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JANUARY
1956

The Wisconsin
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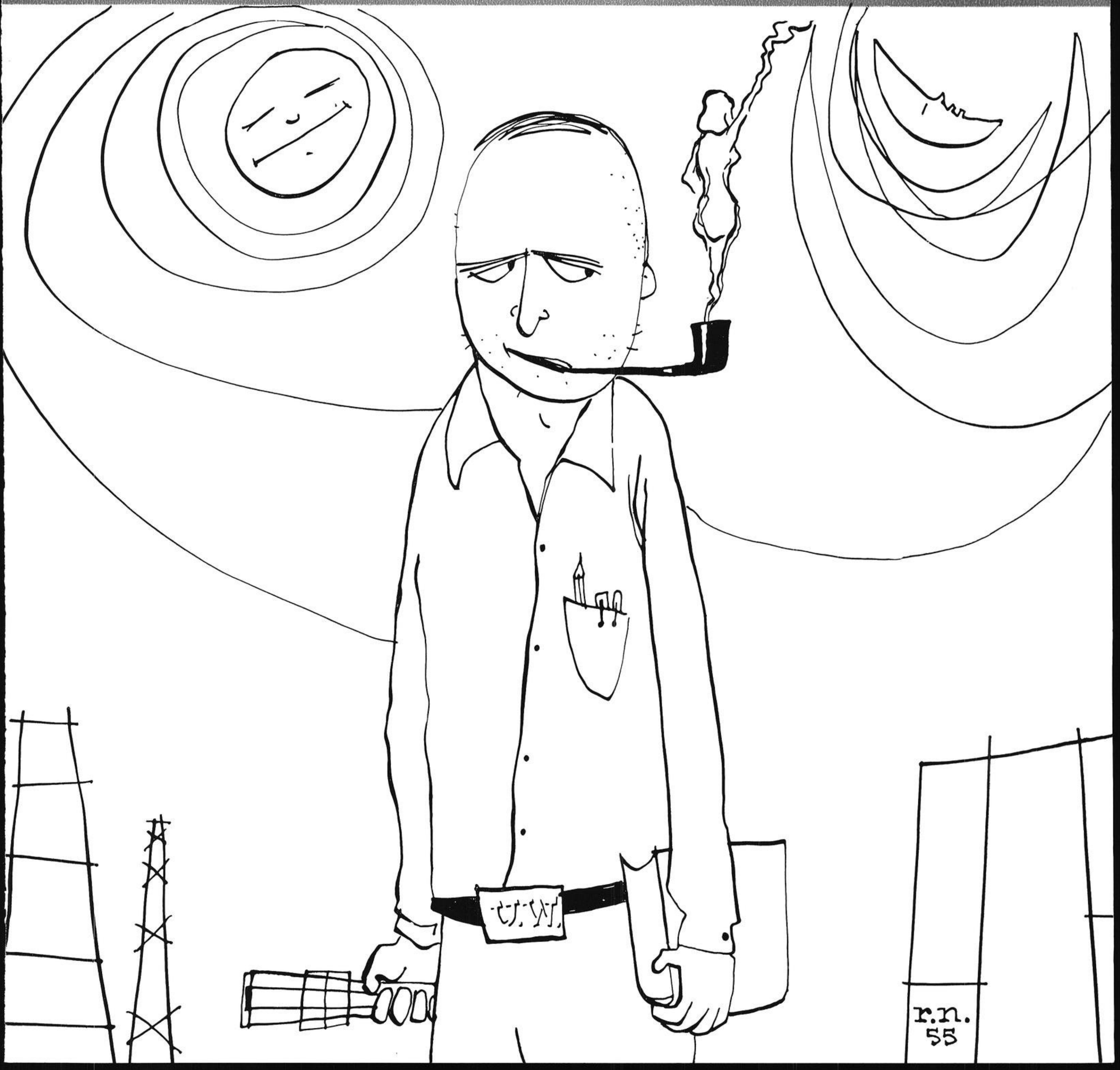
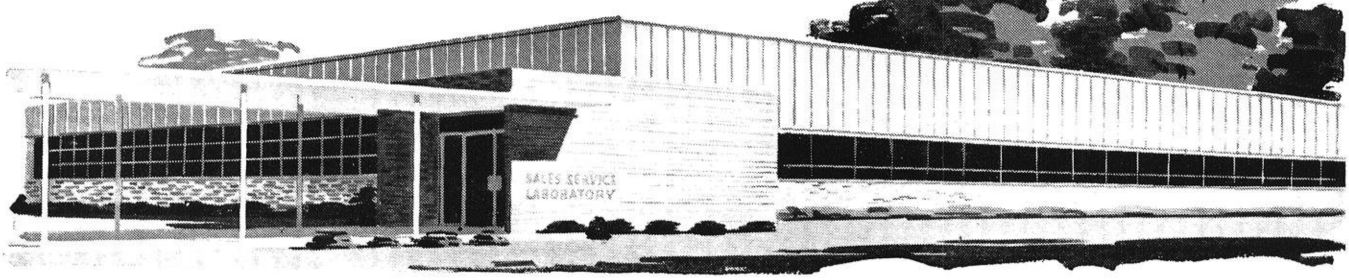
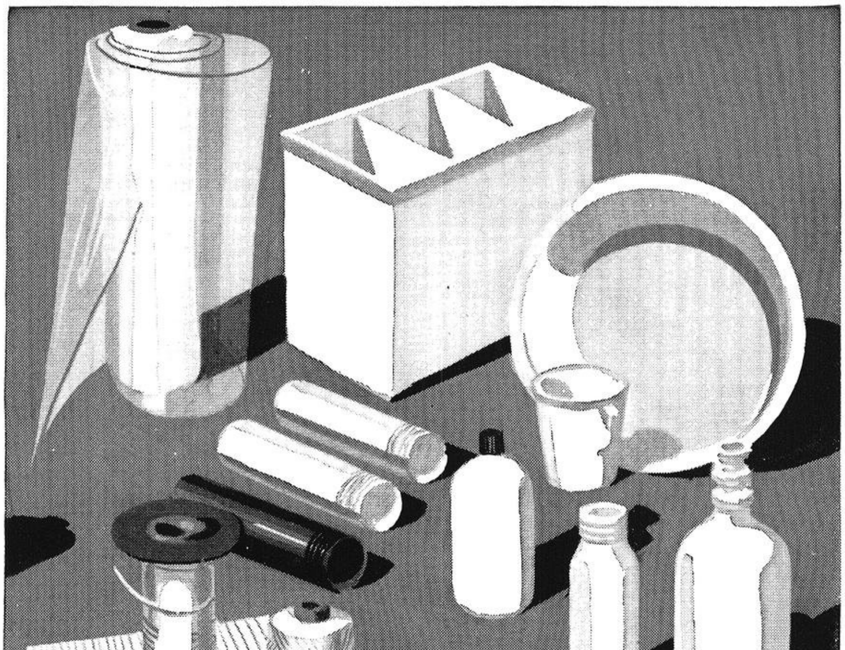


New laboratory, under construction at Phillips Research Center, Bartlesville, Oklahoma, will be concerned with research on plastics in general and MARLEX* in particular. MARLEX, recently developed by Phillips, has been called "the greatest advance in plastics since the first commercial development of polyethylene in 1939."



Opportunities in Petrochemistry



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WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

Volume 60 **JANUARY, 1956** **Number 4**

Articles

Features

Cover

Use your own imagination, the subject of the drawing is evidently using his.

Frontispiece

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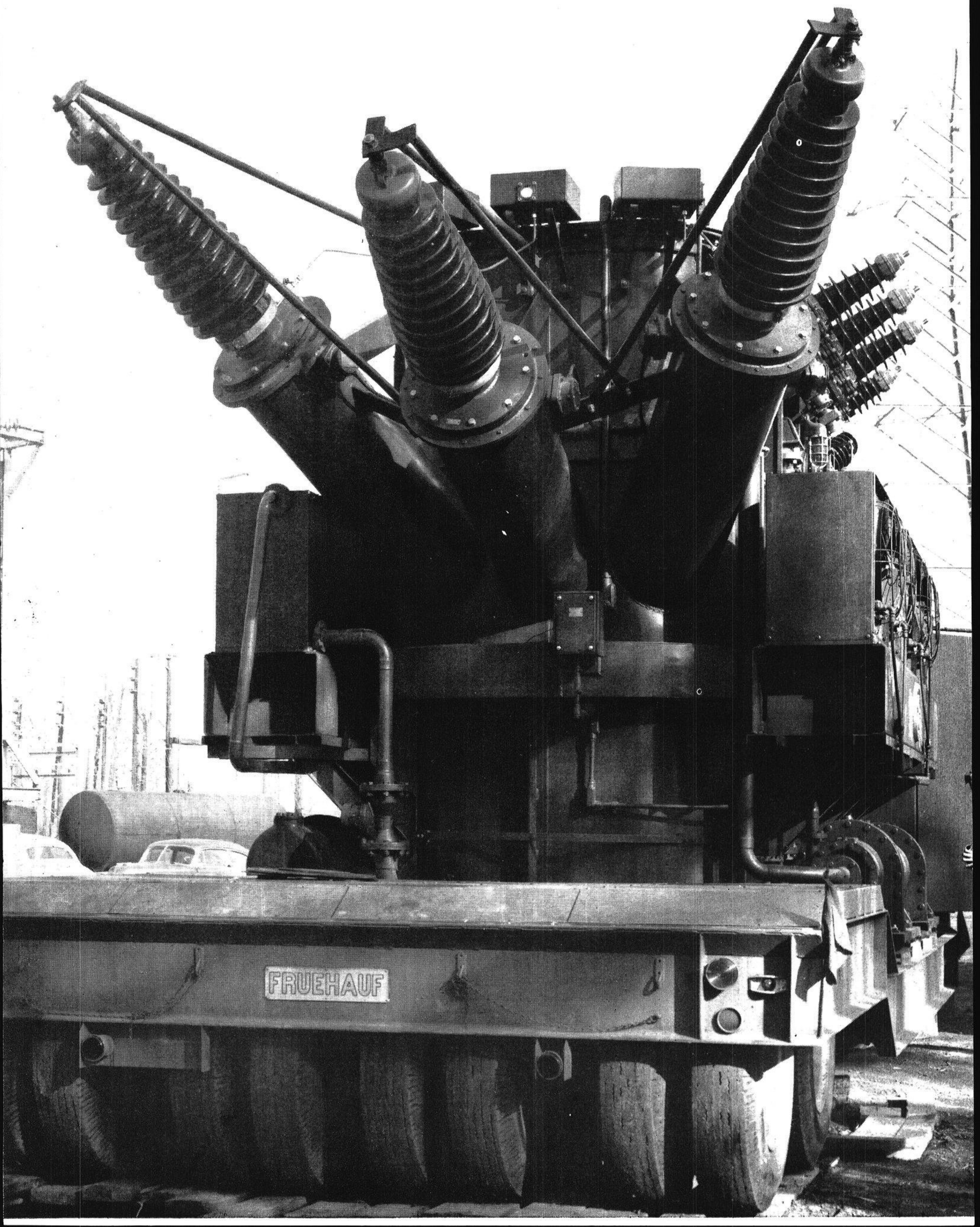

FRUEHAUF

IN THIS ISSUE . . .

by Sneedly (jack-of-all-trades), bs'60

JIM SHILLING, e'58

"Report on Geneva"

The world is becoming increasingly aware of the impact that peacetime atomic energy will have on our everyday lives, as witnessed by Jim Schilling's article, "Report on Geneva" Here you'll find the latest developments from all over the world in the atomic energy field as they were given at the Geneva Conference in Switzerland this summer. The fields of nuclear chemistry, biology, and reactors are covered, with special emphasis on the production of practical electricity from atomic reactors.

Jim, who is a sophomore in electrical engineering, hails from Wausau and is a new addition to the story staff of the Wisconsin Engineer. His qualifications include membership in the AIEE and receiving the freshman engineering award from Tau Beta Pi.

Being especially interested in the possibilities of using atomic energy to produce electric power, Jim hopes to work in this field after graduation and the Army have been completed.

RONALD DOUGLAS, ch'56

"Super Deepfreeze"

Ronald Douglas – jack of all trades, master at most. This may sound like a drastic exaggeration but to those of you who know him it is but a statement of fact. In his years here at Wisconsin, Ron has held and worked successfully at several jobs, the best one being his studies. He is ranked second in his senior Chemical Engineering Class and is a member of Tau Beta Pi. Right now Ron's extra curricular work includes being co-chairman of the Industrial Exhibits Committee for the 1956 Engineering Exposition, which is to be held April 20–22. He says the show will be great and not to miss it.

Ron's article, "Wisconsin's New Super Deep Freeze", concerns itself with a new experimental refrigeration device that was recently built here on the engineering campus. He describes his modern "ice box" with ability and with good flow diagrams. It will be used for testing mechanical and electrical devices at temperatures down to –80° F. I think you will find this a very "cool" article.

DONALD KIOSEFF, m'56

"It's About Time . . ."

Dick Kioseff wrote an article about the St. Lawrence Seaway. And it was good. So we asked him if we could use it, and he said we could. So we are. There is some history—interesting, pertinent history—which focuses the article and brings it into perspective. There are no politics. The project is considered from the engineering and economic point of view. In other words, the article is the type of writing which clearly presents the potential role of the engineer in our times.

The author is a senior in Mechanical Engineering and is from Waukesha. His primary interest is in power engineering—a field in which he has gained some experience while working during the summer for the Falk Corporation of Milwaukee.

LARRY BARR, m'57

"Progress—Spaceward"

"Progress—Spaceward" is a story that Larry helped to write with mixed emotions. He has a standing bet with co-author, Orville Evans, that man will not reach the moon by 1985, but the story is proof positive of his interest along "spaceways", nonetheless.

Larry is a junior mechanical engineer with activities including Phi Eta Sigma, Pi Tau Sigma, Tau Beta Pi, and the Wisconsin Engineer. He is also publicity chairman for the 1956 Engineering Exposition. But, with all that to keep him interested, he still expresses a desire to be in sunny Arizona again. His hometown is Tucson, Arizona so it is a natural desire.

He is married, has two children and spent four years in the Air Force. His ambition, at present, is to invent a machine that will do the work of an engineer, then build one and put it to work.

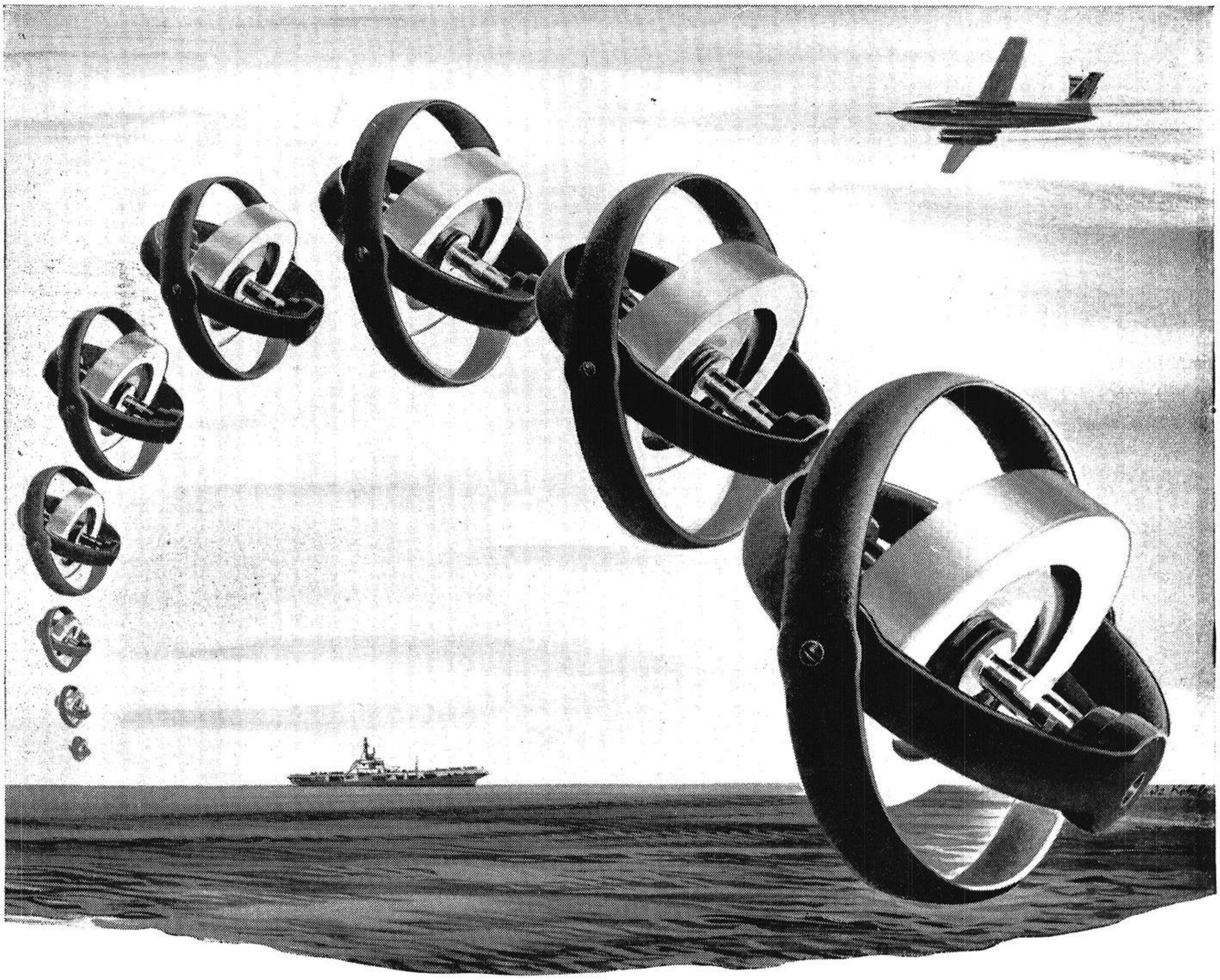
ORVILLE EVANS, e'57

"Progress—Spaceward"

Here is a man well-suited to co-write an article on space. Orv is a "space-nut" of long standing and an avid science-fiction fan. The result is, of course, this months story, "Progress—Spaceward".

Orville calls Monroe, Wisconsin his hometown although he has spent most of his time away from it. In the last 7 years four were spent in the Air Force and three at UW.

He is now a last semester junior, but is taking this semester off to earn some of the green stuff. He is a member of Phi Eta Sigma and Eta Kappa Nu which proves ability at the books in addition to other activities. Orv hopes to become an electronics designer.



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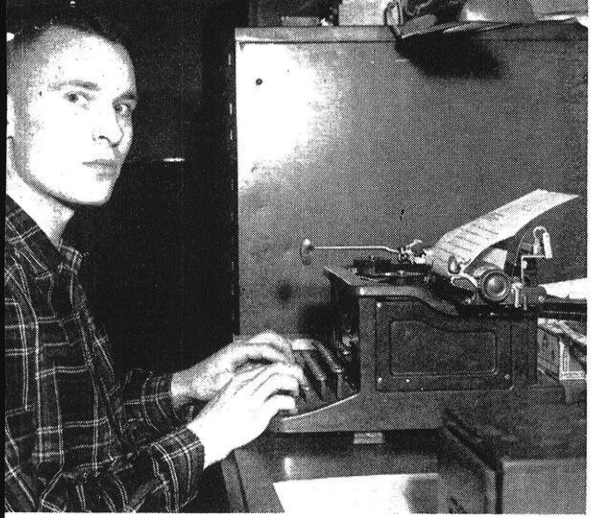


One Man's Opinion . . .

Our engineering curricula aren't too good to be exempt from criticism

"Fools rush in where wise men fear to tread." Confident that I can meet the appropriate qualification, I will tread for a few paragraphs on our engineering curriculum.

The United States enjoys a standard of living unprecedented in all history, an abundance which seems a myth to many of the peoples of the world. The engineering profession rightfully claims a large share of credit for this achievement. This you know.

The engineers responsible for this progress are the product of an educational system which is the envy of the world. The University of Wisconsin rates high among the engineering colleges in the country. Presumably, this you also know.

Therefore, your curriculum is just about perfect, isn't it, You guessed it . . . I don't think so. I'm most familiar with the chemical engineering curriculum, and will use it to illustrate my comments. From my conversations with engineers in other branches, it seems that the same observations could apply in some degree to all schools of engineering.

A Ch.E. taking the prescribed (and is it ever prescribed!) curriculum has exactly four unrestricted elective credits to fritter away in the course of four years, in addition to his history requirement. Perhaps these are sufficient to cover the fields of economics, literature, philosophy, political science, industrial management, languages and technical electives. In that case, I have organized my studies poorly, because I can't stretch those four credits far enough. On the other hand, I feel I have quite a sound background in sheet metal work, and I will match my technique in reading steam engine indicator cards with any man. All engineering drawing students know that to find the true length of a line given only its edgewise and askance projections is to feel a jingle of professional development. These skills, plus a well thumbed handbook, should be enough to guide and fledgling engineer. Guide him, that is, to a career of drudgery, or perhaps as a sophomore into a different college course.

The designer who concentrates on drawing a perfectly symmetrical screw thread is likely to overlook the fact that a staple or some glue might serve better. Similarly, a student who has obediently memorized the detailed procedure of a problem solution is prone to forget the assumptions involved and the limitations of the method. When the student has effectively no choice of students within his field, and when each course has been resolved into a series of standard problems and reports, it's hard to find the basis for any original thought.

Students in many high schools are allowed an almost free choice of subjects. The size of the freshman engineering class indicates that these students were willing to work harder than necessary in high school to acquire the necessary background. In college, many of these students have assumed the responsibility of raising a family and of working their way through school. In the choice of their college courses, however, it has been arbitrarily decided that they are too immature to be trusted with the responsibility. Except, of course, for four credits when they become worldly seniors. Perhaps you sense a paradox here, and hardly a subtle one. I can't believe that a serious student would duck a tough but necessary course if given the chance. I do believe that students are now required to take courses that they know will be meaningless in their chosen work.

And so to the point of these not very profound observations. I propose that engineering students be allowed to make a free choice of subjects after their sophomore year, and that the subject matter of the first two years be revised. In this way, advisors would actually be able to advise students in the light of the student's interests. Students would have the incentive of studying courses they had chosen as being pertinent to their goals after graduation. Among these courses might well be some requiring imagination and perspective, and possibly no knowledge of cookbook methods.

The *Wisconsin Engineer* would be glad to receive any comments on this proposal.

—J. B.

Progress . . . Spaceward

SOME OF THE ASPECTS AND IMPLICATIONS OF CONSTRUCTING THE RECENTLY ANNOUNCED MAN-MADE EARTH SATELLITE

by Larry Barr, m'57 and Orville Evans, e'58

Recent world-wide press releases announced a project whose aim is to place a miniature, man-made satellite in orbit around the earth. Twentieth-century Americans, having witnessed the evolution of radio, television and the transistor, the jet airplane and V–2 rocket, the atomic bomb and atomic powered submarine, seem to have absorbed this latest bit of scientific information with stoic indifference. Nevertheless, the carrying out of this project will be a fascinating and difficut problem. It is some of the implications and aspects of this problem that we will examine here.

In order for a satellite to stay in orbit, it must obey the law:

$$F = mrw^2 = mg = \frac{mv^2}{r}$$

where **F** can be considered the force that keeps it in orbit, m is its mass, **r** the radius of orbit and w the speed of rotation, which **v** as the actual velocity in mph. From this, we see that m would be constant after the satellite is built, and would not affect the velocity, but **r** and **w** are still variable. The first satellite will propably be about 250 miles up, since that altitude will enable researchers to determine presently unknown cosmic ray effects and upper atmospheric conditions. Higher altitudes would be much harder to attain and are not justified at present because of lack of information at lower levels. At 250 miles the satellite is well within the atmosphere which has been estimated to extend 60,000 miles, though it is quite tenuous at even 250 miles. The result of this is that air friction will gradually slow the speed of rotation causing the satallite to spiral back to earth. In the meantime, however, sufficient data will have been transmitted back to earth so that satellite will have served its purpose. A later satellite would have an orbital radius at a distance where air density is almost negligible.

Assuming the satellite is to be placed at an altitude of 250 miles, the velocity necessary to hold the satellite in a stable orbit against the force of gravity is about 18,000 mph. Let us now consider the means required to attain this speed.

At present, the only practical means of propulsion capable of placing a satelline in its orbit is the chemically-fueled rocket because it does not depend on atmospheric oxygen for combustion. Such a rocket is self-contained and will reach high velocities. Proper design and use of multiple stages will result in the required velocity, althought numerous problems, remain to be solved. Before considering these problems, however, let's look at basic rocket theory.

The rocket principle is simple and is based on Newton's 3rd law of action and reaction. A demonstration of this would be to stand in a small boat on a lake and then jump off. The boat goes one way, you go to other. If you did that in space, the boat would go just as far as you did, provided your respective masses were equal, showing that your action equals the boat's reaction. A rocket is similar, but here the action is from the gases escaping from the rear and the reaction is the thrust on the rocket. (Fig. 1.) Note that nothing else is needed and so a rocket works as well in a vacuum as in the atmosphere. In fact, a rocket is about 15% more efficient in a vacuum because air friction is no longer present. The usual arrangement for a liquid fuel rocket is to have one tank of oxidizer and one tank of combustible feeding into a combustion chamber. (Fig. 2) Burning of the fuel is very rapid, but the thrust obtained is great and, therefore, acceleration is high enough to result in a high velocity. The German V–2 burns out in about 60 seconds, during which it climbs 20 miles, but it coasts upward over 80 miles in addition, which gives some idea of the acceleration involved.

An often overlooked feature of a rocket is that it can actually travel forward faster than the rearward velocity of its exhaust gases. This may not seen apparent at first but let's go back to the rowboat analogy. If you and the rowboat have equal masses and you jump off with a certain velocity, the rowboat will move away at the same velocity. Now suppose a friend was with you in the boat. Then you jump off. You will give the

(continued on next page)

FIG. 1

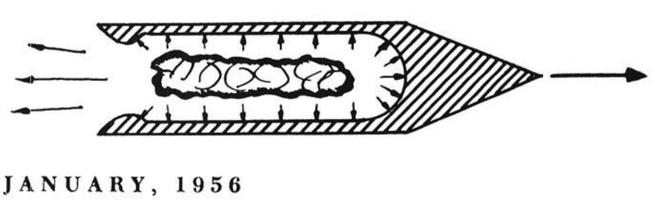
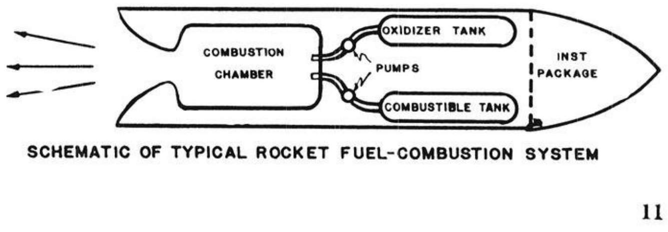
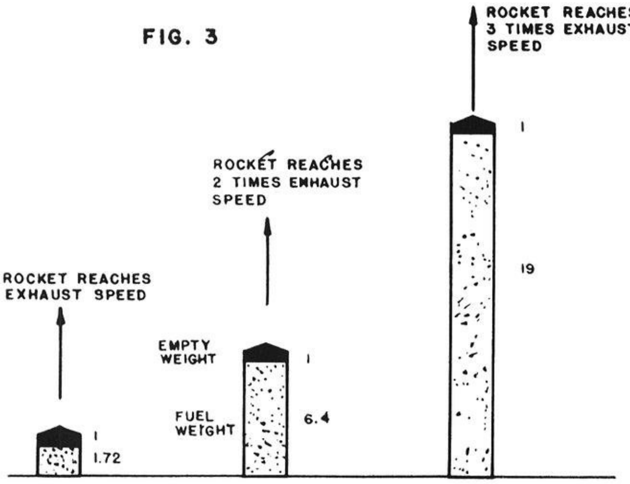


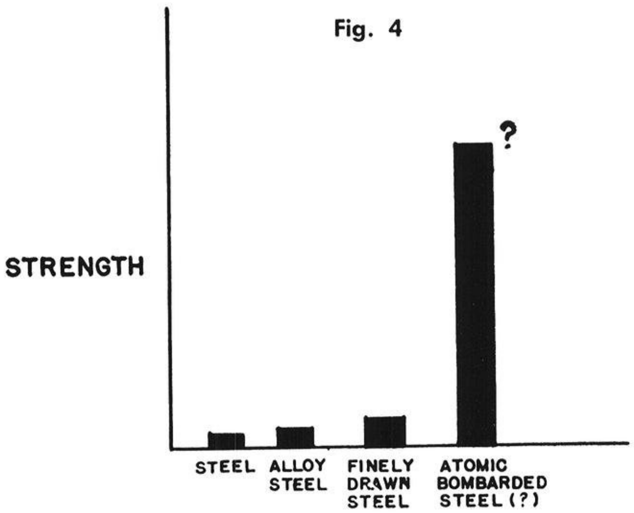
FIG. 2



SCHEMATIC OF TYPICAL ROCKET FUEL-COMBUSTION SYSTEM



MASS-FUEL RATIO EFFECT



boat and your friend a velocity, but it will be less than yours, due to the added mass of your friend. Then your friend jumps off with the boat still moving. He will give the boat an additional push, and if you get enough friends in the boat jumping off in succession the boat will eventually be traveling forward faster than the rearward speed of those jumping off. This comparison of the mass of the boat to the mass of the friends is known as the mass-fuel ratio in rocket terminology. This ratio compares the mass of the fuel used to push the rocket to the mass of rocket. Mathematics will tell you that a mass-fuel ratio of 1.72 will give the rocket a velocity equal to its exhaust velocity while a ratio equal to 19 will yield 3 times exhaust velocity while a ratio equal to 19 will yield 3 times exhaust velocity. (See Figure 3) This will prove helpful in reaching our required velocity, but by itself, is not enough because present day engineering cannot practically accomplish a ratio over about 5 or 6.

Present liquid fuels will give exhaust speeds of over 5,000 mph. Combining this speed with a high mass-fuel ratio results in a higher velocity, but still less than we need.

Most present day rockets are single stage, that is, one rocket, one fuel charge, and one final velocity. A two-stage or two-step rocket has been built and fired, however. An American rocket, the WAC Corporal, was mounted on the nose of a German V–2 rocket. The V–2 was fired at round level and pushed the WAC Corporal to about 100 miles altitude where the "Corporal" was fired and completed the second step. It was this coming anything a single stage rocket had been able to do. bination that set the 250-mile altitude record, surpass-

We can be more ambitious and use a 3-step rocket. With this we can certainly attain the required attitude. A 4-step rocket might be considered, but the size and cost of these things increases rapidly. To carry a one-ton payload to the final possible velocity, the starting weight would go something like this: 1-step, 20 tons, 2-step, 400 tons, 3-step, 8000 tons, and so on. Of course, the final velocity increases, but we do not need 4-step final speed, nor do we want to attempt building an 8000 ton rocket. To place a 100 lb. payload in orbit, using a multiple stage pusher rocket, the weight of fuel required just to push the payload, neglecting rocket weight and maintaining a fuel-mass ratio of 6, would be something like this.

1st stage : 700 lbs.
2nd stage : = 5 tons
3rd stage : = 35 tons
4th stage : = 245 tons

A three-stage rocket will do the job, provided it is designed properly, but here is where things begin to look less rosy. Certainly it can be done very nicely in theory, but in actuality our troubles multiply. Look at what our rocket pusher has to do. Starting at ground level, it pushes the entire weight up to some altitude, drops the first stage hull, fires the second stage, continues pushing, drops the second stage, and finally reaches the required altitude with enough velocity to maintain an orbit. Actually it would go higher than the required altitude, picking up orbital speed on the way back, (as shown in Figure 5.)

At some point along the way, the rocket exceeded the speed of sound, causing severe vibration, not to mention vibrational stresses caused by the engine. Also, during most of the trip, the entire rocket has been subjected to a push powerful enough to rip most structures completely apart. Then, too, thermal stresses are not insignificant since the temperature within the rocket might vary from–300° F of the liquid oxygen to over 5000° F in the exhaust gases. Quite a gadget we plan to build! None of the experts say it cannot be done, but they do list a number of unsolved problems that we can look at. Most of these problems must and will be solved before the first satellite is launched, but they are certainly not "cut and dried" at present.

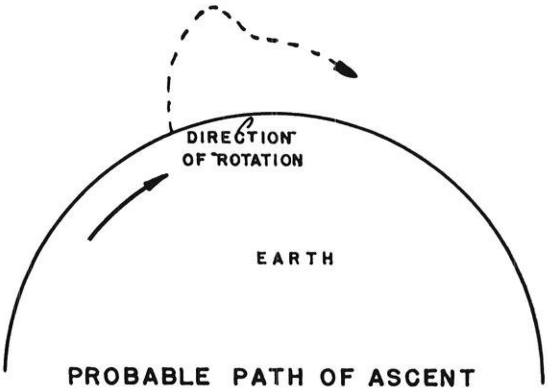
First and foremost is the fuel situation. Present fuels will do, if necessary, but a better fuel is certainly desirable. Common fuels now are combinations of liquid oxygen, hydrogen peroxide, hydrazine, alcohol, analine, and fuming nitric acid. There are other chemical components possible, but in many cases, the problem is two-fold. First the fuel has to be efficient in that it imparts high velocity to the exhaust gases, and second it must be stable. For example, liquid oxygen combined with liquid hydrogen makes one of the most efficient fuels, but the troubles involved in handling them due to low temperatures & rapid evaporation makes their use at present unlikely. Liquid oxygen is used as an oxidizer in some rockets, but the loss from evaporation requires that the rocket be fired shortly after fueling. Even then, losses are great. Furthermore, chemical fuels in general are limited to an estimated exhaust velocity of 10,000 mph, which sounds high at the present but will eventually be inadequate. Atomic power may someday be the answer, although it is of little help at this time.

Relating to high temperature exhaust gases, there is a need for better high temperature materials that can take the heat without losing strength. Right now the tail section of a rocket tends to disintegrate during flight causing navigational instability and setting up severe vibration throughout the entire structure. Vibrations of this type as well as those caused by passing the sound barrier can be very damaging.

Aerodynamic heating is another trouble spot. After rocket speed exceeds Mach 4 (four times speed of sound), the friction of air passing the rocket causes high surface temperatures. If aluminum is used for the outer skin, and at present it would be, this could be disastrous because aluminum softens at relatively low temperatures. In fact, if a single-stage rocket could be built to attain "moon-bound" velocity, it would start at about 7 miles per second close to the ground and would burn like a meteor before it cleared the atmosphere. This can be avoided by using multiple stages, which reduces the need for high initial velocity, but the heating effect is still a problem, since it is a slow rocket that will not exceed Mach 4. It has been proposed that aerodynamic heating be used to vaporize and heat liquid or solid gases, having vaporization temperatures below the surface temperature of the rocket. The gases might then be collected in a pressure chamber and fed through nozzles out the rear of the rocket in the usual manner.

In addition to a temperature resistant material, a strong material is needed. Rockets are subjected to two types of loading; static and dynamic, and designing for one is different than designing for the other. A statically strong structure is not hard to build, but to make it lightweight and dynamically strong as well is a real problem and requires a very strong material. It is somewhat like building a lightweight house that can be turned over without ripping apart.

Steel and steel alloys are strong, but rather heavy. Aluminum and magnesium are light, but not strong enough. A solution to this may eventually come from atomic research, where work is being done on the bombardment of metals with sub-atomic particles in the attempt to make them more dense. If this can be done successfully, a metal stronger than we can imagine may result. A graphic comparison of what may be achieved to the strongest metals now available is shown in Figure 4 (diagram). With a material like that, it isn't hard to imagine a solution to the structural problem.



PROBABLE PATH OF ASCENT

Fig. 5

Even after the rocket is built, many headaches remain for the engineer. Navigational stability is one. It is very easy for a rocket to get off course, and at the speeds involved, any deviation is serious. In recent American rockets, a radio-controlled fuel shut-off device is built into the rocket to enable technicians on the ground to cut power thrust in case of erratic flight. To appreciate the necessity for this and the problems involved try balancing a long pencil on end on the end of your finger and pushing it rapidly to the ceiling. The rocket designer has an even tougher problem, and he has to solve it the first time.

Gyroscopic stabilizing is the answer here, but there are limitations in that the gyro and associated equipment must be as small as possible. This means the rocket must be dynamically balanced before flight. Gyro stabilizers will probably be operated by compressed air acting on a turbine assembly attached to the gyro shaft. The inertia of the spinning gyro will tend to cancel out any outside disturbances on the rocket and keep it on course. Since the gyro must be small, it can only be effective if it is used to overcome these outside effects and not for correcting flaws in balancing.

If by now you are thinking that building a successful rocket pusher is next to impossible, you have given up too soon, and besides, we have only covered the general problems. Rocket engineering is indeed a challenge to the ingenuity, but if every problem was already solved, who would need engineers? A space station rocket can and will be built. We have considered only the means of getting it into orbit so far, now what will it do when it gets there?

The purpose of this first satellite will be to relay information on such subjects as pressures, tempera-

(Continued on page 60)

REPORT ON GENEVA

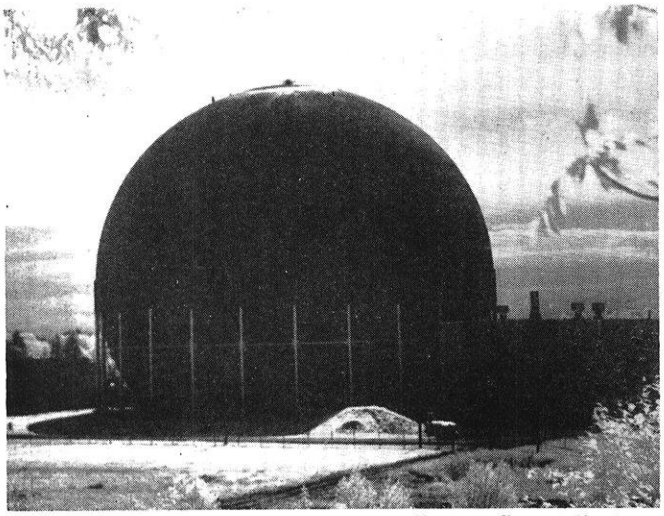
The 70-Nation Conference on Atomic Energy

by Jim Schilling, e'58

Near the Palais des Nations, in Geneva, Switzerland, there now stands a small chalet that houses a "swimming pool" reactor. Over the swimming pool itself are suspended the control rods that extend downward through 20 feet of clear water to the reactor core. When the reactor is in operation a hard blue glow appears in the water around the aluminum plates that house 6 kilograms of fissionable uranium–235.

It is this same hard blue glow that was seen by more than 1,200 delegates from 72 countries in August of this year. At that time Geneva played host to the International Conference on the Peaceful Uses of Atomic Energy, the largest meeting ever held on nuclear power. During a 2-week period 474 technical papers were given orally and a total of 1,125 abstracts were included in the published record of the conference. Here, the best technical minds of countries all over the world expressed the latest developments in the remarkable field of atomic energy.

At the beginning of the conference, all of the time was taken up by discussion of topics that held broad general interest. Descriptions were given of the U.S.S.R. 5,000 kilowatt power station reactor near Moscow, and of the U.S. boiling-water reactor in Idaho. These are the first large station reactors ever built to produce useful amounts of electricity, and so are milestones in the atomic field. Also brought out in this general session were the U. S. prices for nuclear energy materials. Uranium that has a fissionable U–235 content of 20% was priced at $11,000 per pound and heavy water had the price tag of $28 per pound. But these general discussions only occurred during the first 3 days of the conference, and then the delegates divided into three different technical sessions. These sessions were the real essence of the International Conference, the first session concentrating on chemistry and technology, the second on biology and radioisotopes and the third being concerned with the reactors and physics of atomic energy.



—Courtesy General Electric

This 225-foot sphere of the West Milton, New York atomic power plant houses a prototype submarine reactor that distributes commercial atomic-electric power to the surrounding communities.

The first technical session, dealing with advances in chemical and metallurgical technology, brought out reports on studies of new metals that may allow small as well as large nuclear reactors to be built. At present, because engineers have only limited materials, they can build giant reactors that will develop economic electricity, but a smaller power plant is an impossibility unless uranium with a high percentage of U–235 is used. Since U–235 is very expensive, as long as present techniques are employed, the small economical reactor is not probable. However, in the countries where reactors are really needed, in backward and poorly developed nations, it is just this small reactor that would be suitable. Therefore the chemical session spent much of its time dealing with special materials that would allow reactors of the 10,000 to 20,000 kilowatt size to be built, as well as the giant 100,000 kilowatt plants.

At present, graphite, which is used as a moderator, has the disadvantage of burning away when exposed to air, and it also has to be prepared with a high degree of purity. In view of this, two U.S. men at the chemical session reported on how pure graphite can be made from substances like petroleum coke, and it was announced that work is being done in the development of a coating for the graphite that will prevent its exposure to air, and resulting destruction. Zirconium also came in for its share of attention by the chemists and metallurgists. Zirconium, because it is corrosion-resistant and non-neutron absorbing is prized for reactors, but in its ore form it is combined with the metal hafnium. And hafnium is very neutron-absorbant, Since these two metals are alike chemically it is a difficult process to separate the two. However, the conference delegates proposed a solvent-extrating method that can obtain zirconium with only one hundreth of 1 per cent hafnium content.

Apart from the accessory materials of a reactor, the reactor fuel itself was discussed much by the chemical

—Courtesy General Electric

At the Geneva conference, where 70 nations gathered, commercial exhibits of industries from all over the world illustrated almost every aspect of the peaceful use of atomic energy.

men. At present, the common fissionable fuel is composed of rods of uranium metal approximately one foot long, each rod being enclosed in an aluminum or magnesium case. These cases, or "cans" as they are called, stop the outside coolant from corroding the uranium. One U. S. report revealed, however, that a new fuel element has been developed to replace this classical type. The new can has alternating curved plates of uranium and aluminum that are piled up sandwich fashion, until an elongated, square shape is obtained. This new element is used in all modern U.S. research reactors, and is presently in the swimming-pool reactor that the U.S. exhibited at the conference.

Another aspect of the fuel element problem was brought out in a report by J. P. Howe of the United States. Any reactor, if it is to be useful, must have fuel elements that will not break down when in the reactor for relatively long times. And Howe brought up current ideas on the problem that are being developed in the U.S. He mentioned that uranium oxide can be alloyed with aluminum or zirconium to provide a stable can for the fissionable fuel, and he also mentioned plutonium as a fuel prospect. However, because of its radioactivity, plutonium still presents great problems before it can be utilized. All refining, fabrication, and handling would have to take place in completely encased equipment.

The chemical sessions on processing also occupied much of the delegates' time. The ion-exchange processing methods were brought up as a good way of purifying reactor fuels. The principal of the ion-exchange method is well known in industry. Metals usually are positively ionized in solution, but heavy metals give negative ions. And when an amazing substance called an "anion" exchange resin is mixed with the metal ore solution, it has the ability to hold onto one metal and no others. Different anion-exchange resins, of course, combine with different metals, and resins have been developed that can separate uranium from iron, chromium, or nickel, and some can divide U-233 from thorium and plutonium from uranium. Much of this basic anion-exchange work was done by K. A. Kraus of the U. S., and while at the conference Kraus told how this method is gaining wide use in reactor fuel purification.

Also occupying some of the chemical sessions were the occurrence and treatment of uranium and thorium ores. As a result it was revealed that there is a large reserve of uranium in gold ores, and in shales and phosphoric rocks. Usually these sources have only about 1 per cent uranium content, but more than a million tons of known uranium deposits were reported by seven countries. Harrison of the U.S. said that even

(Continued on next page)

Geneva Report

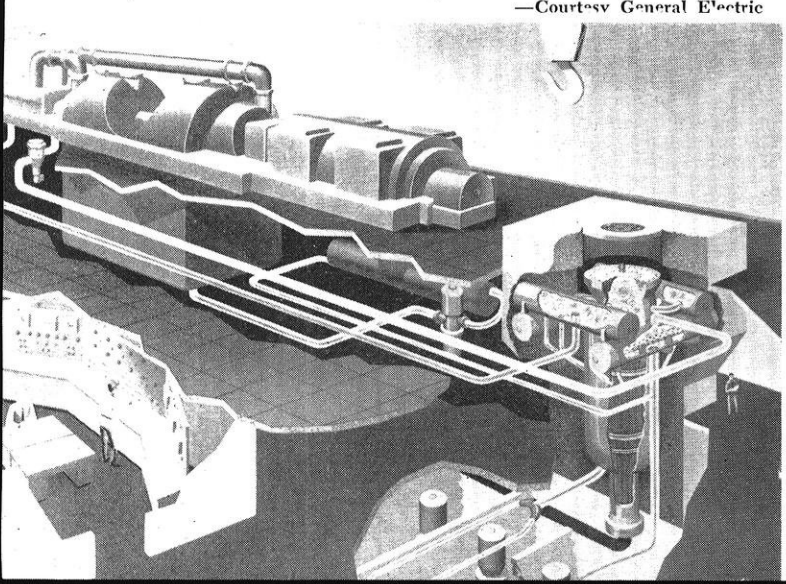
(Continued from page 15)

granite possesses uranium and thorium that would be economical to extract. But perhaps the most optimistic note on the question of reactor fuel supply was struck by Sir John Cockcroft at the conclusion of the chemical session. He believes that our supplies of uranium and thorium will be sufficient for our power needs until the world learns to use the inexhaustible light elements as a fusionable power supply.

The second main session of the conference, which was on biology and radioactive isotopes, presented papers that ranged from the treatment of cancer to the study of photosynthesis. The main emphasis, however, was on radiation hazards and on the use of radioisotopes in agriculture and medicine. Before we consider the radiation danger that the use of atomic energy can subject us to, it must be realized that throughout our lives we absorb natural and inevitable radiation. Normally, we are exposed to cosmic bombardment from the skies, as well as the radiations of potassium 42 and carbon 14, both of which we take into our bodies since they occur naturally in the potassium and carbon of foods. Even the rare uranium, radium, and thorium metals are present in our bones, with the result that the human body has a radioactivity equal to five to nine thousandths of a microgram of radium. It is with this background of natural radiation in mind that the reports of the conference delegates should be considered. W. L. Russell of the U. S. reported that radiation doses given to male mice so damage the sperm-producing gonads that mutation-bearing sperm are produced for the rest of the individual's life. This became especially important when Russell mentioned that the radio-sensitivity of the mouse has been shown to be 15 times greater than that of the fruit fly. And it is the fruit fly that has been used to calculate the maximum radiation doses that a man could safely receive. In light of this, man's maximum permissible radiation dosage may have to be radically lowered. This will be especially true if large population segments are exposed to radiation once atomic power plants become more common. W. Binks of the United Kingdom emphasized this when he reported on the exposure of atomic plant workers in Britain. Even when the maximum exposure level is as low as three-hundrdeths of one roentgen per week, each individual receives in 30 years a dose of radiation powerful enough to cause the normal mutation rate to double. It can be seen that if, as the atomic boom continues, and perhaps 10 per cent of our population are exposed to radiation, this chance of mutation would be a serious hazard.

The Commonwealth Edison Company will use this dual-cycle reactor and turbine generator in their 180,000 kw nuclear power plant to be located near Chicago.

—Courtesy General Electric



Treatments for radiation injury were also reported on. In both the U. S. and the Netherlands chemicals have been developed that cause the radiation-sensitivity of tissues to be lowerd. They include cystine and tyramine, but both unfortunately only help if given before radiation exposure. Treatment after exposure is not as promising, but some chelating agents remove radioactive poisons, such as plutonium, that collect in the bones. The combined use of zirconium citrate and the chelating agent EDTA seems the best way of ridding the body of poisons once the tissues have been exposed.

The medical reports at this session of the conference revealed several ingenious uses of radioactive isotopes. Radioisotopes, of course, are radioactive elements that are produced in a nuclear reactor. When the natural fusion of U–125 takes place, for example, the atomic fragments that break off can cause substances like sodium and iron to become isotopic and radioactive. Several countries use such elements to treat such diseases as brain tumors. Tumors differ from the rest of the brain because they permit substances in the blood to rapidly collect in their tissues, while the brain tissues do not. Thus, when radioactive arsenic is injected in the arteries, it collects in the brain tumor and not in the brain tissues. This radioactive arsenic emits positrons which are constantly combining with ordinary electrons. This encounter gives off an X-ray of energy that is detected by two scintillation counters, which allow the exact area of the tumor to be mapped out since these X-rays are given off only in the tumor area. Then the tumor can safely be removed. A somewhat similar way of using atomic emissions is based on the fact that when a boron atom absorbs slow neutrons, high-energy alpha particles are given off. The boron is injected in the blood, and when it has collected in the tumor, the patient is radiated with neutrons. This causes the alpha particles to rip thru and destroy the tumor cells. And as before, since the surrounding brain tissue does not collect substances from the blood, only the tumor is harmed.

Apart from medicine, radioisotopes were reported on in the fields of agriculture and forestry. Many countries have used radiation to breed mutants in their crops. For example, both the U. S. and Sweden have developed erect varieties of barley through the radiation of seeds with X-rays and slow neutrons (this is of advantage because it allows barley to be cut with a

(Continued on page 52)

combine harvester.) Other radiation mutations have produced crops resistant to disease and crops that thrive on poor and dry soils. From all the reports given by delegates, the age of improved plant development is just beginning, and should eventually give us improved varieties of almost all plants.

The third main session of the International Conference occupied itself with the power house of the atomic field, the reactors. Now that the U.S.S.R. has a 5,000 kilowatt nuclear station in operation, and the U. S. is building a large plant (60,000 kilowatts) near Pittsburgh, most of the delegates were convinced that nuclear power has a tremendous future. Their concern over nuclear power possibilities can be understood when we realize that the world's supply of fossil fuels is rapidly being used up. In just this country, if our population continues to rise at the present rate, we will need a 375 million kilowatt generating capacity by 1975, compared with 102 million kilowatts today. In 45 years the U. S. will require as much energy per year as that possessed by all our remaining oil reserves. And most nations are not nearly as rich in fuel resources as the U. S. Seemingly, the answer to this problem lies in a new source of power, the nuclear power plant.

One of the big points of interest in the reactor field seemed to be the question of the breeding of fissionable materials in fuel reactors. At present, U–235 is the only naturally occurring reactor fuel. But since it composes only 71 hundredths of one per cent of natural uranium–238, the converting of this relatively plentiful U–238 to fissionable plutonium would be very profitable. Plutonium could then be used as the reactor fuel. In theory at least, this can be done by having enough neutrons in a uranium reactor to not only maintain the chain-reaction, but also enough to change a supply of U–238 into plutonium. The possibilities of using this resulting plutonium fuel becomes exciting when we realize that the fission of a plutonium atom releases 2.9 neutrons, so that when plutonium is used as a reactor fuel there would still be 1.9 neutrons to change U–238 into more plutonium (the one atom is used to maintain the chain-reaction). Then, in such a reactor there would be more plutonium fuel produced than destroyed, and the amount of reactor fuel would increase.

There are many factors which tend to stop this cycle, however, by robbing some of the available neutrons. And until the Geneva Conference, most countries didn't know just how feasible this breeding process was. It now appears that the uranium and a similar thorium breeding cycle can be made to function. The United Kingdom gave the results of experiments with their ZEPHYR reactor which maintains breeding by a 2 to 1 neutron ratio. The U. S. told of a similar ERB reactor which is a sodium-cooled uranium breeder. Other data received from the nations attending the conference caused the delegates to believe that larger, production fuel breeders can be built.

Another of the interesting discussions in the reactor field concerned the revelation of cross-section measurements developed in various countries. By cross-section, the nuclear physicist means the probability that any particular nuclear phenomena will occur. For example, the likelihood that a U–238 atom will capture a neutron is spoken of as its capture cross-section. Similarly, a fission cross-section refers to the chance that fission may occur. The unusual thing about these cross-sections is that their revealment showed how closely separate groups of scientists had worked out the same constants. Of course, there are still groups of these nuclear constants which have not yet been determined, but enough assurance was given out by the conference to enable any country to build a research reactor and use it safely as a tool for more knowledge. The Borax experiments, which were performed by the United States, revealed to the conference some interesting data on the safety factor of runaway reactors. Actually, every reactor that is built is designed to prevent the spread of radioactive fission products should the reactor get out of hand. But since accidents are always possible, the Borax experiments tried to find out what would happen in just such a situation. A water-cooled reactor was allowed to get out of control and it was found that the fuel and radioactive products do not spread far from the reactor and no blow-up took place. It therefore seems that big central nuclear power stations can safely be built near large population centers.

Throughout the reactor sessions, various systems of reactors were revealed by countries that had been developing them since the beginning of the atomic age. Great Britain seems to use mostly the gas-cooled reactor. They are developing a nuclear electric station at Calder Hall that uses carbon dioxide to cool the fuel elements. It is a bulky but reliable reactor that promises to produce commercial electricity at 9 mills per kilowatt hour, which is 2 mills above the rate for coal-produced power. However, research is continuing in an attempt to find methods of improvement. The carbon dioxide coolant may be replaced by more expensive and non-neutron absorbing helium; and enriched uranium may be used in the outer fuel elements as an effort to maintain a more constant heat generation.

Outside of Great Britain, the gas-cooled reactors have no great popularity, but water-cooled reactors are being developed in practically every nation that is doing any atomic research at all. Because it is low in cost, and well-known in both chemistry and engineering experience, water coolant combined with light or heavy water moderators, are the easiest of coolants to work with. A Pittsburgh reactor uses the pressurized water system, with light water as a moderator, while a reactor type in Canada has the same pressurized system but uses a heavy-water moderator. In the Soviet Union, where a graphite-moderated pressurized reactor is used, the reactor temperature becomes so high that

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grow with ...

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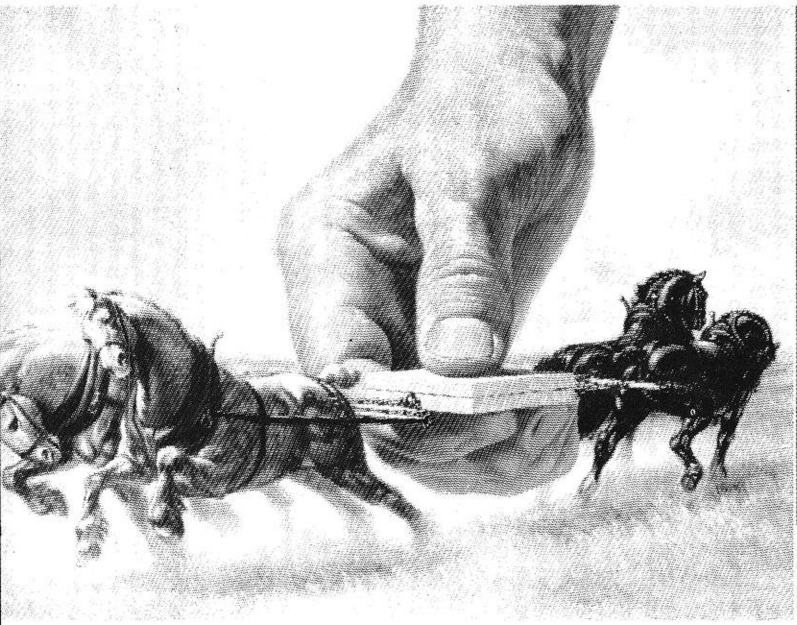

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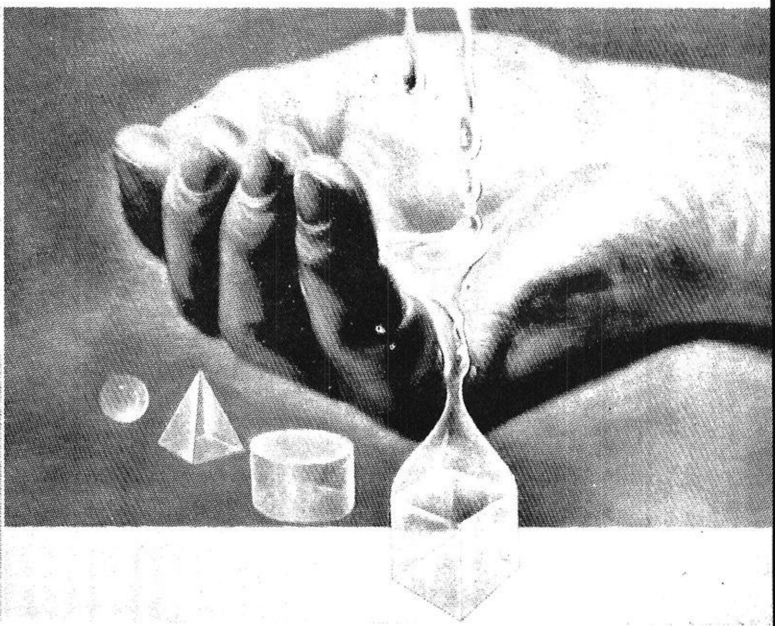

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From an address to the American Society of Civil Engineers, Los Angeles, California

It's About Time . . .

THE ST. LAWRENCE SEAWAY PROJECT IS NEEDED FOR BOTH ECONOMIC AND SECURITY REASONS

by Donald Kioseff, m'56

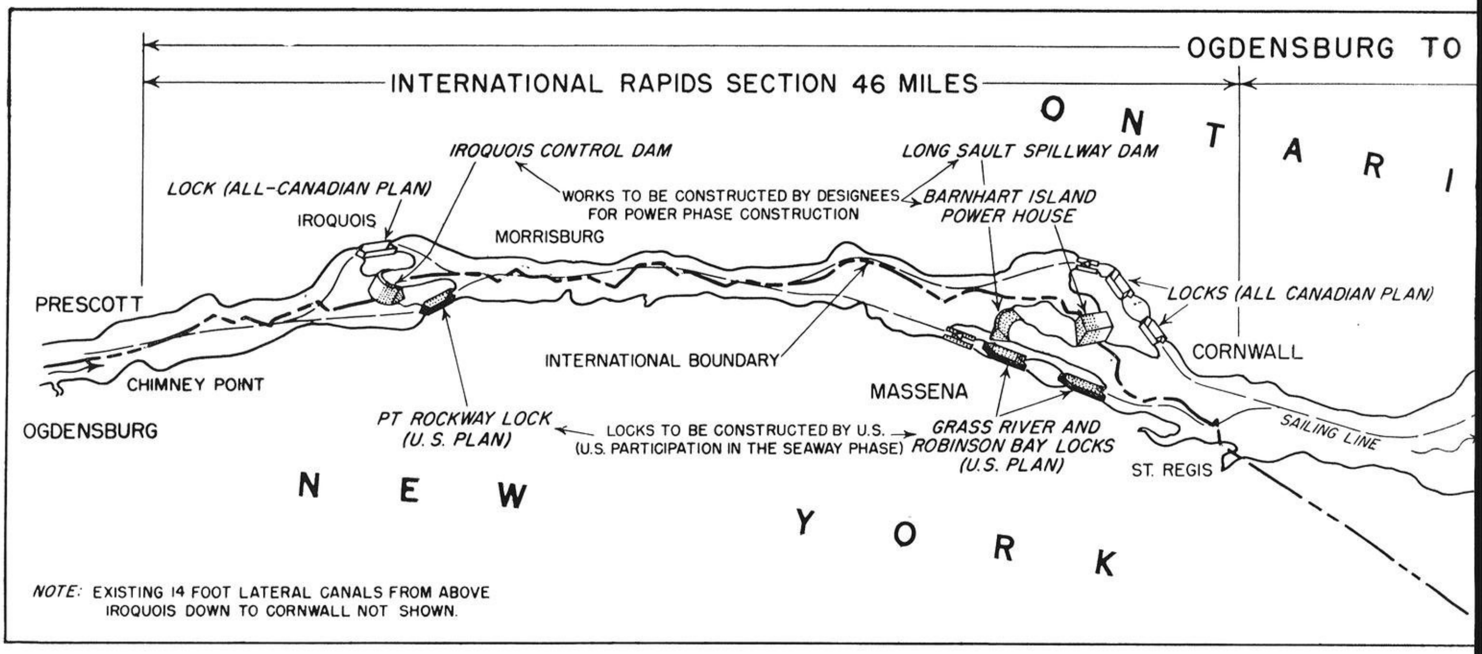
It was the Autumn of 1535 when Jacques Cartier ended his search for the North West Passage. Confronted by the insurmountable rapids he could only gaze into the West and dream before returning home.

Four-hundred years later Champlain paddled beyond the rapids. He disproved Cartier's claim of a North West Passage and instead forsaw the St. Lawrence as the key to North America's future. But, like the dreams of Cartier, Champlain's hopes died beneath the raging waters of the same rapids. No dependable line of communication could be established between the outer world and North America as long as the rapids remained.

The completion of the Erie Canal in 1825 brought part of Champlain's prophecy true for the Canal was soon to surpass the Suez and Panama in importance.

Today the St. Lawrence River remains as the last obstacle between the inland lakes and the sea. The river serves as the boundary between Canada and the United States from Lake Ontario downstream for a distance of 114 miles. From the lake down to Ogdensburg, New York is the Thousand Island section. Here are 68 miles of open river navigation to a controlling depth of 25 ft. The remaining 46 miles of the international boundary is the International Rapids section ending at Regis, New York. In the International Rapids section the river drops 92 ft. Ships utilize several confining, lateral canals with locks 252 ft. long, 44 ft. wide, and 14 ft. over the sills, located on the Canadian side of the river, to by-pass these rapids. Under these present conditions only ships of 14 ft. draft carrying 1600 tons ply the system.

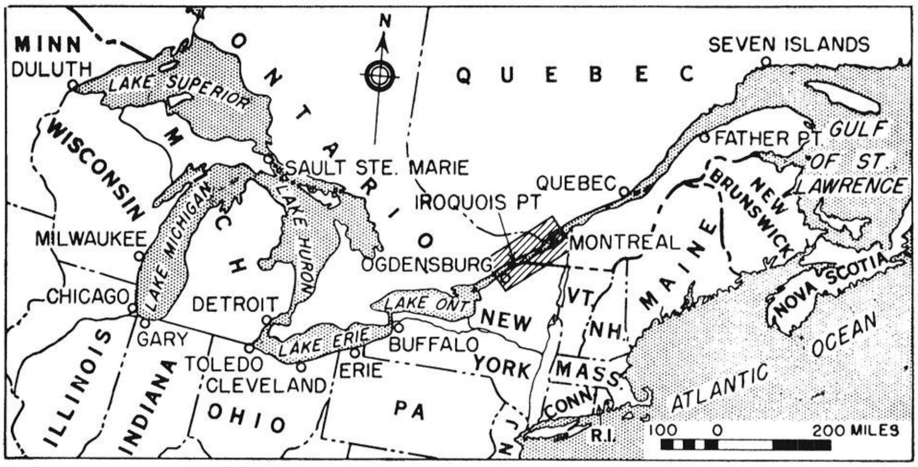
On May 13, 1954, Pres. Eisenhower signed bill S. 2150 creating Public Law 358. The law creats the St. Lawrence Seaway Development Corporation which is authorized to construct in United States territory deep water navigation works ". . with locks at least 800 ft. long, 80 ft. wide and 30 ft. over the sills." The committee on Public Works stated that the United States, in the Thousand Island section, would lower the scattered rock shoals to controlling depth of 27 ft. at present datum plane with a minimum width of 450 ft. at the bottom of the cut. In the International Rapids section the United States is to construct two lateral canals, including three locks to bypass the new dams to be built jointly by the Hydroelectric Power Commission of Ontario and the Power Authority of the State of New York. The proposed navigation works in the International Rapids section are the Point Rockway, or upper canal, which would carry navigation around the Iroquois control dam. It would be three miles long, at least 440 ft. wide at the bottom of the cut and would



Schematic Plan of the St. Lawrence Seaway and Power Project.

—Courtesy The Military Engineer

include one lock at least 800 ft. long, 80 ft. wide and 30 ft. deep over the sills. Normal lock lifts would be from 1 to 5 ft. The Long Sault or lower canal would carry navigation around the Long Sault Dam and would be eight miles long, at least 440 ft. wide at the bottom of the cut. It would include two locks, each the size of the fore mentioned locks. Normal lock lifts would be 43 and 38 ft. over the sills. Also, a 110 ft. guard gate for repairs and draining the canal would be constructed above the upper lock.



—Courtesy The Military Engineer

The St. Lawrence Waterway.

Pres. Eisenhower said in his State of the Union message that, "Both nations now need the St. Lawrence Seaway for security as well as for economic reasons." The seaway will serve as a bulwark to our national defense because it will provide a route for high-grade ore shipment from Labrador at low cost over a submarine-free route. The Committee on Public Works emphasized the need for high-grade ore when it stated that during the peak war year of 1942 the total production of iron ore was 106 million tons. By 1960 steel production is expected to reach 130 million tons requiring 150 million tons of iron ore. It is possible to produce 100 million long tons of ore from the Lake Superior area for several more years, then ore must be obtained from other, more costly locations. The ore in the Ungava area of Northern Quebec and Labrador is as high in quality as our best Mesabe ore. More than 400 million tons have been found there. These deposits are located 360 miles north of Seven Islands, a port on the Gulf of the St. Lawrence. A railroad to transport this ore has been completed. Also, the seaway will offer an alternate ore route in case the Soo Locks are destroyed during wartime, enabling production to continue. It will provide submarine-free protection for strategic shipments to England and Europe for 1000 miles. The seaway will increase the productive potential of the midwest. A Canadian survey forecasts a total of 44.5 million tons annually. "Of this, an estimated 18-million tons will move downriver, including 10-million tons of grain and grain products, 3-million of soft coal, 1.5 million of iron and steel, and 26.5 million tons are expected to move upriver (annually) including 20-million tons of iron ore." Traffic through the 14 ft. Canadian canals now averages 18-million tons annually.

Our Joint Chiefs of Staff also back the seaway and have stated that ". . . its use could . . . be denied to us . . . by a failure on our part to participate jointly with Canada in construction of the waterway." I view of our need for ore they have said, because of ". . . the potential threat of the Russian Submarine, it would be an unacceptable military risk to rely solely on . . . ore from Venezuela."

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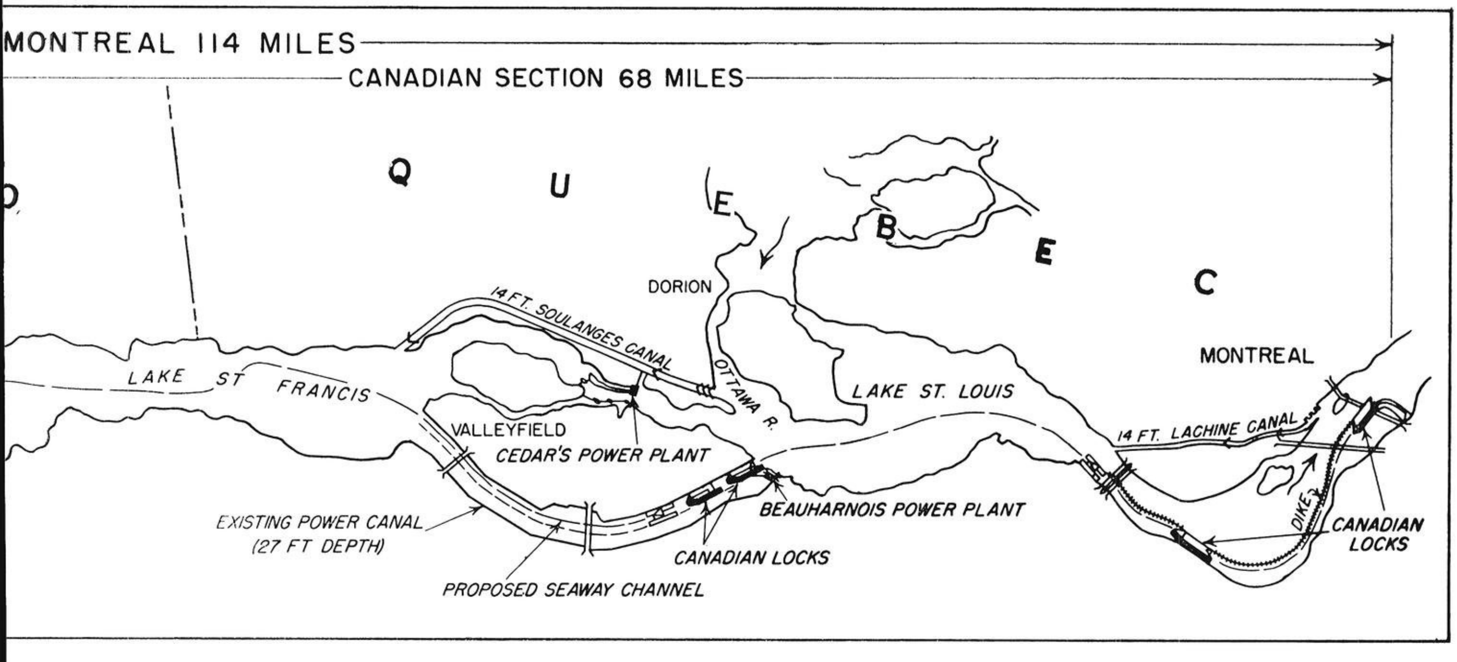


Wisconsin's New Super-Deepfreeze

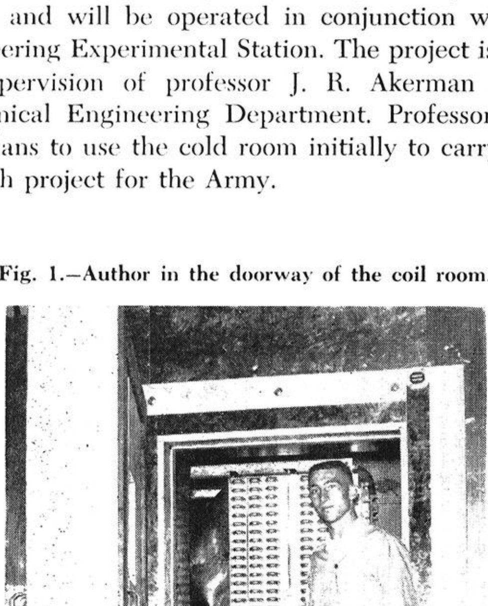
A "COOL" ARTICLE ON THE EXPERIMENT STATION'S NEW LOW TEMPERATURE RESEARCH LAB

by Ron Douglas, ch'56

Perhaps you have seen what looks like a butcher's icebox being installed in the Mechanical Engineering Building recently. As a matter of fact, the new equipment, located in the heating and ventilating laboratory, (south central wing on the first floor of the Mechanical Engineering Building) is in reality a special cold storage unit. This equipment will be used for low temperature research at temperatures as low as minus 80°F.

The low temperature plant is being built by the University and will be operated in conjunction with the Engineering Experimental Station. The project is under the supervision of professor J. R. Akerman of the Mechanical Engineering Department. Professor Akerman plans to use the cold room initially to carry out a research project for the Army.

Fig. 1.—Author in the doorway of the coil room.

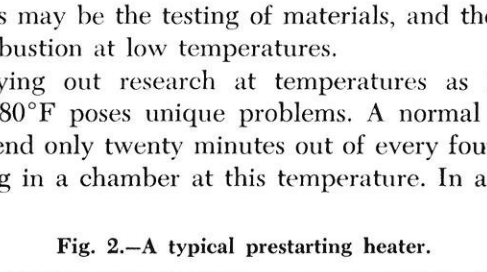


The Army's need for low temperature research has grown out of intensive testing of military equipment under unusual temperature conditions such as exist in Alaska and Greenland. The Army has found that operation of machinery, especially engines, poses special problems in cold climates. For example, in starting a gasoline engine in the Arctic, the crankcase oil is extremely stiff, the gasoline is less volatile than usual, and the battery delivers less power than it would under normal conditions. Hence the engine must be heated before starting.

One method of heating a cold engine has been to circulate the engine antifreeze through a simple, forced-air heater like the one shown in figure 1. These heaters can also be used to heat the motor oil by means of special coils installed in the crankcase. The Army would like a heater capable of operating on any available fuel—diesel oil, gasoline, or jet engine fuel. The testing and design of these heaters will be the first project carried out in the cold room. Later research projects may be the testing of materials, and the study of combustion at low temperatures.

Carrying out research at temperatures as low as minus 80°F poses unique problems. A normal person can spend only twenty minutes out of every four hours working in a chamber at this temperature. In addition

Fig. 2.—A typical prestarting heater.



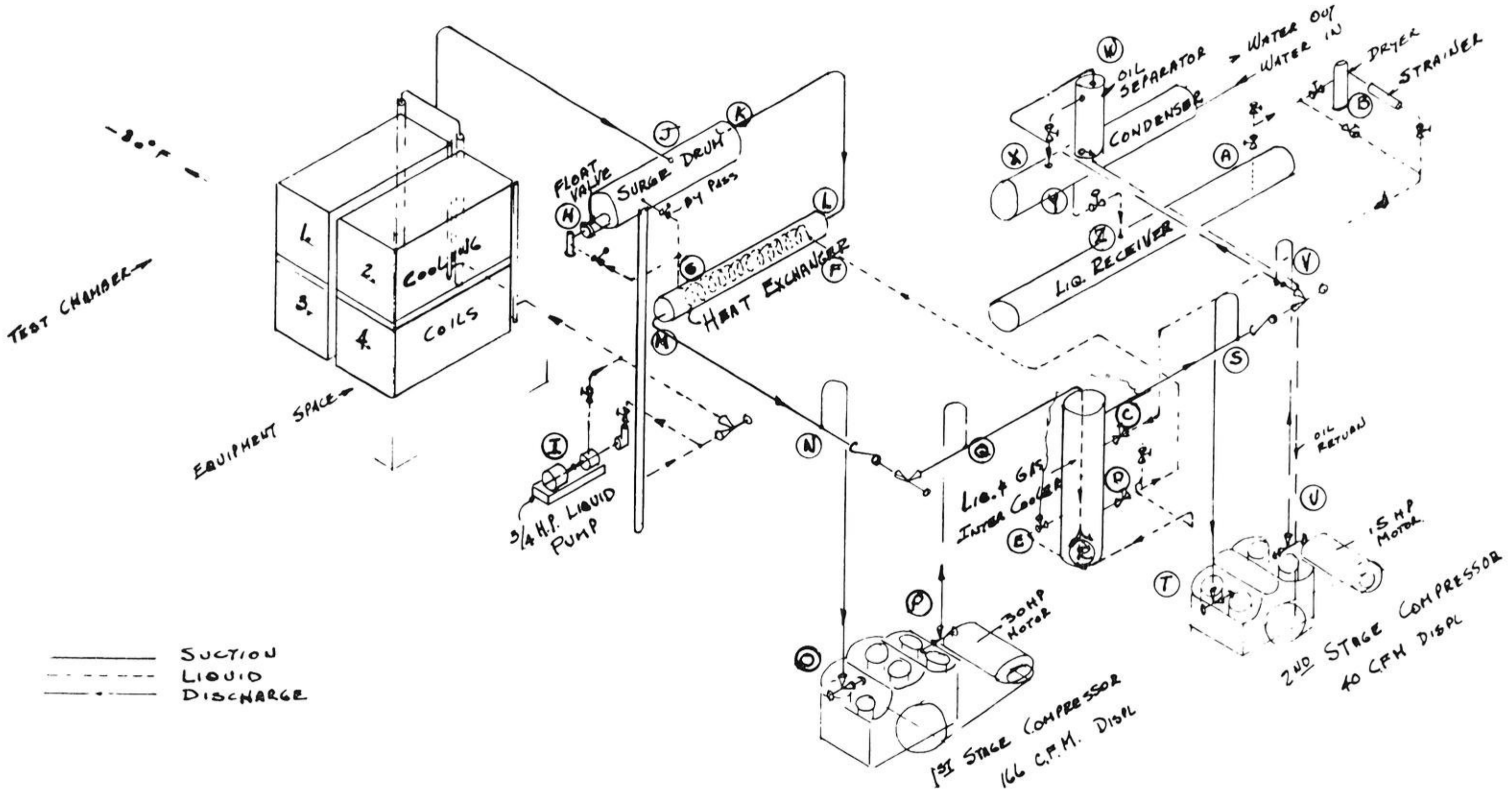


Fig. 3.–Diagram of the Refrigeration Process.

all handling of cold objects must be done with gloves to prevent skin injury. For these reasons, testing will be carried out with all personnel outside the cold room proper.

The design of the low temperature testing plant was a sizeable engineering project in itself. The cold room is divided into two parts—a work space, and a cooling coil section, which is shown in figure 2. The working space is 8′ long, 7′ 6″ high, and 5′ wide. It is built on a 12″ layer of foamglas which insulates the box from the floor. The walls and ceiling are insulated with 12″ of fiberglas, which is covered with aluminum sheet. Inside, the sides and ceiling are of perforated steel to allow the insulation to dry out when condensation collects. The floor is covered with a single piece of steel plate which will prevent any spilled liquids from soaking through into the insulation. A number of special features such as a five-ply thermopane window are found on the cold box. Each door and drain is provided with an electric heater to prevent freezeup. Removable plugs are built into the walls to provide access to the work while under test.

Temperature measurement problems have been turned over to Mr. E. B. Reynolds, a graduate student working with Professor Akerman. Mr. Reynolds expects to install a number of chromel-alumel thermocouples at different points on the equipment in order to record various temperatures. Since a thermocouple measurement depends upon a voltage developed at the junction of two dissimilar metals, the thermocouple is applicable to low temperature work where ordinary thermometers fail.

The basic refrigeration cycle is illustrated in figures 3 and 4. It is composed of a two stage compression system with a rather unusual circulation scheme for the refrigerant. The refrigerant employed is Freon 22 which freezes at minus 256° F. Freon 22 has properties that make it preferable to other refrigerants. For example, Freon 22 has an atmospheric boiling point of minus 41°F as contrasted with Freon 12 which has an atmospheric boiling point of minus 22°F. Since the Freon 22 is more volatile, it has a lower specific volume than the Freon 12. Therefore, Freon 22 requires less compressor displacement than Freon 12 to provide a comparable refrigeration effect.

A detailed analysis of the refrigeration cycle should point out some interesting features. Basically, the gas is circulated through the two compressors and then condensed in a water condenser. The liquid formed in the condenser is passed through heat exchangers and is flashed into the surge drum at minus 90°F. From the surge drum the liquid is forced into the cooling coils labeled 1,2,3, and 4. Finally the cold room air is cooled by forced contact with the coils. The system has a rated capacity of about 2 tons when the cold room is being maintained at a temperature of minus 80°F.

Tracing the process on figure 3, dotted lines indicate liquid and solid lines indicate gas. Liquid Freon 22, at room temperature, leaves the liquid receiver through the king valve, A, and passes through a drier and strainer, B, on its way to the intercooler. At the intercooler the liquid stream is split so that part of the liquid enters the coils at C which the remaining liquid is sprayed into the intercooler through the thermal-valve, E. Flashing the liquid at E serves to cool the

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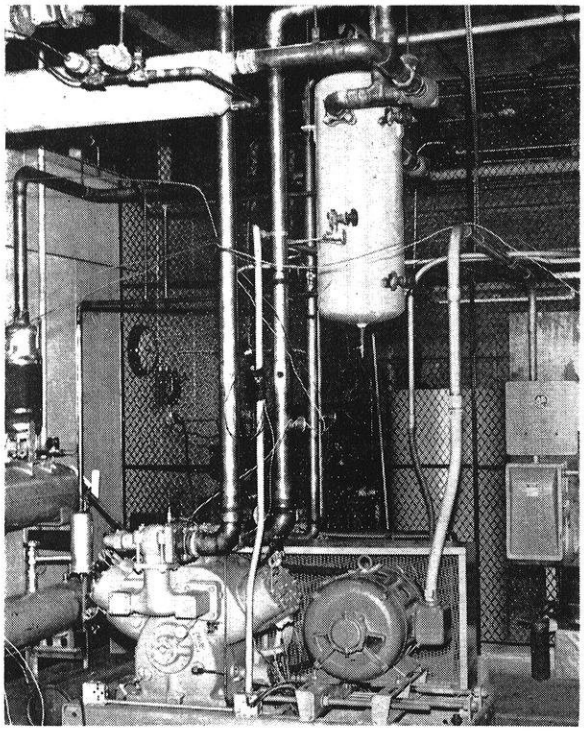


Fig. 3.—Basic refrigeration equipment.

intercooler so that the primary liquid stream, D, leaves the intercooler at about 20°F.

The cooled liquid is passed through the heat exchanger coils, FG, where the temperature is lowered to about minus 40°F. Next the refrigerant is flashed into the surge drum at minus 90°F. The float control, H, is designed to maintain a definite liquid level in the surge drum. The cooling coils, 1,2,3, and 4, are then fed from the surge drum by means of the ¾ horsepower liquid pump. This type of coil feed is called "flooded" operation. Notice that heat transfer is accomplished through a liquid instead of a gas, as it is in the usual case in which the refrigerant is merely flashed directly into the coils.

Gas which returns to the surge drum at J and that gas which was produced at H is then drawn from the surge drum at K. The cold gas passes through the heat exchanger, LM, and is heated to about minus 40°F by the warmer liquid. At N the gas is drawn into the first

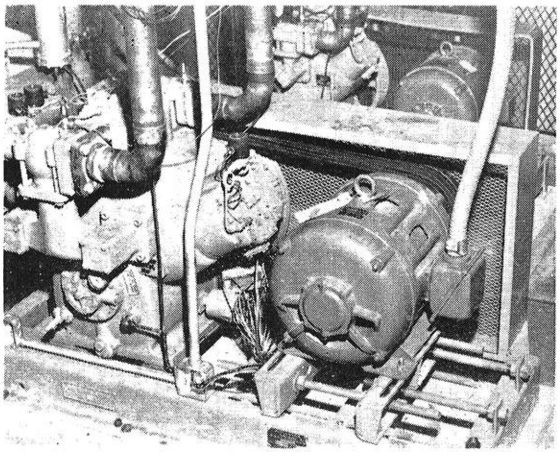


Fig. 5.—Closeup of the Two compressors.

stage compressor which has the suction port, O, and discharge port, P. This compressor is a 6 cylinder machine with a 166 cfm displacement and it is driven by a 30 horsepower motor. The first stage has a greater displacement than the second stage. This is true because the first stage must work on the low pressure gas and hence must handle a greater volume. Figure 5, which shows both compressors with the first stage in the foreground, shows the relative sizes of the machinery.

The gas leaving the first stage is very hot, about 175°F, and must be cooled before entering the second stage compressor. Therefore the gas is piped back into the main gas line, Q, and sent into the intercooler, R. The temperature of the gas drawn into the second compressor at S is used to control the thermalvalve, E, thus making the intercooler automatic. A 4 cyclinder, 40 cfm compressor, driven by a 15 horsepower motor is used for the second stage. T and U are suction and discharge ports, respectively, on this machine. The gas enters the second stage at about 20°F and leaves at about 185°F.

The hot, high pressure gas is returned to the gas line at V and run through the oil separator W. Here any absorbed lubricating oil particles are screened from the gas. The gas is then passed into the condenser, X. Here it is cooled and condensed, using city water. Finally the liquid flows from the condenser, Y, into the liquid receiver, Z. This exhausts the alphabet and completes the refrigeration cycle.

The temperature control system operates with a thermostat and regulates the compressors. Refrigeration capacity can be varied from zero to full capacity over a temperature range of 4 Fahrenheit degrees. Intermediate capacity is achieved by means of electric "unloaders", which inactivate the valves in certain cylinders of the compressor, thus reducing the compressor's gas capacity.

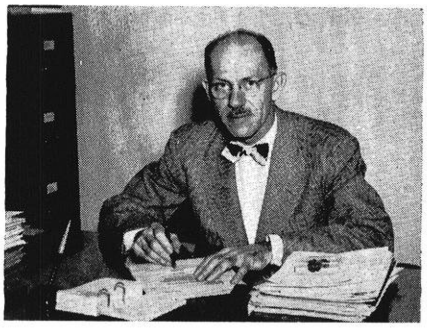
Before this refrigeration plant was charged with Freon, the whole system was freed of air by the use of a high vacuum pump. This was necessary to insure effective compressor operation. In addition, the lubricating oil used on the machinery was screened at minus 65°F to eliminate any wax. Wax-free oil is necessary to prevent clogging of the refrigerant lines.

Testing engines at the low temperatures may require up to 40 cfm of fresh air for combustion. This large fresh air supply must be very dry to prevent rapid frosting of the coils, which would necessitate frequent defrosting. To prevent frosting, the fresh air will be treated by a Niagara "No-Frost" system. This system dries the air and also serves to precool it to minus 30°F before the air is forced into the cold space.

At the time of writing, (December 1955), the low temperature plant is nearly completed. Preliminary tests thus far have shown that the machinery is capable of cooling to minus 74°F. Very soon this superdeepfreeze will be ready to open new avenues of research at Wisconsin. **END**

ACCORDING TO THE DEAN . . .

THE ULTIMATE PERSONAL SATISFACTION TO BE DERIVED IS PROBABLY THE MOST IMPORTANT FACTOR IN DECIDING UPON A JOB



KURT F. WENDT

On every hand today you are hearing about the serious shortage of engineers for business, industry, the military services, and the teaching profession. Opportunities for young men in these fields are unexcelled and it is the general belief that such opportunities will continue to be available for a considerable period of time.

A substantial number of serious and experienced people who have devoted considerable effort to find ways of meeting the shortage of trained engineers believe that the situation is in part real but also in part due to the fact that industry is not using its trained men most effectively. Some go so far as to say that if all trained engineers were used to their maximum potential no real shortage would exist. Certainly it is true that most companies are actively seeking to make more effective use of their trained manpower, to relieve engineers of as much routine and sub-professional work as possible, and to give them greater opportunity to do the creative work for which they have made special preparation.

This means that the young engineer today must assume ever greater responsibility to train and develop himself to meet the growing challenge. Some of you are several years away from the decision about an initial job. Some of you are already in the process of taking interviews and attempting to make a choice from among the many attractive offers of industry, the possible satisfactions and rewards of graduate study, and the opportunities in teaching. How do you arrive at a decision?

Perhaps the most important single factor to take into account is the consideration of ultimate personal satisfaction. No job, no matter how glamorous, no matter how lucrative, can ever lead to success unless it brings to you a deep feeling of pride for work well done and a very real sense of personal satisfaction. As you proceed to evaluate any opportunity, do not lose sight of the fact that you must have something tangible to contribute, that you must bring something of positive value to the job if you are to be acceptable to the employer. Despite the shortage of engineers you cannot afford to "rest on your oars" or to adopt the attitude of "show me what you have to offer and maybe I'll give you some consideration." Employment is a cooperative venture. The employer will have complete information for you about his company and the job he has available, but you must also have something to offer to the company.

What do you look for? Most young men, I believe, want to find good opportunities for advancement as they prove their abilities, they want interesting and challenging work, they want to work in organizations that take an interest in their employees and provide them with the best of facilities to do the job at hand, and finally they want reasonable renumeration, I am not saying that salary is unimportant, but I firmly believe that it should be and is of secondary importance once a reasonably adequate standard has been reached.

What does a company look for? Sound technical training of course, but far more! Every industry must operate as a team and cooperation is vital. You must be able to get along with others, to be willing and able to give as well as take suggestions, and to give credit where credit is due. Every employer is interested in the man who displays initiative, who can plan logically, who can accept increasing responsibility, and who demonstrates qualities of leadership. Once you have established your technical qualifications—and a reasonable scholastic record is a good start—your value to a company and your success are much more dependent upon the kind of person you are, how you get along with the other fellow, and your capacity for work than any other factors. How do you measure up?

When the time comes for you to take interviews with industrial representatives, make sure that your personal appearance is as good as you can make it, be prepared to outline your qualifications for the job sought, and be ready to ask the questions that will secure the information you need to make the best decisions.

—KURT F. WENDT

CAMPUS NEWS

compiled by Dick Peterson, m'57 and Larry Barr, m'57

DEAN MARSHALL ELECTED DIRECTOR OF A.I.Ch.E.

Prof. William R. Marshall, Jr., associate dean of the University of Wisconsin College of Engineering and associate director of the UW Engineering Experiment Station, has been elected a director of the American Institute of Chemical Engineers.

Marshall was elected to a three-year term.

He has been on the faculty of the UW Chemical engineering department since 1947. Born in Calgary, Alberta, in 1916, he gained his higher education in the U. S., receiving his bachelor's degree in chemical engineering from the Illinois Institute of Technology in 1938, and a Ph.D. in chemical engineering from Wisconsin in 1941. Before joining the UW faculty, he served in the experimental station of the Du Pont Co. in Delaware.

Members of ASME who attended the national convention in Chicago are left to right: First row: Joe Murray, Prof. Uyehara, Evelyn Knoche, John Bollinger; Second row: Peter Richelsdorfer, Chuck Siegal, Dick Peterson, Frank Kehrberg.

ASME DIAMOND JUBILEE

The annual convention of the ASME was held in Chicago November 13–18. This gathering was unique in that it commemorated 75 years of successful organization among Mechanical Engineers. So massive was the convention, that it required three of Chicago's largest hotels to house delegates from all over the United States and to provide facilities for the many lectures and banquets given during the six day period.

Representing the Wisconsin chapter of the Society, Wednesday, Nov. 16, were Professor Uyehara, faculty advisor for ASME, Joe Murray, president, Evelyn Knoke, Chuck Siegal, Dick Peterson, Peter Richelsdorfer and John Bollinger. Adverse weather in the form of sleet and ice covered roads, presented itself to the group at 5:30 AM as they left Madison. However, as the outskirts of Chicago were approached the sun appeared, brightening expectations for a successful one day stay in the windy city.

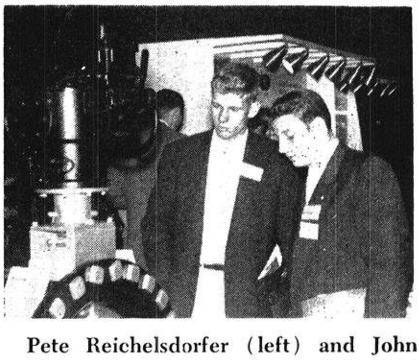
All those attending any part of the meeting were required to register at the ASME registration desk in the Congress Hotel. Upon registering, adequate credentials were issued permitting entrance to the many lectures and exhibits being held in the hotels and in different parts of the city.

First to be visited Wednesday morning was the Power Show, housed in the Chicago Coliseum. Here was a tremendous variety of exhibits and displays showing advancement in design, and machine improvement for better factory efficiency. Outstanding among the exhibits was the Atomic Power Section where working models of nuclear power plants that will some day supply electricity for cities like Chicago were displayed. Many other interesting and educational exhibits were presented by companies from all over the United States.

Highlighting midday activities was the Members and Students luncheon held in the Glass Hat Room of the Congress Hotel. Presiding over the luncheon was retiring president David W. R. Morgan. Mr. Morgan introduced the incoming president Joseph W. Barker. In a short address Mr. Barker stressed closer integration of students and graduate members in the Society and encouraged industrial leaders to further ASME programs in their business to gain and retain the interest of the college grdauate.

The main speaker at the luncheon was Robert C. Dean, Jr. Associate Prof. of Mechanical Engineering at Massachusetts Institute of Technology and recipient of the Pi Tau Sigma Gold Medal Award. Prof. Dean spoke on "A Role for Student Professional and Honorary Societies in Engineering Education", further stressing post college membership in the ASME.

(Continued on next page)



Pete Reichelsdorfer (left) and John Bollinger (right) examine an industrial exhibit at the ASME Convention in Chicago.

Campus News

(Continued from page 31)

After the luncheon, the Automation Show was taken in. Automation, a relatively new word having originated in 1947, means "The act or technique of making a manufacturing process fully automatic". This is truly the case, for here, on Navy Pier, were displayed the most advanced devices for automatic control of plant and office operations.

EXPOSITION NEWS

LARRY BARR, *Publicity Chairman*

The 1956 Engineering Exposition is beginning to gather momentum and before long, it will be full speed ahead. John Bollinger, general chairman, states that more industrial exhibit acceptances are arriving every week. He expects about 40 exhibits from various companies, many of which had displays in 1953. Concerning student exhibits, however, he is not so optomistic. Why? Because the current crop of student engineers is being very secretive about their plans for student exhibits. Or, at least, that is what we like to think.

It is no secret why some affairs, such as the 1956 Exposition are successes. It is because of the enthusiastic support of everyone concerned because it represents what he and his class can do. John Bollinger is fond of saying that the Exposition is not a one, two, or three man job, it is a job for all of us. Well, it is true, although John is beginning to repeat a bit lately. We need your help.

To be more specific, why not see John and find out what needs to be done. Student exhibits are always welcome and other activities are open.

Pi Tau Sigma and Tau Beta Pi are both supporting the exposition and it goes without saying that all the "initial" organizations (ASME, AIEE, etc.) are behind it. How about you?

Speaking of support, the faculty is co-operating very well. All the "99" technical writing classes this semester had one assignment to figure the best exhibit layout in the ME building. With support like that, the exposition cannot fail, even if the assignment did seem unusual.

It would be nice if we had a robot with controls built in that could be set to "plan an exposition", everything would be rosy, but we have no such machine and will, instead, depend on you.

UW TO GET ARMY MATH CENTER

The University of Wisconsin will build an $800,000 addition to Sterling Hall to house the Mathematics Research Center of the United States Army, University regents revealed recently.

The regents:

1. Approved establishment of the Center on the campus;

2. Accepted a $400,000 gift from the Wisconsin Alumni Research Foundation, which, when added to a $400,000 gift provided earlier by that Foundation, will pay for the structure;

3. Authorized preparation of plans and specifications for a four-floor addition on the east side of Sterling Hall to provide space for both the University physics department and the Mathematics Research Center.

The first $400,000 gift from WARF, accepted Sept. 10, was for building a basement structure for high energy physics research. The additional funds will enable the University to build the upper floors for the Mathematics Research Center.

Wisconsin met the needs set up by a special panel of Army and civilian mathematicians which ranged from excellence of Madison as a place to live to eminence of the University as a mathematical and scientific institution.

The University and the Army have agreed that Prof. R. E. Langer, a member of the UW mathematics department since 1927, will be the first director of the Center.

Investigations to be carried on at the Center, Langer said, will be mainly in four general fields:

1. Mathematical analysis and applied mathematics.

2. Statistics and probability.

3. Numerical analysis and the technology of high-speed electronic computing machines.

4. Operations research, decision theory, optimization problems, programming.

NEW SOUND ON CAMPUS

A new sound being heard around the mechanical engineering building these days. Slightly below the upper audible limit for humans, this sound has been increasing in intensity for the last month or so. A personal investigation by Campus News reveals this noise not to be a new development of modern technology, but the old-fashioned complaining of the pigeons about the cold. **END**

ON MAKING ANNOUNCEMENTS IN "THE WISCONSIN ENGINEER"

I. The "Wisconsin Engineer" magazine wishes to print more campus activities each month—Engine Ears (Engineering Society News), Announcements, Awards, Scholarships, Contests, Engineering Institutes, Banquets, and job opportunities, which are of interest to the student engineer at Wisconsin. We will be glad to consider any material you believe to be newsworthy.

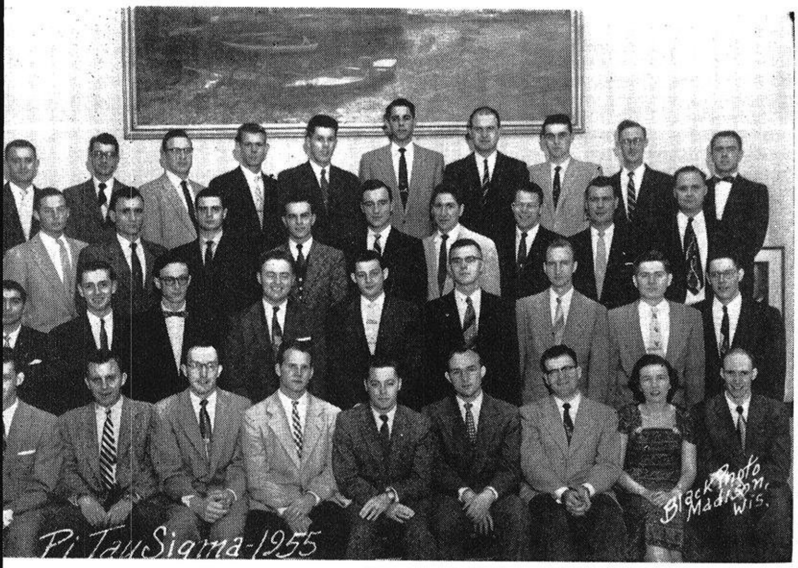
II. News Reaches:

1. A cross-section of the student body.
2. All members of the faculty.
3. The 1,100 members of The Wisconsin Society of Professional Engineers.
4. 450 high schools throughout Wisconsin.

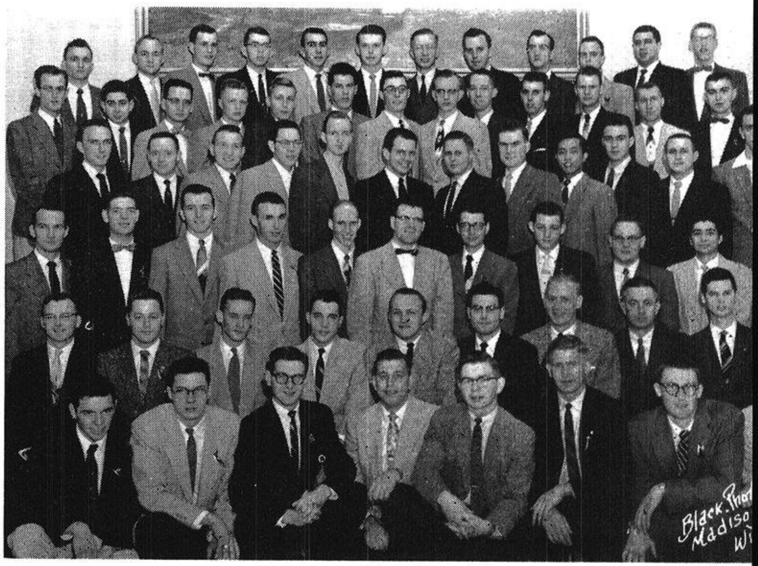
III. Requirements for submitted material:

1. Neatly typewritten—Double-spaced.
2. Submitted in advance of deadline.
3. Check the following deadlines to insure material and announcements are printed in correct issue.

Issue	*Deadline for Submitted Material*	*Mailing Date*
March	Feb. 6	Mar. 14
April	Mar. 5	Apr. 14
May	Apr. 9	May 14



Pi Tau Sigma



Tau Beta Pi

HONOR SOCIETY MEMBERS, FALL SEMESTER

NEW INITIATES

PI TAU SIGMA

Mechanical Engineering

Lawrence D. Barr
John Bollinger
Micheal Cafferty
Jack C. Dudley
Wilbur A. Ebel
Alfred W. Hubbell
Carl L. Jaeck
Ronald Kausch
Robert E. Kruse
David Laun
John Lohrey
John L. Napper
Peter Reichelsdorfer
Olaf Rove
Richard A. Sholts
Jose A. Villalobos
John M. Weinstock

★

TAU BETA PI

Engineering

Gregory Fitzgerald
Wilhelm C. Steffe
Milo C. Swanson
Patrick J. McKeough
John S. Baker
Kenneth E. Niebuhr
Robert E. Thygeson
Thomas W. Ehrmann
Don W. Martens
William G. Marshall
Winfred A. Bezella
Allyn J. Ziegenhagen
James F. Spitzer
Lawrence D. Barr
Thomas P. Kruse
Hilbert W. Baumann
Joseph A. Dattilo
Allwin E. Wudell
Marlin H. Wagner
Ray D. Dunwell
James H. Moy
Allan H. Anderson
John G. Bollinger
Robert L. Elton
John L. Wagner
Gerald C. Pomraning
Charles H. Charlson
James E. Christenson
C. Barclay Gilpin
Kenneth F. Neusen

CHI EPSILON

Civil Engineering

Charles Charlson
Thomas O'Sheridan
Floyd Stautz
Richard White
Gordon Krueger
Vernon Coffey
Earl Reichel
Richard Birner
John Albrecht
Rodney Pike
Raymond Taschner
Thomas Ehrmann
Victor Goodman
Donald Buettner
James Christenson
James Clapp
Paul Jenkinson

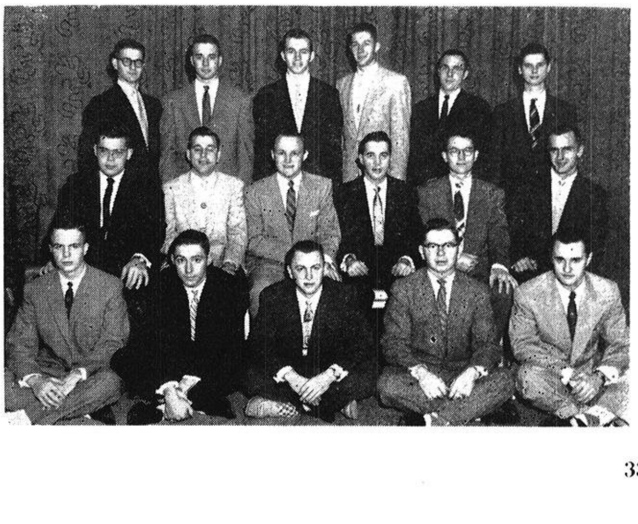
★

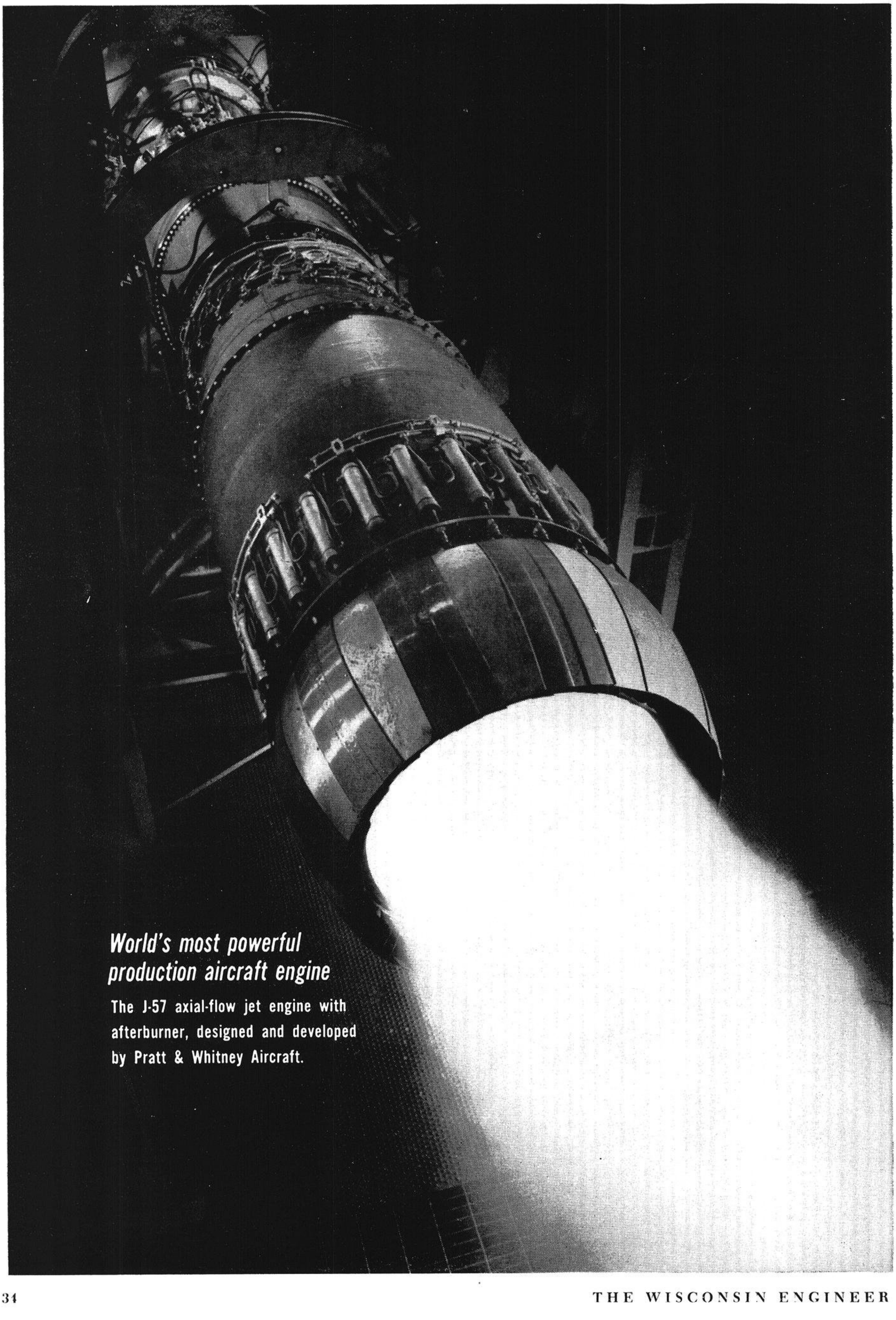
ETA KAPPA NU

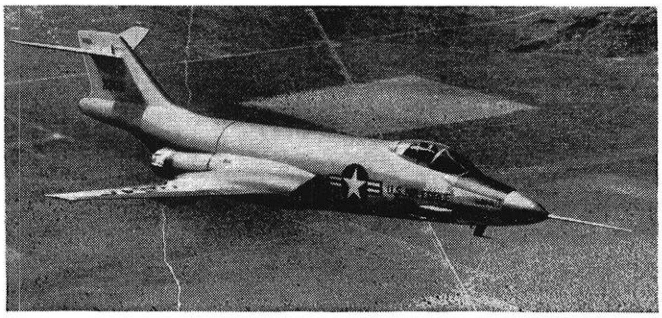
Electrical Engineering

Allan H. Anderson
William E. Boettcher
William J. Cattoi
Ray D. Dunwell
David P. Hartmann
James F. Spitzer
Kenneth L. Stahl

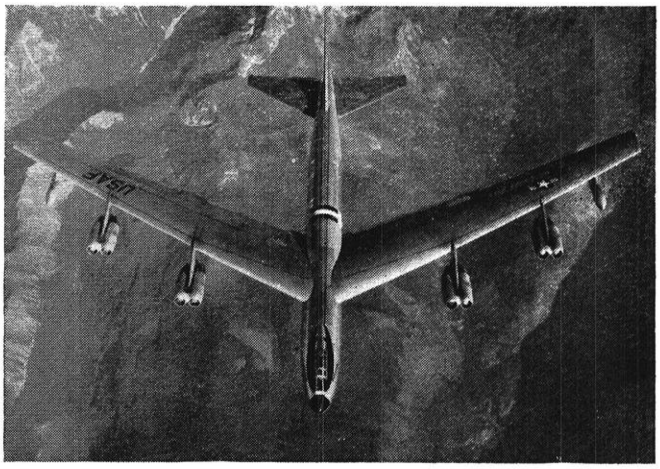
Chi Epsilon



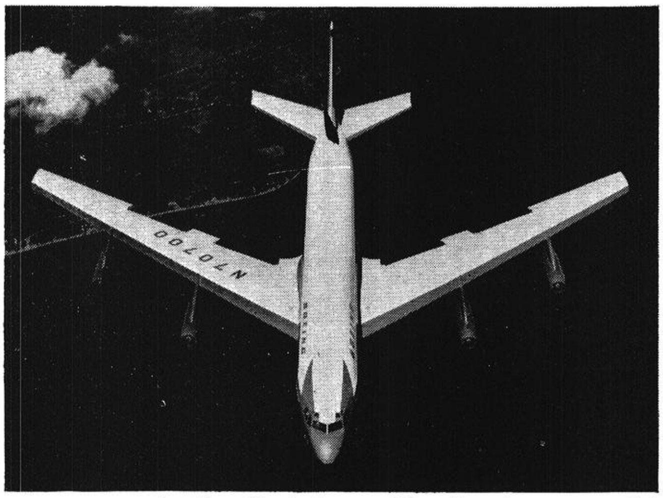

World's most powerful
production aircraft engine
The J-57 axial-flow jet engine with
afterburner, designed and developed
by Pratt & Whitney Aircraft.



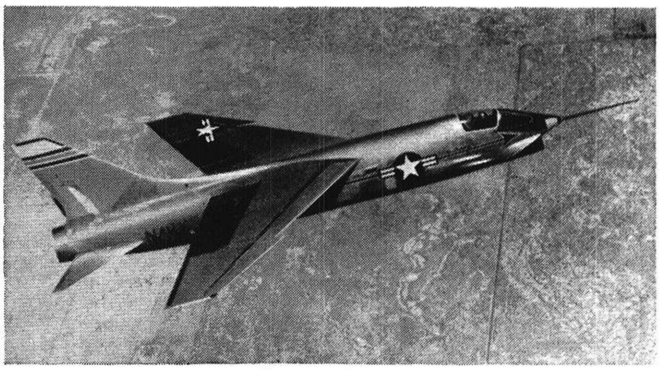
McDONNELL F-101 — The Voodoo, an Air Force supersonic fighter that has two J-57 engines with afterburners, is the most powerful jet fighter yet built.



BOEING B-52 — Eight J-57 engines, mounted in pairs, power this all-jet, heavy Air Force bomber.



BOEING 707 — The Stratoliner will usher in commercial travel in the jet age. It is the counterpart of the KC-135, a military tanker-transport powered by four J-57 engines.



CHANCE VOUGHT F8U — Powered by a J-57 with afterburner, the Crusader is the Navy's fastest carrier-based fighter.

The best airplanes... are designed around the best engines

Today's most valuable military aircraft, capable of supersonic or intercontinental flight, include various Air Force and Navy fighters, bombers and transports. Among these are nine types that have a significant feature in common. They all fly on one type of engine — the J-57 turbojet.

Also entrusted to the efficient, dependable operation of Pratt & Whitney Aircraft's jet engines will be the commercial jet transports soon to travel along the air lanes of the world.

The excellence of the J-57 is attributed to the engineering team that has determinedly maintained its leadership in the field of aircraft powerplants. Effort is now being directed toward the improvement of advanced jet and turboprop designs. Still to be anticipated is mastery of current technology's most provocative problem — the successful development of a nuclear aircraft engine.

Many engineering graduates would like to be concerned with the air power of the next generation. One way to fulfill that ambition is to pursue a career alongside the Pratt & Whitney Aircraft engineers who have consistently produced the world's best aircraft engines.

World's foremost designer and builder of aircraft engines

PRATT & WHITNEY AIRCRAFT · DEPENDABLE ENGINES

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

EAST HARTFORD 8, CONNECTICUT

HOW HERCULES HELPS...

AN INCREASED SUPPLY of para-cresol, raw material for antioxidants used in gasoline and rubber, will become available late in 1956 with the completion of the recently announced addition to Hercules' oxychemical plant in Gibbstown, N. J. This will more than double the amount now being produced by Hercules and is the sixth product to be made commercially by the Hercules' oxidation process. Para-cresol also plays an important part in the production of essential oils and in the manufacture of dyes.

FASTEST DRYING of all protective coatings, lacquer is ideally suited to keep pace with today's mass production methods. At the Standard Box Company in Pittsburgh, for example, a single-application hot-lacquer system protects beverage boxes with no delays for drying. Hercules works closely with the coatings industry in developing and perfecting new uses for lacquer-type coatings based on its nitrocellulose, ethyl cellulose, cellulose acetate, and Parlon® (chlorinated rubber).

ACID, ALKALI, AND WATER are all repelled when paper or paperboard are sized with Hercules Aquapel®. In corrugated cartons or spiral wound fiber drums where alkaline glues are used, Aquapel sizing effectively retards penetration of the glue. Neither a resin nor a wax, Aquapel is a chemical that reacts with the cellulose fiber to form a surface that is resistant to hot and cold water, acid or alkali. That's why so many paper mills are finding ever-increasing use for this new sizing agent.

HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

HERCULES POWDER COMPANY
INCORPORATED

968 Market St., Wilmington 99, Del. Sales Offices in Principal Cities

SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS.

G55-11

W. S. P. E.

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ENGINEERS' CREED

As a professional engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I PLEDGE

To give the utmost of performance, to participate in none but honest enterprise, to live and work according to the laws of and the highest standards of professional conduct. To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge.

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS ANNUAL CONVENTION

Schroeder Hotel, Milwaukee, Wis., January 26, 27 and 28, 1956

The thirteenth annual convention of the Wisconsin Society of Professional Engineers features innovations which, no doubt, will attract the largest attendance in the history of the Society.

The College–Industry Conference of the American Society for Engineering Education, featured all day Thursday, January 26, in a pre-convention program jointly sponsored by the Wisconsin Society of Professional Engineers and the Relations with Industry Division of the A.S.E.E., brings to Milwaukee speakers of national prominence on the theme "Humanities and Engineering."

A supper theater party for the Wisconsin Society of Professional Engineers, their ladies and guests, replaces the entertainment and late luncheon. After dinner at the convention hotel, the engineers and their ladies will proceed for an exceptional evening at the Fred Miller Theater.

A third item is the panel on the four surveys made by the National Conference Board of the Society by four members of the Board's Committee, featuring firsthand information on the problems of the engineer, especially as he emerges into management responsibilities.

Following is the tentative schedule:

Thursday, Jan. 26, 1956

P.M.

2:00 Registration—4th Floor
2:00 Board of Directors—South Room
2:00 Chapter Presidents' Meeting—Parlor H
6:00 Theater Party Dinner—East Room
8:00 Buses leave for Fred Miller Theater
8:30 Performance at Fred Miller Theater
11:10 Buses leave Fred Miller Theater for Schroeder Hotel

Friday, Jan. 27, 1956

A.M.

9:00 Registration—4th Floor
9:30 Functional Groups:
- A. Industrial—Parlor C
  Louis E. Larson, Chairman
- B. Education—Club Room
  (Joint with Committee)
  John Gammel, Chairman
  Speaker: Dean C. Wendt
- C. Public Employment—Parlor D
  Carl Cajanus, Chairman
- D. Consulting—Parlor E
  Philip Davy, Chairman
  Speaker: George Sievers

Committee Meetings:
- A. Education—Club Room
  (Joint with Functional)
  John Gammel, Chairman
- B. Ethics and Practice—Parlor I
  Kurt Roth, Chairman
- C. Membership—Parlor G
  W. F. Baumgartner, Chairman
- D. Program—Parlor F
  K. O. Werwath, Chairman
- E. Public Relations—Pine Room
  A. Graettinger, Chairman
- F. Legislative—Parlor B
  E. J. Kallevang, Chairman
- G. Interprofessional—Room 507
  Charles Nagel, Chairman

P.M.

12:30 Luncheon—Crystal Ball Room
Arthur Behling, Presiding
- A. Recognition of New Members
  July 1 to December 31
  Guests of President A. Owen Ayres
- B. Recognition of Industrialists

1:30 Address—Crystal Ball Room
C. Y. Thomas, Vice President
Spencer Chemical Company
Kansas City, Missouri
Topic: Unity in the Profession

2:30 General Session—East Room
E. C. Koerper, Presiding

Panel on Engineers and Public Affairs

Paul H. Robbins, Exec. Dir.
N.S.P.E., Moderator
Washington, D. C.

(Continued on page 40)

Meet the President

RODERICK F. BOTT

President, Northwest Chapter W.S.P.E.

Mr. Bott, President of the Northwest Chapter, attended the Milwaukee public school system and Milwaukee State College prior to World War I, and served as a Lieutenant in the Infantry in World War I.

After graduating from the University of Illinois with a B. S. degree in 1925, Mr. Bott held positions in various fields, including chemistry and merchandising.

He began work with the Wisconsin State Board of Health in 1935 and was Assistant State Director of the Community Sanitation Program 1936–1942. In 1942 he became District Sanitary Engineer for the State Board of Health in the Chippewa Falls district office, a position he still holds.

He has been active in the Northwest Chapter W.S.P.E. since the chapter was formed, having been a member of the chapter board of directors 1951–1953, Engineers' Week Chairman in 1953 and 1954, and Vice-President in 1954. He is serving his second term on the board of directors of the Wisconsin Association for Public Health and has been affiliated with the Masonic Lodge since 1930. He is married and has two children.

W.S.P.E.

(Continued from page 38)

Participants:
J. D. Coleman, Chairman & Introduction
Frigidaire Division
General Motors Corp.
Dayton, Ohio
Past President, N.S.P.E.

V. E. Gunlock
Chicago Transit Authority
Chicago, Illinois
Vice President, N.S.P.E.

C. Y. Thomas, Vice President
Spencer Chemical Company
Kansas City, Missouri

John B. Jardine
Fargo, North Dakota
Past Vice President, N.S.P.E.

6:00 Reception—Foyer
Dutch Treat—Cash Bar

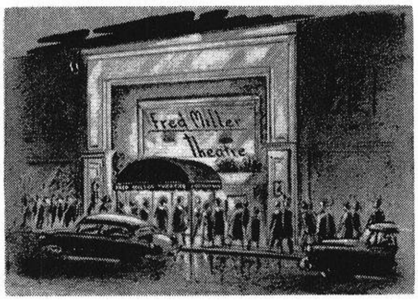
6:45 Speakers' Assembly—Room 508
Out of Town Guests

7:00 Annual Banquet—Crystal Ball Room
A. Owen Ayres, President, W.S.P.E.
Presiding
A. Greetings from V. E. Gunlock
Chicago, Illinois
Vice President, N.S.P.E.
B. Introduction of Old and New Officers
C. Presentation of Awards
(1) Outstanding Engineer Award
(2) Outstanding Science Teacher Award
D. Address
Merryle Stanley Rukeyser
Introduced by Robert C. Bassett
Publisher, Milwaukee Sentinel

Saturday, Jan. 28, 1956

9:00 Registration Continues—4th Floor

9:30 Business Meeting—East Room
President A. Owen Ayres, Presiding
A. President's Report
B. Secretary's Report
C. Treasurer's Report
D. National Representative's Report
E. Committee Reports:
(1) Education
(2) Ethics and Practice
(3) Membership
(4) Program
(5) Public Relations
(6) Legislative
(7) Interprofessional



F. Functional Group Reports:
(1) Consulting Engineers
(2) Education
(3) Industrial Employment
(4) Special Employment

G. New Business

P.M.

12:30 Luncheon—Empire Room
A. L. Genisot, Presiding
Recognition of Official Delegates from State Societies:
Michigan
Iowa
Illinois
Address: (To be announced)
Adjournment

2:30 Annual Business Meeting—Pere Marquette Room
Milwaukee Section
W. C. Lallier, Presiding

W.S.P.E. LADIES' PROGRAM, SCHROEDER HOTEL, MILWAUKEE, WISCONSIN

January 26 and 27, 1956

Thursday, Jan. 26, 1956

P.M.

6:00 Theater Dinner—East Room

8:00 Buses leave for Fred Miller Theater

Merryle Stanley Rukeyser

8:30 Fred Miller Theater—Performance

11:10 Buses leave Fred Miller Theater for Schroeder Hotel

Friday, Jan. 27, 1956

A.M.

9:00 Registration—4th Floor

9:30 Organization of Ladies Auxiliary—Room 508
Discussion led by John B. Jardine

P.M.

12:00 Luncheon and Style Show—Empire Room

2:00 Cards—Empire Room

6:00 Reception—Foyer
Dutch Treat—Cash Bar

7:00 Professional Engineers Annual Banquet—Crystal Ballroom
For Members and Ladies—Informal

7:00 Ladies at Speakers' Table

MERRYLE STANLEY RUKEYSER

A Biographical Outline

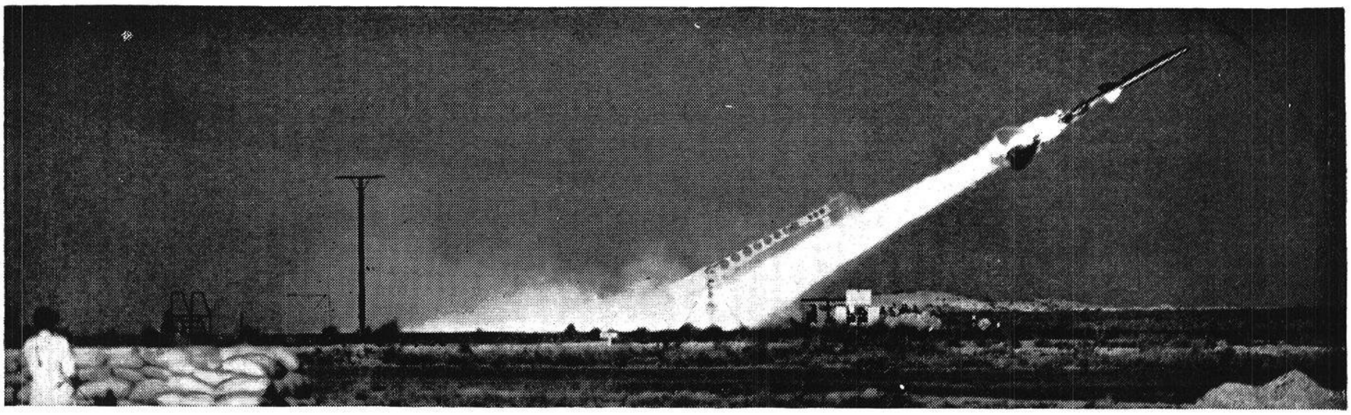
Merryle Stanley Rukeyser is known to millions of Americans from coast to coast as an outstanding lecturer, journalist, economist and author.

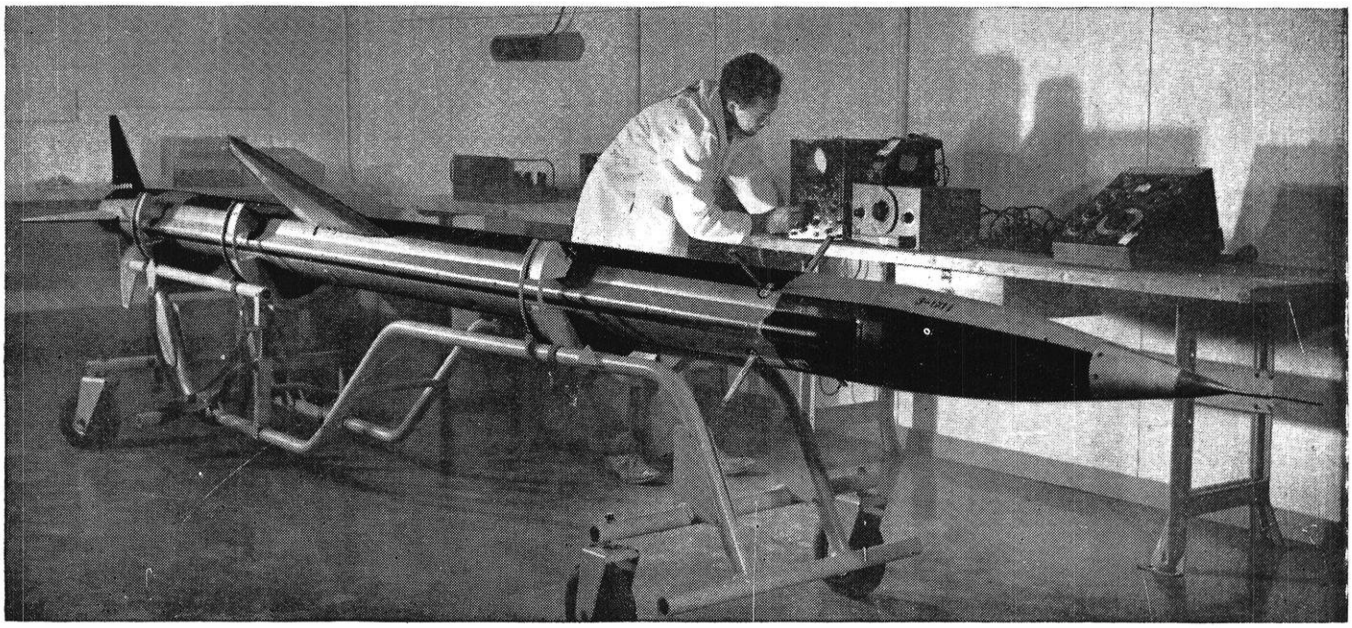
His column of comment on how we live, which is syndicated to newspapers from coast to coast by International News Service, is read by banker, laborer, business man and housewife alike. Keenly discerning, yet always human and dramatic, Mr. Rukeyser's vivid use of simple language changes economics from a "dismal" science to a vital and significant study of the ceaseless human struggle for material well-being.

As editorial writer, author, and broadcaster, Mr. Rukeyser plays a tremendous part in shaping the thoughts and voicing the aspirations of people in every walk of life.

In addition to his frequent repeat invitation to the platform of topflight Town Halls and other lecture groups from coast to coast, Mr. Rukeyser broadcasts each Thursday evening over the Mutual Broadcasting System on "Rukeyser Reports", a discussion of everyman's financial problems and opportunities. He has appeared frequently as a guest on television and radio on "America's Town Meet-

(Continued on page 42)





Boeing engineers are insiders on top-secret work

Engineers are doing vital work on significant new developments at Boeing. For example, the Boeing BOMARC IM-99 pilotless interceptor. Its predecessor, the Boeing GAPA, is shown here, because photographs of BOMARC are highly classified. BOMARC is a supersonic long-range missile that spearheads an entirely new weapons system. It is a key weapon in America's defense planning.

BOMARC, as well as other "years ahead" Boeing projects, which cannot be discussed here, are complex challenges to all kinds of engineers. These men find real creative interest in the problems of very high speed flight: heat, compressibility, vibration, rocket, jet and nuclear power, miniaturization, electronic control, and others. Their goal is to design structures and components that will "weigh nothing and take no space," yet withstand extreme velocities and altitudes.

The prestige of Boeing engineers is second to none. They have created such recent aviation milestones as the B-52 global jet bomber, the 707 jet transport, and the B-47. There are superb facilities at Boeing: the multi-million-dollar new Flight Test Center, the world's most versatile privately-owned wind tunnel, the latest electronic computers, and much more.

Boeing engineers enjoy exceptional opportunities for career stability and growth. There are more than twice as many engineers with the firm now as at the peak of World War II. Living is pleasant in the progressive, comfortable-size communities of Seattle and Wichita.

There is room for top engineering talent on Boeing research, design and production teams. If you feel that you belong with aviation's leader, it will pay you to investigate the advantages of a career with Boeing.

For further Boeing career information, consult your Placement Office or write to either:

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Wash.

R. J. B. HOFFMAN, Administrative Engineer
Boeing Airplane Company, Wichita, Kansas

BOEING

Aviation leadership since 1916

SEATTLE, WASHINGTON   WICHITA, KANSAS

W.S.P.E.

(Continued from page 40)

ing of the Air," the "People's Platform," "The American Forum of the Air," "Meet the Press", the "Author Meets the Critics", the "Court of Current Issues", and "Who Said That?" An advocate for free speech, he has developed leadership in auditing the demagogue.

Amidst his duties as a working journalist, editor, lecturer and business consultant, Mr. Rukeyser has written six standard books on economics and national affairs, including "Financial Security in a Changing World".

Through the years Mr. Rukeyser has contributed numerous articles to national magazines, and he is frequently consulted on financial matters.

Single-handedly he has pioneered in a campaign to streamline and dramatize annual corporate reports. His efforts to make these reports significant documents in industrial relations have been extremely successful, as evidenced by the increasing number of corporations that have made use of Mr. Rukeyser's ideas on the subject.

His three brochures on the subject of annual reports, entitled "Streamlined Financial Statements —For Whom Does Capital Work?", "Sell the Business As Well As The Product", and "The Whole Truth—and the Short Form" are standard reference works on this subject.

Mr. Rukeyser has frequently been called to Washington to testify as an expert before House and Senate investigating committees. He also has served as chairman of the Non-Partisan Social Security Commission and was instrumental in formulating recommendations, which have since been translated into law. Mr. Rukeyser has written two significant brochures recently on job security and the annual wage.

Mr. Rukeyser has behind him a period of seventeen years as a member of the teaching staff of Columbia University, and was formerly associate editor of "Finance".

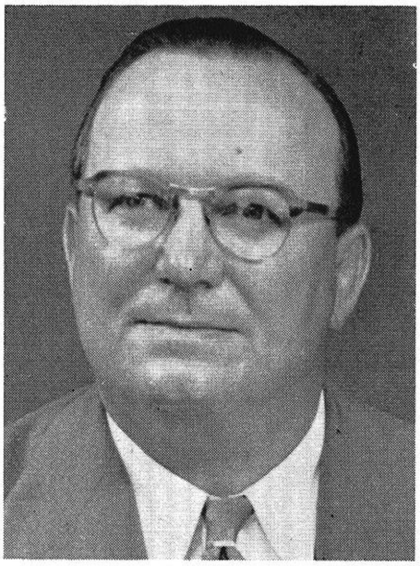
No "armchair" commentator, Mr. Rukeyser goes out to see for himself. He frequently crosses the continent to make personal inspections of the status of the great centers of industrial, mineral and agricultural production. He supplements his observations in the field with visits to Washington, where he confers with important government officials. Mr. Rukeyser's contacts are with top-flight leaders in labor as well as in business, financial, and academic life.

An authoritative biographical outline of Mr. Rukeyser's career as a leader of American common sense appears in the current issue of Who's Who in America. Mr. Rukeyser was born in Chicago on January 3, 1897, was trained in economics and journalism at Columbia University, and at the age of 23 became financial editor of the New York Tribune.

VIRGIL E. GUNLOCK VICE-PRESIDENT, N.S.P.E.

Virgil E. Gunlock, P. E., was born in New Canton, Illinois, May 18, 1905. He received a B.S. in Civil Engineering from the University of Illinois in 1927.

Following is a brief career summary: Assistant Engineer, Sanitary District of Chicago 1927–1938, Resident Engineer Chicago Subways 1928–1941, Engineer of Subway Construction 1941–1943, Chief



Virgil E. Gunlock

Subway Engineer, Chicago 1943-1945, Commissioner of Subways & Superhighways 1945–1952, Commissioner of Public Works, Chicago 1952 to July 1, 1954, Chairman, Chicago Transit Board, July 1, 1954 to date.

He is Past President of Illinois Society of Professional Engineers and Vice President of National Society of Professional Engineers for 1955. He is a member of Tau Beta Pi, many other engineering societies and various civic groups. He is married and has two children.

Chapter News

WISCONSIN VALLEY CHAPTER

The meeting of the Wisconsin Valley Chapter of the W.S.P.E. was held at the Weston Power Plant, located on the Wisconsin River just below Rothschild, on December 3, 1955.

Before the meeting the members and their guests were conducted on a tour through the plant by Mr. Morrison and Mr. Giesler.

The following officers were elected to serve for the year 1956: President–L. W. Lembcke; Vice President–P. L. Schroeder; Secretary–Treauser–John E. Hoeft; and Trustee–Archie E. Becher.

The dates for the 1956 meetings were set as follows: April 14–Tomahawk; July 14–Rhinelander; September 8–Wisconsin Rapids; and December 8–Wausau.

Mr. Lawrence (Red) Carlson was re-appointed Chairman of the Membership Committee with the stipulation that he choose the members of his committee.

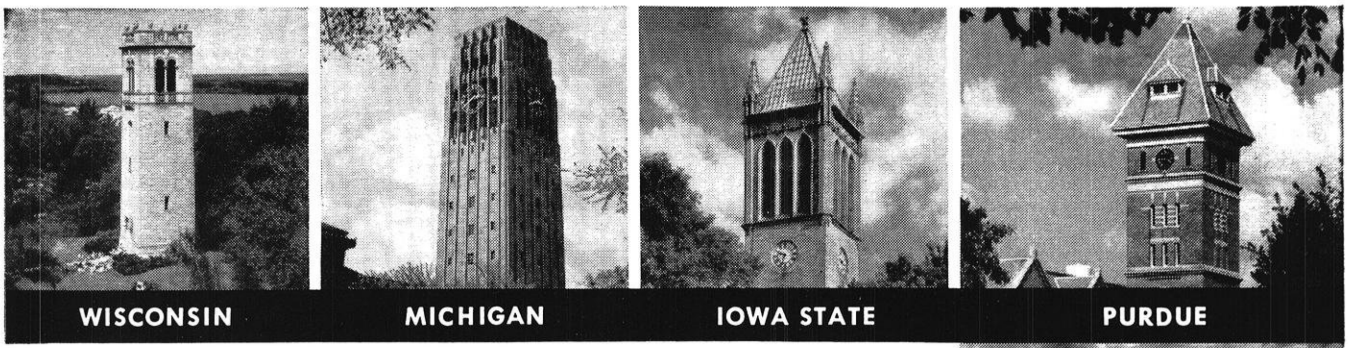
The group was pleased to have Mr. William F. Baumgartner of the Northwest Chapter and Mr. Clifford Nelson of the Western Chapter present at their meeting.

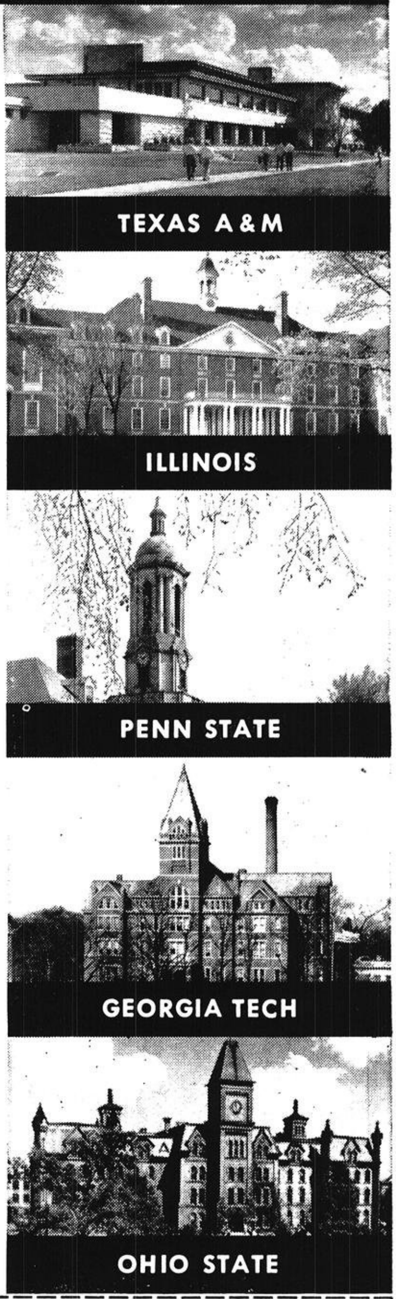
After the meeting cocktails and dinner were served to the guests, members and their wives.

SOUTHEAST CHAPTER NEWS

The Southeast Chapter held its annual Christmas meeting at Wau-

(Continued on page 44)





HERE'S
where we Look
...AND
HERE'S
where we Find
FINE ENGINEERS

Over a period of many years we've found scores of fine engineers in these nine schools. Most of them are still with us, prospering in the ever-expanding electrical field.

Again this year we're looking to these same nine schools for electrical, mechanical, industrial and general engineering talent. If you're looking forward to an active engineering career in one of the world's most vital industries, why not get acquainted with Square D and its excellent opportunities?

Mail the Coupon

We'd like to send you a brochure, "Your Engineering Career." It gives the simple rules to follow in selecting an engineering career.

SQUARE D COMPANY

Square D Company, Dept. SA
6060 Rivard Street, Detroit 11, Michigan
I'd like a copy of Square D's brochure, "Your Engineering Career"

Name__________
School__________ Class_____
Address__________
City__________ Zone____ State_____

W.S.P.E.

(Continued from page 42)

kesha, Wisconsin on December 7, 1955. The group met at Jack Waite's Waukesha Cement Tile Company Plant for the usual "plant tour" and cocktail hour and then moved to the Avalon Hotel for dinner, business and festivities.

The evening's program included the International Harvester film "Man With a Thousand Hands" which gave an excellent account of the building at Kittimat.

Two members of the S. E. Chapter announced a change in position and location.

Mr. James L. Trebilcock, Field Engineer, Fairbanks Morse & Company has been promtoed to Manager of the Electrical Dept., Fairbanks Morse and Company, at Omaha, Nebraska. Mr. Trebilcock is presently a Director of the S. E. Chapter.

Mr. Elroy F. Spitzer, City Engineer of South Milwaukee, has accepted the position of Engineering Editor of the American City Magazine. He will take over his duties in New York City in January. Mr. Spitzer is presently the Vice President of the S. E. Chapter.

The S. E. Chapter is presently conducting a survey within the chapter area by sending out questionnaires to all Registered Engineers in the Chapter area to determine their views on meeting places, frequency of meetings, chapter preference, (Milwaukee, Southeast or adjoining chapters) and other information which should lead to increased activtiy in the Milwaukee and S. E. Chapter area. Copies of the tabulated results will be forwarded to the state officers.

Program Chairman for the evening was Mr. Joe Raynor.

FOX RIVER VALLEY

The Fox River Valley Chapter of the Wisconsin Society of Professional Engineers held their monthly meeting December 8th at the Legion Club in Oshkosh, Wisconsin.

For the entertainment of the members a one act light comedy "Ways and Means" by Noel Coward was presented by the Oshkosh Community Players and directed by Robert F. Berndt.

The local arrangement chairman for the meeting was Robert W. Frazier, and other members include Ivar Van Akkaren, Albert Marsh, and Robert C. Sommerfeld. Because of the annual meeting of the W.S.P.E. in Milwaukee on January 26–27–28, 1955 there will be no meeting of the Fox River Valley Chapter during January.

SOUTHWEST CHAPTER

CHARLES M. PERLMAN

The second meeting of the Southwest Chapter was held Dec. 13, 1955 at the Cuba Club in Madison.

Mr. E. J. Kallevang, (retired) formerly vice president in charge of Engineering and Operation, Wisconsin Power & Light Co. was the principal speaker of the evening. He reported on the 1954 Nationwide "Professional Engineers Income and Salary Survey" of the National Society of Professional Engineers. It was pointed out in this factual, convincing report how much the Engineer earns, for whom he works, branches of engineering engaged in, the type of work which he does, his salary grade together with many other important facts concerning the Professional engineer's income and salary.

The coming Chapter meetings are scheduled for Wednesday, Feb. 22, 1956, Tuesday, March 20, 1956 and Wednesday, April 18, 1956 (Election of Officers). Program Chairman, Mr. T. K. Jordan urges you to attend the Chapter meetings. IT'S YOUR PROFESSION.

Mr. Page A. Johnson, Chairman of the Membership Committee informs us that the Southwest Chapter has 242 P.E. members and 11 E.I.T.s.

Our chapter area has 300 prospective members. In our present membership drive, the state society has set up a quota of 60 new members for this year ending July 1, 1956. Your local membership committee needs your help.

We all know one or more registered engineers who should belong to W.S.P.E. If each member will inform one or more eligible prospects how he will benefit by being a member of W.S.P.E., our quota can become a reality.

W. H. FERRIS NAMED CHIEF WPL ELECTRICAL ENGINEER

William H. Ferris, Madison, has been promoted to chief electrical engineer of the Wisconsin Power and Light Co.

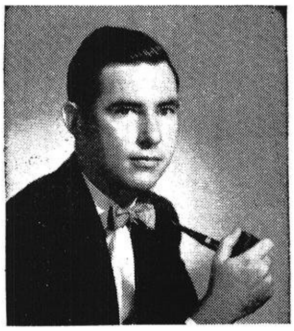
Ferris, who has been assistant chief electrical engineer, replaces C. F. Dobson, Madison, who has retired.

Ferris, a graduate of the University of Wisconsin in electrical engineering in 1931, became planning engineer for the Janesville and Beloit districts in 1953 and assistant chief engineer at the Madison office in 1954. END

George Lincoln asks:

What do metallurgists do in a chemical company?

GEORGE M. LINCOLN, JR. expects to receive his B.S. in metallurgical engineering from Lehigh University in 1957. George is active in sports, vice president of his junior class, and a participant in many other campus activities. He's starting his employment investigations early, for he feels that the selection of an employer is one of the most important decisions in a man's career.



CHARLES I. SMITH, JR. received his B.S. Ch.E. from V.P.I. in 1943, served in the Navy as an engineer officer, and joined Du Pont's Engineering Department in 1946. Since then he has advanced steadily through a number of interesting assignments at various Du Pont plants. Today Charlie Smith is technical superintendent of Du Pont's Newport, Delaware, Plant, Pigments Department.

Charlie Smith answers:

They have an almost endless variety of interesting problems to face, George. As a student of metallurgy you know that about two-thirds of all known chemical elements are metals. Many of them are revealing valuable new applications, when highly purified on a commercial scale. Du Pont is greatly interested in several metallic and semi-metallic elements.

My own experience at Du Pont ranges from work on titanium pigments, to metallic titanium production, and to the ultra-pure silicon used in transistors. You can appreciate some of our metallurgical problems when I point out that impurities in transistor silicon have to be below one part in 100 million. That's equivalent to one pound of impurities distributed through a train of ore cars twenty miles long!

Some of our metallurgists carry out fundamental research on new metals, and, in the development stage, they frequently operate pilot plants for producing them. Other metallurgists study problems relating to engineering materials used in construction, carry out research on intergranular corrosion, or investigate fatigue relationships encountered in dynamic, high-pressure operations.

You'll find many challenging opportunities in every phase of metallurgy at Du Pont, George.

Metallurgists and Metallurgical Engineers can find some of Charlie Smith's challenging new problems described in "Engineers at Du Pont." For a free copy of this booklet write to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington 98, Delaware.

DU PONT

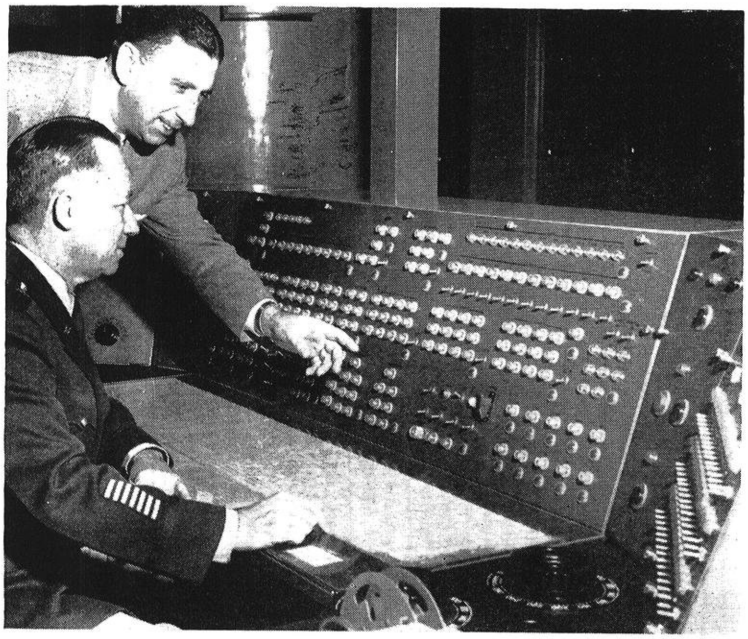
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

WATCH "DU PONT CAVALCADE THEATER" ON TV

SCIENCE HIGHLIGHTS

edited by Dick Tomlin, ch'56



ARMY GETS BRAIN

Purchase by the United States Army of a $4,000,000 electronic data-processing system – "Bizmac" –that converts months of business paperwork into minutes of "push-button" operation has been made.

Announcement of the purchase marks the first detailed public disclosure of the "Bizmac" system. Developed by RCA over a five-year period, the new system is specifically designed for standard business operations.

The RCA 'Bizmac' system will effect major operating economics. The system can perform in minutes inventory control procedures which now take months for the Army's vast Tank-Automotive supply program. The program involves control of replacement inventory of more than 200,000 different categories of parts, ranging from nuts and bolts to fan belts and engines, to keep military vehicles operative.

"The 'Bizmac' system will be used to provide speedy and accurate information on inventories, to determine in minutes the current supply of any item at any Ordnance depot in the nation, and to compute forecasts of future requirements."

TOUGH PROBLEM, SWEET SOLUTION

More than electrical engineering is behind the installation of a 44,000 kilowatt steam turbine-generator stator, at San Juan, Puerto Rico.

For one thing San Juan does not have any dock facilities that could begin to handle the 100-ton monster that was shipped there this summer from a General Electric Co. plant in Lynn, Mass.

This lack was overcome with the aid of twenty-two million pounds of sugar.

Sugar cargo was used to lower a Bull Line ship from 15 to 20 feet in the water so the deck was level with San Juan's dock. The stator was then slid sideways off the boat over a bed of timbers capped with maple planks and a heavy coat of grease.

The ship-to-dock operation was only one special problem of a difficult journey that was mulled over for more than two years by engineers.

Working with a scale model of the stator, they calculated the pulling and holding angles needed to move the load safely. The model weighed 1275 pounds and was one two-hundredths the size of the actual stator. At first it was believed the unit might be moved across the deck on rollers, but it was discovered while working with the model that a variance of less than one degree in these angles made the load too difficult to control. Hence the decision to slide the stator sideways on greased planks. Tides at the dock vary less than one foot and will not hinder the unloading, although it had to be calculated in the over-all plans.

After being shifted to the dock, the stator was rolled some 500 yards on heavy timbers to its permanent home at the power plant.

Its job as ballast completed, the sugar cargo was transported to a refinery in the United States.

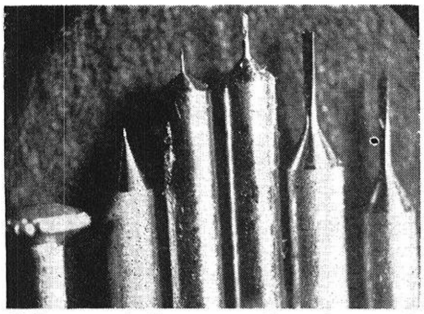
CIGARETTE LIGHTERS FOR JET PLANES

The common auto dashboard cigarette lighter has invaded the realm of electronic warfare, as a built-in part of a complex new ground-based USAF aid defense system in development.

The lighter has a distinctly scientific purpose in the complex, classified electronic equipment being built under a multimillion-dollar contract by General Electric's Heavy Military Electronic Equipment Department.

Engineers say an operator, scanning the system's glowing indicator radar scopes for hours in semi-darkness, could be temporarily blinded by the flare of a match or pocket lighter when lighting a cigarette. Furthermore, his hands must be free to work the dozens of knobs, switches and buttons on the control panel.

Accordingly, the built-in lighter was ordered as part of a "human engineering" program, to keep the operator as undistracted as possible.

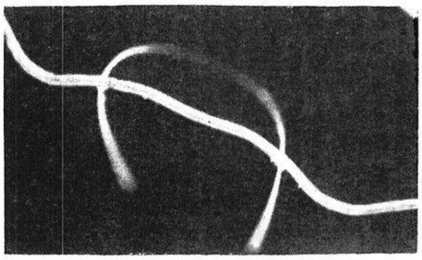


G.E.'s tiny drills compared to microscopic view of ordinary pinhead (left).

DRILLING INVISIBLE HOLES

General Electric's instrument makers have gone one-up on the old bromide about splitting hairs. They have drilled holes in hair and then threaded wire through the holes.

The company's General Engineering Laboratory uses a .001-inch drill, too small to be seen by the naked eye and so delicate it could be snapped or bent by accidental contact with a piece of paper tissue. It takes a microscope and a steady hand to thread such a tiny hole--but GE instrument makers have succeeded in lacing one-mil wire, a thousandth of an inch in diameter, through something that is even smaller than human hair—a strand of nylon stocking.



The laboratory uses this microscopic drill for such jobs as drilling tiny fuel injection nozzles, making orifices in leak disks that control the flow of gas into a vacuum chamber, and making apertures for electron beams in sensitive X-ray equipment.

Contrary to standard shop practice, drill operators must slow down the drill press to approximately 1,800 r.p.m. when using the one-mil size. In drilling operations, the usual formula is the larger the drill, the slower the speed, but the formula is the larger the drill, the slower the speed, but the formula works in reverse on the tiny drills.

RADIATION HAS DIFFERING EFFECTS ON VARIOUS MATERIALS

Research has shown that nuclear radiations can discolor many materials, render certain plastics tougher while reducing others to powder, change some liquids into solids and take the stretch out of rubber. Such radiations bring about operations problems around nuclear reactors, but offer opportunities for valuable new processing methods.

In the vicinity of reactors, the possibilities that radiation can harden or powder certain types of electrical insulating materials, decompose paint and melt down certain rubbers pose many technical problems.

Despite these unwanted effects, nuclear radiations can sterilize foods and drugs, toughen certain types of plastics, produce insulating material by degrading certain plastics and perform other chemical transformations.

Sterilization of foods and drugs by conventional means often requires considerable heat, even though the products might be sensitive to heat.

Radiation is able to sterilize with no appreciable increase in temperature. In addition, amounts of radiation required are relatively small in most cases.

In addition, delayed polymerization of certain materials can be accomplished by irradiating them while they are cool, then heating them at a later time to produce the desired linking of molecules.

Other studies have shown that irradiated wood can be digested as cattle food.

NEW TYPE HIGH-FIDELITY SPEAKER

The development of a new type, electrostatic, high-frequency speaker with a new high in efficiency and a lower degree of distortion has been made possible through the use of "Mylar" polyester film, according to a nationally

(Continued on page 52)

A FEW YEARS AGO, HE WAS ON CAMPUS AT PURDUE UNIVERSITY, AND NOW . . .

FLOYD D. (Doug) WALLACE, JR., above, is a senior project engineer at Allison.

He left Purdue in 1947 with his AE degree and came to Allison the same year. Presently, he is in charge of instrumentation and automatic process controls at Allison's new Research & Development test center.

With Allison now in the midst of a $75 million engineering expansion and building program, much of his time is spent in vendor contact work, studying and selecting equipment most adequate to do the job; observing, and helping with installation. He is shown above checking a control valve positioning amplifier on the instrument panel for controlling air pressures and temperatures of four electric motor-driven, axial flow compressors. This new facility is part of the new Research and Development test center, which—when completed—will enable testing of individual combustion components for turbo-prop and turbo-jet engines, compressor and turbine components.

Doug's work is "cut out" for him for some time to come, for only recently, Allison broke ground for the engineering building which is to be the center of expanded Research and Development facilities for advanced types of aircraft engines for commercial and military use.

With this long-range expansion program, Allison needs more engineering personnel, and opportunity for young graduate engineers is unlimited. Arrange now for an early interview with our representative on your campus, or write for information about the possibilities of YOUR engineering career at Allison: Personnel Dept., Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

ALLISON

TURBO-PROP ENGINES

American built for the new era in air travel

Here is one of a series of advertisements we are running in FORTUNE and BUSINESS WEEK to acquaint company managements with our interest and our experience in the field of automation and data-processing.

We believe we are making good progress in developing activities that should ultimately give us a strong position in the tremendously important and rapidly growing field of automation.

Positions are available for scientists and engineers in these fields of current activity:

Business Data Systems Development

Digital Computer Research and Development

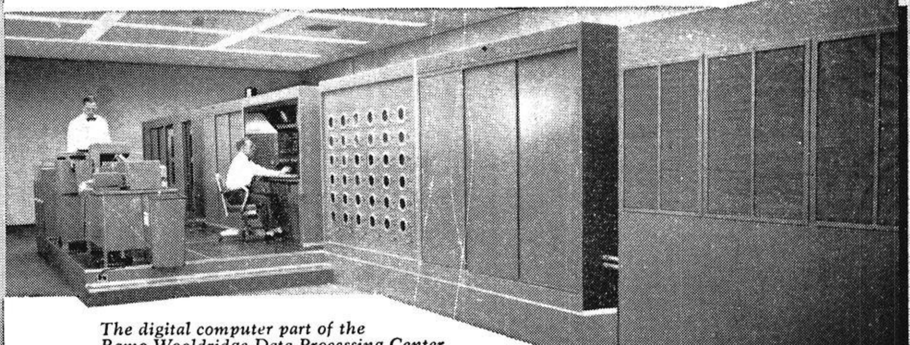
Radar and Control System Development

Communication Systems Development

Guided Missile Research and Development

The Ramo-Wooldridge Corporation

8820 BELLANCA AVENUE
LOS ANGELES 45, CALIF.



The digital computer part of the Ramo-Wooldridge Data Processing Center

BUSINESS AUTOMATION and MILITARY ELECTRONICS

The problem confronting many company managements today in deciding what course to follow in applying the new techniques of automation and data processing is similar to the problem faced in recent years by the leaders of our military organizations in arranging for efficient application of the same powerful tools of electronics to the art of war.

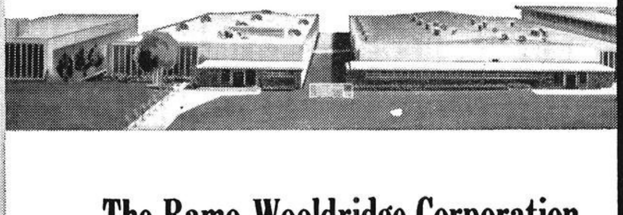
At Ramo-Wooldridge the difficult demands of major military systems responsibility have been met successfully by the placing of heavy dependence upon teams of unusually well-qualified, mature and experienced scientists, operational procedures experts, and engineers. These teams deal with the technical and non-technical portions of a project as inseparable and interrelated aspects of a single problem.

Similarly, work has been done in the last two years by this company on systems problems of non-military clients from such diverse fields as manufacturing, banking, transportation and public utility. The results strongly support the conclusion that many of the difficult problems in automation that face business and industry today can be economically solved by teams that include a breadth of technical and non-technical competence which permits them to conduct a highly objective, scientific analysis of a client's operations and requirements:

One important advantage to the client of such a broad and objective approach to his problems is the possibility of recommendations that realistic operational needs can be met without the necessity for investment in any additional machines or equipment. Nevertheless, the technical strength of The Ramo-Wooldridge Corporation, provided by its hundreds of scientists and engineers, is such that it can also undertake successfully the development of entirely new equipment and techniques, if required. As an example, major programs are currently under way on the development of an advanced type of digital computer and control system, and on the automation of large-scale data processing activities.

To a surprisingly great extent, military electronics experience has charted the course for non-military automation. A major objective of The Ramo-Wooldridge Corporation is to assist business and industry in moving rapidly, yet realistically and economically, to take advantage of the great benefits of the new techniques.

The Ramo-Wooldridge lecture hall during a lecture on Operations Research, as applied to the solution of management problems.



PACIFIC SEMICONDUCTORS, INC., *a subsidiary devoted to the development and manufacture of advanced types of semiconductor devices such as diodes and transistors... of great importance in the future apparatus of automation.*

The Ramo-Wooldridge Corporation

8820 BELLANCA AVENUE • LOS ANGELES 45 • CALIF.

FREDERICK W. WERDERMANN

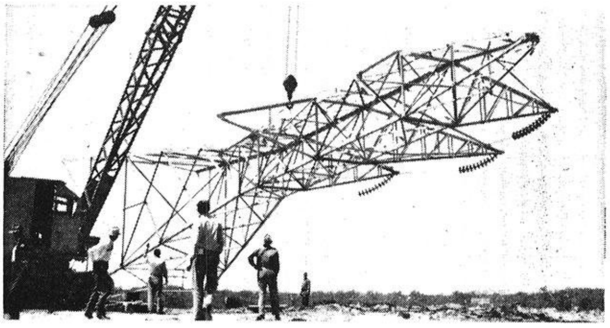
"I'm glad that I chose WISCONSIN ELECTRIC POWER COMPANY"

An engineering graduate of the University of Wisconsin, Frederick W. Werdermann began his utility career in 1945 as a Cadet Engineer at Wisconsin Electric Power Company. He has made steady progress through the positions of Field Engineer, Special Engineer, Technical Assistant to the Superintendent of Interurban Overhead, and now to his present position as Assistant Superintendent of Electrical Construction. He says, "I'm glad I chose WEP Company. My career has been interesting and rewarding."

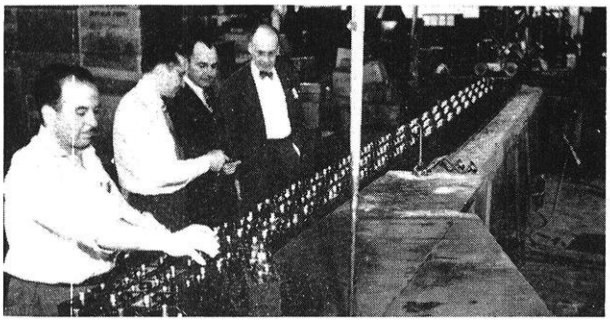
THERE'S A PLACE FOR YOU IN OUR FUTURE!

Many engineering graduates choose Wisconsin Electric Power Company because of its reputation for sound and steady progress . . . for its modern and pioneering policies. For example, our power plants have established world records for efficiency. They were the first to develop and use the process of burning pulverized fuel, the first to introduce radiant superheaters into their furnaces. Engineering talents are needed in the varied fields of our operations. Recognition of ability is assured through an unique "management inventory" system which has received industry-wide attention.

PLANNING — Engineers are needed to help plan and design the generating, transmission and distribution facilities which serve the needs of more than half a million electric customers in Wisconsin and upper Michigan.



CONSTRUCTION — Engineers are needed to supervise the details of a continuing construction program. The 1955 construction budget for the Wisconsin Electric Power Company system amounted to more than 41 million dollars.



SALES — Engineers are needed for many phases of the Company's sales program. Openings are available in the field of industrial sales . . . in the activities of lighting, heating, air conditioning and commercial groups.

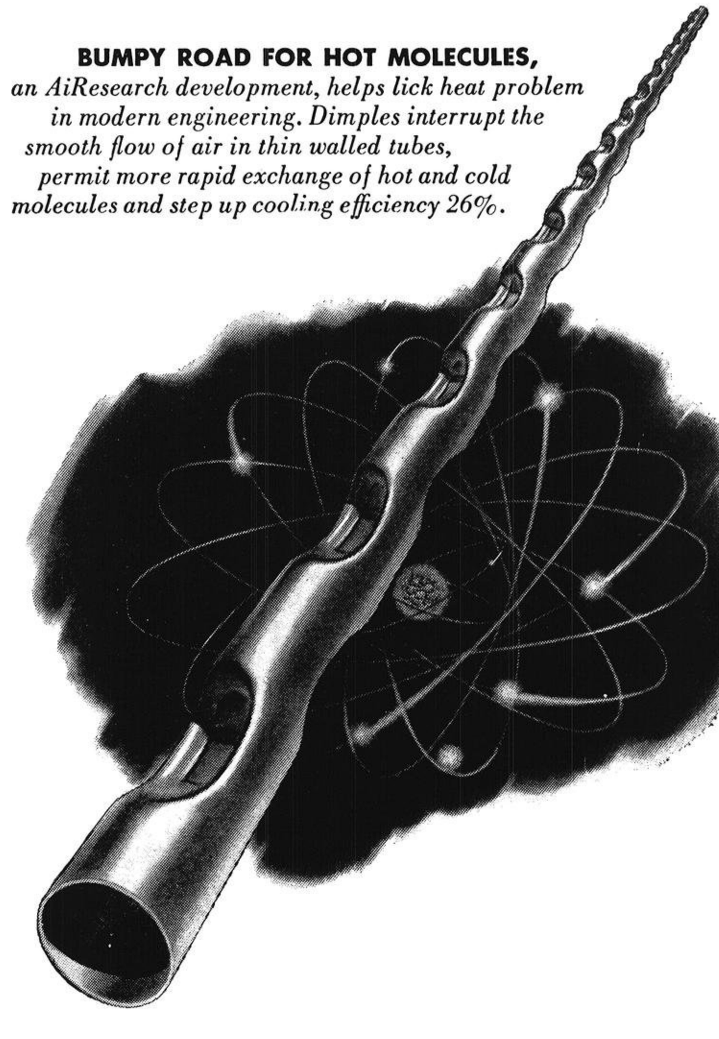
ADMINISTRATION — Engineers are needed for many activities which provide an excellent training for advancement into administrative fields. Many of our executive positions are now held by engineering graduates.

Write to our PERSONNEL SERVICES DEPT. for a copy of our Annual Report and other information

WISCONSIN ELECTRIC POWER COMPANY

231 West Michigan St., Milwaukee 1, Wisconsin

To the engineer who likes to blaze new trails...



BUMPY ROAD FOR HOT MOLECULES, *an AiResearch development, helps lick heat problem in modern engineering. Dimples interrupt the smooth flow of air in thin walled tubes, permit more rapid exchange of hot and cold molecules and step up cooling efficiency 26%.*

AiResearch is looking for your kind of engineer.

AiResearch is a key company in the industrial future of America. We are playing a vital part in the great engineering advances now taking place.

The field of heat transfer is an example. The advent of high-speed, high-altitude aircraft has made heat control one of the most pressing present-day problems. This promises to be even more acute when atomic energy becomes an industrial fact. AiResearch is constantly developing new methods of heat transfer. But this is only one aspect of our operation. We pioneered the field of small turbomachinery, pioneered aircraft air-conditioning and pressurization systems, developed many different types of pneumatic and electronic equipment, now manufacture more than 1000 different products. We develop new solutions for industry as required.

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Science Highlights

(Continued from page 47)

known manufacturer* of high-fidelity phonographs.

Prior to the electrostatic speaker development, the manufacturer says this type of reproduction was attainable only in the most expensive types of high-frequency reproducers.

The small cylindrical speaker—designed for high-fidelity sound in the 7,000 to 20,000 cycle range—replaces larger, heavier and more expensive units. Many of these older style reproducers were not efficient above 10,000 cycles.

The sound originates on the half-mil metalized film, the vibrating electrode of the new cylindrical speaker. It fits over a perforated, aluminum cylinder which is the stationary electrode. "Mylar" is used in this application because it is thin and strong and has high dielectric strength.

In addition to its high dielectric strength, even in the thinnest gauges, "Mylar" is the strongest plastic film made—its tensile strength is 23,500 pounds per square inch. Since sound in the electrostatic speaker is applied uniformly to the entire surface of the diaphragm, the manufacturer says the film's strength was an important factor in its selection as a component part of the speaker.

The ability of the polyester film to take a metallic surface was mandatory in the design and is responsible for the speaker's high-fidelity sound performance, it was reported. In older style speakers, where sound waves are initiated in the voice coil at the center of the paper cone, the sound reproduction distorts at high frequencies. This occurs because the sound, beginning at the apex of the paper cone, is adversely affected by the cone's own characteristics.

"NEW" METALS FOR NUCLEAR POWER REACTORS

Progress in atomic power depends upon the development of metals able to withstand severe punishment by radiation, heat, and corrosion in atomic power reactors.

Four metals playing the most important role in atomic power reactor operation, are uranium, thorium, beryllium, and zirconium. Uranium and thorium are fuel materials, and beryllium is an excellent moderator. Reactor control is easiest when fission takes place at heat-producing energies rather than at the higher radiant energies such as produced by an atomic bomb. In an atomic reactor, the moderator is a material that slows down the speed of atom-splitting neutrons to the desired heat-producing energies. Zirconium can be used as a cladding material for the prevention of corrosion.

A cladding acts as a container for the fuel element. It must be efficient at transferring heat, and provide the fuel a corrosion-resistant seal against the surrounding cooling material. It also functions to prevent the escape of radioactive products into the coolant stream.

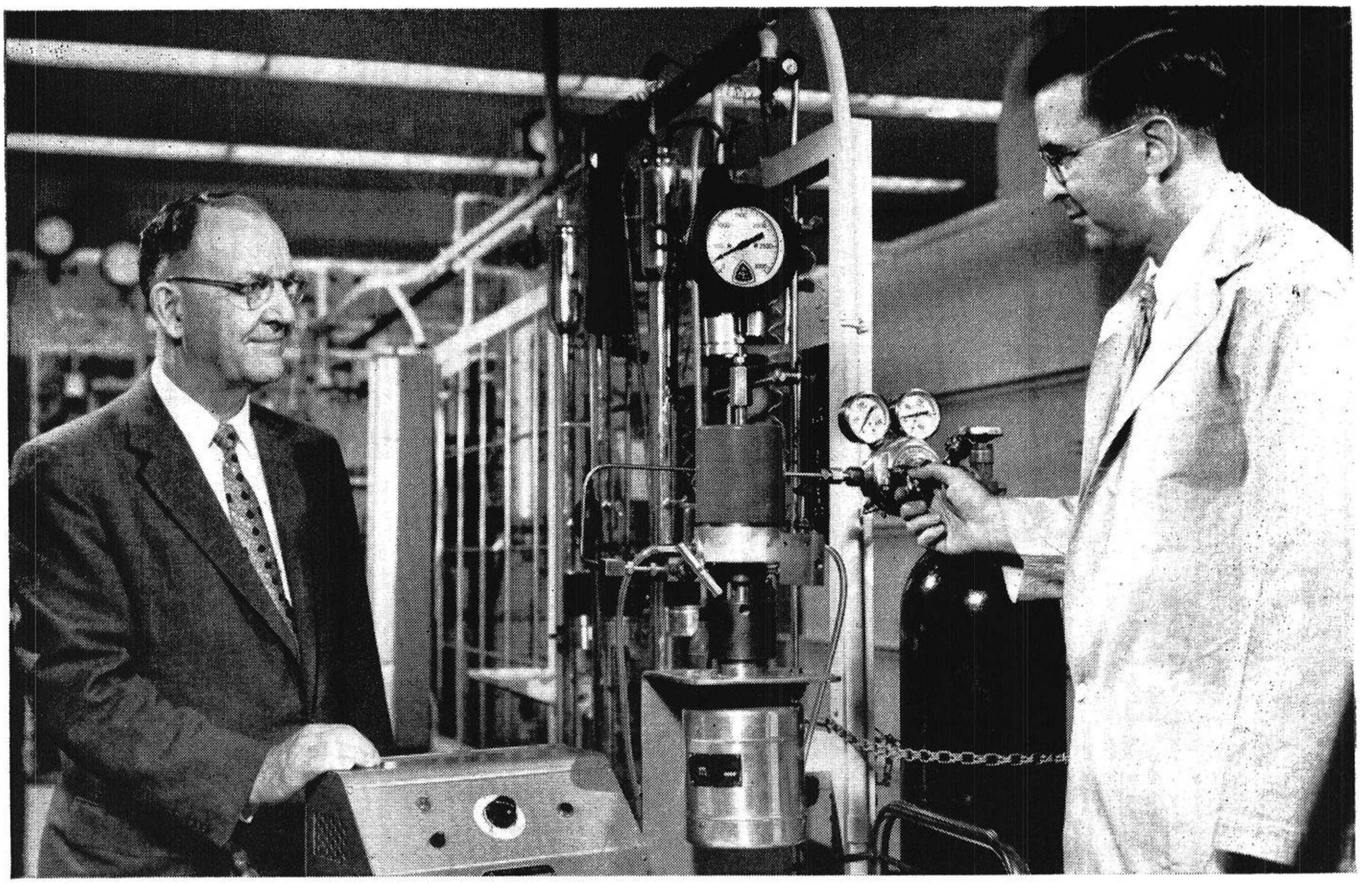
New alloys have been described which are used to obtain efficient heat transfer with a minimum of other adverse effects, an important objective in the design of protective claddings for fuel elements.

One of the major problems in reactor design is the matter of enormous stresses caused by the intense heat of nuclear fission. These stresses can separate a cladding from the fuel element unless an efficient bond can be achieved. Improved bonds are being developed by metallurgists working on atomic reactor problems.

• • •

When you mention 2 by 4's most folks think of the 2 by 4 wood studs used to frame the walls of houses. That's one of their most popular uses. A more unusual use for 2 by 4's is to skim slag from molten iron. A metal skimmer would melt, the lumbermen point out.

END



Dr. Ward Kuentzel and Dr. Edmund Field, co-inventors, observe operation of the new Magne-Dash autoclave in Standard Oil's Whiting research laboratory.

Orders for inventions taken here

MODERN RESEARCH creates a need for brand-new types of equipment. In petroleum laboratories, mixing up some stuff in a beaker usually isn't the answer. The research pioneer may have to use high temperatures and high pressures. If he must stir his mixture, he has a tough job. How can he prevent leakage past the shaft of the stirrer?

To meet this and other difficult situations, Standard Oil has set up a "Special Devices Program". A group of scientists creates the apparatus needed to solve today's problems.

An example is the Magne-Dash* autoclave. It has a magnetically operated agitator, and no external moving parts. Leaks cannot occur. Research men now use freely the high pressures that lead to new plastics and other new products.

Like many other inventions made by Standard Oil scientists to solve our own problems, the Magne-Dash is licensed for production and sale by a maker of scientific equipment.

The Special Devices Program is just one of the creative activities at Standard Oil. Young scientists find it stimulating to work in such an atmosphere.

*Manufactured under Standard Oil license by Autoclave Engineers, Inc., Erie, Pa.

Standard Oil Company

910 South Michigan Avenue, Chicago, 80, Illinois

STANDARD

Geneva Report

(Continued from page 17)

fuel element cans are made of stainless steel rather than the usual aluminum. But still the reactor uses just water as a coolant and produces electricity at a cost comparable to electric stations fuel by coal. All countries indicated that development of advanced water-cooled designs gave good prospects of producing power at economic cost.

Another important type of reactor that was discussed at the session is the class that uses liquid metal as a coolant. Two such systems were revealed for the first time at the Geneva Conference. North American Aviation has a design that uses liquid sodium coolant with graphite moderators. They found that a molten metal has a better heat transfer capacity than water and also eliminates the need for the high pressures that a water coolant requires. North American believes that such a reactor will be flexible enough to not only produce power, but also to manufacture fissionable plutonium fuel.

The fast breeder liquid metal reactors were also discussed in detail. Believing that this type of reactor is the most advanced type, the U. S. is operating an experimental model that is a true breeder, producing electric power and excess fuel. Several problems prevent the fast breeder type from being economical commercially, however. The reactor is not self-regulating and therefore an elaborate safety control system is needed. Coupled with this is a fuel paradox. In order to get maximum power from the reactor, a high percentage of U–238 is necessary, while at the same time good breeding performance requires that a low percentage of U–238 be used. A third problem is the intense radiation that takes place at the fuel element level. It causes the properties of the plutonium fuel to change so that it no longer both produces power and breeds new fuel. This means that

(Continued on page 56)

Geneva Report

(Continued from page 54)

expensive fuel repurifying must continually go on. But in spite of these drawbacks, the Geneva delegates concluded that the fast breeder liquid metal reactor will have a definite place in the commercial power field.

Thus these three sessions — reactors and physics, chemistry and metallurgy, and biology and radioisotopes, become the meeting place for some of the best minds in the world. And the full discussion of all of the developments mentioned here, will soon be published by the U.N., perhaps becoming available early in 1956. These publications are expected to become standard reference works in the atomic energy field. But aside from its scientific value, the Geneva Conference managed to highlight the tremendous importance that nuclear energy should have for the future. Even as the Geneva delegates were speaking, several nuclear power stations were already delivering power to homes and industries. At West Milton, N. Y., the General Electric Company has built a prototype reactor of the type used in the submarine USS Seawolf. This reactor, housed in a 225-foot sphere, provides power for both test equipment and a turbine-generator that sends 10,000 kilowatts of electric power to the surrounding community. This reactor is of the familiar uranium type that uses liquid sodium to transfer heat from the fuel elements to a heat exchanger. And the heat exchanger in turn produces the steam for the turbine-generator.

Of more advanced design is the 180,000 kilowatt boiling water reactor that is being built on the Illinois waterway, near Chicago. This reactor, using a new dual-cycle principal, generates steam immediately at the core level, eliminating the need for heat exchangers like those used at West Milton. The plant is to be owned and operated by Commonwealth Edison Company and promises to produce electric power at a cost comparable to plants using coal as a power generator. It will supply the Commonwealth system of Chicago and Northern Illinois.

Clearly, nuclear generated power is no longer in the strictly experimental stage. The Geneva Conference supports the conclusion that countries all over the world are looking to the atom for commercially feasible electric power, and getting it. Their parallel concern with the medical and biological aspects of the atom's radiation prove that the world expects to live in a future where nuclear occupations will be commonplace. And the engineering and scientific progress revealed at Geneva is the best proof to date that this atomic future is close at hand. **END**

St. Lawrence Waterway

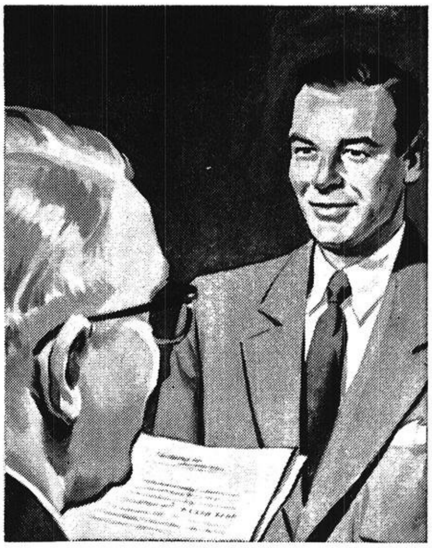
(Continued from page 23)

The seaway is economically sound because an increase in navigation from 10-million tons to 44.5-million tons annually, forecast by the Canadian survey, would result in shipping savings estimated at $50-million annually. Annual costs, estimated by the Corps of Engineers and the Canadian Authorities, amount to $14.5-million. Curtis Hatch, Madison president of the Farm Bureau Federation stated that ". . . 6 to 8¢ a bushel on grain transportation would be saved." It is estimated that 6 to $20 per ton will be saved in moving cars and farm equipment to European ports via the seaway. The Army engineers estimate the cost of the Thousand Island section at $17.5 million and the International Rapids section at $86.5 million. Our government has appropriated $105 million to the St. Lawrence Seaway Development Corporation in the form of outstanding revenue bonds. In order to insure payments of costs of maintenance, operation and interest charges as well as to provide for amortization of the investment for not more than 50 years, the law provides for the negotiation of an agreement between the United States and Canada establishing toll rates. The Committee on Public Works noted that with the passage annually of 44.5 million tons a toll rate of 32.5 cents per ton would pay all total average annual carrying charges. The committee, therefore, feels that self-liquidation of the project is assured.

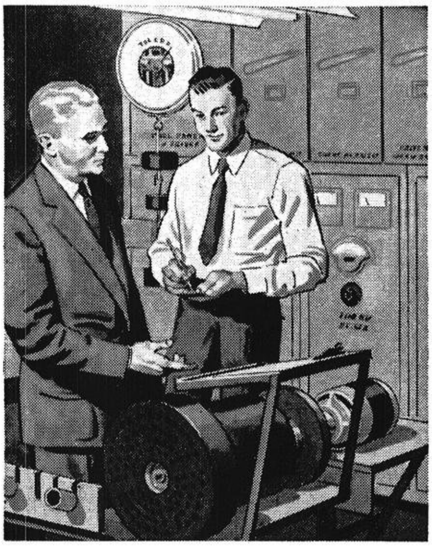
American cities are answering the call for adequate port facilities to meet the flood of trade from abroad. Milwaukee is spending $4.7-million to replace dock cranes, expand harbor railroad facilities, dredge the outer harbor slips to 27 ft. and build a new pier and cargo terminal. Chicago is undertaking a ten year $125-million program which includes new transit sheds, grain elevators, light cranes and docks. Detroit expects a 100% trade increase within one year, because of the Seaway, and is planning a $500-million highway bond issue to aid the port development. Cleveland would like federal aid in building a proposed six and a half mile breakwall costing $15-million and enclosing a $30-million highway to and from the harbor. A $300-million, 103 miles long conveyor from Cleveland to East Liverpool is the center of controversy. The belt would carry ore from Cleveland to East Liverpool and coal on return. Buffalo is going to spend $5.5 million in anticipation of the tremendous ore traffic to her docks. The first ore from the new Canadian deposits left Seven Islands July 31. Of the 1.7-million tons moved almost 70,000 tons went to Buffalo. These are just a few of the preparations for the seaway across. Our Heartland, which extends from the wheat fields of Nebraska to the factories of Ohio and Pennsylvania, can be felt the quickened beat of readiness. **END**

Here's what happens when you take a job with DELCO PRODUCTS

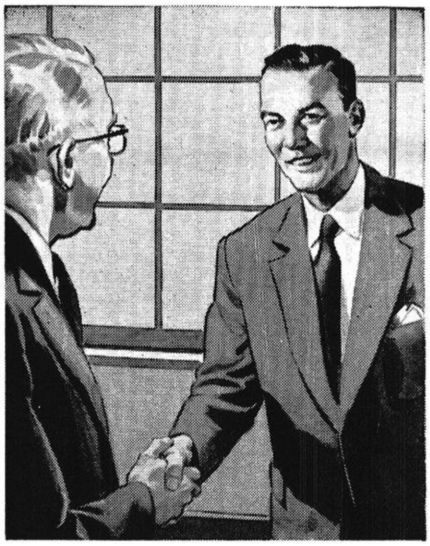
1 When you take a job with Delco Products, you start a career with General Motors—with a division known throughout the world as a leading manufacturer of electric motors, hydraulic shock absorbers, and many other products.



2 You enter into a well-organized training program—a program specifically designed to take full advantage of your particular interests and abilities. You don't just "go back to school." Instead, you *learn* by *doing*, with top-flight supervision.



3 As a trainee you get into every conceivable phase of Delco's engineering operations — engineering laboratory, plant engineering, drafting, sales, processing, standards, quality control. Additional assignments are often made in related departments for broader experience.



4 Training completed, you'll be given a specific departmental assignment. Progress can be made in product development, technical staff operations, sales, or in manufacturing supervision—according to your interests and capacity for future development.

5 With Delco's policy of promotion from within, your opportunities for advancement are virtually unlimited. Not every trainee becomes a supervisor, but some go much farther. Many General Motors top executives today are "graduates" of Delco Products Division.

If this opportunity interests you, sign up for the GM interview on your campus and ask for referral to Delco Products. For booklet detailing Delco's engineering activities, write to:

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Delco Products Division, GMC
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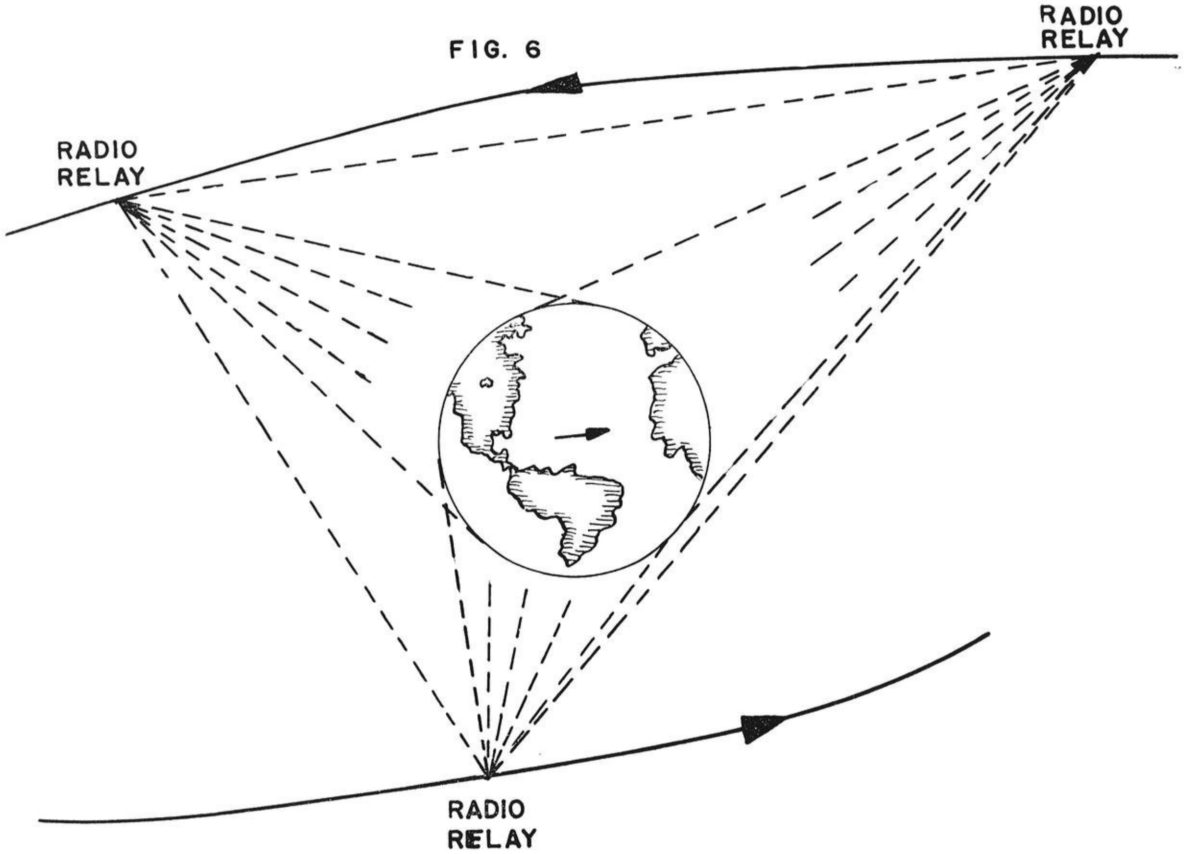

Progress . . . Spaceward

(Continued from page 13)

tures, humidity, air composition, electron and ion densities, cosmic radiation, ultraviolet radiation, and wind velocities. Since the size and weight of this satellite are to be severely restricted, telemetering devices will be used in conjunction with specially designed, miniaturized instruments. Telemetering is a process by which samples of each instrument reading are converted to electrical signals, the signals being used to modulate a radio frequency carrier wave which is then transmitted to receiving apparatus on the ground. The receivers are expected to be distributed at selected points around the world so that a continuous record of the sampled instrument readings will be obtained. All previous, high-altitude instrument readings have been more or less random, being obtained from rockets or balloons. The satellite will thus provide the first really extensive and accurate data pertaining to a particular high altitude. It is hoped that the data so obtained will provide a means for checking the theoretical data now existent, as well as promoting new theoretical lines of thought.

The next satellite will then be constructed on the basis of the new and accurate data. Probably the next step will be to place a satellite at distance of 1000 miles from the earth's surface where similar data will be taken. Eventually, the unmanned satellites may be expected to provide enough information on the nature of space to allow building larger, manned satellites placed in especially valuable orbits. If, for example, three satellites were to be placed at 2200 miles altitude, they would circle the earth with the same velocity as the surface velocity of the earth. Each such satellite would then appear to remain permanently fixed in space over a given point on the earth. The three satellites would be able to contact all points on earth by television or ultra-high frequency radio, thus providing full and continuous radio and television coverage of earth as shown in Figure 6.

Other special satellites could be constructed for astronomical research, meteorological research, re-fuelling stops for rockets, and so on. It might be pointed out that a space station is not well suited for national defense purposes because of its vulnerability to guided missiles from the ground.

The first satellite may then be expected to fulfill a role in the pioneering of space travel similar to that played by the Wright brothers' first airplane in the science of aviation. If present plans, whereby all nations of the world are invited to share in the satellite project, are carried through successfully, the project will establish a political as well as a scientific milestone.

END

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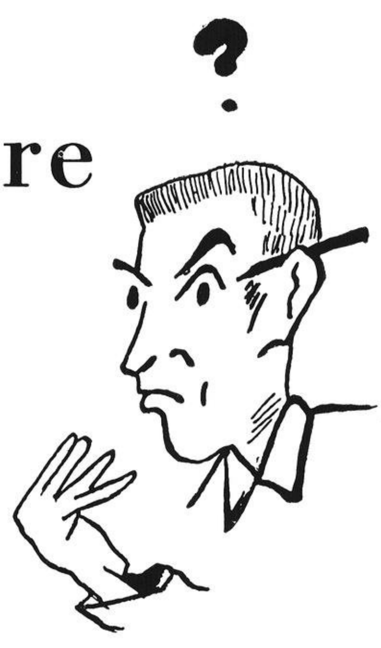
So You Think You're SMART!



by Sneedly, bs'60

Only four more years of school left for poor Sneedly now that it is 1956. As a result of this climactic situation Sneedly made some New Year's resolutions which should impress the readers of this column to no end. No more studying during Spring Vacations and no more four points are to be seen on Sneedly's transcript. Furthermore, to show bigger and better things, more problems and less gibberish are to appear in the column. Of course, the latter was by request to ensure the Engineer a finer and more lasting quality.

Although final exams are here and the main obstacles at the present time, Sneedly is offering some problems to you which will help you in that last "big push."

For the engineer taking his first university mathematics exam Sneedly offers this problem to you:

Recently, one of Wisconsin's wealthier alumni donated a lot in the most valuable part of Miami, Florida to the staff of the Wisconsin Engineer. The lot is triangular in shape, the largest side of which is 101 rods long. The other two sides of the triangle are 51.5 rods long and 49.5 rods long. What is the area of this triangle? Anyone submitting the correct area of this triangle gets the deed to this property.

For review in Algebra Sneedly passes on to you this nutty problem.

Five men and a monkey were marooned on an island in the Pacific. Since coconuts were the only things which grew upon this island the men and the monkey were dependent upon these nuts for their livelihood. The first day they were there the men spent gathering the coconuts. Men being what they are, however, not one of them trusted any of the other four. So during the night, to make sure each received his share each one stole out and got his share. Each man divided the pile of nuts he found into five equal parts and hid his share. In every case, there was one extra coconut which was given to the monkey. On the following day, the men met and divided the remaining pile into five exactly equal piles. How many coconuts were in the original pile?

Sneedly wants all you ROTC men to come through with an "A" so he will speak to the c.o. personally for all you who submit the correct solution of this problem to him.

Using six shots, how can you score 100 shooting at the target shown?

Last month, Sneedly's problems were rather involved and tricky. The minimum number of sets that could have been played to decide the tennis tournament was 15 totaling 90 games for the winners. If you will refer to last month's column you will find that Sneedly's notes show the winners actually took 97 games (4). Actually, one extra set was played in the first round (3), leaving one game to be accounted for. One set in the whole tournament must have reached five all and then was won 7–5.

Haverson lost his first match 6–4 and 7–5 (7). Jones reached the finals where he lost (8). Since he won the only 7–5 set his first round opponent was Haverson.

Other first round pairings were Cromwell vs. Oliver (5), and Ryan vs. Wyconowitz (9). The remaining two entrants must have been paired: McCarthy vs Charles.

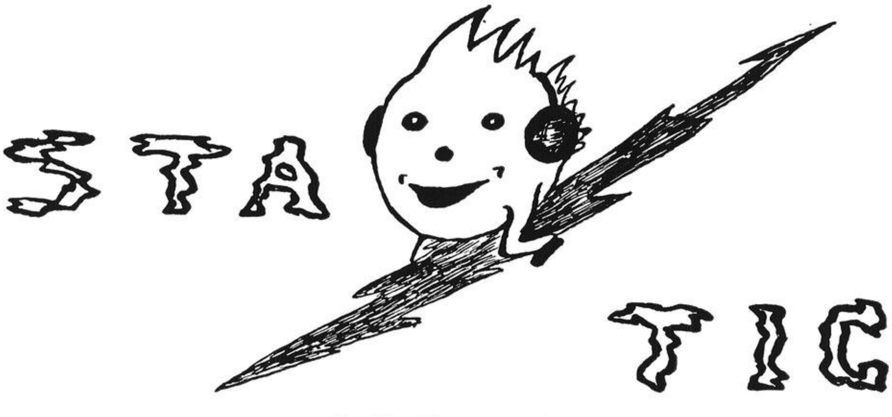
The winners is the first round were McCarthy (3), Jones (8), Wyconowitz and Oliver (6). In the second round Wyconowitz did not meet McCarthy (1) nor did he meet Jones for Jones vs. Haverson and Wyconowitz vs. Ryan were in different halves of the original bracket (2). Therefore, Wyconowitz met Oliver and McCarthy met Jones. The winners were Oliver (6) and Jones (8). Oliver won the final from Jones 6–4, 6–4, 6–4.

The unnameable compound is a ferrous wheel! The ring was saturated and each carbon has four bands. Since only two of these bands are free to latch on to the iron the Fe must be ferrous. This makes the ring a ferrous wheel.

The chemical reaction started at a quarter to nine and lasted 64 minutes 20 seconds.

As a last review for those English finals you can check Sneedly's column for errors the rewriter misses!

END



I. R. Drops, II

A faith healer ran into his old friend Max and asked how things were going.

"Not so good," was the pained reply. "My brother is very sick."

"You brother isn't sick," contradicted the faith healer, "he only thinks he's sick. Remember that he only thinks he's sick."

Two months later they met again and the faith healer asked Max, "How's your brother now?"

"Worse," groaned Max, "he thinks he's dead."

° ° °

Overheard in the Engineer office: "The editor just hung himself!"

"Omigosh! Have you cut him down?"

"Heck no, he isn't dead yet."

° ° °

A little old lady riding on the train was passing the time by working a crossword puzzle. Turning to the man beside her, she asked: "I wonder if you would help me with my puzzle?"

"I might," he replied, "what's the matter?"

"Well," the lady said, "all I need is a four letter word ending in i-t, and it says here it's something found in the bottom of a bird cage, and that the governor is full of it."

"Hmmmm," said the man, "that must be grit."

"So it is," exclaimed the little lady, "do you have a pencil with an eraser?"

° ° °

I also listened to a temperance lecturer. (That's when I was on the wagon.) He asked the audience this question, "Now supposing I had a pail of water and a pail of beer on this platform, and then brought in a donkey; which of the two would he take?"

"He'd take the water," came a voice from the gallery.

"And why would the donkey take the water?" asked the lecturer.

"Because he's an ass," came back the reply.

I immediately saw the logic in the statement and I've been off the wagon ever since.

An Idaho potato married a Long Island potato. Pretty soon they had a little sweet potato, and when the little sweet potato grew up it said: "I want to marry Lowell Thomas."

And said Mama: "You can't marry Lowell Thomas. He's a commentator."

° ° °

Apparently there are some who take a more sprightly view of death and the hereafter than most people do. For example, here's a line from a recent obituary notice in the "Dublin Evening Mail." After the describing the impressive rites, the notice wound up: "Patrick McGovern slipped at the graveside and broke his leg. This accident cast a gloom over the whole proceedings."

° ° °

Pre-Med Student: "You girls wouldn't care to go with us, would you?"

Arts Student: "Would you girls care to go with us?"

Badger Engineer: "Where do we go, you lucky girls?"

° ° °

When you put on your cute rayon scanties
Do they crackle electrical chanties?
Don't worry, my dear,
The reason is clear,
It's just that you have amps in your panties.

° ° °

Television: An improvement over radio. Now you cannot only hear static, but you can see it too.

Love: A lot of dame foolishness.

° ° °

Yesterday some anonymous fool called me and told me it was a long distance from New York.

What did she think I was—a fool. I knew that already.

° ° °

Ed: "Give me a cigarette, Joe."

Joe: "I thought you had quit smoking."

Ed: "Well, I got to the first stage, I've quit buying."

° ° °

"Why does Gale let all the boys kiss her?"

"She once slapped a C.E. who was chewing tobacco."

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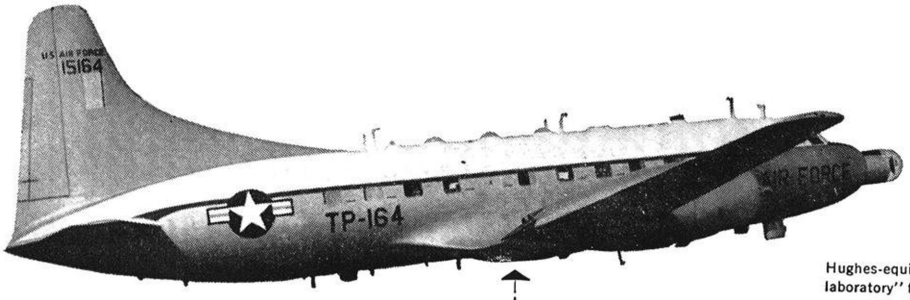


Hughes-equipped T-29 "flying laboratory" for systems evaluation.

Flight evaluation of advanced interceptor electronic system uses unique approach.

T-29 "INTERCEPTOR"

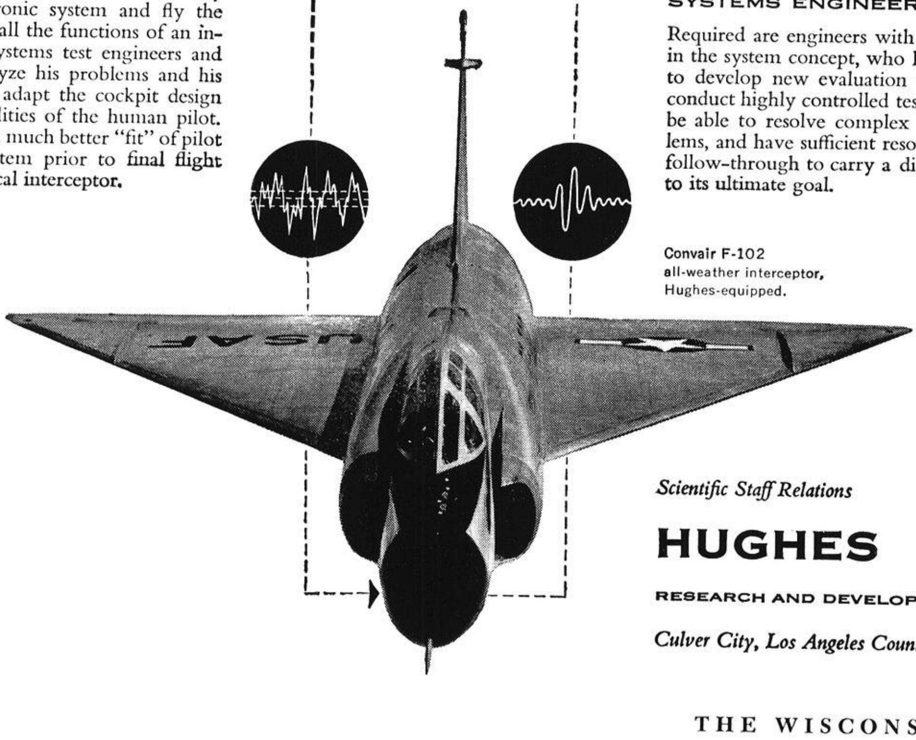
THE DEVELOPMENT OF AIRBORNE ELECTRONIC SYSTEMS REQUIRES THOROUGH FLIGHT EVALUATION OF BREADBOARD AND PROTOTYPE EQUIPMENT PRIOR TO FINAL DESIGN. AT HUGHES, SYSTEMS FOR INTERCEPTORS ARE FIRST TESTED IN "FLYING LABORATORIES" IN WHICH THE EQUIPMENT IS READILY ACCESSIBLE TO SYSTEMS TEST ENGINEERS

One interesting problem recently confronting Hughes engineers was that of evaluating the requirements imposed upon the pilot of a high-speed one-man interceptor. This arose in the development of a new integrated electronic system to control several phases of an all-weather interceptor's flight. Because of the great importance of providing the pilot with the optimum design and arrangement of displays and controls, it became necessary to determine accurately the pilot's work load during flight, and the human factors that affect his ability to carry out his task.

The solution was to install a complete mock-up of the actual interceptor cockpit in a large T-29 aircraft in which a breadboard model of the system was being tested. From this cockpit a test pilot can simultaneously operate the electronic system and fly the T-29, performing all the functions of an interceptor pilot. Systems test engineers and psychologists analyze his problems and his performance, and adapt the cockpit design to the natural abilities of the human pilot. The result will be a much better "fit" of pilot and electronic system prior to final flight testing in the tactical interceptor.

SYSTEMS ENGINEERS

Required are engineers with a basic interest in the system concept, who have the ability to develop new evaluation techniques and conduct highly controlled tests. They should be able to resolve complex circuitry problems, and have sufficient resourcefulness and follow-through to carry a difficult program to its ultimate goal.



Convair F-102 all-weather interceptor, Hughes-equipped.

Scientific Staff Relations

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

PHOTOGRAPHY AT WORK—No. 18 in a Kodak series

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Behind the many photographic products becoming increasingly valuable today and those being planned for tomorrow lie intriguing and challenging opportunities at Kodak in research, development, design and production.

If you are interested in these opportunities in science and engineering—whether you are a recent graduate or a qualified returning serviceman, write to the Business and Technical Personnel Department.

Eastman Kodak Company, Rochester 4, N. Y.

A Southern wholesale confectioner had received an order for $10.00 worth of candy bars from the Horsie Hollow Candy Shop. It was a first order, and when the credit manager didn't find the name listed in the Reference Book, he phoned the Dun & Bradstreet office for a report on the venture.

The reporter assigned to the case located the concern on a dirt road, and he took a snapshot of the premises and its busy proprietors which inspired this illustration. He interviewed the owners and wrote a report which was forwarded to the wholesaler.

It informed him that the enterprise was operated as a partnership by two neighbors who were both "eleven years of age and unmarried"—also that "although the owners are men of limited means, they have a high standing in their community." The financial statement indicated assets of $13.25 in merchandise and cash, with a valuation of $35.00 for the building consisting of a remodeled turkey coop.

The partners were reported as experienced with a five-year record of selling lemonade and cookies with their home pantries as the principal sources of supply. There was no indebtedness as their mothers' terms were strictly C.O.D. The wholesaler took a more liberal attitude and shipped on regular terms. The bill was paid in ten days, and the wholesaler opened an account in his ledger for the "Horsie Hollow Candy Shop."

Kodak
TRADE-MARK

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Apply engineering backgrounds to solve customers' electrical apparatus needs

To develop your technical background into the customer-contact career most suited to your interests and aptitudes, investigate General Electric's Apparatus Sales Training Program. Professional career outlets include work in one of the Company's nation-wide district offices in *sales, application, installation and service engineering; headquarters marketing; or specialization in a particular apparatus product.*

G.E.'s training program equips you to work directly with customers to determine what design, new development or electrical system will best serve their need. Here, Jack Byrne, Manhattan College '41, is shown presenting competitive engineering features of G-E distribution transformers. 956-4

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Mr. G. E. Mullin
Apparatus Sales Training Program
Building 2
General Electric Company
Schenectady 5, New York

Please send me your descriptive bulletin on the Apparatus Sales Training Program, GEZ-515A.

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