Fall 11-1950

# Volume 62 - Issue 2 - November, 1950

Rose Technic Staff
*Rose-Hulman Institute of Technology*

# RoseTechnic

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED


November, 1950

*Klystron: Milestone in the Microwave Art*

# What Happens When 150,000,000 People Say:

# "I WANT!"

## THE STORY OF OIL

COLONEL Edwin Drake's oil well, drilled in 1859, produced only 20 barrels daily . . .

*But it gave people a taste of the benefits of petroleum*—and a great industry was off to a flying start!

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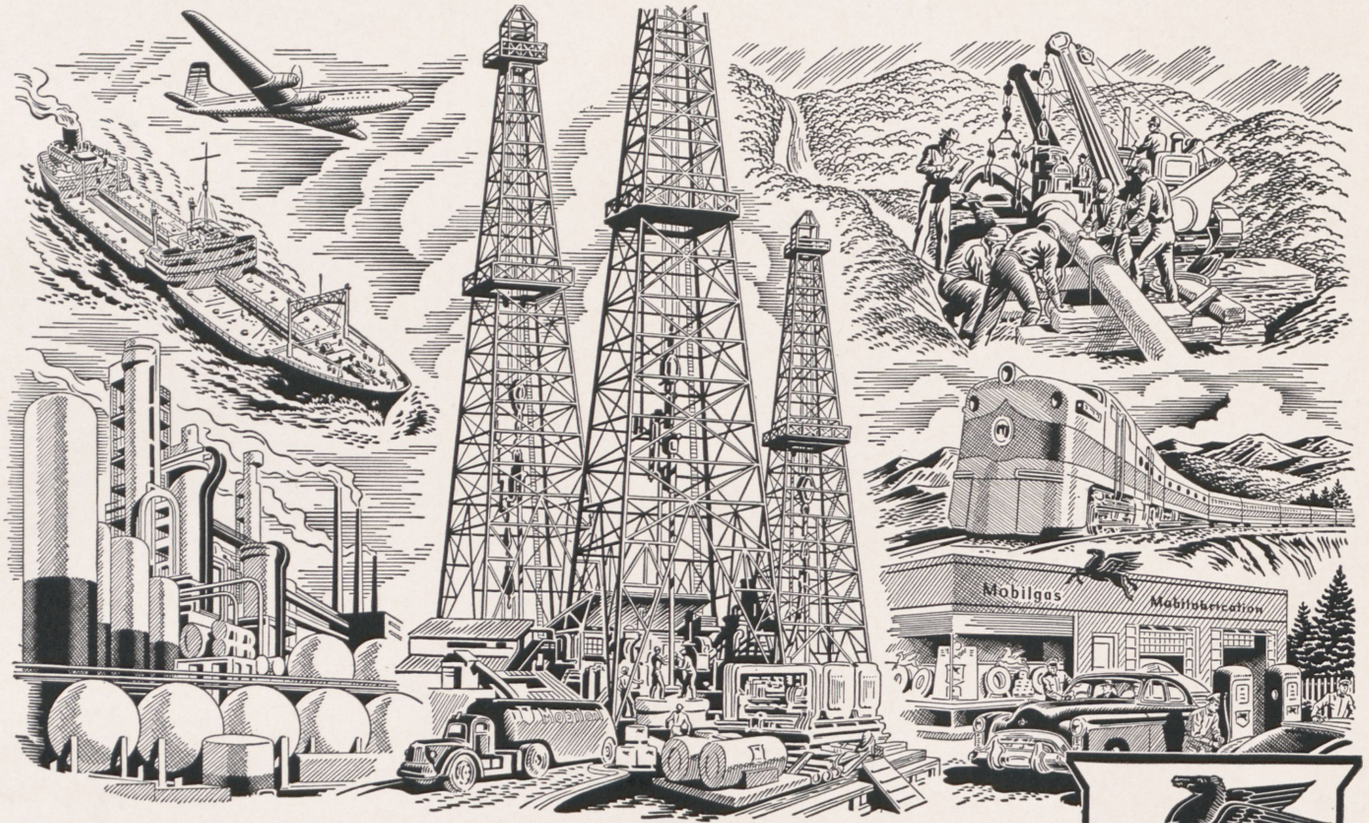


# DEMAND DETERMINES BIGNESS

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# Rose Technic

VOLUME LXII, NO. 2 NOVEMBER, 1950

## In This Issue

### *Cover*

Pictorial representation of the klystron tube as discussed in this issue. Courtesy of SPERRYSCOPE



### *Frontispiece*

The main compressor of the supersonic wind tunnel at NACA's Ames Laboratory. Courtesy of the PEGASUS.

PHOTO CREDITS: Pages 8 and 9, R. A. Moody. Page 12, U. S. Air Force.

PRINTED BY MOORE-LANGEN PRINTING AND PUBLISHING CO.
140 North Sixth Street, Terre Haute, Ind.

Published monthly except June, July, August, and September by the Students of Rose Polytechnic Institute. Subscription $2.00 per year. Address all communications to the ROSE TECHNIC, Rose Polytechnic Institute, Terre Haute, Indiana. Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 13, 1918. This magazine is not responsible for the opinions expressed by the contributors.

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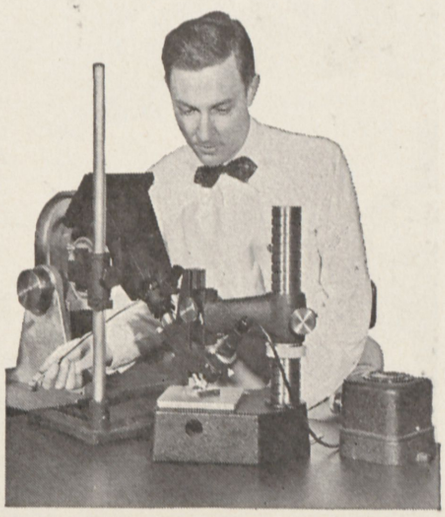
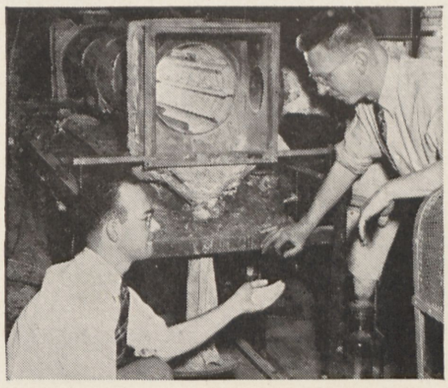
# THE DU PONT DIGEST

## *Engineers At Work*

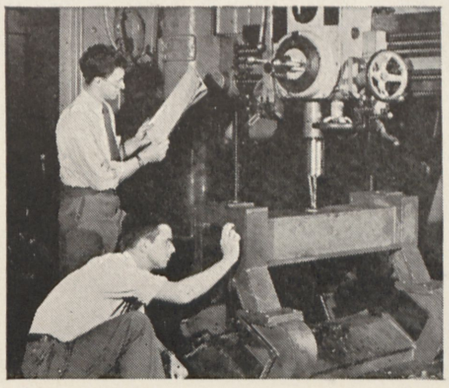
### AT DU PONT THEY FIGURE IMPORTANTLY IN MANY FIELDS



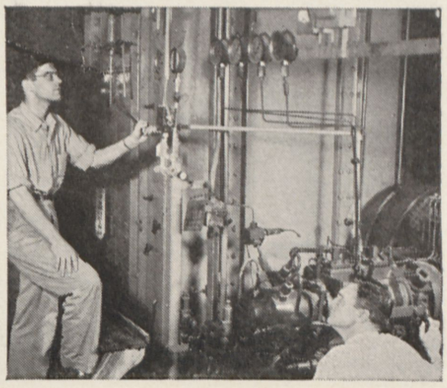
**R. E. Sugg,** *B.S. in M.E., George Washington University, 1948, doing mechanical research to improve machine design. His optical-slit microscope measures surface scratches as fine as 20 millionths of an inch.*



**Studying product development** *in a rotary dryer are: H. J. Kamack, B.S. in Ch.E., Georgia Institute of Technology, 1941; and F. A. Gluckert, B.S. in Ch.E., Penn State, 1940.*



**Checking component** *for machine used to finish rolls to high degree of precision: Donald F. Miller, B.S. in M.E., Lehigh, 1950; and Albert W.G. Ervine, M.S. in M.E., Michigan, 1950.*



**R. L. Stearns,** *B.S. in Ch.E., Yale, 1949; and H. Peterson, B.S. in Ch.E., Northeastern University, 1942, checking a multi-stage carbon-monoxide compressor used for making methanol.*

BECAUSE Du Pont is a chemical company, you might expect most of its technical men to be chemists.

Actually, there are more engineers than chemists at Du Pont. In each of the ten manufacturing departments there is important work for men trained in chemical, mechanical, electrical, metallurgical and other branches of engineering.

These departments operate much as independent units with their own research, development, production and sales staffs. In their respective fields, they do fundamental and applied research on both processes and products. Sometimes engineers participate in the early stages of a project. More often, however, they enter the picture when the project has moved to the point where commercial production is considered. They see it through the pilot plant and semi-works stages and assemble data necessary for the full-scale plant.

Even after manufacturing has begun, development work is continued to standardize and improve the process. Normally, engineers whose main interest is production and plant operation take over when the works stage is reached.

Engineers on the technical sales staffs help maintain contact between Du Pont and its customers. They present data on new products and guide customers in process development and similar problems. They also use their technical knowledge in making surveys of possible markets for the Company's products.

In addition to the manufacturing groups, the Du Pont Engineering Department—a central staff organization—requires engineers with many types of training. This Department carries on its own program of fundamental and applied research. It also makes site investigations, lays out and designs new plants and laboratories for the manufacturing departments. It serves them in research on process development, on materials of construction and on methods of measurement and control.

Yes, engineers figure importantly at Du Pont. Through their teamwork with chemists, physicists and other trained personnel, the Du Pont Company produces its "Better Things for Better Living...through Chemistry."

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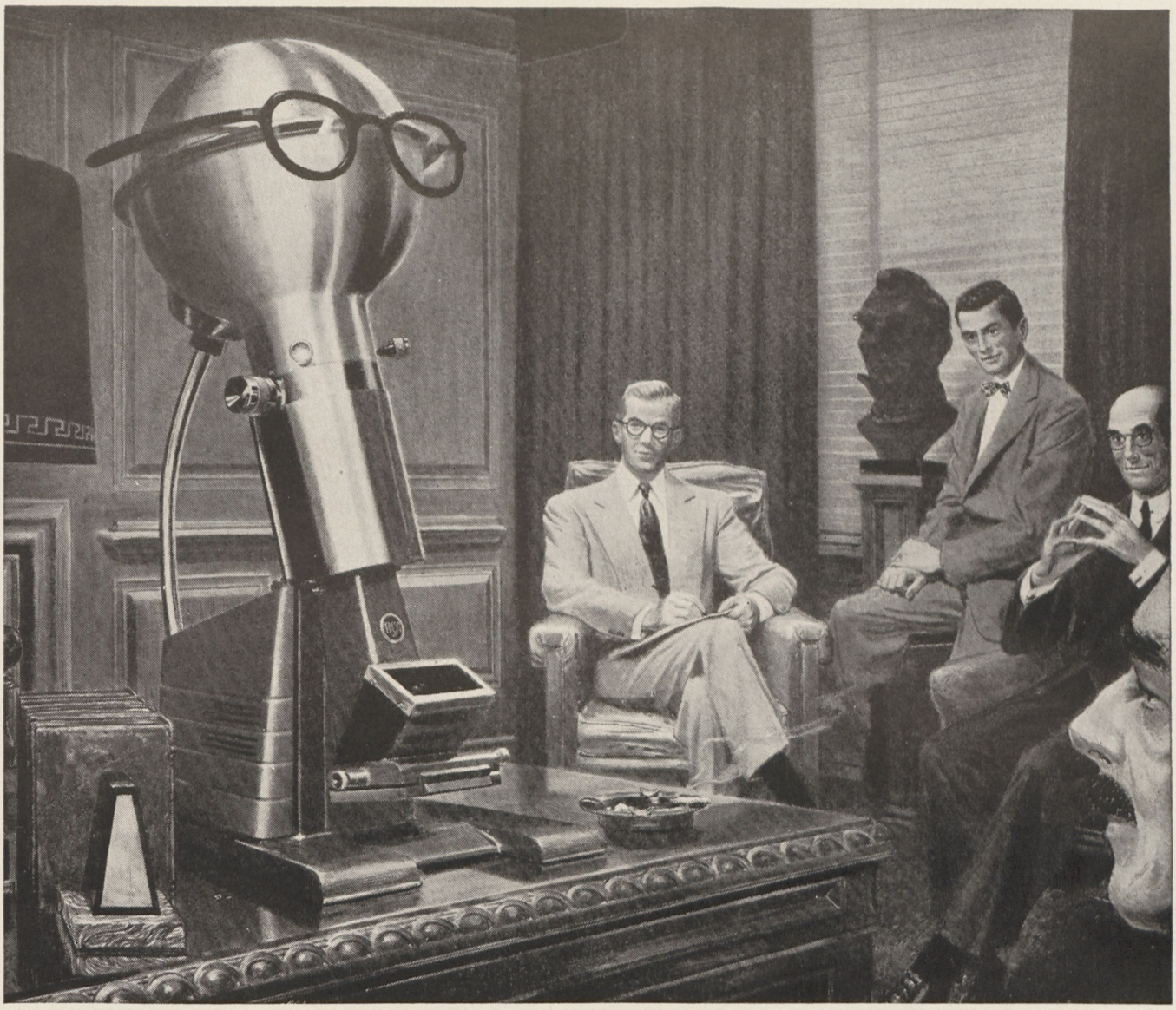

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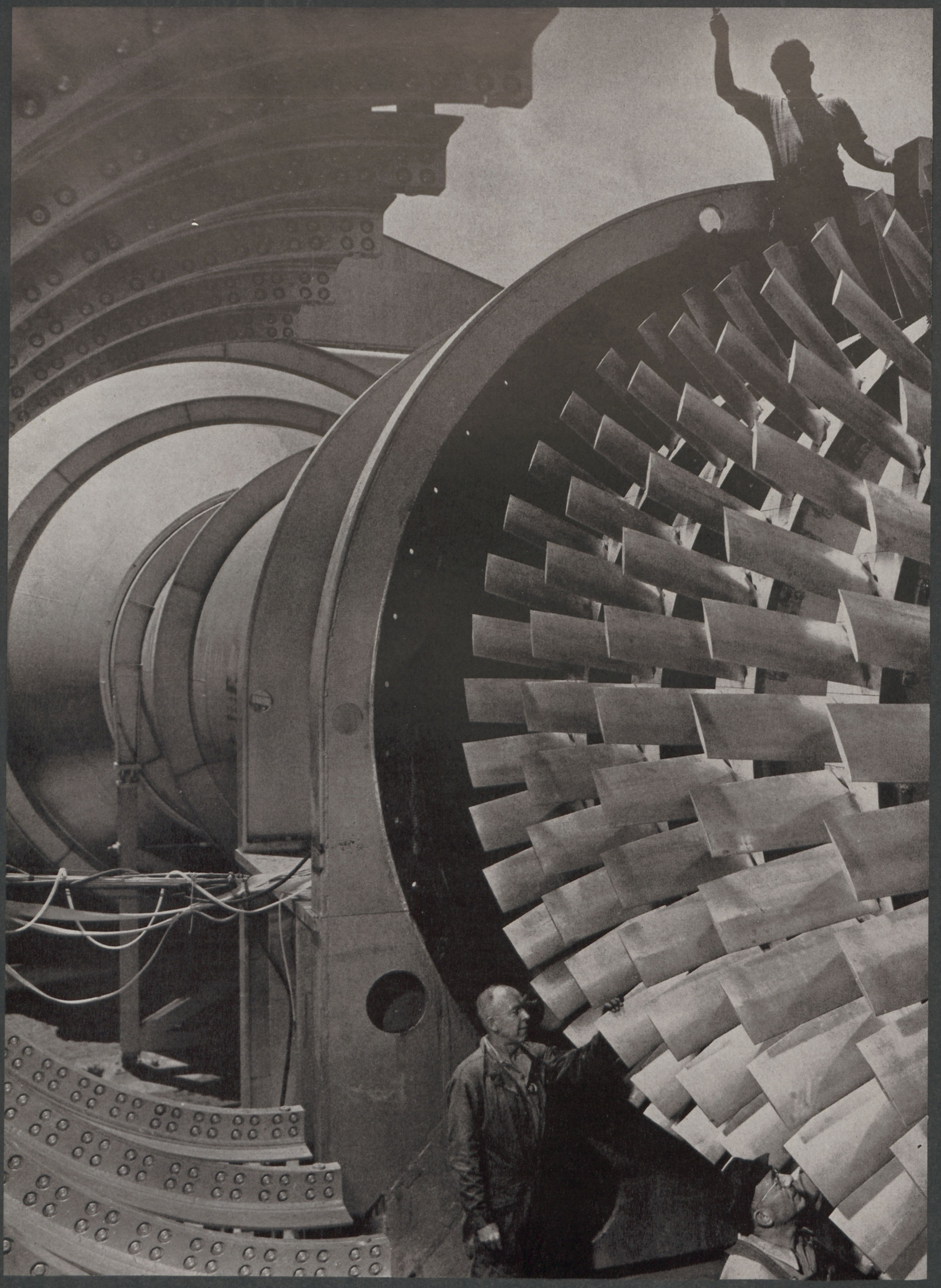


# On Culture

The curricula of engineering schools are so crowded with technical subjects, of necessity, that there is little or no room for courses in literature, music, and the fine arts. The Rose curricula are probably as well balanced as those of most other engineering colleges, but it is extremely doubtful if the Rose student gets a sufficient dose of the humanities to start him in the pursuit of an aesthetic education. The Thursday morning programs are a step in the right direction, and much credit should be given to Dr. Wilkinson, Professor McLean, and the members of the Institute Convocation Committee.

Each student should give some thought to this phase of his development and, if a deficiency exists, make a conscious effort to learn about and enjoy man's cultural achievements. Only then will he begin to enjoy life at its fullest.

J. P.

# The Klystron Tube

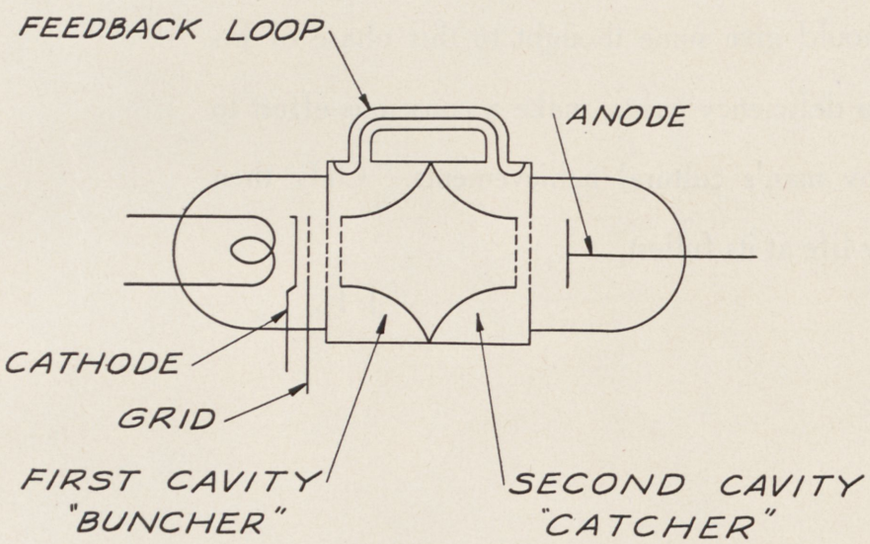
By William G. Rinker

Radio waves of less than six inches are no longer mere laboratory curiosities. The klystron tube can turn out enough microwave power to light a lamp, pop corn, or roast a hamburger. A few watts at this wave length would be enough to reach further than the eye could see. A physicist at the Massachusetts Institute of Technology has labeled this marvelous invention the most important advance in radio since the triode. Others agree that this invention will lead the engineering and scientific world into a new era of UHF (ultra high frequency) technique.

"Klystron" is derived from the Greek word "klys," which means "the breaking of waves." It was so apt a description of the bunching of electrons between spaced grids within the tube that the name became generally used.

The birth place of the klystron was the physics laboratory at Stanford University. It started in 1937 with an able Stanford physicist, Dr. William W. Hansen, who was in tireless pursuit of a less costly supervoltage generator for 500,000 to 1,000,000 volt X-rays. He visualized his generator as a hollow sphere or cavity commonly known as the oscillating sphere or "Hansen's Can." Electrons on the inner surface danced back and forth in such a way that a lab assistant playfully dubbed it the "Rhumbatron."

Russell and Sigurd Varian, two brothers of scientific ability, were friends of Professor Hansen's. They soon became more interested in Rhumbatron activities in the basement of the Palo Alto physics laboratory than in their own personal work. By early summer, the Varian brothers had moved to Palo Alto as research associates to devote full time to developing a tube for use in a blind landing system for aircraft. Landing systems had already been devised, but the most satisfactory of any of them produced a concave glide path which curved downward in one generous sweep, causing pilots to sweat. The bent beams forced the airplanes to fly dangerously low on the last few miles of the beam. Straight beams were needed to make landing systems practical. Some fundamental advance in radio was needed before waves short enough could be generated with enough power for blind landing.




**DOUBLE RESONATOR TYPE**

R.A.M.

In considering this need, Russell Varian foresaw how Hansen's Rhumbatron might be made into a self-oscillator which would produce waves so short they might be called microwaves. After discarding several ideas Russell devised a scheme involving two doughnut-shaped Rhumbatrons, one stacked upon the other. The Rhumbatrons could be made to oscillate by pouring electrons through their holes. As these electrons flowed through the hole, the first doughnut would speed up some electrons and slow down others. Clusters of these electrons would collect as the faster ones began to catch up with the slower ones in the stream. The clusters would excite oscillations in the second Rhumbatron in passing through it. The whole process would continue as long as electrons could be kept pouring through the holes and as long as some of the oscillation energy in the second doughnut was fed back into the first. Thus on June 5, 1937, Russell Varian invented the klystron tube.

A flurry of excitement spread through the Physics Department when the three scientists rushed to test their idea. After all the calculations, sketches, and accumulation of materials, the three hammered and soldered, rigged high vacuum pumps, and sweated out the frustrating trials and revisions. Finally, late one

cool night in August, it oscillated.

It was now time to look for a sponser since finances for the klystron grew meager. The men received no salary for their vast experimenting. Although only half of their $100 appropriation had been used in constructing the first klystron, the cost of living had cut deeply into their personal finances. After many interviews with the Army and Navy headquarters and consultations with the Bureau of Air Commerce (now Civil Aeronautics Administration) at Oakland, it looked as is finding a sponsor might take months; then an unexpected telephone call came from the Bureau of Air Commerce which arranged negotiations between a Mr. Irving R. Metcalf and the research director of the Sperry Gyroscope Company. Sperry then became sponsor of the klystron.

For those who are more technically interested in the klystron, there are two basic forms of klystron tubes. The double-resonator type is used where high power is needed and electrical control of frequency is of secondary importance. The reflex type achieves oscillation by passing the electron stream twice through the same resonator. The electrons are reversed by negative potential on a repeller electrode, changes in which cause corresponding variations in the oscillator frequency. Application of control voltage to the repeller electrode provides a simple automatic-frequency control. The same basic principles govern the operation of both types of tube. Since we are particularly concerned with the local oscillator application, we shall confine our attention to the reflex type.

The grid electrode of the reflex type focuses the electrons which the cathode supplies. The beam electrons are accelerated by the anode voltage and enter the field free space within the central post of the resonator, after they pass the anode plane. The electrons in this space maintain a constant velocity of $v = \sqrt{\frac{2eEo}{m}}$ where e is the charge on the electron, m its mass, and Eo the anode potential with respect to the cathode. The electrons then enter a narrow space between two grid structures that are parts of the resonator walls. In this gap the electric field is varying rapidly as a consequence of oscillations in the cavity. Variations in the velocity of the electrons in the stream are produced by the variations in gap potential. The width of the resonator gap is very small compared with the longtitudinal dimension of the electron path causing an instantaneous variation in velocity imparted to the electrons as they cross the gap.

The velocity of the electrons, on leaving the resonator gap, depends on the phase of the alternating voltage at the instant they cross the gap. Those electrons which cross when the alternating voltage is zero proceed with the initial velocity given by the previous equation. Other electrons, crossing when the field has its maximum forward value (upper face positive) have the highest velocity on exit. Those entering when the field has its maximum backward value (upper face negative) leave with the least velocity.

The electron stream, leaving the gap with the continuous distribution of velocities, encounters the field of the repeller electrode acting against the positive field of the anode. The net potential acting on the electrons is Eo—Er, where Er is the repeller potential. The electrons are acted upon in the reflection space by this difference in potential. During this time the relative velocities imparted during the passage through the resononator gap are maintained. Those electrons which gained velocity in passing through the gap move forward toward those which passed through without changing velocity. Similary those which lost velocity fall back. After a certain critical time, the electrons in the stream become separated into groups of "clusters," each cluster centered on electrons that passed through the gap when the gap voltage was zero. The electron stream thus becomes modulated in density as it traverses the reflection space.

To fully understand the importance of the klystron tube, its applications, demands, production costs, and wartime objectives must be taken into consideration.

The first klystron to see practical application came into being early in 1939. It was for the first microwave landing system. The tube's 300 watts were focused into a narrow beam which, elevated five degrees, was pointed out over the bay at East Boston Airport. CAA's biplane was

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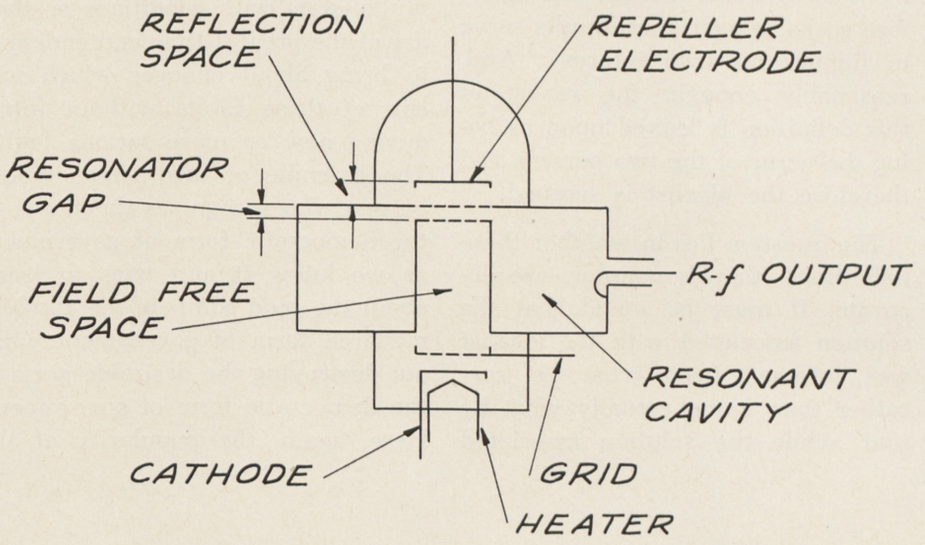



**REFLEX TYPE**

R.A.M.

# Idealism and Realism

## A TAU BETA PI ESSAY

By Gerald C. Laxen, '50

In this time of ill used words and misnomered pursuits it is well to look into the popular conceptions of idealism and realism to determine wherein lies our best course into the future.

Popularly, an idealist is that impractical person who would bring about order by such a means as would destroy its desirability. As an example of this, a person who recognizes faults in the democratic form of government as we know it today and makes his views known is often inferred by the people to be a person who would rather have the absolute monarch form of government. Similarly, the popular conception of a realist is that practical person who realizes that chaos exists and therefore makes the necessary adjustments so as to personally profit most from it. The example of this would be the person who recognizes faults in the democratic form of government as we know it today and therefore seeks to have these faults serve to further his own interests. And, reasonably enough, the realist of this definition is looked upon as being the wiser of the two persons and therefore the idealist is scorned.

The question lies in whether these definitions, though popular, are accurate. It must be noted that the solution associated with the idealist was inferred from what he said rather than being actually what he said, while the solution associated with the realist was proclaimed by his actions. Thus, perhaps the definition of the realist is accurate because it was derived from actions while that of the idealist remains in doubt because of inaction. (This action is probably the reason for the popularity of the realist and this inaction the reason for the unpopularity of the idealist.) Therefore, in order to look further into the primary question of which is the course we had best follow into the future, it will be necessary to divide the idealists into two groups. One of which fits the popular definition and one which does not, keeping in mind, however, that popularly this division does not exist.

Now it will be necessary to form a definition of those idealists which do not fit the popular definition. This group, let us call them constructive idealists, may best be defined as those persons who, recognizing faults, start with conditions as they are at the present time and endeavor to bring about changes which will correct these faults without introducing new or more serious faults. The example of this person would be one who recognizes the faults of the democratic form of government as we know it and tries to bring about the good points of the absolute monarch form of government without destroying the desirable parts of the democratic form of government. Here, again, the popularity of the realist is somewhat explained in that this constructive idealism is difficult and requires personal sacrifice against great odds.

Now the primary question of which course we had best follow into the future may be attacked. What does each attitude offer as to present existence and future outlook? First, the realist offers the very attractive present ease and a future that, he supposes, will, if all works out right, be even easier for him. Secondly; the popular idealist would offer change for the present and a theoretical, though not assured, ease for the future. Thirdly; the constructive idealist offers conservative change for the present and a carefully sought, vigilantly preserved ease for the future.

Which is the attitude which must prevail? Certainly all clear thinking men must agree that the constructive idealist offers the only desirable solution and is, in fact, the only realist of the lot. He realizes that we must start from where we are now since no amount of wishful thinking can change that. He also offers hope which is one of our fundamental human needs. (It is on this point that the popular realist fails us.)

As engineers, who wield a disproportionate amount of influence on future developments, are we capable, both individually and collectively, of this constructive idealism? We cannot be collectively if we are not individually.

# Alumni News

By Chris Sharpenberg, jr. m.e.

'90 Theodore L. Condron was awarded the Distinguished Service Certificate by the National Council of State Boards of Engineering Examiners at the Council's annual banquet in Chicago, October 10, 1950. This award is in recognition of Dr. Condron's more than thirty years service as a member of the Illinois Structural Engineers Examining Committee. Although the National Council has awarded Distinguished Service Certificates annually since 1938, the award to Dr. Condron is the first to be granted to one not connected with a Member Board of the National Council. It has never been possible for the Illinois Structure Committee to become a member.

Mr. Condron was born in Washington, D. C. on the 16th of April, 1866. From Rose he has received a Bachelor of Science degree in Civil Engineering, 1890; Master of Science, 1892; and the degree of Civil Engineer in 1918. In 1947 in recognition of his distinguished career, Rose conferred on him the degree of Doctor of Engineering.

Mr. Condron's long professional career has been devoted largely to the field of structural engineering. Immediately after graduation he gained experience under the late George S. Morison, one of America's most distinguished bridge engineers. This was followed by two years as an instructor in engineering at Washington University under the late J. B. Johnson, and by six years in the Chicago office of the Pittsburg Testing Laboratory. With this background Mr. Condron opened his own office in 1901 and established an engineering practice that was to cover a period of more than forty years and bring to him many important assignments and honors.

In spite of the heavy demands of his practice, Mr. Condron has devoted much time to civic and professional affairs. He has been an active member of many professional societies. Among them are the American Society of Civil Engineers, of which he was a Director in 1923-25; the Western Society of Engineers, of which he is a former officer and now an Honorary Member, and which honored him in 1905 with the award of its Chanute Medal; the American Railway Engineering Association; and the American Society for Testing Materials. He was also one of the founders of the Chicago Engineers Club in 1903, and in October, 1938, the Club elected him to Honorary Membership.

Mr. Condron's long service to registration dates back to about 1915, when he served as a member of a sub-committee of the old American Engineering Council, charged with the preparation of a typical registration act, work which later was to lead to the so-called Model Law for the Registration of Professional Engineers. His official connection with registration began with his appointment as a member of the Illinois Structural Engineers Examining Committee immediately after the adoption of the Illinois Structural Engineering Act. His membership on that committee has continued without interruption for the more than thirty years of its existence. He has served with distinction in all offices of the committee and is currently its secretary.

The Distinguished Service Certificate is a well deserved personal tribute to Dr. Condron, and an honor in which all Rose men can take pride.

'92 The Technic regrets to report that W. Arnold Layman, founder of the Rose Technic, passed away at his home in Clearwater, Florida, October 25, 1950. He would have been 81 years old on the 27th of October.

Dr. Layman was graduated with a B.S. in Mechanical Engineering, and received the additional degrees of M.S. in 1894, E.E. in 1899, and the honorary degree of Doctor of Engineering in 1933. At various times he has served as a member of the Board of Trustees of Rose.

Upon graduation, Mr. Layman started with the Wagner Electric Manufacturing Company of St. Louis as a draftsman. He advanced steadily in the company, and in 1912 became president and chairman of the board of directors, a position he held until 1926. From then until his retirement from active business in 1947, Dr. Layman was a consultant on industrial management and finance in New York City and Chicago. He also served as president of the National Metal Trades Association and on the board of trustees of Washington University of St. Louis. During the past three years he has made his home in Clearwater, Florida.

Dr. Layman is survived by his widow, Mrs. Laura T. Layman, four daughters, and two sisters. Brief funeral services were held in Clearwater, and interment was in St. Louis.

Philip R. Vance received his Master of Science from the Massachusetts Institute of Technology in June, 1950. Mr. Vance is now a development engineer with Goodyear Aircraft Corporation in Akron, Ohio.

# Research and Development

By Fritz Wheeler, soph. m.e.

### Skid Tests Studied

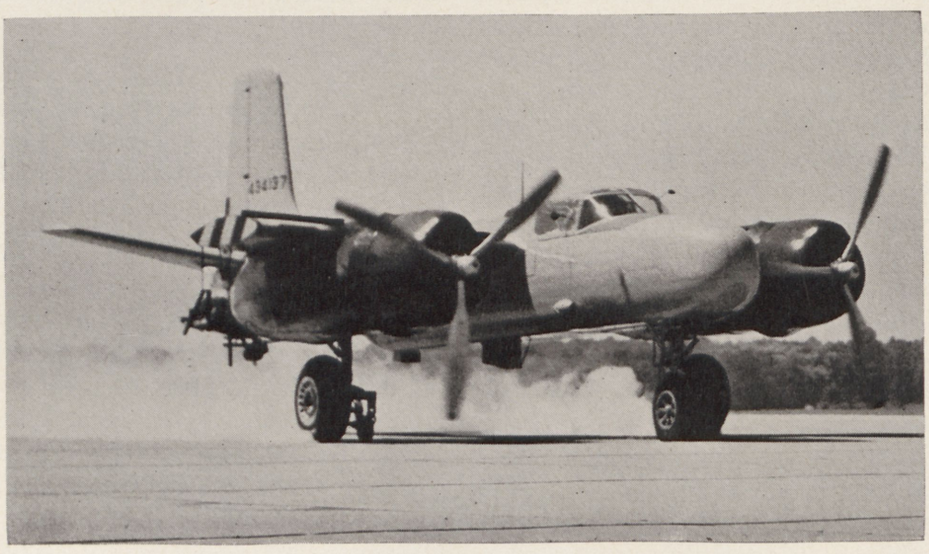
Automobile drivers can take a tip from the latest skid tests conducted at Air Materiel Command Headquarters. They show that jamming on the brakes at very high speeds literally sends you sailing along on melted rubber with hardly any stopping effect. The safety lesson, however, is only a by-product of the skid tests which actually are staged by the Air Force to simulate aircraft landing conditions and get the exact data needed to design lighter, stronger, and smaller landing gears. Through the skid test, engineers intend to learn exactly what happens between the airplane and the ground at the precise instant of aircraft landing. They call it the all-important "coefficient of friction."

Used in the experiments is a salvaged B-26 airplane whose wings have been clipped to avoid "lift" and thereby get as much weight as possible on the wheels. The plane can withstand a wheel loading of about 15,000 pounds on each tire and brake to a full skid at a top speed of 150 mph. Dubbed the "Wingless Wonder III," the B-26 is raced down the runway and braked by the pilot at pre-determined speeds. Here's what happens when brakes are applied at 100 mph. Amidst streaming smoke, the B-26 skids at approximately 150 feet per second. The rubber on the tire melts; grip on the concrete runway is lost. Five or six 300-foot skids, and the tread rubber wears right down to the casing.

Skid forces and other test data obtained from the strain gages, electronic measuring equipment, and high speed motion picture cameras used are analyzed and relayed to aircraft landing gear designers. Along with yielding the data which will ultimately result in the landing gear of the future, the tests are also providing information on how aircraft tires stand up under high-speed landings. That information is expected to help the nation's tire manufacturers improve not only airplane tires but automobile casings as well.

While the tests thus far have been confined to skid tests on dry concrete, soon to follow are skids on wet concrete, dry and wet sod, macadam, and other surfaces.

"Wingless Wonder III"



### New pH Standards

Four new pH standards, intended to provide fixed points at the upper and lower ends of a standard pH scale, have been selected by a group of chemists. The new solutions extend the accuracy of standard scales made to conform with the three middle-range standards with the National Bureau of Standards now distributes to the chemical industry.

Measurements of the degree of acidity and alkalinity play an important part in the research laboratory and in the regulation of such modern industrial processes as food preperation, sugar refining and the manufacture of paper, textiles and dyes. These measurements are expressed in terms of hydrogen-ion concentration, or pH, on a scale ranging from a pH of almost zero (very high acidity) to a value near 14 (very high alkalinity). Although exact measurement of acidity can be made with instruments now in use, there has been a lack of uniformity among the results obtained because of the variety of definitions of the pH unit popular among chemists and the consequent difference in methods of calibrating the instruments.

In a recent study, the extent of inaccuracy at the ends of the practical pH scale was determined. It was concluded that an instrument calibrated with the present solutions of intermediaate acidity will usually yield results that are low by 0.02 to 0.05 unit or more above pH 11. Below pH 2.5, errors as great as 0.03 unit, either positive or negative, were found. In general, solutions of strong acids and bases display larger errors than buffered solutions.

*Concluded on page* 18

# Campus Survey

By James Myers, jr. e.e., Duane Pyle, jr. c.e.
and Allen Forsaith, jr. m.e.

**"Franklin Is Dead . . . "**

Another incident has occurred in the growing feud between Franklin College and Rose. Last year, a group of Franklin students were successful in stealing Rosie. This year, the Rose walks were defaced with "Franklin Grizzlies" signs, painted in black. In just indignation, four Rose student went, incognito, to Franklin, seeking revenge on the Franklin sign painters. The four were Tom Reifenberg, "Porky" Stewart, Bill Bennett, and Bob Risher. Harry Badger generously provided his car for the trip.

The object of the trip was to locate, and confiscate if possible, some article of more than passing interest to the Franklin student body. The fellows found what they were looking for in the Administration Building—a solid bronze bust of Benjamin Franklin. "Rife" carried the bust, weighing about one hundred pounds, out of the building under his arm. Later, the Franklin students insisted that the theft must have occurred late at night; the entire operation was carried out in broad daylight while people were still in the Administration Building.

On the return trip the bust was laid, face up, on the floor of Badger's car. Here, the symbol of Franklin College reached the depths of indignity; it was used as a foot stool.

The following evening four cars filled with Franklin students in various stages of intoxication, arrived on the Rose campus. Their purpose was to get their bust back. They didn't. According to the Terre Haute Tribune, the "invaders escaped." Their escape was quite daring. When the Franklinites finally wandered in from a road hike conducted under the auspices of Rose students, they meekly asked for their car keys. After being given their keys, they "escaped."

On the following morning, President Wilkinson called an assembly. In forceful terms he stated that the action taken was justifiable, but that, considering the value of the bust, and considering that we had had our fun, the bust must be returned to Franklin as quickly as possible. The men directly concerned rose to the occasion and etched "R.P.I. 1950" inside the base of the bust in preparation for its return to Franklin.

Plans were laid, whereby Rose could return the bust without inciting further unfriendly feeling. Acting on a suggestion from Fred Garry, a new Packard hearse was rented from Callahan's for forty dollars. Twenty-five cars containing an estimated one hundred twenty-five students, formed a mock funeral procession which accompanied the bust back to Franklin.

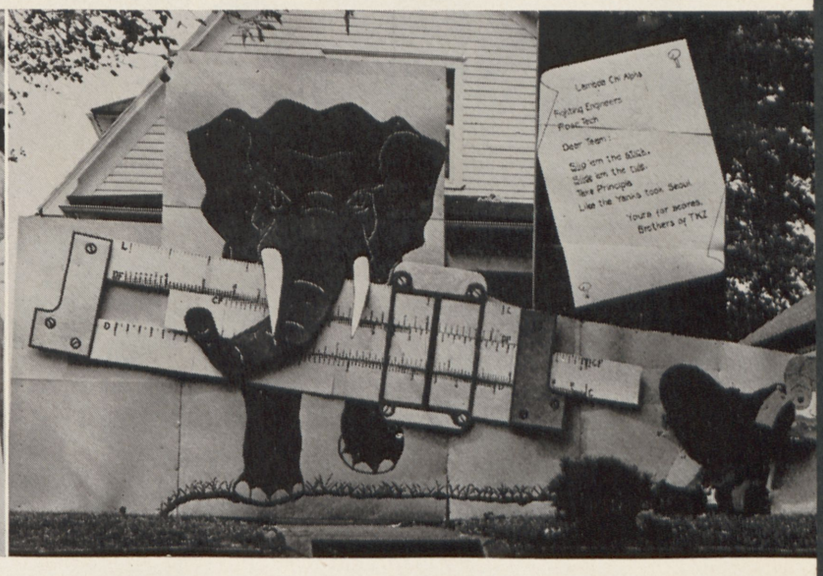
"Frankie" was placed in his tomb, the Franklin Administration Building, in a brief ceremony which lasted perhaps ten minutes. The bust was carried on a stretcher from the hearse to the Administration Building down two long lines of mourning Rose Men. To the tune of "Goodnight Irene" the mourners sang the following improvised ditty:

Franklin is dead,
Franklin is dead.
We know he's dead,
We've got his head.
We etched on it R.P.I."

*Continued on page* 20

**Ben Franklin, '54**

**Lambda Chi Alpha Homecoming**



# Fraternity Notes

### Theta Xi

Theta Xi wishes to congratulate Gene Hailstone, who will be married late in December and Don James, Dale Kilgore, Bob Heckelsberg and Bill Elsey who have all pinned their girls.

Congratulations to John Anderson, Gene Hailstone and Jim Mook on their election to offices in the senior, junior and sophomore classes respectively.

Our Homecoming Banquet and Stag were quite successful but there have been no other social events because about half the fraternity is on the football team and must keep in training. The chapter is, however, planning a Winter Formal for December 9. The dance will be held in the auditorium and music will be supplied by Jimmy Adami and his orchestra.

Congratulations to Bob Rinker on being chosen to attend the national Tau Beta Pi conference in Boston during the weekend of October 20 to 22; and to George Wence who won the chapter's scholarship award for the best improvement in grades during last term.

### Alpha Tau Omega

Gamma Gamma has held another one of those rip-roaring neckers' delights—a hayride. Except for a couple of unexpected stops to remove some jokers' (??) road blocks and to sweep the lane for mines, everything went pretty much as scheduled. A weiner roast after the hayride rounded out the evening's hilarity. About the only comment on the whole affair was, "Wow-w-w!!"

This month congratulations go to Fritz Wheeler, who recently pinned Miss Marjorie Hammond, and Charlie Archer, who pinned Miss Barbara Carter. Both girls are from Terre Haute.

At the first meeting of the Camera Club, Dave Leeds was elected to succeed Bob Johnson as president. Another Gamma Gamma man, Bill Rinker, has been chosen as editor of the Modulus for this year, and Larry Leonard is treasurer of the student chapter of the A.I.Ch.E. In the recent class elections Ray Baker was elected president of the senior class; Ron Brunner, vice-president of the junior class; and Chris Flesor, secretary of the sophomore class.

Gamma Gamma welcomed as a pledge brother this term John Soucie. Everything socially is now centered on plans for the big A.T.O. Christmas Formal which will be held just before the vacation. Social Chairman Riley "Bushman" McKeen claims to have "everything" well under control and with the preparations he's making, the affair is certain to be a huge success. That is, if "Doc" Willian will just stay away from the punch bowl!!

Congratulations are also due those A.T.O. men who were presented awards or were selected for membership in the two honorary fraternities. Bob Bosshardt was the recipient of the Heminway Bronze Medal for the highest cumulative rating for the freshman year. Blue Key pledges include Jim Myers, Ron Brunner, and Joe Perona. Those men tapped for Tau Beta Pi were Fred Reynolds and Joe Perona. Riley McKeen, Jim Phillips, Joe Perona, Warren Allen, Bob Johnson and Jim Myers were awarded Rose Honor Keys.

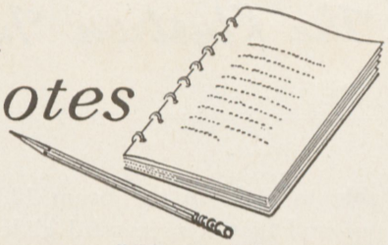
Sigma Nu Officers

### Sigma Nu

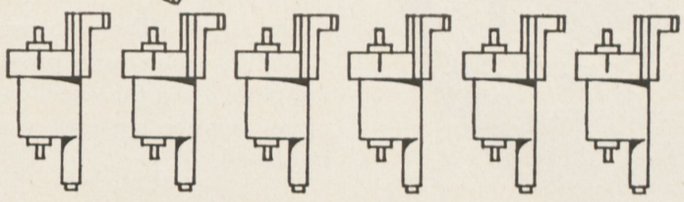
Homecoming week-end for Sigma Nu was a huge success. More than a hundred alumni and friends of Beta Upsilon signed the guest register at the house, exchanged greetings and relived the "good old days" at the house parties held that week-end.

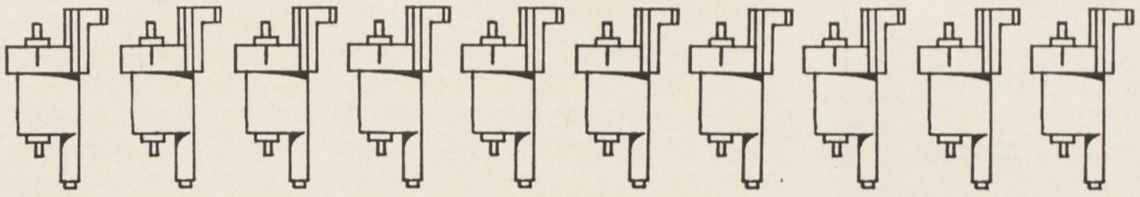
*Concluded on page 23*

# Newsworthy Notes for Engineers



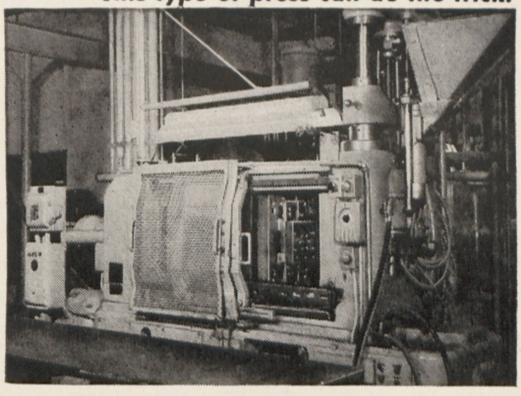
## How to make 16





## at the cost of 1...

***This type of press can do the trick.***



These odd looking little gadgets, called "pawls," go into high speed telephone dials used by Bell System operators.

Until recently, pawls (like the black one) were made of molded rubber with a steel pin for the shaft. They did their job well and lasted a long time. But Western Electric engineers decided to try to make them at a lower shop cost.

The engineers came up with an idea—mold the pawl, pin and all—in one piece of nylon. They made some samples—tested them thoroughly—found the nylon pawls would last as long and perhaps even longer in service. Bell Telephone Laboratories tested them—and approved. So Western Electric engineers tackled the production problems—designed new machinery for molding pawls in one piece. It wasn't easy—because all dimensions had to be controlled with extreme accuracy. But today the new nylon pawls are being made in quantities—*sixteen of them for the cost of one of the old type!*

This story of cost reduction—and there are scores of others like it—shows one way that Western Electric engineers help to keep down the cost of equipment produced for Bell Telephone companies and, therefore, the cost of service to telephone users.

**Western Electric**

**A UNIT OF THE BELL SYSTEM SINCE 1882**

***Engineering problems are many and varied at Western Electric, where manufacturing telephone equipment for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for production of highest quality communications equipment.***

# The Klystron Tube

Concluded from page 9

able to pick up the beam 12 miles out and flew a successful glide path to the airport. The path proved much straighter than any previous landing path. Thus the excellent qualities of microwave systems were clearly indicated.

Later in 1939, when military planning was greatly accelerated here and abroad, radio experts viewed the klystron with even keener interest. Would it cure certain inadequacies in several categories of military equipment? So certain was the klystron's promise that secrecy became the credo of all who worked with it. The tube dropped out of public print; the klystron had gone to war.

Russell Varian had written about velocity measurements, anti-aircraft gun laying, and secret communication systems. Also recorded was an aircraft "talkdown" system based on pulse locators which measured both distance and angular location. In an attempt to overcome the line of slight limitation of microwave communications, consideration was given even to bouncing microwaves off the moon.

Then the microwave activities began to expand. The Sperry klystron laboratory group originally established at San Carlos, California, suddenly found themselves installed at Garden City, New York, to centralize this expansion.

Up to 1940, Sperry's objective in the klystron program was to develop basic tools for the generation and utilization of microwaves. In that year the company added two specific application problems to its program —instrument landing for aircraft and bombing through the overcast by microwave radio. Each succeeding year they developed, in addition to new tubes, microwave measuring techniques, antennas, and several new applications which stemmed from their firsthand knowledge of the microwave art.

Sperry radio and radar engineers became convinced that microwaves could provide highly accurate range and line of sight for laying radar, anti-aircraft gun laying radar, and radar control for searchlights. An aircraft interception radar was developed which sought out enemy aircraft with startling accuracy and a search radar which permitted Navy patrol pilots to spot minute surface targets as submarine periscopes and snorkels.

Klystron production has grown to a four million dollar a year industry since the war. This is sustained by new microwave development activities which require klystrons and by expanding production of microwave systems such as radar. Every microwave radar set requires at least one klystron in its receiver. Over 10,000 of the tubes are accounted for by the marine radars.

In the near future color television will be in popular demand. The 1500 to 1800 UHF broadcast stations planned for color television in the U.S. will need 3500 klystrons yearly. Oil pipe line companies anticipate a network of microwave relays to handle control and communications between way stations. The 35,000 miles of lines now being mapped out will take 10,000 tubes a year.

To the engineer there is a host of challenges in this new era of microwave technique. The Sperry Engineering group, which has been growing steadily, is working on pulsed tubes, 40,000 watt tubes, and klystrons radically different from any known. As one can see the rapidly expanding use of microwave systems demans continuous developments in a practical point of view.

# "Snug Harbor"

JUST AS SNUG HARBORS offer ships protection from stormy seas, there are protective coatings today that guard them against sleet, snow, salt spray—and other damaging forces.

There is a plastic coating for ships' hulls that eases the age-old problem of barnacles and rust. Vessels stay in service twice as long between costly lay-ups in drydock for cleaning and painting. Top-side and below, there are long-wearing coatings to keep the modern craft ship-shape.

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These sea-going coatings are made of the same kinds of plastics that serve us so well in industry and in our homes. In a triumph of synthetic chemistry, these ever-useful basic materials are produced for us from organic chemicals.

The plastics and chemicals for these improved coatings are but a few of the hundreds of better materials supplied by the people of Union Carbide to serve shipping and many other industries.

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Concluded from page 12

In the course of the work 41 solutions of possible value were examined. Out of these, the following four standards were selected:

1. A mixture of sodium bicarbonate and sodium carbonate, both at 0.025 molar concentration, with a pH of about 10 at room temperature.

2. A 0.01 molar solution of trisodium phosphate, pH about 11.7.

3. A solution of potassium hydrogen tartrate saturated at room temperature, pH about 3.6.

4. A 0.001 molar solution of potassium tetroxalate, pH about 2.1.

Although the new standards lengthen the accurate portion of the scale in both directions, the measured pH of highly acid and highly alkaline solutions must still be assigned an uncertainty of at least plus or minus 0.03 unit.

**New Turbosupercharger**

A turbosupercharger which will enable piston-powered commercial airliners to fly non-stop from Chicago to London with heavy payloads has been developed.

The company's Aircraft Gas Turbine Divisions said today that the new turbosupercharger makes possible dramatic fuel savings, together with great power boost, when used with piston-powered engines of the

The CH9 has undergone rigorous test stand operation in combination with a Pratt and Whitney R-4360-C piston engine. Tests have shown 32 per cent more takeoff power, and a reduction of more than 20 per cent in fuel consumption is possible with this combination as compared with transport powerplants now in use. The comparison was made with the performance of a powerplant consisting of a current production turbosupercharger, a BH-4, and production R-4360 engine.

The engineers said this has resulted from aerodynamic design improvements in the turbo and advanced engine designs which permit operation of the turbosupercharger under higher exhaust pressures than previously possible.

The new turbosupercharger entirely eliminates the conventional geared supercharger, or the impeller, operating off the engine shaft. There are no mechanical connections between engine and turbo. Development of a direct cylinder fuel injection system for the R-4360 eliminated the major need for a geared supercharger which is used to insure uniform fuel distribution to the cylinders.




# Why we know this wax carton will stand up

Cartons and wrapping papers coated with paraffin wax have been used in food packaging for many years. They must be able to withstand rough treatment. Their ability to stand up depends largely on the strength and sealing qualities of the coating agent. Yet until a few months ago, there was no accurate way to measure these qualities in paraffin wax.

Recent experimental work in Standard Oil's laboratories has resulted in a new electrically controlled quantitative test. Expressed as Indiana Coating Index, this test gives, for the first time, an accurate yardstick of wax qualities which may be correlated with performance in service. It makes possible the production of *uniformly* high quality coating agents.

The Indiana Coating Index is only one of many scientific tests developed in Standard Oil laboratories. Standard pioneered in quality-testing, as it did in developing many petroleum products that have contributed to better living. There is no ceiling on what can be accomplished by Standard Oil researchers, present and future.

## Standard Oil Company

(INDIANA)

STANDARD

Concluded from page 13

The Rose Men then crowded into the Administration Building until its hall was packed. Numerous Franklin students stood by watching in open-mouthed amazement, while the school song "Dear Old Rose" and cheers "Alamet," and "Nuts, Bolts, Screws, Gears," were given in a manner which sent a thrill down one's spine.

The Rose students then filed quietly back to their cars and returned to Terre Haute. There seemed to be a general feeling of both pride and pleasure.

## LIBRARY NOTES

The library is increasing in popularity by leaps and bounds. Our record for a day's circulation is twenty-six books. In addition to that, the library is croweded at various hours with fellows reading and studying.

An illustrious Rose Alumnus, Mr. H. A. Schwartz, 1901, now Manager of Research of the National Malleable and Steel Castings Company, of Cleveland, Ohio, has recently presented the library with several books, many of which are quite new. All are in the field of recreational reading, such as fiction, bigraphy and humor. The library has been woefully short of this sort of material and the librarians are particularly happy with this gift.

Some of the highlights of the Schwartz gift are: *Chips off the Old Benchley, Brave Men, They Were Expendable, The Mudlark, Hercule Poirot, Raintree County, Two Adolescents, The Egyptian, Father of the Bride, Up Front, and Wind, Sand and Stars.*

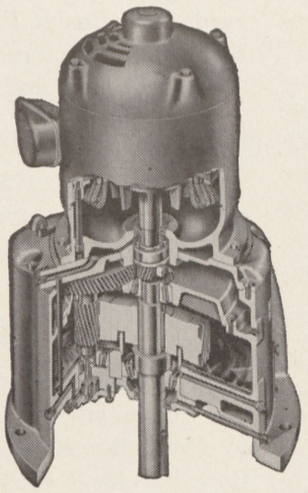
New subscriptions to periodicals which the library will receive at the beginning of the year are: *American Mercury, Coronet,* and the *Engineering Index.* The *Engineering Index* has not been received in the library since 1927.

## CAMPUS SURVEY

Earle Spicer, noted singer of English and American ballads, entertained the students of Rose on October 9. Mr. Spicer's renditions of many of the old ballads were very favorably received by the students.

This program was one of many that have been planned by the Institute Convocation Committee, with Professor MacLean as chairman. On September 28, Dr. Harry A. Schwart, Manager of Research, National Malleable and Steel Castings Company, and graduate of Rose, '01, spoke on "Foundry Practice from an Engineering Point of View." Ralph Roby, Chief Economist of the National Association of Manufacturers, spoke October 2 on the world economic situation. A very enlightening demonstration was given by Dr. J. O. Perrine, Assistant Vice President

*Another page for* **YOUR BEARING NOTEBOOK**



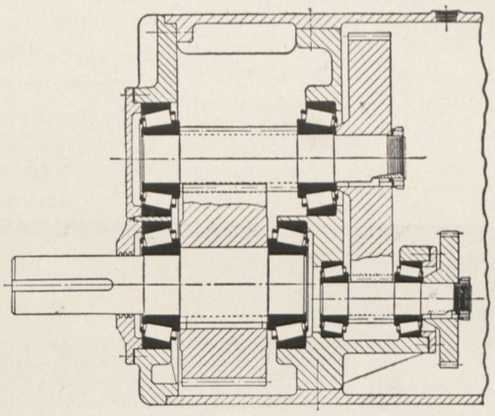
## How to help a gearmotor take care of its teeth

To minimize wear on the teeth and to insure smooth, quiet operation, reduction gears in motors like this must be held in perfect mesh, no matter what the load. That's one reason why engineers mount the gear shafts on Timken® tapered roller bearings. Timken bearings hold the shafts in accurate alignment. Gears are kept perfectly positioned, with each tooth meshing smoothly and carrying its full share of the load.

---

## Gears mesh smoothly, wear longer, with shafts on TIMKEN® bearings

Here is a typical gear-case countershaft showing a common method of mounting Timken bearings. Due to the line contact between the rolls and races, Timken bearings give the shaft maximum support. There's less chance of deflection under load. The tapered bearing design takes both radial and thrust loads in any combination. End-movement of the shaft is kept to a minimum. Gears wear longer—work better.



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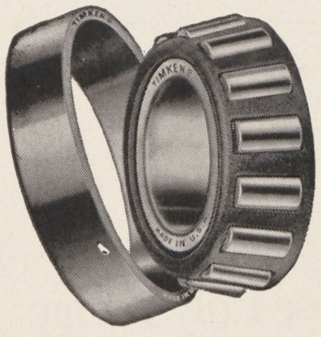

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*TAPERED ROLLER BEARINGS*

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**BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳**

Concluded from page 20

of American Telephone and Telegraph, on October 5.

**McKendree Edges Rose**

The Fighting Engineers of Rose dropped their opening game of the 1950 season to the McKendree College eleven by a score of 24 to 14.

The men of McKendree scored first early in the second quarter after a sustained ground offensive, but failed to convert the extra point. Cliff Hennig then set up the first Rose score by tossing a 30 yard pass to end Bob Rader which placed the ball on the 20 yard stripe. Four plays later Chet Good broke loose for a 10 yard run to pay dirt. Jim Mook kicked the extra point.

McKendree smashed back early in the third quarter with a 52 yard run by Ward which placed the ball on the Rose seven. After four plays Ward cracked the line to make the score 12 to 7. McKendree again failed to convert the extra point.

The Fighting Engineers then shifted into low and started a march which lasted for 83 yards and their second touchdown. Cliff Hennig carried the ball the last six yards for the score. Jim Mook again converted the extra point.

The Poly kick off was returned to the Rose 35 where an intereference penalty moved the ball up to the Rose one yard line. In the process of trying to crack the Engineers' line McKendree was detected clipping. The 15 yard penalty had little effect, however, as Lekrone faked a pass and then ran around end for the score. The last McKendree score came as a result of an intercepted Rose pass.

The final gun found the Engineers threatening on the McKendree five yard line. Coach Phil Brown used 26 players in the game, many of them freshmen and sophomores.

**Principia Spoils Homecoming 7-0**

Rose Poly's 1950 Homecoming celebration was given a severe setback by the Indiana of Principia College. The Fighting Engineers managed to make only two first downs to Principia's 13.

The lone score of the ball game was made late in the first quarter by Norm Rousselot who cracked the Rose line for 7 yards and the touchdown.

The only bright spot of the afternoon, from the Poly bench, was the superb punting of Bob Owens and Riley McKeen. Their educated toes kept the Indiana at a respectable distance and pulled the Rose eleven out of danger several times.

## FRATERNITY NOTES

**Concluded from page 14**

On campus this year representatives from Sigma Nu can be found in every activity. Chet Good has made the varsity squad of the football team, and Dick Myhre and Howard Davis are substitutes. Dick Osborne is student manager of the team, and heading the Rose cheering section is Mauri Jones. Under the leadership of Porky Stewart, newly-elected president of the sophomore class, great accomplishments are seen for the sophs. Those fabulous "Sly Droolings" may get slyer with Dick Myhre and Bud Welling as joke-writers. Bob Bohrman is now vice-president of the student chapter of the A.I.Ch.E.

### Lambda Chi Alpha

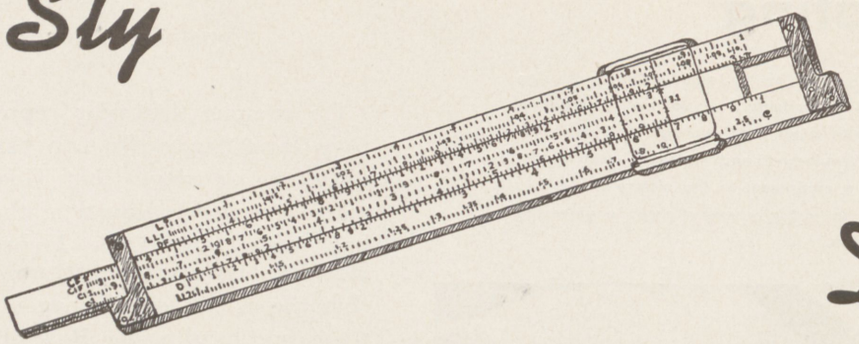
Prior to the 1950 homecoming bonfire, a buffet dinner was held at the house for alumni, actives, and pledges of Theta Kappa Zeta of Lambda Chi Alpha. About thirty-five people attended the festivities. After the spectacular bonfire, open-house was held.

A new trophy has been added to the trophy case. Theta Kappa was awarded first place for their decorations for homecoming.

On Saturday night, October 28, 1950, sixteen members of the chapter and guests spent an enjoyable evening on a combination hayride and wiener roast. Beautiful weather and a perfect autumn moon offered a most enjoyable setting for riding, story telling, singing, and "etc." Half way through the evening everyone gathered around a roaring bonfire and feasted. Then, after the wagons had been reloaded, astronomy was studied under the guidance of Mr. and Mrs. Fred Garry.

The members of Theta Kappa Zeta of Lambda Chi Alpha wish to extend their heartiest congratulations to Mr. Sam Lynch, class of 1950, who recently became engaged to Miss Margaret Sue Clinn. Miss Clinn's father was a former instructor at Rose.

# Sly Droolings



By Richard Myhre, soph., m.e.
and Bud Welling, soph., ch.e.

**A woman saw an elephant in her yard and immediately called the police.**

**"Chief," she said, "there's a queer animal out here in my back yard. He's picking flowers with his tail."**

**"Yes," said the sergeant, "and what does he do with them after he's picked 'em?"**

**"Never mind," was the answer, "you wouldn't believe me if I told you."**

* * * * *

A Southern election board was counting the ballots when a Republican ticket showed up. Not finding anything wrong with it, the board put it aside as suspicious only. After several hours a second Republican ballot showed up. This was going too far. The judge said, "The son-of-a-gun voted twice. Throw 'em both out."

* * * * *

**He: "Here's how!"**
**She: "Say when. I know how."**

* * * * *

Daughter: I took Harry into the loving room last night and—

Mother: That's living, not loving.

Daughter: You're telling me!

* * * * *

**Two old mountaineers, sitting on a cabin porch, were examining an ancient armpiece.**

**"Good shot gun that," said the owner, patting the rusty relic. "It's killed possum, coon, wild turkey, and squirrels. What's more, it got me two son-in-laws."**

**And then there's the cannibal's daughter who liked the boys best when they were stewed.**

* * * * *

The dean of women at a large coeducational college recently announced to the student body—"The president of the college and I have decided to stop necking on the campus."

* * * * *

**A fat lady stepped on the scales. They were out or order and an indicator stopped at 75 pounds.**

**An inebriated gent watched her intently. "My gosh," he marveled, "she's hollow!"**

* * * * *

She: "I'll stand on my head or bust!"

Gym Instructor: "Never mind, Miss Jones, just stand on your head."

* * * * *

**He: "Why do they call her Radio Station?"**

**Him: "Because anybody can pick her up, especially late at night."**

* * * * *

"Did you have your lodge meeting last night?"

"No. We had to postpone it because the Grand All-Poyerful Invincible Supreme Potentate was beaten up by his wife."

* * * * *

**Junkman: "Any rags, paper, or old iron?"**

**Engineer: "No, my wife is out of town."**

**Junkman: "Any bottles?"**

"I can't marry him, Mother, he's an atheist and doesn't believe there is a hell."

"Marry him, my dear, and between us, we'll convince him that he's wrong."

* * * * *

**Ruth: "How do you know he was drunk?"**

**Doris: "Well, he shook the clothes tree and then started to feel around the floor for some apples."**

* * * * *

He: "I have money to burn. Shall I write you a check for a hundred?"

She: "No, thanks, we don't care for the smell of burning rubber around here."

* * * * *

**Mother: "Ah me, your poor father has reached the end of his rope, what shall we do?"**

**Son: "I'm goin' to cut him down maw."** * * * * *

Do you know the difference between a girl's boy friend and her parlor? No? Well, when her boy friend is lit up, he's full, but when her parlor is lit up,it's empty.

* * * * *

**The junior member of a consulting engineering firm flew to New York to see a prospect. Landing there he couldn't recall the prospect's name, so he telegraphed his partner:**

**"What's our prospect's name?"**

**Came the answer: "James B. Johnson. Your name, Harold Jones."**

# How much magic can a square inch hold ?

**Just a frame of movie film—but think what it can hold. Accurate detail, motion, sound, even lifelike color and much more—miracles that work magic in entertainment, and in business and industry as well.**

Here, in a tiny area far too small to examine easily, photography has captured a moment of life faithful in its finest detail—captured it complete with sound—conversation and music. And all this that's been recorded can be endlessly duplicated so that all the world can thrill to its beauty and drama at the same time and in the language of any land.

Such are the wonders of photography. They are wonders that serve entertainment—can serve science, business, and industry in countless ways as well.

For example, motion pictures can present your product or services graphically and colorfully. They can explain production methods—dramatize safety measures—train salesmen. They can spark interest and understanding in the classroom.

With pictorial animation they can make difficult processes clear. They can make time go fast, go slow, or even backward, to facilitate a study or improve a demonstration. All of this because of the inherent magic in photography.

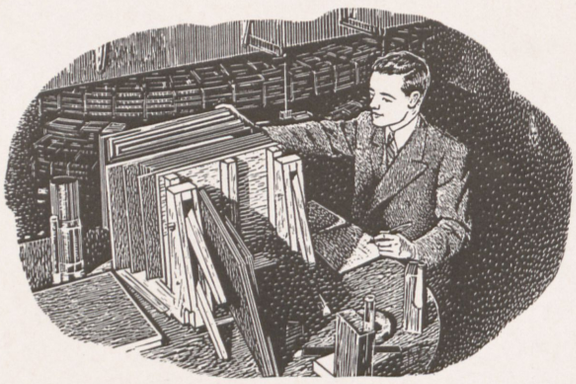
You can use this magic in your occupation. When you meet problems in production, management, or sales, it will pay you to find out how they can be handled better, faster, and more accurately through photography.

**Eastman Kodak Company, Rochester 4, N. Y.**

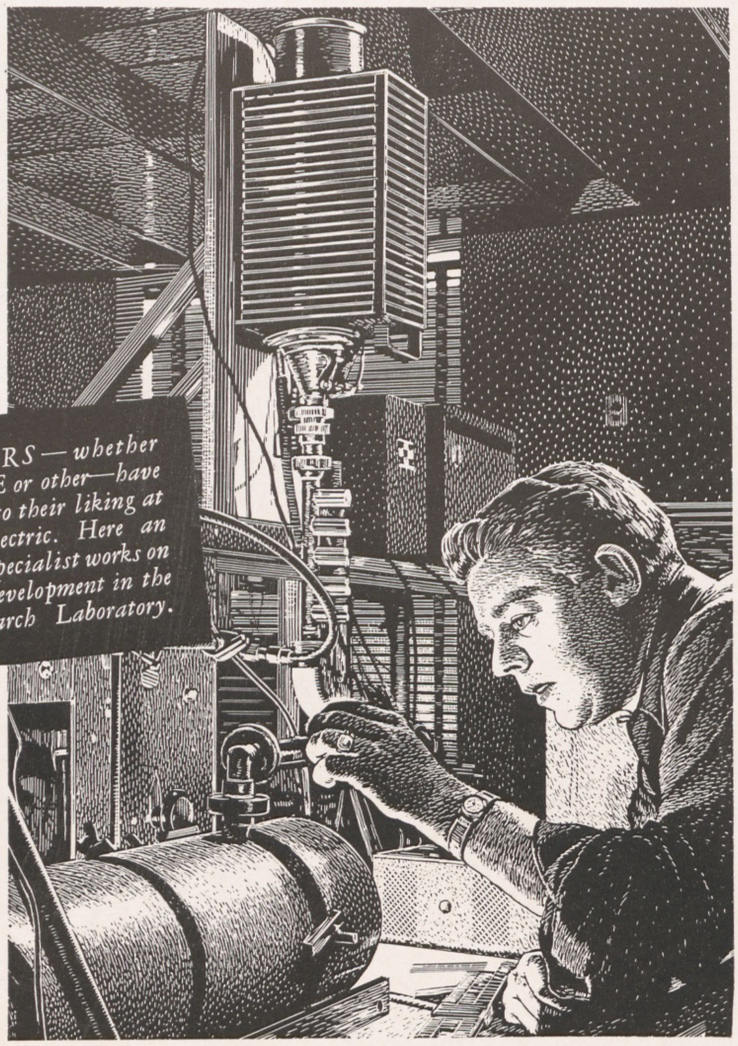
**ADVANCING BUSINESS AND INDUSTRIAL TECHNICS**

## Functional Photography

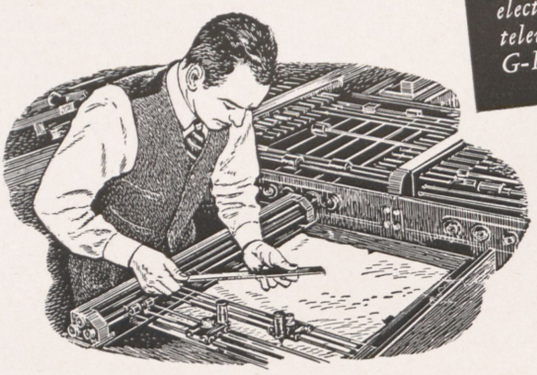
Kodak
TRADE-MARK



*PHYSICISTS at G.E. find opportunities in the Company's atomic research projects.*



*ENGINEERS — whether EE, ME, CE or other — have found work to their liking at General Electric. Here an electronics specialist works on television development in the G-E Research Laboratory.*



*MATHEMATICIANS work on such G-E developments as the differential analyzer and other computers.*

# General Electric's corps of scientific, engineering, and technical specialists has more than doubled since 1941

Products, like streams, rise no higher than their source. At General Electric the source of new and better products is our corps of scientists, engineers, physicists, chemists, and other technicians, recruited from American colleges and given further opportunities for study and training in long-established G-E courses.

In the years since 1941, General Electric has increased this corps of technical graduates from less than five thousand to more than ten thousand.

These men and women have found themselves needed in the Research Laboratory, the Knolls Atomic Power Laboratory, and more than twenty other G-E laboratories . . . in the engineering and developmental staffs of nine G-E Operating Departments, ranging from the manufacture of heavy industrial equipment to the making of lamps and chemicals . . . in manufacturing and sales . . . in such new undertakings as jet engines, radar, silicones, gas turbines for locomotives and electric power generation.

At General Electric, prime importance is placed on recognizing and developing talent and skill, on providing incentives for creative thinking, on keeping ahead in electrical research, engineering, and manufacturing.

*You can put your confidence in—*

**GENERAL ELECTRIC**