Spartan ENGINEER

School of
Engineering

☆

Michigan
State
College

☆

MAY, 1950
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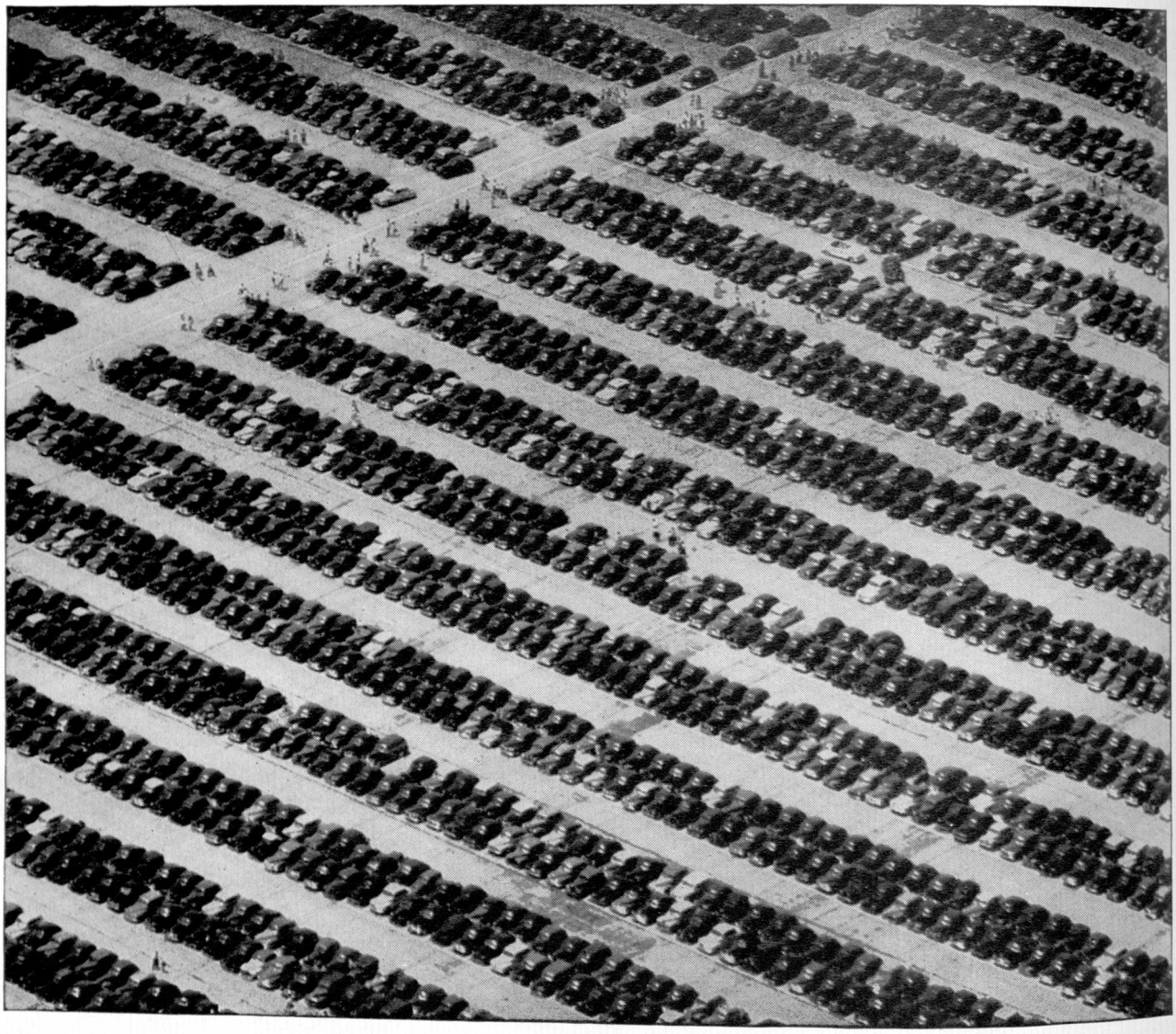
TWENTY-FIVE CENTS

6,250,000 in 1949—*another new record*



THE automobile industry smashed records again in 1949 as it produced 6,250,000 new passenger cars and trucks —more than in any other year in history. This terrific output of the finest cars ever made climaxed a phenomenal rise in production that began at the war's end.

These new cars by the millions are a tribute to the American way of life. Their production is the result of the demands of people working under the American system of free enterprise, which has produced the highest living standard the world has ever known.

Millions of tons of steel of almost every type and form helped America's auto makers boost their production so amazingly high . . . helped the quality of today's automobiles keep pace with the quantity. In fact, many new steels have been developed just to meet the exacting requirements of present-day production.

In spite of record-breaking production, the automobile industry's job is far from finished—the average age of the cars on America's highways today is 8.4 years.

Continuing demands for vast quantities of steel from the automobile industry and from countless other sources mean a big job for the steel industry in coming years . . . mean a promising future for men who make steel their career. To assure itself management men of the highest caliber, United States Steel maintains a continuous training program that prepares young men with suitable backgrounds for places in this great industry.

College engineering courses lay the foundation . . . United States Steel builds a practical knowledge of steelmaking on this foundation.

USS

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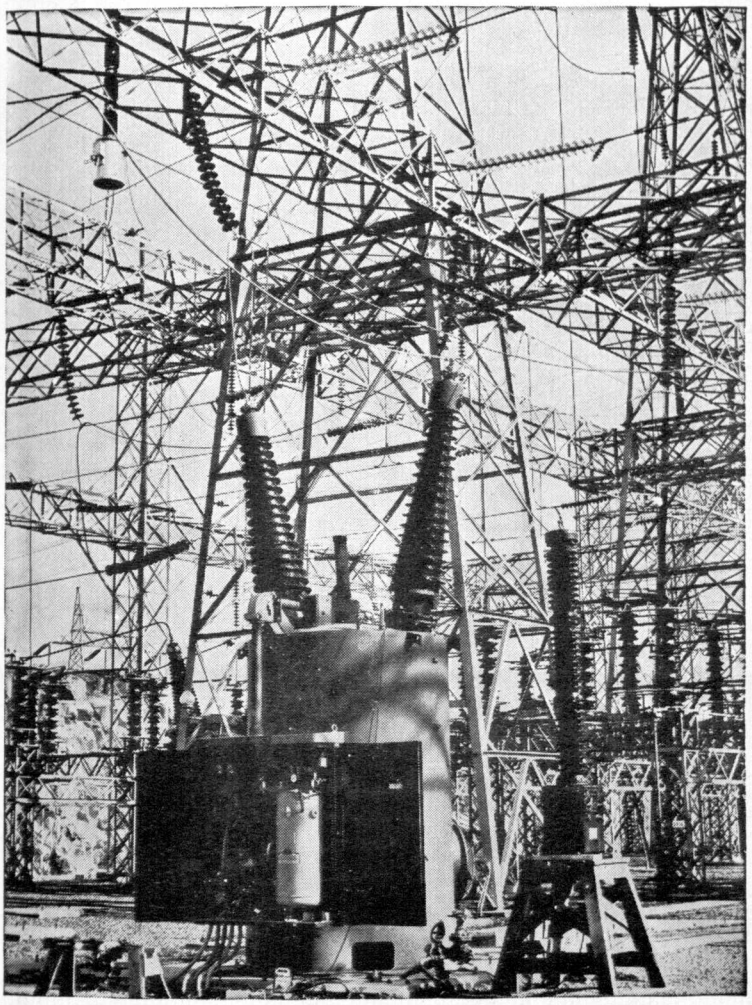
UNITED STATES STEEL



How to Keep a Name STRONG

Names in business can lose strength and vigor, even as you and I. Yes . . . a business can die, just like people. Here are ways business insures against this end:

Research for product improvement and new development . . . plant improvement for more efficient, lower cost operation . . . quality control to maintain standards of production . . . student and employee training to energize and revitalize the mental reservoir. Here's an example of how Research helps keep a business vigorous:

Grand Coulee and other mammouth hydro projects generating tremendous new pools of electrical energy, have created new problems in transmission. Through the great resources of its research department Westinghouse developed a new one-piece, oil circuit breaker to handle these immense capacities.

To test it, the U. S. Bureau of Reclamation routed the short-circuit output of the six, 108,000-kva generators at Grand Coulee Dam together with the back feed over six, 230-kv transmission lines from the Bonneville Power Administration system and the Northwest Power Pool for a tremendous short-circuit test.

The result: interrupting-capacity ceiling raised from 3½ million to 7½ million kva.

Research, plant improvement for efficient production and quality control are all dependent on another basic element . . . training.

Let's look more closely at that element . . . as it is handled by Westinghouse. Engineering Graduates who join us first receive some months of basic training . . . an orientation period with initial work assignments and product conferences. Then further training with specialization in engineering, manufacturing, sales or other activities. Finally, placement.

That is one of the ways an organization is kept strong. It requires strength to protect a name whose reputation is staked on the commitment . . .

G-10070

YOU CAN BE SURE . . . IF IT'S Westinghouse

BEAM - STRENGTH

Without beam strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in *city streets* would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.

CAST IRON

Strength factors of Long Life!

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

BEAM STRENGTH — When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

CRUSHING STRENGTH — The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

SHOCK STRENGTH — The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH — In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON PIPE SERVES FOR CENTURIES

Wayne King, "The Waltz King", is one of America's most popular entertainers. His weekly Standard Oil television show is a delight to see and hear—and it makes him one of Standard Oil's best salesmen.

More than sweet music comes from this horn

Let's assume that Standard Oil researchers and engineers have fully developed and tested a new, outstandingly improved petroleum product. Let's assume that the product has been made and distributed to Standard Oil dealer stations.

What happens then?

That's where Wayne King and all our other salesmen take over. They inform the public about this new product. And when the public buys, there's work for people to do all down the line: work for the service station man, for the refiner, the pipeline man, the driller. The more we sell, the more people we need to make new products. Our present employees become more secure in their jobs, and new jobs open up.

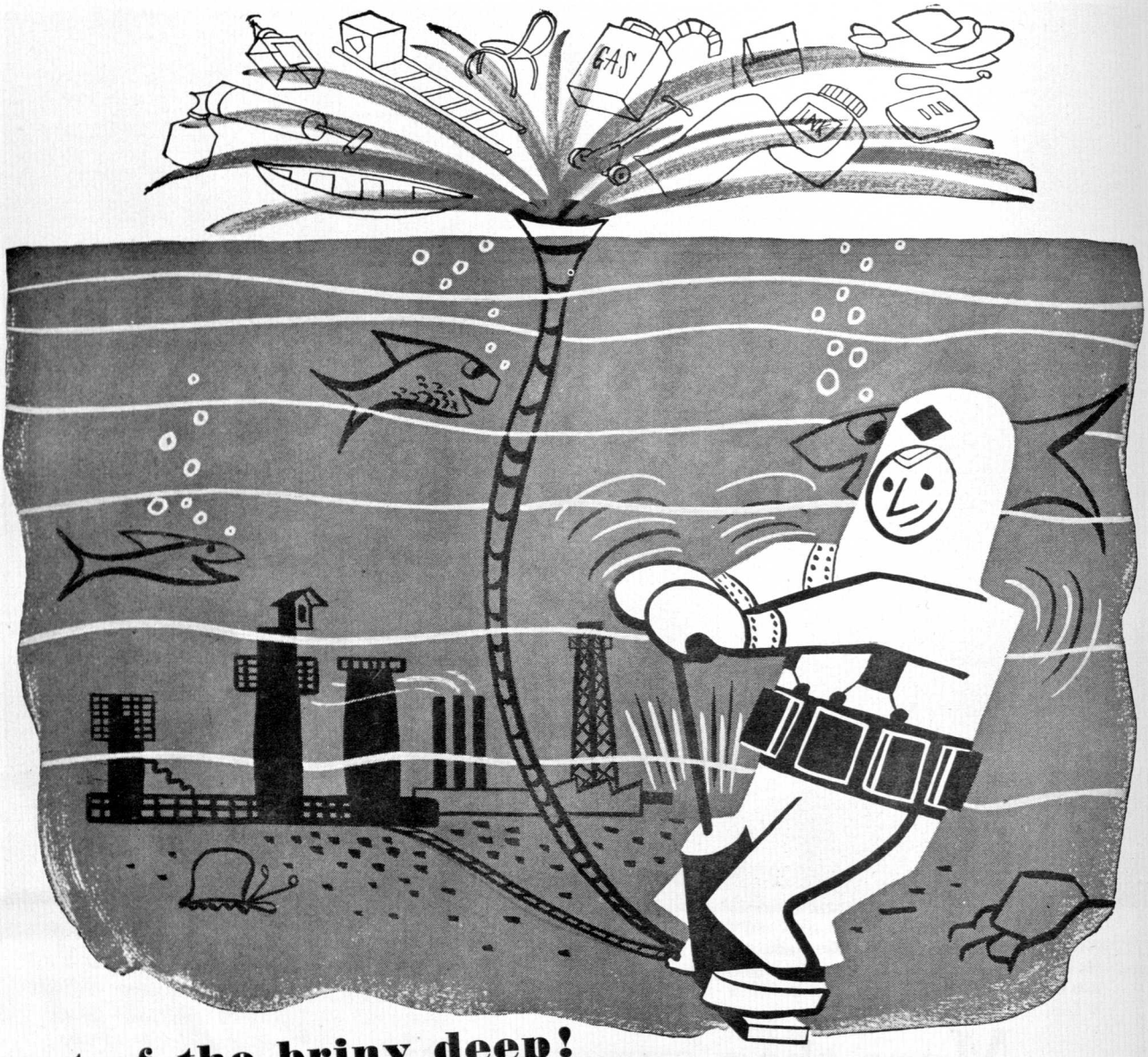
Good salesmanship, you see, is vital to all of us. But good salesmen must have good products to sell —and that is why research and product engineering, as carried on at Standard Oil and other progressive companies, is also vital.

Good products *plus* good salesmanship are an unbeatable combination that helps make our country great and the American standard of living the highest in the world.

Standard Oil Company

(INDIANA)

STANDARD



out of the briny deep!

Metal furniture, lawn mowers, and materials for aircraft out of the briny deep? Drugs, ink, paper products, fumigants and photographic plates from ocean water?

Indeed, these products and many more owe their origin to elements extracted from the brine of the sea and from the earth's subterranean brines . . . bromine, iodine and magnesium.

The first of these, bromine, appears in a host of products which we use daily. For years this basic chemical has been produced for industry by The Dow Chemical Company. Bromine and bromine compounds are utilized in many fields including textiles, petroleum, solvents, fumigation, cosmetics, pharmaceuticals and a variety of others.

In addition to its medicinal use, iodine has many industrial applications, among them dyes and photographic film.

Magnesium, the lightest of all structural metals, is likewise extracted from the inexhaustible waters of the sea through a special process originated by Dow. Proved invaluable for over a decade in aircraft construction, magnesium today contributes strength without dead weight to many varied industrial and consumer applications.

Bromine, iodine, and magnesium are but three of over six hundred products manufactured by Dow in the interests of "chemicals indispensable to industry and agriculture."

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Table of Contents

• articles

• features

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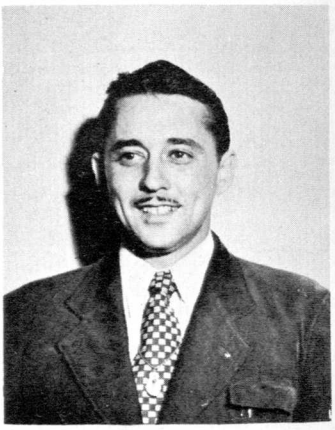
Engin — Ears

Photo Contest Winners — Report on New Honoraries — Alumni Column — Mackinac Bridge — The Editor's Swan Song



BY HERKIE BOWERS
Spartan Engineer Editor

ENGINEERS ARE A VERSATILE lot judging by the quality of the pictures submitted for the Spartan Engineer's first annual photo contest.

First prize — a Pickett and Eckel pocket slide rule — goes to Tom Schwer for his "Sand Monster" shot taken at the limestone quarry near Rogers City, Mich. Bill Cruse receives a two-year subscription to the Spartan Engineer for his entry of the San Francisco Oakland Bay Bridge and a one-year subscription goes to Richard Brelsford for his wintertime view of the College Library.

Reproductions of the three prize winning photos appear on the picture pages in the center of this issue.

* * * *

IN THE LAST ISSUE OF THE Spartan Engineer, we reported on the formation of three new departmental honoraries ME, EE and Chem-Met. To this list now has been added the CE's. Plans are well under way on the groundwork of an application for a local chapter of Chi Epsilon, national civil engineering honorary fraternity.

At the time of this writing, each of the three previously mentioned groups are awaiting formal recognition on campus. The ME honorary will be known as the Tau Epsilon chapter of Pi Tau Sigma. The national initiation was scheduled for April 27.

The EE's are organizing locally this year under the name of Eta Eta. Upon recognition of the group's petition, plans call for affiliation with Eta Kappa Nu, probably during next fall term. The Chem-Met honorary, Chi Mu Epsilon, will remain on a local basis. At present, the group has no knowledge of a similar national organization.

* * * *

THE ADDITION OF THE ALUMNI column, effective with the last issue, was a very valuable one according to several MSC graduates we have talked to recently. Most of them feel that the alumni are much more eager for news of their Alma Mater than are the undergraduates.

From our point of view, we are most happy to include this item among the regular features of the magazine. However, the success or failure of the

column rests almost entirely on the graduates themselves. We have no way of compiling this information without their assistance.

Remember, all those small bits of information make interesting reading to your fellow alumni, so send them in to Bob Kitchen, alumni editor.

* * * *

WE RECEIVED A MOST INTEResting paper a few days ago discussing the prospects of the proposed bridge across the Straits of Mackinac. The paper was submitted by Tom Kirwan, junior political science major who recently transferred out of civil engineering.

According to Kirwan, the much discussed structure is little more than a political talking point with no chance of reaching the construction stage within the foreseeable future.

His reasons for such an opinion seem pretty sound. First, the bridge would have the longest single span in the world and would cost at least a hundred million dollars, not counting several million dollars worth of work that would be necessary to correct existing soil conditions.

Second, the State doesn't have that kind of money to spend, and if it did those dollars probably would go into highway improvements. The interest on a loan of this size would amount to several million dollars per year, at least three times the annual cost of operating the existing ferry service. To this also must be added the maintenance cost of some million dollars a year.

Third, plans already are under way to increase the available ferry service. The Highway Department has contracted for a new 150-car vessel scheduled to be in operation by July, 1951. This new craft will have propellors at each end to eliminate the turn-around time.

We aren't certain just how accurate Kirwan's figures are, but it seems like pretty sound reasoning to us. At any rate, we aren't making any plans for a trip over the new bridge.

* * * *

WITH THE END OF THE TERM in sight, and this being our last issue this year, it seems only fitting that we take this opportunity to express our appreciation for the hard work of this year's staff.

To Bill Throop and Chuck Paul, Business Manager and Assistant Editor, we can only say "Well done" for the many hours that went into making this year's four issues possible. These two men are slated to be the key figures in the success of next year's efforts.

Earl Rogers, associate editor who was graduated last term, advertising manager Bob Easter, and circulation manager Tracy Clark all rate an enthusiastic pat on the back for outstanding work in their departments.

To the rest of the staff goes our heartfelt appreciation for a great deal of hard work. We can only hope they have enjoyed working on the staff as much as we have.

For next year's staff we leave our best wishes for a successful publication and feel certain that they will come up with four issues that will be a credit to the entire School of Engineering.

Alumni Notes

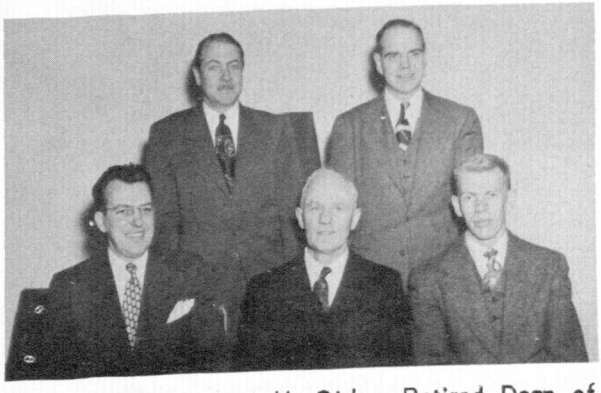
By Bob Kitchen

Freshman, C.E.

MICHIGAN STATE'S ENGINEERS seem to be taking over the engineering department at the University of Illinois.

John Henry, '30, started as an instructor in ME at the U of I in February, 1941. In 1945, he received his M.S. degree and was presented with an associates in M.E. In 1946, he advanced to the rank of assistant professor, and

(Continued on Page 38)



R. Martin; K. Trigger; H. Dirks, Retired Dean of Engineering; J. Henry; and V. Hildebrandt.

COPPER

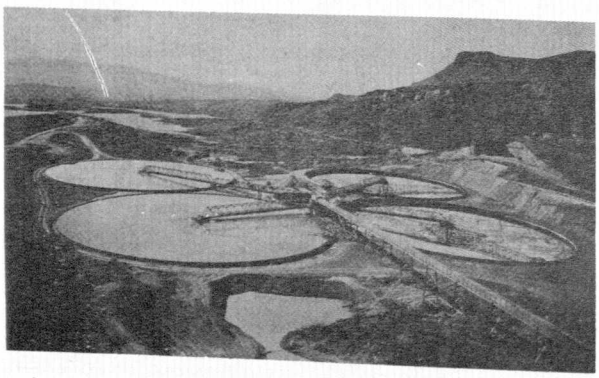
Hubert A. Pattison
Senior, Ch.E.

History Of "Cuprum" Through The Ages

Centuries before the birth of Christ, the Romans sailed to the island of Cyprus and discovered the inhabitants were mining the metal copper. Since the Romans had no word for this new metallic substance, they named it "Cuprum" which is Latin for "Metal of Cyprus."

Copper and bronze were the first metallic substances known to man. The early use of copper is attributed to the fact that the metal occurs in the uncombined condition, is not highly reactive, and can be easily shaped and worked.

It is believed that the first smelting practices occurred from the accidental discovery by primitive man that certain rocks beside a camp fire became changed to a spongy lump of metal which could be shaped with a stone. Following this discovery, the ore was placed in the fire and the impurities burned off. By 1000 B.C. copper production had become a real science. This is substantiated by our knowledge that the Trojan war, which took place about this time, was fought entirely with copper and bronze weapons.



This is the largest Dorr thickener installation in this country. It has a surface area of seven acres. The thickener is used in the concentration of copper ore.

Today, next to iron and steel, copper is the most widely used metal in the world. One can hardly glance about him without seeing some product containing copper, brass, or bronze. This immense production of copper has given rise to many other elements as "by-products" of copper production. Over 90% of the world's nickel is produced as a by-product of copper refining. In addition 70% of the cobalt, 25% of the silver, 50% of the platinum, and almost all of the world's arsenic is obtained as by-products from copper smelters.

Copper has no allotropic modifications as do such other metals as nickel, cobalt, and iron. Therefore, copper has no critical temperature at which changes occur in the crystal lattice pattern. Because of this, copper cannot be hardened by heat treatment, but must be cold worked for a harder product. Also, copper is not effected by low temperatures and most low temperature equipment, such as that used in the distillation of liquid air, is made of copper.

Copper has an extremely high coefficient for both electrical and heat transfer. These properties are in electrical and chemical equipment such as heat exchangers, distillation columns, evaporators, driers, and kettles.

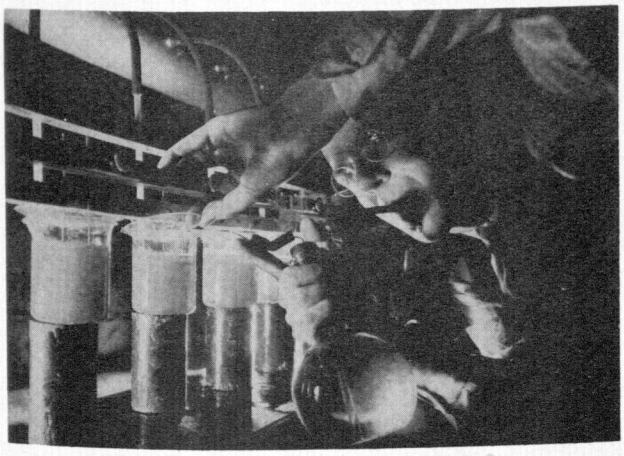
The resistance of copper to atmospheric conditions is excellent. Copper is used more in outdoor fixtures than any other metal requiring no protec-

tive coating. There are many cases where copper has endured for centuries, therefore its life expectancy is often measured in generations rather than years. However, copper does not show these admirable characteristics at higher temperatures.

The resistance of copper, brass and bronze to all sorts of water and oil has long been known. The use of copper oil lines in automobiles, copper tubes for transporting water, and brass fittings in ships is widespread throughout the world.

All of the excellent corrosive resistant properties result in a wide variety of alloys employing a copper component. Brass (copper and zinc), results in a cheaper, harder, and stronger product. Bronze (copper and tin), is slightly more expensive with similar properties. Copper is also alloyed with nickel, beryllium, and aluminum with good results. An interesting alloy is that of copper and silicon. This alloy combines the corrosion-resistance properties of copper with physical and structural qualities very comparable to those of mild steel.

Copper also may be added to steel to increase its corrosion resistant properties. This was brought to light when it was noticed that certain steels withstood corrosion much better than others. Laboratory analyses showed that these steels all contained copper. Naturally, copper was then selected as an additive for many future steels. Only one quarter of one percent copper in steel is necessary to produce these results.



A test used to determine the percentage of copper in condenser tubes. The metal is dissolved in nitric acid and the copper is deposited electrolytically and weighed.

Copper not only is used as a lining but is also employed as a base for coating with other metals. The use of copper as a foundation metal forms a good bond which is rarely destroyed by reasonable changes in temperature. Then too, even if cracks do occur in the clad, the base of copper is itself highly resistant to corrosion and an immediate repair is seldom needed. Such processes as electro-plating and hot-dipping employ large quantities of copper as a foundation for the plating. Such coatings as silver, chromium and nickel are plated on copper whenever possible.

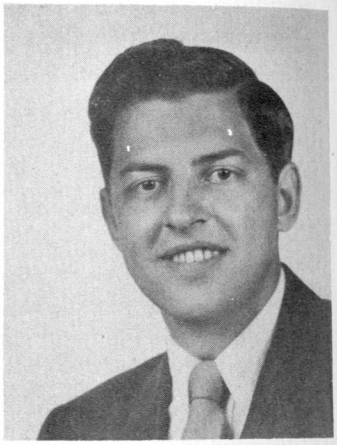
This copper mine at Bingham, Utah is the largest man-made excavation in the world.

Copper is a standard material for equipment used in the preparation of foodstuffs. The resistance of copper gives this equipment an indefinitely long life. It is known that a small quantity of copper is not toxic, thus even if some copper from the containers is introduced into the food it is never removed before selling to the public.

Copper was man's first metal. It has been used throughout the ages and was instrumental as a material of fabbrication for many of our machines during the industrial revolution. Copper is expected to take an even more important role in the future.

DISTILLATION

The Chemical Separation Of Liquid Mixtures



By Donald H. Tuscher
Senior, Ch. E.

DISTILLATION, AN OPERATION for the separation of two or more liquids from a solution, is so named because the solution is partially vaporized and these vapors are separately recovered by condensation.

The basic law which makes distillation possible is that liquids have different volatilities, that is, different vapor pressures or boiling points. A liquid with a low boiling point has a high vapor pressure. Because of this, when a liquid solution is partially vaporized, the vapor will be richer in the more volatile component.

For simplicity, this article will be limited to binary mixtures of liquids miscible in all proportions.

There are many variations of distillation methods, but they may be classified in the following general groups:

1. Simple or differential distillation
2. Equilibruim or flash distillation
3. Fractional distillation or rectification

Simple or differential distillation is where the vapors are removed from the liquid as fast as they are formed, then condensed. None of the condensed vapor is allowed to return to the still. A typical example of this distillation method is the making of distilled water.

This type of distillation, as far as separation goes, is rather incomplete. The only way the product can be purified is by taking successive portions of the condensate and redistilling them. However this is far from efficient.

Equilibrium or flash distillation means that the vapors are allowed to remain in contact with the boiling liquid until they reach an equilibruim. This method may be used when a wide variation exists in boiling points of the two liquids and the vapor and liquid compositions will be quite different. The method has only limited applications.

Fractional distillation or rectification is widely used and is adapted to large scale production. In this type of separation, a portion of the condensed vapors are returned to the still in such a manner that the rising vapors have to bubble through the liquid. The returned condensate is called reflux.

In figure 1, the principle of a fractionating column is shown. Heat is supplied to the bottom still and the rising vapors provide heat for the successive or higher stills. The temperatures of the stills decrease as they rise, thus the upper still is at the lowest temperature.

The vapors rising from still number one are richer in the more volatile constituent than is the liquid. These vapors bubble through the liquid in still number two and are partially condensed. That which is condensed is poorer in the more volatile component. Heat given up by these condensing vapors will vaporize some of the liquid in still number two. These new vapors will be purer than the liquid and will rise to still number three.

This cycle is repeated up through the successive stills. What is actually happening is that there is a "vapor enrichment" on up until almost the pure low boiling point component is realized in the condenser. During this time, the less volatile component is flowing back to still number one, through the overflows.

Since each still will contain a liquid of a different composition, the feed is admitted to the still which has the liq-

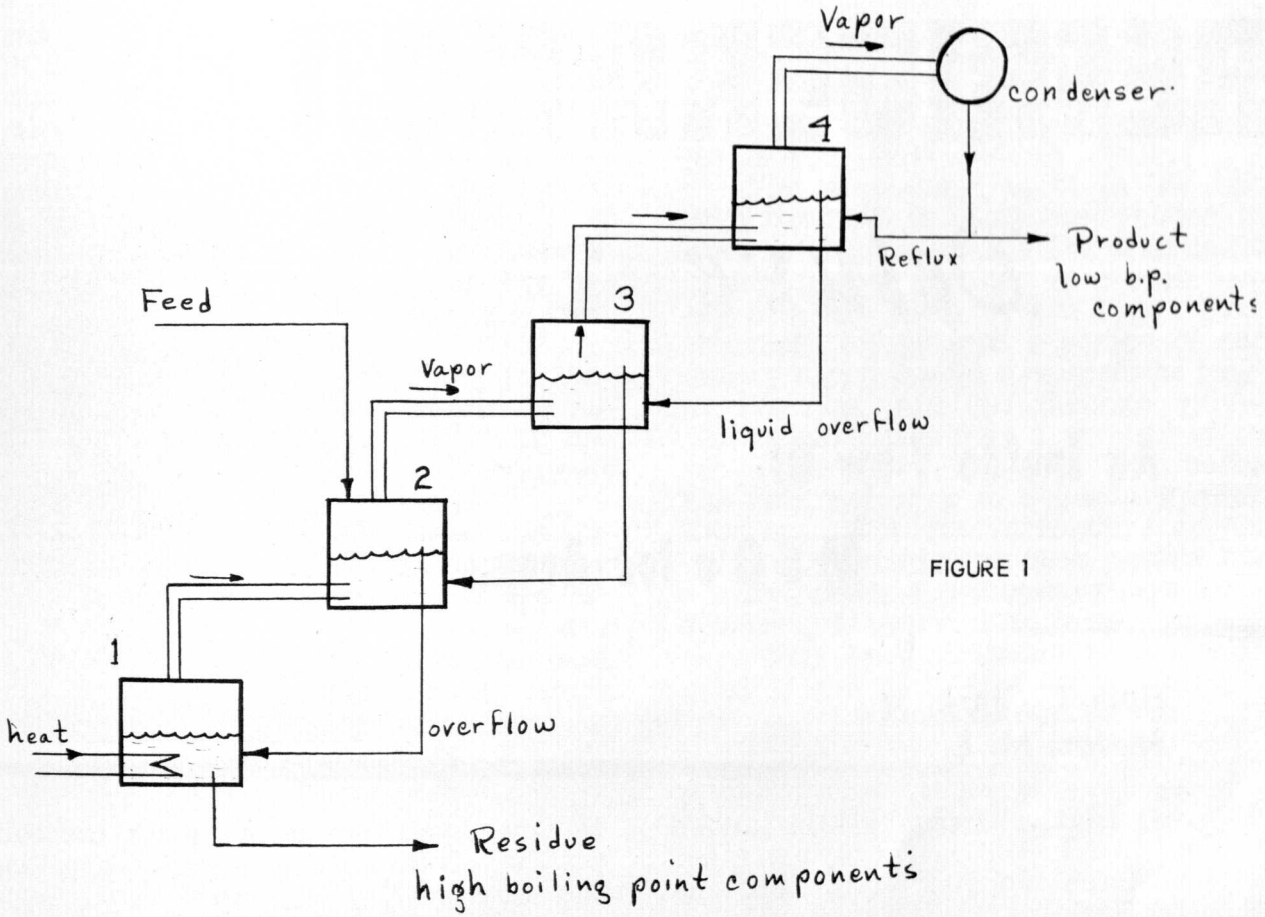
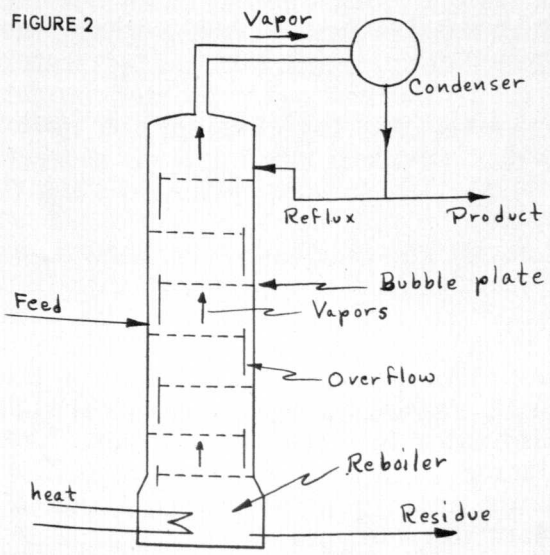


FIGURE 1

uid corresponding to the same composition as that of the feed. Part of the overhead product is refluxed back to the top still and the overflow from each still is fed to the next one lower in order to provide liquid for the condensation-vaporization cycle in each still.

FIGURE 2



Distillation Column

To make this apparatus more compact and practical, these stills are stacked one upon another. In this way, the piping and tubing can be eliminated. Figure 2 illustrates schematically what a common fractionating column looks like. The principle is the same as explained above. To provide more intimate contact between the rising vapors and the descending liquid, a bubble cap plate is provided. A certain liquid level is maintained on each plate to cause the vapors to bubble more thoroughly through the liquid.

The number of bubble cap plates in the column is not standard, but must be determined each time a new set of conditions are specified. Unfortunately, all binary mixtures do not have the same vapor-liquid equilibruim diagram.

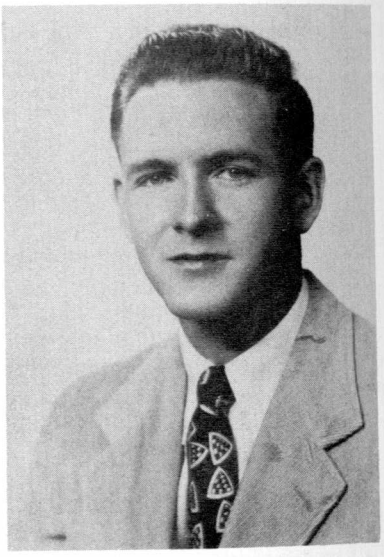
Since these plates are not 100% efficient, the theoretical plates have to be divided by a suitable efficiency determined from experience or practice. Thus, the changing of any one condition will result in the change of several other factors.

This type of distillation column has broad application and with slight modifications is like that used in such industries as alcohol and oil refining.

REFRIGERATION

Deluxe

An Inside View Of M S C's Ice Arena



Elam T. Clark, Jr.
Senior, M. E.

Michigan State College added another leaf to it's laurel wreath when it opened the ice rink in Demonstration Hall last year. The rink, and the equipment supplying it, is considered the finest college-owned plant in the nation.

The heart of the system is a Carrier centrifugal refrigerating machine with a condenser and evaporator. The refrigerant used is Carrene #2, better known as Freon-11. The equipment is capable of 208 tons of refrigeration a day, and may be operated as low as 50 tons a day. Below 50 tons continuous operation is difficult to maintain.

Compression of the vaporized primary refrigerant is accomplished in three stages. The pressure ratios in the three stages are arranged to be nearly equal. In this manner each stage does nearly the same amount of work in raising the vapor pressure from suction to discharge conditions.

A gravity switch is located in the cooling water supply. This device serves two purposes. When the water is shut off, a mercury filled bulb moves into a position that makes contact to close an electrical circuit. The circuit contains a resistance coil in the lube oil sump. This coil keeps the oil warm for starting. It also drives off any of the refrigerant that has been absorbed by the oil. When the water is turned on, the force moves the bulb off the contact point thereby breaking the circuit.

A directly connected motor acts as the prime mover for the compressor. Starting controls are manual, in fact all operation is manual, but provisions are made for automatic shut off if some operating condition falls below normal.

From the compressor the refrigerant is discharged to a shell and tube condenser. Cooling water in the tubes removes the heat from the refrigerant, condensing it to a liquid. The cooling water used is city water. From the two-pass condenser the heated water goes to a cooling tower located on the roof. After passing through the tower the water empties into an open storage tank in the machinery space to restart its cycle.

Leaving the condenser, the liquid refrigerant follows a somewhat different path than in most systems. The first stop is at a condenser float. When it passes through the float some of the liquid is vaporized and passes through an eliminator into the economizer. The eliminator is simply a series of baffles to strain any liquid refrigerant that is swept up by the gas.

The economizer section is unique in this Carrier unit, and is made possible by the use of a centrifugal compressor. The economizer, located at the opposite

end from the compressor suction line, is in the upper portion of the evaporator shell. Vapor from the economizer enters the second stage of the compressor and mixes with the remainder of the vapor from the evaporator that has passed through the first compression stage. Vapor pressure in the economizer is roughly half-way between the suction pressure and discharge pressure.

By utilizing such a scheme, the refrigerating effect of the liquid is increased, the compressor work is decreased and an increase in efficiency results.

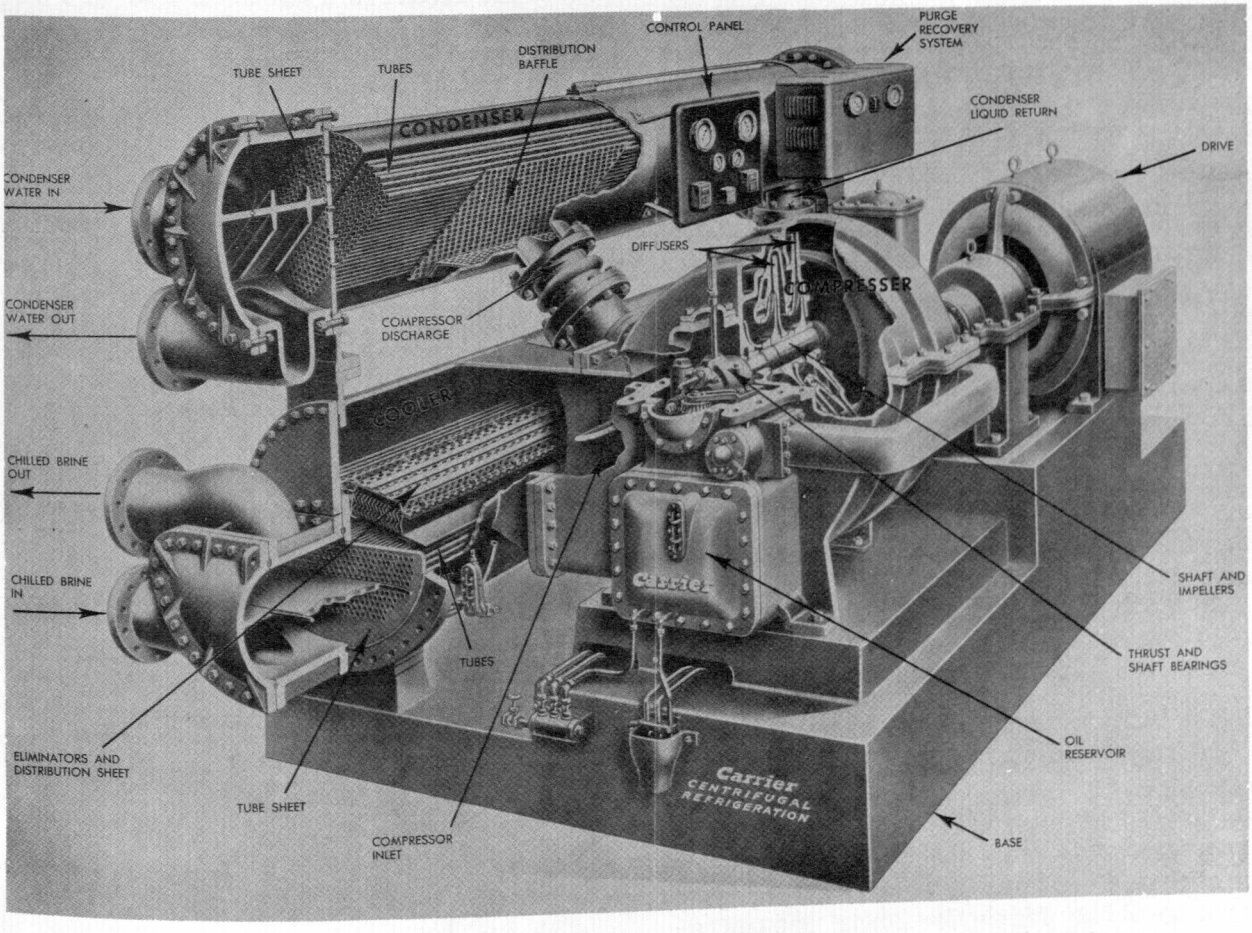
From the evaporator float, the refrigerant is admitted to the evaporator as needed. This primary refrigerant occupies the space in the evaporator shell around the tubes. Inside the tubes, making two passes through the length of the evaporator, is the secondary heat removing agent, calcium chloride brine.

The Freon-11 absorbs heat from the brine and boils off as a gas. This gas then enters the suction line to the compressor to start another cycle.

The secondary agent is the substance which is circulated under the rink to make the ice. The distribution piping system consists of a main supply line and main return line. From the main supply pipe a series of secondary supply headers, spaced the length of the rink, are fed through valves. These headers supply a number of one inch pipes which make one pass across the rink and back to secondary return headers. The return headers connect through valves to the main return line.

By using a secondary system of headers, brine at a uniform temperature may be distributed to the entire area of the rink, thereby obtaining an

(Continued on Page 36)



Cutaway view of a Model 17M Carrier centrifugal refrigeration machine. The economizer described in the article does not show in this view, but is located behind the compresser. The economizer does not run the full length of the cooler or evaporator, but only about a third of the coolers' length, and in the top portion. The eliminators shown in the cooler are for the purpose of straining any liquid that may escape with the vapor in the evaporation process, and return it to the evaporator. They are not to be confused with the eliminators that also appear in the economizer section of the unit, although they both serve the same function.

(Courtesy Carrier Corp.)

Methods - Time Measurement

An Advanced Method For Times And Motion Study Without A Stopwatch

Mel Sandler
Senior, M.E.

For many years there has been a need for the establishment of a procedure to determine production standards that would eliminate the element of judgment on the part of the Industrial Engineer.

Under the conventional method of time-study, the observer must use some judgment to determine the average or normal performance level. An experienced observer usually can make an accurate judgment, but there is no proof that it should take an average worker so many hours to produce a given object. The worker often questions the accuracy of the standards, especially when management-worker relations already are strained. Management has no way of proving the correctness of its production requirements except by exhausting and repetitious study of the job until a large amount of evidence has been compiled.

The conventional methods are costly and time consuming. This necessitates a system that eliminates the element of judgment, is quick and economical to use, and acceptable to labor.

H. B. Maynard, G. C. Stegemerten and J. L. Schwab, executives of the Methods Engineering Council in Pittsburg, became aware of the necessity for a better method of time-study. They developed the Methods-Time Measurement (MTM) system. This system eliminates the judgment of the performance level at which an operator works.

The procedure consists of determining the necessary motions of the operator and assigning predetermined time values to each motion. The total of this gives the standard time for the job. There is no judgment factor because the time standards have been determined from research and are constant for a particular motion.

Here's an interesting example which illustrates the kinds of changes that are being made repeatedly in industry:

1. Management authorizes the design of a new product.
2. The engineer works out a design.
3. The designer develops the tools.
4. The foreman assigns the job to the worker.
5. The worker, after instructions by the foreman, develops a method which turns out acceptable products.
6. The foreman requests a time-study.
7. The time-study man suggests methods changes which are reluctantly accepted by the foreman and worker who feel their abilities are being criticized.
8. The product is sold, and the sales department suggests changes.
9. The engineer changes the design.
10. The tool designer changes the tools.
11. The foreman and worker change the method.
12. The time-study man changes the standard time.
13. An executive thinks he knows

a better method and orders a change.

14. The tool designer changes the tools.
15. The foreman and worker change the method but forget to inform the time-study man.
16. Three months later, the time-study man discovers the change in method and restudies the job.
17. The industrial relations department receives a grievance to the effect that a rate has been cut.
18. The inspection department decides better quality is essential.
19. The tool designer changes the tools.
20. The foreman and worker change the method.
21. The time-study man restudies the job.
22. Production is interrupted for several months. Upon resumption, a new operator is put on the job; he develops his own methods.
23. The industrial relations department receives a grievance that the standard is too low.
24. A new time-study man restudies the job, and finding the standard low for the present method, raises it.
25. The operator, after gaining experience and improving the method, makes abnormally high earnings.

The sequence goes on with new changes, time-studies and standards. The worker makes less and complains until he learns the most efficient method.

The above situation illustrates a striking example of the lack of advance planning. The people mentioned all worked independently. They contributed their suggestions spasmodically after the job was started, rather than getting together and working out their ideas beforehand.

At present, most methods of improvement work is done on existing operations. It isn't always possible to apply methods of engineering principles before the job goes into production.

The present method of improvement is called work-simplification. Under this system existing jobs are studied and simplified, unnecessary work is eliminated and the necessary work is made less fatiguing. As a result, production is increased. This is a fine result, but a factor of change is introduced. This change could, and often does, result in workers being required to produce more, others are transferred or discharged. The worker is inclined to resist change.

Advanced planning isn't a cure-all, but it would facilitate better methods. Fewer changes would result and the problems in human relations would be reduced or avoided. However, regardless of the amount of advance planning employed, there is always room for profitable improvement which comes with experience. The actual effect of advanced methods engineering is to reduce the number of subsequent changes and improvements, not to entirely eliminate them.

Methods-time measurement is a procedure which analyzes any manual operation into the basic motions required to perform it and assigns to each motion a predetermined time standard which is determined by the nature of the motion and the conditions under which it is made. MTM basically is a tool of methods analysis that gives answers in terms of time without using a stop-watch.

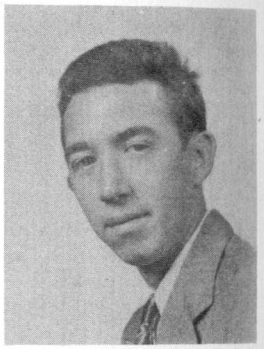
MTM has been in operation in some plants for about four years. During this time, many uses for it have been found:

1. Developing effective methods in advance of beginning production.
2. Improving existing methods.
3. Establishing time standards.
4. Developing time formulas.
5. Estimating.
6. Guiding product design.
7. Developing effective tool design.
8. Selecting effective equipment.
9. Training supervisors to become highly methods conscious.
10. Settling grievances.
11. Research.

(Continued on Page 36)

Ore Flotation

The Chemical Separation Of Ore From The Worthless Gangue



By Jack Marsh
Senior, Ch. E.

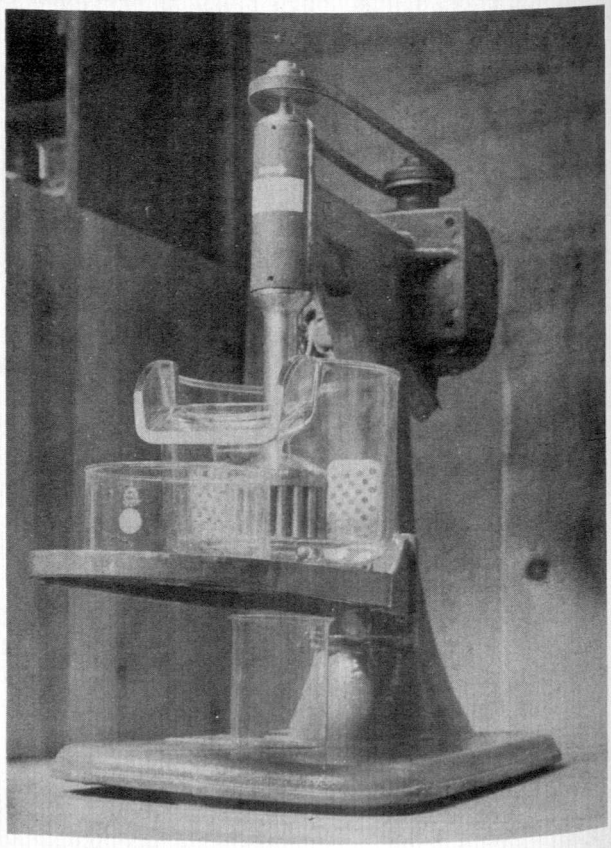
BEFORE METALLURGICAL TREATment of ores can be started, it often is necessary to concentrate valuable minerals contained in the ores. This concentration consists of separating the important mineral from the worthless bulk. If the ore coming from the earth contains relatively little gangue, or worthless rock, concentration may not be profitable. However, such cases are becoming rare as the richer deposits constantly are being depleted.

Of the processes used to concentrate minerals, ore floatation is of primary importance and the one most in use today. Briefly, ore floatation takes advantage of the tendency of certain oils or hydrocarbon compounds to adhere readily to the mineral and to adhere with difficulty to the worthless matter.

This process is said to have its origin in an ordinary wash tub as an alert silver miner's wife washed out her husbands work pants. She noticed while scrubbing out the dirt that the shiny silver dust was carried to the top by the soap bubbles while the remaining dirt apparently dropped to the bottom of the tub.

This first floatation of an ore matches very closely the modern method in that very small particles of ore are carried up to the liquid surface by air bubbles and are skimmed off while the worthless particles drop to the bottom where they can be drawn off.

The first step, after removing the ore-bearing rock from the ground, is crushing it to a very small size. The particles must be less than three millimeters in diameter so that each particle is composed of either valuable material or worthless gangue. Grains larger than 3 millimeters will not be



The Chemical Engineering department's miniature ore flotation unit.

separated from the gangue as the froth is not strong enough to carry larger particles.

The crushed rock and ore next is introduced into the separating machine which contains water and a floatation agent. The feed, water, and agent are thoroughly mixed with the ore particles attaching themselves to the bubbles formed and rising with them to the top of the floatation cell. The gangue particles do not attach themselves as readily to the bubbles and they sink to the bottom, thereby effecting the separation of the ore and the worthless rock.

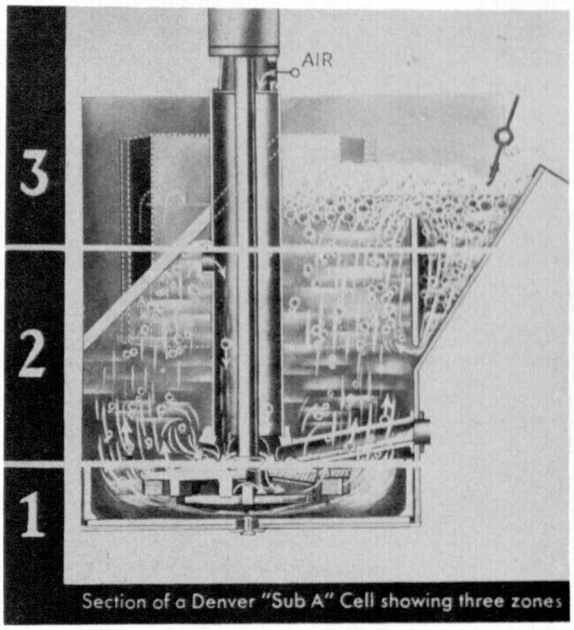
The difficult part of the process was finding the floatation agent that would carry up a certain ore without the gangue yet not reacting chemically with either substance. This work had to be done by experimentation and research workers still are at work trying to find better agents.

Very important in the floatation process is the chemical condition of the floatation cell. This is maintained by the addition of reagent to the water solution. The first of the four general types is the frothing agent, usually an organic substance such as coal tar, pine oil, or eucalyptus oil. When dissolved in water, it must form a stable froth that will be capable of bearing particles of the desired mineral, which is denser than water.

The next agent is a collector, which causes the desired mineral to cling to the interface between the water solution and the layer of frothing agent at the surface of a bubble. This is done by selective wetting; that is, wetting a certain mineral, such as a sulfide, in preference to other minerals or gangue present.

The activator usually is an organic compound which will induce floatation in the presence of some collector that would ordinarily have no effect on the mineral. When some mineral is present that is undesirable in the floatation process, a depressor for that particular mineral is added which prevents the collector from working on this mineral. Very often reagents of all these classes are used in a single floatation process.

The full value of floatation for the concentration of heavy ores can be realized when the number of metals recovered by this process are considered. Some of these metals are gold, silver, platinum, copper, lead, zinc, nickel, mercury, and molybdenum.



Section of a Denver "Sub A" Cell showing three zones

Zone 1 – Mixing and Aeration Zone – The pulp flows into the cell by gravity through the feed pipe dropping on the rotating impeller. As the pulp cascades over impeller blades it is thrown outward and upward by the impeller. This action thoroughly mixes the pulp and air, giving a pulp thoroughly aerated with very very small air bubbles. Zone 2 – Separation Zone – In the central zone, the action is quiet, thus preventing the dropping of the mineral load from the supporting air bubble. In this zone, the mineral laden air bubbles separate from the worthless gangue. Zone 3 – Concentration Zone – In the top zone the material being enriched is partially separated by a baffle from the discharge side of the machine. The cell action at this point is very quiet and the mineral laden concentrate moves forward and is quickly removed by the paddle shaft. *(Courtesy Denver Equipment Company)*

Floatation has done much for the mining industry because it has increased the recovery and grade of concentrated minerals over that obtainable by previous methods. Since this process can get more mineral from the low grade ore, it has raised the level of our ore reserves. The savings brought about by floatation are passed on to the consumer in the form of a lower price level for base metals. The following general changes have been effected by the floatation process.

1. An increase in the grade and recovery of concentrate.
2. An increase in ore reserves.
3. A decrease in the relative cost of metal production.
4. A decrease in the relative price of metals.
5. An increase in the use of metals.

WE PRESENT . . .

The DEAN

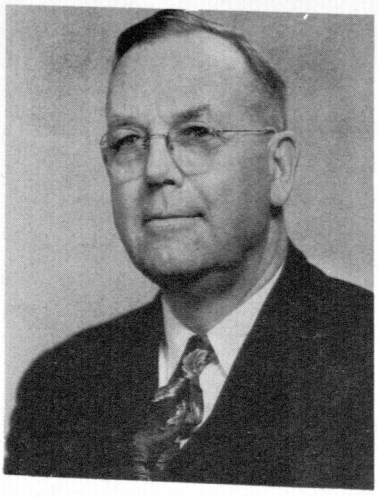
Lorin G. Miller

By Harry Horn
Senior, E. E.

HAVE YOU EVER SEEN A 235 pound, young man barrelling down a cinder track in a 440 yard run? Well, that is precisely what you could have seen had you attended North Des Moines High School while Lorin Miller was a student there. He admits that he usually kicked up quite a dust. He was a fast man, too, as can be seen by the fine 53.6 seconds time that he posted in the 440 while still in high school.

Mr. Lorin Miller is Dean of Engineering at Michigan State College and he attributes his entrance into the teaching profession to his participation and interest in athletics. He explains it this way:

While attending Des Moines University, where he was studying for a Liberal Arts Degree, he played three years of tackle on the varsity football team. He became deeply interested in the coaching profession and remained at D. M. U. as freshman coach and mathematics instructor after obtaining a B.S. in electrical engineering. Dean Miller explains that a man holding a coaching job also was required to teach courses other than athletics.



DEAN MILLER

Two years later, Mr. Miller decided to take graduate work at Massachusetts Institute of Technology. At M. I. T. he studied electrical engineering and participated in varsity track and wrestling. In track, he established the school record in the hammer throwing event.

Once again he returned to the coaching profession. His new job placed him in charge of the Athletic and Manual Arts Departments at Knoxville High School.

His big step away from the coaching profession was taken in 1919 when he received an offer from the University of Wisconsin to become an assistant

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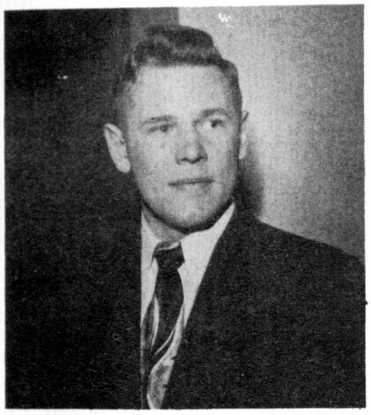
SECOND ANNUAL

ENGINEERING EXPOSITION

Presented By Michigan State's School Of Engineering



By Charles E. Paul
Junior, E.E.

THE FIRST MSC ENGINEERING Exposition was held in May of 1949. The event was a tremendous success and it is now featured as an annual affair at Michigan State College.

Last year, the exposition drew 4,000 persons from various parts of Michigan. Among these visitors were high school students and faculty, professional engineers, industrialists, and other persons interested in various phases of engineering.

With help from the engineering departments and student societies the Engineering Council plans and sponsors the exposition. The council is a group having representatives from the various student engineering societies. The purpose of the council is to coordinate the groups in the engineering school.

A highlight of last years event was the race in the "Rock-it" one-cylinder, 1901 Oldsmobile. Two mechanical engineering students drove the "Rock-it" from Olds Hall to the Oldsmobile Plant in Lansing; a distance of five and three-tenths miles. The race was against time and the cycle was completed in 25 minutes.

Each department of the engineering school participates in the exposition. Last year the mechanical engineers had their power laboratory open. They had large steam engines in operation; Diesel motor-generator units; gauges and instruments used in testing machines; and a materials testing laboratory demonstration.

The Industrial Engineers had a scale model of the engineering school; a scale model of the machine shop used in plant layout; and a kymograph, which is used in motion study and will measure time to .00001 minute.

Metallurgical engineers showed how to test the hardness of steel; automatic temperature controllers, which control metallurgical furnaces; microscopes showing the internal structure of metals; and optical pyrometers, a portable instrument used in determining the temperature of red-hot bodies.

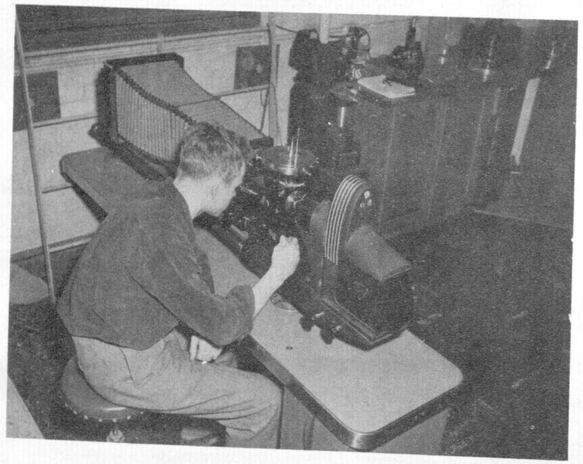
The civil engineers had the State Highway Experimental Laboratory open and had displays showing construction and design; the concrete laboratory demonstrated how concrete is tested for strength and also had mock-ups showing concrete mixing on a job site; transits, various types of levels and other surverying equipment were of great interest to visitors; and the "Truss Bridge", showing tension and compressive gauges to illustrate how a weight in motion causes stresses.

The electrical engineers showed the following: Induction heating of magnetic materials by radio frequencies; transmission of voice on a light beam, electronic welding; stroboscope, a device using a flashing light to indicate the

(Continued on Page 22)

PRIZE WINNERS

7



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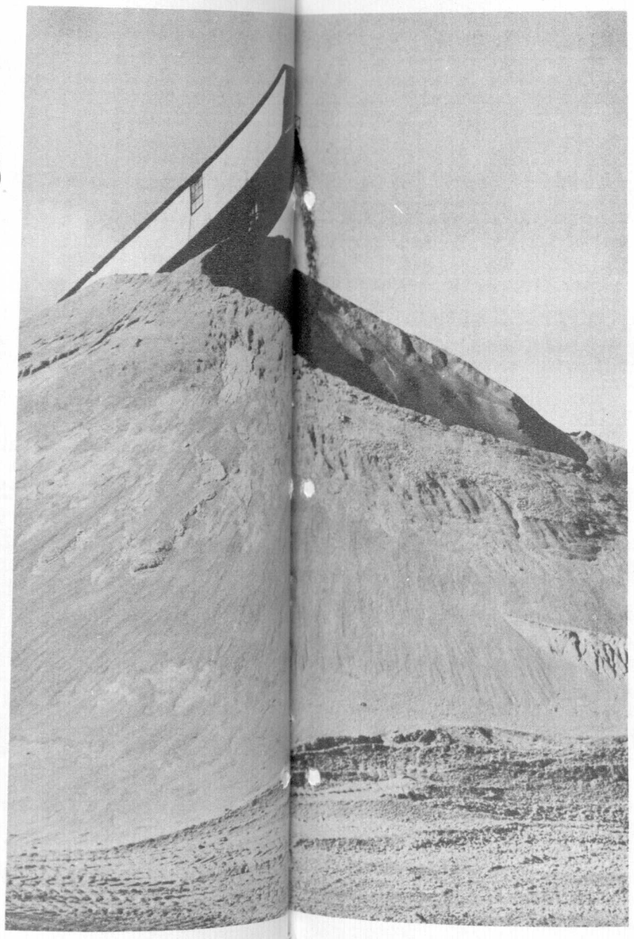

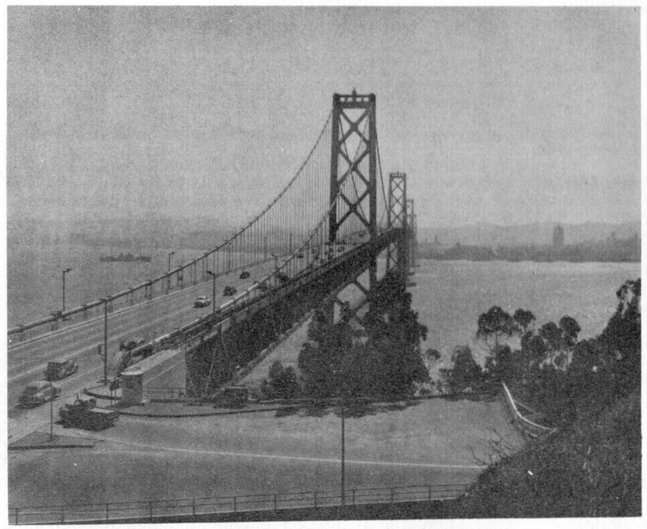

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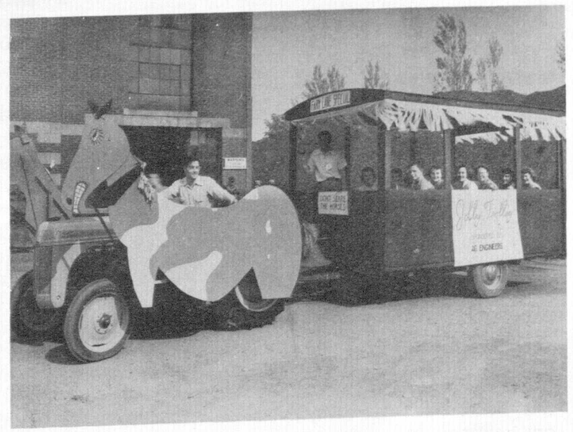


5

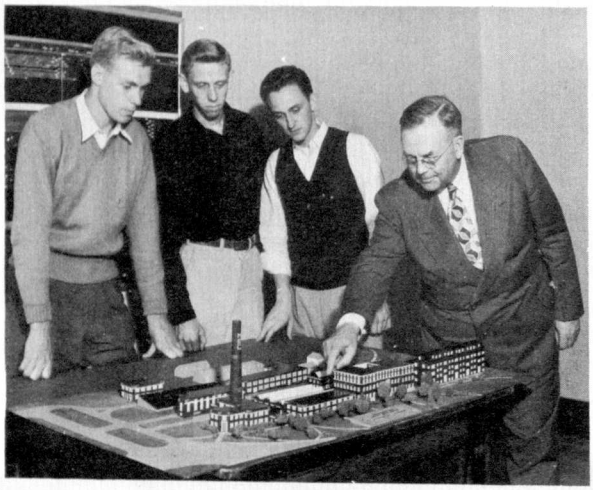
1. First Prize – Awarded to To[illegible]wer.
2. Second Prize – Awarded to B[illegible]use.
3. Third Prize – Awarded to Ri[illegible] Brelsford.
4. Surveying teams are sure sign[illegible] Prize.
5. Ag Engineers provide free carn[illegible] to all Engineering Exposition guests.
6. Cameras have invaded the Met[illegible]ht be used for pictures of metal samples.
7. Phi Lambda Tau initiation ban[illegible]ends in bull session with high brass.

Engineering Exposition

(Continued from Page 19)

speed of rotation; a servomechanism; electronic counting which uses a photoelectric cell and an interruption of a beam of light; electronic motor control; a 150,000 volt industrial X-ray machine used to detect flaws in metal; and a precipition, an electrostatic air cleaner used to remove foreign particles from incoming air.

A shuttle bus, "The Jolly Trolley" was provided by the agricultural engineers. Some of their displays included: the rural electrification laboratory showing farm electrical equipment; various types of equipment used in the processing of foods; latest farm machinery; wood and metal shops; models of farm structures and samples of building materials such as flooring, roofing and siding; portable irrigation pipes, sprays and pumps used in water distribution; and the tourist and resort laboratory which had a typical one-room cabin including the furnishings.



A model of the engineering school. Dean Miller is pointing to the woodshop building.

The Chemical Engineers opened their laboratories and showed: a distillation column which is used to separate mixtures of liquids having different boiling points; an absorbtion column where water absorbs carbon dioxide in passing through it; filter presses; and an evaporator used to boil water off a mixture of water and another substance; a digger used to remove water from a solid material; the heat of water by steam in a heat exchanger; calorimeters used to determine the heating value of city gas, coal, oil, and other fuels; and lubricants and motor testing equipment used to determine the properties of motor oil, kerosene, and gasoline.

Other buildings having displays and demonstrations were the wood shop, machine shop, forge and foundry, sheet metal shop and the automotive laboratory.

The wood shop had students working on special patterns and demonstrated their power tools.

Various phases in the production of the air compressor were demonstrated in the machine shop. A complete line of grinders, shapers, milling machines, radial drill, lathes and other equipment were on display.

The forge and foundry demonstrated hand forging, arc welding, acetylene welding and torch cutting of metal. The heat treat laboratory had demonstrations on heat treating of steel. Students demonstrated the casting of pistons in the foundry. On display were a Detroit electric arc furnace, a 24 inch cupula, and two gas fired furnaces.

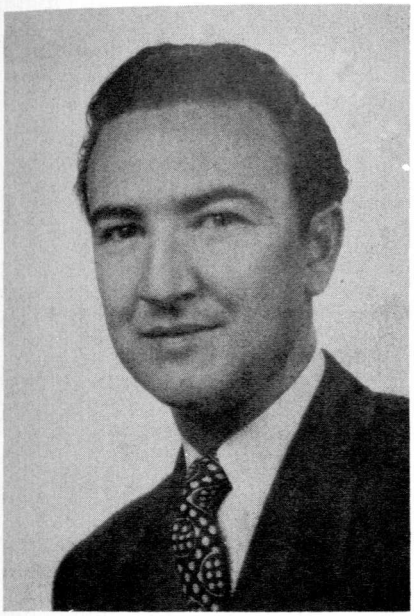
The sheet metal shop gave away ash trays stamped from sheet metal. They also demonstrated a metal cutting saw, forming rolls, press brakes, metal slitting saw, and a spot welder.

Cutaway motors and chassis were exhibited in the automotive laboratory. Dynamometers were demonstrated to show how various characteristics of an engine were determined.

The 1950 exposition will include many of the same exhibits and demonstrations as were shown in 1949 because of the interest shown. In addition, there will be many new exhibits from both the engineering departments and industrial concerns.

A few of the added exhibits to be shown this year are a cutaway jet engine supplied by the Air Force. A television demonstration will be shown and the Amateur Radio Club will present a radio communication demonstration. A display showing the use of radioactive isotopes and the disintegration of the atom also will be portrayed.

The above mentioned displays are just a few of the many exhibits that will make the Michigan State College Second Annual Engineering Exposition one of the college's greatest attractions.



INSTRUMENTATION

A Field Of

Measurement And

Control Engineering

Henry Nay
Senior, E. E.

Instrumentation, the science and technology of measurement and control, if of great importance and of very broad application. It underlies and enters all the branches of industry, more often cutting across the different branches of engineering and science than staying within conventional boundaries.

In the past few years there has been a rapid development of ingenious instruments and, paralleling this development, there has been a commendable increase in the effective use of these instruments. These advances have been necessary because technology has reached a point beyond the ability of human sensory reactions.

Instruments extend the range, discrimination, sensitivity, and precision of our senses. Instruments are the sense organs of society; the eyes, ears, nose and skin wherewith human beings pry out the nature of the world about them.

Recognition of these facts has created the field of Measurement and Control Engineering. The significance of efforts expended on the instrumentation associated with any basic problem make this field one of the most important and urgent in modern engineering. Entire programs in technical fields serve as examples of work based on the ability to measure and control physical factors. It is the job of the measurement and control engineer to eliminate "bottlenecks" which exist at present because of a need for better measurement and control.

A measurement and control engineer is a specialist in the application of physical principles and engineering technology to the problems of measurement and control common to all sciences and industries.

The instruments, in which most of the major companies are interested, are those capable of detecting variations in process conditions and indicating, recording, or controlling these variables. It is not surprising that there is an increasing demand for more knowledge of these instruments.

Practically all of the major instrument companies have been conducting courses in the application and maintenance of their instruments for the benefit of their customers.

These companies publish catalogs, engineering data, and instructions on the application, installation and maintenance of their equipment — yet, this material is inadequate. Unfortunately, there is a lack of understanding among those responsible for their application and performance results. This stems from a mutual lack of understanding on the part of the supplier and (Continued on Next Page)

potential user of their respective needs and abilities.

Manufacturers of instrumentation equipment need top level men with a knowledge of instrumentation that will make it possible for them to develop new processes, and improve present ones, for greater efficiency. The need for men of this calibre is unprecedented.

If science is to progress, then the fundamental problems of measurement and control must receive the attention they demand. Behind any successful application of scientific instrumentation there lies the long road of research and development. From these efforts come the measuring and control tools of science. To insure their continuous flow, a direct source of manpower must be established.

A program of training for those who may eventually fill top positions in the field of instrumentation research and development represents a major change in college curricula. Instrumentation encompasses working principles associated with all of the different fields. In fact, one of the attractions of instrumentation is that the study is so broad and general. In a sense, it represents general engineering.

Training in this field requires a fusion of fundamentals drawn from many established fields. Because they are potential selectors of industrial instruments, measurement and control engineers should know the basic principles of the various types of instruments; how they function; where, why, and how they are applied.

Laboratory experimental work should be set up to emphasize the characteristics and limitations of the instruments. These engineers should understand the functional differences between various types of automatic control mechanisms and why they must be different to cover the broad field of application.

It can be seen that there is a definite need for training in measurement and control. Although training in this field requires a radical departure from established programs, it has been predicted that within five years the majority of engineering schools will offer such a course.

The Societies

At the last meeting of winter term, the ASCE presented a movie on nodular cast iron.

"The River", a documentary film dealing with the soil conservation measures taken by the TVA on the Mississippi River, was shown at the first meeting of spring term. Officers for next year were nominated at this time and elections will be held as soon as possible.

* * * * *

During the latter part of Winter term, the annual banquet of the AIChE was held in the Union. Sam Street Hughes, lawyer and former Lansing mayor, was the main speaker of the evening. His talk was a very timely and interesting one about "An Engineers Responsibility to the Community."

Plans are being made for the Spring term picnic at which the Ch. E.'s traditionally forget their studying for a night of fun.

* * * * *

The AIEE-IRE officers for the next school year were elected at the beginning of Spring term. The new officers are:

Bill Guntrum, Chairman
Chuck Steigleder, Vice-Chairman
Tom Ginther, AIEE Secretary
Chuck Paul, IRE Secretary
Jack D'Agostino, Treasurer.

This group recently has enjoyed talks on "Electric Home Heating by Radiant

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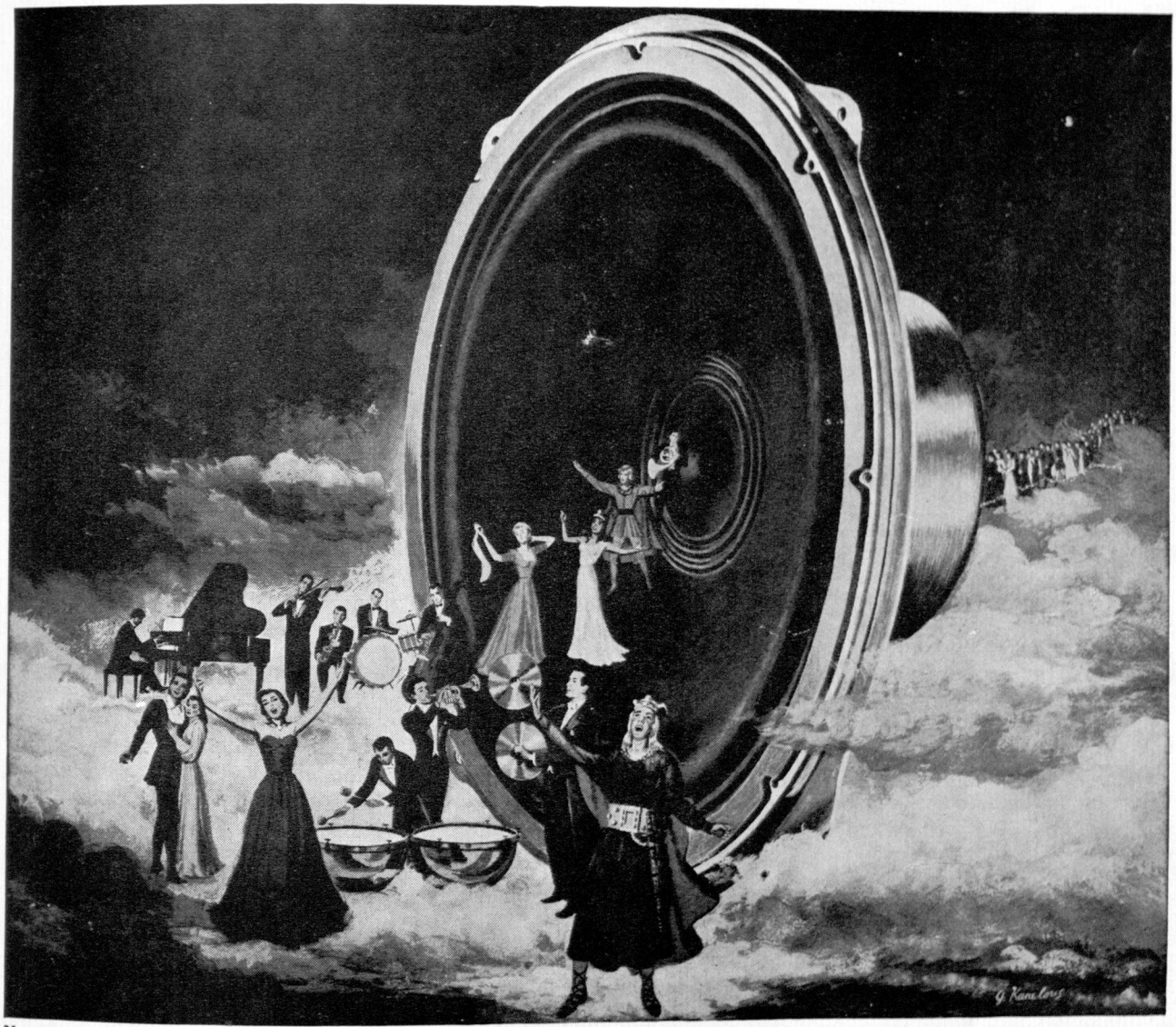

New Duo-Cone loudspeaker, developed at RCA Laboratories, achieves the illusion of "living presence."

Music lovers' **"horn of plenty"**

For years, working toward the ultimate in sound reproduction, scientists have sought for *living presence*—the illusion that a musician or speaker is talking, singing, playing in your home.

Now, with RCA's Duo-Cone loudspeaker, the goal is achieved. Two soundcones in acoustical alignment reproduce sound without distortion, and give you every tonal value from a frequency of 30 on to 15,000 cycles. It is in the area above a frequency of 4,000—seldom touched by conventional speakers—that most of the all-important "overtones" lie. RCA's Duo-Cone loudspeaker reproduces every overtone—to the very peak of a violin's range—and faithfully gives you the deep low notes of a bass drum!

In addition, the RCA Duo-Cone loudspeaker's wide angle of sound pervades every corner of a room without sharply directed blast or blare. Its response to tones of every frequency is smooth, flowing, and even.

* * *

See the newest advances of radio, television, and electronics at RCA Exhibition Hall, 36 W. 49th St., New York. Admission is free. Radio Corporation of America, Radio City, N. Y.

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- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
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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

World Leader in Radio—First in Television

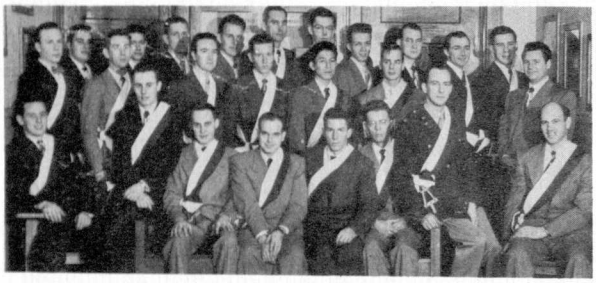
The Societies

(Continued from Page 26)

Heating Panels", "Silicone Electrical Insulations", "Fundamentals of Coordination of Power and Communication Systems," and "Motor Control". Several movies also have been shown.

* * * *

Tau Beta Pi held its annual winter initiation on Feb. 22. The chapter was highly honored by the presence of the honorary's National Executive Council at the initiation banquet.



Tau Beta Pi Initiates

Councilman Harvey Merker, of Detroit's Parke Davis Company, was the principal speaker. He talked about the importance of observations. In his talk he told the stories of the origins of many of medicine's miracle drugs and sanitation measures.

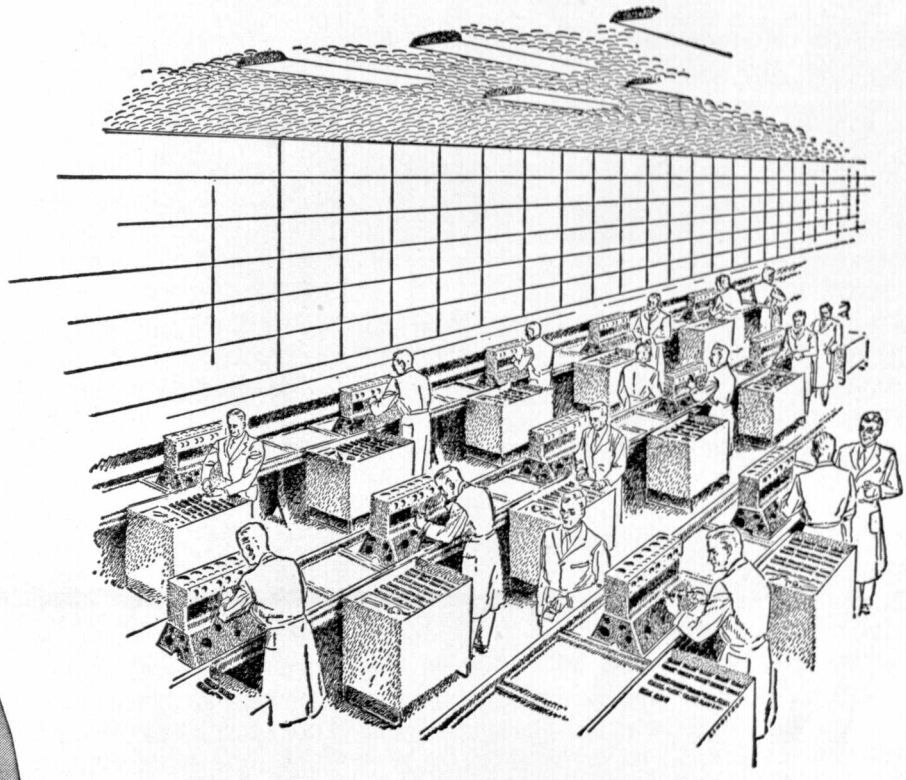
At the March 9th meeting election of officers for next year was held with the following students elected: James Jursik, president; William Little, vice-president; Donald Burrus, correspondence secretary; Lawrence Turner, recording secretary; Adrian Chamberlain, cataloger.

The following men were elected as representatives to the Engineering Council; Donald W. Schriener, Frankemuth, Mich.; Albert G. Kurisu, Hakalau, Hawaii.

* * * *

ASM During recent meetings, members of the American Society for Metals listened to an informal talk and a four man panel discussion on the subject of the metallurgical profession. Dr. A. J. Smith gave a talk on what is expected of the metallurgical engineer in industry.

(Continued on Page 32)



Better product . . . better production

Roebling Aircord contributes importantly to safe, sure "control in the air".

Roebling Oil-Tempered Spring Wire leads for automotive springs.

Roevar Magnet Wire insulation is 10 to 40 times tougher than other types.

WHEREVER HIGH CARBON WIRE can improve the quality of a manufactured product, Roebling wire can be adopted with complete confidence in results. Roebling is one of the world's largest producers of quality Oil-Tempered Spring Wires and Cold Rolled Spring Steels . . . furnishes wire with physical properties and finishes for almost every purpose under the sun.

But besides bettering your product, Roebling round, flat and shaped wires, bring you better production, too. Every inch of these wires is identical in gauge, grain and finish. Your machine preparation time is lowered; machine stoppages and rejects cut way down . . . Roebling research, special techniques and modern, precision equipment assure wires with definite *plus* values for every user.

THAT'S WHY...

Today it's Roebling!

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

Atlanta, 934 Avon Ave. ★ ***Boston,*** 51 Sleeper St. ★ ***Chicago,*** 5525 W. Roosevelt Road ★ ***Cincinnati,*** 3253 Fredonia Ave. ★ ***Cleveland,*** 701 St. Clair Ave., N. E. ★ ***Denver,*** 4801 Jackson St. ★ ***Houston,*** 6216 Navigation Blvd. ★ ***Los Angeles,*** 216 S. Alameda St. ★ ***New York,*** 19 Rector St. ★ ***Philadelphia,*** 12 S. Twelfth St. ★ ***Portland,*** 1032 N. W. 14th Ave. ★ ***San Francisco,*** 1740 Seventeenth St. ★ ***Seattle,*** 900 First Ave. S.

A CENTURY OF CONFIDENCE

We Present

(Continued from Page 18)

Professor of mechanical engineering.

Eventually he moved back to his old stamping grounds at D.M.U. as Dean of Engineering. He later came to M.S.C. where he became head of the mechanical engineering department in less than a year. Two years ago, after Dean Dirks retirement, he was appointed Dean of Engineering.

It may seem odd that Dean Miller, wno graduated as an electrical engineer, should spend so much of his time connected with the mechanical engineering department. The dean says that it is quite easy to be shifted from one field of engineering to another and cites another experience of his as an illustration.

During the first world war, the service placed him with A. T. & T.'s Bell Laboratory in New York. There he began an electrical engineering job involving magnetic circuits. On this job. he had a very small part in developing the magnetic alloy "Permalloy". This was placed on his work record and when he was transferred to the Hawthorne Works in Chicago he was tagged as a metallurgical engineer and was placed in the Metallurgical Department.

Dean Miller is extremely interested in heating and ventilating and is generally considered a national authority on the subject. He is chairman of the Technical Education Committee for the National Warm Air Heating and Air Conditioning Association and was responsible for the inauguration of the Forced Warm Air Conference twenty years ago. This conference is conducted annually at M.S.C. It has been so successful that this year will see the beginning of a similar series at Purdue and Iowa State College. Next year it will be introduced at Syracuse University.

The likeable and good-natured dean, who now tips the scales at 260 pounds, believes he has gained some sort of reputation as an accomplished eater. However, his claim to fame in the culinary field is, in the words of the former coach, "not as a distance man but as a sprinter." His records, if any, are made in putting away a meal in a minimum amount of time.

Photo by USAF Air Materiel Command

Glass face that can take a bath of fire

The man you see here can wade into the hottest part of a gasoline or oil fire and stay to put it out.

He is wearing the latest in fire-fighting dress, developed by the Engineering Division Laboratories at Wright-Patterson Air Force Base, in Dayton, Ohio.

Designing the suit—to protect the wearer against heat up to 2000° Fahrenheit—was a tough enough problem for Air Force scientists. But once they had solved this by using layers of glass fabric, nylon, and metal foil, the problem presented by the visor for the fire-fighting suit was yet to be worked out.

Was there a material transparent enough to let the fire fighter see, yet fire-resistant and fire-repellent enough to let him face up to a 2000° Fahrenheit blaze?

That question was put to Corning Glass Works, and the answer was a fire fighter's face made of Corning's Vycor Brand 96% silica glass.

Two thin panels of 96% silica glass—the Corning glass that can be heated till it glows and then plunged into ice water without breaking—are used to make the visor. And their inner surfaces are coated with thin, transparent films of gold.

This glass transmits cool, visible light, allowing the fire fighter to see. The gold film blocks the hot, invisible rays by reflecting them outward. A small dead-air space between the glass panels prevents conduction of heat through the glass from the hot, burning gases.

We hope this special use for Corning's 96% silica glass will remind you that today—because of Corning research—you can use glass in many ways that you may never have thought of before.

Throughout industry, Corning means research in glass—research which has made glass a material of practically limitless uses. That's a good thing to remember when you've finished college and started working. Then, as you plan new products or processes, we invite you to call on Corning before the blueprint stage. *Corning Glass Works, Corning, New York.*

CORNING
means research in glass

The Societies

(Continued from Page 28)

The four man panel was brought in from the Western Michigan Chapter of the A.S.M. to discuss the metallurgical profession. The speakers included Herb Lloyd, sales engineer for the E. F. Houghton Co. of Grand Rapids; Tom Snyder, chief metallurgist for Continental Motors Corp. of Muskegon; Al Demmler, director of metallurgy and research for Campbell, Wyant & Cannon Foundry Co. of Muskegon; and Lew Haga, president of the State Heat Treat, Inc. of Grand Rapids.

Plans are being made for a talk by Mr. Jominy, who will soon be national A.S.M. president. This meeting will be open to graduate and undergraduate engineers in the vicinity.

* * * *

The ASME presented several interesting programs during the past term for the various interest groups.

A Babcock & Wilcox film, "Steam for Power", showing different types of boilers, their development, construction and erection was shown. Mr. E. W. Burnstadt, a steam turbine specialist from General Electric Co., gave a short talk on steam turbines. He also showed slides of several GE models, pointing out salient features of each.

Perhaps the most interesting meeting of the year was the occasion when Mr. Bill Bean visited our campus. His lecture and demonstrations on design and the uses of strain gages was exceedingly interesting.

Mr. Bean chose three factors of design material, design and load — and built his talk around them. He visually showed how correct application of these factors would form a sound structure when assembled. Mr. Bean went on to demonstrate how a designer could simplify his work, lighten the component parts without sacrificing strength and build better machines or structures by using electrical testing methods on questionable parts or joints.

Mr. J. J. Edwards, supervisor of standards and methods at Oldsmobile, explained his company's system of methods planning. With the use of slides he showed how the Oldsmobile plant attacked the problem of simplifying an operators job, at the same time making it as easy and untiring for the operator as possible.

BOTTLENECKS

Have No Place in Production—or in Your Future Progress!

by CHESTER E. MEYER
Superintendent, Production Scheduling
General Machinery Division
ALLIS-CHALMERS MANUFACTURING COMPANY
(Graduate Training Course 1938)

PRODUCTION CONTROL in a big plant like the Allis-Chalmers West Allis Works is a constant campaign to prevent bottlenecks and keep orders moving along smoothly to meet scheduled shipping dates.

CHESTER E. MEYER

Most men face much the same kind of personal problem when they get out of engineering school and plan a program of graduate training and experience leading to a firm position in the work they want to do. They can't afford to risk bottlenecks and blind alleys in that program, either.

Big Opportunity

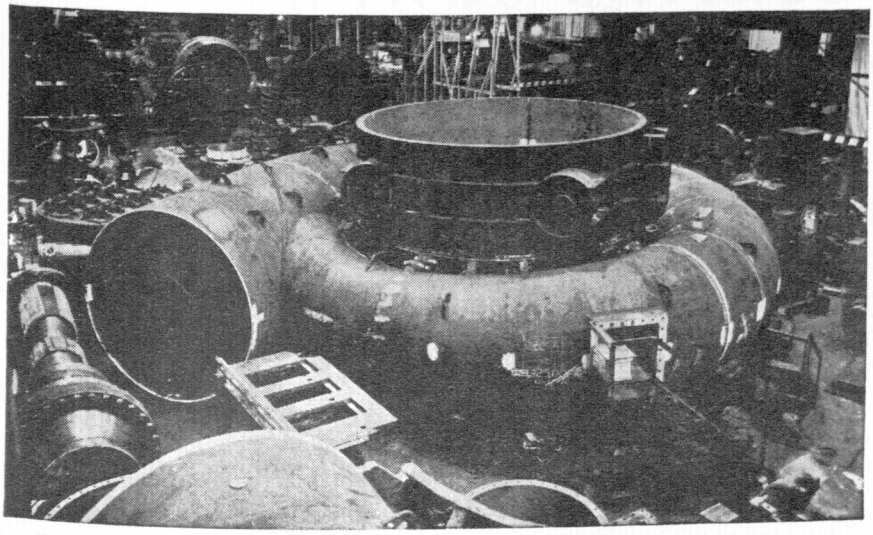
I had this in mind when I graduated from MIT in 1936 and enrolled in the Allis-Chalmers Graduate Training Course. I'd been particularly interested in production and sales. I was looking for practical training, experience and opportunity. And I got them.

First assignment was in Steam Turbine erection. Then I went to the Centrifugal Pump Department, and worked on cost analysis. This job gave me a chance to study plant layout and manufacturing methods, and put me in contact with the Time Study and Planning Department. I liked the work, and finished up the course in that department. I've stayed in the same type of work ever since.

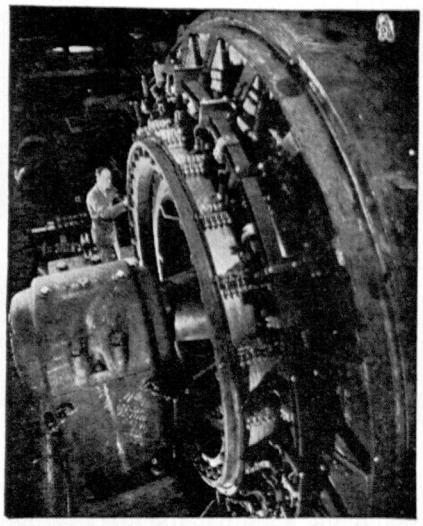
Here in Production Scheduling we pick up each job after the Planning Department has established the routing. It's up to us to set a shipping date, and then work out dates when the job is to be completed in the various shops through which it must go. This requires a thorough knowledge of methods, shop capacities and work loads throughout the entire plant.

Great Diversity of Products

To give some idea of the extent of this operation, here are a few facts about the West Allis Works: The floor area of the buildings is more than 160 acres. There are 14 miles of railway and 4 miles of roads within the plant, and the shops contain more than 30,000 power tools, from small precision machines to the great 40-foot boring mill. It requires 208 traveling cranes to handle materials and equipment. There are twelve great machine, assembly and erection shops, three foundries, pattern shop, tank and plate shop, forge shop, mill shop and many miscellaneous buildings used in manufacturing.



Completed parts flow on a planned master schedule from all parts of the great West Allis Works as this large turbine unit takes form. This is a general view of a part of the vast erection shop.



Assembling big direct-current blooming mill motor for test—last step in the manufacturing process before shipment and final installation.

Some of the big jobs going through now include a 107,000 kw steam turbine unit for a midwest utility and two complete new hydraulic turbine and generator units for Hoover Dam. There's an order for six 22,000 hp pumping motors for a West Coast irrigation project, and another for one of the largest power transformers ever built. Rotary kilns up to 400 ft. in length, gyratory crushers weighing 500 tons and 22 million volt Betatrons are all products of these shops. So are delicate electronic and control devices.

Allis-Chalmers designs and builds basic machines for every major industry: steam and hydraulic turbine generators, transformers and other equipment for the electric power industries; crushers, grinding mills, rotary kilns, screens and other machines for mining, ore processing, cement and rock products; flour mills and oil extraction plants; electronic equipment; big pumps, motors, drives . . . to name just a few.

Widest Choice

As you can see, Graduate Training Course engineers at A-C can move in just about any direction they choose—any industry, any type of work from machine design, research and product engineering to manufacturing, selling and installation.

The course is set up to allow students plenty of chance to gain training and experience in the work they choose. There's no reason to run into bottlenecks or dead-end streets—for students help plan their own courses, and are free to change their plans as new interests, new opportunities, present themselves.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

. . . CAMPUS NEWS

THE ELECTRICAL ENGINEERING Department has started a student research program. This is a program aimed at giving EE's a chance to obtain some research experience before leaving college.

The three options have consented to give credit for projects. Space and all necessary equipment is provided by the EE department. There are students working on projects for the chemistry, physiology, and chemical engineering departments, at the present time.

* * * * *

TWO MECHANICAL ENGINEERING department instructors have recently received their master's degrees. Samuel Mercer wrote a thesis on the "Effect of Martempering on the Endurance Limits of Two Alloy Machine Steels". Luke Yerkovich submitted a paper on airflow in ducts.

Prof. Charles Sigerfoos and Prof. Leonard Price attended a Foundry Education Foundation conference in Cleveland. The FEF is supported by foundries throughout the country. One of its functions is to give scholarships to deserving persons interested in foundry work. Professor Sigerfoos has worked hard to get MSC in the organization, and is very close to succeeding. One of the objectives while in Cleveland was to make final arrangements preparatory to signing the contract. At present there are eleven colleges having membership.

In June, Dean Lorin Miller and Professor Price will attend the annual meeting of the American Society for Engineering Education in Seattle, Washington. In 1951 this meeting will be held at State.

HOW BIG

SHOULD AN OIL COMPANY BE ?

•

HERE IS A STRAIGHT ANSWER FROM ONE OF THE OLDEST COMPANIES IN THE INDUSTRY:

Socony-Vacuum is the size that it is — neither the biggest nor the smallest in the Petroleum Industry — because it is an efficient size for the kind of business we do.

Efficiency is the key to a company's size — for it is the key to what the American public wants, the most for its petroleum dollar.

Under the American system of business, a company that operates *inefficiently* soon *loses business* to other companies able to offer the public more value at lower cost. That's how American competition works — and if any company gets so big that efficiencies inherent in mass operation are more than offset by increasing costs — *competition* will cut that company to a proper size.

To put it another way:

A *company* is as strong as its competitive efficiency —

In turn, an *industry* is as strong as its companies —

And in turn, a *nation* is as strong as its industries.

Thus, *every* company, big or little, must be *"big" enough* to serve the best interests of the people in the area it covers!

Since 1866— the Flying Red Horse Companies have practiced *Competitive Efficiency* to supply you with Finest Petroleum products at the lowest possible cost!

The Flying Red Horse Companies

SOCONY-VACUUM OIL COMPANY, INC.

and Affiliates: MAGNOLIA PETROLEUM CO. • GENERAL PETROLEUM CORP.

Refrigeration

(Continued from Page 13)

even overall ice temperature. Purge line connections are made in each pipe just before it enters the return headers.

The main return line discharges the heated brine into a large storage tank. A centrifugal pump removes the brine from the tank and pumps it through the evaporator.

The capacity required of the plant is quite variable, depending on the type of activity which is scheduled, the number of people that will be on the ice or in the building and the weather conditions.

Capacity may be controlled in four ways: An air-operated, temperature-controlled damper in the suction line from the evaporator; a drum controller that varies the speed of the motor; a by-pass valve and line from the condenser vapor area to the first stage compressor suction line; and a throttle condenser cooling water supply which raises compressor discharge pressure.

Methods - Time

(Continued from Page 15)

On numerous occasions, the tool designer has a choice of several different designs that he might use to accomplish a given purpose. Cost and manipulation time should be the prime factors to be considered. Under present conditions, more consideration is given to cost than to anything else because the designer doesn't have a satisfactory method of determining the time.

By using MTM, the designer has an easy means of determining the manipulation time for any device he may consider.

Methods development and the improvement of office procedures long have been recognized as being worthwhile, but they have been subordinated in favor of the shop. Studies of office procedures have been retarded by the use of the stop-watch. MTM eliminates this.

MTM is four times faster, more economical to apply, and less controversial than the conventional method of time-study.

Like To Be Abreast of New Developments?

FIGURE IT IN ALUMINUM

this one is of major importance to future engineers... and businessmen!

Electricity is so much a part of our lives today that a new, lower-cost way of carrying it is important to everyone.

Alcoa E.C.* Aluminum conductor for insulated electric wire and cable is revising old ideas of cable costs. In large size cables, aluminum conductors weigh only one-half as much as copper of equivalent current carrying capacity, are therefore lower in cost and easier to handle. Cost and weight savings are worthwhile in all sizes down to No. 6.

Electrical Conductor Aluminum

Leading manufacturers of insulated wire and cable are making their products available now with conductors of Alcoa E.C. Aluminum. Suppliers of fittings and accessories are producing correct types for use with aluminum. If you would like further details, toward the day when you may be in a position to suggest a saving on electric wiring, write today for a copy of the illustrated book "Questions and Answers About Aluminum Conductors", ALUMINUM COMPANY OF AMERICA, 742E Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM ®

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

Alumni Notes

(Continued from Page 7)

since 1947, has retained an associate professorship.

John became interested in statistical quality control in 1944 and since then has organized and presented several short courses in that field.

Along with his other work, John is an advisor to the Illinois Technograph and past chairman of the Engineering College Magazines Association. He also is a member of the ASME, Tau Beta Pi, Pi Tau Sigma and many other associations.

Vaughn Hildebrandt, '42, was appointed assistant professor of Metallurgical Engineering at Illinois in 1949.

Immediately after graduation, Vaughn entered the army. Upon his release he took employment with the Ford Motor Co. in the quality control department. In 1946, he held a half-time graduate assistantship and received the MSC graduate council fellowship for 1946-47. Vaughn is very interested in copper-beryllium alloys and expects to continue with his doctorate thesis work at Illinois. He is a member of ASM, Tau Beta Pi, and Alpha Chi Sigma.

K. J. Trigger '35, did a little hopping around before he landed at the U. of I. After receiving his BS in ME at State, he taught here until 1936. Then he spent a year at Swarthmore and one at Lehigh and finally joined the Illinois staff in 1938.

Ken's main interest is in the field of heat treatment of metals and in research in metal cutting. He is the author of a dozen articles on heat treat and metal cutting, and is active in ASME sessions on machinability. Research work on tool-chip interface lumps gave him international recognition by placing him in "Who's Who in Engineering" and "American Men of Science". He is a member of ASME, ASM, ASEE, Tau Beta Pi, Pi Tau Sigma and others.

Ross J. Martin, '40, went to the U of I as a special research assistant in the field of heating — specifically, working with hot-water and steam systems. After spending some time with the navy during the war, he returned to start teaching in the heat-power field. He now is specializing in heating, ventilating and refrigeration.

There isn't much difference in freshmen from year to year. You can tell a freshman girl right off because she says, "Stop," and you can tell a freshman boy just as easy because he does.

If every boy in the United States could read every girl's mind, the gasoline consumption would drop off fifty per cent.

SIDE TRACKED . . . .

We hear that this year's bathing suits are barely big enough to keep a girl from being tanned where she ought to be.

* * * *

A tricky Jane I'll tell the world
Is little Minnie Marters.
An inviting smile on her lips,
But mousetraps in her garters.

* * * *

An eighty year old Playboy had married a girl of twenty-two, and more than anything else he wanted a son. So he went to his doctor and explained his ambition.

"I'm sorry," said the doctor, "You may be heir-minded, but you're not heir-conditioned."

* * * *

A quick look through the brassiere ads convinces us that honesty is no longer the bust policy.

Go make your mark in the world

SIDE TRACKED . . . .

New circus actress: "You know I'm new at this business, and I wonder if you'll tell me what to do to keep from making mistakes."

Manager: "Well, for one thing, don't ever undress before the bearded lady."

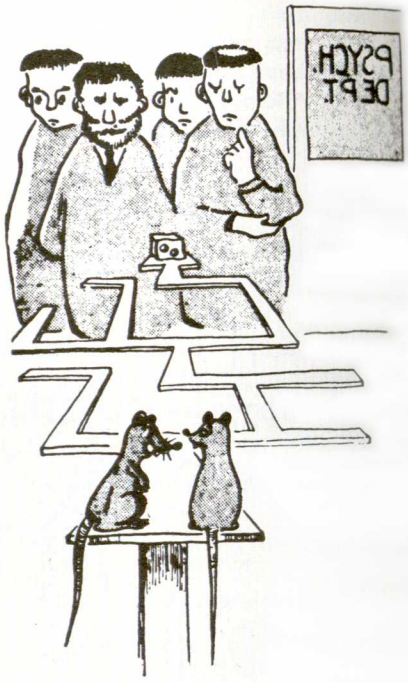
* * * *

First love is only a little foolishness and a lot of curiosity.

He came in through the window,
As the innocent maid lay dreaming.
Her pretty arms beneath her head,
Set his vicious eyes a-gleaming
With a sudden spring he reached her;
She awoke with a violent shriek,
And smashed the darn mosquito,
That bit her on the cheek.

* * * *

A debutante is just a young tomato with lots of lettuce.



"For a lousy piece of cheese."

"Daughter, didn't I tell you not to let strange men come to your apartment? You know it makes me worry.

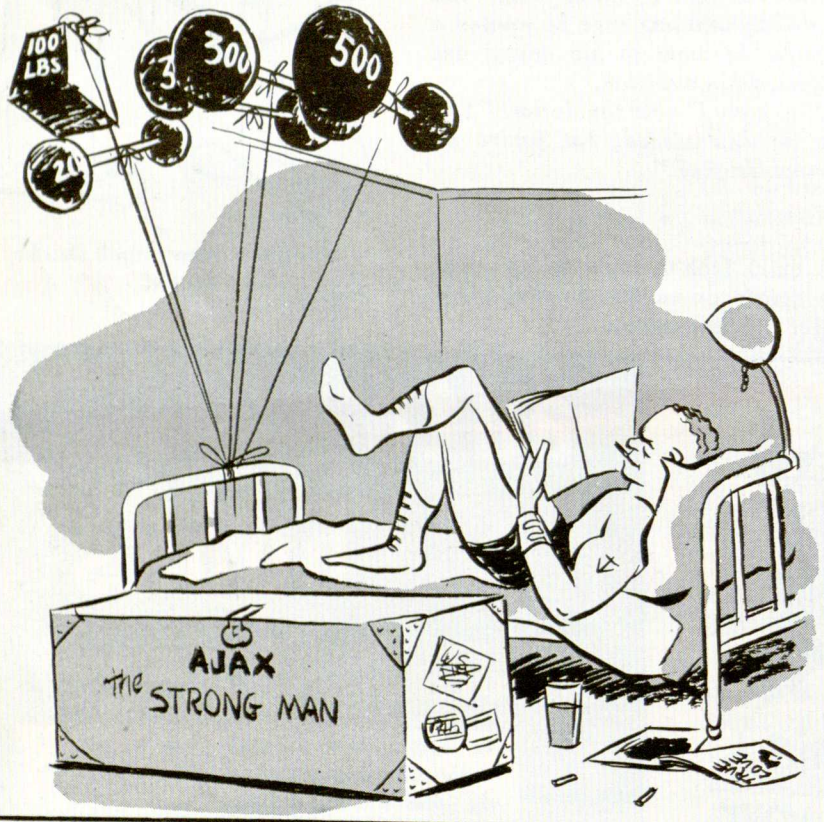
"Don't be ridiculous, Mother, I went to his apartment. . .now let his mother worry."

* * * *

The real reason money is called "Jack" is because a queen takes it.

* * * *

She's a pretty little wench
sitting there upon the bench
looking very coy and shy
at every passing college guy.
Such thrilling eyes,
concentric thighs;
it's too darn bad
she's bald.

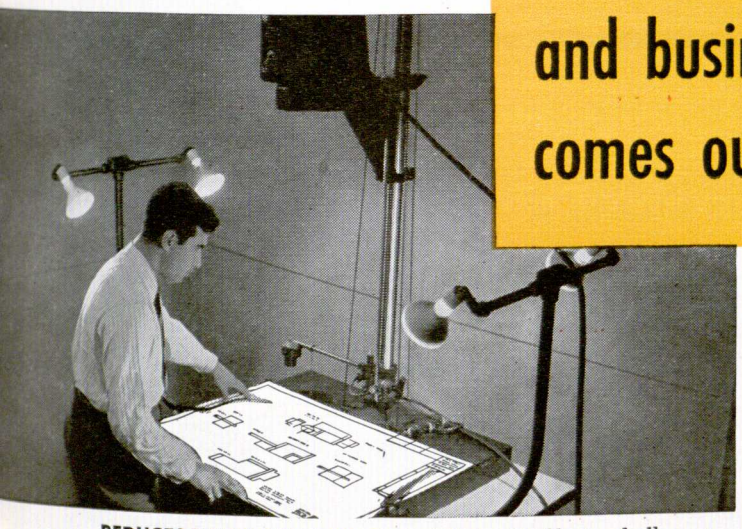


"Nothing, thank you. Just looking."

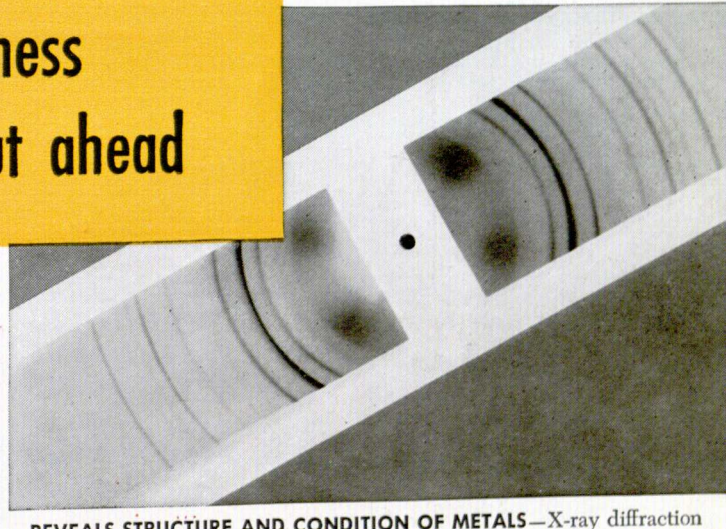
DISPLAYS MASSIVE PRODUCTS—A Diesel locomotive can roar across the Rockies—all on a movie screen in a prospect's office. All because photography can take huge things or small, and make them of a size for a salesman, teacher, or demonstrator to show.

Photography makes big things small—small things big—and business comes out ahead

MAKES MICROSCOPIC DETAILS CLEAR—Photography takes great magnifications produced by the electron microscope (20,000X) on fine-grain Kodak plates, enlarges and records them up to 100,000X on Kodak projection papers. Previously undetectable details and new facts are revealed.



REDUCES FILING SPACE BY 98%—With microfilming, bulky records can be reduced and stored on a few rolls of film. 675 drawings, 24" x 36", can be recorded on a 100' roll of 35mm. Recordak or Kodagraph Micro-File Film. And everything is quickly ready for reference in the Recordak or Kodagraph Film Reader.



REVEALS STRUCTURE AND CONDITION OF METALS—X-ray diffraction patterns on Kodak films or plates provide important information concerning the crystal structure of metals. These patterns help show how alloys can be improved or new alloys made—give data on the effect of machining, drilling, and punching upon the structure of the material.

WITH THE SPEED of a flick of light, photography can reduce or enlarge accurately to scale, and without missing the tiniest detail. And that's not all.

It can magnify time with the high speed motion-picture camera so that the fastest motion can be slowed down for study. It can record the penetrating x-ray and reveal internal conditions of materials and products. With movies and stills, it can repeat a story, time and again, without the loss of a single detail.

Yes, photography serves business and industry in many important and valuable ways. It can work for you, too. If you would like to know how, please feel free to write for literature, or for specific information which could be helpful to you. Eastman Kodak Company, Rochester 4, New York.

FUNCTIONAL PHOTOGRAPHY

serves industrial, commercial, and scientific progress

Kodak
TRADE-MARK

Public Opinion—
NOTHING IS STRONGER
...given the facts
NOTHING IS WISER

On Bigness

We are today a much larger country than we were short years ago. Comparing 1930 with 1948, Federal government expenditures have grown from $3.6 billion to $40 billion. National income has grown from $75 billion to $226 billion.

* * *

Is small business holding its own with big business in this growth? Or being driven from the American scene, concentrating business into a few hands?

* * *

In 1900, there were 15 firms for each 1000 people. Today there are 18. (Apparently small business is not losing ground.) The average firm has the same number of employees as at the beginning of the century.

* * *

According to a survey by the Federal Reserve Board covering approximately 2,000 concerns, during the war, the small and medium-sized firms in total increased their profits, assets and net worth faster than did large concerns. In 1948, there were in operation one-third more business units than in 1944.

* * *

Can new businesses crowd in and climb to the top? In 1935, to take the electrical business as an example, only 153 companies did over $500,000 business. By 1947, there were over 342 companies with sales in that higher bracket.

* * *

General Electric, in spite of its growth during the past 20 years, has only been able to keep pace with the growth of industry and of the country. We estimate that our percentage of production in the electrical industry was about 23% in 1930, 25% in 1940, and is today approximately 24%.

* * *

It is the job of all business and all industry to supply the ever-expanding needs of people. Big jobs require big tools. No company and no industry in the American economy is yet big enough to bring enough goods to enough people.

You can put your confidence in—

GENERAL ELECTRIC