In This Issue

THERE GOES PARITY
SLIDERULE SHAKESPEARES
ELECTRONIC TRACKING
The picture was taken with a camera that exposes 3,000 frames per second. One second of action takes more than three minutes to project at normal viewing speed.

The picture was taken looking into an open hearth furnace, and it discloses action that was only vaguely perceived before. This enables U. S. Steel scientists to develop a better understanding of the kinetics of heat transfer and chemical reaction at temperatures approaching 3,000° F.

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At 30, Harvey Graves directs nuclear design of two major Westinghouse reactors

After completing the Westinghouse Student Training Course in 1951, Harvey Graves attended the Westinghouse Advanced Design Course* and was sent by Westinghouse to the Oak Ridge School of Reactor Technology for one year. Back at Westinghouse again in 1953, Engineer Graves did advanced work on nuclear reactor development.

In 1955, he was promoted to supervisory engineer on the Belgian reactor project. In 1956, he was again promoted to Manager, Westinghouse Nuclear Design Section. Today, Mr. Graves' 24-man section is developing and designing the nuclear portion of commercial reactors for the Yankee Atomic Electric Company and the Center d'Etude de l'Energie Nucléaire in Belgium.

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Cover

This particular picture was snapped as the full output of a 500,000 volt "lightning generator" was discharged to the top point of the antenna beacon.

Courtesy of BROADCAST NEWS, published by RCA.

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 does not necessarily agree with the opinions expressed by its contributors.
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September 8, 1958

February, 1958
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Sherman Francisco tells what it's like to be . . . and why he likes being . . . a Computer Systems Engineer with IBM.

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Think we're stretching our story a bit? Here's your chance to find out. Drop us a note and we'll send you a copy of "Detroit Edison Engineering"—it tells about the challenges and opportunities waiting for you. Write to the Employment Department, Detroit Edison, Detroit 26, Michigan. Or check with our representative when he visits your campus.
Are We Overworked?

Perhaps one of the most difficult problems in this modern day and age is that of acquiring sufficient time to accomplish one’s tasks in a twenty-four-hour period. Yet, efficient management of time through self-discipline can be the key to success in any facet of our lives.

Quite often students here at Rose tend to feel they are being overworked in some of their courses. Admittedly, Rose Poly is not an easy college from which to graduate. If it were, why should we bother to attend? The setting of high goals is necessary for progress in any field.

Requiring each individual to discipline himself and work out his schedule teaches many valuable lessons not obtained by merely attending lectures. Contrary to popular belief, the limit to the amount of mental work an individual might complete very seldom depends on his physical characteristics, but on his ability to discipline himself to the tasks before him. Too many of us waste a large percentage of our study time thinking of unrelated subjects or feeling sorry because we seemingly have so much to do. We are not overworked. We are merely inefficient and poorly disciplined.

We are content to lean back in our chairs and complain about everything in general, but we fail to realize that we are contributing very little to remedy the situation. This applies not only to that supposedly “unfair” test that we didn’t prepare for well enough, to the fact that “everyone else” doesn’t support the football team.

The first step to the solution is to realize that we are solely responsible for our actions. The education we receive depends on us alone.

This is not to imply that extra-curricular activities should be eliminated. Conversely, they should increase considerably. Random or abstract thought has its place—but not during study hours. It is indeed unfortunate that every individual cannot be pushed to his mental capacity and be forced to discipline himself; the reward of such labor could not be measured. It remains, however, for each of us to develop himself in the act of self-discipline.

D. G. M.
You've picked your profession—engineering.

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There's plenty of room to grow at DuPont. One reason is that the very diversity of our products and processes requires specialists in almost every area of science and engineering. Another reason is that DuPont continues to expand in many new directions.

For example, in 1957 sales reached $2 billion. Four new plants were being built. New research projects were launched, new products marketed.

In 1957, too, new technical men joined DuPont in chemical, civil, mechanical, metallurgical, electrical, industrial, petroleum and mining engineering; in atomic energy, instrumentation, chemistry, physics, mathematics and many other fields.

All this activity points to as bright a future today as ever before in our long history. There's a place for the good graduate in this picture. If you would like more specific information on opportunities at Du Pont, we invite you to sign up for a Du Pont interview with your placement director.

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As you might guess, Du Pont's personalized training is closely related to its promotion policy. Almost all advancement is made from within the Company, so if your supervision has indicated that you are ready for promotion, and an opening occurs for which your training has prepared you, you are sure to be considered.

Although Du Pont employs about 90,000 people, management authority is decentralized through many departments into small groups—small enough so that the new man's capabilities can be recognized quickly. This type of organization, plus the Company's steady growth, produces many opportunities for the new man.

* * *

Du Pont, over the past 25 years, has spent $1 on research for every $3 on production facilities.
Recently two young scientists, T. D. Lee of Columbia University and C. N. Yang of the Institute for Advanced Study, won the Nobel prize in physics. They overthrew one of the fundamental laws of quantum physics, the conservation of parity.

Although actually a mathematical concept which is impossible to define in physical terms, the idea of parity may be illustrated easily. Parity says that there is no absolute distinction in nature between right and left. Your left hand is exactly identical to your right when seen through a mirror. So it may be said that both hands are the same; the right hand lives in our world and the left hand in a mirror world. Dean Strum will tell you that when you grasp a wire with the right hand so that the thumb points in the direction of the current, your fingers point in the direction in which a north pole moves in the magnetic field around the wire. But if you put a mirror at the center of a compass and perpendicular to the needle, the north pole when viewed in the mirror becomes the south pole. Also, the right hand becomes the left in our mirror world. So the result of this experiment is the same whether a mirror is used or not. There is no intrinsic physical distinction. Until recently this was believed to be true for all physical phenomenon.

Parity is scientifically a property of the so-called wave function by which quantum mechanics describes the wave characteristics of a particle and represents its position in space. If one of the coordinates used to locate the particle is changed from plus to minus, this is equivalent to reflecting the system in a mirror. If the wave function still remains the same, the parity is "even"; if the wave function changes sign, the parity is "odd." It was thought that in an isolated system parity never changed sign and therefore was conserved.

Lee and Yang first began to question the law of parity while investigating the "tau-theta puzzle." There were two mesons, called tau and theta, which were completely identical except in their modes of decay. Tau disintegrated into three pi mesons; theta into two pi mesons. The pi mesons have a parity of -1; the parity of the tau meson is therefore \((-1)^{3}\) or -1. The parity of theta is \((-1)^{2}\) or 1. Clearly, either tau and theta were different particles or the law of parity didn’t hold. The decay of tau and theta particles belongs to a very special class of reactions known as “weak interactions.” The forces involved are even weaker than those which bind electrons in atoms. The lifetime of tau and theta particles was too short for an experiment, so Yang and Lee had to use some other radioactive material to test whether right and left could be distinguished physically in this world.

They decided to use cobalt-60, which has a half life of 5.3 years. In a reaction know as beta decay, the cobalt isotope emits an electron and a neutrino to form nickel-60.

\[
\text{Co}^{60} \rightarrow \text{Ni}^{60} - \text{e} - \nu
\]

The cobalt nucleus has a well-defined spin. However, in a normal piece of cobalt, electrons will be emitted equally in all directions because of the heat motion. In order to orient the nuclei—that is, force all the nuclei to align their axis of rotation parallel to a given direction and have the same direction of rotation, temperatures of less than 0.1°K and a strong external magnetic field were used.

Let us see what should happen to a group of oriented cobalt nuclei, which follow the law of parity. Consider the emission of beta particles along their axis of rotation, as shown in the diagram. There are two possibilities. Either the same number of electrons are emitted down as up or more electrons are emitted in one direction. Suppose more electrons are emitted upward. In a mirror they rotate the same, but the direction of the electrons is reversed. This violates the law of parity because the law says that using a mirror will not change the experiment. For the case of the right-hand rule both the hand and the pole were changed by using a mirror, but here only the direction of electron emission is changed which makes the mirror system physically different from the initial system. If the emission is random, as many electrons will go down as up, and the mirror image will be the same as the original. Hence, we expect an equal number of electrons to emerge in each direction.

The tests showed the electrons emerging in a preferred direction and parity was dead. However valid it was elsewhere, in the realm of weak interactions it had failed. Soon
other experiments confirmed these results. A possible explanation of this new phenomena was proposed by Lee and Yang. They believe that the spirality is associated with the neutrino, since all other physical phenomena, which involves no neutrinos exhibit mirror symmetry. They claim that the rotation and direction of propagation of the neutrino is the same as a left-handed screw. The antineutrino has the opposite properties—it is like a right-handed screw.

With these helical neutrinos it is easy to explain the preference of direction for emission. The rotation of the neutrino will be the same as the cobalt nucleus. Its direction of emission must then be such that a left-handed screw is formed. This direction must be upwards. In order to provide support for this explanation, an experiment was performed using cobalt-58, where the emitted particles are a positron (a positive electron) and an antineutrino. The explanation states that the antineutrino has right-handed spirality and hence will advance in the opposite direction as compare with the neutrinos from cobalt-60. The positrons “follow” the antineutrinos in the same manner as the electrons pair-off with the neutrinos. It was found that the direction of emission is opposite for cobalt-58, thus giving great support to the theory.

A more dramatic demonstration consist of coating with cobalt-60 the top of a horizontal aluminum disk suspended from the ceiling by a thin wire to its center. The aluminum blocks the few downwardly emitted electrons; as a result the electrons and neutrinos going up give the disk a spin in the opposite sense to their own spin. If cobalt-58 were used, the rotation of the disk would be reversed.

When speaking of the violation of parity, it is valuable to consider a (Continued on Page 34)
The Rose B-ballers returned from the Christmas holidays seeking to improve their three and three record. January 9, the team traveled to Indianapolis to face Marian College which had previously defeated them. The Engineers dropped behind the host but managed to pull within four points of Marian as the half ended. Jim Carr fired up the Rose five and the lead changed hands three times the second half before co-captain Gary Giffel fouled out. Without Giffel’s leadership it seemed Rose could do nothing right as Marian pulled away, winning 79 to 60. Giffel led RPI’s scoring with 15 points.

The next game found the Rose and White on the road once more, this time facing a strong Greenville College five. The Engineers could not hold down Maroon of the home team, who collected fifteen points the first half. Rose entered the dressing room trailing two points, 36-34. Neither team could gain a substantial lead until the closing minutes when Greenville edged in front Rose its second straight defeat, 72 to 64. Taking scoring honors for Rose were John Ray, Giffel, and Mike Smith with 18, 16, and 15 points respectively.

The following week Rose played its first home game of the new year. Much to the delight of the “crowd,” the Engineers completely dominated Eureka, avenging an earlier defeat. The highlight of the game was a rugged Rose defense which held the visiting team to 16 points the first half and Strickland, the small college leading scorer, to three points the entire game. Strickland had scored 47 points in the previous contest. The second half the Engineers remained in front as Carr emptied the bench. Final score: RPI-65, Eureka-51. Again Smith, Ray, and Giffel were high for Rose, scoring 19, 18, and 12 points in that order.

While the rest of the school went home to recover from the finals the round-ballers remained in Terre Haute to face four tough opponents. Oakland City was the first to meet the Engineers. This game featured the return of co-captain Jim Oakes, who had been ineligible the first semester. The visiting squad proved too strong for the Engineers and led 36-28 at halftime. The Rose men pulled within 5 points of the Oaks before they lost their leading rebounder, Ray, by route of personal fouls. The hot-shooting Oakes won going away, 77-52. Oakes was the leading scorer of both squads with 20 points.

RPI opened a three conference road trip against Principia College of Elsa, Illinois. After leading most of the game Rose cooled off in the last five minutes and the Indians tied the score at 61-all with four minutes remaining in the game. After that Rose could only tally one point while the home team was icing the victory with a field goal and a pair of free tosses. The Engineers outscored Principia from the field but lost the game at the charity line. Mike Smith copped scoring honors with 22 points.

Seeking to improve their conference record the Rose men traveled to Carlinville to face the Blackburn Beavers for the first time of the season. After trailing 44-40 at halftime Rose went in front to stay, 70-69, with 4:30 showing on the clock. Larry Berger dropped four free throws and Mike Smith added two more for insurance as Rose won going away, 77 to 70. Hughes, Blackburn’s ace forward, gathered 33 points with Rose’s John Ray next with 23.

The following evening the Engineers were matched against Illinois College for the second time of the season. The host jumped to a 10 point lead in the first five minutes of play. Rose fought back and owned a two point lead at the intermission, 35-33. The second half Rose never lost the lead although the Blue Boys pulled within two points several times. In the closing minutes I. C. tried a press, but this backfired, and the R-men were in no danger when the final buzzer sounded. Final score: Rose 80, I. C. 68. This victory gave the Engineers a 3-3 conference record and a 6-7 overall record.

The Rose and White was still on the road when the second semester began. February 6, the team faced the Oakland Oaks, who had beaten the Engineers at Rose. Led by Anderson, the hosts were unusually hot in the opening minutes while Rose could not seem to hit the bucket. This was the story of the first half and Rose went to the dressing room trailing 39-25. The Engineers caught fire the second half but not soon enough. The Oaks lead was cut to five, but the R-men could do no (Continued on Page 34)
Ethics And Honor

By Charles Skidmore, sr., e.e.

Maybe you have heard or seen the phrase "Engineering is a way of life." Although this sounds narrow, it actually contains a broad concept. It means that engineering thinking is carried farther than the solving of engineering problems. Engineers find themselves applying their way of thinking to problems completely apart from science. It stands to reason then that engineers will also apply analytical thinking to problems of life that deal with human values. How can this be done? Human beings cannot be dealt with like machines.

The answer is that good, correct engineering thinking contains not only sound reasoning, but also this idea of "engineering ethics." To the usual student of engineering, this matter of ethics is something that is mentioned in lectures by guest speakers or discussed in articles by engineering educators. At one time or another, every engineering student hears or reads that this matter of ethics is important in his career after school. The usual reaction is to forget such things quickly and concentrate on getting through college. He is not interested in ethics. How could he be? Ethics is too broad a subject just to read or hear about and then be able to form any lasting opinion on Ethics has to be made real. That is why guest lecturers seem so familiar with the subject. They have been out in the world and dealt with people and, consequently, ethics.

We see, then, that something is needed to make the engineering undergraduate ethics conscious. It is important that this is done on the undergraduate level because this is the most opportune time. Obtaining a B.S. degree will not instill professional integrity into the graduate any more than it will grant him professional status. True, he has a good chance of obtaining both, but it is not a certainty. It is most important that he learn and understand what will be required of him in his relationships with fellow employees, employers, and professional contacts.

One of the best ways to accomplish this is by the honor system, a program that only the students of a college can operate successfully, but then, they derive all the benefits. However, when an honor system is a part of a college, the influence extends beyond the classrooms. It is a common misconception that the honor system is used only in taking tests. The honor system has an important application here, to be sure, but its usage is much broader than this. It covers all phases of classroom work (laboratories, reports, etc.). An honor program is applicable to many parts of student life. It can rid dorms of harried study proctors; social functions can be carried on without chaperons; student government becomes what the title implies by losing faculty overtones. The student has more of a chance to mature and think for himself. To some, college becomes a more serious thing. Many find their values become clearer; usually all are affected in some way.

The honor system, once installed cannot be ignored; it is there day after day. Honor becomes a tangible thing that guides everyday thoughts and actions. By helping to mature students' minds and giving them a sense of honor, professional ethics becomes more than large, righteous sounding words.

This sounds very Utopian and wonderful until you try to start an honor system. For an honor program to be successful, it must be acceptable to all students involved. A few who disagree with its principles ruin it for everyone. An honor system requires a conscious effort from every student.

If anyone has the attitude that they are not their "brothers' keeper," this also hinders an honor program. This person has an apathetic philosophy which says in effect, "What others do is their own business. If they want to cheat, that's all right; they're only hurting themselves. I'll just go my way and let them go their's. Why should I be responsible for the actions of others?" Sure, you've heard it all before; maybe you have even said it yourself — it's a common line of thought. This type of attitude is the reason for crooked politicians in power, Hitlers and Mussolini's, vice troubles and many more grievances common to man.

(Continued on Page 38)
For many years the myth has existed among executives and English professors that engineers are unable to write. This myth has been greatly propagated by provoked executives attempting to understand poorly organized technical articles made worse by poor grammar. To be sure, engineers often do not write well, but it is hardly true that they are unable to write. The horrible fact is that many engineers dislike writing and therefore do not do the job of which they are capable. Many do not realize the value of good reports or papers on their work, and do not make the effort necessary to make reports and papers both clear and interesting.

The size and complexity of today's industry makes accurate technical writing a necessity. The engineer's responsibility is far from done when the technical details of a project are completed. Writing clear and interesting reports and articles is every bit as important as any other part of the job. Information must be transmitted from the field to the executives. Articles must be published in company magazines and in technical journals. Repair manuals must be written.

If a project is big enough, it may be necessary to assign someone to do only the writing. Such jobs must be given to engineers — and to engineers who can write. The Sperry Gyroscope Company frequently does this. The company produces many control instruments such as gyrocompasses — items which must be understood by the people who will use them. In such a business a clearly written operation manual may be just as valuable as an improved model gyrocompass. Therefore the company spends much time preparing publicity publications, operation manuals, and technical articles on their products. The Sperry Company is only one of the many companies who find that the success of their products depends on how well people know how to use them.

In tomorrow's age of automation, this will become more and more important. Tomorrow will find industry controlled by little boxes containing mazes of circuitry. Someone must repair these systems, and someone must operate them; and all too often these someones cannot be engineers. It is imperative that the man who designs the industrial systems of the future be able to tell the world what he has done.

From this increasing importance of technical writing, a new field of engineering is arising. This field is called publications engineering, and was born because it is almost impossible for a good writer to acquire enough technical knowledge to write on some subjects. Consequently a publications engineer is first an engineer — an engineer who likes to write. In this young profession, technical writing is often called "words smithing." Besides just writing, the publications engineer is also responsible for the illustrations, photography, layout, and printing of technical material.

The publications engineer may be concerned with:
- Instructional Handbooks
- Training Manuals
- Engineering Reports
- Engineering Specifications
- Engineering Proposals
- Technical Sales Literature (Catalogs and Brochures)
- Technical Data Sheets
- Reference Publications
- Presentation Materials (slides, charts)
- Technical Films
- Technical Advertising

Opportunities for a publications engineer are rapidly expanding. The more complex our industries become, the more opportunities he will have. At present, the starting salaries for young engineers going into publications work are about the same as for other engineering jobs, providing the applicant has a course or two in publications work. An engineer who likes the work can frequently advance faster than he would in normal engineering jobs because of the newness of the field. Many jobs in the field are lucrative indeed.

Publications engineering requires a peculiar breed of man — an engineer who likes to write. Anyone who tries to write on subjects like heat transfer, or the design of automatic...
transmissions must first of all be an engineer. The Caterpillar Tractor Company tried to give liberal arts students enough training to do technical publications work, and this did not work. The company found that it was far easier for an engineer or mechanic, with enough experience, to become a writer than for a writer to become an engineer.

However, anyone who thinks that a little practice is all that is needed for an engineer to become a publications man had best think again. The publications engineer has many, many problems. They may not be excessively difficult, but they are worthy of a man's consideration.

A sample problem which might fall to a publications engineer is one which befell some engineers at Caterpillar Tractor a few years ago. It seems that many "dozer" operators mistrusted the introduction of torque converters. Many wild tales of the impracticability of the converters ran rampant among the users of Caterpillar products, many of whom were not too well educated. The Problem? How to produce a publication which would explain to men having only a grade school education the theory of operation of a torque converter. The publications men at Caterpillar did it using as an analogy a stream of water directed from a faucet to a series of whiskey glasses. The experiment was described in a small manual using photographs and diagrams of the company's torque converters analogous to the whiskey glass experiment. Anyone who doubted the efficiency of fluid couplings was invited to try the whiskey glass experiment and draw his own conclusions.

Not all material must be as vividly presented as in the whiskey-glass experiment, but the general ideas involved in the solution of that problem arise in the publications of all technical material. A good publications man must have a flair for words and a strong, almost wild, imagination. He must have an unquenchable thirst for knowledge, for he is constantly called upon to describe something about which he knows practically nothing. He must decide whether material can best be presented by photographs, diagrams, or graphs. He supervises the preparation of these aids, and he edits the writing. He sees to it that the printer properly reproduces the material. If he is printing a manual on, say, the repair of an oscilloscope, he should spend a great deal of time actually working with the scope he is attempting to explain. A person can authoritatively transmit knowledge only about subjects upon which he has first-hand knowledge of the smashed-finger type. He must also be capable of getting along with the other engineers on the project he is describing.

Besides this type of highly colorful work, a publications engineer can work with one of the large technical magazines such as Combustion or Chemical Engineering Progress. Also, a great deal of professional prestige is accorded to the men who edit and publish the society journals. The editorship of one of the society journals is one of the highest goals of a publications engineer.

While the publications engineers may be able to take the burden of routine writing jobs from the shoulders of their fellow engineers, this does not mean that a few men are going to assume the work of many. The man who actually does the work is still the man who must tell what he has done, and to this extent, every engineer is a publications engineer. The production of a well-written report is a process requiring much effort and organized thinking. It requires the preparation of graphs, illustrations, and photographs. The writer must use his imagination to think up analogies explaining what he has done. Any engineer can produce a clear and interesting report on any subject on which he is thoroughly interested if only he will put forth the effort required to express himself. As anyone knows, it is far easier to write on a subject about which one is enthused than on one about which he is bored. Not every engineer can be a "slide rule Shakespeare," but the myth that engineers are unable to write can easily be exploded if only engineers will put what they know on paper.
CONTROL
ELECTRONIC TRAFFIC

Operate traffic lights at intersections with greater flexibility than is possible with present techniques.

All of these can be accomplished without actual control of the vehicles themselves, but rather by means of a series of lights along the edge of the highway which go on automatically as a vehicle passes, and remain on until the vehicle is a specified distance beyond the light. In the case of vehicles approaching from the opposite direction of hills or curves, the system can respond to their presence by operating a warning light or signal placed within view of the driver from whom the approaching vehicles themselves are hidden.

Since these applications require no alterations of special equipment in automobiles or trucks, there is no reason why they cannot be introduced at various locations in the near future. A logical next step, but one that will require more extensive testing as well as the cooperation of industry and the driving public, is the addition of simple receiving equipment in vehicles.

This step could be accomplished in two stages. First, simple receiving equipment for indication and warning only could be provided as a removable unit upon entrance on a turnpike or purchased by the driver for installation in his own car. The second stage would be the installation of receiving and control equipment as an integral part of the vehicle manufacturer.

With such equipment, the signals generated by the detecting elements in the road will control brakes, steering gear and engine speed to provide fully automatic driving along entire highways or in a specific area where it may be advisable for reasons of safety.

NEW JET-FLAME USED ON ST. LAWRENCE SEAWAY

Jet-piercing a new blasting process was developed by Linde Company, Division of Union Carbide Corporation. They based the process on the rocket principle which gives speeds up to ten times faster than conventional drilling methods in piercing rock.

"Linde found that their new process works fastest on the class of spallable rocks which normal drilling methods find toughest—especially those containing silica — such as granite, syenite, quartzite, sandstone, and magnetic taconite. Potsdam sandstone, the rock being pierced on the St. Lawrence Seaway, is highly abrasive material that would normally cause excessive bit wear. In the past it has taken as long as a week to drill a 100-ft. hole in this very hard rock using churn drills. But with Jet-Piercing, a 100-ft. hole can be sunk in a single shift. Our country's largest reserve of domestic iron ore consists of iron bearing ore formations called taconite. Known as the "meanest rock on earth," taconite has a hardness capable of scratching glass. Taconite is found principally in the Mesabi Range of Northern Minnesota and throughout Northern Michigan, and at one time, was considered impossible to mine. Blasting was the only possible method, but blast holes couldn't be drilled economically. In fifteen minutes the strongest steel bit would get only three inches down into the tough taconite before it was ruined. But blasters needed thousands of holes at least 18-ft. deep in order to blast out the stubborn but iron-rich taconite. Linde's jet process opened up the taconite-rich Mesabi Range and made it possible to produce blast holes 40-ft. deep and 7-in. wide at speeds of from 12 to 40 ft. an hour. Thanks to Jet-Piercing, it is now estimated that in less than 20 years over \( \frac{1}{3} \) of our country's iron ore requirements will be supplied from taconite.

In addition to the increased speeds of penetration, Linde's Jet-Piercing process makes it possible to "chamber" blast holes. Chambering consists of enlarging the blast hole at any desired depth so that extra explosive charges can be placed exactly where needed. The operator simply lifts the blow-pipe off the bottom of the hole and lets the jet blast away. This induces more spalling at the desired spot and produces a bottle-shaped cavity, capable of holding a large explosive charge."

Jet-Piercing uses thermal energy instead of mechanical energy which eliminates the maintenance problems associated with churn drills, pneumatic drills, and jackhammers.
The thermal energy comes in the form of supersonic jets of flame which travel five times faster than the speed of sound and reaching temperatures of 4000 degrees F., and the flame spits out of a rocket-type burner and disintegrates or spalls the rock in its path. This continuous operation throws disintegrated rock particles out of the hole by combined force of burning gases and steam so that a fresh surface is continually exposed to the jet flame. The only limitation to penetration depth is the length of the hoses (carrying fuel, oxygen, and water) that are lowered into the hole. Deepest penetration obtained to date is 160 feet.

"The jet flame represents one of the highest concentrations of energy available to man. At its velocity, the Jet-Piercing flame has a mechanical energy equivalent of about 500 horsepower — yet this energy is contained in a flame not more than 1-in. long and 2-in. wide.

MECHANICAL POST OFFICES

Under the sponsorship of the Post Office Department, the National Bureau of Standards has established the basic principles of a system for automatically sorting letter mail and is presently supervising development of both large- and small-capacity prototype machines that embody concepts of this system.

The handling of mail is now a major economic problem within the Government. The Post Office Department estimates that in 1956 it handled over 48 billion pieces of letter mail alone. The amount of mail has been increasing exponentially almost since the inception to the postal service, and indications are that this rate of expansion will continue for years to come. To keep up with this tremendous growth, the Post Office Department has been seeking mechanized methods to assist its personnel. In recent years, certain engineering techniques have been perfected that could well be applied to the mechanical sorting of mail. The potentialities of some of these techniques—such as punched card sorting and coded character reading—have been investigated by the Bureau to see how they could be applied to alleviate the large-volume, high-speed letter sorting problem.

Detailed analyses of sorting operations were begun and the development of specifications for sorting equipment undertaken. First, the statistical distribution of the physical characteristics of letters including size, shape, color, and location of address was studied. Then statistical patterns of sorting systems were analyzed for outgoing and incoming mail in post offices. Finally, coding systems were developed for abbreviating addresses in a dot code similar to teletype code; all sorting could be done by machinery. Electronic readers for dot codes are already well developed, whereas readers for printed addresses are in the early stages of development and no satisfactory readers have been proposed for handwritten addresses.

Before mail is presented to any machine, it goes through several auxiliary operations. It is first culled to remove the too large, too small or too thick pieces. The letters are faced to orient the stamps properly and to present all addresses same side up. The mail is then fed into the stamp canceling machine. At this point it is ready to be presented to the coding operators.

The operator reads the address on the envelope and operates a keyboard similar to a typewriter keyboard. By following certain fixed and simple rules of abbreviation, the operator imprints on the back of the envelope, in dot code form, a standardized abbreviated version of the address on the envelope. The degrees of abbreviation depends on the volume of mail that is normally sent to the address in question. Post offices, streets, and individual addresses which receive very large volumes of mail may be given unique single-character codes to save the coding operator's time.

The letter is then mechanically transported to a code reader. Here electronic devices produce electrical signals from the dot code which in turn are passed on to a translator. The translator is an electronic or electromechanical device which

(Continued on Page 36)
MISSILE DETECTION

Electronic Tracking

By Lanny Snapp, soph., e.e.

In the last thirteen years there have come many changes in the speed and design of aircraft. With these changes came the problem of detection of such aircraft. During the Second World War the speed of the aircraft gave adequate time for detection and preparation. If a mistake was made a second detection and preparation was possible, but now there is no second chance. The first detection must be made and with accuracy, to enable for adequate protection. It was known in World War II that the propeller reflected the major proportion of the radar's energy back to it. Also, the type aircraft had a bulky fuselage which returned a considerable amount of the radar's energy. The new type aircraft with their speed and slim design have decreased the effective range of detection systems by at least a factor of four and warning time by a factor of eight to one. These changes in aircraft have made nearly all radar systems of World War II obsolete.

The next step is a detection system for ballistic-type missiles with their greater velocity and minimum of radar-detection area. These new systems of detection must provide information on the precise location of the target at longer distances.

Detection systems: Although human observers are still essential electronic devices are the basic detection systems. Detection is the keystone of the system, but associated computers and other equipment for effectively utilizing the information obtained are also essential in the overall detection system.

Electromagnetic radiations in the spectrum from radio to infrared are utilized in electronic detection systems; different frequencies having their individual advantages and disadvantages. The lower frequencies yield higher power, more sensitive receivers, and greater freedom from atmospheric attenuation. The higher radio frequencies favor higher antenna gain, smaller size and finer target discrimination.

The active system consists of transmitting high-frequency radio signals from a directional antenna and placing target position by noting time of send out and return of signal. The direction is determined by the pointing of the antenna. This system has the advantage in simplicity and reduction in peak power requirements although it is poorly adapted to accurate ranging.

The passive systems do not depend on radiation from the detection system. Although limited in ability as compared to the active system, but they are valuable because of their "invisibility" to the target. The active system betrays itself to the aircraft when the aircraft is equipped with radiation pick-up equipment.

Infrared is becoming an interesting and promising way to detect aircraft. Jet engines, rocket motors, and the skin of high-speed missiles are all strong sources of infrared radiation. Since infrared wavelengths are extremely short, precision optical systems are possible and provide accurate direction and crude range finding. A system is now being considered of infrared for detection and direction finding with short bursts of active radar for ranging.

Special consideration: "Moving Target Indicators"—Many times radar sets pick up numerous objects, although only moving objects are the objects that are wanted. To stop this, circuits have been designed to differentiate between moving and stationary targets. The radar's movement is known and can be compensated.

"Automatic Alarm"—Setting and watching a radar screen for a long period of time tends to slow the operator's reaction time down and could cause him to miss a new object on the screen. To stop this an alarm system has been rigged on the set.

"The design of automatic alarm circuitry involves a statistical consideration of the noise or natural disturbances present in all electronic equipment. These disturbances are completely random and are in fact, generated by electron motion in the circuit components in the input stages of the radar detection system receiving elements. Such random fluctuations can easily exceed a weak signal. This can be avoided if system performance is (Continued on Page 42)
The Webster's New Collegiate Dictionary defines engineering as—
"Applied science concerned with utilizing inorganic products of earth, properties of matter, sources of power in nature, and physical forces for supplying human needs in the form of structures, machines manufactured products, precision instruments, . . . , and other productive work."

It is my purpose to state my opinion of the present day definition of the engineer and to formulate plans for a new engineering outlook.

Webster's definition seems to be, one of a half century ago, when the engineer was the man who "knew it all." An engineer might specialize in one of a half dozen engineering fields, but the general public still expected him to know something about all technical subjects.

In the past 50 years, great strides have been made in this technical world of ours, making literally thousands of specialized fields available to the engineering graduate. Because of this specialization, the job of many engineers has been reduced to that of a mere technician doing his infinitesimal part, the engineering administrator, or coordinator, must have not only a broad engineering background, but a complete working knowledge of economics and personnel relations.

Thus we have defined a need for two types of engineers: the technician and the administrator. Our job now is to decide whether engineers are being given the proper undergraduate study to prepare them for a place in our society.

It has been postulated and possibly can be proven that soon after graduation the average engineering student retains only about five per cent of the material presented to him in school. Of course, the primary purpose of the engineering education is that of indoctrinating the student with precise methodology. The engineer must learn how to approach problems logically, to define them, to analyze them, and to solve them. It is evident that this methodology is essential to the engineer both in specialization and in administration.

It is felt that the present four-year curriculum offered by most engineering schools is too broad for the specialist. He is forced to study subjects in which he has little or no interest and is given little chance to specialize in his chosen field.

You may ask, "How do I know what I am interested in?" It is my proposal that, through the cooperation of industry, the technically inclined high school graduate be allowed to work for two years, choose his specialized field, and receive three year's formal education in that subject.

To be an engineering manager, one must have a broad engineering background plus the qualities usually found in a person holding a business administration degree. The present four-year curriculum probably offers the optimum in a broad concept of engineering, including some courses classified as humanities. With a slight condensation of the strict engineering courses and the addition of several economic, human relations and administrative courses, a five year course could be offered in engineering administration which should be more than equivalent to the present combination of a bachelor of science in engineering with a master's degree in business administration which requires at least six years of formal education.

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Fraternity Notes

Alpha Tau Omega

February has been a big month for Alpha Tau Omega. The house improvement program was in full swing, the fraternity participated in a tag day for The Vigo County Heart Association, and the month will be climaxed by a visit from Worthy Grand Chief, Larry Long.

Over semester break and during the first weeks of the new semester, the ATO’s practically tore the house up and threw it out the window. While this improvement program was going on the house was a mess for a while. Thank goodness the storm has now ceased, and the house looks better than ever before. Each year something new is added to make the house more comfortable. This year it was bigger closets, new desks, and washing machines. Who knows? Maybe in a few years 1454 South Center will become a real mansion.

On Saturday, February 15, the Alpha Tau’s gave their services to the Vigo County Heart Association for their annual Tag Day. Along with pledges from the seven sororities from State, the Tau’s patrolled downtown Terre Haute during shopping hours collecting donations for the Heart Fund. With all that feminine assistance, the job wasn’t bad at all — not at all.

Saturday, February 22, is another red letter day for ATO. Worthy Grand Chief Larry Long, National Head of ATO, is coming to the house for a visit. To close out the big day a dance is planned for the evening.

Another item for the cupid department. Brother Jim Godwin recently married Miss Janice Scobee of Terre Haute. Best of luck to you, Jim.

Congratulations to Rod Baird who was recently initiated.

Robert W. Hall

Theta Xi

The TX tigers have done it again! With an 8-0 record, the Tigers have won the Interfraternity Basketball Trophy. It sure looks nice sitting there on the mantel beside the football trophy. The B-ball trophy was “acquired” from Sigma Nu as soon as it was definite the Tigers were the victors of the annual rivalry.

Just before the season ended, the Tigers received new jerseys to emphasize and maintain the team spirit. The jerseys are blue and white, with Theta Xi on the front and numerals on the back. They really look sharp, guys, so let’s keep them bright and remember their symbolism.

Rush seems to be the next big thing on the agenda. Many improvements were made on the house over semester vacation, including some plastering and further development of the Rec room. Just a side note on the plastering — the Brothers were so intent on the plaster being applied properly, they forgot to watch where the drippings were going. The end result was that the sewer also got plastered. It took five men and two hours to open the pipe. But, all turned out well, and now the house is just about in proper shape to receive the Freshmen when they come to call. We are all looking forward to the parties and the opportunity to see all the Frosh again.

Well, it finally happened! The seniors carried out their threat to shave Brother Ransford and because Brother Mathews came to his roommate’s defense, the seniors shaved his . . . . . , but then maybe you’d better ask Mel himself. The next recipient of senior’s wrath seems to be Brother .11 ton Schmits, who refuses to learn how to use a razor.

Brother Scholle fulfilled his promise and got married over semester break. Now he claims marriage is the greatest thing in the world. We’ll check back with him in six months or so and see if his opinion has changed or been changed.

Dick Jones, Traveling Secretary for Theta Xi, visited with us for about a week recently. He forwarded many complimentary remarks

(Continued on Page 40)
We want engineers who like to WORK

We have plenty of it to be done. We have problems to be licked, and questions to be answered.

Want to roll up your sleeves and tackle the fascinating world of petrochemicals? Union Carbide makes almost 500 of them—it’s a world leader.

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Representatives of Divisions of Union Carbide Corporation, listed below, will be interviewing on many campuses. Check your placement director, or write to the Division representative. For general information, write to V. O. Davis, 30 East 42nd Street, New York 17, New York.

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HAYNES STELLITE COMPANY Special alloys to resist heat, abrasion, and corrosion; cast and wrought. L. E. Denny, 725 South Lindsay Street, Kokomo, Ind.

LINDE COMPANY Industrial gases, metalworking and treating equipment, synthetic gems, molecular sieve adsorbents. P. I. Emch, 30 East 42nd Street, New York 17, N. Y.

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UNION CARBIDE NUCLEAR COMPANY Operates Atomic Energy Commission facilities at Oak Ridge, Tenn., and Paducah, Ky. W. V. Hamilton, P. O. Box “P”, Oak Ridge, Tenn.

VISKING COMPANY A pioneer in packaging—producer of synthetic food casings and polyethylene film. Dr. A. L. Strand, 6733 West 65th Street, Chicago, Ill.
Arthur C. Clark

Thursday, February 20, during convocation hour, Arthur C. Clark, a noted author and lecturer in the science fiction field entertained a large, auditorium filling audience of Rose students and visitors. The subject of Mr. Clark's speech was the present and future possibilities of space travel. His predictions upon the subject were based upon a store house of knowledge of scientific facts and history. One of his many interesting conclusions was that once man reached the moon, he could reach Mars or Venus with only a slight bit more effort; just a matter of increasing the take-off or escape velocity of the space rocket from 25,000 mph to 26,000 mph.

During a question answering session after his speech he suggested that, in the long run, the United States would be better prepared for space travel than Russia, even though Russia got the first satellite up. The reason for this is the U.S. satellite contains a greater variety of space investigating instruments; thus what Russia gained in propaganda, the U.S. would gain in knowledge of space.

All in all, Mr. Clark gave a highly interesting and enlightening speech filled with thought provoking ideas and predictions.

Rose is proud to announce that beginning September, 1958, it will offer Bachelor of Science degrees in the fields of Chemistry, Physics, and Mathematics in addition to the present four engineering degrees. According to Dr. Ford L. Wilkinson, President of the Institute, the faculty had been thinking of doing this for some time and next fall seemed the opportune moment.

Class periods will be reduced from fifty-five to fifty minutes next year, thus making an extra period each day. This will be necessary to make room for enlarging the freshmen class from 150 to 175 students.

Curricula for the new program isn't official yet, but the freshmen year for all seven fields will be the same as it is now.

Miss Jeaneane Dowis

Thursday, February 6, during convocation hour, Rose students were entertained by the exceptional pianistical attributes of an attractive young lady, Miss Jeaneane Dowis. With unusual dedication and style she presented a series of five classical selections, starting with a composition of three movements, "Fantasy Impromptu," "Etude in CC minor, Op. 10 #12 (Revolutionary)," and "Ballade in G minor" by Chopin. With hardly a moment's hesitation, except to bow to the applause, she played the theme and variations of "Ah, Vous Dirais-je, Maman?" by Mozart, the "Three Preludes" by Gershwin, "Ricercare and Toccata" by Menotti. She ended a very fine program with Waltzes from "Die Fledermaus" (The Bat) by Strauss-Dohnanyi.

AIEE - IRE Officers: Riesing, Sonner, Jackson, Hendricks.
INDIANAPOLIS, IND.: (Special) It takes a lot of teamwork to carry out the missions of carrier-based fighter pilots of our New Air Navy. And, it takes a lot of teamwork to design, develop and produce a fighting machine for these dedicated men. Such teamwork is exemplified in the Allison J71 turbo-jet engine with afterburner (above) which powers the Navy F3H-2N Demon all-weather fighter-interceptor. Many Allison engineers—out of school only a few years ago and now well entrenched on the Allison Division team of General Motors Corporation—contributed to the operational success of this powerful engine. If you would like to know more about the Allison team, write Personnel Department, College Relations, Allison Division of General Motors Corporation, Indianapolis, Indiana
'17 Milton Tilley, ch.e., has been promoted from Metallurgist to Assistant Director of Research at National Malleable and Steel Castings Company, Cleveland, Ohio. Mr. Tilley is the third Rose graduate to be associated with that position. Both Harry Schwartz, '01, e.e., and Harold Johnson, '23, ch.e., were Directors of Research for that Company.

'23 Arthur Griepenstroh is now the Chief of the Qualified Products Laboratory, Toledo, Ohio. Mr. Griepenstroh was formerly Product Designer, Detroit Harvester Company, Zanesville, Ohio.

'32 Bertram Menden, c.e., is presently with Acme Air Conditioning and Refrigeration, New York, New York.

'35 P. Byrne Terhorst, c.e. is now the Vice President, Briggs Stratton Corporation, Milwaukee, Wisconsin, after having been Vice President, Operations, Power Products Corporation, Grafton, Wisconsin.

'39 Joseph E. Ross, ch.e., is Manager of Developments, American Viscose Corporation, Marcus Hook, Pennsylvania.

'43 Harry D. Frye, m.e., is an engineer in the Owens-Illinois Glass Company of Toledo, Ohio. Mr. Frye will work in the Technical Center on a glass furnace design.

'46 E. A. Martin, c.e., has been promoted to Assistant General Manager, Footwear and General Products Division, from Plant Manager of the U. S. Rubber Company, New York, New York.

'46 Robert L. Kylander, ch.e., M.S., Oklahoma A&M., will be Senior Technologist, National Petro-Chemical Corporation, Tuscola, Illinois, as of March 15.

'46 Warren F. Haverkamp, ch.e., is now the Chairman of the Board of the Columbia Wax Company, Glendale, California. Mr. Haverkamp and a business partner started the company in 1950 for the purpose of manufacturing and selling industrial floor waxes and allied chemical specialties. The original plant facilities were designed for five hundred gallons a day, the current capacity being approximately five thousand gallons per day with an expected ultimate capacity of approximately twenty-five thousand gallons per day. There are currently thirty people on the payroll.

'47 Dec., John A. Leins, c.e., is the Safety Engineer Safety Engineer and Test Division Safety Coordinator of the Aerojet General Corporation, Liquid Rocket Plant, Sacramento, Calif.

'47, June, Paul A. Benning has recently received the honor of Terre Haute's outstanding young man of 1957 from the Junior Chamber of Commerce, Terre Haute. Mr. Benning has served as Production Manager for the Vigo Plant of Charles Pfizer and Company, and supervises the production records of the plant's five hundred employees, whose yearly payroll exceed $2,000,000.

'48, Oct., Caspar W. Haupt, Jr., c.e., of the M.H. Detrick Company, Greenview, Illinois, has been transferred to the Detrick Company of Canada, Ltd., Quebec, Canada.

'48, Oct., John W. Bryant, m.e., is the Sales Engineer of the Powers Regulator Company, Indianapolis, Indiana.

'49, Jan., Marvin E. Shelley, c.e., is Sales Engineer, Jones and McKnight, Inc., Indianapolis, Indiana.

'49 Jan. James Bowman, e.e., in January was promoted from Project Engineer to Facilities Engineer with Indiana Bell in Indianapolis.


'49 April Ben Ranada, c.e., has returned to Hawaii from California. He is now associated with Park & Yee, Ltd., Consulting Engineers (a firm now including five Rose men).

'53 The wedding of Miss Roberta Ley of Cincinnati and R. Alan Klaus, ch.e., was celebrated in Cincinnati on November 23. Mr. Klaus is employed with Procter & Gamble.

'54 Ron Smith, c.e., entered the Naval Air Corps some time ago and was stationed in Morocco. Recently a Navy plane crashed at Norfolk, Virginia, on which Ron was the co-pilot. He is at present in the U. S. Naval Hospital at Portsmouth, Virginia, and will probably be there for several weeks at least. Smith was a Lieutenant in the Navy.
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February, 1958
AN ENGINEER'S LIBRARY

The Committee on Selection and Guidance of the Engineering College Administrative Council has compiled a descriptive bibliography as a "Dean's List" of recommended reading for engineering students. The following is a list of the books included in this bibliography which can be found in the Rose Library.

A well-written account of the beginnings and development of scientific research which have resulted in benefits for modern man.

Cross, Hardy. Engineers and Ivory Towers.
This philosophical book includes many views which will go far to clarify some of the hazy thinking about what an engineer is and how he is to be educated.

Dunlap, Orrin Elmer. Radio's 100 Men of Science.
A history of radio told through the lives of 100 men who have experimented in radio, electronics, and electricity.

Finch, James Kip. Engineering and Western Civilization.
The history of fifty centuries of engineering against the backdrop of evolving Western civilization.

Forbes, Robert James. Man, the Maker.
The preface states that this is the story of man's accomplishments in the field of discovery, inventions, and engineering from prehistoric times to the present day.

Grinter, Linton Elias, and others. Engineering Preview.
Since each author has written widely in his own field, the book brings the mature experience of seven technical writers together to bear upon the reader's problem of developing a proper background for professional engineering study.

Hawkins, Lawrence A. Adventure Into the Unknown.
The story of the first fifty years of the General Electric Research Laboratory.

Holmstrom, John Edwin. Records and Research in Engineering and Industrial Science.
Presents some general ideas on the merits of technical research and something of the agencies engaged therein.

Hoover, Theodore Jesse. The Engineering Profession.
A discussion of the nature of engineering as a profession, a description of various aspects of engineering, and an objective consideration of qualifications for the profession. Kimball Dexter, S. I Remember.
The recollections of a well known mechanical engineer and educator.

Kirby, Richard Shelton. Early Years of Modern Civil Engineering.
The story of civil engineering advances from the eighteenth century to the present day, told primarily through the achievements of pioneers in the field.

Ley, Willy. Engineers' Dreams.
A round-up of plans engineers have made but have never carried out for political or financial reasons, through the last century and a half.

Discusses briefly the profession and major fields of engineering, the supporting studies, how the engineer solves problems, the slide rule, logarithms, and mechanics.

Mees, Charles Edward Kenneth. The Path of Science.
An excellent book touching on the growth of civilization and discussing the development of the scientific method, the growth of physical and chemical knowledge, applied science and industrial research, and the path of science in its relation to human society.

Mills, John. The Engineer in Society.
The author believes that much in the world could be improved with an engineering-scientific approach, therefore he urges more participation in government by men in the engineering profession.

Montgomery, Elizabeth Rider. Story Behind Great Inventions.
Includes chapters on the A-bomb, the H-bomb, linotype, cotton cleaner, bedrooms on wheels, Fulton's folly, sun on earth, etc.

A panoramic review for the laymen of recent developments in many fields of scientific research.

A challenge to engineers to take the initiative in long range planning in order that errors of the past might not be repeated.

(Continued on Page 39)
"They all agree..."

"Since the day we decided to get married, I've been doing a lot of thinking about our future. It's time I made a choice on a career. I've talked to the Dean of Engineering, most of my professors, and to some of the fellows who have graduated, and you know, they all said the same thing.

"They all agree that the aircraft and missile industry holds the best opportunities and the brightest future for an engineer these days. What they said makes sense, too, because developments in this field today really give a fellow an opportunity to make important contributions on vital projects.

"Not only that, but the aircraft industry is noted for its good salaries. Generous benefits, too. And advancement in both salary and position is limited only by how far I want to go."

Unlimited opportunities, high salaries, company-paid benefits unheard of until a few years ago—these are only a few of the reasons why so many young engineers with a keen eye to the future are choosing the aircraft industry.

It is only natural that many engineering graduates should consider joining Northrop Aircraft, Inc., because the company shares its many successes with every member of its engineering and scientific team. Advanced projects at Northrop are now in production, and active top-priority projects mean rapid advancement and success for the individual engineer.

Such projects include the famous Snark SM-62, world's first intercontinental guided missile, now being activated in the first United States Air Force missile squadron; the USAF T-38 supersonic twin-jet advanced trainer; and other important missile and manned aircraft weapon systems and components.

Engineers in more than thirty categories contribute to Northrop's success in an ideal environment with the latest tools of science, in its new Engineering Science Center. Here you will work with leading scientists and engineers who respect, acknowledge, and reward your individual ideas and abilities.

Why not write us now... regardless of your class at college. Ask us how you might best gain a career with Northrop. Write to Manager of Engineering Industrial Relations, Northrop Division, Northrop Aircraft, Inc., 1033 East Broadway, Hawthorne, California.

NORTHROP
A Division of Northrop Aircraft, Inc.
BUILDERS OF THE FIRST INTERCONTINENTAL GUIDED MISSILE

FEBRUARY, 1958 Page 31
Full-time, off-the-job GRADUATE

STUDY CENTER. New York's Coliseum Tower houses one of three special study centers set aside for W.E.'s Graduate Engineering Training Program. Other centers are in Chicago and Winston-Salem, N. C. Product design principles are one of the main technical subjects our engineers cover in Introduction to West Electric Engineering, the first phase of the program.
ENGINEERING TRAINING helps speed careers at Western Electric

Right now, Western Electric engineers are back “on campus” for a unique new Graduate Engineering Training Program. They’re attending courses at special study centers established by the company in Chicago, New York and Winston-Salem, N.C. It’s a rare chance to study advanced engineering and get paid at the same time.

These “students” are guided by a teaching staff of top Western Electric engineers, outside experts and professors from leading universities. They’re learning the latest technical developments... honing up on everything from manufacturing processes to computer applications.

When the program reaches its peak, some 2,000 to 3,000 Western Electric engineers will attend each year... studying in an atmosphere as close to a university graduate school as is practical for industry.

This engineering “university” was born because of the ever-increasing complexity of Western Electric’s job as the manufacturing and supply unit of the Bell Telephone System. Today, E. engineers are right in the middle of exciting fields like microwave radio relay, electronic switching and automation. Graduate engineering training is designed to spur their development and advancement throughout their entire careers.

How Graduate Engineering Training would work for you

The program gets under way after approximately six months on-the-job experience. First off:

A nine-week Introduction to Western Electric Engineering helps you learn about your W.E. engineering field, sharpens your skills in getting ideas across. Technical subjects include communications systems, product design principles, communication systems, product design principles, technical subjects include communications systems, product design principles, communication systems, product design principles, technical subjects include communications systems, product design principles, communication systems, product design principles, technical subjects include communications systems, product design principles, communication systems, product design principles, technical subjects include communications systems, product design principles, communication systems, product design principles.

Another nine-week program, General Development, starts after your first year with us, helps broaden and strengthen your engineering background. Besides technical subjects like engineering statistics, measurements and instrumentation, and electronics, you receive grounding in human relations and the socio-economic importance of engineering.

To meet continuing needs for formalized technical training, Advanced Development offers four-week courses tailored to the individual needs of the engineers selected to attend. These courses are designed to help develop creative engineering abilities. Computer applications, switching theory, feedback control systems, and semiconductor devices and circuits are sample topics covered in this phase.

Besides taking part in the Graduate Engineering Training Program, engineers are eligible for our Tuition Refund Plan for further study at nearby colleges.

In short, there’s a unique opportunity at Western Electric to develop a professional career... and work in the exciting world of communications.

Knowledge born in the classroom often sparks on-the-job ideas. These engineers are working on transistor manufacturing problems.

OPPORTUNITIES FOR ENGINEERING GRADUATES

(Supervisory and administrative opportunities exist in each field)

Analysis for manufacturing operations:

Planning telephone central offices:
- Equipment requirements—E.E.; Power and cable requirements—E.E.

Development and design:

For further information write: Engineering Personnel, Room 1030, 195 Broadway, New York 7, N.Y.
PARITY
(Continued from Page 13)

better known asymmetry in our physical world, that of particles and antiparticles. Such a pair is the positron and electron. If the two particles collide, they annihilate each other, and their masses are transformed into light energy. Antiprotons and antineutrons are also known to exist. Therefore, it seems that the charge asymmetry of matter is apparent. It just happens that our system is made of one type of matter. A distant galaxy might be made of antimatter, composed of antiprotons and antineutrons for nuclei and positrons around them instead of electrons.

It has been shown that cobalt-58, which emits antiparticles, gives the opposite direction and spirality as compared with cobalt-60. Thus it is probable that “anticobalt-60” would emit its positrons in the opposite direction to cobalt-60. If so, the violation of mirror symmetry appears in a new light. We argued before that the mirror image of cobalt-60 decay does not correspond to any process in nature. Now we see that it probably does correspond to the decay of “anticobalt-60.” It has been stated that the right-hand rule has symmetry because two conditions change when a mirror is used. The beta decay of cobalt-60 is now seen to exhibit symmetry if the two conditions of direction and particle are reversed. It is only when direction alone is considered that asymmetry arises.

In other words, two asymmetries make symmetry. Landau, a Russian, has called this the Combined Parity Principle. This principle says that the mirror image of any process in nature is also a possible process, but only if all charges are replaced by their opposite charges or if matter is replaced by antimatter.

It has been seen in this development that the increase in our knowledge of the properties of nature sometimes rocks the foundation of our understanding and forces us to greater awareness of problems which were assumed to be solved by existing laws.

LOCKER RUMORS
(Continued from Page 14)

better as the home team won, 67-56. M. Smith and Giffel led Rose’s scoring with 15 and 14 points respectively.

The following Saturday Rose returned home to finish the season with four conference games. The first to face a much improved Rose team was Principia who had edged the Engineers by three points in a previous contest. Rose started out hot, springing into a 10 point lead, but the Indians had cut this to four points at the intermission. Led by Mike Smith, who scored 17 points in the second half, the Engineers caught fire and were never threatened. Jim Carr cleared the bench as Rose won, 69-53. Smith walked away with scoring honors, hitting 25.

The Rose and White finally seemed to find itself as they downed a strong Greenville five. The first half Rose threw up a tough defense which the visitors could not crack. At the half the Engineers held a 14 point lead, 37-23. After the rest, the game turned into an offensive battle with both squads scoring at least 40 points. Once more Carr emptied the bench with Rose way out in front 77-64. Although Giffel was high for Rose with 25 points, Whims, Greenville’s center, took the honors with 26.

The Engineers played their best game of the season in defeating conference leading McKendree, which was previously undefeated in conference competition. Rose used superior rebounding and the fast break to hold a four point edge at the half. The second half proved a real thriller with McKendree on the heels of the host. With six minutes left to play the visitors gained the lead, 67-66, but Giffel started hitting from out and spelled the end for McKendree. Scoring the season high for the season, Rose won 90 to 83. Smith and Giffel were high for Rose with 24 and 20 points respectively. This win gave Rose a 6-3 conference record and virtually clinched second place in the conference.
Pump-turbine design is now the work... hydraulics, the field... of John Jandovitz, BSME graduate of College of City of New York, '52.

Water conditioning chemical, service, and equipment specialist in Houston is new assignment of Arthur Brun, BS Chem. E., University of Tennessee, '56.

Field sales engineering of America's widest range of industrial products is choice of Roy Goodwill, BSME, Michigan State College, '54.

Starting up a cement plant in Mexico after coordinating all work on it is latest job of John Gibson, BS Met. E., University of California, '54.

Nucleonics is chosen field of R. A. Hart, BSME, Rensselaer Polytechnic Institute, '53. Currently he is working on design and development of new nuclear power plant.

Recent Training Course Graduates

select wide choice of careers at Allis-Chalmers

THERE'S variety at Allis-Chalmers. Whether you're thinking in terms of types of industries, kinds of equipment, types of jobs, or fields of work, the diversification of Allis-Chalmers provides unsurpassed variety. For example:

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An outstanding training program, started in 1904, is designed to help you find the activity within these groupings for which you are best suited. Up to two years of theoretical and practical training are offered. Direct employment at Allis-Chalmers is available for those with sufficient background. Learn more about Allis-Chalmers and its training program. Ask the A-C district office manager in your area or write Allis-Chalmers, Graduate Training Section, Milwaukee 1, Wisconsin.
converts the abbreviated address information from the dot code into another set of electrical signals, identifying a proper destination bin in the distributor. The translator incorporates a memory which contains all to the necessary destination information. This destination information from the translator is fed to the distributor. The distributor accepts the envelopes from the reader and the destination information from the translator and delivers the letter to the proper output destination bin. From these output bins, letters are removed, tied in bundles and put into outgoing pouches or in the case of incoming mail sent to the carrier stations.

Mail which has already been coded at some other location by-passes the culling, facing, cancelling, and coding operations and enters directly into the reader. Incoming mail is sorted in a similar manner except that culling, facing, and cancelling may be omitted because these operations will have been performed elsewhere. The translator for incoming mail would have impressed into its memory the incoming mail scheme, and the letters would be delivered to output bins according to carrier numbers.

The same machine can sort either incoming or outgoing mail simply by changing the information stored in its memory. Changes in the distribution system do not require altering the dot code. Only the information in the memory—which can be easily modified—need be changed to keep abreast of a growing postal delivery system.

At the Bureau, a different sorting device is being developed which promised to be more compact than other proposed equipment and may save space in post offices. This device is not expected to be suitable for use in large sorting offices because its use requires sorting the same batch of mail several times. It is, however, well adapted to the scale of operations in smaller offices.

A parallel problem associated with facing and cancelling letter mail is under consideration. A method is being sought to make a postage stamp more easily recognized by electro-optical devices as a unique element on an envelope. Fluorescent dyes, magnetic and conducting inks, and metallic laminates that have been investigated. The most promising results seem to be with a phosphorescent ink now being perfected at the Bureau. This ink could also be used in imprinting the code on the envelope.

**POTENTIOMETER WIRE**

A new precious-metal alloy for potentiometer wire which offers high resistivity plus a negative temperature co-efficient of resistance has been developed by Baker & Co., Inc.

The new high-resistivity alloy will make possible a number of improvements in potentiometer design. The most important feature probably is lower vulnerability to severe temperature change, an important factor in such applications as guided-missile instrumentation.

Since the high-resistivity alloys permit the use of less wire, designers will be able to reduce the size of some instruments while retaining a given resistance. In other cases they will be able to avoid the use of very fine wire—which often adds to manufacturing costs—with-out decreasing resistance.

The use of precious-metal wire will lower the instruments' vulnerability to atmospheric corrosion which is often a major problem in construction.

The alloy presently available is composed of palladium, gold, and iron. It has a resistivity of 1100 ohms per CMF and a temperature coefficient of -2.8x10-4 ohms per ohm per degree C between 0 and 100 degrees C.

**STEAM-BOILER WATER-LEVEL GAUGE**

A new steam-boiler water-level gauge which remains readable under all conditions, cannot explode, and can be harnessed to operate controls automatically has been developed by Charles Engelhard, Inc. It was designed for use on ships and in power plants, particularly where steam pressures run in excess of 750 lbs. per sq. in.

The instrument is similar to conventional gauges in size and shape. Instead of a glass or quartz tube, however, it consists of a non-magnetic stainless-steel pipe enclosing a metal float which carries a powerful permanent magnet.

As the float rides up and down on the water in the tube, the magnet acts through the tube walls upon a row of metal reeds mounted beside it. Painted white, each reed can be pulled forward by the magnet so that it comes into view through a window in front of the gauge. When the float moves again, the reed recedes out of sight.

In addition to serving as visible indicators of the water level, the reeds can carry electrical contacts which operate automatic water controls or set off alarms.

Quick-acting valves at top and bottom of the gauge disconnect it from the boiler if a leak or other trouble develops.

The gauge represents the first major improvement in boiler gauges in 150 years.

**MECHANICAL HANDS**

Mechanical "hands" that can dis-assemble an aircraft jet engine "bolt by bolt" are part of the remote handling equipment in one of the world's largest shops for handling radioactive equipment.

The installation is located in a huge "hot" shop, 160 feet long, 50 feet wide and 63 feet high, which is part of the Atomic Energy Commission's test facilities utilized by the General Electric Company at Idaho Falls, Idaho.

The remote handling tools in the "shop" range from a 100-ton crane down through O'Man, a huge mechanical "arm" designed and built by General Electric, to a much smaller master-slave manipulator for making intricate mechanical adjustments.

The O'Man manipulator can handle from 500 to 3,000 pounds, depending on the arm length and (Continued on Page 38)
How RCA brings a richer, wider range of musical sound to your home

Before high fidelity, the sound of recorded music was limited—much as piano music would be if you could hear only the notes played on the center of the keyboard. No rich bass notes, no keen, vibrant highs.

RCA achievements in the science of sound and acoustics changed all that. Today, with RCA Victor records and high fidelity “Victrolas,” the full range of sound is reproduced so faithfully that you can enjoy music almost as though you were there.

And now, Stereophonic Sound! A new and dramatic dimension in recorded music is also yours to enjoy on RCA high fidelity instruments. Stereophonic units can be added to most “Victrola”* Hi-Fi systems any time you choose.

In this, as in almost every area of electronic progress in home entertainment, defense and industry, the leadership of RCA serves you. RCA means electronics at its best!

WHERE TO, MR. ENGINEER?

RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, N. J.
RESEARCH & DEVELOPMENT
(Continued from Page 36)

position used. This giant manipulator is suspended from a crane bridge and can cover the entire working area of the shop.

Problems arise with operator and machine coordination because distances involved between observer and equipment often exceed 50 feet.

RECORDING HEADS

Tiny inch-long recording heads are helping to write experiences in the upper air where man can't travel. With these small gadgets taking shorthand notes, man probably will make these journeys.

The multi-track magnetic recording-reproducing head is used in missiles to take notes. These notes reveal temperatures, speeds, vibrations, flight, and dozens of other items—up to 20 separate records on a single one-inch head.

These small gadgets are also used in supersonic planes, at atomic bomb testing sites, and in other areas to record data where man can't go to make records.

The Davies Laboratories Division of Minneapolis-Honeywell Regulator Company makes these special recording and reproducing heads, which print electrical impulses on magnetic tape. Part of the secret in their manufacture is the metal, which shields the recording-reproducing heads. This material is called Mumetal and is made by Allegheny Ludlum Steel Corporation.

Mumetal is a special metal used in the recording-reproducing heads and is used especially for shielding against electromagnetic fields. In the case of the recording and reproducing heads this is especially important.

The basic design of the recording device consists of two half sections. These are then lapped individually, assembled in molds and embedded in a special plastic.

All the caution that goes into making of the special recording head is necessary to insure proper, accurate playback later.

---

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ETHICS AND HONOR
(Continued from Page 15)

A well known quotation from John Whittier's "Ichabod" says, "When faith is lost, when honor dies, the man is dead." Notice here that faith is mentioned in connection with honor. A little thought will show that to set up an honor system, a type of faith is needed — faith in yourself and in your fellow student. That is why going to school under an honor system is such a rewarding experience. It is very satisfying to be a competent member of a program with such high ethical standards. Students who have gone to school under such a program describe the experience with phrases such as "a warm glow" or "a good feeling."

Of course, the honor system is not infallible. Not everyone who comes in contact with it is affected positively. Generally speaking, though, if a student becomes a part of the honor system, the honor system becomes a part of him.

MEN of ROSE
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April 19, 1958
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129 So. 7th St.
Terre Haute, Ind.
Pupin, Michael Idvorsky. From 11n - migrant to Inventor. An autobiography of a Servian immigrant to this country who became a teacher and a scientist of high achievement.

Reck, Franklin M. The Dilworth Story. The story of how Richard Dilworth, without any formal schooling, rose to become a top engineer and the developer of the Diesel locomotive.

Redman, Lawrence Vincent. The Romance of Research. The book describes methods of scientific research as they have been refined through the centuries, and seeks to impress on the reader the importance of research as an essential of progress.

Steinman, David B. Builders of the Bridge; the story of John Roebling and his son. A fascinating and informative biography of the builders of the Niagara, Cincinnati, and Brooklyn bridges.

Straub, Hans. A History of Civil Engineering. This volume is a well balanced survey of the evolution of civil engineering from its origins—traditional building craft and exact science.

Usher, Abbott Payson. A History of Mechanical Inventions. Discusses the significance of technology, and the processes of invention, and traces, from the earliest records, the development of invention in certain fields.

Williams, Clement Clarence. Building an Engineering Career. A survey of the scope of the several divisions of engineering, coupled with chapters on objectives of engineering education and information on how to study engineering.

Yost, Edna. Modern American Engineers. Biographies of twelve engineers that should provide the reader with some concept of the scope of the profession and serve as an introduction to the nature of some of the divisions of engineering.

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CHARLES J. KANTMANN

FEBRUARY, 1958
plus some constructive criticisms. We're glad you could stay for awhile this time, Dick, come again soon.

Congratulations to Brothers Goheen, Whalen, and White who were initiated recently. Congratulations also to Harry Webber who has pledged TX. Glad to have you, Harry.

While we're putting backs, we'd better mention the marriage of Brother Klepz. Now Chick and Brother Scholle can get together and extoll on the virtues of matrimony.

Speaking of wedlock, there is a rumor going around that Brother Boodt's wife is in a family way. Looks like Ernie is trying to catch Pappy Pierson, who promises to maintain his lead in the offspring department.

About the last item on this month's list is the party which will be held in the Rec room on Feb. 22nd. Refreshments and entertainment will be provided, so all the brothers and their gals are expectant of an enjoyable evening.

So with bloodshot eyes and fading typewriter ribbon, I'll say goodbye until next month.

Eugene Amick

Sigma Nu

With spring around the corner and the last of winter's cold blasts behind us (we hope), we of Sigma Nu are looking forward expectantly to this year's I. F. Softball games. Once again we will be cached by sports minded Brother Dick Light, who always seems to give his all when it comes to winning for Sigma Nu. It's the feeling of all the brothers that this year, we will be known as the principle power in the I. F. League.

While I'm on the subject of sports, I would like to make note of the Intramural Volley Ball League. While this is not a fraternity function, it should be mentioned that the "A. C." team has been showing up very well in the win department. Brothers Light, Neal, Miller, Kurtz, Beckes, Kuykendall and Ryker have really given the teams in that league a good fight in every game.

Also, we snakes would like to express our congratulations to the men of T.X., for their winning of the I.F. Basketball competition this year. All we can say now is—"just wait 'til next year."

Another improvement has been made at the big house at 821 South Center. Our meeting room is sporting a new paint job. I must say, it looks quite a bit better.

We are all glad to see the best cook in the world back in fine shape again. Our house mother, Mrs. Cora DeGraff, or better yet — Mom, was ill for a few days last month. We understand this was your first illness in quite a few years Mom, and we all sincerely hope that you will once again continue in good health for many, many more years in the future.

There may be an increase in the number of chapters in our fraternity in the near future. Eta Alpha of Davidson College in Davidson, North Carolina, is petitioning for a charter in Sigma Nu fraternity. We wish them good luck with their petition, and hope to welcome them in the Brotherhood very soon.

March 7, we had the honor of playing host to girls, girls, and more girls at a party with the A.O. Pi. sorority. Brothers Onnen, Jackson, and Anderson were the prime movers in the way of entertainment and the party was a real success.

In closing, I am speaking for all the chapters in saying congratulations to all the men who are embarking upon the pledgeship trail. No matter to what fraternity you are pledging, you are welcome as a future fraternity man. You will find that after you have past your pledgeship, the rewards of a Brotherhood are worth much, much more than can be told merely by the pin you will be wearing on your shirt.

Fred Ryker

Lambda Chi Alpha

Now that the second semester is under way, the annual officer election has been held. The formal installation was held the evening of February 18. At that time, the following men were installed: Dan Mook, junior, president; Tom Feutz, soph., vice-president; Gary Pipps, soph., secretary; John Kennedy, junior, treasurer; Marlan Hildenbrand, junior, ritualist; Carl Hera-kovich, junior, pledge trainer; Chuck Overbey, Soph., rush chairman; Terryl Hallcom, soph., social chairman; Barlow Brooks, house manager; Hugh Griffin, junior, steward; and Robert Arthur of the Civil Department, faculty advisor replacing Alfred Schmidt. We all wish these men success in the performance of their duties.

Many are the changes being wrought on the chapter house. The alumni contribution fund has enabled us to purchase two new living room suites, one black and white, while the other is black with silver threads. There is an extensive painting program under way, which includes repainting the kitchen and front hall. The living room and dining room are being repapered this week, and new drapes will complete the job.

We would like to welcome John Bratt, soph. mechanical, as a pledge to Theta Kappa.

The national fraternity's General Assembly will be held this summer at the Queen Elizabeth Hotel in Montreal, Canada. This hotel is brand new, in fact, it is still under construction, but will be completed by that date. The chapter named Dan Mook as delegate and Barlow Brooks as alternate for Theta Kappa's representatives.

For the first time in many months, it seems that no one lost his pin to the fair sex. Has the saturation point been reached or is this but a leveling-off point before the parade starts again? See the next installment for the answer to this intriguing question.

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The Light Refreshment
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ELECTRONIC TRACKING

(Continued from Page 20)

sacrificed. However, to avoid this sacrifice a technique of "signal integration" is frequently employed. In this circuit, the radar return from a given direction is added to previous returns from that direction. Since noise fluctuations are entirely random, the effect is to reduce peak fluctuation in comparison with the desired signal returns that are repetitive and therefore accumulate."

"Countermeasures" — Although detection is the prime purpose of the radar system, it must be able to be put out of operation for your own missiles' protection, and this is known as countermeasures. Countermeasures can be divided into two categories—those in which the target emits energy to foul-up the detection system, and passive system that depends upon the dis-demination of false reflection targets to confuse the detector.

One way for the target to obscure itself is for it to emit a powerful noise signal on the same frequency, but it has one difficulty of being recognizable very fast. Much more subtle are systems in which a portion of the signal illuminating the target is amplified by the target and modified before transmission back to the detecting system, so that the detector will make an inaccurate determination of target position.

In the last few years there has been development to a high degree of precision in aircraft radar systems. The problem in aircraft is space for the set. It has been a real challenge to engineers to solve this and many other problems which arise in aircraft radar. There is a constant call for changes and this has created a very interesting field for the engineers.

The future. "The evolution of detection systems will continue. As weapons technology advances, so will the means for detecting and defeating these weapons. Looking into the future, there are at least two discernible directions for this evolution. It appears that a natural result of the attempts to establish an earth satellite will be a series of detection systems mounted in space platforms, which can keep unfailing watch on all corners of the earth. The design problems associated with this type of system are tremendous. While nature supplies the vacuum, thus eliminating the restrictive confines of man-made vacuums and envelopes, the problems of weight, size, and reliability assume an importance in order of magnitude larger than at present. While today's aircraft requires nearly ten pounds of air frame and fuel to carry one pound of electronic equipment, a space station will probably need 100 to 1000 pounds of fuel to deliver this same pound of electronic equipment. Since space platforms may well be unmanned, electronic gear failure would result in an aborted mission costing hundreds if not thousands of times today's aircraft missions."

"The future for detection systems will be built on problems arising from improvements, to be solved by the inventions and discoveries of the electronic industry."
Steel nest that hatched a smoother transmission

YOU'RE looking at a ring gear “nesting” three smaller gears. It’s part of one of the smoothest shifting transmissions ever put in a car. But it was almost too expensive to build.

Getting this extra smoothness called for squeezing more gears into the same size transmission case. Nesting was necessary to save space. And the big ring gear had to be extra tough. The problem was to make it economically.

The manufacturer turned to Timken Company metallurgists—acknowledged experts in fine alloy steels. They showed how to save the cost of boring out each gear—by starting with Timken seamless steel tubing. The hole’s already there. And the Timken steel has all the toughness a transmission needs. It’s another example of how Timken Company metallurgists solve tough steel problems.

WANT TO LEARN MORE ABOUT STEEL OR JOB OPPORTUNITIES?
For information about fine steel, send for “The Story of Timken Alloy Steel Quality”. And for help in planning your future, write for “Better-ness and Your Career at the Timken Company”.

Just drop a card to The Timken Roller Bearing Company, Canton 6, O.
Stolen by Tom Feutz, soph., c.e., and Dick Kirby, jr., m.e.

Two patients in a hospital were exceedingly bored. They found a stack of diagnosis cards in a corner and began a game of poker. One shuffled the cards and dealt. They picked up their hands and looked at the cards. One bet, the other raised, and they raised and raised again until finally one of them called:

“Looks like I win. I’ve got three pneumonias and two gallstones.”

“Not so fast. Not so fast. I’ve got four enemas.”

“Well, I guess you take the pot.”

A sweet old lady, always eager to help the needy, spied a particularly sad-looking old man standing on a street corner. She walked over to him, pressed a dollar into his hand and said, “Chin up.”

The next day, on the same corner, the sad old man shuffled up to the lady and slipped ten dollars into her hand.

“Nice picking,” he said in a low voice. “He paid nine to one.”

Customer “Your dog seems very fond of watching you cut hair.”

Barber: “Naw, it’s just that once in a while I snip off a part of the customer’s ear.”

A young man (hard of hearing) — “Well, Miss Grace, were you in the theatre last night?”

Miss Grace—“No, I was in bed very early . . .”

Youth—“Was it crowded?”

Polo is golf with fertilizer.

A college student arrived at the Pearly Gates where St. Peter asked him who he was. When told he was an Arts student, St. Peter said, “Go to the Devil.”

Some time later an Ag student arrived, and upon being asked who he was, replied that he was an Ag student. He was told to go to Hades. The third student arrived at the Pearly Gates with his slide rule. When asked who he was, he replied, “I’m an engineer,” whereupon St. Peter said, “Come in, son, you’ve been through Hell already.”

“Did you get home from that party all right last night?”

“Yeah, except when I was going up the stairs in the dorm some idiot stepped on my hand.”

Judge: “Officer what makes you think this M. E. is intoxicated?”

Officer: “Well, judge, I didn’t bother him when he staggered down the street, or when he fell flat on his face, but when he put a nickel in the mailbox, looked up at Samford Tower clock and said, “My Gawd, I’ve lost 14 pounds!” I brought him in.”

“Uncle tried to make a new kind of car. He took wheels from a Ford, radiator from a Chevy, tires from a Plymouth.”

“How’d he get?”

“Two years.”

Then there’s the one about a drunk approaching a large downtown hotel in the windy city, Chicago, just as a gust of wind spins the revolving doors the drunk steps back and looking up at the tall building for a few moments, turned to the doorman and says, “He’ll never get it off the ground.”
PHOTOGRAPHY AT WORK—No. 25 in a Kodak Series

Nuclear reactor vessel for Shippingport, Pa., power plant designed by Westinghouse Electric Co. under contract with the A.E.C. for operation by Duquesne Light Company.

Where atoms turn into horsepower

Combustion Engineering designed and built this "couldn't-be-done" reactor vessel for America's first full-scale nuclear power station. And photography shared the job of testing metals, revealing stresses and proving soundness.

Countless unusual—even unique—problems faced Combustion Engineering in creating this nuclear reactor vessel. Nine feet in diameter with walls 8½ in. thick, it is 235 tons of steel that had to be flawless, seameld with welds that had to be perfect. And the inner, ultrasmooth surface was machined to dimension with tolerances that vie with those in modern aircraft engines.

As in all its construction, Combustion Engineering made use of photography all along the way. Photography saved time in the drafting rooms. It revealed where stresses and strains would be concentrated. It checked the molecular structure of the steel, showed its chemical make-up. And with gamma rays it probed for flaws in the metal, imperfections in the welds.

Any business, large or small, can use photography in many ways to save time and money. It can go to work in every department—design, research, production, personnel, sales, and accounting.

CAREERS WITH KODAK

With photography and photographic processes becoming increasingly important in the business and industry of tomorrow, there are new and challenging opportunities at Kodak in research, engineering, electronics, design and production. If you are looking for such an interesting opportunity, write for information about careers with Kodak. Address: Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N.Y.

EASTMAN KODAK COMPANY, Rochester 4, N.Y.
Although many surveys show that salary is not the prime factor contributing to job satisfaction, it is of great importance to students weighing career opportunities. Here, Mr. Gouldthorpe answers some questions frequently asked by college engineering students.

Q. Mr. Gouldthorpe, how do you determine the starting salaries you offer graduating engineers?
A. Well, we try to evaluate the man's potential worth to General Electric. This depends on his qualifications and our need for those qualifications.

Q. How do you evaluate this potential?
A. We do it on the basis of demonstrated scholarship and extra-curricular performance, work experience, and personal qualities as appraised by interviewers, faculty, and other references.

Of course, we're not the only company looking for highly qualified men. We're alert to competition and pay competitive salaries to get the promising engineers we need.

Q. When could I expect my first raise at General Electric?
A. Our primary training programs for engineers, the Engineering Program, Manufacturing Program, and Technical Marketing Program, generally grant raises after you've been with the Company about a year.

Q. Is it an automatic raise?
A. It's automatic only in the sense that your salary is reviewed at that time. Its amount, however, is not the same for everyone. This depends first and foremost on how well you have performed your assignments, but pay changes do reflect trends in over-all salary structure brought on by changes in the cost of living or other factors.

Q. How much is your benefit program worth, as an addition to salary?
A. A great deal. Company benefits can be a surprisingly large part of employee compensation. We figure our total benefit program can be worth as much as 1/6 of your salary, depending on the extent to which you participate in the many programs available at G.E.

Q. Participation in the programs, then, is voluntary?
A. Oh, yes. The medical and life insurance plan, pension plan, and savings and stock bonus plan are all operated on a mutual contribution basis, and you're not obligated to join any of them. But they are such good values that most of our people do participate. They're an excellent way to save and provide personal and family protection.

Q. After you've been with a company like G.E. for a few years, who decides when a raise is given and how much it will be? How high up does this decision have to go?
A. We review professional salaries at least once a year. Under our philosophy of delegating such responsibilities, the decision regarding your raise will be made by one man—the man you report to; subject to the approval of only one other man—his manager.

Q. At present, what salaries do engineers with ten years' experience make?
A. According to a 1956 Survey of the Engineers Joint Council®, engineers with 10 years in the electrical machinery manufacturing industry were earning a median salary of $8100, with salaries ranging up to and beyond $15,000. At General Electric more than two thirds of our 10-year, technical college graduates are earning above this industry median. This is because we provide opportunity for the competent man to develop rapidly toward the bigger job that fits his interests and makes full use of his capabilities. As a natural consequence, more men have reached the higher salaried positions faster, and they are there because of the high value of their contribution.

I hope this answers the question you asked, but I want to emphasize again that the salary you will be earning depends on the value of your contribution. The effect of such considerations as years of service, industry median salaries, etc., will be insignificant by comparison. It is most important for you to pick a job that will let you make the most of your capabilities.

Q. Do you have one salary plan for professional people in engineering and a different one for those in managerial work?
A. No, we don't make such a distinction between these two important kinds of work. We have an integrated salary structure which covers both kinds of jobs, all the way up to the President's. It assures pay in accordance with actual individual contribution, whichever avenue a man may choose to follow.

* We have a limited number of copies of the Engineers Joint Council report entitled "Professional Income of Engineers—1956." If you would like a copy, write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.

LOOK FOR other interviews discussing: • Advancement in Large Companies • Qualities We Look For in Young Engineers • Personal Development.