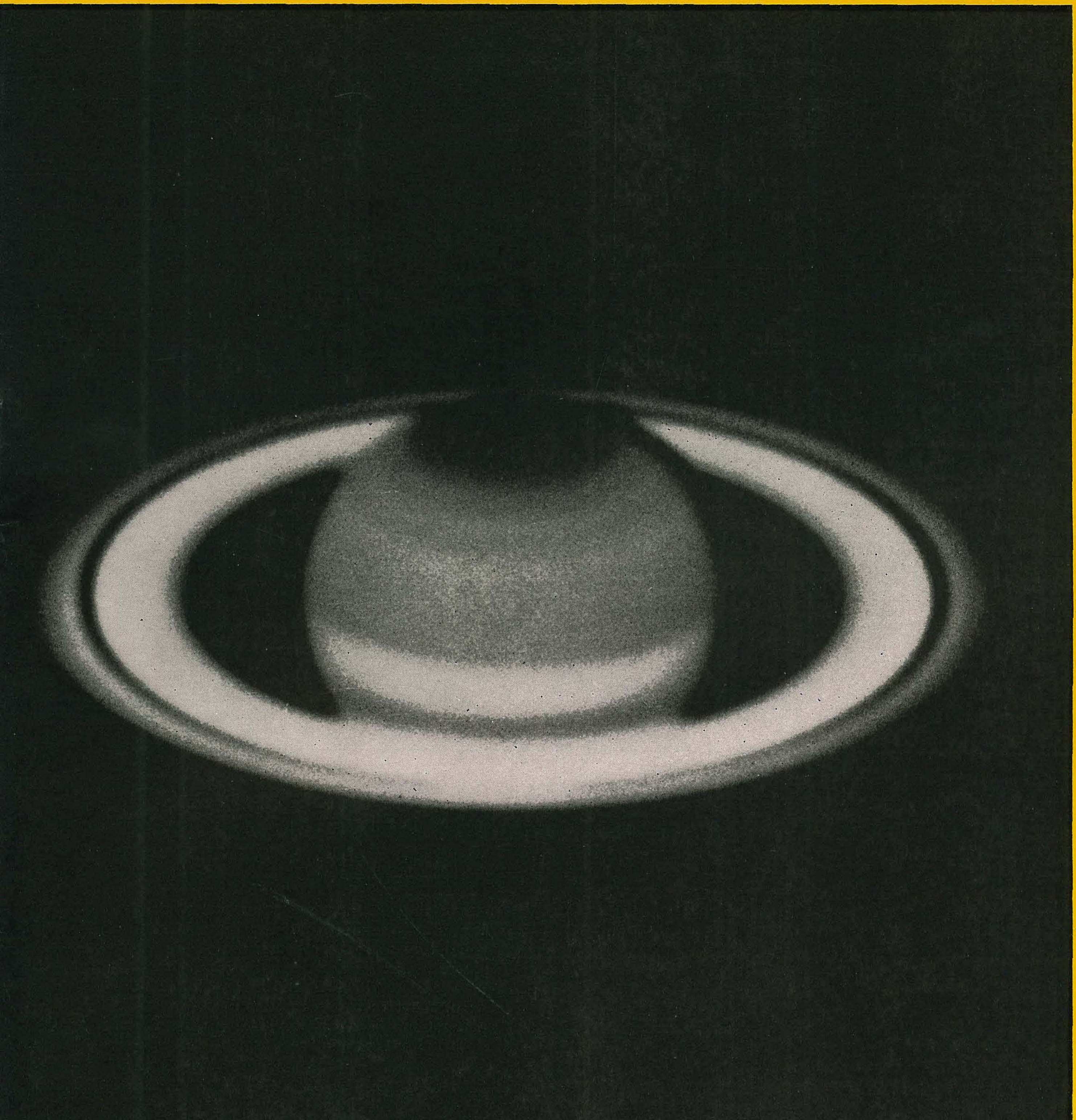
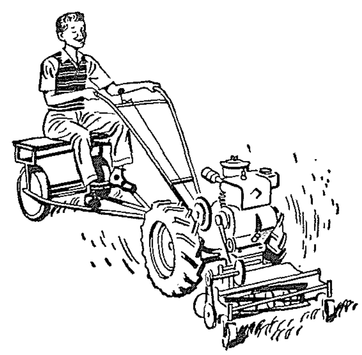
ENGINEERING | AND | SCIENCE

FEBRUARY/1952



New Palomar Pictures . . . page 26

PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY



CAPITALIST!

Johnny used to be a laborer. Brother Tim still is.

Both cut lawns. Both used to use customers' hand mowers. Each could do one big lawn a day, and got $2 for it.

Tim spent his $2 on movies and candy. Johnny saved some money, borrowed some more, and bought a power mower. Now he can cut 5 lawns a day, and so makes $10.

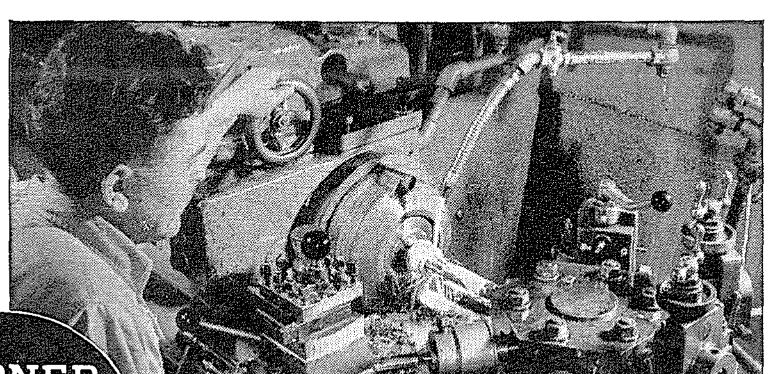
He puts aside $2 a day to pay back his loan, and $1 toward another mower when this one wears out.

He still has seven dollars where he used to have two, and is helping more people get their lawns cut when they want them. Yet some enemies of business would say that that shows Johnny is too big; he should be limited in the number of people he can serve.

These same strange enemies would prevent Johnny from setting aside $1 a day out of his own earnings, to buy a new mower when this one wears out. (Of course, that means Johnny would go back to hand labor at $2 a day, and fewer people would be served—but these strange people don't care about that.)

And some people say Johnny should be forced to share his $7 with Tim so Tim can keep on spending his $2 for movies and candy.

Sound ridiculous? Yes, but every one of these charges and demands is leveled at American business today.



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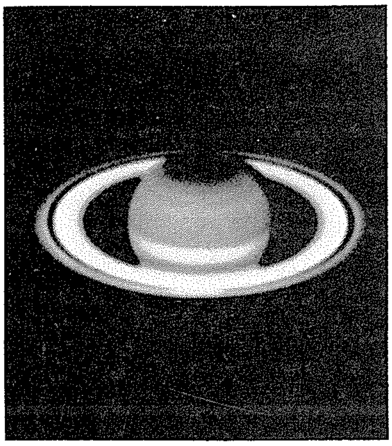
ENGINEERING AND SCIENCE

FEBRUARY 1952 VOLUME XV NUMBER 5
PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

IN THIS ISSUE



This month's cover is a striking photograph of the planet Saturn and its ring system, taken by the 100-inch telescope. It's not a brand-new picture, but it's newly released by the Mount Wilson and Palomar Observatories. The Observatories—you may not know—maintain a catalogue of pictures which are available to the general public, and this month's cover picture, along with several other samples which can be found on page 26, are additions to the new edition of the catalogue which has just been published.

The article on "Alcoholism" on page 9 of this issue was adapted from one of two Hixon Lectures delivered at the Institute last month by Dr. Roger J. Williams, Director of the Biochemical Institute of the University of Texas.

Dr. Williams, a distinguished biochemist, is the discoverer of pantothenic acid. He was born, of American parents, in Ootacumund, India, in 1893, received his B.S. from the University of Redlands, California, in 1914, his M.S. (in 1918) and Ph.D. (in 1919) from the University of Chicago.

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He worked as a research chemist for the Fleischman Company in Chicago in 1919 and 1920, then went to the University of Oregon as Assistant Professor of Chemistry. He was made an Associate Professor in 1921, and a full Professor in 1928. In 1932 he became a Professor of Chemistry at Oregon State College, where he remained until 1939. He has been at the University of Texas since that time, and has been Director of the Biochemical Institute there since 1941.

He received an honorary D.Sc. from the University of Redlands in 1934, and from Columbia University in 1942. In 1941 he received the Mead-Johnson Award of the American Institute of Nutrition, and in 1942 he was awarded the Chandler Medal by Columbia University.

He is a Fellow of the American Association for the Advancement of Science, and a member of the National Academy of Sciences as well as a number of professional societies.

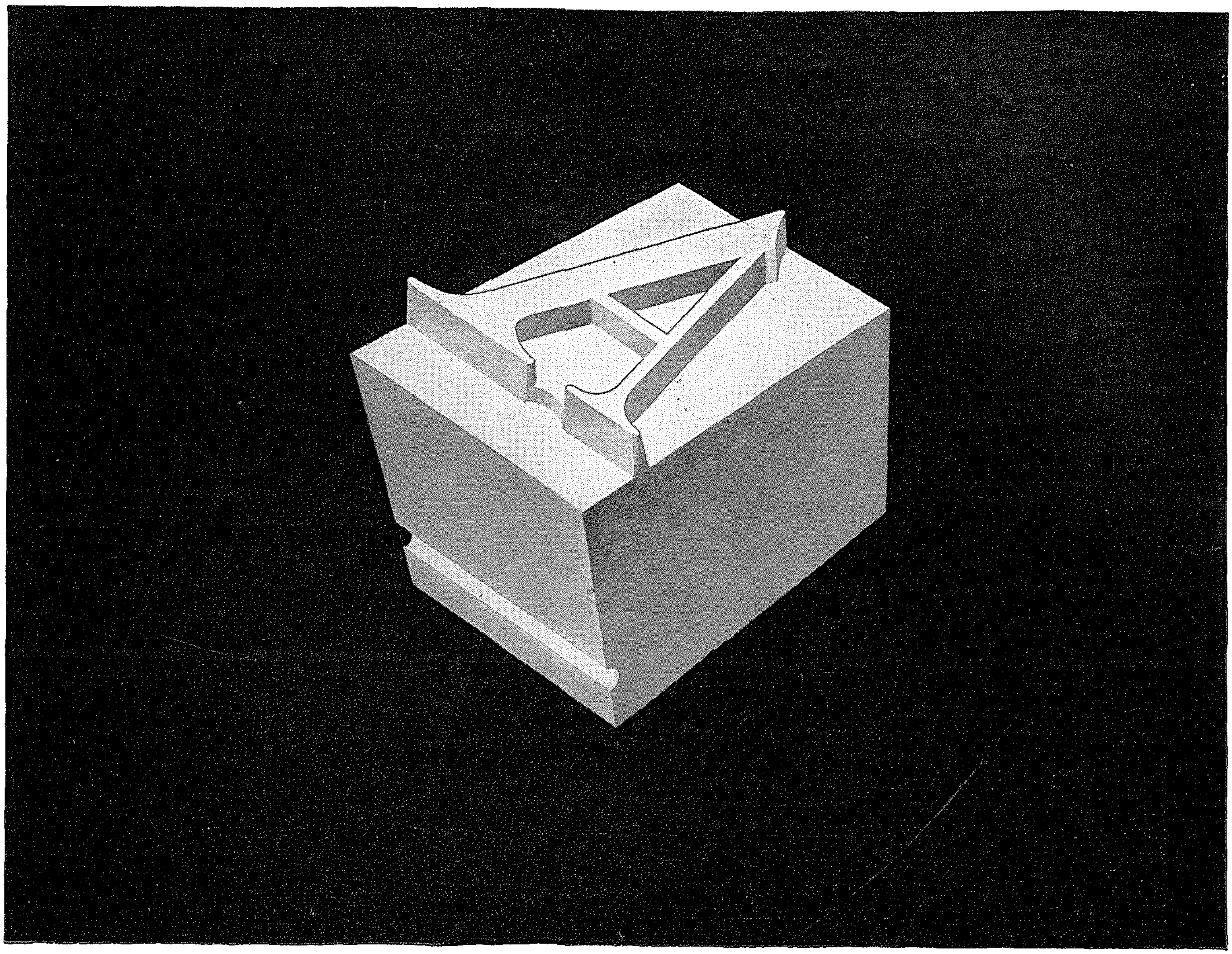
He is the author of several textbooks on organic chemistry and biochemistry, of *What to Do About Vitamins*, published in 1945, and *The Human Frontier*, published in 1946.

Williams' work on alcoholism, as the article on page 9 explains, was a direct result of his having written *The Human Frontier*. It's a new, and revolutionary approach to this age-old problem.

The collapsed volcano described in the article on page 13 was spotted by Bill Miller, photographer for the Mount Wilson and Palomar Observatories. Exploration is Bill Miller's hobby, and on a rugged jeep trip into the Pinacate region of northern Mexico last year, he found and photographed a remarkable mile-wide chasm. When he showed the photograph to Dr. Richard H. Jahns, Professor of Geology at the Institute, Jahns recognized it immediately as a caldera, or collapsed volcano, and decided it was worth some field study. His decision was borne out in the ensuing investigations. In recent months Jahns and his group of co-workers have located several other similar cavities in the region. The original, however, known as Crater Elegante, is still the outstanding example in the area.

Ernest R. Hugg's story of the construction of the new bomb-resistant addition to the Huntington Library is on page 17 of this issue. One interesting sidelight that the story doesn't reveal though, is that the fame of the new bomb-resistant structure has already spread far and wide. The Huntington keeps receiving queries from other museums, which are interested in setting up some protection for their treasures too. We respectfully refer them to the Hugg article for complete details.

The Letters column of the January 1952 issue of E&S carried a letter from William H. Proud '50, asking the magazine to print regular Caltech athletic schedules. We promised to do this if enough readers wanted us to. Well, not having defined what we meant by enough, we've decided to go ahead and run the schedules in the magazine on the basis of a couple of dozen requests. We figure that when two dozen people take the trouble to write us *in favor* of something, it's safe to say at least half our readers feel the same way. The schedules are on page 48 of this issue.



ALCOHOLISM

Roger Williams and his co-workers at the Biochemical Institute of the University of Texas are tackling this age-old problem in a new and revolutionary way

A GOOD MANY people still think alcoholism is a sign of moral depravity. Others recognize it as a disease, but consider it a mental one. Recent research at the University of Texas, however, has begun to produce evidence that alcoholism, after all, may have a physiological basis.

In 1946 Roger J. Williams, Director of the Biochemical Institute of the University of Texas, wrote a book called *The Human Frontier,* in which he proposed the development of a new branch of applied science — humanics — to undertake a comprehensive study of individual human beings.

It was Williams' conviction that most scientific studies of man were concerned with a non-existent "average" man — whereas what we really needed was a science of human beings to help us cope with such social problems as marriage, health, employment, crime, group bigotry, alcoholism and war.

Having expressed this conviction, Williams determined to do something about it. Obviously it was impossible to try to learn everything about everybody all at once. In order to make any headway at all he would have to tackle some specific problem, and after considerable cogitation and discussion he settled on a study of real people in connection with alcoholism.

Williams suspected that the differences which people exhibit with respect to alcohol—and the fact that some people develop a craving which they cannot control—had a genetic basis, as well as a physiological basis. So, with his co-workers at the Biochemical Institute at the University of Texas, he began to explore the problem of alcoholism in relation to differences between people and to inborn difference.

The work began with studies of the metabolic patterns —the body chemistry—of various individuals. Though the body chemistry of human beings is broadly the same

This article has been adapted from "Alcoholism as a Genetotrophic Disease," a Hixon Lecture delivered by Dr. Roger J. Williams at the California Institute of Technology on January 31, 1952

Dr. Roger J. Williams, Director of the Biochemical Institute of the University of Texas, who has been studying the effects of nutritional deficiencies in relation to alcoholism

from individual to individual, and the same chemical reactions take place in each of us, nevertheless individual human beings can differ greatly in the degree of effectiveness with which they carry out the various reactions. Different individuals, for instance, react differently not only to alcohol but to drugs, anesthetics, coffee, and nicotine.

The studies revealed at once that the metabolic pattern of each individual is quite different from that of all other individuals. But the investigators soon discovered that some of these patterns were significant from the standpoint of different groups. Highly significant differences were found between schizophrenics from a state hospital and normal individuals, between children from feeble-minded institutions and normal children, between morons and imbeciles—and between alcoholics and non-alcoholics.

Alcoholics and non-alcoholics compared

Alcoholics and non-alcoholics were compared with respect to some 62 items that could be measured. Urine and saliva samples were collected from the two groups five times a week for a period of four weeks, and analysis of these samples revealed, for example, that the sodium content of the saliva of alcoholics was extremely high. Uric acid in both the urine and the saliva of alcoholics was also high. Gonadtropin and citrilline in the urine of alcoholics were low.

The evidence was by no means watertight, but it was sufficient to indicate to Williams that many of these metabolic patterns were to a considerable degree genetic in origin. Could the inheritance of a specific pattern of endocrine gland activities, for example, be responsible for alcoholic tendencies?

The next step in the studies was animal experimentation. In order to study the tendencies of animals to consume alcohol, a group of rats was put into individual cages. Each rat was given two drinking bottles—one containing 10% alcohol, the other water. The positions of the bottles were shifted each day so that the rats would have to make a deliberate choice each time they took a drink.

All social influences had to be eliminated. ("The rats were not allowed to give parties," Dr. Williams wryly observes, "—nor were they given the opportunity to look over each other's records or anything like that.")

The principal difference between this experiment and most animal experimentation was that the investigators here were interested in observing *individual* rats. The usual thing, of course, would be to take a group of rats, average them together, and come up with a result. At the risk of being considered unscientific, Williams and his co-workers watched each rat by itself.

They found immediately that the rats showed a great degree of individuality in their response to alcohol under this particular set of conditions. One rat, for example, consumed alcohol at a substantially high level—continuously, from the first time it was offered to him. Another rat was, as far as any of the investigators could observe, a teetotaller. He didn't touch a drop of alcohol during the 60 days he participated in the experiment. A third rat was a very moderate drinker, taking just enough for the investigators to be able to tell that he was drinking alcohol at all.

Another rat started at a low level of consumption but, after 20 or 30 days, showed a high consumption. A number of the rats reacted in this way. Sometimes it would be four or five weeks before they would begin to take alcohol in substantial quantities, sometimes only a couple of weeks.

Spasmodic drinkers

Some of the rats were spasmodic drinkers. They would drink for a day or two, then go on the wagon for a week or more, only to come back and drink heavily for a couple of days again.

The behavior of the rats was, in a word, individual. As Williams points out, if the investigators had taken a group of rats (and the larger the group the worse the results would have been, he adds) and averaged them all together, they would have found a pattern of behavior that *no* rat exhibited.

But *why* did the rats behave so variously? They were on identical diets, and they were under as nearly identical conditions as possible. Did diet have something to do with it?

To find out, the rats were put on a stock diet—a diet which was marginal on B vitamins only. On this marginal diet it was found that *all* the rats would drink alcohol. Some began to drink from the start; others delayed, but eventually all the rats came up to a fair level of drinking.

Drinking on an abundant diet

As a follow-up to this experiment, the rats were put on an abundant diet, which included everything they could conceivably want. None of the rats drank alcohol at a high level.

The researchers then tried the obvious experiment of putting the rats on a marginal diet, allowing them to drink at a high level, while giving individual rats various supplements to see how each would behave. The responses of the rats to this treatment were, again, highly individual.

One rat, for instance, started out at a very high level of alcohol consumption. After several weeks, the rat was given a supplement containing ten vitamins, which it was thought might bring his diet up to a satisfactory level. His alcohol consumption rate dropped overnight. Because of this striking response, the treatment was carried on over a long period of time. The rat showed no tendency to go back and try the alcohol again.

The behavior of this particular rat is not something than can be duplicated with every rat, of course, though it is a fact that most of the rats in the original group chosen for these studies reacted in this manner. As the work progressed and different strains of rats were brought in, however, this particular assortment of added vitamins was not sufficient to keep them off the alcohol. Other nutritional supplements had to be added to their diets. But the more supplements that were added, the more rats were prevented from consuming alcohol.

Probably it was just a fortunate coincidence that the original group of rats used in these experiments gave such conclusive responses. It is an interesting sidelight that, when the researchers began to run out of these rats, they had to borrow others from the Home Economics Department at the University of Texas. These proved to be much heavier drinkers, and were much harder to cure.

Some people, of course, blamed this on environmental influence—though the researchers continued to suspect genetics. They reasoned that the Home Economics rats reacted differently because these animals had in their makeup a possible genetic block which increased their nutritional demands. For instance, if an animal has a mechanism — genetically received — involving riboflavin deficiency, then it may require more riboflavin to make the system work efficiently. So rats, it was argued, may differ in their needs for riboflavin or other vitamins, amino acids or minerals.

Alcohol and nutrition

Presumably, some of the original rats did not consume alcohol because the stock diet furnished them with all the nutrients they needed. And some took to alcohol from the start because this diet was deficient for them in certain respects. Why deficiencies should cause an appetite for alcohol is still not too clearly understood, but it is nevertheless an experimental fact in regard to these rats.

Dr. Williams and his co-workers have made a number of studies to find out which vitamins are most effective, and whether amino acids, minerals or other nutrients have much effect. In general, they have found that a lack of thiamine, riboflavin, pantothenic acid or pyrodoxine is particularly effective in producing an alcoholic appetite. When animals are put on a deficiency diet of any of these substances, the animals drink; when the vitamins are supplied, the animals stop drinking.

An individual matter

It doesn't always work out as cleanly as this. Sometimes when the researchers produce a diet deficient in riboflavin only, the diet is apt to be marginal in respect to some other things. But all the results fall in with the hypothesis that each animal has different needs from a quantitative standpoint. The researchers have found that they are not able to give rats generally—all strains and all kinds of rats—all the things which are important in their nutrition. But, as far as rats are concerned, when this *can* be done, alcohol consumption will pretty much disappear.

Of course, Williams and his co-workers are not primarily interested in alcoholism in rats. ("It is not," Dr. Williams observes, "a really serious problem.") So, when they thought they knew something about what made animals consume alcohol, they began to turn their attention to human beings. Possibly, they decided, a potential alcoholic is an individual who has rather high demands for certain vitamins, amino acids, minerals or other substances. Because of these high demands he is not nourished sufficiently on an ordinary diet. When he consumes alcohol he dilutes that diet. (It is a fact that some people *do* drink instead of eating; they don't drink in addition to eating. They take in so many calories a day, and if they take these in the form of alcohol they don't take them in the form of foods that contain vitamins, amino acids and minerals.) The more he drinks, the more he dilutes his diet, the more deficient he becomes, the more he drinks.

If it were possible to get these potential alcoholics to eating things they need, or if their diets could be supplemented with things they have high requirements for, the tendency toward alcoholism might disappear. It was on this basis that the Texas scientists began their experiments on human beings.

Human experiments

Soon after this work got under way a man came to them who had been an alcoholic for ten years, and a heavy drinker for 20 years. He was on his last legs. He had tried psychiatry and gotten no relief; he had tried Alcoholics Anonymous, but their program had not seemed to click with him, despite its general excellence. Now his wife had finally turned him out of their home.

It seemed like a long shot. "Suppose," said Williams, we could do something that would decrease your appetite for alcohol, or abolish it. Would you know it?"

The man was confident. Certainly, he would. He knew what the symptoms were; he was very conscious of his craving for drink.

So they started him out. They were careful not to try to sell him anything or promise him anything—in fact, they *couldn't* promise him anything. They gave him 15 vitamins to take regularly and asked him to report back from time to time.

At the end of a month the man reported that he was able to sleep better than he had for a long time. After several more weeks he announced that his craving for liquor was gone. The treatment was continued until, after four months of complete abstinence, the man insisted on proving that he was cured for good.

Acid test

It seemed risky and Williams tried to talk him out of it, but the man was determined to test himself.

"I'm going down to the beer parlor," he said, "and drink some beer and come back here sober."

He did. He drank a couple of bottles of beer with reasonable relish, forced himself to drink more to confirm the experiment, then reported back to Williams —sober.

Today, after three years, the man continues under treatment. He drinks moderately, but his compulsion is gone. Williams thinks this may well be the first case on record in which an alcoholic has become a moderate drinker.

It was a matter of several weeks before this man reported any effects from his treatment, but in general— as with the rats—Williams has found that improvement often comes "overnight."

Case history

A young married student at the University of Texas came to Dr. Williams for help after hearing him give a talk. Since the war he had been unable to leave liquor alone. Though he had been working at a job he loved, he had lost it because of his drinking. Thinking that a change of environment would help him, he moved to Texas and went to law school. But it wasn't long before he was as bad off as ever, and he was unable to stay in school because of his drinking.

Williams put him under treatment. In less than two weeks his compulsion was gone, and, following his own inclination, he was able to spend an hour and a half dawdling over a bottle of beer, then leave it without wanting more. At last report, his condition was unchanged.

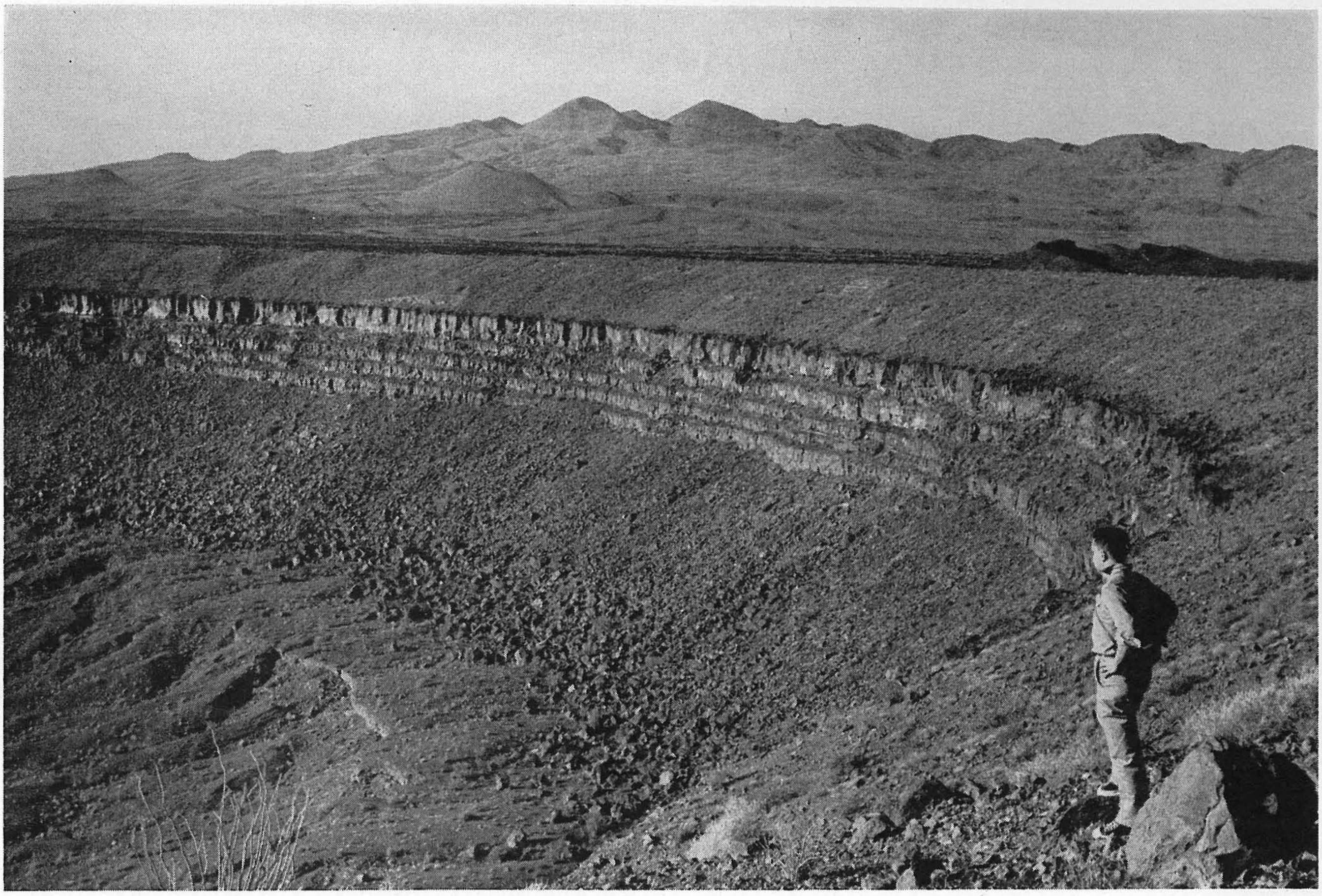
The Williams experiments with human beings are still just a little more than a year old. Overall results can hardly be expected to mean much yet, but Williams estimates that the partial successes and the complete successes are, to date, about equal in number. The work has already encouraged other researchers to enter the field, and has now received the cooperation of a number of physicians.

Parallel results

The fact that gives the Texas workers the greatest encouragement in connection with the human trials made so far is that the results parallel closely the clear-cut findings obtained with experimental animals.

"People have developed an unfortunate tendency," says Dr. Williams, "to think that a particular treatment will either alleviate a disease or fail to do so. If our basic findings are valid, our treatment of alcoholism in its present form is as certain to fail in particular cases as it is to succeed in others. If the results were different, if they were uniform in one direction or the other, our basic ideas would be seriously in question.

"We cannot say that we have fully demonstrated in a scientific manner the efficiency of nutritional treatment and that there is no room for doubt or questioning. We can say that in view of the animal experiments, which are clear cut, the inescapable logic of the genetrophic concept, and the striking results obtained with many of the alcoholics who have taken the treatment, we are convinced of its essential soundness and efficacy. We hold the opinion that any alcoholic wanting help will do well to arrange with his physician for a trial—a trial which at worst can do no damage."



Jesus Ruiz Elizondo, geology graduate student at Caltech, on the rim of Crater Elegante, in his native Mexico.

COLLAPSED VOLCANO

Caltech geologists reconstruct the history of Crater Elegante, a mile-wide chasm in the Mexican wastelands

A MILE-WIDE HOLE in the ground in the uninhabited wastelands of Mexico is furnishing Caltech scientists with invaluable information about the surface features of the earth on which we live. From it may also come a better understanding of how rocks form and how large crystals grow.

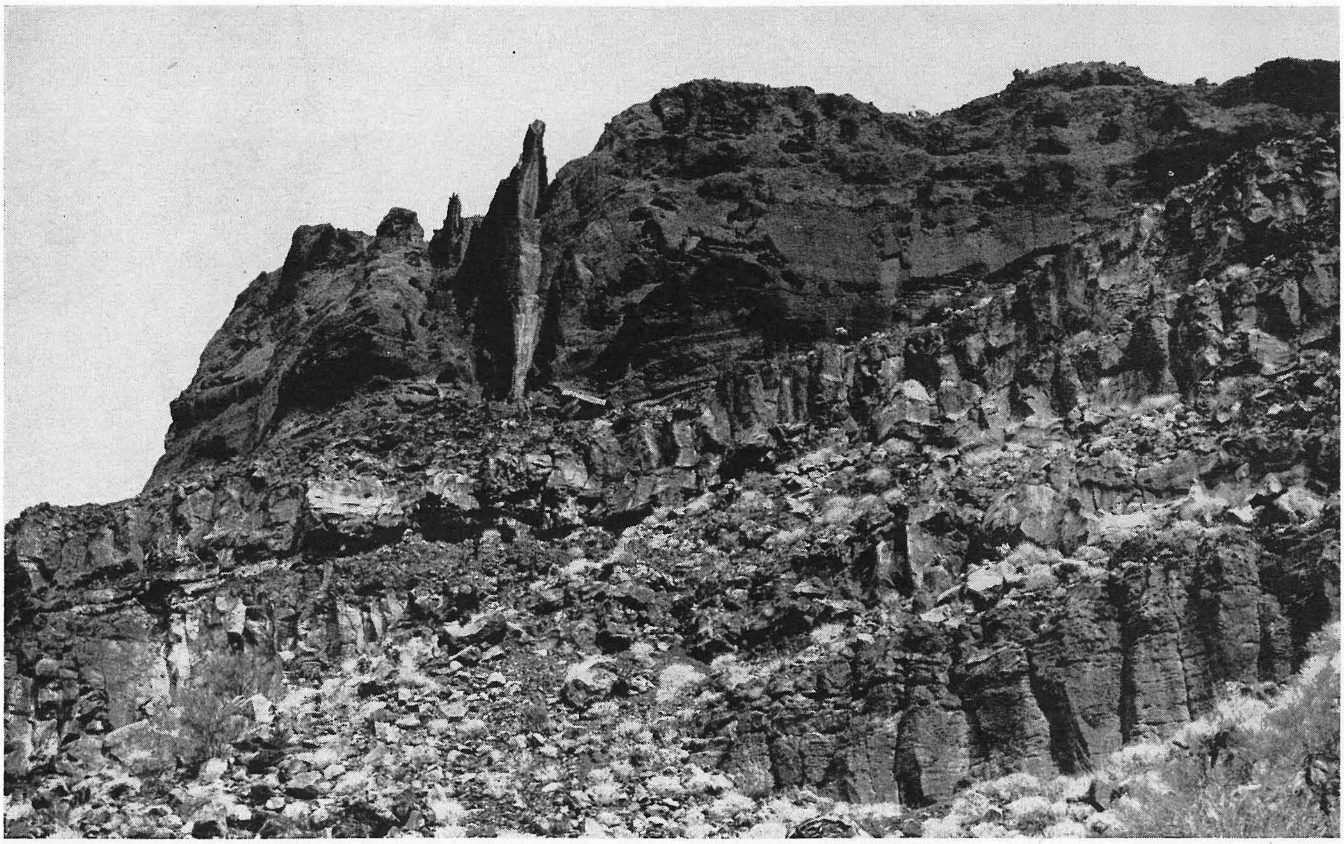
Known as Crater Elegante, this huge pit is about 30 airline miles south of the Arizona-Mexico border, near the Pinacate Range of Sonora State, Mexico. Once it was a great volcano which grew from the earth and spewed its hot lava and cinders over the surrounding countryside. Then, many centuries ago and more quickly than it was born, the towering peak disappeared from the skyline. It dropped back into the earth to become a caldera, or collapsed volcano.

After the shock and thunderous roar of its collapse subsided, Elegante lay quietly, a huge, desolate hole seen only by an infrequent traveler. The raw materials for a reconstruction of its life history were etched in its deep walls and strewn about in its vicinity, but Elegante was essentially an unread book until Dr. Richard H. Jahns, Professor of Geology at the Institute made his first field trip to the area last year. He has made three further trips to Elegante since then.

Jahns found it an outstanding model of a caldera. Such striking examples of the reaction of the earth's outer crust to changes in its physical environment, along with other crustal adjustments, form an important part of our geological record. Their origins and mechanisms have posed some of the most challenging and fundamental problems to be found in the earth sciences.

Perhaps the best known example of a caldera in the United States is the Crater Lake depression in southern Oregon. Some details of its history, however, are masked by debris and the water covering its floor and obscuring much of its walls.

The unusually graphic Elegante looks from the air like a gigantic pockmark in an undulating plain. It is



nearly circular and about a mile in diameter. The maximum depth of its flat floor is about 800 feet. From its rim the ground slopes gently outward in all directions. Neither water nor the mantling of debris usually found on the walls of other calderas obscures the significant past of Elegante. Conspicuous on its walls is a great thickness of cliff-making basalt flows, above which are other revealing strata.

The layers of lava are topped first by black and red cinders. These in turn are covered by sedimentary beds rich in small pieces of porous basalt. Larger chunks of this dark rock and of granite are scattered through the sedimentary beds. They evidently were deposited from the air as volcanic bombs.

Deep within the caldera are aprons of coarse debris from the basalt cliffs and some finer-grained sediments deposited as a delta in a lake that once filled the lower one-quarter of the depression.

All these materials clearly document the life story of Elegante.

It may have begun, Jahns believes, with the shallow rumblings of earthquakes and the appearance of fractures in the ground through which boiling springs and clouds of dust and cinders poured forth. Later, as he reads Elegante's autobiography, very fluid basalt lavas flowed through the fissures, formed a major vent and slowly built a domelike hill several hundred feet high.

Dome building apparently lost momentum for a time as the subterranean pressures were relieved and the central vent became clogged with hardened lava. Cinders were blown out along the perimeter of the vent and formed small cones dotting the dome. Alternately, lavas poured sporadically from cracks on the slopes of the cones and added their bit to the dome. A small cone exposed in cross section on one side of the caldera provided many details useful in reconstructing this complex sequence of explosive episodes and hot lava flows.

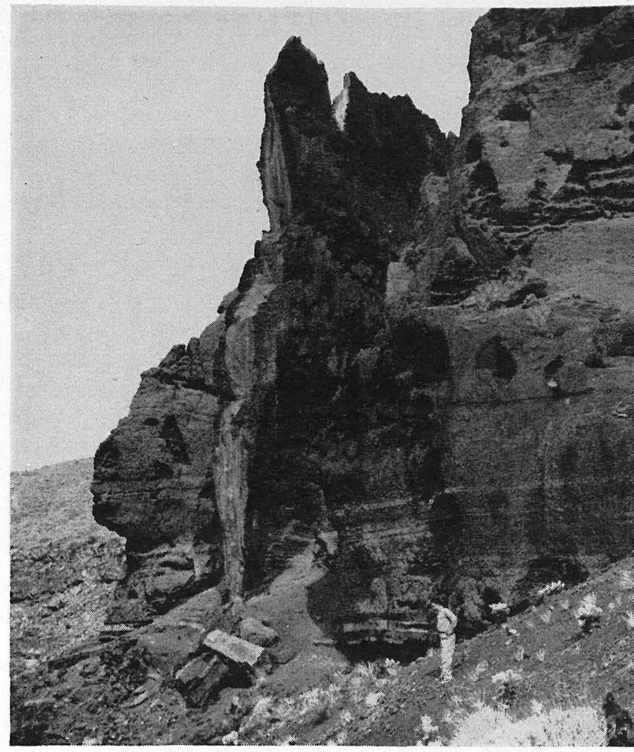
This sequence preceded the construction of a vastly larger central cone, in part by explosive activity as internal pressures again built up, the investigators found. They observed that much of the cone was made up of broken masses of the earlier rocks. These apparently were exploded out of the vent as volcanic bombs when the old, partly choked-up volcano cleared its throat. The rest of the cone was essentially new material, chiefly small pieces of cellular lava, transparent crystal fragments of feldspar and vast quantities of glassy froth.

The life of the now-towering volcano reached an abrupt climax after the tall cone was built. Its entire top and adjacent parts out to a radius of one-half mile vanished from the landscape. Elegante fell into the earth like a piston dropping in an almost circular cylinder.

Subsidence carried the floor of the newly-formed caldera well below the general level of underground water in the area, and a lake about 200 feet deep formed. Erosion carved bits of the soft, broken rock from the caldera walls and a narrow delta was built up along the shore of Lake Elegante. In some places the bottom of the caldera continued to sink. But there was no further outpouring of lava, no further ejection of clouds of cinders. Only fumaroles and hot springs remained as evidence

Left, a view of the upper part of the east wall of Crater Elegante. The lower cliffs are basalt flows, the upper ones thin-bedded "cinders." The spine-like protuberance in the cinders is a dike of highly vesicular basalt which evidently was injected laterally from the volcanic vent that once lay where the void of the caldera now is.

Right, a close-up of the dike shows some of the layering inside it. In addition to the many cavities it contains glassy crystals of feldspar.



of the once great activity—but it is quite probable that even these expired not long after the collapse.

When this occurred is not definitely known, although Elegante is thought to be many thousands of years old. Institute geologists will attempt to find organic materials, such as fossil wood or charcoal, at the caldera which could be used in carbon-14 radioactive dating procedures in an effort to establish its age. The lake which formed in it, at a level considerably higher than the present water table, appears to indicate it existed during a period when the climate was considerably wetter than today. This may have been during or after the close of the Pleistocene epoch some 25,000 years ago when glaciers covered portions of the northern United States.

Change of climate

As the centuries passed the climate gradually became drier, for the level of Lake Elegante slowly dropped, as evidenced by the narrow beach deposits formed at successively lower levels. Longer ago than the beginnings of any known records of man in this area, Elegante dried up completely.

From the arid cavity which remains, Dr. Jahns was able not only to document the life cycle of the volcano but also to determine the mechanism of its destruction. His field studies were augmented by chemical and microscopic examinations of rock samples in the laboratory.

Chemical analyses demonstrated that the glassy froth from the upper walls of the caldera had significant characteristics in common with the basalts found at the lower levels. These studies confirmed that its manufacture was the final stage in a single cycle of volcanic activity.

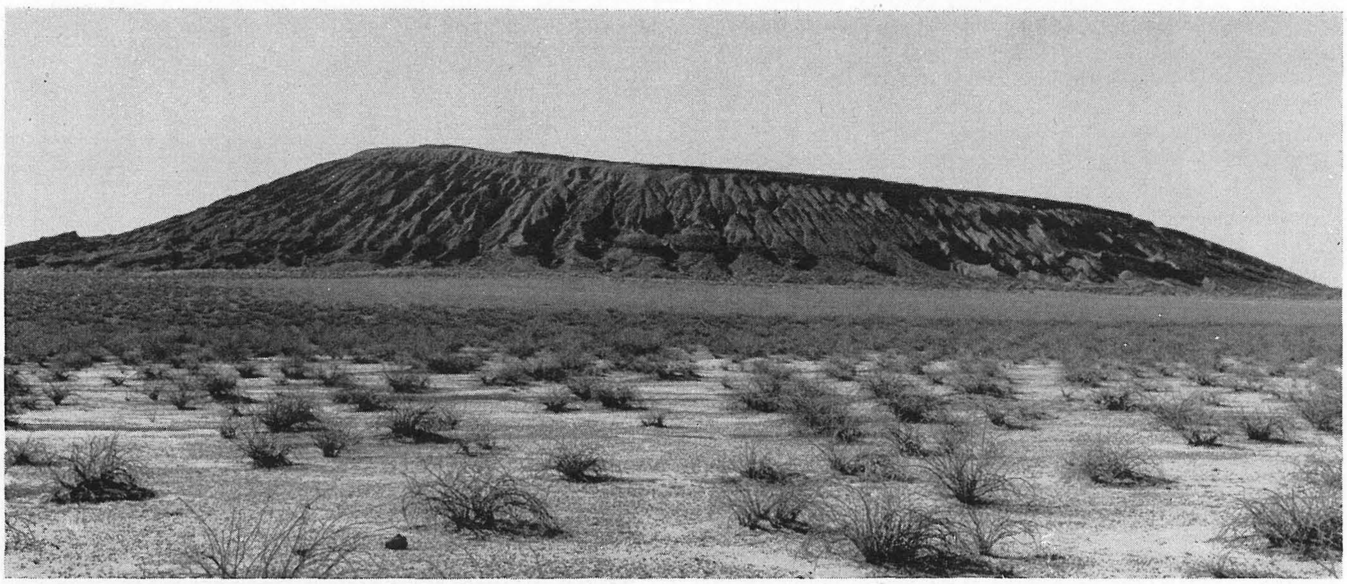
Microscopic examinations of tissue-thin sections of the froth showed that tremendous quantities of gas had been involved in its formation. In minute detail the microscope revealed a foamy structure throughout the partly devitrified basaltic glass. Scattered about in the open, spongy mass were large crystals of feldspar, some as much as three inches across. The finer structures of the froth clearly showed that the feldspars had been tossed about violently during their journey to the surface.

This, then, is the reconstructed picture of the collapse of Elegante:

Its superstructure was not blasted away—such a cataclysmic series of explosions would have strewn a billion tons or more of volcanic material over the area. Rather, this vast rock heap shuddered and dropped on a grand scale into a void which had grown larger as the central cone grew taller. Its very growth sealed its doom.

The top of the cone was built with materials brought up from a closed source chamber deep underground. In it lava bubbled and seethed, ever more furiously, until eventually the underground pressures became so great that this cauldron began to effervesce. Feldspar and lava bubbles were carried upward through the volcano's throat with the escaping gasses and hardened into the glassy froth at the surface. So much unreplenished lava frothed away in this fashion that a great void grew in the subterranean chamber. And when enough of its support had thus been withdrawn, Elegante collapsed into that void of its own weight.

So ended the volcano Elegante, but not its usefulness to science. The caldera, for instance, has yielded climatological information on a bygone age. One bit of knowledge derived is that the prevailing winds probably blew from the southwest during the growth of the volcano,

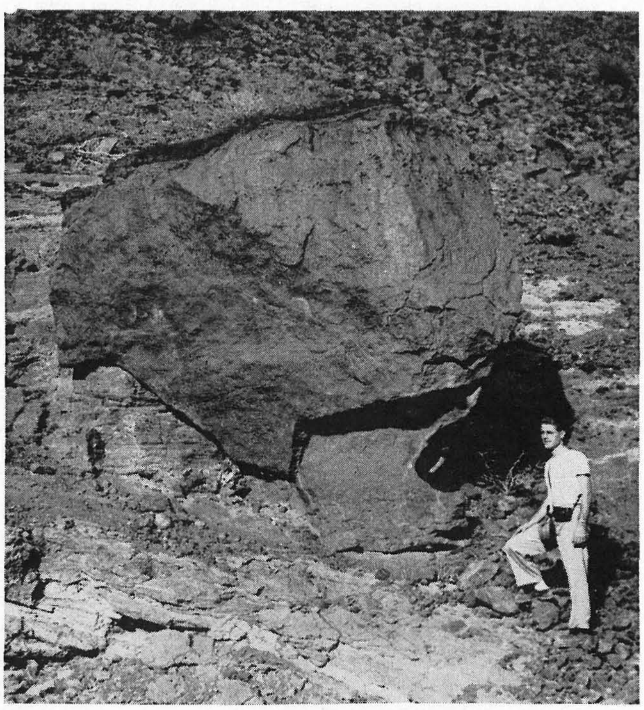


Outer rim of another caldera known as Cerro Colorado (Red Hill) was preserved because the collapse was asymmetric. This gives us the best clue we have as to the probable appearance of Elegante volcano, prior to its collapse.

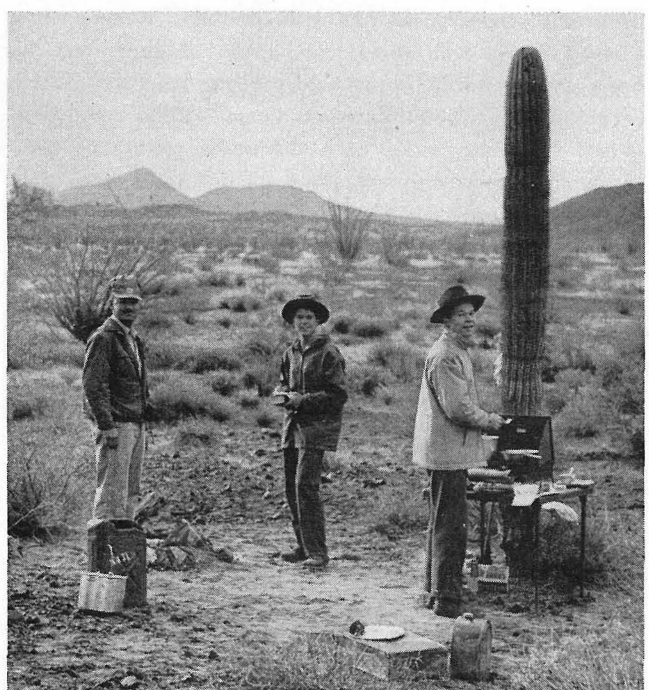
just as they do today. The investigators found this evidence in the fact that most of the cinders accumulated on the northeast sides of the small subsidiary cones. Another such contribution was the moisture pattern revealed by the old lake bed.

Materials from the caldera are being studied also in search of a better fundamental understanding of rock formation, particularly in a gas-rich environment. Samples of the glassy froth and heavily-honeycombed lavas are being subjected to further physico-chemical examination in the Institute laboratories for this purpose.

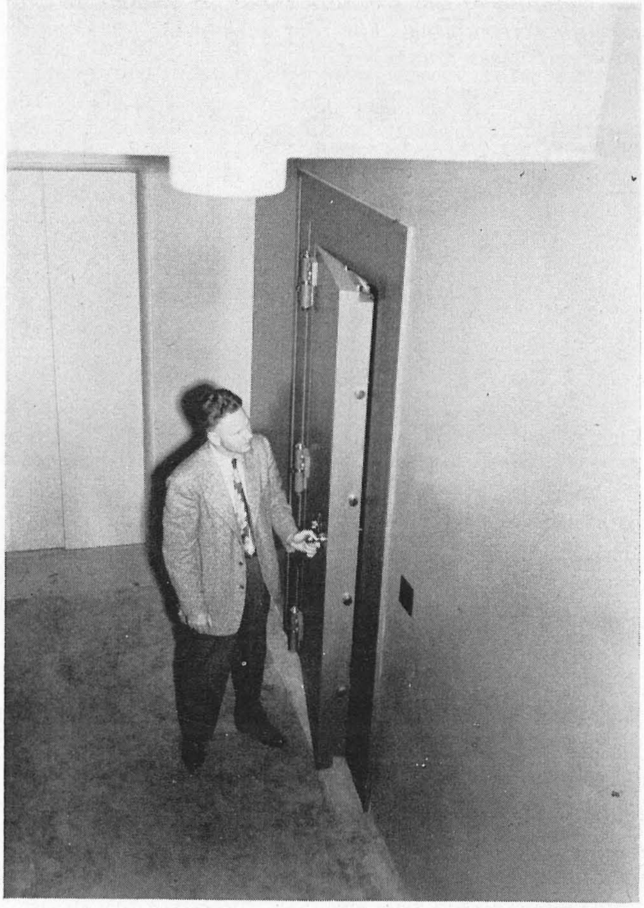
The scientists hope ultimately to shed more light on the effect of gases on the development not only of crystalline lava but of large crystals in general. They are seeking answers to such questions as how fast crystals grow, what governs the size they reach and what makes some of them perfect while others are full of imperfections. Such knowledge may prove valuable in the light of increased mineral synthesis and the laboratory growth of crystals for electronic equipment.



This large boulder of basalt tumbled off the wall of Crater Elegante shortly after the collapse of the volcano. It was incorporated into the fine-grained delta deposits being built into the lake that once occupied the bottom of the depression. Helmut Abt, graduate student in astrophysics at Caltech is looking it over.



The field party enjoys a leisurely breakfast in the rain. Dr. Jahns is assuming a nonchalant air at the left; Peter Kamb, graduate student in botany at the University of California, is feeling the cold in the center, and his twin brother Barclay, senior physics student at Caltech, is doing the cooking on the right.



Door to outer vault of Huntington Library's new bomb-resistant structure is solid steel, three inches thick.

BOMB-RESISTANT STRUCTURE

The Huntington Library gets a new building which provides needed stack room along with spaces designed to be bomb-resistant

by ERNEST B. HUGG

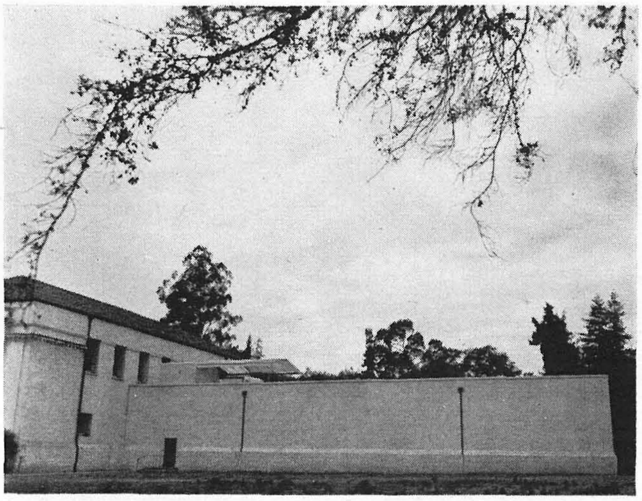
THE BOARD OF TRUSTEES of the Henry E. Huntington Library and Art Gallery has always been keenly aware of its obligation to the public to do its best to protect the rare books, manuscripts, paintings, and other art objects in its custody. During World War II, when air attacks on southern California seemed imminent, some of the more valuable articles were removed to distant places.

When fighting started in Korea the Board was already working on preliminary layouts for a new building which was needed to relieve an acute shortage of book stack space. Since it was now within the realm of possibility that there might be enemy attacks on this country within the next few years, the Board began to consider the construction of a building which would provide the needed stack room *along with* spaces especially designed to be bomb-resistant.

Since there has always been a close relationship between the two institutions, the Board turned to Caltech for assistance in connection with the design and construction of a bomb-resistant structure. Plans and specifications were prepared by Caltech's Buildings and Grounds Department with the assistance of Professor R. R. Martel of the Engineering Department as a consultant.

Preliminary design and cost studies indicated that the addition would be both practical and economical, and the Board's decision to proceed was based on a full understanding that it would be practical to design even a small portion of the building so that the contents would be safe in the event of a direct hit by an atomic bomb or by a heavy super-bomb of the conventional type. In either of these cases the required thickness of reinforced concrete protection would be staggering. Consequently, the building was designed to give various degrees of protection in different portions of the structure.

The building is a reinforced concrete structure approximately 40 feet by 120 feet with a main floor, basement and sub-basement. To allow for future book space it is designed to support two additional stories. The two principal bomb-resistant portions of the building comprise the sub-basement. The inner vault, 12 feet wide by 23 feet long by 12 feet high, with a net usable volume of approximately 3,000 cubic feet, has protection equivalent to ten feet of reinforced concrete on top, bottom and sides. It can be reached only through the outer vault which is 35 feet by 67 feet by 8½ feet high and has a net usable volume of approximately 20,000 cubic feet. This large outer vault has protection equivalent to four feet of reinforced concrete on top, bottom and sides. In each case the unusually thick bottom slab is required because experience has shown that a great



East elevation of the structure shows its relation to the main library building. The roof deck at the left is used as an employees lounge.

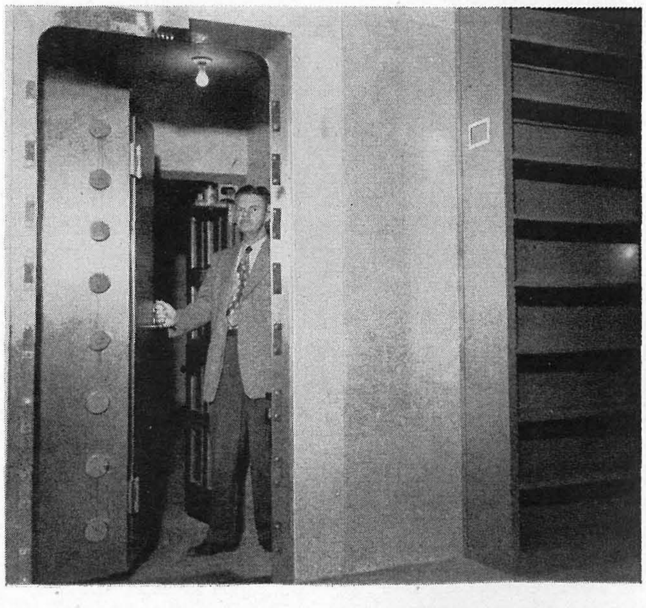
number of bombs follow a path in the earth which resembles a J. This fact makes it imperative that all surfaces, including the bottom, have approximately the same thickness of protection. Otherwise a near miss could easily penetrate to a level below the side wall and turn upward to pierce the bottom slab.

The relatively small inner vault was provided for the storage of the most valuable items. Consequently one additional precaution was taken to protect its contents from damage by flying objects. This was considered necessary because of the fact that when a wall or slab is hit by a projectile, chunks of varying sizes often pop off the opposite side, even though failure of the structural member does not occur. A 1/4 inch steel plate, anchored securely to the concrete, was used to line the interior surfaces of the inner vault to overcome this hazard. This liner plate was welded solid at all intersections and so performs the additional function of insuring against moisture entering the vault.

The opening into the inner vault from the outer vault is protected by a solid steel door 12 inches thick, set in a solid steel frame and recessed eight feet in a reinforced concrete wall nine feet thick. This steel frame is further protected by being welded to three solid steel armor plates surrounding the opening, each of which is four inches thick. These armor plates are in turn securely anchored into the concrete. The total-weight of these armor plates alone is about 60,000 pounds.

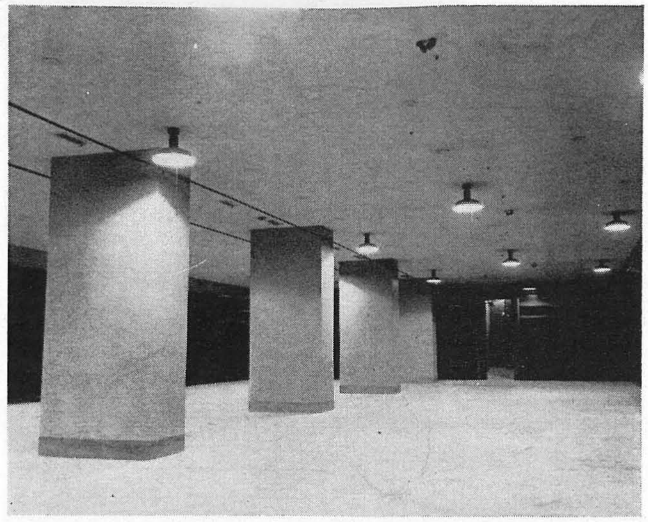
Experience has shown that pour joints form a definite plane of weakness during a bombing attack. It was therefore decided that, even though certain construction difficulties would result, the entire inner vault from the bottom of the eight-foot floor slab to the top of the ten-foot top slab would be cast in an unusually large continuous pour of approximately 1300 cubic yards. Having made this decision, it was apparent that it would be highly desirable to provide a relatively thin base slab to serve simply as a working platform. A steel angle framework was then designed to support the 1/4 inch liner plate and the 60,000 pounds of four-inch thick armor plate until such time as the reinforced steel was placed and the big pour was completed. The liner plate was fabricated as a huge 3,000 cubic foot box (23'x12'x12') by the structural steel sub-contractor in his own shop, and then transported to the building site.

It was recognized that considerable heat would be generated by the curing of this large mass of concrete. Calculations, however, led to the conclusion that no



Lyle Wright, head of the Library's Reference Department, opens the 12-inch solid steel door to enter the inner vault. The smaller door behind him closes automatically when the carbon dioxide fire extinguishing system goes into operation.

This view down the length of the large outer vault shows (as black dots between the ceiling lights) some of the carbon dioxide fire alarm devices on the ceiling.



special provision for cooling would be required. As there did not seem to be very much information available on heat during curing of structures comparable to this vault, it was decided to insert thermo-couples at various points in the big pour so that the rate of liberation and of dissipation of heat could be studied. The readings taken subsequent to the pour confirmed the conclusion that no artificial cooling was necessary even though three cranes were used and the concrete was deposited at the exceptionally fast rate of 100 cubic yards per hour.

As stated previously, varying degrees of bomb resistance were built into different parts of the building. Most of the attention was given to the two vaults in the sub-basement. However, the basement floor was protected with the equivalent of approximately 18 inches of reinforced concrete and the first floor with 12 inches. Even on the first floor, where the protection is the least, there are no windows and the structural protection is sufficient to withstand the explosion of an atomic bomb directly overhead at about 2,000 feet elevation. This height is mentioned because it is the one that was used for the Hiroshima and the Nagasaki bombs. It was undoubtedly selected as the height that would cause the most widespread damage.

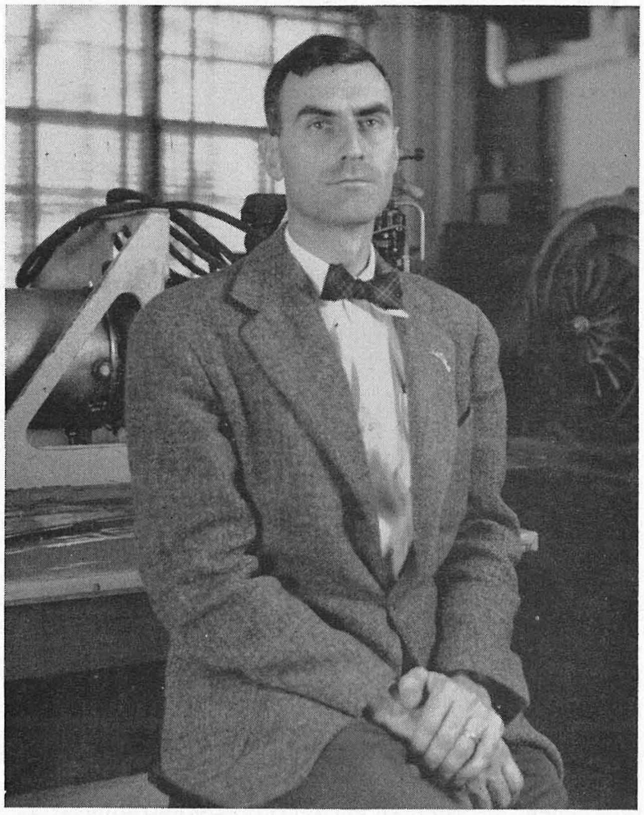
The problem of providing a bomb-resistant structure was also complicated by the necessity of running all of the various service lines to and from each of the spaces. Not even the smallest of the many required conduits, pipes and ducts was allowed to run straight through a protecting concrete member. This precaution was taken to protect against damage from fragments and from the effects of blast. In addition, when relatively large pipes or ducts ran within the structural members and parallel to their length, the members were increased in thickness as required so that the degree of protection would not be lessened.

Every possible precaution has been taken to prevent water damage to the valuable contents. No lines which might contain liquid were run in or through any of the protected areas. For fire protection in the two vault areas, since water systems were not permissible, high pressure type CO_2 extinguishing systems, which would be set off either by rate-of-rise heat actuated detectors or by smoke detectors, were used. In order to be certain that the system as installed would function properly when called upon, complete tests including discharge of the gas were required. Smoke from a smoldering rag on the floor was detected in about five minutes and heat from a pan of gasoline in considerably less time. Upon discharge, a smothering concentration of gas was reached in less than a minute and was held for over an hour.

The Library Board felt that it might be desirable at some future date to have year-round air conditioning, but did not wish to authorize the expense now. Consequently, a ventilating system using washed air was installed, but it was designed so that air conditioning could be installed later with a minimum of revision to the building. Independent control of temperature and humidity was a definite requirement and was provided; however, cooling is limited to the amount that can be obtained from the spray system without exceeding the upper limit of humidification allowed. This severely limits the range over which the desired humidity can be maintained, and explains why the Board feels that year-round air conditioning may sometime be installed.

All of the air passes through two types of filters. Strainer-type cellulose media filters are used to remove most of the suspended matter. Charcoal filters are intended to remove the harmful constituents of smog. In so far as is possible the major portion of the air is recirculated to limit the introduction of dirt and contaminants.

The design and construction were under the supervision of Wesley Hertenstein, '25, Caltech's Superintendent of Buildings and Grounds, with Professor R. R. Martel of the Engineering Department acting as consultant. Detail plans and specifications were prepared in the engineering office of the Buildings and Grounds Department under the direction of the author of this article, Ernest B. Hugg, '29, Assistant Superintendent of the Department. The low bidder, and subsequently the general contractor who constructed the building, was Ray Gerhart, '13.



PETER KYROPOULOS

He's Assistant Professor of Mechanical Engineering at the Institute, and General Automotive Adviser—both in and out of the department

THE FIRST RECORDED instance of Peter Kyropoulos' interest in engines occurred when he was four years old. He discovered his mother cleaning the living room with the family's irascible vacuum cleaner, listened attentively to the sound of the motor for a few minutes, then walked over to his mother and embraced her.

"I am so happy," he said tenderly, "that the thing hums so nicely."

To this day the sound of a nicely humming motor can make Peter a happy man—though the world does not yet produce many motors whose hums come up to his high standards.

As Assistant Professor of Mechanical Engineering at the Institute, Kyropoulos teaches basic fluid mechanics and thermodynamics to ME juniors and seniors in the engineering lab, and gives graduate courses in the experimental background of engine research.

Research under his supervision at the Institute includes studies of reaction kinetics, involving the reciprocating engine. The general problem here—and it's one that concerns everyone who studies engines—is detonation, or the behavior of fuel in knocking combustion.

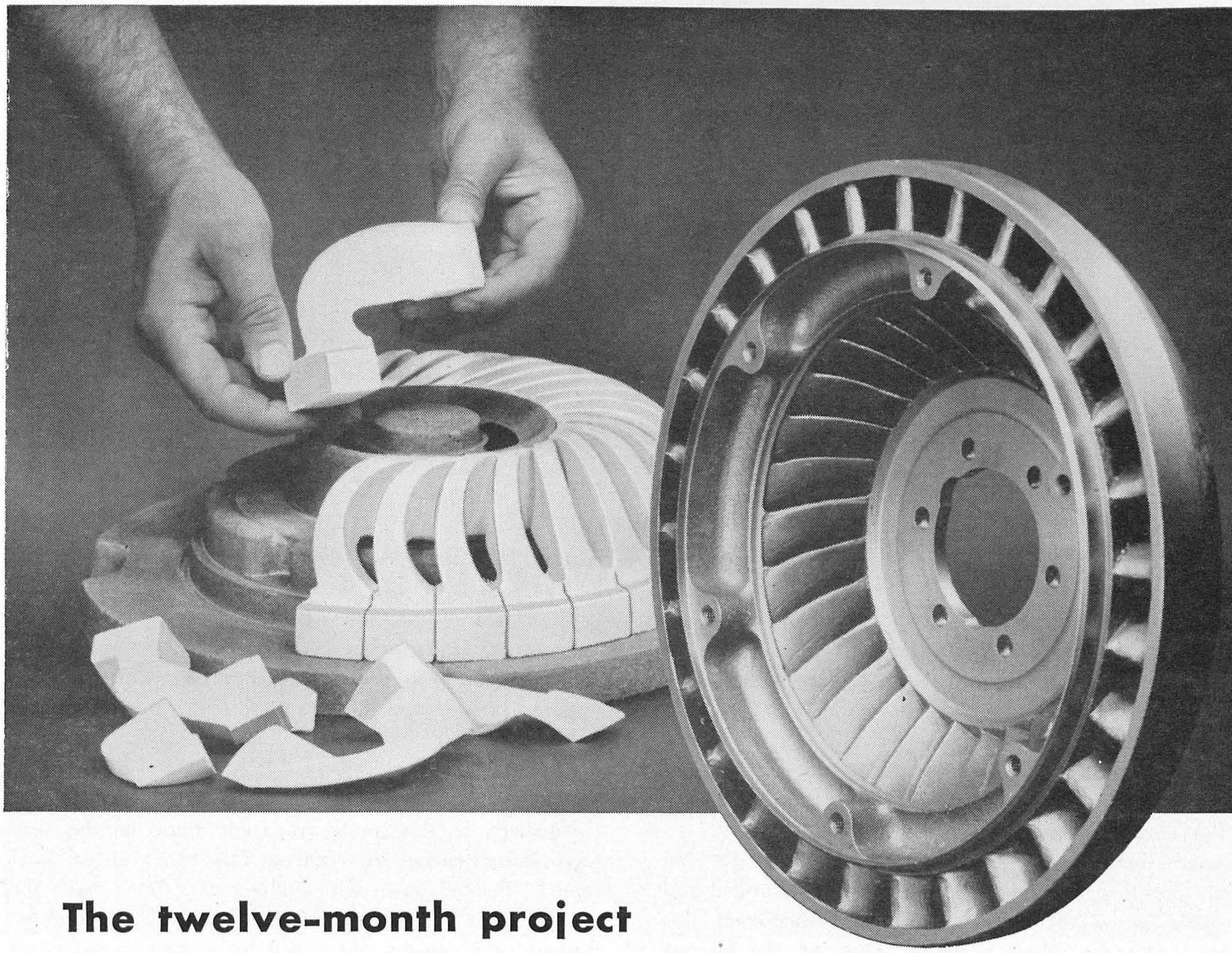
Another Kyropoulos project is the spectrographic analysis of crankcase drainage. This, as he explains it, is simply urology applied to engines. He wants to know what and how much you can tell about what ails an engine by looking at drainage oil.

These are his catalogued or advertised functions in the ME department. His actual functions go far beyond this—to the point where he is the all-around handy man of the department, performing several dozen odd jobs around the place just because he likes to see things get done.

During the war, for instance, he gave a good many of the Navy V-12 courses in ME. Even before the Institute reached the point where it became necessary, he developed and gave a course in naval machinery as an elective. Later this became a required course in the V-12 program—and was, according to a good many men in active service, one of the most valuable courses given here.

He's been largely responsible for building up the ME lab to a top position here, and his special interest in internal combustion engines has resulted in a marked development of the work in that field at the Institute.

He serves as placement representative of the ME department, as director of the enormously complicated procedure by which Caltech students serve as observers for the Automobile Association of America in the



The twelve-month project that improved no-shift driving

ANOTHER ALCOA DEVELOPMENT STORY:
One automobile manufacturer set out to improve his fluid coupling to the Nth degree.

Torque converters had been made by machining cast or forged blanks, or by assembling stamped parts. But these engineers wanted better performance. This meant their converters must be stronger, lighter, more intricate. They asked, "Can we do it in aluminum?"

Our Research specialists saw the chance to show the economy of a little-known process called plaster casting. A process in which plaster, instead of sand, is used for cores to provide more intricate and smoother castings—castings that require no machining of the blades. It promised results that might even exceed the auto maker's requirements.

Final design refinements were made. Then we cast the first samples. They came from the molds smooth and clean—perfect in detail.

While the auto manufacturer machined them to finished dimensions, we set up to test them for strength at high speeds. Coating the parts with brittle lacquer, we spun them in our whirlpit up to 10,000 rpm—over twice their normal operating speed. Cracks in the brittle lacquer told us where strains concentrated. Designs were modified. New samples cast. Tests repeated. The final castings are smooth, faithful in detail, exceed every strength requirement.

This is typical of the development jobs we do at Alcoa. Others are under way now and more are waiting for mechanical, metallurgical, electrical, chemical and industrial engineers having the imagineering skill to tackle them. Perhaps you may be one of those men.

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annual Mobilgas Economy Run, and as general automotive adviser for the Institute—involving everything from the loftiest theoretical problem to why a freshman is getting such poor mileage on his rebuilt Maxwell.

His interest in automobiles, in fact, reaches a peak in his own car, which is usually bristling with gadgets for measuring gas consumption, oil consumption and general wear and tear in every conceivable part of the vehicle. In recent months—and largely as a result of his having worked on Project Vista—he has broadened his horizons somewhat, and developed a passion for armored vehicles. He is already collecting models of armor with such vigor that his colleagues at the Institute are nervously awaiting the day when he will rumble in to work in a late-model tank.

Some family history

Peter Kyropoulos was born and raised in Göttingen, Germany, where his father was Professor of Applied Physics at the University. The family originally came from Macedonia, in Greece—whose people are not unlike the Scotch Highlanders. (In Peter this affinity is not only responsible for his enormous collection of tartan neckties, but for his wife—a Scotch girl—as well.) Peter's grandfather, a Macedonian fur merchant, and a Christian Greek, quit the country rather than serve in the Turkish army.

Peter's interest in engineering may possibly have been partly due to genetics. His mother's family founded and operated one of the largest agricultural machinery factories in Europe. More probably, however, the interest was due to environment—specifically, the Harley-Davidson motorcycle his father bought from the U.S. Army of Occupation in 1922, when Peter was eight years old. This machine was lovingly rebuilt into a very showy vehicle by Peter and his father—the first of a long series of motorcycles in the Kyropoulos family.

From motorcycles to aeroplanes

At the University of Göttingen, Peter switched his allegiance from motorcycles to aeroplanes when he joined a student flying and gliding group. In 1935, when he was inducted into the German Army, he was given pilot's training as well as a special course for engineering students, who were ultimately expected to become inspectors in the German Air Force.

At about this time Peter's parents began to come in for a good deal of criticism from the Nazis for whom they had little love. In 1936, Spyro Kyropoulos lost his university position and was charged with "showing no enthusiasm" for Nazism, preventing people from making the Nazi salute and similar crimes.

It was ironic that the Kyropoulos family, which had fled from Greece rather than knuckle under to a regime it opposed, now had to leave Germany for the same reason. Spyro Kyropoulos came to America, and to Caltech, in 1937. Peter followed him a few months later—ostensibly to complete his studies in the U. S.

He took out his first citizenship papers here as soon as he arrived in Pasadena, where he enrolled in the graduate school in aeronautics at Caltech, to work for his M.S. in Mechanical Engineering.

After receiving his degree in 1938, Peter went to work for Consolidated Vultee, both in California and in Detroit, as flight test engineer for Vultee Aircraft and as Chief of Aerodynamics for the Stimson Division of the company. Back at Caltech on a Vultee Research Fellowship, Peter became an instructor in the Mechanical Engineering Department in 1943. In 1948 he received his Ph.D., writing his thesis on Exhaust Dynamics of Diesel Engines. In 1948 he also became Assistant Professor of Mechanical Engineering at Caltech.

ME students at the Institute generally consider Kyropoulos' courses pretty tough. At the same time, his are some of the most popular courses in the engineering curriculum. Unwary students are often thrown off guard by the Kyropoulos teaching technique when first exposed to it. The deadpan humor and slangy terminology are apt to be taken at their face value—only to result in the sad discovery that they are the sugar-coating on the bitter pill of concentrated knowledge.

Report on reports

Nowhere is this more apparent than in the way Kyropoulos teaches his students how to write technical reports. Bedded down with flu recently, Peter made the mistake of trying to convalesce by grading some of his students' lab reports. He ended by writing a report on how to write a report which is not only a model of its kind, but a particularly juicy sample of his teaching technique.

The laboratory report, explains the Kyropoulos report, is addressed to people who

(a) want to disagree with you
(b) have to follow up your work
(c) have to check you numerically
(d) want to make a similar test and need enlightenment as to "how."

"Put yourself into one or all of these categories," Peter advises his students, "and read your own reports. You will hate yourself."

The Kyropoulos report goes on to present a few choice samples of richly inventive English from several student reports.

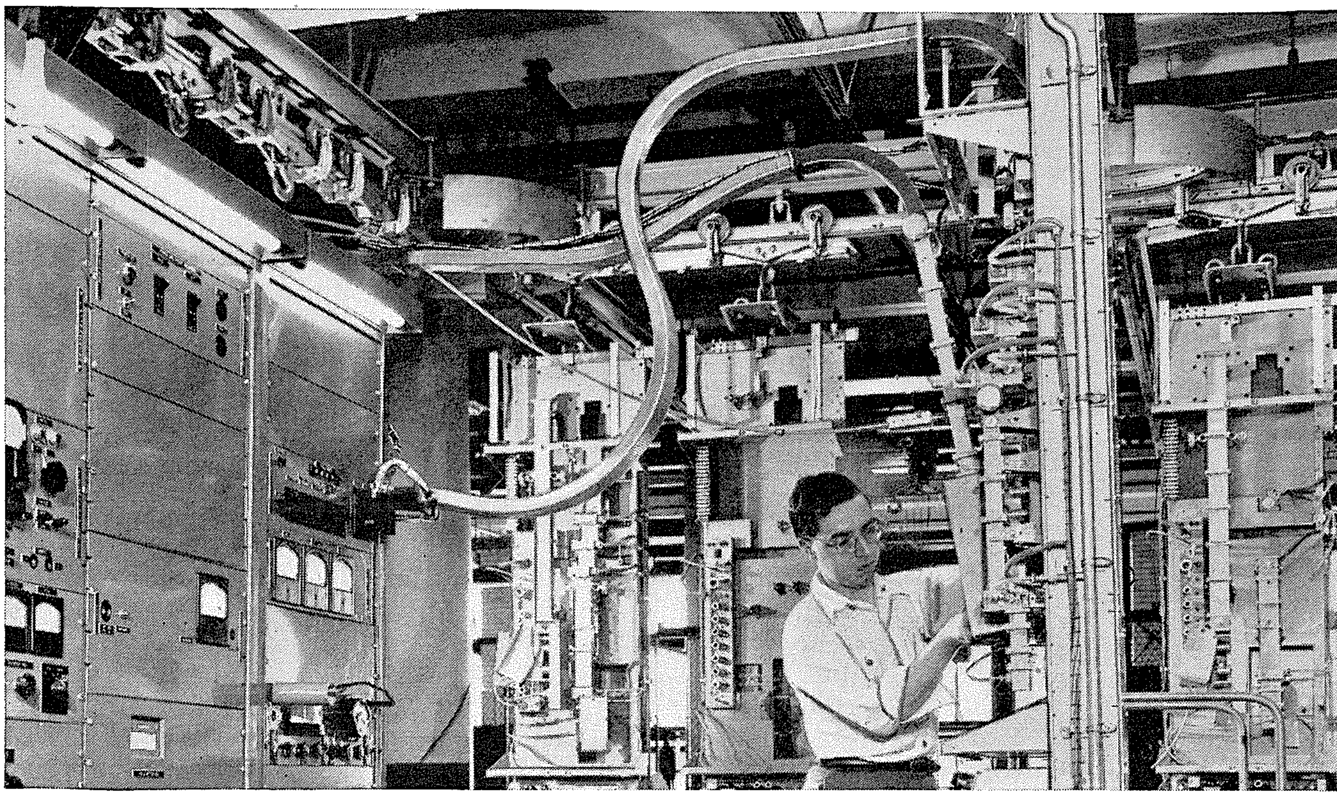
"And all this," he remarks, "after we spend 25 percent of our time on Humanities."

"Discuss all graphs you have made," he notes. "If you cannot find any good reason why you were asked to make a plot or calculation, *ask.* Don't just write it off as another one of the old man's peculiarities. There is method in his madness."

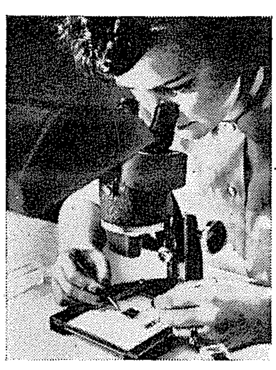
The whole report is cheerfully signed by

P. Kyropoulos
Hell on Wheels

Where engineering and pioneering go together!



The transmitter-receiver bay unit being worked on by a Western Electric tester, is part of the complex equipment installed in the Bell System's coast-to-coast microwave relay towers. Special testing equipment is at the left.



Operator inspects a grid blank. The grid controls the flow of power through the tiny electron tube which is the heart of radio relay. Western Electric engineers designed machines to wind wire .0003 inch in diameter on the grid at 1000 turns per inch—spaced exactly .0007 inch apart.

COMPLETION last Fall of the Bell Telephone System's coast-to-coast radio relay route climaxed a production feat that involved doing many things never done before.

The engineers at Western Electric—manufacturing unit of the Bell System—were treading on uncharted ground when they tackled the challenging job of making the highly complex equipment.

This radio relay equipment—which transmits telephone and television signals at a carrier frequency of four thousand megacycles per second—called for many components never made before and for which no machinery, no tools, no assembly processes were known. Some components required almost unbelievably tiny parts—and fantastically small tolerances.

Manufacturing facilities and techniques had to be developed to assemble and wire the complicated equipment which receives signals having less than 1/10 millionth of the power of an ordinary flashlight bulb—at frequencies ten times as high as those used in television sets—amplifies these signals 10 millionfold and transmits them to the next tower some 30 miles away.

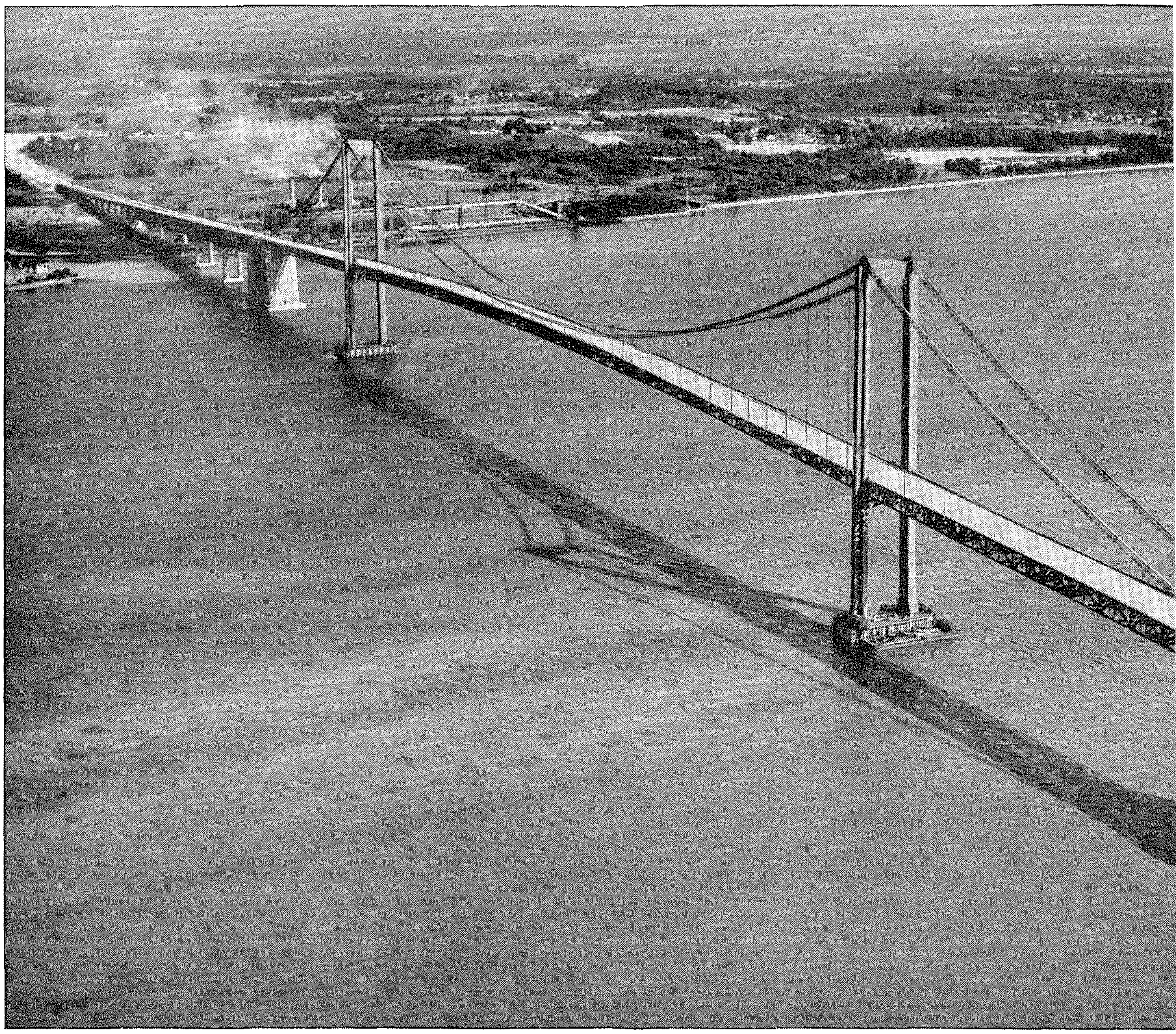
Finally, Western's engineers were responsible for installing the equipment in 107 towers across the nation.

In all phases of this job, engineers of varied skills worked closely together as a team which just wouldn't be stopped merely because "it hadn't been done before." That's typical of work at Western Electric—where engineering and pioneering go together.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Only STEEL can do so many jobs



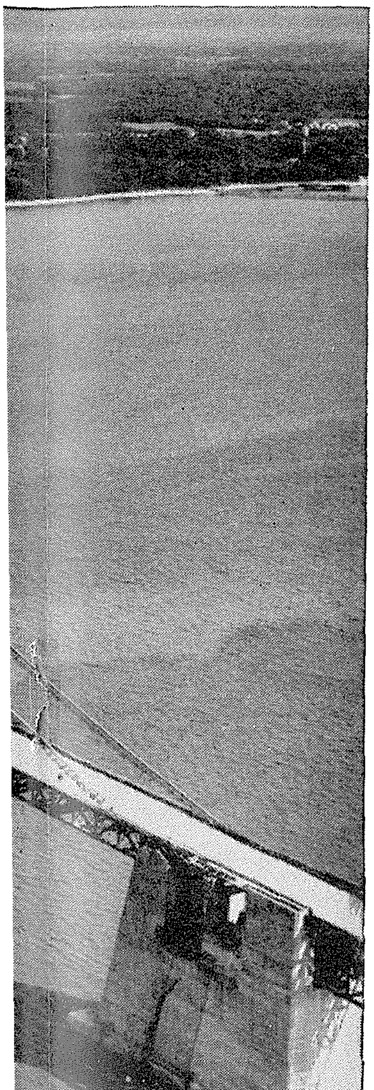
THE SINEWS OF DEFENSE are mostly steel, whether weapons, or steel mats, or the steel strapping that binds boxes of supplies. And for years, United States Steel has followed an uninterrupted program of expansion . . . so that it can produce ever-greater quantities of steel to help safeguard America's security.

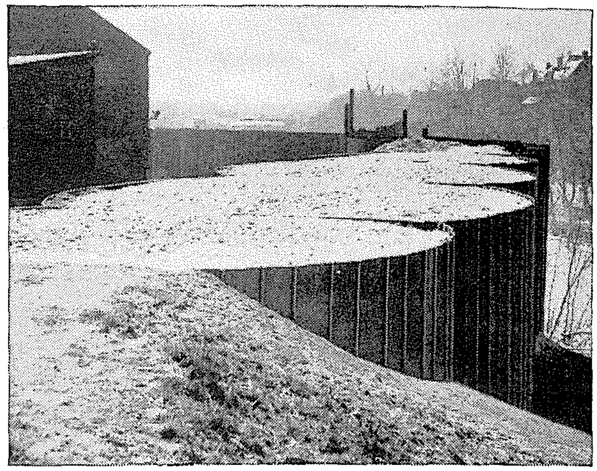
NEW DELAWARE MEMORIAL BRIDGE, linking southern New Jersey and Delaware, will have an estimated traffic of 5 million vehicles a year. The bridge proper, with a total length of 10,765½ feet, contains the world's sixth largest suspension span, with a center span of 2150 feet. U.S. Steel products used include the structural steel, U·S·S AMERICAN High Tensile Wire for the huge cables, U·S·S TIGER BRAND Wire Rope and Universal Atlas Cement. The giant structure was fabricated and erected by United States Steel.

FACTS YOU SHOULD KNOW ABOUT STEEL

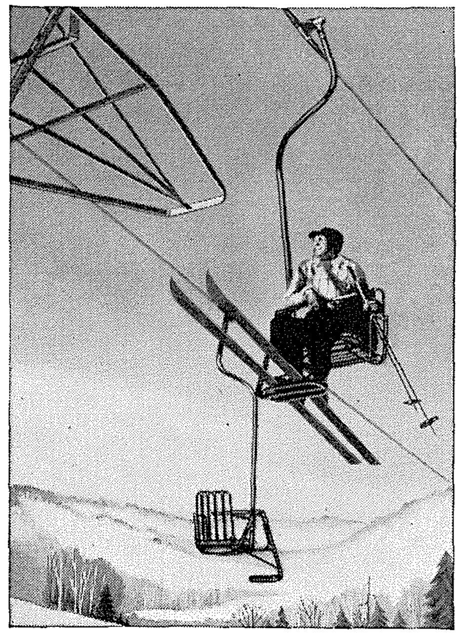
In the United States, there are 253 steel companies; 375 iron and steel plants. The payroll of the iron and steel industry in 1950 amounted to $2,390,000,000, and its approximate total investment to $6,750,000,000. The industry employs 635,000 people, exclusive of non-steel jobs, and has 650,000 stockholders.

so well



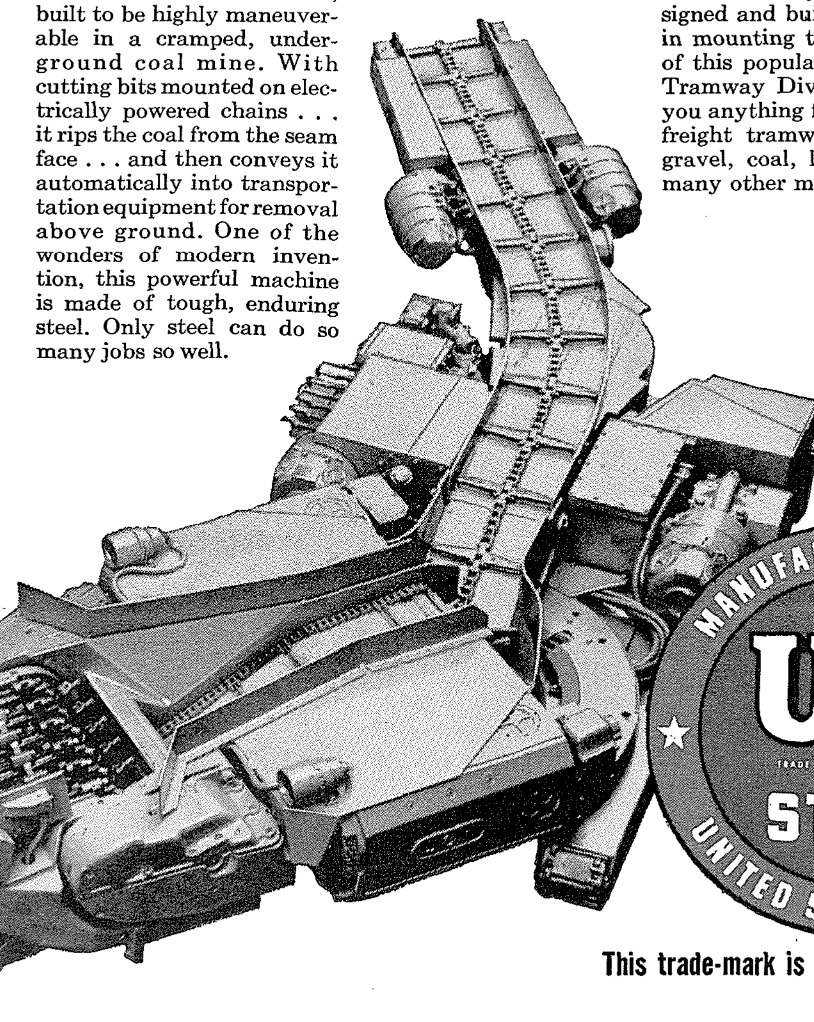


FLOODWALL OF STEEL. 76 earth-filled cells like this, built of interlocking U·S·S Steel Sheet Piling, protect a Kentucky rolling mill against flood waters in the Ohio River Basin. Because of its great strength, long life, and low installation cost, this product of U.S. Steel is invaluable in all types of projects involving control of earth and water.



EASY WAY UP FOR A FAST TRIP DOWN. Skiers at Sun Valley find this "chairway" designed and built by U.S. Steel, a big help in mounting the world famous ski slopes of this popular Idaho resort. U.S. Steel's Tramway Division can design and build you anything from passenger tramways to freight tramways for transporting sand, gravel, coal, lumber, ore, limestone and many other materials.

STORY-BOOK DRAGON? No, this is a continuous miner, built to be highly maneuverable in a cramped, underground coal mine. With cutting bits mounted on electrically powered chains . . . it rips the coal from the seam face . . . and then conveys it automatically into transportation equipment for removal above ground. One of the wonders of modern invention, this powerful machine is made of tough, enduring steel. Only steel can do so many jobs so well.



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THE MONTH AT CALTECH

New Palomar Pictures

LIKE THE PICTURE on this month's cover of E&S, the pictures on this page have recently been released for the first time by the Mount Wilson and Palomar Observatories. They are included in the new catalogue of the Observatories, which lists all pictures available for public purchase at the Caltech Bookstore.

The picture at the top of this page, photographed in red light by the 200-inch telescope at the Palomar Observatory, is officially known as Nebulosity in *Monoceros*. Obviously, though, it's going to be much better known as Madonna and Child.

The picture at the bottom of the page, which was also photographed in red light by the 200-inch, is of a nebula in Orion, aptly named the Horsehead Nebula.

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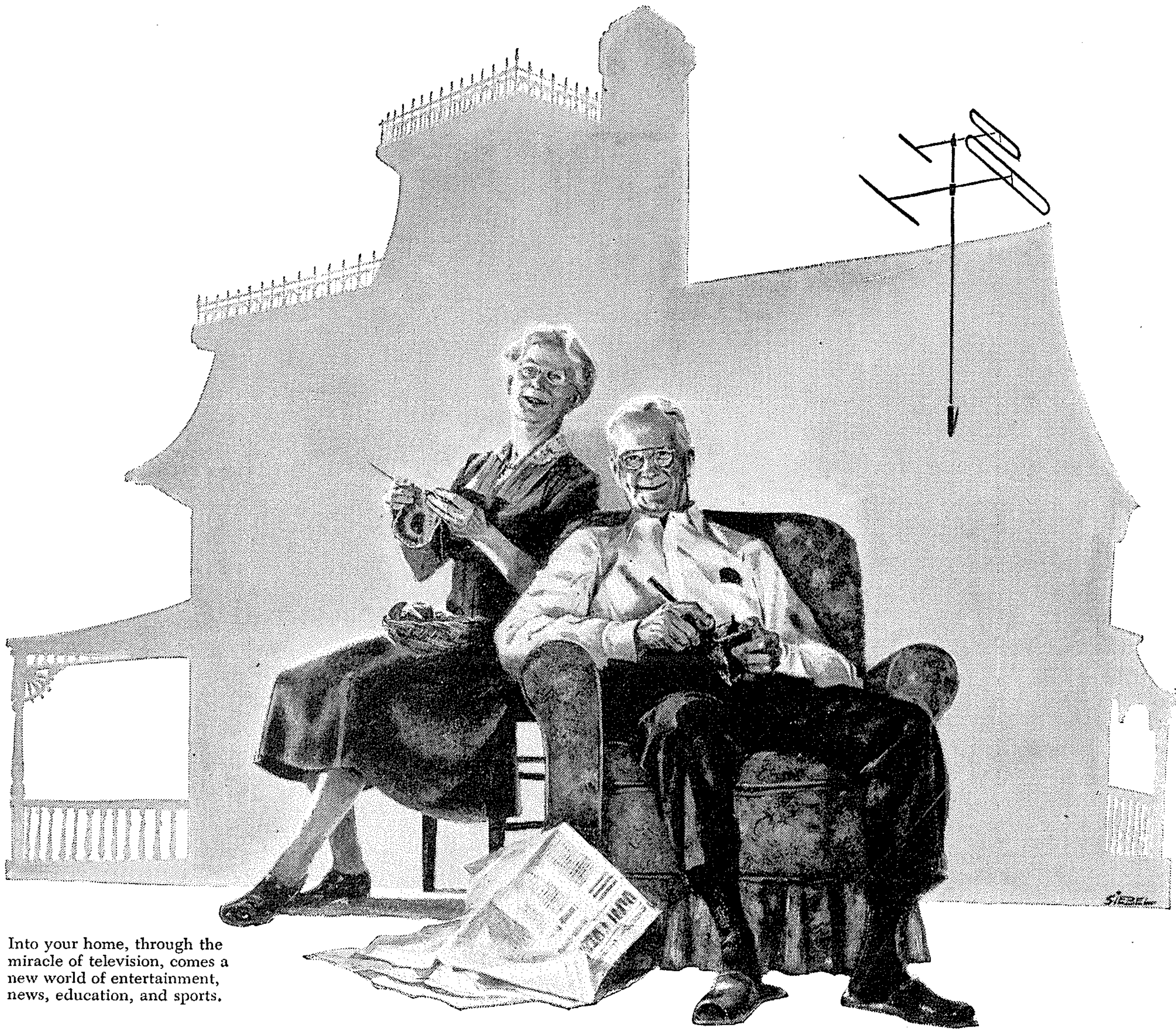

Into your home, through the miracle of television, comes a new world of entertainment, news, education, and sports.

They can still go out while staying home

Now "homebodies" who seldom leave their neighborhoods can view programs from distant cities—with all the comforts of home. Drama, comedy and variety shows are brought into the living room. Sports, news events as they happen can be viewed by all. Now television is open coast to coast . . . Those in the East may look in on the West, and the West may look in on the East.

Television is enjoyed in more than 15 million homes, as a result of research at the David Sarnoff Research Center of RCA at Princeton, N. J. Today's image orthicon TV camera was perfected there. Dr. Vladimir K. Zworykin of RCA developed the *kinescope*—which is the screen of television receivers. And RCA scientists have also perfected electron tubes, circuits, sound systems, phosphors, and antennas to make television part of everyday life.

The development of modern all-electronic television is only one example of RCA research at work. This leadership assures you high quality performance from any product or service of RCA and RCA Victor.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., New York. Admission is free. Radio Corporation of America, Radio City, New York 20, New York.

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Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
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Write today to College Relations Division, RCA Victor, Camden, New Jersey. **Also many opportunities for Mechanical and Chemical Engineers and Physicists.**

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Oxypolygelatin

REPRESENTATIVES of various government and civilian research groups held a two-day conference at the Institute early this month with the Caltech chemists who developed Oxypolygelatin, an emergency substitute for blood plasma.

The closed conference concerned the clinical and chemical aspects of the material, which was developed under government sponsorship during World War II. It was the first such meeting since research on Oxypolygelatin was resumed after the outbreak of the Korean war.

Said Prof. Linus Pauling, a co-developer of OPG: "Significant progress was made at the meeting in formulating specifications for an ideal plasma extender. Results obtained so far . . . support the belief that OPG is an inexpensive and effective plasma that could be manufactured and stockpiled on large quantities."

NACA

SIX CALTECH representatives have been appointed to the technical subcommittees of the National Advisory Committee for Aeronautics for 1952. Dr. Clark B. Millikan, Director of the Cooperative Wind Tunnel and of the Daniel Guggenheim Aeronautical Laboratory, was reappointed to the Committee on Aerodynamics, and reappointed Chairman of the Subcommittee on Fluid Mechanics; Dr. Hans W. Liepmann, Professor of Aeronautics, reappointed to the Subcommittee on Fluid Mechanics; Richard B. Canright, Research Engineer at the Jet Propulsion Laboratory, reappointed to the Subcommittee on Rocket Engines; Dr. Ernest E. Sechler, Professor of Aeronautics, reappointed to the Subcommittee on Aircraft Structures: Dr. Frank E. Marble, Assistant Professor of Jet Propulsion and Mechanical Engineering, appointed to the Subcommittee on Combustion; and Dr. W. Duncan Rannie, Associate Professor of Mechanical Engineering, appointed to the Subcommittee on Compressors and Turbines.

Appointees serve in a personal and professional capacity without compensation. Recognized for their leadership in a special field, they include engineers from the aircraft industry and the airlines, scientists from universities, and experts from the civil and military agencies of the Government most concerned with aeronautics.

With the United States expanding its military aviation to levels never before reached except in the midst of a major war, and civil aviation continuing to grow, the 1952 appointments reflect the importance of the NACA's conducting an adequate program of aeronautical research. Selected because of their technical ability, experience, and recognized leadership in a special field of competence, the subcommittee members meet regularly to consider problems related to an assigned technological area, to review research in progress both at NACA laboratories and in other organzations, to recommend research projects, and to assist in the coordination of research programs.

Scientific Advisors

DR. MILTON S. PLESSET, Professor of Applied Mechanics, and Dr. W. Duncan Rannie, Associate Professor of Mechanical Engineering, have been named by General Hoyt S. Vanderberg, U. S. Air Force Chief of Staff, to serve as members of his Scientific Advisory Board for a term expiring in June, 1952. Dr. Plesset is to be a member of the new Panel on Physical Sciences, and Dr. Rannie on the Panel of Fuels and Propulsion.

Dr. Theodore von Karman, former director of the Institute's Guggenheim Aeronautical Laboratory, is Chairman of the Scientific Advisory Board, which was set up in 1946 to assist the Air Force with problems in research and development.

Polio Grants

TWO GRANTS totaling $26,920 were made to the Institute last month by the National Foundation for Infantile Paralysis.

Under a grant of $16,920, Dr. Max Delbrück, Professor of Biology, will direct a study of the properties of bacterial viruses and how they grow. He will be assisted by Drs. J. J. Weigle, Renato Dulbecco and N. Visconti.

Drs. Linus Pauling and Robert B. Corey, Professors of Chemistry, received a $10,000 grant for continuation of their attempts to obtain physical evidence of the structure of certain animal and plant viruses.

The "phage group" of Dr. Delbrück will conduct investigations on bacteriophage — viruses that attack bacteria — as simpler models to work with in an attempt to determine the properties and growth mechanisms of viruses. It is hoped that ultimately the knowledge gained may be applied to the polio virus.

In commenting on the project, Dr. Delbrück explained that he and his fellow researchers plan a thorough study of the properties of viruses under varied laboratory controlled conditions.

Much of their work will be directed at tracing the source and extent of the substances of which the virus is composed. To accomplish this they plan to "tag" the virus or its host with radioactive isotopes. Part of their study will also be concerned with the mechanism of genetic recombination between several viruses infecting the same host bacterium, as well as the reactivity of viruses which have been damaged by exposure to ultraviolet light.

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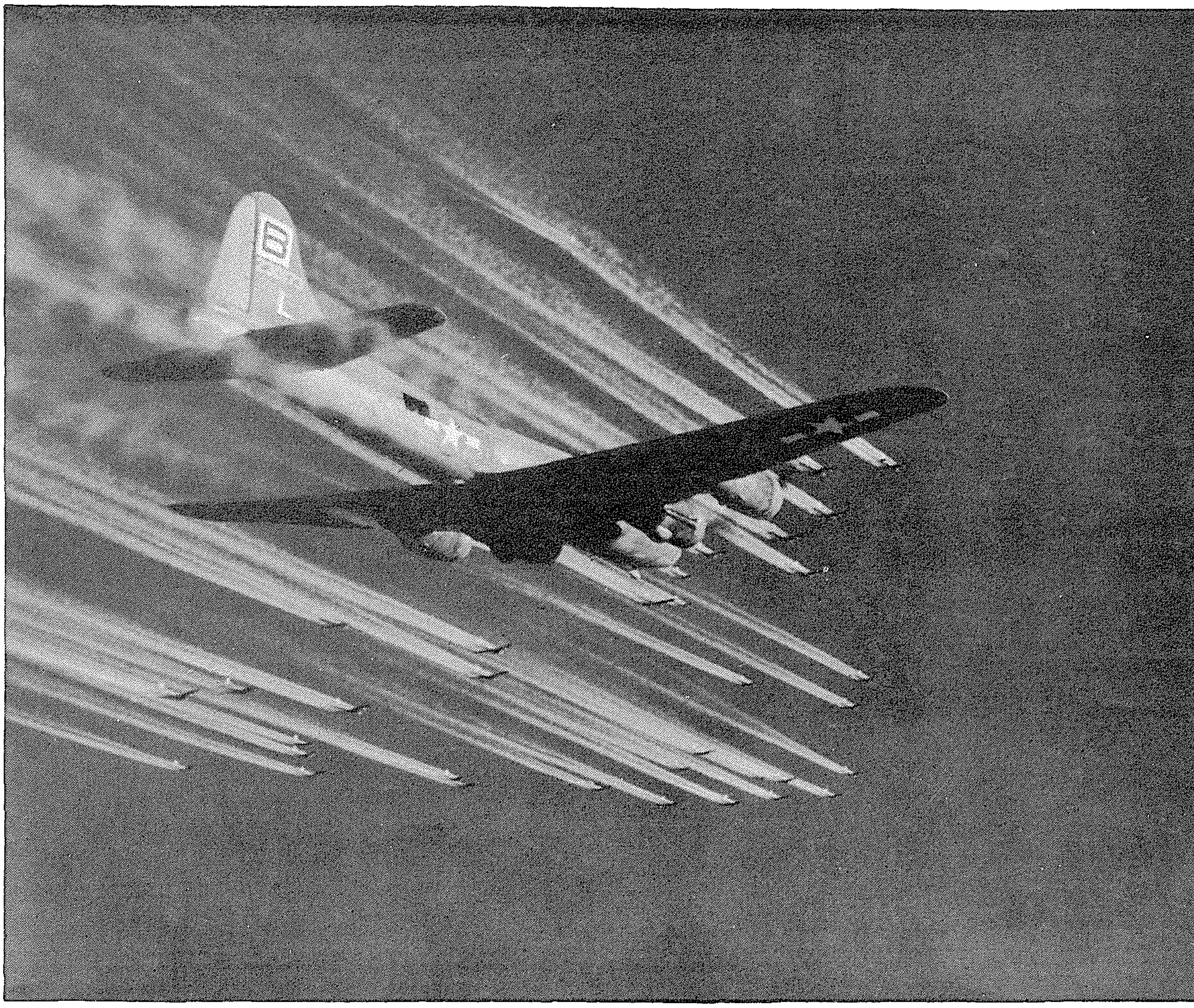

We hired an engineer over Berlin

"The Boeing Flying Forts came through a wall of flak and fighters that night to hit Berlin right on the nose. They never let us down—not then or on any of the raids to come. I was proud to fly the old Boeings. Now I'm prouder still to be on the great engineering team that designs the new ones."

Boeing engineers feel that way. And they'd be honored to have you join them as they pioneer in dramatic new fields of aviation.

The steady growth of Boeing's Engineering Division over the past 35 years is an index of its stability. There's great work to be done here in all phases of aircraft design. Boeing engineers are now working on such truly exciting projects as the world's hottest jet bombers, the B-47 and the B-52; on secret guided missile programs, on the new Boeing gas turbine engine and other revolutionary developments.

At Boeing you'll find some of the world's best research facilities and you'll work with the men who have helped establish Boeing's world leadership in the fields of aviation research, design and engineering.

You can live in the Pacific Northwest, at Seattle; or, if you prefer, you can settle in the Midwest, at Boeing's Wichita, Kansas, Division. Your inquiries will be referred to the plant of your choice.

So plan *now* to build your career at Boeing after graduation. Salaries are good, and they grow as you grow. Boeing has present and future openings for experienced and junior aeronautical, mechanical, electrical, civil, electronics, acoustical, weights and tooling engineers for design and research; for servomechanism designers and analysts; for physicists and mathematicians with advanced degrees.

For further information,
consult your Placement Office, or write:

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

BOEING

Since 1947, March of Dimes funds have enabled Drs. Pauling and Corey to determine the basic structure of certain proteins. The present study is an extension of the previous work and will utilize data and techniques developed in the earlier research.

Using an X-ray diffraction technique, the scientists hope to find out the composition and structure of certain chemical molecules which are fundamental constituents of both plant and animal viruses. Their study, when completed, should go far toward a complete understanding of the molecular configuration of virus particles.

Although not working directly with polio virus, the scientists supported by the March of Dimes hope that their basic findings will make a significant contribution to an understanding of its structure and mode of action, and to its eventual conquest by the physicians and other scientists engaged in the fight against infantile paralysis.

Automotive Council Scholarship

A $600 Automotive Transportation Scholarship has been established at the Institute for 1952 by the Automotive Council of Los Angeles, Inc.

The Council is an association of proprietary truck operators whose primary purpose is the furtherance of highway transportation. The new scholarship has been set up in recognition of the need for a sound engineering approach to highway and highway equipment problems. Funds for the scholarship are provided by proceeds from the annual Truck, Trailer and Equipment Show which is sponsored by the Automotive Council.

Caltech was the school selected to receive the award this year, and the $600 scholarship—which is to go to an engineering student or students needing financial assistance, and interested in automotive transportation—has been given to Albert Snider '52.

"So far as is known, this is the first scholarship granted by any organization for this specific purpose, and it is the Automotive Council's hope its use will be productive of substantial benefits to highway transportation," said Ray. F. Labory, Caltech '31 and President of the Council.

The 1952 Truck, Trailer and Equipment Show is scheduled for the Pan Pacific Auditorium from June 12-15 this year. It is the Council's plan to continue its scholarship program with funds received from the show each year.

Honors for Pauling

Dr. Linus Pauling, Chairman of the Division of Chemistry and Chemical Engineering at the Institute, has been honored by two Brazilian educational institutions for his contributions to modern chemistry. The University of Recife School of Pharmacy has named its analytical chemistry research center the Linus Pauling Study Center, and the Emil Fischer Study Center in Pernambuco has made Professor Pauling an honorary member.

The two centers are research organizations whose staffs include teaching personnel and research associates. They have honored Professor Pauling, specifically, for his "fundamental discoveries on the nature of chemical binding and the structure of crystals and molecules, discoveries in the field of protein chemistry and great contributions to the teaching of general chemistry."

Carnegie Appointment

Dr. David W. Bishop, Visiting Professor of Biology at the Institute, has been appointed a Staff Member of the Carnegie Institution of Washington.

Dr. Bishop, a native of Philadelphia, received his undergraduate training at Swarthmore College and received his Ph.D. from the University of Pennsylvania in 1942. He has been at Caltech since last September, on leave from the University of Massachusetts for a year's study of sperm activity and metabolism with Dr. Albert Tyler, Caltech Professor of Embryology. His new appointment will take effect next October.

Safety Engineer

Roy I. Wilson, a safety specialist for 17 years, has been appointed Safety Engineer of the Institute, succeeding Stuart M. Seeley, who resigned to become a safety engineer at the North American Aviation Corporation.

Mr. Wilson recently returned to the United States from Tokyo, where he became Safety Director for the Army Engineers Corps in April, 1949. While abroad he helped the Occupation government set up safety standards for Japanese industry and spent six months as Safety Director at Eighth Army Headquarters in Korea.

A native of Asheville, North Carolina, Mr. Wilson attended Porter Military Academy, Charleston, South Carolina, and was graduated in 1932 from the New Mexico School of Mines.

After graduation, Mr. Wilson worked at Boulder Dam, then went to South America as a junior engineer with the Shell Oil Company. He became a safety engineer for Shell in 1934 and from 1935 to 1939 operated a safety engineering consulting firm in Honolulu for Hawaiian and Philippine plantation owners. He became Safety Director for Pacific Naval Air Base contractors in 1939.

During World War II, he was Chief Safety Engineer for the Navy at Pearl Harbor. Mr. Wilson also has been Safety Director of International Bechtel Construction Company in Arabia and of Morrison-Knudsen, which built Army housing in Guam and the Philippines. He is a member of the American Society of Safety Engineers.

"Daddy...draw me a Freedom"

"Susie thinks I'm Rembrandt.

"She's not too bad at drawing cows or moons or pumpkins. But every time she hears a new word, she expects *me* to draw it for her. She doesn't take *no* for an answer . . . so, for 'Freedom,' I drew her an American Flag and she was satisfied.

"Later I thought: how *else* can you describe a word like 'Freedom'? For instance . . .

"When a churchbell peals in America, it rings Freedom. Every time we mark a ballot, it votes for Freedom. Each paycheck I get from Republic Steel is drawn on Freedom. Our newspapers have a rustle of Freedom to them.

"Freedom is a major subject in every good American School. The auto you drive is a deluxe Freedom model. All radio and TV sets are tuned in to Freedom. And every cop pounds a beat on Freedom Street . . . in America.

"Sure, *we* like Freedom, and some governments abroad *don't*. But . . . watch out for the home-grown commies, socialists and hate-mongers among us who are trying to get us to turn our Freedoms over to the 'State.' Watch out, too, for wasteful splurging of public funds by the government . . . federal, state and local, alike. This is one sure shortcut to the loss of our personal Freedoms.

"Y'know, our fathers passed along to *us* a pretty wonderful country . . . with all the important Freedoms included. Wouldn't we be pretty poor parents if we, in turn, handed over a socialistic, bankrupt America to *our* kids?"

REPUBLIC STEEL

Republic Building, Cleveland 1, Ohio

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Republic BECAME strong in a strong and free America. Republic can REMAIN strong only in an America that remains strong and free . . . an America which owes much of its progress to the men and machines of its countless industries. *And through these industries, Republic serves America.* A good example can be found in the Roadbuilding Industry, responsible for the more than three million miles of highways that crisscross our nation from border to border and coast to coast. *Steel* earthmovers pave the way, followed by graders, mixers, forms, roadbed wire mesh, drainage pipe, guard rails . . . the list is long. All products of *steel*, much of which comes from the mills of Republic.

* * *

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Some Notes on Student Life

Students' Day

EARLY ON THE MORNING of Saturday, January 12, 750 eager high school students and their teachers swarmed over the Institute for the second annual Students' Day. The Institute invited the students, all of them male high school seniors, upon the recommendation from their teachers that they exhibited interest in science and engineering. They came from 130 different high schools and prep schools in southern California, including schools as far away as San Diego and Bakersfield.

The original idea for Students' Day came several years ago from a group of imaginative undergraduates who reasoned that an Institute open house open only to prospective students would be a good replacement for the pre-war Exhibit Day, which was open to all members of the community, and which became excessively successful to the extent that it was unmanageable.

Appropriately enough, the planning and work were done mostly by the undergraduates. An elaborately efficient hierarchy of committees, technical assistants, and general flunkies functioned to make this second annual Students' Day an overwhelming success. Being a successful event, it necessarily had to produce a few experiences which, in retrospect, we can call lighter moments. There was the exhibitor in Electrical Engineering and his jumping ring, which, to his dismay, was nowhere to be found on one crucial occasion. Then there was the guide who led his group of rain-soaked guests up to a locked door, which situation he unceremoniously mastered by picking the lock.

The agenda consisted of twenty-five student-planned and student-manned exhibits in the morning; luncheon in the student houses, with addresses by Dr. DuBridge and Dave Hanna, ASCIT President; and more than a dozen lectures in the afternoon embracing everything from "Liquid Air" to "What Biologists Do."

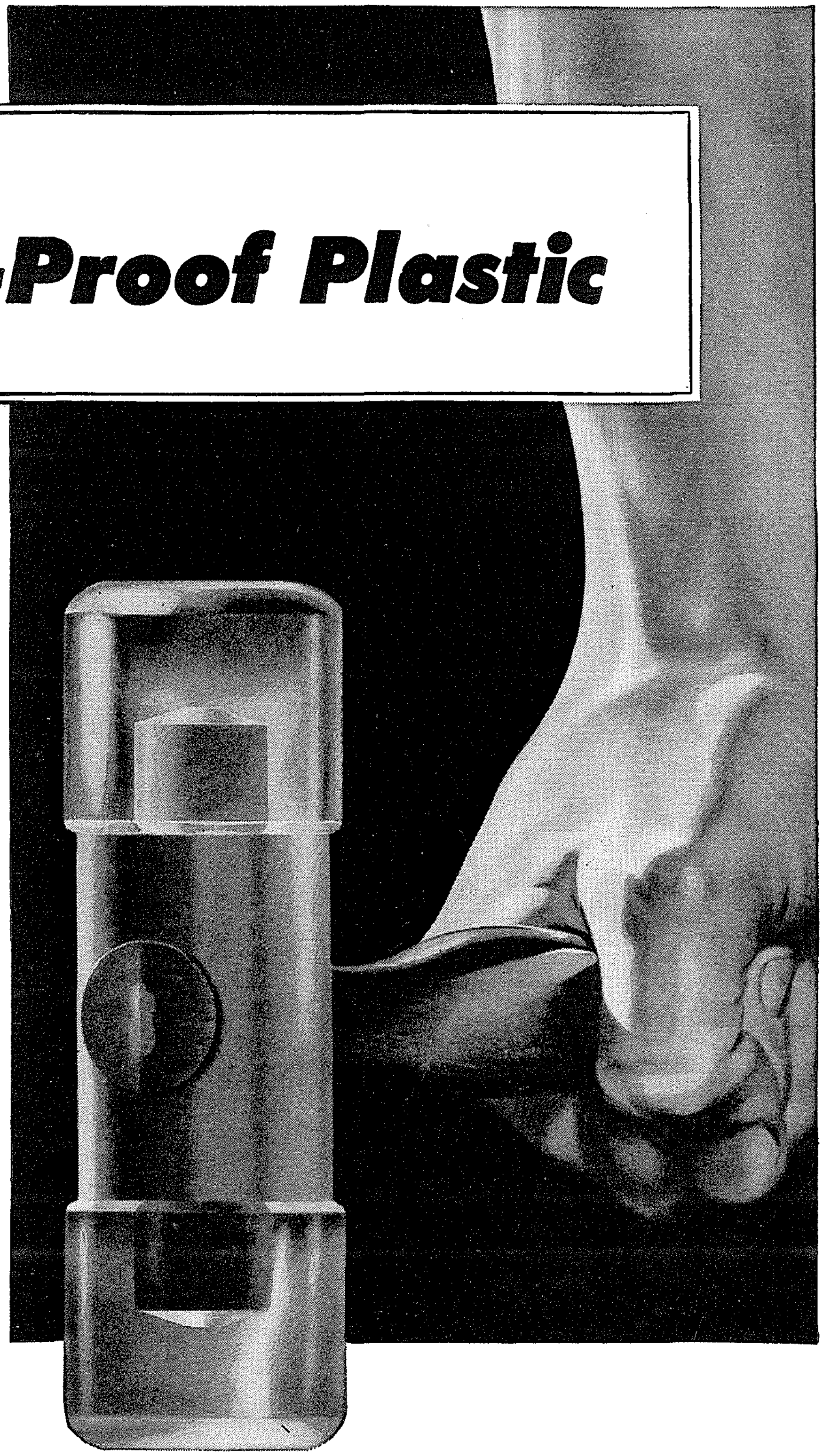
The undergraduates contemplated smugly the entire proceedings, which they aptly termed Operation Snow Job. It seemed to them that our young visitors were amazed, bewildered, and, most important of all, impressed. Most of the exhibits lasted only ten minutes, and the exhibitors crammed as much as possible into their short speeches.

Even the least patronizing of the undergraduates could not help but regard himself as a big brother to these high school kids who seemed as impressed as farm boys in the big city. And the undergraduates remembered that they, too, thought of science and engineering in terms of such bright-eyed ambition—but that was a long time ago.

The usual topics of conversation arose when the high school students had time to talk with the undergraduates, so that a person moving from one student house lounge to another might think the undergraduates had all planned the same speech: "Why yes, we do work hard here, but not too hard . . . Geniuses? This school couldn't be full of geniuses, or I wouldn't be here." And one freshman, having the enormous benefits of more than three months at the Institute, gave some paternal words to a youngster one whole year his junior, and told how

Richard Jaffe, Caltech junior, lectures on the synchrotron to high school students visiting the campus on Students' Day.

Pound-Proof Plastic



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... Hercules® Ethyl Cellulose ... an extremely tough and durable plastic widely used for tool parts and other industrial needs. No other low-cost plastic can match its impact strength and resistance to distortion from humidity and temperature extremes. "Ethyl" now plays a major role in many key defense and civilian products.

COLLEGE MEN...

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Hercules' business is solving problems by chemistry for industry...

... textile, paper, rubber, insecticides, adhesives, soaps, detergents, plastics, paint, varnish, lacquer, to name a few, use Hercules® synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products and other chemical processing materials. Hercules® explosives serve mining, quarrying, construction, seismograph projects everywhere.

HERCULES

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Sales Offices in Principal Cities

he averaged four hours' homework per night here. The high school student thus addressed replied blandly that a smart fellow could do it in less time, and that he, the high school senior, would prove it when he come here next fall.

Students' Day did a good job of selling the Institute's technical facilities, and a few of its outstanding personalities. But many undergraduates regretted that it was so difficult to present more completely many details of student life. And it seemed that, at least in the minds of high school students, the weakest link in the Caltech chain of education would be opportunities for extracurricular life at the Institute.

A considerable number of undergraduates were sorry they could not see the big show themselves. A mathematics major learns nothing about automobile engines, and an engineering student has no opportunity to see the exciting progress going on in biology. Why not, they ask, let this intellectual charity begin at home? The more thoughtful among them reasoned that the Institute has already seduced them, and would consider that such an educational luxury was no longer necessary.

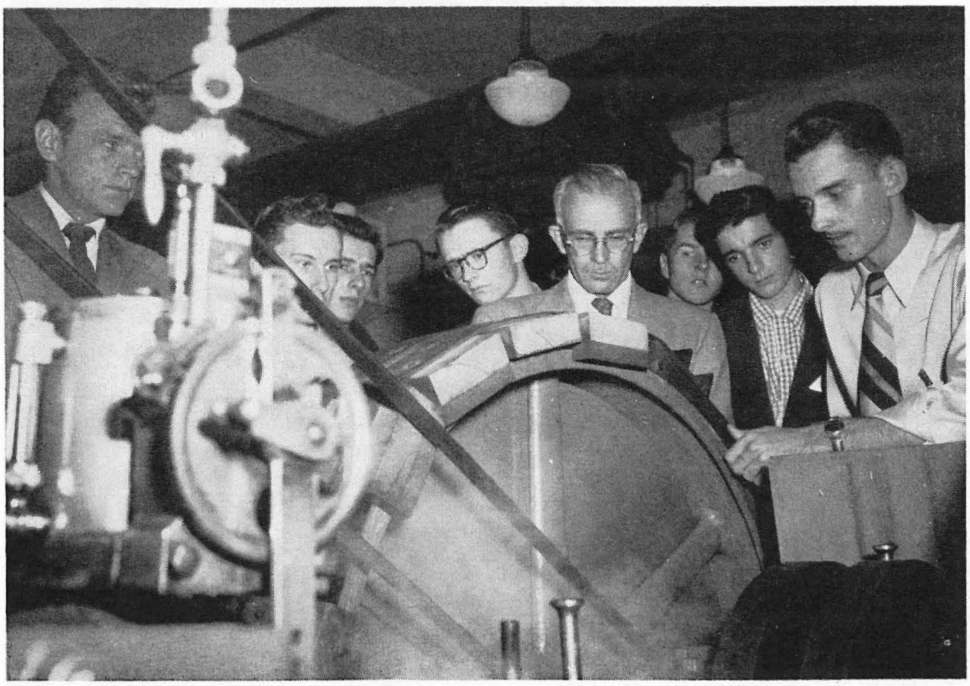
Pendulum

Pendulum, the new undergraduate literary magazine, is beginning to stand on its own feet, although its ultimate success will be largely determined by alumni subscriptions. The first issue—as was reported in this column last month—was financed by the Division of the Humanites. But from here on, the magazine is on its own. Students and faculty have already responded encouragingly to the *Pendulum* subscription appeal. Now if it can get some alumni support, *Pendulum* should really be in business. Coupons for subscriptions can be found on the last page of this issue of E&S.

Second Term

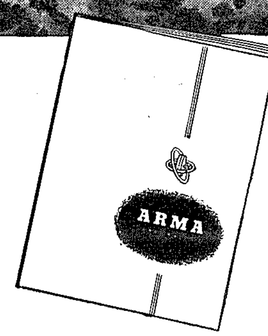
The second term generally produces more griping and ennui than is usually found tugging at the Tech man's morale. The first term offers reunions with friends, and the spirit generated by football season and frosh rotation and initiations; and there is the Interhouse Dance. The third term has the beach, and vacations and graduation looms ahead of it. The second term has nothing; the social programs are handicapped by the frequent basketball games.

It is during the second term that Milton becomes unreadable, that Econ 4 exhausts all patience, that ME 3 takes its greatest toll in human suffering. It is during the second term that desiccators fall from tables in analytical chemistry lab. And, perhaps most significant of all, it is during the second term that the bright eyes of the freshmen grow dim with disillusionment as they discover that a pure scientist is really no more spectacular than other people, and that perhaps an engineer is just another businessman. With this, the frosh scamper to their elders, the stoical upperclassmen, for comforting words and solace. And they receive it, for, in the words of the well-rounded Tech man: "We have now reached a minimum point in this closed cycle of human happiness, and our next point of inflection is due shortly before midterms next term." —*Al Haber '53*



Students' Day visitors swarm over the reciprocating steam engine in Caltech's Mechanical Engineering Laboratory.

Hitting modern military targets poses ever-new engineering problems



This booklet – "Engineering at Arma" – describes in detail the challenges of an engineering career at Arma. It can open new horizons to you. Write today for your copy to Engineering Division, Arma Corporation, 254 36th Street, Brooklyn 32, N. Y.

Increasing emphasis in speed and mobility in modern warfare intensifies the problem of destroying the target—takes it out of the reach of manual ability and into the realm of electronics. Electrical and mechanical engineering—of the highest skill and ingenuity—are required.

Since 1918, Arma Corporation has worked closely with our Armed Forces and American Industry in pioneering and developing equipment to solve such problems. Today, Arma is in the forefront in supplying these precision instruments for our nation's defense, through techniques which tomorrow can be widely applied.

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ALUMNI NEWS

Seminar Day

THE 15TH ANNUAL Alumni Seminar will be held at the Institute this year on Saturday, April 12th. Details concerning the program and events scheduled for the day will be going out to alumni shortly, and the complete program for the day will be printed in the next issue of E&S.

Remember the day—April 12th.

Institute Doctor

WILLIAM R. V. MARRIOTT, M.D., Caltech '40, M.S. '42, arrived on the campus last month to take the position of Director of Student Health.

Dr. Marriott succeeds Dr. William S. Gevurtz, who resigned because of ill health.

Dr. Marriott comes to Caltech from March Air Force Base, where he was director of the base hospital. He held the rank of Major. A chemistry graduate at Caltech in 1940, he got his master's degree in biology here in 1942, doing bio-chemistry research under the guidance of Dr. Borsook. It was through his suggestion he first considered going to medical school. In 1941 he received a research grant at the Huntington Hospital, where he did research on lead poisoning under Dr. Alvin Foord.

He entered the University of Southern California Medical School in June, 1942 as a part-time student, at the same time directing the laboratory of a vitamin manufacturing company. In 1943, with the initiation of the Army Specialized Training Program, he entered the Army and continued his education in that Program. He completed his academic work in 1946, and was made a member of Phi Kappa Phi while a medical student. He served a one-year rotating internship at the Los Angeles County Hospital in 1946-47. He received an M.D. degree in April, 1947 and obtained a California Medical License in June, 1947.

He returned to active military service as a First Lieutenant in August, 1947 and was promoted to Captain in August, 1948. From August, 1947 to June, 1948 he was an instructor in biochemistry and pharmacology at the School of Aviation Medicine, Randolph Air Base, Texas. His time there was mostly spent doing research, but while there he also learned to interpret electroencephalograms. Desiring to return to clinical medicine, he asked for a transfer and was reassigned to the 317th Station Hospital, Wiesbaden, Germany, in June, 1948. Because Wiesbaden was the neuropsychiatric center for the armed forces in Europe and because he had some neuropsychiatric training during his internship, he became an Army psychiatrist. During a good portion of that time he was acting chief of the department.

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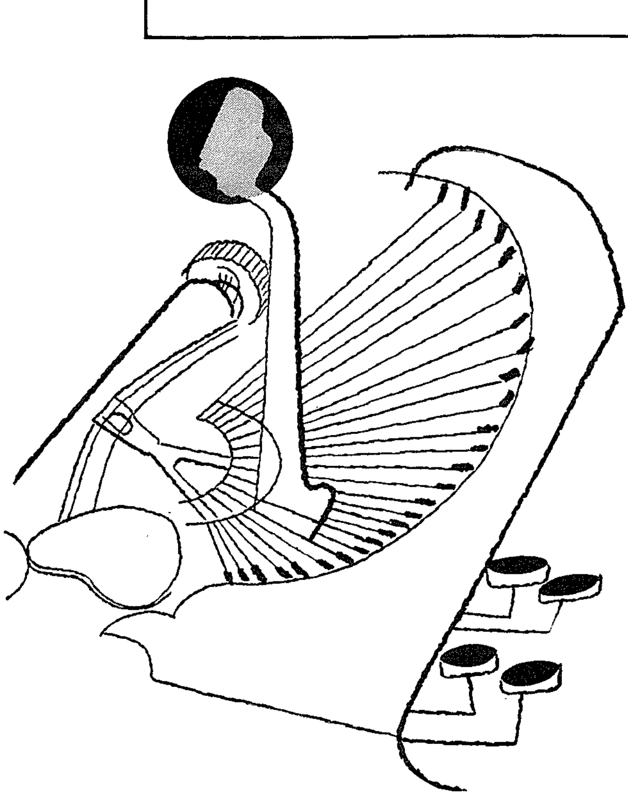
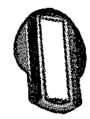
What's Happening at CRUCIBLE

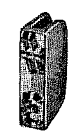
about special shape type steel



5. The flash trimmed off after the swadging operation.



6. The finished type ready for hardening, plating and soldering to the type bar.



The production of Crucible steel for this job is the result of engineering and practical know-how combined with a special method of manufacture to assure a homogeneous microstructure for maximum forming properties, excellent surface characteristics for good die life, and close accuracy control for all dimensions of the shape.

The production of type steel requires the use of small precision rolling mills equipped with shaped rolls and operated by skilled workmen. During preliminary and final inspection, shadowgraph equipment is constantly used to check for size accuracy.

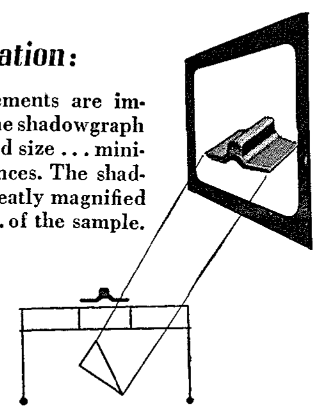
As a result of its outstanding quality, Crucible's special shape type steel is constantly in demand and used by leading typewriter manufacturers.

Crucible special purpose steel for type character application

The development of cold rolled special shape type steel is one of Crucible's important contributions to the business machine industry. A major part of the type characters used for the manufacture of typewriters are made from this special shape.

Shadowgraph Operation:

Since micrometer measurements are impractical due to the shape, the shadowgraph is used to measure shape and size . . . minimum and maximum tolerances. The shadowgraph is a projection, greatly magnified . . . on a calibrated screen . . . of the sample.

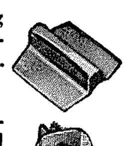


Schematic of shadowgraph

Here's the step-by-step process:

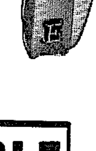
1. Cold rolled special shape produced by Crucible.

2. The type slug cut from the special shape material.



3. The wings of the type slug are bent down and taper formed toward the edges.

4. The type characters are cold swadged on the solid edge of the bent type slug.



If you have a requirement for special steels—check with Crucible. Feel free to draw on the experience of our metallurgists and engineers. Crucible Steel Company of America, General Sales and Operating Offices, Oliver Building, Pittsburgh, Pa.

CRUCIBLE first name in special purpose steels

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National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin

In the winter of 1949 he was able to take a seven-weeks' course of advanced training in dermatology at the University of Vienna Medical School. In May, 1949 he transferred into the department of Internal Medicine. From 1949 till October, 1951 he remained at the Air Force Hospital in Wiesbaden, serving as Chief of the Medical Service or Assistant Head of the Service and also as Chief of the Laboratory Service. He remained in the hospital in Wiesbaden for two and one-half years over his required military service. This was not especially for the advantage of being able to tour Europe, but rather because of the excellent experience he was gaining, and the confidence and satisfaction he received from treating very sick patients entirely on his own. Since May, 1951 he had been eligible for immediate discharge upon his request.

As an undergraduate at Caltech, Marriott was on the Board of Control for two years, a member of the Varsity Club and the Beavers. He received an Honor Key, was treasurer of Throop Club, secretary of Pi Kappa Delta, on the Election Committee and the Publicity Committee. He was on the Frosh and Varsity track and cross country teams, was a debater for four years and a member of Tau Beta Pi.

Dr. Marriott was married in 1946. Born in Canada, he became a naturalized citizen in 1943. He has had eight and one-half years of military service, of which four and one-half years were commissioned service as a medical officer.

President Beckman

Arnold O. Beckman, Ph.D. '28, has been elected president of the Instrument Society of America. He's the first western man elected to the post since the Society was founded in 1945.

Beckman received his doctor's degree at Caltech in photographic chemistry, and served as a member of the Institute's faculty from 1926 to 1940. He is now president of three companies in the Pasadena area — Beckman Instruments, Inc., the Helipot Corp., and Arnold O. Beckman, Inc. The Beckman spectrophotometer is known as the work horse in modern biochemical research. With similar instruments it provided controls for materials used in production of synthetic rubber during World War II. Beckman instruments are also widely used to control industrial processing operations such as sugar refining, electroplating, water treating and brewing.

The Instrument Society of America is now devoted largely to industrial process control. As president of the organization, Beckman hopes to broaden its scope to include other instrument fields such as meteorology, aviation, medicine, and electricity.

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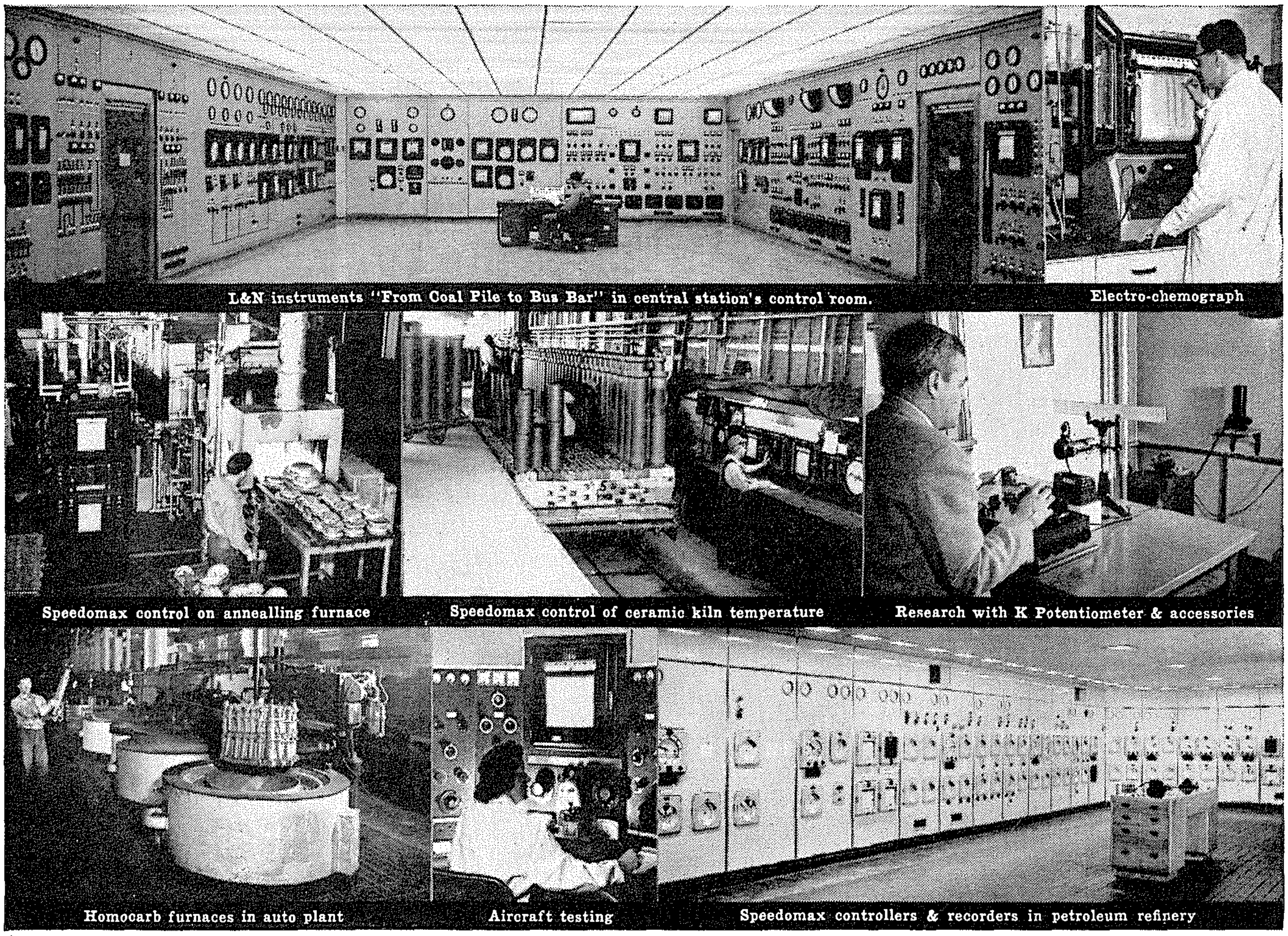

L&N instruments "From Coal Pile to Bus Bar" in central station's control room.

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LOOKING FOR OPPORTUNITY? LOOK AT L&N!

Because instruments are basic both to industrial and to scientific work, the instrument field ranks high in opportunity. As long as men make pig iron or pills, guns or butter, clothing or kilowatts or gasoline, industry will use more and more instruments on the production line. As long as scientists "unscrew the inscrutable" they will need instruments for laboratories, defense projects, and industrial research.

As a result, L&N job opportunities are quite varied. The openings in sales engineering utilize technical training in the examination of processes, and in selection and application of correct instruments in industrial plants. Other openings are in research and still others in engineering development of L&N products. Also beckoning are production, advertising, inspection and other operations.

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ALUMNI NEWS . . . CONTINUED

Zarem Address

A. M. Zarem, M.S. '40, Ph.D. '44, in an address before the Lake-Colorado Business District Association in Pasadena last month estimated that Caltech has indirectly created a $50,000,000 annual industrial payroll in the Pasadena area — and is the source of a grand total of $100,000,000 a year pumped into the area's economy.

As a result, he added, sometime in the not too distant future this will become a multi-billion dollar industrial area.

The Far West, Zarem said, has just passed through a 100-year industrial handicap, due to two great barriers — the Rocky Mountains and the mental attitude of the industrial East. Right now, the North Central and Northeast sections of the United States have 16 per cent of the country's land area, and 98 per cent of its industries — regardless of the fact that the West has the unlimited supply of natural resources.

The change in Pasadena in the last decade, he said, is an example of the change being wrought by industrial research. In 1920 there were 300 research laboratories in America. Today there are 2500. A survey conducted by the National Research Council in 1940 proved that the majority of big industrialists admit that their industries would be out of business within three years' time, without the research laboratory.

Training of scientists at Caltech, therefore, has become of extreme importance, for trained scientists start new industries. Examples of some of Pasadena's growing industries based upon fundamental research done by men at Caltech are the Arnold Beckman Instrument companies (see p. 38); the Consolidated Engineering Corporation, first in the field with the mass spectrometer; Aerojet Engineering Corporation; the U. S. Naval Ordnance Test Station; Applied Physics Corporation; the Hycon Manufacturing Company and the William Miller Corporation, all tied closely to Caltech.

Director of the Los Angeles Division of the Stanford Research Institute, Zarem said he was even forced to admit that 12 of the scientists on his own staff were Caltech graduates.

Stuart Fraser

Stuart Fraser '39 was one of three men who lost their lives in an avalanche near Sun Valley, Idaho, on January 19. A guest at the resort, Fraser and another student skier were working with a ski instructor on Sun Valley's famous ski course when the snow-slide occurred.

Stuart had been Materiel Manager with the Ryan Aeronautical Company in San Diego. As an undergraduate he was a member of the band, orchestra and drama club, and was captain of the Caltech ski team.

Springer Memorial Ski Race

On March 23 the Dick Springer Memorial Ski Race will be run at Kratka Ridge, California. Dick, who died in an auto accident last May, was graduated from Caltech in 1945. His M.S. degree was awarded posthumously at the 1951 Commencement. An ardent skier, Dick was a charter member of Ski Club Alpine, one of the sponsors of the Springer Memorial Race to be held next month. The other sponsors: Kratka Ridge and the Mountain Dancers, who have donated a trophy.

Identified Motorist

At the height of the winter rains the accompanying picture appeared one morning in the Los Angeles *Times*. "A motorist," said the caption, "mercifully unidentified, stalled on Jefferson Blvd. west of Centinela Ave., had to shed his pants, jump in waist deep and push."

Now that the worst of the rains have gone and tempers have improved it seems safe to identify the motorist in the picture as Lowell C. Parode, M.S. '47. According to one of Lowell's classmates, who might as well remain mercifully unidentified, the picture "illustrates Lowell's latest ideas on underwater devices."

Unidentified motorist demonstrates underwater device

A REPORT ON THE ALUMNI FUND

THIS IS THE FIFTH year of the Caltech Alumni Fund. As of February 1 the Fund totals $101,356.62. Last year's gain equaled $21,688.08.

The Alumni Fund rightly dates back to a meeting of the Board of Directors of the Alumni Association on March 28, 1946. At that meeting a motion was passed requesting the President to appoint a committee to consider the possibilities of contributions by alumni for the assistance of the Alumni Association and the Institute.

The Fund Study Committee, under the chairmanship of Howard B. Lewis '23, presented its report to the Board of Directors on March 4, 1947, estimating that annual contributions of $2,500 to $5,000 might be expected from the solicitation of alumni, over and above Alumni Association dues. It was estimated that this would increase rapidly in the next ten years to between $15,000 and $25,000.

The Committee made certain specific suggestions for a program of fund raising, the most important being to "determine a definite and tangible objective for the use of funds which will render maximum service to the Institute and have maximum appeal for the alumni." It was suggested that an objective that would fulfill these requirements might be a gym and/or pool.

The Board of Directors accepted the program at its meeting of March 4, 1947 and Howard B. Lewis was appointed as a representative of the Board to consult with the Institute concerning a mutually acceptable objective and an allocation and authorization for the use of funds when, as and if available.

On March 11, 1947 Howard Lewis reported that a discussion with President DuBridge indicated that the cost of a gymnasium and swimming pool might run anywhere from a quarter to a half million dollars. The Board agreed that this amount would be difficult if not impossible to raise, and the suggestion was then made that the Association sponsor the construction of a swimming pool which might cost between $50,000 and $150,000.

Meanwhile the Board of Trustees of the Institute was discussing the proposal of an alumni fund, but was unwilling to establish a specific project without further detailed study. It was Howard Lewis who suggested to the Alumni Association that fund solicitation could be initiated, at any rate, even though a specific project had not been established. Members of the Alumni Board and committee chairman therefore contributed $1,560 to start the Alumni Fund and the money was presented to President DuBridge at the Annual Meeting of the Alumni Association on June 13, 1947.

On November 17, 1947 a meeting of the Board of Directors, President DuBridge, the chairman of the Board of Trustees of the Institute, and several faculty members was held for the purpose of informing the representatives of each class of the Institute of the proposed fund-raising program. The class representatives elected the following as members of the Directing Committee:

Chairman, J. W. Lewis '41;

Vice Chairman, G. A. Alles, for classes of 1896-1923;

Vice Chairman, J. E. Kinsey, for classes of 1924-1932.

Vice Chairman, A. A. Ray, for classes of 1933-1940;

Vice Chairman, S. E. Sohler, for classes of 1941-1948;

Joseph W. Lewis reported to the Board shortly thereafter that, at a meeting of the Directing Committee, it was agreed that the goal of the Alumni Fund should be $250,000 to be raised on a five-year basis for the construction of a gymnasium for the Institute. The Board of Directors was in such disagreement as to whether or not this goal was too high that a motion was passed requesting the Fund Committee to recommend at least two alternative objectives having a lower dollar value.

The alternatives were arrived at in a special meeting of the Board of Directors on December 8, 1947:

Raising $100,000 toward an outdoor swimming pool with dressing-room facilities.

Raising of no specified amount of money with no specific goal established.

After extremely lengthy and pointed discussion, the Board passed a motion approving the recommendation of the Fund Committee to attempt to raise $250,000 in five years for the Alumni Fund.

The program was officially established on December 8, 1947 with H. B. Lewis and J. W. Lewis directing the solicitation for the year 1947-48. Subsequent annual programs have been under the direction of the following members of the Board:

1948-49—J. W. Lewis, and R. F. Mettler;

1949-50—R. F. Mettler, and R. J. Hare;

1950-51—D. C. Tillman, and E. J. Macartney;

1951-52—D. C. Tillman, and K. E. Kingman.

As the Fund enters its fifth year with the $100,000 mark just passed, serious consideration is being given to the possibility of starting construction this year on a swimming pool and locker room as a first phase of the gymnasium program. Preliminary plans and specifications have been drawn up by the Institute—despite the fact that there are several sizable hurdles to be cleared before such a project can become a reality. First, the Federal government would have to allow the Institute a permit for the allocation of materials. And, secondly, this year's contributions will have to be sufficiently above those of previous years, since the rough estimate of $100,000 originally set for the project is hardly adequate for a swimming pool and locker room today.

Whatever construction results from the Fund this year, it is apparent from all the discussions which led to the initiation of a Caltech alumni fund, that this is to be a permanent institution which—it is hoped—will be of continued benefit to the Institute.

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The San Francisco Chapter meets for lunch at the Fraternity Club, 345 Bush St., every Thursday.

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U. S. Coast & Geodetic Survey

SECRETARY-TREASURER Charles R. Cutler '45
800 World Center Building

Sacramento Chapter:

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California Division of Water Resources,
Public Works Building.

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PERSONALS

1920

Fred A. Marshall, Ex., recently became Western Wholesale Representative of Knickerbocker Shares, Inc., sponsors and distributor of the Knickerbocker Fund, a mutual investment fund. His office is in Los Angeles.

1921

Louis Korn has been reappointed a member of the ethics and practice committee of the American Institute of Architects, Southern California Chapter. This committee passes on problems arising between architect and client, architect and contractor, etc., and standards of practice within the profession itself.

1924

Fred Groat and his wife Peggy celebrated their wedding anniversary with a large group of Caltech alumni at Professor Sorensen's home in Pasadena over the Christmas holidays.

Emmett M. Irwin reports that his son, Bill Irwin '52 was married last April to Dona Eagleston, a Pomona College girl. Emmett is at present the major owner of Induflux Testing Service, which tests sucker rods for the oil companies and determines the amount of fatigue that has developed in them due to service in the oil wells.

1925

Howard Tackabury has been with U. S. Steel for the past ten years, and is manager of the structural section of the Consolidated Western Steel Division.

1927

Harry Farrar has been living in Palo Alto and working in San Francisco for over a year. The Farrars have built a new home and claim they like the climate better than in southern California. Harry is now Toll Equipment Engineer on the staff of the Operating Vice President of the Pacific Tel. & Tel. Company — who is, incidentally, R. E. Hambrook '21.

Edwin L. Rose, Ex., is now serving as one of the highly-trained scientists under Colonel Carroll D. Hudson at the Redstone Arsenal in northern Alabama. He is at present top technical advisor to Colonel Severin R. Beyma, chief of the technical and engineering division at Redstone. This division is responsible for all arsenal guided missile and rocket development. Ed was decorated after World War II for his outstanding services in the National Defense Research Council. After the war he was a free lance consultant engineer, an electrical engineering instructor at M.I.T., and took an important part in building the multiple-domed Coolidge Dam.

1929

Leonid V. Leonard is division engineer for the natural gas and gasoline division of the Shell Oil Company, Los Angeles.

Kenneth E. Kingman has been with Union Oil for 22 years, and is now Vice President in charge of Manufacturing. His daughter is a junior at Scripps College, one son is a freshman at Stanford, and another son is in the fifth grade. They recently bought a home in Pasadena.

Homer C. Reed, M.S. '30, is chief engineer in the Process Division of the Research and Process Department at Union Oil Company.

1930

J. H. MacDonald writes that at the beginning of 1951 he promoted himself to the sole owner of the John Hastie Company and curtailed operations to the manufacture of Pomona Irrigating Equipment, which the company had acquired from Pomona Pump in 1926. That ran well until the Los Angeles County Air Pollution Control District found his iron cupola. P.S.: Exit one small gray iron foundry. Now he is continuing to cast his own brass parts and aluminum patterns, and has branched into magnesium sand casting. Anyone using magnesium alloy sand castings can easily get some casting time in his foundry (Advt.).

1932

Charlie Jones is still operating his own consulting office in Los Angeles. At present he is doing work for American Potash and Chemical Corporation in Trona.

G. E. Bowles is head of the fire control systems section of the research and development labs of Hughes Aircraft Company. In November he was appointed to the advisory council of the research and development labs.

Joshua L. Soske, M.S., Ph.D., '35, has been appointed to the Henry Salvatori Associate Professorship in geophysics at Stanford University. Formerly chief geophysicist and president of the Geophysical Engineering Corporation, Joshua is the first person to occupy the Salvatori chair.

1933

Alvin J. Smith, M.S. '34, announced the arrival of a son in November. Alvin is still with the H. L. Gogerty organization, as head of the electrical department.

Robert B. Grossman is now with the Holly Manufacturing Company in Pasadena.

Merrill Berkley, who owns and operates the Berkley Engineering and Equipment Company, reports that they have expanded their business and moved to a new location (2439 Riverside Drive in L.A.) in December. The company now represents six top-ranking equipment manufacturers in southern California, Nevada, and Arizona.

In January 1951 Merrill started the Arizona Business Service, designed to furnish mail and telephone service, as well as rent desk and office space, to business men in the area. On January 1 of this year he formed another new company to promote the sale of products for chemical cleaning and water treatment services—the Arizona Solvents Service Company.

1934

Anatol A. Fomilyant, Ex., was recently appointed Los Angeles district manager of the Rockwell Manufacturing Company. The Los Angeles district consists of southern California, Arizona, and Utah.

1935

James H. Jennison, M.S. '36, became head of the design and production department at the U.S. Naval Ordnance Test Station in Pasadena where he's worked since 1945. He is also chief engineer, Project SNORT (Supersonic Naval Ordnance Research Track). Construction on the project begins soon and will last about a year.

Lawrence J. Stuppy is practicing medicine in Los Angeles. He has five children.

1936

Curtis G. Cortelyou, Ex., acquired a fourth child, a ten-pound boy, in October. That makes two boys and two girls for the Cortelyous. Curtis is still a project engineer in the engineering department of General Petroleum Corporation in Los Angeles.

Robert G. Heitz was recently promoted to the position of Director of Research of the Western Division of the Dow Chemical Company in Pittsburg, California.

1937

Carl B. Johnson, M.S. '44, Engr. '46, is in business as a consulting structural engineer, and has moved his office to San Marino. His family consists of wife, Margaret, daughters Ann (12), Christine (6), and son David (21 months).

Charles S. Milliken, M.S. '39, is an aircraft design engineer "A" at Lockheed Aircraft Corporation in Burbank. He's assistant to the electrical staff engineer.

Robert M. Dreyer, M.S., Ph.D. '39, Chairman of the University of Kansas department of geology, has been elected a fellow of the Mineralogical Society of America. He now becomes one of only twenty persons living between the Mississippi and California who are fellows of the Society. He is the only geologist in the U.S. who is both a fellow of the Mineralogical Society and a member of the Society of Exploration Geophysicists.

Martin Summerfield, Ph.D. '41, in addition to being editor of the Princeton Aeronautical Series, has taken on the job of editor-in-chief of the *Journal of the American Rocket Society* in New York City.

Edward T. Price, Jr. has been Assistant Professor of geography, since last September, at Los Angeles State College. Prior to this, Ed was a teacher at the University of Cincinnati. He has five children—three boys and twin girls, three months old.

1938

L. Bruce Kelly is still head of the Morris Dam Propulsion Laboratory for the Navy. He has a son 7 and a daughter 2½.

1940

Mark M. Mills, Ph.D. '48, and his family—which includes Polly, Mark John (6) and Ann (3)—now live in Princeton, New Jersey, where Mark is employed as technical director on Project Squid, a co-operative program of combustion research administered by Princeton University.

1941

William J. Wagner is still with the Shell Oil Company, but has moved from Bakersfield to Long Beach. The Wagners have two daughters—Lietta, 4½, and Avalee, 2½.

1943

Paul R. Saunders was promoted to Associate Professor of Pharmacology and Toxicology at the University of Southern California School of Medicine in September.

Herbert A. Lassen, M.S. '47, Ph.D. '51, is a research engineer at the Hughes Aircraft Company, in the guided missiles division. He married Joanne McClure in March 1950. Their daughter, Christine Ann, was born last May.

1944

Max L. Panzer, M.S. '45, Ph.D. '48, and his wife, Kate, are spending the winter in Europe. They plan to return to Berkeley late this spring.

R. B. Pearce, M.S., is the acting leader of the experimental aerodynamics group of North American Aviation's aerophysics laboratory. He was formerly supervisor of the internal aerodynamics unit there.

Ko Sameshima is now Captain Kō Sameshima, U. S. Army, and is serving in Korea.

1945

Albert S. Fulton is still a bachelor and still working at Hughes Aircraft, but has been transferred from the missile to the radar labs to operate a new REAC installation there.

Adrian C. Anderson was married on November 11 to an Oxy girl. He graduated last June from the Harvard Graduate Business School with an M.B.A., and is now working with Bechtel Construction and Engineering at the new $80,000,000 Pacific Gas and Electric Power Plant in northern California.

John L. Stern has been appointed an instructor on the faculty at U.C.L.A., where he teaches real estate practices in the evening. He has been teaching real estate principles and practices at U.S.C. for the past two years. On top of this, John has a full-time job as sales manager at the Walter H. Leimert Company, where he manages the main office on Crenshaw Blvd. and a second office on Rodeo Road. The Sterns bought a home in August. Their daughter, Debbie, is now 22 months old.

1946

Norman A. Gottlieb is working in the Bureau of Engineering in Los Angeles and was recently promoted to Civil Engineering Associate. The Gottliebs had an addition to their family on October 20 — a girl, Denise Lynn. Their son, Steve, is 21 months old.

Bert W. Downs, Jr. is now Lt.(jg) stationed in the Radiological Laboratory of the San Francisco Naval Ship Yard. He re-enlisted in the Navy in September 1950, and has been stationed in San Francisco since that time.

Louis K. Jensen is now working on his Ph.D. in experimental nuclear physics at U.C.L.A. He and his wife and two boys (2½ years and 2 months) live in U.C.L.A.'s Vets Housing Project.

Rev. James O'Reilly, M.S., Ph.D. '50, is instructor in mathematics, physics and theology at Mt. St. Mary's College in Brentwood Heights, Calif. He's been at the school since 1949.

Morris Lebovits, M.S., reports that he's still with Douglas Aircraft in Santa Monica as an aerodynamicist in the Stability & Control Group. He's been with Douglas five years. Morris is also Commanding Officer of a Naval Reserve Volunteer Bureau of Ships Unit in Santa Monica. He's married and has a three-year-old son.

John P. Calligeros is now on his third tour of duty with the Arabian-American Oil Company in Dhahran, Saudi Arabia. He recently attained the status of Senior Petroleum Engineer in the Abqaiq District. John and his wife, Jae, have just returned to Dhahran from a four-month vacation in Greece, Spain, France, Austria and Italy. They also spent some time in the United States, where John attended the Carter Reservoir Engineering School in Tulsa, Oklahoma.

1947

John P. Terry, since last September, has been employed as a lamp engineer by Tung-Sol Electric Inc. in Newark, New Jersey.

Stanley Mendes has been working as a structural designer for Donald F. Shogart '22 for the last five years. He is also a member of the Structural Engineers Association of southern California and is a licensed civil engineer in California. In 1948 he married Pauline Joan Burgess, and they now have a daughter 6 months old. The Mendes are living in Whittier, Calif.

Patrick Quinlan, M.S., Ph.D., has a new home, located on Model Farms Road in Cork, Ireland. Pat and his wife, members of the Inter-Nations Association when he was at Caltech, have named the new place Altadena to remind them of the happy times they had and good friends they made here. Pat's teaching at the University of Cork.

Henry C. Keck still heads his own industrial design firm. He reports that business is good. Henry is also the author of two articles which appeared in *Motor Trend*, "A Car Interior Meant for Safety" in November, 1950, and "The Helicar" in August, 1951.

David O. Caldwell spent the summer at Los Alamos doing physics research and is now continuing to work for his Ph.D. at U.C.L.A. as an AEC Fellow. He hopes to get his degree in June, when his wife receives her M.A. in math.

1948

John C. Bear expects to transfer from the Consolidated Vultee Aircraft Corporation in Carlsbad, California, to Convair's guided missile plant in Pomona sometime this month.

Don Lovelace has a son, Jeffrey Brian, and is working for the Bill Jack Company in Solano Beach.

Robert Krueger has a son, Clarence Frederick, who arrived on October 8, 1951.

David S. Stoller is an aerodynamicist in the engineering department of North American Aviation in Inglewood.

Thomas Lang has been working at the Naval Ordnance Test Station in Pasadena since September, 1951. The work involves the preliminary design and feasibility study of underwater missiles.

1949

Richard Schoen is a teaching associate at U.S.C. He married Alice Liberman, sister of David Liberman '49, last March.

John C. Marshall, M.S. '51, is at present working in the Propulsion Wind Tunnel facility of ARO, Inc., operators of the Arnold Engineering Development Center near Tullahoma, Tennessee. He and his wife (nee Sharon McFadden, formerly of the Caltech mail office) spent five months in St. Louis at the ARO, Inc. office there, and were transferred to Tennessee last December. They are expecting their first child in April.

Edward Levonian has spent the last couple of years combing India, Tibet, Pakistan, and the Middle East for scenes from which to make educational films. He is now working on a feature film about India.

C. J. Savant, Jr., M.S. '50, has a new baby boy, Paul, and a new home in La Crescenta. He is working part time at JPL, and part time on a Ph.D. at Caltech.

Richard Pollak has completed the work for a Master's Degree in aeronautical engineering at the University of Michigan. He has been working at the University's Willow Run Research Center for the last ten months on several guided missile projects.

J. A. Dobrowolski is still working for the California Division of Highways as Assistant Highway Engineer in charge of design of a portion of the L. A. River Freeway. He has one daughter, 10 months old.

Hugh Carter is employed by the Bechtel Corporation, forecasting costs on engineering and construction projects.

Frederick Flam was admitted to the California Bar on January 9, 1952, and is now an attorney at law associated with his father in the practice of patent law. After leaving Caltech, Fred studied law for three years at U.S.C. where he received his LLB degree.

Claude A. Lane recently joined the Hughes Aircraft Research and Development Department, working in the advanced electronic techniques section. He'll soon own his own home in Sunkist Park, Culver City.

1950

William T. Staats, Jr. has left his job at Preco Inc. to take a junior designer's job with the Peerless Pump Division of the Food Machinery Corporation in Los Angeles.

Floyd B. Humphrey found that one cold winter in Minnesota was enough, so he's back in California taking graduate work at Caltech.

ALUMNI CALENDAR

April 12	Seminar Day
June 4	Annual Meeting
Date to come	Family Day

PERSONALS . . . CONTINUED

James L. Kohl and Rella Ann Pyle were married on January 27 in Arcadia. They are living in Monrovia.

Marco A. Romero has been in the Army since last June, after twelve months with the producing department of Texaco on the Texas Gulf Coast. After finishing at the infantry school at Fort Benning, Marco hoped to visit his home in San Juan, Puerto Rico — for the first time in five years. By Christmas he expected to be in Korea. Marco is the proud father of a son, Edgar Charles Romero, born last Easter.

William H. McLellan is still working for Kelman Electric & Manufacturing Company on oil circuit breakers. He is buying a new home in Pasadena.

1951

Bob Crichton has returned from Mexico and is living in Wallingford, Pennsylvania.

Earl C. Hefner is working for his Master's Degree in civil engineering at Caltech. He's a Hicks Memorial Fellow.

Richard G. Merritt says he can't truthfully say he's gone far in the seven months he's been out of college — unless you count driving 5000 miles to Minneapolis to marry Joan M. Kelley (Vassar '50, Yale M.S.' 51) and 3000 miles to Seattle and back this Christmas to visit relatives. Joan is Dr. Albert Tyler's research assistant in the Biology Division at Caltech, and Dick is learning about rockets and missiles while working as a civil engineer for the Naval Ordnance Test Station in Pasadena.

Jerome E. Jacobs, who is an electronic engineer at Hughes Aircraft, will soon become a home owner in Sunkist Park (formerly Asthma Gulch), Culver City.

William F. Sheehan, Ph.D., has joined the staff of Shell Development Company as a research chemist.

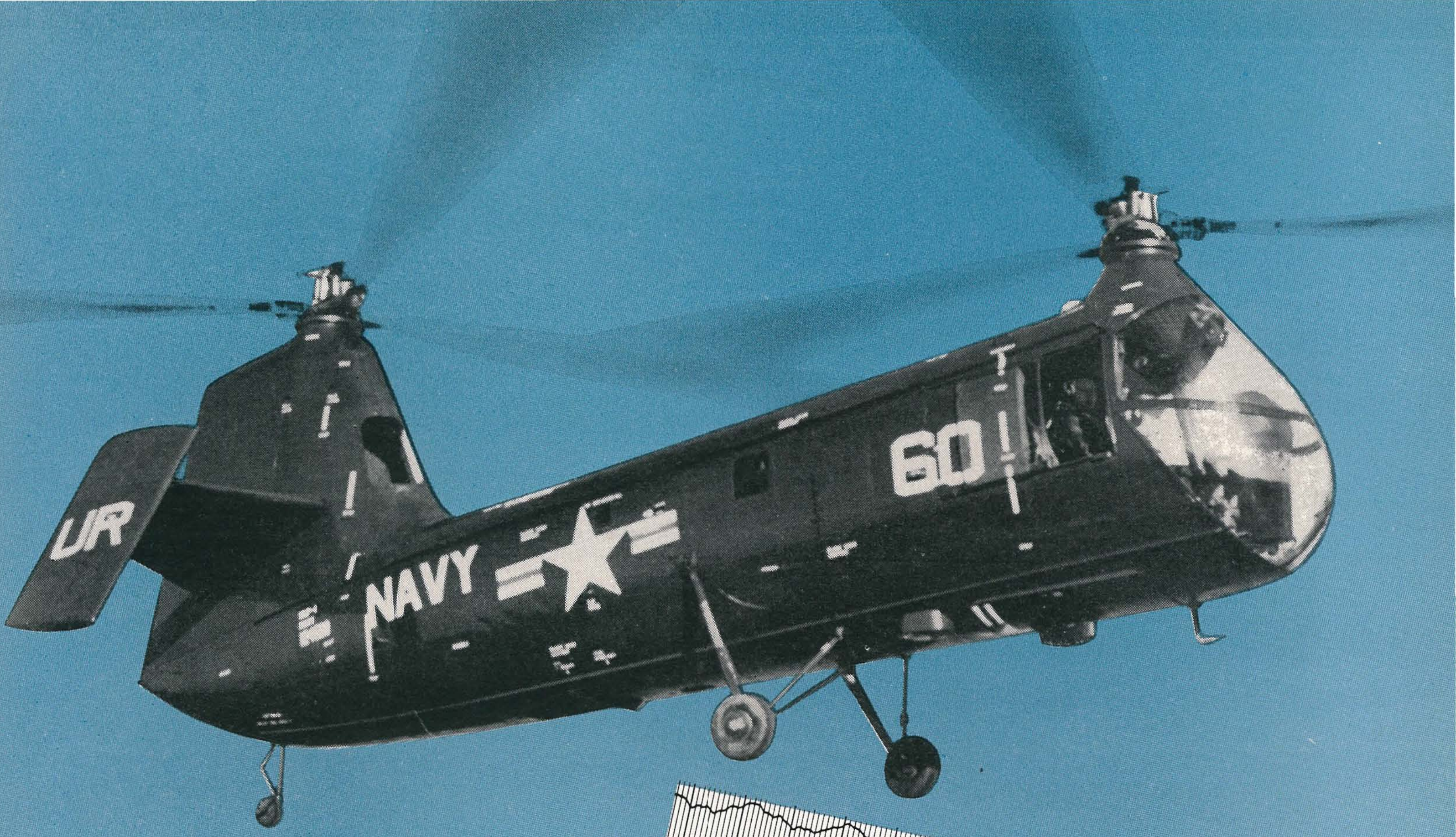
John M. Bozajian is a mechanical engineer in the guided missile laboratories of the Hughes Aircraft Company in Culver City. His work is mainly in heat transfer, and aerodynamic heating in particular.

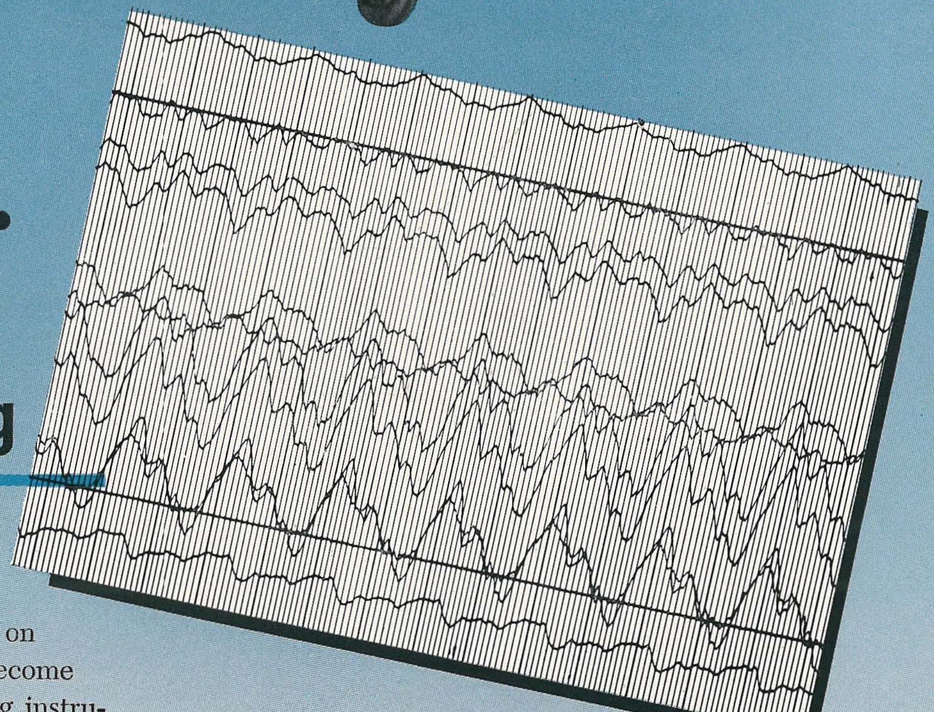
Dean Daily is working for his M.B.A. at Stanford Graduate School of Business. He is to be married on June 21.

Kenneth R. Berg and Lillian Louise Leech have announced that they'll be married this summer. Louise is attending the University of California at Davis and Kenneth is now working in the structures department at Lockheed Aircraft Corporation.

W. F. Jaskowsky, M.S., has been working as a development engineer with General Controls, in Glendale, since last September. He's living in Pasadena, and has been elected chairman of the Inter-Nations Association of Caltech.

John H. Walter is attending the University of Michigan this year, working for his M.S. in mathematics.





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