Fall 11-1961

Volume 73 - Issue 2 - November, 1961

Rose Technic Staff
Rose-Hulman Institute of Technology

Rose Technic

November, 1961

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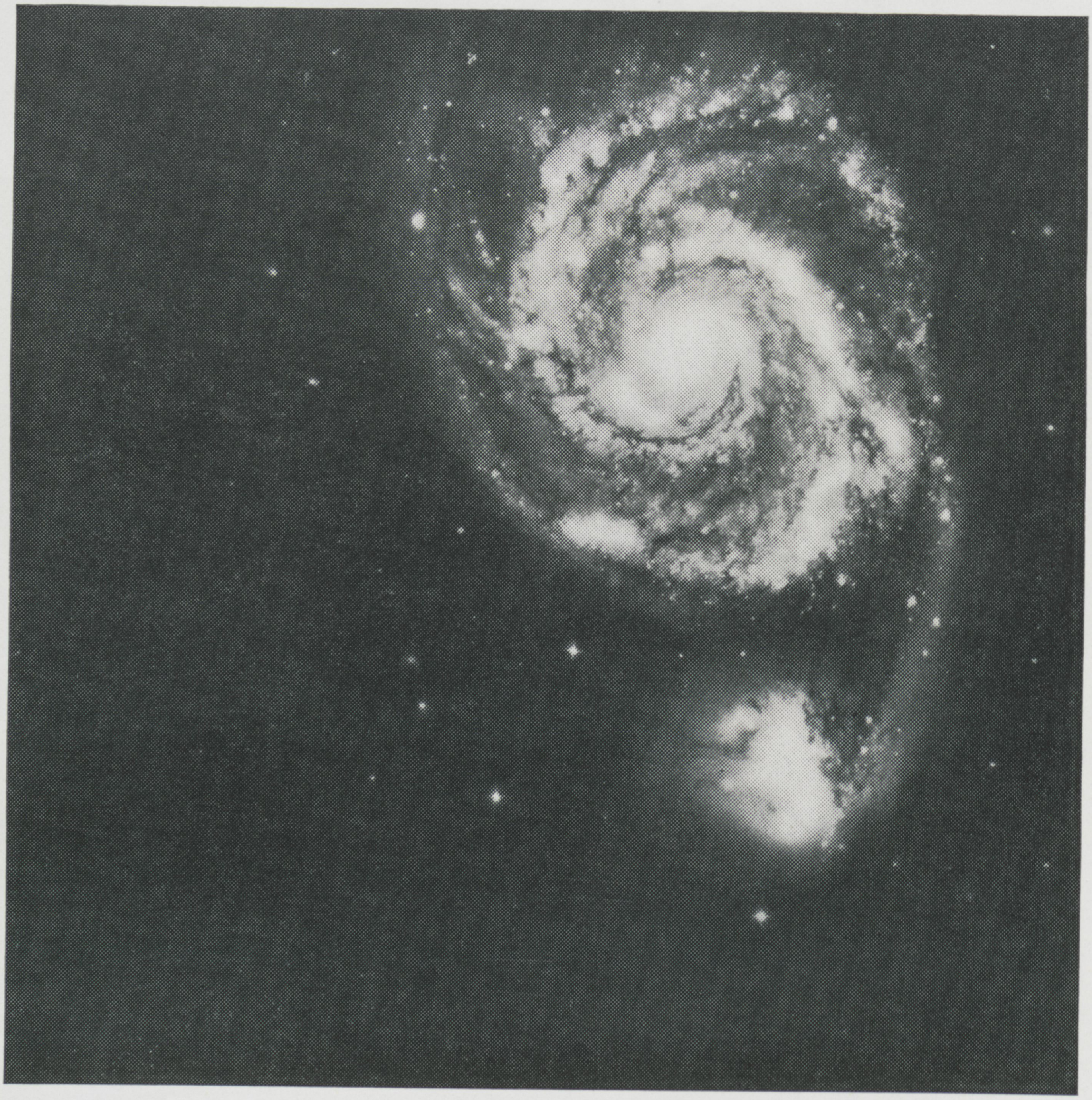
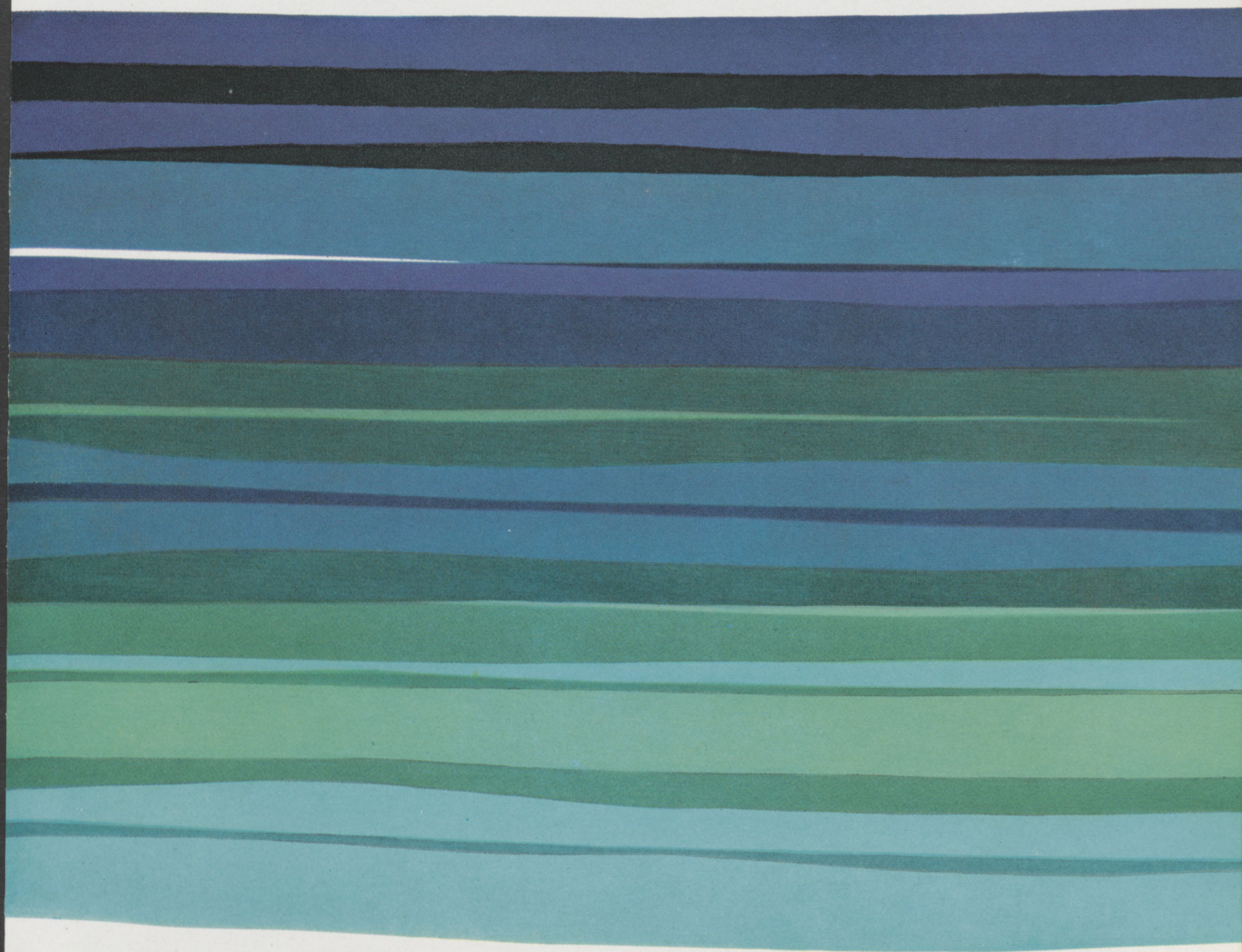


How cold is up? We know that outer space can never be colder than minus 459.72° Fahrenheit—that's absolute zero, the point at which all molecular motion ceases. We don't know what coldness like this will do to materials, but we're finding out. Scientists are using a heat exchanger to produce temperatures as low as minus 443° Fahrenheit. They test materials in this extreme cold and see how they perform. Out of such testing have already come special grades of USS steels that retain much of their strength and toughness at −50° or below; steels like USS "T-1" Constructional Alloy Steel, TRI-TEN High Strength Steel, and our new 9% Nickel Steel for Cryogenics applications. And the heat exchanger to produce the −443° Fahrenheit is Stainless Steel! No other material could do the job as well. Look around. You'll see steel in a lot of places—getting ready for the future. ■ For information about the many career opportunities, including financial analysis or sales, write U. S. Steel Personnel Division, Room 6085, 525 William Penn Place, Pittsburgh 30, Pa. U. S. Steel is an Equal Opportunity Employer. USS, "T-1" and TRI-TEN are registered trademarks.

USS United States Steel

Things we know about tomorrow



FRESH WATER FROM THE SEA

"If we can develop low-cost means of bringing water to thirsty lands and people of the world, we shall bring a boon to mankind that is even more meaningful than the conquest of outer space . . ."–U. S. Senate Report.

In the desert sheikdom of Kuwait, a Westinghouse plant is now extracting nearly 17 million gallons of fresh water every week from the extra-salty Persian Gulf. In San Diego, another Westinghouse plant will soon be producing drinking water from Pacific Ocean water—seven million gallons a week.

Westinghouse scientists foresee "water factories" like these going up in seacoast cities all over the world. For peoples who never had enough water, a new kind of abundant life will be created.

This is just one of the exciting things going on at Westinghouse. To learn more about a career with Westinghouse, an equal-opportunity company, see the Westinghouse representative when he visits your campus or write: L. H. Noggle, Westinghouse Educational Department, Ardmore at Brinton Road, Pittsburgh 21, Pa.

You can be sure . . . if it's

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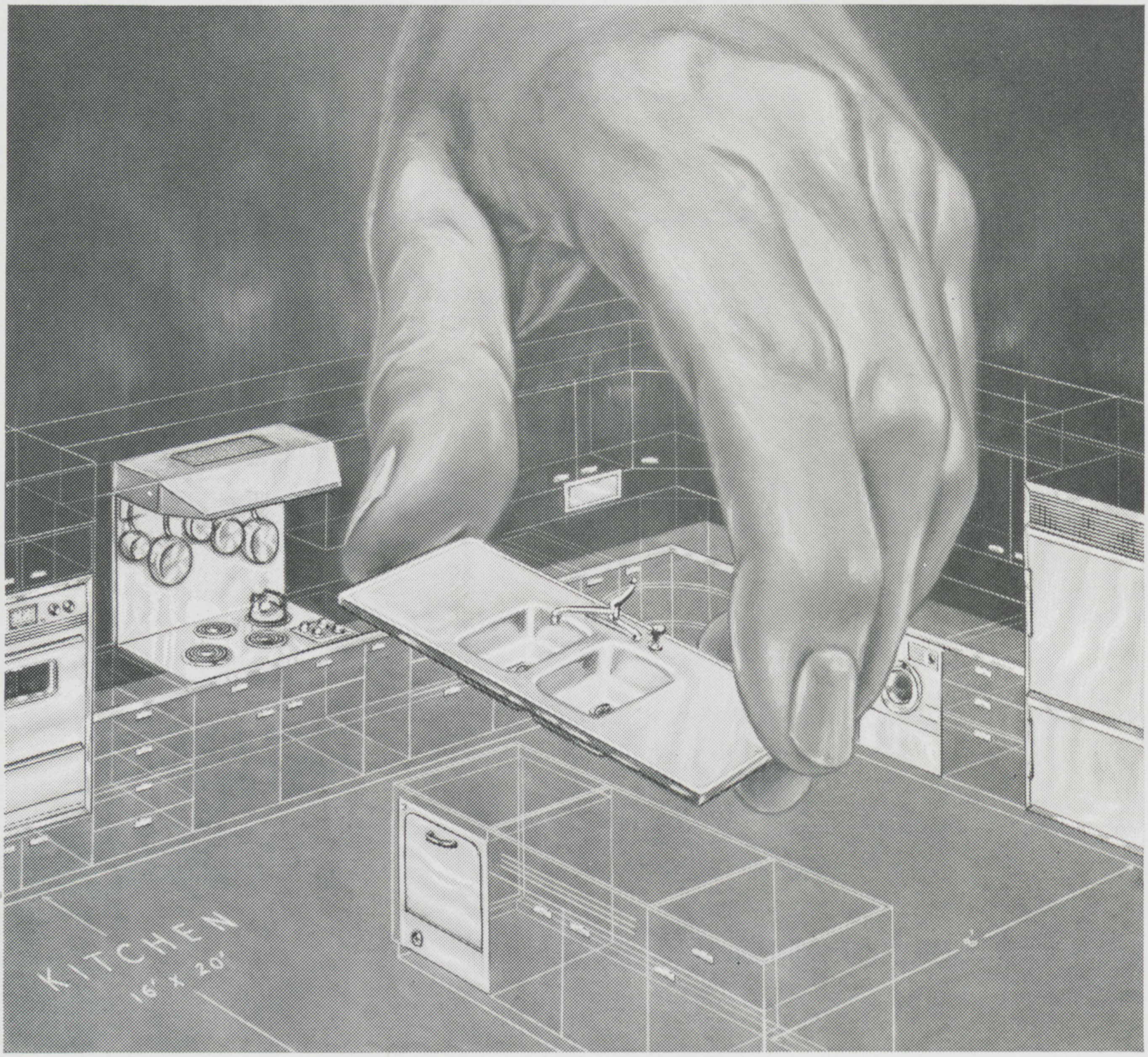
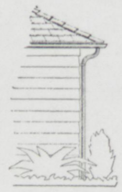
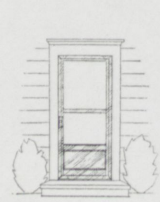


Build with the carefree beauty of stainless steel



Handsome appliances and gleaming counter tops that stay bright and are so easy to wipe clean . . . even the kitchen sink becomes a thing of beauty when it is made of shining stainless steel —the useful metal that was developed after years of research.

Whether you're building or remodeling, stainless steel gives a lifetime of value . . . saves many dollars in upkeep. You can now have gutters and downspouts that are almost indestructible because they won't rust or rot. And the strength of stainless makes possible door and window screening so fine you hardly know it's there.



The secret of stainless steel lies in chromium—one of many indispensable alloying metals developed by Union Carbide. They are typical of the hundreds of basic materials created through research by the people of Union Carbide in metals, as well as carbons, chemicals, gases, plastics and nuclear energy.

See the "Atomic Energy in Action" Exhibit at the new Union Carbide Building in New York

FREE: *Find out how stainless steel enhances the value of your home. Write for "Carefree Living with Stainless Steel" Booklet* **T-60.** *Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. In Canada, Union Carbide Canada Limited, Toronto.*

UNION CARBIDE

. . . a hand in things to come

Rose Technic

VOLUME LXXIII, NO. 2 — NOVEMBER, 1961

Member of
Engineering College Magazines
Associated

Publisher's Representative
LITTELL-MURRAY-BARNHILL, INC.
369 Lexington Avenue,
N. Y. 17, N. Y.
and 737 N. Michigan Avenue,
Chicago 11, Illinois

Contents

Cover Note

This month's cover appears through the courtesy of ASTRONAUTICS, a publication of the American Rocket Society. It is one of a series of photograms prepared for Astronautics by the talented team of Erich Locker and Gladys Washburn. The background, a photograph of the Andromeda galaxy was provided for them by the Harvard College Observatory.

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.

ROSE

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

HIGH SCHOOL GRADUATES OF 1962

You are cordially invited to visit Rose Polytechnic Institute where you can earn a degree in:

CHEMICAL ENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
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MATHEMATICS
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ROSE POLYTECHNIC
INSTITUTE
TERRE HAUTE, INDIANA

rose and athletics

Some form of athletics should be a part of every student's career, whether it be varsity athletics, intramurals, or just watching the home team. Rose has probably the finest athletic facilities of any college its size, yet surprisingly enough, few students actually take advantage of them. It has been estimated that over fifty percent of the Rose students participated in hign school varsity athletics. However, less than 20% of our students are participating on the varsity teams, at the present time.

There are several possible reasons for this apparent lack of interest: (1) The heavy academic demands of an engineering college (2) The fact that our teams have not been the best for the last 2 years (3) The lack of support given the athletes by the rest of the students.

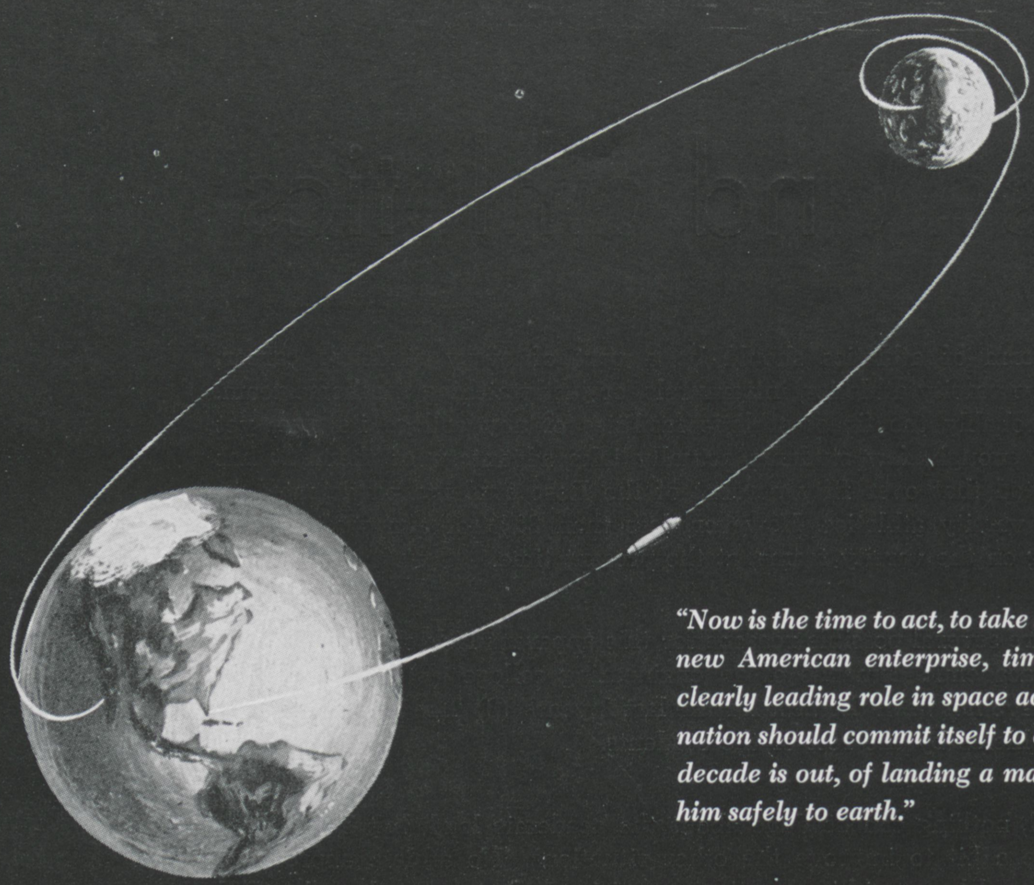
Granted, nothing can be done about the academic load, but I think we can do quite a bit to improve the other situations. No athlete appreciates spending several hours of his own time practicing only to see a bare handful of students at the home games, especially when the visiting team's crowd exceeds our own.

It seems to me that this is one of the biggest reasons why some of our best athletes won't play on the varsity teams. Rather than being proud of the fact they're on the team, they seem to have the feeling that it keeps them from playing intramurals. On the other hand, if the entire student body enthusiastically supported the teams, more athletes would have a desire to be on them.

Recently, the suggestion has been made that a booster club be organized to increase support for our teams both at home and on the road. This could very well be the solution to our present problem if a few students would take the iniative and start the ball rolling. So let's get behind our teams and go!

T. C. C.

National Aeronautics and Space Administration



"Now is the time to act, to take longer strides, time for a great new American enterprise, time for this Nation to take a clearly leading role in space achievement. I believe that the nation should commit itself to achieving the goal, before the decade is out, of landing a man on the moon and returning him safely to earth."

The President
of the United States
May 25, 1961

The nation has committed itself to accelerate greatly the development of space science and technology, accepting as a national goal, the achievement of manned lunar landing and return before the end of the decade. This space program will require spending many billions of dollars during the next ten years.

NASA directs and implements the nation's research and development efforts in the exploration of space. The accelerated national space program calls for the greatest single technological effort our country has thus far undertaken. Manned space flight is the most challenging assignment ever given to mankind.

NASA has urgent need for large numbers of scientists and engineers in the fields of aerospace technology who hold degrees in physical science, engineering, or other appropriate fields.

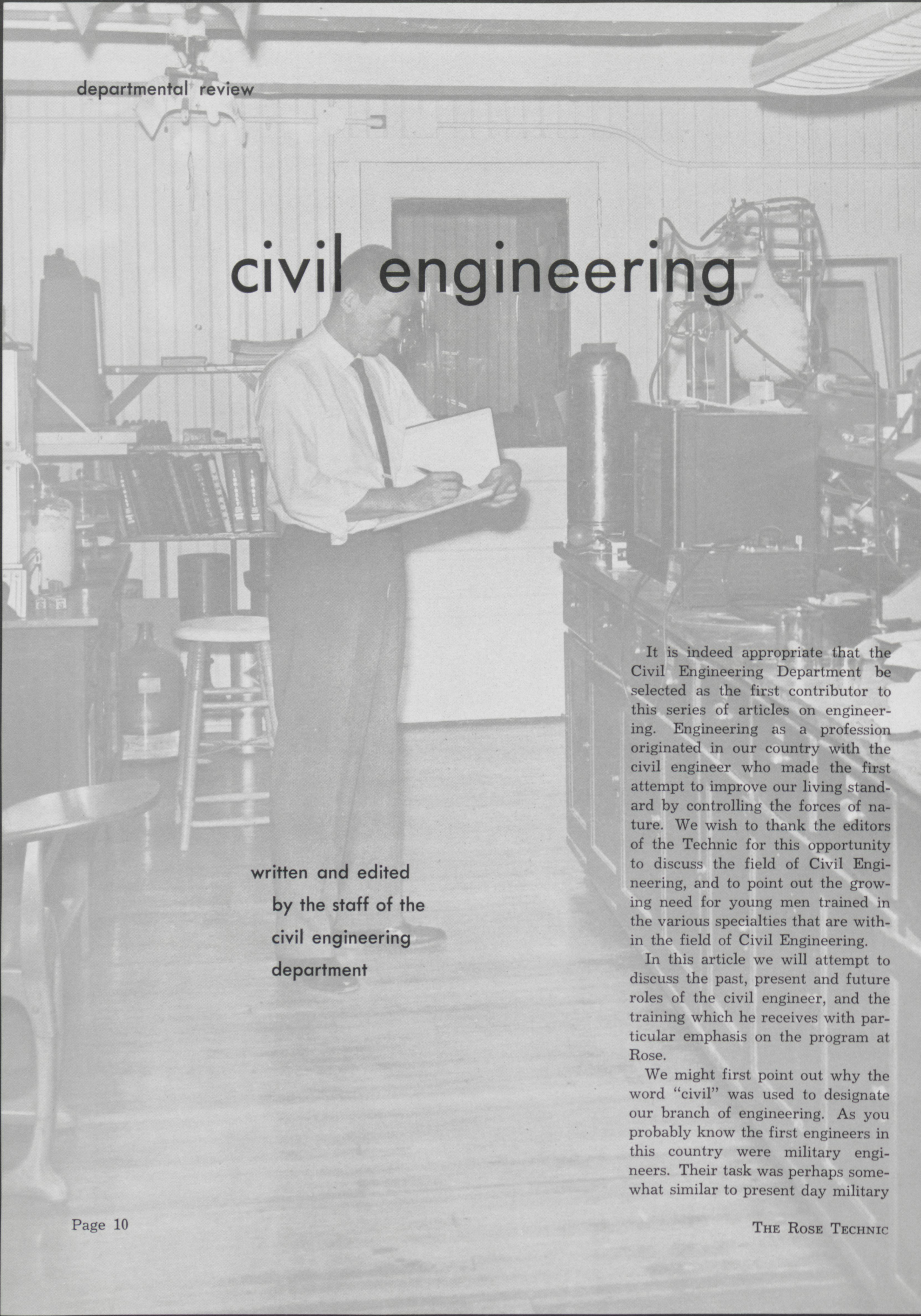
NASA career opportunities are as unlimited as the scope of our organization. You can be sure to play an important role in the United States' space effort when you join NASA.

NASA positions are available for those with degrees or experience in appropriate fields for work in one of the following areas: Fluid and Flight Mechanics; Materials and Structures; Propulsion and Power; Data Systems; Flight Systems; Measurement and Instrumentation Systems; Experimental Facilities and Equipment; Space Sciences; Life Sciences; Project Management.

NASA invites you to address your inquiry to the Personnel Director of any of the following NASA Centers: NASA Space Task Group, Hampton, Virginia; NASA Goddard Space Flight Center, Greenbelt, Maryland; NASA Marshall Space Flight Center, Huntsville, Alabama; NASA Ames Research Center, Mountain View, California; NASA Flight Research Center, Edwards, California; NASA Langley Research Center, Hampton, Virginia; NASA Wallops Station, Wallops Island, Virginia; NASA Lewis Research Center, Cleveland, Ohio.

Positions are filled in accordance with Aero-Space Technology Announcement 252B.

All qualified applicants will receive consideration for employment without regard to race, creed or color, or national origin.



civil engineering

written and edited
by the staff of the
civil engineering
department

It is indeed appropriate that the Civil Engineering Department be selected as the first contributor to this series of articles on engineering. Engineering as a profession originated in our country with the civil engineer who made the first attempt to improve our living standard by controlling the forces of nature. We wish to thank the editors of the Technic for this opportunity to discuss the field of Civil Engineering, and to point out the growing need for young men trained in the various specialties that are within the field of Civil Engineering.

In this article we will attempt to discuss the past, present and future roles of the civil engineer, and the training which he receives with particular emphasis on the program at Rose.

We might first point out why the word "civil" was used to designate our branch of engineering. As you probably know the first engineers in this country were military engineers. Their task was perhaps somewhat similar to present day military

engineers. Engineering, however. was not limited to the military, for eventually the need for engineering was found to help enrich and develop the civil environment of man. Since these engineers were no longer in the military service they became known as civil engineers. At that time the primary job of the civil engineer was to help develop the nation's natural resources for the betterment of man. In other words, the civil engineer attempted to exert some type of control over the natural environment. Perhaps his first job was to construct control works for the use and regulation of flow in rivers, buildings for residential, commercial and industrial use, and roads and bridges for transportation purposes. No one would doubt that these accomplishments helped to improve man's environment. Perhaps it was at this time that three of the various specialties within the field of civil engineering also originated. The field of structural design originated from the construction of buildings; hydraulics, from the study of flow in rivers; and transportation from the design of roads. However, the primary responsibility of the civil engineer was to *build,* and more art than science was used to accomplish this.

"DEPARTMENTAL REVIEW" is a series of articles written by members of the faculty at Rose. Each month a different department will describe for you the nature of their curriculum, some history of their profession, and what a student in their department might expect after graduation.

Because satisfaction during years of undergraduate study is so highly dependent on the proper choice of a curriculum, this series is designed to differentiate between the various fields of study at Rose and help the present and prospective student make his choice. Therefore it would be wise to consider the facts presented by these authors before making your selection of an undergraduate field of study.

From the begining to the present time the civil engineer has greatly increased his responsibilities in the control of man's environment. The specialty of structures is no longer concerned solely with buildings; airplanes, missiles, and atomic reactors are now all considered a part of the broad field of structures. From the civil engineer's basic knowledge of hydraulics has come the use of pressure conduits for the transportation of liquids, air and even solids. Also from this basic knowledge came an entirely new specialty, i.e., sanitary engineering, which is now concerned with the problems of air pollution, water pollution and environmental health. Aerodynamics is still another specialty which is closely related to the civil engineer's basic knowledge of fluid flow. In the field of transportation, the civil engineer is not only called upon to build highways and bridges, but also to perform analyses of traffic flow problems whether they be on land or in the air. It is therefore quite evident that the civil engineer is still contributing to the control of man's environment for the betterment of man. His primary responsibility, however, has changed from that of a *builder* to that of a *designer*. Design here may be defined as the analysis of a project in relation to its utility, safety and feasibility. To do this the civil engineer now applies his basis knowledge in engineering science as well as his artistic intuition to arrive at a satisfactory solution.

What of the future of civil engineering? It is evident from the above that the past and present civil engineers adapted themselves to a changing environment. It is expected that the future civil engineer will also adapt himself to whatever changes may occur in man's environment. It is impossible now to predict what problems will arise which will require the training of the civil engineer for their solution. There is no doubt that the increasing population, or the exploding population as it is sometimes called, will present many new problems in transportation, in the disposal of waste, in the supply of water and in the structure of buildings; which will require new methods and new ideas for their solution. The manifold problems attendant with an exploding population can no longer be solved by specialists in structures, hydraulics or transportation. An entirely new breed of civil engineer must be developed to handle problems of our future environment. The future civil engineer must be able to visualize the entire problem so that the solution can be developed which will yield optimum benefit in relation to all facets of environment. He must be able to consider social, economic, political, as well as engineering factors in the solution of future problems. In effect he will not be a *builder* or a *designer* but will be a *planner,* an engineer capable of thinking creatively and therefore finding new solutions to the many new problems which are sure to arise. ,

The work of the civil engineer has changed from that of a builder to that of a designer and possibly in

(*Continued on page* 28)

the moral aspects of the atom bomb

by Jack Hobbs

Jr. Chemistry

At 8:15 (Japanese time), August 6th, 1945, the world was shocked by the explosion of the first atomic bomb at Hiroshima, Japan. This one act opened up a new world—a world of tremendous power and fear. Prior to this historical event, man lived in an age of miracle drugs, speedy jet aircraft, and mechanical gadgets. The above things have done many great wonders in the past. They have performed our simple tasks and cured our illnesses. But what about atomic energy? Is it a wonderful invention or just another weapon to help destroy mankind? To one who works at an atomic energy installation it is good because nuclear energy provides him with a place to earn a living, but what about the rest of the world?

The new force got its start in 1903 when Albert Einstein revealed to the world his theory of relativity. From this theory and his equation $E=mc^2$, which showed that mass and energy were interchangeable, Einstein predicted that by splitting the atom great amounts of energy could be released. Thirty years later, Chadwick, an English scientist, discovered in 1932 the building block of all nature—the neutron. Between 1934 and 1938, Fermi bombarded almost all the elements of the perodic table with these neutrons. From his experiments he found that he had made transuranium elements in the laboratory. Fermi could not find a theory which explained this phenomenon, and it was two German scientists, Hahn and Strassmann, who verified that Fermi's achievement was fission—the splitting of an atom by bombardment with neutrons.

Following these momentous events there were many new elements and processes developed. It was Franklin D. Roosevelt who finally decided to group all the resources and scientists in the United States toward the production of the atomic bomb. This decision was encouraged by Albert Einstein who realized in 1939 that Germany was also on the trail of understanding the atom. The Atomic Age was finally ushered in when Fermi and his associates produced the first nuclear reactor in late 1942.

Hence, we have seen the birth of nuclear power and the events leading to the concept of the atomic bomb. From here it was only a matter of a few years until a bomb was produced, and in July 1945, the first atomic bomb was detonated at Alamogordo, New Mexico.

There were many things to be considered behind the decision to use the atomic bomb in Japan. To understand these we must analyze the situation of the United States at that time. It was early 1945; the United States was actively engaged in the war with Japan and Germany. Although the bomb was being built, it had not yet been decided to use it. If it were to be used, it would be as a psychological factor to force the Japanese to surrender. In May, Germany surrendered and the islands near Japan were all in the possession of the United States. The Japanese Navy had been driven from the sea and American bombers bombed the island daily. Japan was regarded as a defeated nation. It was at this time that the idea to use the atomic bomb to shorten the war appeared.

However, Japan was expected to put up a strong resistance to invasion of her homeland. Qualified experts claimed that blockade and bombing would not bring about an unconditional surrender before the date set for the invasion of the island. They also predicted that the invasion would be costly, and that it may become quite lengthy. Here again arose the suggestion to bring the war to a quicker close by the use of the atomic bomb.

It was also believed that Russian participation would bring the end of the war sooner. But late in the summer of 1945, the Americans hoped that Russia would not enter the war

This month, in the first part of a two part article, Jack Hobbs tells of the events and decisions leading to the bombing of Hiroshima. Next month — should the bomb be used?

because this would allow Russia to spread communism into the Far East. It was suggested that the bomb be dropped before Russia entered the war and thus, at the same time, to serve as a warning to keep communism out of the Far East.

When Truman became President after Roosevelt's death, he formed the Interim Committee which played an important role in the decision to use the bomb. The committee consisted of Secretary of State Henry Stimson; James F. Byrnes, President Truman's personal representative; Ralph A. Bard, Under Secretary of the Navy; William L. Clayton, Assistant Secretary of State; and Doctors Vannevar Bush, Karl T. Compton, and James B. Connant. Generals Marshall and Groves also attended some of the meetings. The Interim Committee completed their work on June 1, 1945. Their work consisted of the following points: (1) the bomb should be used against Japan as soon as possible; (2) the bomb should be aimed primarily at a military installation and then at surrounding buildings; and (3) the Japanese should have no prior warning that a bomb of this nature would be used.

The scientists working on the Manhattan District Project had a different idea and disagreed with the Interim Committee's proposals. They recommended that the new weapon be detonated before the eyes of the policy makers of the world, and then that an ultimatum be delivered to Japan. If Japan refused the ultimatum, and if the United Nations gave their approval, then the bomb should be used.

In reply to the recommendation of the scientists, Stimson and Barnes stated that a demonstration followed by a misfire would be damaging to the effort, and that if the enemy were informed that an atomic bomb would be exploded over a military target, they might bring American prisoners of war into the area.

On July 26, 1945, the Japanese were offered terms resulting from the Potsdam Conference which made the final plans for the invasion of the Japanese mainland. Japan did not reject the proposal, but delayed in order to see what Russia was going to do. This delay was interpreted by the United States as a rejection of the Potsdam proposal. This is one factor which aided in the decision to drop the bomb.

The final decision to use the atomic bomb on Japan was made by President Truman. It was not a decision which was hastily made nor was it a decision not influenced by others of authority. The President had the advice of his cabinet and the advice of the men who developed the bomb and knew its capabilities. The final justification for using the bomb was that it ended the war and saved many American—and Japanese—lives.

Hiroshima, at the time of the blast, was a city of 295,000 people. After the blast there were 80,000 killed and 135,000 injured. Total damage resulted within a circle with a radius of one-half mile. The shattering of windows was reported at eight miles from the center of the blast. In Nagasaki, a city of 195,000, 45,000 were killed and 60,000 were injured.

It is hard to describe in common terms the tremendous forces at work when at atomic bomb is detonated. Thomas E. Murray describes an atom blast in the following manner:

> Space is annihilated. Time is measured in millionths of a second. Temperatures approaching those at the center of the sun are produced. The sensation and the emotional reaction that one feels cannot be translated into words. There is an empty feeling in the pit of the stomach when, out of the waiting stillness, a great ball of bursting light fills the scope of a man's vision.

Thus in this descriptive paragraph, we see what super and fantastic results would result if the world were subjected to an all out atomic war.

There is one result of the bomb blasts which will not show up until sometime in the future. This is the effect of atomic radiation. From experiments it has been shown that radiation does produce harmful results in our children. What appears more shocking is that these effects may not show up in our children, but only in theirs. This is a danger which will lie hidden for years and which will become more terrifying since all such radiation effects have proven harmful.

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translating machines

written by Bob Valle
Sophomore Mechanical

An automatic computer is a machine that manipulates symbols in accordance with given rules in a pre-determined and self-directed manner. Or, more technically, an automatic computer is a high-speed, automatic, electronic, digital data processing machine.

The field of automatic translation of languages, more commonly known as machine translation, got its first large boost when the First Conference on Machine Translation was held at M. I. T. in June, 1952. At this time there was only one person who was spending any appreciable amount of his time on research in the field of machine translation. It was estimated that at that time all the bits of research being done in this field amounted to only about three full-time researchers.

In 1959, an article entitled "The Present Status of Automatic Translation of Languages," from which much of the material for this article is taken, was written by Yehoshua Ben-Hillel, who worked for some time at the Research Laboratory of Electronics of M. I. T. B'Hillel is recognized as one of the outstanding authorities on machine translation in the world.

In his article, B'Hillel discusses the advances in machine translation from the time of the 1952 conference until early 1959. From the research on his article, it is B'Hillel's approximation that as of April 1, 1959, the United States had an equivalent of eighty full-time workers in the field of machine translation at a yearly budget of $1,500,000. At the same time Russia had approximately 120 workers at the same yearly budget of $1,500,000.

Although the electronic computer is now being utilized in various fields and applications, it was once a very specialized instrument with a highly technical task. It is important to remember that the original computers were designed by the scientists and engineers for their specific uses. These men originally needed some computational device to evaluate tediously long mathematical expressions. Therefore, computers were born with the characteristic of being highly applicable in sequential operations.

"Sequential operations" means that the automatic computer first computes one step of the problem, uses this computation to compute the second step, and then uses the second result to compute the third step, etc. This sequential operation is very important to the scientist because the scientist is frequently working with variables and relations among variables, such that the results of one computation must be known before a second computation can be made. However, the sequential operation type of design is not necessary in many of the more recent applications of the electronic computer. Therefore, the design of new methods of computer operation become necessary in the early stages of computer-translator research.

During the early stages of the research in machine translation, enough success was attained that many workers who were once skeptical of the feasibility of such a venture, were convinced that very satisfactory machine translation was eminent. This illusion, and it is termed an illusion by B'Hillel, was created because many of the rather large number of problems were readily solved and also that the output of the machine "translations" of various texts in Russian, German, and French were often of a form that could be read by an intelligent and expert reader. It was not sufficiently realized that there was still a large gap between such an output, which could almost not be called a "translation," and the translation of the quality produced by an experienced human translator; and that the many problems so far answered were, indeed, the simplest ones, whereas the remaining problems were much more complicated.

Many groups engaged in machine translator research still regarded fully automatic, high quality translation as a feasible goal. However, according to B'Hillel, the structure of any natural language limits, at least for the near future, the ability of a machine to make a high quality translation. For instance, in the English sentence "The pen was in the holder," if a machine-translator were to look at the word "pen," there is no way yet devised whereby the translator could choose the correct meaning of "pen," either (1) a writing utensil, or (2) an enclosure where small children can play.

Until such a time as high quality

(*Continued on page* 32)

electrical discharge machining

r & d

written by Ned Hannum
Junior Mechanical

Electrical discharge machining, or EDM, is the process of removing metal by erosion at the point where an arc is struck between electrode and the workpiece. The exact mechanics of the process are not known, but it is certain that the bombarding action of the electronc in the arc is an important factor.

A more comprehensive description of the electrical discharge machining, EDM, will shed considerable light on what is being accomplished. The story starts with a metallic block or machine part which is to be reshaped. Machining a round hole in a square block will serve as a simple example. The block, commonly referred to as the workpiece, is made the positive electrode, and a cylindrical rod is used as the negative electrode. They are submerged in a nonconduction fluid called the coolant.

Forty volts, in the form of a 20 kcps square wave, is applied across the gap. The cylindrical electrode is fed slowly toward the block. When the gap nears 0.002 inches, an arc is struck between the closest points on the block and the rod as the rod is pulsed negative. The arc erodes a small particle from the block at the point. It is extinguished by the power supply when the rod returns to zero voltage. This is absolutely necessary to prevent the arc from maintaining itself for many cycles at the same location instead of moving to the two points that are now closest after the erosion during the first cycle. Thus the arc continuously wears away the highest point on the workpiece as the rod progresses through the block.

It is now evident that EDM takes place in a microscopic area at any instant of time, and the process would appear to be quite slow. However, at close to 20,000 arcs per second and currents from one to three hundred amperes, metal removal can take place rapidly enough to be economical in suitable applications. Tests have indicated that twenty amperes of current will remove about ½ cu. in. of metal per hour, depending on the metals involved.

Since EDM only takes place at the point where the gap is least, it is possible to sink three dimensional electrodes into a metal block and accurately reproduce the shape of the electrode. This is one of the

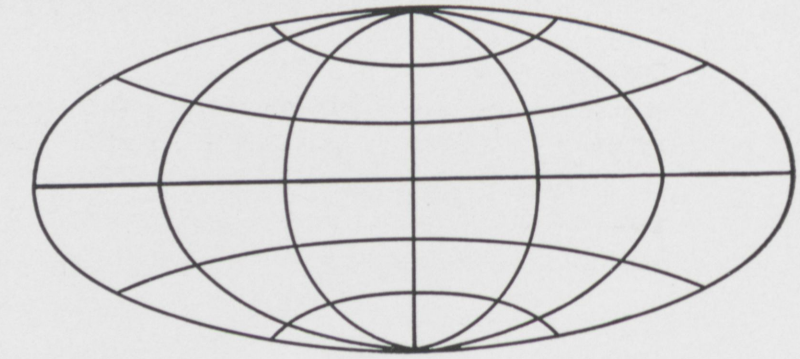
(*Continued on page* 30)

miss technic for november

The TECHNIC art feature for November is Miss Linda Eldred, a senior majoring in Elementary Education at Indiana State.

Linda, a native of Terre Haute, is a very active coed in State activities. She is president of the Student Union Board, vice-president of Chi Omega sorority, and a member of the Student Council. Linda also loves sports, as a player or a spectator.

Art is Linda's hobby as well as her minor—and she is, of course, naturally qualified. Along with beautiful dark brown hair, hazel eyes and a vivacious 2.95×10^5 carats of well arranged protoplasm, Miss Eltred is 1.7×10^{13} angstroms tall and has such curvacious proportions as 5.52×10^{-5} miles—0.7499 veras — 1.03×10^{-16} light years.



library notes

written by Carson Bennett and Winifred Kitaoka

"When others fail him,
the wise man looks
To the sure companionship
of books."

Andrew Lang: *Old Friends*

Whether you wish to listen to one of the old standards — or to the unusual, we have something for your listening pleasure. We list some of our newly acquired records:

The Orchestral Wagner, containing the "Tannhauser Overture," "Die Meistersinger von Nurnberg," and "Gotterdamerung."

A record entitled *Virtuoso!* features the Roger Wagner Chorale presenting Handel's "Hallelujah Chorus" from the *Messiah,* "Echo Song" by Orlando Di Larso, Mozart's "Alleluia," and others including "Polly Wolly Doodle."

We have Felix Stalkin conducting the Light Brigade in a record entitled *Charge!* which "brings to life a chapter of history that has long passed into dust," the days when men marched into battle to the tune of martial music.

Come Rain or Come Shine, two organs and rhythm, features Rosa Rio, the top girl organist in her field on the East Coast, playing such favorites as: "Oh What a Beautiful Morning," "Softly as in a Morning Sunrise," "Over the Rainbow," and others.

A collection of the more popular marches from the works of Berlioz, Bizet, Mendelssohn, Prokofieff, Tchaikovsky, and Wagner is presented in *March Tempo.*

Victor Herbert's operettas, *The Red Mill and Naughty Marietta* are both recorded on one album, with Gordon MacRae, Marguerite Piazza and Lucille Norman singing the beautiful melodies.

Square Dance Promenade is recorded without calls bringing together traditional tunes with a "glorified" country air about them.

Also new to our collection is a group of records of different nations, in a series called "International sounds." They are of Mexico, Japan and Paris. Along the same theme, however, not belonging to the series, we have the record entitled *The Sounds of Old Mexico. Matching Songs of the British Isles and America* presents variants of diverse folk songs and ballads originally created and sung in England, Scotland and Ireland, and later brought to the United States. Also new is *St. Patrick's Night in Dublin* which records the sounds of a St. Patrick's Day celebration in Ireland, from the renowned Irish Club at 41 Parnell Square in Dublin.

* * *

If you're stumped for ideas for party entertainment, here is a new slant:

Humorous Monologues, by Vernon Howard presents fifty original monologue for dramatic presentation before mixed groups. These monologues average five minutes in length. *Holiday Monologues* is also a collection by Mr. Howard of more than fifty monologues that are specially written for holidays and other occasions, whenever groups get together and would like light, amusing performances by amateurs.

Pantomimes, Charades and Skits, are explored in this volume by Vernon Howard. Acting out, has caught on as a home and school recreation, and Mr. Howard gives meticulous directions for performing, with hints for beginners and advice for everyone.

101 *Best Party Games,* by the Frankels is a collection of games for home parties, club and church gatherings, and picnics. For surefire success at all parties, these games have been tested by the authors and found to be successful in breaking the ice, getting guests acquainted and keeping them happy.

* * *

FROM THE NEW BOOKSHELF

The Winter of Our Discontent,
By John Steinbeck

Steinbeck's versatility should no longer cause astonishment. Each of his books is apt to be a new departure, differing sharply from the one before. Yet this new novel will probably surprise even his warmest admirers. Insttead of being set in the Far West, the scene of most of his books, this one takes place on the

(*Continued on page* 31)

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Energy Conversion is Our Business

ALLISON DIVISION GENERAL MOTORS CORPORATION

educational co-ordination

written by John Rohr, Sophomore Math.

"A Survey of the Co-ordination between High Schools and Rose Polytechnic Institute"

Education never stops! Whether it be formal education or practical experience, education is a constant, continuous process. Education by practical experience is often a series of relatively unrelated events; formal education, however, generally follows a co-ordinated, sequential pattern with a few breaks. These breaks are between grade school and high school, between high school and college, minor breaks between elementary grades, and differences encountered when moving between towns. Probably the most significant break occurs between high school and college. This change involves increased study time, concentration, effort, and in most cases new independence for the student.

The students of Rose have come from high schools throughout the United States, including Hawaii. The classes from which they graduated have ranged in size from less than ten to over five hundred. A student must rank academically in the upper half of his class to be accepted into Rose: many are in the upper quarter or even the upper tenth.

A completely adequate survey of high school and college co-ordination would require interviews with large numbers of students. I have attempted to approach this situation by talking with a number of Rose students on various occasions. These conversations have given me a better insight into the co-ordination of individual high schools with Rose. The general survey seems to divide the discussion into the study of small schools and large schools.

In general, those students who have come from small schools, while expending as much effort and time while in high school, have not been as completely prepared as students from larger schools. There are a number of plausible explanations for this result.

Probably the main reason is lack of facilities. A large school must, by its nature, have more teachers than a small school with a similar faculty-student ratio. With an increased number of teachers, there are persons qualified to teach advanced subjects in a larger school. With a large student body, there is enough interest by enough people to have special advanced courses.

As a particular example, let me present some statistics from my own school, Hinsdale Township High School in Hinsdale, Illinois. When I graduated in 1960, the total school enrollment was about 1800. My class had 458 members. With this many students in the class, there was enough interest to set up advanced courses in math, chemistry, physics, and English. About thirty students were chosen from the class at the end of the freshman year and invited into the advanced math course. About fifty students were in advanced chemistry, thirty in physics, and thirty in English. The math course included calculus and analytic geometry in the senior year. It was a three-year sequence. The other advanced courses were for one year each. In advanced chemistry the basic theory was stressed and investigated farther than usual. Advanced English considered great works of literature and also involved rhetoric. The rhetoric course was as complete as many college courses. Advanced physics was more concerned with basic theory than "plug and crank" problem solving.

These advanced courses are becoming more and more common in high schools today. Cities like Chicago, Ill.; Dayton, Ohio; Los Angeles, Calif.; Evansville and Indianapolis, Ind., and many others have schools offering such courses. There is at present a group called the "Physical

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principles of ultrasonics

written by Ken Miller
Junior Math.

One of the most versatile and powerful tools invented by man is revolutionizing modern industrial techniques. This inexhaustive source of energy smashes molecules against one another to boil, break, clean, cut grind and weld. It can detect minute flaws even undiscernable by X-ray inspection and can precisely measure the thickness of super-thin sheet metal. While the new marvel can destroy any known form of bacteria, at the same time it is capable of cutting through delicate brain tissue in complete safety. Among this new tool's other achievements are production of chemical combinations of solids and liquids hitherto not possible, activation of burglar alarms and remote control of television sets. All this is made, not just a possibility, but a reality by the relatively new science wonder, ultrasonics.

Nevertheless, these are but a few of the applications of ultrasonics. Hundreds of ultrasonic amplification, detection, and communication processes have recently been unveiled; many others, yet to be discovered, will exceed all expectations. Before considering its applications further, let us investigate the ultrasonic wave: its basic principles, advantages over ordinary sonic waves, and methods of generation and transmission.

Ultrasonic waves might best be described as "silent sound," that is, sound above the extent of human hearing (20,000 cycles). Hence, it should no longer be termed "sound" according to our conception of "sound" as something which stimulates the auditory system. Perhaps this definition is a bit confusing and scientifically incompatible. To illustrate by example, certainly everyone has heard, or rather heard of, dog whistles that can be detected by canines but are imperceptible to human ears. Invented by Sir Francis Galton over one-hundred years ago, the canine whistle, often called the Galton whistle, is the earliest known man-made utilization of the principles of ultrasonics.

Even before that, however, ultrasonic radar systems enabled bats to avoid hitting obstacles even in absolute darkness. So dependable are their guidance systems that bats can fly between two adjacent parallel wires without ever touching either of them. Any such "sound-like" waves, whether natural or man-made, from 20,000 cycles per second to beyond 25,000,000,000 cycles per second constitute the region of ultrasonics.

Why should we concern ourselves with ultrasonics rather than ordinary sonics in the range of human hearing? The reasons for this are two-fold. First, in order that sound waves be effective in boiling, cleaning, welding, drilling and other operations, they must be very high energy waves of great amplitude. Within the scope of human hearing, such great energy would shatter our eardrums. It is, therefore, imperative to increase the frequency of vibration beyond 20,000 cycles, where it is safe to operate at any desirable power level.

Secondly, the frequency of a sound wave is directly proportional to the inverse of the wave length, and the constant of proportionality is the velocity of the wave, as shown:

$$f = (v) 1/\gamma \ .$$

For non-destructive testing (NDT)

(*Turn the page*)

with ultrasonic waves it is advantageous to use the smallest wave length possible. If, for example, one is testing a metallic specimen for internal defects by bombarding it with both high and low wave length sound waves, the low wave length wave will bounce back and be recorded upon striking a tiny depression. On the other hand, the large wavelength wave will merely "step over" the flaw as if there is nothing there. Noting that the velocity of sound is constant in any given medium at any given temperature and pressure, one can conclude that extremely small wave lengths and correspondingly high frequencies (20,000,000 cycles) are required for ultrasonics NDT.

Now that the existence and need of ultrasonic waves are established, from where do they come? Ultrasonic waves can be generated in any number of ways, the particular method selected being dependent upon the power output and frequency range desired. Mechanical generators, such as gas current generators, tuning forks, vibrating glass or metal rods and Galton whistles can produce sonic waves around 20,000 cycles. Few of these mechanical methods are practical because the frequency range attainable is limited.

A second type of ultrasonic generator, based upon thermal concepts, employs a spark gap to produce vibrations. Such devices are not common at present, however.

By far the most frequent method of ultrasonic generation is the use of electronic oscillators to produce a very high frequency alternating current signal. The problem then arises of how to transmit the energy from the oscillator into the material. This is the function of the transducer, which converts an alternating current electrical energy input into a mechanical energy output in the form of high-frequency vibrations. The heart of any ultrasonic system, the transducers, can be separated into the following three general categories, the first two of which are the most common:

1. Magnetostrictive Transducers
2. Piezoelectric Transducers
3. Miscellaneous Transducers
   a. Ceramic Transducers
   b. Electromagnetic Transducers

Magnetostrictive transducers, the oldest of the types considered, are desirable because they can operate at full power for extended periods. They work on the principle of expansion and contraction of nickel or nickel alloys in an alternating magnetic field, called the magnetostrictive effect. Nickel is particularly suited to the task because it can endure great internal forces present in ultrasonic applications.

A typical magnetostrictive transducer has three major components: the stack, connecting body, and toolholder. A coil of insulated wire surrounds the laminated nickel stack. When subjected to an alternating magnetic field at the natural frequency of the stack, the stack expands and contracts minutely. Supporting the entire system and attached to the stack, the connecting body detects, transmits and amplifies these very small changes in length. The third and final element, the toolholder, transmits and again amplifies the vibrations at the tip of the cutting tool. However, magnetostrictive transducers are limited almost exclusively to machining operations, because their frequency response does not extend beyond 60,000 cycles.

Piezoelectric crystal transducers, generally made of quartz or Rochelle salt, are capable of transmitting at frequencies from just a few kilocycles to beyond twenty-five megacycles. If the crystal is vibrating in a fundamental frequency, harmonics tends to push this figure higher, even to an unbelievable 25,000 megacycles.

Around 1880, the Curie brothers discovered that certain crystals will develop an electric charge when mechanical pressure is applied to their opposite surfaces; the principle has since been termed the piezoelectric effect. So as to achieve the greatest piezoelectric effect, the crystal slabs used have been cut from the original, rough crystal at right angles to the polar or piezo axis, which is in the direction that maximum charge will appear. When tension and pressure are alternated, the sign of the induced charge likewise alternates. Also, the resultant charge is directly proportional to the mechanical forces and is dependent upon the piezoelectric modulus, characteristic of the type of crystal. However, the charge accumulated is independent of crystal thickness, temperature, and cross-sectional area. In so many words, the electric field intensity is directly related only to strain, and the variations in ultrasonic energy due to other factors are a minimum.

Conversely, if a high frequency oscillator output is applied to opposite faces of a piezoelectric crystal, designed to resonate at that particular frequency, the crystal faces will move with respect to one another. By now holding the vibrating crystal against a suitable medium, ultrasonic waves will be produced and and transmitted through the medium. Limited to sending and receiving at low power levels, piezoelectric quartz crystals are still widely used to produce ultrasonic waves for cleaning and non-destructive testing.

Among the less common transducers are ceramic transducers, more recent than the preceding two types. Coming in all assorted sizes, they yield greater power outputs at higher frequencies. This is advantageous in that ultrasonic energy can be more easily focused by using parabolic-shaped transducers. Barium titanate and lithium sulfate are just two examples of ceramics utilized in making transducers.

Another infrequently used transducer is the electromagnetic transducer, which utilizes the motion of a current-carrying coil in a magnetic field. Such a device is just a modified loudspeaker using a resonant bar in place of the paper cone.

In conclusion, the two actions of a transducer, producing mechanical vibrations from electric impulses, and vice versa, form the basis of most ultrasonic processes.

EDUCATION AND INDUSTRY—working together for the future

Put an engineer in an environment compatible with his scientific interests and he is quite likely to do great things and be happy about doing them. That's the way it is at Detroit Edison, whether it's on one of our long range development programs, our day-to-day studies for system improvements, or on our summer program for engineering professors and students as shown above.

Here Assistant Professor Aziz Fouad of Iowa State University's Electrical Engineering Department, University of Michigan student Nicolas Spewock and Detroit Edison Senior Engineer Ray Pillote examine a problem of extra high voltage transmission, using the System Analogue and Network Computer.

There's very little precedent to draw on in the area of 400 to 500 KV transmission voltage and much remains to be clarified about system design and integration, radio interference, line losses, relays, operation and performance.

If you want to find out more about career opportunities or our summer program, drop us a note and we will send you a copy of our booklet which will describe the challenges and opportunities you can expect. Write to Detroit Edison Employment and Personnel Research Department, 2000 Second Ave., Detroit 26, Michigan—or see our representative when he visits your campus.

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greek briefs

LAMBDA CHI ALPHA

Homecoming afforded the brothers a great opportunity to strengthen the brotherhood and to share the traditional spirit. On Wednesday, Novefber 17, the chapter hosted the nurses of St. Anthony's for a buffet dinner and paper-stuffing party. After the elements of the Homecoming display had been sheltered from Thursday's drizzling rain, Lambda Chi assembled its 1961 display Thursday night and Friday afternoon. A buffet supper for members and guests was held preceding the bonfire and talent show, and afterward the house was opened for a gathering of undergraduates and alumni. Preceding the Homecoming dance Saturday night a buffet supper and punch party were held. The brothers would like to congratulate Brother Dumford, who was chairman of the Homecoming display committee, for an exceptionally fine job.

On October 8, 1961, the chapter initiated two new brothers, Larry MacDonald and Bob Gordon, to bring the chapter active strength to fifty.

The brothers congratulate Jim Watkins, who pledged Lambda Chi Alpha on October 23.

Homecoming was a time of merriment, and two of the brothers felt that life was treating them so well that they shared their good feeling with others. Brother Curt Jones pinned Miss Jan Perry, a Ball State coed. Miss Sarah Meyers, a student at ISC, received the pin of Brother Bill Templin. Congratulations to both brothers and their pin-mates.

Interfraternity football is about to end for this season. Hard and spirited play prevailed as the brothers participated in this endeavor. Lambda Chi Alpha now rests in second place in the league standings.

John Stockton
Bob Valle

SIGMA NU

Along with fall comes the election of a brand new house manager and assistant for the old homestead at 831 South Center. This year we have chosen Brother Bob Lovell for a re-run. Bob was our house manager last year too, and we couldn't bear the thought of giving him up. His new assistant is Brother Joe Griffin.

Recently pledged is Joe Wise, to join Dave Larue as our two man fall pledge class. Congratulations Joe.

Our social season has been under full swing since the new semester began. A house party with girls from St. Mary's of the Woods on October 6 was first on the agenda.

I trust the alumni have recovered from the shock of no beer at homecoming for the second straight year. The new policys of entertainment at the bonfire and more dancing room on Saturday night were tremendous improvements. Maybe homecomings will turn out better without the golden liquid. But if nothing else, everyone will forget how they used to be. Cheer up alumni, next year will be your year to find the right party.

At the recent fall honors convo pledge Dave Larue received an award for raising his grades more than any other student in last year's freshman class. Brother Al Ratz received a check for having the highest grades in his chemistry section, and Brothers Brda and Grumme were tapped for Blue Key Fraternity. Congratulations and keep up the good work go for you from us, guys.

Athletically speaking, Sigma Nu has roared into the lead in competition for the all-sports trophy by a blazing unbeaten-untied-un-scored-upon football team. This is our third consecutive year in possession of the football trophy, thus retiring it. We are all especially proud of Brother Dick Landenberger who has been coach all three years. Our five for the hardwood this year look so good that they scare me (and I'm fearless), but you can never tell.

Brother Gary Reynolds has recently bestowed his pin upon Miss Sandy Higgins. Exchanging High School rings are Brother Larry B. Hall and Miss Sue Hawley, also Tom Davidson and Miss Sandy Manthy.

Brother Tom Fite, our new scholarship chairman, reports that according to the results of a gallop pole, our grades will reach an all time high this semester. Watch out, books, we're coming.

Joe Grumme

THETA XI

Would anyone like to buy a quantity (in number, pound, kip, or ton) of second hand firebricks? Right now, the TX Television Club is trying to raise funds for a new 36 inch color television set so we can watch the "Shirley Temple Storybook Time" in living color. In trade for the bricks, we the members will take old black and white TV sets, 1921 Stutz firetrucks, olive oil, or vertical control tubes to put the top of the lighthouse back in the picture so we can receive "The Guiding Light." By the way, we are also trying to raise funds to purchase the old seats from the Swan theatre, along with their automatic corn popper and box office. We are also considering the marquee.

You may or may not know that the excess funds from our brilliant homecoming display went down the esophagal of all actives and alumni present at our revolutionary homecoming banquet. Everyone seemed so very joyful, and seemed to really enjoy themselves. From this, one may conclude that the banquet was a success. Although the attendance did not fill up the whole of Louise's as we originally and optimistically anticipated, the area we occupied was well utilized. Very well utilized. After the banquet, all the alumni returned to the house and really had a blast with the aid of Ray Gomph from Cape Canaveral.

Say, does anyone have a second-hand Kamikaze plane from the second World War? We are training our champion with the traditional broomstick. We are preparing for our first annual December 7th celebration.

Curt Yee

ALPHA TAU OMEGA

For those of you who have survived the ordeal don't give up yet, this is only one six weeks session. Remember, sleep well tonight, your teachers are busily engaged in finding more fiendish and ingenious ways of tripping you up with the next six weeks set of exams.

However, teachers aren't the only tricky ones at Rose. We just learned that Brent Robertson lost his pin last spring to the wiles of Diane Bandy and then forgot to tell us. After a noisy and wet congratulation though, all was forgiven. Then we found that one of Rose's football players, Don McNally, had been thrown for a loss by Betty Warner. He is still feeling the effects of this and is walking around in a daze—minus pin, of course. Also Dave Starnes was stung by Bee Rupple for his pin.

These fellows will probably be the last to be showered at ATO. We decided that we were tearing up the showers too much and have decided on a stouter replacement. Does anyone know where we can get an *old* bathtub cheap?

For those who can remember, Homecoming was a weekend long blast. The Seniors had the best time while it lasted, but Monday saw a bunch of tired bleary-eyed engineers. Really, we saw a lot of our old friends and made some new ones among the alumni.

Our one and only pledge won't be lonely any more. He now has Charles Yager, a Sophomore, and John Reed, a Senior, to keep him company. Charles Yager, along with Don McNally, are both fighting away for Rose on the Varsity football team.

The Chapter as usual is a progressive one and we led the way again in the form of a Homecoming display. Even some of the most beat artists will probably still be asking us what it was. The display was a fifty by twenty-five foot white plastic sheet on which the members of the chapter were allowed to express their Homecoming best wishes. The result was the wildest abstract painting anywhere. The icing on the cake which summed up the spirit were the words "Go Rose" in fluorescent paint which glowed under black light.

As always the *comaraderie* at the house is an important part in the pride each person had of being an ATO.

Bronis de Supinski
Nicholas J. Kira

Civil Engineering

(*Continued from page* 11)

the future to that of a planner, and it is evident that the training of the civil engineer must also be changed accordingly. In the past many civil engineers received their training in the "field" with little formal education and even the formal education which was available was more art than science. Today, the civil engineer is basically trained in the physical sciences and then receives additional training in the so-called engineering sciences, such as strength of materials, fluid mechanics and thermodynamics. In addition, he receives training in the actual design of engineering projects. He receives training in hydraulics, sanitary engineering, structures and soil mechanics, all of these being based on the knowledge gained in the engineering sciences courses. Since the civil engineer's responsibilities are continuously changing, it is evident that his formal training must also change. In fact, the civil engineer should not be trained for what the civil engineer is doing today, but rather should be trained for what the civil engineer may be doing in the future. If this is not done the training of the graduate civil engineer would be outmoded in less than five years after graduation. Since it is anticipated that the responsibilities of the civil engineer will continue to broaden, it is evident that the training of the civil engineer must also broaden. However, it is not possible to include sufficient training in the various specialties of civil engineering at the undergraduate level. It is possible, however, to include more basic science and engineering science to provide a foundation for the creation of new ideas to solve new problems. In addition, it is not *what* is learned that is important, but learning how to *think creatively is* important.

The Civil Engineering curriculum at Rose has been revised many times in the past and is due for another revision this year. The revised curriculum will utilize the engineering science approach and will incorporate a much greater selection of electives in the final semester of the senior year. It is believed that this curriculum will provide more flexibility for the student and more opportunity for him to select courses of his choice and develop a personal engineering philosophy. It is hoped that the civil engineering project course in the second semester of the senior year will help to test the student's ability to think creatively in the development of some project of his own choice.

Civil engineering has developed through the stages of builder, designer and possibly in the future, planner. His training has also changed from that of an art to that of an engineering science. Civil engineering was born to help solve the problems of man's environment, is still accomplishing this aim, and will do so in the future. We hope that the training that a student receives at Rose will help him to think creatively to the solution of these manifold problems.

Educational Coordination

(*Continued from page* 22)

Science Study Committee" which is working towards a standard, uniform, theoretical course in high school physics. Some Rose students have taken PSSC physics. Some high schools offer advanced math courses other than calculus, for example, set theory. Besides having exposed the student to college level material, these courses are helpful in other ways. For one thing, they require the student to do college level thinking. Also, a great deal of self-discipline is required for most of these courses.

A smaller high school is more limited in the courses it can offer. Even with the best teachers, there is not too much opportunity for advanced classes because there is not enough student interest. Also, many schools have a limited budget and cannot afford to have small classes. A small school does have the advantage in that the individual student can get help from a teacher with no trouble, while at a larger school the teacher is not always available. In order to be truly effective, a large school must keep its student-faculty ratio low. The person who comes from a small school can be well-educated in the courses offered to him, but he usually has not been offered many advanced courses.

Another point of view in considering high school preparation for Rose is consideration of a few particular subject areas, particularly freshmen courses which are the basis for future studies at Rose. Math, English, chemistry and physics are such courses.

The entrance requirement for mathematics includes algebra, geometry, and trigonometry. All these are important in Math I and II. Students who have had some calculus in high school have already been exposed to some of the fundamental concepts and when they study the course for a second time they will probably get a different approach than the first time. They should be able to understand the theory better than before. Working problems should be considerably easier if the material is not completely new.

Students who have had good courses in high school math can begin where they stopped. Many failures in college math are due to lack of effort rather than lack of ability or preparation. Most people to whom I have talked have said that their math background was adequate.

Both literature and rhetoric are studied in freshman English at Rose. The aesthetic value of literature makes it a good medium for relaxation while the practical value of rhetoric makes it a requirement for engineers. Most high schools have English courses which include American and English literature, rhetoric, and possibly speech. The English courses at Rose are both a review and a continuation of these courses.

High school chemistry involves a study of elements and compounds and usually includes problem solving. Some courses also include an intensive study of the theory of atoms and molecules. Some of these courses also include some organic chemistry. The Rose chemistry course begins again the study of chemistry with a systematic approach to the investigation of theoretical and practical aspects of chemistry. The knowledge gained in chemistry can later be applied by the student in his engineering studies and practice.

Physics is another entrance requirement. Physics is a very basic course in the science or engineering curriculum. Basic concepts for many other courses are first taught in physics. High school physics courses often give principles and formulae based on an intuitive approach. In the Rose physics course, these formulae are developed theoretically.

These four examples have shown how college subjects begin where high school courses have ended. In some instances, individuals have already studied part of what is covered in the college courses, but in any case, almost everyone has had a good background for the courses here.

The general opinion of most Rose students is that they have, individually, each put forth a concentrated effort to profit from high school courses. Whether they were taught only enough to bring them up to the point where Rose subjects begin, or whether they begin with a review of the last part of high school, the background is generally diversified and sufficient.

Because Rose is a small school, it can be selective in its enrollment. Therefore, most Rose students should be well-prepared for college. This is actually the case with most students here. Their preparation enables them to fit into the college program as described in the earlier examples. The students backgrounds, though diversified, include basic concepts needed here. Large high schools are able to offer more advanced courses and teachers of small schools are able to give the student more individual time so that in either case, there is excellent coordination between high schools throughout the country and Rose Polytechnic Institute.

R. & D.

(*Continued from page* 15)

major uses of EDM, as complicated parts of steel dies for die casting can be made this way. The electrode can be made of a fairly inexpensive, easily workable material plated with zinc or copper. Since the electrode wears some, especially at sharp corners, several electrodes may be required to achieve the desired accuracy. Tolerances of 0.001 in. can be obtained if enough electrodes are used. Wear ratios or the volume ratios of workpiece removal vary from 2:1 to 15:1, depending upon the metals involved. Theoretically cutting action should be independent of the metals involved, but it is a fact that some metal combinations cut very poorly. In these cases only small currents can be obtained, and the servo feed mechanism, which maintains a constant gap as the workpiece wears away, become unstable.

Fortunately, EDM works well on several hard metals, tungsten carbide being outstanding among them. This leads to the use of EDM in many simple operations to avoid wear on conventional steel tools. It should be pointed out that the electrode and the workpiece never come in contact in EDM.

The EDM process is new only in its present advanced state. The U.S. Patent Office has records of the same phenomenun back to 1920. In its first form the electrical discharge milling machine was a rod attached to a vibrator and a block connected across an A. C. coil.

EDM was born in industry when someone used this gadget to remove broken taps from valve bodies as a salvage operation. The sharpened electrode and vibrator unit were held in the hand. Soon the company involved had several people doing this, as the salvaged parts were worth $200 a piece. Later two diodes were added to the circuit, signifying the realization that the process was essentially pulsing D. C.

The first major advancement can be credited to the Russians. They developed what is known as the Russian circuit, or the relaxation oscillator. This circuit allowed the full charge of a capacitor to pass across the gap after building up to a firing voltage. Once the capacitor was discharged, the arc was extinguished by a resistor. Note that no vibrator was used.

Present day circuits are similar to the Russian circuit, but with an important difference. Realizing that the amount of metal removal is proportional to the charge transferred across the gap, modern power supplies for the EDM machines are designed to pulse a square wave form across the gap. Comparing the two current versus time graphs, the area under the square wave is considerably greater than the area under the other. Since charge is equal to the product of current and time, it is proportional to the area under the curves. This illustrates clearly the advantage of the present day circuit.

This covers the power circuit fairly well, but there is another circuit which is equally important to good cutting action. It is the servo circuit. In order to get good detail for steel casting dies, EDM machines are run at a gap of one or two thousandths. This requires very accurate control of the servo mechanism and the gap spacing. There are several ways to measure gap spacing. The firing frequency at the tap varies from zero at large distances to the multivibrator frequency at short distances. Gap voltage drops as the distance decreases. Current will increase as the gap becomes smaller. All of these take place with the components of the power circuit held constant. The simplest way to control a servo is to measure the gap voltage and compare it to a fixed voltage, using the difference to operate a solenoid valve or an electric motor. One circuit in use measures frequency by placing a toroidal winding around the wire leading to the electrode and amplifying the voltage output. The servo must feed in as the workpiece is eaten away, and maintain this small gap without oscillating much, which would destroy cutting action.

A brief survey of the factors which affect the quality of the work done by EDM machines will shed some light on the direction of present design. Speed of machining is, of course, an important consideration. Machines up to 300 amperes have been designed and are being sold. Any increase in current will require more tubes, or higher voltage tubes, or both. Controlling a 300 ampere current at 20 kcps to 130 kcps poses difficult problems. Large circulation currents must be prevented and the arc must be shut off at each pulse. High frequencies are used because they give a better finish. The individual arcs deliver less charge and make a smaller divot in the workpiece. It follows that smaller amperages yield a better finish. When close work is required, the bulk of the metal is removed at high currents after which another electrode is used at lower amperes. Low voltage operation is also desirable, since the arc strikes neither as hard nor as far. This is somewhat limited by the quality of the servo. High frequencies, permitting good finishes at greater currents, is the goal, but there is a conflict in design requirements here.

While the EDM industry is operating quite successfully and profitable now. it is new and several problems are very much in existence and demand attention. At present frequencies, currents of 20 amperes cannot produce a finish better than 204 micro-inches. The dollars per ampere cost of the power supply is high. The power supply is complex and employs several fragile elements. Electrode materials seem to have individual maximum current limitations covering a wide range on a particular machine. Machining takes place at one minute area at any instant of time. Finally, the electrode wears during the operation, requiring its replacement several times for sharp detail on each workpiece. Each of these problems will be undergoing careful scrutiny during the coming years toward the achievement of a mature, stable industry.

Morals of Atomic Bomb

(*Continued from page* 21)

Radiation directly affects the genes; the one-celled, microscopic bodies which contain our personal characteristics and traits. That is, the genes are the basis of heredity. Through the genes our children will inherit a color of hair and eyes, sex, and general overall physical appearance. A gene is an extremely finely constituted object. It is very orderly in its life processes, and a mutation will spoil this order, and in a great majority of cases the mutation will prove to be detrimental. Many are lethal.

All that can be said about radiation is that there is a limit to the tolerable amount of radioactive material which can be safely deposited in the soil; and therefore there is a limit to the number of nuclear explosions that the human race can tolerate and survive. Hence, it is the duty of every policy maker the world over to see that such a limit is not exceeded.

LIBRARY NOTES

(*Continued from page* 18)

northeastern seaboard; instead of depicting simple uneducated people, this deals with a well-born, well-to-do society with long traditions behind it. But it deals with it in a way that reveals the continuity within diversity: through the lives of one family and their friends, he has taken that society apart, shown its frightening shams and shortcomings, and measured it against true human decency. The result is a novel in its very different way as powerful as anything he has done, and certain to stand as a major work in the Steinbeck canon.

Lewis Gannett says of this book, "The finest thing Steinbeck has written since "The Grapes of Wrath."

The Will Rogers Book, compiled by Paul M. Love

This book assembles, for the first time, 531 of Will's deathless remarks — many from personal letters, some from speeches and radio broadcasts, a few from his books, the majority from the daily columns he wrote for newspapers.

Translating Machine

(*Continued from page* 14)

translation can be attained, B'Hillel proposes an equally accurate, yet less-automatic method. He calls it "Commercial Partly Mechanized, High Quality Translation." In this method the output of the machine would be reviewed by a human "post-editor" who would be an experienced translator and thereby could recognize descrepancies in the machine translation.

Since June, 1957, the United States Air Force has had an experimental model of a machine translator developed by the International Business Machines Corporation in use translating the daily edition of *Pravda,* a publication of the Russian national news service. This model was translating Russian to English at the rate of thirty words per minute and seemed to be limited by the electric typewriter output.

The heart of this system is a rotating glass disc, the "photoscopic disc memory." A Russian dictionary of some 55,000 word stems, plus word endings, is arranged on about 700 almost miscroscopic concentric tracks in a band toward the edge of the disc. As the disc rotates at about 1400 r. p. m., a beam of light matches the Russian text to the Russian dictionary. The corresponding English words are then printed out automatically on the electric typewriter. If the translator finds a word in the text that is not in the dictionary, it prints this word in red for later addition to the disc memory. With this unit any word in the dictionary disc can be located by the machine in less than 1/300 of a second.

Sometime in November it is believed the Air Force will put into operation the most advanced unit yet devised for machine translation. It will consist of a print-reader which will scan and input the text at up to 100 words per minute, a translator, and a lexical-graphical output printer.

In this newest system, the Russian text is first photographed on 70 mm. film—that way all print, no matter what the original size, can be reduced to uniform dimensions. This film is then read on a matrix disc. Simultaneous imaging — comparing the film image being read with all the letters and numbers on the matrix disc—makes possible the rapid 100 words per minute reading rate.

Mergenthaler Linotype Co. in cooperation with I. B. M. has designed a machine which arranges layout of the translated text as well as illustrations. The operations in this process include justifying lines so that all columns have uniform margins, specifying type from 108 different sizes and styles, and juggling pictures so they do not overlap with type.

Consistent with its philosophy of simultaneously developing equipment and linguistics, the Air Force is already contracting for equipment to crack the next language barrier—Chinese. Mergenthaler Linotype is now working on a transcription machine for converting Chinese ideographs into electrical signals—9,000 characters have been mechanized.

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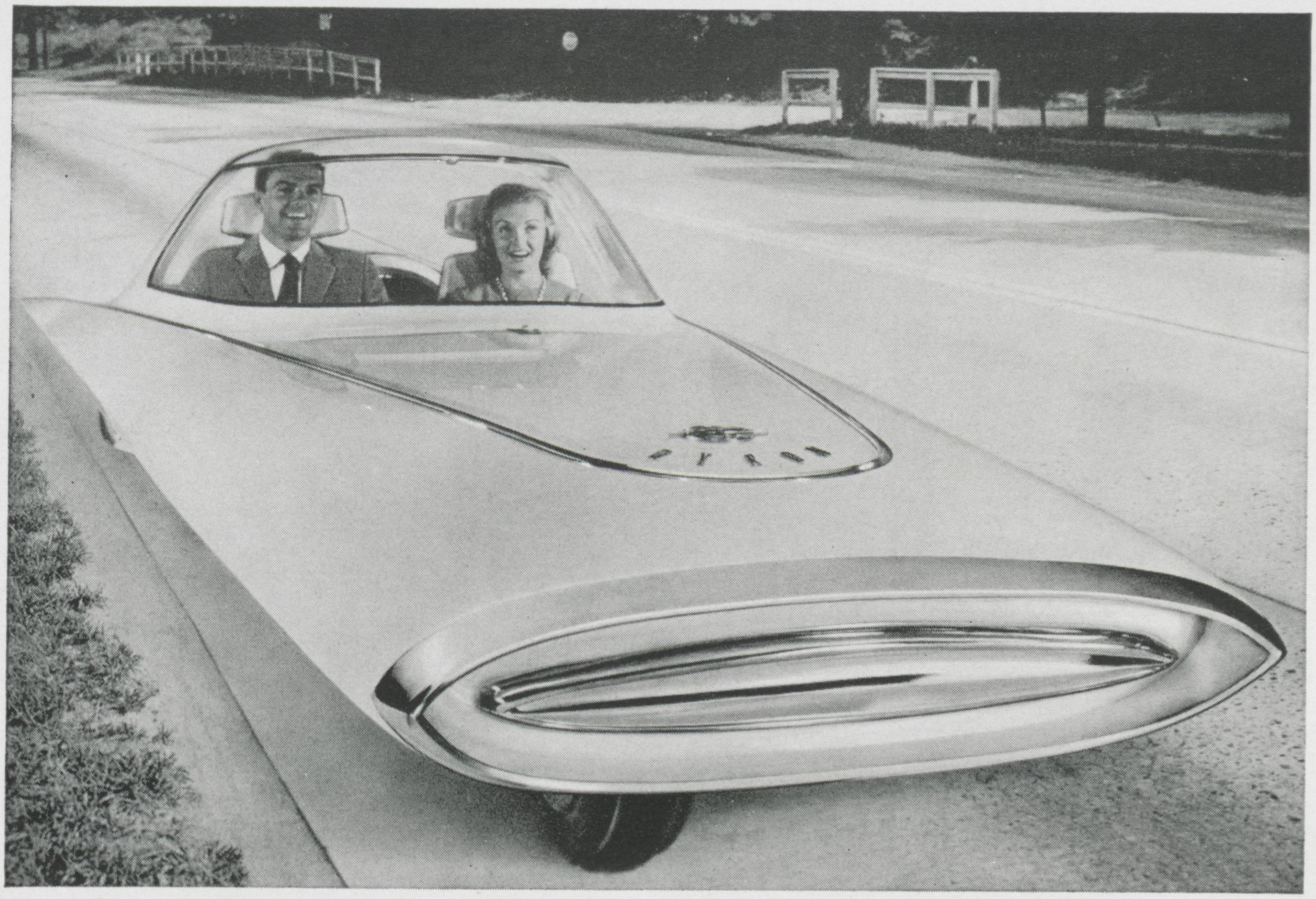
ADVERTISING INDEX



Gyron—dream car that drives itself. This two-wheeled vehicle of the future envisions automatic speed and steering control for relaxed "hands-off" driving. Designed by the advanced stylists of one of America's leading automotive companies, the delta-shaped Gyron would feature a computer that permits motorists to "program" their journey—distance, speed, arrival time—on a non-stop expressway. A gyroscope would stabilize the car in motion. Setting off the Gyron's sleek lines are parts coated with bright, corrosion-resistant nickel plating. The front bumper, exhaust ports, taillight bezel, control console, all get solid beauty-protection with this durable nickel coating system.

How Inco Nickel helps engineers make new designs possible and practical

The engineer is vitally concerned with design—inside and outside—whether it's an advanced new car or a nuclear-powered ship. With Nickel, or one of the many metals containing Nickel, he has a material that can meet the demands of a wide range of service conditions—providing an excellent choice for the equipment of today and the designs of the future.

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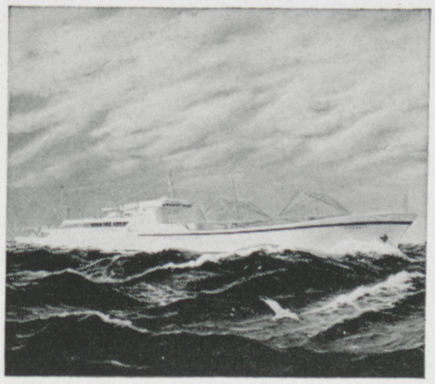
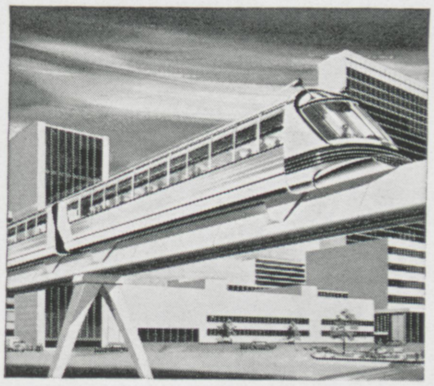


The Nuclear Ship Savannah is capable of sailing 350,000 nautical miles without refueling. Her uranium oxide fuel is packaged in tubes of Nickel Stainless Steel, more than 5,000 of them. Engineers specified 200,000 pounds of Nickel Stainless Steel for use in the ship's reactor to meet critical service demands.



Monorail "Airtrain"—a compact, high-speed transportation system that will be automatic, almost noiseless. Development is being explored by leading U. S. cities. Lightweight Monorail design demands strong weight-saving metals. Logical choice: Nickel alloys to take advantage of newest engineering concepts.

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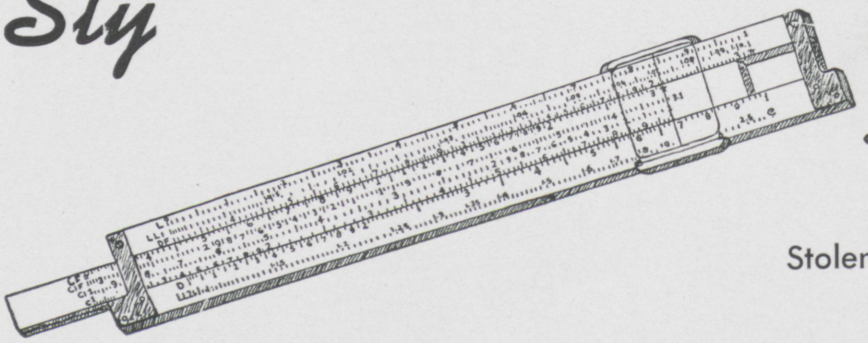
Sly  Droolings

Stolen by Rick Rapson, Junior Electrical

Larry: "Do you know what good clean fun is?"

Lou: "No, what good is it?"

* * *

She: "What's the matter? Don't you love me anymore?"

He: "Sure I do. I was just resting."

* * *

Second: "Well old man, I'm afraid you're licked now."

Boxer: (Gazing dizzily across to opposite corner) "Yeah, I shoulda got him in the first round when he was alone."

* * *

Two characters had been drinking merrily for sometime when one lost his grip on the floor.

"That's what I like about Slim," his companion remarked, "He's dependable—always knows when to stop."

* * *

A C.E. the other day was seen trying to calculate the fiber stress in the cross member of a Wheatstone Bridge.

As he felt his way around the lamp post, the overloaded chemical engineer muttered, "S'no use, I'm walled in."

* * *

Senior engineer: "We're coming to a tunnel. Are you afraid?"

Co-ed: "Not if you take that cigar out of your mouth."

* * *

The Salesman whose pants wear out before his shoes is making too many contacts in the same place.

* * *

Two men were knocking another: "To me," said one, "he's a pain in the neck."

"Funny," said the other, "I had a much lower opinion of him."

* * *

Thermometers: Something else graduated with degrees without having brains.

* * *

Scene: A lonely corner on a dark night.

A voice: Would the gentleman be so kind as to assist a poor hungry fellow who is out of work? I haven't a thing in the world besides this revolver.

* * *

A divinity student named Tweedle
Once wouldn't accept a degree.
It's tough enough being Tweedle,
Without being Tweedle, D.D.

* * *

Coed: "I'll stand on my head or bust."

P.E. Instructor: "Just stand on your head, we don't ask too much.

* * *

M.E.: "Is my face dirty, or is it my imagination?"

E.E.: "Your face is clean. I don't know about your imagination."

* * *

She was only an oculist's daughter . . . Two glasses and she made a spectacle of herself.

* * *

Fellow to blind date:

"I never believe in reincarnation —but what were you before you died."

* * *

"I'd like to buy a corset."

"What bust?"

"Nothing busted. It just wore out."

The waitress was wondering why the elder man was eating while his wife was staring out the window.

"Aren't you hungry?" asked the waitress.

"Sure am," was the reply, "I'm just waiting till Paw gets through with the teeth."

* * *

Blonde: "I'd like to see the captain of the ship."

Steward: "He's forward, Miss."

Blonde: "That's O.K., this is a pleasure trip."

* * *

I serve one purpose in this school
On which no man can frown.
I quietly sit in every class,
And keep the average down.

* * *

C.E.: "I'm glad I have a sense of humor. Every time I see something funny, I laugh and laugh."

E.E.: "I'll bet you have a hell of a time shaving."

* * *

Tourist: "Our waiter is either a fool or a comic."

Wife: "Be specific."

Tourist: "I ordered extract of beef and he brought me a glass of milk."

* * *

Many fond parents believe that 22 is a good age for a girl to get married, especially if she is 30.

* * *

He: "I had to come clear across the room to see you, so I want to kiss you."

She: "Gad, I'm glad you weren't in the next block."

Kodak beyond the snapshot...

(random notes)

A little x-ray news

More precious than rubies is confidence in the importance of what one does for a living. One thing we do for a living is to manufacture x-ray film. Unkind words are rarely spoken about society's need for x-ray film. Now we have news about x-ray film and need to make it seem important. Easy.

The first piece of news has it that Kodak x-ray film of high contrast and fine grain is now obtainable with emulsion on one side only. Ties in to the current push for great structural strength in small mass. Load-bearing members are now getting so thin that putative flaws on their radiographs have to be checked out with a microscope. Since a microscope can focus on only one side of the film at a time, it's better to have the other side blank. Simple, yes; trivial, no. Manufacturing and distribution problems on our scale are rarely trivial.

The second piece of news much exceeds the first in importance. You have been given estimates by various authorities of how much radiation you and your children can expect to soak up, barring disaster. You have been told how much to figure for medical and dental radiological examination over a lifetime. Meanwhile we have been quietly goofing up the statistics! We have been upping the response of the films. With the latest step, the same amount of examination requires half or a third as much radiation as before. Just privately rejoice a little at how the deal has been sweetened a bit for you, statistically.

To John!

We are not alone in polypropylene. Seven other large and reputable companies are known to be playing in the game against each other and us. All we players must be very brave, hide our nervousness, and raise our glasses high in a toast to the memory of Senator John Sherman, who believed in the great public good that comes of free and untrammeled competition.

(Other nations have ambitious polypropylene plans of their own and are outproducing the U.S. in polypropylene right now in the aggregate. The peoples of the earth had better start making their artifacts out of polypropylene—and fast!)

As the game gets under way, we hold certain strong cards. Our Tenite polypropylene

- Can be polymerized from propylene by two completely different processes of our own devising, both free and clear of the U.S. patents of others.
- Comes in many flow rates.
- Comes in the widest variety of reproducible colors.
- Is exceedingly well fortified by our own antioxidants against oxidative deterioration.
- Has "built-in hinge," i.e. tremendous fatigue resistance under flexure.
- Weathers very well when extruded in monofilament for webbing and cordage, because of our own ultraviolet inhibitors.
- Has high-enough softening temperature so that when it is extruded as sheet you can cook in it and yet on a yield basis it costs less than cellophane.

A familiar force

Here is a picture of the basic amplifier

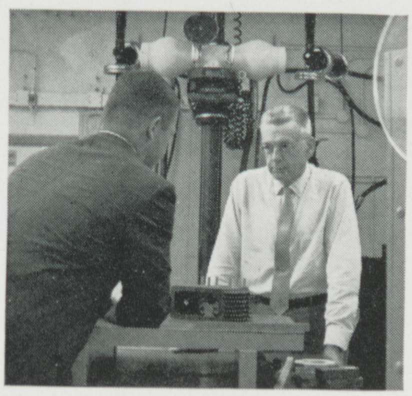
used in photography. This amplifier can provide a gain of 10^9. There is a genie in the bottle. Familiarity with him breeds not contempt but admiration.

Once upon a time, it was customary to summon the genie by retiring to a little darkroom and pouring him out of his bottle into a white enameled tray. No longer does he demand such ceremonious treatment.

Our wet friend now works unseen inside a box, responding to push buttons. His very fluidity has been replaced by a kind of viscosity which need little concern the client, who merely inserts a probe into a disposable cartridge. When the work is done, the genie uses his private exit to the sewer.

This newly announced Eastman Viscomat Processor does 36 feet of 16mm film per minute. Not entirely by coincidence, this happens to be the rate at which film runs through a projector. The film spends about one minute in the processor. It emerges processed to standard commercial quality, ready to project. It can be stopped for seconds or days and restarted without loss of quality. Were we not so touchy about processing quality, the gadget would have been on the market long before.

Note: Whether you work for us or not, photography in some form will probably have a part in your work as years go on. Now or later, feel free to ask for Kodak literature or help on anything photographic.



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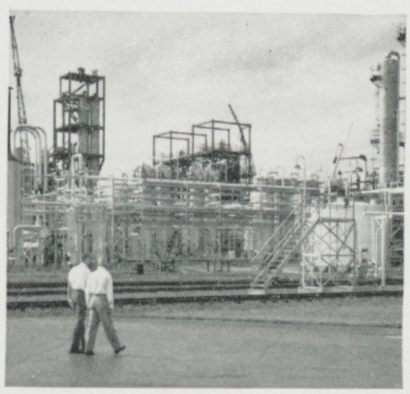

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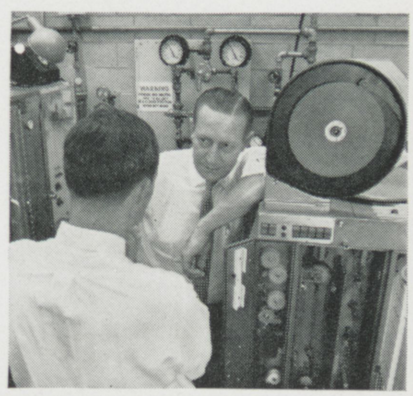

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