temperatures.

An interesting example of Synthane at work is this jack panel which enables the broadcast technician to plug in or transfer amplifiers, microphones, telephone lines or other equipment, giving the input system greater operating flexibility. This is an appropriate job for our type of plastics because Synthane is an excellent electrical insulator, and contributes to the attractiveness of the control booth. Synthane Corporation, 14 River Road, Oaks, Pa.

SYNTHANE

DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

INLAND STEEL . . .

(Continued from page 24)

programs as mentioned above, there are numerous opportunities in mill management for men with civil, mechanical, chemical, and electrical engineering backgrounds. Many engineering graduates are able to start in immediately as providers, staff assistants, testers, or members of construction engineering parties in the operating departments and assume direct responsibility almost immediately. Engineers who enter the mill in such starting jobs have typically advanced rapidly, depending upon their individual abilities. In addition to the more typical engineering jobs there are some opportunities for men with engineering backgrounds in the field of industrial relations and in industrial hygiene. For example, industrial engineers who like time study and job evaluation work have an opportunity to move into the rapidly expanding field of labor relations wherein these problems frequently occur. Engineers with an interest in industrial hygiene will find the program a fascinating combination of engineering and human health, safety, and welfare in the industrial plant. There are also opportunities in mining, quarrying, and vessel operation for men with those particular interests. It is not possible to enumerate all of the possible types of engineering careers which are, and will be available in the steel industry in the years ahead. There is room for men with initiative and ambition to get ahead as far and as fast as their personal willingness and ability will permit them.

Steel-making has been, and will continue to be, one of the largest and most important industries in the world. The Inland Steel company is one of the prime producers of steel for the manufacturing industries in the heart of America. Efficient production of quality steel demands a high degree of technical engineering competence. The door of opportunity is always open to the engineering graduate in this industry.

VACUUM TUBES . . .

(Continued from page 13)

tube is rigorously tested under performance conditions. The power, efficiency, and even the life of the tube are tested. Since the tubes produced are largely for use in the micro-wave region, especially designed test equipment must be used. For example, wires. As the frequency of alternating current is increased, the electricity flowing through a wire tends to concentrate near the surface. This selectiveness increases with frequency until the center of the wire is of no use. A large surface is needed, so the wire is replaced by a hollow tube. Further increase in frequency causes a decrease in efficiency because of the crowding of the electricity on the outer surface of the tube. So far, the circuit contains two wires or tubes; one outgoing, one return. The next step, taken to increase the efficiency, consists of the use of a coaxial cable, a wire inside a tube. This concentrates the electricity on the inner surface of the tube, the outer surface of the wire, and especially in the space between the two. So important does this space become at microwaves that, for efficiency, the central wire is omitted. The current is piped through the tube like water. Technically, the pipe is called a wave guide; familiarly, it is known as "plumbing." This plumbing is quite expensive. Much of it is silver plated, and some even gold plated. This type of conductor bears little resemblance to ordinary circuit wiring. There is no return wire. This makes it easy to send signals out from an antenna into space. Most of the testing equipment used at high frequencies is equally bizarre.

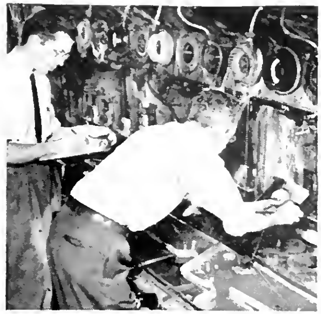
Test data taken on the tubes are tabulated, analyzed, condensed, and written into reports. Tube performance charts are fastened over the end of a cathode

(Continued on page 28)

DU PONT *Digest*

For Students of Science and Engineering

Many Theoretical and Applied Studies Behind Development of "Cordura" Rayon



Determination of spinning tension by C. S. McCandlish, Chemical Engineer, Northwestern University '44, and A. I. Whitten, Ph. D., Physical Chemistry, Duke University '35.

Stronger, lighter tires made possible by teamwork of Du Pont chemists, engineers, and physicists

On the surface, the viscose process for rayon seems fairly simple. Cellulose from cotton or wood is steeped in NaOH to give alkali cellulose, which is treated with CS_2 to form cellulose xanthate. Adding NaOH gives molasses-like "viscose," which is squirted through spinnerets into a coagulating bath of acid and salt to form from 500 to 1,000 filaments simultaneously:

$$\underset{\text{(cellulose)}}{R^*\text{-}OH} + NaOH \longrightarrow \underset{\text{(alkali cellulose)}}{R\text{-}ONa} + H_2O$$

$$R\text{-}ONa + CS_2 \longrightarrow \underset{\text{(cellulose xanthate)}}{R\text{-}O\text{-}\overset{\overset{S}{\|}}{C}\text{-}SNa}$$

$$R\text{-}O\text{-}\overset{\overset{S}{\|}}{C}\text{-}SNa + H_2SO_4 \longrightarrow \underset{\text{(cellulose)}}{R\text{-}OH} + CS_2 + NaHSO_4$$

$$R^* = C_6H_7O_2(OH)_2$$

Du Pont scientists were working to improve on the properties of rayon made by this process when, in 1928, a rubber company asked for a rayon yarn that would be stronger than cotton for tire cords. The problem was given to a team of organic, physical, and analytical chemists, chemical and mechanical engineers, and physicists.

Theoretical and Applied Studies

In developing the new improved rayon, a number of theoretical studies were carried out: for example, (1) rates of diffusion of the coagulating bath into the viscose filaments, (2) the mechanism of coagulation of viscose, (3) the relationship between fiber structure and properties by x-rays, and (4) a phase study of spinning baths.

Concurrently, applied research was necessary. This proceeded along many lines, but the main problem was to perfect the spinning technique. It was known that a short delay in the bath between the spinneret and the stretching operation allowed greater tension on the filaments. Du Pont engineers, therefore, designed a series of rollers, each revolving faster than the previous one, to increase the tension gradually. In addition, a textile finish was developed that combined just the right amount of plasticizing action and lubricating power, allowing the filaments to twist evenly in forming the cord. A new adhesive was prepared to join the yarn with rubber. New twisting techniques for cord manufacture were found, since the usual methods caused loss in rayon strength.

Engineering Problems Solved

Chemical and mechanical engineers were faced with the design and operation of equipment for more than 15 different types of unit operations. Equipment had to operate every minute of the day, yet turn out perfectly uniform yarn. It was necessary to filter the viscose so carefully that it would pass through spinning jet holes less than 4 1000th of an inch without plugging. Some of the most exacting temperature and humidity control applications in the chemical industry were required.

Out of this cooperation among scientists—ranging from studies of cellulose as a high polymer to design of enormous plants—came a new product, "Cordura" high-tenacity rayon, as strong as mild steel, yet able to stand up under repeated flexing. Today, this yarn is almost 100% stronger than 20 years ago. Tires made with it are less bulky and cooler running, yet give greater mileage under the most punishing operating conditions. In "Cordura," men of Du Pont have made one of their most important contributions to the automotive industry.

Questions College Men ask about working with Du Pont

How are new men engaged?

Most college men make their first contact through Personnel Division representatives who visit many campuses periodically. Those interested may ask their college authorities when Du Pont men will next conduct interviews. Write for booklet, "The Du Pont Company and the College Graduate," 2518 Nemours Building, Wilmington 98, Del.

DU PONT

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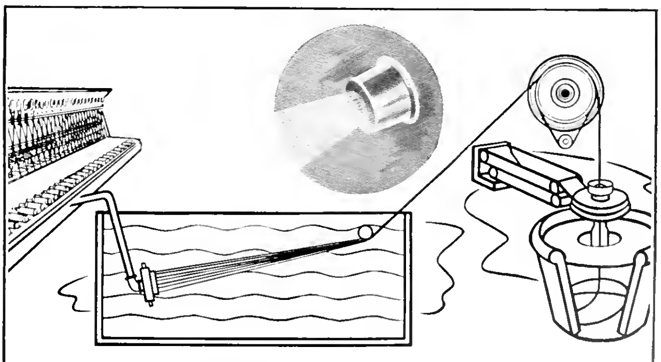


Rayon spinning machine. The spinning solution is pumped through a spinneret immersed in a hardening bath. Filaments are guided over a rotating glass wheel and down into the whirling collecting bucket. Inset shows close-up of spinneret; each hole forms a filament.

VACUUM TUBES . . .

(Continued from page 26)

r.a. oscilloscope and curves drawn directly. Offices where the reports are written are adjacent to the testing room.

Dr. A. L. Samuel, director of the vacuum tube projects, came to the University in June, 1946, from the Bell Telephone laboratories. A graduate of Emporia College and Massachusetts Institute of Technology, Dr. Samuel has had 24 years of experience in vacuum tube research. He has published widely, holds more than 40 United States patents, and has many others pending.

Research Professor J. T. Tykociner is likewise noted for major contributions to research. He pioneered on models of antennae and ultra-high frequency transmitters. His early work established and demonstrated the principles of photographic recording of sound and its photo-electric reproduction, making possible the modern talking motion picture. Early in World War II he set about the development of micro-wave magnetron tubes. Subsidized by the Air Material Command at Wright Field, these investigations have expanded, until at present, there are five separate vacuum tube projects.

McCARTHY . . .

(Continued from page 18)

Radio," "Fundamentals of Electronics," "Great Men of Science," and subscribes to, and reads the Readers' Digest, Omnibook, Coronet, Science Illustrated, Technograph, and Mechanical Engineering magazines. He seems, rather, to be trying to catch up with Karl T. Compton. He is also studying German and has taken a correspondence course on social science. Since he started here, he has attended every lecture on mechanical engineering given, and a large portion of those of physics, chemistry, and electrical engineering.

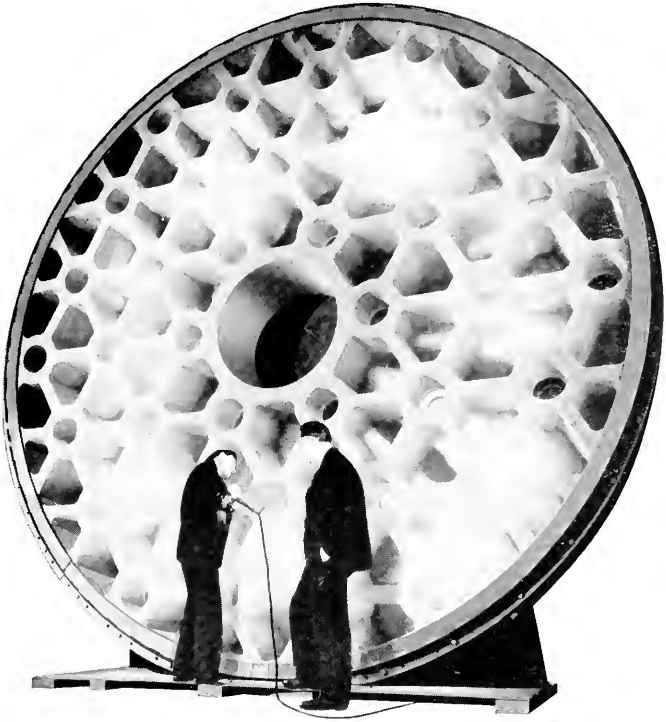
He has been nicknamed "Grandma" by his roommates at the Illini club, because he has learned all of his lessons so well that he is constantly counseling the other boys in the house on their engineering homework. This name was partly earned by the fine soup he formerly made on his hotplate. "But I had to give that up," he stated. "The fellows in the house started hanging around all day waiting for me to make hamburgers and soup, and never went out to eat." In addition to cooking, his hobbies also include photography and stamp collecting.

In between all this, he has been holding down two or three jobs per semester. These have ranged from working on the cyclotron to baby-sitting. One of his recent jobs was in the lately-destroyed Urbana Flatiron building.

During his college career, he has belonged to the Newman club, the Y. M. C. A., played intra-mural touch football, served as M. I. A. representative, sold homecoming badges, and ushered at the football games. When he first came down here, Bill won the intra-mural wrestling meet just because some of his friends said he couldn't do it. Last semester, he acted as vice-president of the A. S. M. E. and as representative to the Engineering Council. This semester he was elected president of the A. S. M. E. Asked whether his duties as president kept him busy, his comment was a long, drawn-out, "Brother!" A member of the A. S. M. E. bowling team, he boasted, "We beat the 'chem' engineers last Sunday and the 'ag' engineers a few weeks ago."

Graduating this June, Bill hopes to get more schooling in some industrial training program and then devote himself to developmental work. "I like engineering and I like to work," said he. "I don't mind getting my hands dirty."

If, as they say, hard work is the secret of success, Bill McCarthy is sure to succeed in the engineering field.



R. J. HALES . . .

(Continued from page 18)

ball. His teams were better than average and won the county championship three times while he was coach.

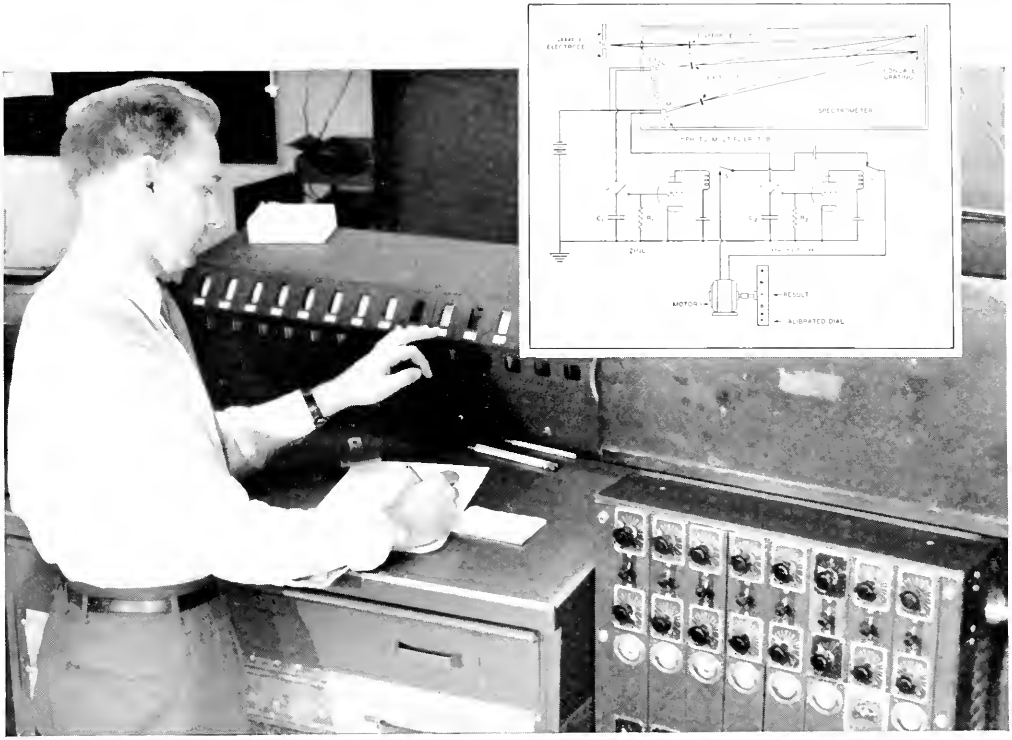
During the war, Prof was employed by the Army at Chanute Field. In 1946 he became a storekeeper in the chemistry department. Although comparatively new in the department, he is popular with the students and likewise the students are popular with him. When asked what he thought of the students, his face brightened and he said, "I'll tell you now, I've seen a lot of students in my day, but I've never seen a group that worked as hard as the students here. They're sure a hardworking bunch."

Each summer Prof Hales spends his vacation at the Illinois Boys' State in Springfield teaching archery. He considers that a vacation and enjoys every minute of it. He has been active for many years as a track official. Prof has a keen interest in sports and his two hobbies, photography and archery.

Reporter: "How about your team? Are they good losers?"
Coach: "Good? Hell, they're perfect!"

* * *

Prof: "You missed my class yesterday, didn't you?"
Stu: "Not in the least, sir."



The Dow-developed Spectrometer with simplified schematic diagram showing its essential features.

An example of Dow research

This electronic and optical device, called the Direct-reading Spectrometer, is a Dow-developed instrument which—using photoelectric tubes—measures the relative amounts of different metallic constituents in a complex alloy.

A tribute to man's intelligence and industry, the Spectrometer was devised to obtain closer control and more accurate analysis of the magnesium alloys used with such spectacular success in World War II. For the past three years it has been used in the magnesium alloying plant to make many thousands of measurements and recordings of the exact concentration of the several metals in an alloy.

An outstanding feature of the Spectrometer is its speed of operation. For instance, only thirty seconds will have elapsed from the time two magnesium samples are locked into clamps and a spark passed between them to start the operation, before an analysis can be determined from direct-reading, rotating dials.

The entire operation is automatic and takes less than 10% of the time required by the Spectrographic method of analysis, which in turn is many times faster than conventional chemical methods of analysis. This enormous saving of time enables a much closer and more nearly constant control over melting, alloying and casting of magnesium.

This method eliminates the necessity for photographic and developing equipment used in Spectrographic analysis, as well as the opportunity for photographic error possible in the latter method.

Here is another example of Dow research applied to production methods. Such research is typical of all divisions of The Dow Chemical Company . . . a company where intelligence and industry are held in high regard.

DOW

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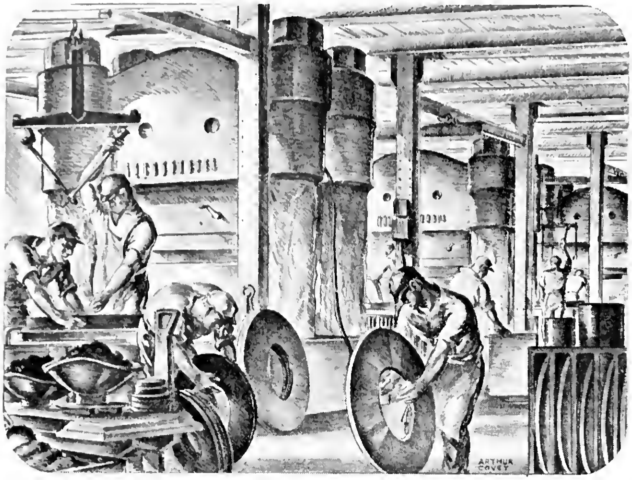

NAVY PIER . . .

(Continued from page 15)

ident and her plans for the club's future are progressive. The club has planned several field trips with the A.S.C.E.

Her favorite pastime is constructing "something" around the house. Currently, she is putting up linoleum tile in her bathroom. She also likes to travel. "Sully" would like to go back to Wright Field as an aeronautical engineer. She plans to specialize in the structure of aircraft.

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Richard Choronzy — Leonard Cohen

Ogden Livermore........*Faculty Adviser*

The Technae Illinae

By Naomi S. Suloway, Aero. E. '51

The newest student organization to be formed in the College of Engineering is for women only! Known as the Technae Illinae, it boasts of seven architects and one each of mechanical, electrical, and aeronautical engineers.

Credit for forming this organization can be claimed by the gracious and very capable Mrs. Dee Mette Holladay, instructor in G.E.D. who is herself an Illinois graduate of '30 in architectural engineering. Mrs. Holladay struggled for two semesters to get this group of reluctant and highly overworked damsels in one place at the same time. Once this was accomplished the organization shifted into high gear; officers were elected and a petition for recognition as an official organization of the University of Illinois was submitted to the dean of students.

Naomi Suloway was elected president, Blanche Malekovic, Brookfield, Illinois, was elected vice-president, and Barbara Engert, Glen Ellyn, Illinois, was elected secretary-treasurer.

Membership requirements of the Technae Illinae are quite simple; they state that one be female and that she must be slugging her way through one of the various engineering curricula. Purposes of the organization are parallel to those of the other engineering societies: industrial field trips, guest speakers, and the like. To date, the women have been guests of the A.S.C.E. on an inspection trip to the construction of the new Canal Street bridge and have visited the curator's rooms (generally restricted to the public) of the Field museum. Their latest plans include a trip to one of the steel mills in the city.

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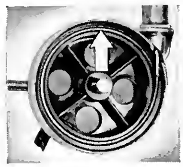
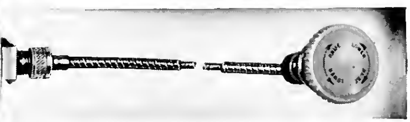
PROBLEM—You are designing a telescoping radio antenna for automobiles. You want to provide a means for extending and retracting the antenna sections from a convenient point inside the car. How would you do it?

THE SIMPLE ANSWER—The illustrations show how one manufacturer did it—with two S.S.WHITE FLEXIBLE SHAFTS. One shaft, operated from the control knob, turns a reel at the base of the antenna. The other, on the reel, pushes up and pulls down the antenna sections as the reel is turned. As S.S.WHITE shafts can be supplied in any length, this arrangement makes the antenna adaptable to all types of cars and other motor control shaft vehicles.





Photos courtesy of L. S. Brach Mfg. Corp., Newark, N. J.

This is just one of hundreds of power drive and remote control problems to which S.S.WHITE FLEXIBLE SHAFTS are the simple answer. All engineers will find it helpful to be familiar with the range and scope of these "METAL MUSCLES"* for mechanical bodies.

*Trade Mark Reg. U. S. Pat. Off. and elsewhere

SEND FOR BULLETIN 4501
It gives basic information and engineering data about flexible shafts and their many uses. We'll gladly send you a free copy on request.

S.S.WHITE INDUSTRIAL DIVISION
THE S. S. WHITE DENTAL MFG. CO.
DEPT. C, 10 EAST 40th ST., NEW YORK 16, N. Y.
FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
MOLDED RESISTORS • PLASTIC SPECIALTIES • CONTRACT PLASTICS MOLDING
One of America's AAAA Industrial Enterprises

PROF. LAING . . .

(Continued from page 18)

history of architecture until 1940, at which time he came to Illinois as an associate professor of architecture. In 1941 he received his full professorship in architecture.

His associations with college and professional societies are so numerous that Professor Laing had to think a while before he could name them all. The final list included: Scarab and Gargoyle, architectural honoraries; presidency of the Central Illinois chapter of the American Institute of Architects in 1945-1946; membership in the Society of Architectural Historians and editor of that organization's Journal; Illinois Historical Society; Beta Theta Pi; board of directors of the Cosmopolitan Club; Living War Memorial Organization; Central Illinois Chapter A.I.A., and faculty advisor to the Illinois student chapter A.I.A.

What spare time he finds is spent in painting in water-colors. He also has a regular day for golf—"one Wednesday afternoon—every two years." When asked if he was a collector of some sort, Mr. Laing waved his hand towards his desk which was covered with business material, and said, "Yes, I collect everything. One should have three desks and move to the second when the first is filled, and to the third when the second is filled. When the third is filled one can move back to the first and sweep everything off the top since it is all out of date. This is one of my architectural inventions."

Well, here the interview was nearly at an end and we still had no inkling . . . We were almost positive that . . . but yet . . . ah! . . . he MUST be of English descent. Professor Laing grinned and said, "No, Laing is a Scottish name, not English." Oh, well, we were ALMOST right!

TECHNOGRAPH . . .

(Continued from page 11)

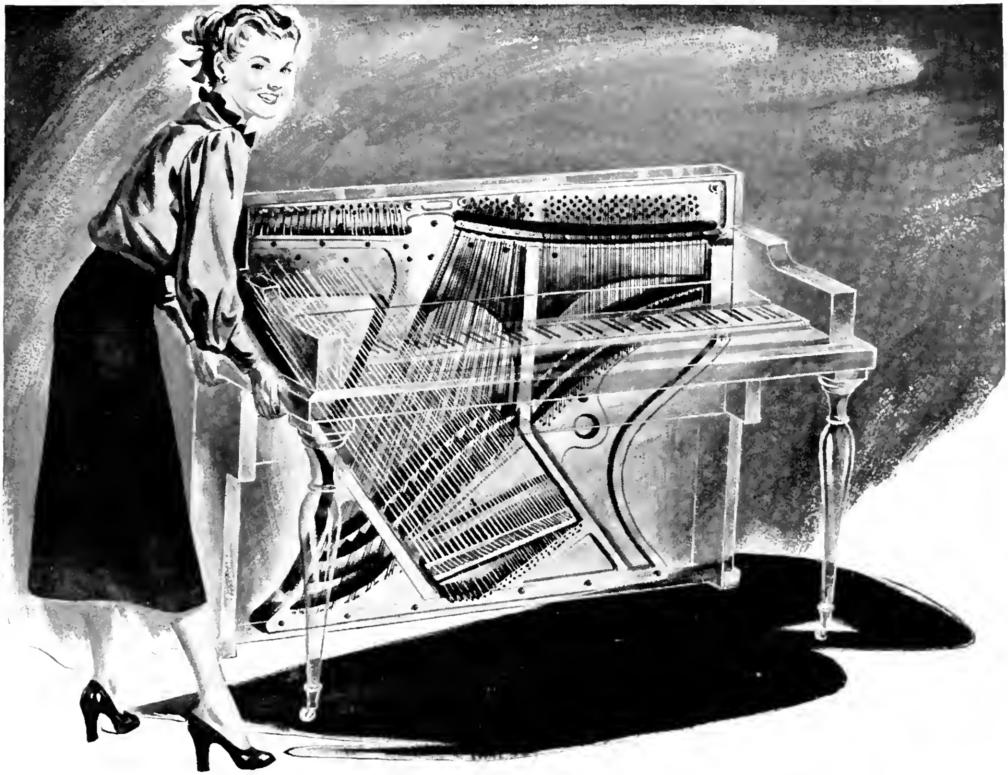
azine, and four printing signatures of eight pages each and two signatures of four pages each are used on the printing press. The pages are arranged in these printing signatures so that, when the paper is printed and folded, the pages will be in the order that they are to appear in the magazine.

The Illini Publishing company uses a flat-bed, cylinder press. The printing signatures are locked on the bed of the press, and the press makes the printed impression by rolling the paper, held to a cylinder by grippers between the cylinder and the signature chase, over the type. The type is inked by a roller prior to each contact with the paper. The paper used for this magazine is a 70-pound, coated, enamel book paper. A sheet of paper, printed on both sides and containing sixteen printed pages, is called a binding signature. Before being bound, these binding signatures are placed on trays to dry because the ink used is job ink which must dry by oxidation.

When the pages have dried for about twenty-four hours, the binding process begins. The signatures are fed into a Dexter folding machine. This machine can be rigged-up with tapes for a variety of page sizes and folds, and for the sixteen-page binding signature of this magazine, it is set to fold the paper three times. Then all groups of pages are assembled into the proper sequence by page number and the cover is wrapped around the signatures. The assembled magazine is then stapled together with a saddle stitch, and the magazines are trimmed with a power cutter.

Sixty magazines are trimmed simultaneously on the power cutter. As a safety measure the operator of the power cutter must manipulate two releases at the same time, one on each side of the machine, in order to allow the blade to descend. The magazine is usually

(Continued on page 36)



TECHNOGRAPH . . .

(Continued from page 34)

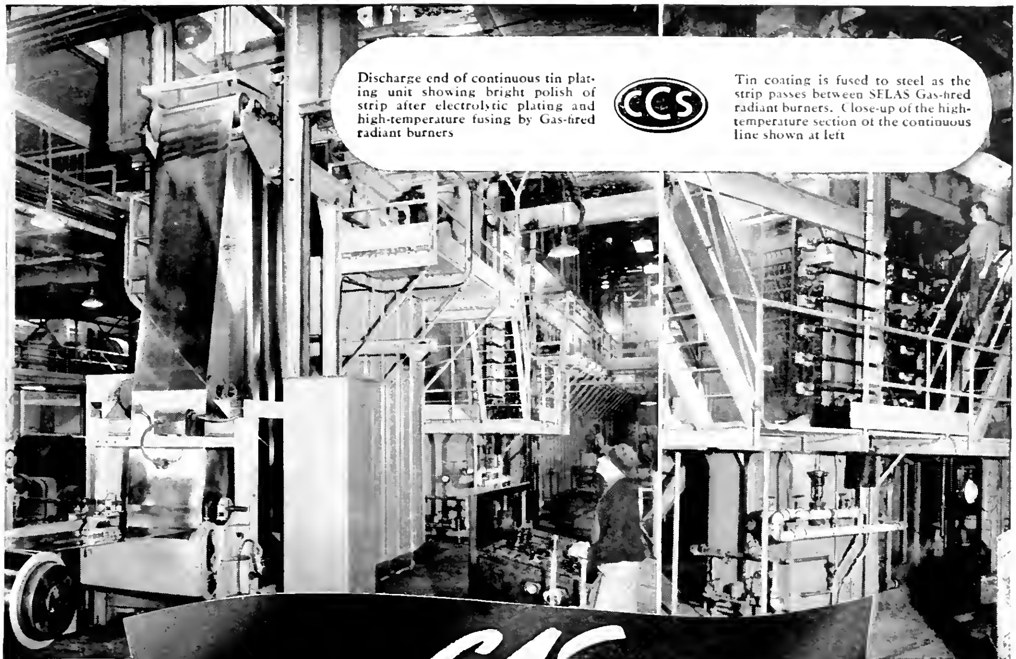
trimmed to $8\frac{1}{2}$ by $11\frac{5}{8}$ inches, but the trim size is often altered slightly to "bleed" an advertisement on the cover. A bleed ad has a picture that extends all the way to the edge of the cover, consequently the magazine must be trimmed properly to bleed the advertisement. After the magazines are trimmed, they are ready to be distributed by the circulation department.

The life span of a publication would, without a doubt, be snapped short if it were not distributed promptly to its readers. This is why every publication organization which hopes to have more than one issue has a circulation manager. It is the circulation manager's job to see that all of the magazines are mailed and distributed to the proper persons and that the subscription sales are carried through—down to the last ounce of energy.

In order to take a big load off the clerks at the post office, the magazines are wrapped and mailed in four groups. These four groups are mailed to Champaign, to Urbana, to Illinois, and to outside areas. The magazines in the groups which are mailed to Champaign and Urbana go to students and faculty. The third group includes magazines which go to the Galesburg branch, the Navy Pier branch, and other readers in the state. The last group is composed of all the magazines which are sent out of the state. These Technographs eventually find their way to all parts of the United States and even to some foreign countries.

However, after these magazines have been mailed, there is still a large number left to be distributed to various places and people. Some of the Technographs are taken to the bookstores to be sold as single copies. Each firm that advertises in the Technograph is sent a free copy. Littell-Murray-Barnhill,

(Continued on page 38)



Discharge end of continuous tin plating unit showing bright polish of strip after electrolytic plating and high-temperature fusing by Gas-fired radiant burners

Tin coating is fused to steel as the strip passes between SELAS Gas-fired radiant burners. Close-up of the high-temperature section of the continuous line shown at left

RADIANT GAS BURNERS *create high-temperature* tin-coat fusing zone

BRIGHT FINISHING was the problem—and engineers of Crown Cork and Seal Company, Inc., Baltimore, adopted a high-temperature method for fusing tin to low-carbon strip, with resultant high-polish surface, in a continuous production mill.

Then, to obtain the high temperatures necessary for heat-processing, these engineers selected GAS and modern Gas Equipment. By directing the heat of radiant GAS burners over a concentrated area of the freshly-plated strip it was readily possible to coordinate the fusing action with the plating process to accomplish continuous high-speed production of bright finished strip.

This typical installation demonstrates the flexibility of GAS and the applicability of modern Gas Equipment for continuous, production-line heat processing. Compared with available fuels GAS is most readily controlled by simple automatic devices; Gas Equipment can be adapted for use with existing machinery or incorporated in new machinery without radical design changes, or expensive supplemental apparatus.

Manufacturers of Gas Equipment and the American Gas Association support continuing programs of research designed to assure the most efficient use of GAS for every heat-processing requirement.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

TECHNOGRAPH . . .

(Continued from page 36)

Inc., the company which handles the procurement of advertising from large companies, is sent several copies for its use. Engineering College Magazines Associated, of which the Technograph is a member and which is the headquarters or allying association for twenty-seven engineering college magazines, gets twenty-six exchange copies. The copies are sent to the E.C.M.A. in exchange for a magazine from each of the other schools. The officers of the E.C.M.A. also get a copy of the Technograph. A large number of the Technographs are sent to high schools throughout the state through the support of the College of Engineering. A survey conducted last spring shows that the high schools are very appreciative of this service and that they desire to keep receiving the Technograph.

The third problem about which the circulation manager perspires freely is the subscription sales. The actual selling of the subscriptions is carried on by the entire staff during campaigns which usually take place at the beginning of each semester. The subscriptions are sold on a whole year or half year basis. In order to boost the efficiency of the campaign, booths are placed in the engineering buildings and the sales are made from there. A periodical is very dependent upon its circulation. It is not the money that it receives from a large number of sales that keeps a magazine aloft, but the advertisement it can obtain because of a large circulation.

The advertising carried on in the Technograph by large firms is handled

A close-up view of the Intertype. Helmuth Frey is setting the type from copy handed in by staff members.

by the general advertising manager. All of these advertisements are obtained for the Technograph and other engineering college magazines by Littell-Murray-Barnhill, Inc. The first notice that the Technograph receives of a company's desire to advertise is a contract from Littell-Murray-Barnhall, Inc. It is stated on the contract who is buying the advertisement, the price and size, and the issues the ad is to be run in the magazine. The contract, however, is not the order for the advertisement and the firm cannot be held to the contract. The actual authorization to run the ad is the insertion order. The order shows the purchaser, what issue it shall appear in, the price and size, and an identification of the cut. The last thing to appear from Littell-Murray-Barnhill, Inc., is the ad itself.

A record is kept with a list of all the firms who have contracts to advertise in the Technograph. Each month this list is checked with the insertion orders and the cuts to make sure that all of them are in our hands. If anything is missing a letter is sent to Littell-Murray-Barnhill, Inc., to find out what happened.

At a scheduled time, the staff gathers up all the cuts and carries them to the printers. The staff then pulls two proofs of each advertising cut. One set is used

(Continued on page 40)

TECHNOGRAPH . . .

(Continued from page 38)

in the dummy and the other set is checked for errors. These proofs are returned to the printer at the same time the galley proofs go back.

The general advertising manager also has to make a report. The report must include who advertised in the magazine, and the size and price of the advertisement. This report has to be turned over to the Illini Publishing company along with a magazine which has the prices marked on each side of the advertisements. A list of the advertisers must also be supplied to the circulation manager so he can send a magazine to each of the firms.

The advertisements which are placed in the Technograph by local businessmen come under the jurisdiction of the retail advertising manager. This advertising is solicited by the personnel on the retail advertising staff. The first step in the procedure for obtaining these ads is to draw them up. The salesmen then visit the various businessmen to sell them the ad which was drawn up for their store. When the contract is made, the advertiser can either approve the advertisement as it is or fix it to suit himself. The ads are then turned over to the Illini Publishing company where they are made up in type form. After the printer pulls proofs of these ads, the advertiser has a chance to check his advertisement for errors before it goes to press. An extra set of these proofs is also returned to the office to be used in the dummy.

The retail advertising manager must also keep a record, make out a report, and send a list of the advertisers to the circulation manager, just as the general advertising manager does.

In every organization which expects to prosper, new ideas are born. The Technograph has its little baby also. This idea is the statewide advertising department. The purpose of this department is to get more Illinois firms to advertise and represent themselves in the Illinois Technograph. Although this department is still in its promotional state, a great deal of trouble has been taken to procure a list of prospects. Letters have been sent to some of these firms to acquaint them with the advantages of advertising in the Technograph. It is very possible that in the future this new idea will take the form of a permanent member on the Technograph.

Without advertising, a periodical cannot be published. Without circulation, there will be no advertising. Without publicity, there is no circulation. These three statements all add up to prove that publicity is a very important factor.

The publicity for the Illinois Technograph is handled by the circulation manager. Write-ups for the magazine, for the staff meetings, and for other publicity are carried in The Daily Illini, the News-Gazette, and the Champaign-Urbana Courier. The publicity comes from posters on the bulletin boards and the Technograph blotters. However, there are plans for widening this department considerably.

The laurels of this magazine rest on two men — the editor and the business manager. It is their duty to see to it that the above operations are carried out and co-ordinated, and only through co-operation of the entire student body will this magazine be all to keep up its great progress.

Technocracks . . .

Frosh 1: "Hear you got thrown out of school for calling the dean a fish."

Frohs 2: "Didn't call him a fish—just said 'that's our dean' real fast."

* * *

"I used to curse the day I was born. Did you ever do that?"

"No, I was three years old before I learned to swear."

* * *

"You say the water in your house is unsafe?"

"Yeah."

"What precautions do you take against it?"

"First we filter it."

"Yes."

"Then we boil it."

"Yes."

"Then we add chemicals to it."

"Yes."

"Then we drink beer."

* * *

College man (finishing letter to friend)—"I'd send you that five I owe you, but I've already sealed the envelope."

* * *

Prof: "Didn't you have a brother in this course last year?"

Student: "No sir, it was me. I'm taking it over again."

Prof: "Extraordinary resemblance, though . . . extraordinary."

* * *

First C. E.—"I wonder if I could borrow that blue necktie of yours?"

Second C. E.—"What's the matter, couldn't you find it?"

* * *

Prof: "Oxygen is essential to all animal existence. There could be no life without it. It was discovered only a century ago."

Student: "What did they do before it was discovered?"

* * *

Bum: "Have you got enough money for a cup of coffee?"

Student Vet: "Oh, I'll manage somehow, thank you."

... ACCOUNTANT ... SILICONES SPECIALIST

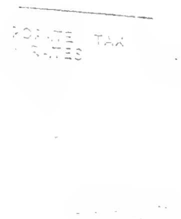
for each, General Electric has assignments to his liking

... one business, but an organi- ... ranging from the ... at Pittsfield, Mass., to ... Calif. Graduates of American colleges and universities are finding that the 125 plants of General Electric offer opportunities to all degrees of specialists, all sorts of enthusiasms, all kinds of careers.

PILE ENGINEER

... Patnode (Cornell '27) of the G-E Nucleon- ...: "Seldom has the engineer been offered the oppor- ... achieve greatness that is contained in the development of atomic power . . . The pile engineer must know radiation as the aeronautical engineer knows air flow, as the electrical engineer knows electromagnetism . . . There is work for more ... engineers, educated men who comprehend the nature and magnitude of controlled nuclear energy."

UP FROM BTC



Donald L. Millham (Union '27), today the G-E Comptroller, is one of the many top officials of General Electric who got their start in the company's Business Training Course, the oldest nontechnical training program offered by industry. BTC trains nontechnical college graduates for managerial accounting positions such as department comptrollers, division accountants, district auditors, operating managers, and treasurers of affiliated companies.

SILICONES SPECIALIST

"... of silicon chemistry has only been touched, with ... continually appearing"—that is the opinion ... (M.I.T. '42), now helping start up the new G-E ... at Waterford, N. Y. Oils, resins, greases, "bounce- ... having silicon as a basis of the molecule ... being marketed in increasing quantities, as they gain ... temperature stability and other ...

... IN THE ELECTRICAL INDUSTRY," WRITE TO DEPT. 237-6, GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

GENERAL ELECTRIC

the Illinois Technograph

OCTOBER, 1948 • 25 Cents

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Machines in RCA's Lancaster Tube Plant are designed for mass production of Kinescopes—television picture tubes—at lowest possible cost.

Behind the magic of a Television Tube

Every morning, 14 tons of glass "bulbs" go down to the production lines at the RCA Tube Plant in Lancaster, Pa.

By evening, the bulbs are television picture tubes, their luminescent faces ready to glow—in television homes everywhere—with news, sports, entertainment, education, and major political events.

Born of glass, metals, and chemicals, the picture tube comes to life through flame and intense heat. Its face is coated with fluorescent material—forming a screen on which an electron gun "paints" moving images.

Each step is so delicately handled that, although RCA craftsmen are working with fragile glass, breakage is less than 1%.

Water, twice-distilled, is used to float the fluorescent material into place on the face of the tube, where it clings by molecular attraction—as an absolutely uniform and perfect coating.

Every phase of manufacture conforms to scientific specifications established by RCA Laboratories. Result: Television tubes of highest perfection—assuring sharp, clear pictures on the screens of RCA Victor home television receivers.

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

From the Dean's Pen

MELVIN E. ENGER
Dean of Engineering

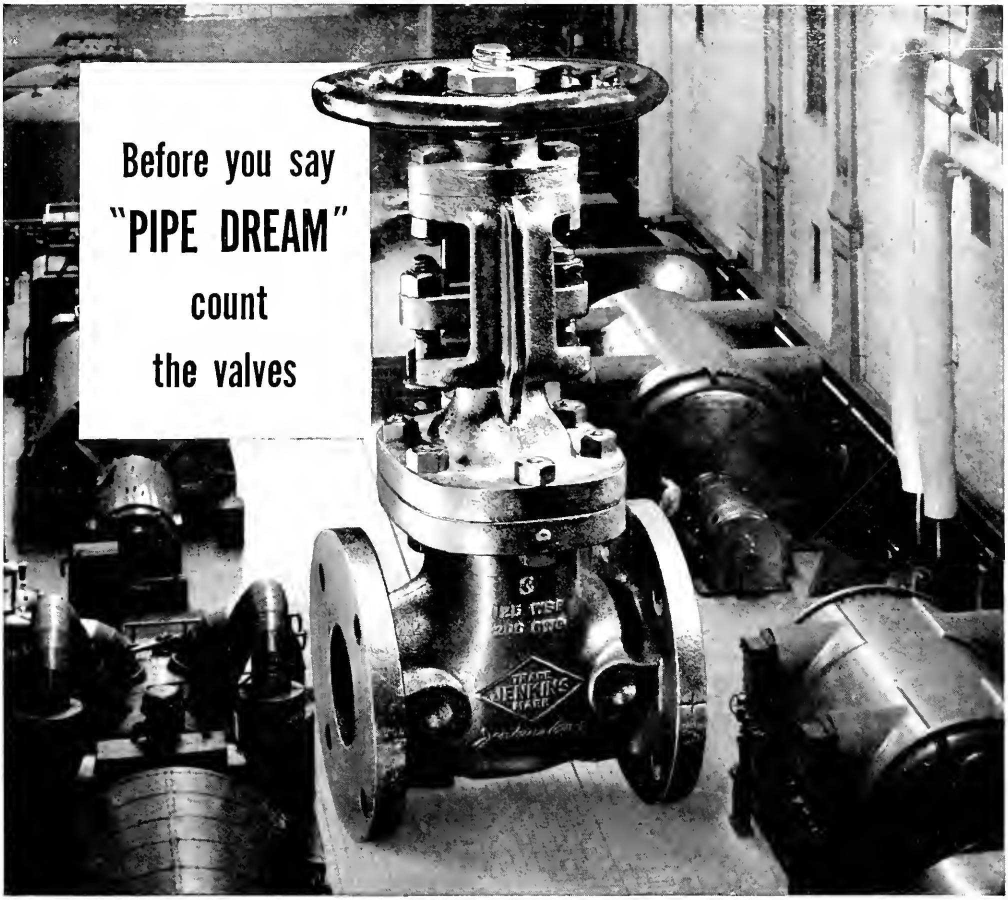
Before the war the maximum enrollment in the engineering freshman class was about 700 students. Two years ago branches were opened at the Navy Pier in Chicago and at Galesburg, and in addition, many branches were established in Illinois high schools to give first-year work in engineering. The engineering freshman enrollments in September, 1946, were about 1,100 in Urbana; 1,000 at the Navy Pier; 200 at Galesburg, and over 600 in the high school branches, a total of more than 2,900 engineering freshmen.

Now that two years have elapsed it is estimated that about 1,200 will register in Urbana as engineering juniors in September, 1948, as compared with a pre-war maximum of less than 500. Senior engineering enrollments will probably be about 800, as compared with the pre-war maximum of about 350. The enrollment of full-time graduate students has increased from 25 in 1945-46, to 253 during the past year. Part-time graduate students increased from 12 to 159 in the same period. A further increase to 275 full-time and 180 part-time graduate students is expected in September, 1948.

The increased enrollment of upperclassmen and graduate students increases the teaching load and overcrowds some of the laboratories. We are determined not to lower standards of class or laboratory instruction. It may therefore be necessary to limit the enrollment in some courses. A few students may have to defer registration in certain required courses, but it is hoped that their schedules can be arraged so that their graduation will not be delayed. Others may find it desirable to register in another curriculum.

The curriculum preferences of many students bear little relationship to the relative professional opportunities in the various fields of engineering. There seems now to be grave danger that the concentration of students in certain curricula will result in an oversupply of trained men in such fields, while a shortage of trained men will continue in other fields. Desirable openings and opportunities for excellent careers exist in ceramic, metallurgical, mining, and sanitary engineering. The nation-wide college enrollments in these curricula falls short of supplying trained men for these expanding fields of engineering.

The selection of a career is one of the most important decisions which each student must make. Because a change of curriculum can be made with relatively little difficulty by freshmen and sophomores, they should investigate the various fields of engineering to insure that they have not overlooked a course of study better suited to them than the one initially elected. Members of the staff are available for advice, and the rich resources of the engineering library should be consulted.



THINK OF *all* the valves in this power plant as *one* valve, and your mind's eye will see something like this photo-illusion. It emphasizes an important fact—that valves, collectively, are a major investment in *any* plant, *any* commercial or institutional building.

WITH WAGES and material costs the highest ever, it is just as important for alert management to keep a sharp eye on valve maintenance costs as it is to watch operating expense of larger plant units.

EXCESSIVE MAINTENANCE of one inferior valve is insignificant, but multiplied by thousands, it is a serious drain on operating budgets. JENKINS BROS. helps to meet this problem two ways. First, by building extra endurance into Jenkins Valves, making them the longest-lasting, lowest-upkeep valves that money can buy. Second, with advice from Jenkins Engineers on any question of proper selection, installation, or maintenance.

That's why, for all new installations, for all replacements, progressive management relies on Jenkins quality and engineering for lowest valve costs in the long run. Sold through leading Industrial Distributors.

•

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

"PREVENT VALVE FAILURE" is a 28-page guide to valve economy, fully illustrated, with case histories of valve damage, and recommendations for its prevention by proper selection, installation, inspection, and maintenance. FREE on request. Write: JENKINS BROS., 80 White St., New York 13, N. Y.

LOOK FOR THIS DIAMOND MARK

SINCE 1864

JENKINS VALVES

Types, Sizes, Pressures, Metals for Every Need

the Illinois Technograph

Volume 64 | Number 1

The Tech Presents

ARTICLES

DEPARTMENTS

OUR COVER

Engineers at the University of Illinois are familiar with these typical scenes and unusual views of their campus. (Photos by Ken McOwan and C. M. McClymonds).

FRONTSPIECE

The atom bomb dropped in the test at Bikini is seen exploding in this joint Army-Navy photograph. In the left foreground is the Japanese battleship Nagato.

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Published Eight Times Yearly by the Students of the College of Engineering, University of Illinois

Published eight times during the year (October, November, December, January, February, March, April and May) by the Illini Publishing Company. Entered as second class matter, October 30, 1920, at the post office at Urbana, Illinois, under the Act of March 3, 1879. Office 213 Engineering Hall, Urbana, Illinois. Subscriptions $1.50 per year. Single copy 25 cents.

Publisher's Representative—Littell Murray-Barnhill, 605 North Michigan Avenue, Chicago 11, Ill. 101 Park Avenue, New York 17, New York.

Overfeed Stokers for Home Use

By Carl Sonnenschein

In this article is covered the design, functions, and operation of a new type of overfeed stoker. Although the field of stokers is one that fits primarily into mechanical engineering, this article presents the subject in a clear enough manner that all engineers will be able to understand it.

The subject of domestic stokers, like any other technical subject, can only be discussed against a background of understanding. That is, an understanidng of not only the technical vocabulary, but also the needs which the equipment is designed to fulfill.

Since the problems relative to stokers are, in general, very closely akin to the work of the mechanical engineer, it is felt that a few definitions of terms should be made for the benefit of those readers who may not be mechanical engineers.

"Fly-ash" is that part of the fuel which is in a very finely divided state and therefore is light enough that it can be carried along by a blast of air.

"Coking" is that quality of a fuel which evidences itself in fusing of the lumps of coal and the resulting incomplete combustion of the individual parts.

"Tuyeres" are those parts of any furnace which are used, and so placed, in order to direct a blast of air into the combustion zone at the particular places where it is most desired.

"Grates" are those parts of the furnace upon which the combustion of the fuel activity takes place.

Whenever a new product is introduced, the persons responsible for its introduction must be able to answer two questions. They are: 1. Why is this new piece of equipment necessary? and 2. What can this piece of equipment do that previously designed apparatus cannot? The following discussion is concerned with these questions.

What are the general requirements that any automatic type stoker must fulfill? In an attempt to answer this broad question, the following set of requirements have been set-up and are generally accepted as being very close to the final conditions which should prevail.

The stoker should be capable of burning both anthracite and bituminous coal, as well as coke. This should be accomplished with equal facility and with a minimum of manipulation of the mechanism. The required sizing of the fuel should not be such as to introduce any stringent limitations upon the sources of supply. Coking or free-burning characteristics, as the case may be, and the fusing temperature should not be limiting factors in the selection of the fuel.

Losses of the heating value of the fuel due to volatile matter which is passed out of the combustion zone and into the stack before it has been burned, must be eliminated to an appreciable extent. Unless this is accomplished, the unit cannot be considered to be operating efficiently.

Fly-ash must be eliminated to a very large extent in order to avoid deposition of insulation around the boiler water tubes and to eliminate objectionable sooting in the neighborhood.

The removal of all ash from the combustion zone should be a fully automatic operation.

The unit, being of a mechanical type, must be immune to damage from foreign matter which may be carried into it along with the fuel. In this category may be included bolts, spikes, wood, rags, stones, or any one of a myriad of things which have been known to cause difficulties in the past.

The most common type of automatic stoker in domestic service today is the horizontal, underfed, augur type. However, this type of stoker has certain inherent faults.

The most common cause of mechanical failure of the augur type stoker is the jamming of the screw caused by the introduction of some one of the types of foreign matter mentioned above. Generally, the method of rectifying the trouble involves the removal of the foreign matter and the insertion of a new shear pin. This operation may be quite lengthy, although no permanent harm is done to the mechanism under most circumstances.

The underfeed, augur type of stoker is well known, particularly where various grades of coking coal are used, for its tendency to produce a "coke-tree." This "tree," in essence, resembles a small volcanic cone, and the effect is one of causing poor combustion at the center of the cone due to the lack of air required for combustion. Frequently, the furnace must be shut down so that the "coke-tree" can be broken up and removed.

Some, but not all, of the automatic

(Continued on page 22)

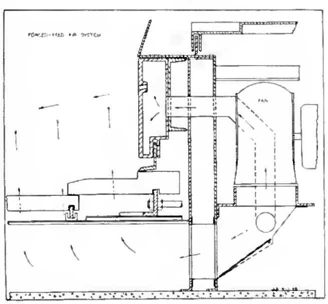


Figure 1

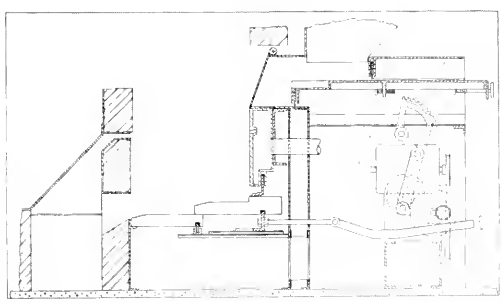


Figure 2

Miniature Printed Circuits

Condensed by Glenn Massie, E.E. '49

FROM A THESIS BY JAMES MATT

Described in this article is one of the outstanding radio developments of recent years—the printed circuit. By the use of extremely small radio tubes and new methods of construction, radio transmitters which can be housed in lipstick containers and radio receivers the size of a package of cigarettes are being produced. The article was condensed from an original paper written by James Matt.

Tremendous gravitational forces are exerted on miniature radio equipment when fired in a shell from mortar or artillery weapons. This force approaches 10,000 G's in some cases, and components wired into the circuit in a normal manner are thus subject to being torn from their mountings. This was sufficient reason for the development of printed circuits, but probably of equal importance were the greater ease of mass production and the smaller size.

Since the war, the National Bureau of Standards and Centralab Division of Globe-Union, Inc., and a few other private companies have continued development of the printed circuit technique with a view to its use in the manufacture of commercial radio receivers and transmitters. Most of the development is now being concentrated on sub-miniature receivers and transmitters, but it is hoped later to incorporate into normal-sized receivers and electronic devices. Printed circuits will most likely find their widest application in low-power, high-frequency radio equipment where small size is an especially important factor.

Another factor favoring the further development of printed circuit techniques is the economy which it effects in production. Present assembly line methods of radio manufacture require the placing of individual wires and components, then their mounting and soldering. The printing technique, on the other hand, would allow a single operator to turn out thousands of complete printed circuits a day, with the added reassurance that each would be an exact reproduction of the original. This process reduces rejects to a minimum, assures standardization, and cuts inspection costs.

Some of the suggested peacetime uses for these sub-miniature printed circuits are somewhat imaginative. One manufacturer, for example, proposes the development of a printed "memory" device which would be small enough to fit into the base of the dial telephone. This unit would make it possible to dial the desired number *before* taking the receiver off the cradle; then lifting the receiver would automatically transmit the stored signal to the selection circuits at the telephone company's sub-station. Thus the selection circuits would be utilized only a small fraction of the time now required for each call, and so make them available for much heavier traffic loads.

Proposed uses for sub-miniature radios and transmitters include a citizens' radio service whereby a person may carry in his pocket a sub-miniature very-high-frequency transmitter and receiver combination, and with it be able to contact his office or home from wherever he may be, within the transmission range of his set. This same set could be used by surveyors, hunters, explorers, and by the traffic policeman or patrolman on his beat.

Practical applications of these printed circuits are available today. Miniature hearing aids about half the size of those manufactured just a few years ago are already on the market. Vest-pocket radios equipped with hearing-aid receivers are also commercially available and are no larger than a pocket-size cigar case.

Figure 1 shows five types of sub-miniature radio transmitters which have been produced by printed circuit techniques. They were designed and constructed at the National Bureau of Standards to transmit in the 132-144 megacycle government band. All five types require only a connection to a microphone, batteries, and antenna in order for them to operate. The two transmitters on the left have their circuits printed on steatite cylinders surrounding the sub-miniature tube. The circuit of the unit in the center is painted directly on the glass envelope of the radio tube. The next transmitter is painted on the envelope of a still smaller tube, which measures only ¼ inch in diameter and 1 inch in length. It is housed in a lipstick container for protection. The last transmitter on the right is printed on a steatite plate 3-32 inch thick by 1½ inches long and 1½ inches wide.

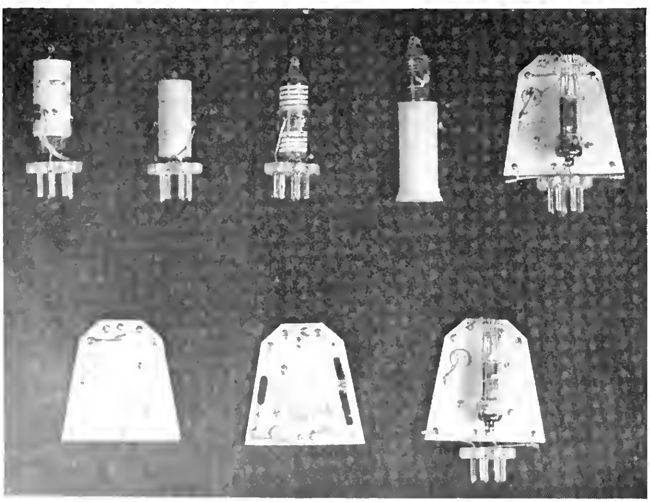


Figure 1. Types of Sub-Miniature Radio Transmitters

The bottom row shows development

stages of the steatite plate transmitter. The plate on the left shows the three radio-frequency coils and a single high-dielectric capacitor. The center picture shows the reverse side of the plate, thus exposing the silver wiring, three resistors (the black rectangles), and four circular ceramic capacitors. The completed transmitter is shown next.

Figure 2 shows the companion radio receivers. The top row shows a four-tube developmental receiver whose printed circuit is visible on the left, and the completed receiver, except for speaker and batteries, is on the right. This receiver is printed on a 2 inch by 5 inch lucite plate. The center row shows an identical receiver printed on a steatite plate. The bottom row shows a receiver equivalent to the one above, but mounted on a smaller 2-inch by 3-inch steatite plate. On the left is shown the circuit as applied freehand with a camel's-hair brush, except for the spiral coil which was put on with a stencil. Wiring on the center plate was done with a rubber squeegee through silk screen stencils. The completed receiver is at the right. All of the receivers shown in figure 2 have four stages, consisting of a grid-leak detector, two stages of pentode audio amplification, and a triode output stage which feeds a permanent-magnet loud-speaker.

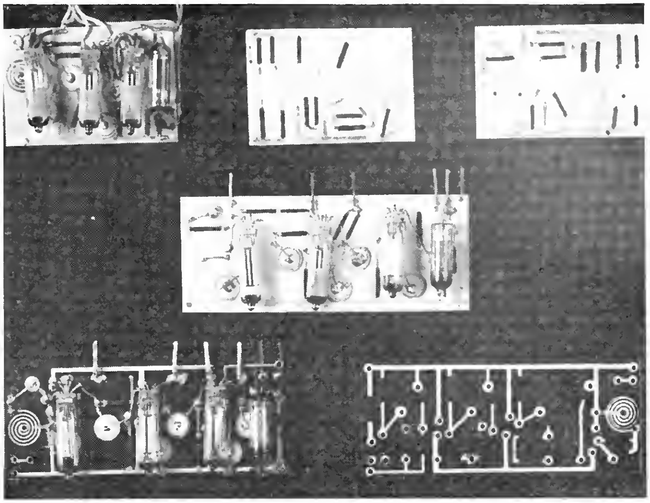


Figure 2. Types of Sub-Miniature Radio Receivers

Construction of Printed Circuits

The materials most commonly used as a base for printed circuits is a relatively new ceramic called steatite. Steatite possesses several advantages over other ceramic materials:

1. Greater physical strength and hardness.
2. Non-absorbent even though completely submerged in water, common solvents, or acids.
3. Better electrical characteristics under adverse conditions.
4. Can be formed to closer tolerance.

Lucite and other plastics have also been used as bases for printed circuits and are satisfactory for ordinary commercial use.

Several kinds of conducting paints are required for printed circuits: 1. A silver conducting paint which has a low resistance and so is used for general wiring and coils, replacing copper wires in the standard radio sets, and 2. A paint containing graphite and lampblack in solution which is used to paint the resistors. Although the silver conducting paint is applied to a thickness of less than .001 inch, its current-carrying capacity is ample to replace all wiring, including filament supply leads. In tests at the National Bureau of Standards, a silver line .002 inch thick and 1/8 inch wide carried more than an ampere of current continuously and satisfactorily. It required eighteen amperes to puncture the line.

Values of the resistors are controlled by varying the length and width of the applied paint strip or by varying the proportions of graphite and inert filler (lampblack) in the paint. After the resistor has been made, its value may be increased by grinding away part of the resistor, or may be decreased by adding another layer of paint.

Vacuum tubes specially developed for service in sub-miniature printed circuits are extremely small. Triodes and pentodes are available which are only 1/4 inch in diameter and 1 inch in length.

Actual printing of the electronic circuits may be done by any one of several methods:

1. Stencil
2. Paint brush
3. Spraying
4. Vacuum methods
5. Die stamping
6. Electro-photography

Of these six methods, the first three are most important. In the stencil method, a stencil is prepared in the same way as a printer prepares a silk screen stencil for printing. The screen is prepared by stretching it over a supporting frame and coating with a photo-sensitive solution. A photographic positive of the wiring pattern is held firmly against the sensitized screen and exposed to strong light. Exposure makes the coating insoluble except for those portions beneath the wiring diagram. When the screen is washed in water, the portions not exposed to light wash out, leaving a clean-cut pattern corresponding to the desired wiring diagram.

The stencil is then placed on top of the steatite plate and the conducting paint applied by means of a camel's-hair brush or by a spray-gun. After printing, the plate is heated. This heating intimately bonds the silver to the base.

The resistors are applied in the same manner as the silver conducting paint, with the most uniformity in resistance values being obtained by the use of a stencil. Wiring of the unit is completed by soldering the disc capacitors, tubes, and leads for batteries, antenna, and loudspeaker directly to the silver wiring on the plate. Eyelets may be placed at strategically-located points to provide a physically stronger contact for mounting components. When all components are mounted, the completed circuit may be coated with a thin covering of lucite cement to provide protection against humidity and mechanical damage.

Performance of electronic devices produced by the printed circuit technique is entirely comparable to that of similar equipment produced by standard manufacturing methods. The day may not be too far off when equipment presently seen only in the comic strips will be commonplace.

Voice from upper floor: "What's the matter down there? Have you no key?"

Noisy one on pavement: "Gotta key all right—how about tosshin down a few keyholes?"

* * *

"Whey!" screamed the farmer boy, drinking a Holstein of beer. "I dairy to curdle up close to me."

"I cud," said the milkmaid, "but I'm not that kine of a girl."

* * *

"What's the professor talking about?"
"Integration, you half wit!"
"Is he for it or against it?"

Your Training in . . .

ATOMIC ENGINEERING

By Francis Green

This article, accompanied by the article on the next page, covers preparatory courses, employment opportunities, and various other phases of the relatively new atomic field in such a manner as to be particularly interesting to the student considering a future in this vital branch of engineering.

A fertile imagination and an acute foresight are prerequisites in surveying a workable plan to be followed in order that the student get the most advantageous initiation into atomic energy engineering and research. To assist those of you who envision being a benefactor of mankind by developing the most powerful force on earth, some facts and suggestions are presented. Most of the material herein was obtained through the cooperation of Dr. W. M. Manning and Dr. Hoylande Young of Argonne National Laboratory in Chicago.

The future of atomic power and tracer techniques rests with the research and engineering personnel now employed, or soon to be employed, at the National laboratories and the many cooperating institutions. It is entirely within the power and ability of the American scientist to create an industry unequalled in size throughout the world, and in benefits to all mankind unequalled throughout all time! We stand on a threshold of incomparable brilliance and promise; those of you who are interested in helping lead the world across that threshold, to you is extended the invitation to read on, and welcome!

At present there is no demand for persons with formal training ending at the high school or junior college level in the field of atomic energy research.

A bachelor of science or arts degree in an engineering field or in one of the sciences—such as chemistry, biology, or pre-medicine—is needed, and a master's degree is indeed preferable. If you intend to go into industry or research without the graduate degree, it is imperative that you include a substantial amount of higher mathematics including Differential Equations and Orthogonal Equations (Math 19) if possible. Aside from the inclusion of mathematics, there are no recommendations that can be made that apply generally to all fields of undergraduate work.

What is to follow is by no means a complete listing of necessary courses for each branch of engineering in preparation for a master's degree. The listing and discussion is primarily for the purpose of presenting courses which are background to problems peculiar to atomic energy.

For the electrical engineer courses in Advanced Engineering Measurements (E.E. 112) and Servomechanism and Automatic Control Devices (E.E. 113) are imperative. Progress in research of a basic nature and the engineering of materials handling is based upon the knowledge and ability of men to invent new, more accurate means of measurement and control of radiations from materials which are poisonous to life. Also recommended is the course given on Vacuum Tube Circuit Analysis (E.E. 120).

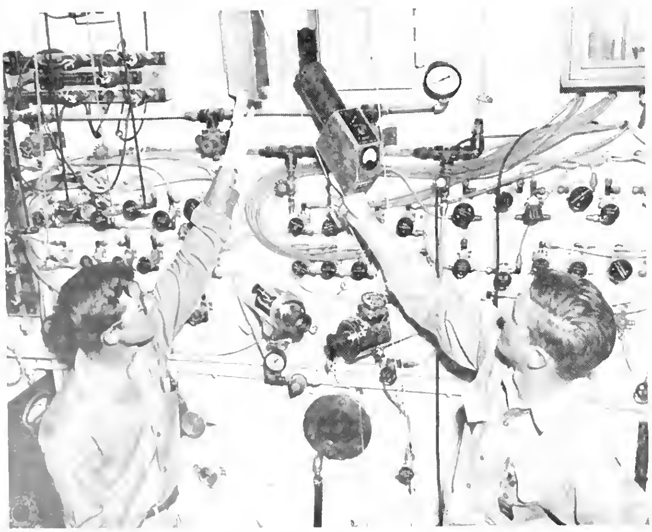
Courses of optimum value in other fields are Advanced Calculus (Math 18), Vector Analysis (Math 41), and Functions of a Complex Variable (Math 102), Line Spectra and Atomic Structure (Physics 184), and Flow of Fluids and Heat Transfer (M.E. 108a).

The mechanical engineer is likewise advised to take the mathematics courses mentioned under electrical engineering, and the course on Servomechanism and Automatic Control Devices (E.E. 113). Also, in his own field, Flow of Fluids and Heat Transfer should not be missed. Elementary Physical Chemistry, and an elementary course in Metallurgy, are preferred.

Until sanitary engineering comes into its own as a career in the field of production and handling of 'hot' materials, the mechanical engineer and the chemist will be working hand-in-hand on the problems of decontamination.

Courses recommended for civil and architectural engineers are Heating, Ventilation and Air Conditioning (M.E. 28), Sewage Disposal, Wastes Disposal, and General Sanitation (C.E. 144), and such courses as your respective adviser may name in structural design and soil mechanics.

(Continued on page 28)



Checking the radiation emitted through an opening with a radiation instrument. The operation on the inside of the thick-walled concrete cell is remotely controlled by the apparatus mounted on the outside wall.

Atomic Energy Means . . .

OPPORTUNITIES FOR YOU!

By Don Hornbeck

At approximately 8:14 a. m., August 6, 1945, Hiroshima time and date, Hiroshima and the rest of the world became suddenly aware of the potentialities of atomic power. Heretofore, the talk of smashing the atom was as little understood by the average man, most college men included, as was the reason for sunspots.

That explosion over Hiroshima unleashed not only a phenomenal amount of physical energy, but it also unleashed a chain reaction in the imagination of the columnists and contemporary writers the world over. Writers paged through the files of the Buck Rogers comic strip to see what fantasies might be made plausible to the minds of their impressionable readers. Within a few hours, everyone became an atomic physicist, who believed himself capable of predicting the weapons, machines, power, and life-habits of the coming decade.

Popular magazines carried the artist's conception of the automobile of tomorrow, powered by a small atomic pile which would be capable of supplying power to the vehicle for a time to exceed the normal life-expectancy of the automobile itself. Gone were the days of filling the gasoline tank every 200 miles. The filling station attendant was to be as obsolete as the livery-stable operator.

The day after the announcement of the atomic bomb explosion the conservative New York Times reported an interview with Mr. William B. Stout, who was reported as saying "an automobile engine no bigger than a man's fist" would be used although he did not predict the realization of this engine for at least ten or possibly twenty years.

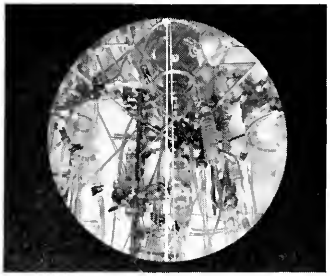
The time of idle dreaming has passed, and people have begun to recognize that peacetime use of atomic power can come only as the end product of years of intensive research. The question is still present—what is delaying our development of atomic energy for use in power plants?

Lack of Trained Personnel

Nucleonics megazine reports that the primary reason for the lack of recent advancement in the field of atomic power is a definite lack of trained personnel who are capable of doing research work on this phase of atomics. At the present time there is a limited number of people who are sufficiently well founded in atomic physics and mathematics such that they are qualified to do basic research on this subject of current interest. Since the fundamental research is of greater priority than the practical applications, just as better engines are fundamental to better automobiles, the qualified men are kept on projects of more basic research. In order to realize the age of atomic power, we must interest many of our graduating engineers and physicists in this field of nucleonics.

Employment Opportunities

The field of atomic energy, now in its infancy, holds excellent employment opportunities for graduates with degrees in chemical, electrical, ceramic, metallurgical, and mechanical engineering. Not only is the work most fascinating, since the materials under consideration are quite unique, but the opportunities for advancement are great since a graduate could "get in on the ground floor" of this new industry!



View inside a "hot" cell as seen through a periscope shows the complex equipment necessary for chemically processing highly radioactive materials behind thick concrete walls.

At the present time the industry is subsisting at government expense because it has not been well enough developed to warrant any private company investing the amount of money required for equipment and labor to do this long-range fundamental research. Although the government is sponsoring the program the actual research is being done largely by private companies and universities who have been awarded contracts to continue the work in the wartime sites. These companies and universities furnish the technical personnel for the project.

A B.S. in Engineering

Before discussing any of the specific duties that one might expect to perform while on the job, let us discuss the general qualifications that the industry is demanding in its prospective engineering personnel. At the present time, an individual with only a B.S. degree must show unusual aptitude and interest in this field to be considered as an employee. This can be attributed almost entirely to the elementry stage of the development of this field. Although this does not serve to eliminate men with a B.S. from seeking employment in this field, the facts are that they prefer men with advanced degrees.

Types of Work Available

The types of work that a man can expect to find in the field of atomic energy do not differ greatly from the types found in a large industrial organization. There are problems in research, design, development, instrumentation and operation. An engineering graduate will find no difficulty in finding the counterpart to his preferred type of work in this singular field.

The basic research is being directed by men of relatively long acquaintanceship with the field of atomic energy. Most of these men possess a Doctorate in physics or chemistry. Since any work on the nuclear reaction will require a thorough knowledge of atomic theories and structure, it is apparent that an advanved degree will be desirable for this fundamental work.

However, there are research problems in the development of related equipment that will not require a Doctor's degree. The Argonne National Laboratory at Chicago (featured in the February, 1948, issue of Technograph) conducts research on instrument development. Here the researcher applies his background in electronics toward the development of remote control devices to control the nuclear reactions which must be controlled from behind lead or heavy concrete walls to prevent exposure to the deadly radioactive disintegration rays. The *electrical engineering* graduate who has specialized in electronics and servo-

(Continued on page 28)

ADOBE HACIENDAS . . .

by Don Johnson, E.E. '49

A typical example of what can be done by the use of rammed-earth construction methods. The house shown can be built at a much lower cost than would be possible with ordinary construction methods.

Included in this article is a description of the methods and applications of rammed earth construction. Its development is traced from prehistoric times to the present, and examples of its durability are cited.

The author is indebted to Vernon Senour for the use of his paper entitled "A History of Rammed Earth Construction," from which the material for this article was taken.

Rammed earth construction has appeared in relatively recent times on a large scale in the cheap but adequate housing projects during the depression of the 1930s. The present post-war housing shortage could be eased at least in part by this same method of construction. Indeed, rammed earth is applicable to many different situations, and is a valuable and durable material when properly used.

Rammed earth construction is a process of building construction in which moist earth is rammed hard into rigid forms for the walls of buildings or vaults. It is frequently referred to by its French name, pise' de terre, foreshortened to pise'.

The origin of pise' has been fairly definitely established as reaching back into neolithic times (3000 to 10,000 years B.C.) on all five of the major continents. Primitive forms of earth construction far antedate the written history of man, but pise' is not a primitive form of earth construction despite its very early origin.

One very common type of primitive earth building is wattle and daub, which is simply mud plaster (daub) on a lathing (wattles) of twigs or rushes tied to upright posts forming the wall frame. The wattle and daub is simply a filler between the framing members and is not self supporting. The mud is covered with cement plaster in present European practice.

From wattle and daub the next step forward was the cajon method. This, too, utilizes the earth only as a non-bearing filler between studding, where it is laid up as sun-dried brick filler or sometimes rammed into a form clamped to the studs. This is a distinct advance over wattle and daub insofar as it may be relatively permanent if well constructed; also, it utilizes earth in sufficient thickness to obtain effective insulation.

The next step forward was the use of uncompacted earth as a bearing wall. The sod houses of pioneer days on the American prairies are a crude example of this method. The English cob houses are a better example. Cob, so called from presence of cobble stones in the earth mixture, is a method of forming walls by piling up layers of wet earth intermixed with vegetable-fibre binder and allowing each layer to dry partially before adding another.

Adobe construction, very popular in the American Southwest in pioneer days, is a distinct improvement upon cob in the bearing strength and weather-resistance of the walls and in facility of construction. Poured adobe walls are made by pouring the prepared earth wet into a low wall-form, the form being moved upward for the next layer as soon as each layer becomes dry enough to support weight. Adobe bricks are usually formed of prepared, wet earth in small hand-molds.

Rammed earth, or pise' de terre, unlike adobe, is not compacted by water action but by ramming in a moist (not wet) condition. Pise' is formed by various methods, the commonest being ramming the earth into monolithic walls. For this, rigid wooden (or metal) forms three feet high by ten feet long are used. These are of two inch lumber, the two halves of the form being held apart the thickness of the wall by wooden spacers, and held together by tie rods. The form is erected on the foundation, and a four or five-inch layer of loose earth shoveled into the form and rammed down to about half its volume as loose earth. Then the form is removed and erected on top or beside the freshly rammed wall section and the wall continued. No drying time is required since the earth attains a bearing capacity of five to thirty tons per square foot immediately after ramming.

Asia and Africa

Numerous examples of earth structures have been excavated or discovered in Mesopotamia. Some of the more important or more famous were: Temple of the Sun God at Sippar (3750 B.C.), the famed Tower of Babel at Babylon, Temple Ezida at Birs Nimroud near Babylon. The Hanging Gardens of Babylon are another structural type.

One ancient method of earth construction in India is that of kneading balls of clayey earth with water and building walls with them, filling up interstices with liquid mud. Houses built thus stand well for years when protected from heavy rain. Such walls, running to a height of twenty feet, are common in India.

In the nineteenth century, pise' cottages were built by British colonists in India and, at the time of observation about forty years later, showed no sign of deterioration in spite of monsoon rainfall of more than eighty inches in three months. The whitewashed walls

(Continued on page 36)

In This Corner... NAVY PIER

NAVY PIER . . . Full Speed Ahead

By Siegmund Deutscher, A.E. '50

Nearly half of the normal student enrollment in the main campus of the University of Illinois, located in Urbana-Champaign, 138 miles southwest of Chicago, are residents of the Chicago area.

The Urbana-Champaign campus could not accommodate the thousands of veterans and non-veterans who applied for admission following V-J day. The General Assembly of the State of Illinois, however, was determined to make good its promise to provide educational opportunities for all state residents, both G.I.'s and high school graduates.

To do the latter, the Undergraduate Division at Navy Pier in Chicago was started, especially since it would enable many G.I.s who could not afford to live away from home, an opportunity to live at home while attending the University. The fact that such a large number of qualified teaching personnel lives in the Chicago metropolitan area added to the choice.

In August, 1946, the work of converting Navy Pier into a college was started; three months later classes were under way. Since the Pier was built in 1916, it has served as a shipping and storage pier, an amusement center, headquarters for conventions, and as a training base for the Navy. During the war Navy Pier was used as a training school for more than 50,000 electronics and special device technicians.

The man who has directed the establishment of the Navy Pier branch is Dean Charles C. Caveny. Dean Caveny was formerly the executive and educational officer at Navy Pier during the war.

The University of Illinois leases 500,000 square feet, approximately one-half of the entire Pier. Most of the classrooms and laboratories are located on the first floor of the north wing. The University also occupies the second floor addition between the north and south Pier, the auditorium at the east end of the Pier, and the large gymnasium adjacent to the west end of the Pier.

A total of 62 classrooms, 33 laboratories, and 6 large lecture halls serve 4,000 students offering freshman and sophomore courses in the Colleges of Liberal Arts and Sciences, Commerce and Business Administration, and Engineering and Architecture.

Commencing with the 1948 fall semester, the complete pre-professional course in medicine will be offered. Upon completing their work here, the students may apply for admission to the University's professional College of Medicine, located in the medical center on the west side of Chicago.

A complete two year curricula in commerce, chemistry, and chemical, aeronautical, civil, electrical, metallurgical and mining engineering, and architecture is offered at Navy Pier.

The Chicago undergraduate division boasts one of the best equipped machine shops of any college in the country. More than a quarter of a million dollars in equipment is used by engineering students who receive practical training in the operation of industrial machines.

The Navy Pier branch had an enrollment of 3,846 when it began its first classes on October 21, 1946. Last fall, the enrollment reached a record high of 4,550. In the spring semester of 1948, 4,251 students were in attendance. More than half of the students are veterans.

The University's interest in the individual student extends beyond the classroom to provide educational, vocational, and personal guidance.

A student health service is maintained to promote better physical and mental health among the students at the Chicago undergraduate division.

Daily food service for 6,000 staff members and students is provided. To supplement the classrooms and laboratories, the University has a 20,000-volume library, a cooperative bookstore, and three large student lounges.

Yes, all this has been accomplished in two years, but the sailing was not very smooth. Many hardships had to be overcome by both students and staff members. During the first semester, half of the classrooms had folding chairs for seats, the laboratories were unequipped, the drawing rooms had tables instead of drawing desks, and half of the books and supplies were unobtainable. Yet, the students and faculty dipped right in and did their best. Even with new fluorescent lighting, desks, and equipment, the "gripes" were continuing. Many of the

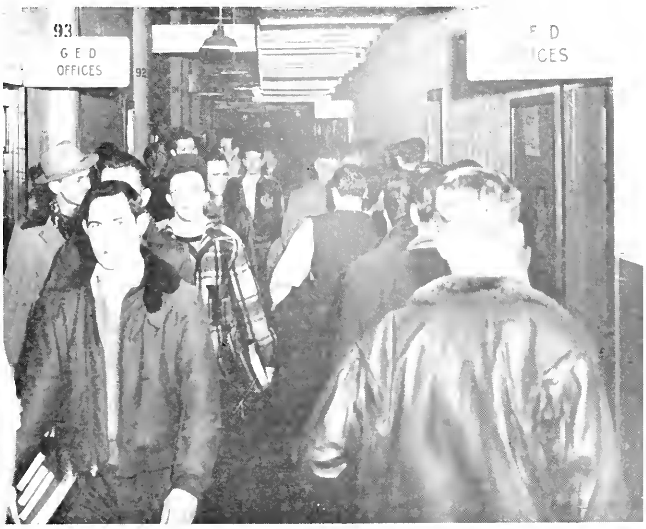
(Continued on page 38)

EDITORIAL STAFF

Siegmund Deutscher...*Navy Pier Editor*
Naomi Suloway...*Navy Pier Bus. Mgr.*
Richard Choronzy...*Navy Pier Asst. Ed.*

Reporting

John Fijolek — Norbert Ellman
Leonard Cohen — Robert Mihalik
Thomas Fehr...*Photographer*
Ogden Livermore...*Faculty Adviser*



In between classes around "Engineering Hall" at Navy Pier

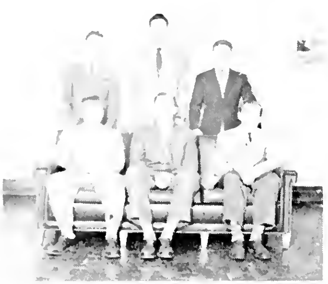
Undercover at... GALESBURG

The Technograph Staff

By Dwight R. Beard, E.E. '50

At the close of last semester over one-half of the Technograph staff left the Galesburg campus and it was necessary to reorganize the remaining members into a new and much smaller group. Following the same general policies as its predecessor, this new staff, although reduced in strength, will endeavor to meet the high standards familiar to Technograph readers.

The new editorial staff has two main objectives: the reporting of news of engineering activities and personalities on the Galesburg campus and aiding the Engineering Council by publicizing their activities and encouraging more active participation in these activities by engineering students.



Seated from left to right: Bill Carr, H. Roy Johnson, and Luther S. Peterson. Standing from left to right: Dwight R. Beord, Dean R. Felton, and Stanley Runyon. Not in the picture were Jock Porlier and Joe Graham.

The staff is headed by H. Roy Johnson, a graduate of Lane Tech in Chicago, who served with the Army in Panama. While in the service, he gained much experience in preparing reports for his regimental news bulletin. His interests lie in the field of civil engineering which he is following with much success, marked by his initiation into the Phi Eta Sigma fraternity.

Aiding Roy on the editorial staff are four reporters who gained experience working on the staff last semester. Stanley F. Runyon, who, after graduating from Manito Community high school in 1946, attended the American Television school in Chicago, is presently following his chosen field in electrical engineering and spends most of his free time as an active member of the Radio Club. Dean R. Felton, who hails from Kewanee, Illinois, spent nineteen months with the Army. He is enrolled in civil engineering and spends quite a bit of his free time on his hobby of building model jet racers. Luther S. Peterson comes from Chicago and provides an interesting paradox. Both he and Roy Johnson were members of the same high school class, army unit, and even went to Panama on the same ship, yet they never met each other until they became members of the Technograph staff. Last but not least, we come to your author. I am a graduate of the community high school at Virden, Illinois, and spent 29 months with the Army Ordnance Department. Later, I accepted a position with a photographic measurement group at White Sands Proving Grounds at Las Cruces, New Mexico. My work there convinced me of the need of a more formal education and led me to choose electrical engineering.

Our photographer, Joe Graham, is the newest member of the staff. He became interested in photography at Freeport high school where he was an active member of the Camera Club. After graduating, he joined the Navy and was assigned to duty afloat in the Pacific. Because of his love of the out-of-doors and his interest in construction, he chose civil engineering as a career and is now very successfully preparing for that field.

The business staff is chiefly concerned with the sale and publicity of the magazine on the Galesburg campus and securing advertising from industries. The staff is headed by Bill Carr who gained much of his experience as business manager of the 1947 year book at Kewanee high school. Bill decided on electrical engineering after working on rural electrification and spending numerous hours tinkering with radios. Jack Parlier, a graduate of Canton high school, aids Bill by taking care of the advertising. Jack's hobby is building model racers.

GALESBURG STAFF

H. Roy Johnson .... *Asst. Editor*

Reporting

Stanley Runyon — Luther S. Peterson
Dean R. Felton — Dwight R. Beard

Photography

Joe Graham

BUSINESS STAFF

Bill Carr .... *Asst. Bus. Mgr.*
Jack Parlier .... *Advertising*

Mr. Francis Pratt

By Thaddeus F. Boblak, E.E. '50

Electrical engineering students at Galesburg look mainly to Mr. Francis E. Pratt, faculty member in the engineering science division, to provide a sound basis for further studies in their specialty. This is quite natural, for each electrical engineer studies illumination and circuit analysis under Mr. Pratt's tutorship. Most other pre-engineers get acquainted with him while taking their first and second course in mechanics.

Mr. Pratt began his higher education at Cornell College in Mount Vernon, Iowa. From there he transferred to Northwestern University where he completed studies necessary for a B.S. degree in physics. After graduation he attended the University of Iowa and there obtained a B.S. degree in electrical engineering.

His teaching career began at Central State Teachers College in Stevens Point, Wisconsin. After this, he journeyed to Eastern New Mexico College where he held a post as assistant professor in engineering and physics. But the midwest beckoned, and he returned to take his present position with the University of Illinois.

During World War II Mr. Pratt detoured from teaching, to work in industry and on several development projects. His services in industry included periods of time at Skokie Electric company in Glencoe, Illinois, Galin Manufacturing company (Motorola) in Chicago, Illinois, and Stromberg Carlson in Rochester, New York. His efforts were acknowledged by the National War Production Board for which he received a war production award.

Mr. Pratt also held a position with the physics and engineering development project at the University of Iowa, which was part of the system of campus war development projects which contributed so many new and improved devices to the American war effort. Among the more prominent developments in which he aided was the radio proximity fuze (VT), which became well known as the Posit fuze to the artillerists during the latter half of the European war. A direct result of its employment was an increase in speed and accuracy with which artillery fire could be conducted.

His industrial experience, together wtih his education and personality, assure Mr. Pratt continued success as a teacher. He provides the student with not only the technical essentials, but also with some practical preparation for the future by discussing how theoretical study matter is applied in industry and by emphasizing the importance of fundamental concepts.

Extra-Curricular Engineering Activities

By H. Roy Johnson, C.E. '51

As the prospective engineer enters his undergraduate training in college, he is confronted with many problems. The most prominent of these is the problem of learning correct study habits and how to use any spare time available to its proper advantage. The former is a problem best suited to individual solution along with some aid from the various counselors available here at Galesburg. The problem of using spare time properly is one which has been well handled by our Engineering Council. They have arranged a program of extra-curricular activities which has aided many of the pre-engineers on our campus..

One of the most prominent of these projects is the Engineers' Lounge which presently is housed in building number E-11. This lounge has been outfitted with current publications obtained from some of the largest engineering firms in the nation and also with other informative, as well as interesting, literature on all of the engineering sciences.

Because of the fact that this lounge was not completed until late in the past semester, it has not been put to its intended use. A pre-engineering student must learn that he should know what developments are taking place in industry that affect his chosen field of endeavor. The Engineers' Lounge is just the place for the prospective engineer to obtain this type of information. Industry is clamoring for well informed, as well as well educated, engineers and it is up to us to satisfy their desires.

Definite plans for this semester have not as yet been released by the Engineering Council. It is expected that there will be field trips, vocation and educational movies, and many other activities designed to interest engineering students.

WILLIS YARD

By Bayard L. Wright, M.E. '50

Galesburg, Illinois, is the midwest nerve center of the Chicago, Burlington, and Quincy railroad. Through Galesburg pass the Chicago to Denver main line and the Beardstown, Quincy, Peoria, and Savanna secondary and branch lines of this company. The Burlington lines are important to the economic life of Galesburg, employing a large part of the city's 29,000 population.

South of the city is Willis Yard, one of the largest classification yards owned by a single railroad in the world. Named for R. W. Willis, the designer, these yards were completed in two sections, the eastbound hump in the year 1931, and the westbound in the year 1942. The receiving yard for trains from the north (twin cities via Savanna), east (Chicago), and Peoria contains ten tracks with an 1,112 car capacity. The receiving yard for trains from the south and west (southern Illinois coal fields, Kansas City, Colorado and Pacific northwest) has nine tracks with an 1,134 car capacity.

The receiving tracks lead onto the humps, artificial hills used for gravity switching, which in turn lead into their respective classification yards. The west classification yard has a 1,542 car capacity on its 35 tracks while the east yard holds 1,306 cars on 49 tracks. From the classification yards cars move to the departure yards where they are serviced before leaving as trains. The eastbound departure yard has two extra tracks, holding 90 cars, which are used for eastbound perishable trains. Refrigerator car ice bunkers are refilled from a long, roof high icing dock between the tracks.

The humps themselves are the heart of the yard. The gradient on the westbound hump starts at 4% and works off to 2% before reaching the level classification yard. The east hump is not quite so steep, working from 3.5% to .25%. The cars are slowed on the hump by electro-pneumatic retarders (electrically controlled but operated by compressed air). These retarders consist of long heavy metal bars on both sides of each rail which press against the wheel flanges and rims at varying pressures controlled by the operator. The operators controlling the retarders, and also the switches leading from the hump into the classification yard, are situated in towers along the hump and lead tracks. Willis Yard has five such control towers.

During each twenty-four hour period the operating crews work thirty-two tricks (a trick being an eight hour work period for a single switching crew). Much of the switching is done by diesels, there being nine 1,000 h.p. and one 600 h.p. diesels employed in the yards. The average switching crew consists of the engine crew, the foreman who is in charge, the pin man who uncouples the cars, and the field man who applies metal track skates to stop the first car down each classification track.

The best way in which to relate the various operations in the yards is to follow a train through them. The train first pulls onto one of the receiving

(Continued on page 30)

This is the Willis Hump Yard located in Galesburg, Illinois. The Yard is capable of handling approximately 80 to 95 trains in a 24-hour period and holds a record of 1,387 cars humped in an 8-hour period.

The Engineering Honoraries and Societies

By Ray Hauser, Ch.E. '50 and Dick Ames, Cer.E. '49

PI TAU SIGMA

Pi Tau Sigma, the national honorary mechanical engineering fraternity, was formed by a group of upperclassmen from Illinois and Wisconsin. At a joint meeting of the two groups in Chicago in 1916, the fraternity was formally established and the Illinois and Wisconsin chapters were designated as the Alpha chapters.

Active members are chosen from the junior and senior classes on the basis of scholarship, personality, leadership, and probable future success in the field of technical engineering. Fifteen per cent of the junior class and 25 per cent of the senior class are eligible for selection as active members.

Plans are being formulated at the present time for a smoker to be held later in the semester to introduce new pledges to the organization, and the initiation after pledge duties are completed.

Faculty adviser, Professor J. C. Miles, helps to keep the gears running smoothly. Officers of the local chapter are Bernard Peskin, president; Clarence Brown, vice-president; Charles A. Lessing, treasurer; Harold K. Levy, recording secretary; and Harold I. Blotner, corresponding secretary.

I.T.E.

Traffic engineering, one of the newest and fastest growing engineering fields, is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon as their use is related to the safe, convenient and economic transportation of persons and goods.

The second chapter of the I.T.E. was formed here at Illinois in 1947 and has been extremely active since that time. The members have participated in actual research, including the collection, study, and reporting of data on the traffic problems confronting the University and the cities of Champaign and Urbana.

The officers for this year are Edward Bolden, president; Howard E. Morey, vice-president; and Thomas E. Young, secretary-treasurer. Professor C. C. Wiley is the faculty adviser. The chapter normally meets twice a month. Dates, locations of meetings, and other announcements will be posted on the bulletin board outside 103 Engineering Hall. Watch for the yellow stop sign!

ENGINEERING COUNCIL

After a very successful first year, the Engineering Council is looking forward to even greater accomplishments this year. Consisting of delegates from each engineering society and the editor and business manager of The Technograph, the Council has worked for better harmony and cooperation among its constituent groups. Other aims are to stimulate the interest of the engineering students in all engineering activities on campus and to be responsible for the planning and carrying out of combined activities of the engineering societies. Included in the latter are the annual St. Pat's ball and the engineering show.

Officers of the Council are Allen Benson, president; Dick Coderre, vice-president; Bill Paulson, secretary; and Dick Ames, treasurer.

SIGMA TAU

Open to all engineering students who have brains as well as good looks, Sigma Tau honorary promotes cultural and scholastic improvement. Pledges are chosen and initiated each semester. It is planned to present a scholarship medal each year to the most outstanding freshman engineer on the campus. This will help to stimulate competition and interest in Sigma Tau among the underclassmen.

Officers of the Illinois chapter are as follows: George Gore, president; Norton W. Bell, vice-president; Paul E. Backer, treasurer; Daryl M. Papke, recording secretary; James F. Chandler, corresponding secretary.

M.I.S.

Very much interested in brevity is the M.I.S. which uses but one "M" to signify mining and metallurgical engineering. Membership in this society is open to anyone whose curriculum may include mining, metallurgy, or geology. Speakers from the professional chapter of the A.I.M.E. in Chicago are often obtained to inform the group about the life and work to be expected outside. There has been a scarcity of mining engineers in the M.I.S. so the present officers are being urged to bring about a better balance of membership in the society.

If you are interested, just contact Dr. William R. Chedsey or one of the officers, Keith Lampson, president; Norbert Blaski, vice-president; Charles Fournier, secretary, or Verle Udzinger, treasurer. If they are too hard to contact you might find one of them at the meetings which are announced on the bulletin board on the second floor of the Metallurgical laboratory.

A.S.A.E.

Down in the "you all" end of campus is the agricultural engineering building, headquarters of the A.S.A.E. Mr. Robert Whittacker is faculty sponsor for this group, whose activities include operation of a lunch stand during Farm and Home Week. Local and imported speakers are usually presented at the bi-monthly meetings.

Officers of the A.S.A.E. are: Earl Moss, president; Lawrence Bitterman, vice-president; D. A. Jones, secretary; and Dave Cash, treasurer.

A.S.M.E.

The A.S.M.E. was a very successful and busy organization last year with a record-breaking membership. After giving Professor Seyfarth, the honorary chairman, a short rest during the summer months, the organization is ready to start action again.

A committee of A.S.M.E. students was responsible for starting the course-grading sheets in the M.E. department. At the end of each semester the students fill out a form, giving suggestions and comments about the course and instructor. The society's bowling team did quite well last spring and may be continued this year. Watch the bulletin board in the Transportation building for notice of future activities.

A.I.E.E.-I.R.E.

To make sure that the "word" gets around to all the members a newsletter is sent out by the Electrical and Radio engineering society on campus. Thus, the many events are well publicized and no one needs to miss out on the activities throughout the semester.

A competition in writing technical papers will be held this year for members with or without rhetoric abilities. The entrant with the most pull (or bull, whichever it takes) will receive a trip to the AIEE convention at Michigan.

The AIEE-IRE is expecting to lend a hand in planning for the grand opening and dedication of the new EE building this year.

Professor E. A. Reid is the adviser for this group, whose officers are Keith Goodwin, chairman; Don Hyer, vice-chairman; Ed Schwartz, secretary; Laverne Wente, treasurer; James Stewart, Engineering Council representative; Robert Beck, AIEE corresponding secretary; and James Schussele, I.R.E. corresponding secretary.

I.A.S.

Whether you're a "fly-boy" or just high on weekends, you might be interested in joining the Institute of Aeronautical Science. Jacque Houser, of the Aeronautical Engineering department, is adviser for the group and though not a D.D., would be glad to help you shape your wings.

Leading the flight are these officers: Vernon VanHeyningen, president; William A. Brooks, vice-president; Lowell Masley, secretary-treasurer. Allen M. Benson and Vernon VanHeyningen are the Engineering Council representatives.

A.S.C.E.

You don't have to be a civil engineer to belong to the A.S.C.E. General and architectural engineers are more than welcome to join up and take an active part in the program.

About 35 members from the branch chapter at Navy Pier will be welcomed onto the campus at a smoker to be held soon. Anyone interested is invited to attend and get acquainted with the faculty and learn about the plans for the future.

A novel arrangement that gives continuity to the society and experience to the officers is used. Each vice-president learns the ropes from the man higher up and then takes over the presidency after a semester's apprenticeship.

Wheels of the A.S.C.E. for this semester are Kenneth McGann, president; Wendall Rowe, vice-president; Charles Lampe, secretary; Cliff Anderson, treasurer; and Frank Sexton, Engineering Council representative. Professor M. O. Schmidt is the faculty adviser.

To get the latest dope, take a look at the bulletin board just across the hall from the Technograph office in Engineering hall.

A.I.Ch.E.

A rounded program of speakers covering subjects from the economic and business viewpoints, as well as the technical side, is to be presented to the members of the A.I.Ch.E. throughout the coming year. On the list of probable speakers are several outstanding men of industry and distinguished faculty members from this campus and other schools.

Open to chemistry curriculum and chemistry majors as well as chemical engineers, the A.I.Ch.E. provides social as well as technical programs. Well worth looking forward to are the Beer Bust and the Banquet, which climax the year's entertainment program.

Faculty adviser for the society is Dr. H. G. Drickamer, of the chemical engineering division. If you're interested, contact one of the plumbers with the economy-size pipe wrenches: Al Birkelbach, president; Ray Harris, vice-president; Bill Barnes, secretary; Herb Schultz, treasurer; or one of the Engineering Council representatives, Dale Glass or Dick Coderre.

ETA KAPPA NU

The electrical engineering honorary, Eta Kappa Nu, was founded here at Illinois in 1904 to stimulate and reward scholarship and to advance the electrical engineering profession. Requirements include not only scholastic proficiency but also acceptability to the members of the chapter.

Professor A. R. Knight is faculty adviser for the local Alpha chapter. Present officers are Edward W. Ernst, president; Wayne L. Hall, vice-president; James H. Schussele, secretary; Frank J. Dill, corresponding secretary; Floyd Dunn, bridge correspondent; and James L. Moon, treasurer.

TAU BETA PI

You have to be more than a brain to get a Tau Beta Pi key, as selection of members is based on scholarship, integrity, breadth of interest both inside and outside of engineering, and unselfish activity. Illinois Alpha chapter, the fifth oldest in the country, was founded here in 1897.

Members of the faculty advisory board are S. H. Pierce, M. A. Faucett, W. N. Espy, and J. O. Smith. Chapter officers are Charles Drury, president; Charles Studt, vice-president; Stafford Kulcinski, treasurer; Gilbert Kamm, recording secretary; and John Parry, corresponding secretary.

ELECTRONICS CLUB

To provide technical practice, facilities, and instruction for students and faculty members who are interested in electronics is the aim of the still-wet-behind-the-ears Electronics Club. University equipment and facilities are for the use of members desiring to construct electronics equipment. Work on personal projects is encouraged and, whenever possible, technical assistance is supplied.

To keep in the know, take notice of the "bull" on the bulletin board next to room 212, E.E. laboratory. I. G. Evans is president; M. L. Embree, vice-president; and G. M. Boyd, secretary-treasurer of the Electronics Club.

S.B.A.C.S.

The Student Branch of the American Ceramic Society is an organization designed to give future ceramic engineers a more professional interest in the industry in addition to their academic course. A second, and no less important aim of the society, is to promote activities so that all members of the society will become acquainted with each other. In the past, before the influx of veterans, it was the boast of the ceramic department that each man was known to all members of the department, both students and faculty, by his first name. With the present large enrollment, however, this becomes increasingly difficult, without having a special agency for the purpose. The S.B.A.C.S. has fulfilled this function in the past two years, and will endeavor to increase its scope of activities in the year ahead.

In the 1947-48 school year the outstanding activities of the society were the annual "Pig Roast," a stag dinner at which senior students roasted the faculty, and a picnic to which the wives and girl friends of the members were invited. Both functions were a huge success. The S.B.A.C.S. points with pride to the fact that its vice-president during 1947-48, Floyd Maupin, was also elected vice-president of the Engineering Council. This gave the society increased prestige among the larger societies of the engineering campus.

At the last meeting of the spring, 1948, semester the following officers were elected: LaVoy Schneider, president; Dick Ames, vice-president; Howard Rapp, secretary; Bob Bender, treasurer. Bob Degenkolb was elected as the Engineering Council representative for the '48-49 school year.

It was voted at this meeting to change the tenure of office from one year to one semester for all officers, in order that more of the members would have the opportunity to direct the society's activities. It was also decided at this meeting to draw up a new constitution. A meeting of graduating seniors, faculty, and the new officers was held to exchange ideas and make suggestions as to what the new constitution should embody. President Schneider will appoint a working committee at the beginning of the fall '48 semester.

Many suggestions have been made for activities in the future. These include a pottery club, a newspaper, and a camera club. It is also planned to have a picnic at the beginning of the fall semester to introduce new students to the department.

"My wife and I had a big argument last week. She wanted a convertible, but I refused to buy it since I prefer a station wagon."

"Does she like the new convertible?"

* * *

Ruth rode in my new motorcycle
On the seat in back of me
I took a bump at fifty-five
And rode on ruthlessly.

* * *

"Yes, I'm married now."
"What's your wife like?"
"Bourbon, rye, almost anything."

Introducing . . .

by Art Dreshfield, Chem.E. '51

PARESHNATH CHATTERJEE

On an average sunny afternoon, the best way to find Nath Chatterjee would be to look around the campus tennis courts. Although he considers himself barely above a beginner, he is really a very good player. What he considers as an "average" tennis player, a man with

PARESHNATH CHATTERJEE

a powerful serve, strong forehand and backhand, and good net play, would give the best of players a hard fight.

Born in Calcutta, India, 28 years ago, he has lived and studied there most of his life. In 1938, he received a B.S. in physics from the University of Calcutta, and three years later a B.Eng. from the same place.

The Indian Army next claimed a year of his time, after which he went to work for a construction company. This work was required of graduate engineering students in India, much as medical students in this country are required to intern for a year. Most of his two years at this job was spent supervising the digging of ditches and the erecting of ramparts, as this was during the war, and Calcutta was under the constant threat of air raids by the Japanese. Because this work had no future and gave no important practical experience, he resigned, feeling that he could spend his time in better ways.

Nath did use this time to good advantage reviewing his college work, and in 1945 was one of five Indian students to be awarded a scholarship to the University of Illinois.

Starting in February, 1946, he has studied here continuously since then, and finished his work and thesis this summer.

Between now and February, when he will be awarded his Ph.D., Nath would like to get a job in the United States. Otherwise, he will probably return to India. After he gets his degree, under the terms of his scholarship, he is required to work for five years at any job assigned by the Indian government.

Besides tennis, Nath also plays bridge and is interested in photography. That these do not interfere with his studies is testified by the fact that he is a member of Sigma Xi.

Comparing U. S. with Indian education, Nath feels that, in general, they are similar. However, he feels that here, the physical phases of engineering, while in India the theoretical and mathematical aspects, are the areas of greater concentration.

Nath likes Illinois and the United States, but naturally will be glad to return home. He has no plans beyond working the required time for the Indian government. "India is now in a period of transition, and everything is too uncertain," he says. But whether he eventually settles down in India, the United States, or elsewhere, his industriousness, personality, and education are certain to make him successful.

VERNON SENOUR

Would you like to live in a house with walls of earth? Vern Senour is a man who feels that more people should live in this type of building. He says that, actually, rammed earth walls can be made stronger than brick, as resistant to water action as concrete, and far more inexpensively than any other building material. "But," he says, "no one would benefit by their use except the consumer, so there has been no commercial interest in them."

Vern is in a good position to talk authoritatively on this subject for he has been interested in it for over ten years. While not having done any intensive research, he has done much extensive reading and some practical work on it. This summer he made some rammed earth buildings near his home in Bourbon, Indiana.

Vern was born there in 1920 and lived there most of his life. In 1938, he received a scholarship for his first semester at Purdue, which he attended for five semesters in a general engineering curriculum. Transferring to the University of Chicago, he began studying architectural engineering and continued for three semesters until he was called into service.

He went into the Army in 1942 and spent the next three and one-half years as an enlisted man with the air force ground services.

After receiving his discharge, Vern came to the University of Illinois in February, 1946. He has continued in the architectural engineering curriculum,

VERNON SENOUR

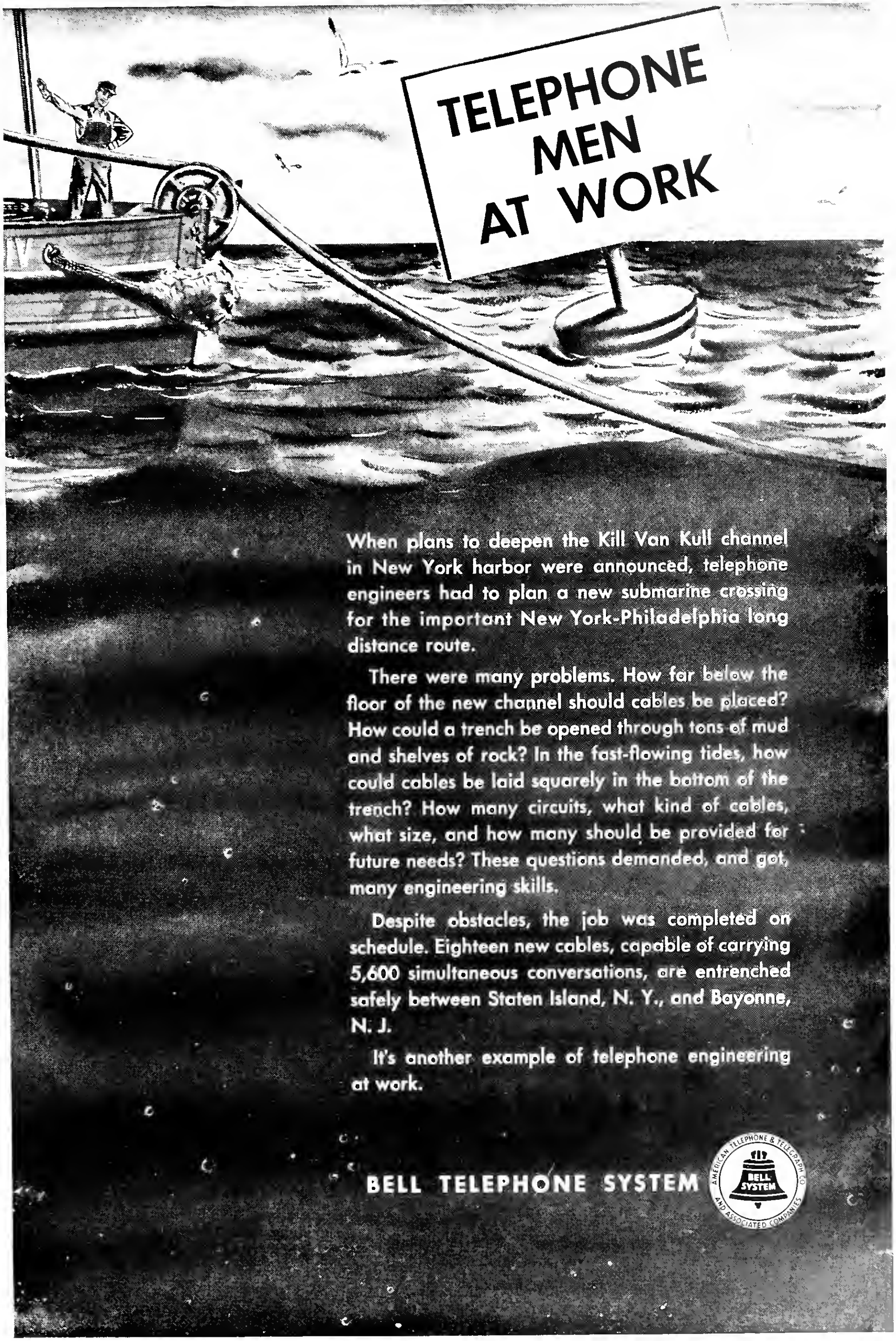
has made Honors Day twice, and expects to get his B.S. this February. Then, rather than doing graduate study, he plans to go right to work. "It's best to start now while the housing boom is on. It can't last forever," he says.

With Vern, architecture is a hobby as well as a profession. He is well informed, not only on rammed earth construction, but on many modern developments. He reads Architectural Forum and other such magazines whenever he has time. In addition, he has designed and built some small houses his relatives now occupy.

With his broad architectural knowledge and experience, Vern is exceptionally well qualified to enter the field of architecture. Whether booms or depressions come, he should be destined for a successful career.

FIRST COED METALLURGIST

Miss Margaret E. O'Donnell has the unique distinction of being the first girl ever to receive a diploma in metallurgical engineering at the University of Illinois. Professor Harold L. Walker, mining and metallurgical engineering department head, says that despite the scarcity of co-eds being trained in this field, employment for them is excellent. Miss O'Donnell will be a research assistant in the University's metallurgical laboratory this fall.


TELEPHONE MEN AT WORK
When plans to deepen the Kill Van Kull channel in New York harbor were announced, telephone engineers had to plan a new submarine crossing for the important New York-Philadelphia long distance route.
There were many problems. How far below the floor of the new channel should cables be placed? How could a trench be opened through tons of mud and shelves of rock? In the fast-flowing tides, how could cables be laid squarely in the bottom of the trench? How many circuits, what kind of cables, what size, and how many should be provided for future needs? These questions demanded, and got, many engineering skills.
Despite obstacles, the job was completed on schedule. Eighteen new cables, capable of carrying 5,600 simultaneous conversations, are entrenched safely between Staten Island, N. Y., and Bayonne, N. J.
It's another example of telephone engineering at work.
BELL TELEPHONE SYSTEM
AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES
BELL SYSTEM

EDWIN A. WITORT
Editor

PHIL DOLL
Assoc. Editor

the Illinois Technograph

To the New Student . . .

Another school year is well under way. For some of you this is an entirely new adventure, interesting and enjoyable, and is is probably the realization of plans that were made years ago. By the time you are ready to graduate a good number of you will probably have explored every nook and corner of the campus; you will have been active in campus life, burned gallons of midnight oil, attended many social activities, and in general, your entire college life will fill your memory book to capacity. Others of you will have been content to ignore all things except your studies. It is the latter group to which this piece of printed matter is directed.

Before starting, it might be well to state that college life consists of a great more than just going to classes and doing homework. It is surprising to note that a good number of engineering students on this campus either do not know that this is so, or do not care. This is evidenced by the fact that about one-third of the students in any branch of engineering, mechanical, electrical, civil, etc., are members of their respective societies. This is a pitifully low percentage. The fault may lie with the students who run these organizations. However, this is doubtful because membership drives are perpetually in progress throughout the school year; notices of meetings and smokers are always posted on the bulletin boards throughout the engineering campus.

The importance of extra-curricular activities cannot be over-emphasized. They improve a person's character and teach him how to get along with people. They simulate actual working conditions and the highly active student is much better fitted for industry when he graduates. The University recognizes this fact. It encourages every University student to take an active part in the activity that interests him most. Huff gym was turned over to the activity sponsors a few weeks ago in order that they might acquaint the new students with the various activities present on the campus.

Membership alone in an organization is not sufficient. There are many members of organizations who are entirely too passive. The benefits you receive from any activity are greater or less, depending upon whether your dealings with the activity are active or passive.

Those of you who say that you don't have the time and ability should stop and reconsider. The amount of time that you are able to give will be sufficient in nine cases out of ten. Ability is not a prerequisite to membership in most of the organizations on campus.

The time to start the ball rolling for yourself is right now. The school year is young. Make yourself known to the sponsors of the the activities of your selection and show them that you are genuinely interested. They will do the rest. The valuable experience and other benefits you will receive from your extra-curricular activities will more than compensate you for the time you spend on them.

OVERFEED STOKERS . . .

(Continued from page 7)

domestic stokers now in use, have a means provided for admitting over-fire air to the combustion zone. This is a prime requisite if complete combustion of all volatile matter is to be accomplished. Also, properly directed over-fire air will tend to knock down the fly-ash which otherwise would be carried out of the stack.

In 1940, after many years of consideration of the problems to overcome, Joseph Harrington, a well known combustion engineer, consolidated his thoughts and ideas into the design of a new type of automatic stoker . It is with this stoker that this article is concerned.

A cross-sectional drawing of the stoker mechanism, including the grates and ash-pit, is shown in Figure 1. The fuel supply is contained in the hopper which is represented in the upper right corner of this drawing.

Immediately below the hopper is the stoking mechanism which consists of a pusher that is operated by a rack and pinion, as shown. The quantity of fuel which is fed to the combustion zone per stroke, is adjusted by the hand screw on the rack. By use of the hand screw, the length of the effective stroke is altered. The pinion is activated through a geared speed-reducer from an electric motor. The fuel is forced out through the swinging door and falls directly onto the grates below. The swinging door is provided as a means of preventing any possible preheating of the fuel which might cause volatiles to be driven off and possibly cause an explosion in the fuel bin.

The combustion zone, as shown, shows only the two grates in section. These grates constitute 0.6 square feet of area. However, the total space provided for combustion is increased by the area of the slope plates which are placed on either side of the grates. As the fuel bed is built up, the coals spread out over the lower area of the slope plates and thus increase the burning area. This combustion area is adequate for meeting the heating and hot water requirements of a six or seven room house.

Of the two grates shown, the one farthest to the left is fixed and remains in that position at all times. However, the right hand grate is movable, and it is through the action of this grate that the fuel is progressively moved across the grates and ultimately to the ash-pit.

The movable grate, as shown, has reached its return position. To trace the flow of the fuel through the combustion zone, it will be considered that the grate has reached its farthest extended position. When the grate is at the position mentioned, the fuel is fed to it. As the grate then moves backward, the scraper pushes the fuel forward and some of it falls off the front end of the grate. As the grate again moves forward, the fuel and ash upon the fixed grate are pushed toward the ash-pit, and the part of the bed which has been in the combustion zone the longest, drops off the grate and into the ash-pit. The movable grate is actuated in much the same manner, but instead of a rack and pinion being used, a lost-motion linkage is substituted, and the length of the stroke is here again controlled by the use of a hand adjusting screw.

The removal of ash is simplicity itself, as it only involves the removal of the ash bin from the ash-pit; this is accomplished through a door which is not shown in the drawing.

In order to provide an adequate air supply, a good deal of thought must be given to the air system. The system, as designed, is shown in Figure 2.

The air is supplied under pressure by a centrifugal fan. The fan is driven by the same motor which supplies the motive power for the stoker and grate mechanism. The requirements for over-fire air have been previously discussed, so it will suffice to indicate the method and objective of the constructional fea-

(Continued on page 24)

OVERFEED STOKERS . . .

(Continued from page 22)

tures of the overfire air supply.

A shown by the arrows, the air enters the wind-box and then passes into the overfire combustion zone through the tuyeres. There are three tuyeres, and the drawing shows the position of the middle one. The tuyere shown directs the air downward and through the center of the zone. The two outside tuyeres are so directed as to introduce a turbulence in the corners of the zone. This has the effect of producing a rotary action in the furnace.

The underfire air is forced through duct work into the undergrate zone where it is then passed up through the fuel bed. There is nothing very revolutionary about this method of introducing underfire air, but the method of insuring adequate distribution of same is another matter. This will be considered in more detail later.

The bin loading door, the equipment maintenance door, and the automatic controls with which the unit is equipped, is illustrated in Figure 3. It is with this latter item that due thought and consideration must be given. The controls provided are the conventional high and low water cut-off switches and high and low pressure cut-off switches. These pieces of regulatory equipment provide the full safety and comfort features that the stoker unit, as a whole, is designed to provide.

After the design characteristics of this apparatus have been considered, it becomes necessary to examine the operational characteristics in the light of the previously stated requirements.

The characteristics of the fuel supply and its control and handling will be considered first. Any grade of anthracite or bituminous coal, or coke, can be burned with equal facility. This is accomplished by adjusting the quantity of fuel and the length of time the fuel is in the combustion zone. This time interval depends upon the burning qualities of the fuel. The factors involved are the free burning or "coking" qualities, the amount of volatile matter which the fuel contains, and the fusing temperature of the ash.

The grates are practically insured against being burned out, since a progressive type of fuel is used. The characteristics of the bed are such as to insure an insulating layer of ash between the hottest part of the fire and the grates at all times.

Any foreign matter, which may be passed into the grate zone, will merely be passed on out of the zone along with the ash. There are no surfaces upon which this foreign matter can impinge and obstruct the normal operation of the reciprocating grate.

(Continued on page 30)

New Developments

by Ken McOwan, M.E. '49
Leonard Ladof, E.E. '49
C. M. McClymonds, M.E. '49

Automatic Waffles

Although science has been devoting most of its energies to projects concerning research in atomic radiation, jet fuels, polio, etc., the palate of the common man has not been neglected. The Downy flake baking mix division of the Doughnut Corporation of America, after more than five years of research and over a year of actual testing in commercial kitchens, has introduced a new type of waffle oven for commercial use. Ideal for restaurant use, three nested units can produce 66 waffles per hour and yet require only half the space needed for three ordinary waffle irons.

Appropriately named the "Waffle Robot" it consists of an automatic batter dispenser and a battery of heaters. The entire unit is sheathed with Monel.

The heater plates are of a cast austenitic-nickel-chromium iron alloy which possesses improved resistance to warping that assures 100 per cent contact between the heater plates and griddles and have been given an artificial "polymerization" treatment to prevent sticking of the waffles. The artificial "polymerization" was recently developed by the Doughnut corporation.

The durability of the Waffle Robot is reported to be one of its most important features. In its year of test operation it has demonstrated an ability to (1) make perfect waffles, (2) make them automatically and steadily, and (3) prevent sticking.

Puncture Tester

A device has been developed by a well known manufacturer that tests boxes and other containers for resistance to puncture, tearing, and other forms of failure. The machines are very sensitive and will indicate the slightest variation of a product. Such machines are responsible for uniform products from mass production methods.

Inhibited Oil in Use With Power Transformers

Some work is being done on transformer oils to increase their resistance to oxidation. This is being done by adding certain oxidation "retarders."

The successful use of such additives should not only increase transformer life but also the life of the oil itself, thereby removing the need for changing oil in operating units.

New Earthmover

The R. G. LeTourneau company of Peoria, Illinois, has announced the addition of a new electrically controlled high speed earth moving scraper.

The new unit will handle a load of thirteen and one-third yards of dirt at

one time, or a maximum load of sixteen tons.

It is powered by a 150 horsepower diesel engine and has four speeds forward. Obtainable speeds range from two and nineteen-hundredths miles per hour to seventeen and one-third miles per hour.

The scraper, steering, apron, and tailgate are all electrically controlled.

Miniature Electric Motors

Electric motors commonly associated with heavy duty are taking over increasingly in automatic controls. The continued reduction in size for a given fractional horsepower has opened the field for diminutive motors. One motor small enough to fit in the palm of the hand delivers three horsepower and operates at the amazing speed of 120,000 revolutions per minute.

On the A.A.F's. new heavy bomber, the B-36, more than 300 electric motors are in service. Their jobs range from feathering propellers to powering automatic pilots and gun computing sights.

Highway Travel

The new double-decker 50 passenger Greyhound bus, the Highway Traveler, has twin air-cooled engines, one of which will normally propel the coach, and the other to be used for extra power when needed. Both engines are rated at 154 horsepower.

Riding qualities are improved with a springing system of two air-spring type cylinders with torsilastic springs. Side sway will be kept to a minimum by placing the spring suspension points high and near the center of gravity. Brakes and steering are hydraulically power operated.

Additional passenger comfort is provided by air conditioning, individual radios, snack bar, refrigerator, sight seeing windows, and toilet.

New Military Vehicles

Several new army ordnance vehicles feature eye-openers in the automotive field. The two main attractions are the air cooled power plants and a type of torsion bar suspension.

A new five-ton aluminum body 6x6 cross country carrier built by the General Motors corporation has a 250 horsepower vertical crankshaft engine, which weighs 1,600 pounds less than a comparable water cooled engine. The space required for the engine is a little more than that required for the radiator and fan of a conventional installation.

Precision Camera

A new camera has been developed to test lenses for cameras. Thus the camera industry, like the machine tool industry, has come to a point where the products of its industry can be turned back to work in helping to reproduce itself.

The designers of the new camera point out that it may be used to check lenses to an accuracy equal to one-sixth the thickness of a single sheet of paper.

Checks may be made of the resolving power, curvature of field, astigmatism and distortion.

As may be well imagnied, the camera can also be used for very precise work in the photographic and copy field.

Speed Measurement

A well known corporation has introduced an electric recording tachometer. This device can measure speed in any desired units and is provided with a means of recording speeds over a period of time. Attachments for this machine can be adjusted to give warning if the speed should fall below any set standard.

Walking with a friend one day, a professor passed a large fish shop where a fine catch of codfish with mouths open and eyes staring were arranged in a row. The prof suddenly stopped, looked at them, and clutching his friend by the arm, exclaimed: "Heavens! That reminds me, I have a class in EE this hour."

ATOMIC ENGINEERING . . .

(Continued from page 10)

Atomic energy and power engineering is the natural home of the adventurous chemical engineer and physicist. It seems that nearly every course in the graduate school announcement is potentially useful to you. Here is an earnest attempt to name a few not to be omitted—mathematic courses, mentioned previously, Inorganic Chemistry (Chem. 101a and 101b), Line spectra and Atomic Structure (Physics 184), and probably Biochemistry (Chem. 50).

The job of the mining engineering is for the most part conventional when applied to extracting uranium and thorium ores. In the future, however, it is expected that primary reduction of ores beyond the flotation stage will be effected at the mines, and therefore study of ground water flow, decontamination, and the nuclear properties of materials is advised.

For all engineers and scientists working on the various projects, provisions have been made for night- and part-time courses in nuclear studies. Therefore, as it is easily surmised, your formal training will not constitute the sum total of your study in this newly developed field of endeavor. Many elements necessary in the full understanding of the specific problems now being attacked are yet to be presented in a college course anywhere. The engineering prospects in atomic energy appear infinite in scope—the ambition and perseverance of engineers and research men will create hundreds of thousands of jobs eventually. There will be "room at the top" for thousands of the more enlightened men and women in atomic energy engineering and research.

OPPORTUNITIES FOR YOU . . .

(Continued from page 11)

mechanisms will find opportunities to apply his training in this field. The accompanying article will discuss the academic courses that he should include in his curriculum to further equip himself for work in this field.

The *metallurgical engineer* and the *ceramic engineer* will find application for their training in the development of new heat-resistant metals and ceramic materials. These materials are used in heat-exchangers and associated equipment designed to remove the heat generated by the atomic pile and transfer it to appropriate power-generating equipment. As is stated in the second law of thermodynamics, the maximum efficiency of any conversion of heat to useful work is equal to $\frac{T_2 - T_1}{T_2}$, where T_2 is the higher temperature and T_1 the lower operating temperature. Theoretically, atomic fission can supply heat at much higher temperatures than chemical reactions because there is no reverse equilibrium involved such as the dissociation of carbon dioxide around 2500° C., but the limit of temperatures, useful for power, is set not by these considerations but by the inability of present materials to retain their properties at high temperatures. Accordingly, in the present state of the art the very high temperatures obtainable in piles cannot be utilized. But there is present this higher horizon toward which research is being directed. Solution of this pertinent problem will require the concentrated efforts of many metallurgists and metallurgical engineers.

In addition to the metal being resistant to high-temperature, it must possess a low neutron absorption factor since the reactions are sustained by the neutrons striking the fissionable atom. If the structural materials of the pile are of a nature to absorb a large number of these liberated neutrons, the statistical number of neutrons available to fission more of the U_{235} isotope will be reduced below a critical value which must be maintained to propagate the chain reaction.

While the metal in the structure is of prime importance, the coolants must also be chosen with care. They, too, must

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OVERFEED STOKERS . . .

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As has been previously explained, the removal of the ash is easy due to the accessibility of the ash pit. Since there is a possibility of some fine ash sifting through the grates and into the under grate area, a clean out door is provided so that this material can be periodically removed.

In many fixed grate furnaces, the tendency of the bed to "coke," and then to cut off the air supply, is a serious one. The thing that usually happens is that the air pressure is built up until it finally breaks through the bed at one or more localized points. When the air supply is so limited in its extent, there is incomplete combustion of much of the fuel.

Figure 3

However, the reciprocating grate motion prevents the formation of a coking layer, and the under-fire air remains evenly distributed throughout the fuel bed.

The location of the tuyeres, as previously explained, causes the overfire air to knock down the fly-ash and thus help to eliminate this constant source of trouble. The whirlpool turbulence, which is created in the center furnace, insures complete combustion of the volatile matters, and thus decreases to a minimum the losses due to incomplete combustion of this source of heat value.

For the person who has to tend a stoker, the most important question to be answered is the one which concerns the operation of the various control devices. During periods of normal operation, such as when the full capacity of the furnace is required, and the source of electrical power is constant, the controls are fully automatic, and the flow of fuel into the furnace is based upon the demand only.

There may be, however, periods during which the flow of electric power will be interrupted. During periods when the motor and electric controls do not operate, the grates can be shaken by hand and the fuel delivered to the combustion zone in the same manner. In order to facilitate this "emergency" operation, a door is provided in the furnace fire wall. When the blower is not working, the air required for combustion is naturally convected to the fuel bed and will provide the minimum requirements for combustion.

When the automatic controls are operative, in order to insure a "hold-fire," the stoker will only feed enough coal to keep the fire from going out. In passing, it might be well to mention that under normal operating conditions, the stoker and grate reciprocating mechanisms will make approximately 22 strokes per hour. By use of mercoid switches, the possibility of the mechanism being stopped in the middle of a stroke is eliminated. It need not be pointed out too minutely the inherent danger to the equipment if the grates should be stopped at any other than the rearmost position. It is evident that there would be a great danger of burning the grates. If the swinging door to the coal pusher was left open, there would be present the very dangers which the door is intended to prevent.

The service and maintenance of the equipment is provided for by the ready accessibility of the various mechanisms through the inspection doors provided. Several of these doors can be clearly seen in Figure 3.

In closing, a brief resume of the situation is in order. The desirable qualities that should pertain to the equipment have been fully enumerated. The operational characteristics of this particular domestic stoker have been fully investigated and explained. Therefore, the second or "what" question can be answered.

What this equipment possesses that other equipment does not possess is apparent in the simplicity and universality of its operation.

Why this equipment should be designed and marketed is, or certainly should be, obvious to any person who has ever had to hand fire a domestic furnace.

At the beginning of this article two questions were presented for the reader's consideration. It has been the intent of the author to answer those two questions. The ultimate success or failure of the equipment, however, can only lie with the people who purchase and attempt to use and evaluate the qualities from an operational viewpoint.

Mistress: "You know, I suspect my husband is having an affair with his stenographer."

Maid: "I don't believe it. You're just trying to make me jealous."

GALESBURG . . .

(Continued from page 15)

tracks where carmen bleed off the airbrakes on each car, inspect the cars, and uncouple the caboose and engine which moves to the roundhouse at Galesburg for servicing. The waybills are taken to the branch yard office and sent by pneumatic tube system to the main yard office. These waybills (one for each car) contain pertinent information about the car, such as owning company, number, weight, and destination. At the main yard office the waybills are checked for diversion by shipper and expiration of livestock laws, and then are sorted according to the train on which the car will leave. The cars then move to the hump and are pushed over at about walking speed. The foreman instructs the pinman as to the order in which the cars are to be uncoupled according to a list supplied by the yardmaster's office compiled from information on the waybills. The towermen retard and switch the cars according to duplicates of this same list. The foreman is on the alert for cars listed in incorrect order, and it is rarely necessary for an engine to shift a car from the wrong classification track. The actual humping only takes about thirty minutes for a 100 car train, and many Burlington trains run from 100 to 110 cars. The cars are moved from the classification to the departure yard where they are grouped according to destination into outbound trains. The caboose and engine are coupled to the cars. The waybills are delivered to another branch office in this part of the yard by pneumatic tubes, and are turned over to the conductor. Meanwhile, carmen service the train. This servicing consists of checking journals, coupling airhoses, and inspecting for damaged equipment. After an air brake test, the train is ready to leave.

At present, this yard handles approximately 80 to 95 trains in a 24 hour period. During February of last year, over a 29 day period, more than 196,000 cars were handled. In one eight-hour period (November 22, 1936) 1,387 cars were humped. These figures indicate the handling of cars in quantity at a rate which would be difficult, if not impossible, to realize in a yard not gravity switched. With the great speed up of railroad freight service in the last twenty years, fast and efficient switching of cars in large numbers has become more and more important. The hump yard appears to meet these needs, and yet keeps the size and operating complexity of the yard within reasonable limits. Therefore, it is not unusual that the number of hump yards in operation in the United States has increased greatly in recent years.

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OPPORTUNITIES FOR YOU . . .

(Continued from page 28)

have a low neutron absorption factor, must be chemically and physically stable when subjected to intense radiations, and they must not corrode or erode the material of the pile with which they come in contact. The knowledge of organic, inorganic, and physical chemistry would qualify the *chemical engineer* and the *chemist* for research work on these required coolants.

The diverted training of a chemical engineer makes him particularly adaptable to work on this project. Improved methods of processing the ores and the development of ores of much lower concentration will require the best abilities of mining, metallurgical, and chemical engineering. The two minerals most widely used as starting material for this nuclear process, uranium and thorium, are estimated to occur in the earth's crust in considerable quantities of four parts per million and 12 parts per million, respectively. Early rough estimates, which are probably optimistic, were that the nuclear energy available in known deposits of uranium was adequate to supply the total power needs of this country for 200 years. This assumes the utilization of U_{238} as well as U_{235}, the latter isotope occurring in one part to 140 parts of U_{238} in the natural uranium metal. Only U_{235} is directly fissionable

The *chemical engineer* will find many and varied applications for his training. The Hanford Engineer Works, Richland, Washington, reports that they employ chemical engineers in the physics department and in the chemical operations department. Their duties in the physics department are working with the physicists to design new power piles and design modifications of uranium—graphite piles for the transmutation of uranium to plutonium. This department also provides technical assistance to pile-operating units.

The chemical separations department consists mostly of chemists and chemical engineers. Its function is to develop new types of chemical processes for the separation of plutonium and uranium from the fission products. It also has a staff of experts to give technical assistance to the chemical separations plants operating division. In addition to the personnel in the technical department, the overall supervisory force of other departments are all technically trained men. For example, in the operating departments a large number of chemists and chemical engineers made up the supervisory, so in addition to opportunities in development work and process design, there are many other opportunities for those with supervisory talents.

Mechanical Engineers

Much of the operating equipment must work with tolerances and service times much more severe than have ever been previously required in industrial operations. One example of this mechanical equipment would be the pumps required to pump the coolant outside of the pile. They must be absolutely reliable. If a pump failed and the heat-transfer medium were to stop circulating in the unit, the heat would build up so rapidly that excessive temperature might be reached in the pile and jeopardize its operation. Further, since the pump is handling a radioactive fluid, it would not be possible to approach the inoperative pump for repair except after a prolonged shut-down. Various design features eliminating hazardous shut-downs; leakage and any physical change due to being subjected to the action of neutrons, radioactive rays and particles are yet to be worked out by the mechanical engineers. Remote control operation and maintenance must be emphasized in these designs.

Civil Enginers

The work in civil and architectural engineering is not greatly different from

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OPPORTUNITIES FOR YOU . . .

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the structural work found in the construction of most industrial buildings. In some cases there may be required special designs for very efficient ventilation and special materials of construction as, for example, the construction of shielding barriers.

In summary, it may be said that there are almost unlimited opportunities in the field of atomic energy for the men who are actively interested in applying their training toward advancement of the atomic age. While an advanced degree is desirable, it is not imperative. The graduate who is interested in the work to a degree greater than it being merely a job will find it to be a most fascinating career. It cannot be said that the remuneration is generous but it is quite in line with other industrial salaries paid to practicing engineers.

The work is definitely not dangerous as one might be led to believe. In awareness of the existing hazards of radioactive materials, the Atomic Energy Commission exercises the greatest care in protecting all workmen, making certain that no one is exposed to radiation greater than a medically-safe limit. For all American industry, in the last year for which there is an enviable record, 1946, the accident frequency rate was 14.16 injuries per 1,000,000 man-hours. The lowest recorded figure that Dr. C. P. Cabell, of the Hanford Engineer Works, was able to find was 1.1, which was for industrial office employees in the state of Washington. This makes the Hanford Works, Richland, Washington, the safest of any industry on record—they had a cumulative figure, through October, 1947, of 0.73 accidents per 1,000,000 man-hours, and the value during 1946 was only 0.34. And, furthermore, not a single case of injury due to radiation has occurred in the plant.

The industry is still young. The difficulty today is the lack of properly trained personnel in order to carry on the program which has already been approved. The approved program covers only a small fraction of the work that should be done. For example, in the field of atomic energy we may expect a very large industry to develop, particularly as other countries have greater need of power from this source than the United States does. We may reasonably expect that this country will be sufficiently far-sighted so as to take the lead in the development of backward countries by use of power from atomic energy. Because relatively small amounts of materials will liberate enormous amounts of energy, power stations may be located in regions which are remote from the usual fuel sources of coal and oil.

An excellent discussion of some of the operating problems currently confronting the industry is found in the March, 1948, issue of the Westinghouse Engineer. There is a considerable volume of literature published on the topic of atomic energy, written for comprehension by various levels of background training. Anyone interested in learning about the field, generally or technically, will have little difficulty in finding material.

ADOBE HACIENDAS . . .

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were impossible to distinguish from brick and plaster.

Africa has millions of earth buildings existing today. Karl J. Ellington, an engineer of Seattle, Washington, and author of "Modern Pise' Building," claims that in North Africa whole cities are built of pise'.

The Roman author, Pliny the Elder, has given us one of the earliest written records on pise' construction in his "Natural History." He says, "Do we not find in Africa and Spain walls of earth which are called 'frame walls,' because two planks are placed, one on either side to form a frame, and the

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NAVY PIER . . .

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students had programs which kept them at the Pier from early morning until late evening, and it seemed inevitable that if the previous class was at one end of the 3 5 mile classroom area, the next class would be at the other end.

In the past two years even the latter had been improved, and it is hoped that for the present semester it will be improved further, especially for working students. Yes, the University of Illinois undergraduate division at Navy Pier is now going—FULL SPEED AHEAD.

SMATTER ABOUT MATTER

By John Fijolek, E.E. '51

Webster's Collegiate dictionary defines physics as that branch of knowledge treating of the material world and its phenomena: natural philosophy. It is further defined as the science which deals with those phenomena of inanimate matter involving no changes in chemical composition; more specifically, the science of matter and motion.

We are all interested in the world in which we live from the day we are born. Because of this interest we have been able to discover certain definite relationships or, laws of Nature, which we have used as tools to make our lives more comfortable and ourselves the masters over other forms of life upon this earth. But tools can be used for good or evil, and the laws of physics can be applied to atomic warfare as well as to harnessing the unruliest of rivers.

Navy Pier in its physics courses and laboratory work furnishes no magic key to the student whereby he can gain entrance to the halls of wisdom or fame. Rather, as Dr. R. E. Harris, head of the physics department, puts it, "it gives the general background of our technological civilization which every well-educated man and every engineer must have."

The physics laboratory rooms at the Pier have available both modern and time-tested facilities for performing basic experiments in the five main divisions of physics. Mechanics, heat, and sound are covered in the first semester, while electricity and light are studied in the second semester.

The equipment available includes such items as oscilloscopes, used for analysis of sound waves and electrical currents; Wheatstone bridges, resistance boxes, galvanometers, etc., for electrical measurements; and tuning forks and water-filled glass tubes for sound experiments. Some of the experiments performed during the two semesters are free fall, to illustrate the laws of gravity; telescope construction, to demonstrate relationships in light optics; resistance measurements and use of electrical circuits verifying Kirchhoff's laws; and application of vector analysis principles in the field of mechanics.

Although certain elements are stressed for specific classes of students (for instance, the field of heat and light for pre-medics; the field of sound and light for architects; and the field of mechanics for engineers), the curriculum is generally the same for all students taking the course. In addition, the final test is a standard one in use throughout the country in comparable institutions.

The department has been able to procure modern tools as part of the laboratory equipment and thus is able to give the student a more vivid illustration of the basic principles involved in the experiment, as well as some practical experience in operating equipment which is in standard use in industry. Other tools have seen little change during their service throughout many decades and have become standard items for this type of work. But in all cases, the spirit of scientific curiosity, observation and experimentation, is inculcated into the student.

In this manner, the department, which last year with the help of 18 staff members introduced the science to over one thousand students, has been able to give those students a better understanding of nature and to provide the prospective engineer with a very important stepping stone to the practical application of that knowledge.

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ADOBE HACIENDAS . . .

(Continued from page 36)

wall is then packed in rather than built? These walls endure for ages, proof against rain, wind, and fire, and stronger than any cement."

Some of the most beautiful old homesteads of South Africa, especially Rhodesia, are pise' buildings. Some of these have stood the wear of a century and are still much admired as houses.

In Johannesburg, South Africa, the Pise' de Terre Construction company does contract work in this material. A letter from Mr. E. T. Baines of this company states: "We have found from experience that a foundation of pise' is equally good to one of brick or stone. Such a foundation should be rammed into a two-foot trench some six inches wider than the walls with a damp-proof course at the top at ground level. These are used even in districts receiving as high as 100 inches of rainfall per annum; so long as water is kept from running directly against the base of the walls it has no more detrimental effect on pise' than brick work. The capillary attraction in walls which are built straight on the ground without even a damp-proof course never exceeds a foot, and there is no sign of disintegration of the wall which dries out as strong as before." Thus is established another use

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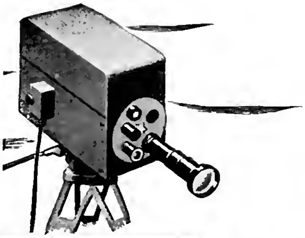

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ADOBE HACIENDAS . . .

(Continued from page 40)

for pise', namely, the subgrade foundation footings. Reinforced concrete footings for pise' walls are, of necessity, large and expensive due to the thickness and weight of the walls.

Europe

Karl J. Ellington says that the Moors brought the pise' method into Spain, where the centuries-old Alhambra palace at Granada is built partly of pise'. One of the medieval writers refers to a Spanish pise' church eighty feet long, forty feet wide, and fifty feet high, which was in use eighty years. During that period the only attention given the walls was a coating of rough cast every ten or fifteen years. A fire occurred which left only the walls standing. When these were razed, great difficulty was encountered in reducing them to pieces small enough to be readily handled. Hundreds of peasant families in France and Spain are nowadays occupying pise' homes which have withstood the ravages of 150 years or more without appreciable wear.

In the American Architect of February 23, 1921, appears the following note: "The discoveries of Schliemann at Hissarlik showed that among other remarkable methods of ancient building was the practice of vitrifying the walls after erection. And he put forward the idea that the walls had been built of unburned clay and then vitrified by the subsequent lighting of huge fires on both sides at once. The interest for us lies in the transformation of a singularly perishable material into an almost imperishable one."

In the valley of the Rhone river, France, pise' de terre houses of great age (600 to 900 years) are still occupied and in good condition. World War I brought to light the earth core under the plaster coating of numerous buildings whose earth construction would otherwise not have been noticed, nor even suspected in many cases. Eshelby stated that he found numerous examples of pise' or other type earth building everywhere between Lyons and the Belgian frontier, at Landrecies, Le Cateau, and all along the line of the British retreat in 1914 from Mons, shell stricken and full of holes but still standing. He said that one-third of Rheims is built of earth, not pise', but unburnt brick; it is even used as partition walls in four-story buildings. The city of Lyons, internationally famous for its venerable buildings, consists in large part of pise' structures. Many tourists who exclaim over the delightful French manor houses along the Rhone valley are quite unaware of the heart of dirt beneath their picturesque whitewash. Some of these houses are six centuries old and sound as rock. During modern times, since industrial plants have occupied the valley, a variation of pise' known as pise' de machefer has been used almost exclusively. It is obtained from clinkers or slag. Building with pise' de machefer can go on at any time of year, and houses ca be inhabited as soon as built.

In the late eighteenth century Rev. Mr. Joucour, a French clergyman who emigrated to England, tells of a pise' church at Montbrison (southwest of Lyons, France), where he resided. He said that the church was about eighty feet long, forty wide, and fifty high. The walls were built en pise' eighteen inches thick. Soon after his arrival at Montbrison the church was burned and remained unroofed for about twelve months, exposed to rain and frost. "As it was suspected that the walls had sustained much damage by the fire and the inclemency of the season, and might give way, it was determined to throw them down partially, and leave only the lower parts standing; but even this was not done without much difficulty, such was the firmness and hardness these walls had acquired: the church had stood above eighty years, and all the repairs it required were only to give it, every twelve or fifteen years,

(Continued on page 46)


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a new coating of rough cast on the outside."

The Americas

On the subject of pise' in the Americas, Karl J. Ellington says, "In Central and South America the prehistoric races have left some remarkable architectural creations, among which can be found proof that these people also knew how to build terraces and buildings with rammed earth. To this class of buildings, no doubt, belongs the Casa Grande ruins in Arizona. In 1632 this ruin was six stories high and the government is now preserving what remains of it. To many it is a puzzle by what method the Casa Grande was built. But the markings of pise' forms can still be seen, and we are sure at least, that that method was used in its construction."

The well known "first house" built by white settlers in the U. S. in 1556 at St. Augustine, Florida, has first story walls of pise' with a wood-frame second story; it is still standing.

S. W. Johnson's book, "Rural Economy," inspired the building of the Church of the Holy Cross on Hill Crest Plantation near Sumpter, South Carolina, 1850 to 1852. Dr. Anderson had difficulty persuading his congregation to accept the idea of rammed earth until he pointed out that it would give them the most church for the least money. The church is still standing and measures one hundred and five feet by twenty-seven feet with walls fifteen feet high at the eaves and forty-three feet at the roof peak. Originally the church has a square pise' tower forty feet high surmounted by a twenty foot spire. A record kept of the church cost shows a total of $11,900 spent for labor, materials, and interest for two years while it was built. In 1926 T. A. H. Miller of the Division of Agricultural Engineering investigated the church and estimated it would cost $80,000 to duplicate it in any other material. Anthony French Merril estimates that in 1947 it would cost $100,000. The tower withstood the Charleston earthquake of 1886 (Charleston 80 miles distant). This earthquake, noted for its severity, did cause a minor crack in one of the walls. The tower safely passed through a three-day hurricane in 1895 and was then 45 years old. In 1903 a cyclone caused the tower to crack across the roof, necessitating rebuilding, with concrete, the tower and portion of wall on which it fell. Otherwise the church remains, solid to the present day.

In 1945 the following appeared in Colliers Magazine: "One of the great advantages of pise' construction is the high degree of insulation provided by the dirt walls. R. B. Wade, a farmer near Flandreau, South Dakota, built a poultry house in 1939, and found the temperature inside the building so much cooler in summer and warmer in winter that he double-crossed his hens and moved in himself. He is now making plans to build a pise' residence; then the chickens can have their home back."

All of the foregoing qualities: strength, flood immunity, fire proofness, chemical stability, weather tightness, rodent and insect immunity, wind resistance, and earthquake resistance, may be summed up by the single word durability. In addition to durability pise' has several other merits, namely, insulation, economy, speed and simplicity of construction, availability, and appearance.

Among the disadvantages of pise' are lack of contractors and workmen experienced in its use and lack of any commercial backing. Pise' also has a relatively low tensile strength.

Most building codes outlaw any type of economical construction, including pise', prefabricated houses, etc., regardless of the merits of such types of construction, aside from economy.

Among the interesting developments in modern research of earth construction are the methods developed for earth stabilization. This eliminates the one significant disadvantage of pise', its vulnerability to running water.

Thus pise', however "old fashioned" it may be, is as good as most of our present day construction for small and medium-sized buildings, and is better than some of our commonly accepted methods of building.

Culled by A. Hevesh

Man dining in a small town hotel: "Why does that dog sit and watch me all the time?"

Waitress: "You've got his plate."

* * *

Jeanie: "Why did you quit teaching to join the chorus?"

Queenie: "Well, there is more money in showing figures to the older boys."

* * *

Mary had a little lamb.
Its fleece was white as snow.
She took it to Pittsburgh,
And now look at the damned thing.

* * *

Professor—"Give me a round-trip ticket."

Agent—"Where to?"

Professor—"Back here, of course."

* * *

"Who was that lady I saw you with in a sidewalk cafe last night?"

"That was no cafe. That was our furniture."

* * *

Passenger—"Which end of the car do I get off?"

Conductor—"Either one. It stops at both ends."

* * *

The president of a midwestern college, speaking on state education, said:

"Our girls are poorly educated, but our boys will never find it out."

* * *

The professor put the following notice on the campus bulletin board:

"Professor Brown will be unable to meet his classes tomorrow."

A bright wag among the students came along, and smartly rubbed out the letter "c" from the word "classes." Since the college was not co-educational, the effect caused much hilarity.

The professor, happening by, noticed what had been done to his announcement, and promptly went the students one better by rubbing out the initial letter of "lasses."

"What is college bred, Pop?"

"College bread is a four-year loaf made from the old man's dough."

* * *

Professor—"What is nitrate of sodium?"

Chem. Eng.—"Half the day rate, I suppose."

* * *

"Samuel!"

"Mumm-wmph."

"Samuel! Wake up!"

"Uh . . . mpff . . . wassamatter?"

"Samuel, I'm certain I heard a mouse squeak!"

"Waddya want me t'do? Get up an' oil it?"

* * *

The dam burst, and a raging flood quickly forced the townspeople to flee to the hills.

As they gazed down sadly at their flooded homes, they saw a straw hat float gently downstream for about fifty feet. Then it stopped, turned around and plowed slowly upstream against the rushing waters. After fifty feet, it turned and moved downstream again. Then upstream again. Then downstream again.

"Say," said one of the townsfolk, "what makes that straw hat act so durn funny?"

"Well, I ain't sartin sure," spoke up a youth, "but last night I heard Grandpa swear, come hell or high water, he was a-gonna mow the lawn today."

* * *

"What time is it?"

"It's not one o'clock yet."

"Are you sure?"

"Well, I've got to be back at the office by one o'clock and I'm not there yet."

* * *

A farmer once called his cow 'Zephyr'
She seemed such an amiable hephyr
But when he drew near
She bit off his ear
And now he is very much dephyr.

"I've been thinking it over," said the husband, "and I've decided to agree with you."

"That won't do you any good," said his wife, "I've changed my mind."

* * *

An enemy I know to all
Is wicked, wicked alcohol.
The Good Book, though, commanded me
To learn to love mine enemy.

* * *

"Mother, are there any skyscrapers in heaven?"

"No, son, engineers build skyscrapers."

* * *

"How many cigars a day do you smoke?"

"About ten."

"What do they cost you?"

"Twenty cents apiece."

"That's $2 a day. How long have you been smoking?"

"Thirty years."

"Two bucks a day for thirty years is a lot of money . . . Do you see that office building on the corner?"

"Yes."

"If you had never smoked in your life, you might own that fine building."

"Do you smoke?"

"No, never have."

"Do you own that building."

"No."

"Well, I do."

* * *

She: "You look badly this morning."

He: "I have a cold or something in my head."

She: "It's probably a cold."

* * *

Breathes there a man with soul so dead
That never to himself hath said
—— —— —— —— —— ——
As he stubbed his toe against the bed?

* * *

Inebriate: "Shay, officer, where am I?"

Officer: "Why, you're on the corner of Green and Wright streets."

Ineb.: "Never mind the details. What city am I in?"

... a great name in research with a big future in **CHEMISTRY**

PLASTICS—INFANT INDUSTRY THAT GREW UP FAST

Ten years ago the infant plastics industry was teething. It has since rushed through a precocious childhood and grown to a vigorous and impressive maturity. Today the plastics industry is a multimillion-dollar business. Two-thirds of all American factories use plastics materials in their manufacturing operations.

Of course, plastics were not new ten years ago. In fact, back in 1891 General Electric was making lamp carbons out of an early plastic—lampblack-impregnated potter's clay.

New Materials Encourage Growth

But the rapid growth of the plastics industry came in the late 1930's when new materials and improved molding

Synchrotron ring, molded by G. E. for Univ. of California's new betatron atom-smasher.

techniques encouraged its expansion. Then, with World War II, plastics manufacturing accelerated tremendously.

General Electric's position in the plastics field is unique in that G. E. is the world's largest manufacturer of finished plastics products and also a manufacturer of molding powders.

General Electric offers a complete plastics service. It has facilities for developing special compounds and for designing, engineering, and molding plastics products to meet individual customers' requirements.

The variety of parts and products turned out by General Electric's Plastics Division is startling—and it illustrates the diversity of applications that are being found for plastics in the postwar world.

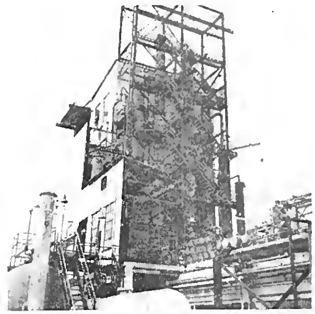
For Rowboats and Radios

Take, for example, the plastics dinghy. This is a four-passenger boat molded of laminated plastics by General Electric for a New England boat manufacturer. Then there is the synchrotron ring for

This plastics dinghy was molded by General Electric for the Beetle Boat Company.

the University of California's new betatron atom-smasher. It's the largest single part ever molded by G. E. Less spectacular, perhaps, but still important, are the hundreds of more familiar plastics products like clock cases, compacts, radio cabinets, camera cases, packages of all sorts. Textolite surfacing material, plastics parts for automobiles, refrigerators, and other appliances—even plastics cups for milking machines.

Since 1920, General Electric has manufactured molding powders for its own use. Recently, a synthetic phenol plant was completed in Pittsfield. As a result of this increased production capacity, G. E. can now provide high quality phenolic compounds to other molders.



New G-E Phenol plant at Pittsfield, Mass., showing fractionating towers on distillation building.

General Electric's plastics activities are just one phase of the operations of the Chemical Department, where research is opening new doors to progress. In the fascinating new field of silicone chemistry, in resins, in insulating varnishes, in permanent magnets, General Electric is making contributions to chemical knowledge. For more information on any of these activities, write *Chemical Department, General Electric Company, Pittsfield, Massachusetts.*

A message to students of chemistry from

DR. J. J. PYLE

Director, General Electric Plastics Laboratory

The field of plastics is surely a stimulating one—and one that offers many opportunities and the utmost in challenge to graduate chemists and chemical engineers. At General Electric, plastics research is presenting new possibilities in this fascinating field that should prove exceptionally interesting to young technical men.

GENERAL ELECTRIC

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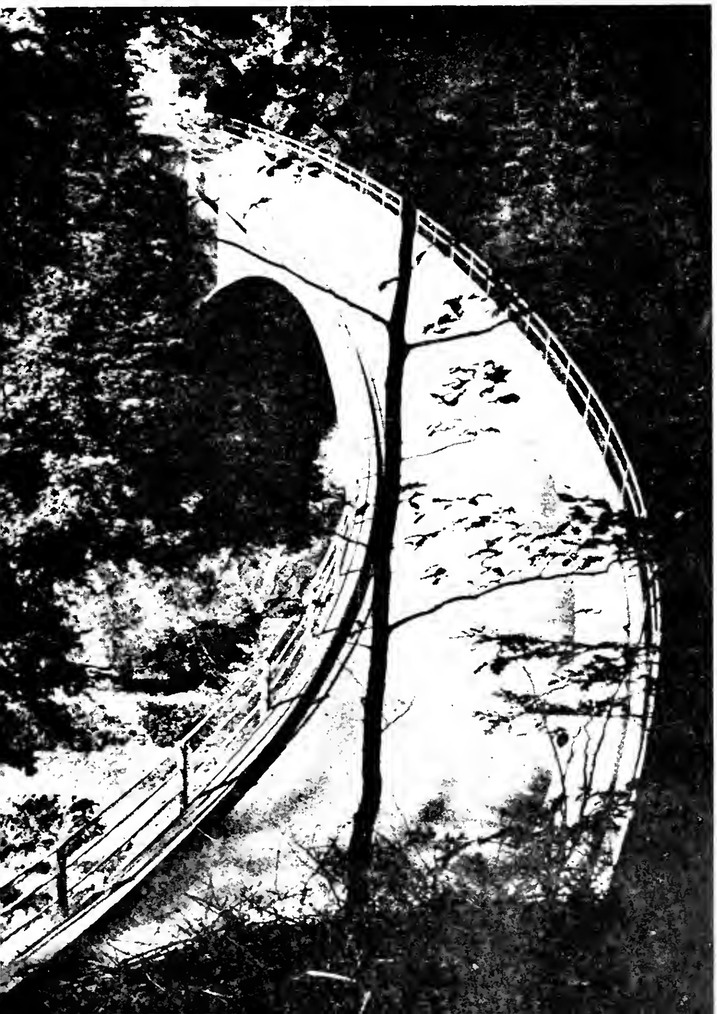
PLASTICS • SILICONES • INSULATING MATERIALS • GLYPTAL ALKYD RESINS • PERMANENT MAGNETS

the Illinois Technograph

NOVEMBER, 1948



★

TWENTY-FIVE CENTS

SUPER TENSILE MUSIC WIRE PLATED WITH PURE GOLD...

developed by American Steel and Wire Company

Tenor banjo and tenor guitar players have long been plagued by unsatisfactory "A" or first strings. This string, when properly tuned, is under such high strain that most wires barely reach pitch. At the request of the Mapes Piano String Company, the Metallurgical Department of the Worcester Works of the American Steel and Wire Company, a subsidiary of United States Steel, created, after months of research, a wire specifically for this purpose. This new wire is made so strong that it possesses more than twice the tensile strength, in pounds per square inch, of cross sectional area, of the steel wire which American Steel and Wire spun into cables to suspend the 8¼ mile bridge across San Francisco Bay from San Francisco to Oakland, California. This makes the new string the strongest wire of its size of any kind known today.

This high quality super tensile wire is produced by a special combination of heat treatments and exceptionally long and exacting cold working. The result is a wire of 0.010 gauge with a tensile strength of approximately 460,000 pounds per square inch. One pound of this wire extends 3749 feet, or sufficient footage to pass from nut to bridge on approximately 1500 banjos or guitars. This unusual wire is then plated with pure gold in order to prevent rust and to impart beautiful appearance.

Opportunities

This wire development is typical of the work being done in United States Steel Laboratories. But such research is only one kind of development to be found within the United States Steel industrial family. United States Steel and the steel industry are famous for development of men.

Have you seen our book "Paths of Opportunity in U·S Steel?" Ask your Placement Officer about it.

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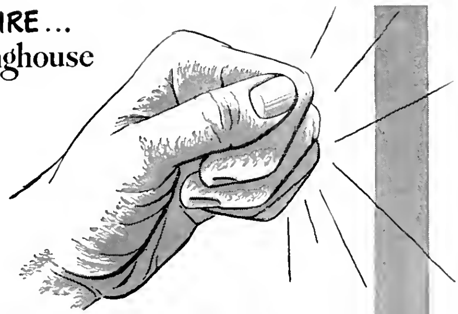
UNITED STATES STEEL

YOU CAN BE **SURE . . .**
IF IT'S Westinghouse



HOW TO MULTIPLY YOUR OPPORTUNITIES BY 27

Probably you think of Westinghouse as one of the world's largest manufacturing companies—which it is.

Yet Westinghouse is not just a single giant company. It is actually made up of many individual units. Each has its own sales, engineering and manufacturing organization. With such a divisional set-up, your progress toward a key job can be more rapid—advancement more frequent, your opportunities and scope of activities almost unlimited in any of the many divisions or subsidiary companies listed at the right.

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New Developments

By Leonard Ladof, E.E. '49
Ken McOwan, M.E. '49
Bill Shurtleff, E.E. '50

Educational Gas Turbine

A major step has been taken in providing student engineers with the means of studying at first hand the type of power plant which drives jet planes, and which promises to play an important part in land applications.

Rensselaer Polytechnic Institute has installed in the laboratory of its mechanical engineering department, an "educational gas turbine," the first of its kind in any engineering school.

The equipment now installed at the school is built around a General Electric company design of a turbosupercharger, which has been equipped with a combustion chamber compressor inlet flow nozzle, compressor discharge control, and other equipment. The turbosupercharger was purchased from the War Assets Administration, and is of the type used on the B-29 superfortress to provide high pressure air to the engines at high altitude.

Professor N. P. Bailey of Rensselaer Polytechnic Institute, Troy, N. Y., adjusts a connection on an "educational gas turbine" belonging to the mechanical engineering department of that school. (Photo courtesy General Electric.)

Stratovision

Stratovision, one of the ways that can be utilized to transmit television programs over long distances, has been successfully tested.

The system uses a television receiver and low wattage transmitter mounted in a converted B-29 superfortress. One of these planes flying at 25,000 feet has a coverage of twenty-five times greater area than a similar unit on the ground. This can be done with one kilowatt compared to the average power of fifty kilowatts of ground stations. One such aircraft will replace 100 ground stations.

Plans are under way to fit this device to an especially designed craft. Fourteen such planes would provide 78 per cent of the population with television coverage.

New Valves for Dangerous Gases and Liquids

Accidents or equipment damage may result from valve failure when dangerous gases or liquids are being handled. High temperatures, pressures or vacuums can be safely controlled by a new type of valve.

The valves, in highly corrosion-resistant alloys, have been developed by the Powell company of Cincinnati. This line features a welded leakproof bellows seal which completely surrounds the lower part of the stem within the valve body. The bellows consists of metal discs welded alternately at their inner and outer circumferences. The lower end of the bellows is welded to the valve's disc, and at the top to the body neck itself. This creates a seal protecting the valve packing which is provided only as an additional safeguard in case of damage or leaks developing in the interior valve parts.

The valve seats are hand lapped and can be hard-surfaced if necessary. Tests completing up to 1,000,000 cycles indicated a good resistance to fatigue.

New Refrigerant Possibility

A refrigerating mixture, particularly suited for use with foodstuffs because it has no objectionable odor, no taste, and is edible, may be prepared from glycerine and water. Glycerine added to water lowers its freezing point and, more than that, it prevents hard freezing of the mixture below that at which ice starts to form. Such a mixture can be used either for immersion freezing of foods or for refrigerating coils and cold plates. The first use will be the most useful in the light of the fact that there are other refrigerants that work better in closed systems.

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the Illinois Technograph

Volume 64 Number 2

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

Air view of Maillart's Schwandbach bridge in the Canton of Berne, Switzerland, opened in 1933. This bridge is the first example of a reinforced concrete road bridge with a sickle-shaped platform. (Photo from Giedion's "Space, Time, and Architecture.) The new cover, appearing this month for the first time, was designed by our talented make-up editor, Mel Reiter.

FRONTSPIECE

An engineer in the General Electric electronics laboratory, adjusts the antenna used for receiving information from a lightweight device which transmits 28 items of information each one thirty-fifth of a second from 3800-mile-an-hour rockets. (Photo courtesy General Electric.)

The Future of Highway Engineers

By Bernard Gray

Mr. Gray holds two degrees from Tufts College and is a member of Tau Beta Pi. His first work was with the Massachusetts highway commission on surveys and as resident engineer. After a year in banking he was appointed engineer-economist with the U. S. Bureau of Public Roads and later became senior highway engineer in charge of some of the first Federal Aid Projects. During the twenties he was division engineer and state maintenance engineer in West Virginia. Since 1930 he has been with the Asphalt Institute and is now chief engineer and general manager. Over the years Mr. Gray has made field studies in all of the 48 states as well as abroad. He has been associated closely with engineering education and a frequent lecturer at colleges and universities. He presents an industry viewpoint on the present situation regarding the shortage of highway engineers.

The article in the April issue of American Highways, by General Anderson, of Virginia, dealing with the current shortage of highway engineers, should indeed make everyone stop and think. We have all been aware that it was difficult to obtain competent men in sufficient numbers to permit preparation of plans and the direction of construction at the desired rate, but to some extent this condition was assumed to be of temporary nature and at least partly related to the disruption of war. The statistics presented indicate very clearly, however, that the shortage is not temporary, but on the contrary has been developing for some time and is only now becoming evident in its real proportions.

In talking to a lawyer friend of mine about the matter, he expressed considerable curiosity as why such a shortage had occurred. On every hand he had seen great activity with huge equipment and he had just assumed that highway engineering must be very well paid work. As a matter of fact when I mentioned the starting salaries in many states he was still of the opinion that lawyers began for less, and furthermore that they had put in three or four years more college work than most engineers had done. Well, that conversation started me to make a little more study of the situation, and as suggested in General Anderson's article, I asked myself whether or not under present day conditions I would enter the highway field of engineering. Knowing what I do about the business, I still believe that I would, but if I only knew what the average student in college knows I am afraid that I would be looking for opportunities elsewhere as the record indicates.

With regard to my own college, while I knew from previous talks with the Dean of Engineering that the highway courses were not particularly popular, nevertheless I was surprised that not a single graduate in 1948 planned to become a highway engineer. And yet in times past this college has graduated many outstanding engineers who have been quite successful in this branch of engineering. Of course I must admit that with \$280 per month being the minimum wage accepted by last year's graduates, it was a little difficult to persuade a man to start in a highway department at \$200 per month or even the lesser rate paid in some states.

However, I am also certain that a low salary is not the basic reason for not entering highway work. Not only are highway engineer students few in number but civil engineering majors constitute only about 15 per cent of the present graduating classes. In my own college, only 5 per cent are civil engineers, as contrasted with an entirely different situation 25 years ago. Recently there were two good openings in our organization and I requested the College Placement service to recommend some fellow alumni. Not a single one was available who had the needed background of experience.

Reference has been made to the fact that highway departments lose men because they seek greener pastures. That is true, and I think it is not only to be expected but in addition it is desirable, provided we can have every year a new group of educated young men entering public work to serve at least a number of years and learn what it is all about. Not every engineer is qualified by temperament to be a good administrator in the higher brackets of public service, nor are there sufficient positions to take care of all the qualified men as they develop in capacity with the years. The very fact that industry and contractors supplying the highway field are able continually to employ trained engineers, is a proper encouragement to the many who find after their apprentice period that their talents run in that direction.

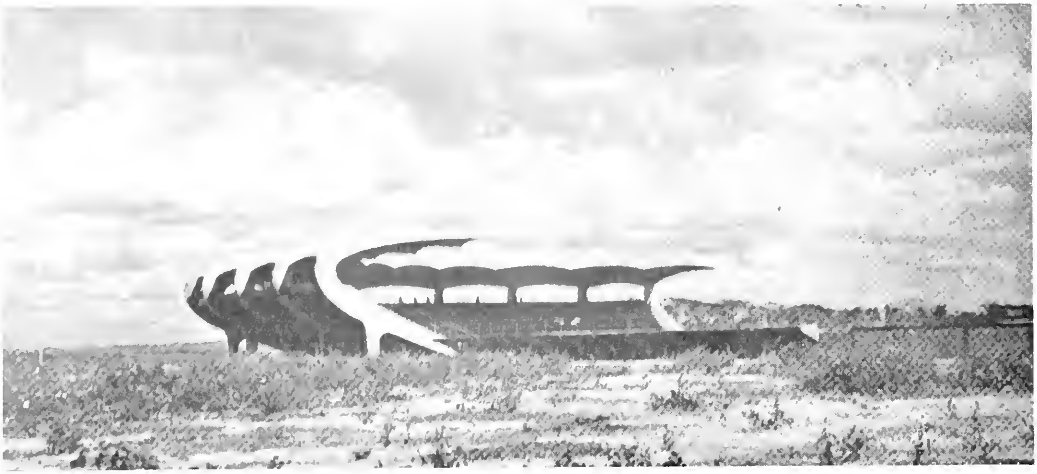
Not only that, but in the long run such transfers force laggard legislators to a proper appreciation of the necessity for the retention of trained men in public work and that they cannot expect to continue to be served on a philanthropic basis. Recently, in making a new addition to our staff, I asked the state engineer if he would have any objections. He was definite in saying that he was distressed to lose the man, but on the other hand he thought his resignation might help to bring home to his legislature the need for salary adjustments. I am glad to say that, in this instance, some increases have been recently made.

In addition to salary increases, there is another adjustment that must be accomplished in order that men will be induced to make highway engineering in public service a career. That, too, has been touched upon in the April issue of American Highways and in some respects it is more serious than low salaries, particularly after a man has gone through the ranks and is beginning to have a position instead of a job. I refer to the political handicaps under which many highway departments are obliged to operate, and which have grown with the years.

The young engineer is not unaware of this situation, and he does not propose to enter a kind of work where, as soon as he advances to a reasonably good job, say district engineer, he runs the risk of being demoted or fired every time the state has a new governor. Now in making this comment I know that there are many states where civil service protects against discharge, but in some states it also militates against advancement, and the young engineer is familiar with that situation too and therefore looks elsewhere for a career.

It is too bad that in some way the public cannot be educated to the waste involved in the constant turnover in public work brought about purely by political changes. For a highway department alone it runs to millions of dollars. Just suppose a railroad or an industrial corporation fired or demoted all its key engineers every two or four years, not

(Continued on page 28)



How's this for pitching a bold curve in concrete? It's a baseball stadium built at Cartagena, Colombia, S. A., in 1946. Solano, Gaitin, Ortega, and Burbana were the architects, with structural engineering by Gonzalez. (Photo by Foto Industrial and courtesy of Architectural Record.)

MAILLART AND HIS EGG-SHELL BRIDGES

By Connie Minnich, C.E. '51

Art has Picasso; poetry has its Whitman and Sandberg; music has its Gershwin. These people have shown themselves to be the disciples of the new trend of "futurism" in the aesthetic world.

What is "futurism"? Futurism might be defined as man's emotional expression in this present world in which he lives, a world now steeped in industry and science.

Looking at this new trend from the engineer's point of view, what do abstract notions like "futurism" and aesthetics have to do with a steel I-beam and a mixer of concrete? Is the average engineer aware of the world that lies beyond his T-square and slide rule?

The answer is definitely, "Yes." Frank Lloyd Wright and Walter Gropius have given the architectural world a few figurative wallops with their revolutionary designs. In the engineering world, Robert Maillart was one of the first to introduce a touch of "futurism" into bridge design.

Born in Switzerland in 1872, Robert Maillart was an engineer in charge of the construction of a concrete sanatorium at Davos early in his career. Here he met and worked with Hennebique, a reputed European contractor whose reinforced concrete structures had been the cause of much eye-brow raising in foreign engineering circles. It was this contact that became the turning point in Maillart's life. He became a self-appointed pupil of Hennebique, learned the contractor's theories, and then, with this knowledge as a basis, started experimentation and calculation with the object that became his life work — the reinforced concrete slab.

What do abstract notions like "futurism" and aesthetics have to do with a steel I-beam and a mixer of concrete? Here is the answer—the story of a Swiss consulting engineer who introduced a new trend in structural engineering with his fairy-like bridges.

When Maillart began his experiments at the turn of the century, reinforced concrete was gradually coming into wider acceptance and greater use as a new construction medium. However, so little was known about the potentialities and properties, if any, of this new material that the engineering world trusted it no further than the end of its arm. Everytime the slab was used in bridge design, it was reinforced and strengthened supposedly by all manner of cumbersome floor beams, trusses, dirt fill-in arches, and other supports.

Maillart was one of the first of the European engineers to master the reinforced concrete slab to any appreciable degree. Jerking it out of its role of passivity in construction, the Swiss engineer put the slab to work by treating it as a plastic functional element of bridge design. He gradually developed reinforced flat and curved slabs that dispensed with the old methods of support, which now made the slab an active bearing surface capable of withstanding any stresses and tensions applied to it. Mathematical analysis of these forces entailed years of calculation.

Slabs of this nature were first used for flooring and ceiling work in some warehouses that Maillart designed, the most notable being one in Zurich, Switzerland, which had the first "mushroom" ceiling in Europe. A "mushroom" design is one in which the piers have splayed heads resembling the underside of a mushroom. Pier and ceiling have no break; they seem to blend one into the other.

Robert Maillart turned to bridges next. One of the worst problems of construction that he had to face was the rugged topography of Switzerland which ranged from high, unconquered mountains to deep gorges and chasms.

He first began by throwing out all nonessential members of a bridge. Thus, all that remained was the skeleton or framework usually consisting of four parts: a flat, rigid, reinforced concrete slab for the deck, a curved one for the arch, and thin vertical posts or column slabs joining the two together. Seemingly inconspicuous, the strengthening agents were two stiffening girders, one on either side of the deck and running parallel to it, whose coordinating actions united the other components into a structure of apparently fairy-like proportions that yet possessed a gigantic strength.

The first notable results of Maillart's theories were realized in his Valtschiel bridge near Andeer, Switzerland, in 1935, although he had experimented as early as 1905 with a bridge over the Tavanasa river in which he threw out the massive beams in favor of the platform-arch-column slab arrangement. The Valtschiel highway bridge was unusual in that it was the first stiffened elliptical concrete bridge of its type. While the rib is designed to take only direct thrust, the stiffening girders on either side of the platform take the unbalanced live-load moments and, in addition, carry the floor slab and act as railings for motor traffic. Data on the bridge is as follows:

span ....140 ft.
rise .... 17 ft.
roadway width .... 10 ft.
depth of stiffening girder .... 6.3 in.
thickness of rib slab ....varies from 11 inches at springing to 9 inches at crown
uniform load ....61 lbs. per sq. ft. (7.7 to truck)

Another example of this type of design can be seen in Maillart's Landquart railroad bridge at Klosters. Data on this bridge includes the following:

length (incl. approaches) ....246 ft.
arch span .... 98 ft.
rise .... 26 ft.
thickness of rib slab....10 inches at crown to 13 inches at abutment
thickness of floor slab .... 12 inches

The unique design of the bridge causes the rib slab to look as though it were laid out on a curve, but it is actually laid out in polygon form with straight slabs between column points. One completely new feature is the curved deck that lies on a 410 foot radius and carries the ballasted railroad track. The outer girder is elevated to resist dynamic forces and the centrifugal force of a moving train draws the resultant force nearer the center. Forces of traction, expansion, and contraction are transferred to the abutments via thrust in the rib taken from the crown and bending in the girder.

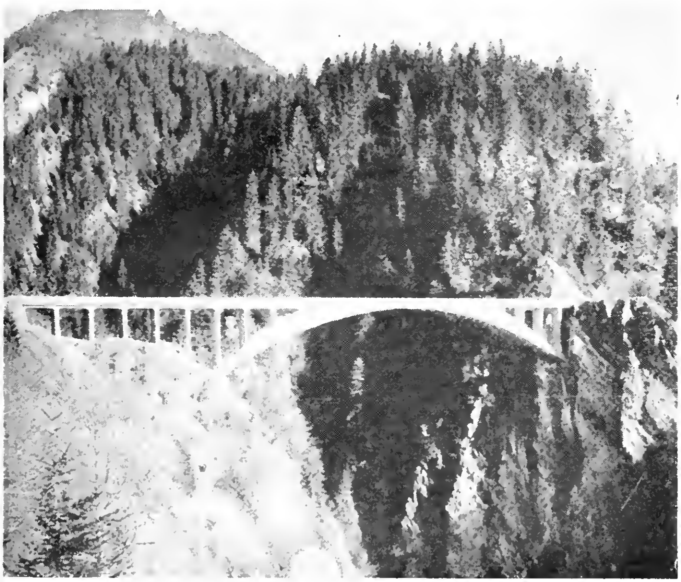
Testings made after completion for vibration, deflection, and unit deformations were done with slight overloadings. The results showed no excessive vibration and actually showed deflections less than those originally computed.

Scaffolding used in these structures is very light due to the slender proportions of the slab. For sites at an extreme height, this factor, and the little amount of concrete used, often amount to a large saving. However, the necessary high grade of concrete and great care in placing it often more than counterbalance these points.

On a glance at one of Maillart's bridges, the casual observer becomes first aware of the lack of "bulk" that characterizes most modern bridge design today. This almost ethereal appearance of delicacy in his bridges has been one of the main objections to Maillart's type of design. Quite a common belief has always been the one that a strong and durable bridge is one in which there is good "solid" construction, whether in concrete, wood, stone, or even earth fill, and more material and checks against possible disasters than may actually be necessary. Maillart's designs call for less material, but the quality, checks, and safety factor are incorporated in his bridges to the same degree as in a bridge of the "solid" type. Other objections frequently raised are the singular features that appear from time to time in Maillart's bridges such as peculiarly-shaped columns with splayed heads in the approach viaducts to his River Thur bridge or the hour glass-shaped posts in a bridge over the River Arve near Geneva. Here Maillart departed from the conventional horizontal and vertical dimensions to put forth a few queer-shaped pieces that were the uncompromising result of what the Swiss consulting engineer considered a structural necessity. In both of these examples he was able to make two columns do the work of four.

This treatment of the reinforced concrete slab—putting it to work as an active bearing surface—is gradually coming into use in the Americas, but the engineering world is still distrustful of its possible merits. One of the boldest designs in slab-work recently appeared at Cartagena, Columbia, in South America. Due to the action of salt air from the nearby Carribean, reinforced concrete was employed to build a stadium that, in its cross-section, looked like a parabola with a horizontal axis. The Columbian architects and engineers, some of them graduates of Yale and Harvard, were their own authorities on codes. The final result of their work

(Continued on page 38)



Maillart's bridges spring out of shapeless crags with the serene inevitability of Greek temples. Witness his Salginatobel bridge. (Photo from Giedion's "Space, Time, and Architecture.")

For Men of Expectations . . .

ELECTRICAL ENGINEERING DEPARTMENT
University of Illinois

One of the most remarkable condensations of valuable information that every engineering student should know before he enters the engineering profession was presented to the electrical engineering students last semester. This information was in the form of a brochure which was prepared by members of the electrical engineering staff under the chairmanship of Professor H. S. Helm.

What is engineering? What are the characteristics of an engineer? These, and other questions are answered in this article, which is a further condensation of the brochure mentioned above.

Because of its length, the article is divided into two installments. The second installment will appear in the December issue of the TECHNOGRAPH.

The selection of a career is one of the most important decisions which must be made by the average person. This choice should be based on the person's particular talents and not upon the popular conception of the glamor and social position of certain professions. When a person is engaged in the life work for which he is best suited, he is not only happier but is also a more valuable citizen to his community and to his country.

The final choice of a career must be made ultimately by each person himself. In order to do this intelligently, information regarding various careers should be studied and personal interviews should be secured with men in various professions.

This article has been prepared to give the student who is considering engineering as a life work, help in reaching an intelligent decision.

What is Engineering?

In the modern professional sense engineering is defined as the art and science by which the properties of matter and the sources of power in nature are made useful to man. Similarly, an engineer is defined as a person specifically trained and experienced in planning, developing, and supervising the creation of the structures, machines, and devices which make nature useful to man.

Some technicians, craftsmen, artisans, and skilled engine operators are popularly referred to as engineers. This article, however, deals only with the engineer as a professional man. This does not imply any lack of importance to society of all kinds of technicians and craftsmen. They are as necessary a part of society as engineers and other professional people.

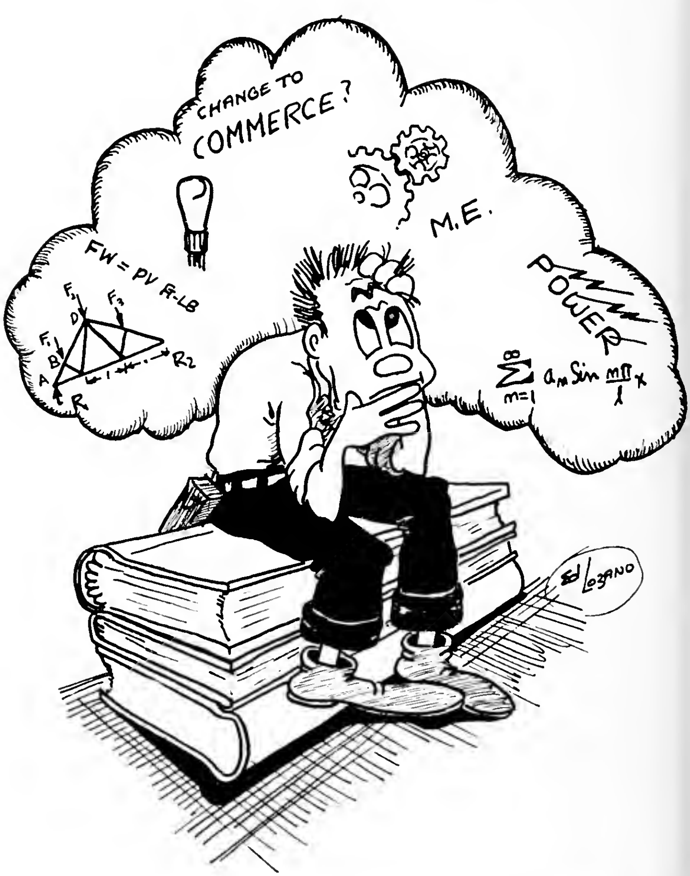
A good distinction between the professional engineer and the craftsman can be found in the definition of Professional Engineer as set forth by the Congress of the United States. Quoting:

"The term Professional Employee means (a) an employee engaged in work (1) predominently intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work; (2) involving the consistent exercise of discretion and judgement in its performance; (3) of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (4) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual or physical processes; or

(b) any employee, who (1) has completed the courses of specialized intellectual instruction and study described in clause (4) of paragraph (a), and (2) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (a)."

From the above it is evident that engineering does not consist merely of the properties of nature useful to man but also of doing this in a particular way. An engineering solution of a problem consists of the following parts:

(Continued on page 34)



I Stayed in Ceramic Engineering

By D. W. Gates, Cer.E. '48

From a purely practical point of view there was no choice in my own case. Having worked in an enamel plant for several summers both before and after coming to college; believing in the future of the plant in which I worked; enjoying both the work and the personnel, and being offered a job upon graduation at a good salary, doing the type of work which holds a special attraction for me, I had no real choice. However, for others who might consider ceramics there are many good reasons to choose one of its fields over other engineering possibilities.

The main branches of ceramics are as follows:

1. Structural clay products, which include brick, sewer pipe, floor and roof tile, chimney tile, drain tile, architectural terra cotta, and paving brick, made in about 2,000 plants. 2. Porcelain enamel products are produced in about 400 plants and are table tops, stoves, refrigerators, glass lined tanks, bath tubs, building panels, pots and pans, and signs. 3. Refractory products include linings for furnaces of all types and other uses where heat, fumes, and corroding effects of fuels must be withstood. They are made in about 230 plants. 4. Earthenware and porcelain are made in about 260 plants in many forms such as china, earthenware jugs and bowls, insulators, whiteware, wall and floor tile, spark plugs, and the common semi-vitreous dinner-ware from which we eat. 5. Glass products are windows, bricks, bottles, tableware, cooking utensile, bulbs, and insulation, produced in about 263 plants; even cloth and rope are now being made from glass.

Besides these divisions there are special fields to include abrasives, cement, lime, gypsum, and optical glass. Ceramic plants also produce fillers and coating materials for paper, rubber, paint, and oil purification. The making of false teeth is one special branch of ceramics.

In order to decide whether it might be worthwhile for me to enter the field of ceramics, I worked for a plant for a summer before coming to school. Having decided upon the field which I wished to enter, it seemed reasonable to try it out. Probably one type of plant was not a fair trial, but at least one portion of the picture was investigated.

Why did I decide on ceramics? Investigation of statistics of census of manufacturers reports turned up information on value added by manufacturers in many industries, and the value of wages paid out.

There are about 3,200 ceramics plants but only 1,600 engineers trained in ceramic schools. Regardless of the reasons for this deficiency, it would seem that there is a future in this branch of engineering. But, one of the reasons for this demand is that the field is new. Formulas that for years were mixed by the "dark of the moon" or on certain days only, time-honored methods that smacked of witch-craft are only now becoming modern standardized formulas,

	Values in Billions of Dollars of Products	% Added Value by Mfg.	% as Wages
Ceramics Products	1.687	58.6	24.3
Furniture and Related Products	.677	53.4	26.1
Iron and Steel	7.480	45.9	22.2
Leather Products	1.096	43.6	22.8
Paints, Pigments, and Varnishes	.538	42.0	7.9
Petroleum Refining	2.547	18.9	5.5
Rubber Products	.863	41.8	19.4
Smelting and Refining Non-ferrous	1.290	12.1	3.9
All Industries	60.713	41.5	16.7

and the methods are just beginning to advance to efficiency and uniformity. The growth of the industry in the last 52 years, since the opening of the first department of ceramic engineering in an American university, has been tremendous; hence the shortage of trained men.

Usually a graduate must start with an established industry unless he is a ceramic artist who wishes to produce hand-made individual art ware. Some few may produce an entirely new product, but ordinarily the young ceramic engineer's place is with a well-established ceramic plant. Before the war one might expect to receive about $2,500 as a yearly salary after five years' work. The starting salaries offered at present vary in the range of $3,000, and jobs are offered in all parts of the country. Truly, one can pick his location, type of work, and amount of pay.

The types of positions and percent of graduates in each branch of ceramics are about as follows:

Teaching	7.4 %
Art	1.08
Production	51.1
Sales	6.16
Executive	18
Research	15.7

The following is a list of the various types of work done by ceramic engineers:

Mining

- Supervision of prospecting, drilling, testing samples, making maps
- Mine Surveys
- Procuring of samples from mine to be tested to control mining operations

Plant Control

- Testing and checking raw materials before permitting them to go into production — correction of batches
- Control tests on water — degree of mixing — dying — firing
- Checking of finished product
- Remedying plant troubles

Plant Development Work

- New glazes, body compositions, or new special materials to:
  - (a) develop a new line of products
  - (b) use another source of materials
  - (c) overcome defects — cut losses
  - (d) improve product

Engineering Work

- Tests on various types of equipment to improve efficiency
- Designing new or remodeled equipment—driers, kilns, dies, conveyors, plant layouts, special machinery
- Designing small structures

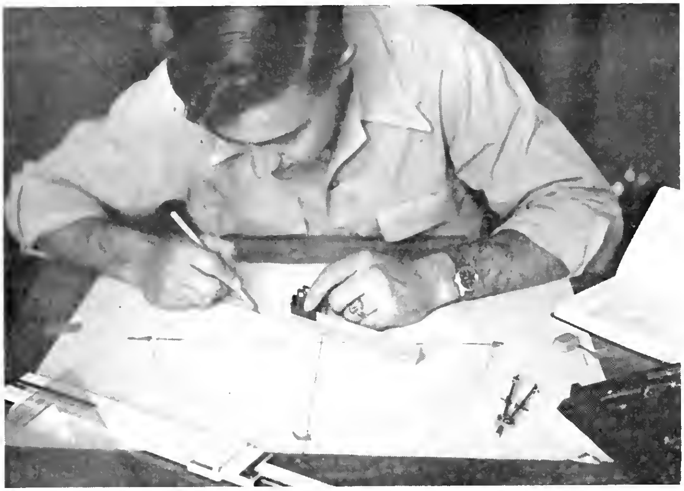
Plant Supervisory Duties

- As foreman, superintendent, production manager, etc.

Less publicity has recently been given to ceramics by the department here at Illinois because of the influx of returning veterans and crowding of the facilities in the department. During the war also, students in ceramics were non-

(Continued on page 20)

Undercover at...
GALESBURG



One of Mr. Johnston's students struggles with problems concerning measurement of angles and prolonging of lines as he busily does his surveying homework.

Surveying at Galesburg

By Dean R. Felton, C.E. '51

A 156 acre campus plus two large city parks within walking distance combine to give the Galesburg Undergraduate Division ideal conditions for a well filled curriculum in surveying. At present three courses of surveying are being presented to engineering students. These classes are C.E. 111 (Plane Surveying), C.E. 112 (Topographic Surveying), and C.E. 115 (General Surveying).

The classes are ably led by Mr. J. H. Johnston and are doubly fortunate in having at their disposal approximately eighteen thousand dollars worth of the finest equipment available. The equipment includes transits, levels, alidades, and supporting equipment which is beyond the dreams of even the most enthused engineering student.

In the initial course of surveying, C.E. 111, the student becomes acquainted with the instruments and proficient in their use. Familiarity follows by actual problems in the field which make future operations seem second nature. Such problems as prolonging a line, measuring angles, and plotting courses are now elementary to the "old engineer" and the culmination of the first semester is a topographical map of the campus showing accurate location of buildings and all public utilities. These maps are being made of consecutive sections of the campus with the ultimate aim of completing an extremely detailed overlay of our whole campus.

A city park comes next under the unblinking eye of the transit as the classes spend 12 weeks of their second semester gathering data of every sort. Complete notes are kept of elevations, utilities, and shore lines. Outstanding features are sighted from every direction. After reduction, the notes are used in producing a large scale map of the whole area. This map shows contours and complete detail to give the student experience in general plotting and map making. Constructive criticisms are given of the completed maps and much valuable experience is gained in reading and interpreting the type of map most commonly used by the engineer.

In no manner do the combined courses pretend to make a full-fledged surveyor of the student. The object of these courses is to acquaint the student engineer with surveying instruments and procedure and to instill in him confidence in his future studies of surveying.

Army Stratosphere Facilities

By Dwight Beard, E.E. '51

The New Stratospheric Facility, located at the Aberdeen Proving Grounds, Maryland, which has been under construction since July, 1945, is the largest firing chamber in the world capable of simulating both changes in temperature and atmospheric pressure occasioned by the fastest aircraft. Starting at 70 degrees above zero and sea level pressure, aircraft weapons as large as the 105 mm. cannon can be fired as temperature and pressure are varied to simulate an aircraft ascending at the rate of climb of 5,000 feet per minute, up to 50,000 feet altitude arriving at a temperature of 70 degrees below zero and a pressure of about 1.7 pounds. Descents can be simulated to speeds approaching that of the speed of sound.

The facility consists of an insulated steel firing chamber, heavily reinforced, in which the guns and personnel operating them are located, and is connected by a firing port to a concussion chamber. The concussion chamber is a large heavy steel pressure chamber into which the muzzle of the guns extend and which absorbs the concussion caused by the firing of the big guns. The rear of this chamber contains 25 feet of sand weighing 180 tons, and finally, armor plate three inches thick to stop the larger high velocity shells. The firing chamber and concussion chamber are capable of being independently controlled in both temperature and pressure. Over 600 h.p. of refrigeration equipment and vacuum pumps maintain the rarified air condition at 50,000 feet, and the sub-zero temperature of 70 degrees below zero while aircraft cannons are fired automatically at high rates of speed.

Instrumentation is available which records the velocity of each round from machine guns firing over a thousand rounds per minute, temperature changes of fractions of a degree can be almost instantly detected. Even the strains set up in the gunports by the rapidly changing temperature and sub-zero cold are continuously recorded for detection of

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In This Corner... NAVY PIER

Rubbing Aladin's Lamp

By John Fijolek, E.E. '51

Think of something you would like to experience, to do or to know. In most cases, someone not only has felt the way you do about this particular something but has experienced or done it and described it in writing for you.

Do you want to save time, heartache, and disappointment? Learn from experience—someone else's wherever possible—at least the guide-posts so that your own experience will be safer, quicker, and more profitable.

How can you do all this? It's easy! Learn how to best use one of the most important tools of your profession — the library. Navy Pier's library now has a collection of over 20,000 volumes, a tremendous store of experience of every shade and description in every field of human endeavor. And, if the experience you desire is not among these, at least the clue to where you may find it will most probably be there.

To the engineer, the library should prove one of his most valuable tools; it makes his work easier and speeds his objective. Where else can he at a moment's notice, without hesitation, consult with the masters in his profession? Where else can he obtain priceless information for only the fee of time well spent?

But, like all tools, it needs care in its use. Slipshod search may well prove fruitless. Proper use will afford limitless dividends. It is a mine that can never be worked out.

You don't have to be a bookworm or study library routines for hours on end to make the library serve you profitably and well. For instance, the Pier library maintains a Reference Information desk, staffed at all times by one or more professional librarians especially trained to handle inquiries. At their command and yours is a collection of reference books numbering over 2,000 volumes. Handbooks and encyclopaedias form only the core of this vast network of information. The entire staff of 21 help to make this information accessible and usable.

The library currently receives 429 periodicals. Included among these are many of the engineering journals, proceedings and papers. Extensive back files of many of these are on hand in bound form, providing ready access to source material for the research worker or man with a special problem.

The Industrial Arts Index (1918-1947 on file) provides a subject index to a selected list of engineering, trade and business periodicals. This and the Engineering Index do for the engineer what the Reader's Guide to Periodical Literature does for the L.A.S. student.

The Engineering Index is an annual volume which reviews the current engineering literature of the world. Recent trends and technological progress are recorded in the annotated references to articles, papers, and reports from engineering, scientific and industrial publications, including periodicals, society transactions, bulletins and reports of government bureaus, research laboratories, experiment stations and similar organizations, and reviews of recently published books. Not necessarily all articles published in these publications are indexed in the Engineering Index, selection being made on the basis of articles dealing with the art and science of engineering.

There is no attempt to equal the Urbana engineering library in facilities since the job each has to do is different. What it does do is to furnish more than adequate material for the Pier engineering student and, through the new Reserve Book station and proposed art and architecture department, bring this material as close to his fingertips as possible. Where the request for information goes beyond normal demands, the library, thru the use of the Union list of serials, is able to refer the inquirer to any of the Chicago libraries that do possess the information.

The Pier library is headed by Librarian David K. Maxfield who is currently expanding its services and facilities at a rapid rate to the goal of 40,000 volumes by September, 1950. Acting on the recommendations of the various department heads, nine from engineering, he is adding continually to the store of available material. By reorganization and closer contact with the student body, the Pier library is becoming the widely used tool it should be—in many ways, a modern Aladdin's Lamp!

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Why Engineering?

By Richard Choronzy, M.E. '51

The question arises once more as to who is studying engineering and why. This query need not be heeded by the majority of the engineering students here at the Pier; rather, it is directed at some few so-called 'engineers' who are literally staggering their way through the various curricula offered by the college.

Just why this minority is attempting college work is a paradox. Undoubtedly, the great influx of ex-G.I. students is responsible, in part, for the existing situation. This is not intended as a "knock" to the veterans—quite a number of them are our honor-bright students. But sadly enough, some are attending college 'just for the ride.'

There are an equal number of non-veterans, if not more, who have no business attending the University. To them, college is a social function; in other words, it's just plain fun. Too many high school students matriculate with the erroneous thought that college-life is one of gayety, parties, fraternities, proms, and other social doings. Nothing in the world could be more incorrect. College is a serious undertaking, an educational institute. We should keep it that way.

An interesting incident occurred during our last honors day convocation. We learned that the college of engineering was unable to fill their quota of B-average students. Why is it that we couldn't meet the requirements (no one was considered who had an average below 4.0, excluding P.E.) for at least one-tenth of the college requirements? Is college work that tough? We aren't going to try to answer that or suggest methods to solve this particular problem; that is the job of the University Senate. However, one fact is undeniable. We would have had 10 per cent on the honors day program if the enrollment in engineering was decreased.

Apparently the original question of 'why engineering?' is just as perplexing to Mr. I. K. Feinstein, instructor in mathematics here. He plans to personally meet every one of his students and discuss informally the purpose of the student's education. He also would like to know why the student is studying engineering. The reason will probably be astonishing, and we would like to hear the results (off-the-record, of course) from Mr. Feinstein, if possible.

Once again, we stress the importance

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Introducing

By Jim Iocca, C.E. '50

WINSTON E. BLACK

All engineers are required to take a "T. A. M." course at one time or another during their college career. For the benefit of those of you who have not as yet completed your "T.A.M." courses may we introduce Professor Winston E. Black, a member of the theoretical and applied mechanics department.

Mr. Black is a native of Chicago. He entered the University of Illinois in 1932 and was awarded a B.A. degree in civil engineering in 1936. After receiving his degree he enrolled at Lehigh university to do graduate work towards an M.A. degree. In 1938, after receiving his masters, he accepted a position on the staff of the theoretical and applied mechanics department at the University of Illinois as an instructor and research assistant.

In 1942 Mr. Black took leave of the University to enlist in the corps of engineers. He was stationed at Fort Belvoir, Virginia, and later transferred to Yuma, Arizona. His assignment was chiefly to aid in the design and testing of portable bridge equipment. He was discharged in 1946 with the rank of captain.

After being discharged from the service he returned to his position at the University of Illinois. Since his return he has been instructing dynamics, statics, and elementary and advanced strength of materials. In addition he has been conducting various experimental research problems primarily in structures.

Mr. Black likes sports, but he finds very little time to participate, for when his departmental duties aren't calling, his leisure moments are spent with his three children.

WINSTON E. BLACK

Mr. Black, with his congeniality, warm smile, and quiet mannerisms, has the ability to put anyone at ease. His popularity in the engineering college is evidenced by the fact that he has been elected president of the faculty bowling league for the coming season by his fellow instructors.

Mr. Black is a member of A.S.C.E., Tau Beta Pi, Sigma Xi, and an honorary member of A.K.L. He is also a registered professional engineer. He has written various articles in conjunction with his research work, two of which have been published, one as a University bulletin, and another included in an A.S.C.E. publication.

GEORGE B. CLARK

This issue introduces a faculty personality from one of the smaller departments of the College of Engineering, the school of mining engineering. Readers of the May issue of the Technograph should be acquainted with Professor George B. Clark for he is the contributor of "Opportunities in Mining Engineering," and perhaps you, as well as I, became interested in this particular phase of engineering as a result of his fine article.

Professor Clark was born in Pleasant Grove, Utah, where he received his elementary and high school education. Upon graduation from high school, he enrolled in the department of mining engineering at the University of Utah and received his bachelor's degree in 1935.

While in college, he became interested in the possibilities of mining the placer deposits along the Colorado river, but his desire to prospect for gold never materialized for, after graduation, he accepted a position with the Tintic Standard Mining company in central Utah.

He remained with the mining firm for three years after which he returned to his alma mater as instructor and temporary acting head of the department of mining engineering. He taught at Utah for one year and then returned to the mining firm by which he was formerly employed.

In 1940, he accepted a position with the United States Bureau of Mines. A year later, he returned to the University of Utah for a master's degree. After he had completed a year of school, war was declared and he was ordered to active duty in the Corps of Engineers, United States Army.

His sojourn in the Army lasted four years. During this period, he served eighteen months with the engineers in the Mediterranean theater from North Africa to Italy. After service in the Mediterranean, he returned to the states where he taught in the engineering school at Fort Belvoir. After six months of instructing, he embarked again, this time to the European theater for a period of ten months. While overseas, he was awarded eight battle stars. In February, 1946, he was returned from overseas and discharged with the rank of captain.

He returned to the University of Utah to complete work for his master's degree, which he received in June, 1946. Shortly thereafter, he accepted a position as assistant professor of mining engineering in the department of mining and metallurgical engineering at the University of Illinois.

Flying and playing the piano are his favorite hobbies, but Mr. Clark has found very little time to enjoy them because of the volume of work he has committed himself to. In addition to teaching, he has been working on his doctorate. He has also contributed articles to the Engineering and Mining Journal, and some of his articles have been published as technical bulletins by both the American Institute of Mining and the University of Utah. In addition, he is an active member of the American Institute of Mining and Metallurgical Engineers and the research honorary, Sigma Xi.

During the interview, Mr. Clark could not resist putting in a "plug" for mining engineering and, to be frank with you, there were occasions when I

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GEORGE B. CLARK
(Photo by John McGlone)

Illini in Action

By Herb Jacobson, M.E. '50

New dean of the Yale school of engineering is WALTER J. WOHLENBERG, M.S. '16. He is world famous for his theoretical work in heat transfer leading to a rational basis for design of industrial furnaces. He has been on the Yale faculty since 1918 and has taught at the Universities of Oklahoma and Montana. During the war he was staff aide in charge of engineering for the New Haven Civilian Defense council and a member of the advisory committee of the national fuel efficiency coordinator.

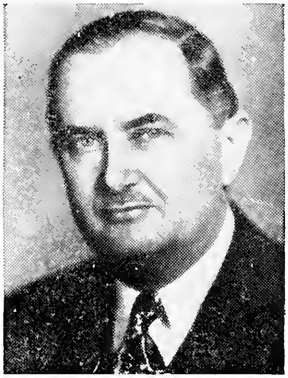
FREDERIC T. MAVIS '22, M.S. '26, head of the civil engineering department at Carnegie Tech, now also is consulting editor for a new McGraw-Hill series of books on civil engineering. The series is to be a selection of books for undergraduate and graduate study, and for use by practicing civil engineers. S. D. KIRKPATRICK '10, editor of Chemical Engineering, is the consulting editor for a chemical engineering series started in 1928.

When MERLIN M. BRUBAKER, M.S. '25, Ph.D. '27, became director of research for the Du Pont company's chemical department laboratories and director of services for the experimental station, he was succeeded by PAUL L. SALZBERG, M.S. '26, Ph.D. '28, as laboratory director of the experimental station. Salzberg had been general assistant laboratory director at the station. Both men have been with Du Pont for 20 years.

MACK C. JONES '35, an electrical engineering graduate, recently received much favorable comment on his invention, the "micromatch," which is a device used by amateur radio operators to measure standing waves. A consulting engineer with Cardwell Allen Manufacturing company, Jones also has his own electronics laboratory and manufacturing plant, M. C. Jones Electronics company, Bristol, Connecticut. He was with RCA Manufacturing company from 1935 to 1945 and designed special radio equipment for the army and navy during the war.

Traffic superintendent of the newly created Champaign district of the Illinois Bell Telephone company is WILLIAM T. BRIDGES '30. Since joining the company immediately after graduation he has held the positions of engineering assistant, engineer, assistant traffic supervisor, traffic supervisor, assistant traffic superintendent, and division supervisor of force adjustment of the Chicago Toll division.

Heads Rail Engineering



Newly elected as fiftieth anniversary president of the American Railway Engineering Association—the organization which is the principal national authority on railway construction and maintenance—is Charles H. Mottier, vice-president and chief engineer of the Illinois Central Railroad. A 1910 engineering graduate of the University of Illinois, Mr. Mottier has been in Illinois Central service the last thirty-seven years. His Illinois Central predecessors in the top AREA office were: J. F. Wallace, the association's first president, 1899-1901; A. S. Baldwin, 1916-17; L. A. Downs, 1921-22; D. J. Brumley, 1927-28.

EDWARD E. WITT '42 is in San Leandro, California, where he is the newly appointed special representative in construction and industrial sales for the western division of the Caterpillar Tractor company. He will serve as a consultant to all west coast Caterpillar distributors. Before he entered service with the Army artillery corps, he worked with the state highway department.

New vice-president in charge of employe relations for Western Union is THOMAS F. McMAINS '27. He has been with the telegraph company 20 years, starting out in 1927 as an engineering apprentice. Later he assumed various supervisory positions in southern states, became an engineering assistant and general inspector in the traffic department headquarters in New York in 1935, was appointed traffic superintendent of the metropolitan division in 1941, and assistant vice-president of the traffic department in January, 1947.

THOMAS H. BEAN '34 is president of Food Freezers, Inc., of New Orleans. He also maintains an office as consulting engineer at 813 Hidalgo street.

Directing the aviation maintenance engineering department of St. Louis university's Parks College of Aeronautical Technology, East St. Louis, is HAROLD N. HERTENSTEIN, M.S. '40, newly appointed to the position. He has been an instructor and assistant director of the aeronautical engineering department at Parks. Previously he taught at McKendree college and at the Air Force Technical School, Biloxi, Mississippi.

Capt. LEWIS L. BOWEN '04 is attending the Air Institute of Technology at Wright Field, Dayton, Ohio. He was an inspector for the Chicago and North Western railroad for years, taught civil engineering in the University of Minnesota, and did important work for the city of Minneapolis in making topographical surveys. He was much impressed with the development of the Illinois campus since '04.

This is a little story about a noted Illini engineer who quit a good job because he knew he could make a machine better than the one his company was making.

The man is STANLEY T. GOSS '09, who heads the firm of Goss and Deleeuw in New Britain, Connecticut. That company was organized in 1922 and now, a quarter century later, 54 per cent of the men employed in 1927 still are working in the plant, one of the most modern of its kind in the U. S.

The company manufactures the world's finest chucking machine.

When he was quite young he worked for a yacht company in Chicago. A Mr. Judson came in, wanting someone to take his drawings of a two-cylinder gasoline engine and build a working model. Goss did the job—and with the product Judson started the Continental Motor company.

After leaving the University, Goss went to New Britain and worked for the Corbin Motor Vehicle corporation. Cars were virtually tailor made then. Goss would take a new car out on the road, make the necessary changes and repairs on the road, and bring it back properly broken in.

He went with the New Britain Machine company where he soon became vice-president and director, having charge of the chucking machine division. There he got the idea for a radical new chucking machine. But the directors didn't want to change their patterns then. Goss quit, and formed the company which made a chucking machine of his own design.

The Engineering Honoraries and Societies

By Ray Hauser, Ch.E. '50

SIGMA TAU

George Gore, president of Sigma Tau, took a "sentimental journey" to the national conclave at Pittsburgh, October 6. Meeting with engineers from other chapters, George picked up a few good ideas as well as convention stunts.

Shingles and keys were distributed to members at an organizational meeting October 5. Plans for social events and pledge lists were discussed.

A.S.M.E.

Off to a good start this year, the mechanical engineers have signed up about 300 members, forming a very active group. There was a good turnout for refreshments at the first meeting, September 22, at which Professor W. N. Espy gave a pep talk on "Your Professional Society."

Committees were selected and the following officers elected at this meeting: chairman, Charles E. Drury; vice-chairman, Robert L. Pontius; secretary, Donald G. Smith; treasurer, Carl W. Falk; assistant treasurer George L. Frandsen; and engineering council representative, Robert Carlson.

ENGINEERING COUNCIL

The Engineering Council has been in full swing since the early part of this semester and has already discussed many items of importance.

The temporary Saint Pat's petition committee states that petitions for spring events cannot be accepted until the start of the spring semester. The petition for the Ball will be filed in Dean Hampton's office now for formal action at the beginning of next semester.

The question of a location for the Ball was discussed, and the A.S.M.E. recorded a formal vote in favor of Huff gym. As this matter requires considerable deliberation, council representatives are to consult their societies on the matter.

A committee to investigate the opinions of the various departments in respect to an all-engineering open house was named at a recent meeting.

At this meeting the petition of the S.A.E. for council membership and previously proposed amendments were approved by all societies except the A.I.E.E.-I.R.E., A.S.C.E., I.A.S., and the S.B.A.C.S., whose representatives had not yet received instructions.

Starting with October 14, the council meetings will be held on alternate Thursdays, at 7 p. m. in the Illini Union.

A.I.E.E.-I.R.E.

The A.I.E.E.-I.R.E. is the student electrical engineering society. Its purpose is to promote interest in the electrical engineering profession, and to further student-faculty relations outside of the classroom. Its programs are designed to give the electrical engineering student an insight into the electrical engineering profession, showing what the electrical industry is doing today, and what it will be doing tomorrow. Socially, it gives the E.E. student a chance to meet his fellow students and faculty on an informal basis, and it provides an opportunity for him to participate in an activity that is closely related to his intended profession.

Plans for this year include many fine speakers, such as Mr. T. G. LeClair, assistant chief engineer of the Commonwealth Edison company at Chicago, and Mr. M. V. Maxwell, assistant manager of the Northwestern Engineering and Service of the Westinghouse Electric corporation. Field trips have been arranged to nearby electrical industries, including Sangamo Electric company and the Municipal Light and Power company in Springfield. Picnics and student-faculty-get-togethers have also been planned.

A new feature which has been inaugurated this year is a newsletter, known as the "WHAT-METER," which is being sent to all members. It contains meeting announcements, news, activity announcements, humor, and other items of interest.

The A.I.E.E.-I.R.E. membership has passed the 500 mark this year. This is one of the largest, if not the largest, membership the local branch has ever had.

The officers for this year are Keith Goodwin, chairman; Don Hyer, vice-chairman; Ed Schwartz, secretary; Robert Beck, corresponding secretary, A.I.E.E.; Jim Schussele, corresponding secretary, I.R.E.; and Jim Stewart, engineering council representative.

TAU BETA PI

The study of the moment of inertia of a big wheel was begun at the Tau Beta Pi national convention at Austin, Texas, October 14-16. One of the big wheels was Charles Drury, president of this local all-engineering honorary. Charles W. Studt, vice-president, was the alternate delegate.

A.F.S.

Latest arrival on north campus is the American Foundry Society, officially installed October 22. James L. Leach, assistant professor in the M.E. department, is the faculty adviser for this group whose aim is to enlighten students in the possibilities of foundry work.

Among the professional men present at the installation were C. B. Soper, of the American Foundry & Furnace company, Bloomington, and representatives from the General Motors foundry, Danville, and the Caterpillar foundry, Peoria. Student officers are Charles Drury, chairman; Harold French, vice chairman; Robert W. Bales, secretary; and Joseph M. David, treasurer.

I.T.E.

Using a whistle as well as a slide rule, the traffic engineers are often seen on the campus streets taking their numerous traffic surveys. If you have campus traffic problems, or know how to solve the existing situation, see the I.T.E.

Meetings were held September 21 and October 15 to plan and organize this year's activities. Is it true that "The Sidewalks of Chambana" has been officially adopted as their theme song?

PI TAU SIGMA

Pi Tau Sigma, the mechanical engineering honorary plans to sponsor a senior banquet this semester to get the boys together for good eats and a good time. A pledge smoker and initiation banquet are also on the agenda for the near future.

Mssrs. Peskin, Stolley, and Johnson went to Madison, Wisconsin, October 29 to take part in the two-day national convention.

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EDWIN A. WITORT
Editor

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

A Question of Application . . .

All of us, at one time or another, have heard ourselves or someone else ask: "Why is this subject required?" Maybe the question was in reference to descriptive geometry, the nemesis of many an engineer; or maybe it was rhetoric, chemistry, a particular design course, or any of the many other subjects that are prescribed in your particular curriculum. As an example, maybe your aspirations lean towards sales engineering and your curriculum states that you must have credit in a design course in order to meet graduation requirements. "What good will it do me? I certainly won't ever use it." The prospective engineer may look with antipathy upon many courses not related to his field and make the same statements. There probably are very few of us that haven't asked the same questions of at least one of the required courses.

These questions can be answered by almost any of your instructors and, if you sit down and analyze the question yourself, the answer will present itself in short order.

First of all, there aren't many of us that know exactly what type of work we will be doing when we graduate. It wouldn't be impossible that your particular position will require that you know at least a little about the subject that you so politely snubbed when you were in school.

Secondly, it should be stated that the various engineering curriculums, as they are set up now, are the results of years of research by some very competent men; men who have made studies of what industry requires of the student engineer when he graduates. Every required course has a definite purpose, and you defeat that purpose when you enroll for the course with a negative attitude. There are a certain number of specified credit hours required for graduation and the men who make up the curriculums certainly are not going to require your taking a course that would not benefit you in one way or another.

Most engineering courses teach you to think and analyze. If you don't get anything more out of a course than just to learn "analytical procedure," the course will have served its purpose well.

The point that should be stressed is that each and every subject that you are familiar with, be it related to engineering, commerce, politics, sports, laying bricks, crocheting, or what have you, is like "money in your pocket," as the saying goes.

How can this be true? Well, let's say that you go to work some day and your boss asks you to look over a descriptive geometry plate, or maybe solve a simple beam problem that has been puzzling him. Will your reply be: "Sorry, sir, but I didn't like the course and I don't remember very much about it." What is so important about this incident is not that you would have been fired because you didn't know the answer, but the fact that if you had presented the solution, you would have been on the inside track with your boss. Similar examples can be presented in defense of every course offered at this University.

If you have a myriad of subjects that you can discuss intelligently you will have an asset that a large number of people do not possesses: The ability to make interesting conversation. Every course you take, every news item you read, every talent you possess, and every bit of knowledge you have crammed into your brain has the potentiality of doing you some good.

If you can converse with the boss about technical topics and the next minute speak your piece to the office boy about who won yesterday's ball game with equal facility, you are destined for success. Soon your own experience will dictate the truthfulness of this statement.

CERAMIC ENGINEERING . . .

(Continued from page 11)

deterable, while M.E., C.E., and E.E. students were kept out of the draft for sometime. That there were fewer graduates during the war has increased the shortage of men. Men are desperately needed now in many rapidly expanding plants, though the demand has always been steady and increasing from the depression years to the peak levels of today.

When I talked about the future of enamels with Dr. R. L. Cook, he stated that the new prefabricated enameled houses alone would increase the number of men employed in the enamel industry by about 50%. This five room house will cost about $7,000 per unit, and production of 50,000 homes per year is expected to be reached this year. The appliance field is also rapidly expanding the use of enamel finishes because of the wear resistance, color stability, and glass-hard surface. Signs are being produced in ever increasing numbers because of the low replacement necessary. This more than compensates for the higher original cost of paint-surfaced advertisement of a semi-permanent nature. Mr. L. E. Nordholt of Tennessee Enamel Manufacturing company expressed fears that increased cost of steel might force the price of enameled articles up, but Dr. Cook pointed out that enamel costs about 35c per square foot while steel is only 2 or 3c per pound. Steel shortages have curtailed the operation of some plants as it has in many other industries, but cast iron and newer "Tienamel" stock may be one way out of this difficulty. Processes have also been developed for many grades of steel and iron which it was thought impossible to enamel a few years ago. Continued research and newer processes have also cut down waste from 10 to 20% ten years ago until 1% is common today.

The aim of the department, as published on its founding, was stated, "The ability to manage any large business enterprise successfully can not be acquired completely in school. There is a large element of practical experience which can be obtained only by actual contact with the business world in which one embarks. The school ought to give the student training in scientific methods of experimentation and interpretation of results, and familiarity with fundamental processes covering the field of research with which he is engaged." (U. of Ill. Bulletin, Vol. III, Nov. 1, 1905.)

The college of engineering at the University makes this statement as to the purposes and scope in its ceramic department: "Two curricula are offered in the Department of Ceramic Engineering leading to the degree of Bachelor of Science, one in Ceramics and the other in Ceramic Engineering. The courses as a whole prepare the student in the general scientific principles underlying the silicate industries, which include the manufacture of glass, vitreous enamels for metals, cements, and clay products. The curriculum in Ceramics is intended primarily for the training of ceramists for control of factory processes, for testing and investigation, for teaching, and for research. The curriculum in ceramic engineering prepares the student for the designing of plants and equipment, the construction of kilns and driers, and the supervision of manufacturing operations. It is distinctly an engineering course in which engineering subjects predominate. An administration option is offered those registered in ceramic engineering who wish to engage in salesmanship or management in the industry. This option contains courses in accounting, management, salesmanship, cost accounting, etc., which are substituted for some of the electives and required courses in the strictly technical curriculum."

Close cooperation with industrial establishments has always been maintained by the staff. This was, and is, promoted

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CERAMIC ENGINEERING . . .

(Continued from page 20)

by the ceramics short courses given here at the University for men now working in plants throughout the country. Designed to allow them to get up-to-date information easily and presented understandingly in a short time, these courses have been given since 1912. In 1912 they were given for two weeks in January and this was continued up until 1916. From 1916 to 1934 they were given every two years, and the enrollment continued to grow from the first meeting, which was attended by 50 to 70 men in brick, glass, enamels, and pottery. In 1934 the course was broken up into sections:

A. "Clay Product Plant-operators Conference" which dealt with structural and refractory products and attended by about 65 men.

B. "Conference on Glass Problems" which includes glass refractories, fuels, glass wool, and other sections of the field. This is attended by 50 to 100 men, and in connection with this is given a forum on factory problems.

C. "The Porcelain Enamel Institute Forum" (renamed in 1938 the "Porcelain Enamel Institute" and held alternately at the University of Illinois, and the University of Ohio) included preparation of surfaces, drying, application, special short courses such as "Heat Treating for Porcelain Enamelers." The attendance has averaged better than 200 men from all over the country.

At these courses talks are given both by members of the department and industrial manufacturers representatives as well as the plant men, and the value of the courses to the industry has been widely proclaimed in the scientific society journals and trade publications in the various fields of ceramics covered by the courses.

Progress of the branches of ceramic engineering can be illustrated by window and automobile glass production which was produced by hand until 1905, and now is 95% sheet drawn. Brick manufacture has increased production with the continuous furnace and machines capable of making 15,000 bricks per hour. Glass progress in textiles, brick, sound, heat and electrical insulation, polarized glass, containers, and continuous batch furnaces, has come to the point where mechanical methods are now requiring less research and greater uses are being stressed along with better technical processes and formulas. Better control in porcelain enamel variants of manufacture and increased use of automatic and continuous processes along with a continuously improved product have led to large expansion of application and greatly increased sales. These improvements are due to technical trained men and the day has passed when the worker rises from the ranks to key positions. Except in a very few instances the advantage the college trained men have is never caught by the men with only the vision and training that practical experience can give. In the atmosphere of proper professional attitudes the necessary skills and techniques are introduced in college when the time is best to acquire and use them. The underlying scientific principles and the fundamentals of mangement and production are taught with a perspective that views the entire ceramic field and gives the student a scope and a point of view not obtainable elsewhere.

That the field of ceramics is interesting and worth while for those who finally decide may be illustrated by Ohio State university's report to the effect that only eight percent of the graduates had left the field of ceramic engineering.

"Taking the field of ceramics as a whole, in all of its aspects, the prospects of a college-trained ceramic engineer as he enters the industry are excellent. In comparison with the chances of other types of engineers—mining, chemical, civil, mechanical, etc.—the ceramic engineer may expect as bright a future as any. Part of this is due to the health

(Continued on page 24)

"Energy and persistence conquer all things"—BENJAMIN FRANKLIN

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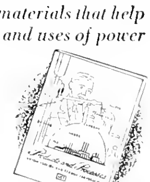

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CERAMIC ENGINEERING . . .

(Continued from page 22)

and general prosperity of the ceramic industry and part of it to the relatively small number of well-trained men entering the field of ceramic engineering. Although more students are enrolling in ceramic schools from year to year, there yet remains a considerable shortage of technical men in the industry. Even with greater numbers graduating each year, it will be years before the field is overcrowded. Many plants do not have a single technical graduate in their employ, yet the industry as a whole is becoming more technically-minded.

Said the moth as it sniffed at the camphor,
"I'm sorry I'm here where I am, for
Some things that I eat
Taste pleasant and sweet
But camphor I don't give a damphor."

* * *

She: "Perhaps you too have seen the golden fingers of the dawn spreading across the eastern sky, or red-stained sulphurous islets floating in the evening sky, or ragged clouds at midnight blotting out the shuddering moon?"

Elect. Eng.: "Nope, not lately. I've been on the wagon for over a year."

SOCIETIES . . .

(Continued from page 16)

A.I.Ch.E.

Some top-notch men in the chemical engineering field are speaking to the A.I.Ch.E. this semester. Scheduled for November 3, is Mr. Carpenter, an executive director of the Whiting laboratories, Standard Oil of Indiana. His talk will deal with personnel problems. From the U. S. Bureau of Mines Synthetic research department at Louisiana, Missouri, come two speakers on the synthesis of petroleum products. Dr. Sternberg and Loren C. Skinner, the chief engineer, will present this timely topic.

M.I.S.

"Conglomerate" might be a good word to describe the Mineral Industries Society, inasmuch as it is composed of metallurgical and mining engineers, and geology students. Professor Walker, Dr. Chedsey, and Dr. Hough, representing these respective fields, spoke to the society at a smoker September 23.

Professor Shedd gave the boys a pep talk on professional engineering at a meeting held October 13. Other speakers lined up for interesting talks this year are Dr. Vaskuil, of the State Geological Survey, speaking on "World Mineral Economics;" James R. McIntyre, training director of the Wisconsin Steel company, whose topic is "Problems of Graduate Engineers;" and George S. Mikan, superintendent of the rolling mills at Carnegie-Illinois. "The Fundamentals of Rolling Mill Practice" is Mr. Mikan's subject.

She (alighting from taxi): "John, the party isn't until nine. What time is it now?"

He: "Ten-thirty, dear."

She: "Oh—I was afraid we might be late."

* * *

Judge: "For your singing, I award you this ribbon."

Contestant: "Yeah, but what good is a ribbon?"

Judge: "Well, you could use it for a gag."

* * *

If you're fed up now with parties,
And the night life of the town,
Just marry a girl for love
If you want to settle down.

But if night life has you broke,
And you can't pay for your keep,
Just marry a girl for money
If you want to settle up.

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NAVY PIER . . .

(Continued from page 13)

and seriousness of education. It isn't something we can kick around or play with. Good education is an elevation few students reach. All of us should strive toward that goal. If you don't agree with us, we would like to know why you are studying engineering, and perhaps the answer will justify our opinion.

Bill—"Why did you break off your engagement with Jane?"

Jack—"She wanted to get married."

Golfer — "Notice any improvement since last year?"

Caddy — "Had your clubs shined up, haven't you, sir?"

* * *

First Cop: "Got away, did he, the dirty crook! Did you guard all the exits?"

Second Cop: "Yeah, but we think he escaped out of one of the entrances."

* * *

"Your advertisement said that at this hotel there is a beautiful view for miles and miles."

"So there is. Just put your head out of that window and look up."

E.E. 1—"Did I borrow five dollars from you last week?"

E.E. 2—"No, you didn't."

E.E. 1—"How careless of me! Could you let me have it now?"

* * *

Jim: Looks like a smart dog you got there.

Tim: Smart? All I gotta say is, "Are you coming or aren't you?" and he either comes or he doesn't.

* * *

Landlubber—"But how do you tell the starboard from the port?"

Sailor—"By the label on the bottle, you dope!"

HIGHWAY ENGINEERS . . .

(Continued from page 7)

because they weren't capable, but just because they didn't belong to some party or because politico Bill Smith couldn't run them. They wouldn't last long, because that kind of an unstable employment condition could not produce results. If we do not establish our public service on a level above petty politics, we can not hope to continue to attract the kind of engineers needed, similar to the ones who built the present system, and who are largely maintaining it today.

We, as an engineer group, whether in public work or on the industry side of the fence, are largely to blame for this condition and it is high time that we did something about it. The so-called American way of life is dependent very largely upon engineers and engineering, and it will only require the right kind of action to gain for engineers the recognition that their contribution to the welfare of society merits. When we complain about the fact that graduate engineers do not enter highway work, we should remember that it wasn't too many years ago that we were graduates and that it has been in our hands to protect our position and see to it that other groups did not usurp prerogatives that properly belong to us.

And just how is that to be done? Well, engineers are supposed to be able to analyze a set of conditions and prescribe the solutions to problems. In spite of the somewhat cynical mood prevailing today that the principal objective in life is to make money, I don't believe it. I believe that engineers work at their profession because they love it; because they can see facilities built and maintained where either none (or else inadequate ones) existed before. Just for the record I might say that I speak from experience. A few years after graduation I decided engineering progress was too slow and went into banking — did fairly well at it as a matter of fact, and was earning, or at least making, about $400 a month in the middle teens. But I didn't get any fun out of it and I returned to an engineering job at $175 a month and was never so happy over anything that I can remember.

I am sure that the situation is always the same with the man who really likes engineering and is fitted for it. What we need today is to take a leaf from the book of the merchant. After all, in an industrialized society, everyone is selling something no matter where he may work. Highway engineering is a high profession and it has a great deal to offer in the way of a satisfying life. Highway departments should have much better publicity on the subject. Instead of just a back page item, or none at all on what is being done, have it properly reported. This should not be glorification of the man but an interesting account of accomplishments, pointing out the magnitude of the work, any unusual features, the huge sums involved and what they mean in building a better society. There should not be too many statistics and in publicity work of this kind set forth the story in general terms easily understood by the layman. The public is fair minded once they understand the facts and will applaud rather than criticize when they know those facts.

Highway departments are big business and it takes big people to run them properly. Where do you find corporations doing business of twenty to eighty million dollars or more a year which expect to hire a president for $6,000 to $15,000 a year? I don't believe the public expects it either, once they understand it.

Every college and university should be canvassed systematically, not only at graduation time, but beginning in the junior year. In each state the highway department should arrange to have some of its men who are good speakers periodically attend the junior engineer society groups and put on a real sales talk. If we would just do half as much work

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HIGHWAY ENGINEERS . . .

(Continued from page 28)

in this regard as we do in trying to find new football material, I think we could make a showing rather quickly, and the coming years would find an ever increasing number who would be attracted to highway work.

In this regard, it is pertinent to note that where definite effort has been made to present up-to-date courses in highway engineering, the percentage of civil engineer graduates entering this field is above the average. Our own investigations indicate that most colleges will welcome any suggestions and help, either from the highway departments or industry, which will lead to a better course of instruction. The new subjects in highways at Oklahoma A. & M., for example, under Professor Martin, have been very well received. Recently, I attended the opening lecture at the University of California in Berkeley, which was the beginning of a special series on highway materials and design. These are three hour periods on Saturday mornings, and where sixty were expected to register, over two hundred presented themselves. This all indicates the degree of interest that may be expected if the courses are carefully planned.

And now in conclusion, I believe it is in order to offer a little encouragement, because really there is a great future for the undergraduate civil engineer of today. Only those of us who have been in highways for the past thirty years appreciate fully how many important jobs came into being after the end of the first World War. There was such a shortage of engineers that each highway department had to advance its men in order to keep another highway department from taking them away. I ran want ads in all the engineering magazines for over two years and paid the rate necessary to obtain good men. If they were good enough they were promoted, if they weren't they were fired. The result was that positions ranging from division engineer to chief engineer in state highway departments were filled with comparatively young men who, in many instances, have retained their positions until now. Within the next four or five years, these men will — in a large measure — be retired, and so, while opportunities for advancement have appeared to be rather restricted such will not be the case over the next decade. Of course, these higher positions should be first filled by present subordinates wherever possible but the turnover will mean an upward climb for a large number of the younger men, and provide new and better openings for the graduating engineer of tomorrow.

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HIGHWAY ENGINEERS . . .

(Continued from page 30)

Then in regard to salaries, while they lag behind in boom times, they do have a way of catching up, and when times come again which are not so good (and they, too, have a way of returning) the engineer in public work may find that he has chosen not only wisely for his own happiness in doing work he likes to do, but also well in respect to a reasonable income. There are great days ahead; the whole transportation system — highways — railroads — airways, needs coordination, integration, and improvement. It will take years to do it. I believe that now is certainly the time for the qualified boy to study civil engineering, and to major in highway engineering as one of its most important divisions.

Preacher (visiting home for first time): "And how high can you count, sonny?"

Little Oscar: "1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, Ace."

* * *

What do you charge for your rooms?

$15 up.

Yes, but I'm a student.

In that case, $15 down.

She was peeved and called him "Mr."
Not because he went and kr.'
But because just before,
As she opened the door,
This same Mr. kr. sr.

* * *

Jan. 2: Wanted—Teller, First National Bank.

Jan. 3: W. Smith has been appointed teller at the First National Bank.

Jan. 4: Wanted—W. Smith

* * *

"Hey, your shoes are mixed; you've got the right shoe on the left foot!"

"And here for twenty years I thought I was club-footed!"

* * *

And then there was the butcher that backed into the slicing machine and got a little behind in his work.

* * *

"You should be more careful to pull your shades down at night. Last night I saw you kissing your wife."

"Ha, ha, ha, the joke is on you, I wasn't home last night."

* * *

There was a stage star named Celestus:
When she danced the applause was tempestuous.
She whirled and she tripped
'Til her shoulder strap slipped—
And they had to ring down the asbestos.

INTRODUCING . . .

(Continued from page 14)

was tempted to transfer to this "college of opportunity." If any of you engineers find you are not suited for, or become dissatisfied with your present curriculum, Mr. Clark will give you information about the mining engineering curriculum.

Small boy: "Shine your shoes, Mister?

Grouch: "No!"

Small boy: "Shine your shoes so you can see your face in them?"

Grouch: "No."

Small boy: "Coward!"

* * *

He: "Do you like nuts?"
She: "Is this a proposal?"

* * *

"What a splendid fit," said the tailor as he carried the epileptic out of his shop.

* * *

She paints,
She smokes,
She drinks Pa's liquor,
She stays out late,
She cusses, too,
She does lots of things she ought not do,
But she's my grandma, and I love her.

MEN OF EXPECTATIONS . . .

(Continued from page 10)

(1) A study of the nature of the problem and its scope.

(2) An analysis of the problem into its component parts.

(3) Determination of the relationships between the component parts.

(4) Consideration of the various factors involved in each part, making use of all the available knowledge gained by experience, experiment, and research, and giving the necessary attention to the economic aspects. At this point the factors which have been adjudged to have a negligible effect are omitted.

(5) Synthesis of the component parts to give the solution to the original problem.

Thus the engineer bases his work on known laws and facts, and by logical reasoning along with a strict sense of honesty regarding facts, knowledge, and men, he proceeds in an orderly manner to the solution of his problem. It is the organized, well planned attack in conjunction with the engineer's mental integrity which is one of the outstanding characteristics of engineering.

Characteristics of an Engineer

Since engineering is a mental occupation in contrast to a manual or manipulative one, the personal characteristics which make for success as an engineer are largely mental. Some of the questions a student should ask himself are:

(1) Do I like mathematics and do the reasons given in a mathematical proof seem convincing?

(2) Do I have a curiosity about and an interest in natural phenomena?

(3) Do I want to know *why* things happen the way they do?

(4) Do I have imagination—that is, can I set up mental pictures of things I haven't seen from a description of them?

(5) Do I accept the first meaning of a sentence or paragraph that occurs to me, or do I read it over to see if it might have another meaning?

(6) Am I ingenious in devising ways of making a piece of equipment work, or of finding a method of solving a problem?

(7) Do I like puzzles, such as mechanical puzzles, crossword puzzles, jig-saw puzzles, and mathematical puzzles?

If the student can answer most of these questions with a "yes", he has the native ability to be a successful engineer. As will be pointed out later under the classification of jobs on a functional basis, the kind of work an engineer does varies from research to sales and operation. The different kinds of engineering work require different degrees of emphasis on the mental qualities suggested above, and therefore it is not necessary that a student be able to give an unqualified "yes" to every question. For example, for research, development, and design work, affirmative answers to questions (1), (2), and (3) are important; for production, test, application, construction, and operation work, (4), (6), and (7) are important.

Other personal characteristics which help to make a successful engineer are industry, honesty with facts and with men, ability to co-operate and work with others, initiative, reliability, willingness to take on responsibility, and realization of citizenship responsibilities.

(Concluded next month)

"I went out with a fellow last night that I'd never seen before."

"Not a perfect stranger, I hope."

"No, just a stranger."

* * *

"We'll have to rehearse that," said the undertaker as the coffin fell out of the car.

* * *

Down our way, they tell of a man who was so hard that he could ride a porcupine through a bed of cactus and never get a scratch.

IF HE COLLECTED SAMPLES

as he made his rounds

A sample from every industry served by Square D Field Engineers would make quite a load, indeed. For these men serve as liaison between Square D and every segment of industrial America. Their full-time job is working with industries of every kind and size—helping find that "**better way to do it.**"

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Norton Chairman of the Board George N. Jeppson pays tribute to the work of development engineers Wallace L. Howe (left) and Edward Van der Pyl (right) for their work in solving countless problems in building and equipping the world's largest grinding wheel plant

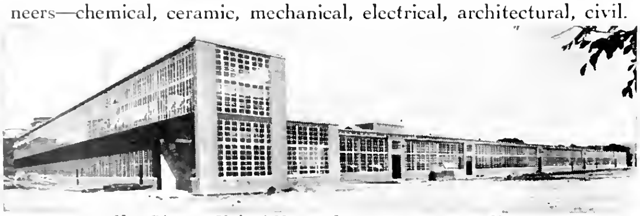
New Era in Grinding Wheel Manufacture

A revolutionary new process in the manufacture of grinding wheels is being carried out in the recently dedicated Norton Plant 7, the largest of the eighty-six buildings that stretch for a distance of one and one-half miles in the Greendale section of Worcester.

In this new Norton plant, with floor space of approximately five acres, grinding wheels are being made at a speed and with a uniformity never before known in the abrasive world.

Abrasive grain and bond, brought in one end of this six hundred and two foot building by a modern conveyor system, moves down the line for various processes, through continuous electric kilns, to finally emerge at the shipping end ready for service in the industrial world.

The new process envisioned through the more than half century experience of George N. Jeppson and the mammoth new building to house it have become realities by the co-operation of Norton engineers—chemical, ceramic, mechanical, electrical, architectural, civil.



New Plant 7, Unit of Norton Company, Worcester, Mass.

GALESBURG . . .

(Continued from page 12)

possible weak points in design or construction. High speed movie cameras record the movement of the gun ports and can photograph the projectile in high velocity flight. Rate of fire of these weapons in rounds per minute can be determined with special instrumentation at any altitude from ground level to 50,000 feet.

Effect of extremely low temperatures on metals, fuels, lubricants, and automotive parts can be determined in a section of this facility which is capable of producing a temperature of 110 degrees below zero!

Tests of ordnance material, to determine its functioning and improve its accuracy and reliability, can now be accomplished in fractions of the time and expense, and with much higher degree of precision than formerly possible. So urgent has been the need for a high altitude firing range that the facility was placed in service prior to the dedication.

The boss (looking over drafting room): "That new fellow from Illinois seems to be tending to business. He isn't shooting off his face like most of the other draftsmen. I like a close-mouthed man."

Chief Draftsman: "Oh, he isn't close-mouthed, boss, he's just waiting for Pete to bring back the spitoon."

* * *

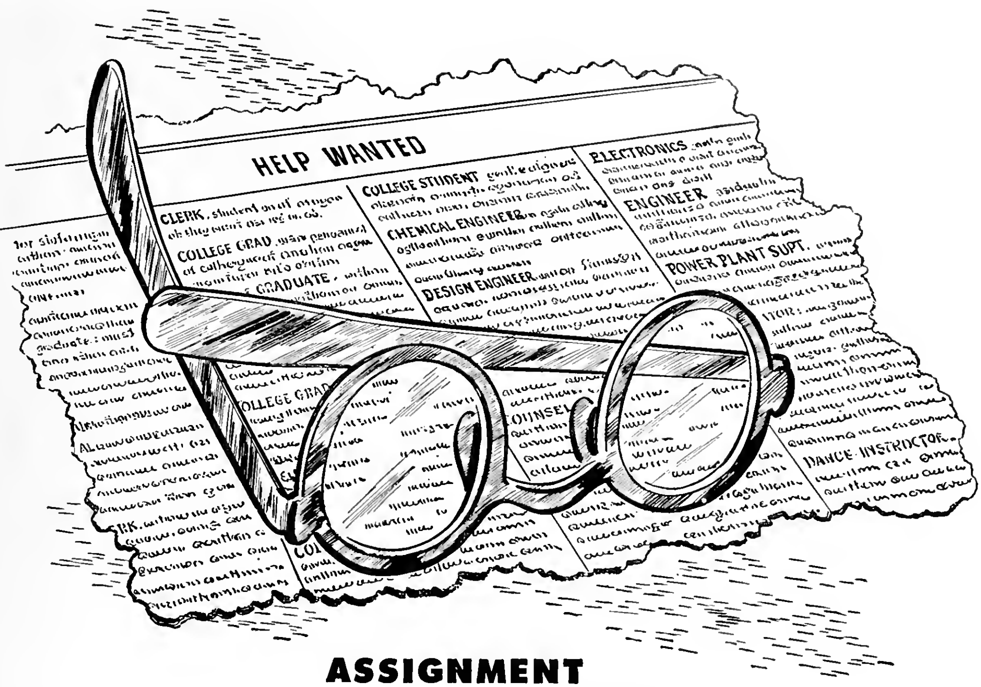
"D'you ever shee me before?"

"No."

"Then how do you know ish me?"

* * *

THANKS VERY MUCH, BUT I THINK I CAN MANAGE!



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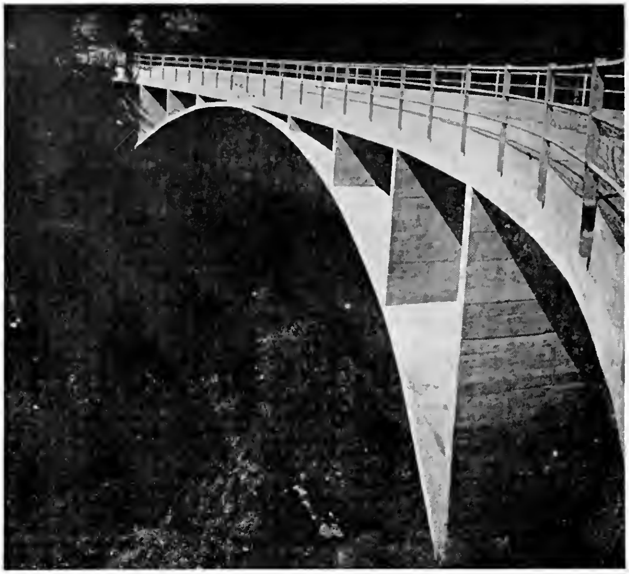
MAILLART . . .

(Continued from page 9)

was a stadium seating 18,000 with its curved vertical frame supported on two parallel rows of columns and a beautifully cantilevered canopy spread over the top columns like a fine membrane which consisted of reinforced concrete slabs tapering at the end to 1½ inch thickness. As the Architectural Record of July, 1948 worded it, "The South American architects declare that the North American tendency to find structures 'impractical' or 'not quite safe' arises in reality from an Anglo-Saxon timidity in the face of bold plastic invention."

Will Robert Maillart's "futuristic" structural design be the forerunner of a new era in engineering? It is highly probable that it may. One factor that may hasten this revolution is precast concrete slabbing, a type of hard, wearable reinforced concrete that is poured and set in the factory in forms that fit the specifications and then is shipped to the site of constructoin and, in some cases, is then actually nailed or cemented into place. So far this type of precast slabbing has been used only for ceiling, flooring, and blocking in stadium design.



Maillart resolved bridge building into a system of flat and curved slabs. Here is his Schwandbach bridge in the Canton of Berne, Switzerland, erected in 1933, another view of which is shown on the cover. (Photo from Giedion's "Space, Time, and Architecture.")

The day may soon come when the engineering world will see a whole bridge poured in the factory and then transported and set up at its location much on the order of prefabricated house construction of today.

DU PONT *Digest*
For Students of Science and Engineering

They said, "You can't do it!"

But Du Pont scientists developed a synthetic rubber with superior properties

"Synthetic rubber is an impossibility at any price!" declared a noted European scientist a number of years ago. And most people were inclined to agree because for more than a century chemists had been unable to duplicate natural rubber.

Du Pont scientists knew that all rubber had bad qualities as well as good. "Why struggle to duplicate its faults?" they asked. "Why not find a new chemical compound with all the good qualities of rubber, but none of the bad?"

They took as their starting point a discovery by Dr. J. A. Nieuwland of Notre Dame in connection with the polymerization of acetylene. By modifying this process, they made monovinyl acetylene. Adding hydrogen chloride, they made a new chemical compound called chloroprene—a thin, clear liquid at low temperatures. Like isoprene, it polymerized to form a rubber-like substance. But the new material, now known as *neoprene*, required no sulfur for vulcanization and was superior to rubber under many service conditions.

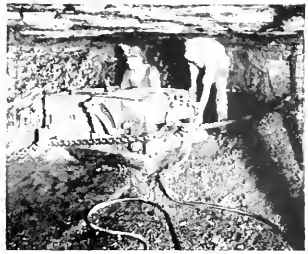
Today neoprene production is measured in millions of pounds a year, even though it is priced higher than natural rubber. Hardly an industry is not now using it, for such good reasons as these: neoprene products resist deterioration by oils and greases. They stand up under exposure to direct sunlight. Their aging and flame-retarding properties also are superior to those of rubber.

Three types of Du Pont research

Modern research involves time, money, manpower. To develop neoprene, for example, took six years of laboratory study, a research and development expenditure of millions of dollars, plus the work of skilled research chemists, physicists, engineers, and other scientists.

At Du Pont, research is continuous. Some of it is designed to develop new products or processes; some to improve existing products or processes; and the balance is fundamental research to uncover basic facts without regard to immediate commercial use. Each of ten manufacturing departments has its own research staff and is operated much like a separate company. In addition, the Chemical and Engineering Departments, which are not engaged in manufacturing operations, conduct research in the interests of the Company as a whole.

A typical Du Pont research team may include physicists, chemists, chemical and mechanical engineers, each of whom brings specialized training to bear on a specific phase of the subject. The man who joins one of these teams finds himself associated with some of the ablest minds in the profession and receives the opportunity and friendly support needed to make fullest use of his capabilities.



Neoprene, *used in wire, cable and hose jackets, resists abrasion, oil, heat, and sunlight.*

Neoprene gloves *and protective clothing resist deterioration by chemicals, greases and oils.*

Milling and compounding *neoprene in the rubber experimental laboratory.*

The new research man *has frequent contact with experienced supervisors. Here M. Hayek, Ph. D., Indiana '47, discusses data obtained in an experiment with F. B. Downing, left, a member of research supervision, and M. B. Sturgis, a research group head.*

What you want to know about Du Pont and the College Graduate

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Of the Illinois Technograph published eight times a year (Oct., Nov., Dec., Jan., Feb., Mar., Apr., and May) at Urbana, Illinois for October 1, 1948.

State of Illinois }
County of Champaign } ss.

Before me, a notary public in and for the State and County aforesaid, personally appeared Stanley Diamond, who, having been duly sworn according to law, deposes and says that he is the business manager of the Illinois Technograph, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management and the circulation, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Illini Publishing Company, 725 South Wright Street, Champaign, Illinois:

Editor, Edwin A. Witort, Urbana, Illinois.

Business Manager, Stanley Diamond, Urbana, Illinois.

2. That the owner is the Illini Publishing Company, a non-profit corporation, whose president is C. A. Moyer of Urbana, Illinois, and whose secretary is Manning D. Seil of Champaign, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are none.

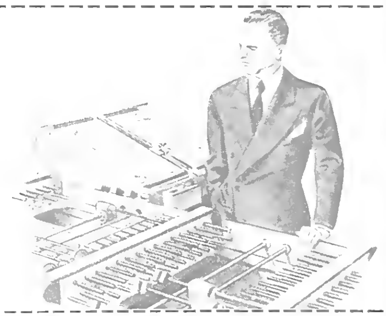
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

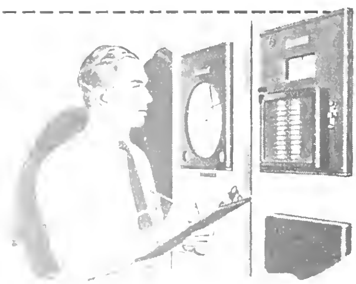
STANLEY DIAMOND, Business Manager.

Sworn to and subscribed before me this 28th day of September, 1948.

(SEAL)

MARGARET E. CAIN, Notary Public.





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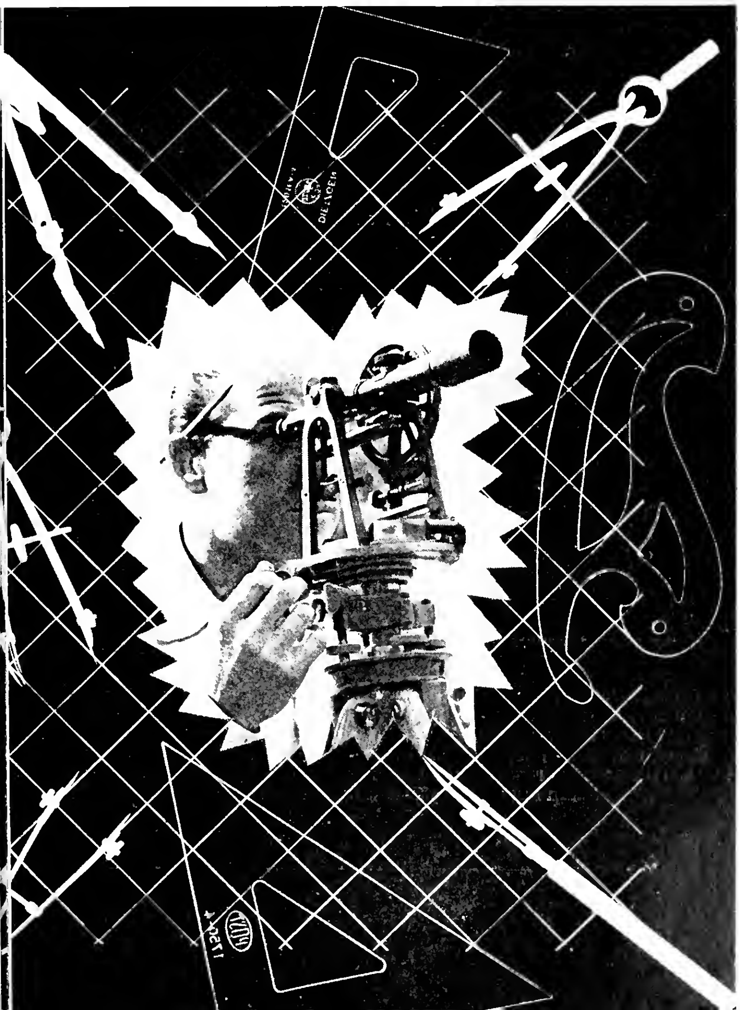


★

TWENTY-FIVE CENTS

New Developments

By Leonard Ladof, E.E. '49
Ken McOwan, M.E. '49
Bill Shurtleff, E.E. '50
C. M. McClymonds, M.E. '49

The main purpose of the New Developments page is to keep our readers informed of the latest advances in the engineering field. If any of the short items arouse your curiosity, drop us a card and let it be known. If more material is at hand on the subject, or is obtainable from the manufacturers, we will try to work it into a full length article for your pleasure.

Army Supersonic Wind Tunnel

The Army ordnance has perfected and built a supersonic wind tunnel laboratory at Aberdeen proving grounds, Maryland, which promises to propel related research into a speed which would seem supersonic in comparison to that carried on in previous years. The great advantage of the Aberdeen tunnel, as will be explained later, is the facility to vary air stream velocity with little or no effort.

First, let us consider the better known airplane-type subsonic wind tunnel. Here one merely causes air to go through a test section at high velocity by forcing the air through with propellers and narrowing the channel of the test section. The air circuit may be continuous, or the tunnel may exhaust into the atmosphere. Supersonic flow, however, is an entirely different problem. With sufficient power, velocity can be increased in a wind tunnel up to sonic velocity by narrowing the channel, just as one increases the exit velocity of a fire hose by a convergent nozzle. However, no amount of pressure or convergence will cause velocity to exceed that of sound, even at the narrowest part of the system. Velocity, to exceed that of sound, is achieved at the expense of decreased density by using a diverging, or flared, nozzel. Thus, we narrow the channel to get sonic velocity and then widen it, in a very special and very peculiar way, to obtain a velocity in excess of that of sound.

For each supersonic speed, a specific and unique shape of flared section is required. Thus, one must have a separate throat for 2.5 times the velocity of sound, for 2.6, and for each speed desired beyond that of sound. Heretofore, one has not only had to have a most carefully-constructed throat section for each desired speed, but the changing of a throat sometimes required several days.

As a consequence of these conditions, supersonic wind tunnels have been limited in practice not only to a very few mach numbers (a mach number is speed in term of the velocity of sound, at sea level, as a unit), but still more limited as to the frequency with which they change mach numbers. A flexible throat, in which one can achieve a mach number at will, has been the dream of the aerodynamic world for many years. This high-speed flexible-throat supersonic wind tunnel removes from the experimental aerodynamicist the shackles which have, until now, both slowed his progress and limited the latitude of his experiments.

New Uses for Wood Products

There have been some rather startling developments in the field of wood product. This is especially true in the case of waste materials. A method has been devised to form the sawdust and mill shavings into the shape of small logs. They are then compressed at 50,000 pounds per square inch. These artificial logs find use as fireplace fuel.

Another new development that has added to the usefulness of wood products has been the introduction of dielectric heat to various glued joints. This type of wood welding makes it possible to fabricate strong joints without the aid of metal fasteners.

A Party-Proof Cabinet

The plastics industry has perfected a material that is almost indestructible. The stuff, a composite plastic with a striking resemblance to mahogany, simply won't mar. It can't be scratched, dented, chipped, cracked, burned or broken.

Cabinets made of the material have been subjected to such severe tests as being slammed by bottles and heavy ash trays. Cigarettes and cigars have been left to burn out on the surface, nail polish remover, alcohol, grease, hot salt water, and citrus acids have been poured on it, 110 pounds of live weight have skipped rope on its top. No deal—it has emerged unscathed in each instance.

The plastic is easily fabricated, and is being used in the manufacture of timing gears, refrigerator liners, and fan blades.

New Airforce Planes

The United States Air Force has officially revealed two new fighters and a sonic research plane.

They are the following:

McDonnell's XF-88, a sweptwing, supersonic fighter. This plane is powered by a pair of Westinghouse 24C jet engines slung internally in the fuselage belly under the wing. Top speed is better than 720 m.p.h. Other specifications are wingspan of 40 feet and the fuselage is 55 feet long. The wings and tail surfaces are swept back at an angle of 35 degrees.

Northrop's XF-89, a heavy, straight wing, twin jet night fighter. Power is supplied by two General Electric-Allison J-35 jet engines. Top speed is said to be well over 550 m.p.h. The wingspan and fuselage are both approximately 50 feet. This plane carries a pilot and a radar operator who sit tandem in a pressurized cockpit.

Northrop's X-4, a sweptwing, twin jet, research plane. This ship is designed to explore stability and control problems at high sub-sonic speeds. It is powered by two Westinghouse 19XB jet engines. It uses the elevons developed by Northrop on its flying wing type aircraft for aileron and elevator control. The X-4 has no horizontal tail surfaces, but it does have a large vertical fin. The fuselage is 20 feet long, and it has a wing span of 25 feet.

The Perfect Soldier

A portable "electric weatherman" which automatically and continuously records data in remote, unmanned weather stations has been developed for the U. S. Army Signal corps.

The device, built by the General Electric company, is slightly larger than an infantryman's pack. Time, wind, speed and wind direction are marked continuously on a moving roll of paper long enough to make an 800-hour record. Hence the unit requires attention only once a month.

The "weatherman" uses no ink in its records. Moving arms, connected electrically to a conventional anemometer and to a weather vane, mark specially sensitized paper by sending sparks through it. The instrument can register wind velocities up to 150 miles per hour and can read directions correctly to within 1½ degrees.

TO EACH AND EVERY

STUDENT ENGINEER AND ALL

THE FACULTY

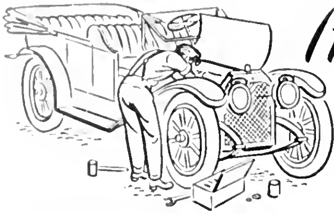
A Merry Christmas

and a

Joyous New Year

from

the entire staff of ye ol' Technograph



It's springtime 256 times a second

Your doctor counts your pulse beat. The musician calls it rhythm. The sportsman knows it as timing. The engineer, who designed your automobile, refers to it as cycles.

The valves that admit and exhaust the gas to and from your engine are timed to form a cycle.

Spiral springs made of high-carbon round wire play a vital part in maintaining this cycle—in keeping your automobile engine running smoothly—at the torturing rate of 256 spring-actions a second.

Taken for granted today, they were a major headache to the driver of yester-year. Today's springs are as superior to the springs of thirty years ago as are the cars themselves.

Improvements came with demand and competition. No other country advanced as rapidly . . . or as far.

Just as the discovery of America was made possible by enterprise capital, so the automobile was the product of free enterprise—including the cash that buys it.

It's Springtime 256 times a second under your hood and Roebling is proud of its contributions to that engineering feat.

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the Illinois Technograph

Volume 64 **Number 3**

The Tech Presents

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ARTICLES

FEATURES

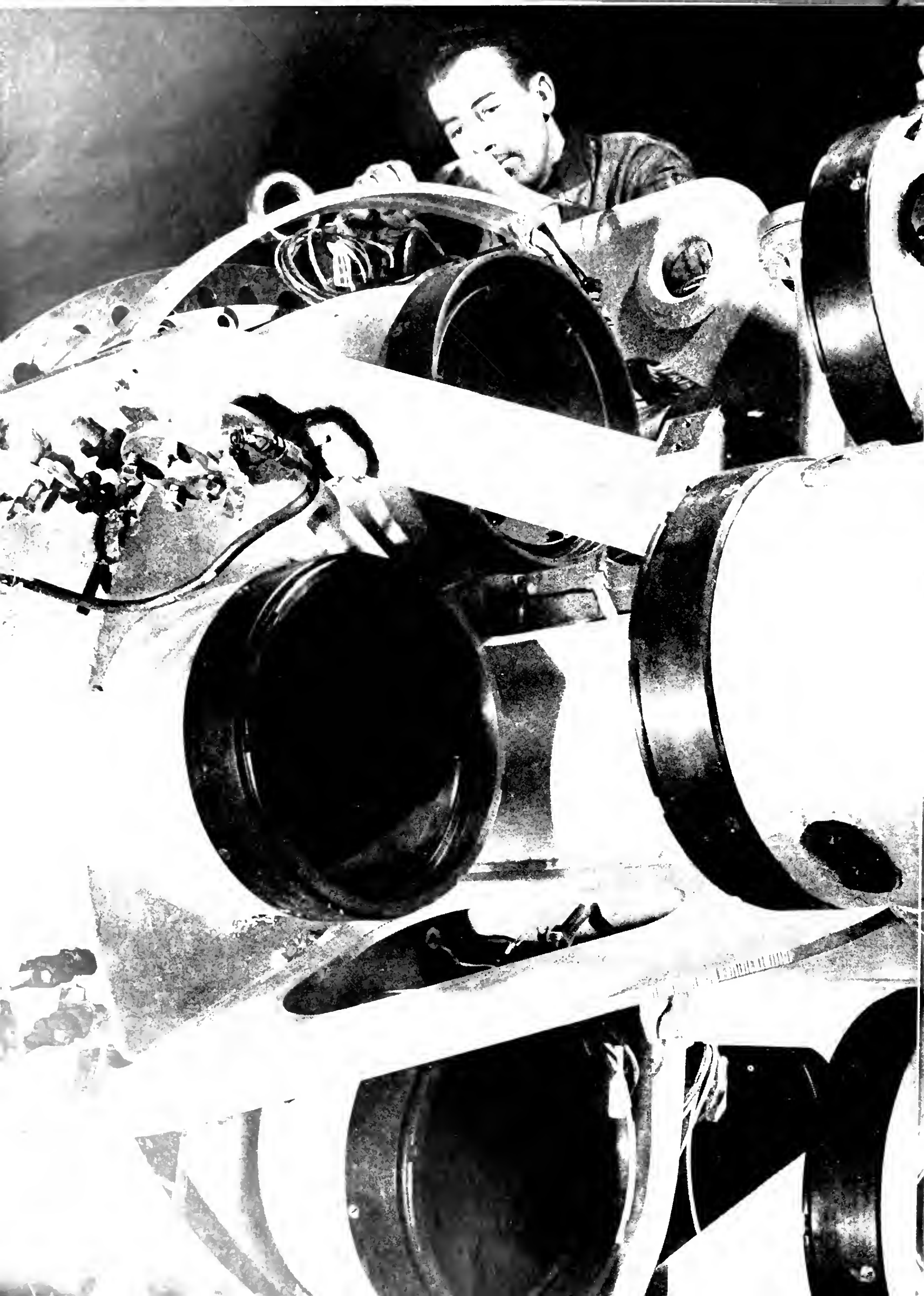
DEPARTMENTS

OUR COVER

This neat bit of "darkroom deception," rigged up by one of our versatile staff members, C. M. McCymonds, shows Jack D. Easley, C.E. '50, up bright and early one Saturday morning looking at some of the more interesting scenes of South Campus.

FRONTISPIECE

Three of the six combustion chambers in a developmental locomotive gas turbine will connect the black-edged aperatures. A technician is shown making adjustments as the 4,800-horsepower engine is reassembled after having been dismantled for inspection. (Photo courtesy of General Electric.)



What's in a Name?

By JOHN A. HENRY, Associate Professor of Mechanical Engineering

Did you ever notice that one item all "applications for employment' have in common is References: ____________? Apparently this is no small detail in the minds of the men who make the selections of future employes.

This article, prepared by a professor in the mechanical engineering department and also adviser to the Technograph, gives an insight into how you can proceed to obtain a letter of reference.

About the end of every semester, and especially in the spring, come many requests from seniors for letters of recommendation by members of the faculty. This is one of the little outside jobs that Professor Z has to do, and, in general, he faces it with mixed feelings. There are times when he is delighted to have an opportunity to do something that will give a first class man a well-deserved boost. In fact, that is one of the joys of the job. There are, alas, some times when he wishes the person in question didn't have such a naive impression of his instructor's gullibility. When puzzled as to the reason for his selection, Professor Z looks up the student's grade record to see if, by chance, he gave him an A, and (as is sometimes the case), the only A in the files.

Before discussing this matter at any length, let's see what a letter of recommendation really means. A person who teaches in a college or university is generally regarded by the outside world as a person of integrity, regardless of other less flattering attributes that are alleged to make up the character of the "typical college Prof." In effect, when Professor Z writes a letter of recommendation for student A, he is putting his own reputation in jeopardy for a person of whom the recipient knows little. The teacher has everything to lose and nothing to gain. Being a kind sort of soul at heart, the average teacher will stretch a point or two to accommodate a student whom he does not believe to be a washout. Of course, there are times when Professor Z should, and does, turn down such a request on the grounds that he does not know enough about the party. Again, being a kindly old gentleman, he may use that excuse when in reality he knows too much.

Is this a square deal for either of the parties concerned? It may not be in many cases. When whole-hearted understanding does not exist, the teacher is left with a bad taste in his mouth, the student gets an indifferent recommendation, and the prospective employer faces the alternative of taking the letter at face value or reading between the lines.

Should the student refrain from asking for recommendations from his teachers? By no means. If a student has confidence that Professor Z can, and will, vouch for him, he should ask him, and in general, he should ask permission before suggesting him as a reference. But let us be honest about these letters. It is not too much of a triumph to secure one. Someone is usually willing to make a half-hearted attempt. The situation is grave indeed if no one is willing to vouch for a person.

The prospective employer is not interested in finding out the grade point average of a student, or his general scholastic ability. That he can secure from the college office. The boss wants to know about personality traits. Is the student honest? Can he make friends and keep them? What kind of associates does he keep? Is he willing to assume responsibility? Can he lead? Can he follow? Unfortunately, most of these traits do not come to the surface in the classroom, or even in the laboratory. Professor Z doesn't know how to answer these questions for nine men out of ten who pass before him, but luckily for him, seven of the nine realize that and do not embarrass themselves or poor old Z.

How can some of these nine men build themselves up to the point where they rate the favorable notice of their professors? The answer is simple. *Take part in a worthwhile campus activity*, preferably one in which the same teacher can guage both intellectual and social performance. The part must be taken whole-heartedly, and an important contribution to the organization must be made; mere membership is of little value. Is this apple-polishing? It certainly is not. Growth in character and social grace is an important part of educational life. Personnel men tell us that for each engineer discharged for technical incompetence, nine are released beause of personality traits.

Let us dive into the files of our hypothetical Professor Z and come up with some of his hypothetical letters.

"Mr. B. Z. Bee was in one of my classes in earthworm navigation. He was a better-than-average student, but not outstanding in this subject. However, as faculty adviser to the student chapter of the Society of Tonsorial Engineers, I had an excellent chance to observe his actions as chairman of the membership committee. He did an excellent job, not only by his individual efforts, but also due to his leadership in getting others to share his enthusiasm and duties. He looks like an excellent employment risk."

"Mr. Eager Beaver was not in any of my classes, but his excellent scholastic rating speaks for itself. He was selected to serve as a laboratory instructor in his senior year during the past emergency, and was under my jurisdiction. I can state that he was conscientious, dependable, and well-received by the students. He looked up most of the technical information by himself, but when in doubt, he did not hesitate to come for advice and knew what he wanted. I would hire him myself for any job requiring intelligence, drive, and tact."

"I have your letter of February 6 inquiring about Mr. Fair. He was in one of my classes and did work that was a little better than average, but I can tell you little about his personality or habits, as requested. From superficial observation, I imagine that he would do well on some types of work, probably if carefully supervised at first."

Notice that the payoff comes in the last sentence in each case. What would you, as an employer, think of them? Finally, let Professor Z write two more hypothetical letters, both of which would give him much joy—if he then tossed them in the wastebasket.

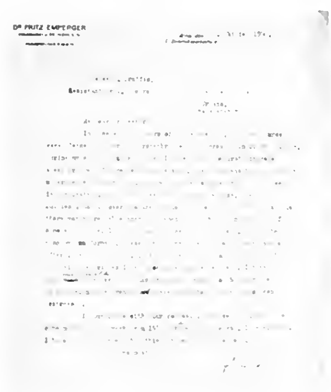
"I have your's of February 7 requesting information about I. M. Good. He did not ask my permission to use my name, but there are one or two things I'd like to say about that young man. He is probably one of the smartest men I have ever had in class, but he knows it. He likes to come in after an examination and have his 99 raised to 100, despite excess of leniency already granted. He belonged to the student branch of the Terpsichorean Engineers, but I am told that he repeatedly refused to take any part in the "infantile antics of his fellows!" He has no known friends.

(Continued on page 28)

Engineering Hall of Fame

by George Heck, C.E. '52

Throughout this great campus of ours there are to be found many interesting scientific, historical, and literary exhibits on display. These exhibits reflect directly upon the colleges which they represent and they add quite a bit of fame and prestige to those colleges. The College of Engineering is no exception to this rule, and it claims possession of a complete collection of portraits which compose our own "Engineering Hall of Fame."


Dr FRITZ EMPERGER

Emperger, an early builder in reinforced concrete who advocated the use of hooped columns with cast iron cores, sent the above letter to Professor Draffin.

Within the doors of the Arthur N. Talbot testing laboratory, and adorning the walls and hallways therein, can be found an assembly of portraits of engineering heroes whose names shall live forever in the annals of engineering history. When one walks down these halls he cannot help but feel humble in the midst of these great men. This collection, of which there is no duplicate in any other college or engineering institution in the United States, is the product of countless hours of research, correspondence, and personal effort by Jasper O. Draffin, professor of theoretical and applied mechanics.

Mr. Draffin gained his degree at the University of Illinois; after teaching three years at the University of Ohio, he came back to teach here at the University of Illinois. He began this assembly of pictures sometime during the year 1929 and has continued through to the present day. During the war years his collection was halted because he acquired many pictures from great European engineers. Now, with the presence of peace, Mr. Draffin is again starting to add to his library of portraits the pictures of the many new scientific greats who have emerged out of wartime research and discovery. The majority of the pictures, of which there are over three hundred, were gathered by Mr. Draffin during the ten-year period following 1929. He obtained these photographs, etchings, sketches, and paintings from rare engineering and history books, magazines, the men themselves, and from their families. He has corresponded with men from all over the world, including America, England, Europe and Asia, and has gathered many interesting replies from these engineering geniuses. Although most of the men were humble in their ways, they were always anxious to supply their pictures, proving the fact that you can be a genius and still remain human.

The fields of engineering in which these men were most active are mechanics, metallurgy, hydraulics, strength of materials, engineering mathematics, and testing of materials. The selection of the men who were to have their pictures hanging from the walls of Talbot laboratory was made by Mr. Draffin, who chose only the best known and most outstanding men in the above mentioned fields.

PROF. JASPER O. DRAFFIN

We congratulate Mr. Draffin for his contribution to the University of Illinois by his assembling this valuable collection of which any engineering student can be justly proud. We can only look with awe at the achievements represented by the pictures of these men and proceed to endeavor to accomplish the completion of our tasks that will face us in the engineering world as well as they accomplished theirs.

General Electric Employment

A record number of more than 1400 graduates of 150 colleges and universities have been hired by the General Electric company this year, surpassing by almost 600 the previous high mark of last year.

Expansion of the company, coupled with the effects of the war-time shortage of graduates, led to selection of this record number.

Of this group, 1046 are electrical, mechanical, and industrial engineers. Fifty chemistry and fifteen physics graduates also have been selected.

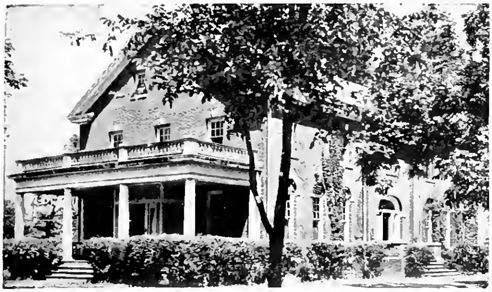
The new college-trained employees will enter General Electric's $1,000,000 education program, which includes not only technical, scientific, and business courses, but also apprentice training for high school graduates.

The largest number of the graduates are engineers who will enter the test course, which more than 20,000 have completed during past years. At the present time, 1,339 student engineers are enrolled in the test course, to form the largest single group in company history.

During their twelve to fifteen months of training, the student engineers work a full shift testing electric apparatus and then take advanced classroom courses in the evening.

Others will be assigned to the rotating engineering or physics programs conducted by the G. E. general engineering and consulting laboratory, or the program for chemists and metallurgists conducted by the G. E. chemical department.

Several hundred women college graduates are employed each year, the majority of whom have backgrounds in mathematics, physics, and chemistry. A small number of women are trained as student engineers.

The Triangle chapter house on the University of Illinois campus is seen on the left, while on the right is the Sigma Phi Delta house.

Professional Fraternities for Engineers

By Arthur Dreshfield, Ch.E. '51
and Robert Beals, Assistant in Ceramic Engineering

The social fraternities exclusively for engineering students are described in this set of articles. The organizations have for their objective the aiding of the student to become a good engineer and a good citizen. To do this, they offer a social program which tends to produce a well-rounded individual but still emphasizes the importance of scholarship. Members are encouraged to participate in extra-curricular activities in which they have a true interest.

TRIANGLE

There is one feature which makes Triangle fraternity different from most of the other 55 fraternities on the campus. All of its actives, and all of its many honorary members, are in some phase of engineering field, or are students of engineering or architecture.

Thus, a member of Triangle has an immediate common bond with every other member, over and above the fact that they are fraternity brothers. Such a mutual interest has many benefits, for it serves to stimulate an added interest in engineering among the members.

Founded on this campus 46 years ago by 16 students, Triangle originated as a fraternity exclusively for civil engineering students. Incorporation papers were granted in April, 1907, giving the fraternity its official beginning. April 15 is designated as Founders' day.

Interest in the organization spread rapidly to many engineering schools and universities with engineering colleges. In 1909 the Purdue chapter was installed, followed soon by chapters at Ohio State, Wisconsin, and Kentucky by 1920.

Up to that date, Triangle had been limited to civil engineers only. It was felt, however, that the fraternity would be improved and that the members would receive greater benefits if this limitation were relaxed somewhat. With this in view, the various chapters consented to a revision of the chapter, which allowed the initiation of persons in any engineering curriculum.

This step catalyzed the growth of the fraternity, with the result that it has grown steadily and rapidly. It now has a chapter at every Big Nine school except Indiana, as well as chapters at Cincinnati, University of Kansas, Missouri School of Mines, Penn State, South Dakota School of Mines, Marquette, Louisville, and Cornell. Thus, it now has 18 chapters scattered throughout 13 states. Its growth, like that of most fraternities, was halted by the war, but there seems to be no reason why it should not now continue to expand.

Scholarship is of prime importance to members of Triangle. Initiates are required to have a 3.4 average, which is above the University minimum requirement. In addition, the national organization maintains a scholarship cup and awards it annually to the chapter with the highest scholastic average. This award is eagerly sought, and it en-

(Continued on page 30)

SIGMA PHI DELTA

"The promotion and advancement of the engineering profession and engineering education; the instilling of a great spirit of cooperation among engineering students and their organizations; the inculcation in its members of the highest ideals of Christian manhood, good citizenship, obedience to law, and brotherhood; and the encouragement of excellence in scholarship" are the objectives of Sigma Phi Delta fraternity. The motto: "Pro Bono Professionis," which translated from the Latin means, "For the Good of the Profession," further bears out the objectives of this international social fraternity of engineers.

Alpha chapter of Sigma Phi Delta fraternity was founded at the University of Southern California on April 11, 1924, making Sigma Phi Delta one of the youngest of the national fraternities. Delta chapter of Sigma Phi Delta was established at the University of Illinois January 25, 1928. There are seven chapters in existence today. They are located at the University of Southern California, University of Illinois, North Dakota State college, Marquette college, and Tri-State college. Prior to World War II, active chapters were also located at the University of South Dakota, University of Texas, and Tulane University.

The Greek letters sigma, phi, and delta, stand for science, friendship, and duty. The colors of Sigma Phi Delta

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Solid Phase Welding

By Carl Sonnenschein, Assistant in Mechanical Engineering

No longer is welding merely the tool of the repairman. Having taken its place as a production tool, the techniques and methods of welding have increased in numbers and complexities. This article introduces a new and different concept of welding as an important manufacturing process. Considered also, are the technical and metallurgical bases of solid-phase fabrication.

The objectives of this article shall be three in number. Organizationally, the article will first present an introduction to the ideas and theories of solid phase welding; secondly, the problems in ferrous metallurgy, inherent in solid phase welding will be considered; and lastly, some brief consideration will be given to the industrial problems which may influence the general use of solid phase welding as a production tool.

As the name implies, solid phase welding is concerned with the "fusing" of two pieces of metal while they are still in the solid state. Of the more widely known types of welding, there are oxy-acetylene, flash, arc, atomic-hydrogen, and several others, all of which cause the metals to become molten prior to the fusing process. There are also methods, such as brazing, in which only the bonding metal actually becomes molten. All of these above mentioned welding methods may be broadly classified as falling within the group known as liquid phase welding methods.

In liquid phase welding, the diffusion of the one metal into the other, is a function of the fluidity and missibility of the two molten constituents. Due to the above stated functional qualifications, the weldment may possess greater or lesser degrees of homogeneity across the weld.

Whenever metals are made molten by the addition of high temperatures, there is always a great danger of entrapment of gas bubbles or possible oxidation of the metal in the immediate zone of the weld. Both of these conditions are undesirable and tend to produce weak and brittle welds.

The subsequent solidification of the weld metal, in liquid phase welding, will be accompanied by recrystallization and in many cases unequal grain growth depending upon the physical dimensions of the weld. The conditions, as stated, may be responsible for high intercrystalline stresses as well as other undesirable physical characteristics. It is for the purpose of achieving homogeneity of structure and physical properties that most liquid phase welds must be subsequently heat treated when close tolerances and specifications must be met.

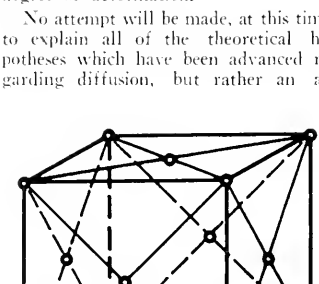
These characteristics of liquid phase welds have been discussed so that they may serve as a background for the following discussion of the solid phase welding technique and the results achieved with it.

"Solid-phase welding is the process by which particles or members are bonded by atomic forces without the presence of a liquid phase at any stage of the process."[1]

In this age of atomic-power, it seems most fashionable to consider everything and anything in the light of the atom, but in this case it is an absolute necessity. In order that the process of diffusion may be better understood, the lattice structure of gamma iron will be considered.

Gamma iron possesses a face centered cubic lattice which has "closely packed atoms in 12 directions and since slip or shear occurs along these planes,"[2] it is capable of a great degree of deformation. The degree of plasticity which a metal will show, is directly a function of its degree of deformation.

No attempt will be made, at this time, to explain all of the theoretical hypotheses which have been advanced regarding diffusion, but rather an attempt will be made to qualitatively define diffusion as it is normally intended when the subjects of welds are at hand. Normal, complete diffusion in a weld, shall be understood to mean that when the weld is subsequently examined, under the most powerful available device, no evidences shall be found of discontinuity or non-homogeneity of the crystalline mass.



FACE CENTERED CUBIC LATTICE

With the above stated criteria as an objective, the full case for solid-phase welding as applied to the ferrous metals can be considered.

As has been stated, the gamma iron possesses a face centered cubic lattice which has properties of high plasticity. However, inspection of the iron-iron carbide diagram will reveal that the metal must pass through at least one allotropic change before the gamma phase is achieved. Without going into the matter too deeply, it has now become obvious that in order to achieve the greatest potential diffusion, the temperature of the particular metal must be in excess of the Ac_3 temperature for that particular composition. This then will fix the lower limit of temperature range to be used.

Having already decided that this process shall at no time involve any liquid phase, the top temperature limit is automatically fixed by the solidus line or freezing temperature of the metal.

Briefly consider the constituents of the metal in the above stated range. The material is composed of a solid solution of iron carbide in gamma iron. This composition is known as austenite and is the most important composition for the heat treatment of steels that exists. In this range, recrystallization takes place automatically when the metal is held for the proper period of time at temperature.

It is commonly recognized that some degree of interface diffusion will take place between any two metals if they are maintained in contact and at an elevated temperature for a long enough period of time. However, the length of time required may be so great that it presents insurmountable practical difficulties and also, the presence of an oxide film, at the interface, may bar all diffusion to a very great extent.

As a result of the difficulties encountered with mere surface pressures, the solid-phase process is of necessity one involving the use of selected high pressures as well as temperatures.

The introduction of high pressures into the process immediately introduces the problem of the upsetting of the plastic metal. The theory relative to the use of pressure, to increase the rate of diffusion, has been well substantiated and has been explained upon the basis of two separate arguments. The atomic theory of diffusion contends that the mean free path of the atoms in the space lattice is no greater than the inter-atomic distance. This being the case, in order for the atoms to be able to displace themselves into other lattices, especially those of another and disconnected crystal, every effort must be made to insure the very closest crystalline approach that is possible and required under the circumstances,

As was previously mentioned, the presence of an oxide layer on the interface is a great deterrent to diffusion. The upsetting, due to the pressure, causes a greater surface area to exist at the interface, and in as much as the oxide film is of a definite area, it will be broken and cracked in several places. Once the film has been partially dispersed, the process of diffusion can proceed as intended.

Time, as a governing factor in diffusion, has already been alluded to. A cursory perusal of the facts would cause one to immediately assume that the rate of diffusion is a function of time, temperature, and pressure, and such is the case. However, what is more difficult, all three variables are in turn functions of one another and this leads to some complicated mathematical expressions. The general LaPlace partial differential equations have been adapted to the theoretical determinations of the correct combinations to use when the other variables, such as the lattice dimensions and the closest approach distances, have been established.

The concept of the mathematical prophesy is not a new one to the engineer although he has always demanded that the theory be substantiated by tests. It is with the results of various tests that this paper must now deal.

Kinzel[1] reported the results of a series of over 500 tests which were made at the research laboratories of the Union Carbide and Carbon company. The tests reported included some in which non-ferrous metals were used. These tests will not be reviewed.

Of the tests which were performed, two series, those which were at constant temperature and those at constant pressure were the most enlightening. Through the medium of maintaining one variable fixed, an empirical relation could be obtained for the proper cycle for the different materials tested.

Ingot iron, S.A.E. 1020, and S.A.E. 1045 were the materials used in the temperature and pressure calibration tests. These materials, not being alloyed, the various states on the iron-iron carbide diagram can be easily determined.

The critical temperature for the ingot iron was found to be in the neighborhood of 1900 F (1050 C) when very low axial pressures were used on the test bars. With the pressures used, there was no upset of the metal even at this elevated temperature. The ingot iron, being something of an oddity, no more time will be placed upon the results with the low carbon steels.

The pressure used for the tests in which the temperatures were varied, was 500 psi. At this pressure, it was found that practical minimum temperature, so as to achieve the previously stated criteria, was 2250 F for the S.A.E. 1020 steel. Approximately the same result was obtained with the S.A.E. 1045 steel.

However, from the purely engineering standpoint, there exists another criteria of performance which is much more important than the previously stated metallurgical criteria.

The problems with which the engineer is faced are those which concern the usable physical characteristics of the material. The ductility and the endurance limit, of the weld material, were felt to be the criteria for acceptance or rejection by the engineer. This is based upon the assumption that the virgin metal already possesses those qualities which the designer desires. Therefore, it is necessary to know whether or not the ultimate physical properties of the weld zone will limit the usefulness of the weld as a creative process.

Determinations of the various physical properties, and in particular those mentioned above, of the solid-phase welded materials has been investigated by Lytle[3], Durst[4], and others besides Kinzel.[1]

Generalized conclusions as to the physical properties of the solid-phase weld in ferrous metals can be drawn from the work that has been done. However, in most cases, it must be borne in mind that in order to obtain the optimum conditions, a post-cooling normalize must be used. Although the method shows good homogeneity and refined grain structure, there is always a pos-

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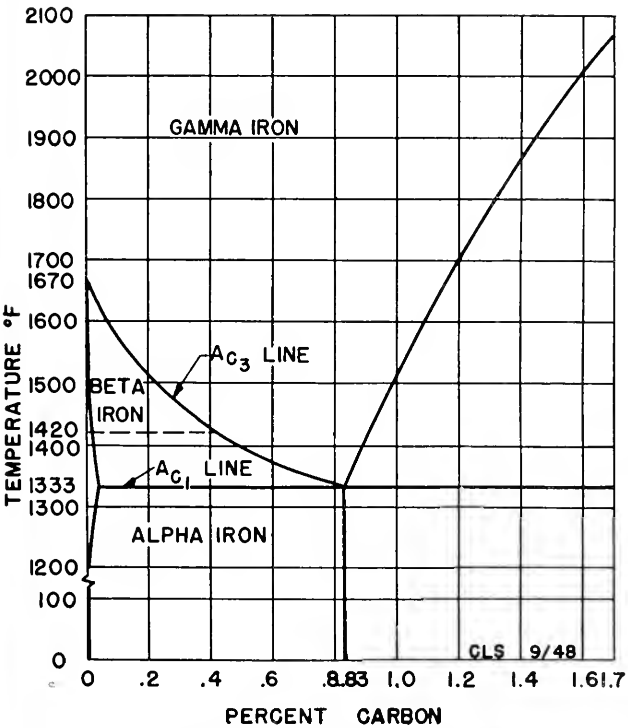

IRON-IRON CARBIDE DIAGRAM

For Men of Expectations . . .

ELECTRICAL ENGINEERING DEPARTMENT

University of Illinois

PART II

Functional Classification of Engineering Jobs

There are a wide variety of functions performed by engineers in each of the engineering fields. On a functional basis engineering jobs may be divided into research, development, design, production, test, application, sales, service, construction, and operation.

The *research engineer* devotes his energies toward extending the horizons of knowledge. This involves a search and study of the literature on a particular subject, calculations to verify theory, and experimentation to prove, reject, or modify theory. In *pure* research the engineer investigates physical laws for the purpose of increasing scientific knowledge, without being particularly concerned with the immediate applicability of his discoveries. In *applied* research the engineer has as his aims the solution of specific manufacturing problems, the development of new equipment, and the discovery of new materials for which there is a need.

The *development engineer* takes the results and discoveries of research and develops them into useful methods, products, or apparatus. Development involves considerable analytical and experimental work in order to get a product into its final form for production.

The *design engineer* is responsible for the preparation of the detailed plans and specifications from which a piece of apparatus is produced or a system is constructed. He makes the necessary calculations and sketches, writes or supervises the writing of the electrical and mechanical specifications, selects the materials and processes to be used in manufacture, helps prepare specifications for test procedure, and established acceptable performance standards. The design engineer must be analytically inclined and have the ability to visualize what goes on in the operation of a given piece of equipment. He must keep up with new developments and know the patent situation in his field.

The *production engineer* is responsible for the manufacture of products and apparatus from raw materials and designs. He analyzes the methods, processes and equipment used in manufacturing. He works with the design engineer on manufacturing problems in order to keep costs to a minimum. In addition to a good engineering background and a good knowledge of industrial management and manufacturing operations, the production engineer must know and be interested in people.

The *test engineer* is in direct charge of the actual testing of apparatus and equipment to determine if it meets specifications and accepted engineering standards. It is his duty to see that correct and standard test methods are safely applied. He consults with the design engineer on special testing problems and methods. He also works to develop improved and cheaper methods of testing.

This, the second and concluding installment of this article, reviews the functional classification of engineering jobs, the responsibility classification of engineering jobs, the objectives the engineering student should have in mind while he is in college, and the essential tools of the engineer.

Part I of this article appeared in the November issue.

The *application engineer* solves plant and system problems. He recommends specific equipment and coordinates the engineering requirements of an entire installation. He informs the design engineer of the characteristics which each piece of apparatus in a system should have. In a manufacturing company he also acts as a consultant to the sales organization and helps select specialized equipment which will best serve the customer's needs.

The *sales engineer* is the manufacturer's sales and engineering representative who works directly with the customer. He studies the customer's needs and makes engineering applications of equipment. He must know his companies' equipment thoroughly so that he can explain its design, construction, and operating features to the customer. The sales engineer also negotiates the sales price of the equipment and its delivery date. In addition to his technical training, he must have the ability to work with people and a personality that inspires confidence.

The *service engineer* supervises the installation of new apparatus and performs the final tests. He investigates customer complaints and corrects troubles found in the field. He directs repair work, and in cases of emergency, he restores operation as soon as possible. The service engineer must have a broad engineering knowledge since his work covers a wide field. Service work also requires initiative, ingenuity, resourcefulness, and the ability to direct people.

The *construction engineer* supervises the construction of facilities and structures such as plants, transmission lines, air fields, and radio stations from their proposed designs and plans. In addition to technical problems this involves the procurement of materials, the selection and proper use of construction equipment, and the handling of men. The ability to work with and direct the work of others is as important to the construction engineer as his technical background.

The *operating engineer* is charged with the responsibility of operating a part or a whole enterprise safely, efficiently, and without interruption. He may work with a group of machines, a plant, or a system such as those found in the electric-power, communications, and transportation fields. He supervises the procurement of supplies and repair parts, supervises the protection and maintenance of the equipment, selects and coordinates new equipment, and directs the operating personnel. In case or breakdown or emergency he must have the ingenuity and resourcefulness necessary to restore operation under the most adverse conditions. The operating engineer must have a broad engineering background and must be able to handle men.

The above sequence does not imply the relative importance of the various classifications. It is based largely upon the order in which a new discovery is usually handled until it has been made useful to man. It also indicates the extent to which the engineer must deal with things and people. Research and development engineers deal primarily with things; at the other extreme, production, sales, service, construction, and operating engineers must know and be interested in people.

It should be pointed out that not all companies will need every classification listed, as this depends on the exact type of business involved. Also, in some companies one engineer may perform two or more of the functions.

Responsibility Classification of Engineering Jobs

The work of the engineer in any of the preceding classifications can be further classified on the basis of the type of responsibility involved—that is, into technical, supervisory, and executive work.

(Continued on page 36)

Light Detected by Sound

By Ray Hauser, Ch.E. '50

Despite the many differences between sound and light, there has been found a definite coupling action between them. The effect of infra-red radiation on a field of supersonic sound is being studied by Professor W. J. Fry and assistants, in the electrical engineering research laboratory. Specifically, the project is the detection of infra-red rays by its measurable effect on high frequency sound. This method of detection has been found to give greater sensitivity and more rapid response to radiation than has been heretofore possible. This is of extreme importance to the Army air force, sponsor of the research project. Hot exhaust gases from airplanes radiate considerable quantities of infra-red. If supersonic detection of this radiation is sensitive enough, it may supplant radar as a method of airplane warning. The research is still in its fundamental stage, so it isn't known yet if suitable aircraft indication is practicable.

The new and ingenious feature of the rather complicated-looking apparatus is an acoustic interferometer—an infra-red detecting device. The amplifier, oscillator, detector, oscilloscope, and vacuum tube voltmeter are standard units. Their functions, at least, are known to most engineers, and their relation to the detector unit is shown by the block diagram. The gas control equipment is necessary to provide accurately known compositions of gas mixtures used in the interferometer chamber. The vacuum pump makes possible a continuous flow of gases through the chamber. Temperature measurements and heater controls are of great importance. The interferometer must be kept within one-tenth of one degree centigrade variation, as the character of sound transmission through the gases is found to vary considerably unless the temperature is kept constant.

An outline of one of the fascinating investigations in progress in the electrical engineering research laboratory, this article also indicates some practical applications. The project is the detection of infra-red rays by its measurable effect on high frequency sound.

The acoustic interferometer is the key to the whole detection apparatus. It is a well insulated, sealed chamber containing two x-cut piezo-electric quartz crystals. These are the same type that are used in radio transmission. The spacing between the crystals is varied with a micrometer screw. A potassium bromide crystal on the side of the interferometer acts as a window, permitting infra-red radiation of up to 25 microns wave length to pass into the chamber between the two quartz crystals. A simple heated body, variable from room temperature to red heat, is used as the source of a wide band of infra-red waves.

A mechanical shutter between the hot body source and the interferometer window cuts the beam at frequencies variable from five to 100 cycles per second. It is simply an evenly notched disk that rotates at a constant rate, alternately permitting the infra-red beam to enter the chamber, and blocking its path. Thus, the gas in the interferometer chamber is exposed to periodic radiation.

High frequency radio waves (932 kilocycles) are generated by the oscillator, amplified, and impressed upon the upper piezo crystal, causing mechanical vibration at supersonic frequencies. This vibration excites the gas mixture and is transmitted through the chamber where the gas absorbs infra-red radiation. Periodic exposure to the beam changes the transmission character of the gas and its wave motion is consequently modulated according to the shutter frequency.

The detector crystal (exactly like the driver crystal) receives these modulated waves and responds by vibrating "in tune" with the supersonic vibration of the gas. Piezo-electric crystals generate voltages characteristic of their vibration and dependent upon the amplitude and frequency of the wave causing the vibration. Hence, the voltage generated in the detector crystal varies with the modulated supersonic waves subjected to infra-red radiation. The voltage is amplified and fed into a detector circuit much like that of an ordinary radio. Variations of wave pattern may be seen

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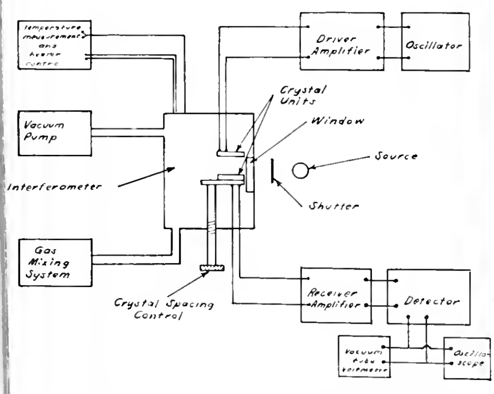
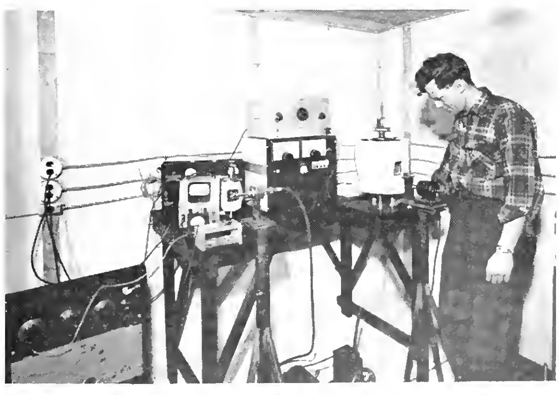
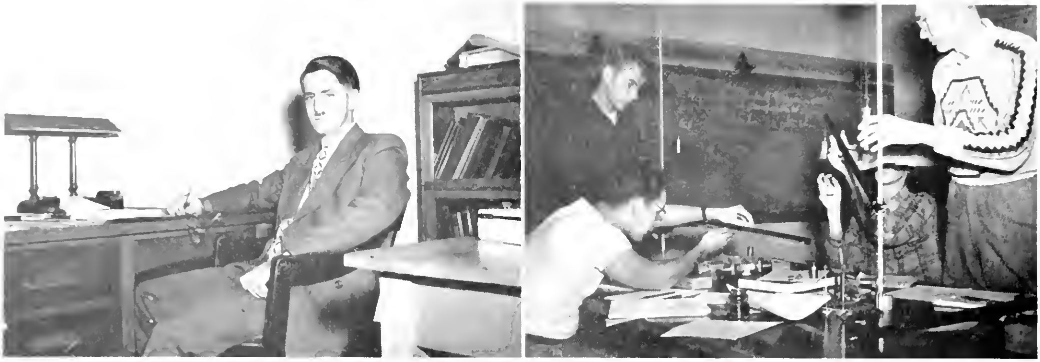




Frank Fry, research associate, inspects the main piece of equipment used in the present research project of the electrical engineering laboratory. On the left is shown a simplified block diagram of the same piece of equipment.



On the left is seen Mr. A. M. Johnson in his office, which is always open to students with or without problems, while on the right a group of first semester students work on the derrick problem in one of the well-equipped laboratories at Galesburg.

Undercover at . . . GALESBURG

MEET MR. PHYSICS

By Luther S. Peterson, E.E. '51

It has been said that knowledge of the physical world that surrounds us is the knowledge of life itself. To acquire this knowledge is a task which is remembered by seniors and juniors, is being experienced by sophomores, and is yet to be realized by freshmen. However, this is not the difficult task it once was when a student was required to improvise all of his experimental equipment.

Such was the situation prevailing here at Galesburg at the start of the fall semester of 1946. This condition, which was conquered quite commendably by the many students involved, is no longer present. War surplus equipment, plus equipment which was sent here from Urbana, has aided in the development of our present physics department. It now ranks with comparable institutions throughout the country.

The department is split up into two definite, but closely related, sections: pre-med physics, led by Miss Zielesh, and engineering physics, led by Mr. O. Estes and Mr. A. M. Johnson. Through the medium of their instruction, the student obtains a usable knowledge of mechanics, heat, sound, electricity, and wave motion. The knowledge of these fundamental principles is indispensable to the engineer in his further pursuance of knowledge of the physical world. To the pre-med student, an understanding of these principles is necessary so that he will be able to operate and understand the varied equipment which is used by his profession in the healing of the human body.

Knowledge of the physical world and its many peculiarities is not restricted to the engineer or the pre-med student, but is helpful to all who wish to have a scientific background adequate to face the problems present in our "atomic age." The presence of equipment such as oscilloscopes, Wheastone bridges and galvanometers, coupled with able instructors, enables anyone to obtain such a background here at Galesburg.

MR. A. M. JOHNSON

By Dean R. Felton, C.E. '51

The honor of being the third person hired at our Galesburg undergraduate division goes to Mr. A. M. Johnson, who is one of the most well-known teachers on the campus.

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Ewing Sharp   *Advertising*

Mr. Johnson has aided in the growth of our division in that he has been one of the leaders in setting up our physics laboratories, and developing them into the finest possible. At present, Mr. Johnson teaches the advanced course of engineering physics and acts as adviser to the electrical engineers.

Mr. Johnson began his higher education at Illinois Wesleyan university from which he received his B.S. degree with a major in physics. Graduating in the class of '40, he studied later at Northwestern university and the University of Iowa. While attending Iowa he was a staff member of a weekly student publication.

Mr. Johnson then accepted a position with the Anthony company, which is one of the greatest producers of hydraulic hoists and truck bodies. Acting as co-director of research at Anthony, he was instrumental in developing a welding timer which is produced in numbers, and is used by that company in their many welding processes. In this position he led in the establishment of monthly tests, whereby samples of the individual worker's products are tested for the many stresses and strains to which they will be subjected, in order to insure a consistent high quality in the finished welds.

After completing three years of work for the Anthony company, Mr. Johnson worked at the Dodge plant in Chicago as a chemical spectrographer. In this capacity he tested incoming materials for the relative content of the many special metals and alloys which had to meet strict specification. This process involves burning a sample of material by a very high ampere spark, or arc, which produces light waves. The resulting arc is filtered through lenses and prisms. The identifying bands of color, and their density, allows very accurate

(Continued on page 26)

In This Corner...NAVY PIER

PIER PERSONALITY

By John Fijolek, E.E. '51

One of the functions of a university is the expansion of the frontiers of human knowledge. How best to perform this task has been the problem of educators of every age. It is only by imparting to each generation all that experience, research, and thought, gleaned by the old generation, that a stepping stone is provided for the younger. Our educators, in many cases, have slipped into a groove in being satisfied to merely impart, and make available, all that is known, and in trusting to latent human inquisitiveness, ambition, and desire to provide the stimuli for further activity on the part of the student.

There are some educators, though, that use cajolery, flattery, and other psychological tools to keep students alert and to transmit their store of information surely and effectively. If, in walking down the corridors of Navy Pier, you see a class of students trying to answer the question, "Why do you want to be an engineer?" then you know Mr. Feinstein is waking up his class.

Room 105 has been Mr. Feinstein's Navy Pier home for many a lesson, and as he has told his classes on occasion, "They always assign me to this room, and I always scuff my shoes on this nail protruding from this platform. Some day I'll bring my own hammer and nail it down myself."

You'll learn a lot more than just mathematics in his class, and you'll be faced with many questions outside of the assigned text. The unstated latitude and longitude of Chicago may be an additional hazard in a trigonometry problem. "How do you know the author is right? Did you check it?" may be other questions to upset the calm of the average student. Habit and accepted solutions are not holy ground in his classrooms.

Irwin K. Feinstein, as you may have surmised, has his own ideas on education. He describes himself as a fanatic on general education and states that his passionate interests are the training of student growth and the teaching of mathematics. That it is not a home hobby of his is evident in his classroom teaching and his representation of the mathematics department as a member of the general education committee —an advisory body on the problems of education to the associate dean of liberal arts at Navy Pier.

EDITORIAL STAFF

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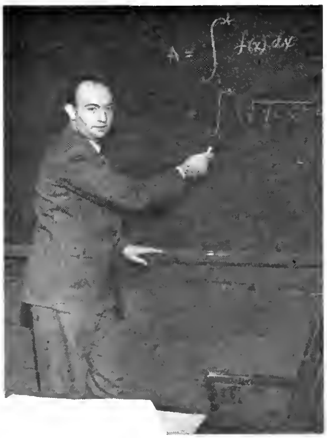
Robert Groemling, *Photography*

Mr. Feinstein is still single, received his B.S. at the Illinois Institute of Technology in 1936, graduated from Chicago Teachers' college in 1938 and obtained his M.A. at Northwestern university in 1946.He has taught physical education in the Chicago elementary schools and mathematics in the Chicago high schools, primarily at Steinmetz. He



MR. IRWIN K. FEINSTEIN

served four years in the Coast Guard during World War II, 36 months of which he spent at sea in the European-Mediterranean theater of operations, and also in a limited amount of Pacific duty.

Among his other achievements, he is co-author, with Messrs. Corliss and Levin of the Pier mathematics department, of the analytic geometry book now in use at the Pier, and which will be published in book form early in 1949. He is now working on a Ph.D. at Northwestern university.

He has a brisk mannerism about him and applies himself to his teaching. "Can you hear me?" in a loud voice; followed by, "Why don't you answer, then?" keeps more than one student awake. Or an informal vote of the class as to which answer is correct will bring forth, "Let's see, five say it's right, four say it's wrong, and we have 22 in the class. What happened to the rest of you?" Or, perhaps he'll say, "You make an 'A' in algebra, a 'B' in trigonometry, a 'C' in analytic geometry, and a 'D' in calculus, and you wonder why. It's just because you only memorize and don't think! Why do you want to be engineers and make only $22.50 a week?"

All this, however, is just added attraction to the prescribed curriculum and if you pass his course you've learned your mathematics. When the students talk about a mathematics instructor who is a little rugged but good, the odds are that they're talking about an interesting individual, Irwin K. Feinstein.

Let's Give a Helping Hand

By Siegmund Deutscher, A.E. '50

Yes, the Chicago undergraduate division of the University here at Navy Pier has grown. But have we, the students, grown with it? Of course, I am not referring to physical growth. I am aiming at our extra-curricular activities.

Since the beginning of this semester many students have approached me with questions such as "Whom do I see to join the A.S.M.E.?"; "When will the A.S.C.E. meet?" or, "Where does the A.I.E.E. meet?"

Whenever possible, I have tried to answer the questions. But, of course, some are outside the scope of my limited information. More so, many of the students do not know me or the few others that have information.

What is the solution to the above problem? I do not think that it is for me alone to decide. It is up to the combination of all the societies and organizations to solve. This could very easily be done if we had an Engineering Council.

Many times during the past and present semester, I have tried to get the officers of the organizations and societies together and establish an Engineering Council. At every approach I found enthusiasm, yet there has been no action.

This time, my appeal is in the form of this article. I propose that the officers

(Continued on Page 26)

The Engineering Honoraries and Societies

Bruce Brown, E.E. '52
Henry Kahn, Ch.E. '50
Jim Ephgrave, E.E. '51
Bill Soderstrum, Cer.E. '52

ENGINEERING COUNCIL

A bulletin board for the use of all engineering societies has been obtained by the Council, through the cooperation of Dean Enger.

At present, the societies have the use of one section of the glass-cased board outside the entrance to the Engineering library. If the single section should prove inadequate, additional space will be provided. The board is identified with the banner, "Student Engineering Societies."

This board, if full use is made of it, will do much to fill a long felt need for a means of letting all students know what the engineering societies on the campus are, what they are doing, and how to join them. It will provide a common link for informal business between the societies, and, for engineering students in general.

Additional information concerning the use of this bulletin board may be obtained from Bill Paulsen, secretary of the Engineering Council.

The open house committee reported at the October 21 meeting, that a willingness to cooperate on plans for an open house existed among the faculty.

Definite plans have been made to bring a well-known speaker to the campus on December 16. The talk is to have an engineering theme and will be given in the east ballroom of the Illini Union. All students are urged to attend.

The American Foundrymen's Society, installed officially at the University on October 21, petitioned for membership in the Engineering Council at the meeting held on October 28.

A.I.Ch.E.

The American Institute of Chemical Engineers was quite busy during the last month getting the chemical engineers oriented on possible future fields of specialization.

On November 3, 1948, the assistant research director of the Standard Oil laboratories at Whiting, Indiana, spoke on personnel problems that may be encountered by engineers. Two weeks later, on November 17, Dr. Sternberg of the United States Bureau of Mines at Louisiana, Missouri, spoke about synthetic fuel possibilities.

Tentative plans include among others, a talk on general problems encountered by chemical engineers in industry in December, and a dance in Club Commons in January.

A change in the organization was made in that Dr. J. W. Westwater has assumed the position of faculty adviser, which had been so ably filled by Dr. H. G. Drickamer during the last few years.

A.F.S.

The American Foundry Society is the student branch of the American Foundrymen's association. The first meeting of the year was held October 22 in Gregory Hall. Frank Shipley, of the Caterpillar Tractor company, conducted a panel on foundry practices and Robert Maloney, secretary-treasurer of the A.F.S., was present for the installation of officers.

The branch officers are Charles Drury, chairman; Harold French, vice-chairman; Robert Bales, secretary; and Joseph Davis, treasurer.

S.B.A.C.S.

The University of Illinois Student Branch of the American Ceramic Society has attained the largest membership in its history, with 102 active members. The program of the society has also reached new heights of activity with three events in the first complete month of school.

Approximately 60 watched the seniors battle the faculty and graduate students of the department of ceramic engineering to a 6 to 6 tie football game October 10 at Crystal Lake park in Urbana. After the hard-played game, a picnic supper of wieners, salad, and all of the trimmings was served by the students.

One of the most popular events at the Illini Union open house for the faculty October 16 was an exhibit of ceramic materials and products, prepared by the student branch. Four large tables of ware representing the glass, refractory, whiteware, porcelain enamel, abrasive, and structural clay products divisions were prepared by LaVoy Schneider, Jerome Schweitzer, Albert Siska, and Charles Curtis. They were assisted by Prof. A. W. Allen, Prof. G. F. Stockdale, graduate student W. D. Fitzpatrick, and L. R. McCraight, special research associate. Another table contained sample copies of the various journals and trade papers of the ceramic industry, along with copies of "Ceramics—What It Is—What It offers as a Career," which were distributed to many of the 1,500 guests at the party.

The student branch held its second regular meeting of the year Wednesday, October 20. The main speaker of the evening was Dean Howard Bowen of the College of Commerce. He gave a general outline of the economic system of the United States and where it is going. It was his opinion that business men must take a more active and open interest in the government. Dean Bowen told the group that the United States is the last outpost of free enterprise in the world, and it is up to us to demonstrate to the world how to make free enterprise work.

The student branch has entered two bowling teams in the Illini Union bowling tournament and plans the formation of other athletic teams to enter intramural competition.

ETA KAPPA NU

Come on all you electrical engineering geniuses, get out of your rut and see what's going on in the rest of the world. Eta Kappa Nu, the electrical engineering honorary, is giving a series of luncheons, one each month, followed with a lecture by a member of the University's non-engineering faculty. The first lecture this year was given by Dr. Goldman of the English department on the subject, "Engineering and Humanities." These luncheons are for the benefit of the actives, pledges, and alumni of Eta Kappa Nu.

About 75 electrical engineers are being pledged by Eta Kappa Nu this semester. Their initiation and a banquet will be held in Hotel Tilden Hall December 15.

S.A.E.

Are you tired of walking to school because your hot-rod eats up too much petrol? Is your car flat on its back in the garage? Tell you what you should do. Visit the meetings of the student branch of the Society of Automotive Engineers.

A good example of what one can do with stock cars was pointed out by Prof.

R. C. Juvinall at the October 29 meeting of the S.A.E. Mr. Juvinall revealed how he obtained the amazing rate of 50 miles per gallon from a stock car. That would have come in handy during gas rationing.

At that same meeting, R. C. Williams, chairman of the Central Illinois division of the Society of Automotive Engineers, also spoke to the group. He expressed the interest of the national society in the student branch. He also invited the student branch on an inspection trip of the Caterpillar Tractor company at Peoria sometime in the early part of December.

Don't get the idea that the S.A.E. is devoted entirely to automobiles. Its activities embrace standards, research projects, meetings, and publications. It fosters the exchange of engineering information in the fields represented by the 11 S.A.E. professional activity committees, which include among others: aircraft, diesel engines, passenger car production, tractors and farm machinery, transportation and maintenance, and trucks and busses. It is evident from this that the society is not limited to mechanical engineers.

Anyone interested in attending the inspection trip in December is urged to contact Bob Pontious, at 205 Mechanical Engineering laboratory.

SIGMA TAU

George Gore, the president of the local chapter of Sigma Tau, has returned from a national conclave of this all-engineering honorary and is again presiding in his official position. The conclave was held in Pittsburgh over October 7, 8, and 9 and was attended by members from all of Sigma Tau's widespread chapters.

The local chapter held its first formal meeting of the year on October 26 for the purpose of straightening out its business. At the next meeting plans for this year's social program will be discussed.

PI TAU SIGMA

Betty Lou Bailey had the honor of becoming the first woman member of Pi Tau Sigma at the pledging smoker October 19, 1948. Thus a 29-year-old precedent was broken. Professor H. J. Schrader, Associate Professor L. C. Pigage, and Assistant Professor J. L. Leach were invited to honorary memberships.

The highlight of the evening was a talk by Professor O. A. Leutwiler former head of the mechanical engineering department, who summarized the history of Pi Tau Sigma and spoke on the social and psychological aspects of engineering.

I.E.S.

"Kinda dark in here, ain't it? Let's call in an illuminating engineer." The best place to look for one is the I.E.S.

The Illuminating Engineers' club was formed last spring for the purpose of introducing to each other future illuminating engineers, the faculty members who deal in illuminating, and men in the illuminating industry.

Through the diligent efforts of Prof. John O. Kraehenbuehl, the Illuminating Engineers' club hopes to become the first student branch of the Illuminating Engineers' society sometime this month. This society is the national organization for those in the illuminating field.

Extensive programs for the coming year are to include such things as lectures on illuminating, and other lectures pertaining to illuminating such as "Psychology of Colors" and "State Engineering Exams." A number of demonstrations and movies will also be prominent on the programs. An open house for wives, freshmen, sophomores, and other guests has been planned for the near future, with lectures and demonstrations designed to gain the interest of the visitors.

The membership now stands at 50, with good prospects of a large increase in the near future. The officers for this year are Lowell Shepard, president; Stanley L. Burnham, vice-president; Robert E. Birr, secretary-treasurer; and Ralph Hintz, corresponding secretary.

At the first meeting of the I.E.S., which was held October 6, the program consisted of the lecture, "A Tour of Slides," a group of slides on outstanding lighting installations for 1947-48. This lecture was completed on the next meeting held October 27.

A.S.C.E.

Tote that slide rule! Lift that T-square! Another rugged semester has started for the engineers. The monotony of the constant studying can be broken for civil, architectural, and general engineers, however, by membership in the A.S.C.E.

The present membership of the American Society of Civil Engineers is up to the three hundred mark, the largest of any student branch. It looks like a promising year for the A.S.C.E.

At the last meeting of the student branch, Prof. W. W. Hay of the civil engineering staff gave an interesting and informative talk on "Rehabilitation of the Alaskan Railway." Mr. Hay spent the summer in Alaska working on this project, and is exceptionally well qualified to speak on the subject. Approximately 200 students attended this meeting at which the faculty and all civil engineering students were guests.

M.I.S.

A meeting of the M. I. S. was held on October 8. Before 60 mining and metallurgical engineers, T. C. Shedd, professor of structural engineering, spoke on "Professional Engineering Examinations."

During the business portion of the meeting several committee chairmen were appointed. They are the first to serve in such a capacity in the history of the organization. Those appointed were Jim Stanley, arrangements; William Green, publicity; Norbert Blaski, Illio picture; Ben Tudor, picnic; and H. C. Turner, programs.

Plans for the meeting on December 8 include an address by George S. Mican, rolling superintendent of Carnegie-Illinois Steel company. He will speak on "Rolling Operations."

CHI EPSILON

Hey, you brains! Don't bury yourselves entirely in books! There are other phases of life than studying! You have been working diligently and are just short of a five-point average. So what! So you now can join one of the honorary fraternities. For civil engineers the Chi Epsilon fraternity rates pretty high.

Requirements for Chi Epsilon consist of a high scholastic average and, as is the case with all fraternities, a good personality. This year Chi Epsilon started off with 25 members. Tuesday evening, October 12, they entertained 38 pledges at a smoker given at the YMCA. These pledges will be initiated sometime in December.

The officers this year are George Roberts, president; Dominic Principeli, vice-president; Dean Collins, secretary; and Richard Foley, corresponding secretary.

GAMMA ALPHA RHO

Friday night, September 30, Delta chapter of Gamma Alpha Rho, newly formed aeronautical engineering honorary society, held a smoker at the Illini Union. The purpose of the meeting was to acquaint eligible aeronautical engieering students with Gamma Alpha Rho.

The program consisted of short addresses given by Vernon Van Heyningen, president; William Brooks, vice-president; Frank Wohlmuth, treasurer; and Simon Sommer and Lowell Masley, initiation committee.

Gamma Alpha Rho is a recent newcomer to the ranks of the campus honoraries. The aeronautical engineering honorary was recognized by the University Senate April 30, 1948, and was declared Delta chapter of Gamma Alpha Rho May 3, 1948.

(Continued on page 44)

Introducing . . .

by Robert Lawrence, E. Physics '51

SAM J. PIAZZA

"Golly, I wish I were carrying a little more weight. I'd sure like to play some football in high school!" Every boy with athletic ability likes to dream of the day when he'll become one of the boys out there on the gridiron.

So it was with Sam Piazza from Chicago Heights, Illinois. He entered Bloom township high school in 1941 weighing 150 pounds. His greatest struggle with athletics concerned his weight; but with a strong will power and a desire to participate, he went out for three major sports. He was on all

SAM J. PIAZZA

varsity teams: football, baseball, and track. In 1945 he made "all state" in football.

Today we know Sam Piazza as "No. 54," playing halfback for "The Fighting Illini." He attains recognition as being the lightest member of the squad, tipping the scales at 160 pounds as compared to the squad average of over 190 pounds.

Sam is a quiet fellow and rather modest; he finds no time for hobbies on the college campus. We found him in his room at the Sigma Pi fraternity tackling a calculus assignment. He is enrolled in the College of Engineering, and is specializing as a civil construction engineer.

He has worked at several different jobs. During his high school days he worked in his father's meat market and grocery store. Following his graduation, he served 16 months in the quartermaster corps. At present, he spends his summers gaining practical experience by working with construction crews.

The dating ratio on the campus doesn't affect Sam because his girl, Eleanor Malizia, is back home at Chicago Heights. Sam and Eleanor reigned as king and queen at their high school homecoming festivities during Sam's senior year, and they have been dating regularly ever since.

Finding time for leisure, Sam works earnestly for his achievements. He strives to accomplish, and he accomplishes by striving.

WILLIAM L. HULL

The mechanical engineering students will soon be attending classes in their new building on the corner of Mathews and Green streets. They will conduct experiments in laboratories containing some of the most modern testing equipment available today.

The man responsible for most of the construction details and processing of the laboratory is William L. Hull, associate professor of mechanical engineering. His office is piled with various materials, waiting to be transferred to the new building.

Mr. Hull has proven to be a very capable man for handling such a project. He received his B.S. in mechanical engineering at the University of Colorado in 1934, and went to work for the Chrysler corporation as an experimental and development engineer. While with Chrysler, he attended the Chrysler Institute of Engineering and received his master's degree in automotive engineering. He left Chrysler corporation in 1937, and joined the mechanical engineering staff at Purdue university. While there, he instructed courses in heat and power, internal combustion engines, and thermodynamics. He also received his M.S. in mechanical engineering.

Mr. Hull's specialized interest is internal combustion engines; he broadened his knowledge by picking up practical experience during the summers.

In 1938 he worked for the Lockheed corporation; in 1939 he worked for the Allison division of General Motors; and in 1940 he took an assignment for Combs Aircraft corporation, Denver, Colorado, working under Prof. Norman A. Parker, the present head of our mechanical engineering department.

In 1940, Mr. Hull joined the staff of the University of Colorado, where he taught and did research work. There, too, he was under Mr. Parker, who was at that time head of the Colorado mechanical engineering department.

An interesting part of his research work covered an assignment for the U. S. Army air forces. This was a fuel

PROF. WILLIAM L. HULL

volatility performance project on an Allison engine, operating at low temperature conditions. Mr. Hull worked on this project from 1944 to 1945, producing satisfactory results, and presented a 900-page report to the air forces.

He followed Mr. Parker to Illinois in 1947 and is now instructing M.E. 6 and M.E. 7, along with his work on the new M.E. building.

Last year, Mr. Hull built a new home in west Champaign for his wife and two children. He has a little girl three years old and a boy seven years old.

He likes to bowl, play bridge and, when he has time, play "at" golf. He is certainly one busy man, being a member of Acacia social fraternity and four honoraries: Sigma Tau and Tau Beta Pi, engineering; Pi Tau Sigma, mechanical engineering, and Sigma Xi, research. He is also a member of the American Society of Engineering Education, and is the faculty adviser of the Society of Automotive Engineers.

Students who really know Mr. Hull say that he is "tops," because he enjoys his work and is so actively interested in his students. As one member of his class says, "He is a swell guy to know—and a great man to work with."

EDWIN A. WITORT
Editor

•

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

Considering the Fish . . .

When you go fishing, how do you bait your hook? You may have a fondness for big, thick, juicy, sirloin steaks, but do you hang one of those on a hook and drop it in the water? Certainly not—a fish wouldn't flip his dorsal fin twice at blue-ribbon beef dangling in front of him. Instead, you consider the situation from the viewpoint of the fish.

Why not use the same reasoning in dealings with people?

In dealing with people, no matter who, where, or when, there are two prime considerations—getting along with people, and getting them to do what you want them to do. Either or both appear, from shooting the breeze between classes to rehabilitating Europe. The only person who can ignore them is a prisoner in solitary confinement.

In this civilization of the Atomic Age, of accelerated living, mass production, and ulcers, the ability to get along with people and get them to do what you want them to do is of increasing importance. Friendships have become "contacts"; the friendships of yesteryear have today become a few close friends and many contacts. More and different people are encountered every day, and some system is necessary to get along with these people and influence their activities. At the same time, this must be done so as to leave a mental attitude conducive to further agreeable relations and cooperation.

The engineer should be vitally concerned with these considerations, whether he is in design, management, production, sales, research, or some other of the multitudinous phases of engineering. The big problems are not solved by one harassed man working in a dimly-lighted garret. Rather, they are solved by an organization, working in close cooperation and harmony. The days of kitchen table chemistry and make-shift apparatus are over. The talk now is of electronic calculators and pilot plants. Gone are the charcoal forge and anvil; enter the automatic screw machine and quality control. Getting along with people and directing their activities is a vital part of this program.

How are we going to find a method to accomplish this? It's simple. It's so absurdly simple that too few people even think about it, let alone practice it. It consists merely of a mental attitude; consider the other person. You consider the likes and dislikes of a fish. Why not amplify this to include your fellowman?

Henry Ford knew this. He said, "If there is any one secret of success, it lies in the ability to get the other person's point of view and see things from his angle as well as our own." This should be posted at the gate of every plant, cast into the base of every Alma Mater statue, carved into the tables of the United Nations, and printed on the back of every vehicle tax sticker.

Talk to the other fellow in terms of his interests and desires, and he will listen all day. Of course, this must be administered with care and insight, for often what appears on the surface is far from the whole story. There are, in general, two reasons for doing something—the reason that sounds good, and the real reason. The real reason can usually be traced right back in terms of personal interests and desires.

Call it "practical psychology," "the technique of handling people," or what you will. One grain of it is more valuable than a ton of advanced theory and application. For, unlike the latter, the ability to get along with people and get them to do what you want them to do is not something to be absorbed by a few geniuses; it is a necessity for modern living.

VOCABULARY CLINIC

Do you know that the position YOU will have in years to come will, to a great extent, depend upon YOUR vocabulary? Yes, your vocabulary will be a veritable measure of your success. It has been proven time and time again that one of the most common traits among men of success in any professional field whatsoever is a large, useable, functioning vocabulary.

Realization of the importance of these facts should spur any man into action. To acquire a large vocabulary is not difficult; but it does take time and practice.

The TECHNOGRAPH will endeavor to assist its readers to enlarge their vocabularies by publishing a short vocabulary quiz in this and the remaining issues of this year. The words in this quiz, as well as the words appearing in subsequent quizzes, will not be selected haphazardly from a dictionary, but rather, they will be choice words that are used every day by successful professional men.

As an added note: When you finish the quiz, in order to make yourself more familiar with these words, make sure you know the correction pronunciation and are able to use each of them in a sentence. Then, and only then, will you be able to claim these words as a part of your vocabulary. Answers will be found on page 32.

1. Ineffable—(a) unable, (b) witty, (c) not alive, (d) unutterable
2. Flatulent—(a) pretentious, (b) not carbonized, (c) insane, (d) terrible
3. Exigent—(a) leading out, (b) in urgent need, (c) afraid, (d) polite
4. Efficacious—(a) effective, (b) reluctant, (c) easy, (d) unconquerable
5. Cogent—(a) abusive, (b) convincing, (c) aware, (d) unaware
6. Collusive—(a) deceitful, (b) sticking together, (c) tender, (d) inquisitive
7. Panacea—(a) a waffle, (b) a remedy to cure all ills, (c) reason, (d) an alloy
8. Enervating—(a) detestable, (b) deceiving, (c) trespassing, (d) weakening
9. Didactic—(a) a diaper, (b) teacher-like, (c) exact opposite, (d) idiotic
10. Palaver—(a) a corpse, (b) empty talk, (c) pastry, (d) a myth
11. Penchant—(a) a strong inclination, (b) loud talk, (c) comfort, (d) harsh
12. Prowess—(a) frustrate, (b) prominence, (c) superior ability, (d) forgetfulness
13. Bromidic—(a) common-place, (b) a cure for headaches, (c) like bromide, (d) toxic
14. Captious—(a) captivating, (b) hard to please, (c) spicy, (d) esteemed
15. Supine—(a) attractive, (b) tasty, (c) having no interest or care, (d) penniless

---

"How did you find the ladies at the dance?"

"Opened the door marked 'Ladies' and there they were."

* * *

"I'll never take another drop," said the drunk as he fell off the sky-scraper.

* * *

M.E. 1 — "How is ol' Bill these days?"

M.E. 2 — "Oh, he's much better since his operation!"

M.E. 1 — "What operation?"

M.E. 2 — "Haven't you heard? They removed a brass rail that was pressing against his foot for years."

* * *

Mother: "Martin, every time you are naughty, I get another gray hair."

Martin: "Gee, mamma, you must have been a terror when you were young. Just look at grandma."

Electron microscope, perfected at RCA Laboratories, reveals hitherto hidden facts about the structure of bacteria.

Bacteria bigger than a Terrier

Once scientists, exploring the invisible, worked relatively "blind." Few microscopes magnified more than 1500 diameters. Many bacteria, and almost all viruses, remained invisible.

Then RCA scientists opened new windows into a hidden world—with the first commercially practical electron microscope. In the laboratory this instrument has reached magnifications of 200,000 diameters and over. 100,000 is commonplace . . .

To understand such figures, picture this: A man magnified 200,000 times could lie with his head in Washington, D. C., and his feet in New York. . . . A hair similarly magnified would appear as large as the Washington Monument.

Scientists not only see bacteria, but also viruses—and have even photographed a molecule! Specialists in other fields—such as industry, mining, agriculture, forestry—have learned unsuspected truths about natural resources.

Development of the electron microscope as a practical tool of science, medicine, and industry is another example of RCA research at work. This leadership is part of all instruments bearing the names RCA, and RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

Scenes A

Upper left—Univers
Mater statue. Lo
Building. Upper
center—Athletic fie
—Engineering Hall.

ıd Campus

ı Lower left—the Alma
-cupola of the Union
ɔrial Stadium. Right
)ld gym. Lower right

GALESBURG . . .

(Continued from page 14)

tabulation of the quantity of material present in the product.

During the war, Mr. Johonson taught at Ripon college, in Wisconsin. He was one of the many teachers who did excellent service to our country by teaching during the day and working at a local war plant in the evening. Mr. Johnson taught for two and a half years at Ripon and then entered the Navy as a radio technician. After discharge from the Navy, he came directly to the Galesburg undergraduate division, and since, has established himself as an able instructor and a willing counselor.

Freshman Orientation Program

By H. Roy Johnson, C.E. '51

The prospective engineer faces many problems, some of which can be eliminated by proper counseling and instruction. To supplement the individual counseling service now in operation here on the Galesburg campus, a program of freshman orientation has been successfully undertaken.

Such prominent men as Dean Jordan, associate dean of engineering at the University of Illinois; Dr. Carter, head of the department of student welfare here at Galesburg; and Dr. Aherns, chairman of the college of education at the Galesburg division, have highlighted this program, which is sponsored by the Engineering Sciences division, under the guidance of Prof. F. W. Trezise.

Not entirely new in the history of education, this program, which familiarizes the freshman engineer with college life in general, has been in operation in many of the most prominent schools in the nation.

This course, which is non-credit, and meets only once a week for a one-hour period, has been enthusiastically received by the freshmen engineers. Movies, illustrating the use of the slide rule, have already appeared on the program, and a course in the instruction of this instrument is now being arranged because of the aforementioned enthusiasm.

Such a course, which advises the new student as to the proper methods of study and concentration, enables him to pursue his vocation in a more orderly and consolidated manner. By the pursuance of such a program, the future of our youth, and therefore the future of our nation, is assured.

Soph: "Why don't you major in pharmacy?"

Dumb Frosh: "Oh, no. I couldn't think of living on a farm all my life."

NAVY PIER . . .

(Continued from page 15)

of all the engineering societies and organizations meet in our common office, Room 354-1, on Monday, December 20, at 5 p. m. and form into an active council.

We have in our possession at this time, a copy of the Urbana Engineering Council constitution and some of their past meetings minutes.

The foundation has already been laid —*let's give a helping hand.*

"And what do you do with your old razor blades?" questioned Sam.

"Try to shave with them," replied Joe.

* * *

Definition: research—a blind man in a dark room hunting for a black cat that isn't there.

* * *

A laborer doing a hauling job was informed that he could not get his money until he submitted a statement. After much meditation he evolved the following bill: "Three comes and three goes at four bits a went—$3."

* * *

20th Century Version

George Washington: "Father, I cannot tell a lie. I cut your sherry."

DU PONT *Digest*

For Students of Science and Engineering

Science paints the future

41 of every 1,000 U. S. chemists are engaged in production of paints, lacquers, varnishes and colors

Modern paint making is an outstanding example of chemistry at work—of the way the scientific approach has replaced rule-of-thumb methods.

Today, paints are formulated by chemists to meet specific needs. In their search for better finishes, these highly trained technical men are aided by the electron microscope and infrared spectroscope. A variety of goniophotometric and spectrophotometric devices are used by the physicist and physical chemist in the study of gloss and color.

Du Pont men have produced many superior finishes. One of them, "Dulux" nitrocellulose lacquer, made mass production of automobiles possible by shortening paint drying time from weeks to hours.

Finish failures—chipping and scratching—were costing manufacturers of home refrigerators a million dollars a year before Du Pont chemists developed "Dulux" synthetic resin enamels, based on alkyd resins. A "Dulux" coating on metal or wood dries into a film that even a hammer blow won't break. Tests with mechanical scrubbers prove it outwears old-style enamels by more than five times. "Dulux" enamels now guard boats, large and small, as well as petroleum tank farms, machinery and other industrial installations.

At Du Pont's paint laboratories, a wide range of materials is under study. Where the colloid chemist, the physical and organic chemist, the analyst, physicist and other technically trained men leave off, the chemical engineer, mechanical engineer and metallurgist stand ready to design equipment to make better commercial production possible.

Modern equipment speeds research

Many of today's research tools are complex and expensive. The modern research worker may use a $30,000 mass spectrometer installation which can make an analysis in three hours that formerly took three months. High pressure equipment, ultra centrifuges, molecular stills, and complete reference libraries are other tools which speed research and enlarge its scope.

Young scientists joining the Du Pont organization have at their disposal the finest equipment available. Moreover they enjoy the stimulation of working with some of the most able scientists in their fields, in groups small enough to bring about quick recognition of individual talent and capabilities. They find here the opportunity, cooperation and friendly encouragement they need. Thus they can do their best work, both for the organization and themselves.

Mark P. Morse, *B. S., Physics, Washington College '40, measures specular and diffused reflection of a sample paint surface with a goniophotometer, a Du Pont development for obtaining data on gloss and brightness.*

Rust would quickly weaken *this structure. Because "Dulux" resists salt water and salt air, it has for years protected many famous bridges.*

Satin-smooth beauty *and outstanding durability are properties given by "Duco" or "Dulux" to furniture, trucks, buses and trains.*

Paints are tested *by exposure to weather at paint "farms." Research men interpret results as guide for development of improved paints.*

Send for your free copy of this new booklet

The 40-page, fully illustrated brochure, "The Du Pont Company and the College Graduate," answers your questions about opportunities at Du Pont. Describes openings in research, production, sales and many other fields. Explains the plan of organization whereby individual ability is recognized and rewarded. Write today. Address: 2518 Nemours Building, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

More facts about Du Pont — Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

WHAT'S IN A NAME . . .

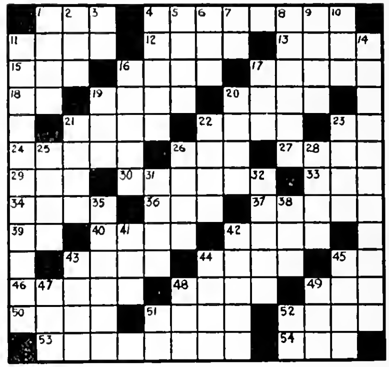
(Continued from page 7)

There is an excellent chance that he will make his mark in the world after losing his first three jobs due to incompatibility. You will be doing him a great favor if you give him the first one."

"Mr. Chip Shoulder is one of the most unpleasant young men that I have ever encountered. He is practically illiterate, argumentative, and has an excellent opinion of himself in direct contrast to his ability. In behalf of the university, and with the full concurrence of my fellow teachers, I apologize for his degree (cc. to C. S.)"

In summary, and all kidding aside, there is a way of making people want to write a letter of recommendation. First, if possible, get a reputation for scholarship. Second, enter into some useful extra-curricular activity. The exact balance is up to the student, but both are necessary. Even the "C" student will get his boost if he gets into some worthwhile project and does a good job which can be measured in results and not in wind. A student who feels that he enjoys the confidence of his teachers should not hesitate to ask for the privilege of using their names, remembering that as old Will Shakespeare so aptly put it, "—he who filches from me my good name takes that which enriches him not and makes me poor indeed."

Crossword Puzzle



ACROSS

1. Grassy field
4. Englishman who was first to read by electric light, 1709
11. Laid the first submarine cable, New York Harbor, 1843
12. Iridescent gem stone
13. Heedless
15. Lightning protector
16. Rumple
17. Lariat
18. To a higher level
19. Foundation
20. Insinuate
21. Have courage to
22. Food for furnaces
23. Hush!
24. Published details of his zinc mercury cell in 1873
26. Heavy weight
27. Dark evergreen trees
29. Relatives
30. Invented the automatic electric toaster, 1919
33. Destructive rodent
34. Break suddenly
36. Fish that generates electricity
37. Heavenly food
39. That man
40. Devised his discharging-jar electrometer, 1767
42. Anatomical network
43. Support for an antenna
44. Small, timid animal
45. Holy person: abbr.
46. Middays
48. Developed a crude arc lamp in 1808
49. Popular American dessert
50. German philosopher
51. Part in a play
52. Discovered the electro-optical effect in dialectrics, 1875
53. Discovered X-rays in 1895
54. Turn to the right

DOWN

1. Highly directional form of antenna
2. Old age: poetic
3. Near
4. Patented the first practical printing telegraph system in 1846
5. Part of a church
6. Existed
7. 1,000 liters: abbr.
8. Invented the "coherer" or wireless detector, 1885
9. Orient
10. S-shaped worm
11. His researches led to the process of electroplating
14. Patented electro statically shielded cable, 1916
16. Designed an enclosed arc light in 1893
17. Be situated
19. Legal profession
20. A search
21. Developed a vertical bar magnet in 1827
22. Thin metal sheet
23. Developed the all-glass electric light bulb in 1879
25. Cover the inside of
26. Large plant
28. Sea eagle
31. Canvas shelter
32. Corundum used for grinding, etc.
35. Designed a lead-plate storage battery in 1859
38. Devoured
41. Simpleton
42. Black crowlike bird
43. Single: prefix
44. In good health
45. Father
47. Rowing device
48. Fastening device
49. Part of an anchor
51. Football position: abbr.
52. 1,000 grams: abbr.

DID WE STICK OUR NECK OUT IN 1930?

Look How Alcoa Aluminum Extrusions Have Helped Our Prophecy Come True!

On June 21, 1930, this advertisement appeared in one of America's great national magazines. "Aha!" chortled a lot of people. "Look at Alcoa sticking its neck out!"

Now, in 1948, there are many aluminum trains to ride. In the past three years alone, 450 passenger cars have been ordered in Alcoa Aluminum. 103 freight cars. 412 tank cars.

One reason for the railroads' swing to Alcoa Aluminum is typified by the big extrusion press shown above. Squeezing out intricate aluminum shapes like toothpaste from a tube, it permits big assembly savings in car structures . . . without sacrifice of strength. From the massive but lightweight beam, 80 feet long, that serves as a car side sill, down to the satiny fluted moldings around the windows, Alcoa Aluminum Extrusions find wide use.

Getting metal where it's wanted, in the most intricate of shapes, and in gleaming, lightweight, corrosion-resistant Alcoa Aluminum—these advantages have helped many an industry to production short cuts, better products.

The story of aluminum is still being written. New developments are in the making that promise as much for the future of aluminum as the promise we made about aluminum trains back in 1930. Aluminum Company of America, Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

Alcoa ran the advertisement above before being able to make big aluminum beams for railroad cars—in fact, before the railroads even showed much interest in aluminum. Believing the idea was sound, Alcoa took a chance, built costly machinery to make beams, then went out and sold them. *Result:* these days you *do* ride on aluminum trains.

This is typical of the history of Alcoa. In 60 short years, Alcoa Aluminum has found its way into thousands of useful things: utensils that cook better, buildings that last longer, planes that fly faster. But this is only the beginning. New developments, now in the laboratory stage, are pointing the way to even wider uses for aluminum tomorrow.

TRIANGLE . . .

(Continued from page 9)

courages harder study and better grades by serving as a constant reminder of the importance of scholarship.

High scholarship alone does not necessarily insure that a person will be either a good engineer or a good citizen, and Triangle recognizes this fact. Triangle is definitely a social, as well as a professional fraternity, and members are encouraged to take part in its various functions. Participation in intramural events is limited by the fact that the fraternity has fewer than 20 actives, but Triangle does have basketball and bowling teams, and enters into the sports requiring small teams.

Extra-curricular student activities are recognized as an asset both to the persons participating and to the school, so members are also encouraged to work on any activity on which they have a true interest. It is a policy of Triangle, however, not to force members into such work merely for the sake of participation, so no one is asked to work on an activity unless they wish to do so.

While Triangle limits its membership to engineers and architects, it does not limit it to undergraduates. Graduate students, professors, and outstanding men in the engineering field are eligible for election as national honorary members, or as honorary members of an individual chapter. Such men as Daniel W. Mead, authority on hydraulics, formerly at the University of Wisconsin, and Arthur N. Talbot, for whom Talbot laboratory is named, are indicative of the type of person elected to the former status. M. L. Enger, dean of the engineering college, A. C. Willard, president emeritus of the University of Illinois, H. H. Jordan, associate dean of the College of Engineering, and A. R. Knight, professor of electrical engineering, are some of the several men elected by this chapter as honorary members. The latest initiate is W. L. Everitt, head of the electrical engineering department here, and recently named dean-elect of the engineering college. The two faculty advisers to the Illinois chapter, R. S. Crossman and L. D. Walker, are alumni members.

Triangle is much more than a group of persons who eat, sleep, and live engineering. It is an active social fraternity which has combined many of the features of professional and honorary fraternities. It is firmly rooted at Illinois and elsewhere, and should remain as long as engineers and engineering students remain.

Then again, maybe the professor who sent his wife to the bank and kissed his money goodbye wasn't so absent-minded after all.

I.A.S.

The aero's announce some great things in store for all aeronautical engineers, and especially for those who belong to the I.A.S.

In the spring, the aeronautical engineering department will take over the greater part of the first floor of the Transportation building and will replace railway motifs with aviation displays, including scale models of airplanes. A model airplane meet and the I.A.S. regional convention are also planned.

The highlights of the meeting on October 14, 1948, were a technical movie titled, "Martin PBM-3 Static Wing Test" and comments on the film by Prof. John M. Coan, who worked on similar projects prior to the recent war.

"Are you going to take this lying down?" boomed the candidate.

"Of course not," said a voice from the rear of the hall, "the reporters are doing that."

* * *

'Twas midnight in the parlor
'Twas darkness everywhere;
The silence was unbroken—
There was nobody there.

DETECTED BY SOUND . . .

(Continued from page 13)

in the oscilloscope, and voltage readings are taken with the vacuum tube voltmeter. A much higher voltage is read at the instant when the gas is subjected to radiation than when the shutter prevents exposure of the gas to intra-red.

Carbon dioxide-water mixtures seem to absorb more radiation than other gas mixtures used in the interferometer. The intra-red coupling effect in these mixtures exhibits markedly different characteristics depending on the water vapor concentration. This is easily understood in view of the fact that water vapor has a number of strongly absorbing bands in the infra-red region of the spectrum.

The distance between the driver and detector crystals is adjusted to be some multiple of the wave length of the supersonic vibration. When this distance is ten wave lengths, the energy of the sound wave is decreased by a factor of 16 at the time of maximum radiation absorption. This means that the detector crystal receives alternately large and small amounts of energy.

Two distinct types of coupling take place between the infra-red radiation and the supersonically excited gas. The simpler, due to periodic heating of the gas by radiation, has relatively slow response. When the gas is irradiated with infra-red, the rising temperature of the gas causes a changing velocity of sound, and consequently, a corresponding shift in wave length of the supersonic vibrations. The shift of wave length is proportional to small temperature changes. The time lag in heating the gas column, however, causes a decrease in the effect of this coupling at fast shutter speeds.

A second type of coupling, present at all shutter frequencies, deals with a change in the absorption coefficient of the gas molecules. Radiation changes the number of molecules in states associated with high acoustic absorption. The modulation amplitude (effect of radiation on the supersonic field) remains fairly constant despite varying shutter speeds. Very rapid response detectors for use in the far infra-red regions are made possible by this second type of radiation effect, as there is an infinitesimal time lag in the coupling action.

This may mean that detection of airplanes by the heat of their exhaust gases will actually be feasible. Anti-aircraft gunners of the future may use the slogan, "Where there's smoke, fire!"

The slogan for a night's entertainment: So-fa and no-father.

Quick, Doctor, do something! I was playing a harmonica and swallowed it.

Keep calm, sir, and be thankful you were not playing the piano.

* * *

She: "I ought to leave you and go home to mother."

He (angrily): "Well, why don't you?"

She: "I can't. She's left father and is coming here."

* * *

A pedestrian is a case of survival of the flittest.

Answers to Vocabulary Quiz

1. d, 2. a, 3. b, 4. a, 5. b, 6. a, 7. b, 8. d, 9. b, 10. b, 11. a, 12. c, 13. a, 14. b, 15. c.

Crossword Answer

■	L	E	A	■	H	A	W	K	S	B	E	E	■
C	O	L	T	■	O	P	A	L	■	R	A	S	H
R	O	D	■	M	U	S	S	■	L	A	S	S	O
U	P	■	B	A	S	E	■	H	I	N	T	■	C
I	■	D	A	R	E	■	F	U	E	L	■	S	H
C	L	A	R	K	■	T	O	N	■	Y	E	W	S
K	I	N	■	S	T	R	I	T	E	■	R	A	T
S	N	A	P	■	E	E	L	■	M	A	N	N	A
H	E	■	L	A	N	E	■	R	E	T	E	■	D
A	■	M	A	S	T	■	H	A	R	E	■	S	T
N	O	O	N	S	■	D	A	V	Y	■	P	I	E
K	A	N	T	■	R	O	L	E	■	K	E	R	R
■	R	O	E	N	T	G	E	N	■	G	E	E	■

WELDING . . .

(Continued from page 11)

sibility of incomplete diffusion due to variations in the material. The use of the normalize will tend to increase homogeneity where the same is lacking. However, any subsequent heat treatment must be predicated upon a full knowledge of the crystalline structure that is present or else there is the danger of grain growth and oversized grains.

The weld material showed as good ductility as did the parent metal while the endurance limit was greater than that of the original metal. There has been no definite explanation of this phenomenon but it is speculated that the effect is due to the orientation of the newly formed crystals in the former boundary area. The conclusion then, that can be made, is that the weld is not the limiting factor in the selection of the material to be used on a particular job.

Of the other physical properties, the yield point was slightly higher for the weld, but the ultimate remained very closely in agreement with the original value. The hardness of the weld was only slightly greater, and the use of the normalize treatment eliminated this difference within the range of practicability.

What are the problems which face the industrial user of the solid-phase welding process? There are several which are important but not insurmountable obstacles. The greatest problem is providing a means of establishing and maintaining a constant pressure between the pieces to be welded. The question of heating the zones of the metal immediately adjacent to the interface uniformly and equally becomes more difficult as the sizes of the pieces become greater. This is definitely a production process in that the initial investment is a high one and as yet not too flexible a procedure has been developed.

The process has been used successfully in the welding of medium sized pressure vessels, tie rods, and other such items where quantity production is the immediate objective.

In conclusion, a summation is in order. It has been shown that the liquid-phase welding methods possess some certain inherent difficulties which are not obtained in the solid-phase methods. The solid-phase method has been shown to be a workable one and a good one in so far as the physical properties of the metal are concerned. The great problem of the future, in solid-phase work, will be the experimentation with the many and varied possible combinations of metals that may possibly be joined through the medium of pressure, temperature, and time, without resort to a liquid phase.

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Two farmers met on a country road, and pulled up their teams.

"Si," said Josh, "I've got a mule with distemper, What did you give that one of yours when he had it?"

"Turpentine. Giddap!"

A week later they met again.

"Say, Si, gave my mule turpentine, and it killed him."

"Killed mine, too. Giddap!"

* * *

"I can't imagine what we ever got married for; we're totally different in every way."

"Oh, you flatterer."

MEN OF EXPECTATIONS . . .

(Continued from page 12)

In *technical* work the engineer solves technical problems under the general supervision of someone else who determines what problems are to be attacked and when a satisfactory solution has been obtained.

In *supervisory* work the engineer assigns problems to other engineers under his direction and supervises their work. He is usually responsible for the proper operation of a group or a department in an organization.

In *executive* work the engineer is concerned with the broader aspects of the operation of his company. This includes problems of general policy, organization and coordination, personnel, finance, law, and public relations. Many engineers hold important executive positions, this being particularly true in the engineering industries.

For the first few years after graduation the young engineer normally works on technical problems under the supervision of an experienced engineer. During this time he should be preparing himself, through study and observation, to assume direction of the efforts of others. This study should include such fields as human relations, management, labor relations, corporate finance, economics, and business law as well as subjects in his field of technical specialization. He should also begin to participate in the civic and sociological activities of his community so that the benefit of his training in handling problems will be available for the general welfare of all.

College Training of the Engineer

The prospective engineer should realize that the engineering college graduate is not a finished engineer. He does have, however, the foundation on which he can continue to build his career through experience and further study.

The foundation resulting from college training is so important in the development of the engineer that it must be as solid as possible. This requires an understanding and appreciation of the objectives of engineering college training. These objectives are to impart *knowledge*, to develop the *mental skills*, necessary to make use of the knowledge, and to develop the *attitudes and personal characteristics* which make it possible to get the greatest return from the application of the mental skills, in other words, to become a successful engineer and a good citizen.

The attainment of the foregoing objectives requires a carefully designed curriculum administered by good teachers.

An examination of the first two years shows that they are largely devoted to

(Continued on page 38)

MEN OF EXPECTATIONS . . .

(Continued from page 36)

a study of fundamental laws and principles; development of the ability to find sources of information; and development, likewise, of facility in comprehension, expression, and visualization. Some factual information is, of course, accumulated and a start is made on the development of judgment and the ability to think straight.

Mathematics is a means of conveying ideas in symbolic form and is a tool needed in engineering calculations. Drawing is another important means of conveying ideas. Additional development in comprehension and expression and also development in the ability to find sources of information is given by the study of rhetoric and public speaking. The ability to write and speak clearly, concisely, and correctly is a necessity for the engineer, as he must convey information and ideas to others. Descriptive geometry has its greatest value for the prospective engineer in that it develops visualization, or the ability to set up mental pictures.

Further examination of the curriculum shows that the last two years are mainly devoted to technical courses. In these the student acquires a technical vocabulary and factual information in his field as well as further training in visualization and in analysis and synthesis. By contact with problems based on practical application he also begins to develop the judgment needed in his professional work.

It will be noted that the technical courses of the later semesters are usually arranged as options. This permits the student to work in the field of his special interest and reduces the general field sufficiently to permit a deeper and more detailed study than would be possible otherwise. This opportunity to work on more difficult problems results in a greater development and growth for the student along the lines of an engineering solution.

Much of the student's development in the ability to think straight, in the ability to analyze and synthesize, of confidence in his ability to learn, of honesty with facts and men, in the spirit of cooperation, in leadership, and in such characteristics as imagination, ingenuity, resourcefulness, industry, initiative, and self-reliance comes about more from the way a course is taught than from the material itself. This is true of the laboratory courses as well as for the theory courses. In the laboratory the development is accomplished by using experiments which are actually in the form of problems. With the problem type of experiment the responsibility for the determination of the data to be taken, the procedure to be followed, and the use to be made of the data is left mostly to the student.

In addition to the technical courses in the last four semesters, provision is made for the student to select a limited number of electives. Thus he has the opportunity to develop along cultural lines and in fields that will make him conscious of his broader responsibilities to his community and society in general. To utilize these electives most efficiently the student should select them to fit into an over-all general plan. Therefore during his second year he should gather as much inrfomation on this subject as possible and select the complete list to fit into an integrated whole. To aid the student in this selection the following reasons for the choice of an elective are given.

(1) Subject develops cultural and sociological background—are, literature, history, music, sociology, political science, classics, philosophy, languages, etc.

(2) Subject requires criticism of student's efforts — speech, business letter writing, report writing, dramatics, modern languages, etc.

(3) Subject requires specialized equipment or library facilities—bacteriology, astronomy, botany, zoology, archeology, etc.

(Continued on page 40)

MEN OF EXPECTATIONS . . .

(Continued from page 38)

(4) Subject develops a hobby for recreation in professional life—geology, astronomy, music, botany, dramatics, etc.

(5) Subject is advantageous or adjunct in professional work—economics, business law, mathematics, industrial relations, accounting, etc.

It should be apparent that every course in the curriculum may contribute in some way or other to the attainment of each of the objectives of engineering college training. In the preceding discussion only the major contributions were pointed out.

The student should realize from the beginning that true education comes from the inside—that is, *the student educates himself.* It has been said that education consists of working *one's self* out of a state of mental confusion and that the complexity of the problem a student can solve is a measure of his capability. The curriculum, the University organization, and the instructors foster the student's growth in self-education by presenting the training material in properly graded steps and by helping the student acquire the techniques necessary in self-education. The student can contribute considerably to his growth by the way he studies. In this respect the word WHY is of the utmost importance. Studying with a questioning attitude, trying to determine the WHY for everything, rather than trying to remember only the end result, will help a great deal in the process of self-education.

In the complete educational program to develop an engineer it must be recognized that certain concepts are best taught in the university and that other ideas can be learned best by outside contacts, notably those in industry. For the closest integration between these two areas of learning, contact with industry should not be postponed until after graduation. Work in an industrial environment gives the student the opportunity to:

(1) Learn by experience how an industrial organization functions.

(2) Set up mental pictures of shops, apparatus, and devices which will be valuable in later college study.

(3) Secure experience and information which will be helpful in the selection of an option and of the type of industry to work in after graduation.

(4) Observe and obtain knowledge of labor relations through actual work with the men who produce. (This association can be more intimate at this time than after graduation, when the student becomes a member of an engineering department which is usually associated more with planning than production.

The student will receive less guidance in industry than in the university. Consequently, the value derived from the summer work in industry will depend largely upon the student himself.

Although not often mentioned, a good personality is also an important factor in the attainment of success in engineering just as it is in nearly all other walks of life. When several men of equal abilities are being considered for promotion, the man with the better personality will nearly always be selected. Conversely, numerous cases exist where an otherwise well qualified man is not promoted because of a poor personality. Thus the student should give considerable attention to developing his personality, to the end that he will become possessed of good personal and social traits. Just as in the development of mental skills, development of a pleasing personality requires initiative and earnest effort. The student will find that improvement in his personality can be accomplished better by association with his fellow men than by formal education. He should take advantage of opportunities to de-

(Continued on page 42)

He's a Square D Field Engineer... his full-time job is working with industries of every kind and size in finding "a better way to do it." He talks less about theory, more about proven practice. He has a tremendous amount of actual experience to back him up.

Through a staff of such Field Engineers located in more than 50 offices in the United States, Canada and Mexico, Square D does this three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends, speeds development of new methods and equipment.

If you have a problem in electrical distribution or control, call in the nearby Square D Field Engineer. He makes a lot of sense in finding **"a better way to do it."**

For many years ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

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MEN OF EXPECTATIONS . . .

(Continued from page 40)

velop himself socially by attending parties, group meetings, church activities, banquets, dances, and other social functions.

One of the definitions of the word "tool" given by Webster is "anything that serves as a means to an end."

Every profession has certain necessary tools which an individual must expect to acquire as a part of his investment in his future success. The following items are essential to the engineer. They are mentioned here because they should be purchased early in his collge career so that, by repeated use, he will feel thoroughly at home with them:

(1) Drawing instruments—for clarity in the graphical presentation of ideas.

(2) Typewriter— for clarity in the written presentation of ideas.

(3) Slide rule—for speed and reasonable accuracy in computations.

(4) Tuxedo—for freedom and ease in associations with people on formal occasions.

An adequate library is also an important tool of the engineer. The collection of such a library, containing not only required texts, but also important reference works and technical periodicals, requires time and money, and should be started as early as possible.

SIGMA PHI DELTA . . .

(Continued from page 9)

are red and black, and the official flower of the fraternity is the American Beauty rose. The pledge button has a red triangular background on which is a black castle, the whole bordered in gold. The active pin is triangular in shape and upon the face are three raised arms bearing the characters of the fraternity name. In the center of the pin shines a ruby. A star in each of the three apexes of the triangle completes the pin.

Delta chapter of Sigma Phi Delta is located at 1103 West Illinois street, Urbana, Illinois. President of this fraternity, strictly for engineers, is Robert S. Degenkolb, a student in ceramic engineering. Members of Sigma Phi Delta may be found in almost all branches of engineering, including chemical and architectural engineering. Likewise, members of this fraternity may be found in most of the engineering activities, including the Engineering council, The Technograph, Sigma Xi, and other engineering societies and honoraries.

Dual membership is not permitted members of Sigma Phi Delta. The founders of this fraternity combined the functions of all three types of fraternities—honarary, professional, and social, into one fraternity. Delta chapter justifies the faith of the charter members by retaining a high position on the all-fraternity scholarship roster each semester. The last two semesters, the fraternity has held a high second place. The social life of the engineering student is limited by the amount of time he has to devote to his laboratories and studies. Therefore, a social program which tends to provide a well-rounded individual, but which does not occupy too much time, is the aim of the chapter. Sigma Phi Delta is a member of the Interfraternity council and the Professional Interfraternity conference. Twenty-eight members of Sigma Phi Delta live in the chapter house and 12 members elsewhere on the campus. The fraternity participates in the intramural activities sponsored by the I. F. council and supports all the other activities and plans of the council.

Faculty members of Sigma Phi Delta fraternity are Professors Babbitt, Crandell, Knight, Straub, Tuthill, and Wiley. There are also some alumni in teaching and research positions on the faculty. Delta alumni of Sigma Phi Delta have been very active and cooperative in the support of the active chapter. The alumni chapter continues the ties of brotherhood after the members graduate and leave the campus. There are approximately 1,800 alumni members of Sigma Phi Delta throughout the engineering profession.

"I'm anxious to make this a good shot. That's my mother-in-law watching up on the club house porch."

"Don't be a fool. You'll never hit her at 200 yards."

* * *

Author: "I have just written my first novel. There isn't an immoral line in it."

Critic: "That's not a novel; that's a textbook."

* * *

Jones: "His father died from hard drink."

Bones: "He did?"

Jones: "Yes, a cake of ice fell on him."

* * *

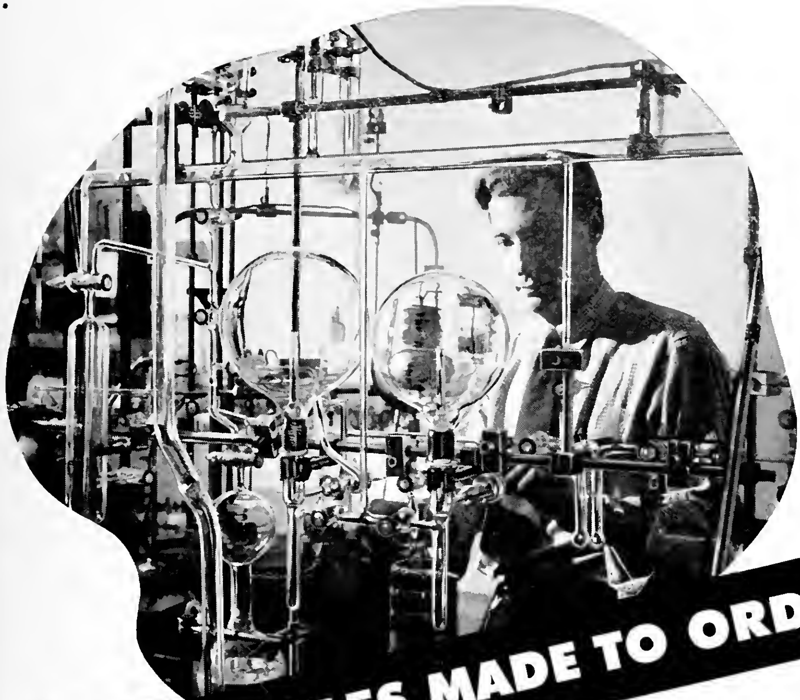
Old Lady: "I wouldn't cry like that, my little man."

Boy: "Cry as you damn please, this is my way."

* * *

"I can't marry him, mother, he's an atheist and doesn't believe there is a hell."

"Marry him, my dear, and between us we'll convince him that he's wrong."



SOCIETIES . . .

(Continued from page 17)

I.T.E.

Tweet! Pull over to the curb, Bub! Thus the local student branch of the Institute of traffic engineers is off to a big start again this year. Their first meeting, held on September 24, was merely an introductory meeting to get the new students and prospective members acquainted with the group.

Only five former members yet remain in the I.T.E. The enrollment now stands at 17, with hopes of reaching the 25 mark in the next few meetings.

This organization, devoted to the studies of traffic problems in the Twin-Cities area, has offered many recommendations in their short existence. Some of these recommendations have been used and have produced remarkable results.

The second meeting of the I.T.E. was held on October 5. At this time a problem program for the following semester was outlined. It was decided to investigate: (1) parking problems on the University of Illinois campus, and (2) Temporary traffic problems due to the large amount of construction about the campus. It was also decided to make follow-up reports on last year's recommendations to see what improvements, if any, were brought about by them.

The last meeting, held on October 19, was devoted to talks by Prof. C. C. Wiley, and Prof. Eilis Danner on the problem program for the coming semester.

TAU BETA PI

With the fall semester well under way, the various committees of Tau Beta Pi are hard at work ironing out the details of the election, examination, and initiation of new pledges.

The new chapter officers have been elected for the spring term. Robert Carlson was elected to fill the office of president, and James Crawford was elected to the post of vice-president.

Charles E. Drury, chapter president, attended the national convention of Tau Beta Pi held at the University of Texas, Austin, Texas, from October 14 to 16 inclusive. While at the convention, Drury came in contact with many prominent alumni of the University of Illinois. Among them was Robert C. (Red) Matthews. Matthews was introduced between halves of the Arkansas-Texas football game as the father of organized cheer-leading. Matthews became a member of Illinois Alpha of Tau Beta Pi in 1902. At the present time he is a member of the faculty of the University of Tennessee.

A.I.E.E.-I.R.E.

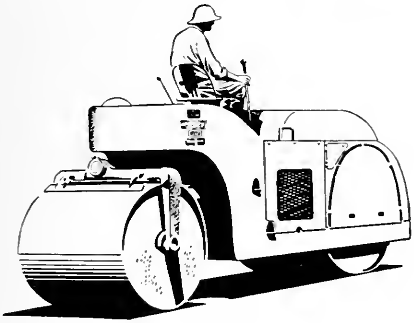
About 115 members of the A.I.E.E.-I.R.E.E. went on a field trip recently to Springfield to visit the Sangamo Electric plant. These field trips are an important part of the extensive program of the electrical and radio engigineering societies; two will take place each semester.

The organization's over 500 members will be able to keep up to date now by reading the A.I.E.E.-I.R.E.'s newsletter, "What-Meter." The meeting of November 9 included a lecture given by a member of the University's electrical engineering research laboratory staff. C. N. Hoyler of the R. C. A. research laboratory at Princeton, N. J., spoke on Electronic Computers and Counters" at the meeting of November 19.

The A.I.E.E.-I.R.E. also has its fair share of brains. Ed Schwartz, its secretary, has received the Eta Kappa Nu outstanding junior award. Congratulations, Ed!

M. E.: "Resist the temptation."
E. E.: "Would, but it may never come again."

Another page for **YOUR BEARING NOTEBOOK**



How to keep a tandem roller from doing the shimmy

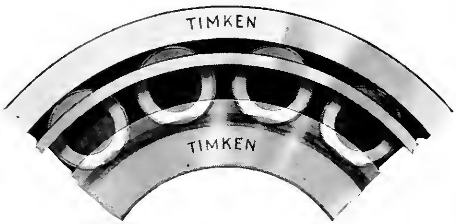
The king pin bearings on tandem road rollers like this take heavy thrust and radial loads. If wear and looseness develop, shimmy is the result. Here's another example of a difficult problem that engineers solve by using Timken tapered roller bearings.

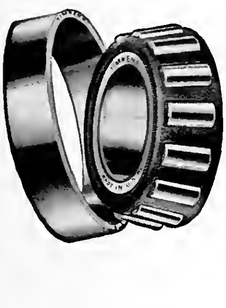
Timken bearings take both thrust and radial loads in any combination. Their true rolling motion means smooth, almost frictionless operation with negligible wear. Easy, accurate steering and freedom from shimmy are assured, even after years of hard service. The need for frequent lubrication is eliminated and maintenance is reduced to a minimum.

Here's why Timken® rollers stay in positive alignment

Accurate and constant roller alignment in Timken tapered roller bearings is assured by their design. Wide area contact between the roll ends and the rib of the cone keeps the rollers stable. It prevents skewing, eliminates the need for alignment by the cage, and increases load capacity.

The Timken Roller Bearing Company developed the principle of positive roller alignment—one more reason why Timken bearings are the number one choice of engineers everywhere.





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TAPERED ROLLER BEARINGS

Want to know more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

An Engineer Goes Through Hell!

Three men—a lawyer, a doctor, and an engineer—appeared before St. Peter as he stood guarding the pearly gates.

The lawyer stepped forward—with confidence and assurance he proceeded to deliver an eloquent address which left St. Peter dazed and bewildered. Before the venerable Saint could recover, the lawyer quickly handed him a writ of mandamus, pushed him aside and strode through the open portals.

Next came the doctor. With impressive, dignified bearing, he introduced himself: "I am Dr. Brown." St. Peter received him cordially. "I feel I know you, Dr. Brown. Many who preceded you said you sent them here before their time. Welcome to our city!"

The engineer, modest and diffident, had been standing in the background. He now stepped forward. "I am looking for a job," he said. St. Peter wearily shook his head. "I am sorry," he replied, "we have no work here for you. If you want a job you can go to Hell."

This response sounded familiar to the engineer and made him feel at home. "Very well," he said, "I have had hell all my life and I guess I can stand it better than the others."

St. Peter was puzzled. "Look here, young man, what are you?" "I am an engineer," was the reply. "Oh, yes," said St. Peter. "Do you belong to the Locomotive Brotherhood?" "No, I am sorry," the engineer responded apologetically, "I am a different kind of engineer." "I do not understand," said St. Peter, "what on earth do you do?"

The engineer recalled a definition and calmly replied: "I apply mathematical principles to the control of natural forces." This sounded meaningless to St. Peter and his temper got the best of him. "Young man," he said, "you can go to Hell with your mathematical principles and try your hand on some of the natural forces there!"

And it came to pass that strange reports began to reach St. Peter. The celestial denizens, who had amused themselves in the past by looking down upon the less fortunate creatures in the Inferno, commenced asking for transfers to that other domain.

The sounds of agony and suffering were stilled. Many new arrivals, after seeing both places, selected the nether regions for their permanent abode. Puzzled, St. Peter sent messengers to visit Hell and report back to him. They returned, all excited, and reported to St. Peter:

"That engineer you sent down there," said the messengers, "has completely transformed the place so that you would not know it now. He has harnessed the fiery furnaces for light and power. He has cooled the entire place with artificial refrigeration."

"He has drained the lakes of brimstone and has filled the air with cool perfumed breezes. He has flung bridges across the bottomless abyss and has bored tunnels through obsidian cliffs. He has created paved streets, gardens, parks and playgrounds, lakes, rivers and beautiful waterfalls.

"That engineer has gone through Hell and has made of it a realm of happiness, peace and industry."

—Reprinted from News Letter of Association of Professional Engineers of the Province of Ontario, Canada.

Liquor Salesman: "Y'know, I hate to see a woman drink alone."

Food Salesman: "I hate to see a woman eat alone."

Mattress Salesman: "Say, what do you fellows think of the cold weather we've been having?"

* * *

A faith healer ran into his old friend Max and asked how things were going.

"Not so good," was the pained reply. "My brother is very sick."

"Your brother isn't sick," contradicted the faith healer, "he only thinks he's sick. Remember that: he only *thinks* he's sick."

Two months later they met again and the faith healer asked Max, "How's you brother now?"

"Worse," groaned Max, "he *think's* he's dead."

* * *

A girl who worked as a hostess in Roseland was complaining to her friend, also a hostess, that she was never invited out to swell parties. "I get invited once—but that's all." Her friend took her aside and said, "The reason that you're never invited again is that you can't discuss any subject with people. Read a book and you'll become an interesting conversationalist." So the social climber read a book.

When she was invited to a party a few days later, she was all prepared. She listened to the conversation for a while and then cut in, "Say, wasn't that tough about Marie Antoinette?"

Temperature Ranges Required for Pressure Vessels

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Demonstrate Controllability of *GAS*

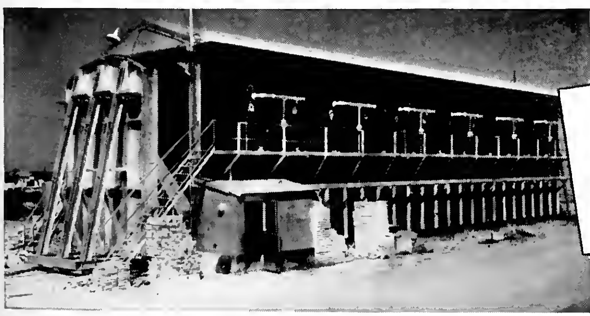
Safety codes govern many of the manufacturing and testing methods for pressure vessels. One of the most important processes, stress relieving, requires precise control of temperatures throughout the cycle—just the type of temperature control to be found in thousands of industrial applications of GAS for heat treating.

Specialists in the manufacture of pressure vessels depend on GAS for heat processing of all types. The pioneering firm of Black, Sivalls and Bryson, Inc., Kansas City, uses GAS in the manufacture of tanks, valves, pressure vessels and safety heads. President A. J. Smith says,

"Throughout the past 25 years we have depended on GAS to provide the exacting temperatures for our work. In many of our plants we have developed special GAS equipment; our large stress-relieving furnace at Oklahoma City is a typical example."

In this large furnace the GAS control system is arranged to provide temperatures up to 1200° F. for any time-cycle required. Automatic regulators and recording pyrometers assure maximum fuel efficiency while the flexibility of GAS is an important factor in maintaining production schedules on vital equipment.

Stress-relieving is just one of the applications of GAS for heat processing. You'll find hundreds of other uses for the productive flames of GAS—they're worth investigating.



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THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

One of the largest stress-relieving ovens in the United States, this installation at Oklahoma City is 77' long, 12' wide, 18' high—Gas-fired and equipped with recording pyrometers.

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE NEW YORK 17, N. Y.

"Mister, if you think you can kiss me like that again, I'll have something to say about it."

"Well, I'm going to, so start talking."

"The light switch is right next to the piano."

* * *

The Human Race—the only race which is never over and which no one ever won. Each succeeding generation is a new relay. They travel 'round nature's course neck and neck and usually end up tied!

* * *

When you knock at the door and find hubby home, then, brother, sell something.

* * *

The Old Maid: "Has the canary had its bath yet?"

The Maid: "Yes, he has, ma'm. You can come in now."

* * *

Student: "I could dance on like this forever."

Coed: "Oh, don't say that. You're bound to improve."

* * *

"Don't talk to me about lawyers, my dear. I've had so much trouble over the property that I sometimes wish my husband hadn't died."

* * *

Bill: "The girl I am married to has a twin sister."

Mac: "Gee! How do you tell them apart?"

Bill: "I don't try. It's up to the other one to look out for herself."

* * *

"I hear he was a big gun in college."

"That so? What kind?"

"A sort of smooth bore."

* * *

Then there's the bachelor who got thrown out of his apartment when the landlady heard him drop his shoes on the floor twice.

Zoo Visitor: "Where are the monkeys?"

Keeper: "They're in the back, making love."

Visitor: "Would they come out for some peanuts?"

Keeper: "Would you?"

ANNOUNCING — a new department — "Letters to Ye Ed," in which you will have the opportunity to express your ideas on any thing that interests you: pet peeves, campus activities, suggestions, etc.

Letters should be addressed to The Illinois Technograph, 213 Engineering Hall, University of Illinois, Urbana, Illinois. Length of the letters should not exceed 300 words, and they must be signed by the sender. Names will be withheld upon request.

A wealthy dowager invited about 50 soldiers from a near-by camp to her home. At about 4 o'clock, she served cookies and lemonade. At about 5 she served more cookies and lemonade. At about 6, she stood up and said, "I have just four more cookies left—now what shall I do with them?"

Immediately a lieutenant stood up and said, "The first guy who answers gets the guardhouse for a week."

* * *

Ed Gardner's friend, Finnegan, was down at Duffy's Tavern enjoying a glass of beer. "How many barrels of beer do you use a day?" he asked the proprietor.

"Four," said the barkeep. "Why do you ask?"

"Cause I can tell you how you could use eight barrels a day."

"You can?" came the delighted response. "How can I?"

"Give full glasses," Finnegan retorted bitterly.

* * *

Mother: "What took you so long to say goodnight to that fellow?"

Daughter: "But, mother, if a boy takes you to a movie, the least you can do is to kiss him goodnight."

Mother: "But, I thought you went to El Morocco."

Daughter: "Yes, mother."

* * *

In the old days, when a fellow told a girl a naughty story, she blushed. Nowadays, she memorizes it.

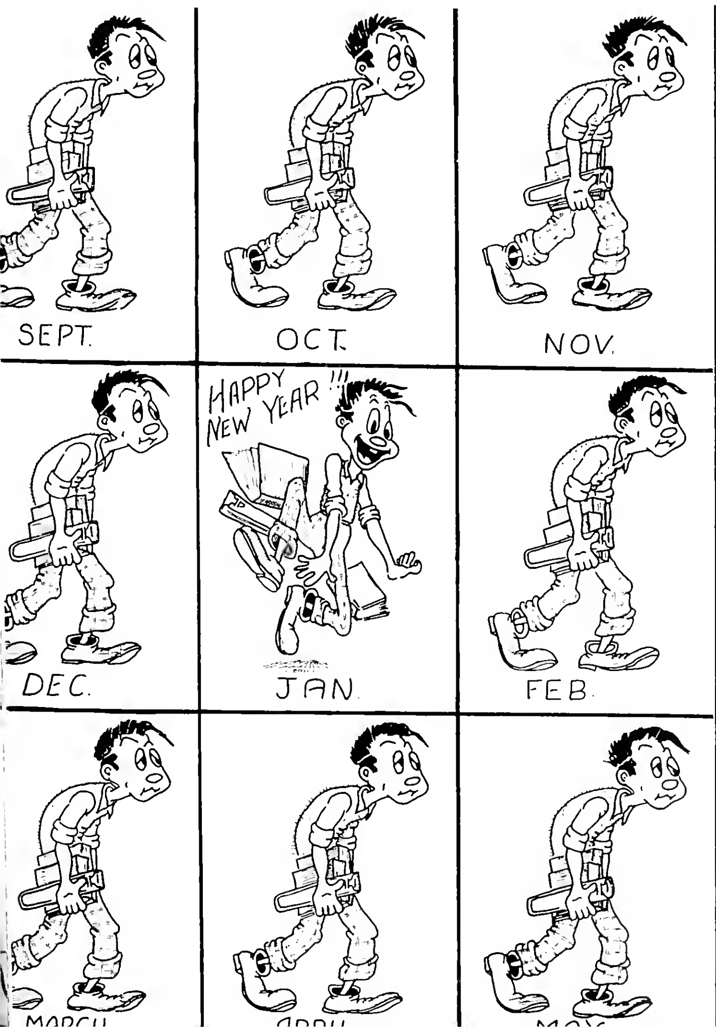
* * *

Then there was a girl named "Checkers" because she jumped whenever you made a wrong move.

SPEAK UP, HENDRICKS. I CAN'T HEAR A WORD YOU'RE SAYING!

The Illinois Technograph

JANUARY, 1949



★

TWENTY-FIVE CENTS

The Engineering Honoraries and Societies

By Bill Soderstrum, Cer.E. '52 and Bill Stahl, E.E. '52

A.I.E.E.-I.R.E.

Featured at the November 9 meeting was a demonstration and lecture by Professor Van Velzer concerning electron discharge in vacuum tubes. One very colossal demonstration featured the balancing of a twenty-foot two-by-four on a watch glass. The remainder of the meeting took place in the electron tube research lab.

Although the present membership is in excess of 500, A.I.E.E.-I.R.E will sponsor another membership drive next semester, hoping to attract even more prospective members.

The Weston Electrical Instrument company of Chicago is sending to the December 27 meeting a representative who will lecture on the theory and operation of electrical meters. Supplementing the talk will be some special "blown-up" meters, which will illustrate, in exaggerated detail, the mechanisms involved.

The final entries in the A.I.E.E.-I.R.E. "Technical Paper Contest" will be judged December 14. The writer of the winning paper will receive a ten dollar first prize as well as have his paper go into the graduate competition to be judged next spring.

A.S.C.E. (Navy Pier)

The American Society of Civil Engineers, a branch of the oldest engineering organization, was organized at Navy Pier in October, 1946, shortly after school started. Its purpose is to bring all student civil engineers together for their mutual benefit.

The chapter, in the past, has had one business and one instructional meeting per month. At the instructional meetings it is customary to have an engineer from some firm speak on a topic of interest to engineers and engineering students. The speakers are chosen from all branches of civil engineering, such as transportation (highways and railroads), sanitation (water supply and sewage), structural (bridges and buildings), and other related fields.

Posters announcing the time and place of these meetings appear on several bulletin boards throughout the hall.

The chapter's activities include guided inspection trips to various projects. With the chapters of the Illinois Institute of Technology and Northwestern Technological Institute, the members of this society were guests of the Illinois section of the American Society of Civil Engineers at a meeting held at Navy Pier on November 1. Over 300 members and students were present.

The officers at the present time are A. J. Boyle, president; F. J. Koepke, vice-president; R. Dzierzanowski, secretary; and J. Ratski, treasurer. The sponsor of the organization is Mr. J. C. Chaderton of our G.E.D. department.

A.S.C.E.

If you have had occasion to visit the vicinity of the Armory lately, you no doubt have run into several civil engineering students with their transits and chains. They aren't always looking through transits, however. Sometimes they are watching other fellows look through them. Thus was the program of the November 9 meeting of the A.S.C.E.

After a short business meeting, on that date, a social meeting was held. At this social meeting, films were shown of the summer surveying camp in Minnesota last summer. Also on the program was the group of singers which sang at the camp last summer. After this entertainment, refreshments were served.

During the business meeting, plans were laid for a dinner meeting with the central section of the American Society of Civil Engineers. This meeting was held in the middle of December.

A.I.E.E. (Navy Pier)

At the organizational meeting of the American Institute of Electrical Engineers an election of new officers was held with the following results: Joseph Loos, Jr., chairman; Everett S. Remus, vice-chairman; George Conetzsky, secretary; and Harold G. Cohon, treasurer. For each of the two committees, only two volunteers were selected. On the program committee are Bill Meyers and R. T. Paul; Tony Creco and R. B. Laube are on the advertising and publicity committee.

A program of movies, lectures, and field trips is being planned by the new officers, with the possibility of at least one every two weeks.

With the vast number and variety of electrical industries in the Chicago area, it is expected that a very interesting program should be available for A.I.E.E. members next semester.

CHI EPSILON

The Chi Epsilons have added another bunch of fellows to their little brood. Last month, at a banquet, 29 pledges were initiated into this honorary civil engineering fraternity. The addition of these men will boost the present membership to 54.

The names of the pledges are as follows: Robert Renwick, Clifton Woest, Donald Waggoner, John Goodell, Robert Williams, Howard Morey, A. Bemis, Charles Givens, Floyd Brown, George Wear, Roger Schierhorn, William Mottershaw, James Chandler, Jacob Whitlock, Harvey Hunt, Suat Atay, Allen Kanak, Wilford Novotny, Neal Hennegan, William Swofford, Henry Suzuki, Don Kaminski, Max Weberling, Joe Marsik, Phillip Stikes, George Keele, Wendell Rowe, Carl Sands, and Robert Hart.

A.I.Ch.E. (Navy Pier)

The American Institute of Chemical Engineers has already been on a field trip this semester to the Revere Copper and Brass corporation. They have seen two movies, "Gasoline's Amazing Molecules," and the "Story of Lubricating Oil," at their meetings thus far. Another field trip is planned to the new laboratories of Standard Oil of Indiana. At every meeting the society presents movies, and whenever possible, a lecture by a prominent man in the field of chemical engineering.

The society is sponsored by Dr. C. R. Malloy, of the chemistry department. The officers are Jerrold Radway, president; Phil Ebart, vice-president; Mrs. Charlotte Rieger, secretary; and Walter Bensen, treasurer.

A.S.M.E. (Navy Pier)

At its first meeting, the American Society of Mechanical Engineers elected the following officers: Victor E. Swen-

(Continued on page 20)

Be Careful . . .

the life you save may be your own

Standard Oil promotes this slogan of the National Safety Council as a reminder to the motoring public to drive carefully. In its own affairs, Standard Oil works and lives by the same slogan.

In the last twelve-month period reported (1948), our accident rates per million man-hours were 1.51 in the company's manufacturing department, 3.31 in our sales department. This compares with an average of 13.16 accidents per million man-hours in the entire petroleum industry, and 13.26 in all industry. It is a record we are at all times attempting to improve.

Because of our great interest in safety, we are glad to see the subject getting more and more attention every year in engineering colleges. Many mechanical engineering curricula now include courses in safety engineering.

We welcome the trend. We hope that students now being trained in safety engineering will soon be helping to make Standard Oil and thousands of other American companies better, safer places to work.

Standard Oil Company

(INDIANA)

STANDARD

STANDARD SERVICE

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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The Tech Presents

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ARTICLES

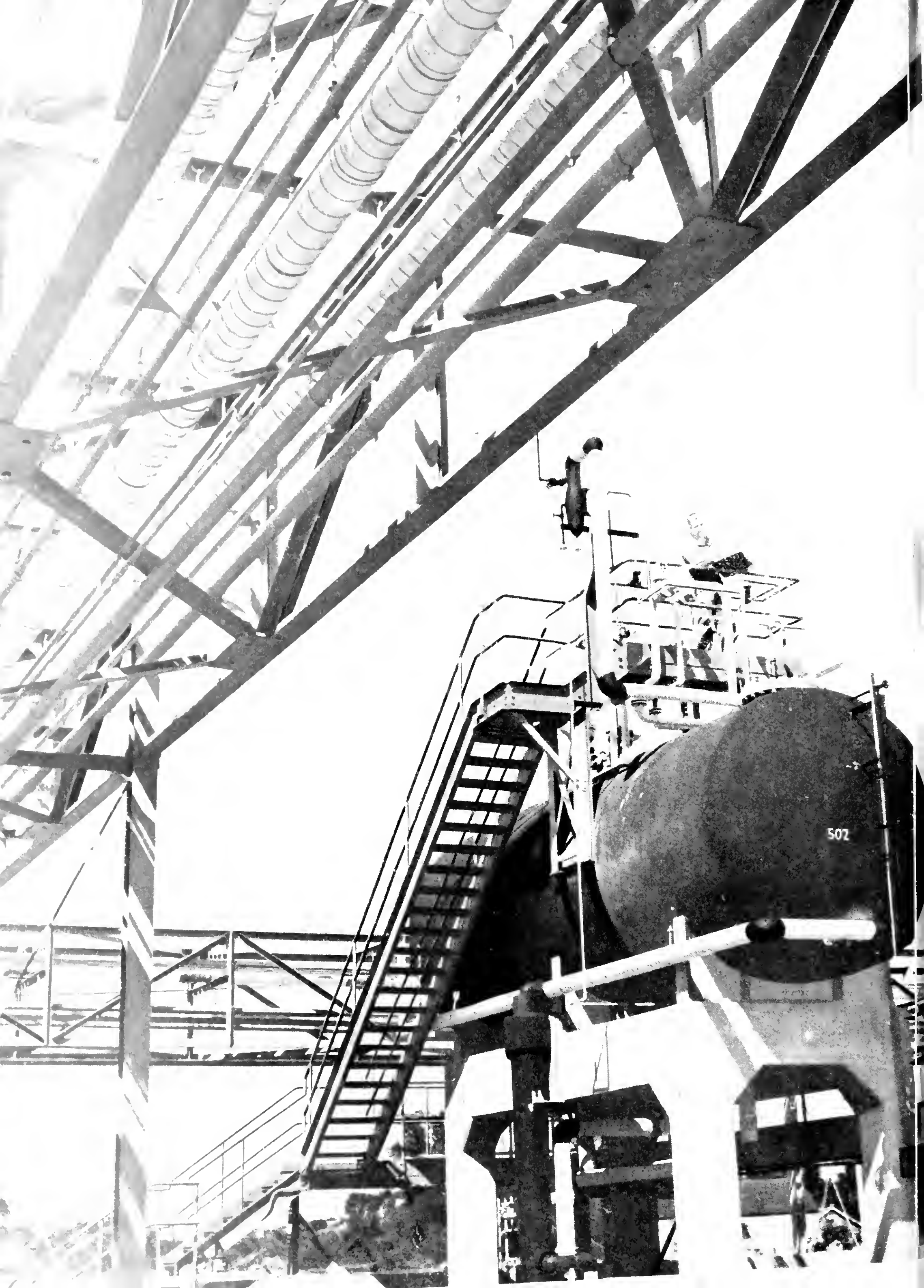
DEPARTMENTS

OUR COVER

Our talented artist, Ed Lozano, adds a bit of humor to his season's greeting.

FRONTISPIECE

Located at a silicone plant at Waterford, N. Y., this storage tank holds methyl chloride, an important ingredient in the manufacture of silicones. Silicone resins, ores, greases, and rubber are remarkably resistant to extremes of heat and cold. (Photo courtesy of General Electric).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Know Your Automobile!

By J. C. Bassie and C. M. McClymonds

The automobile is probably the second most-discussed subject in and around the classrooms and laboratories on the engineering campus. This, the first of a series of two articles to appear in the TECHNOGRAPH, is written in an effort to further the understanding of the basic concepts of the automobile, and to familiarize the reader with what the American-made car has to offer technically. Just as a girl can't be judged by her face and make-up, a car can't be judged solely by its exterior appearance, which, in any case, is tending toward uniformity in new models.

Because the engine "makes it go," the logical starting point for a discussion of the automobile would be the source of power. All stock cars being delivered to the consumer today are propelled by an internal combustion engine using gasoline as a fuel. The usual method of operation involves mixing fuel and air together outside of the engine, bringing them into the engine, and then compressing and igniting the mixture by an electrical spark.

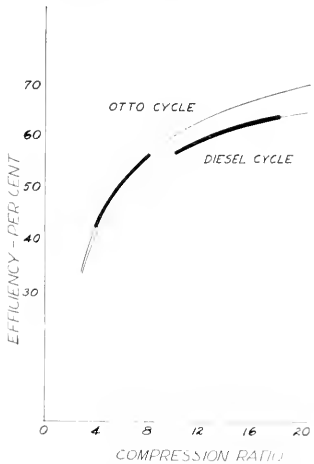
The principle used is known as the Otto cycle, and differs from the Diesel cycle in that in the latter, only the air is taken in and compressed, the fuel then injected, and the mixture ignited by the heat of compression. The thermal efficiency of both cycles increases with an increase in the ratio of the volume before and the volume after compression. This ratio is known as the compression ratio. Theoretically, the efficiency of the Otto cycle is always greater than the efficiency of the Diesel cycle for any given compression ratio. At the present time, the Diesel engine has a higher thermal efficiency than the gasoline engine, due to its higher compression ratio.

The compression ratio is not actually based on pressures, inasmuch as they vary with loads and speeds. An engine that has a 7:1 compression ratio reduces the volume of every seven cubic inches of air taken in, to one cubic inch.

It is a popular belief that an engine having a large bore and stroke, and a high horsepower rating, will consume more fuel than an engine having small dimensions and a low horsepower rating, even though they both might be delivering the same amount of power. Fuel consumption is usually determined by the amount of fuel used per horsepower output; thus, a large, high-powered engine may not use as much fuel as a small, low-powered engine, although operated under the same conditions. The fuel consumption rate per horsepower output is not a constant value. From tests of maximum power output at varying speed, it is usually found to be higher at low and high speeds than it is at intermediate speeds. Also, from tests of variable horsepower output at constant speed, it is found that the fuel consumption rate decreases slightly and then increases as the horsepower output is varied at this speed from the maximum possible to zero. At zero horsepower output, the fuel consumption rate per horsepower output is infinite. For maximum economy, the engine should be operated at some intermediate speed and at some power output just below the maximum for that speed.

An ideal condition of engine and car performance would be one in which, with increasing speed, the horsepower required by the car increased in the same manner as the horsepower output of the engine. The actual horsepower output is proportional to the speed of the engine times the torque. If the torque output is constant, the horsepower will increase in direct proportion to the increasing speed. Many manufacturers go to great lengths to keep the torque output constant but cannot entirely reach this goal. As a result, torque output is usually a maximum at intermediate speeds. The horsepower required, on the other hand, is proportional to the cube of the speed of the car. The drag on the car is mainly air resistance, which varies with the velocity of the air squared.

The maximum speed of the car is that speed at which the horsepower required equals the maximum horsepower of the engine. Since the engine speed is directly proportional to the rate at which the car moves, it would seem that the car should be geared to give the engine speed corresponding to maximum horsepower. However, since the torque is decreasing at a gradually increasing rate as the speed of maximum horsepower is approached, the horsepower peaks in a gradual manner and is nearly constant for several hundred revolutions per minute.



Thermal efficiencies are compared above, where heavy lines indicate workable ranges of compression ratio.

At any given speed between zero and maximum, the difference between the horsepower available from the engine and that required to maintain the given car speed is the power available for acceleration. This must not be interpreted as establishing the horsepower as being directly responsible for acceleration. Acceleration equals force divided by mass. In this case, the force is the torque of the engine, multiplied by the gearing, and divided by the radius of the driving wheels, with the forces retarding the motion of the car being subtracted. By having the car so geared that the required horsepower curve intersects the available horsepower curve at some point just beyond the maximum horsepower, the "pick-up" of the car can be greatly improved without losing more than a few miles per hour from the top speed.

Having a car geared for a high acceleration rate is inconsistent with economical operation. Furthermore, since the acceleration is temporary, changing gear ratios after acceleration will permit more economical operation. Neglecting first and second gears, this is accomplished by means of a hydraulic coupling in conjunction with an automatic transmission, a torque converter, or an overdrive. An overdrive gives a single, positive change of gear ratios, thus giving an exact, known, accelerating factor to an economical gear ratio. A torque converter gives a variable accelerating factor to an economical gear ratio whose maximum is greater than that supplied by an overdrive. A plain

(Continued on page 26)

ENGINEERS AS EXECUTIVES

By Glenn Massie, E.E. '49

GLENN MASSIE

When Glenn Massie first entered college before the war he planned to major in business administration. However, after four years in the Army, he decided to change to engineering. As evidenced by this article, his interest in the business side of industry has not waned. After graduation in February, he plans to enter into the production field.

Glenn has been on the TECHNOGRAPH staff for two years and is an assistant editor this semester. He is a member of Sigma Tau, Eta Kappa Nu, and A.I.E.E.-I.R.E.

Engineering graduates often hope to become executives sooner or later, since such positions pay large rewards in money and satisfaction. But in the ranks of engineers, there are many more potential executives than actual executives. Mr. J. M. Gillet, director of commercial research for the Victor Chemical works, writing in The Bent of Tau Beta Pi, explained this condition when he said, "Our engineering graduates usually come to us with a good technical preparation and are, as a rule, capable of doing well in strictly technical lines. It is when they are considered for advancement into managerial functions that many of them show a definite lack of preparedness. Most of them have no conception of business principles, labor relations, or elementary economics." Mr. Walter Evans, vice president of Westinghouse Electric, recently stated that one of the biggest needs in industry is for engineers who have the qualifications for executive positions.

There is a definite trend toward using engineers, as well as bankers and lawyers, to fill top managerial posts. Graduate engineers are the presidents of one-third of the 150 largest corporations in America. According to a survey of 500 typical industrial companies, made by Mr. Robert Spahr, director of the General Motors institute, the engineering college graduate is 12 times more likely to reach the presidency of an industrial company than is the man who graduated from a non-engineering college. He is five times as likely to be treasurer and 24 times more likely to be a sales official. All in all, the engineering school graduate is 30 times more likely to become an officer of an industrial company than is a graduate of a non-technical college. These figures show that the engineer does have an advantage. Why is this? Mr. Ernest E. Jenks, vice president of the Alexander Hamilton institute, points out that, "There is no question that engineers should make excellent executives. They have the ability to pierce the heart of complex problems with a vision uncommon among business men. Their judgment is sound, conservative, and clear of prejudice. They have logical minds—minds trained to the factual and the specific. Their reasoning qualities are mature and well balanced. They have most of the mental traits which spell success in business, industry, and finance."

Various authorities, including Dean A. A. Potter of the college of engineering, Purdue university, and Profesor Eugene L. Grant, college of engineering, Stanford university, have stated their belief that more than two-thirds of engineering graduates reach executive, managerial, or other administrative positions within 10 years of their graduation. Figure 2 taken from The Engineering Profession in Transition, published by the Engineers' Joint Council, seemingly does not bear this statement out. It indicates that of 37,000 engineers questioned, 30.9 per cent of these engineers, whose median years of professional experience numbered 22.2, were in the field of administration-management, technical. Including engineers in the fields of production, sales, personnel, and administration-management, non-technical, brings the percentage up to 41, with median years of professional experience now 18.

Figure 1 shows the occupational status broken down in terms of experience level in years. It indicates that the sharpest increase in engineers engaged in administration - management, technical, occurs during the 9-11 years. However, the number of engineers in this field, 1,100, is only 28 per cent of the number of engineers in that experience level, 3,910.

Dean Potter's statement and the Engineers' Joint Council survey may be partially reconciled by noting that only 37,000 out of the 250,000 engineers in the United States took part in the survey. These 37,000 engineers were all members of the six principal national professional engineering societies, and consequently may be supposed to be primarily interested in engineering. Many of the graduate engineers not covered by the survey may be engaged in a line of activity which is not engineering or a direct outgrowth of their engineering training. Dr. Karl T. Compton, while commenting on the fact that 50 per cent of the graduates of the Massachusetts Institute of Technology are in fields not relating to engineering, said, "The conclusion may be drawn that an engineering education is a good general preparation for life in this day and age."

When the background of the success-

Occupational Status	Experience Level in Years																
	Total	Under 1	1	2	3	4	5	6	7-8	9-11	12-14	15-19	20-24	25-29	30-34	35-39	40 or more
Total	36,541	650	477	715	1,064	1,614	1,796	1,671	2,363	3,910	2,184	4,319	6,145	3,191	2,861	2,431	2,361
Administration - management, nontechnical	1,242	3	2	6	11	19	9	18	41	68	81	160	218	168	166	143	160
Administration - management, technical	11,190	20	20	42	77	168	243	247	478	1,110	720	1,574	2,051	1,328	1,219	1,010	893
Analysis and testing	801	51	40	48	60	63	72	56	61	94	31	69	68	31	21	25	21
Construction, supervision	1 739	40	19	26	33	45	58	50	83	143	90	212	283	187	174	164	142
Consulting, independent	954	2	—	—	—	6	4	11	32	70	64	101	163	124	121	127	149
Consulting, as employee of private firm	1,579	18	11	21	23	38	43	61	92	167	88	180	226	163	154	131	163
Design	5 631	128	98	142	213	327	398	370	484	711	327	639	666	336	291	187	214
Development	2 552	67	58	99	206	231	268	199	265	302	138	225	222	104	87	68	43
Drafting	428	67	45	35	29	36	36	28	27	24	10	17	21	16	11	17	10
Editing and writing	258	—	4	4	9	7	8	13	12	35	18	32	41	19	12	18	26
Estimating	395	22	7	10	14	25	20	16	30	65	12	40	39	32	24	25	25
Inspection	339	16	6	7	10	22	21	11	18	44	21	42	39	23	16	22	21
Installation	226	12	8	8	12	29	26	16	25	30	8	14	13	7	10	2	6
Library and information service	12	1	—	—	—	—	—	1	1	—	—	—	3	1	1	2	2
Maintenance	686	13	7	8	16	28	43	29	37	84	41	93	97	59	44	39	49
Operation	910	12	13	19	24	36	53	31	63	112	67	117	164	74	66	38	31
Patents	115	1	3	—	3	1	6	6	6	8	7	12	12	9	9	15	17
Personnel-labor problems	81		—	—	3	3	—	1	5	10	7	9	15	9	8	5	6
Production	773	29	23	24	58	72	82	50	84	102	67	71	66	27	14	13	12
Research in basic science	240	6	6	20	16	20	17	23	20	26	11	22	23	14	4	2	12
Research, applied	2 184	36	38	93	147	191	203	157	241	274	133	196	177	95	90	69	44
Retired	76				—	—	—	—	—	—	—	—	—	2	7	7	69
Safety engineering	110	2	2	2	—	6	4	6	7	8	10	19	15	7	12	6	6
Sales	1,502	33	20	30	26	46	86	76	99	177	111	170	224	139	121	92	65
Student	104	23	13	16	11	16	12	3	3	6	1	—	1	—	—	—	—
Teaching, college or university	1 624	24	17	32	43	51	44	51	99	166	105	211	229	173	122	146	111
Teaching, other	71	—	1	2	2	4	6	2	2	7	2	18	9	2	3	6	6
Unemployed	76	1	2	—	3	5	4	6	—	—	—	8	7	6	7	10	17
Any occupational status not specified	744	33	15	22	17	30	40	36	58	79	34	78	84	47	67	63	61

Figure 1 above and the chart on the next page are reproduced from "The Engineering Profession in Transition," published by Engineers' Joint Council.

ful engineer-presidents of the 50 large corporations mentioned previously was investigated, it was found that in each instance, the engineer had had to expand his training and knowledge to include business principles. For promotion into executive work, he had to have a working knowledge of business fundamentals as well as technical knowledge. Mr. C. E. Groesbech, who was a very successful electric utility executive, has stated that, "Between a high-grade technical engineer without executive and business ability and a high-grade executive without technical ability, the choice of an administrator, even for an engineering or construction organization, should fall to the latter." Perhaps, though, it is likely that it is easier for the trained engineer to pick up the business side of a technical enterprise than it is for the businessman to learn the engineering aspect.

An article appearing in the April, 1947, issue of Mechanical Engineering, gives the results of questionnaires sent to 104 industrial companies, employing more than two million persons, including 40,000 engineers. It indicated that the deficiencies of engineering graduates, from the industry viewpoint, included lack of knowledge of economics, of business in general, and of production control and methods. Many ideas may be good if viewed from a purely technical standpoint, but may be of little practical value to the industry if the engineer failed to consider the business aspects.

A knowledge of business methods is important to the engineer. Without introductory courses in economics and management subjects, he is frequently not aware of the existence of important problems with which he will have to deal. When he later meets these problems, he may not be conscious that there are certain principles which he may use in their solution. Electrical engineers take service courses in mechanical engineering (thermodynamics) and mechanical engineers take service courses in electrical engineering (machines and electronics). These courses have been included in the curricula because it has been recognized that the engineers will come up against situations where such knowledge is vital. It may well be that engineers should take service courses in the college of commerce. By taking introductory courses in accounting, business law, economics, industrial organization and management, and industrial relations, the engineer will be able to understand basic principles and will be introduced to current practices and terminology. Knowledge of business terminology and practice will help the engineer from feeling like a foreigner when he is in a gathering of men associated with other aspects of industry. Even

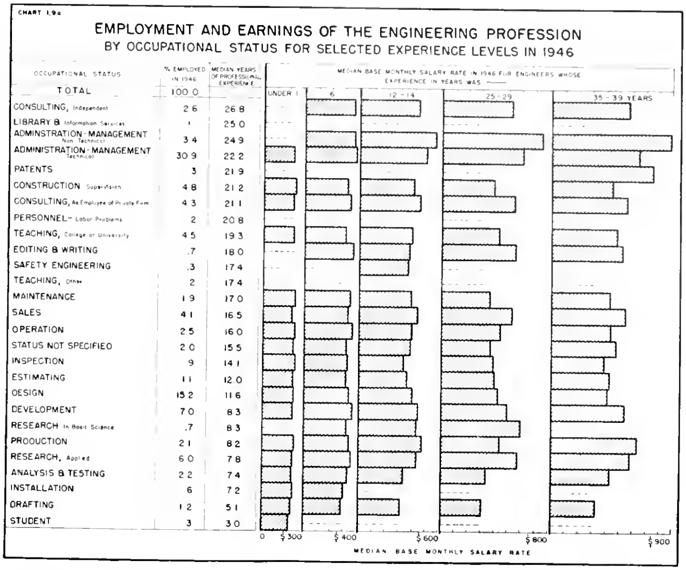


Figure 2 abave shows the distribution of engineers reporting bose manthly solary rates only, by occupational status and experience level in 1946 only.

though he will not be an authority on such matters, at least he will know the essentials and will be able to understand the language they are talking.

After having completed these introductory courses, he will have background that will help him in further study of the subject, either by reading on his own, or at night school, or by correspondence courses. The University of Illinois offers seven courses in economics, three business organization and operation courses, seven accounting courses, and two courses in business law—all by correspondence.

The engineering student's study of accounting would probably be similar to his study of machine tools and shop practice. In shop work, he doesn't learn enough to be able to compete with the machinist, but does learn the fundamentals, is able to judge quality of work done, and knows the advantages and limitations. So in accounting, he probably won't become expert in posting a ledger, but will know the fundamentals. If an engineer becomes responsible for estimates of cost or profit, he should be able to determine whether the books, as kept, are trustworthy. A balance sheet should be a clear picture of cause and effect to him. If an engineer should ever need to evaluate manufacturing property, a knowledge of accounting is vital.

A knowledge of cost accounting is important, for it enables a close supervision of manufacturing costs to be made. Even the designer must keep in mind that when a product is to be sold in competition, a minimum of cost is essential. For prices of articles to be fixed intelligently, the costs must be known. The ever-present emphasis on economy of man-hours, material, and money is likely to become even greater when the present seller's market does end and competition becomes sharper. The ability of the engineer to analyze costs will be even more important then.

A study of business law would, of necessity, be brief and incomplete. It would, however, impress on the engineer the dangers of ignorance of the law and the necessity of knowing when to seek thoroughly competent legal aid.

Knowledge of the broad field of business organization and management is especially vital to the engineer. It will make him more familiar with the departments and functions of business and industry, the interdependence of departments such as sales, production, engineering, research, and finance; and the necessity for clearly established lines of authority and responsibility.

Industrial relations is concerned with wage scales and methods of computing wages; it covers working hours, pension systems, employee insurance, collective bargaining, and supervisory techniques. In short, it is the study of the relation of industry to its own personnel. One of the facts brought out by the surveys mentioned earlier was that en-

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Rolling Along the Railway

By Art Dreshfield, Ch.E. '51

(The author is indebted to Professor Herman J. Schrader of the department of theoretical and applied mechanics for his help and for the use of his talk given on the radio program, "The Library Presents," last May.)

ART DRESHFIELD

Art Dreshfield, a sophomore in Chemical engineering, is from Brookline, Massachusetts. He was born November 9, 1929. An interest in photography brought him to the TECHNOGRAPH staff a year ago, but the lure of writing changed him from photographer to author. He is a member of the American Institute of Chemical Engineers, Phi Eta Sigma, and Tomahawk.

Wheels on railway cars differ from those on automobiles, buses, trucks, and almost all other vehicles in one vitally important respect. In addition to withstanding all of the shocks and stresses of ordinary travel, the railway wheel must also function as a brake drum. It is the use of the wheel in this role that has caused many serious problems.

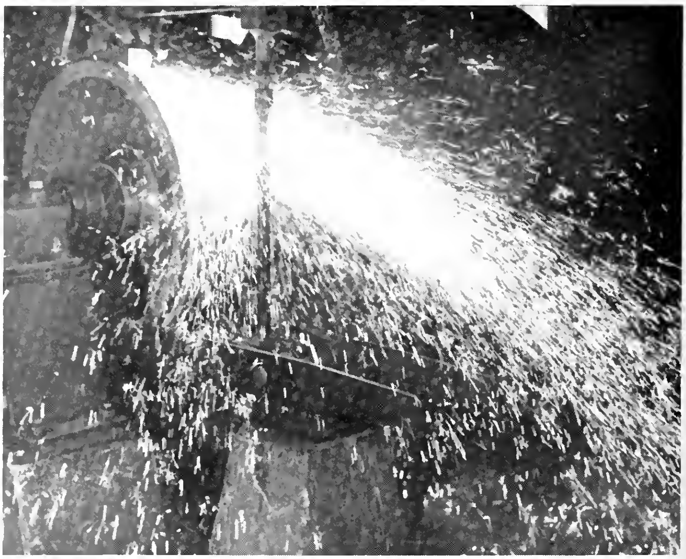
Basically, railway wheels are of simple design. There are five types which are in current use: the forged steel wheel, the cast steel wheel, the rolled steel wheel, the built-up wheel, and the chilled iron wheel. Of these, the first three types need little explanation. They are used on practically all passenger cars and to some extent on freight cars, and they compose about 30 per cent of the wheels in service. The built-up wheel is limited to use on locomotives and tenders for a reason which will be made apparent later. It is, as the name implies, built up of either a spoked wheel or a disc as the center, with a tire of rolled steel attached upon the periphery. The fifth type, the chilled iron wheel, is by far the most common. There are well over 10,000,000 of them in use on American railroads today. This means that about 70 per cent of the car wheels being used are made of chilled rolled steel. This type of wheel is used mostly on freight cars, and only a few of them appear on passenger cars.

The manufacture of the chilled iron wheel is quite simple. The molten metal is poured into a mold, the outside of which is kept cool. In this manner, the inner part of the wheel is gray cast iron which is soft and easy to machine, while the tread is made of white, or chilled cast iron which is hard and extremely resistant to wear. Because of the ease of manufacture and the low price of iron, this type of wheel is much less expensive than any other, the cost approximating about $50 per wheel.

All five types of railway wheel have been found highly useful as a rolling bearing for the car. Under tests at the University Experiment station, they have been found capable of bearing many times the weight imposed upon them in actual service, and withstanding several times the stresses to which they are subjected in normal use.

However, the use of a brake drum presents quite another picture. In such a capacity, the wheel must absorb, or dissipate, a large amount of energy, primarily as heat, in a short period of time. More quantitatively, to stop an average passenger train going 100 miles per hour within 3,600 feet, which is the maximum distance prescribed for such a stop under existing railway safety regulations, the set of wheels on each axle must dissipate energy at the rate of over 1,000 horsepower. A 15-car passenger train, pulled by a Diesel locomotive at this speed, has enough kinetic energy to light an average home for six months, yet this must be expended by the brakes in less than one minute.

No satisfactory method has yet been devised for measuring the surface temperature of a wheel under brake action, but in laboratory tests, the surface has been noted to approach and reach red heat. The resulting thermal expansion is enough to loosen the rims of built-up wheels, which renders them useless under such conditions because of the danger of shedding the tire. This heating also lowers the hardness of the chilled iron wheel and may set up permanent strains within them. More important, though, is the fact that any slight defects which may be in the wheel, and the strains which are inevitably introduced in the casting and mounting pro-



Sparks fly as this wheel "grinds" to a halt during a laboratory test simulating conditions met in stopping a fast-moving train.

cesses, are aggravated. Slight cracks, known as thermal cracks, develop in the rim. These thermal cracks are not serious in themselves, but they can precede a violent and dangerous rupture in the flange, or rim. Several accidents, a few of which resulted in injuries or fatalities, have occurred in recent years as a result of this latter type of failure.

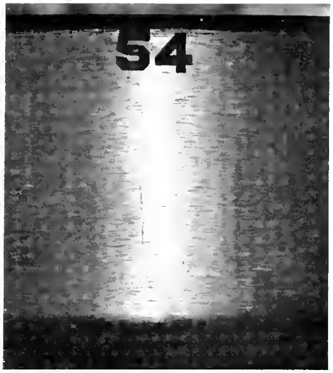
Naturally, the railroads wish to do everything possible to prevent such failures. Wheels which normally should be good for 300,000 miles, may be taken out of service after 10,000 miles or less, due to the development of thermal cracks. Obviously, this is costly and troublesome.

The most obvious remedy would be to install separate brake drums on the axles. However, the tremendous energies to be dissipated make this impracticable. A brake of similar design to that on autos would require a drum two feet in diameter and three feet long on every axle. The problem of servicing such a brake would be extremely difficult.

Regenerative braking is of some help, and is useful in certain circumstances. In this type of brake, the motors on the axles of the engine are allowed to act as generators, and the electricity developed is fed back into the power lines, if the engine is electric, or is short-circuited across a ventilated grid on a Diesel engine. But this braking is only on the axles of the engine, and there the motors are only 500 horsepower, which is half the amount which must be absorbed at every axle of the train in order to stop a rapid train in the prescribed distance. Regenerative brakes have proven very effective in retarding trains on grades, but are of little use in emergency or service stops.

Many other ideas have been presented, and some may have possibilities. Disc brakes have been used experimentally with some success, and work is being done on inexpensive generators which could be mounted on the car axles and run at great overload for short periods of time. Even such devices as forward-firing rockets have been suggested, but for the present, the most practical thing to do is to attempt to improve the wheels to the point where they can withstand the high temperatures of the present type of brakes. It is in research on this project that much work has been done at the University Experiment station.

In 1906, a machine was installed here for the purpose of testing brake shoes and car wheels. Early research concentrated on the study on brake shoes, but it was not long before work on car wheels was begun. In 1922-1923, the Experiment station published the findings of Prof. J. M. Snodgrass and F. H. Guldner in three bulletins



High temperatures encountered in braking caused this typical thermal crack in the rim of a wheel.

entitled "An Investigation of the Properties of Chilled Iron Car Wheels" (Bulletins number 129, 134, and 135). The conditions of the investigations simulated those of actual use, and many facts concerning the stresses and strains due to mounting, static loads, and brake application were disclosed. As a result of these findings, the chilled iron car wheel was re-designed, and the Association of American Railroads standardized on a single plate wheel in 1928.

Research on the subject was continued, and five more bulletins (157, 294, 298, 301, 312) were published between 1933 and 1938. The first two were by Profs. Edward C. Schmidt and Herman J. Schrader of the theoretical and applied mechanics department; the next two were by Profs. Frank E. Richart and Rex L. Brown, of the same department. The Association of Manufactures of Chilled Car Wheels cooperated with the Engineering Experiment station on the first six bulletins, while the seventh concerned wrought steel wheels and was done in cooperation with Carnegie-Illinois Steel corporation. The last bulletin was by Prof. Schrader and dealt primarily with brake shoes. Since 1938, more work has been done on the subject, but no further bulletins have been published.

As a result of all this research, car wheels today are of better design and are much safer than they have ever been. In the period 1930-1940, there was an average of 18-20 violent type failures per year, while in 1946 and 1947 there were only four failures of this type. However, the length of service of the wheels has been considerably shortened, because the new type of wheel, while being much safer, does not wear as well as did some of the older types. Many new alloys have been tried as substitutes for the cast iron and plain carbon steel in order to extend the wheel life, but the vast majority have been found to be much more sensitive to heating effects of rapid braking and for this reason cannot be used. Many excellent metallurgists are at work on this problem, but no quick solution is in sight.

The improvement in car wheels has been great. Whereas 15 years ago the top speed of trains was about 75 miles per hour, trains today are being run at speeds of 110 miles per hour or over, and yet they may still be stopped within a safe distance without weakening or

(Continued on page 24)

VOCABULARY CLINIC

How did you do last month? This month's quiz contains words that will be very useful to you in your everyday speaking. Remember, you won't be able to use these words until after you have consulted the dictionary for their pronunciation. From the group of words at the right, select one whose meaning most closely resembles the word in capitals on the left. Answers will be found on page 20.

1. COMITY—(a) glory, (b) fear, (c) friendliness and courtesy, (d) resentment
2. GARRULOUS—(a) frightening, (b) antagonistic, (c) scrawny, (d) talkative
3. VITIATE—(a) inflate, (b) unstable, (c) inconsistent, (d) corrupt
4. PRODIGIOUS—(a) immense, (b) careful, (c) untrue, (d) puzzling
5. INEXORABLE—(a) indolent, (b) unspeakable, (c) unyielding, (d) infallible
6. EFFRONTERY—(a) relaxation, (b) boldness, (c) scholarship, (d) conclusion
7. VOLITION—(a) grief, (b) power of willing, (c) electric potential, (d) popularity
8. DEMUR—(a) insult, (b)object, (c) demote, (d) condemn
9. SANGUINE—(a) hopeful, (b) bloody, (c) profitable, (d) talkative
10. AVARICE—(a) modesty, (b) reliance, (c) greediness, (d) speed
11. ABROGATE—(a) escape, (b) absolute, (c) confident, (d) annul
12. CAVIL—(a) find fault with, (b) cancel, (c) to separate, (d) to intrigue
13. DESIST—(a) to butt in, (b) erase, (c) to explain, (d) stop
14. FORTE—(a) machine, (b) volume, (c) one's strong point, (d) to expose
15. STIPEND—(a) a salary, (b) an introduction, (c) to lessen, (d) an untruth

Undercover at . . .

GALESBURG

Equipment for the head frame of the God's Lake Mining Co. in Manitoba had to be shipped in by tractor over the winter ice roads.

Go North, Young Man Go North

By Ewing Sharp, M.E.'51

The lure of new frontiers and strange horizons is an ever moving force that is present, to a varying degree, in every man, woman, or child. This compelling urge to conquer new frontiers is what moved the adventurous pioneers, settlers, and prospectors to move into the western area of the United States in a great tidal wave of immigration that has been unequaled in the history of the western world.

True, the days of the old west are gone forever, and many a would-be explorer and adventurer has wished it were possible to have had a part of the glamorous and adventurous history, but it is never too late to look for adventure and new frontiers.

The scientist and engineer are opening ever increasing fields in both medicine and technical research, and, in reality, are pioneers and explorers. Anyone who has wished to participate in the exploration and development of new territories has but to open his eyes and look north into the vast land of Canada. Her extensive undeveloped mineral fields, which to this day are largely unexplored and thoroughly unknown except to a few trappers and Indians, offer unlimited opportunities to these would-be adventurers.

It is only in recent years that exploration and prospecting was begun in the Laurentian or Pre-Cambrian shield. This area consists largely of granite rocks formed from the molten state far below the surface. This shield covers nearly three-fifths of the province of Manitoba and extends through most of northern Michigan and Minnesota.

Early in the present century the discovery of gold-bearing quartz in central Manitoba started a wave of prospecting that uncovered gold ore at Herb, Flin Flon, and Schist lakes in 1915. This interest in prospecting continued until the collapse of metal prices in 1929 brought prospecting to a standstill. However, in 1931, with the increase of the price of gold, the gold mining industry grew steadily. Prospecting was further stimulated by the need for new sources of base metals caused by the increasing depletion of the supply of American metals. In spite of all this development and prospecting, it is estimated that apart from one or two localized sections, the great majority of all the mineral areas have been incompletely prospected, leaving many areas practically unexplored.

It would be interesting to observe the founding and development of a typical mining camp in this new and largely unexplored territory. The discovery of gold on an island north of the western tip of Elk Island on God's lake, by R. J. Jowsey and his associates in 1932, was the basis of increased prospecting activities in the surrounding area, with the subsequent discovery of gold in many other sections. By air, God's lake is 350 miles northeast of Winnipeg. For the more adventurous, a canoe trip, with its numerous portages and excellent fishing, provides an exciting, but rather strenuous voyage of about four weeks.

One of the first steps in organizing a mining camp, after the gold is located, is the establishing of a supply route by which the heavy machinery and supplies may be transported to the site. Most of the equipment for the God's lake gold mine was hauled on tractor trains of four or five trailers carrying 70 to 80 tons of freight over the ice road from Ilford, the nearest Hudson Bay railroad station. Although the distance is only 130 miles southeast of God's lake, it took two or three days for the tractor crews, working in shifts and sleeping in the caboose, to make the difficult journey. Plane service was also established from Ilford during the winter months and from Norway House (275 miles north of Winnipeg) during the summer season.

In such an isolated outpost one would not expect to find most of the facilities such as hospital, complete plumbing systems, steam heat, electric lights, ball diamond, and golf course, which are common to more settled areas, to be developed in a few short months, but this was accomplished. To a large extent, these modern conveniences were due chiefly to the convenient source of electric power of 6,000 kw. about 45 miles away. This power plant has been adequate to supply power for the 150 ton mill on Elk island, in addition to the entire region of God's lake.

The original main street of God's Lake Mining Company, Ltd., camp was reminiscent, to outward appearances, of a typical pioneer settlement. On the north side of Main street was a row of log cabins consisting of the Canadian Airways radio station and camp post office, laboratory, hospital, mine, geologist and engineering offices, in addition to the hospital and staff house. Facing these on the south side

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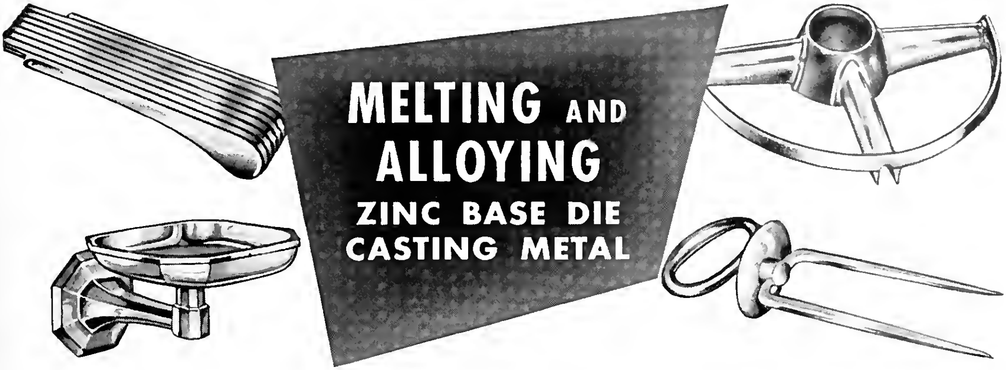

Reverberatory Furnace Operations

GERITY-MICHIGAN CORPORATION

Demonstrate High Temperature GAS Firing Technique

REVERBERATORY FURNACES designed to increase the production of zinc base die casting alloys have expanded melting and alloying capacity almost 50% over conventional pot melting. At Gerity-Michigan Corporation, Detroit, these Gas-fired furnaces operate on practically continuous schedules with savings of 35% to 40% based on time-saving methods and more efficient fuel utilization.

This application demonstrates the flexibility of GAS for industrial heating processes in high temperature ranges. But it also emphasizes the role of GAS in the development of production-line equipment for non-ferrous metals.

R. L. Wilcox, metallurgical engineer and Vice President of Gerity-Michigan Corporation describes the furnace and its application—"**This 18-ton Gas-fired reverberatory furnace has the advantage of extended service life, more efficient fuel utilization, closer temperature control, simplified alloy analysis.**"

Regardless of the type of heating operation or heat-treating process, GAS is the ideal fuel for any temperature requirement, or any production-line application. The characteristics of GAS—speed, flexibility, economy, controllability—are useful features for every industrial heating need. In view of rapid developments it's always worthwhile to keep your eye on what's new in Modern Gas Equipment.

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Gas-fired reverberatory furnace designed and constructed especially for melting and alloying zinc base die casting alloys at Detroit Die Casting Division.

AMERICAN GAS ASSOCIATION

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The officers of the A.S.C.E. are (left to right) John Rotski, Roy Dzierzonowski, Austin Boyle, and Frank Koepke. (Photo by Bloomquist). Dr. Roscoe, head of the physics department, is known not only as an eminent physicist, but also as a friend and counselor.

In This Corner... NAVY PIER

TOPS AGAIN

By Eugene Stojack, A.E. '51

A minority of the chemistry students, enrolled in the Chicago Undergraduate Division of the University of Illinois, realize the true value of the chemistry department. Although the school is in its infancy, the chemistry department is very well developed in respect to other colleges in this country. The courses taught here are the required undergraduate courses necessary to a student in his college education. These courses consist of general chemistry, organic chemistry, quantitative chemistry, qualitative chemistry, and physical chemistry.

The chemistry department, headed by Dr. Carl R. Meloy, consists of 23 teachers. Almost all the teachers have master's degrees and are working toward their doctorate. Seven of the teachers have already attained the latter. Two of the instructors also teach courses in geology. A factor which benefits the student is that many of the teachers have had industrial research experience, as well as teaching experience, and tend to stress, in class, the material most useful in industry.

In the chemistry courses the student uses three types of classrooms, the quiz classroom, the lecture rooms, and the laboratories. The quiz section seats 35 students comfortably. There are two lecture rooms, each seating 180 students. There is a smaller room connecting the lecture rooms, which the teachers use to prepare demonstrations usable in their lectures.

There are four laboratories which can hold a maximum of 576 students. The well-constructed laboratories have concrete floors, cement block walls, heat-air-conditioning units, and fluorescent lighting fixtures. In each laboratory there are shelves along the wall that contain the materials used by the student in his experiments. The general materials are kept in bottles on these shelves. The solid materials are kept on the opposite side of the room from the liquid materials. The bottles on both sides are numbered and are kept in alphabetical order according to their scientific names.

A very efficient ventilating system has been installed to draw out all the harmful gases. There are six unit hoods that compose the gas ventilating system for each laboratory. For every two units there is a separate electric pump that draws out the impure air, neutralizes its harmful effects, and sends it out of the building through concealed vents.

The expensive equipment used in the laboratories is the latest. The laboratories are supplied with distilled water by the chemistry department's own distilling equipment which turns out 10 gallons of water per hour. There is a constant supply of compressed air and natural gas. A gasometer that supplies H_2S gas to the laboratories is also in constant use.

The work benches used by the students have alberline soapstone tops, metallic structure and drawers, and a convenient wooden shelf in the center extending the length of the bench. Each student has access to running water and natural gas which is very essential in his experiments. The students also re-

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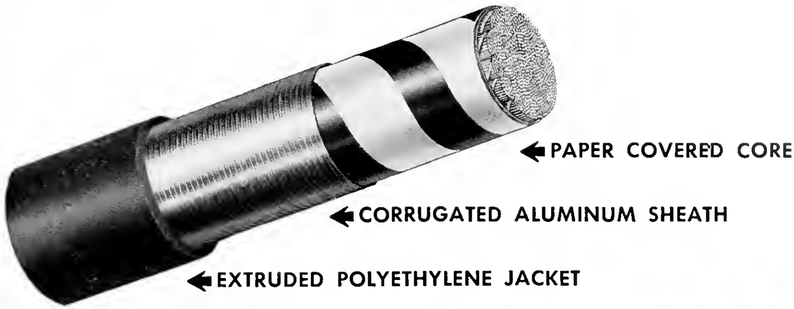
Newsworthy Notes for Engineers



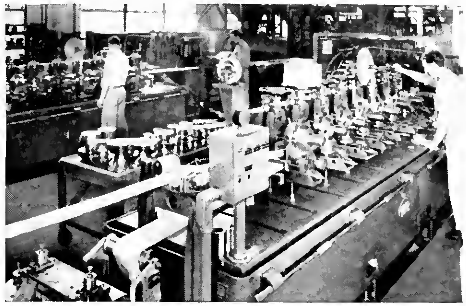
PROBLEM:

How to put a new type of covering on telephone cable

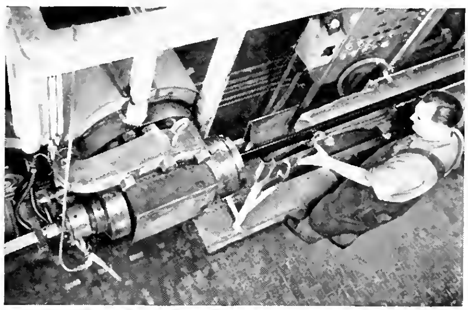
Make a new type of cable sheath no one has ever made before—make it to rigid specifications—make it fast! That was the challenge put up to Western Electric's manufacturing engineers.

The new type of cable sheath — developed through cooperative research at Bell Telephone Laboratories and Western Electric Company—is a valuable alternative to the traditional lead covering for telephone cable. It is called Alpeth. "Al" stands for an inner shield of aluminum; "peth" for the outer coating of the plastic, polyethlene.

To produce this new cable sheath, Western Electric engineers developed the Alpeth production line—a combination of new machines and new manufacturing techniques—which turns out finished cable in a fast-moving, straight-line operation.



From the desert-dry 125° F "hot room" where thoroughly dried cable cores are stored, the core moves into this machine. An aluminum strip is fed from a supply reel underneath. After being corrugated to provide flexibility and strength, the aluminum strip is wrapped around the core and flooded with a sticky protective compound.



The aluminum-clad cable then passes into this machine and comes out seconds later with an extruded coating of flexible, impervious, gleaming black polyethylene. Finally, after a 100-foot bath in a cooling trough, the finished cable is wound on reels and readied for shipment to Bell Telephone companies.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

EDWIN A. WITORT
Editor

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

What Kind of a House are You Building?

Not so many years ago, a moderately successful contractor in Peoria, Illinois, decided to retire. During his long business career, he had managed to accumulate a sizable sum of money, and hence, could afford to be a little generous.

Now, for many years, two of his foremen had been with him and had stood faithfully by him through good times and bad. As his time for retirement grew near, this contractor, being a good soul, wanted to show his appreciation for their steadfast loyalty. After considerable thought he hit upon a plan to reward them.

Calling them into his office one day, he said, "Boys, I have one more job I want you to do before I retire. I've secured two fine lots in the new addition on the west side of town, and I'd like you to build a large six-room house on each."

As on previous assignments, one foreman undertook the construction of one home, while the other foreman proceeded to build the other.

The first foreman was always anxious to "get the job over with." In his haste, he would take unnecessary short-cuts. Where three nails should be driven, he would drive two, and where four supporting boards were required, he would use three. Thus, he constructed his house carelessly, hastily, and shoddily.

The other foreman, however, went about the construction of his house in an entirely different manner. Where three nails were needed, he used three; where four supporting boards were called for, he used four. His house throughout was constructed carefully and judiciously, as if he himself were to live in it.

Finally, the two houses were completed. The contractor again called his two foremen into his office. "Boys," he began, "You've been with me a good many years. Through good times and bad you have stuck with me, always doing the tasks assigned you. Such loyalty certainly deserves some sort of a reward, so I've decided to give you something for your faithfulness. The house that each of you recently completed is yours. Yes, boys, the house and the lot are both yours. You have each built your own home, and it hasn't cost you a cent."

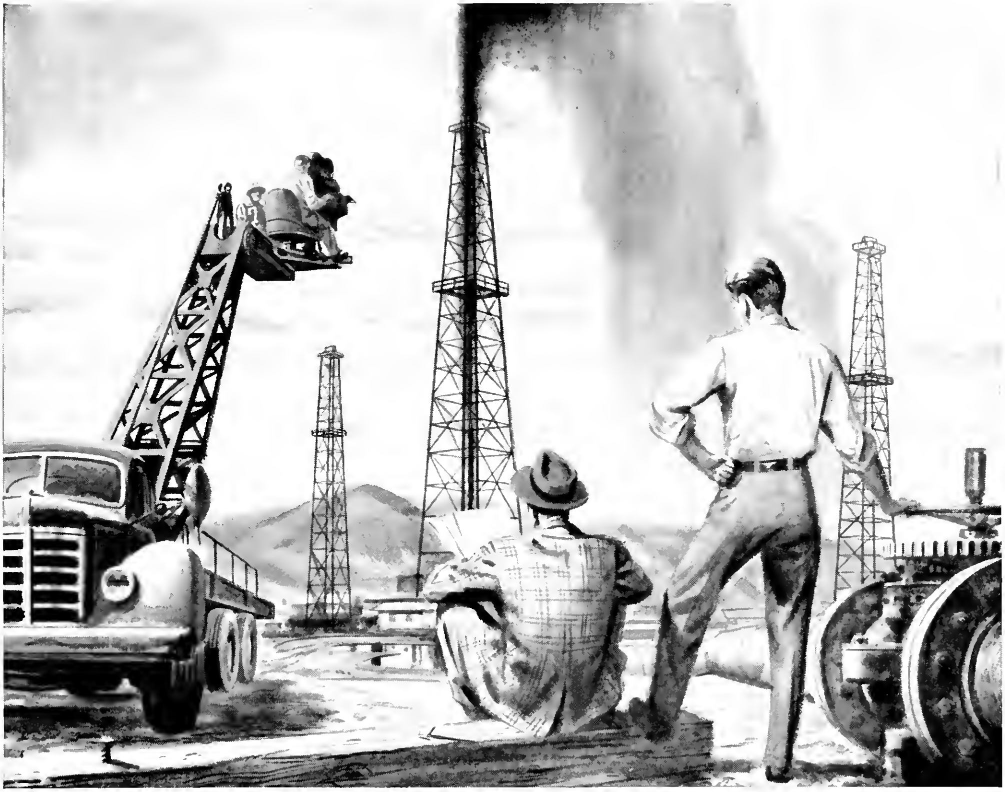
Well, it doesn't take much figuring to decide which of the two men was overjoyed and which was bitterly repentent.

How often have we ourselves been guilty of such action—of doing a job in a careless but passable manner, when only a little more care would have resulted in a much better job? The moral of this tale can be summed up very nearly by the axiom, "Anything worth doing is worth doing well."

It has been said of more than one outstandingly successful man, "The reason he is such a success is, that everything he does is done as if it were the most important thing in the world."

Now that a new year has rolled around, why don't we resolve to do that very thing. Let's not succumb to that temptation to save a little time by turning out a "sloppy" job. Resolve now to take just a few more seconds here and just a minute longer there to turn out a job you are proud of. Take those few minutes required to produce a good, sturdy structure, whether the task be large or small.

On the next occasion that you are tempted to do an interior job to save time, stop and think. Remember this question, "What kind of a house are YOU building?



Engineers As Executives . . .

(Continued from page 9)

gineers are likely to be doing personnel work in highly technical manufacturing concerns.

The engineer who aspires to a supervisory position, either in an engineering department or in operations, has to study and become familiar with reactions of people, just as he has studied and knows the reactions of material things. His performance in directing the work of others determines his future success in management. The old saying is still true: It is not so much what a man can do himself as what he can get others to do that makes him valuable. Dean L. E. Grinter of the Illinois Institute of Technology, writing in the *Journal of Engineering Education*, stated: "Some of the greatest difficulties encountered by young engineers are difficulties of adjustment to people and to social situations. Appreciable numbers of engineers fail to acquire during their college career the ability to analyze and solve the difficult problems of getting along with other people." Study of supervisory techniques, psychology as applied to industry, and personnel problems would perhaps yield the greatest return to the engineer of any subjects. This study may save him a great many headaches later on. And while there may be many things that only experience can teach, the student will have at least gained an inkling of what his problems as a supervisor are likely to be.

Statistics has been defined as a means of getting more information out of fewer figures. Courses in statistical analysis are included in the curricula of economics, sociology, marketing, agriculture, business administration, mathematics, and biology. Why not in engineering? Training for the engineer probably would not take up the advanced theories, but would be sufficient to enable an engineer to understand the principles of quality control. Quality control is the use of statistical procedures to obtain quantity production of high quality and low cost. Understanding of statistics would be of particular value to the design engineer, for statistics have many applications to tolerances and to engineering alternatives.

Engineering graduates usually, in their first jobs after graduation, do drafting, testing, inspecting, or other such tasks. These jobs may be of small responsibility, but do give the chance to look the company over and become more familiar with the practical side of engineering. The employer has an opportunity to size up and see where the young graduate will fit in, to determine what responsibility he can carry. If the superintendents, managers, and officers of the company are predominantly technical men, the graduate can look ahead at his future more confidently. With his background in business subjects, he can become more thoroughly informed on the policies, operation, and organization of his company. With his preparation, he will be in a position to work his way up, perhaps faster than many of the present executives. That this might be the case is indicated by the statement of Mr. R. C. Muir, vice-president of General Electric, that "Most men in industry now carrying management responsibilities have learned what they know of management through the hard school of experience, often at the expense of valuable time and costly errors in judgment."

As the new graduate's judgment in the application of his technical and business knowledge learned before, as well as after, graduation, and his ability to lead men, increase with his experience, he will leave the ranks of *potential* executives and enter the field for which he prepared himself.

The modern glamour gal has what it takes to take what you have.

Making television history, first coverage of air-sea maneuvers demonstrates value of research by RCA Laboratories to our armed forces.

Now television "stands watch" at sea

Picture the advantage—in military operations—when commanding officers can watch planes, troops, ships maneuver at long range . . .

This new use of television was seen by millions when the aircraft carrier *Leyte*—as Task Force TV—maneuvered at sea before a "battery" of 4 RCA Image Orthicon television cameras.

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Action was beamed by radio to shore, then relayed over NBC's Eastern television network. Reception was sharp and clear on home television receivers . . .

Said high officials: "The strategic importance of television in naval, military, or air operations was dramatically revealed" . . . "There is no doubt that television will serve in the fields of intelligence and combat."

Use of television as a means of military communications is only one way in which radio and electronic research by RCA Laboratories serves the nation. All facilities of RCA and NBC are available for development and application of science to national security . . . in peace as well as war.

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When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

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- Design of component parts such as coils, loudspeakers, capacitors.
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- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

Honoraries and Societies . . .

(Continued from page 2)

son, president; Gordon Knudson, vice president; Dick Swanburg, secretary; and Frank Bartkowicz, treasurer. The following committee chairmen were also appointed: Jim Makanishi, program; Harry Wallinder, publicity; Wolfgang Junkel, membership; Sal Grassadonia, field trip; and Bob Beardmore, social. The organization's sponsor is Mr. Cobb of the G.E.D. department.

At the second meeting, a movie on the "Design of Packaging Machines" was shown by Mr. Shapiro of the G.E.D. office. Plans for a smoker were completed, and plans for a dance were started.

Student members of the A.S.M.E. at the Illinois Institute of Technology are invited to the smoker. Those present will be addressed by Mr. Oldacher of the Junior Division of the A.S.M.E., and other entertainment will consist of a sports movie and magical phenomena by a magician. Refreshments? Cider and doughnuts!

The organization is planning a field trip during the Christmas vacation to one of the largest manufacturing plants in the Chicago area. It will be an all-day affair, beginning and ending at Navy Pier. Also tentatively planned, is a lecture by Dr. Allison, of the Nuclear Institute at the University of Chicago, on the atom bomb. This lecture is not of a highly technical nature; therefore the organization is planning to make it available to the entire student body.

In the latter part of October, a three-day membership campaign, conducted by Wolfgang Junkel, increased the membership from 56 to 109 paid members, with many more signed up.

GAMMA ALPHA RHO

Members of the Delta chapter of Gamma Alpha Rho held their first formal initiation at 6 p. m., November 3, at the Illini Union building. The members initiated included: Charles H. Anderson, Walter L. Bedenkop, Paul W. Born, Joseph W. Meyer, Carl O. Orkild, William R. Stephens, Joseph M. Zabinsky, and Henry J. Hirtzer.

Following the initiation, a banquet was held at the University club. Dr. Leslie A. Bryan, the after-dinner speaker, discussed 10 basic rules for obtaining success.

As part of the initiation requirements, prospective members were required to build a scale model of an airplane. Joseph Meyer, a senior aeronautical engineering student, was awarded first prize for his model of the navy Hellcat.

I.A.S. (Navy Pier)

The Institute of Aeronautical Sciences is in the process of being organized by Mr. George Zanotti of the G.E.D. department here at Navy Pier. In November, a film on the P-47, "High Altitude Flight in Aerobatics," was shown, and at this time the following officers were elected: Raymond E. Kreuger, chairman; Edwin A. Arvesen, Jr., vice-chairman; Naomi Suloway, secretary-treasurer.

Answers to Vocabulary Quiz

1. c, 2. d, 3. d, 4. a, 5. c, 6. b, 7. b, 8. b, 9. a, 10. c, 11. d, 12. a, 13. d, 14. c, 15. a.

She: "If wishes came true, what would you wish for?"

He: "Gosh, I'm afraid to tell you."

She: "Go ahead, you sap, what do you think I brought up this wishing business for, anyway?"

Undercover at Galesburg . . .

(Continued from page 12)

were the cook house and dormitories, or bunk houses, which were also constructed of logs. The manager's home faces the street from the west end. In a little less than two years after the discovery of gold in this camp, the first gold bricks, valued at $10,000, were shipped out.

New discoveries are being made continuously, not only in gold, silver, and copper, but also in platinum and uranium. There is much work to be done in developing the resources of this area. The person who is looking for new frontiers might do well to peer over the horizon to the north, or in the words of Professor Trezise, who spent considerable time in this Arctic area, "Go north, young man, go north."

Introducing Omar Estes

By Luther S. Peterson, E.E. '51

OMAR ESTES

In the April issue of the Illinois Technograph was an article entitled "Introduction to the Galesburg Division." This article was the culmination of two months' work in the organization of the staff here at Galesburg. Mr. Omar Estes was instrumental in the organization of this staff and has since proved his ability to assist the students in all phases of University life.

Mr. Estes, an adept physics and engineering sciences instructor, has been with this branch of the University of Illinois since September, 1947. He is a native of Canton, Illinois, and it was there that he got the desire to attend college. He fulfilled this desire by attending Western State Teachers college at Macomb, Illinois, where he received his B.S. degree. However, his desire for more education didn't decline after this accomplishment. He soon enrolled at the University of Missouri, where he worked diligently for his M.S. degree. He soon went into teaching, but like many other college graduates, he was certain that education didn't stop after an M.S. degree was obtained. As a result, he has since taken some graduate work at both the University of Illinois and the University of Colorado.

After his formal education had been completed, he entered the teaching profession as an instructor of the natural sciences and as a coach of athletics in a school of secondary education. He demonstrated his abilities to such an extent that he was promoted to the position of principal, and remained in that capacity for five years.

After his five year tenure as principal, Mr. Estes received the well known "greetings" from the President of the United States and entered the Army Air corps. His work in the A.A.F. was concerned mainly with administrative duties, and upon receiving special orders from Washington, he went to Oahu, Hawaii, to assist in the organization of the Army University Center. After he had finished this task, and had proven himself at various other jobs, he was finally discharged as a major in 1946, with 52 months of service to his credit.

Immediately after Mr. Estes was discharged, he accepted a job with the Veterans Administration as Institutional Training officer at Urbana, Illinois. This close contact with the veteran

(Continued on page 24)

Galesburg . . .

(Continued from page 22)

student, and the close association that was prevalent between his office and the school administration, gave him ample opportunity to view the problems of the student at first hand. This knowledge has aided him ever since, and as a counselor of many engineering students here at Galesburg, he has been able to remove many of their worries and assist them with their problems concerning their probable transfer to Urbana.

The urge to teach prevailed once again, and he soon left his Veterans Administration job to accept a position here at Galesburg as instructor of engineering physics. At present he is instructor of the first semester of engineering physics, although he has also taught the second semester physics course.

Since Mr. Estes has been here at Galesburg, his friendly and helpful attitude has given the student greater initiative to get ahead on his own. Mr. Estes' enthusiasm to help the student not only with his studies, but with his extra-curricular activities as well, is witnessed by the fact that he himself is a member of two educational societies — Kappa Delta Pi and Pi Kappa Delta.

Railway . . .

(Continued from page 11)

damaging the wheels. This is, however, just about the present day limit. As speeds get higher, the extra work done by the brakes for an increase in speed becomes greater and greater. Because the kinetic energy of a moving body is given by the formula, $K.E. = mv^2/2$, and because higher speeds require more powerful, hence heavier engines, a train going 150 miles per hour will require not 150 per cent of the braking power needed at 100 miles per hour, but over 225 per cent more. At present, no brakes or wheels have been developed which could withstand the extremely high temperatures which would be developed. Thus the problem of wheel failures seems to be the limiting factor in raising train speeds.

Slow progress is being made, and work on this problem is continuing at the University of Illinois and elsewhere. However, many unanswered questions and unsolved problems remain to be answered before train speeds of 150 miles per hour or greater, which are so glibly talked of by some people, can become a reality.

It isn't what a girl knows that bothers us, it's how well and where she learned it.

Automobiles . . .

(Continued from page 7)

hydraulic coupling does not multiply the torque—in fact, it actually reduces the torque output in that it does not add an accelerating factor to an economical gear ratio. However, when the hydraulic coupling is used with an automatic transmission, it does apply an accelerating factor by automatically shifting gears in the transmission.

The main selling point at present for both the fluid drive and the torque converter is that both prevent the engine from stalling when heavily loaded with the car almost stopped. For this purpose, the torque converter and the fluid drive with a fully automatic transmission are b e t t e r because of their ability to multiply the torque of the engine without freeing the load from the engine.

It is probable that changes will be made in future transmissions, but even now an extra piece of optional equipment, such as mentioned above, can pay for itself during constant use, whether for city or country driving.

The electrical systems are very nearly the same for all of the popular American cars. Therefore, they will be overlooked, except to note that needless and extra electrical accessories can overload the system. Care should be taken in their selection.

The heating system has been greatly improved in most cars in recent years. The engine wastes, in the form of heat, about 70 per cent of the energy put into it by the fuel. This quantity of wasted heat could easily heat the average home on the coldest day. It would be foolish not to utilize some of it in keeping the interior of the car at a comfortable temperature. If this heating is accomplished by heating the air already in the car and then reheating it as it cools, the moisture that is given off by the passengers is condensed on the windows and creates a driving hazard. On the other hand, if outside air is heated and introduced into the car and the cooled air is exhausted from the car, the moisture given off by the passengers is removed with the cooled air before enough is formed to condense on the windows. The newer-type heaters that bring outside air into the car have a larger capacity and are thermostatically controlled, thus maintaining a more constant temperature. Obviously, if a heater is at all necessary, the outside air type is worth the additional cost.

Visibility is one of the items which is abused, misused, and not generally agreed upon. Good visibility is not particularly proportional to the window area of the car. It consists mainly of an unobstructed horizontal view in all directions and a good view of the road immediately in front of the car. While it is necessary to be able to see overhead stop lights, it is not necessary to see the tops of tall buildings. Thus, a manufacturer that adds window area by increasing the height of the windows excessively is merely adding a selling feature.

Riding comfort and driving comfort are two items of major importance that are closely linked together. Riding comfort is usually thought of as being how effectively the car isolates road shocks, but should also include the isolation of vibration, noise, and the atmospheric elements.

The isolation of the atmospheric elements is accomplished very well in most cars by the use of weather stripping around doors and c o n t r o l s that go through the floor and dash-board, as well as snug-fitting windows.

The isolation of n o i s e s is accomplished partly by the use of sound-absorbing m a t e r i a l s. The ideal case would be the complete elimination of the vibration whenever possible, but where this is not possible, springs and rubber cushions can be used to isolate

(Continued on page 28)

DU PONT *Digest*

For Students of Science and Engineering

a giant on the farm

Products of the laboratory are saving time, toil, money for the American farmer

Through chemistry, farmers are gaining control over many of nature's uncertainties. Costly losses of crops and livestock are being curtailed or prevented. Efficiency is increasing. New applications of chemistry to agriculture are becoming more important than ever as demands for more production increase.

Today, new organic insecticides and fungicides help control insects, plant diseases and blights that threaten crops. Seed disinfectants and protectants help guarantee bountiful harvests by protecting crops in the critical period after planting. Plant hormones hold fruit on trees until fully ready for picking.

Days of labor saved

Du Pont weed killers and explosives accomplish in minutes tasks that used to take hours or days of backbreaking labor. With 2,4-D farmers can kill weeds without harming certain crops. Dynamite removes stumps, digs ditches for draining and irrigation, and loosens the soil to forestall erosion.

New fertilizer formulations meet the changing nutritional requirements of plants during the growing season. Thus the farmer has better control over crop development, and he can utilize his materials, labor and equipment more efficiently.

Du Pont *agricultural specialist Dr. Arne Carlson, M.S., '40, Ph.D., U. of Minnesota, '48, helps develop sprays and dusts to control fungous diseases.*

Phenothiazine *kills more kinds of livestock worms in more kinds of animals than any other drug . . . promotes normal growth.*

For growth insurance, *farmers treat seeds with disinfectants. "Ceresan" treated wheat gives up to 20% better yields.*

Spraying orchards *controls infestations of insects or plant diseases . . . or holds fruit on the trees until it is fully ready for picking!*

Feed compounds, developed by industry, are making poultry flocks and livestock herds vastly more productive. Research on chemicals to control animal diseases and internal parasites is making great progress. Control of insect pests is already changing livestock management practices.

Turning ideas into products

Achievements such as these are the result of Du Pont's team research. An idea may start with one or two individuals. But many specialists—chemists, physicists, biologists, plant pathologists, and entomologists—must contribute their skills before a new product is ready for market. Normally, engineers—chemical, mechanical, civil, and electrical—develop the commercial processes and plants for making the finished products.

The new Du Pont employee, whether he holds a bachelor's, master's, or doctor's degree, enters into this cooperative effort. Yet the immediate group with which he is associated is small and congenial, offering him every opportunity to display individual talent and capabilities.

Find out more about Du Pont and the College Graduate

"The Du Pont Company and the College Graduate" is just off the press in a completely revised edition. Fully illustrated, it describes opportunities in research, production, sales, and many other fields. Explains the plan of organization whereby individual ability is recognized and rewarded. Write for your copy today. Address: 2518 Nemours Building, Wilmington 98, Del.

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BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

More facts about Du Pont — Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

Know Your Automobile . . .

(Continued from page 26)

the vibrating items from the body of the car.

The isolation of road shocks is accomplished by using soft springs and proper shock absorbers at each wheel and attempting to isolate each wheel from the others. If the spring on the wheel is soft, and the mass of the car is great, only a small amount of the road shock will affect the people riding in the car, who are also sitting on upholstery. If what happens to one wheel also affects another wheel, it will almost double the force transmitted through the springs to the body of the car. Thus, the best combination for easy riding is a heavy car with soft springs and independently mounted wheels.

Driving comfort is more difficult to evaluate because no two people drive the same and consequently, have different preferences concerning car response. People will agree that the car should be easy to handle in a cross-wind. Driver fatigue should be kept to a minimum, which depends upon the position the driver must maintain to operate the controls, and the amount of work necessary for steering, shifting, braking, and just simply holding the accelerator down.

The next installment of this article will include a point-by-point breakdown and comparison of the specific features of current models of American cars.

Women wear girdles from instinct —a natural desire to be squeezed.

* * *

"That's a nice suit you have on; do you mind my asking how much you paid for it?"

"Not at all, a hundred and ten dollars."

"Don't you think that's quite a lot?"

"Oh, I don't know. I got nine pairs of pants with it."

* * *

Mable: "Ever been pinched for speeding?"

Soph Engineer: "No, but I've been slapped for going too fast."

* * *

She: "I'm so discouraged. Everything I do seems to be wrong."

He: "What are you doing tonight?"

* * *

A freshman engineer is a young man who knows *why* a strapless evening gown is held up, but doesn't yet know *how*.

* * *

"Won't your wife hit the ceiling when you get home tonight?"

"Yeah, she probably will—she's a hell of a shot."

In This Corner—Navy Pier . . .

(Continued from page 14)

ceive a private drawer in which to keep their basic equipment.

There are two balance rooms connecting the laboratories. One of the rooms is used by the students studying general chemistry; the other is used by the students studying analytical chemistry.

A recently added course in the curriculum, is physical chemistry which shares one of the balance rooms. This course requires the finest equipment available. At the present time the space allotted to it is of telephone-booth size, but the future has prospects.

Each student, while working in the laboratory, must wear a rubber apron and a pair goggles to protect his clothes and eyes. The common safety precautions, such as fire blankets, fire extinguishers, and sand buckets, are conveniently placed around each laboratory. A steam cone, another safety device, has been added to the organic laboratories. These safety precautions are to prevent serious injury to the student, and also to prevent costly damages to the laboratories. The chemistry department at the Chicago Undergraduate Division of the University of Illinois has organized and developed into one of the best equipped in the country.

Faculty in Review

By Richard Kawka, Ch.E. '52

Probably one of the most outstanding impressions one gets when visiting Navy Pier is the close relationship that exists between students and faculty. This is especially predominant in the physics department. Dr. Roscoe Harris, head of this department, has gained the admiration and respect of students, not only as an eminent physicist, but also as a friend and counselor.

Born in 1896 in Oakridge, Mo., Dr. Harris, after obtaining his elementary and intermediate schooling, received his B.S. at Missouri State Teachers college. During the first World War, he served the armed forces as a second lieutenant in the field artillery. After peace was declared, he resumed his education at the University of Chicago, where he received his Ph.D. in physics and mathematics. After completing his studies in 1923, Dr. Harris went to the University of Vermont to accept a position as associate professor of physics. He remained there for two years. In 1925 Dr. Harris was offered a position at Lake Forest college as head of the newly formed physics department. He remained as head of this department until the outbreak of the second World War. In 1942 he again entered the army, this time as a captain in charge of personnel. The army soon recognized his exceptional talents and placed him on the Coast Artillery board in charge of electronic and communication experimentation. From there Dr. Harris received special orders to go to the office of the military attache at Istanbul, Turkey, where he remained until the end of the war.

When he returned to the United States, he received a position at Bell and Howell as engineer in charge of supersonic radar equipment. From his experience he published a technical manual on airborne supersonic radar equipment.

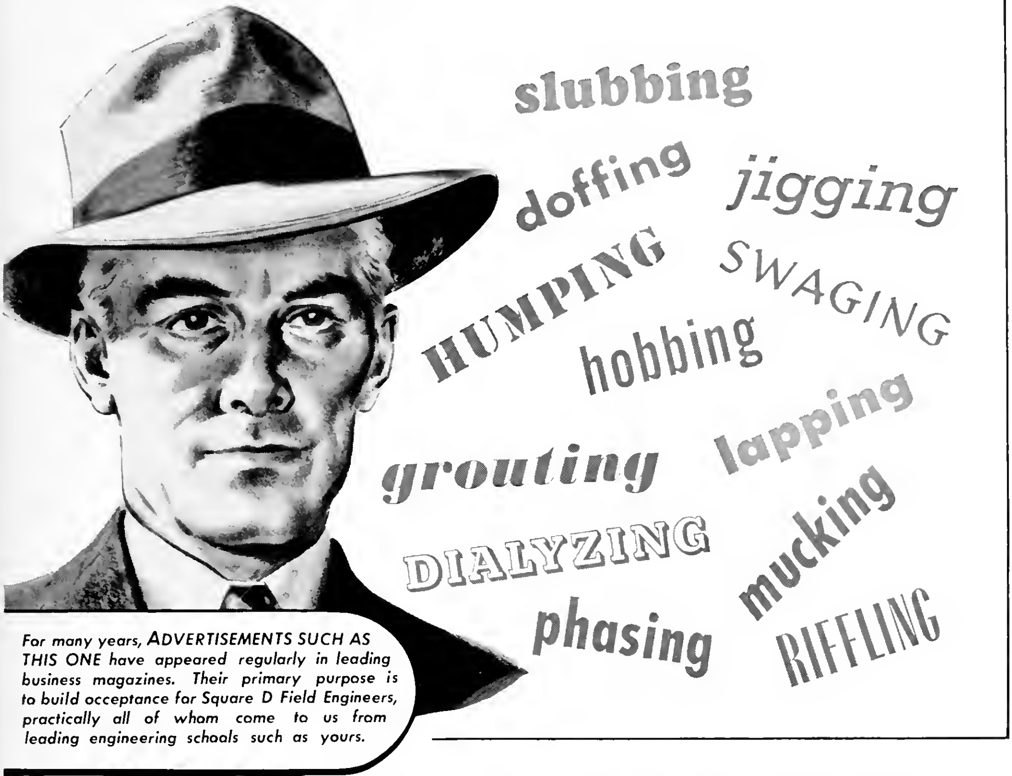
Not only is Dr. Harris a well-known writer, but he is also a well-known inventor and designer. He has invented a new type of internal combustion engine, an X-ray exposure control device, and a way to communicate sound on a light beam. He has also published many articles such as "Velocity Determination by Photographic Distortion," "The Use of the Oscilloscope in Basic Electrical Measurement," and many others helpful to science.

The salesman was trying to "pick up" a beautiful blonde in a hotel lobby.

Said she: "Don't bother me!"

Said he: "Pardon me, I thought you were my mother."

Said she: "I couldn't be. I'm married."—*Saturday Evening Post.*



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He speaks a Lot of Industrial Languages

He's a Square D Field Engineer. He speaks the language of many industries because his full-time job is working with them . . . helping them find "**a better way to do it.**"

Through a staff of such Field Engineers located in more than 50 offices in the United States, Canada and Mexico, Square D does this three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends, speeds development of new methods and equipment.

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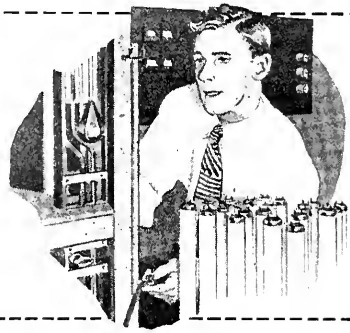
General Electric is not one business, but an organization of many businesses, offering opportunities in virtually all the professions. Here three G-E men brief the career-possibilities which the company offers to the student of advertising, the physicist, and the accountant.

FOR A FUTURE IN ADVERTISING

D. S. Mix (Yale), Manager of Personnel and Training Programs, Advertising and Publicity Dept.: Besides our A & P Department here in Schenectady, there are eight G-E operating departments, each with its own advertising staff. These provide the career-opportunities. Our Training Program, including six months' work and study here followed by a year on rotating assignments with various staffs throughout the company, opens the door.

PHYSICIST

August Binder (Carnegie Tech), of the G-E Physics Program: I've been one of the first group of physicists taking part in this program. We've changed assignments every few months, trying out interesting lines of work, and have chosen permanent positions in everything from research to sales. My assignments: nuclear instrumentation, research in cathode spot phenomena, quality-problems in fluorescent lamps, which I've selected as my permanent assignment.



TRAVELING AUDITOR

E. B. Murray (Princeton), Chief Traveling Auditor: After our business administration and liberal arts graduates finish the G-E Business Training Course, certain of them are transferred to the auditing staff as traveling auditors. It's my job to assign these men and co-ordinate their activities at G-E locations in this country and abroad. The varied experience acquired in this work fits them well for responsible accounting and financial positions.

For further information about a BUSINESS CAREER with General Electric, write Business Training Course, Schenectady, N. Y. — a career in TECHNICAL FIELDS, write Technical Personnel Division, Schenectady, N. Y.

the Illinois Technograph

FEBRUARY, 1949

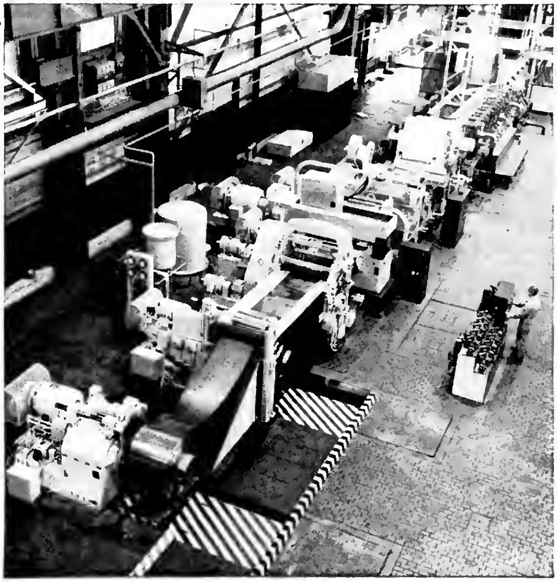
★

TWENTY-FIVE CENTS

Electrolytic tinning process stretches tin supply

—makes better, less expensive tin-plated products

• pioneered by Carnegie-Illinois Steel Corporation



▶ Before the war, almost all tin plate was made by the hot-dip method in which a sheet of steel was coated by dipping it into molten tin. In the 1930's, Carnegie-Illinois Steel Corporation, a member of the United States Steel family, played an important role in the research work and the technological development of the *electrolytic process*—an improved tinning method in which a strip of steel is given a thin, uniform coating of tin by passing continuously and rapidly through a bath of special plating solution. This process necessitated the development, by Carnegie-Illinois engineers, of complex mechanical equipment completely revolutionary in the industry.

Since the electrolytic process covers a given area of steel with only one-third the amount of tin that the hot-dip method requires, it makes the tin supply go 3 times as far.

Today, United States Steel Corporation has nine electrolytic tin-plating lines producing U·S·S Ferrostan. These lines are helping to lower the cost of tin-plated steel . . . stretch the supply of tin—and make better tin-plated products.

Opportunities

Work such as this has an important place in the operations of all U. S. Steel Subsidiaries. To be carried out successfully, these undertakings require qualified technical men. Why not see your Placement Officer about the book "Paths of Opportunity in U. S. Steel" and find out how you can take part in this interesting, important work?

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UNITED STATES STEEL EXPORT COMPANY · UNITED STATES STEEL PRODUCTS COMPANY · UNITED STATES STEEL SUPPLY COMPANY
UNIVERSAL ATLAS CEMENT COMPANY · VIRGINIA BRIDGE COMPANY

USS

UNITED STATES STEEL

New Developments

By Leonard Ladof, E.E. '49
Ken McOwan, M.E. '49
Henry Kahn, Ch.E. '50

Winter Proof Highway

Another triumph for highway engineering will be realized with the new year when a snow-melting highway is opened for use in Klamath Falls, Ore.

The application of radiant heating principles to a public road will keep a four lane highway clear and skid free in all weather. The heated road section is an eight per cent grade, 450 feet long, on the Dalles California highway, leading into Klamath Falls from the north. Heat is supplied by hot water from an underground spring, circulated through a network of welded, wrought iron pipe laid in the concrete. Work was started on the road last spring after a 10-inch well had been drilled and a good flow of hot water tapped at a depth of 390 feet. A coil of two-inch pipe is submerged deep into the well, which acts as a boiler. A pump sends ordinary water and anti-freeze through the coil where the solution is heated to 160 degrees.

The pump, thermostatically controlled, begins to circulate the water when air temperature drops to freezing and continues to operate until the temperature rises above freezing. Another pump draws water from the well since it loses its heat value as the cool solution flows from the road through the transfer coil. Hot water then bubbles up from the earth back into the well. In continuous operation, the system is capable of melting one inch of snow per hour.

The New Look

In the future, when you admire the beautiful finish on refrigerators, washing machines, sinks, and other products finished in this manner, don't be too sure it is baked enamel.

A new finish called Superclad was developed by Sherwin-Williams engineers, because baked enamel can be applied only to a special steel. This new product, however, has the advantage of "sticking" to such metals as aluminum and low grade steels.

Superclad's chemical inertness is certainly a desired property, especially when it is to be used in industry. Tests on the synthetic enamel showed that it could withstand acids and alkalies up to eighteen months, while ordinary top-grade enamel succumbed within forty-eight hours.

F-M Radio for Railroads

Two-way radio communication as an aid to more efficient yard operation is now being used by the Illinois Central railroad. Station WMWK employs frequency modulation at 161.85 megacycles with a power of 15 watts. The reasonably effective range is about 15 miles.

The transmitter is located in the northbound "hump" office in the freight car classification yard at Markham, about 20 miles south of Chicago. The main communication is with the crews of switch engines engaged in making up the long lines of freight trains which roll down from the "hump."

High-Visibility Temperature Indicator

A new highly accurate temperature indicator can be read even under the worst conditions of visibility. This high degree of visibility is assured by contrasting colors between the background and the hands and numerals, a uniform scale, and shockproof and weatherproof construction, which eliminates fogging of the glass. In such construction, resetting of the maximum-temperature indicating hand cannot be accomplished by the usual knob protruding through the glass. Consequently the hand is reset by "wiping" a small magnet over the face of the cover glass. The magnet, which is screwed into a hub on the side of the instrument for safe keeping when not in use, is attached to a light chain to prevent loss. The temperature indicator can be furnished with an alarm contact that indicates when a pre-set temperature is reached. An oil-tight mounting will permit removal and re-installation of the unit without changing the oil level or disconnecting the transformer.

Automatic Flux Mapping Machine

The invisible field of force surrounding electrically charged pieces of metal can automatically be represented on a drawing board with a new instrument developed by the General Electric company. This field mapping instrument may be used to study such problems as the flow of heat in and around heated objects, the magnetic field surrounding an atom-smasher magnet, and the twisting forces set up in propeller blades.

Field mapping up to this time has been a tedious process of calculation and point by point plotting of curves. This new instrument can map fields of any two-dimensional and many three-dimensional shapes in a few hours.

In operating the instrument, the metal boundaries are connected to a power supply and submerged in a shallow tank of water, which acts as a conductor of electricity. Three small probes, extending downward into the water like miniature fingers, are used to pick up the voltage which varies from place to place. These probes are suspended from mobile equipment above the water. The machine is built so that when the probes move, they follow a line of constant voltage. The motion of the probes is then reproduced on the drawing board by means of a four-foot-long metal arm. Only the center of the three probes actually follows the lines of constant voltage. The outside probes serve as guides which steer the center probe around the corners taken by this line.

The same process applies equally well to heat problems and to twisting forces in propeller blades. The lines of equal temperature or strain are equivalent to the constant voltage lines.

Supersonic Parachutes

The pilot of the future may safely escape from a disabled supersonic craft at high altitudes where an ordinary parachute would be useless. He would be enclosed in a bullet-shaped metal "capsule" with a propeller on its tip.

The device, also called a "rotochute" and developed by General Electric engineers, is now used in rocket research. At present the "rotochute" is capable of gently lowering delicate instruments to the ground from rockets flying as high as 100 miles. After being released from the rocket, the "chute" slows gradually from supersonic speeds to about 27 miles per hour by means of its whirling propellers or vanes which act as an air brake.

Although not now intended for use by humans, the "rotochute" can be redesigned so that it could carry a pilot and could be fired by an explosive charge from the rocket. The pilot could then guide the course of the device by controlling the pitch of its vanes and could land with greater accuracy than is possible with a parachute.


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We don't work with
ALL THIS STUFF!
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Published Eight Times Yearly by the Students of the College of Engineering, University of Illinois

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the Illinois Technograph

Volume 64 **Number 5**

The Tech Presents

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ARTICLES

DEPARTMENTS

OUR COVER

Air view of the Northrop XP-79, highly unconventional twin-jet Flying Ram, in flight over Southern California. Features of the XP-79 are fully enclosed cabin and jet engines, prone-position for the pilot enabling sharper turns and pull-outs, and over 500 m.p.h. speed. (Photo courtesy of Aeronautical Engineering Review.)

'Engine' Students Take Note . . .

Early next month, a contest will be held to determine which instructors are considered, by vote of the students, the most effective in their teaching methods. The objectives of this contest, sponsored by the Engineering Council and the Illinois Technograph, are to promote an active interest in the advancement of effective teaching, to honor members of the faculty in each department of the College of Engineering, in particular, those who are chosen by vote of the students as the most effective teachers, and to bring about a closer relationship among the faculty and the students.

Here's how the contest will work:

1. Voting is open to all juniors and seniors in engineering.
2. Junior and senior engineers will cast three votes for their most effective instructors, no more than one vote being cast in any one department.
3. Voting will be for instructors in all engineering departments at the University, including chemical engineering and architectural engineering. For the purpose of this contest, mining and metallurgy are considered two separate departments. The departments to be included are as follows:

Aeronautical	Civil	Physics
Agricultural	Electrical	Mining
Architectural	G.E.D.	Theoretical and Applied Mechanics
Ceramics	Mechanical	
Chemical	Metallurgical	

4. The starting date of the contest will be Wednesday, March 16, and voting will continue until Friday, March 18.
5. Between the above dates you can cast your votes either at the special booth to be located outside Engineering Hall or at the ballot box in your respective departmental office.

Shortly after the close of this contest a special College of Engineering convocation will be held in the University auditorium. At that time the winners of the contest will be announced and a plaque, with their names inscribed, will be presented.

Below are listed some points which mark the good instructor. Before deciding who your most effective instructors are, consider these points carefully!

The good instructor . . .

Knows his subject thoroughly
Is interested in his field
Is orderly, systematic and careful
Is always prepared for class
Has definite standards of work
Gives assignments which are clear and varied
Gives tests that are fair and grades them accurately
Keeps the student informed of his standing

Remember to Cast Your Vote!

VOTING DAYS: MARCH 16 THRU 18, INCLUSIVE!

Can We Improve Technical Education?

By John Johnson, M.E. '51

Can we improve technical education? Certainly before the answer to such a question can be determined, an analysis of our teaching is in order.

Few people connected with technical education today, either in the capacity of administrators, teachers, or students are willing to say we have reached the ultimate in our teaching processes. Is it the ability of the teacher, the attitude of the student, or the process by which our teaching is done? Let us look at these factors separately.

Our Teachers

Are they educated men or are they teachers? Asking such a question indicates a belief that there is a distinct difference between knowledge and knowing how to teach. It is felt, with at least some justification, that too often a man is employed to teach on a basis other than his teaching ability.

To find the justification for such a statement, one has only to review the technical curricula of some of our representative institutions. This curricula, the only preparation many of our instructors have, in many cases shows a decided lack of courses on teaching methods. Such is not the case in non-technical curricula, for therein many education courses are offered; but in preparing to teach technical subjects, practically all the available time is spent in acquiring that technical knowledge which is to be imparted to others at a later time.

A frequently heard comment of students today is, "He knows his subject, but can't teach it." If such comments have basis, there must be requisites of a good teacher; requisites which some of our teachers in technical schools do not have. Let us enumerate but a few: (1) the technical knowledge, (2) the desire to teach and work with others, (3) the personality for teaching, (4) the ability to teach.

Before we discuss these factors, let us divide our present day faculties into two groups, which we may call the "stop-gap" and "normal" groups. Such classifications certainly overlap, and are not to indicate definite segregation.

The "stop-gap" group came into being as a result of the second world war. The return of thousands of veterans, along with the normal flow of high school graduates, presented an almost insatiable demand for instructors. Few colleges or universities in this country had sufficient faculties to handle the tremendous rush to college which took place at the close of the war. Additional teachers were required almost immediately; certainly more quickly than our normal process of training teachers could supply. What was the alternative?

This first-place winner of the recent Tau Beta Pi pledge competion treats a very worthy subject—education. By discussing the attitudes of teachers and students and analysing teaching methods, the author shows conclusively that there is much room for improvement in our present educational system.

The only apparent answer was to draft into the service of teaching those people who had finished undergraduate work, and who were remaining in school to work on advanced degrees. Many of these people had no desire to teach, but accepted employment as instructors as a means of partial support. Many, although technically trained, had no particular ability to teach. Some had personalities not conducive to instructing others.

A look at some of our great technical experts serves to prove there is a place for those who prefer to work alone. But how many of our great educators have been men whose best work was done in the confines of their own offices or laboratories? The need for the desire to teach and the personality for teaching seems apparent. It suffices to say that ability is essential.

Can we condemn this group who is teaching as a means to an end, who is using a faculty position as a stepping stone to an advanced degree? No, rather they are to be profoundly thanked for the service they are rendering. But as we approach the normal flow of students again, every effort should be made to reduce within appropriate limits, this group who have tried to combine teaching others with advanced studies of their own. Either seems to be a full-time job, with the result that a mixture of the two only dilutes the success of each.

The "normal" group includes those people who have chosen teaching as a career, are qualified technically, and have the ability and required personal traits to teach. This group is to include all those who do well the job of their choice. Obviously, an expansion of this category is desirable, but also difficult. Many men who could have potentially been great teachers are in industry today. The reason is economic. Today, many students feel sincerely that they would like teaching as a career, but are forced to pass the choice by, afraid of the economic shortcomings involved. Certainly, we have no right to expect men to enter the field of teaching, when that very entry means, in many cases, great financial loss. When and only when the people of this country are willing to "pay the price" for good teachers, through taxation or otherwise, can we expect this group to be expanded.

This so-called normal group, naturally includes good, fair, and poor teachers, but an expansion of this category would, by the normal process of competition, eliminate those not qualified for the job they chose, as is the case in any field.

Our Students

What student factors greatly affect the success of technical education? Probably the three most important are ability, aptitude, and attitude. The casualty rate in our technical schools indicates that too great a percentage do not have the ability to master technical subjects. In many cases, a lack of aptitude for the chosen curricula is evident. How about attitudes? Certainly they are not all that is to be desired in many cases. Let us examine each of these factors separately.

One possible cause of inability to master technical subjects lies in the lower level education of our students. It is very possible that students in high school delay too long the choice to study technical subjects, and hence fail to adequately prepare themselves for their college work. Many returning veterans have been unable to readjust themselves to the study processes required. At least some justification must be given the theory that many students enter college at too young an age to be fully capable of mastering technical subjects.

Little can be said about the lack of

(Continued on page 22)

JETS ARE JUMPING

By George Ricker, Aero.E. '49

As time follows time and man gathers new knowledge, startling and revolutionary creations are produced in the fields of industry. However, the advent of these new products is not wholly one of recent research but the growth of a feeble idea in the minds of ancient scientists. This is very true of the latest development in aeronautics—jets. The jets which are seen streaking across the sky today are reminders of a long research process which began before the birth of Christ and has continued up to the present day.

Hero, an Alexandrian philosopher, began this research by the construction of an aeolipile in 130 B.C. This aeolipile was a hollow sphere supported between two pillars. One of the pillars was hollow, and steam was transmitted through this pillar into the sphere. There were two jets located diametrically opposite of each other on the sphere, and as the steam was released through the jets, the sphere rotated on the pillars. However, at that time there was no explanation for this result, and the progress of jet propulsion was mired down for 18 centuries until Sir Isaac Newton introduced his third law of motion. This law, which states that for every action there is an equal and opposite reaction, was presented to the public in 1687, along with his other works, in a volume entitled "*Principia.*" The explanation of jet reaction which this law provided brought about new enthusiasm. Scientists renewed the investigation of jet propulsion. The results of the experiments were not very encouraging though, and the most practical thing designed was a four-wheel "steam carriage" accredited to Gravesande. This carriage was propelled by releasing steam through a jet at the rear of the carriage.

By the middle of the 18th century another lull had developed in the field of jet reaction. This lull was not infringed upon until the beginning of the 20th century.

At the start of the 20th century the inventors began to focus their thoughts upon the use of jet reaction to propel aircraft. In 1903, Avery, an American, visioned a helicopter with steam jets at the tips of the blades to produce rotation. However, the steam plants were too heavy for this purpose, and a model was never made.

In 1908, Lorin, a French engineer, proposed a multi-cylinder construction or wing installation. The layout was an inline reciprocating engine with divergent nozzles attached in such a way that the pistons would force the exhaust through these nozzles. The unit was to use only jet reaction for propulsion and no power was taken off of the crankshaft. The mass of air handled by this power plant was inadequate, and the thrust obtained was far too small. Lorin had made a start in the right direction though, and inventors realized that the solution was a device which would increase the mass of air used and thus develop more thrust.

It is very possible that you have seen a jet plane streak across the sky and wondered about the development and operation of its revolutionary, jet propulsion engine.

This article presents the history of the jet engine and explains the operation of the four basic types of jets—the ram-jet, pulse-jet, radial flow turbo-jet, and axial flow turbo-jet.

In 1917 a Frenchman, Morize, proposed an "ejector" scheme which employed a convergent-divergent nozzle. An engine drove the compressor and a fuel pump. The fuel and compressed air were delivered to a combustion chamber and the combustion gases were discharged through the combustion chamber nozzle into the convergent-divergent ejector tube. This process utilized a large amount of air, and the thrust was increased. In the same year H. S. Harris, of Esher, devised a propulsive unit which employed two ejector tubes. However, Harris' ejector tubes were divergent-convergent nozzles, just the opposite of Morize's. Harris used an engine to run the compressor, but the fuel was sucked into the combustion chamber and the fuel pump was eliminated. No attempt was made to put either Morize's or Harris' units into an airplane.

In 1930, Whittle, a British airforce man, tried to get the British government interested in a jet unit composed of a radial compressor and a gas turbine which was used to run the compressor. The British refused it on the grounds that the practical difficulties were far too numerous.

From 1917 up to the middle of the 1930's the progress was slow and the work was still being done mostly as an individual interest.

The first nation to start a large-scale research program was Germany. In 1934 three German aircraft companies, Junkers, Heinkel, and B.M.W., were assigned the task of producing jet units to be used in the aircraft which Messersmidt, Junkers, and Heinkel were designing.

Two years later, in England, Whittle formed the Power Jet, Ltd., with hope of building a workable jet unit. The British government was still very unconcerned about the matter and did not offer Whittle any encouragement.

Later in that same year the Junkers company in Germany started the layout for the Jumo-004 jet unit.

Meanwhile, Whittle had been constructing his radial compressor jet, and in 1937 it was given the first test run. The results were very discouraging. There was still a great deal of work to be done on the compressor and the combustion chamber. However, the British Air Ministry was beginning to take an interest in Whittle's jet, and the construction of another unit was started immediately. This unit was completed in 1938. A test run of the second jet brought about severe damage to the unit. Therefore, Whittle began the design of another unit.

During this time the Heinkel company of Germany was finishing the research of the HeS-3 jet unit, and in 1939 this unit was installed in the He-178 airplane. On August 27, 1939, the He-178 took off for the world's first jet propelled flight. However, the HeS-3 unit developed less than 1,500 pounds of thrust and was not put into production. Junkers also finished the Jumo-004 in 1939 but it was not flight-tested until later. The Jumo-004 developed 1,760 pounds of thrust and had better prospects than the Heinkel unit.

Meanwhile, Whittle was working hard on the W1X, his new jet unit. The W1X was finished in 1941 and was installed in the Gloster E-28 airplane. On May 15 of that same year, the Gloster E-28 made the first British jet propelled flight. By this time a large number of British aircraft companies were beginning designs for jet units.

In 1941, General H. H. Arnold of the U. S. Army Air Forces visited England and arranged to have one of the Whittle jet units shipped to America. The Americans were behind in the field of jets, and in order to speed up production of an American jet unit, the job of construction was given to the General Electric company whose personnel were experienced in turbosuperchargers. By 1942 the General Electric company had developed the I-A jet unit. During the construction of the I-A jet engine, the Bell Aircraft company designed and completed the XP-59A for the purpose of housing two of the I-A units. The jet units and the airplane were shipped to Muroc Lake, California, and assembled. On October 1, 1942, the XP-59A took off for the first jet propelled flight in America. The following year the General Electric company turned out the I-40 jet unit which was to be installed in the XP-80.

However, the Germans were still ahead in jet development, and in 1944 they commenced mass production of the Jumo-004B jet unit and the ME-262 aircraft. Late in 1944 the ME-262 was put into action against Allied bombers.

The Germans were defeated before they could do much more with jet propulsion, but the Americans and British have continued to improve jet engines and the planes which house these engines.

The jet propulsive units that are being built by the Americans and British can be cataloged into four divisions: rocket, pulse jet, ram jet, and turbo jet.

Although the rocket employs jet reaction for its propulsive power, it is somewhat different from the other jet units. The rocket is not an air-breathing unit; it carries its own oxygen or oxidizing agent along with its fuel. There are two types of rockets: (1) those which use solid fuel, and (2) those which use liquid fuel. The fuel is burned in a combustion chamber and the combustion gases are emitted through a nozzle at the rear of the rocket.

The rockets at the present time are used for assisted take-offs of aircraft and for guided and unguided missiles. One of the greatest handicaps of rockets today is the large amount of fuel which

(Continued on page 30)

The Xf2H1 Banshee was built for the U. S. Navy by McDonnell. (Photo Courtesy of Aero Digest.)

Wing tonks give the Republic P-84 Thunderjet a range of over 1000 miles. (Photo Courtesy of Flying.)

First A. A. F. fighter in the 600 m.p.h. speed class wos the P-84. (Photo Courtesy of Aeronautical Engineering Review.)

Stepping Stones to Octane Numbers

By Wallace Hopper, M.E. '50

Whoops! Wait a minute! I looked again and drew to a stop just inside the south door of the mechanical engineering laboratory. What's this? An Ethyl Series 30 knock test engine! A glance at the name plate verified it. This very engine was one of the stepping stones in the story of the development of "octane number."

"Octane number" is a laboratory evaluation of the anti-knock quality of a fuel. Knock, or detonation, is that disagreeable little pinging sound which many drivers of cars hear when they are going up a hill, beating the other guy away from the stop sign, or passing another car. It is caused by the secondary self-ignition of the unburned portion of the charge in the cylinder because of the rapid rise in pressure and temperature following the primary firing.

Several factors combine to determine the degree of disgust which the driver may feel toward his car during the periods of knocking. These are (1) compression ratio, (2) jacket temperature, (3) spark advance, (4) air-fuel ratio, (5) speed, (6) combustion chamber design, (7) temperature of air-fuel mixture, and (8) fuel type.

The phenomenon of detonation is common to internal-combustion engines used on the ground and in the air. In the aircraft engine, this characteristic is a very serious consideration, because it can rapidly produce a destructive condition at the piston.

Knock determination was an individual research problem among the industries in the eight years preceding 1928. Methods employed for establishing a relative knock rating for fuels were many; there is no absolute rating. One method, used by H. R. Ricardo, a British engineer, was to determine the compression ratio which would produce a light knock. This ratio was designated as the highest useful compression ratio (HUCR) of the fuel. The intensity was judged by aural means and was standardized periodically using a fuel of a given value.

Chemical analysis was attempted, as was power output and spark advance, in trying to evaluate the degree of knock; after much investigation along these lines, it became obvious that only an engine test could give the desired

WALLACE HOPPER

Wallace Hopper, one of the newest Technograph members, is a junior in mechanical engineering from Alton, Illinois.

Born on October 6, 1909, Wally has spent 18 of his years working in the petroleum industry. Fifteen of these years were devoted to anti-knock testing, which certainly qualifies him to write authoritatively on the subject of octane ratings.

Returning to school after such a long time in industry was surely a difficult but wise decision for Wally to make. However, after graduation he plans to return to his former occupation.

results. When using an engine, the only satisfactory substitute for the aural method is the "bouncing pin." Its essential parts are shown in Figure 2. As the pressure in the cylinder rises, due to the fuel combustion, it flexes the diaphragm which in turn allows an electrical contact, and a current flows. In the early development, the current went through an acid mixture, thus evolving a measurable amount of hydrogen. The pressure in the cylinder must be of the magnitude to produce knock before this takes place. Later, a knock meter was substituted for the hydrogen evolution process.

By 1928, it had become obvious that

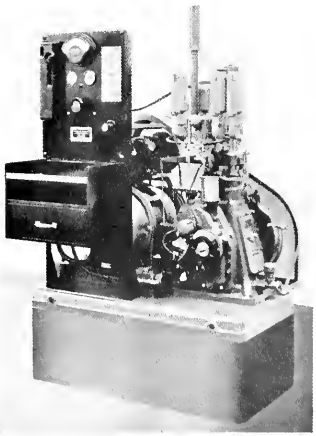


Fig. 1. C. F. R. engine tests motor fuels for knock characteristics of motor fuels.

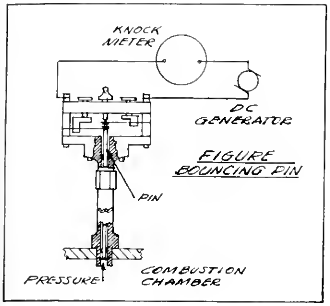
for marketing reasons some uniform method of knock determination had to be devised. With this in mind, the Co-operative Fuels Research committee, made up of members from the American Petroleum Institute, Society of Automotive Engineers, and The National Bureau of Standards, set up a sub-committee on detonation.

The sub-committee decided on three primary objectives as necessary to a standard test: (1) a test engine, (2) a scale of measurement, and (3) a reproducible method. Success culminated their efforts in 1932. During the intervening period, much work and thought had taken place; here is the niche which is partially filled by the Ethyl Series 30 engine.

The dictionary defines a stepping-stone as a means of progress or advancement. As such, the Ethyl Series 30 engine has a place among the many stepping-stones used in the development of the term "octane number." Octane number, although usually thought so, is not self-identifying. There are four types. This article points out the justification for the several types, the manner in which they differ, and the methods used to determine them.

It is interesting to note the important part the predecessor of this engine played in the development of the anti-knock compound tetra-ethyl lead. The unit was originally produced as a small lighting plant by C. F. Kettering of the General Motors corporation, but because of the hazards connected with gasoline storage, kerosene was considered as a fuel. Knocking and loss of power immediately followed the change of fuel.

It was thought, by analogy, that other engines must act similarly. So the search was on to find some substance which would raise the resistance of a fuel to knock. Thomas Midgley and T. A. Boyd, two veterans at knock research, were given the problem of finding the material. They did, after investigating 30,000 compounds. Tetra-ethyl lead, or more familiarly, lead, was the answer.



After considering several engines, the committee approved one which had been developed by the Waukesha Motor company, Waukesha, Wisconsin. This testing unit is shown in Figure 1. Basically, this engine has remained unchanged since its development. It is a single-cylinder, variable-compression unit, with overhead valves, and has 3¼-inch bore and 4½-inch stroke.

The next consideration, a scale of measurement, was answered by Dr. Graham Edgar, of Ethyl Gasoline corporation, who suggested the use of the pure chemicals iso-octane (2, 2, 4-tri-methyl pentane) and normal heptane; the former being arbitrarily assigned the value of 100 and the latter 0. An "octane number" of a fuel was established as equal to the percentage of iso-octane in the normal heptane required to give knock intensity equal to that of the fuel under test, when run under the specified conditions of test and in the designated engine. These fuels are ideally suited for the purpose because they have similar physical properties and are unreactive to change in engine conditions.

Because of their cost, approximately $30 per gallon at that time, it was necessary to set up secondary standards for routine use. Of course, as in the case of the engine, these fuels were not immediately obvious, and it required considerable elimination of other possibilities before they were approved.

Finally, for complete success of the initial "mission," the method was defined. This original method, presently called the research method, although suffering minor changes through the years, is still a factor in determining fuel characteristics. Its features are outlined in Table 1.

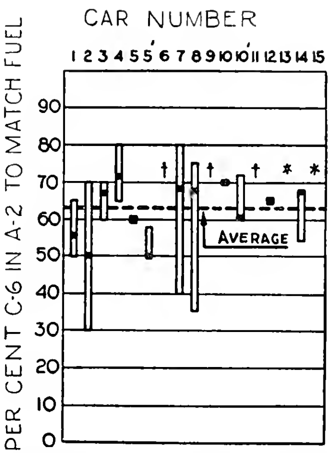


Fig. 3. Road knock ratings of one fuel are shown for several makes of cars.

The octane number of an unknown fuel is determined by putting the unknown fuel in one of three carburetors, setting the carburetor to the maximum knock mixture strength, and noting the meter reading. This reading is then bracketed with fuel blends of known octane values by putting them in the other two carburetors and adjusting for like conditions. An interpolation of the readings gives the equivalent rating of the unknown fuel.

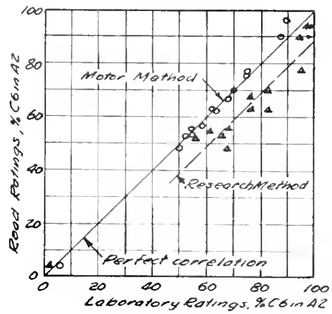


Fig. 4. Motor and research methods with the 1932 road tests are comparatively plotted.

The answer had been found so far as the laboratory measurement of knock was concerned, but another very important question arose. How would these laboratory results correlate with the knock as found in the car on the road? To solve this, a hill near Uniontown, Pennsylvania, was chosen in 1932 as a site for road tests, and representatives of 15 oil companies and automotive companies rated 15 fuels in several cars of different makes. These fuels were rated at the point of maximum knock encountered during the run up the hill. The results were interesting since knock is a function of compression ratio, air-fuel ratio, speed, spark advance, and air-fuel temperature, and no one of these is exactly the same in any two cars, or for that matter, in any two cylinders of a given car. Wide variations were found in rating the same fuel in the diffenent cars. Figure 3 shows how one fuel rated against the secondary reference fuels in use at that time. The extreme difference represented about five octane numbers. The reproducibility of the laboratory engine was ±0.5 octane number.

With road data in hand, the group tested the identical fuels by the research method at the Waukesha Motor company laboratory. The degree of correlation between the average road test and the laboratory ratings is shown in the Figure 4. On the basis of this work, a revision of the laboratory method was necessary. Additional investigation brought about the more severe motor method; its specifications are listed in Table 1. The usefulness of the two methods lies in the ability to determine the effect of engine conditions on a knock rating. The following table lists a few data by both methods.

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Table 1— Operating Conditions for Laboratory Knock Test Methods[1]

Method	Speed, rpm	Spark adv., deg	Jacket temp, F	Humidity int air gr lb	Intake air F	Fuel-air ratio	Comp ratio	Determined by
A.S.T.M. D908-47T Research Method Formerly CRC F-1	600	13.0	212	25-50	125	max. knock	variable	bouncing pin
A.S.T.M. D357-47 Motor Method Formerly CRC F-2	900	Variable auto.	212	25-50	100 mixture 300	max. knock	variable	bouncing pin
A.S.T.M. D614-47T Formerly CRC F-3 Aviation Method Fuels of 70 O.N. or over at a lean fuel-air ratio	1200	35	374	25-50	125 mixture 220	max. thermo plug	variable	thermo-couple
A.S.T.M. D909-47T Formerly CRC F-4 Superch'ge Avia. Meth.	1800	45	375	70 max.	225	variable	7.0-1	aural
Fuels of 85 O.N. or over at knock limited power, under supercharge rich mixture conditions	Note: Fuel injection							

[1]See: 1947 Supplement to Book of A.S.T.M. Standards, Part III-A, American Society for Testing Materials, Philadelphia, Pa., 1948

SALES ENGINEERING

By BERNARD LESTER

Sales Manager Westinghouse Electric Corporation

Sixty days ago the new plant for building pumps would have been a great place for an entertainment: walls glistening, floor big enough for a roller skating rink. But now the steady fluorescent light from the ceiling sheds its bright rays over long rows of machine tools, conveyors, and spotless work tables. Not only a safe, efficient layout, but a pleasing place to work.

It had all come about through the persistent skill of the works engineer and his crew, and sales engineers representing suppliers of machine tools, material handling equipment, and other suppliers of just the right apparatus for the job. Back of it all were the stockholders' dollars wisely spent by the folks up top for capital equipment. A building itself years ago was 90 per cent of the investment. But now the tables have turned. The "house," important enough, is designed to enclose a whole array of carefully engineered apparatus, many times its value.

Machines? Plenty of them. And here they were alive; all were selected and tailored for one particular job. Motion and power with infinite exactness all engineered to perform one particular duty: make high-grade pumps, efficiently and profitably.

In accomplishing such a result, the work of the sales engineer is seldom recognized. To the casual observer the credit for producing all this productive apparatus goes to the men at the supplier's headquarters who designed and built it, and to the people who own and run the plant where it is installed. But to the capable and resourceful sales engineer should go much of the credit for intelligence in putting the various tools to their proper use. His job is never done, until what he sells is properly engineered and in place, continually producing the full service for which it was intended.

Exactly what does this sales engineer representing the apparatus manufacturer do? He is an engineer, a practical economist, and a promotional force—these, all in one. He must know his customer's processes and problems and be able to solve them. He must know the design and construction and operating factors of what he sells. And too, he must know people, how their minds work, from the customer's engineers to the purchasing agent who places the order.

Sales engineering during recent years has jumped by leaps and bounds into a position of singular importance. Everyone knows the age in which we are living is becoming increasingly mechanical, but technical products are useless unless skillfully applied.

Saving the old horse and buggy with paint and repair no longer works. Machinery and equipment are on the move. There are better designs each year, with new operations to perform. Results come in the ever-expanding use of capital goods, through spending wisely, with a keen knowledge of depreciation and possible output and earning power.

With all this progress has come a great change in the art of selling productive equipment. Years ago the machinery salesman was a high-powered entertainer. For instance, he knew scarcely more about the power plant apparatus to be sold to the village than the city fathers themselves, as they accepted his entertainment and sometimes his graft. Sales engineering today is a serious job, requiring talents of a high order. Yet we still associate with selling the idea of persuasion to buy that which one may not actually need. Not so with the sales engineer. He does not grab the order and disappear. He must live with his customers year after year. He is the consultant, the expert on his line of equipment, the man who gets into the plant and works out the problem. Sometimes his recommendations are "not to buy" and often this advice creates a reputation that is worth its weight in gold for many years to come.

"Wanna buy a duck?" No, you wouldn't hear this phrase from a sales engineer. Sales engineering is a position of singular importance and requires the talents of a man familiar with many other aspects of life besides engineering.

Perhaps, up until this moment, you have had no concept of the various duties performed by the sales engineer. An excellent description of these duties is given in this article by Mr. Bernard Lester, a man of vast experience in this field, and who now holds a position as assistant industrial sales manager of Westinghouse Electric corporation.

Creative? No class of engineering service is more creative than that of the sales engineer. Of course he creates business for his employer. But materials are of little value in their native state. The value in the machine tools he sells, for instance, traced away back, is the work that has gone into the making of them.

Who could be more productive in creating work for his own company or for the plant that uses his machines, products, and services?

But sales engineering is creative also in another sense. Back in the black thirties, there was a run-down paper mill, antiquated, inefficient, tottering. The sales engineer of an important builder looked upon it with vision and with intelligent enthusiasm. He set to work. Nothing was further from the paper mill owner's mind than to buy. But the sales engineer had resourcefulness and ability. He studied the mill and its inactive layout. He drew sketches and developed a new possible productive layout, all reduced to figures of expenditures and resulting reduction in the production cost and price per ton of paper. He interested local bankers and consulted with other apparatus suppliers in lines parallel to his own, gaining their support. Finally, he developed a practical program of revamping, and the willingness to invest funds. The decision was made to go ahead, even in the poorest time. He got a substantial order for apparatus. Was he creative?

Numberless examples can support this same idea. In 1934, the steel mills rolled cold-rolled tin plate at a maximum speed of 400 feet per minute. Only five years later, in 1939, a mill was in operation producing this tin plate at a speed of 2,300 feet per minute. This remarkable improvement came about largely from the efforts of a sales engineer selling rolling-mill machinery and a sales engineer selling electrical equipment, both working in conjunction with the engineers connected with the steel mill.

Where do sales engineers come from? How are they trained? Some few capable men, likely older ones, never took

(Continued on page 20)

Introducing . . .

by Robert Lawrence, E. Physics '51
and James Ephgrave, E.E. '51

JOHN L. WESTENHAVER

Contrary to common belief, there are some engineers who have interests south of Green street. A good example is the editor of the 1948 Illio, John Westenhaver, a senior in electrical engineering.

Although born in Pittsburgh, John spent most of his life in LaGrange, Illinois, where he attended Fenwick high school. At Fenwick he was active in many affairs, including work on the newspaper and yearbook. In 1942 he moved to San Bernardino, California, where he now has his home.

After graduating from high school in 1942, John came to the University of Illinois. Both his father and mother were loyal Illini. His father, a consulting engineer, graduated from Illinois in 1918.

After one semester, John left for the Army Air Force. During most of his time in the service, he was a radar operator in the Pacific theater. In the fall of 1946, he returned to the University.

When he became editor of the Illio this year, John took on many varied duties. As editor, he decides on the organization and layout of the book. He also suggests and approves the design and art work. Under his personal supervision are the Illio "beauties" and "campus leaders" sections. Their contents remain secret until the day of publication. In addition, he must organize and train the staff to take over next year's Illio.

An estimate of the size of his job

JOHN WESTENHAVER

may be shown by the size of the Illio. Even though it has the reputation of being the world's largest college yearbook, this year's volume will contain 120 more pages than last year, and 100 more than the previous record holder. It is no wonder that the editor is a very busy young man.

As well as working on the Illio, John has served as house manager and secretary of his fraternity, Phi Kappa Sigma. In addition, he has been secretary of Sachem and is now secretary-treasurer of Ma-Wan-Da. He is also a member of Skull and Crescent and A.I.E.E.-I.R.E.

John put in a plea for more men from north campus to work on the Illio and in other activities. He has certainly shown that it is possible for an engineer to take an active part in extracurricular affairs and still keep up his grades.

DR. HARRY G. DRICKAMER

In 1947 the American Institute of Chemical Engineers presented their junior award to a chemistry professor on this campus. The award went to Dr. Harry G. Drickamer, assistant professor of chemical engineering, for the best publications submitted of the previous three years' work.

Dr. Drickamer came to the University of Illinois in July, 1946, on a research assignment. In the fall he started teaching chemistry courses in both the graduate and undergraduate schools.

He was born in Cleveland, Ohio, and attended Shaw high school there. According to Dr. Drickamer, his life at high school went along rather smoothly. He was active on several committees and played football and baseball.

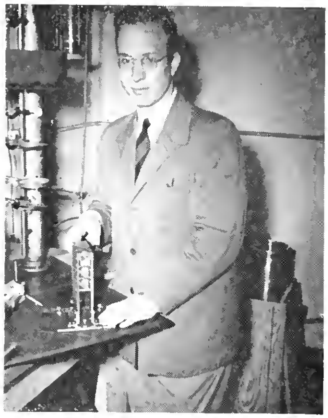
He enjoyed sports and continued to play football and baseball at Vanderbilt university; but he gave them up after the first year in order to devote more time to studies. He then attended the University of Indiana.

He spent three years at the University of Michigan and soon found himself in school activities again. This time he became president of his senior class, and served on a number of active committees.

He received his bachelor of science degree in June, 1941; and that summer, he went to work for the engineering research department at Michigan. In 1942 he went to Texas City, Texas, to work for the Pan American Refinery company. This job also included research and a design assignment of new units for making aviation gasoline and chemical petroleum. He earned his master's degree in 1942 and became a member of two government committees. They were the Aviation Gasoline Advisory committee and the Toulene Technical committee.

While still in Texas, he worked on his doctor's thesis. For the spring semester of 1946, he returned to Michigan to complete the requirements for his doctor's degree.

It was soon after he received his doc-



DR. HARRY G. DRICKAMER

tor's degree that he came to Illinois for his research work. He is now working on such experiments as the fluctuation of liquids, the kinetic theory of gases, and other critical phenomenon pertaining to gases and liquids.

Dr. Drickamer is a member of five honorary fraternities. They are Phi Eta Sigma, Phi Kappa Phi, Phi Lambda Epsilon, Sigma Xi, and Tau Beta Pi. He was also counselor of the student chapter of the American Institute of Chemical Engineering last semester.

He is married, has two children, and lives in eastern Champaign. He enjoys a good round of golf whenever he has a spare moment, and finds relaxation from his work by maintaining a garden.

The tailor was selling his best friend a suit. "I'm telling you, Harry," he said, "that even your best friend won't recognize you in that suit! Just take a walk outside for a minute and get the feel of it."

Harry went out and returned a moment later. The tailor rushed up to him with a smile. "Good morning, stranger," he beamed, "what can I do for you?"

In This Corner... NAVY PIER

Our New Engineering Council

It's taken a long time, but after two semesters of pushing, our engineering societies finally have the ball rolling. Yes, we do have an Engineering council here at the Pier. The students have come to the conclusion that a council is necessary for greater cooperation and recognition of our engineering societies.

Ever since the first article appeared in the Technograph concerning an Engineering council at the Pier, many readers have approached us with the question, "What power will the council have?"

We'd like to clarify this question for our readers. The council was not designed primarily to have power, but rather, as the preamble of its constitution states, to bring about a closer relationship between all engineering societies, promote mutual benefits, and sponsor the annual St. Pat's ball and Engineering show.

The council is already making progress. Within the past three weeks, there have been three meetings, during which the council has ratified its constitution, made application for recognition, and is currently working on the St. Pat's affair. There are still many things to be ironed out. However, we have high hopes for this new organization. As of date, it represents approximately 50 per cent of our engineering enrollment. Certainly a council that represents such a large body must be very responsible to the latter. We hope the council realizes this responsibility, and in turn, we urge that the entire student body get behind the plan with all their support.

To the members of the Engineering council, we wish the best of luck and success in the hope that you will be truly representative of our large engineering student body.

Mr. Ogden Livermore presents Matrix awards to Siegmund Deutscher on the left and Richard Choronzy. (Photo by Groemling.)

First Awards Presented

By Robert Lessin, M.E. '51

The Navy Pier staff set a new precedent in holding its first "coffee and cake" meeting during December, just before the Christmas holiday.

The highlight of the meeting was the presenting of matrix awards to Siegmund Deutscher, retiring editor; Richard Choronzy, recently appointed editor; and John Fijolek, ace reporter. The awards were presented by Mr. Ogden Livermore, faculty adviser here at the Pier.

These awards are given by the Illini School of Journalism in conjunction with the Illini Publishing company. The awards are given to those staff members who have worked faithfully in behalf of the magazine for at least one year.

At the meeting, an informal discussion was held concerning sales and methods to improve them. Many new ideas and plans were brought forth and much consideration is currently being given to them. It was during this part of the meeting that the editorship of the Navy Pier staff was formally turned over to Richard Choronzy. At this

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NAVY PIER STAFF

Richard Choronzy .... *Asst. Editor*
Naomi Suloway .... *Asst. Bus. Mgr.*

Editorial Associates

John Fijolek	Robert Lessin
Eugene Stojack	Richard Kawka

Business Associates

Robert King — Arthur Stanchurski
Clarence Niebow

Robert Groemling .... *Photographer*

Enjoying the Pier Technograph staff meeting are, left to right, Robert Lessin, Naomi Suloway, Richard Choronzy, Siegmund Deutscher, Mr. Ogden Livermore, Robert King, and Richard Kawka. (Photo by Groemling). Officers and sponsor of the A.S.M.E. are, left to right, Frank Bartkowicz, Dick Swanburg, Prof. Arnold Cobb, Gordon Knudson, and Victor Swenson.


Mr. J. H. Johnston, as counselor of civil engineers, aids the students in their many problems. Commander M. J. Gabbroith, U.S.N.R., explains the up-to-date electronic equipment in the electronics laboratory to the author, Ewing Sharp.

Undercover at . . . GALESBURG

MR. J. H. JOHNSTON

By Dean R. Felton, C.E. '51

A rather young instructor who looks more like a student than the average student does himself, is one's first impression of Mr. J. H. Johnston. This impression is very effectively erased though, when Mr. Johnston conducts a class and painstakingly leads his students through the bewildering maze of theoretical and applied mechanics and surveying.

A graduate of the Thayer School of Engineering at Dartmouth, he received his B.S. degree in civil engineering as a member of the class of 1946. His experience is not limited strictly to books, even though a recent graduate, but also consists of an understanding gained as a junior engineer with a Los Angeles engineering firm and in work at the Point Mugar, California, guided missile test center.

Commissioned an ensign in the U. S. Navy, he served for four years and five months as an officer in the civil engineer corps. In this capacity he held positions as maintenance officer at the seabee center, Port Hueneme, California, and as assistant training officer at Camp Rousseau, and also at Port Hueneme. His naval records show him to be a sea going officer as well, with time served aboard the U.S.S. Cleveland.

Mr. Johnston's most recent contact with a civilian engineering project was as a special engineer on the Matilija dam in Ventura county, California. A Recent development, this project encountered difficulty with the foundation material on which the dam was constructed. As an engineer on Matilija, Mr. Johnston aided in special grouting operations and helped conduct tests where-by compressed air was forced into grouting holes and resulting blow holes reported. This indicated faults in the underlying strata. This portion of his experience makes available to this aspiring civil engineer, knowledge which will be of great value to him in his future operations.

The University of Illinois is Mr. Johnston's first position as a college instructor. He came to Galesburg in April of 1948 and has since taught T.A.M. 150 and T.A.M. 211 as well as his classes in surveying. As an adviser to the civil engineering students enrolled here at Galesburg, he performs an important service. His knowledge of the industrial applications of the subject matter taught in school aid the young engineer in choosing the proper courses for his particular speciality.

NAVAL ELECTRONICS

The effectiveness of any organization depends largely upon the technical skill, efficiency, and close teamwork of its members. In industry, mass production demands a large number of trained engineers, technicians, and skilled maintenance men. The same is true for a military organization. It need not be stressed that the operation and maintenance of modern warfare units must be thoroughly understood by members of the military. Before the armed forces of the United States could wage an effective war with the equipment that the vast industrial forces provided, it was necessary to train and instruct a large number of inexperienced recruits in the use of modern military equipment. This was a tremendous undertaking, for most of the equipment was completely unfamiliar to many men who had no previous mechanical experience.

The large expenses involved in maintaining a regular army makes it impractical to keep a large standing army in times of peace. However, with world conditions such as they are at present, the government has decided that a large reserve force, subject to immediate service in case of emergency, is necessary.

The program of building this reserve force of trained men is carried out by the Army and Navy through various training units established in all parts of the United States. A particular example of such a training unit is the Naval Reserve Electronics Warfare company established by the commandant of the Ninth Naval district at the Galesburg division of the University of Illinois in the spring of 1948.

(Continued on page 38)

GALESBURG STAFF
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Luther S. Peterson
Photography
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The Engineering Honoraries and Societies

By Bill Soderstrum, Cer.E. '52

Engineering Council

The Engineering Council, re-activated only three semesters ago, now consists of representatives from 12 engineering societies. The newest members of the Council are S.A.E. and A.F.S.

Plans for this year's St. Pat's Ball, to be held on March 5, are nearing completion. The Queen's crown is already made, and all member societies are working diligently on the displays that will border Huff gymnasium durin the dance.

Copies of a streamlined constitution, the result of many weeks of effort, were distributed at the meeting of January 12. This new constitution contains provisions to enable the council to function more quickly and effectively. The following officers were elected at this meeting: Carl Falk, president; Stanley Burnham, vice-president; Earl Moss, secretary; and Francis Sexton, treasurer.

A.S.C.E.

The student members of the American Society of Civil Engineers were honored at a joint dinner meeting with the Central Illinois section of A.S.C.E. The meeting was held at Latzer hall on December 7. Other guests were members of I.S.P.E.

Mr. Alex Van Pragg, Jr., president of the National Society of Professional Engineers, spoke on "Professional Engineering Societies." Mr. Van Pragg, also a member of A.S.C.E., is a member of the consulting engineering firm of Warren and Van Pragg of Decatur, Illinois.

M.I.S.

Distinguished guests of 75 mining and metallurgical engineers at the December 8 meeting of the M.I.S. were Mr. George S. Mican and Mr. John W. King of the Carnegie Illinois Steel corporation. Mr. Mican, superintendent of the South Works rolling mill, spoke to the members about the fundamentals of rolling practice. He accompanied his talk with several slides on the subject and afterwards held a discussion with the various members answering any questions which they had.

An election was also held at this time, and the officers chosen were Edward Sperr, president; Norbert Blaski, vice president; and Beverly Solliday, secretary.

TAU BETA PI

The ultra elite of engineering honoraries, Tau Beta Pi, held its initiation banquet at Hotel Tilden Hall on December 9, 1948. Prior to the initiation, President R. B. Carlson and Vice President J. W. Crawford were introduced to the group.

The speaker for the evening was Dr. Robert Dubin who spoke on expectations in industry as contrasted with reality. Dr. Dubin obtained his Ph.D. at the University of Chicago and now has a joint appointment at the University of Illinois from the department of sociology and the institute of labor-management relations.

I.T.E.

A curriculum for undergraduate civil engineers in traffic engineering was drafted recently by members of I.T.E. This curriculum should prove extremely helpful to future traffic engineers.

At the November 30 meeting, the I.T.E.s also laid plans for a field trip to the Chicago area this spring.

Nominations for this semester's officers were made at the December 14 meeting. Also at that time, the semester plans were brought to completion. The final meeting of the semester was held Tuesday, January 11. It was a dinner meeting at which State Traffic Engineer H. H. Harrison was the speaker.

I.E.S.

Mr. Dan Dunne was the guest speaker at the December 8 meeting of I.E.S. held at 319 Gregory hall. Mr. Dunne addressed 50 members on the subject, "What to Expect After Graduation" pertaining to the illumination field. Mr. Dunne is sales manager for Lighting Products Incorporated of Highland Park, Illinois, and chairman of the papers committee of the I.E.S. Chicago section. He has had a great deal of experience in lighting applications and sales engineering. His sales work has taken him all over the country, thus enabling him to compile information concerning employment in the illumination field.

During the business meeting it was decided to back the Senior banquet of the electrical engineers.

A.I.E.E.-I.R.E.

The electron chasers held their December 7 meeting at 100 Gregory hall. Carl G. Miller, sales engineer for Weston Electrical Instruments corporation, gave a lecture-demonstration on electrical instruments to 100 members of the A.I.E.E.-I.R.E. Mr. Miller exhibited several of the instruments to the audience.

During the business meeting, Charles Eletson, chairman of the field trip committee, announced plans for the field trip, which was taken January 6, 1949. The trip was to the Mallory Electric company of Indianapolis, Indiana. This company manufactures a large number of radio parts. The tour included inspection of the processes involved in the manufacture of capacitors, potentiometers, vibrators, and high-current contacts.

ETA KAPPA NU

The brilliant sparks (Eta Kappa Nu to you) held their December luncheon at the University club on the sixth of that month. At that time they heard an address by Dr. Louis Ridenour, dean of the Graduate college, who spoke on "The Second Industrial Revolution." Dean Ridenour briefly discussed possible unemployment due to "push-button" mechanization of industry.

Wednesday evening, December 15, Eta Kappa Nu held its semi-annual initiation and banquet. Dr. R. G. Bone, head of the Division of Special Services for War Veterans, was the guest speaker. Approximately 75 graduates and undergraduates were initiated at this meeting.

(Continued on page 26)

"—The seeds of godlike power are in us still"—MATTHEW ARNOLD

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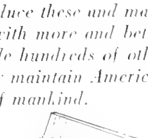

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EDWIN A. WITORT
Editor

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PHILLIP B. DOLL
Assoc. Editor

The Illinois Technograph

What Happened to the Inspection Trip?

After registering for the inspection trip last semester, the senior class of the College of Engineering was looking forward to a pleasant and educational four days of visiting various industrial plants. Less than two weeks after registration, the senior class was informed that the trip had been cancelled.

During the war, security reasons were responsible for cancellation of the inspection trip; immediately after the war, hotel accomodations were unavailable; last year, with the return to normalcy, it was agreed by the faculty that the inspection trip should again be a requirement for graduation. A representative poll of the students taken last spring showed that they too, were in favor of the trip.

As a result of these favorable conditions, several members of the various departments of the College of Engineering, during the summer interim, proceded to make arrangements for the inspection trip. Companies were contacted, the date was set, hotel reservations and special train arrangements were made, and the entire plan completed before the start of last semester.

Shortly after registration was completed, the same companies were contacted and informed that plans for the inspection trip had been abandoned; hotel reservations and special train arrangements were cancelled.

The reason for this action, reportedly, is that a large number of veterans found it financially impossible to make the trip. Complaints were heard from all corners. The administration ceded to the wish of its veteran students by cancelling the trip and graduation requirements for the trip.

It is erroneously thought by a great number of persons that the Veteran's Administration was indirectely responsible for having the trip cancelled, because the VA would not finance the trip. This is not true. The VA will finance all expenses incurred by veterans in pursuing a required course of the College. Expenses for the inspection trip would include travel, subsistence, and hotel accomodations. The VA will pay for travel expenses, but refuses to reimburse veterans for subsistence and hotel accomodations on the basis that these are covered by the monthly allowances paid to veterans. This certainly is a justifiable stand.

The College of Engineering was too lenient last semester in cancelling the inspection trip because a number of veterans were unable to meet the required expense. There will always be students, veterans and non-veterans alike, who will express disapproval of a trip of this type because of the expense involved. The College of Engineering should realize this and proceed to make arrangements for such cases. Waiver of the required credit or petitions by students for this credit could be arranged to handle the hardship cases.

Many instructors feel that the opportunity afforded a student by these inspection trips will never present itself, once the student leaves school. The reason is obvious. An industrial concern makes adequate and elaborate preparations for a tour and inspection of its plants for occasions of this sort. Especially appropriate arrangements are made which are practically "tailor made" for senior student engineers. Special features are included and fine points are brought to the surface which would not be included in a tour of the same company by some other inspection party.

Several of the various departments of the College did schedule regular inspection trips or field tours when they were informed that the original plan was cancelled. These trips were certainly good substitutes, but not as effective as the original plan.

Freshmen, sophomores, and particularly juniors, should see to it, as soon as possible, that the inspection trip is again made a requirement for graduation. Plans for next year's trip will have to be made this summer. It might be well for the presidents of each society, as representatives of students, to express the existing enthusiasm about the trip to the heads of their respective departments.


1=2

SALES ENGINEERING . . .

(Continued from page 12)

an engineering degree. Most manufacturers of machinery, as well as of special products to be technically applied as alloys, lubricants and chemicals, take on from the technical schools each year a number of engineering graduates for training. Larger companies can establish definite and thorough training courses. With many of the smaller companies, the boy is simply put to work to learn the business.

Though the work of the sales engineer is an art, back of it stands science. It is a science based upon a knowledge of business organization, markets, distribution methods, and an understanding of group and individual human effort. More and more the heads and executive staff of manufacturing and operating companies are now drawn from the ranks of sales engineers.

Thirty or forty per cent of engineering graduates within a few years are engaged in work that is largely commercial in nature. The various courses in salesmanship—so commonly given in almost any important city—are often of little significance to the sales engineer, for they concentrate on merchandise and commodity selling. The fundamental training most needed by the prospective sales engineer is a combination of technical training and business training—the latter dealing with capital investment for technical accomplishment. The sales engineer must have one eye well trained to engineering, and the other trained to detect values and economic results. He must possess not only technical skill, but an understanding of where the use of his technical skill is leading us.

Salesmen and salesmenship are often frowned upon in academic circles—too close to the peddler or slap-the-back promoter. Because the sales engineer sells, he is often mentally catalogued as a pronounced extrovert. Unfortunately too few of us have had a chance to meet a mature, friendly individual selling machinery, foundry equipment, power plant equipment, or a host of other classes of equipment or highly technical products, and to watch him exercise an ability quite his own, comprehending a whole system of specialized production. His tools of accomplishment are in his head crammed full of experience.

The great need today in technical accomplishment is an understanding of where the invention, the new design, the improved process, the new material, will lead us, quite apart from the skill to create it physically. Sales engineers can lend a vision to Management, for they can be skilled in detecting the overall result, whether it be mechanical, economical, or social. They can give the "why" so greatly needed today, to guide the "do."

Although the sales engineer is the mouthpiece for the company he represents, he is also the eye which detects customer's needs. He is the one who can point to improvements. He can guide the designer in the character of the apparatus built. He often points to new items which his company might build, and provides the necessary spark to accomplishment.

The barometer of business activity points to various conditions at different times. Only about one-quarter of the time is the emphasis on production—times when the plans are loaded and the chief problem is to produce. The remainder of the years, plants are not working up to capacity, and the pressure is on distribution—not production. Today, when we are still wriggling out of the harness of war, the importance of distribution is coming to the front again with alarming force, and the sales engineer is taking his place at the head of the parade.

CAN WE IMPROVE . . .

(Continued from page 7)

aptitude for chosen courses of study, except that this lack of aptitude must, by some system, be discovered before the student has wasted his own time and that of others, merely to find he is not suited.

Poor attitudes can be traced to several factors. First, a feeling that the best possible instruction is not being received breeds discontent. Second, poor prior showings in some subjects definitely foster belligerent attitudes on the part of the student. The conversion from war to peace-time and the accompanying disillusion doesn't make for the ideal attitude.

Rather than seek individual corrective actions for these factors, let us mention but a few possible improvements obvious to everyone, but slow in coming forth, which will aid in correcting all three factors.

Aptitude tests in the high school senior year would certainly catch many cases. At present, the tests are brought to light by the blunt force of failure. Screening tests upon entering college would tend to sort out those not capable of mastering technical subjects. Preparatory schools could, in short periods of time, prepare these screened individuals for the proper approach to a technical education. Possibly the greatest single boon would be a five-year technical program, rather than the current four. The additional year could tend to decelerate the program, which admittedly now progresses too quickly for adequate instruction. Part of the additional year could be used for non-technical subjects, a definite aid to better understanding and attitudes. Also, in the additional year, provision could be made for courses in teaching methods, indicated so sorely lacking. Many students who cannot master their subjects at the present pace, would have enhanced chances if the program was decelerated and spread over an additional year. Certainly any combination of these improvements should be welcome in our present system.

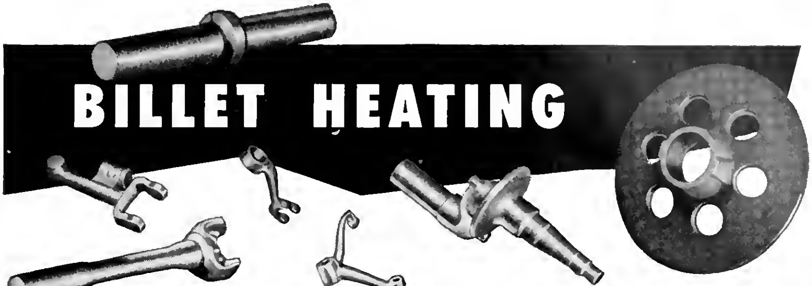
Our Methods

Are they the best possible ones? Probably one of our greatest shortcomings is the lack of necessary laboratory equipment, a condition due to wartime restrictions on production and to budget problems. Normal reconversion should partially alleviate this situation. Nor do our lecture rooms seem to be equipped with sufficient training aids, particularly in the form of visual aids. Blackboard recitations, though proven they are, are almost non-existent today. Does the instructor sufficiently prepare the lesson? How well is the material presented? Do examinations cover the material to be mastered? Is there sufficient discussion of the examinations? In spite of its many shortcomings, the Army theory of teaching might well be revived by our technical training institutions. The six-step method of preparation, explanation, demonstration, application, examination, and discussion certainly has worthwhile points to offer.

In view of what has gone before, the answer to our opening question is obviously yes. The correction of the existing conditions will necessarily be a slow and tedious process, for many factors, economic and physiological, are involved. But only when the teaching profession is made more attractive, when students are suitably prepared, when our colleges and universities are better equipped, will we even approximate the ultimate in technical education.

Jack: "Grandpa, we've been having an argument about whether the clock stands or sits on the mantel."

Grandpa: "It's half-past eight by the clock and it is only a quarter to eight actually; therefore, I should say it lies on the mantel."



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SPEED HEATING of small billets for drop forging demonstrates the speed of GAS for production-line operations requiring a flexible, controllable fuel.

Drop Forge Division engineers and metallurgists, working with the furnace manufacturers, devised a simple Gas-fired, continuous-cycle billet furnace with the following characteristics and capabilities:

- Billet Temperatures—2,200°-2,300°F
- Billet Heating Time—4 minutes normal (can be regulated as required in production schedules)
- Billet Discharge Rate—440 per hour, on 4-minute cycle
- Piece Dimensions (Average)—1"-2.5" thickness or diameter for rounds, squares, or flats up to 10" in length
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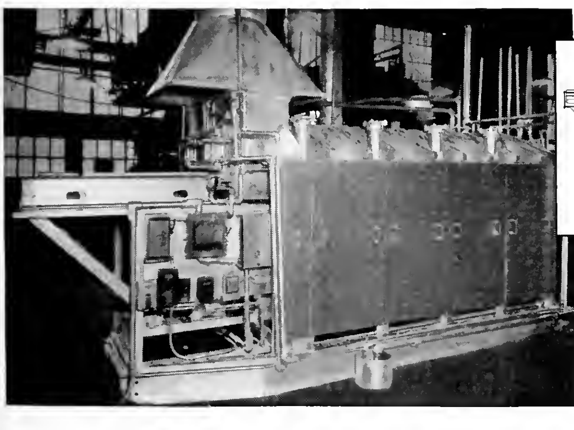
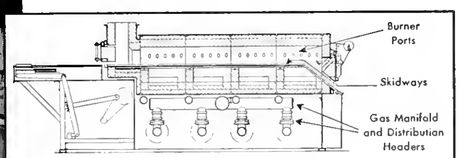
Quite as important as the productive capacity of the furnace are results of high-speed billet heating with GAS—

- Uniform temperature of billets improves workability in forge
- Reduced scale minimizes abrasion in dies
- Flexibility for different sizes and shapes without costly equipment changes
- Economy of operation, of fuel costs, and of equipment investment

This application of modern Gas Equipment in an important production-line process is just one of the contributions made by GAS to industrial progress. There are many other heat-processing operations such as annealing, normalizing, stress-relieving, case-hardening, in which the productive flames of GAS have established records for productioneering. They're worth investigating.





Longitudinal section thru billet heating furnace shows simplicity of equipment

Section Drawing courtesy of Surface Combustion Corporation, Toledo, Ohio, manufacturers of the billet heating furnace.

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STEPPING STONES . . .

(Continued from page 11)

In 1933, the American Society for Testing Materials adopted the motor method as tentative.

It was thought that the new method should be tested directly against some road data, so a new road test was carried out in 1934 on current model cars. The correlation was substantiated, as is shown in Figure 4. Again, in 1939, the motor method was put to trial by running a road test program; again it proved itself by giving a good correlation with the average road rating. Both motor and research methods are now recognized as laboratory tests for motor fuels, the motor for routine testing, and the research for what its name implies.

Table 2—Fuel Rating by the Motor and Research Methods

	Octane Numbers	
Fuel	Motor Method	Research Method
Iso-octane	100.0	100.0
Fuel A	82.0	93.5
Fuel B	80.0	82.0
Fuel C	73.0	82.5
Fuel D	71.0	71.5
Normal Heptane	00.0	00.0

Although, during the period just described, the emphasis was on motor fuels, there also was an interest in aviation fuels. In an aircraft engine, the fuel may knock, but most flyers have slight interest in this characteristic. The appearance of this condition, concomitant with overheating, can be rapidly destructive to pistons and cylinders, which is infinitely more important than noise. Because of the predominant importance of the engine temperatures, aviation fuels are rated for lean mixtures using a thermocouple and a potentiometer.

Until the war period, when the major portion of aircraft engines required fuels below 100 octane number, the rating was determined by bracketing the unknown fuel temperature with known blends of iso-octane and normal heptane and interpolating. Special conditions were used for this aviation test, and these are listed in Table 1. This is known as A.S.T.M. Method D614-47T.

With the war, however, came the demand for high output fuels; this required ratings above that of iso-octane and under supercharge conditions. These requirements meant a deviation from the methods used so far. It was required to evaluate the knock through a fuel-air range met in the aircraft operation for full rich, or take-off mixture. Figure 5 shows how a knock limited

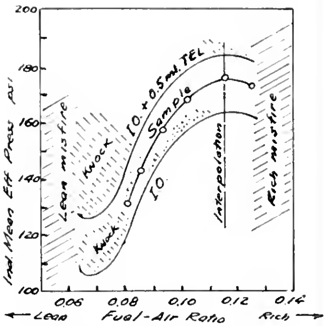
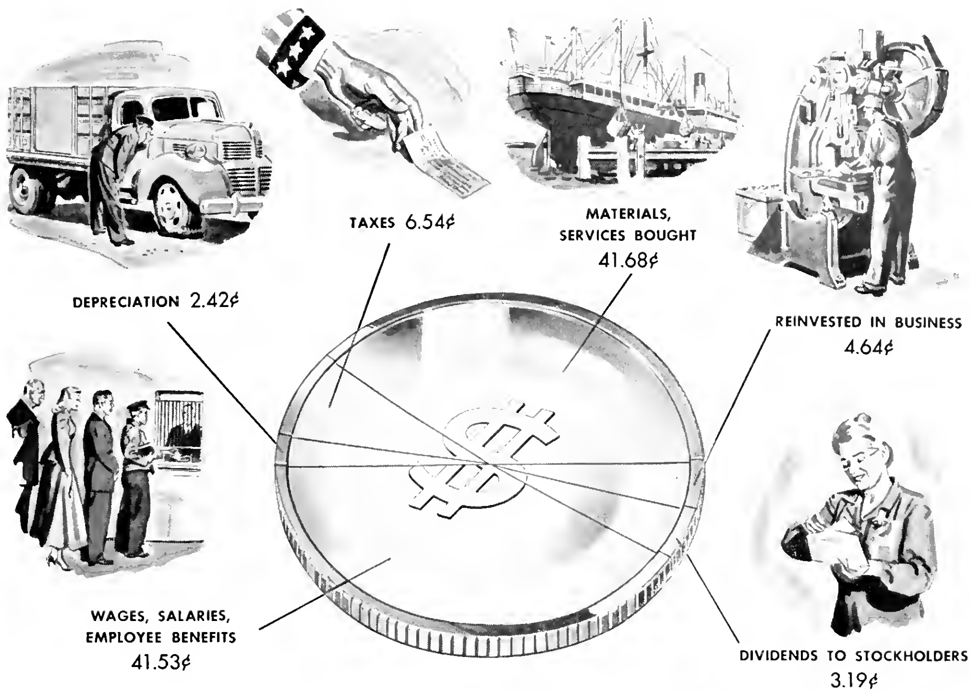


Fig. 5. Shown are knack-limited power curves determined by A. S. T. M. method D909-47T.

power curve looks when plotted against fuel-air ratio at otherwise constant conditions.

In this test, as in the other cases, the basic engine is the Waukesha engine. The induction air is under pressure, which can be varied to simulate supercharged conditions, and thus control the power output. The fuel is injected directly into the induction system. See Table 1. To obtain a rating, the unknown fuel is run into the engine and

(Continued on page 26)



HOW TO DIVIDE UP A DOLLAR

. . . the American Way

It may interest you to know the mistaken notions most folks have about the profits of American companies.

They tell interviewers that they *think* such companies are entitled to make 12 to 15 cents on every dollar of income, as a fair return. Yet, they add, it's their guess that manufacturers *actually do* make about 25 cents!

The facts are that in normal years American companies average about *nine cents* profit per income dollar.

Take Aluminum Company of America in 1947, for example. Out of each dollar received last year by Alcoa and its subsidiaries, the net profit amounted to *less than eight cents*. We show above where the rest of that dollar went. Nearly half of it in wages, salaries, and employee benefits, to Alcoans. Almost another half for materials and services we bought. Over six and a half cents for taxes.

The dollars-and-cents story of Aluminum Company of America represents the kind of facts you'll get from any typical American enterprise. Facts that show a fair return for a good product.

By dividing up a dollar, the American way, Alcoa has provided secure employment for 46,000 aluminum workers and has helped America to gain world leadership in aluminum production and research.

ALCOA ALUMINUM ®

Aluminum Company of America

STEPPING STONES . . .

(Continued from page 24)

the fuel flow is adjusted: the air flow is then adjusted until a reproducible intensity of knock is found at about 0.08 fuel-air ratio. After this point, the fuel flow and air flow are increased, and, maintaining the same intensity of knock, a curve similar to that shown in Figure 5 results. This curve is then bracketed by doing the same with blends of iso-octane and normal heptane, or iso-octane and lead, as the case may demand. The results are interpreted on the basis of the interpolated per cent power value of the test fuel. Iso-octane equals 100%. Data are reported in terms of performance number, which is a power increase rating.

An aircraft fuel designated as grade 100/130 has a lean rating of 100 performance number, or 100% iso-octane, and a rich rating equivalent to 130 performance number, or iso-octane plus 1.30 milliliters of lead. This test is now A.S.T.M. Method D909-47T.

(Figures 1 and 3 are from "The Science of Petroleum" by Campbell and Boyd (Oxford University Press) and figures 2, 4, and 5 are by the author, Wallace Hopper.)

SOCIETIES . . .

(Continued from page 16)

PI TAU SIGMA

Members of Pi Tau Sigma, mechanical engineering honorary fraternity, enjoyed themselves at Latzer hall for their December 8 meeting. This meeting was the semesterly initiation banquet at which 61 pledges and 3 honorary members were pledged and welcomed into the fraternity.

At the business meeting which preceded the initiation, members accepted changes and revisions of the chapter constitution and by-laws. Mr. David Duff, chairman of a committee which will conduct a rating survey of the mechanical engineering department faculty, gave a report on the plans and progress of this committee. Officers for the spring semester who were elected at this meeting were John G. Johnson, president; Harold I. Blotner, vice president; Frederick T. Fariss, secretary; Harold D. Barthel, corresponding secretary; and Charles A. Lessing, treasurer.

Speaker of the evening was Dr. C. F. Hottes, professor emeritus in the department of horticulture at the University of Illinois. In his after dinner speech, Dr. Hottes told of a trip he and eight other scientists made through the uncharted regions along the San Juan and Colorado rivers. He gave a brief history of this section of the country and showed colored movies that he had taken on this trip.

SIGMA TAU

Sigma Tau, all-engineering honorary fraternity, entertained prospective pledges at its December 7 meeting held at Wesley foundation. Professor H. N. Hayward of the electrical engineering department told the guests of the history of Sigma Tau, its purpose, its past activities, and of its future social functions.

At the December 14 meeting, pledges were chosen. The initiation was at a banquet held in the early part of January.

Professor: "What's your idea of civilization?"

C.E.: "Good idea, someone ought to start it."

* * *

Women blush not in reflection upon what has happened, but in rosy anticipation of what may.

NAVY PIER . . .

(Continued from page 14)

point, we wish to congratulate our newly appointed editor and wish Sig Deutscher all the luck in the world. It was grand working under Sig, and we are sure that Dick will have his work cut out for him in following Sig.

Pier Engineering Societies

By Bob King, C.E. '51

A.S.M.E.

Approximately 85 per cent of the members were present at the smoker held in November. Mr. Oldacher spoke on the "Importance of the Professional Society," and movies on atomic energy and the Ohio-Illinois football game were shown. Everyone enjoyed the cider and doughnuts, as well as the interesting program.

Bob Beardmore acted as host and presented many novelty dances at the "Turkey Trot," also held in November. Seventy members and guests were present to enjoy the refreshments and dances.

The lecture by Dr. Allison of the University of Chicago, a noted authority in the field of atomic research and nuclear fission, turned out to be a wonderful success. The lecture by Dr. Allison cleared up many false impressions that many of us had about atomic energy, and was most interesting. In the subject, "Nuclear Physics Today," Dr. Allison stressed the importance of radio activity and its uses in industry, pathology, biology, and pharmacy. He also gave a brief history of his research at the Midway laboratories at the University of Chicago and the development of the present cyclotron and problems encountered in its development.

On December 8, a regular meeting was held. A movie, "Fixed Gauges" was shown, and the newly formed engineering council was discussed.

A field trip to the electromotive division of General Motors at LaGrange was held on December 21.

At the Freshman Convocation and at registration in February, the society is planning to operate a booth to familiarize new students with the society. New memberships will also be accepted at that time. The society also plans to hold regular meetings every other week during the spring semester, with speakers and movies alternating for the program. Also, if it is possible, additional programs similar to the lecture by Dr. Allison—which drew a very large crowd—will be scheduled.

The society wishes to extend its full cooperation to the Engineering council, and the societie's chairman, Mr. Victor E. Swenson, wishes to thank all his fellow officers and the society sponsor, Mr. Cobb, for the excellent and diligent cooperation he has received from them in making the fall semester program successful.

A.S.C.E.

About 100 men and their dates had a good time dancing and playing games at a party and get-together at Keyman's hall on Friday evening, December 3. The party broke up around midinght.

Mr. C. A. Walls, of the Portland Cement corporation, spoke on "Expressways," at the regular meeting held on Monday, December 13.

The society hopes to have a big meeting in January, when an out-of-town speaker will be present.

A.I.E.E.

Thus far this semester, two movies, "Dawn of Better Living," and "Magic of Fluorescence" have been presented. It is planned to have an I.B.M. representative speak at a meeting in January.

At the business meeting held on December 14, the constitution of the A.I.E.E. was drawn up. John Doering has been appointed as Engineering council representative.

JETS ARE JUMPING . . .

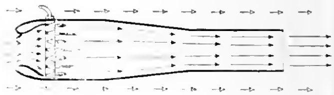
(Continued from page 9)

they use. However, the development of atomic power might remedy this defect.

Pulse Jet

Another jet reaction unit which is not being extensively used is the pulse jet. The pulse jet is composed of a long tube with non-return admission valves at the entrance to the tube. The fuel injection nozzles are located just behind these valves and are directed straight back. Immediately following the injection nozzles are venturi sections through which the fuel enters the combustion chamber. The combustion chamber, which is formed by the tube, narrows down to a tail pipe of smaller diameter.

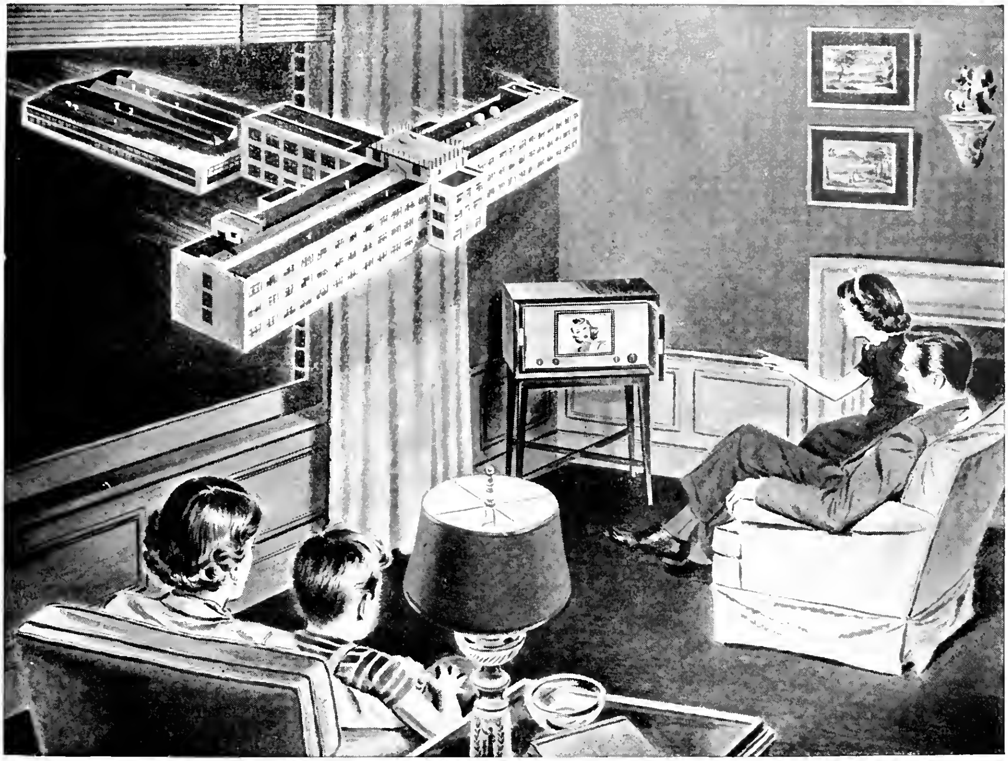
In order to start the pulse jet there must be air pressure against the valves at the nose of the tube. This pressure is supplied either by moving the unit through the air or by shooting compressed air against the front of the tube. The air pressure on the nose opens the valves and air is admitted into the tube. As the air travels to the combustion chamber it is mixed with the fuel, which is injected through the nozzles, and a combustible mixture is formed. Compression is obtained partially by the air itself as it is rammed into the combustion chamber. The rest of the compression is obtained during combustion as a result of the rapidly expanding gas. As soon as the combustible mixture has been rammed into the combustion chamber, it is ignited by a spark plug. The spark plug is needed only for the first explosion, for the operation is continuous thereafter, and the mixture is ignited by the heat formed from the previous explosion. When the mixture is ignited there is a rise in pressure inside of the tube, and the non-return valves at the nose of the tube are closed. The gases then expand out the tail pipe. As the gas rushes out of the tail pipe, the pressure in the combustion chamber drops. As soon as the pressure inside has dropped below that of air pressure on the front of the valves, more air is admitted in, and the process is repeated.



The impulse jet was employed on the German flying bomb.

The phase of operation is repeated in pulses and this is how the unit obtains its name. One of the most difficult achievements in the design of a pulse jet is to obtain correspondence be-

(Continued on page 32)



Into your living room comes the "Age of Electronics"—through radio and television research achievements of RCA Laboratories.

Research comes to life in your Living Room

Turn on your radio, tune in a television set—as simply as that you have completed the final step in a long chain of research and invention...

In a generous measure, your new command of *sound* and *sight* comes from research conducted at RCA Laboratories and made available for useful purposes. Almost every single major advance in radio and television during the past 30 years was pioneered by RCA.

A few examples of RCA leadership: all-electronic television, the all-electronic radio receiver, and the Victrola radio-phonograph. The iconoscope, television's electronic "eye," was developed by Dr. V. K. Zworykin—now of RCA Laboratories. Super-sensitive Image Orthicon television cameras and kinescope "picture tubes" for receiving sets and radio relays are RCA *firsts*.

Actually, these are just a few of the *hundreds* of examples of RCA leadership in radio and electronic research and engineering "know-how" . . . that give *value beyond price* in any product or service of RCA or RCA Victor.

• • •

When in Radio City, New York, you are cordially invited to visit the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

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Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

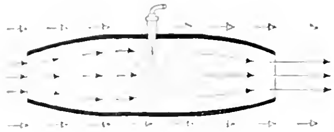
JETS ARE JUMPING . . .

(Continued from page 30)

tween the pulses or vibrational frequency of the valves and the vibrational frequency of the tailpipe. The frequency with which the combustion gases leave the tail pipe depends upon the dimensions of the pipe.

The reaction opposite to that of the gases passing out the tail pipe or tail nozzle of the jet is the jet reaction or jet propulsion which propels the plane.

The pulse jet is used mainly for model airplanes and for guided and unguided missiles. One difficulty of the pulse jet is the large frontal area formed by the valves at the nose of the tube. The impact of the air upon this area imposes a large drag force. The efficiency of the pulse jet falls far below that of the other propulsive units.



The ram jet does not have any moving parts.

Ram Jet

The ram jet is the only air-breathing jet unit which does not have any moving parts. This unit somewhat resembles a stovepipe with a small diameter at each end and a large diameter in the middle. All of the dimensions of a ram jet are dependent upon calculations made by the use of thermodynamic formulas.

The ram jet is composed of three parts: (1) the diffuser, (2) the combustion chamber and, (3) the exit nozzle. The diffuser is located at the front of the jet. It forms a small diameter at

(Continued on page 34)

JETS ARE JUMPING . . .

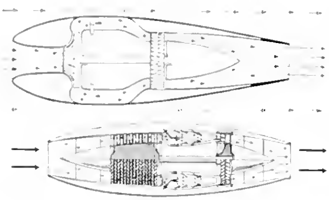
(Continued from page 32)

the nose and tapers into the larger diameter of the combustion chamber. The combustion chamber then tapers down to form the tail pipe and exit nozzle.

The air enters the ram jet through the small diameter at the nose of the diffuser. As the air passes along the diffuser the diameter becomes larger, and thus the area increases. This increase in area causes the velocity to decrease and the pressure to rise. The rise in pressure gives the unit its compression. As the air enters the combustion chamber, it is mixed with fuel to form a combustible mixture. The initial ignition is caused by a spark plug, but the operation thereafter is continuous, and the ignition is brought about by the heat of the previous explosion.

The ram jet cannot produce static thrust. It has to obtain a very high speed before it will operate as a propulsive unit. For small units this speed is around 200 miles per hour and for large units around 400 miles per hour. The explanation for this is that the ram jet cannot produce enough thrust to overcome the internal drag until it has reached this speed.

The ram jet's most promising use at



The radial flow turbo jet (above) and the axial flow turbo jet (below) mechonicolly compress the entering air.

the present is in the field of helicopters. The jet units are placed on the tips of the blades and their propulsive power is used to rotate the blades. The ram jet will operate very successfully in this capacity since the top speeds range from 400 to 500 miles per hour. The ram jet also offers promising results as a supersonic propulsive unit, but this requires a slightly different design of the exit nozzle.

Turbo Jet

The jet unit which is being used to operate all of the current jet airplanes is the turbo jet. The turbo jet has proved to be the only practical unit for the present type of aircraft.

The turbo jet is divided into two classes. The distinction is made in the type of compressor which is used. One type uses a centrifugal or radial flow compressor and the other type uses an axial flow compressor. All of the German turbo jet units employed axial flow compressors, and at the beginning, all of the American and British turbo jet units were constructed with radial flow compressors. However, the Americans and British have now developed a number of axial flow compressors also.

The compressor, whether it is axial or radial flow, is located at the nose of the turbo jet. The combustion chambers are placed behind the compressor. Directly to the rear of the combustion chamber is an axial flow turbine. The turbine and compressor are connected on a common shaft. The bullet and exit nozzle are located behind the turbine. The bullet can be moved in and out and is used to vary the exit area.

The turbo jet is started by mechanically turning the main shaft. The jet airplanes are equipped with electric starters which spin the shaft at about one-eighth of the operating speed. As soon as the shaft starts to rotate, the compressor forces air into the combus-

(Continued on page 36)

JETS ARE JUMPING . . .

(Continued from page 34)

tion chamber. The fuel is injected into the combustion chamber and forms a combustible mixture with the compressed air. Since the process of combustion is a continuous one, the spark plug is needed only for the initial ignition. In most turbo jets the spark plug is placed in only one of the combustion chambers and the flame of the initial explosion travels to the other chambers through inter-connecting pipes. After the explosion, the gas is expanded through the turbine. However, only part of the energy is used to turn the turbine; the rest of the energy is expelled as the gas expands through the rear nozzle. As soon as the operation of combustion has begun, the electric motor is turned off and the turbine is used to turn the compressor.

The biggest advantage which the jet engine has over the reciprocating engine is speed. However, the jet reaction engine has many other advantages which place it in such high favor. Listed below are a few advantages of the turbo jet engines compared to the reciprocating engine:

1. No warmup time is needed for the turbo jet.
2. The turbo jet can be designed and produced in about one-quarter of the time that it takes to test a piston engine.
3. Vibration is eliminated since the turbo unit is composed of only rotating parts.
4. There is no sliding friction and no heavy bearings to be lubricated.
5. The absence of an air screw permits a low undercarriage and therefore, a light landing gear.
6. The jet propelled aircraft offer better vision and less restriction for armament.
7. Jet fuels are easier to get and are less expensive.

Although the jet airplane was not developed until recently, there are a large number of different designs in production today.

As time follows time and man gathers new knowledge, startling and revolutionary creations will be produced in the field of aeronautics. However, the advent of these new products will represent the labor, learning, and knowledge which is being endowed upon the aircraft of today.

Bob: "That was a close call, old man. Don't you know you always ought to give a woman driver half the road?"

Bill: "Well, I always try to, as soon as I find out which half she wants."

GALESBURG . . .

(Continued from page 15)

The Navy leased a building on the Galesburg campus containing approximately 2,800 square feet of floor space to house all the equipment and facilities necessary for training electrical technicians. This building will house equipment representing a total value of over $100,000, when the remainder of the equipment is received from the Navy.

The volunteer unit has an authorized complement of five officers and 40 men under the command of Comdr. M. J. Galbraith, U.S.N.R., who is the director of student welfare at the Galesburg division. The unit's executive officer is Lt. Comdr. De Voss, U.S.N.R., a resident of Galesburg. Dr. H. L. Lawder, commander, U.S.N.R., is the company's medical officer, and Lt. Comdr. H. C. Woolsey, U.S.N.R., is communications officer.

The specific purpose of the Electronics Warfare unit is to keep the naval reservists up-to-date and familiar with the most recent developments in the field of electronics. The program is designed to provide former navy personnel with up-to-date information on the repair, maintenance and operation of radio transmitters and receivers, radar gear, direction finders, and all types of electronic equipment. In addition, the program provides for the training of new recruits in the Naval Reserve who are interested in the field of electronics.

The recruit who has had no previous experience is taught the basic principles of electricity. The trainee progresses through the various phases of radio transmission and reception of code, and learns the repair and maintenance of electronics equipment.

The training and re-orientation program follows as closely as possible the procedure used in the regular Navy training schools. Naval Reserve officers and enlisted men who have had considerable training and valuable experience instruct the trainees in the various specialized fields of electronics.

The unit meets regularly twice a month for the purpose of training. Lectures on the various phases of study are given during the first part of the period. The latter part of the period is devoted to the practical applications of the principles presented in the lectures. The electronics laboratory is a great aid to the trainee because he can actually see and put into practice the subject matter covered in the lecture period.

The Naval Reserve student who applies himself may receive advancement in grade after he has completed the requirements specified by the Navy, provided the commanding officer and his instructors have deemed his progress satisfactory.

To Naval Reserve members of all branches and to new recruits in the reserve, the Naval Reserve Electronics Warfare unit offers excellent opportunities to learn a trade in a relatively new and very improtant field. The training of qualified technicians and repairmen by the unit at Galesburg, and the many other units throughout the United States will result in better job opportunities for many of those who could not otherwise secure this specialized training. In addition, the program will create a large reserve force of technicians who are able to take over important duties in case of a national emergency.

The Galesburg division of the University of Illinois is fortunate in having such a unit on the campus. The physics and engineering department may use the equipment and laboratory at the discretion and supervision of the commanding officer. At the present time about 90 per cent of the complement consists of division students, mostly engineers, with the remainder consisting of reservists from the Galesburg area.

Answers to Vocabulary Quiz

1-b, 2-b, 3-c, 4-b, 5-b, 6-d, 7-b, 8-b, 9-c, 10-c, 11-d, 12-b, 13-c, 14-b, 15-a.

—"Well, Sam, I see you're back for fighting with your wife. Liquor again?"

—"No sah, Jedge, she licked me dis time."

* * *

She: "I want a lipstick."

Clerk: "What size, please?"

She: "Three rides and a house party."

* * *

"Is your wife having any success in learning to drive a car?"

"Well, the road is beginning to turn when she does."

* * *

As one little electron said to another when they met in a new element: "I don't know you from atom."

* * *

"You know, you're not a bad-looking girl."

"Oh, you'd say that even if you didn't think so."

"We're even then. You'd think so even if I didn't say so."

* * *

He: I've got to get rid of our chauffer; he's nearly killed me four times.

She: Oh, give him another chance.

* * *

Floridian (picking up melon): "Is this the largest apple you can grow in your state?"

Californian: "Stop fingering that grape."

* * *

Pop: "Well, I received a note from your teacher today."

Son: "Honest, Pop? Give me a quarter and I won't breath a word about it."

* * *

"Good morning, Mrs. Kelley," said the doctor, "did you take your husband's temperature as I instructed?"

"Yes doctor, I borrowed a barometer and placed it on his chest. It said 'very dry,' so I bought him a pint of beer and he's gone back to work."

The following took place in the reading room of our library:

A coed was reading birth and death statistics. Suddenly she turned to a male on her right and said, "Do you know that every time I breathe a man dies?"

"Very interesting," said he, "why don't you try Sen-Sen?"

* * *

Young Wife: "Would you be surprised if I gave you a fifty dollar check for your birthday, darling?"

Husband: "Yes, sweet, I would."

Y.W.: "Well, here it is, all made out ready for you to sign."

Lady: "Have you ever been offered work?"

Tramp: "Only once, madam. Aside from that I've met with nothing that kindness."

* * *

—"What are the young man's intentions, daughter?"

—"Well, he's been keeping me pretty much in the dark."

* * *

Hyde—Were you lucky at the race track yesterday?

Wyde—I'll say I was! I found a dime after the last race, so I didn't have to walk home.

* * *

She (spurning suitor)—"I wouldn't leave my happy home for any man."

He (brightly)—"All right, we'll live here."

* * *

1st Coed: "That boy you were riding with has trouble with his vision?"

2nd Coed: "Yes, he sees parking spots before his eyes."

* * *

Woman on crowded bus: "I wish that good looking man would give me his seat."

Five engineers got up.

* * *

Mary had a little car
She drove in manner deft
But every time she signalled right
The little car turned left.

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronunciation. From the group of words at the right, select one whose meaning most closely resembles the word on the left. Answers will be found on page 38.

1. Welter—(a) prize fighter, (b) turmoil, (c) North Atlantic fish, (d) sultry heat
2. Putative—(a) quarrelsome, (b) reputed, (c) arithmetical, (d) cruel
3. Semantics—(a) an Asiatic race, (b) empty talk, (c) science of meanings, (d) division of biology
4. Hiatus—(a) Japanese musical instrument, (b) an opening, (c) a pretentious person, (d) legislative bill
5. Anomalous—(a) similar to, (b) exceptional, (c) pertaining to a goose, (d) dramatic
6. Puissant—(a) cat-like, (b) cowardly, (c) insignificant, (d) powerful
7. Epicene—(a) African antelope, (b) sexless, (c) sensual, (d) glutton
8. Matutinal—(a) mother-like, (b) pertaining to the morning, (c) tasty, (d) musical
9. Cognizant—(a) mechanical, (b) lustrous, (c) sensible, (d) surly
10. Mitigate—(a) to cut into four parts, (b) to travel, (c) to make milder, (d) to pick a quarrel
11. Inchoate—(a) improper, (b) polished, (c) penniless, (d) recently begun
12. Prescience—(a) introductory course in science, (b) foreknowledge, (c) authorization, (d) warning
13. Scintillate—(a) to destroy, (b) to break the Ten Commandments, (c) to glitter, (d) to go away
14. Overt—(a) dishonest, (b) apparent, (c) to prevent, (d) to overlook
15. Pragmatic—(a) opinionated, (d) citizen of Prague, (c) influential, (d) uncultured

This is a picture of "PING"

It's a picture that gives automotive engineers clear-cut facts on performance—a picture that suggests how photography with its ability to record, its accuracy and its speed, can play important roles in all modern business and industry.

No, this is not the "doodling" of a man on the telephone. Far from it. It's the photographic record of an oscilloscope trace that shows, and times, detonation in a "knocking" engine. It all happens in a few hundred-thousandths of a second—yet photography gets it clearly and accurately as nothing else can.

Oscillograph recording is but one of countless functional uses of photography in bettering products and improving manufacturing methods. High speed "stills" can freeze fast action at just the crucial moment—and the design or operation of a part can be adjusted to best advantage.

And high speed movies can expand a second of action into several minutes so that fast motion can be slowed down for observation—and products be made more dependable, more durable.

Such uses of photography—and many more—can help you improve your product, your tools, your production methods. For every day, functional photography is proving a valuable and important adjunct in more and more modern enterprises.

Eastman Kodak Company, Rochester 4, N. Y.

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. . . is advancing business and industrial technics

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If you've ever used paint, chances are you've already had experience with G-E Glyptal alkyd resins. Because Glyptal—a development of General Electric chemists—is incorporated in the formulas of hundreds of different paints, lacquers, enamels, and industrial finishes of almost every type.

These versatile synthetics, blended

In exterior or interior paints, enamels, primers, and sealers, 2509 Glyptal formulations are ideal.

from phthalic anhydride, glycerine, and linseed, soya, or castor oil, serve the paint industry like so many faithful genii. General Electric has developed a Glyptal for almost every paint function—for adhesion, heat-resistance, arc-resistance, and humidity; for acid-, alkali-, and oil-resistance. These moderate cost resins have excellent durability.

Master Mixers

These qualities have demonstrated Glyptal's value in coatings, both preservative and decorative, for metals, woods, paper, textiles, and in adhesives, printing inks, rubber compounds and floor coverings. The resins are recommended as specific vehicles for architectural, automotive, and industrial finishes; water-thinned paints; nitrocellulose lacquers; urea-formaldehyde enamels; aluminum paint; bulletin colors; marine paints, and in numerous other applications.

Glyptal alkyd resins are supplied in a variety of solvents so that they can be easily applied by spraying, dipping, brushing, flowing, or roller coating.

For automobile and aircraft formulations, use 2477 Glyptal.

They are compatible with a variety of pigments, and disperse and suspend them very well. Many are miscible with each other and with some varnishes and oils, making possible the formulation of numerous intermediate products.

One from Many

Glyptal alkyd resins are only one of the numerous offspring of General Electric research. Like G-E silicones, permanent magnets, and plastics compounds as

In paints for toys—or farm machinery—2592 Glyptal is suitable.

well as molded products—they are being used more and more extensively every month. Expanding production facilities, with new plants in Anaheim, California and Waterford, New York, are helping to meet the paint industry's growing needs for Glyptal. For more information on these products, write to Chemical Department, General Electric Company, Pittsfield, Massachusetts.

A message to students of chemistry from

C. S. FERGUSON, Engineering Manager,

Chemicals Division, G-E Chemical Department.

"The increasing awareness of the role of science in the future of every one of us will continue to stimulate opportunities for young chemists. Here at General Electric, research in synthetic resins is just one of the Chemical Department's activities that hold great promise for further development."

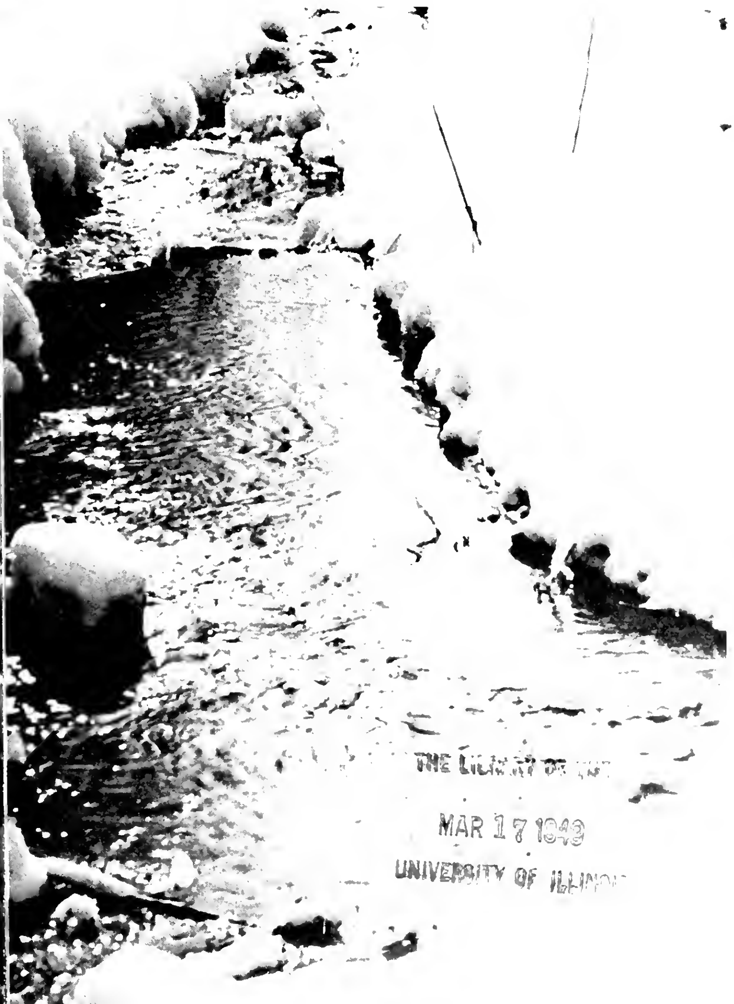
YOU CAN PUT YOUR CONFIDENCE IN

GENERAL ELECTRIC

PLASTICS • SILICONES • INSULATING MATERIALS • GLYPTAL ALKYD RESINS • PERMANENT MAGNETS

the Illinois Technograph

MARCH, 1949



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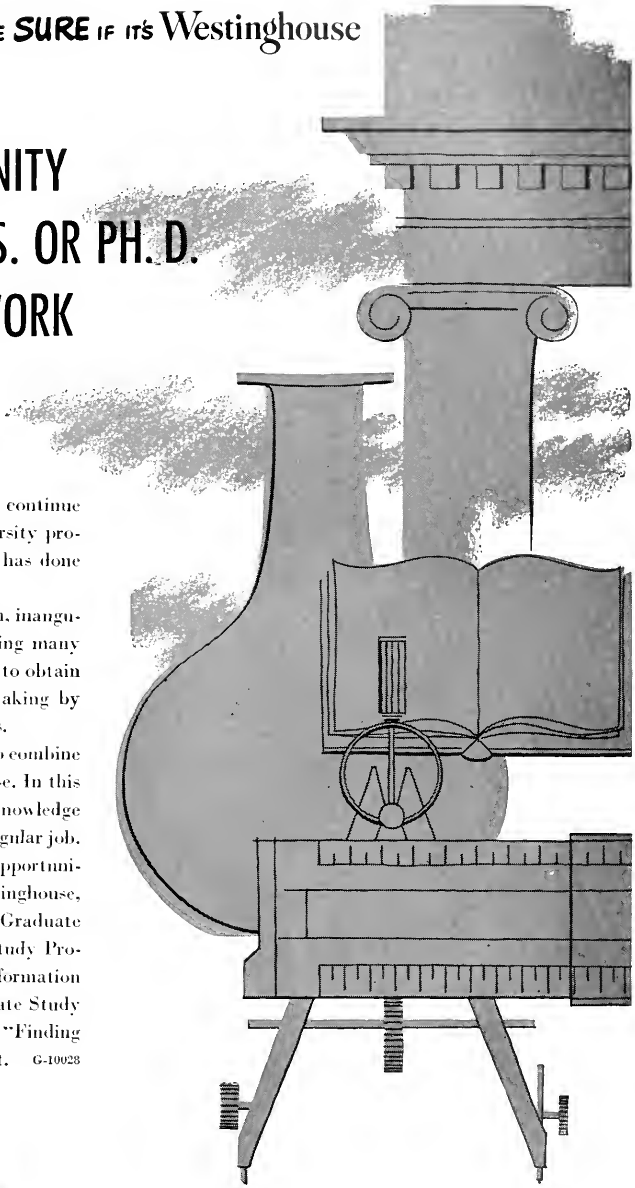

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New Developments

By Leonard Ladof, E.E. '49
Ken McOwan, M.E. '49
Henry Kahn, Ch.E. '50

Safety First

Development of explosion-proof electric motors has in the last few years received a great deal of attention from designers, in order to satisfy the demand for safer and more efficient motors in coal mines and industries where dust accumulation may cause explosions.

Enclosed motors seem to be the answer; however, the standard enclosed motor, due to the insulation and lubricant used, had to be equipped with a cumbersome cooling system. This problem has now been overcome by the use of silicone insulated winding and silicone grease.

These silicone resins can withstand high temperature and a great deal of wear. The value of this type of motor is best illustrated by comparing the physical properties of this silicone insulated motor to the conventional one.

The efficiency, power factor, and torque are about the same as that of open motors of the same rating, and it is only sixty per cent as heavy as a Class A insulated motor.

Switch Heater

A new type of heater has been devised that will keep railway switches from freezing in the coldest weather. The use of such devices not only reduces the number of men needed to keep switches clear during bad weather to almost nothing, but assures clear switches without the uncertainty caused by the human element in this important matter.

Ceramic Crystals

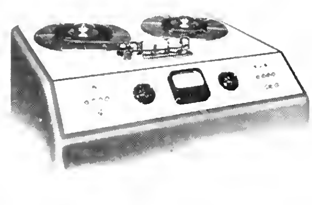
The use of ceramic elements to replace the Rochelle salts type of crystals has been announced by the Astatic corporation of Conneault, Ohio. The most common use of the elements is in microphones and phonograph pickup arms. The features of the cartridge are its independence of high ambient temperatures, ruggedness, and resistance to moisture. Rochelle salt crystals are fragile and decompose at temperatures above 135° F.

The frequency response of the unit is essentially flat from 30 c.p.s. to 10,000 c.p.s. When employed in a microphone the output level is −62 db. into a load impedance of 5 megohms. The pickup cartridge operates into a similar load, and has a needle pressure of less than one ounce.

The Latest in Tape Recorders

A new tape recorder, scheduled for delivery in early 1949, has been announced by the Fairchild Recording Equipment corporation of Jamaica, New York.

One of its outstanding features is its 15 inches per second tape speed. The high fidelity performance, formerly thought possible only at 30 inches per second, is still maintained. Recording time for any specific amount of tape is doubled, and the operating speed of the equipment is reduced by this low tape speed. This results in lower costs of operation, and nicer controls of starting, stopping, spotting, and editing.



The Fairchild tape recorder doubles recording time of standard tapes while maintaining high fidelity performance.

In numerous tests, the finest ears have been unable to detect the difference in an instantaneous A-B test in switching between the monitoring of a live studio program and the same program from the Fairchild tape recorder. Tests also show better than 60 db. signal-to-noise ratio with a maximum total harmonic distortion of two per cent.

Other features of the instrument include plug-in type construction, both mechanical and electrical, for uninterrupted service; interlock system to prevent accidental erasing; volume indicator for reading recording level, etc; adjustment of playback head during operation; and automatic control in event of tape break.

Ford Truck Conversion

The Marmon-Harrington company Inc., of Indianapolis, has announced a complete new line of all-wheel-drive converted Ford trucks to be known as the "Q" series. The trucks are especially engineered and powered for heavy-duty service which has been proven too difficult or impossible for trucks of conventional drive. They promise to be particularly suited for oil field and pipeline work, mining and logging operations, construction and maintenance of roads, airports, bridges, dams, farming, and other types of off-the-road services.

In converting the F-7 models, (Ford's new heavy-duty truck, powered by the big 145 horsepower engine), Marmon-Herrington makes the following changes to the "Q" series:

1. Original front axle assembly replaced by new front driving axle.
2. New two-speed auxiliary transmission of Marmon-Herrington design provides a total of ten forward speeds and two reverse. The final low reduction of 89.215 to 1 gives extreme tractive power for off-the-road operation.
3. Steering assembly and brake connections necessarily changed.
4. Frame is lengthened and reinforced, and a third driving axle installed on six-wheel-drive models.
5. Tires are replaced for increased flotation, when necessary.

"The Blind Shall See"

A new electronic letter recognition system to enable blind persons to read was recently developed by RCA as a result of extended research for the Office of Scientific Research and Development and the Veterans Administration.

This system consists of a scanning unit, a selector, and a loudspeaker. As the user moves the scanning device along a line of type, a miniature cathode ray tube explores each letter with eight vertically arranged spots of light.

Each of the black letters actuates a different number of impulses, which are electronically counted and noted on the selector unit. Each set of numbers actuates a magnetic tape recording, which is made audible by reproducing through a loudspeaker. This device is limited to the 26 letters of the alphabet and a few commonly used words.

This model is still in its experimental stage but a possibility exists that this instrument can also be used to translate coded patterns, such as those which form the basis of teletype messages.

liquid death!

THAT'S WHAT ESTERON 245 IS to tough, stubborn weeds and woody growth.

Weed and brush control along highways, power lines and other utility right of ways is important. Esteron 245, a close cousin of 2,4-D, was developed for weeds found resistant to that well-known compound. It is particularly effective against woody growth, osage orange, gum, brambles, hickory and oak.

An unusual feature of this plant hormone-type weed killer is that it kills by chemical action which accelerates the normal growth processes, resulting in death of the plant.

The development of Esteron 245, following Esteron 44 and 2,4-D, is indicative of the unceasing effort to better things that is characteristic of Dow research.

Dow produces more than five hundred essential chemicals from plants located in Michigan, Texas, California and Ontario, Canada. These include agricultural chemicals, the Dowicides (including PENTAchlorophenol—the chemical that increases the life of wood many years) plastics, which is becoming a by-word in everyday living, as well as major industrial and pharmaceutical chemicals.

They Die!

Esteron 245 destroys or inhibits herbaceous and woody growth, spares grass and allows the establishment of good sod.

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EXCESSIVE MAINTENANCE of one valve is insignificant, but multiplied by thousands, it is a serious drain on operating budgets.

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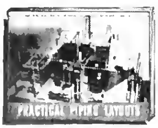

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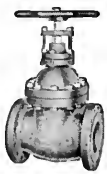

Types, Sizes, Pressures, Metals for Every Need

The Illinois Technograph

Volume 64 — Number 6

The Tech Presents

ARTICLES

DEPARTMENTS

OUR COVER

This "babbling brook" snow scene is not the "Boneyard," as most of you might think. The picture was taken in February, 1946, in Kassel, Brasselsberg, Germany, while the photographer, C. M. McClymonds, was on duty with the Army Engineers.

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Operation: South Pacific

By Connie Minnich, C.E. '51

(ILLUSTRATIONS BY THE AUTHOR)

Out of the ruins of the past war have arisen new examples of engineering ingenuity that have violated every rule in the Engineer's Hoyle, some of which have been fundamental theorems of engineering ever since the first caveman threw a log across a stream and, by the grace of St. Pat, became the first engineer.

Bailey bridges, pontoon structures coral airfields—the list of engineering feats of the past war runs to infinity. Obstacles of climatic conditions, topographical features, and availability of building materials met extremes from the poles to the equator. How American engineers surmounted these obstacles, and how they created many things out of practically nothing on the old necessity-is-the-mother-of-invention rule makes a story worth the telling from Life to Engineering News-Record.

Globe-trotting became an occupation for the armed forces who fought the war in the South Pacific; or, as one Seabee officer expressed it, "Too damn much water and too little land." Their military tactics necessitated such speed and systematic cooperation that things had to be accomplished with only the impossible "taking a little longer."

Probably one of the greatest feats that came out of this theater was the highly-secret operation known as "Red Hill." From start to finish, the project. done by private corporations under government contract, was entirely experimental since no construction of this particular type had been attempted before.

The story began early in 1940. At that time the United States government had just completed its coastal and territorial defenses in the Pacific to the tune of 65 million dollars worth of work done by PNAB (Contractors, Pacific Naval Air Bases), a combo of three large corporations: the Hawaiian Dredging Company, Turner Construction of New York, and the Raymond Concrete Pile Company, also of New York. In the new contract of 1940 given by the Navy department to PNAB appeared an unexplained paragraph entitled Project 16.

"Underground Fuel Storage, $4,000,000."

An explanation soon followed. The Navy wanted to store oil—four million

CONNIE MINNICH

"I'm in engineering because I love it!" Connie Minnich emphatically answers queries about her north compus habitudes.

Already an assistant editor of the Technograph, Connie is completing her sophomore year in civil engineering. Proof of her engineering interest is her active participation in the A.S.C.E., I.T.E., Mu-San, a sanitary engineering society, and the Illinois Society of Professional Engineering; also, she desires to do graduate work in hydraulics or sanitory engineering at Harvard.

barrels of it—for the Pacific fleet somewhere in the vicinity of Pearl Harbor. They wanted it stored in underground bombproof tunnels.

The problem looked simple enough on paper, but locating such a storage place around Hawaii was difficult. The ground was practically all "puka-puka," the native for the lava deposits of hard basalt and volcanic ash spliced with bubble holes that ranged from a pinpoint in size to caverns as big as barns and underground streams that threaded the whole undersurface.

After a month of test borings, a low ridge known as Red Hill was chosen as the site of tunneling; two miles from the harbor, it was all and more than PNAB could ask for, since it was beautifully free of the "puka" ground and composed of fairly soft rock that would make tunneling a fairly simple operation.

Red hill and Pearl harbor are easily located on the Hawaiian island of Oahu.

Now the conferences began. Authorities, among them geologists, tunneling and hydraulic experts, the best that America had, were called in for consultation. The original idea had been to carve a system of horizontal vaults out of the side of the mountain; elaborate plans and specifications were laid out on this basis. However, it was a short conversation over a dinner table one night that developed the final plans. Two of the resident engineers outlined a process of tunneling which, with its simplicity and economy, floored even the Naval department, which had long since grown accustomed to the sudden brainstorms of PNAB. Immediately all plans were halted and gears shifted within two weeks time to meet the new specifications.

History books and other documents will hand down to posterity the record of the politician's and militarist's past war, but what about the engineer's chronicle? The following article, reviewing very briefly the highlights of engineering feats in the South Pacific theater, is the beginning of a series of such articles that give the engineer behind the man behind the gun a pat on the back.

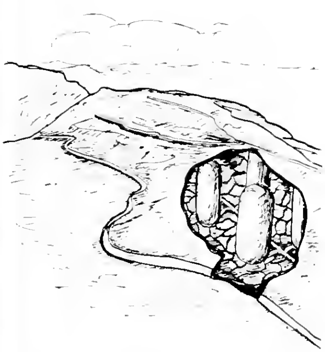
These new plans now called for vertical tunnels—a series of wells, each double the diameter of the original tunnels and each 300 feet deep. Operations began with the boring of a horizontal tunnel the length of the mountainside. Smaller tunnels were cut off from the sides of this passage which eventually became the main connecting tunnel for all the wells. On top of the ground, meanwhile, shafts were sunk through the soft strata down to the point where they met these small side tunnels. Each shaft thus formed was the centerline of a vault.

In the following tunneling operations, the excavated rock and dirt was dropped down the center shaft to the small side tunnel where it was taken out through the main passageway by a system of conveyors. This nifty use of gravity to eliminate the cut alone saved the Navy hundreds of thousands of dollars in hauling expenses; for, as fast as the rubble came out of the side of the mountain, it was eaten up by Army and Navy demands for road-grading material and concrete aggregates—about five million tons of it.

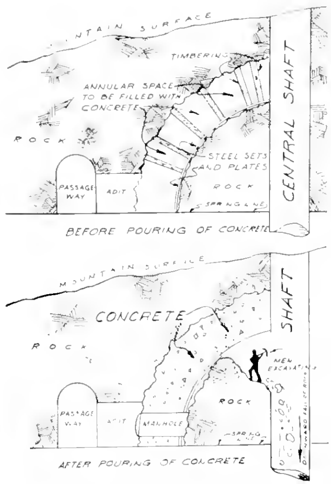
Excavation work now carved a form in the mountain in the shape of a huge inverted bowl stemming from a point in the center shaft 100 feet down from the ground surface (for bombproofing purposes) to the springing line of the vault. This cavity—the upper dome of the vault—had to be a perfect mould for the concrete pourings and constituted the most difficult part of the operation with its precision cutting and pouring.

The whole space required timber bracing due to the fairly soft rock. Lined on its lower surface with firmly welded steel plates, the "bowl" also had an elaborate network of reinforcing rods which were "floated" with accessory wires attached to the rock ceiling and the steel floor. Concrete was then poured steadily from a batching plant on top of the mountain down through a pipeline in the center shaft and distributed evenly throughout the mould. As fast as the concrete came, work crews ribbed out the timbering directly above it. The whole pouring operation of this upper dome took 70 hours.

After the concrete had set, excavation now began on the underside of the "cup," with the crews widening the center shaft in a V or funnel shape so that the rock debris rolled right down to the edge and then down the shaft to the heavy-duty belt conveyors far below. After the cylinder of the vault and the bottom of the dome had been hollowed out, the whole rock surface was grouted to seal off all cracks. Some



A cutaway of Red hill shows the wells as they appear beneath the ground.



The dome of a well is shown before and after pouring of the concrete.

of the puka holes that had been found (the largest in this mountain was only the size of a trunk) were filled with concrete. The bottom dome, or invert, was then cast. Next, fabricated steel rings were assembled for the skeleton of the circumferential framework and, as these progressed upwards to meet the spring line of the upper dome, the welding crews followed and put on form plates. After these came the actual concrete pouring. After hardening, the concrete was prestressed to meet the tremendous pressure of the oil which otherwise would cause the plate seams to burst with resulting leaks. This was done by forcing grout under heavy pressure, into the space caused by shrinkage of the concrete from the form plates while it was setting.

Final testing for leaks was accomplished by a rather unique method. The finished vault was filled to the brim with water till it rose through a small pipe in the top. If in twenty-four hours the water level in the pipe dropped only half an inch, the test was deemed unsatisfactory. A system of indicator pipes leading up from the bottom passed through the plating at intervals where they were open. A hundred-pound pressure was put through the pipes and as the water level slowly rose again, any leaks were located by bubbles on the surface of the water. A crew of welders floating around on the surface of the water would locate a leak, signal the ground crews to lower the water level a bit, then repair the leak.

Final construction on the vault consisted of the stopping up of the original shaft with concerte. All other vertical entrances except the main passageways were wedged in solidly with eight-ton plugs.

Even though the Red Hill operation was important as a means of supply of the life blood of the Pacific fleet, equally as important was the undertaking of the mass construction of air fields on many of the islands that dotted the South Pacific. Part of this project was completed by the PNAB before the Pearl Harbor episode. After the commencement of the war, however, the U. S. Naval Construction Battalions, or "Seabees" as they were called, took over the work.

For the most part, these fields were constructed of materials native to the surrounding area, although in some cases, concrete and steel were employed. The most abundant source of material was coral. Although not the best possible surfacing material, coral served very well even under the heaviest of bombers; and, in some cases, it actually proved superior to concrete under the hot and moist climatic conditions.

In one instance on an airfield on Guadalcanal, the surfacing was a perforated steel mat on a fairly soft foundation. The first mat required constant repair; finally it broke down and had to be replaced by a second. Eventually, the second wore down, too, mainly because of uneven settling of the foundation. This was comprised of soft black silt that beat up to a thick foamy mud under the daily thumping of tropical rains, and which most of the time was little more than a swamp. Another runway in the adjacent vicinity was constructed by using coral for surfacing and the foundation was built in the following manner: first, a network of drainage ditches running in both directions was dug; the soil was compacted as much as possible; this was then covered with a four-inch layer of noncapillary earth to seal the mud; on top was spread and packed down a four-inch layer of gravel; finally, the four-inch layer of coral was spread and compacted. Even at the very end of the war, this coral runway was still giving excellent service on this footing.

Coral, as usually used, was mixed with a small percentage of clay and required a setting period of three days. During this time, the coral seemed to "come alive" and have certain expansions, contractions, and movements that caused the construction crews to tab it as "live" coral. These queer properties seemed to cause it to result in a very compact slab surface.

The heavy tropical rains presented the biggest problem—drainage. A $3\frac{1}{2}$ per cent grade was the general rule although some runways were constructed with alternate sloping grades of $1\frac{1}{2}$ per

(Continued on page 32)

Know Your Automobile

By J. C. Bassie and C. M. McClymonds

Part II

Everyone seems to have quite definite ideas about the car he desires, but very few of the people one talks to really know enough about the car they love to accurately judge whether this car meets and fulfills their needs. In fact, from the number of people who say, "I like that new ———— convertible," without having a better reason than the fact that it costs more money than they will ever be able to spend on a car, the need to explain to them that their needs are in contrast with their desires is quite apparent.

The basic thing to consider when purchasing a new car is the amount of driving one expects to do. For those who drive less than 5,000 miles per year, perhaps a car isn't needed at all. If the mileage requirements are less than 10,000 miles per year, a car may be needed, but the smaller, less-expensive car is the wisest choice. Only for those who drive more than 20,000 miles per year should the large expensive car be considered.

At this point it should be apparent that this article is not intended for the "prestige" car buyer. Instead, it is an attempt to study the basis for selecting, on technical principles, the best car from the standpoint of economics for the needs and desires of the prospective motorist.

The reason for the preceding breakdown on a mileage basis is to keep in mind that the only fair economical cost analysis is on a cost-per-mile-operated base. Naturally, if one gets an expensive car which uses more fuel per mile plus the high first cost, high insurance rates, high depreciation, high taxation, and high maintenance costs, the mileage driven must be very high to bring the cost per mile into line with that for a less expensive car driven fewer miles.

To refer back to the preceding article ("Know Your Automobile," Technograph, January, 1949), it was shown that the horsepower required varies with the cube of the speed. To carry this one step further, it may be demonstrated that, at speeds of less than 50 miles per hour, this horsepower is nearly the same for all cars. Since the horsepower required is one of the determining factors of what the fuel consumption will be, most cars are on an equal footing for judgment if over two-thirds of the miles driven are at speeds less than 50 miles per hour. If the requirements fall into this category, two more factors must be known. First, the fuel consumption per horsepower (which most manufacturers decline to furnish), and second, the degree to which the driver accelerates his car. This latter is usually a very difficult factor to even try to guesstimate because of the fact that even in the city driving conditions will vary over wide limits. Therefore, the best thing to do is to attempt to find the lightest and lowest-powered car that will meet the riding and driving requirements so the cost of acceleration will be minimized.

To generalize, long trips at high speeds should entitle one to make the choice of a heavy, high-powered car for the sake of riding comfort. To further simplify this discussion, some of the basic points to be considered are listed with their effects, both pro and con.

WEIGHT—Increases the riding comfort and frictional forces with the road, making the car safer. It also increases the power required for acceleration, thus increasing fuel consumption and the inertia forces in turning and stopping.

SIZE — Exterior: determines the space required for maneuvering and parking, and the necessary size of the garage. Naturally, a small car is best suited for easy handling in city traffic. Interior: determines passenger comfort and the capacity of the car. A club coupe or similar body style is always lacking in leg and head room in the back seat. The height of the seats, as well as the width, is important for riding ease. Today's dealers are willing for the prospective buyer to try the seats for size.

WINDOW AREA—This is only an approximate index of the visibility from the inside of the car. Seat height, window slope, and window-to-passenger relationships also affect the visibility. In most of the new cars, an outside mirror is more of a necessity than an accessory in order for the driver to obtain a clear view of the conditions to the rear of the car. Another point to check is the field of vision that the rear seat passengers have when the front seat is carrying its normal capacity of passengers.

BRAKE LINING AREA—A light braking load (pounds of car weight per square inch of brake lining), is usually a good index of cool and subsequently safe braking. It will also increase the life of the linings.

TIRE SIZE—Large, oversized tires (with increased cross-sectional area rather than diameter) give a softer ride, longer tire life, and greater safety. The softer ride is due to the fact that more load is carried by the air in the tire and less by the tire sidewall. The greater life and safety is due to the greater area in contact with the road and thus, for the same frictional force, the unit stress in the tire is less. This decrease in unit stress reduces the tendency for the so-called "black mark" skids, which are the result of rubber shearing off of the tire.

HORSEPOWER — This factor is the most important in the determination of the top speed of the car, the second being the air resistance or drag.

TORQUE — This is the quantity which determines the acceleration rate of the car and the hill climbing ability. The exact manner of its effect was discussed in the preceding article, but it can be noted from the accompanying specification chart that the maximum torque is usually found at engine speeds from 1,200 to 1,600 r.p.m. for six-cylinder engines and at speeds from 1,600 to 2,200 r.p.m. for eight-cylinder engines. Other things being equal, it is apparent that a six-cylinder car can accelerate faster below 35 m.p.h. than an eight, but the eight can accelerate faster at speeds above 40 m.p.h. This should be kept in mind when making the choice, depending on one's speed requirements.

REAR END RATIO—This, as previously explained, affects the acceleration, the top speed, and the economy of fuel that may be expected. It was quite common before the war for the purchaser to make a choice between three different ratios: one of approximately 3.7:1 for economy, one of approximately 4.5:1 for performance and hill climbing, and a third of approximately 4.1:1 for all-around utility. The parenthesized ratios are indicated as optional.

TRANSMISSIONS—The type of transmission available with the car is a controlling influence on the choice of

(Continued on page 11)

MAKE	SERIES	NO CYLINDERS	BORE (IN.)	STROKE (IN.)	PISTON DIS-PLACEMENT (CU. IN.)	MAXIMUM BRAKE HORSE-POWER	MAXIMUM TORQUE (FT.-LB.)	STANDARD COMPRESSION RATIO	REAR-END RATIO	WHEEL-BASE (IN.)	FRONT TREAD (IN.)	REAR TREAD (IN.)	BRAKING AREA (SQ. IN.)	WINDOW AREA (SQ. IN.)
BUICK	50	8	3 3/32	4 1/8	248.1	115 @ 3600	212 @ 2000	6.6:1	4.46:1	124	59 1/8	62 3/16	161 1/2	3600
	70	8	3 7/16	4 5/16	320.2	150 @ 3600	280 @ 2000	6.9:1	4.46:1	129	59 1/8	62 3/16	207 1/2	3600
CADILLAC	61	V-8	3 13/16	3 5/8	331	160 @ 3800	312 @ 1800	7.5:1	3.77:1	126	59	63	220	3494
	62	V-8	3 13/16	3 5/8	331	160 @ 3800	312 @ 1800	7.5:1	3.36:1 (H)	126	59	63	220	3494
	60	V-8	3 13/16	3 5/8	331	160 @ 3800	312 @ 1800	7.5:1		133	59	63	220	3477
	75	V-8	3 13/16	3 5/8	331	160 @ 3800	312 @ 1800	7.5:1	4.27:1	136 1/4	58 1/2	62 1/2	233	2930
CHEVROLET		6				90		6.6:1		116	57	58 3/4		
CHRYSLER	C 38	6	3 7/16	4 1/2	250.6	114 @ 3600	204 @ 1200	6.6:1	3.9:1	121 1/2	57	60 9/32	173 1/2	
	C 39	8	3 1/4	4 7/8	323.5	135 @ 3400	270 @ 1600	6.7:1	3.91:1	127 1/2	57 13/16	61 9/16	189 1/2	
DE SOTO	S 11	6	3 7/16	4 1/4	236.6	109 @ 3600	192 @ 1200	6.6:1	3.9:1	121 1/2	57	60 9/32	173 1/2	
DODGE	D 24	6	3 1/4	4 5/8	230.2	102 @ 3600	184 @ 1200	6.7:1	4.1:1	119 1/2	57	60 9/32	173 1/2	
FORD		6	3.3	4.4	226	95 @ 3600	180	6.8:1		114	58.08	60		
		V-8	3.187	3 3/4	239	100 @ 3600	180 @ 2000	6.8:1		114	58.08	60		
FRAZER		6	3 5/16	4 3/8	226.2	100	180 @ 1400	7.3:1	4.09:1	123 1/2	58	60	175.7	
HUDSON		6	3 9/16	4 3/8	262	121 @ 4200	200 @ 1600	6.5:1	4.1:1	124				
		8	3	4 1/2	254	128 @ 4200	198 @ 1600	6.5:1	4.1:1	124				
KAISER		6	3 5/16	4 3/8	226.2	100	180 @ 1400	7.3:1	4.09:1	123 1/2	58	60	175.7	
LINCOLN		V-8	3 1/2	4 3/8	336.1	152 @ 3600	265 @ 1800	7.0:1	3.9:1	121	58 1/2	60	219.8	2527
	COSMOPOLITAN	V-8	3 1/2	4 3/8	336.1	152 @ 3600	265 @ 1800	7.0:1	3.9:1	121	58 1/2	60	219.8	3208
MERCURY		V-8	3 3/16	4	255.4	110 @ 3600	202 @ 1800	6.8:1	4.27:1	118	58 1/2	60	179.12	2527
NASH	600	6	3 1/8	3 3/4	172.6	82 @ 3600		7.0:1	4.4:1	112	54 11/16	59 11/16		
	AMBASSADOR	6	3 3/8	4 3/8	234.8	112 @ 3600		7.02:1	4.1:1	121	54 11/16	60 1/2		
OLDSMOBILE	76	6	3 7/32	4 3/8	257.14	105	202	6.5:1	4.1:1	119 1/2	57	59	159.8	2752
	88	V-8	3 3/4	3 7/16	303.73	135	263	7.25:1	3.23:1 (H)	119 1/2	57	59	191.7	2752
	98	V-8	3 3/4	3 7/16	303.73	135	263	7.25:1	3.23:1 (H)	125	58	61 1/2	191.7	3070
PACKARD	DE LUXE	8	3 1/2	3 3/4	288	130 @ 3600	225 @ 2200	7.0:1	3.9:1	120				
	SUPER	8	3 1/2	4 1/4	327	145 @ 3600	266 @ 2200	7.0:1	3.9:1	120				
	CUSTOM	8	3 1/2	4 5/8	356	160 @ 3600	282 @ 2200	7.0:1	3.92:1	127				
PLYMOUTH	P 15	6	3 1/4	4 3/8	217.8	95 @ 3600	172 @ 1200	6.6:1	3.9:1	117	57	60 1/8	158	
PONTIAC	STREAMLINER	6	3 9/16	4	239.2	93 @ 3400	183 @ 1200	6.5:1	4.1:1	120	58	59	173	
	CHIEFTAIN	6	3 9/16	4	239.2	93 @ 3400	183 @ 1200	6.5:1	4.1:1	120	58	59	173	2779
	STREAMLINER	8	3 1/4	3 3/4	248.9	106 @ 3800	194 @ 2200	6.5:1	4.1:1	120	58	59	173	
	CHIEFTAIN	8	3 1/4	3 3/4	248.9	106 @ 3800	194 @ 2200	6.5:1	4.1:1	120	58	59	173	2779
STUDEBAKER	CHAMPION	6	3	4	170	80 @ 4000	134 @ 2000	6.5:1	4.1:1	112	56 1/4	54	148	2368
	COMMANDER	6	3 5/16	4 3/4	245	100 @ 3400	200 @ 1600	6.5:1	4.09:1	119	55	54	178	2368
	LAND CRUISER	6	3 5/16	4 3/4	245	100 @ 3400	200 @ 1600	6.5:1	4.09:1	123	55	54	178	2408

COMPARATIVE SPECIFICATIONS OF CURRENT PRODUCTION MODELS OF AMERICAN-MADE CARS
FROM DATA OBTAINED FROM THE MANUFACTURER
(BLANK SPACES INDICATE UNAVAILABLE INFORMATION) (2-1-49 - CMM)

The Coming Convocation

By Dale Glass, Ch.E. '49

On April 8, 1949, the slide rule boys will observe the launching of something new in the history of the University—the first annual all-engineering convocation, sponsored by the Engineering Council and the Illinois Technograph.

The objectives of this new venture are (1) to promote an active interest in the advancement of effective teaching at the University, (2) to honor members of the faculty in the various engineering departments, in particular, those who are chosen by vote of the students as the most effective teachers, and (3) to bring about a closer relationship among the faculty and the students.

President Stoddard to Speak

Because of his contributions to the educational field, our own president, Dr. Stoddard, has been chosen to deliver the main address at this first convocation in the University Auditorium. Sharing the spotlight with President Stoddard will be M. L. Enger, retiring

PRESIDENT STODDARD

dean of the College of Engineering, and W. L. Everitt, dean-elect of the College, who will each give a brief talk. The concluding feature of this event will be the presentation of awards to the engineering instructors chosen by the students for their effective teaching methods.

Classes to be Dismissed

Engineering students will be dismissed from their 10 o'clock classes on Friday, April 8, so that they will have the opportunity to hear President Stoddard speak and to learn the results of the effective teaching contest. Not until then will the results of the contest be announced.

Effective Teaching Defined

Just what is effective teaching? Here is what two professors and one student have to say about it. (In fairness to other instructors eligible for the contest, the instructors quoted have not been identified):

"The effective instructor is one who stimulates each student to learn, to think and to perform at his highest capacity."—Well-known M.E. instructor.

"Effective teaching should accomplish the following: (1) direct results—development of mental skills, development of confidence in ability to learn, acquisition of factual information, and (2) indirect results—appreciation of viewpoints of others, increase the horizon of interests, development of sense of individual responsibility, increase in capacity for self-direction and self-discipline. Direct results depend upon . . . knowledge of teaching methods and material on the part of the instructor. Indirect results depend upon the philosophies and personality of the instructor."—A popular E.E. instructor.

"A good instructor, in my opinion, is one who possesses an ability to teach. No matter what academic degree is held, the ability to teach consists of a few important points: primarily, a knowledge for one particular course or even one of subject matter beyond that required field of study, and secondly, the ability to communicate information to students. Among the basic necessities are an understandable speaking voice, a sense of humor, and a knack for improvising subject matter to correlate it with the present-day picture."—Wm. Peeples, editor, Daily Illini.

Contest Date

All junior and senior engineering students will have the opportunity to cast three votes for their most effective instructors in any engineering department. Voting dates will be Wednesday through Friday, March 16 through 18, inclusive. The student may cast no more than one vote in any one department. (For this contest, mining and metallurgy are considered as separate departments.)

Location of ballot boxes:

Aero. E.—Office Transportation building.

Ag. E.—Office, Agricultural Engineering building.

Arch E.—Office, Architecture building.

Cer. E.—Office, Ceramics building.

Chem. E.—Office, Noyes laboratory.

Civil, Gen., DSSWV. E.—First floor, Engineering Hall.

Elec. E.—Office, E. E. R. L.

Eng. Physics—Office, Physics building.

Mech. E.—First floor, M. E. laboratory.

Min. and Met. E.—Office, Ceramics building.

(Previous information concerning the Convocation and Contest appeared in the February issue of the Technograph.)

A sample ballot appears on the next page.

A farmer and a professor were sharing a seat on a train. It was getting lonesome so the farmer started a conversation and they soon became a friendly pair.

"Let's have a game of riddles to pass the time," said the professor. "If I have a riddle that you can't guess you give me one dollar or vice versa."

"All right," replied the farmer, "but as you are better educated than I am, do you mind if I only give fifty cents?"

"OK," replied the professor, "you go first."

"Well, what animal has three legs walking and two legs flying?"

"I don't know. Here's your dollar. What's the answer?"

"I don't know either. Here's your fifty cents," answered the farmer.

* * *

A woman is a person who can hurry through a drugstore aisle 18 inches wide without brushing against the tinware piled up there, and then drive home and knock off one of the doors from a 12-foot garage.

* * *

"Willie, I'd like to go through one whole day without once scolding you or punishing you."

"All right mother, you have my consent."

Ballot for Effective Teaching Contest

SPONSORED BY

The Engineering Council and Illinois Technograph

Vote for one, two or three instructors in any engineering department listed below, but do not vote for more than one instructor in any one department

AERONAUTICAL	**CIVIL**	**PHYSICS**
AGRICULTURAL	**ELECTRICAL**	**MINING**
ARCHITECTURAL	**G.E.D.**	**THEORETICAL and APPLIED MECHANICS**
CERAMICS	**MECHANICAL**	
CHEMICAL	**METALLURGICAL**	

Name of Instructor — Department

1. ____________________

(SAMPLE BALLOT)

2. ____________________

3. ____________________

Don't spoil a ballot. Polls open Wednesday, Thursday, and Friday, March 16, 17, and 18. 8-12 a.m. and 1-5 p.m.

AUTOMOBILES . . .

(Continued from page 8)

rear end ratio, and the parenthesized "H" in the rear end ratio column illustrates those ratios furnished by the manufacturers employing the Hydramatic transmission. It was found that most people using an automatic or semi-automatic transmission find that they had to develop a steadier foot on the throttle than they had been using in the past on manual transmissions, or the transmission would have a tendency to "hunt." This hunting is less noticeable on the torque convertor than it is on the automatic transmission.

USEFUL CAR LIFE—For the past decade, it has been considered that the maximum useful life of most cars, without excessive maintenance costs, is about three and one-half years or 100,000 miles, whichever occurs first. The most desirable wearing-out of a car, from the economical point of view, is through usage, because it lowers the cost-per-mile-operated.

Beyond this, and with the help of the accompanying chart, perhaps those contemplating the purchase of a new car can make their own comparison of these basic points and come to a logical conclusion as to which car will be the best suited for the job.

Prof. (during the summer quarter): "That's five times this week that you have failed to turn in your assignments. Do you have any comments?"

Frosh: "Yes, sir. I'm certainly glad it's Friday."

* * *

Lieutenant (in the mess hall, roaring with indignation): "Who told you to put these flowers on the table?"

Sergeant: "The Colonel, sir."

Lieutenant: "Pretty, aren't they?"

* * *

Student: "Professor, can you help me with this problem?"

Professor: "I could, but I don't think it would be right."

Student: "I don't suppose it would, but let's take a shot at it."

* * *

Friend (to young wife contemplating divorce): "Remember, you took your husband for better or for worse."

Young Wife: "But I didn't take him for good, did I?"

* * *

Studies by the U. S. Bureau of Standards show that the average car gets 21 miles per gallon at 20 miles an hour, 16 at 40 miles an hour, 11 at 60 miles an hour, and 8 at 80 miles an hour.

Mrs. Jones was sitting in the breakfast nook shelling peas when she heard the back door open. Thinking it was her son, she called, "Here I am, darling."

Silence: Then a deep voice boomed, "This is not the regular iceman, Ma'am."

* * *

How's Your Tooter?

Automotive terms differ in many parts of the world. Here, for example, are American and British terms that mean the same thing:

A car horn is a tooter. A valve-grind job is a decoke job. The car transmission is a gearbox, the windshield a wind-screen. Gasoline is petrol, the generator is the dynamo, and the old-time rumble seat is a dickey seat.

The car hood is a bonnet, and when you talk of the car top in England you call *that* the hood. The trunk is a luggage boot.

You don't have a tire blow-out, you have a "burst." When you race the engine, you "rev up." The sidewalk is the pavement, and a paved road is a "built up."

A lug wrench for removing a car wheel is a wheelbrace. And the driver does not "step on the gas." He just "hits up."

Beginning Your Career in Engineering

By ***ELLIS DANNER***
Associate Professor of Civil Engineering

Are you looking forward to graduation with a lot of employment questions still on your mind? If so, this article will provide you with a very helpful point-to-point analysis of factors that should be considered before making a decision. Also, some important suggestions on how to make the most of your first position are included.

Are you one of those young men who is about to complete his college training in engineering and who will soon begin an active career in engineering work? If you are, then you are probably struggling with some of the most difficult questions that you have had to answer during your college days. "What type of work would I like to do?" "Who offers the best opportunities?" "How much salary will I get?" "Where do I want to go?" "Which job shall I take?" "Why should I get an advanced degree?" "When will I find the answers to these questions?"

The answers to these and other similar questions must be worked out by you. You may receive advice and suggestions from others, but the final decisions are yours to make. Certain information which may be of assistance to you in making the proper start in your career in engineering is presented here for you to consider.

Where Shall I Begin My Career?

1. What engineering work is available?

Before you can compare jobs you must have some idea of what jobs are open to you. You will find the information about specific jobs in your college of engineering employment offices and through other employment contacts which you may establish. But you will also find it useful to know in a general way the various fields in which engineering services are used. The Engineers Joint Council made a survey of the engineering profession in 1946 and has published under the title "The Engineering Profession in Transition" extensive data on the distribution of engineers in the various fields and the ranges of salaries in those fields.

TABLE 1

Percentage Distribution of the Engineering Profession in 1946, by General Field of Employment.

General Field of Employment	Percentage
Total	100.0
Chemical	9.8
Civil	23.6
Electrical	25.2
Mechanical-Industrial	23.7
Mining-Metallurgical	7.6
Other Engineering	6.5
Non-engineering	3.6

The membership of the engineering profession in the United States in 1946 was estimated to be 317,467. A projected estimate of the total for 1950 was 336,722. You are about to become a member of a very large profession with a wide variety of interests. First you may want to know how many engineers there are in your branch of the profession. Table 1 gives the percentage distribution in 1946 according to the general fields of employment. Table 2 shows the percentage distribution in 1946 according to major industry fields for each of the branches of engineering. Table 3 shows the percentage distribution in 1946 for the entire profession by class of worker and Table 4 by occupational status. The distribution for Tables 3 and 4 for the various branches of engineering may be found in the E.J.C. Report, but is not reproduced here.

From these tables you may determine the comparative demand for engineering services in the many phases of the profession and you may also learn of the various fields and occupations in which your engineering training may be used.

2. Should I get an advanced degree in engineering?

About the time that you are to receive your bachelor's degree in engineering, someone brings up the question of staying in school a while longer to get a master's or doctor's degree. How much demand is there for an advanced degree in engineering? Table 5 gives the percentage distribution of the engineering profession in 1946 according to educational level for the general fields of employment.

Since the matter of return on the investment in an advanced degree is always of interest, Table 6 is included to show the median salaries for the various educational levels at several levels of experience. There is little variation of salaries for the three college degrees during the first six years of experience, the greatest variation at aboute 20 years of experience and the variation disappears at about 30 years of experience. The highest salary levels in engineering are in the technical and non-technical administration-management field (higher years of experience) and the advanced degrees seem to be of little advantage in this type of work.

In college teaching and in engineer-

TABLE 2

Percentage Distribution of the Engineering Profession in 1946, by Major Industry Field and by General Field of Employment.

Industry Field	Total	Chem.	Civil	Elec.	Mech.-Indus.	Mining-Metal.	Other Engi.	Non-Engi.
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture and Forestry	0.5	0.5	1.2	0.0	0.1	0.1	1.1	1.5
Mining	6.1	1.6	0.8	0.6	1.0	55.1	13.4	6.6
Construction	18.4	2.9	63.9	4.6	4.1	0.4	12.2	5.6
Manufacturing	41.8	82.3	7.5	41.8	65.6	34.4	28.7	35.7
Transportation	2.2	0.1	4.1	1.6	1.9	0.1	3.3	3.1
Communication	4.2	0.2	0.1	13.8	1.3	0.4	3.3	3.2
Utilities	11.1	1.1	8.9	25.7	6.7	0.3	8.7	7.1
Personal services	9.4	6.8	7.3	6.8	12.8	5.3	17.0	22.4
Other fields	5.8	4.3	5.8	4.8	5.8	2.4	11.8	12.7
Unemployed	0.5	0.2	0.4	0.3	0.7	0.5	0.5	2.1

TABLE 3

Percentage Distribution of the Engineering Profession in 1946, by Class of Worker.

Class of Worker	Percentage
Total	100.0
Private engineering	76.3
Employe	67.1
Employer	6.0
Independent consultant	3.2
Public engineering	20.4
Federal Government	9.7
State Government	5.6
County Government	0.9
Municipal Government	3.4
Other public authority	0.8
Non-engineering	2.3
Student	0.4
Retired	0.3
Unemployed	0.3

ing research advanced degrees are highly desirable or in many cases essential. The trend seems to be towards a greater demand for advanced degrees in many other phases of engineering. When the supply of engineers exceeds the demand as is expected to occur by 1950 or 1951, advanced degrees will become of relatively greater importance in the process of selection.

3. *What factors should I consider in deciding upon a job?*

While salary is always an important and basic consideration, there are a number of other factors worth thinking about in choosing a job. They might be listed as follows:

A. On the job factors.

1. Salary—present and future possibilities.
2. Prestige and recognition given to engineers in the particular field of business.
3. Opportunity for advancement—system for handling advancement.
4. Do I like the type of work that I am to do?
5. Character and congeniality of associates.
6. Security and continuity of employment under variations in business conditions.
7. Quality of engineering experience obtained.
8. Possibility of contacts leading to a better position in other fields or with other employers.

B. Home factors.

1. Availability of suitable housing.
2. Character of community and its people.
3. Amount of travel required on the job and the time at home.
4. Amount of moving necessary.
5. Accessibility of adequate schools for children.
6. Recreational facilities in the area.

At this point you might be interested in some information about the range of salaries for engineering services. In Table 7 you will find a listing of the median salaries paid in 1946 to the various classes of engineering workers at several levels of experience. Salaries have generally increased about 10 to 20 per cent since 1946 with the largest gains in public engineering. Private engineering no longer offers the great advantage in pay, particularly in the early years of experience, that it did a few years ago. In order to give you an idea of the variation in salaries for several levels of experience, Table 8 is included.

Some of the factors listed above will be of interest to you and others will not. Check over the list, decide which elements are of concern to you and then fill in the corresponding information about the jobs which you are considering. By weighing the good and bad points of each job opportunity in the light of the relative importance of these factors to you, you are on the way to making a logical selection of the starting point in your engineering career.

TABLE 4

Percentage Distribution of the Engineering Profession in 1946, by Occupational Status.

Occupational Status	Percentage
Total	100.0
Administration-management, tech.	30.4
Design	14.9
Development	6.8
Research, applied	5.8
Construction, supervision	4.7
Teaching, college or university	4.4
Consulting, employe or private firm	4.2
Sales	4.1
Administration management, nontech.	3.6
Consulting, independent	3.6
Operation	2.4
Analysis and testing	2.2
Production	2.1
Any occupational status not specified	2.1
Maintenance	1.9
Drafting	1.1
Estimating	1.1
Inspection	0.9
Editing and writing	0.7
Installation	0.6
Research in basic science	0.6
Patents	0.3
Safety engineering	0.3
Student	0.3
Unemployed	0.3
Personnel-labor problems	0.2
Teaching, other	0.2
Retired	0.2

How Can I Make the Most Out of My Job?

While the selection of the right job for you requires careful consideration, it is more important that you make the most of whatever job you take. You may get nowhere on the very best job that you could have chosen and you may be very successful in a much poorer job opportunity, depending upon your own capabilities and application to the work.

Since most of you will be employes, at least for a time, a few suggestions from the employer's point of view may help you to make a better impression and to do a better job.

A. Give your employer full value for his money.

1. Be at work on time.
2. Don't be a clock watcher or afraid of a little extra time. Engineering is brain work, and brain work is note very well regulated by the clock.

B. Show interest and enthusiasm for your work.

1. Seize every chance to learn more about the business.
2. Continue to study and improve yourself—your knowledge at graduation is only a small fraction of what you will learn in the next 10 years unless you are content to stagnate and sit in one place.
3. Don't be afraid to tackle a new job. Get as much varied experience as you can. Advancement depends upon your breadth of experience,

TABLE 6

Median Monthly Salaries for the Engineering Profession in 1946, by Basic Educational Levels and by Experience Level.

Basic Educational Level	Exp. Level in Years 6	20-24	30-34
Doctors	$400	$534	$575
Masters	367	501	580
Bachelors	337	489	568
Incomplete college	316	421	507
No college	340	411	472

TABLE 7

Median Monthly Salaries for the Engineering Profession in 1946, by Classes of Engineering Workers and by Experience Level.

Classes of Engineering Workers	Exp. Level in Yrs. Under 1	9-11	25-29
Private engineering employes			
Chemical	$256	$443	$765
Civil	243	371	476
Electrical	237	366	535
Mechanical Industrial	225	405	567
Mining-Metallurgical	236	431	623
Other engineering	224	399	595
Non-engineering	215	417	659
Private engineering			
Employers	235	484	672
Independent consultants		415	513
Public engineering employes			
Federal Government employes			
Civil engineering	225	368	486
All other engineering	230	403	495
Non-Federal Government employes			
Civil engineering	234	314	371
All other engineering	230	343	432

particularly for the better jobs which are administrative in nature.

C. Organize your work. Plan things ahead so that you know where you are going. Be neat and orderly. Practice lettering and drafting, the tools with which the engineer expresses his ideas.

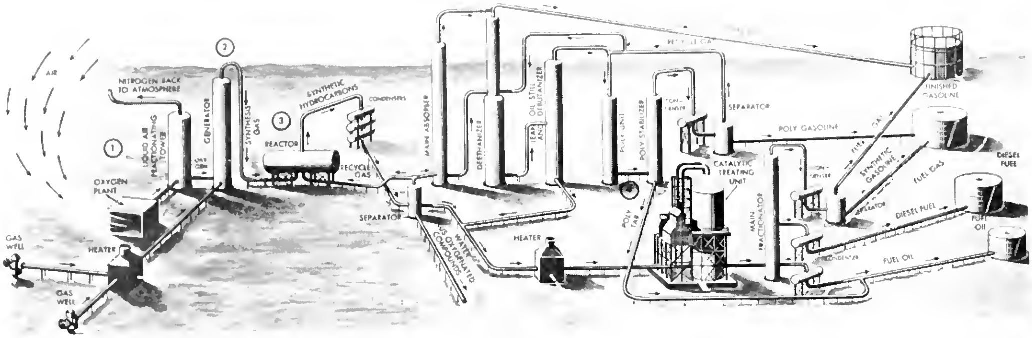
D. Practice speaking and writing *clearly concisely* and *correctely*. This is the means by which you sell yourself to your employer. How much you

(Continued on page 22)

TABLE 5

Percentage Distribution of the Engineering Profession in 1946, by Educational Level and by Genetral Field of Employment.

Basic Educational Level	Total	Chem.	Civil	Elec.	Mech.-Indus.	Mining-Metal.	Other Engr.	Non Engr.
All Levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Doctors	3.7	12.7	1.8	2.4	2.0	7.1	4.5	2.5
Masters	15.4	24.0	13.7	13.4	14.9	19.3	14.1	15.0
Bachelors	63.8	57.2	63.7	66.2	67.3	57.4	61.2	60.5
Incomplete college	13.0	4.7	15.9	13.6	11.7	12.5	15.7	16.0
No college	4.1	1.4	4.9	4.4	4.1	3.7	4.5	6.0



A simplified illustration of the Hydrocol process for production of synthetic fuels in shown above. This process is to be put in operation by Carthage Hydrocol, Inc., at Brownsville, Texas, near the San Salvador natural gas fields. (Photo courtesy of "Texaco Star.")

FROM GAS TO GASOLINE

By Ray Hauser, Chem.E. '50

There has been considerable interest lately in the economic and industrial feasibility of synthesizing liquid fuels and lubricants from carbon monoxide and hydrogen. The need for such a process to augment our diminishing crude petroleum reserves has led to hurried, but significant, advances. Both coal and natural gas are being investigated as raw materials. It is estimated that natural gas will last only a few decades, but coal is expected to last for centuries—especially if lignite can be used successfully. Conversion of coal to gasoline has not yet become economically practical, but conversion of natural gas to hydrocarbons is already of great significance.

The Fischer-Tropsch process for synthesis of liquid fuels has been varied so many times, and so much, that the aggregate systems are now being called the "synthine" process. Carbon monoxide and hydrogen in the right proportions react under the proper conditions to produce a mixture of aliphatic alcohols, aldehydes, ketones, acids, and esters called "synthol." Although the yield of hydrocarbons is only one per cent, heating of synthol for an hour at 840° F. gives a mixture of hydrocarbons and oxygenated compounds. Separation, refining, and polymerization of the hydrocarbons produces gasoline and oils. The alcohols, aldehydes, and ketones are by-product chemicals of considerable value.

Synthesis gas is the basic material from which petroleum products are made. It is mainly a mixture of CO

RAY HAUSER

A prospective chemical engineer of 1950 is blond-haired, blue-eyed Ray Hauser.

A native of Litchfield, Illinois, Ray was born on April 16, 1927. A loyal member of the Honorable Order of BMOC's here on the campus, his activities include an assistant editorship of TECHNOGRAPH, membership in A.I.Ch.E., and Engineering Council.

Outside of the slipstick realm he is active in McKinley Foundation as a member of the choir and chairman of the recreational committee. Like many others, Ray came to college after he left the Navy in 1946.

and H_2, the exact composition depending upon the process to be used and the products desired from synthesis. The normal-pressure synthesis method uses a H_2:CO ratio of 2:1, and the more prominent medium-pressure synthesis uses a ratio of 1.4:1.

Synthesis gas may be made from coal or from methane, depending upon the availability of the raw material and the cost of production. Production from coal may be done by the "Winkler" generator, water gas process, or by underground burning. Methane may be obtained from coke oven gas or natural gas.

Are you worried about a future gasoline shortage? Synthetic gasoline prepared from hydrogen and carbon monoxide may soon be at the gas stations to help prevent this condition. This article presents the Fischer-Tropsch, or Synthine process of liquid fuels.

The "Winkler" system uses cheap lignite, a very low-grade brown coal that is found extensively in this country. A high-velocity blast of hot oxygen and steam passes through a bed of lignite. A temperature of 2500° F. is attained, and the entire mass—except moisture and ash—is converted to CO and H_2. Impurities are usually present, especially sulfur products. The necessary oxygen is usually obtained by the Linde-Frankl process, involving fractionation of liquid air. The cost of lignite is very low, but the expense of producing oxygen is considerable.

Where practical, water gas prepared from coke and having the composition, CO—40%, H_2—50%, CO_2—5%, and N_2 and CH_4—5%, may be used. However, the H_2:CO ratio is too low for hydrocarbon synthesis, and the proper ratio is attained by conversion of a portion of the CO to CO_2 by high-temperature oxidation over FeO. In this conversion, steam and water gas are passed over the iron oxide catalyst at 840-925° F. The per cent bypassing the convertor is regulated according to the exact composition of the original gas and the required H_2:CO ratio of the synthesis gas. The carbon dioxide produced by the conversion is passed through the Fischer-Tropsch reactors, its effect being only that of a diluent.

Underground gasification of coal is

(Continued on page 24)

The Engineering Honoraries and Societies

By Bill Soderstrum, Cer.E. '52

SIGMA TAU

Radar! That awesome subject was the main theme of the address titled "Nothing Is Impossible" which was delivered by Dean L. N. Ridenour, dean of the Graduate College, to Sigma Tau, all-engineering honorary fraternity. Dean Ridenour addressed the group at its initiation banquet held on January 12, 1949, at the Town Club.

Members initiated to the fraternity at this time are as follows: H. O. Barton, L. F. Brown, R. Brown, D. Burgener, R. A. Campbell, D. T. Carter, W. H. Christoffers, R. D. Collins, H. G. Cooper, J. W. Crawford, P. Dasher, F. S. Eby, R. D. Eilers, B. W. Everitt, W. J. Evers, J. F. Farris, J. J. Fishman, J. Gordon, J. R. Harlan, M. Henderson, J. R. Howard, R. L. Hyde, R. N. Irgens, W. Jarvis, J. Johnson, G. Keele, H. W. Knoebel.

S. W. Kulcinski, L. G. Ladof, R. T. Loewe, A. London, W. R. Loomis, G. Massie, C. A. McGovney, P. Mooney, T. G. Morrison, H. M. Passman, R. L. Parr, C. M. Peterson, E. Petkus, D. P. Protzman, R. M. Robinson, W. A. Schaaf, R. E. Schilson, E. W. Schwarz, H. B. Scott, S. C. Sommer, J. Stephens, N. E. Wandke, P. Wargo, H. Ward, H. C. Watton, D. Weaver, M. J. Weberling, I. Weissman, R. E. Wilson, D. W. Wright, and L. K. Yoskowitz.

S.B.A.C.S.

A colored film on the making of steel opened the pre-Christmas meeting of the Student Branch of the American Ceramic Society held on December 16, 1948.

After the films, the new constitution and by-laws of the organization were discussed and ratified. After the business meeting, refreshments were served and a general "bull session" was in order.

Officers for this semester, who were nominated at the December 16 meeting and elected at the January 10 meeting, are president, Norman Russell; vice president, Bob Bender; secretary, John Cox; historian, Lucas Pfeiffenberger; treasurer, Al Siska; and Executive Council representative, Howard Rapp.

Mr. Ralph Hanna, ceramic engineer of the Square D company of Peru, Ind., was the speaker at the January 10 meeting. He addressed the group on the "Background of Ceramics and Ceramics in Industry."

As a grand finale to the semester activities, the society held a record dance on January 15, 1949, in 314 Illini Union.

M.E. NEWS

Two M.E. societies and one M.E. honorary fraternity banded together to sponsor a Senior-Faculty banquet. Pi Tau Sigma, honorary fraternity, S.A.E. and A.S.M.E. gave the banquet in the Illini Union ballroom on January 6 in an attempt to revive the prewar annual event.

Dr. Henning Larsen, dean of the College of Liberal Arts, was the guest speaker. Approximately 170 members attended.

ETA KAPPA NU

"The Two Most Seductive Women in History." This (believe it or not), was the topic that Dr. R. G. Bone, director of the Division of Special Services for War Veterans, chose for his speech at the semi-annual initiation banquet of Eta Kappa Nu. In his address, Dr. Bone discussed a few of the more illuminating adventures of Cleopatra and La Maquise d'Aubrion.

This banquet, which was held December 15, 1948, at Hotel Tilden Hall, was also the scene for the election of officers. Officers elected at this time included president W. A. Schaaf; vice president, K. R. Brunn; corresponding secretary, J. R. Stone; recording secretary, E. A. Kitsch; treasurer, J. Schrivner; and bridge correspondent, G. B. Foster.

Seventy undergraduate and eight graduate students were initiated into the electrical engineering honorary fraternity at this banquet.

The last noon-time luncheon of last semester was held on Monday, January 10, 1949, at the University Club. Dr. H. R. Bowen, dean of the College of Commerce and Business Administration, was the guest speaker. Dean Bowen spoke on "The Causes of Wars," in which he briefly discussed historical causes of war and their possible effect in the future.

CHI EPSILON

Do you ever wonder what a civil engineer does? And is a civil engineer always civil? Prof. J. J. Doland didn't answer these questions but he did say "What a Civil Engineer Might Do." This was the subject of his talk at the Chi Epsilon initiation January 5, in which he brought forth some good advice for the members.

Thirty-one initiates received a warm welcome into the organization and a banquet meal consisting of swiss steak and all the trimmings. George Roberts, president of the local chapter, served as toastmaster and Gerald Engelbart welcomed the new members. George Wear responded to the latter in behalf of the initiate class.

Club Commons in the Illini Union was the scene of a very enjoyable party and dance held Saturday, January 15, for the members and their guests. Tricks of magic during the intermission were especially entertaining and contributed to the good time had by all.

I.E.S.

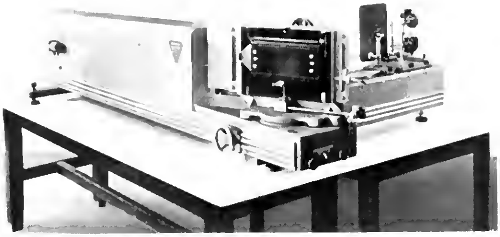
Dr. Ward Harrison, international authority on lighting, was the speaker at the January 13, 1949, meeting of I.E.S. Dr. Harrison, former director of engineering for the General Electric Lamp department at Nila Park, spoke on glare factors that are important in lighting design. At present he is doing research work toward eliminating glare in lighting installations.

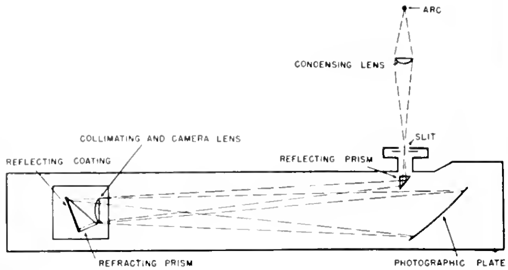
A new secretary-treasurer, Robert Vandenboom, was elected at this meeting. The next meeting is tentatively scheduled for February 16.

A.F.S.

"We're in!" The University of Illinois Student Branch of American Foundrymen Society was accepted into the Engineering council last December. Latest arrival on north campus, the American Foundrymen Society was officially installed on October 22. James L. Leach, assistant professor in the M.E. department, is the faculty adviser for the group, whose aim is to enlighten students in the possibilities of foundry work.

(Continued on page 31)





The Bausch and Lamb spectroscope of the large Littrow-type is pictured in Figure 1 (left) and outlined in Figure 2 (right). (Photos courtesy of Bausch and Lamb.)

Undercover at . . . GALESBURG

The Magic of the Spectroscope

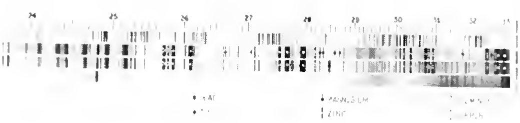
The science of spectroscopy is defined as the science of the phenomena observed by the spectroscope. Such phenomena is the process of breaking a light beam up into its constituent wave lengths. The discovery and development of this process or any process of this type dealing with light has been a most recent one. It was for Sir Isaac Newton, early in the 18th century, to make the initial discovery. In his experiment, he allowed sunlight to pass through a small round hole, a glass prism, and then let it fall on a screen. The view on the screen was a series of colored images of the hole which he named the spectrum. He developed his idea to the extent that he came very near to the production of a modern spectroscope. Newton later recognized that this series of colors appeared in the same order with each additional experiment. This, however, was the limit of Newton's discovery and his prestige at this time was such that he sent everyone off on the wrong track when he refuted the idea that emitted light was characteristic of the atom or molecule which produced it.

At the turn of the 19th century many discoveries led to the modern concept of spectroscopy. Among these were the discovery of the infra-red spectrum, the ultra-violet spectrum, wave length determinations, and the finding of the lines in the sunlight spectrum and the subsequent lettering of these lines with the surprisingly accurate wave length determination which resulted. The final step in making spectroscopy the true science it is today was the realization that each atom or molecule has its own characteristic spectrum. This conclusion was gradually brought about by experiments with light sources of single certain types of light waves.

A process by which industry has made use of this great discovery is in the analysis of samples of an unknown material. This process is so developed today that not only can we get a qualitative analysis but also a quantitative analysis. The process is initiated with the arc (see Fig. 2.) The sample is introduced here into a source of temperature which is high enough to volatize it and convert it into a luminous vapor. This can be accomplished in many ways with the sample in a solid or liquid form and with a high temperature source, which can be anything from the Bunsen burner to a high tension spark. The light given off, characteristic of all the elements in the original sample, passes through the condensing lens and then to the slit. The width of the slit has a great deal of effect on the resolving power, which is the ability of the instrument to separate the light of different wave lengths. The slit must be kept free of dust particles because the end result is a series of images of the slit and the dust particle would show up on the photographic plate. The light then passes through the instrument to the refracting prism. This is the heart of the apparatus, in as much as here is where the work of separating the light into its own wave length is done. (Instead of a prism, many instruments are now made with a defraction grating which is a piece of glass with as many as 20,000 lines to the inch etched upon it.) The shorter the wave length the more the rays are bent and every type of light, representative of its element, is therefore divided and recorded on the photographic plate.

From this brief description one can see how a qualitative measurement can be made. However, the quantitative measurement is made by determinations

(Continued on page 18)



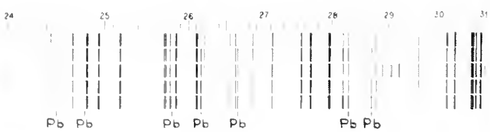


Figure 3 (left): In these spectra of two die casting alloys containing 93 per cent zinc, four per cent aluminum, and three per cent copper the second spectrum from the top was an alloy that failed. Figure 4: Lead in a sample quantitatively determined by these spectra. (Photos courtesy of Bausch and Lamb.)

GALESBURG . . .

(Continued from page 16)

of the densities of the lines. (Fig. 4). The more dense the lines the greater the quantity of the element present in the sample. The spectroscope is a most sensitive instrument and in cases where the element may be present in too small an amount to be noted by chemical analysis, the spectroscope will discover it.

To aid in the identification of elements, most instruments have a provision for imprinting a scale of approximate wave lengths on the plates (note the numbers on the tops of Figs. 3 and 4.) This system is of its greatest value when the same spectrum is to be photographed repeatedly. If the plates were not numbered a new set would be required for each test. A more accurate identification of the lines is made either by comparing them with the spectra of known elements, photographed adjacent to the spectrum to be studied, or by measurement of the wave length of the line (see Fig. 3, the top and bottom spectrum are comparison spectrum). The iron spectrum is usually the one photographed as an identification, since it has many lines well distributed throughout the spectrum and their wave lengths are known to a high degree of accuracy. With experience, one can usually classify an unknown line by comparing its position to that of certain groupings of the known spectrum. Because of the very accurate results of analysis obtained from the spectroscope, many manufacturers are turning to it as a means to analyze materials before they are unloaded.

Certainly no article on spectroscopy can be written without mentioning its use in the field of astronomy. One of the more recent determinations is that water, in a solid state only, exists on the planet Mars, was made with a new infra-red spectrometer by Mr. Gerard Peter Kuiper at MacDonald Observatory in Texas. The ballistic research laboratory of Aberdeen proving ground, Maryland, is studying the jet of the V-2 rocket in flight by these methods. It seems entirely possible that by the time the space-ship era arrives, details of the life or lack of life on the outlying planet, to which a ship of this sort could go, will be known.

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HOUSE OF MAGIC

Music that is transmitted by a beam of light, spinning gears that seem to be stopped, and the many other oddities of science that are shown in the General Electric "House of Magic" show lead a person to believe in the old adage that truth is indeed stranger than fiction.

In 1930 the late radio commentator Floyd Gibbons visited the General Electric research laboratory in Schenectady, New York, and exclaimed that the laboratory was truly a house of magic. In 1933, for the Chicago world's fair, a show was made up using interesting parts of this laboratory which were believed to be of interest to the average person and thus the show which we now

Mr. Hoverman of General Electric lights a flourescent tube without the aid of electrical connections.

call "House of Magic" was born. This show now has played at all of the major world's fairs and in all the states of the Union plus many of the provinces of Canada.

The G. E. laboratories, noted primarily for their research in the fields of electronics, also delve into the research of modern chemistry. An example of one of the recent discoveries of the research chemists has been the perfecting of the important substances called "the silicones." One of the most interesting is a by-product referred to as "bouncing putty." This material, if slowly formed into any shape, will retain that shape, but if an attempt is made to change this shape suddenly, the putty has a strong tendency to return to its original form. This property makes it especially practical for use as golf ball centers and other similar uses.

An aid to modern medicine has been made in the form of the inductotherm. This apparatus produces high frequency waves which will induce artificial fever in the human body. Most doctors believe this will aid the natural heat of the body to combat certain disease bacteria. With the induced current from the coil of the inductotherm, Mr. Hoverman, the G. E. representative, was able to light gas-filled and common light bulbs by holding them in his hands.

In the "House of Magic" demonstration of stroboscopic light, a gear which was spinning at speeds above 1,000 r.p.m. appeared as though it were standing still. This stroboscopic lamp is capable of delivering a flash of light which has a duration of one five-millionth of a second or less. By carefully timing this ray of light so that the flash always takes place when the wheel is in the position occupied during the preceding flash, the eye sees the wheel as if it were standing still. Using two different colored lamps and timing one slower than the other in relation to the revolutions of the wheel, the illusion of two oppositely turning gears was formed. The stroboscopic light is used in industry today in the study of rapidly spinning gears, turbines, and propellers under conditions which are actually experienced in their varied uses.

Another use of the stroboscopic lamp is in the taking of pictures of ultra-high speed objects. When used in this manner, the lamp is connected to a photoelectric cell which trips the lamp and the camera shutter at the same instant. An example of this would be in the study of the fracture of a high speed turbine. In this study a beam of infra-red light is directed on the spinning turbine and as the turbine fails, an electric eye is uncovered which simultaneously activates the camera shutter and the stroboscopic lamp. This results in a picture of the object at the exact instant of failure. This procedure is also used in the photography of projectiles while in flight.

A very popular portion of the show is the small train which seems to obey the spoken commands of the demonstrator. This model will back up, go forward or stop when the operator speaks into a microphone. Although the train seems to obey the spoken command it is the number of syllables of the command which operate the sensitive selector switches. This was shown when a meaningless series of sounds caused the train to operate in the desired manner as long as the series contained the proper number of syllables.

One of the highlights of Mr. Hoverman's demonstrations was the transmission of sound on a beam of light. While the transmission of sound by radio waves has become quite common to the world, the science of using a light wave for this purpose is still in the experimental stage. To demonstrate this phenomenon, an ordinary phonograph turntable was used

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In This Corner . . .

NAVY PIER

Engineering Societies

Bob King '51

A.S.C.E.

There were about 120 members and guests at the regular monthly meeting held by the A.S.C.E. on January 6. Besides the regular business, those present heard a discussion of "Pumpcrete," by Mr. Roy Hawkins of Chain Belt, Milwaukee.

Arrangements were made for meetings to be held during the spring semester, with the first one on February 22, at which time the survey camp for 1949 will be discussed.

I.A.S.

At its last meeting the I.A.S. discussed the constitution of the newly formed Engineering Council. The principle sections of the constitution were read by Jack Jensen, and a talk on the purpose of the council was given by Mr. Zanotti, the faculty sponsor. The constitution was ratified, with minor changes, and is subject to further ratification by the Engineering Council.

NAVY PIER STAFF

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PHI ETA SIGMA

The freshman honorary society, Phi Eta Sigma, here at the Pier, has a total membership of 57. The engineers have something to be proud of in their representation of 22 members. Two of the officers are engineers; namely, John Fijolek, president, and Henry Aoyama, treasurer. The following is a list of, if you'll pardon the expression, "brains" who were fortunate enough to keep their averages above 4.50, thus making them eligible for membership.

Marion Baty, Gordon Brenker, Bruce Capek, James Cleary, John Fijolek, Charles Furtak, Bill Gillespie, Tony Grieco, Lloyd Gross, Henry Aoyama, Norman Inoue, Henry Lahr, Alexander Magnus, Ed Mattbei, Jim Nakanishi, Gordon Nelson, Harry Quinn, Gilbert Riske, Bill Roseberry, Bob Seavey, Vic Swenson, and Charles Wheeler. Congratulations, boys!

A Scot who was a poor sailor was crossing the Channel. He went to the captain and asked him what to do to prevent seasickness.

"Have you got a sixpence?" asked the captain.

"Aye," replied Sandy.

"Well, hold it between your teeth during the trip."

YOUR CAREER . . .

(Continued from page 13)

know is of little importance if you can't convey that information to others.

TABLE 8

Variation in Monthly Salaries for the Engineering Profession in 1946, by Experience Level.

Range	Exp. Level in Yrs. Under 1	9-11	20-24
Lower 10 per cent	$181	$287	$310
Lower 25 per cent	206	333	409
Median	231	395	481
Upper 25 per cent	259	470	623
Upper 10 per cent	298	561	889

E. Consider other people. Learn how to get along with them. Know your boss and how he wants things done.

F. Develop initiative. See things to be done without being told and find methods of improving the things that you are doing. Don't be afraid to make suggestions and to lead the way.

G. Finally: enjoy your work or change your job. Much of your lifetime will be spent at work.

All statistical data in this article is reproduced by permission of Engineers Joint Council from the Report "The Engineering Profession in Transition."

Wife: "Dear, I saw the sweetest little hat downtown today."

Husband: "Put it on; let's see how you look in it."

* * *

The man with a wonderful vocabulary is one who can describe a shapely girl without using his hands.

* * *

"Do you drink?"

"No."

"Then hold this quart while I tie my shoe."

GASOLINE . . .

(Continued from page 14)

the project of extended interest and research. The cost of "mining" is very low, and there is no transportation expense. Especially adaptable to inclined seams, the stream method of gasification is the simplest of several processes. Two shafts, a convenient distance apart, are drilled into a seam and a galley is driven through the coal connecting the shafts. A fire is started at the bottom of the deeper shaft, and steam and air are alternately blasted in from above. The coal surrounding the fire is burned to CO_2. In passing along the galley, however, this is reduced in the presence of steam to CO and H_2. These are taken off at the top of the outlet shaft. Ash is formed as the burning progresses along the galley and falls to the lower part of the seam where the coal is already burned out. Thus, the ash doesn't obstruct the access of inlet gases to the coal surface.

The coke-oven gas (methane) conversion is accomplished in two steel towers, lined with refractory brick, and filled with refractory checker brick. As the reaction is endothermic, the temperature must be maintained at 2550° F. The two towers alternate in function, one converting the gas while the other is being heated. Water for the reaction is supplied by passing the gas countercurrent through a water-saturation tower at 158° F. The reaction in the conversion units is:

$$CH_4 + H_2O \rightarrow 3H_2 + CO.$$

The heat required for the high-temperature reaction is a decided disadvantage of this process.

Natural gas is to be used in the methane-oxygen process at a plant of Carthage Hydrocol, Inc., now being constructed at Brownsville, Texas. Partial oxidation of the methane to synthesis gas follows the overall reaction,

$$CH_4 + \tfrac{1}{2}O_2 \rightarrow CO + 2H_2.$$

This reaction gives off thirty thousand calories per gram mole of CH_4 burned. Use of the heat from synthesis gas production to drive turbo-compressors for the plant is expected to result in a net oxygen cost of five cents per thousand cubic feet. Proof of the economic feasibility of this process is the estimated daily yield of 6,000 barrels of gasoline at a cost of five and one-quarter cents per gallon (compared with petroleum-base gasoline at seven and one-quarter cents per gallon).

Synthesis gases from all the foregoing processes contain some sulfur impurities, principally in the form of H_2S and organic sulfides and mercaptans. As presence of more than ten parts of sulfur in a million parts of gas poisons the catalysts used in the synthesis process, its removal must be practically complete. The H_2S is removed by passage through a bed of moist iron oxide, forming FeS. The organic sulfur is then removed by passing through a 30 per cent Na_2CO_3, 70 per cent FeO mixture at 356-536° F. About 0.25 per cent oxygen is added at the inlet to oxidize the organic sulfur to sulfates, which deposit as sodium sulfate.

Catalytic Synthesis Process

Choice of products and process conditions, as well as production costs, determine what catalyst should be used in synthesis of liquid fuels. A high yield of saturated hydrocarbons is obtained by using nickel-base catalysts to hydrogenate synthesis gas having a H_2:CO ratio of 2:1. The predominant reaction is:

$$nCO + (2n+1)H_2 \rightarrow C_nH_{2n+2} + nH_2O$$

A cobalt-base catalyst used with synthesis gas of the same composition gives the same type of reaction, with about 25 per cent of the reactants forming olefins by the following reaction:

$$nCO + 2nH_2 \rightarrow C_nH_{2n} + nH_2O$$

Iron catalysts at higher temperature and pressure causes the formation of

(Continued on page 26)

GASOLINE . . .

(Continued from page 24)

about 75 per cent olefins in the resultant product:

$$2nCO + nH_2 \rightarrow C_nH_{2n} + nCO_2$$

All of the above reactions are exothermic, so low temperature and high yield pressure generally favor the per cent yield. A yield of 0.0106 pounds synthol per cubic foot of synthesis gas is obtained when nickel and cobalt catalysts are used at 370° F. and atmospheric pressure. Gaseous nickel carbonyl is formed at higher pressures, so deterioration is decreased by using nickel at one atmosphere.

Iron catalyst used at 465° F. and 150 *psig* pressure (medium-pressure process) gives a total yield comparable to that of nickel and cobalt. Higher-octane fractions are much more prevalent when iron catalyst is used due to olefin formation.

Nickel and cobalt catalysts were used almost exclusively in Germany in the normal-pressure process. Synthesis gas passed through one or more stages of reaction chambers, with or without recycle of the unconverted portion, and the heavier products condensed from the residual gas. Charcoal was used to adsorb the lighter products.

The relatively expensive loss of catalyst and the low-octane number of the resultant product in the normal-pressure process have caused most American firms to concentrate research on the iron catalyst, medium-pressure process. Using the medium-pressure synthesis, the catalyst de-activation is appreciably slower and an optimum yield of solid and liquid hydrocarbons is obtained. Among the many specific processes used in medium-pressure synthesis, the suspended catalyst and the fluid catalyst processes seem to be the most noteworthy.

In the former process, finely-divided iron particles are suspended in a heavy oil medium, through which the synthesis gas rises countercurrent to the flow of the heavy oil. This gives the advantage of uniform-temperature control, in that the oil carries the reaction heat out of the reactor to a heat exchanger. A disadvantage is encountered, however, in that the reaction products are often difficult to separate from the heavy oil.

The fluid catalyst system is essentially a reaction chamber of finely divided catalyst suspended or "fluidized" in the up-flowing stream of incoming gas. The particles are in a constant state of violent agitation and transfer the heat of reaction to water pipes imbedded in the reactor walls. The many special difficulties encountered in this process include regulation of particle size, shape, and weight, and gas velocity. Gradual poisoning of the catalyst necessitates variation in feed of synthesis gas to the reactor so that the maximum yield may be obtained. The advantage of fluid catalysts are the intimate contact with the reacting gases and the close temperature control possible.

Although there are many variations and specific processes of the medium-pressure synthesis, a general flow system is usually followed. Reactors in the three stages are in a ratio of 2:1:1. Synthesis gas fed into the two reactors in the first stage has a H_2:CO ratio of 1.4:1. The liquid products are condensed in an indirect condenser, and the non-condensables are enriched with fresh synthesis gas to a H_2:CO ratio of 1.6:1, and charged into the second stage reactor. The liquid from the second stage is condensed in a like manner, and the effluent gas is enriched to 1.8:1 before entering the third stage. Products from the final stage are condensed in a direct water condenser, and C_3 and C_4 hydrocarbons are adsorbed in carbon.

Conventional petroleum methods are then used to separate and refine the gasoline, Diesel fuel, and fuel oil. By-product chemicals, consisting primarily of oxygen function compounds, are separated and processed for marketing.

A backwoods woman, the soles of whose feet had been toughened by a lifetime of shoelessness, was standing in front of her cabin fireplace one day when her husband addressed her:

"You'd better move yore foot a mite, maw, you're standin' on a live coal."

Said she nonchalantly, "Which foot, paw?"

* * *

Then there's the one about the poor fella who caught his buddy making love to his girl. There was a lapse of silence and then he said, "I don't mind your kissing my girl, but get your hand off my fraternity pin."

Funeral Director (young and ambitious): "How old are you, sir?"

Aged Mourner: "I'm 98."

Director: "Hardly worth going home, is it?"

* * *

Barber: "What's the matter? Ain't the razor takin' holt?"

Victim: "Yeah, it's takin' holt all right, but it ain't lettin' go again."

* * *

I was struck by the beauty of her hand.
Then I tried to hold it, and—
I was struck by the beauty of her hand.

Greek Lesson No. 1
(*Overheard in an Athens tailor shop*)

Tailor: Euripedes?

Customer: Yas, Eumenides.

* * *

The Kentucky colonel always closed his eyes when he took a drink. When questioned on this habit, he readily explained, "The sight of good lickah, suh, always makes mah mouth water. An' I don't like to dilute my drinks."

* * *

Mrs.: "Here's my new dress, dear. I bought it for a song."

Mr.: "All right, send in the collector and I'll sing to him."

The Ring Test

The ring test, shown above, is a scientific method for determining the modulus of rupture of pipe. It is not a required acceptance test but one of the additional tests made by cast iron pipe manufacturers to ensure that the quality of the pipe meets or exceeds standard specifications.

A ring, cut from random pipe, is subjected to progressively increased crushing load until failure occurs. Standard 6-inch cast iron pipe, for example, withstands a crushing weight of more than 14,000 lbs. *per foot.* Such pipe meets severe service requirements with an ample margin of safety.

Scientific progress in the laboratories of our members has resulted in higher attainable standards of quality in the production processes. By metallurgical controls and tests of materials, cast iron pipe is produced today with precise knowledge of the physical characteristics of the iron before it is poured into the mold. Constant control of cupola operation is maintained by metal analysis. Rigid tests of the finished product, both acceptance tests and routine tests, complete the quality control cycle. But with all the remarkable improvements in cast iron pipe production, we do not forget the achievements of the early pipe founders as evidenced by the photograph below of cast iron pipe installed in 1664 to supply the town and fountains of Versailles, France and still in service. Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction. Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3, Illinois.

Section of 285-year-old cast iron water main still serving the town and fountains of Versailles, France.

CAST IRON PIPE SERVES FOR CENTURIES

SOCIETIES . . .

(Continued from page 15)

Officers for this semester were elected at a meeting held at the Foundry on January 4, 1949. The officers are chairman, Paul Green; vice chairman, H. Rodbro; secretary, Keith Van Ness; and treasurer, Joe David.

A.S.C.E.

More new officers for this semester were selected by the A.S.C.E. A nominating committee chose three candidates for each office and ballots were distributed by mail to the 320 members. The final count was taken on January 13, 1949, and the newly elected officers met with the retiring officers on January 15.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Those officers chosen for this semester are president, Wendall L. Rowe; vice president, John R. Anderson; secretary, Donald V. Sartore; and treasurer, Robert Mack.

KERAMOS

Keramos welcomed and initiated 13 new members at its December 8 meeting. The meeting and smoker were held at McKinley Hall. At this time the resolution of by-laws and proposed amendments to by-laws were discussed. A donation to the Campus Chest was also voted in.

Men initiated at this time were Bob Bender, Martin Berg, Jr., Charles Curtis, Jr., Lynn Fussell, Stanley Paspy, Jr., Henry Rapp, Jr., Norman Russell, Albert Siska, Harlan Tripp, John Cox, John Jero, Delmar Johnson, and Howard Rapp.

C.I.E.

One of the oldest and perhaps the least known of all engineering societies is the C.I.E. You are no doubt as surprised as I was to learn that there is a Chinese Institute of Engineers here at Urbana. You will be more surprised to learn that it has been on this campus for more than 10 years.

C.I.E. and C.A.A.S. (Chinese Association for the Advancement of Science, formerly known as the Science Society of China) are the two biggest academic organizations in China. The organization of C.I.E. is very much similar in nature to A.S.C.E., A.S.M.E., etc. in this country except that it covers the whole field of engineering rather than a particular phase.

In 1918, an informal Chinese engineering association was organized at Ithaca, N. Y., by some Chinese students of engineering at Cornell University. Later on, when those Chinese students went back to China, the association was formally combined with the Chinese Association of Engineers, founded in 1911. The combined organization is the presente C.I.S.

The C.I.E. branch in the United States was established in 1920 at New York City. The activities include presentation of technical papers during the annual meeting, publications of the C.I.E. Journal (a semi-annual publication), and the C.I.E. News Bulletin (bi-monthly). In 1937, chapters were founded successively at Ann Arbor, Boston, Buffalo, Detroit, Indianapolis, Ithaca, Philadelphia, San Francisco, Urbana, Milwaukee, Washington, D. C., and Montreal, Canada. C.I.E. Journal and C.I.E. News Bulletin are traditionally published by either the New York branch office or the Boston chapter. Membership in this country at the present time is roughly estimated at 750.

At the present time there are 80 members in the local chapter. Only 16 of these are working for their bachelor of science degrees. Twenty-nine are working for masters and 35 are working for Ph.D.'s. These men are engaged in nearly all phases of engineering.

The officers for this year are president, V. T. Chow; vice president, Andrew T. S. Yen; secretary, Charles C. S. Yen; treasurer, Arthur W. N. Lo; and business manager, Chi Lung Kang.

SOUTH PACIFIC . . .

(Continued from page 7)

cent. However, the rains also solved another problem—that of moistening the coral, since in this wet state, it could be handled and set the most effectively in order to obtain a smooth hard-finish surface.

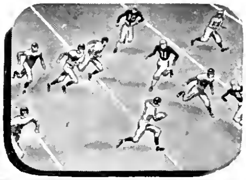
No one worried about such matters as bomb craters and the effect of the surprise air attacks; had the strips been of concrete Seabee officials would have had good cause for worry, but with a coral air strip, it was a matter of having waiting truckloads of coral to be rushed out on the field after the all-clear signal. After being hand-shoveled into the patch and rolled down, the coral quickly united with the mother slab, leaving hardly a trace or scar behind. A subsequent sprinkling of salt water served to unite the coral better than fresh water, probably exercising anhydrous qualities.

Another construction item that became a piece of standard equipment in the South Pacific was the pontoon cell. Made of thin steel plates which were shipped flat and welded on the spot, the pontoon cell came in one general size of 5 x 5 x 7 feet. The method of assembly of the cells was fairly simple—cell fastened to cell by steel angles around the deck of each one.

Combinations of these cells served as bridges, drydocks for PT boats, small landing craft and seaplanes, self-propelling unloading barges, and wharfs for unloading supply freighters. With the addition of marine tractors, they have even been used as "tugs." An excellent example of their use as a wharf was the situation at a base in New Caledonia, center of the Solomon Island operations. A wharf was needed quickly for the unloading of badly needed supplies; however, time was scarce and the equipment for building such a pier was even more scarce.

A small crew of Seabees went to work and, putting in eighteen hours a day, turned out in record time a wharf 434 feet long by 40 feet wide—a wharf comprised of some 500 cells with rigid connections of three transverse joints on hinge connections with 1½ inch pins, thus allowing for free wave action. The wharf was held in place by mooring spars driven through thirty feet of water; the connection with shore was a series of "bridges" or groups of cells just wide enough for truck travel. This wharf was the first of its size ever built and served to pave the way for many more like it at other bases; for it had the advantage of being at home in practically every environment from atolls profusely spiked with coral reefs where ordinary piers would be out of the question, to rock-bound islands where other

(Continued on page 34)



Plastics where plastics belong

for high dielectric and structural strength, light weight and ease of machining

In the RCA television camera, for example, Synthane was selected for coil forms, tubes, flanges and other components because of its electrical insulating properties, especially at high frequencies and high voltages. Its ease of machining, light weight and structural strength were other factors that led RCA's design engineers to select Synthane as the best possible material for this job.

Synthane, laminated phenolic plastic, is at its best in applications requiring unusual *combinations* of characteristics. Its excellent electrical insulating ability, combined with ease of machining, light weight, rigidity and many other properties, such as moisture and corrosion resistance, make Synthane a valuable material for many industries.

Synthane Corporation, 1 River Road, Oaks, Pennsylvania

SYNTHANE **where Synthane belongs**

SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-LAMINATED • MOLDED-MACERATED

SOUTH PACIFIC . . .

(Continued from page 32)

wharfs might be possible, but for the sake of time, not probable.

No matter how brief the resume of engineering operations in the South Pacific, a tribute to the Seabees and a brief explanation of their organization should be included. This offspring of the Civil Engineer Corps of the Navy was the answer to a Navy bottleneck in large-scale construction. Modern warfare methods demanded all manner of construction as well as the mass production of supplies and trained troops. No longer able to rely on civilian firms such as the PNAB after the outbreak of the war, the Navy needed their own construction corps, a highly organized army of men skilled both in the trades of construction and military tactics. This was the origin of the Seabees.

The usual Seabee recruits were men with experience in some phase of construction and generally a little older than the average draftee. Trained for actual combat and military engineering and given the largest and best construction equipment the Navy could dig up, these men turned out work in record time and on such massive scales that they have become sort of a legendary organization in the eyes of the American public. They also kept one eye cocked on projects where they could apply economy and ingenuity, instilled traits carried over from their civilian days.

Military divisions among the Seabees were the same as in the regular Navy. However, each company was divided up into highly specialized units, each of which had a definitely assigned job for each project. Although trained for the main purpose of land construction, the Seabees tackled whatever came their way, whether it was the repair and dry-docking of torpedoed ships or the building of a little village of straw huts for the native evacuees of enemy-held territory.

Although operating with greater freedom from military commands than other Navy divisions, the Seabee battalions worked under conditions that definitely placed them in the combat classification. Often, they began repairs on Japanese air fields or started entirely new construction on territory that was either listed as "battle zone" or enemy territory and that had not yet been decisively won by Army troops. Fairly true may be the old rag about a Marine, the first to land on the captured enemy isle of X, who found a Seabee lying on a sand dune and inquiring, "What's been keeping ya, Bub?"

ANSWERS TO VOCABULARY

1-c, 2-b, 3-a, 4-c, 5-d, 6-c, 7-a, 8-d, 9-b, 10-b, 11-b, 12-b, 13-c, 14-a, 15-d.

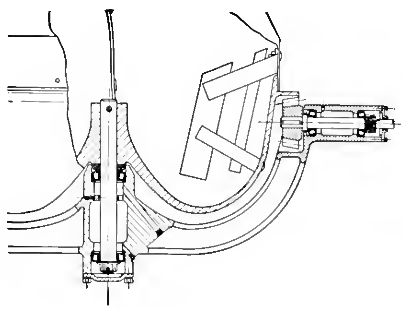
Another page for YOUR BEARING NOTEBOOK

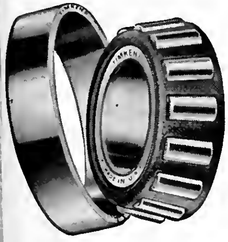
How TIMKEN® bearings pave the way for long life in a concrete mixer

Keeping concrete mixers from growing old too soon is the aim of construction equipment builders. That's why they use Timken® tapered roller bearings on drum shafts, driving pinions, and in the road wheels. Because Timken bearings practically eliminate friction and keep parts in rigid alignment, wear is reduced to a minimum.

TIMKEN® bearings keep gears meshing smoothly

This drawing illustrates how Timken bearings are used to insure smooth operation in a concrete mixer. Because of the tapered design, Timken bearings take thrust as well as radial loads. End-movement of shafts is eliminated and parts are held in rigid alignment. Timken bearings carry the heaviest loads with minimum shaft deflection. Gears wear longer—work better.





TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

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Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

GALESBURG . . .

(Continued from page 18)

in conjunction with a vacuum tube amplifier. This vacuum tube amplifier causes the beam from a small crater lamp to vary in intensity according to the vibration of the phonograph needle. The resulting modulated light beam is focused, through a system of lenses, on a distant light collector which directs it to a photo electric cell. The photo electric cell transforms these variations of light into a series of electrical impulses which are connected to a loud speaker, which in turn transforms them into audible sound. This method of transmission is effective within a range of approximately 25 miles and has been adopted by the Navy for ship-to-ship communication.

The "House of Magic" show was very ably and interestingly presented by Mr. William Hoverman and his assistant, Mr. Roy Verlilis. Mr. Hoverman is a graduate electrical engineer from Brown university of the class of 1946. After graduation Mr. Hoverman accepted a position with General Electric in their test and research laboratories. Entering the commercial field after a year and a half in the laboratories, Mr. Hoverman became one of the lecturers who present the "House of Magic."

DU PONT *Digest*

For Students of Science and Engineering

PRODUCING METALLIC TITANIUM FOR INDUSTRIAL EVALUATION

C. M. Olson, *Ph.D.Phys.Ch., Chicago '36, and C. H. Winter, Jr., B.S.Ch.E., Virginia Polytechnic Institute '40, removing 100-lb. titanium ingot from furnace in heat-treating study.*

Du Pont group research developed a pilot plant with daily capacity of 100 pounds

Du Pont research has just made available to industry what may become one of America's key structural materials, titanium metal. Midway in density between aluminum and iron and with an especially high melting point, silvery-white titanium offers an extraordinary combination of strength, lightness, corrosion resistance and hardness.

Titanium is the ninth most common element. But it has been slow in coming into its own as a metal because of the difficulty of separating it in pure form from its ores.

Men pictured *on this page were members of titanium research team. E. L. Anderson, A.B.Ch., Brigham Young '40; J. B. Sutton, Ph.D.Phys.Ch., West Virginia '35; A. R. Conklin, M.S.Phys.Ch., Georgia '40, are shown inspecting 300 lbs. of Du Pont titanium metal sponge.*

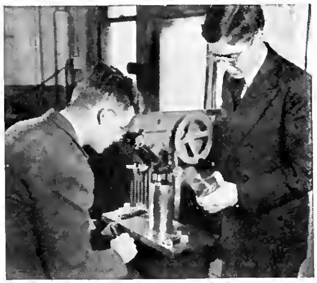
Du Pont scientists first began to probe the possibilities of metallic titanium in the course of their long experience with the titanium oxide pigments. Their research was interrupted by World War II. Meanwhile, the U.S. Bureau of Mines laboratories succeeded in producing the metal for research purposes.

After the war, Du Pont scientists developed a process for the production of ductile titanium metal that can be scaled up to meet commercial demands. The research team that mastered the complex problem consisted of chemical engineers specializing in design and production, as well as chemists and a metallurgist. In September 1948, a pilot plant was opened with a daily capacity of 100 pounds. Titanium metal is now being produced in sponge and ingot form. Samples are available to industrial and college laboratories with research projects in related fields. Studies of methods for forming, machining and alloying are under way.

Exhaustive studies will be necessary before the many possibilities of titanium metal can be known. Because of its high ratio of strength to weight, early uses may be in airplane power plants and structural parts. Its hardness and rust-resistance recommend it for railroad transportation equipment, marine power plants and propellers, and food packaging equipment. Its high melting point suggests use in pistons, and its resistance to electric currents points to electronics. Titanium wire may be used for springs and titanium sheet for such highly stressed parts as microphone diaphragms.

Your Opportunity in Research

The commercial development of titanium metal is a typical example of Du Pont research in action. However, the Pigments Department, which worked out the process, is but one of the ten Du Pont manufacturing departments. Each conducts continuous research. Each is operated much like a separate company. Within these "companies"—whose interests range from heavy chemicals to plastics and textile fibers—college trained men and women work in congenial groups where they have every opportunity to display individual talent and capabilities. Who knows what their contributions will mean in the future to science and the world!



R. C. Reidinger, *B.S.Ch.E., Princeton '47, and T. D. McKinley, B.S.Ch., Worcester Polytechnic Institute '35, making a test of the hardness of ingots of Du Pont titanium metal.*

THIS BOOKLET WILL HELP YOU PLAN YOUR CAREER

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WRITE TODAY *for "The Du Pont Company and the College Graduate"*

Smith, of Smith and Waverly, the well known manufacturers, hadn't taken a vacation in more than 20 years. He was finally prevailed upon to set out on a fishing trip. No sooner had he arrived than he immediately telephoned his office. Miss Jones, his secretary, spoke to him and told him that after his departure from the office the firm had received the largest order in its history. The order had been placed by telegram and Miss Jones started to read it to him. "Send immediately two hundred gross number 34 stop three hundred gross number 83 stop one hundred and fifty gross number 36 stop . . ." At this point Smith called out excitedly, "For heaven's sake, Waverly, leave that girl alone until she finishes reading me the telegram."

* * *

An engineer, who had a bottle of Scotch on his hip, slipped on the icy pavement and fell. On rising he felt something wet running down his leg.

"I hope it's blood," he said.

* * *

Foreman: "Hurry up, you guys, hurry up."

"Okay boss, but Rome wasn't built in a day."

Foreman: "Yeah, but I wasn't foreman on that job."

When the grocer's little girl came home after a holiday at her aunt's, she found that triplets had been added to the family.

"How silly of you, mummy," she said, "you should have done the ordering—you know daddy stutters!"

* * *

A spy was being led to his execution by a squad of soldiers on a cold rainy morning.

"You soldiers are barbaric," the doomed spy grumbled, "to make me march through this cold rain like this."

"Quit squawking," snapped one of the soldiers, "we've got to walk back."

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronunciation. From the group of words at the right, select one whose meaning most closely resembles the word on the left. Answers will be found on page 34.

1. Largesse—(a) very large, (b) very small, (c) a gift, (d) a container.
2. Nescience—(a) penetration, (b) complete ignorance, (c) nourishment, (d) magnificence.
3. Otiose—(a) useless, (b) a color, (c) graceful, (d) humorous.
4. Prefatory—(a) suitable, (b) poisonous, (c) introductory, (d) possessive.
5. Requite—(a) assure, (b) select, (c) dictate, (d) repay.
6. Verbiage—(a) an old verb, (b) grassland, (c) wordiness, (d) slaughter.
7. Ruminate—(a) ponder, (b) bring to light, (c) idolize, (d) delay.
8. Adjure—(a) reside, (b) imitate, (c) tell a story, (d) entreat.
9. Acrimonious—(a) stinging, (b) judicious, (c) plentiful, (d) ugly.
10. Nettle—(a) a small net, (b) irritate, (c) itemize, (d) offer for acceptance.
11. Behest—(a) a perfect specimen, (b) a command, (c) a forest, (d) take leave.
12. Cacophony—(a) music, (b) discord, (c) an imitator, (d) northern cactus.
13. Deference—(a) boldness, (b) loud talk, (c) consideration, (d) sly work.
14. Equivocal—(a) ambiguous, (b) equal, (c) monotone, (d) very clear.
15. Guile—(a) guide, (b) praise, (c) degrade, (d) deceitful cunning.

A fashionably dressed woman approached the florist and asked for some blooms. After the purchase she inquired:

"Will you be here next Wednesday, as I shall want some flowers for my daughter? She's coming out that day."

"She shall have the best on the market, ma'am," the salesman answered. "What's she in for?"

A burglar, who had entered a poor minister's house at midnight, was disturbed by the awakening of the occupant of the room he was in. Drawing his weapon, he said, "If you stir, you are a dead man. I'm hunting for your money."

"Let me up and strike a light," said the minister, "and I'll hunt with you."

—Hear about Bob being in the hospital?

—In the hospital? Why, I just saw him last night dancing with a blonde.

—Yeah! So did his wife.

* * *

Newly-wed Husband: "Do you mean to say there's only one course for dinner tonight? Just cheese?"

Wife: "Yes, dear. You see, when the chops caught fire and fell into the dessert, I had to use the soup to put it out."

* * *

Prof.—Don't you think you are straining a point in your explanation?

Stud.—Maybe I am, but you often have to strain things to make them clear.

* * *

"Did you give your wife that little lecture on economy you talked about?"

"Yes."

"Any results?"

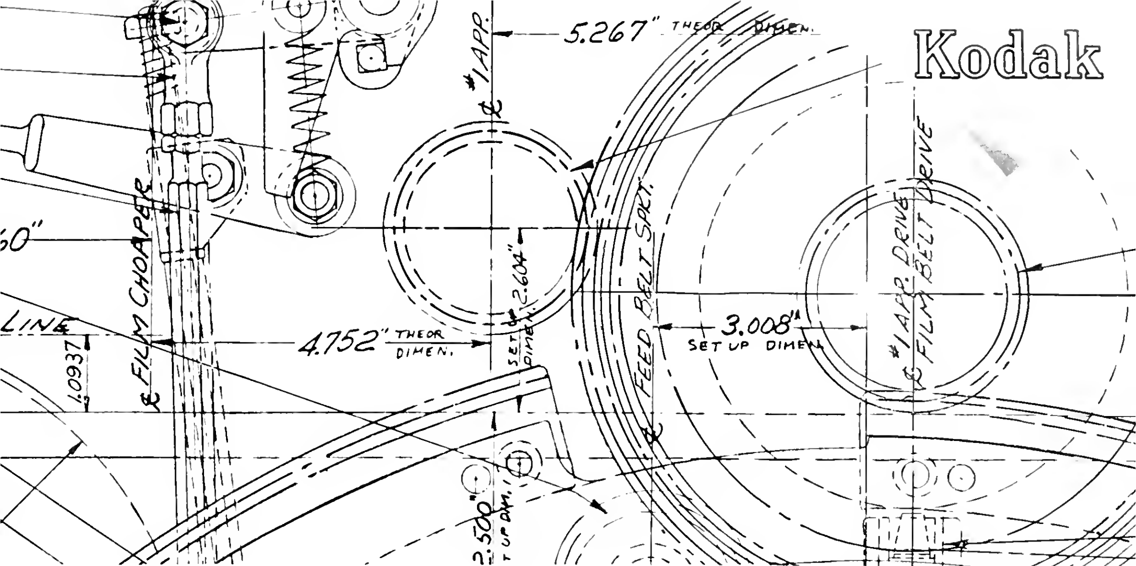
"I've got to give up smoking."

* * *

Drunk (to splendidly uniformed bystander): "Say, call me a cab, will yuh?"

Splendidly uniformed bystander: "My good man, I'm not a doorman; I'm a naval officer."

Drunk: "All right, then call me a boat. I gotta get home."



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APRIL, 1949

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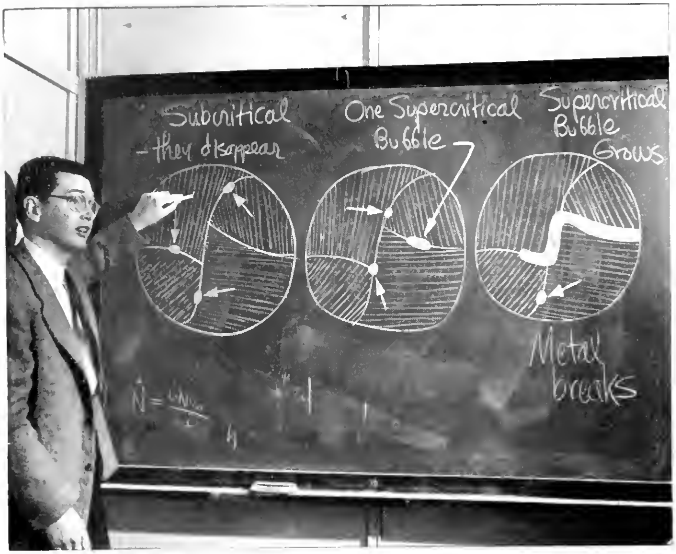
TWENTY-FIVE CENTS

New Developments

By Leonard Ladof, E.E. '49
and Henry Kahn, Ch.E. '50



How minute cracks or "bubbles" cause metals to fracture is illustrated in sketches by John Fisher of General Electric. (Photo courtesy of General Electric.)

Metal Fracture Theory

New theories as to why and how metals break were recently announced by scientists of the General Electric research laboratory. Their investigations show that the fracture of metals begins with extremely small cracks, which act as nuclei and grow into a large split when enough tension is applied.

The nuclei, which may result in fracture, form along the boundaries between the grains or crystals of metal where the atoms in the grains are most active. The minute cracks tend to grow under tension, and if a nucleus reaches a certain critical size, it will form a complete split between grains.

Enough rapidly growing nuclei in a sample will eventually cause the sample to break.

Prior to these investigations it was usually assumed that the break in the metal occurred simultaneously through the sample. However, the new theory leads Dr. J. H. Holloman of the G. E. laboratories to predict metals five to ten times stronger than they are at the present time. "If we can find ways of preventing crack formation along the boundaries, and make the only possible break occur through the much stronger grains, we can increase the metal's strength at high temperatures."

Curved Light

A new plastic which conducts light like a garden hose conducts water has been produced by Westinghouse research laboratories.

This translucent, ember plastic is so flexible and light conducting, according to Westinghouse, that no matter how many times it is bent and even if it tied in a knot, a beam of light will shine completely through it.

Three-Dimensional Glasses

Paul H. Gesswein and Co. announced the production of magnifying spectacles giving three-dimentional views. Models which can be attached to regular eye-glass frames are also available. These glasses are especially useful for inspection of small parts and are made in long, medium and short focal lengths.

Atomic Migration

Among General Electric's most recent developments is a method of determining the speed of diffusion of atoms is metals. It is believed that the determination of these characteristics of metals may lead to "designing" metals for specific uses just as implements are now designed.

The method consists of electroplating a block of ordinary silver with radioactive silver. Then the block is heated to 500° C. for several hours; after it is cooled the block is sliced into sheets about the thickness of tissue paper. By finding the innermost radioactive sheet of silver, the speed of the silver atom within the block may be determined.

The study just completed indicates that at 500° C. the atoms which travel around grains of silver have a speed of about one-tenth of an inch per week, while atoms that travel through grains have a speed of approximately one inch in 10,000 years.

Theatre Television

An advanced optical system has made possible the television "theatre." The optical system, part of the direct projection television equipment used by the Radio Corporation of America, is the prime factor in obtaining high quality pictures 18 by 24 feet. In the direct projection system are three major elements: the special projection kinescope which is the source of the light image; the optical system which projects the image; and the viewing screen.

Although similar in many ways to the direct viewing tube used in the conventional television receiver, the kinescope produces an image of much greater brilliancy because of the higher voltage applied to it.

Elements of the optical system, based on an astronomical camera, consist of a spherical mirror and a correcting lens. The lens are made of plastic, by a cold setting process. Lenses as large as 20 inches in diameter have been made by this process.

The principal feature involved in the R.C.A. developments is the method employed to correct the spherical aberration of the system for finite focus. The shape of the lens must be such that all rays emanating from any point on the tube face and reflected by the mirror shall meet at an image point a standard distance from the correcting lens. The shape of the lens can be determined by tracing a large number of rays and evolving a final curve. Such a curve is difficult to generate and is derived by dividing the surface of the lens into any zones and grinding them progressively.

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the Illinois Technograph

Volume 64 **Number 7**

The Tech Presents

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ARTICLES

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DEPARTMENTS

OUR COVER

Sue Welch and George "Mike" Mahaney smile for their public after being chosen, respectively, Queen of the Ball and St. Pat at the annual St. Pat's Ball for engineers. Sue holds the cup presented to her by Carl Falk, president of the Engineering Council. (Photo by Felix Ou.)

A Thousand and One Nights

By Connie Minnich, C.E. '51

Of the thousand and one nights that the Persian Gulf Command spent in Iran, every sunset saw the departure of more supply freights, trucks, and fighter planes from the Persian Gulf to Russia, 700 miles away over one of the most hazardous traveling routes known to exist—the Persian Supply Corridor. It was the Command's task to deliver American lend-lease supplies to the Russians as fast as they could be shipped from America.

For the Command, the famed Arabian nights of legend were filled with mud, torrential rains, malaria, flies, temperatures of 135° F, lonesomeness, and an everlasting sand that even found its way into food until the stomach was little more than a sand grit pit. Yet, in spite of calamities as bad as those of Biblical lore, the Persian Gulf Command was a key factor in the punishment the Russians were able to feed Hitler's troops in driving them back to their own borders.

Back in 1941 originated the problem of getting our lend-lease supplies through to Russia. The Black Sea entrance was blocked from the Mediterranean by Nazi occupation of Greece. American relations with Japan were on the verge of severance, which eliminated the Siberian entry. To the south, the Himalaya ranges formed a natural barrier, and to the north, German submarines patrolled the North Sea and the waters off Denmark and Norway. The least of the evils, then, was a possible supply channel through Iran, up to Russia's back door.

The routes selected belonged to the age of camels. After considerable scratching around Iran's some 628,000 square miles, Army officials decided upon two main routes: the rail travel was settled upon an 800-mile stretch of rails going from Bandar Shapur on the Persian Gulf to Bandar Shah on the Caspian Sea; the truck route followed an ancient Iranian highway 700 miles long. This road passed from Basra on the Gulf to the west of the rail route and had its terminal in Teheran, the capital of Iran.

Both rail and truck routes in their original states were outstanding enough to be classified as the eighth and ninth wonders of the world. One of the highest-priced standard gages in the world, the railway cost $160,000,000 when it was built in 1938 by the old Shah of Iran. This expenditure seemed reasonable enough when one observed the construction of the railroad. The route it followed climbed from sea level to an elevation of 7,200 feet with frequent grades of 2.8 per cent. The spiraled switchbacks and curved tunnels had few equals in the whole of Europe; and in one section of 120 miles through the mountains, the railway had 132 tunnels (amounting to 47 miles) and innumerable side-hill galleries for protection against rock slides.

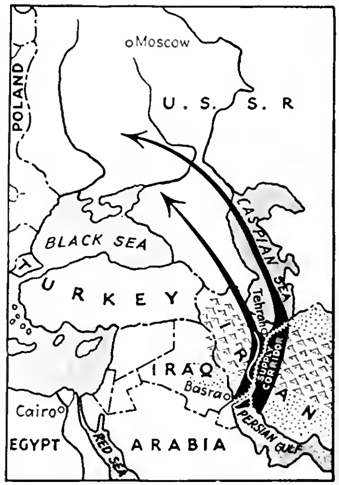
Both routes ran the gauntlet of topographic extremes. The first 180 miles out of Bandar Shapur and Basra went through desert similar to Death Valley where the shady temperature was often 150° F.; where the humidity soared to 80 per cent; where monsoon rains turned the entire desert into great stretches of lakes that disappeared only through long periods of evaporation; and where ground water was so near the surface that it oozed out of the sand even in the light impression of a foot print. The other 500 miles of the route climbed into ranges of mountains in the Luristan and Elburz provinces with their Alpine snows and Siberian temperatures.

The first detchment of the Persian Gulf Command (about 9,000 officers and men) landed in Iran in December of 1942. The first step was to transform the sleepy little fishing towns of Khorramshahr, Bandar Shapur, and Cheybassi on the Persian Gulf into full-time Liberty ship terminals complete with 40-ton tower-mounted revolving cranes and 100-ton guy-derricks. Port battalions had to be trained in dock-walloping and lighterage operations for the unloading of these vessels. These ships came in such a stream a few months later that they had to wait in line at the docks until more wharfing facilities were completed. As fast as the supplies were unloaded, they had to be packed into waiting freights or trucks for the long overland route.

In the handling of trucks and fighter planes, "C.M.T." tonnage became the most efficient method of shipment. "C.M.T." stood for Cased Motor Trucks and referred to trucks that were shipped piecemeal in cases to be assembled at the ports upon arrival. For this purpose General Motors established two large truck assembly plants, one at Khorramshahr and the other at the inland town of Andimeshk. In the usual procedure, the parts of the truck would arrive in four cases which, after unloading, were broken open and the parts assembled, tested and inspected. The finished product would then roll back to the supply dumps on its own four wheels, load up with other supplies, and be off on its way to Russia the same day it arrived. Staffed with native labor, these two assembly plants turned out an average of 7,500 vehicles a month when the Russians were asking for 200. These vehicles not only included trucks, but also covered jeeps, command cars, half-tracks, ambulances, weapon carriers, and even fire engines.

The same technique was also employed in the assembly of fighter planes. P-39 Airacobras, P-40 Warhawks, and B-26 Mitchells with their white star insignia changed to red were turned out of the airplaine assembly plant by the thousands. A-20 light bombers were flown in from America and turned over to Russian fliers who were waiting at P.G.C. air bases to fly them immediately to European combat zones.

During the first few months of P.G.C. operation, most of the overland hauling was done by freight train since



—*Photo courtesy of McGraw-Hill*

The route of the Persion "supply corridor" American Army engineers.

the truck route was in no shape for decent travel. Before the route was rebuilt by Army engineers, the surfacing was in such a bad condition that the Motor Transport corps practically became a suicide unit of the Army. The intense heat of the desert, the jagged cliffs and terrific cold of the mountains and bandit hordes took an alarming toll of lives before repairs were made. So rough and full of holes was the roadbed that gasoline tanks being jarred off by the bumping were an hourly occurrence, and drivers would frequently steer their trucks while standing on the running board to escape the jouncing.

At one time or another you've probably heard the poets and romanticists baying about Iran, "land of romance." For a different slant on the story this article pays tribute to the Persian Gulf Command, one of the key factors in Russia's fight against Germany. The P.G.C. saw little of the famed Arabian thousand-and-one nights that were not filled with rain, heat, knee-deep mud, and gritty sand.

The first 180 miles of the truck route was over pure desert, where the land was so flat that the slope was less than six inches to the mile. The standard road as given by Command specifications called for a 24-foot wide slab raised 18 inches above the desert floor with a three-inch wearing surface. Large side ditches warded off to a certain extent the danger of flash floods which were a freak and frequent occurrence on the Iranian desert in the early spring. The road-building operation was accomplished by several outfits, each comprised of four close-traveling units: an elevating road-grader in the ditch; a patrol grader on the embankment to level out the discharge of the belt; water-distributor trucks to wet down the subsurface; and sheepsfoot rollers to compact the layer. The asphalt wearing surface was achieved by the addition of asphaltic oil to the top layer and, then, final compaction.

The road-building was accomplished at the rate of two miles a day. Then, one day when the construction crews were in sight of Andimeshk, the terminal of the desert road and the end of the drudgery, the "impossible" happened. Although it was a clear day without wind, water suddenly appeared on the horizon, and without warning, rapidly and efficiently washed out the last 30 miles of road. Three-foot waves created by a sudden wind kept beating upon the stretch until not a telephone pole or culvert was left standing. A day later, the whole area was a large lake some 250 square miles in area. A subsequent investigation showed that a nearby river had undergone some geological disturbance causing an overflow. The P.G.C. engineers, however, will never be quite convinced that the flood was not something akin to a Biblical calamity.

Until the Military Railway Service of P.G.C. acquired a fleet of Diesel engines, the freight locomotives used were "mikes," an old design of engine that was suitable for Iranian peacetime travel, but hardly serviceable for the round-the-clock rail schedule that the Command required. The "mikes," used only for light passenger travel, were unequipped with air brakes for the mountain-climbing. Whenever one of these engines went through one of the 220 tunnels on the train route, the crew had to slow it down to a crawl and get out and walk beside the train because the engine steam packed the tunnel until the mercury hit 180° F. Unlike the United States, there is no Iranian law requiring tunnel ventilation, so that going through these tunnels was justifiably called "charging the ratholes."

The arrival of Diesels eliminated most of these hazards. They traveled through the tunnels without a degree temperature change, and their powerful brakes stopped the monthly occurrences of runaway trains.

Despite the heat, cold, sand and bandits, the worst of the P.G.C. enemies were the Iranian versions of the Texas mosquito and the Iowa fly. The method of water purification was another example of a necessary combination of the modern and the ancient in a land in which Waldo Bowman, *Engineering-News Record* war correspondent, observed, "has a native population that regards water courses as combination latrines, laundries, bath tubs, and drinking fountains."

The most effective treatment was given, oddly enough, by the practically obsolete slow-sand filter. Needing few valves and pipe fittings, which were at a minimum in Iran at the time, some of the treatment plants had a daily capacity of 400,000 gallons. In other cases, pressure filter units, tanks four or six feet in diameter filled with filter stones, were used. These filtering operations cut down on the heavy chlorination that otherwise would have been needed to entirely eliminate the prevalent amoebic dysentery.

The water supply for the capital city of Teheran arrived from the mountain in a system of *ghanats*, supply lines built on the Roman aqueduct principle. The *ghanats*, however, were a network of underground tunnels rather than the large superstructures of the aqueducts. They were laboriously hand-mined by native labor crouching and crawling through

— *Photo courtesy of McGraw-Hill*

The engineers' roads opened the way for transportation and communication.

the underground. At Teheran, several of these *ghanats* are directed together in a flume from which steel pipes take the water to the treatment plant for chlorination and filtration.

Malaria control was effected by the constant treatment of still pools of water, ditches, and other possible breeding places for mosquitoes. Oiling and dusting with Paris green were the operations performed by native labor for a radius of three-quarters of a mile around P.G.C. camps and zones. The three-quarters of a mile limit was taken as the flying range of *anopheles stephansi*, the most common breed of mosquito. In one case, an officer made a game of malaria control for a large group of ten- and twelve-year-old boys. Under his direction, an "army" of boys "charged" the huts of native labor settlements with Paris green spray guns and sprayed the entire contents of the house, including the occupants. Tenants as well as the boys enjoyed the game and the only sufferer was the mosquito.

While the Iranian natives, steeped in their ancient cultures, gazed in awe at the monstrous cranes, derricks, planes, graders, and tractors that a modern industrial company brought with them to accomplish their bustling noisy business, it became P.G.C.'s turn to stare at the practical but ancient methods of building construction in this torrid land. Try as they would, Army engineers could not equal the native fabrications of mud bricks, straw roofing, and "bally pole" trusses.

Buildings constructed by these methods gave long and serviceable wear. There was certainly no scarcity of materials. Mud bricks were simply slabs

(Continued on page 36)

St. Pat's Ball . . .

By Bill Soderstrum, Cer.E. '52

For the second year in succession Dick Cisne entertained the engineers with his music at the annual St. Pat's Ball. On Saturday, March 5, Huff gymnasium was crowded with 650 engineers and their ladies.

The dance floor was bordered with displays from all the engineering societies and the Technograph. As usual, these displays were the center of attraction during intermissions and proved to be very entertaining. Some of the more interesting displays included a Link trainer furnished by the I. A. S., a Kiss-o-meter which was one of the features of the A. I. E. E.-I. R. E. display, and the bottle of "heavy milk" which made up the display for A. I. Ch. E.

The two most popular displays were those of the A. S. M. E. and S. B. A. C. S. The former display featured various types of gears and heating units. The most attracting part of the display, however, was the lathe used to cut brass rings for the ladies' fingers from a solid brass rod.

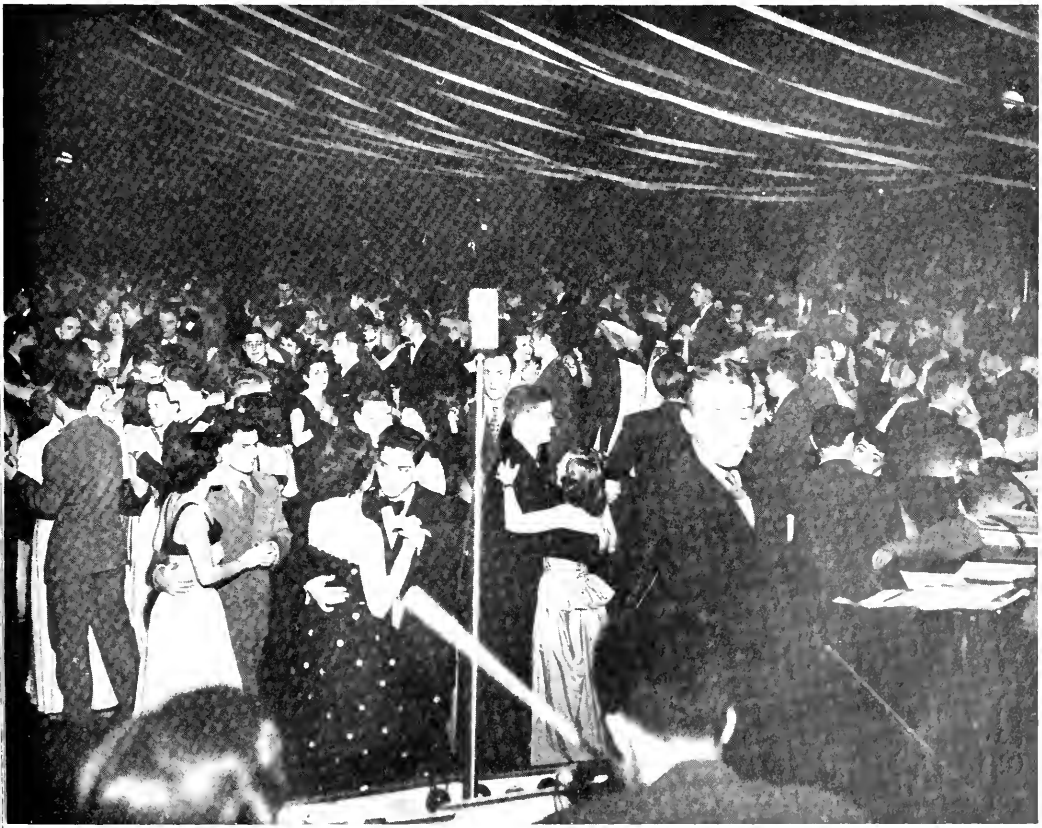
The S. B. A. C. S. display, voted best and most informative, included various raw materials and the different ceramic products into which they are made. The highlight of the display was a series of plates showing the steps in the process of enameling. The plates were approximately three inches by four inches and were coated with a white enamel. On the surface of this enamel was placed a green enamel shamrock with the words "St. Pat's Ball" above it. The finished product was presented to each couple as a souvenir of the dance.

Entertainment during one of the intermissions, introduced by Master of Ceremonies Bill Bierbaum, was furnished by the "campus characters," Jim and Jerry Sedgwick, Dave Johnson, and Bob Black. The quartet rendered their versions of "Home Sweet Home" and "Clancy."

George "St. Pat" Mahoney, Sue "St. Patricia" Welch, and their courts were introduced by Carl Falk, president of the Engineering Council and chairman of the ball. The queen's crown, the traditional North Campus novelty, was made by Joan Hessler.

Queen Sue Welch, George "St. Pat" Mahoney, and their court pose with last year's winner, Alvina Sorzickos, at St. Pat's Ball. (Photo by Felix Ou.)

An interested audience watches brass rings turned out on a turret lathe in the M.E. department's exhibit (left). Engineering training pays off; the Kissometer thermometer boils over in the E.E.'s exhibit (right). (Photos by Felix Ou.)



The dance floor of Huff Gym is packed with couples dancing to the music of piano-playing maestro Dick Cisne. (Photo by Felix Ou.)

Professional Engineering Exam

Edited by Philip Doll, M.E. '49

"In order to safeguard life, health and property, any person practicing or offering to practice professional engineering is required to submit evidence that he is qualified so to practice and to be registered as hereinafter provided." Thus is stated the purpose of the Illinois Professional Engineering act in Section 1 of the act.

The examination, consisting of three parts, for registration under this act is frequently given at the University. Parts I and II of the examination will be offered on May 24, 1949, and part III on May 25, 1949. Seniors may take only the first two parts now, and must wait at least four years after graduation to take the last part.

As a guide, in preparation for this examination, a sample of the questions asked last fall is presented below. Only a specified number of questions from each of the three parts must be answered, allowing considerable latitude in choosing familiar material. As may be noted, one of the advantages in taking the examination as a student is that a large amount of the subject matter covered has been recently studied and is still fresh in the student's mind. Certain reference books and hand books are permitted.

PART I

1. Given the equation of a curve as

$$y = x - x^2/240$$

(a) Plot the curve in the interval $x = -120$ to $x = +240$.

(b) Write the equation of the tangent to the curve at $x = -120$.

(c) Write the equation of the tangent to the curve at $x = +240$.

(d) Calculate the area between the curve and the tangents.

2. A body when submerged in an oil having a specific gravity of 0.80 weighs 16 lbs. and requires a downward force of 20 lbs. to keep it submerged in a liquid (acetylene tetrabromide) having a specific gravity of 2.96.

(a) What is the volume of the body?

(b) What is the weight of the body?

(c) What is the specific gravity of the body?

3. A closed tank standing in a vertical position has an inside diameter of 6'-0" and an inside length of 20'-0". The tank has flat ends. A pipe leading from a source of water supply is connected by means of a valve to the bottom of the tank. The water surface in the source of supply is open to the air and 120 feet above the bottom of the closed vertical tank. With the valve closed and the tank empty a pressure gage in the top indicates a pressure of 5 psi. when the temperature of the air in the tank is at 60° F. If the temperature of the air in the tank remains constant:

(a) When the valve is opened how high will water rise in the tank?

(b) What pressure will the gage in the top show?

(c) Assuming the air to be dry, how many pounds of air will the tank contain?

4. One tank contains 5 pounds of air at a gage pressure of 50 psi and a temperature of 120° F. A second tank has a volume of 20 cu. ft. and contains air at 40° F and 20 psi gage. If some time after the tanks are connected, the temperature is found to be 80° F.:

(a) What will be the pressure in the two tanks?

(b) How many pounds of air remain in the first tank?

5. A steel sphere rolls 120 feet down an incline having a slope of 1 foot vertical to 3 feet horizontal. The incline down which the sphere rolls is connected by a smooth transition curve to an upward incline having a slope of 1 vertical to 1 horizontal. Neglecting friction:

(a) If the sphere starts from rest what will be its speed at the bottom of the incline?

(b) How far will it roll up the second incline?

6. The electrical resistances in ohms of two coils of wire, one manganin and one copper, at the temperature t, (degrees centigrade), are given by:

$$R_c = 1.8 (1 + 0.00393t).$$

(a) Find the horizontal intersection of these lines.

(b) What is the physical significance of this point?

7. Twenty cubic feet of air at a pressure of 25 psi abs. and temperature of 60° F. is compressed adiabatically until its temperature is 200° F.

(a) What is its final volume?

(b) What is its final pressure?

8. Chlorine gas containing 3.6 per cent oxygen is flowing through an earthenware pipe. The gas is measured by introducing into it air at the rate of 150 cubic feet per minute and further down the line, after mixing is complete, removing a second sample of gas for analysis. The gas is now found to contain 9.6 per cent oxygen. How many cubic feet per minute of the initial gas were flowing through the pipe?

9. Calculate the exact length of a tight belt to connect two pulleys 7'-0" and 3'-0" in diameter respectively, the centers of which are 8'-0 apart.

10. (a) Describe briefly the manufacture of soap.

(b) Name the important by-product of this process and give a use of it.

(c) Write a formula that represents each of the following:

(1) Alcohol.

(2) A carbohydrate

(3) An ester

(4) A hydrocarbon.

(d) Write the structural (graphic) formula that represents:

(1) Propane

(2) Benzene

PART II

1. A rectangular channel 30 feet wide by 14 feet deep is closed at one end by a bulkhead in which there is a rectangular orifice 1'-6" high by 12'-0" wide, the bottom of the orifice being 1'-0" above the bottom of the channel. Water in the approach channel is maintained at a depth of 10'-6" above the bottom, and flows through the orifice into an outlet channel. The bottom of the outlet channel is at the same elevation (at the bulkhead) as the bottom of the approach channel, and water in the outlet channel is maintained at a depth of 4'-6" above the bottom. The outlet channel is 30' wide.

(a) How much water flows through the orifice into the outlet channel?

(b) What is the average velocity in the approach channel?

(c) What is the average velocity in the outlet channel?

2. Oil is being pumped from a truck to a tank 10 feet higher than the truck through a 2-inch galvanized pipe line 100 feet long. If the pressure of the discharge side of the pump is 15 psi, at what rate in gallons per minute is oil flowing through the pipe? The oil has a kinematic viscosity of 0.001 sq. ft per sec. and a specific gravity of 0.92 at the temperature in the pipe.

3. An overhead crane which is to have a full load capacity of 50 tons is to be designed for a bridge travel speed of 250 feet per minute. The weight of the crane itself in ready-to-operate condition, will be 150,000 lbs. For the purpose of this problem it may be assumed that a force of 40 lbs. per ton of total load is required to overcome all mechanical and electrical resistances and maintain the bridge travel speed of 250 feet per minute.

The problems appearing in this article were taken directly from the "Illinois Professional Engineering Examination for Registration" given November 9, 1948.

They should prove to be an excellent exercise for those student senior engineers planning to take the next examination to be given on May 25.

(a) What horsepower motor will be required for bridge travel?

(b) If the bridge is to reach its travel speed of 250 feet per minute under full load in 7½ seconds, what overload must the travel motor be capable of exerting?

(c) In what distance will the bridge reach its maximum travel speed of 250 feet per minute?

(d) If the crane under full load is to be brought to rest from full speed in 10 seconds, how much energy will the brakes have to absorb and what will be the stopping distance?

4. The end truck for the crane of the previous problem has four wheels spaced 5'-4", 3'-8", and 5'-4". Under maximum load each wheel brings to the rail a load of 45,000 lbs. The runway beams on which the crane travels have a length of 30 feet between supports.

(a) Where should the wheels be placed to produce maximum moment in a runway beam and how much is the moment

(b) Where should the wheels be placed to produce maximum shear in a runway beam and how much is the shear?

5. A 3-phase, 440 volt, 60 cycle, 4 pole induction motor drives a pump with an output of 50 hp. The efficiency of the pump is 80 per cent, while that of the motor is 90 per cent. The motor power factor is 88 per cent lagging, and the slip is 3 per cent. Determine the *torque* delivered by the machine and the *line current* to the motor.

6. A certain 230-volt d-c shunt motor whose armature resistance is 0.07 ohms, including brushes, generates a torque of 250 lb.-ft. at 1200 rpm with an armature current of 210 amperes. Calculate the torque developed when the armature current is 300 amperes and the field is reduced to 75 per cent of normal.

7. (a) A tractor is to have a drawbar pull of 5000 lb. The differential has a double-threaded worm acting on a wheel having 35 teeth. The rear wheels are 42 in. in diameter. The motor has a maximum torque of 200 lb.-ft. The efficiency of the drive is assumed to be 90 per cent. What gear ratio is necessary in the transmission?

(b) Calculate the stress in the rear axle if the diameter is 1.75 in.

8. Calculate the volumetric efficiency of a Diesel engine from the following data: per cent of CO_2 by Orsat 6; bore of engine cylinders 4¼ in.; stroke 6 in.; number of cylinders 6; rev. per min. 1200; temperature of air at intake 60 F.; pressure 30 in. Hg.; weight of fuel burned per hour 17.3 lb. Assume the per cent of CO_2, if all the oxygen were perfectly combined, to be 14.8. Assume that 14.8 per cent of CO_2 indicates an air-fuel ratio of 15 by weight.

9. A 3-phase, 3-wire, 208-volt, 60-cycle system draws 10 kw. at 80 per cent power factor, lagging. It is desired to connect three capacitors in delta across this line to raise the power factor to 90 per cent lagging.

10. A compound beam is composed of 20" I at 65.4 lbs. in a horizontal position fastened through its web to the top flange of a 36" WF at 160 lbs. and a 15" channel at 33.9 lbs. (flanges down) fastened through its web to the bottom flange of the 36" WF. The compound beam is symmetrical about the center line of the 36" WF. The beam is 40 feet long between supports and is loaded over its entire length with 6500 lbs. per foot including its own weight.

(a) What is the maximum intensity of stress in compression and in tension?

(b) What is the shear per inch of length between the 20" I and the 36" WF at the end of the span? Between the 15" channel and the 36" WF at the end of the span?

11. A 30" WF beam has a span of 50 feet between supports and is simply supported. It has a load such that the intensity of stress in the extreme fiber at the center of the span is exactly 20,000 p.s.i.

(a) What should be the stress in the extreme fiber at the center of the span of a 20" WF beam, having the same span and the same load, so it will have the same deflection at the center of the span as the 30" WF beam?

(b) If the load is uniformly distributed over the entire length how much is the deflection at the center of the span in inches?

PART III

Group A

1. State in approximately 200 words why you believe you are qualified for registration as a professional engineer in Illinois. Illustrate briefly by describing some engineering project or accomplishment for which you are responsible.

Group B

1. A syndicate wishes to purchase an oil well which, estimates indicate, will produce a net income of $200,000 per

(Continued on page 22)

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronounciation. From the group of words at the right, select one whose meaning closely resembles the word on the left. Answers will be found on page 38.

1. Acquiesce—(a) impede, (b) agree, (c) imply, (d) resent.
2. Quiescent—(a) unruly, (b) greasy, (c) motionless, (d) quickly.
3. Terpsichorean—(a) dancing, (b) ancient, (c) physiognomy, (d) dinosaur.
4. Approbation—(a) approval, (b) investigation, (c) trial, (d) doubtful.
5. Improbity—(a) improbability, (b) treachery, (c) integrity, (d) humorous.
6. Turpitude—(a) depravity, (b) innocence, (c) sluggishness, (d) enthusiasm.
7. Perseverance—(a) perplexity, (b) temperance, (c) determination, (d) irresolution.
8. Commiseration—(a) submission, (b) sympathy, (c) distress, (d) horror.
9. Refutation—(a) compensation, (b) distinction, (c) approval, (d) vindication.
10. Usurp—(a) devour, (b) seize, (c) repetition, (d) force.
11. Fastidious—(a) starve, (b) hasty, (c) indifferent, (d) squeamish.
12. Sibilant—(a) hissing, (b) ill, (c) self-important, (d) secrecy.
13. Phlegmatic—(a) deliberate, (b) explosive, (c) foreboding, (d) exacting.
14. Rejuvenate—(a) reinvigorate, (b) rejoice, (c) disinfect, (d) purify.
15. Facetious—(a) witty, (b) fatuous, (c) facial, (d) pernicious.

Introducing . . .

By Robert Lawrence, E.Phy. '51

STANLEY FELDMAN

The Illini baseball team will be on the march this spring, and Stanley "The Whip" Feldman will be providing plenty of spark from the mound.

Stanley has his heart in baseball and has earned his position as number one pitcher for the Illinois nine. His nickname, "The Whip," was given to him by Ruck Steger two years ago, because Stanley throws a terrific fast ball. Stan's past record in sports is excellent. He attended Farragut high school in Chicago where he was voted All-Sectional in basketball, and he was also a member of the Farragut baseball squad.

Stan made a fine showing on the Illini nine last spring. He pitched nine games and was accredited with eight wins and one loss. He pitched a four-hitter against Northwestern, but the best game he ever pitched was a shut-out against Purdue.

He remembers his greatest thrill as the Ohio game. It was the last Big Nine game and we were tied with Michigan. To lose that game would have meant a broken tie and Michigan would have captured the crown, single handed.

Stanley's big thrill came in the first inning. He found himself in a tight spot. The bases were loaded with no outs. The fourth batter popped up to the catcher to provide the first out; then Stanley opened up with his fire ball. He struck out the next two batters to retire the side, as the Illini fans went wild with cheers for "The Whip."

—Photo by C. M. McClymonds

STANLEY FELDMAN

Stanley has received several offers to play professional ball this spring. He plans to accept one of them soon after graduation.

If professional baseball doesn't satisfy, he will enter the field of electrical engineering. Stan is tops as a student as well as an athlete. He maintains a high scholastic average of 4.4 in the College of Engineering.

Although seemingly quiet, Stanley has a nice personality and is active about the campus. He is a good looking fellow, standing six-feet-one and weighing 175 pounds, and is considered a valuable player in intramural basketball by his fraternity brothers of Alpha Epsilon Pi. He is a member of the Tribe of Illini, Ma-Wan-Da, and a mathematics honorary, Phi Mu Epsilon.

A short review of Stanley Feldman's record in scholarship and athletics shows that he is well prepared to find a good future in baseball or electrical engineering.

EDWARD A. BOLDEN

The Institute of Traffic Engineers is working on a new and special curriculum for traffic engineers this semester. They feel that a special curriculum would improve the present method of picking option courses in traffic engineering from the general engineering curriculum.

Past president of I.T.E., Mr. Edward L. Bolden, states that at present the new curriculum is under development by the I.T.E. members only; but they are trying to arouse the interest of their professors to support the plan and put it into operation.

Mr. Bolden was born in the state of Texas and spent his early years at El Paso. In 1940 his parents moved to Lone Wolf, Oklahoma; but he returned to Fort Worth, Texas, for his high school education.

He graduated from high school in 1944 with a scholarship to the Hampton Institute in Virginia, and enrolled there that fall to study architectural engineering. At the end of one year, he decided that he was not in a field relating to his interests and transferred to the University of Illinois to study traffic engineering.

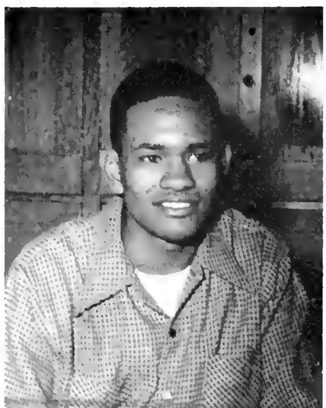
Mr. Bolden has taken several highway courses in our engineering curriculum, majoring in structural work. He attended the first University-operated summer camp for civil engineers at Blackduck, Minnesota, in 1946. It was an old C.C.C. camp, now being leased by the University for study and actual field work in surveying.

In the summer of 1947, Mr. Bolden experienced a change in study. As a member of the R.O.T.C. advanced air corps he received six weeks of training at Chanute Field, Rantoul, Illinois. Some of this training consisted of flying time in C-47s.

Last summer Mr. Bolden was able to gain some actual experience by working for the highway department at Ottawa, Illinois. This June he expects to graduate; and if he is not drafted, he has big plans of working in a foreign country. An oil company in Arabia seems to be the center of his interest. They have offered him a colorful opportunity abroad on a two-year contract; and if he accepts, his assignment will cover the engineering phase of pipe line laying and surveying.

Although a very pleasant conversationalist, Mr. Bolden seems to maintain a serious attitude toward his work and future, and he finds very little time to devote to outside activities. While in high school, he served on the student council and was appointed presiding officer of his senior class. He joined a local fraternity, Omega Sigma Chi, while at the Hampton institute; after he came to Illinois he became a member of Phalanx, our honorary military fraternity.

He is not asking for any great miracles after he graduates. He merely wants to live comfortably and earn a regular income. A man of Mr. Bolden's ability should find it relatively simple to reach such a goal.



—Photo by C. M. McClymonds

EDWARD A. BOLDEN

DEAN MELVIN L. ENGER

DEAN ENGER RETIRES

By Robert Lawrence, E.Phy. '51

Upon the completion of 42 years of faithful service to the University of Illinois, Melvin Lorenius Enger, dean of the engineering college, will formally retire Thursday, September 1, 1949.

In recognition of his splendid record of untiring devotion and service to the University, a farewell banquet will be held May 5 in the Illini Union ballroom. The event will be sponsored by fellow faculty members, friends, and students. Following the banquet, a reception will be held at which time a large portrait of Dean Enger will be unveiled. The sponsors are having the portrait made for the purpose of having it placed on a wall of a corridor in Engineering hall.

Dean Enger well deserves such a tribute. Under his counsel, leadership, and direction, the College of Engineering has grown and expanded to a position of great esteem among the engineering colleges in the United States.

Talbot laboratory was built while he was head of the department of theoretical and applied mechanics. Since his appointment to Dean of the engineering college, four new buildings have been added. They are the sanitary engineering building, the physics research laboratory, the new electrical engineering building, and the new mechanical engineering building. Being director of the C.A.A. student pilot training program in 1942, he contributed a great deal of time and effort towards the promotion of the University airport.

Dean Enger has acquired the respect of his colleagues for his research in engineering mechanics and hydraulics. He has always been considered an unusually good teacher, a capable administrator, and a generous contributor to educational and technical literature. He is joint author of two bulletins of the Engineering Experiment Station.

The result of tests made by Professors M. L. Enger and A. N. Talbot in 14 water columns, representing the principal types employed in American railway practice for supplying water to steam locomotives, were summarized in one of the bulletins. The information developed in such tests enabled manufacturers to re-design their water columns, making them more efficient, thereby reducing the delay to locomotives and the cost of water services.

Other topics of his research included the study of transmission of pressure in granular materials, penstock design, and air inlet valves for hydraulic pipe lines. His research work and study have made him a well known authority in engineering mechanics and hydraulics, his field of specialization.

In 1940, Dean Enger was awarded the John M. Goodell Award by the American Water Works association. The award is made annually by the association to the "member who has made the most notable contribution to the science or practice of water works development." Dean Enger and T. H. Wiggin, New York City consulting engineer, each received engraved certificates and a monetary award for their article, "A Proposed New Method for Determining Barrel Thickness of Cast Iron Pipe." This article was published in the May, 1939, issue of the American Water Works association journal.

Dean Enger is a good scholar and prepared thoroughly for his field of work. He entered the University of Minnesota in 1900 and stayed two years. The following two years he taught in a public school. In 1904 he entered the University of Illinois, receiving his bachelor of science degree in civil engineering in 1906.

He went to work on his first job as an instrument man for the Chicago, Milwaukee, and St. Paul railroad.

The following year the late Professor A. N. Talbot appointed him instructor in mechanics and hydraulics. Within the next three years he received his civil engineering and master's degree, and in 1919 was appointed professor. He was appointed head of the department of theoretical and applied mechanics in 1926; and, eight years later, he was named Dean of the college, succeeding A. C. Willard who was moved up to the presidency of the University. He also was in charge of research investigations in engineering in engineering materials and director of the University's Engineering Experimental Station.

Dean Enger has been very active in a large number of engineering organizations, being a past president of the Illinois Society of Engineers, chairman of the Illinois section of the American Waterworks association from 1930 to '31, vice president of the Society for the Promotion of Engineering Education from 1938 to '39, and honor member of the Illinois Society of Professional Engineers in 1948. He also was chairman of the engineering section of the Association of Land Grant colleges and universities, past president of the University Club, and has served on the board of directors of the American Society of Civil Engineering since 1932. He maintains membership in several social and honorary fraternities such as Sigma Xi, Tau Beta Pi, Sigma Tau, Mu San, Chi Epsilon, and Triangle. Other organizations include the Newcomen Society, A.A.A.S., and the American Society for Testing Materials. He served as an Urbana alderman from 1919 to 1922, and

(Continued on page 38)

In This Corner... NAVY PIER

PIER FACULTY

By Robert Groemling, L.A.S. '52

DR. JOHN J. CORLISS

The Technograph would like to introduce to you another member behind the academic curtain. Dr. John J. Corliss is an associate professor of mathematics, chairman of the division at Navy Pier, and co-author with Winifred Berglund of a new, more understandable trigonometry textbook. The most striking feature of this text is its departure from the more conventional by providing four introductory chapters giving the basic ideas before the appearance of right triangles. The virtue of the book is that it gives a very thorough explanation of the material. A previous book is an analytic geometry text which is co-authored by Messrs. I. K. Feinstein and H. Levin, also of the Pier faculty.

Although Dr. Corliss' life has revolved around mathematics, he has an interesting and varied background of education and teaching. He was born and attended school in White Haven, Tennessee, and later the University of Mississippi. Incidentally, he never did graduate from high school. He was admitted to college by examination.

At Mississippi, he was very active in extra-curricular activities. To mention a few, the Honor society, Literary society, and newspaper. He worked his way through his second year by tutoring students in mathematics at the rate of twenty-five cents an hour. He netted two hundred dollars that year which meant a lot of tutoring. Dr. Corliss studied both engineering and liberal arts subjects and received his B.A. in '25 and M.A. in '27.

After this he spent two years at Texas Christian University where he taught mathematics and engineering courses. During his spare time he watched the "horned frogs" play football.

He was an instructor of mathematics at the University of Michigan from '27 to '33 while he worked on his Ph.D. Here he did research in the deflection of a coil spring due to a horizontal thrust. Dr. Corliss is a member of Gamma Alpha and Sigma Xi, scientific honorary fraternities.

Before coming here to head the mathematics department at the Pier, Dr. Corliss was head of the mathematics department and founder of the graduate school of mathematics at DePaul university.

Gardening takes up a great deal of his spare time now, but fishing and most outdoor activities, including the work done around his home keep him fairly busy.

Although Dr. Corliss through his books has made mathematics courses easier to understand, there still remain the difficult problems of mathematics everpresent to the engineers of tomorrow.

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Robert Groemling . . . *Photography*

Photo by J. V. Tullis

DR. JOHN J. CORLISS

Engineers at the Pier

Quite a few changes have taken place here at the Pier of late. The chief innovations are the birth of the Engineering Council and the St. Pat's Ball which they are sponsoring. The engineers have all greeted the latter affair with much enthusiasm. Arrangements are still being made, but tentatively speaking, it will be held at the Edgewater Beach Hotel, March 18. By the time this issue appears, the St. Pat's Ball will already have taken place.

This awakening of the engineers is an innovation in itself. Formerly, they have been content in struggling with their studies, and for the most part, being seen and not heard. Within the past few months, however, the engineering societies have strengthened their ranks and sponsored small dances and smokers of their own.

There is a time and place for everything. An exhuberance of social activities would eventually prove to be detrimental to the studies of the engineer. In addition, our campus, situated as it is in Chicago, offers innumerable forms of amusement and pleasure for the student during the week-ends.

However, we do believe that an engineer should participate in at least one extra-curricular activity. He should seek his individual engineering society and join in the fun. There is much to be gained from such participation and you do not realize the importance of such a group until too late.

Although many engineers have arisen from this lethargic state, there still remain a great number that do not join in these informal gatherings with people of common interest. This is especially true of freshmen. College life lasts a brief four years, and since two are spent here at the Pier, there is no reason why these years should be deprived of friendly, social activities with your fellow engineers.

Let's take notice engineers, and join now!

Engineering Organizations

By Bob King, C.E. '51

A.S.M.E.

During the lull between semesters, this organization sponsored four field trips. On January 26th, the boys were conducted on a tour of the Chicago Hardware and Foundry Co. at North Chicago, on January 28th, the Hills McCanna Co., on February 1st, the Crane Co., and on February 3rd, the Continental Foundry and Machine Co. All four tours were well attended.

A mid-semester dance was held on Friday, January 28, at 8:30 to 12:30 in the third floor lounge. It was intended as a "good-bye" to the boys going down-state, and as a "hello" to the new M. E. students. There were 42 couples present to enjoy the dancing, conversation, cokes, ice cream, and "brownies."

At the first meeting of the spring semester a new vice president and treasurer were elected. The results were not available at this writing.

(Continued on page 20)

Undercover at . . .
GALESBURG

A Visit to Keokuk Dam

In the bright, blustery dawn of January 6, about 60 representatives of our engineering department boarded two chartered buses and journeyed 85 miles to Keokuk, Iowa. The object of this field trip, sponsored by the Engineering Council, was to furnish our engineering students with some visual knowledge of the construction and operation of the Keokuk dam and power plant, which is dam No. 19 of the Mississippi flood and navigation control project system.

With a slight feeling of misgiving on our part, the buses rolled carefully over Keokuk's antiquated toll bridge, negotiated some hairpin curves, and pulled into the employees' parking lot at the entrance to the dam site. On our half mile walk to the power plant we passed a cavernous drydock which was occupied by two barges being repaired, the locks, which were then idle as they always are during the winter months, and the unused foundations for an extended power plant which was never needed. When we entered the power plant we signed a paper waiving the Union Electric company from any responsibility for accidents, and entered an elevator, five at a time, that took us to the upper floor.

Here, with 20 students to a guide, we started our tour. The first stop was the control room, the brain and nerve center for the control of the 180,000 horsepower capacity of this famous dam. In this room there are four control cabinets and panels which are covered with a maze of gauges and switches. Some of these instruments indicate the speed and output of each generator, the height of the river at strategic points, wind velocities, and other information needed for the economical management of such a variable source of power.

Exploring this top floor further we found 110,000 volt circuit breakers, transmitters, repair rooms, and storage rooms for replacement parts.

We returned to the first floor via a steel stairway where we found the means by which the gates of the almost mile long dam are raised. It is a crane mounted on a railroad car. Two sets of tracks run the entire length atop the dam so that the crane can move from gate to gate. Early winter is a time of low water so none of the gates were open. The flow of water must be carefully regulated to prevent severe shortage of electricity during low water and to prevent floods during high water stages.

Also on this first floor is the generator room housing 15- 9,000 KVA generators. They generate, on the average, enough current in one day to operate an electric iron for 250 years. These generators (four are 60 cycle ones running at a speed of 62 revolutions per minute and the rest are 25 cycle ones with a speed of 57.7 revolutions per minute) operate with an oil pressure of 140-180 lbs. per sq. in. and are regulated by a fly ball mechanism. Turning each generator from below is a reaction type turbine receiving its power from the 32 foot fall noted and if it falls too near freezing, the water is heated by hot water pipes. To facilitate repair work in the generator room there is a 150-ton Alliance crane overhead.

This completed our tour of this $27,-000,000 dam that serves Galesburg, Burlington, St. Louis, and Chicago. This dam, the largest on the Father of Waters, was completed in 1913 under the direction of designing engineer Hugh Lincoln Cooper and remains as an inspiring tribute to his genius.

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Introducing . . .
Mr. Harvey Mullen

Many engineering students here at Galesburg will remember the various objects used to illustrate the principles of descriptive geometry. It is most likely that this experimental equipment was made by the popular instructor, Mr. Harvey Mullen. Mr. Mullen's interest in his work is the outgrowth of his early labors in woodwork. His work, plus his interest in athletics, was the main reason

(Continued on page 27)

—*Photo by Charles J. Kukura*

Railroad tracks and power lines along the top of Keokuk dam, Keokuk, Iowa.

—*Photo by Charles J. Kukura*

Keokuk dam, stratching for almost a mile across the Mississippi.

—*Photo by Charles J. Kukura*

The fifteen generators of Keokuk's power plant, delivering 135,000 KVA.

EMPLOYMENT DIRECTORY

For the convenience of our readers we have contacted the companies listed below asking them about their needs for engineers. If you desire employment with any of the companies inquiries should be made directly to the company.

COMPANY and ADDRESS	CERAMIC	CHEMICAL	CIVIL	ELECTRICAL	MECHANICAL	INDUSTRIAL	METALLURGICAL	SPECIAL QUALIFICATIONS AND COMMENTS
Personnel Manager American Gas Association Testing Laboratories 1032 E. 62nd St. Cleveland 3, Ohio		x			x		x	Good personality, ability to cooperate with others and desire to merit promotion to higher responsibilities. Information about training program at Technograph Office, 213 E.H.
Dow Chemical Company Technical Employment Department Midland, Michigan		x		x	x			B. S. and graduate students in chemistry
Business and Technical Personnel Dept. Eastman Kodak Company 343 State Street Rochester 4, N. Y.		x		x	x	x		Specific information and application blands may be obtained in the Technograph Office, 213 E.H.
Frick Company Waynesboro, Penn.		x	x	x	x			Want men for sales engineering; good height, appearance, and at ease with people to sell refrigerating, ice making and air conditioning equipment. M.E.'s and E.E.'s offered a two year training course in refrigeration
F. J. Littell Mach. Co. 4127 N. Ravenswood Chicago 13, Illinois Attn: Mr. F. M. Littell					x			
C. E. Butler, Off. Mgr. Norton Company New Bond Street Worcester 6, Mass.	x	x			x			
Employment Dept. Industrial Relations Division Proctor and Gamble Co. M. A. and R. Bldg. Ivorydale 17, Ohio		x	x	x	x	x		
Training and Specialized Recruiting Div. Personnel Dept. R.C.A. Victor Div. Camden, N. J.		x		x	x			Desire top notch men with high academic standing and ability to get along with men. The R.C.A. training program is a one year period of rotated and on the job assignments within various product and staff activities.
Union Carbide and Carbon Corp. Attn: Mr. C.M. Barlow 30 E. 42nd St. New York 17, N. Y.		x		x	x			Also chemist and business administration students. Some vacancies in research, development, production, sales, advertising, industrial relations, patient and purchasing work.
George D. Lobingiar Mgr. Student Recruitment Educational Dept. Westinghouse Electric Corp. E. Pittsburgh, Penn.				x	x			
F. H. Roby, General Sales Manager Square D Company 6060 Rivard Street Detroit 11, Mich.				x	x			Students in upper third of their class; initiative; leadership for sales engineering. Also frequent vacancies in Engineering and Manufacturing Dept.

President of S.A.E. Addresses Local Chapter

By C. M. McClymonds, M.E. '49

How modern automobile engines are developed by manufacturers was interestingly presented by Mr. Stanwood W. Sparrow, president of the Society of Automotive Engineers. He was a guest of the University of Illinois student branch of the S.A.E. at a meeting of the local group March 23, in 319 Engineering hall.

The organization on this campus of the student chapter of the S.A.E. on May 20, 1948, marked the start of a rapidly growing interest in a "highly American institution," (as the magazine, *Fortune*, so aptly credited it). The 51 charter members here, as well as those

STANWOOD W. SPARROW

who have since joined, have finished the steps necessary for admittance to the national membership now exceeding 15,000. The student branch has shown a mile-stone of progress which was highlighted March 23 by the presentation of the charter and the presence of Mr. Sparrow.

Mr. Sparrow's address, "Your Friend, the Engine," told of the development of the Studebaker "champion" engine from its inception to its present stage of development. The popular 80-horsepower "three-by-four" in use in America's first post-war car came as a result of years of design, development, and experimental work.

The speaker's biography is even more colorful. He looks like a scientist, acts like an engineer, and is generally regarded as one of the industry's best intellects. Some of his earlier experience in the automotive industry was obtained while

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EDWIN A. WITORT
Editor

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

Of Books and Men . . .

"Engineers are unsociable isolationists" seems to be a prevalent south-campus opinion. Is this opinion partly justified, or can it be shrugged off with a "not by choice"?

I have come to the opinion that the matter cannot be treated lightly. In trying to sell tickets to the St. Pat's Ball, I was turned away by a number of engineers who said they simply didn't know anyone to take. Many of them would have had no trouble getting and enjoying dates, if they had only known a few of the cute coeds on campus. According to ticket sales, this asocial situation was, and still is, too universal on the engineering campus. But something *can* be done about it!

Social dexterity is not only desirable but necessary from at least two important standpoints.

Because we live in a world of people, we must know how to get along with people, and how to make them our friends. We have to take an interest and learn to cooperate with our neighbors. An interesting fact worth mentioning is that second only to your hometown, your campus is the best place to start a happy marriage. Chances for success in this all-important endeavor are greatly diminished if you wait till you go to work before looking for your life partner.

Industrial concerns are consistently asking for men who know to handle themselves with ease in social situations. Notice the right-hand column of the employment directory on page 16. The demand is for engineers who have developed their leadership abilities and know how to handle personnel—men who can get out and do things. In responsible positions, you'll have to judge the personality, characteristics, and qualifications of your fellow workers. You can't judge a person's character without knowing what to look for, without the experience of meeting and working with people in all types of situations.

The usual comment is that engineers just don't have enough time to work problems, write reports, pass exams, and still partake of social functions. There may be many in this dull routine—too many—but I'm not advocating that less time be spent studying. Rather, I suggest that relaxation be done as effectively and as efficiently as possible. Movies and beer parties may be relaxing(or stiffening) but how much do they add to your life? Or do they subtract? To get the most worth-while improvement out of relaxation time, take advantage of opportunities to meet people—get acquainted with varied personalities, ideas, and interests.

From my own experience, I've found that the campus Foundations are the best and most natural places to meet and enjoy other students. In their parties and socials you'll find an informality and spirit of fellowship that will help you to learn to make friends and feel at ease socially.

If you try to be a friend to all people, you will find an experience that can't be found in books or problems, or anything but life itself.

"From quiet homes and first beginnings,
Out to the undiscovered ends,
There's nothing worth the wear of winning
But the laughter and the love of friends."

—R. L. H.

NAVY PIER . . .

(Continued from page 14)

The organization has plans for a lecture and demonstration by a representative of the Magnaflux Corp., and a movie by the Elco Boat Manufacturing Co.

A.S.C.E.

This organization held its first business meeting of the spring semester on February 22nd. The topic was, "Summer Survey Camp for 1949." More information will appear in the next issue concerning this topic.

I.A.S.

This organization held its first business meeting of the spring semester on February 22nd. A movie on "Aircraft Wing Structure," and a movie on "Aircraft Fuselage Structure" were shown. There was also an election of officers held—results in next issue.

A.I.E.E.

In January the society was addressed by Mr. Hulla, an electronics engineer from the Westinghouse Corp., on the "Application of Electronics in Industry." Included in his lecture were such items as "voltage regulation in a generating station," "color control in painting," and "switchgear for high amperage spot welding."

Cards were distributed to all the members present at this meeting to secure names for a nominating committee.

At the first meeting in the spring semester a film on "Adventures in Research" was shown, and an election of officers for chairman, secretary, and treasurer was held—results in the next issue.

We can get the new world we want, if we want it enough to abandon our prejudices, every day, everywhere. We can build this world if we practice now what we said we were fighting for. —Gwen Bristow.

ENGINEERING EXAM . . .

(Continued from page 11)

year for 30 years. What should the syndicate pay for the well if, out of this net income, a return of 10 per cent on the investment is desired, and a sinking fund will be established at 3 per cent interest to recover the investment?

2. A 4 per cent bond with interest paid annually will mature in 10 years. What is the market value if 3 per cent is considered a fair return?

3. Determine how much more could be paid for a hydroelectric power plant and transmission line than for a steam plant, to be run at full load for 3000 hours per year, if the operating costs for the latter as 0.6 cent per horsepower hour, while for the hydroelectric system they are only 0.2 cent. Assume the life in either case to be 30 years and interest to be 5 per cent, while all other things are equal.

4. What provisions can be made in a contract for engineering construction to avoid dispute over payments for extra work?

Group C

1. Where the presence of nitrogen is not objectionable, hydrogen for reductions may be procured by cracking ammonia at high temperature. A cylinder of hydrogen under high pressure contains 1 lb. of hydrogen and weighs approximately 100 lbs. An ammonia cylinder containing 100 lbs. of ammonia weighs approximately 150 lbs. A plant wishes to reduce one ton of Fe_3O_4 to metallic iron per day with hydrogen. If freight is 20 cents per 100 lbs. and it costs three cents per pound to crack ammonia, calculate and compare the costs of cylinder hydrogen and hydrogen from ammonia. Ammonia costs 12 cents per pound and cylinder hydrogen $1.00 per pound.

2. It is desired to market oxygen in small cylinders having volumes of 0.8 cu. ft. each containing 1.5 lbs. of oxygen. If the cylinders are subjected to a maximum temperature of 110° F., calculate the pressure for which they must be designed. Assume the applicability of the simple gas law.

3. How much heat is lost per hour from a rotary kiln, 30 ft. in length by 3 ft. inside diameter (I.D.)? The kiln is covered with insulating brick (k equals 0.05 Btu °F. ft. hr.) of 2.0 ft. thickness, and the temperature of the outside surface of the brick is 500° F. less than the inside surface of the brick.

Group D

1. A 36-inch, new vitrified sewer pipe on a one-half per cent slope is flowing 24 inches deep. How many cubic feet of water are flowing per second?

2. Calculate the elevations at 50 ft. stations for a circular vertical curve 600 ft. long between tangent grades at 3.96 per cent (before) and 4.32 per cent (after) meeting at Station 13 25 at elevation of 105.68 ft.

Group E

1. A balanced three-phase load, star-connected, has a resistance of six ohms, and an inductance of 0.015 henries in series in each phase. The load is supplied at 120 volts, sixty cycles.

(a) What is the line current?

(b) What is the power consumed per phase and the total three-phase power consumed?

(c) Draw the complete vector diagram of currents and voltages.

(d) Show a connection diagram for connecting two watt-meters to read the total three-phase power. What will be the reading of each meter?

(e) What is the reactive power of the circuit?

2. (a) In a shunt-wound motor the applied voltage is 240 volts, and the back emf is 230 volts. The resistance of the armature is 0.25 ohms and that of

(Continued on page 24)

No...he doesn't know every industry like a book...

... but there are a lot of things he <u>does</u> know about each of them. As a Square D Field Engineer, it's his business to know electrical distribution and control as it applies to <u>any</u> industry. By working with all kinds and sizes, he encounters a lot of questions—and helps work out the answers. As a matter of fact, his full-time job is working with industry—helping find that "**better way to do it**."

Through such Field Engineers, located in more than 50 offices in the United States, Canada and Mexico, Square D does its three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends and new methods and speeds their development.

If you have a problem in electrical distribution or control, call in the nearby Field Engineer. He'll help a lot in finding a "**better way to do it.**"

For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

ENGINEERING EXAM . . .

(Continued from page 22)

the field, 60 ohms. If the iron and copper losses in the armature are equal, what is the efficiency of the motor?

(b) A d-c motor under test gave the following results:
Voltage 460 volts
Current 30 amps.
Effective load on brake at periphery 200 lbs.
Diameter of brake pulley 6.25 in.
R. P. M. 1725

Find the brake horsepower and the efficiency.

Group F

1. A furnace wall consists of nine inches of firebrick, 4½ inches of Sil-O-Cel brick, and 4½ inches of building bricks. Calculate the heat transmission through the wall in Btu per hour per square foot when the inside surface is 2400° F., and the outside room and air temperature is 100° F. Use K for firebrick as 0.81, K for Sil-O-Cel as 0.043, and K for building brick as 0.40. State clearly any assumptions made.

2. A manufacturing plant has installed reciprocating steam-driven air compressors and finds it more economical to modernize with electrical-driven equipment. Daily average demand is 1250 cfm, with maximum and minimum demand factor of 1.5 and 0.6, respectively. Past records indicate a rate of growth of 7 per cent per year. You are asked to select equipment for a 10-year growth. Outline size, type, drive, and number of compressors you would select, and give reasons.

3. A gear reduction set on a lathe with ratios 1:4, 1:6, and 1:8 has final drive gear on a lead screw shaft. If the shaft has eight threads per inch, what must be the RPM of the original line shaft to produce final translation of apron of two inches per minute.

New RCA 16-inch direct-view television tube fills gap between popular 10-inch tubes and the projection-type receivers.

"*Inside story*" of a bigger, brighter picture on your television screen

The screen on which you are accustomed to seeing television is the face of an electron tube—on which electrons "paint" pictures in motion.

And the size of the picture, unless projected, is determined by the size of the tube.

Working to give you *bigger,* brighter pictures, RCA engineers and scientists developed a new way to make large, direct-view television tubes. They found a method of "welding" large areas of glass and metal . . . while keeping a vacuum-tight seal!

Using this development—ideally suited to mass production—RCA can now build television tubes of light, tough metal . . . using polished glass for the face, or "screen."

An achievement of research

Development of this new way of making television tubes is a continuation of *basic television research* which began at RCA Laboratories. Such leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

. . .

Examples of the newest advances in radio, television, and electronics—in action—*may be seen at RCA Exhibition Hall, 36 W. 49th St., New York. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.*

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

GALESBURG . . .

(Continued from page 15)

for his entering the Kansas State Teachers college and studying in the architectural curriculum. His ability to maintain friendly relations with people was demonstrated in college life, for he had a keen interest in extra-curricular activities and also served three years on the football team.

Like all discerning students Mr. Mullen decided early that the college's main effort is to give an education. Because of this realization, he did graduate work at the Colorado College of Education after receiving his B.S. degree from Kansas State.

His first position was with the high schools of Colorado, but industry next laid claim to Mr. Mullen's talents. At the beginning of World War II he decided that industry was not his line, and he re-entered the teaching profession at the Jefferson City Junior college, an extension of the University of Missouri.

During the war, Mr. Mullen was an instructor in the E.S.M.W.T. (Engineering Science Management War Training) program at the same college. Finally the wander lust prevailed in him once again and he struck out for greener pastures, arriving at Galesburg in February of 1947.

HARVEY MULLEN

It wasn't long before the students learned that Mr. Mullen was their friend, able and willing to help anyone and everyone who sought his advice. His interests are varied and he enjoys talking with students about almost anything. Due to his Army experiences in World War I, he can hold his own in any of those "old soldier" bull sessions.

His duties here at school are many, but he has found time for a very interesting hobby, the making of furniture. He is also a Mason and a member of the American Association of University Professors. All these activities combined with his past experiences indicate that Mr. Mullen is an active person, an able instructor, and a man who takes much pleasure in aiding his students.

FRESHMAN ORIENTATION

Our aim in presenting these accounts is two-fold: Although this program is required only of new students, we feel the information is of equal importance to all the old, experienced engineering students and at the same time will give the new students something a little more permanent than a lecture.

The program committee, under the chairmanship of Professor F. W. Trezise, has obtained some well-known and distinguished men to speak. Included among these personalities are such well-known men as Mr. L. J. Fletcher, who is director of training and community relations for the Caterpillar factory in

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GALESBURG . . .

(Continued from page 27)

Peoria, Illinois, and Mr. J. F. Roberts, who is manager of the Hydraulic Dept. of Allis-Chalmers Mfg. company.

Mr. L. J. Fletcher, who is also past president of the American Society of Agricultural Engineers, and is on the board of trustees of Bradley University in Peoria, Illinois, gave the pre-engineering students valuable tips on how they may prepare themselves for their work in industry. His general topic was "The College in Industry." This included a rather unique definition upon which the college graduate's success depends. His definition stated that "the success of the college graduate in industry depends upon the amount of industry in the college graduate."

Mr. Fletcher stated that industry itself is merely people and the know-how which they possess. Therefore, the graduate engineer is concerned, to a large extent, with the actions and peculiarities of people. The personality of the engineer is extremely important when brought into this light. When, upon graduation, he is interviewed by the representative of one firm or another he is placed within a showcase, wherein he must prove to the representative that his ability to cope with people and their personalities is of sufficient quality to be acceptable. Then, and only then, is he offered a position with the firm represented.

Obviously, the scholastic average of the student is also of importance, but it is the opinion of the Mr. Fletcher that the success of the engineer is dependent upon from fair to good grades and upon a pleasing personality.

Mr. Roberts was concerned mainly with acquainting the orientation group with the processes and problems involved in the construction of a dam. He also explained quite thoroughly the position of the civil engineer in hydro-electric work.

The process of constructing a large dam is quite complicated and thus could only be outlined by Mr. Roberts. However, he supplemented his fine talk with numerous slides showing the various important features of a well-constructed dam.

A site sufficiently capable of producing the necessary power and also capable of bearing such a large structure is of prime importance. Once a proper site has been selected, the civil engineer has the all-important task of surveying the land and the subterranean strata to determine whether or not there would be any water power loss due to underground leakage. He must also estimate, with a large degree of accuracy, the cost of the land, the construction of bridges and railroads, the cost of moving both industries and people out of the land to be flooded, and the cost of constructing the dam itself. These are only a few of the considerations that must be taken into account before a total estimate of both time and cost can be made. Careful design and planning can save both money and time, and is therefore of great importance.

Following this estimation and planning a schedule is made up to coordinate the actual construction. Such a schedule is generally made flexible so that any necessary deviations from it can easily be made.

The problems encountered are varied and many but probably the most impressive of those explained by Mr. Roberts was the fact that allowances had to be made for the growth of the structure itself. This growth, as much as one-tenth of an inch per year per foot of depth of concrete, had led to the comparatively new study of the chemistry of dam construction. This "growing" of dams has caused some damage to the turbines contained therein. The growth is apparently due to the swelling of the alkaline particles in the aggregate. However, allowances are now made for the turbines within the structure so that no damage

(Continued on page 30)

GALESBURG . . .

(Continued from page 28)

is expected in any of the newer types of dams.

The conbination of such speeches as those given by Messrs. Fletcher and Roberts aid the student of engineering immeasurably. They not only add to the students' knowledge of the field of engineering but also give them a wide range of general information. It has been the practice of the speakers thus far to open the lecture to informal discussion at the conclusion of the hour and it is then that the student obtains answers to problems which may have troubled him previously. It is through the medium of such discussion and lecture groups that the future leaders of our nation's industry are formed, and it is the sincere hope of all those concerned that this program will be continued in the future.

THAT DECIMAL POINT

Attention, engineers who are careless with the math. Below is an excerpt from a letter received by Professor Trezise from an engineer friend:

Puebla Tramway, Light and Power Co.
January 26, 1949

Dear Fred:

I was indeed gratified upon receiving your card, and its written message. You are indeed fortunate, think I, in being in education. I have often imagined what great stimulus it must be to live among people who can afford the time to do abstract thinking, instead of the more focused thinking connected with a job—and to have the privilege of guiding younger thoughts through channels that will lead them to even more profound knowledge than has their teacher.

Since you heard from me (a couple of letters must have gung aglee), I finished the Merida job, and built a steam plant here. Then went to Celoya to iron out the wrinkles in a new plant there prior to putting it on the line. At present, the company has placed me in charge of all of the generation and transmission in the southern Mexican district with headquarters here at Puebla.

We have nine small (800 to 56,000 kw.) hydro-electric plants, and one steam plant, the new one at Puebla. In addition we purchase power from the government steam plant at Veracruz, and from several industrial plants on a power exchange basis.

The construction of the Puebla steam plant offered some unusual problems in foundation work. Several years before I came here a stenographer made an error in placing a decimal point, and the dictator failed to catch it. Soil bearing tests indicated a maximum safe loading of .42 kilograms per square centimeter. The steno wrote 4.2, and New York used that figure in their design of footings. Result was that when the plant was half built (all of the building and footings were in place) we noted foundation failure. Footings were redesigned and rebuilt—and the pedestal for the unit was torn down and rebuilt on piles.

A 48′ x 48′ high steel storage tank was lifted four feet, out of the mud into which it had sunk, moved 80 feet and then moved back on an extended crushed rock foundation carried down to underlying limestone layers. . . .

Sincerely,

Arthur Wheatley

Along the same line, the following paragraph was written on a C. E. final last semester:

"In second order surveying work, there should be no mistakes because mistakes and discrepancies can be totally eliminated by checking and cagey technics. . . ."

Great men speak to us only so far as we have ears and souls to hear them; only so far as we have in us the roots, at least, of that which flowers out in them.—Durant.

Scene from the Alcoa Technicolor Film, "Unfinished Rainbows", starring Alan Ladd as Charles Martin Hall with Janet Shaw as his sister Julia. Available on request for your church, school or organization. Address Gulf Building, Pittsburgh 19, Penna.

ALAN LADD now co-starring in "WHISPERING SMITH", a Paramount Picture. Color by Technicolor.

How a group of American pioneers has held the price of Aluminum down

Charles Martin Hall, founder of America's aluminum industry, had a special kind of gleam in his eye. Every one of us has it too.

He was bound and determined to find a way to make aluminum cheaply. The schoolbooks all tell how he did it, where the world's greatest scientists failed.

Bluntly speaking, Charles Martin Hall set out to cut the world price of aluminum.

He was the first of the men and women of Aluminum Company of America. He licked a process. We who followed him engineers, chemists, metallurgists, physicists, production experts —have been at it ever since.

But the gleam is the same. It's bumping elbows in the research lab with men who, in fifty years, have accomplished most of the finding-out that took fifty centuries, with the age-old metals.

It's working in the mill and having it seem that every shining sheet racing over the rolls is your own.

It's typing a letter in answer to a simple query, and having the deep-down feeling that you may be in at the birth of a new business, taking root in aluminum.

We propose to keep on being pioneers in broadening the usefulness of aluminum. Alcoa Aluminum sold in 1939 for 20 cents a pound. It sells today for 16 cents.

We are pioneering with microscopes and calipers and rolling mills. We'll stack them against axes and squirrel rifles and spinning wheels, for a place of importance in the history of our America.

To know other stories of the Alcoa family and the growth of aluminum's usefulness to you, write for free copy of "Aluminum Its Story", ALUMINUM COMPANY OF AMERICA, Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

"Mamma, do angels have wings?"
"Yes, dear," replied the mother.
"And can angels fly, mamma?"
"Yes, dear."
"Daddy said nurse was an angel last night. When will she fly?"
"Tomorrow," replied the mother.

* * *

Prospective Employer: "Are you looking for work, my good man?"

M. E.: "Not necessarily—but I'd like a job."

* * *

A coach is a fellow who is always willing to lay down your life for his school.

"Why are you crying, little girl?"

"'Cause my brother has holidays and I don't."

"Well, why don't you have holidays?"

"'Cause I don't go to school yet."

* * *

The E. E. student was puzzled. "Hey," he called to his lab partner, "put on one of these wires."

His lab partner did as he was told.

"Feel anything?"

"No."

"Good," replied the E. E. "I wasn't sure which was which. Don't touch the other or you'll drop dead."

He dashed up to the bar and hollered: "Gimme a double shot, quick, before the trouble starts!"

The bartender did, and he drank it.

"Gimme another double shot—before the trouble starts."

The bartender, puzzled, did, and asked: "Before what trouble starts?"

He replied sadly: "It's started now. I ain't got any money."

* * *

"You say you never have a quarrel with your wife?"

"Never. She goes her way and I go hers."

Variety of Equipment used by

SUPERIOR METAL TREATERS, INC.

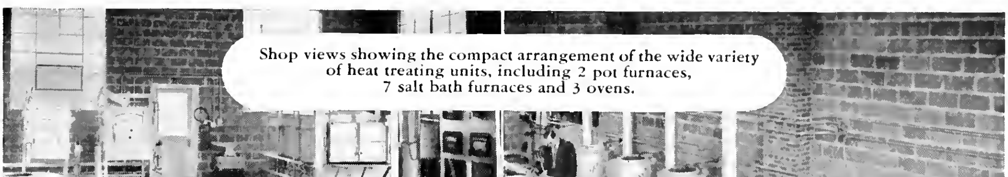
Emphasizes the Versatility of GAS

VARIETY is one of the most characteristic features of a commercial heat treating shop—variety of customer demands and variety of equipment required to fulfill them.

With a background of 22 years experience, Evan D. Ehmann, President of Superior Metal Treaters, Inc., knew just what to look for when he established his Newark, New Jersey, shop. This modern plant has the productive capacity to cope with the miscellaneous requirements of many customers.

Key feature of the installation is the versatility of the equipment. Each unit was chosen for its ability to perform under a number of different conditions. In selecting this equipment Mr. Ehmann determined to use GAS because, as he expresses it, **"During my years in this business I discovered that Gas Equipment provided the accurate control, economical operation, and versatility we needed. The precise temperatures and speed of heating we obtain with GAS mean a lot of extra production in our shop."**

Whether the heat treating process is a production-line application, or a commercial shop operation, the flexibility of GAS and the versatility of modern Gas Equipment are important economic factors. The characteristics of GAS make it stand out in any comparison with other available fuels for heat processing.



Shop views showing the compact arrangement of the wide variety of heat treating units, including 2 pot furnaces, 7 salt bath furnaces and 3 ovens.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVE., NEW YORK 17, N. Y.

The Gospel According to Saint Joe

Verily, I say unto you, marry not an engineer for the engineer is a strange being, possessed of many devils, yea he speaketh eternally in parables which he calleth "formulas", and he hath but one Bible,—a handbook.

He talketh always of stresses and strains, and without end of thermodynamics. He showeth always a serious aspect and seemeth not to know how to smile, and he picketh his seat in the car by the springs therein and not by the damsel beside him; neither does he know a waterfall save for its power, nor the sunset except for her absorption spectrum.

Always he carrieth his slide rule with him and he entertaineth his maiden with steam tables. Verily, though his damsel expecteth chocolates, when he calleth he brings samples of iron.

Yea, he holdeth his damsel's hand, but only to measure the heat content thereof, and kisses but to test the viscosity. In his eyes shineth a faraway look which is neither love nor longing but a vain attempt to recall a formula.

There is but one key to his heart, and that is the Tau Beta Pi key; and one love letter for which he yearneth and that an "E"; and when to his damsel he writeth of love and signeth with crosses, take not these symbols for kisses but rather for unknown quantities.

Even as a youth, he pulleth a girl's hair to test its elasticity, but as a man he discovered different devices; for he would count the vibrations of her heartstrings and reckons her strength of materials; for he seeketh ever to pursue scientific investigations, and inscribeth his passion in a formula; and his marriage is an equation involving two unknowns and yielding diverse answers.

Prosperity is only an instrument to be used, not a diety to be worshipped. —Coolidge.

* * *

All experience hath shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed.—Jefferson.

1001 NIGHTS . . .

(Continued from page 7)

of mud carved out of the ground and burned for three days in the sun. "Bally poles" were the trunks of abundant young poplar-like trees, ranging in diameter from six to eight inches. Mortar was a mud-straw combination, and plaster was a refined type of mud known as "sweet earth," whose consistency is selected for its taste.

While all the main construction reports containing the most pertinent data are filed away in the proper military offices, there were a few other, smaller incidents that will only live on by passage of word-of-mouth. There was the story of an airfield on the south coast of Arabia that was constructed of 430 tons of supplies hauled inland over 25 miles of country roads by a camel caravan numbering 1,100. On another job, when the native labor slacked off on their work, the American civilian superintendent bought his Arab foreman three new wives at $10 apiece from a local market—p r o g r e s s spontaneously improved. There was another rumor of a wily Arab chieftain who demanded payment for his men in Maria Therese dollars, old silver Austrian coins; by stint of an expensive plane trip to Austria once a month, the contractors paid the Arab his price.

The Persian Gulf Command had just about completed their assignment in December in 1944. They started on nothing and came out with a spectacular climax, and in the process, saw little of the Iran of a thousand and one nights. All they will remember of Iran is one little factor that makes a pleasant topic of conversation over here in America. Hereafter, when a remark about the hot weather is made in the presence of one of the Command boys, he won't say a word—he'll just grin.

S.A.E. . . .

(Continued from page 16)

testing the famous Liberty and Hispano-Suiza aircraft engines of World War I. After work connected with numerous projects at the National Bureau of Standards, Mr. Sparrow went to Studebaker in 1927 and has been at South Bend, Indiana, ever since. By the time World War II broke out, he was chief research engineer, and devoted almost his entire time to the supervision of Studebaker's building of the Wright "cyclone" engine. Now he is vice president of engineering, and ranks among the automotive industry's six senior engineers. He has been an S.A.E. councilor; a member of the S.A.E. Technical board; chairman of the Washington section; and served several years as chairman of the Publications committee.

DU PONT Digest

For Students of Science and Engineering

Chemists in Pictures

How Du Pont and studio scientists solved the problem of noisy film

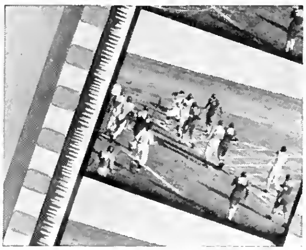
Who'd ever expect to find Du Pont chemists in Hollywood? When motion pictures suddenly started to talk, a whole new series of perplexing scientific problems was born, not the least of which was "noisy" film.

As you know, sound is usually recorded directly on film. If you hold a strip of motion picture film to the light, the sound track is seen as a narrow band of irregular lines. A light ray passing through the moving sound track falls on a photocell with rapid interruptions or changes in intensity. The photocell converts these interruptions into electrical impulses which, amplified, reach the theater audience as voice and music.

If the film has a coarse grain structure, it tends to give lines that are not sharp and uniform in density. Such irregularities interrupt the light ray—come out as distracting noise.

What could be done about it? Du Pont scientists of the Photo Products Department started a program of research, in cooperation with technical experts from the studios in Hollywood. They made and tested scores of film coatings. Finally there were developed films of exceedingly fine grain structures.

M-G-M and Paramount were among the first to use the new type Du Pont films. The development was heralded by the press as "another milestone in the technical progress of the industry," and in 1943 Du Pont received an Academy Award of Merit for its achievement. Now the use of fine grain films is practically universal in Hollywood. Actors, actresses speak their lines, with no technical restrictions to cramp their artistry.



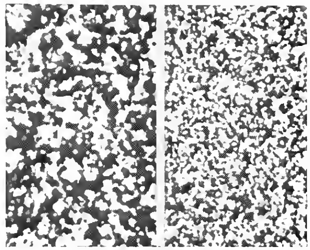
Voice and music *appear as a continuous band of irregular lines on this movie sound track. Any irregularity means noise.*

You may have a place in Du Pont research

Had you been a member of a Du Pont Photo Products research team since 1931, you might have shared in many outstanding achievements, two of which have been recognized by "Oscars."

Achievements *of Du Pont scientists over the years have won two "Oscars" from Academy of Motion Picture Arts and Sciences.*

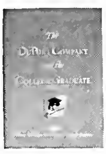
W. L. Foy, *Ph.D. in Physical Chemistry, Clark University, 1947, and A. C. Lapsley, Ph.D. in Physics, Virginia, 1947, discussing details of Color Densitometer Wiring Diagram used in connection with research on color photography.*



In coarse grain films, *the particles of silver are large and scattered. Compare with Du Pont fine grain film, right. (Magnified 1000 times.)*

The Photo Products Department, however, is just one of ten Du Pont manufacturing departments, all of which engage in continuous research. Operated much like separate companies, each holds challenging opportunities for young, college-trained chemists, engineers and physicists. Du Pont not only tries to select young men and women of promise, but makes a conscientious effort to help each one develop as rapidly as possible. Whatever your interests, you will find here the cooperation and friendly interest you need to do your best. As a member of a small, congenial working team, your ability can be seen, recognized and rewarded.

Don't miss reading this new booklet about Du Pont



Send for your copy of "The Du Pont Company and the College Graduate." This fully illustrated, 40-page booklet answers your questions, describes many fields which may be new to you. Tells about opportunities in research, production, sales, etc. Explains how recognition of ability is assured. For free copy, address: 2518 Nemours Bldg., Wilmington 98, Delaware.

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. . . THROUGH CHEMISTRY

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DEAN ENGER RETIRES . . .

(Continued from page 13)

has rendered excellent service on many state and national committees.

His service has been recognized by several noted biographies such as Who's Who in America, and the American Man of Science.

On the twelfth day of July, 1948, Dean Enger was recognized by the University as being "King for a Day." For the first time in his life he was a University president. He attained the position of president because all of the University officials, of higher priority than himself, were out of town. Since he was the oldest dean on the campus, he was informed that he would have to take over. Everything went along smoothly according to Dean Enger and nothing but routine matters concerning the College of Engineering were presented to him. He had even forgotten that he was holding the University's top position. Provost Coleman R. Griffith relieved him of his duty the following day.

Dean Enger has earned a rest; and he expects to take one this fall. He enjoys his summer trips by automobile and has traveled throughout the United States and Canada. In 1939, he toured the Baltic Sea nations in Europe. For recreation, he likes an occasional game of golf.

Dean Enger was born in Decorah, Iowa, on May 5, 1881, and he married Mary Crawford on August 24, 1908. They have two children, a boy and a girl, both graduates of the University of Illinois. Bertha Marie Enger graduated in 1932 from the school of journalism and married Henry Molden, former sports editor of the Daily Illini. Mr. Molden is now on the sports staff of the Omaha World Herald. Walter M. Enger graduated from the College of Engineering in 1935 and has been employed on a major dam project near Redding, California.

Dean Enger and his wife have been residing in their new home at 606 West Delaware since 1940. It is of modern brick veneer and follows the Georgian style of architecture.

Answers to Vocabulary Clinic

1-b, 2-c, 3-a, 4-a, 5-b, 6-a, 7-c, 8-b, 9-d, 10-b, 11-d, 12-a, 13-a, 14-a, 15-a.

Good judgment comes from experience, and experience—well, that comes from poor judgment.—S. B. Buckner.

The more intellectual people are, the most originality they see in other men. To commonplace people, all men are much alike.—Pascal.

A Scot was leaving on a business trip, and he called back as he was leaving, "Goodbye, all and dinna forget to take little Donald's glasses off when he isn't looking at anything."

* * *

"Were you excited when you first asked your husband for money?"
"Oh, no, I was calm—and collected."

* * *

1st Prisoner: "What are you in for?"
2nd Prisoner: "Want to be a warden, so I thought I'd start from the bottom."

* * *

"Just look at old Phillips over there—thoroughly enjoying himself! And I've always understood he was a woman-hater."
"So he is; but she's not with him tonight."

* * *

He: "Who spilled mustard on this waffle, dear?"
She: "Oh, John! How could you? This is lemon pie!"

* * *

Visitor: "And what's your name, my good man?"
Prisoner: "974238."
Visitor: "Is that your real name?"
Prisoner: "Naw, dat's just me pen name."

* * *

"Whaddya mean, she's a drug addict?"
"Usually under the influence of some dope."

* * *

He was sitting at the bar, downing one after another and laughing boisterously. Every so often, as he mumbled to himself, he would hold up his hand in protest. Finally the bartender's curiosity got the better of him.
"What are you doing?" he asked. "I'm telling myself jokes," was the reply. "But why the hand in the air?" "Oh, that's when I stop me if I've heard it before."

Mary had a littele dress
A dainty one and airy,
It didn't show the dirt a bit
But, wow, how it showed Mary!

* * *

She: Oh darling, the baby swallowed the matches. What will we do?
He: Here, use my cigarette lighter.

* * *

"I was a spy."
"Did they shoot you?"
"I don't know. I was blindfolded."

* * *

"Tell me, is this good perfume?"
"It's one of our best smellers."

* * *

"They say bread contains alcohol."
"That so? Let's drink a little toast."

"Doesn't your wife miss you when you stay out till three in the morning?"
"Occasionally—but usually her aim is perfect."

* * *

1st Coed: "Give me a man with a past. A man with a past is always interesting."
2nd Coed: "That's true; but I don't think he's nearly as interesting as a man with a future."
3rd Same: "I like a man with a present."

* * *

"Doesn't that soprano have a large repertoire?"
"Yes, and that dress she has on makes it look worse."

* * *

"Broken off your engagement to Mary?"
"She wouldn't have me."
"You told her about your rich uncle?"
"Yes. She's my aunt now."

* * *

Judge: "And what did you do when you heard the accused using such awful language?"
Policeman: "I told him he wasn't fit to be among decent people, and brought him here."

* * *

Employer: "What do you mean by telling me that you had seven years experience in a bank when you never held a job before?"
College Grad.: "Well, you advertised for a man with imagination."

IT'S BEEN LIKE THAT EVER SINCE PETE BOUGHT THE TECHNOGRAPH!!

the Illinois Technograph

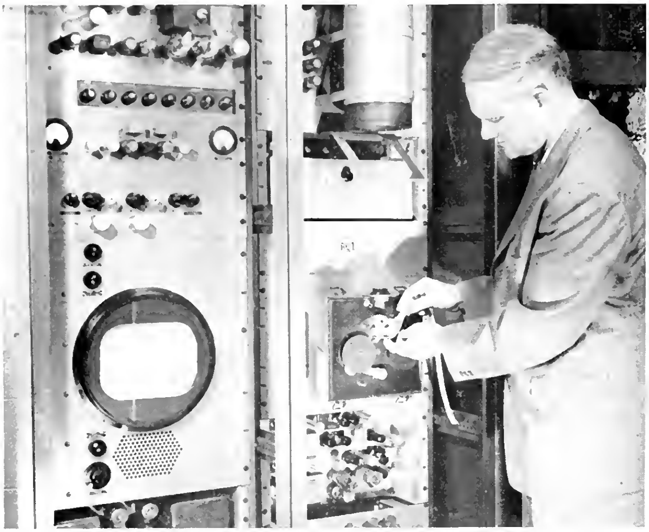
MAY, 1949

★

TWENTY-FIVE CENTS

New Developments

By Leonard Ladof, E.E. '49
and Henry Kahn, Ch.E. '50



C. J. Young of the RCA laboratories loads the camera which copies the incoming messages received by the Ultrafax equipment in front of him. (Photo courtesy of R. C. A.)

"Ultrafax"—A Million Words A Minute

Ultrafax, a newly developed system of television communications capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute, was demonstrated publicly at the Library of Congress recently.

The system is a development of R.C.A. laboratories, in cooperation with the Eastman Kodak company and the National Broadcasting company. Basically the operation combines the elements of television with the latest techniques in radio-relaying and high-speed photography. Any languages or line drawings may also be transmitted by this medium.

Future possibilities of Ultrafax are numerous. Homes equipped with television sets could, with proper attachments, print the daily newspaper broadcasts without interrupting the programs being viewed. Military departments would find a ready use for the system. The transmission could be scrambled for secrecy and still handle with only one transmitter, in ten minutes, the peak load of communication that passed through the Pentagon building during a single war day.

New Porcelain Enamel Testing Machine

The department of ceramic engineering has just received a machine for giving an accelerated service test under simulated refrigerator lining conditions, it was announced by Dr. A. I. Andrews, head of the department. The unit consists of a cabinet having space for ten one-foot-square enameled panels which are alternately cooled on one side by a refrigerator then heated on the other side by infra-red lamps in the presence of moisture. Each cycle takes two minutes and in one week, it is estimated that the machine will duplicate conditions in a cold-wall type refrigerator for one year.

R. J. McEvoy, assistant in ceramic engineering, will make these studies as a research problem for an M.S. thesis. The machine was designed and built under the supervision of Mr. L. H. Davidson, project development engineer of the American Central corporation at Connersville, Indiana.

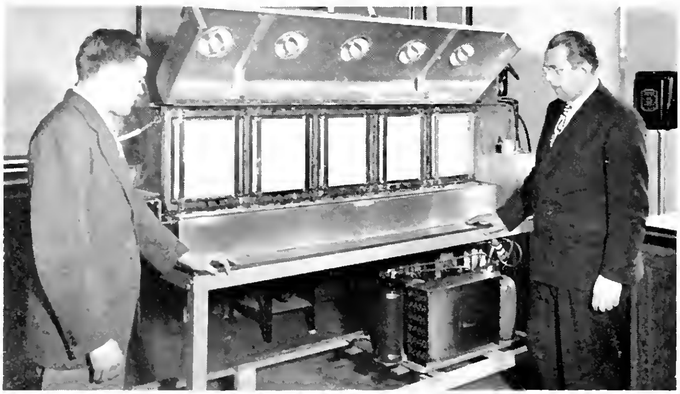
An Ultra-Sensitive Photo Emulsion

Kodak research laboratories have developed a new emulsion for nuclear track plates which is four times as "fast" as the company's previous emulsions of this type.

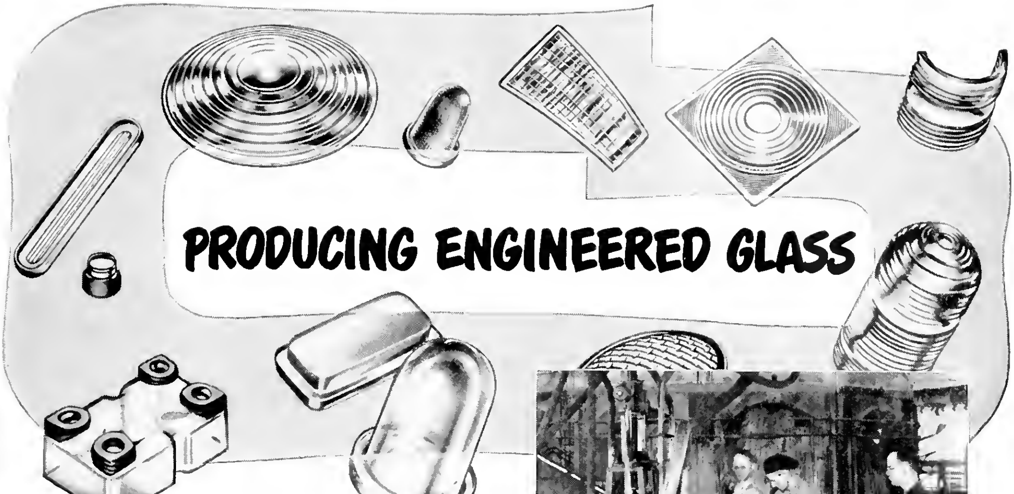
This emulsion is, in fact, so sensitive, that it must be protected from cosmic rays, which are constantly bombarding the earth. This protection, at present, consists of decreasing the sensitivity by cooling with dry ice to —79° C.

Dr. John Spence, in charge of research on the new emulsion, commented

(Continued on page 38)



R. J. McEvoy, assistant in Ceramic engineering (left) and L. H. Davidson, of American Central Corporation, inspect the new testing machine for porcelain-enameled steel, which was recently installed in the Cer.E. department.



PRODUCING ENGINEERED GLASS

Modern Techniques Employed by KOPP GLASS, INC. Illustrate Effective Utilization of GAS

Molten glass from the Gas-fired regenerative furnace (rear) is placed in the mould for pressing.

Continuous Lehr in which GAS is used for annealing signal and industrial glass products.

ENGINEERED GLASS—produced for signal, technical, and industrial purposes—involves small-batch operations and specialized glass-making practices. At Kopp Glass, Inc., Swissvale, Pa. engineers have applied modern production machinery to these highly technical processes, utilizing flexible GAS for all heating requirements.

As large users of fuel, Kopp executives are concerned with the operating economies made possible by effective utilization of GAS in modern Gas-fired Equipment. But equally important is the automatic controllability of GAS for the varying temperatures used for melting, annealing, tempering, mould heating, in this specialized glass business. The importance of GAS in the Kopp plants is stressed by the wide range of equipment using this efficient fuel—

- 2 pot-type regenerative furnaces
- 2 special heat treating lehrs
- grinding and polishing plate heaters
- 4 day tank furnaces
- 3 annealing lehrs
- 1 mould oven
- 2 pot arches
- 2 ring ovens
- 1 cut-off machine
- 1 trial-pot furnace

In commenting on the use of GAS for heat-processing in the manufacture of engineered glass, supervisor of Equipment J. B. Fullen says, "The automatic controllability and the speed of GAS are of great importance, but we can't overlook the cost of fuel in our type of operation. That's why we use every device for effective utilization of GAS."

You'll find it worthwhile to investigate modern Gas Equipment for heat-processing in glass manufacturing.

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the Illinois Technograph

Volume 64 — Number 8

The Tech Presents

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ARTICLES

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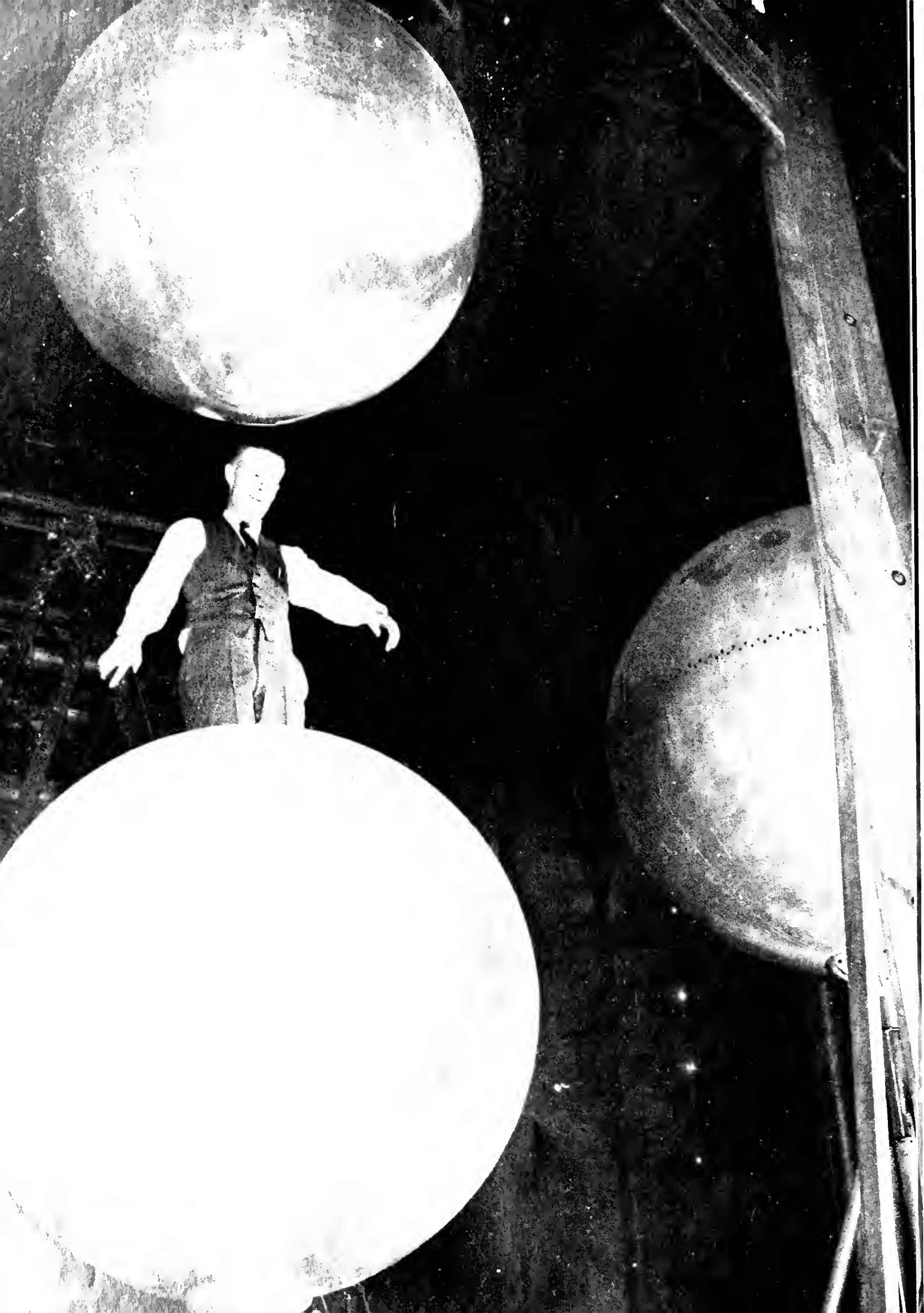
DEPARTMENTS

OUR COVER

Dean-Elect William L. Everitt (left) shakes hands with retiring Dean Melvin L. Enger at the first annual All-Engineering Convocation at which they were featured speakers. (Photo by Ralph Zuccarello.)

FRONTISPIECE

J. H. Hagenguth, engineer in charge of General Electric's high-voltage laboratory, stands framed between three huge sphere gaps, preparing to set off a 10,000,000 volt charge of man-made lightning. (Photo courtesy of General Electric.)



The Thermistor, Simple and Rugged

By Leonard Ladof, E.E. '49

Thermistors are made of semi-conductors which are extremely sensitive to slight temperature changes. Variations in temperature as small as one thousandth of a degree centigrade can be measured with the use of a thermistor. These control devices are made from a mixture of metal oxides under very precise procedures, as the resistance of the materials can vary by factors up to a thousand or a million with surprisingly small amounts of certain impurities, with heat treatment, or with methods of making contact.

LEONARD LADOF

Leonard Ladof, a senior in electrical engineering, combines extensive practical experience with theory in his field. He has worked in the radio field since 1936, and served three years in the Navy as a radio technician.

Born in Chicago on May 17, 1913, Len started his college career in 1929 by taking two years of pre-med. The medical profession's loss was the engineering profession's gain when, after a 15-year absence, he decided to return to school. Len is a member of Sigma Tau, Eta Kappa Nu, Chi Gamma Iota, and A.I.E.E.-I.R.E.

To be generally useful in industry the thermistor should meet these requirements:

1. Mass-produced units should have the same characteristics.
2. Ability to maintain constant characteristics during use; the contact should be permanent and the unit should be chemically inert.
3. The units should be mechanically rugged.
4. The technique of manufacture should be such that the material can be formed into various shapes and sizes.
5. The unit should cover a wide range of resistance, temperature coefficient, and power dissipation.

Production Methods

The methods of production include: melting the semi-conductor, cooling and solidifying, cutting to size and shape; 2) evaporation; 3) heating compressed powders of semi-conductors to a temperature at which they sinter into a strong compact mass and firing on metal powder contacts. While all three processes have been used, the third method has been found to be most generally useful for mass production. This method is similar to that employed in ceramics or in powder metallurgy. At the sintering temperatures the powders re-crystallize and the dimensions shrink by controlled amounts. The powder process makes it possible to mix two or more semi-conducting oxides in varying proportions and obtain a homogeneous and uniform solid. It is thus possible to cover a considerable range of specific resistance and temperature coefficient of resistance with the same system of oxides. By means of the powder process it is possible to make thermistors of a great variety of shapes and sizes to cover a large range of resistances and power handling capacities. The most common forms are beads, rods, discs, washers and flakes.

In designing a thermistor for a specific application, the following characteristics should be considered: 1. Mechanical dimensions including those of the supports; 2. The material from which it is made and its properties. These include the specific resistance and how it varies with temperatures, the specific heat, density, and expansion coefficient; 3. The dissipation constant and power sensitivity. These constants are determined by the area and nature of the surface, the surrounding medium and the thermal conductivity of the supports; 4. The heat capacity which is determined by specific heat, dimensions and density; 5. The time constant. This determines how rapidly the thermistor will cool or heat. If a thermistor is heated above the surrounding temperature and then allowed to cool, its temperature will decrease rapidly at first and then more slowly until it finally reaches ambient temperature. The time constant is the time required for the temperature to fall 63 per cent of the way toward ambient temperature; 6. The maximum permissible power that can be dissipated consistent with good stability and long life, for continuous operation and for surges. This can be computed from the dissipation constant and the maximum permissible temperature rise. This and the resistance-temperature relation determine the maximum decrease resistance.

Even though the thermistor, or thermally sensitive resistor, was discovered only about 15 years ago, industry has already found important and large scale uses for the device.

Some of the uses, as explained in this article, are as time delay devices, protective devices, voltage regulators, thermometers, and temperature control devices, pressure gauges, flowmeters, and detecting elements for very small amounts of radiant power. Thermistors are simple, small, rugged, have a long life, and require little maintenance. Because of these and other desirable properties, thermistors promise to become new circuit elements which will be used extensively in the fields of communications, radio, electrical and thermal instrumentation, and research in physics, chemistry, and biology.

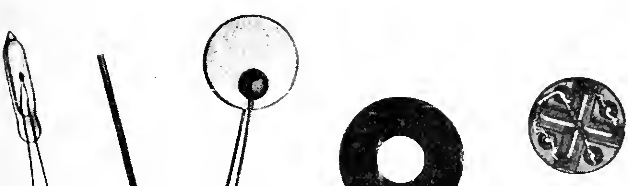


Fig. 1. Thermistors can be manufactured in a variety of forms as (left to right) beads, rods, discs, washers, and flakes. (Photo courtesy of General Electric.)

Properties of Semi-Conductors

As most thermistors are made of semiconductors it is important to discuss the

(Continued on page 20)

THE CONVOCATION

By Dean R. Felton, C.E. '51

DR. WILLIAM L. EVERITT

The Winners

M. Z. Krzywoblocki	Aeranautical
D. G. Carter	Agricultural
R. C. Hay	Agricultural
N. D. Margan	Architectural
A. W. Allen	Ceramic
R. L. Cook	Ceramic
T. Baron	Chemical
W. E. Hanson	Civil
M. S. Helm	Electrical
S. G. Hall	G.E.D.
E. D. Luke	Mechanical
E. J. Eckel	Metallurgical
W. R. Chedsey	Mining
F. W. Loomis	Physics
G. R. Tape	Physics
O. M. Sidebottom	T. & A. M.

CARL FALK

Honorable Mention

H. S. Stillwell	Aeronautical
R. I. Shawl	Agricultural
E. F. Tath	Architectural
F. V. Toaley	Ceramic
W. M. Campbell	Chemical
E. R. Bretscher	Civil
D. E. Glum	Electrical
J. K. Tuthill	Electrical
M. B. Reed	Electrical
L. D. Walker	G.E.D.
B. O. Larson	G.E.D.
D. H. Krans	Mechanical
J. R. Fellows	Mechanical
B. G. Ricketts	Metallurgical
G. B. Clark	Mining
R. A. Becker	Physics
W. E. Black	T. & A. M.

"An historic occasion," in the words of Dr. Stoddard was the first annual All-Engineers' Convocation held Friday, April 8, 1949, in the Auditorium.

Sponsored jointly by the Engineering Council and the Illinois Technograph, the convocation was the first assembly of its kind here at the University. The program began with music presented by the First Regimental Band under the direction of Everett D. Kisinger.

Carl W. Falk, president of the Engineering Council, opened the ceremonies with a short introduction and presentation of Dean Melvin L. Enger, head of the College of Engineering and Professor W. L. Everitt, head of the electrical engineering department.

Highlighting the convocation was the announcing of the awards to the winners of the most effective teaching contest by Ed Witort, editor of the Illinois Technograph. Dean Enger made the presentations. The teachers were voted these awards by the junior and senior students of the College of Engineering in a recent poll.

The main address was presented by Dr. George Stoddard, president of the University of Illinois. Dr. Stoddard's address was concerned with the value of effective teaching and stressed that although many teachers were awarded certificates for the most effective teaching, that this by no means detracted any merits from the rest of the instructors. No single method of conducting

(Continued on page 34)

The sixteen instructors voted "most effective" in the recent contest line up on the Auditorium stage after receiving their awards. The list of winners above reads from right to left. (Convocation photos by Ralph Zuccarello.)

Dr. Everitt: Dean-Elect

By Robert Lawrence, E.Phy. '51

Doctor William Littell Everitt, head of the University of Illinois department of electrical engineering since 1944, will become dean of the College of Engineering next September.

Professor Everitt, widely known as one of America's foremost authorities on electronics, has been appointed by the board of trustees to succeed Dean Melvin L. Enger. Dean Enger has reached the retirement age of 68, and will step down as dean of the college on September 1, 1949.

Dr. Everitt's appointment was influenced by his broad experience of teaching, writing, and pratical work. He served in the U. S. Marine Corps in World War I and joined the Signal Corps reserve in 1922. He received his bachelor degree in electrical engineering from Cornell university the same year. He was also a member of the teaching staff at Cornell from 1920 to 1922.

In the summer of 1920, he was an engineer for the New York Telephone Co., and from 1922 to 1924 was employed as a telephone engineer for the North Electric Manufacturing Co., at Galion, Ohio. The following two years Dr. Everitt was an instructor at the University of Michigan. He obtained his M.S. degree there in 1926 and went to Ohio State university as assistant professor of electrical engineering. He received his doctor's degree there in 1933 and in 1934, was appointed professor of electrical engineering.

Dr. Everitt chose the communications branch of electrical engineering early in his college career. He remained active in the Signal Corps reserve and rose to the rank of major by 1936. He became a member of the communication section of the National Defense Research commission in 1940, and in 1942 obtained a leave of absence from Ohio State university to serve as director of operational research in the office of the chief signal officer, War Department, Washington, D. C.

In carrying out this vital research, Dr. Everitt's principal dealings were with the Air Corps operators from whom he learned the results of the radio and radar equipment supplied by the Signal Corps and determined what improvements were necessary.

WILLIAM LITTELL EVERITT

In recognition of his exceptional performance in this research, Dr. Everitt was presented with the Exceptional Civilian Service Award in May, 1946, by General C. H. Arnold.

The citation on the certificate states, "His outstanding contribution in devising methods and procedures improving Signal Corps equipment and the accompanying instructional literature and improvements in the technical training program resulted in better utilization of radar equipment."

General Arnold emphasized these outstanding duties performed:

"Doctor Everitt developed and improved methods and procedures which accomplished results for the War Department by directing a staff in a thorough investigation in IFF Mark III (identification, friend or foe) and in devising corrective procedures which improved the efficiency in IFF from 70 per cent to 97 per cent; in preparing prototype manuals of preventative maintenance on Signal Corps equipment; in preparing a report on radio wave propagation that showed how each fundamental factor of a radar set effected the maximum range; in developing a new type antenna for use with L. F. Loran; in preparing a handbook 'Fundamentals of Radar A. J.' which furnished basic engineering design information on anti-jamming; in developing a method of measuring the velocity and drag of rockets by use of radar; in devising methods of training radio code operators; and in collaborating with the assistant chief signal officer; Dr. Everitt reviewed the course in electricity at the U. S. Military Academy and recommmended fundamental changes in the course that placed stress on electronics."

Dr. Everitt was named to head the electrical engineering department here in 1944, succeeding Professor Ellery P. Paine, and was granted an automatic leave from the University to continue his Army work

Since he came to Illinois, intensive new research programs in electronics have been inaugurated, such as the new vacuum tube research laboratory, and contracts from the Army and Navy departments for resarch work have been made.

The department has increased research on ultrasonics to include detection of infra-red rays and the effect of ultrasonics on nerve tissue and bacteria. Other improvements include a program to give assistance to other departments using electrical measuring instruments, and a revised curriculum for electrical engineers.

Several electrical inventions have been developed by Dr. Everitt, which include a counting relay chain and other automatic telephone equipment, a frequency modulation radio altimeter, and several antenna matching and feeding systems. He has also developed high-power radio amplifier principles.

As a recognized authority on electronics, he has written a number of books. Among them are *Communications Engineering* and *Fundamentals of Radio*. He wrote the section of "Telephone and Telegraphy" in the *Standard Handbook for Electrical Engineers*, and has written and published many articles on radio engineering and communication that have appeared in various technical publications.

Dr. Everitt has been active in several engineering societies and organizations. He has been president and director of the Institute of Radio Engineers and has given lectures before more than forty sections of the Institute. He has been a member of the electronics committee of the joint Research and Development Board of the National Military Estab-

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I SEE YA TALKIN'

By Avery Hevesh, E.E. '49

The concept of "voice writing" is not a new one. Many of us are familiar with the complex wave trace representing speech visually on the screen of an oscilloscope. Motion picture sound tracks portray the characteristics of voice or music by a pattern of light and dark areas on film. These methods and several others achieve the display of what may be called "visible sound." On many occasions it may be desirable to analyze the sound in order to learn more about the complicated combination of single frequencies that blend to form audible sensations.

Usually, the interest lies in splitting sound into its separate fundamental frequencies and their attendant harmonic frequencies. Unfortunately, none of the sound patterns produced by the methods mentioned above lend themselves to easy analysis. Harmonic analysis in the laboratory may be done by picking out single frequencies from a steady state complex wave. Separation is accomplished by sending the wave through a series of narrow filters, each of which selects a single frequency or a small group of adjacent frequencies. Graphical methods of Fourier analysis may also be applied to a complex wave form, but the mathematical labor is usually discouraging when speech is concerned. In any event, conventional methods of analysis are found to be impractical due to the equipment or effort involved.

Here is presented a survey of the historical development and results achieved with a new device which started off as a research instrument for sound analysis. The device finds one of its most important uses in the training of the deaf to "read" sound and learn to speak effectively—some for the first time.

Still another limitation that may be found is the clear presentation of all the dimensions of speech. While frequency and relative amplitude may be shown by some of the analyzing methods, the third variable, a chronological time order, is either obscured by the display or neglected entirely. The time dimension is supplied by the memory in aural reception, and to some extent in visual discrimination. In the latter it is commonly known as persistence of vision. It has been found, however, that visual analysis is much easier when the time sequence is included. Since speech energy varies with frequency and time, three-dimensional models may be constructed which correctly show the energy distribution as a function of its two variables. All three basic dimensions are required in order to learn new facts in the study of sound; but it would be quite inconvenient to work with solid models. Therefore, one of the problems related to the sound display is that of representing three independent variables on a plane surface. The new process of visible sound, using the sound spectrograph, accomplishes this successfully.

AVERY HEVESH

Avery enrolled in L.A. when he arrived here at Illinois but later switched to electrical engineering. The change seems to have agreed with him, for he attained membership in Tau Beta Pi, Sigma Tau, Eta Kappa Nu, and joined the A.I.E.E.-I.R.E.

After completing the communication option this June, Avery is planning to work for a while in development work before starting graduate school.

Development of the Spectrograph

From studies on speech distortion in telephone circuits, it was realized at the Bell Telephone Laboratories in New York that no device adequately fulfilled the requirements of sound analysis. The first model of a sound spectrograph, designed to overcome the aforementioned disadvantages, was built at Bell and produced patterns that were crude—by present standards of detail—but the initial step had been made. Several years of steady improvement in the device followed. Further refinements were made at Haskins Laboratories in New York in connection with the development of reading machines for the blind. The patterns produced by the latest spectrographs simplify sound analysis considerably and introduce some entirely new applications.

It was appreciated rather early during these developments that the methods of "reading" sound would be of considerable interest to the deaf, since the spectrograph would present sound visually. "Voice writing" is an apt description of the process of learning to recognize the visual counterparts of spoken words and sentences.

Thus, there are two fields of interest that merge in the study of visible speech. The scientist, who is interested in sound anaylsis, is concerned with the detailed patterns that represent speech or other audible sound. Those interested in the problems of the deaf are concerned with the modulations of speech that carry intelligence—that is, readability of the patterns. Accordingly, two general types of spectrographs have grown out of the basic model. One deals with permanently recorded pat-

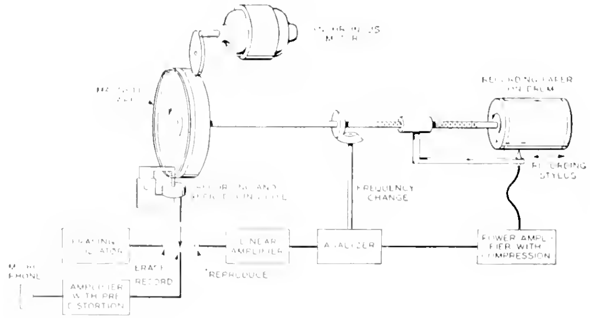

Fig. 1. The Bell spectrograph records sound on a magnetic tape drum and transfers it, separated into frequency bands, to a sensitized paper for a permanent record. (Courtesy of Bell Telephone laboratories.)

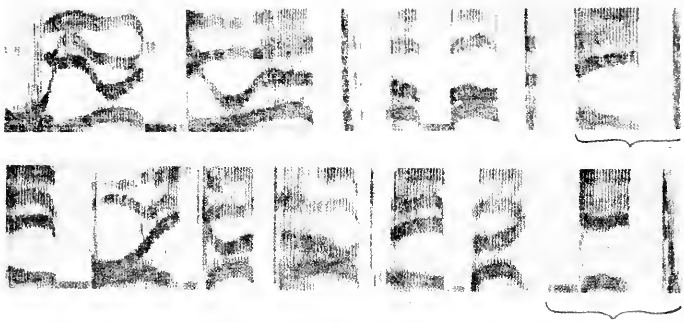

Fig. 2. Two spectrographs of ordinary speech made on recent machines are shown above. The sentence recorded on the upper strip is, "We are due at about eight,." and on the lower, "A boy got out a back gate." The words "eight" and "gate" are bracketed for comparison. (Courtesy of Bell laboratories.)

terns suitable for analysis and study; the other provides transient patterns suitable for visual hearing.

Permanent Spectrograms

Figure 1 represents a block diagram of the basic Bell spectrograph for producing permanent patterns. Two spectrograms made with recent machines are shown in Figure 2. Two of the variables are represented by the coordinate axes. Frequency is shown along the vertical axis with the high frequencies at the top and the low frequencies at the bottom. Time sequence is indicated along the horizontal axis and proceeds from left to right. The third variable, intensity, is shown by the varying shades of gray. Even at first glance the pattern resolves itself into a form that is readily retainable in the memory. The dark bands that appear on the spectrograms are regions of mouth cavity resonance.

In the Bell instrument the speech is recorded on a rotating loop of magnetic tape. Transfer of the sound from there to the sensitive paper is a delicate process that involves synchronization. The frequency axis on the recording drum is horizontal; and since the time axis is around the circumference, a point on the magnetic tape corresponds to a point on the time axis around the drum. The magnetic tape is constantly rotated to give a repeated reproduction of the initial speech. The sound is then separated into 60 different wave bands by the analyzer, and each band is fed into the power amplifier. For one revolution of the magnetic tape only one wave band actuates the recording stylus. For the next revolution the stylus moves horizontally and records the impulses in the next wave band. This process continued until the whole range of frequencies is covered.

The Haskins device is almost identical except that the record tape is replaced by a single-groove record of the desired sound and a photographic film is used on the recording drum. Here again, the sound to be pictured is played repeatedly through the scanning filter, which moves slowly across the frequency spectrum from 100 cycles to about 4,000 cycles. A high-intensity electron spot is produced on the screen of a small cathode-ray tube where an optical system focuses it upon photographic film in a light-tight drum. The cathode-ray tube is actuated by the sound which passes through the analyzer, and the intensity-modulated electron spot produces upon the film a progressive spectrogram as each sweep cycle is recorded.

The advantage of using film on the recording drum is that a greater range of intensity variation is possible. The maximum and minimum power levels of normal speech are on the order of 100,000 : 1. The amplifiers used with the Bell instrument cover most of this range, but the whole recording system is limited by the 12 db. sensitivity of the recording paper. There is a much wider latitude to the density range of film, and levels up to 50 or 60 db. are not uncommon. Thus, better dynamic range in the film spectrograph leads to more faithful reproduction of sound patterns. However, even with the wide sensitivity range, some signal compression is necessary to reduce the effect of the excessive contrast that appears in human speech.

The two spectrograms shown in Figure 2 were produced by a unit using wide band-pass filters to reduce unnecessary detail and raise the readability level, or "discrimination index." Each word stands almost as a unit in itself, since single-syllable combinations were used primarily. Notice the similarity in the words "eight" and "gate" in the respective patterns. The visual pictures of these two words are almost identical except for the low frequency resonance bar (the dark band) at the beginning of the word "gate." The vertical striations are caused by beats between adjacent harmonics.

To show still more conclusively the ease of recognition, Figure 3 is included. Here, the same sentence was spoken by four subjects from different regional areas. It is apparent that the speech similarities are greater than the differences. Although no two individuals have identical voice characteristics, visible speech as considered here does not emphasize the dissimilarities. The variation of pattern shapes for different people has been described in much the same way as the variation of handwriting among individuals.

The spectrogram patterns used for illustration here have been chosen to represent one of the most complex of sounds—that of human speech. Yet the adaptability of the equipment to other types of signals is quite feasable and many studies have been made of sounds other than speech. Such varied sounds as those of bird songs, machinery, noise, and even snoring are exposed by spectrographic study.

Spectrograph work has made possible the reproduction of many sounds

(Continued on page 30)

Fig. 3. Shown above are four spectrographs of the phrase, "We are here," spoken by subjects from four regions: upper left, general American; upper right, English; lower left, eastern American; lower right, southern American. (Courtesy of Bell laboratories.)

New Headquarters for Chem Engineers

By Art Dreshfield, Ch.E. '51

The opening of the new chemical and chemical engineering building this fall will mark another major addition to the expanding engineering facilities on the Urbana campus.

Started in September, 1947, the building is now practically completed and ready for the installation of equipment, most of which will be moved in and assembled during this summer. By the beginning of the fall semester, the chemical engineering department will move in, and, for the first time, will be housed in a building designed for their needs.

This building has five floors plus a basement, sub-basement, and penthouse, and contains over 100,000 square feet of floor space. An elevator transverses the entire height of the structure, except the penthouse, and a tunnel connects the sub-basement with Noyes laboratory and Chemistry annex.

Unit Operations Lab

One of the outstanding features of the building is the unit operations laboratory, which will replace the present inadequate facilities in Noyes laboratory. A large amount of equipment now scattered in several places will be installed here, and much new equipment is now on order.

This laboratory will have 3,600 square feet of floor space, and will extend through three stories. Mezzanines of iron grilling, five feet wide, will run completely around the laboratory at nine-foot intervals, making three additional operating levels besides the main floor. Thus the entire 40 feet of headroom will be easily available for those without heart trouble.

Adjoining this laboratory and the elevator shaft will be another shaft which will extend to the top of the building. It will give a space over 70 feet high to be used for distillation columns or other unusually tall equipment.

The laboratory will be used primarily by students in the laboratory courses in unit operations—Ch. E. 372 and 374, but it will also be available to others who wish to make use of some of the equipment or to take advantage of the high clearance.

One of the completely new items in this laboratory is a single effect evaporator which is 20 feet long, 11 feet wide, and 12 feet high. It has vertical tubes and a 20-inch diameter tank, built to be operated at pressures ranging from 10 pounds vacuum to 15 pounds gauge; it can be operated as a forced circulation evaporator or as a natural circulation long-tube evaporation unit. With the pumps by-passed, it can also be used as a rising film or a falling film unit, or as a flash type evaporator.

All motors on it will be explosion proof, so that it can be used with a wide variety of substances under greatly varying conditions. With it, students will be able to study heat transfer and evaporation and processes in detail.

Another new piece of equipment is an 11-foot-high, six plate distillation column. It is a foot in diameter and made of bronze. Operating at pressures up to 100 pounds gauge, it, too, is very versatile, and will be useful for studying distillation processes with various liquids and at several capacities.

Two other new units are also planned for this laboratory. One is a stainless steel rotary filter, 18 inches in diameter, with a 12-inch face. It will replace the old Oliver filter which is now being used. The second is to be a rotary tunnel drier, a piece of equipment looking and operating somewhat like a rotary kiln, but at much lower temperatures.

Besides this, there will, of course, be much other equipment. Thickeners, driers mixers, and all the usual equipment found in a unit operations laboratory will make this one very complete.

An overhead crane running the full length of the laboratory and extra-large doors which open directly onto a driveway will make the task of installing and moving equipment much easier.

Other Features

Across the hall from the unit operations laboratory will be the crushing and grinding room. While nothing new has been ordered, it will have a large stock of equipment. This includes ball mills, disc pulverizers, hammer mills, a jaw crusher, roll crusher, gyrating crusher, shaker screens, and other items which will be capable of processing stones and powders ranging from three-inch diameters down to pigment sizes.

Separate electric motors will be mounted on each piece of equipment, eliminating much of the noise and trouble formerly caused by the shaft and belt drives. Locating all this equipment in a separate room will eliminate abrasive dusts from the shops and from other laboratories where it could damage bearings and machinery.

A high pressure laboratory on the first floor will contain many new innovations. A pit six feet below the floor level of the main laboratory is provided for somewhat hazardous equipment to keep it off the main operating level; and there will be new and old safety cubicles made of quarter-inch boiler plate.

Two new compressors will be placed in this laboratory. One will be a five-

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The new Chemistry and Chemical Engineering building at the corner of Matthews and California streets is nearing completion. Photo by Al Augustyn.)

Room 50, the big basement motor-generator laboratory in the new E. E. building, is shown above. (Photo by Jack Chandler.)

E. E. Building Dedication

By Luther Peterson, E.E. '51

At last! The formal dedication of the new electrical engineering building will take place on May 20, 1949.

After many years of planning, the new electrical engineering building will officially become part of the engineering campus. Extensive and interesting programs are planned for the three-day dedication with alumni as guests.

To make this dedication a memorable and educational affair, several talks on various scientific topics, pertaining mostly to the field of electrical engineering, will be given. These talks and discussions will be divided between the two main interests of the dedication—the symposium, and the general sessions.

The symposium, whose theme is "Expanding Frontiers in Engineering," will consist of four sessions. In these sessions, timely topics such as "electron and ion dynamics," "semi-conductors," and "statistical problems in electrical engineering" will be discussed.

The general sessions will deal mainly with the training of electrical engineers. To cover this subject adequately it will be divided into three main topics—the "electrical engineering curriculum," "post graduate training in industry," and "the approach to a research problem."

In order that these subjects be properly discussed, well known speakers from General Electric, Massachusetts Institute of Technology, Carnegie Tech, Nela Park Laboratory, National Bureau of Standards, RCA Laboratory, Bell Laboratory, and of course, representatives from our own University of Illinois will be present; in fact, Mr. E. S. Lee, president of the A.I.E.E., will be the keynote luncheon speaker. To round out such a splendid program, President G. D. Stoddard will speak at the dedication ceremony and the genial department head, Professor W. E. Everitt, will close the celebration.

Interspersed among these various events will be very important dinners and luncheons.

It might be worthwhile noting that the engineering students will be dismissed from their E. E. classes. Of course, the idea of no classes might make some students feel "blue," but due to the fact that a dedication is held only once in the lifetime of a building, the E. E. department feels that lack of instruction for a few days won't be too disastrous. On the other hand, the E. E. department has contemplated holding a few classes for a few engineers to display the "brilliance" that has befuddled the instructors for years.

Included in the program is the inevitable tour of the new building—to give the College of Engineering a chance to "expand its chest."

The New Internal Combustion Laboratory

By Art Dreshfield
Ch.E. '51

Next fall another north campus building will be ready for use by the engineering students. It is the new mechanical engineering building at the corner of Green and Mathews streets. This new unit will contain several laboratories in addition to classrooms and offices. A good part of it will be ready for the 1949-50 school year, and the rest should be completed in time for use in the fall of 1950. Of special interest to all mechanical engineers is the new internal combustion engine laboratory which will occupy part of this building.

This laboratory will be of approximately the same size as the present engines laboratory, about 100 feet long and 40 feet wide. In it will be much new equipment. It will contain five new 150-horsepower dynamometers, which can be run at speeds up to 6,000 r.p.m. Five new motors are on order which will be connected to these. One is an International Harvester U.D.-6 Diesel; another a General Motors two-cycle, three-cylinder motor; a six-cylinder Chevrolet motor; a Kettering V-8 Oldsmobile motor; and a new Plymouth motor. All of these are 1949 models, so students will be using the latest equipment available.

Two 150-horsepower motoring dynamometers will also be installed, one running up to 3,500 r.p.m. and having a Walker-Shaw test engine attached, while the other will be used for testing centrifugal superchargers.

There will also be much equipment for testing motor accessories and parts. Tests will be made on magnetos and generators, on water, oil, and fuel pumps, and on carburetors and carburetor flow.

Two other large installations will also be in the main laboratory. One is a two-cylinder Atlas Imperial engine equipped with a Prony brake. This was formerly in the old mechanical engineering laboratory, but will be moved. The other is a gas turbine, made at the University from a turbosupercharger and a turbo-jet unit. Eventually a more conventional turbine may be bought which will replace this.

All of this apparatus is located in the main laboratory, where it will be used by undergraduate students taking courses in internal combustion engines. This will not replace the present engines laboratory, which contains mostly steam equipment, but will serve to augment it and to make more facilities available to student engineers.

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In This Corner... NAVY PIER

St. Pat Visits Navy Pier

By Robert Lessin, M.E. '51

On March 18, 1949, in the Grand Ballroom of the Edgewater Beach hotel, the Chicago branch of the University held its first annual St. Pat's Ball. Sponsored by the newly formed Engineering Council, the highlight of the evening was presentation of the *R. P. Hoelscher* Award. The award is given to the engineering society that contributes the outstanding achievement of the year. This year the award went to the Penalears through the efforts of Frank Hoelterhoff for designing the Council emblem.

The original dance was established in 1934 as an annual affair for the engineers at the Urbana campus. This dance is patterned, in part, after the annual affair held Downstate.

Approximately 250 couples danced till one o'clock to the danceable music of Eddie James and his orchestra. Some of the features of the dance were the Grand March during the latter part of the evening and the introduction of the heads of the various engineering societies. The bids—a shamrock with a slide rule center—were unusual and aroused interest from all who were present.

The general chairman of the ball was Roy Peterson, C.E. '51. M. C. for the evening was Gordon Knudson, M.E. '51, who had much to do with the original formation of the council.

It is hoped, in the years to come, that the dance will be presented at the climax of an engineering show held here at Navy Pier.

Gordon Knudson presents the R. P. Hoelscher award to Richard Welden of the Penalears.

PIER PERSONALITIES

By John Fijolek, Eng. Phys. '51

DEAN R. P. HOELSCHER

As every engineer at the Pier knows, Room 184 near the east end is one of the control points in his college career. When he wishes to change his curriculum, to alter his records in any way or to explain why so many D's slipped in among those more pleasing first three letters of the alphabet, he knows a trip to room 184 is almost inevitable. But, besides his records, he knows this room houses one of Navy Pier's leading personalities, Dean Randolph P. Hoelscher, associate dean of engineering science and professor of general engineering drawing.

Not every Pier engineer has seen or met Dean Hoelscher but they have all heard of him. Due to his many duties and the great number of engineering students present at the Pier, only the last has been possible. He is readily accessible to all who have business requiring his personal attention. To those, who by their past conduct required corrective advice, certainly he appeared formidable; but to others who came seeking relief from excessive burdens and who needed support for student projects and activities, he has been an able and willing counsellor. His efforts have enabled the Pier engineering societies to grow and function more efficiently.

Before he achieved his present position of trust and responsibility, however, he had origins elsewhere. Randolph Philip Hoelscher was born in Evansville, Indiana, on December 12, 1890. He received his B.S. in civil engineering at Purdue in 1912, his M.S. in civil engineering at the University of Illinois in 1927 and his civil engineering from Purdue in 1929. He has been a member of the faculty since 1918 in various capacities at the University of Illinois, where he came after two years as an instructor of physics at Baldwin Wallace college in Berea, Ohio. Before this, he had spent four years with George L. Mesker and company of Evansville, Indiana, as a structural engineer.

In addition to his teaching and administrative work, he has become well-known in engineering and educational circles through his authorship of technical textbooks, notably "Engineering Drawing," "Essentials of Engineering Drafting," "Teaching Mechanical Drawing," "Graphic Aids in Engineering Computation" and "Industrial Production Illustration."

He has participated actively in various organizations through membership in the Kiwanis, ASCE, ASME, AIEE, Tau Beta Pi and Triangle. He has been president of several of these organizations, is now chairman of the committee on commencement at the Urbana campus as well as secretary of the University Senate. In addition to being a member of several other important councils and committees, he is a licensed structural engineer in the state of Illinois. In the past year, the Pier branch of Phi Eta Sigma, recognizing his talents and popularity among the students, elected him to honorary membership in that organization.

RANDOLPH HOELSCHER

All of the above facts added to the personal information that he married in 1914 and has two children, show that the head of the engineering college at Navy Pier is a likeable, approachable human being and truly an outstanding Pier personality.

ENGINEERING SOCIETIES

By Bob King, C.E. '51

A.S.C.E.

There were 150 members and prospective members present at the chapter's meeting on February 22 . The topic of the meeting was "Summer Survey Camp" for '49. Dean Hoelscher was the guest speaker and movies taken at the summer camp last year were shown. The Dean discussed the camp in general and announced that a scholarship was to be awarded by the Civil Engineering society to one of its members for use at camp this summer.

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Undercover at . . .
GALESBURG

MR. HOWARD C. NELSON
By Robert D. Giffrow, E.E. '52

One of the men who was instrumental in launching a successful engineering department at this Galesburg division is our drawing instructor, Mr. Howard C. Nelson.

Since the initiation of the division, Mr. Nelson has become a familiar figure to the engineering students, most of whom met him either in the descriptive geometry or mechanics of machinery classes.

Mr. Nelson's position as a competent instructor is fortified by several extra years of schooling. That he was interested in obtaining a diversified education was illustrated by the fact that he attended several colleges while intermittently teaching. He was a student at Illinois Wesleyan university, Illinois State Normal, and finally the University of Wisconsin, from which he receiv his B.S. in industrial education. His formal education did not stop there,

HOWARD C. NELSON

however, for he then attended the University of Illinois, where he received his M.S. degree—also in industrial education.

As a result of this keen interest in education he has written three books on woodworking projects and mechanical drawing. In his attempts to convey his ideas to the student he has written innumerable articles for various magazines.

Before arriving here in the fall of 1946, Mr. Nelson was an instructor at the LaSalle-Peru and Monmouth high schools and Monmouth college for a total of 29 years. These years of experience have made him a valuable asset to the University, for they have enabled him to make a clear presentation of engineering curriculum to the student.

Proof that Mr. Nelson's knowledge and abilities have not gone unnoticed is found in the fact that he is listed in *Who's Who in American Education.* He is also a member of two honorary educational societies—Phi Delta Kappa and Kappa Delta Pi.

His earnest ability to help the student, coupled with his warm personality, has surely made Mr. Nelson a man that every engineer on the Galesburg campus should know.

Curriculum Planning Made Easy
By Roger Franzen, G.E. '52

The problem of planning what courses to take has been greatly simplified for engineering students here by the development of a chart called the flow sheet.

The flow sheet is a blue print designed to serve as a guide to engineering students in determining what courses lie ahead and what the prerequisites to these courses are. In addition, by using the legend in the lower left hand corner of the flow sheet, engineering students are able to keep a record of the courses that they have completed and to keep an account of their grades and credit hours.

The flow sheet was formulated at the Galesburg campus by Professor Fred Trezise, chairman of engineering sciences at the division. They have been placed in the possession of all Galesburg engineering students and their advisers, and are expected to appear on the Urbana campus before long.

The flow sheet has a unique feature, in that it consists of only one paper which gives any desired information at a glance, thus eliminating the bother of thumbing through the University catalog. A series of evenly distributed squares along with arrows and dotted lines conveys the information contained in the sheet. Each square is labeled to represent a specific course.

A directed arrow from one square to another indicates that the square from which the arrow originated is a prerequisite to the square (course) to which the arrow is pointing. For instance the square representing Rhetoric 101 has an arrow leading from it to the square representing Rhetoric 102, indicating that Rhethoric 101 is a prerequisite to Rhetoric 102.

A dash line connecting two squares indicates that a prerequisite can be taken concurrently with the course. For example, the dash line between Math 132 and Physics 103 indicates that Math 132 is a prerequisite for Physics 103 and that it can be taken concurrently.

Mr. Trezise has adapted a flow sheet to fit the needs of every engineering student at Illinois, regardless of the type of engineering he is studying. Each curriculum has been divided into various options and a flow sheet has been prepared for each specific option. For example, the flow sheet for "Mechanical Engineering-Production Option" would differ in some ways from the "Mechanical Engineering-Design Option" sheet.

Since most students have difficulty in understanding curriculum requirements as set down by the University catalog, and since there is a possibility that advisers may mistakingly encourage students to take unrelated courses, it seems that the flow sheet could be valuable as a guide to everyone concerned.

Its graphic illustration of prerequisites and requirements leaves little chance for uncertainty.

"Lumber Men Go to School"
By Jack Keefner, E.E. '52

A temporary twist has been added to the curriculum at the Galesburg campus in the form is a lumber dealers' short course, sponsored by the Illinois Lumber and Material Dealers' Association in cooperation with the extension division, University of Illinois. The students who attend this course are lumber dealers, or prospective lumber dealers from Illinois and adjacent states, all of whom have had experience in their field.

These lumber men are ideal students. Lively discussions follow each lecture, indicating the desire of the men to learn everything the course has to offer. Their dividends, anything that will make their yards run more smoothly or make the boss raise an eyebrow of approval, will be realized more quickly than those of the regular college student. Also, an honest desire to help ease present day conditions is a major factor.

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The Engineering Honoraries and Societies

By Bill Soderstrum, Cer.E. '52

A.S.A.E.

Our representatives on the farm front give a most amazing financial report. The balance reported at the February 28 meeting was $500. A large part of this came from the Farm and Home lunch stand profit.

At the February meeting the members of A.S.A.E. also selected committees for the promotion of "George Mahoney for St. Pat." If you have been keeping up the events on the Engineering campus, you should know how successful that committee was.

At their March 28 meeting, the agriculture engineers listened to Mr. Louis B. Howard, professor of food technology. Mr. Howard addressed the group on "What is Food Engineering?"

Officers for the spring semester are William Fletcher, president; Richard Sharp, vice president; Warren Harris, secretary; and Robert Camp, corresponding secretary.

A.I.E.E.-I.R.E.

Looking forward to that job after graduation, the electrical engineers received with enthusiasm the talk given by Mr. C. M. Henderson, member of the General Motors college relations staff, at the March 2 meeting of A.I.E.E.-I.R.E.

Business conducted at this meeting included the election of Norton Bell as corresponding secretary for I.R.E. and Dick Wurzburger as Engineering Council representative.

During the month of March the A.I.E.E. sponsored a student opinion poll. The subject of the poll was "too many class hours for the amount of credit given." Results are not yet available.

At the March 31 meeting, Mr. Howard L. Clark, development engineer for General Electric, was the guest speaker. Mr. Clark spoke on the type of work done in the general engineering and consulting laroratory of General Electric in Chicago.

KERAMOS

Keramos, the ceramic engineering honorary society, elected 17 students to membership. Of the 17, 10 were juniors, one a sophomore, and six were graduate students. These men were entertained at a smoker held on April 17. Pledge week for the neophytes was observed from April 11 to April 14. These pledges were finally initiated on April 21.

CHI EPSILON

The new officers have been chosen for Chi Epsilon. At a meeting held in Engineering Hall on March 16, 1949. This society elected Ronald D. Collins, president; John D. Goodell, vice president; Philip Sikes, treasurer; Floyd E. Brown, secretary; and William B. Sands, corresponding secretary.

At this time Prof. Ellis Danner gave a talk on "Future Highway Development in Illinois." Petitions were also approved at this time for establishing chapters at the University of Connecticut, the University of Virginia, and the University of Michigan. Refreshments were served after the meeting.

A smoker, held on March 28, acquainted the members with the new pledges and vice versa. At an initiation banquet held in the early part of April, the acceptable pledges were taken into the fraternity.

M.I.S.

Dr. A. B. Cleaves addressed some 75 members and guests of the Mineral Industries Society on "Geological Engineering on the Pennsylvania Turnpike" at the February 16 meeting of M.I.S. Dr. Cleaves of Washington University worked on the Pennsylvania Turnpike as a geological engineer. He is also a mining engineer.

At the March 9 meeting, Mr. Paul Wier spoke on "The Young Engineer and the Coal Industry." Mr. Weir of Penn State has his own coal company in Chicago. The highlight of this meeting was the presentation of a watch to George Eadie by Mr. Weir. Mr. Weir is president of the Old Timers club which each year presents a watch to the outstanding graduate in mining engineering.

The meeting for this month will be replaced by the annual Spring Picnic.

C.I.E.

People seem to be the same all over the world. The Chinese are just as much influenced by a pretty girl as any American. Proof of this lies in the fact that Miss Shook-May Young, the only woman member of the Chinese Institute of Engineers at Urbana, was elected its president for the spring semester.

The election was held at a meeting in the University YMCA on February 19. Speakers at this meeting and their topics were as follows: Mr. M. T. Chang, "Railway Yard"; Mr. T. S. Yen, "Ceramic Industry"; and Mr. H. C. Hu, "Vacuum Tube." Each one of the speakers is working for his doctor of philosophy degree in his particular field.

Sixteen of the 80 members received their master of science degrees at the end of last semester. They are Mr. Chang, Chi-Shih; Mr. Pang, Dick-Noe; Mr. Chen, Chia-Yung; Mr. Chai, Chang-Ba; Mr. Jean, Jia-Hung; Mr. Lee, Dah-Hsuan, Mr. Li, Kou-Jun; Mr. Lee, Zur-Kong; Mr. Pan, Sai-Lung; Mr. Sun, King-Sang; Mr. Liu, Chen-Hua; Mr. Mei, Hsien-Hao; Mr. Tu, Yu-Ching; Mr. Chao, Mein; Mr. Wang, Ronald Hung-Chao; and Mr. Chin, Te-Ning.

I.E.S.

Mr. G. K. Hardaire, manager of commercial sales for the Public Service Co. of Northern Illinois, was the guest speaker at a joint meeting of I.E.S., and the A.I.E.E.-I.R.E. in Gregory Hall on March 9.

Mr. Hardaire, a past president of I.E.S., spoke on "What the Young Engineer Should Expect After Graduation." He also presented the local chapter a charter as an official acceptance of the student chapter into the national I.E.S.

At the meeting of March 30, Mr. Knudstrup, chief commercial engineer for the Electro Manufacturing Co. in Washington, D. C., spoke on "Design and Application of Fluorescent Lighting Equipment." Other business conducted during this past semester included nomination and election of officers for next semester and the annual picnic.

Most of the I.E.S. members went to Chicago to attend the third International Lighting Exposition and Conference at the Stevens Hotel on April 1.

Greatness stands upon a precipice, and if prosperity carries a man ever so little beyond his poise, it overbears and dashes him to pieces.—Seneca.

Introducing . . .

By Henry Kahn, Ch.E. '50 and Alfreda Mallorey, M.E. '52

Chalmers W. Sherwin

Chalmers W. Sherwin, now associate professor of physics, came to the University of Illinois two and a half years ago after completing graduate work at the University of Chicago.

During the war, Mr. Sherwin spent five years working with radar at M.I.T., devoting most of his attention to radar displays, especially the ones

CHALMERS W. SHERWIN

used to conduct blind landings. After leaving M.I.T., he spent a few months working at Columbia university and at the present time he can be found working in his office on the top floor of the Physics building.

Having done work with electronics and radiation, Mr. Sherwin became interested in a new particle, the neutrino, believed to be present in the nucleus of the atom. When asked how the presence of the neutrino was determined, he explained, "It is as simple to understand as the sophomore physics problem, 'what happens when a bullet is fired from a gun?' " The bullet is hurled into space with a force equal and opposite to the recoil of the gun. Now, suppose there was a second bullet. This bullet would represent the neutrino and would be fired with the first. It would disrupt the forces so that the force between the gun and the first bullet would no longer be in a straight line. Mr. Sherwin's extensive research proved that the pull between an atom and an electron is not in a straight line; therefore the presence of a third force, caused by the neutrino, is necessary.

When not working at his office or the class room, one can find him at home with his wife and four daughters reading, especially books on philosophy and religion; experimenting with photography; or studying his newest semantics discovery.

MRS. M. C. BARBER

"I have the best job at the University," Mrs. Barber, secretary of the architecture department, remarked; and that is, to say the least, unique.

Mrs. Barber was born in 1906 at Nokomis, Illinois. In 1920 she moved to Urbana. Soon after her marriage in 1927, she started her career in the architecture department as a clerk-stenographer to L. H. Province, who was succeeded by Dr. T. C. Bannister as head of the department last Steptember.

The connotation of secretary of the architectural department is certainly not comprehensive enough to cover all the duties of Mrs. Barber. In 1932, she started a system of graduate records, which are used for the placement of students. She also helps in the publishing of an annual newsletter which is sent to former students, among whom are famous men like Charles Luckman, president of Lever Brothers, and Max Abramovitz, United Nations architect.

In addition to her official duties Mrs. Barber has been very active socially. She has served on the clerical council and the non-academic social committee. She is also serving as treasurer of the Civil Employees Council to which she has been elected for the third time. Another one of her interests has been non-academic civil service classification.

MRS. M. C. BARBER

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronounciation. From the group of words at the right, select one whose meaning closely resembles the word on the left. Answers will be found on page 38.

1. ASCETIC—(a) austere, (b) ill at ease, (c) uncouthness, (d) sickly
2. PROLIXITY—(a) ambition, (b) overabundance, (c) precise, (d) redundancy
3. CLEMENCY—(a) kindness, (b) rigor, (c) exoneration, (d) control
4. SUPERFLUITY—(a) paucity, (b) freely flowing, (c) excess, (d) indulgence
5. PICAYUNE—(a) Dixie, (b) type of candy, (c) of little value, (d) large
6. IMPORTUNATE—(a) unlucky, (b) chaste, (c) impotent, (d) troublesome
7. COMPLICITY—(a) inspiration, (b) complexity, (c) tact, (d) silence
8. ABATOIR—(a) slaughterhouse, (b) monastery, (c) pigpen, (d) brewery
9. PROPENSITY—(a) inclination, (b) hatred, (c) wealth, (d) coy
10. NOMENCLATURE—(a) equipment, (b) type of architecture, (c) probability, (d) classification of names
11. DOGMATIC—(a) brazen, (b) meek, (c) dictatorial, (d) slow-moving
12. ASSUAGE—(a) to seek, (b) to satisfy, (c) to open, (d) to kill
13. TRANSCENDING—(a) surpassing, (b) going across, (c) flowing (d) traveling
14. APPELLATION—(a) star, (b) name, (c) beauty, (d) foil fencing
15. ENNERVATE—(a) to unnerve, (b) to dispose of (c) to invigorate (d) to enforce

EDWIN A. WITORT
Editor

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

Fore and Aft . . .

As the present school year nears completion, it might be well to look over the past eight or nine months' activities of the "north side of the campus." While reminiscing, our thoughts will naturally stray to the '49-'50 term, and perhaps by applying a bit of "engineering analysis," we will arrive at some interesting predictions concerning next year's activities.

The professional and honorary societies affect the majority of engineering students and, as a result, are responsible for consuming more of our time than any other one organization on the campus. Practically every engineering society was successful in their undertakings this year. Membership boomed, and attendance at meetings, smokers, and other events was well above average. Several societies reached the highest membership in their history. This success was probably due to the members' realization of the benefits received by participation and to the societies' success in setting up an interesting and educational program for the year.

At present, an investigation is underway to determine the feasibility of having the dean's office coordinate the meeting dates of all engineering societies. If this plan is put into effect it should prove to be very beneficial. Engineering Council business will be able to progress at a rapid pace and society programs of general interest will not conflict with meetings of other societies.

St. Pat's Ball, the "Effective Teaching Contest," and the "All-Engineering Convocation" were among the events sponsored by the Engineering Council, the latter two events in cooperation with the Technograph.

The attendance at St. Pat's Ball, although not large percentage-wise, indicates that Huff Gymnasium will again be used for the affair next year. The society displays, bigger and better than last year's, played an important part in attracting the engineers and their dates. Probably a little more emphasis on the Queen Contest and displays during the time of ticket sales next year would attract many more than this year.

The favorable comments, unsolicited, concerning the Effective Teaching Contest and Convocation indicate clearly that both events will be continued next year. A larger vote will be cast, if more publicity is given to this worth-while project.

At the time of this writing, it is still undecided whether the "Electrical Show" or "Engineering Open House" will be presented next spring. The Engineering Council, sponsors of the Open House in past years, has been given the privilege of deciding which show will be presented. Because the Council attempted to arrange for the Open House this year, it is logical to assume that it will be presented next year, if the "precedent" of Electrical Show on even numbered years—Open House on odd number years—is overlooked.

At any rate, with all the above mentioned events taking place, and possibly a few extra events, brought about by energetic students, the '49-'50 school term appears to be one that shouldn't be missed.

All this brings us to the point where we realize that not one of these events can be a success without the whole-hearted cooperation of every engineering student. It is the student's duty, to himself and other students, to see to it that every ounce of effort is expended to make each and every endeavor of the societies, the Engineering Council, and other student organizations a complete success. We should all strive to bring about an engineering student body that is closely meshed. So close, in fact, that all activities of the organizations of the college are common knowledge to all engineering students. Then we will be certain that ours is a "North Campus—second to none."

THERMISTORS . . .

(Continued from page 7)

properties of the latter. A semi-conductor may be defined as a substance whose electrical conductivity near or at room temperature is much less than that of typical metals but much greater than that of typical insulators. While no sharp boundaries exist between these classes of conductors, one might say that semi-conductors have specific resistances at room temperature from 0.1 to 10^9 ohm-centimeters. Semi-conductors usually have high negative temperature coefficients of resistance. As the temperature is increased from 0° C., to 300° C., the resistance may decrease by a factor of a thousand. Over this same temperature range the resistance of a typical metal such as platinum will increase by a factor of two. The resistance temperature curves for the two common types of thermistor materials are shown in Figure 2. Material No. 1 is produced by the powder metallurgy methods and is composed of manganese and nickel oxides. The specific resistance of this material is approximately ten times that of the No. 2 material at room temperature. This material is used when high resistance and stability at high temperatures are desired. Material No. 2 is the same as the No. 1 material except for the addition of cobalt oxide. The No. 2 material is used in applications where low resistance and limitations on physical dimensions are important. Some types of thermistors have been developed which have a temperature coefficient of electrical resistivity as great as 1.5 per cent per degree centigrade. Since the specific resistance of these electronic devices cover a wide range, considerable flexibility of design is possible.

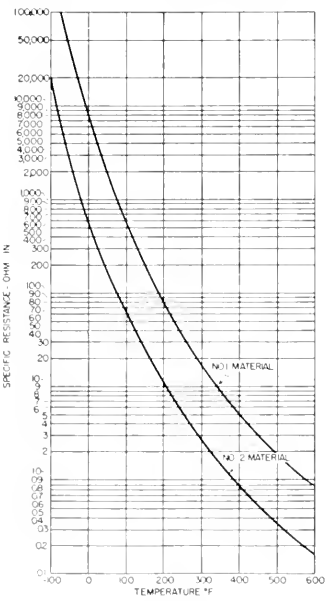

Fig. 2. Resistance - temperature curves for No. 1 and No. 2 G.-E. thermistors. (Courtesy of General Electrical.)

A thermistor will pass a current proportional to the applied potential difference when the current is low and no heating of the element is effected. However, when the current is of sufficient magnitude the thermistor will heat up internally. There is a corresponding decrease in resistance allowing more current to flow. The final magnitude of the current must be limited by the resistance of the exterior circuit.

The change in resistance does not occur instantaneously with variations in ambient temperature. Nor does it vary simultaneously with current but rather with the thermal capacity of the element. This time delay characteristic is useful in many applications. By proper design of the circuit and the thermistor it is possible to vary the time delay from a few milliseconds to several minutes.

Operation and Uses of Thermistors

The operation of a thermistor, as has been indicated, is a function of the change in resistance. It is surprising that the versatility of the device can result from a temperature dependent resistance characteristic alone. However, this effect produces a very useful nonlinear volt-ampere relationship. This relationship and the great flexibility in shape and size results in the application in diverse fields. The variables of design are many and inter-related, including electrical, thermal and mechanical dimensions.

The more important uses of thermistors as indication, control and circuit elements will be discussed, grouping the uses as they fall under the primary characteristics: resistance-temperature, volt-ampere, and current-time, or dynamic relations.

The resistance-temperature phase has been mentioned but the variation in resistance may be accomplished by three methods. 1. External—by changes in the temperature, pressure, conductivity, or velocity of the matter surrounding the thermistor.

2. Direct—by internal resistance heating brought about by passing a current through the thermistor.

3. Indirect—by controlled heating of the thermistor body using an external source of heat, such as resistance coil, to produce the desired ambient temperature.

The large value of the temperature coefficient of thermistors permits a new order of sensitivity to be obtained when the usual principles of resistance thermometry are followed. Thermistor thermometers have long time stability which is good for temperatures up to 300° C. and excellent for more moderate temperatures. A well-aged thermistor used in precision measurements was found to be within 0.01° C. of its calibration after two months use at various temperatures up to 100° C. Conventional bridge or other resistance measuring circuits are commonly employed with thermistors. In the application shown in Figure 3 the current passing through the element is

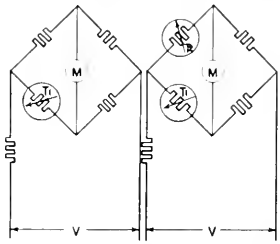

Fig. 3. Absolute and differential temperature measurement using thermistors. (Courtesy of General Electric.)

kept low so that no appreciable self-heating occurs. The instrument is calibrated and read as a thermometer since the resistance of the thermistor is solely dependent on the ambient temperature.

Since thermistors are readily designed for higher resistance values than metallic resistance thermometers or thermocouples, lead resistances are not ordinarily bothersome. Hence the temperature sensitive element can be remotely located from its associated measuring circuit. Variations in temperature may be transmitted automatically from distant locations by wire lines or by radio. This is especially helpful in meteorological studies and permits the study of several different temperatures by one operator. For the temperature of objects which are inaccessible, in motion or too hot for contact, thermometry can be determined by permitting radiation from the object to be focussed on a suitable thermistor by means of an ellipitical mirror.

The use of thermistors for temperature control purposes is closely related to their application as temperature measuring devices. The high temperature sensitivity previously mentioned makes the thermistor ideal in this respect. For most applications the thermistor is inserted in a simple relay circuit such as shown in Figure 4. As the temperature increases, there is a corresponding increase in current through the element. At a predetermined current value, the thermistor actuates a relay which in turn operates equipment controlling temperatures. As before, care must be taken not to permit

(Continued on page 22)

THERMISTORS . . .

(Continued from page 20)

self-heating of the thermistor. This application is used in aircraft engines, refrigeration, chemical and food processing, air conditioning systems, and heating systems.

The volt-ampere and allied resistance power characteristics have resulted in the use of thermistors as sensitive power measuring devices and as automatically variable resistances for output amplitude controls for oscillators and amplifiers. To permit their use in these applications for d-c as well as a-c circuits, non-polarizing semi-conductors alone are employed in thermistors. The small capacitive effect of the thermistor and its ability to stand severe overloads without change in calibration and its ease of calibration with d-c or low-frequency power have a special use in ultra- and very-high frequency ranges as power measuring elements. For this application the thermistor is used as a power absorbing terminating resistance in the transmission line, which may be of Lecher, co-axial, or wave-guide form.

In previously discussed applications of the thermistor, care was taken to limit the current passing through the element to avoid self-heating. However, in use as a vacuum gage the heating power as generated by the copper loss is employed. The temperature of the element will rise until it reaches a state of equilibrium as determined by the rate of heat transfer to the surrounding medium.

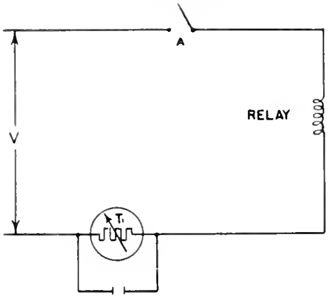

Fig. 4. Time delay relay circuit employing a thermistor. (Courtesy of General Electric.)

The inherent thermal inertia of the thermistor, previously described, makes for a good time delay device. In Figure 4 a typical circuit is shown. When switch A is closed, the initial current is limited by the cold resistance of the thermistor. As the current continues to flow through the element, self-heating takes place and resistance is lowered. This increases with reduced resistance, and at a predetermined value of current, the relay is actuated. Time delay characteristics of the thermistors are modified by changes in ambient temperature and self-heating of the element. This is accomplished by short circuiting the element as soon as the relay is pulled up. This permits the element to cool immediately and it is soon ready for re-use.

The uses of the thermistor as outlined are but a few of the many applications of this versatile unit. At present the thermally sensitive resistor has probably excited more interest as a major electric circuit element than any other except the vacuum tube. Laboratory use of thermistors as oscillators, modulators, and amplifiers for the low frequency and audio range foretell an even wider circle of activity for this fairly recent discovery.

Man must be disappointed with the lesser things of life before he can comprehend the full value of the greater. —Bulwer.

The probability that we may fail in the struggle ought not to deter us from the support of a cause we believe to be just.—Abraham Lincoln.

Car speeds on main rural roads last year averaged 46.8 miles an hour, as compared to the prewar average of 47.1 miles an hour.

"Madame X" was the code name, during research and development, for an entirely new system of recorded music . . . perfected by RCA.

The remarkable background of "**Madame X**"

Now the identity of "Madame X", the unknown in a long search for tone perfection, has been revealed. From this quest emerges a completely integrated record-playing system—the first to be entirely free of distortion to the trained musical ear . . .

The research began 11 years ago at RCA Laboratories. First, basic factors were determined—minimum diameters, at different speeds, of the groove spiral in the record—beyond which distortion would occur; size of stylus to be used; desired length of playing time. From these came the mathematical answer to the record's speed—45 turns a minute—and to the record's size, only $6\frac{7}{8}$ inches in diameter.

The record itself is non-breakable vinyl plastic, wafer-thin. Yet it plays as long as a conventional 12-inch record. The new RCA Victor automatic record changer accommodates up to 10 of the new records—1 hour and 40 minutes of playing time—and can be attached to almost any radio, phonograph, or television combination. The record *player* ends faulty operation, noise, and cumbersome size. Records are quickly changed . . . RCA Victor will still supply 78 rpm instruments and records.

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- Design of component parts such as coils, loudspeakers, capacitors.
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- Design of receiving, power, cathode ray, gas and photo tubes.

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Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

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CHEM BUILDING . . .

(Continued from page 12)

stage compressor handling five cubic feet per minute, and up to 15,000 psi. The other, a hydraulic pump, will develop pressures up to 30,000 psi. There will also be a high pressure gas storage shelter. All of the equipment which is now located in the high pressure laboratory situated near the Physical Plant building will be moved into the new laboratory.

No classes will be scheduled to use this laboratory, as it will be used to continue the research program which has been conducted at the University for over 20 years. Much work has been done on the behavior of gases at high pressures and near the critical point, and on high pressure reactions and syntheses. This has already resulted in the discovery of much important information, and the new laboratory should prove to be an aid in further work.

There will be a compressor room, for student use, adjoining the unit operations laboratory. The main compressor unit there will deliver 300 cubic feet of air per minute at 125 pounds gauge; and there will also be other smaller units, two fans, and a cycloidal blower.

Two other laboratories, intended primarily for research, are the new electrochemical and electroplating rooms. However, these will be used in conjunction with the unit projects laboratory. In them will be the complete pilot plant equipment for electrolytic operations. There will be standard tanks up to 35 and 50 gallon capacities, and a large trough in the floor to facilitate washing plated parts and handling solutions.

Students studying unit processes will henceforth use the new unit process laboratory in this building. It will be equipped with a distillation column and pilot plant equipment. There will be two floor levels in this laboratory, with two working mezzanines of iron grillwork located in one part. It will also contain conventional laboratory benches, and in addition, specially designed pipe frameworks on which the students will erect equipment for their own projects.

The process and development laboratory is also two stories high. Direct connections to the stacks through the walls are available. Equipment now located in a laboratory in the Abbott power plant will be transferred here.

The new instrumentation laboratory is designed completely for undergraduates in chemical engineering. In it will be 10 benches, each equipped with compressed air, vacuum, gas, electricity, and hot and cold water outlets. All students taking Ch.E. 267 will use this laboratory.

A new feature included in this building is the computing rooms, which are situated on the third floor. Here, small groups of students will be able to work together in evaluating data and calculating results of laboratory experiments. Eventually, most of these will contain a computing machine.

There are many smaller laboratories in the new building which are designed for special purposes. A boiler water research room will be set up and equipment from the present frame building on North campus will be moved into it. A low temperature room in which temperatures as low as —40 degrees Fahrenheit can be maintained, a constant temperature room, and a constant humidity room, are other new features.

Other new facilities for chemical engineering include a drafting room for the equipment design course, Ch.E. 381, a blue printing room, two dark rooms, machine shops, a furnace room, and a small kitchen.

There are also about 20 research rooms, ranging in size from 8 x 15 feet to 20 x 30 feet. They will have no special apparatus, but each will contain a bench and a pipe framework.

Three new class rooms, about 10 offices, a seminar room, and a lecture hall accommodating 200 students will furnish additional lecture and discussion space.

The building is designed for the chem-

(Continued on page 26)

CHEM BUILDING . . .

(Continued from page 24)

ical engineering and the biochemistry divisions. The latter will use the fourth and fifth floors, and will have a laboratory on the ground floor. A room will be completely equipped for running Kjedahl nitrogen analyses, and there will be available space for working with rats. There will be quarters for keeping and feeding them, an operating room, a metabolism room, and a general experiment room. The offices of this division will also be moved to the new building.

This building should prove to be a definite aid to much of the research which has been conducted at the University, and will provide better laboratory facilities for undergraduates. Students and faculty will have at their disposal a variety of new chemical engineering equipment, and modern quarters in which to use it.

If we achieve by hard work the thing we labor for, the enjoyment we receive is tenfold.—Ben Temple.

What sunshine is to flowers, smiles are to humanity. They are but trifles, to be sure; but, scattered along life's pathway, the good they do is inconceivable.—Addison.

M. E. LAB . . .

(Continued from page 13)

Besides the main room, there will be two smaller ones, each about 30 feet by 30 feet, which will be used by graduate students. Each will contain a 250-horsepower dynamometer. A six-cylinder, Continental, 145-horsepower, air-cooled engine will be attached to one of these dynamometers. Much equipment will be available for regulating the conditions under which the motor is running. Intake and exhaust pressures can be regulated, and the temperature of the intake air can be varied from −40° to 150° Farenheit. The quantity and humidity of intake air can also be regulated, so that conditions from below sea level to above 20,000 feet, and from the tropics to the poles can be simulated.

Two smaller rooms, one a fully equipped shop and the other a calculating room, will adjoin the laboratories and thus increase their usefulness. With all this equipment available, student engineers may look forward to improved combustion engine laboratory courses, making use of the best and most recent equipment.

A proverb is a short sentence based on long experience.—Cervantes.

NAVY PIER . . .

(Continued from page 14)

A.S.M.E.

During the past semester this organization has swelled its ranks and now has a total membership of 169. This has probably been one of the busiest semesters that the organization has in its records. They have been active in the formation of the Engineering Council and have had a full program. Some of the recent lectures the group has heard were by Mr. Schiebel of the Magnaflux corporation on the subject of "Non-destructive tests with Magnaflux and Zyglo," and Mrs. J. Pierce, secretary-treasurer of the Chicago section of the A.S.M.E., on the subject of "A Graduate Engineer's First Job." Many movies and field trips have also highlighted the program, and the officers of this organization would like to thank all the people that helped make this past semester's program a success.

A.I.E.E.

Election of officers was held at the meeting of February 22, with the following results: Harry Quinn, president; John Doering, vice president; Don Jackson, secretary; Steve Cook, treasurer; and Dale Hileman, Council representative. Dr. Harris was present as guest speaker and discussed, in his inimitable fashion, "Adventures in Research."

At the meeting held on April 5th, Mr. Edward J. Wolff, a consultant engineer, spoke on "Professional Engineering License Laws" and "Coordination of Engineer and Architect on a Project."

NAVY PIER STAFF

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Louis Krawczyk

Mr. Ogden Livermore, *Faculty Adviser*

A young woman found a delightfully secluded, beautiful, quiet pool. Warm from her walk, she decided to take a plunge.

To dry herself she leaned back upon the soft, mossy bank. Suddenly she heard a noise and thought it must be one of the neighbor's little boys. So she called, "How old are you, little boy?"

A voice replied, "Ninety-six, dammit!"

DU PONT Digest

For Students of Science and Engineering

TEN UNIVERSITIES TO BENEFIT BY GRANTS FOR UNRESTRICTED FUNDAMENTAL RESEARCH

With a view to stock-piling basic knowledge, the Du Pont Company has announced a program of grants-in-aid for the college year 1949-50 to 10 universities for unrestricted use in the field of fundamental research in chemistry.

The grants-in-aid of $10,000 each are to be used for research that has no immediate commercial goal. The universities themselves are to select the projects in which the grants will be employed, and results of the research are to be freely available for publication.

Du Pont's purpose in offering the grants is to help insure the flow of fundamental knowledge in science upon which the future industrial development of our country is so dependent. It is intended that the funds be utilized for such expenses as employing additional research personnel or lightening the teaching load of a professor who is eminently capable of research of a high order. They may also be expended for the purpose of obtaining supplies, apparatus or equipment.

This program of grants-in-aid is largely experimental. However, it is Du Pont's hope, should the program work out satisfactorily, to continue each grant for a period of five years.

The 10 universities to which grants-in-aid are being offered are California Institute of Technology, Cornell, Harvard, Massachusetts Institute of Technology, Ohio State, Princeton, Yale, Illinois, Minnesota and Wisconsin. Du Pont fellowships are also offered at these institutions.

Four of Many Outstanding Du Pont Fellowship Winners

STANLEY

MARVEL

WALKER

FAWCETT

Dr. Wendell M. Stanley, at University of California, is Chairman of the Department of Biochemistry in Berkeley and in the Medical School at San Francisco; Director of the Virus Laboratory. Bachelor's degree at Earlham College, 1926; M.S. at Illinois, 1927 and Ph.D. in Organic Chemistry, 1929. Honorary Doctor's degrees from five prominent American universities and the University of Paris. Has received more than 10 medals and awards for distinguished work in chemistry and biochemistry; co-recipient of the Nobel Prize in Chemistry in 1946. Du Pont fellow at Illinois in 1928-29.

Dr. Carl S. Marvel, Professor of Organic Chemistry at the University of Illinois since 1930. received his A.B. at Illinois Wesleyan University in 1915; A.M. at Illinois 1916 and Ph.D. in Organic Chemistry 1920; Sc.D. (honorary) at Illinois Wesleyan, 1946. President American Chemical Society, 1945; Director 1944-46. Has received numerous honors such as the Nichols Medal and memorial lectureships at outstanding universities. Du Pont fellow at Illinois in 1919-20. Consultant on Organic Chemistry to the Du Pont Company at present.

J. Frederic Walker is a Research Supervisor on formaldehyde products in the Electrochemicals Department. Trained at Massachusetts Institute of Technology. Awarded Bachelor's degree in Chemistry, 1925; Master's degree 1928, Ph.D. in Organic Chemistry, 1929. Author: "Formaldehyde Chemistry," "Organic Chemistry of Sodium," "History of Chemistry." Du Pont fellow in 1926-27.

Frank S. Fawcett is now doing synthetic organic research with Du Pont's Chemical Department. Received Bachelor's degree in Chemistry, Furman University, 1940; Master's degree Pennsylvania, 1944; Ph.D. in Organic Chemistry, Massachusetts Institute of Technology, 1948. Du Pont fellow at M.I.T. in academic year 1947-48.

77 DU PONT FELLOWSHIPS MADE AVAILABLE TO GRADUATE STUDENTS

Again in the academic year 1949-50, the Du Pont Company is awarding post-graduate and post-doctorate fellowships to universities throughout the country.

This is a continuation of the company's 30-year-old plan to encourage advanced studies in the fields of chemistry, physics, metallurgy, and engineering.

It is hoped that the plan will continue to help maintain the flow of technically trained men and women who will go into teaching and research work at the universities and into technical positions in industry. Some of them, as in past years, may come to work for Du Pont when they finish their studies, but there is no obligation to do so; fellowship holders are free to enter any field of activity they choose.

The students and their research subjects will be selected by authorities of the 47 universities participating. In this year's program, 45 of the post-graduate fellowships are in chemistry, 4 in physics, 15 in chemical engineering, 5 in mechanical engineering and 2 in metallurgy. There will be 6 post-doctoral fellowships as an incentive to those who would prefer to remain in academic work in order to obtain additional advanced training in chemistry.

What Fellowships Provide

Each post-graduate fellowship provides $1,200 for a single person or $1,800 for a married person, together with an award of $1,000 to the university towards tuition and fees. Each post-doctoral fellowship provides $3,000 for the recipient and $1,500 to the university.

(Continued from page 11)

in the laboratory. To duplicate a sound, one refers to the pattern and blends the proper frequencies in the proper proportions as indicated by the spectrogram. Experimental work has already begun on a "playback" unit that runs the spectrogram through a device and delivers the original sound. The objective is not to compete with disc, wire or tape recordings, since the expense of the unit is quite high. Rather, the idea is to make possible a playback of hand or machine-drawn patterns to produce any sound effect desirable—even that of speech. It is not unthinkable that music, for example, may be drawn by hand, and full orchestral effects achieved at a single stroke of the pen.

These examples tend to illustrate important aspects of permanent-pattern spectrograms, but there exists another field devoted to the study of transient patterns, a field that has drawn the interest of many investigators.

Translator Spectrograph

In order to realize the full potentialities of visible speech for the deaf, methods of instantaneous presentation of transient patterns were devised. The object was to present to the eye the ever-changing patterns of sound analogous to the sustained conversations of normal life. The devices constructed were to give a visual display of the same type of spectrogram that has been discussed previously, except that it would be instantaneous and continuous.

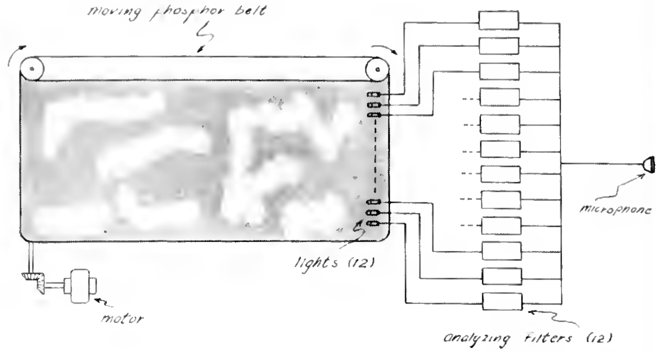


Fig. 4. A translator spectrograph is shown in the block diagram above. The pattern is made visible on the phosphorescent belt and is loter automatically "erased."

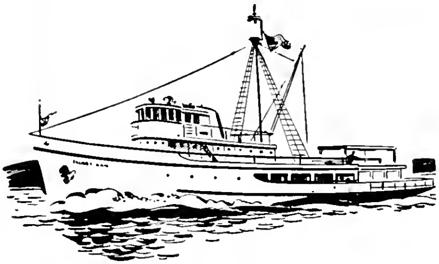
Two basic forms of instantaneous translators are in use today. One depends upon the patterns produced on a rotating screen by a new type of cathode-ray tube. The other, which has been built successfully in the form of a portable unit, presents the display on a moving belt of phosphorescent material. Both rely upon a number of fixed filters covering the frequency bands that were normally s c a n n e d in successive cycles by the permanent-pattern spectrograph. The detail achieved in the instantaneous patterns is necessarily limited by the number of filters used. For the purpose of readability, however, as few as 12 filters (each of 300 cycle band-pass) may be used to cover a spectrum of 3,500 cycles.

In Figure 4 is shown a block schematic diagram of the moving-belt translator. Speech input is fed to 12 fixed analyzing filters and the output of each filter is used to modulate a grain-of-wheat incandescent lamp. As the moving phosphor belt passes beneath the row of lamps, traces of light are produced upon the dark surface of the belt. This makes an instantaneous spectrogram of the input voice signal. Not shown on the reverse side of the belt are several infrared lamps which erase the phosphorescence that has passed the angle of vision. After this infra-red quenching the belt is ready to start another trip past the exciting lamps. Whereas the permanent recorder produced a pattern of gray against a white background or a photographic transparency, both the cathode-ray and the moving-belt translators give pictures of varying brightness against a dark background.

Encouraging results in visual hearing has led to development of large console translators that are suitable for group teaching of the deaf. These more recent devices are fundamentally the same as the belt translator just described, but make use of larger displays.

(Continued on page 32)

Another page for YOUR BEARING NOTEBOOK

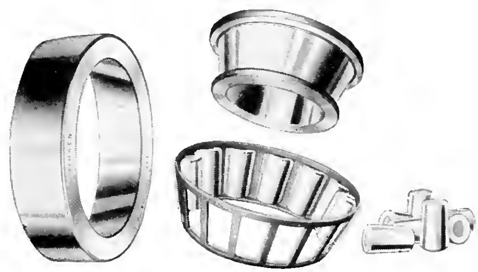


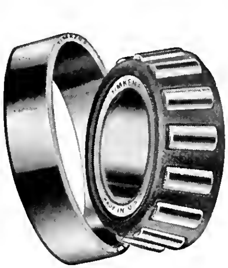
How to keep a hold cold

Both time and tuna are lost if the refrigeration unit breaks down while a fishing boat is at sea. Engineers insure dependability in sea-going ice machine compressors by specifying Timken® tapered roller bearings on crankshafts. Because of their tapered design, Timken bearings carry any combination of radial and thrust loads. With Timken bearings on the crankshafts, friction and lateral play are minimized. Shafts are held in rigid alignment. Wear and maintenance are reduced.

Why does TIMKEN® lead in bearing design?

The tapered roller bearing was pioneered by Timken and every important tapered roller bearing improvement since has been introduced by Timken. For example, Timken developed the one-piece multiple perforated cage to insure exact spacing of the rollers. And to provide positive roller alignment, Timken introduced wide area contact between the roll ends and the ribs. For almost fifty years this leadership in design has helped make Timken bearings first choice with engineers in every field.





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Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

SPECTROGRAPHS . . .

(Continued from page 30)

Results and Applications

Research has shown that the reading of printed material is accomplished by a succession of fixations in which the eyes focus briefly on a region of print and then move abruptly to fix attention upon the next group of characters. The results of reading tests show that the eye normally reads considerably faster than the average rate of speaking. There is, therefore, little time lag in reading speech with a visual translator.

The learning rate for the new "language" compares favorably with that for lip-reading. The process of visible speech, however, would permit the deaf to carry on telephone conversations where no amount of skill at lip-reading plays a part. As better training methods become available, there is little doubt that visual hearing instruction can be extended to cover the early school years of deaf children. The familiarity with visual patterns, if introduced at early ages, will lead to better facilities in reading sound.

Almost as important as reading sound is the ability for the deaf to speak and enunciate correctly. This has been one of the acute considerations for the totally deaf. Only in rare cases have the congenitally deaf been able to use their voices properly. Without the faculty of hearing one's own voice, there is a tendency for speech to degenerate and the voice to sound unnatural. This speech degeneration process has been observed to a marked degree in those whose hearing was lost some years after childhood. Conversation with such persons is difficult, and, in most instances, is nearly unintelligible.

The translators make it possible to show how a normal voice should sound; this has been of inestimable value in teaching the deaf to speak for the first time. In tests of congenitally deaf persons great progress has been made. Some

(Continued on page 36)

DR. EVERITT . . .

(Continued from page 9)

lishment since 1946. He is a fellow and a director of the American Institute of Electrical Engineers, a member of the American Society for Engineering Education, the Acoustical Society of America, Illinois Society of Professional Engineers, Theta Chi, Tau Beta Pi (National Executive Council 1935-36), Sigma Xi, Phi Kappa Phi, Eta Kappa Nu, Pi Mu Epsilon, Iota Alpha, Gamma Alpha, and Pi Tau Sigma.

For diversion from these activities he finds relaxation in his photography, and enjoys swimming and tennis.

This fall Dr. Everitt will be leaving what has grown, in recent years, to be one of the largest departments of electrical engineering in the country, to take over the leadership of the University's second largest college—surpassed in size only by the College of Liberal Arts and Sciences.

Born in Baltimore, Maryland, on April 14, 1900, he was married on August 20, 1923, to the former Dorothy Wallace. They have three children, Barbara Alice, Bruce, and Pamela Ann. Versatility seems to run in the family. Barbara Alice entered Cornell university and became woman's editor of the Cornell Sun. Bruce is an electrical engineering student at this University and has been chairman of Homecoming and of the Spring Carnival this year.

CONVOCATION . . .

(Continued from page 8)

such a poll is infallible, but is only an indication of the students' personal viewpoint. Dr. Stoddard mentioned that the polls, on the other hand, were conducted for the good of all teachers, not to determine their popularity among the students, but to determine how effective their methods of teaching are. The "best" teacher is not necessarily the most effective teacher, Dr. Stoddard continued, and cited numerous examples of this condition.

Members of the convocation committee were Dale S. Glass, chairman, Phillip Doll, Richard Kanak and Allen Benson.

When a fool has made up his mind the market has gone by.

* * *

A great leader never sets himself above his followers except in carrying responsibilities.—Jules Ormont.

* * *

It does seem incredible that 3,500,000 laws are being made and still no improvement to the simple Ten Commandments.

* * *

Think wrongly, if you please; but in all cases think for yourself.—Lessing.

SPECTROGRAPHS . . .

(Continued from page 32)

of the deaf who have undertaken the speech training with visual translators are now able to speak with amazing distinctness and clarity.

Another point of interest is in the acoustic study of sounds other than human speech. Supersonic frequencies and very low frequency phenomena can be studied with the spectrograph by selecting filters to correspond to the desired frequency range. Of special interest in the low frequency range are heart beat oscillations. Tests of machinery noises have indicated definite frequency regions of greater prominence than others. By close observation of the separate frequency components in what usually appears to be a random noise region, much information is obtained on particular machine parts that do not function as smoothly as desired. Music has been mentioned in connection with hand-drawn play-back spectrograms, but the analysis of musical sounds is an important consideration in itself. New standards of harmonic content in an instrumental sound are within reach, and these criteria are entirely independent of the ear.

The sound spectrograph grew out of needs for more information on speech distortion in communication circuits, and much work still remains to be done in this field. The research to date has far from exhausted the possibilities for exploiting the study of speech and non-speech forms. The recent technique of visible sound proposes a stimulating number of entirely new ideas and has offered an important tool for further knowledge and discovery.

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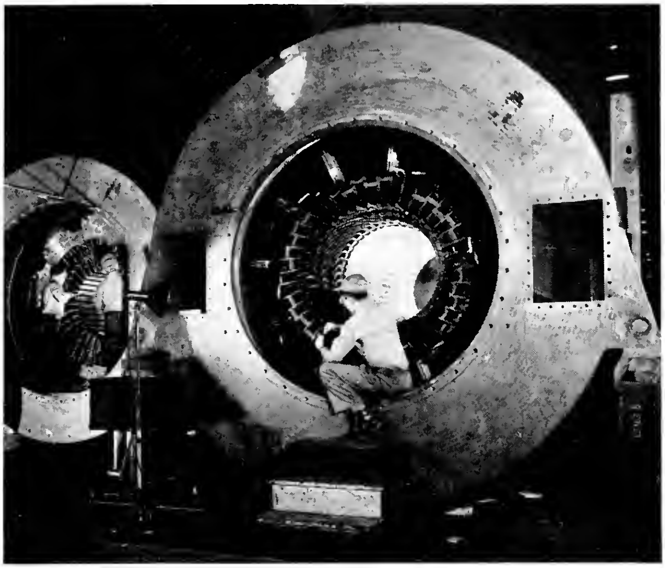
Get a Close-Up OF THE BASIC INDUSTRY OF YOUR CHOICE!

by R. S. FLESHIEM
Manager Electrical Department
ALLIS-CHALMERS MANUFACTURING CO.
(*Graduate Training Course—1904*)

R. S. FLESHIEM



Inside View of a hydrogen-cooled steam-turbine generator. A-C Graduate Training Course students may follow important electric power equipment from blueprint to installation.

WHEN YOU GET into daily working contact with an industry, you may find it offers specialized opportunites that you hadn't known about before. That's why it's not always possible—or wise—to pick *your* final spot in industry until you've had some all around first-hand experience.

I want to suggest a good way to *get* a close-up of the industries that appeal to you.

Naturally, I can talk with most assurance about the electric power industry. But the same principles apply to others.

When I got my engineering degree from the University of Michigan, the electric power industry was a fast-growing youngster. I decided to go to Allis-Chalmers, where I joined the company's first Graduate Training Course in 1904. I was sent to Cincinnati and started in the old Bullock Electric Mfg. Co. plant that Allis-Chalmers had purchased that same year. Bullock, incidentally, started in 1884—one of the real old-timers in the electric industry. It was the start of the present Allis-Chalmers Electrical Department.

Opportunities Are Increasing

The industry was growing fast at the turn of the century, but it's growing even faster now. Opportunities were never greater—or more varied.

Studying power and capacity factors in ore crushing, in Allis-Chalmers' complete basic industries laboratory. Camera-recorded data will be applied to commercial mining operations.

Today we have Graduate Training Course engineers applying their ability and training to the problems of machine design—research and development—manufacturing and production—sales—application engineering. Here we're working with electric power generation, control and utilization—with advanced industrial uses of electronics—with research in D. C. transmission. We're in intimate touch with the electric power industries—with transportation—with steel, metal working and other big power users. And I know that the field is just as broad in the other major industry departments here at Allis-Chalmers.

What Industry Interests You?

I firmly believe that Graduate Training Course engineers have a unique opportunity at Allis-Chalmers. They have the opportunity here to explore thoroughly not one, but many basic industries if they choose. This company produces the world's widest range of major industrial equipment, and every department is open to the graduate engineer. That includes electric power, mining and ore reduction, cement making, public works, steam turbines, pulp and wood processing. It also includes the full range of activities within each industry: design, manufacturing, sales, research, application, advertising.

Graduate students help plan their own courses at Allis-Chalmers, and they move around a good deal. It's possible for a man to come here with the idea of designing electrical equipment—later become interested in manufacturing—and finally find his greatest satisfaction and success in sales work. Men move from department to department, getting a practical working knowledge of each. And—the departments get to know the men. Opportunities present themselves according to ability.

At the completion of the Graduate Training Course, you've had a close-up of many industries. You're ready to take your place in the work of your choice.

Write for details of the Allis-Chalmers Graduate Training Course—requirements, salary, advantages. Representatives may visit your school. Watch for date.
Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

GALESBURG . . .

(Continued from page 15)

The course is covered in thirty days, and is designed to promote, through lectures and field trips, knowledge that would be equivalent to two years of "on the job" experience.

The field trips are made to give the men a better understanding of the processes of manufacturing. These dealers also gain common points of interest with the manufacturer, which they can use in selling their products.

Generally, the lectures are related to the field of engineering. Such courses as "blue print reading," "frame construction," "wood decay," "cement and concrete," "insulation," and "steel products" are offered. The lectures are given by men representing the manufacturers of the material being discussed, or by professors, both of whom have years of training and experience. Thus the lecturers are able to hand down facts about the quality of the material, maximum endurance under year-round all-weather conditions, and what is in the material that meets specifications.

The lumber man who knows these facts knows, when he builds, what to specify. He learns new uses, developed through changing trends, of old standbys in building materials. He also gains information on new materials. This is valuable when critical material shortages call for substitutes that can be depended upon.

Considering all, this course will help the lumber dealers to gain the wisdom to combat the obstacles presented by present day building conditions, and it will help prepare them for a future of keen competition.

NEW DEVELOPMENTS . . .

(Continued from page 2)

that the emulsion "comes very close to recording any nuclear particle," and compared an atomic particle in the emulsion to a "skipping stone" in a pond.

"Assuming one has a good, round, disk-like stone and throws with precision," he said, "the frequency of the skips increases toward the end of its path. . . The faster the stone is travelling, the less the frequency of the skips on the water. This is paralleled by the passage of a high energy particle through a nuclear emulsion. As with the skipping stone, the rate of energy loss is reflected in the number of grains along the track. . . ."

Thus characteristics of a nuclear particle, such as speed and energy, can be determined from the length and curvature of the track and the grain spacing along it.

New Insulation

Johns-Manville has announced the development of Zerolite, a low-temperature insulation that has exceptional resistance to fire and chemicals. According to the manufacturer, this material combines high fire resistance, immunity to many organic solvents, and excellent moisture resistance with low heat conductivity. Zerolite was especially designed for service between -400 F. and 250 F.

If the power to do hard work is not talent, it is the best possible substitute for it.—J. A. Garfield.

* * *

If Americans can give an an example of the effectiveness of honest reasoning and spiritual responsibility, the whole world will take hope.—David Lawrence.

* * *

An ideal is the most practical thing in the world, for it is a force behind action that must be reckoned with by frankest materialist.—E. H. Griggs.

* * *

The thing that nourishes the root determines the fruit, be it tree or man.

Answers to Vocabulary

1-a, 2-d, 3-a, 4-c, 5-c, 6-d, 7-b, 8-a, 9-a, 10-d, 11-c, 12-b, 13-a, 14-d, 15-a.

Special Features!

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October Technograph

Trusses Across the Rhine

Engineering in the E.T.O.

YOUR SLIPSTICK

IF HE COLLECTED SAMPLES

as he made his rounds

A sample from every industry served by Square D Field Engineers would make quite a load, indeed. For these men serve as liaison between Square D and every segment of industrial America. Their full-time job is working with industries of every kind and size—helping find that "**better way to do it.**"

Through these Field Engineers, located in more than 50 offices in the United States, Canada and Mexico, Square D does its three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends and new methods and speeds their development.

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For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom came to us from leading engineering schools such as yours.

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CONCENTRATION

I sat down at the type — no wait. I didn't sit down. . . . There was no chair. . . . I couldn't find it—we borrowed it one night for a brawl at Bidw—, I mean—that candy they sell at Bidw—, skip it!

I sat down at the typewriter and . . . Huh? . . . no, I don't know. . . . Sure, it's a typewriter. Look! 2hjl,,-98 765"&'?—it makes words. . . . Hey, leave him alone—that's a thoroughbred cutie—sure—got beautiful conformation and depth through the heart—sire was the famous Cootie-of-War—never lost a race in his life—had him with me since he was knee-high to a cockroach —I—Don, please don't hit me anymore. It makes my head ache. . . .I—.

I sat down at the typewriter and proceeded to—Ha! Ha! Fooled you! Bet you didn't think I'd get this far—got a wonderful power of concentration—like my old man—he's resident engineer up at Kankakee now—designs precast concreteless concrete bridges—good job, too—pays ten yen and twenty straight-jackets a month—he—I—.

I sat down at the typewriter and proceeded to rack my brains—brains—brains—. Saw some floating down the Boneyard this morning—some poor chump transferred—L.A.S. to engineering—took an E.E. 48 quiz—poor chap —brains exploded and they dumped him in the Boneyard. . . . *The Boneyard must be cleaned!* Sure I read Gene (Campus Scout) Shalit last year. However—as a veteran engineer I can also appreciate the more subtle and intrinsic merits of the Boneyard after four years of its fragrance. —I—for Pete's sake! Will ya stop hitting me with that steam hammer? . . . which reminds me —steam hammer, I mean, —I must remember to mail off two box tops and two-bits for my steam hammer—I—.

I sat down at the typewriter and proceeded to rack my brains to think —yes, I *do* think—yes, . . . *no!* You don't say! Well, now that's very interesting—I wouldn't dream—which reminds me—dreams, I mean—dreamed that St. Pat was doing a T.A.M. 163 problem for me and he couldn't figure out this one constant so he got mad as anything and tore my K. & E. log-log-wood-log dirty-trig polyphase duplex —and I loved it so!

I sat down at the typewriter and proceeded to rack my brains to think of something that—that—that—that—"*that*", pronoun. (AS, that, neut. nom. & acc. sing. of the demonstrative pron. and adj. also used as a relative pronoun). Equivalent to who or which, either sing. or pl.;—(now how the devil did Webster get in here?). . . . *Everyone wants to get into the act!* . . . Kill 'em! . . . Moider da bum! . . . Put 'em in Rhet 0! . . . (Horrible fate)—heard of an engineer who paid for his crimes at the hands of fellow engineers—he got an "A" on a Rhet theme the other day—the funeral will be conducted from 1522 W. Green St.

I sat down at the typewriter and proceeded to rack my brains to think of something that I could write to meet the oncoming deadline. The above stupid nonsense occurred to me and I wrote it down, for I wanted to conduct a little psychological experiment of my own. If you read this article through its entirity, then pat yourself on the back for being as average a dope as the rest of us, for it is amazing to observe how guiless and unwitting some people are who will read a silly article like this —through—to—the—very—very—bitter —end.

Standing at the corner of Wright and Green were two engineers whose names were Wood and Stone. A pretty girl went by. Wood turned to Stone and Stone turned to Wood. Then both turned to rubber.

P. S. The girl turned into a drug store.

A hen, hit by an army jeep, got up, straightened out her feathers and said: "Lively little cuss . . . but he didn't get anywhere!"

* * *

He: "Every time I kiss you it makes me a better man!"

She: "Well, don't try to get to heaven in one night."

* * *

Deciding to teach her drunken husband a lesson, his wife dressed up in a devil's costume. That night when he came staggering home, all lushed up, she met him at the front door. Through his bleary, bloodshot eyes, he looked her over and said: "Who are you?"

"I'm the devil."

"Well, I'm sure glad to know you. I married your sister."

* * *

Two very cute coeds, slipping in late, met a couple more just going out. "Shhh, we're coming in after hours," said one of the entrants. Replied one of the others, "Think nothing of it. We're going out after ours."

* * *

"If you kiss me I'll call a member of my family," the town girl warned.

He kissed her.

"Bro*ther!*" she whispered.

* * *

A dilapidated car wheezed up to the toll gate of the Golden Gate bridge in San Francisco. Its last drop of gas was gone and its wornout tires were almost flopping in the breeze.

"Four-bits," demanded the bridge attendant briskly.

"Sold!" exclaimed the two weary M. E.'s.

* * *

A true music lover is a man who, upon hearing a soprano in the bathroom, puts his ear to the keyhole.

* * *

She: "So you want to kiss me! I didn't know you were that kind!"

He: "Baby, I'm even kinder than that!"

* * *

And puppy love is just a prelude to a dog's life.

* * *

"Wife: "John, dear, I'm going to appear in an amateur theatrical. What do you think folks would say if I wore tights?"

John: "That I married you for your money."

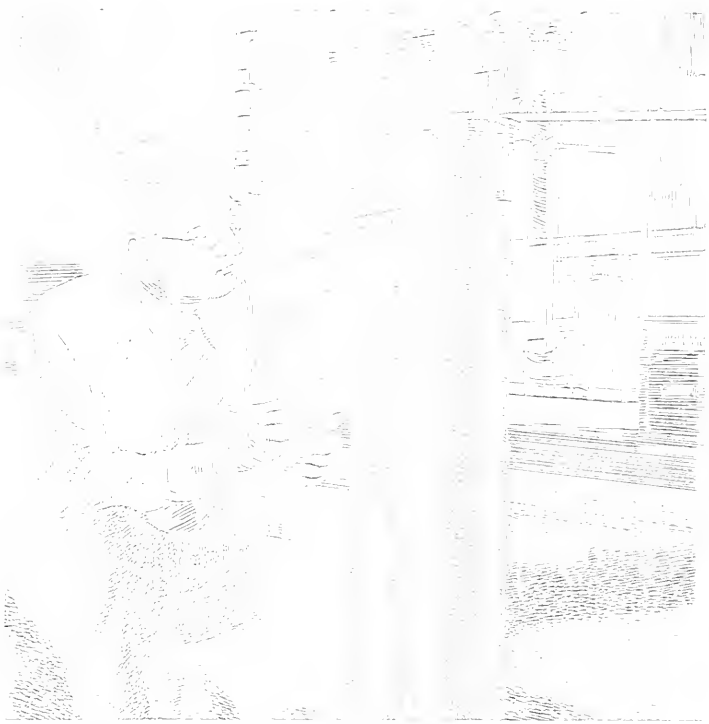
* * *

A Texan entered a salon with his wife and three-year-old child. "Two straight whiskeys," he said.

"Hey Pa," the kid asked, "ain't Ma drinkin'?"

[illegible] Bannister
c/o J. [illegible]
[illegible], U. of Ill.

[illegible]



[illegible]

55 degrees below zero Fahrenheit, liquid [illegible] becomes a "superfluid." That is, it loses [illegible] were to be set in motion like stirred [illegible] in a cup, part of it would theoretically [illegible] forever.

[illegible] "super-wetting" agent, meaning [illegible] the sides of a container and flow [illegible]

[illegible] develop the property of [illegible] columbium nitride, for example [illegible] below 15 degrees [illegible] set in motion in a [illegible] in theory flow [illegible]

[illegible]—the study [illegible] a group of young General Electric scientists are directing their investigations.

So far their studies are in only the earliest stages. But already the lure of this nether world of temperature has aroused enough interest that with the building of a new Research Laboratory near Schenectady, a $250,000 laboratory unit has been especially constructed to aid and amplify their work.

Through its emphasis on research and creative thinking, through encouraging fertile minds to follow their own inclinations and by implementing their work with the best available facilities, General Electric remains a place where interesting things are happening, and stays in the forefront of scientific and engineering development.