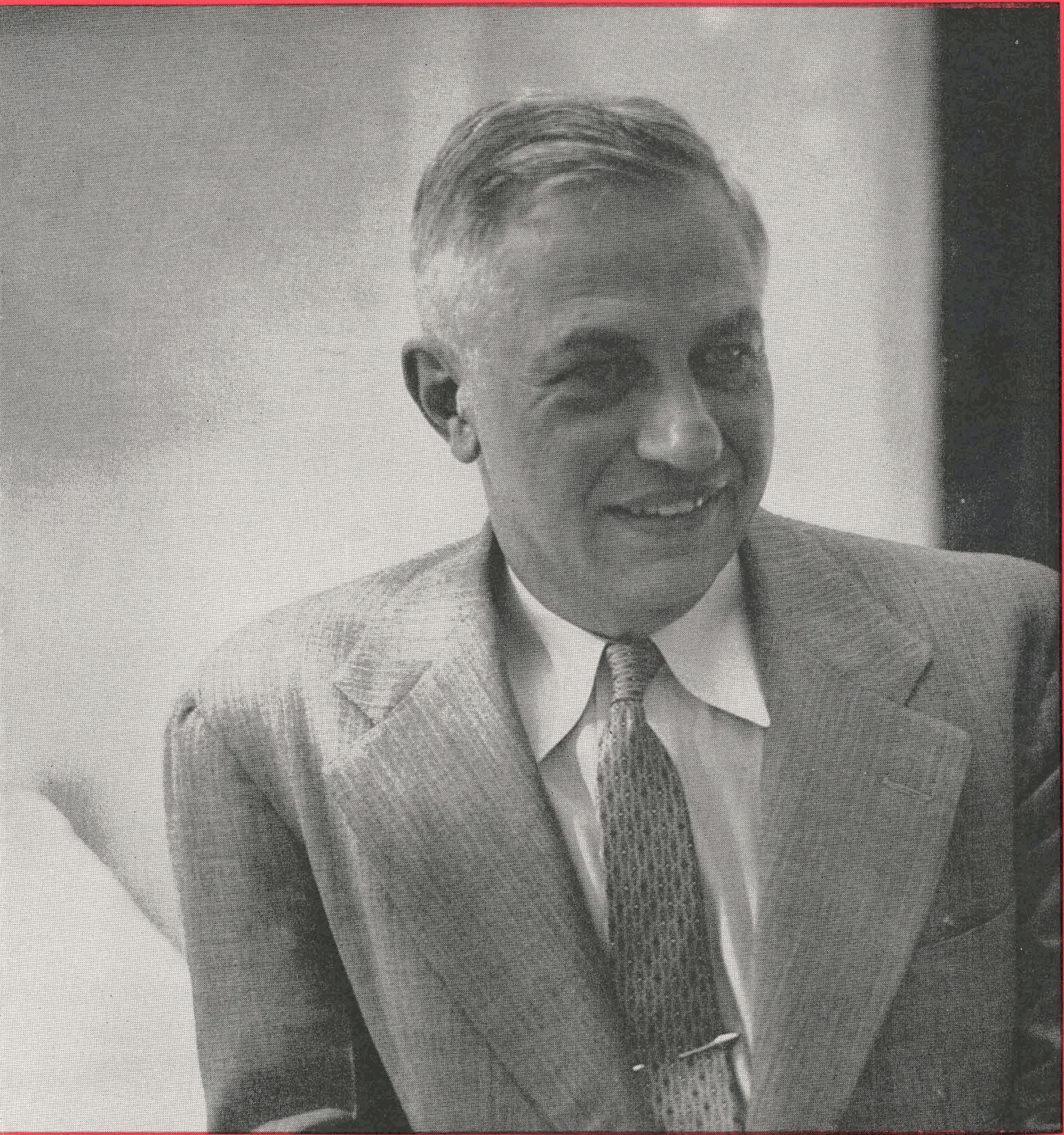
# ENGINEERING AND SCIENCE

MAY/1954



*Investing in research . . . page 7*

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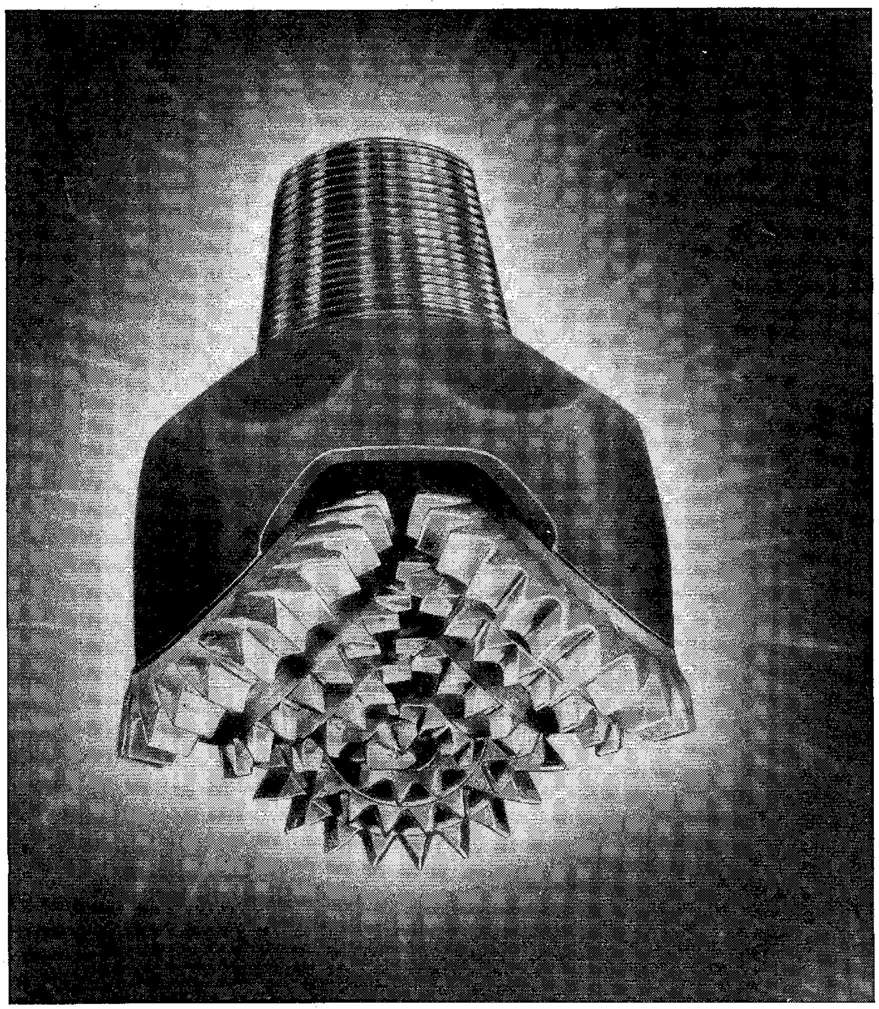

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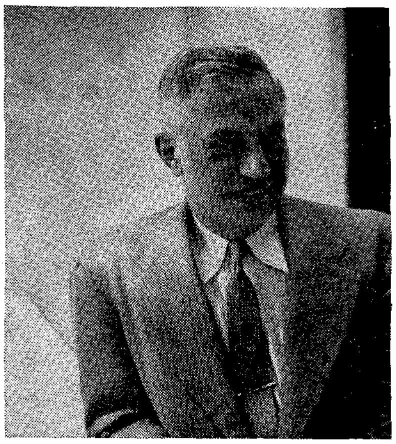
## IN THIS ISSUE



**On the cover** this month is a portrait of President L. A. DuBridge, taken by photographer Florence Homolka. On page 7 of this issue you'll find a recent speech of Dr. DuBridge's —"Investing in Research"—which he delivered at the 63rd anniversary convention of the California Bankers Association in Pasadena this month. It's a plea for the impractical guy—the dreamer—and a reminder to practical men that it is not always practical to be practical.

**Dr. Alfred M. Stern,** author of the article, "Why De We Laugh and Cry?" on page 16 of this issue, is Associate Professor of Languages and Philosophy at Caltech. His article has been adapted from his book, *Philosophie du Rire et des Pleurs*, published in Paris—and in a Spanish translation, in Buenos Aires.

Dr. Stern, who has been at Caltech since 1947, was awarded his doctor's degree, with honors, at the University of Vienna in 1923. He holds the Academic Palms and the title, Officer of the Academy of France.

**The synchrotron** sits for its portrait on page 14—and on page 13 of this issue are some striking pictures of the supernova, or stellar explosion, discovered by a Caltech researcher in astrophysics last month.

**PICTURE CREDITS**

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MAY, 1954 VOLUME XVII NUMBER 8
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## CONTENTS



STAFF

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*Staff Photographers*....Byron Johnson, Jr. '56
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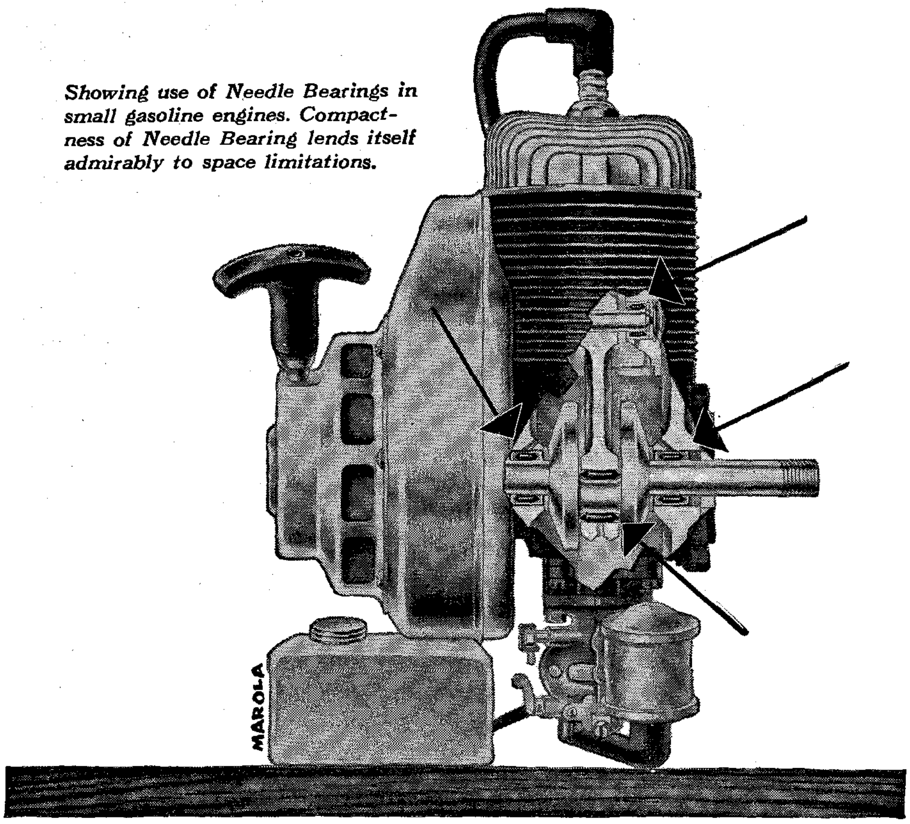
# *Torrington Needle Bearings save weight and space in many designs*

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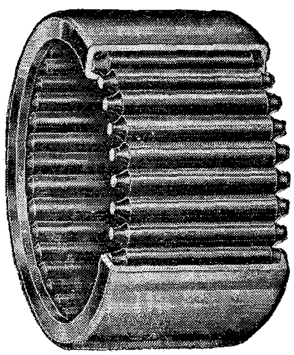

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# INVESTING IN RESEARCH

**New ideas in the field of science deserve encouragement. Even though they may have no immediate usefulness, they may turn out to have a profound effect on tomorrow's world.**

by L. A. DuBRIDGE

SOME DAY, I HOPE, when a proper history of civilization is written, the date 1769 will be described as one of the most significant moments in human history. It was in 1769 that James Watt invented the steam engine. Never before that moment had man had any source of energy to help him with his work other than his own muscles, the muscles of his horse or ox and, for those few who lived near a tumbling stream, the energy of falling water. Up until 1769, practically all of the mechanical work of the world had been done at the expense of human and animal energy—the human energy being largely that supplied involuntarily by slaves.

Men had, of course, learned to use fire—to warm themselves by burning wood and, later, by burning black rocks which the English called "coals"—but they had not learned how to put heat to *work.* That discovery did more to change the world than any single previous event.

Curiously enough, it was at a coal mine that James Watt put his new invention to work. Most British coal mines in those days were usually flooded. It took back-breaking work by men or horses to keep them pumped dry. James Watt conceived the idea of using some of the coal to generate steam to help in the work of running the pumps. The idea was successful—except that the engine had such a colossal appetite for fuel that almost the entire output of the coal mine was consumed in running the pumps. But ways were soon found to make the engine more efficient. And in a few years steam engines were pushing ships across the Atlantic, pulling strings of cars on rails across the countryside at unheard-of speeds of 15 or 25 miles an hour, and running all sorts of machines in many kinds of factories. It was not wholly a coincidence that less than 100 years later a great war was fought in America which wiped out human slavery from the Western World. Man's *new* "black slaves" were lumps of coal.

A number of years after James Watt's invention, a man named Michael Faraday was experimenting with some queer-looking gadgets and with pieces of iron and coils of wire. As a result of his work, Watt's steam engines were soon running *new* devices called electric generators—and the Age of Power had really begun. The symbol of the new age was also a salute to the age that had passed—the unit of the rate of energy consumption was called the "horsepower".

In the past 185 years the reciprocating steam engine has been followed by other forms of heat engines—the internal combustion engine, the turbine and the jet en-

*"Investing in Research" was delivered as a speech before the California Bankers Association, meeting at the Huntington Hotel in Pasadena, May 1954*

gine. The electric generator was followed by a whole complex of devices for transmitting and transforming energy. And today men produce many, many times as much wealth per day as in olden times—and yet few men indeed have to do real back-breaking work.

Now I realize that all of this is an old, old story to you. Why do I tell it again?

I tell it because, like many other old stories, it is so often forgotten. We forget so easily how enormously civilization has changed in the past 200 years—more than in the previous 4000 years of human history. The late Dr. R. A. Millikan, who died last December at the age of 85, frequently remarked that he belonged to the first generation of men who had ever been able to say that physical conditions of living were substantially different for their children from what they had been for them. The world before 1850 did not change much from one generation to the next. Our world hardly stays even recognizable for ten years at a stretch!

## A changing world

Why? Because political institutions have changed? No! They haven't changed much. If they have changed, it has been a result and not a cause of other changes.

Have men changed? As far as either mental or moral capacities are concerned, there appear to have been no changes in men for the past 10,000 years—possibly more.

Has the earth itself changed? Is it warmer? Colder? Wetter? Drier? There have been changes in the past 5000 years in certain areas—but nothing very spectacular in the last 200.

No. The cause of all the change is simply that man, after thousands of years of cumulated experience, finally developed a new way of *thinking!*

That sounds like a surprising thing to say—but I believe it is true. Note that I did not say that men suddenly became more *intelligent*. No modern man has ever exceeded Aristotle or Euclid or many other ancient giants in intelligence or in the brilliance and originality of the thought processes.

## Observation, deduction, thinking

But two men—named Galileo and Newton—invented a new *process* of thinking. This consisted, first, of observing nature, and then of deducing the regularities in the way nature behaved. Now men had observed nature before. And they had speculated before on what nature was like. But the idea had never fully dawned that nature behaved in a regular way according to fixed principles or "laws", and that these laws could be deduced by careful, systematic observation and analysis. Furthermore, once this deduction had been made, men could then *predict* the behavior of nature under similar conditions.

This process of observing, deducing, predicting, followed by new observation to test the predictions and correct the deductions, was a new thing in the world in the early 1700's. This new technique enabled men, for the first time, really to understand things—the falling stone, the moving planets, the whistling wind, the running water, the spinning wheel, the tossing ship, the hiss of steam.

And so—at first slowly, then faster and faster—men used this new technique of learning, of understanding, of thinking, to *do* new things. They could now design new devices and predict their behavior. The new knowledge and the new "laws" enabled men to predict what would happen—and what could *not* happen. As nature became understandable, her bounties became usable. Man was now the master of nature—not her slave.

## Science—a new thought process

This new way of thinking—of learning, of understanding—is called science, from the Latin word meaning "to know". And this new process of using the knowledge of science to produce new things is called technology. It is science and technology joined together which have changed the face of the modern world. Science and technology—new ways of thinking!

It is so easy in these days to forget the importance of the human mind—of thinking. We send children to school to memorize letters and words, to learn tables of numbers, names and dates, how to move their pencils to write. All of these things are fine and necessary. But do we—about the sixth grade, say—ask if the child is learning to think? Or do we—if his bothersome questions suggest that he really is thinking—berate the teacher for putting strange ideas in his head? A famous *New Yorker* cartoon pictures a mother sending her daughter off to college with the admonition, "Now I hope you don't come home from Vassar with any *ideas*." Most parents actually hope the same thing. How they hate to see their offspring thinking—especially if he or she thinks up something they don't agree with!

And we don't restrict this aversion to thinking to our children. We admire the adults, too, who are "doers", not the ones who are thinkers—the great football player, the man who finds oil, builds a factory, flies an airplane. Fine! Sometimes these achievements require thinking, too. But it is the physical achievement, not the thinking, that we praise and reward.

## Congress looks at science

Four years ago the Congress of the United States was debating a bill which had been before it intermittently for five years. No one was much against it. But only a handful seemed to be really for it. It did finally pass, and later the munificent sum of $250,000 was appropriated to implement it.

Was this a bill to build a monument to a dear old Kentucky Colonel? To widen the creek that ran through a Congressman's ranch? To air-condition the Senate office building? Oh, no! They would have passed easily.

This was a bill to create a National Science Foundation and to enunciate for the first time that the Government was interested in the progress of science and would even spend a little money to advance the kind of thinking that had revolutionized the world—and had, in the process, handed untold billions of dollars in wealth to the American people. Congress would not invest too much money, of course! Not as much as it would cost to build a new battleship. Not even a new destroyer. What about a couple of tanks? That was about right for the first year. For the second year, after a long argument, Congress appropriated about the amount that would have built a fighter aircraft. Four years later, today, there is a desperate hope that next year, at last, the amount will be brought up—to 100 million? Heavens, NO! 50? No! 20? Still dreaming! Actually, the budget request is for 13 million dollars. Thirteen million dollars to lay the base for the future! Thirteen million dollars—not enough to build a decent shoe factory!

## Science and survival

Now it is not my contention that the progress of science will be halted if Congress fails to appropriate more money to the National Science Foundation. Science will find ways of moving ahead (more slowly, perhaps), no matter what Congress does. But I think it is disgraceful that only a small handful of Congressmen realize that it makes any difference what happens to basic science in this country (and I would guess that Congressmen are good representatives of the average citizen on this point). The issue before Congress is thus *not* whether it shall insure the *survival* of science, but whether or not it is to the selfish interest of the government and the country to *accelerate its progress* beyond what non-government funds can support. And this question refers not to whether we accelerate progress in the development of new weapons and products, but in the discovery of new *knowledge.*

## Inventing before understanding

To illustrate this point, let us take some examples.

The invention of the steam engine was actually a very unusual type of event in the history of technology. Here an invention was made and put to use before the principles underlying its operation were understood. The science of thermodynamics—the interconversion of heat and work—was developed after the steam engine had come into use—not before. It was indeed the steam engine which stimulated research in this field. There have, of course, been a few other examples where invention preceded understanding, in cases where simple and well-known things like wheels and levers and hissing steam were involved.

Nevertheless, the invention of the steam engine did come after, and not before, the development of the scientific method by Galileo and Newton. It is since Newton that man's understanding of nature has grown so rapidly and uncovered so many wholly unexpected phenomena. Soon it became the standard pattern for new knowledge to lead to invention rather than vice versa. It is still true that every invention which proves useful stimulates further scientific studies which lead to improvements and to more new inventions.

## Science leads to invention

The development of the technology of electricity is a perfect example of this flow from science into invention. The simple phenomena associated with static electricity —such as sparks from rubbing cat's fur—were known for 2000 years before systematic investigations were undertaken. Then came Gilbert, Franklin, Coulomb, Volta, Ampere, Oersted and, finally, Faraday and Maxwell. Within a space of 100 years, the science of electricity was created, and the basis laid for the technology of the electrical age.

It is astonishing to reflect on the rather simple series of observations and discoveries which laid the basis for modern electrical technology. Coulomb measured the tiny attractive forces between two charged pith balls—and showed that electric forces were like gravitational forces. He thus laid the basis of electromechanics. Oersted observed the deflection of a magnet placed near a wire carrying a current and Ampere analyzed the data and discovered the law of force on which all modern electrical machinery is based. Faraday thrust a magnet into a coil of wire and noted a momentary electric current—the phenomenon underlying all electric generators.

These simple experiments were, of course, repeated, elaborated, refined and subjected to extensive analysis and further tests by scores of other workers before the science of electricity was a complete structure. And even today it is still being built.

## Intellectual "dreamers"

Now these men I have mentioned were not inventors—they did not themselves invent practical machines or electrical devices. These men were dreamers, "impractical guys". They were probably called "eggheads", or the equivalent, by the anti-intellectuals of those days. Their primary concern was the *understanding* of electrical phenomena.

It was another group of imaginative men who used this new knowledge as a basis on which to devise the motors, generators, lights, telephones, radios and other electrical gadgets that are so much a part of our modern daily lives. You know the names—Edison, Marconi, Bell, Westinghouse, and many others.

By the early part of the 20th century, it was evident that electricity was here to stay and that it was big business. Consequently, special laboratories were established by electrical companies to extend the bounds of knowledge about electricity, to improve electrical machinery and devices and to develop new uses for electricity. Thus began the industrial laboratory which proved in a big way the commercial value of applied scientific research.

Such applied research indeed has built our modern industrial civilization. There is hardly a single major industry in this country which is not now largely built on products or techniques which were mostly unknown a century ago. Many are new in the last quarter century.

But, while industrial laboratories have been turning out new products, the university laboratories have been equally busy uncovering new knowledge. In the 1890's, for example, while electrical machines were just beginning to come into practical use, the physicists in the universities in England, France and Germany were busy looking into still newer things. They found that electricity could be conducted through gases at low pressure and from a host of exciting experiments came the discovery of X-rays, of emission of electricity from the surfaces of hot bodies or surfaces illuminated by light. This electricity, it was found, consisted of charged particles—the electrons. Thus, the basis for the modern electronic industry was laid. The discoveries of the university laboratories again became the basis for new developments in industrial laboratories.

## Common sense can be a handicap

At about the same time, while investigating the recently discovered X-ray, the French physicist, Becquerel, discovered radioactivity. No one knew what that was going to lead to. Indeed, physicists struggled with their attempts to understand radioactivity—and the new science of nuclear physics which it led to—for 40 years before anything of practical value emerged. Here was a really new and puzzling area of science—what goes on in the unimaginably small nucleus of the atom. A whole new set of techniques had to be developed and a whole new way of thinking about things. In this subatomic world our old "common sense" ideas no longer hold. In fact, common sense is a distinct handicap in doing research in this field. For common sense, after all, is only the accumulated and systematized past experience of human beings, leading to a sort of innate feeling that we all have about how things *ought* to behave. Common sense tells us that water, left to itself, flows down hill, not up—which is true. It used to lead people to the belief that the sun and planets rotate about the earth—which is *not* true. It tells us that heavier things fall faster than light ones—which is, in general, *not* true.

## The atom contradicts

*But human beings haven't had much experience inside* the atom. It turns out that things are different in there. Things that ought to be particles turn into waves, and vice versa. An atom which has been sitting around the earth quite peacefully for several billion years, suddenly blows up—for no determinable reason! Worse still—it apparently is not even sensible to ask what the "reason" was!

You can understand, perhaps, how the physicists of the 1920's and 1930's appeared to many people to have gone quite crazy. The industrialists, especially, were disgusted with the nuclear physicists—they seemed to have lost all contact with the "real world". They were no longer talking "common sense"—which was true. They were talking about things wholly new to human experience, things for which common sense—by its very nature—could not be any guide.

## Dreaming into reality

Today—with the excitement about the H-bomb ringing in our ears—there is no longer any argument about such studies being "useless". We may wish they had never been undertaken, because some of the consequences are so unpleasant. But we realize now that the dreamy *nuclear physicists of the 1920's and 1930's were doing* things which would have far more influence on man's future than the activities of all the businessmen, engineers and politicians put together. Again we see an example of the oft-repeated truth—that it is not the "real" world but the *dream* world of today which leads us to the "real" world of tomorrow.

## Accelerating discovery

Now it is so easy for the layman to appreciate how the discoveries of *past* years have led to the commonplace things of *today*. It is less easy to visualize that this process of discovery is still going on *today*. Still less that there are things we can do to affect the rate of discovery. Industry long ago proved that once a discovery is made, it is possible to accelerate the process of making practical applications. But the idea of accelerating discovery itself is new and its possibilities are not fully realized. How does one go about it? Only a few simple things are required:

1. Find the good and the promising scientists. (*This is quite easy.*)
2. Pay them enough so they can stay in science, rather than go into engineering and administration. (That is not so easy!)
3. Provide them with the facilities they need. (If our government spent one-twentieth as much for *science* as for weapon development, we would be fairly well off!)
4. Encourage the education of young scientists. (The Russians have twice as many young scientists in training as we do!)

*And yet, right now we are drafting into the Army* thousands of graduate students in science and engineering. Thousands of others, seeing what happens to their friends, enlist for an even longer period. These kids laugh in a rather hollow way at those of us who keep insisting that our country needs more scientists. If the need is so great, why has not the Selective Service System heard about it? Possibly you know the answer to that. I don't! It is another example of the failure of our people to understand that our future welfare and security depend so vitally on a few thousand people who are seeking new knowledge.

Now I have suggested that great new discoveries still lie ahead. I believe indeed that our mode of living will change as much in the next 50 years—assuming we survive them—as in the past 50.

### Research into the unknown

What are the discoveries that are going to be made? If I could answer that question, obviously the research would not have to be done—for we would already know the answers. That is one of the great difficulties in explaining the situation to many Congressmen. They say, in effect, "Tell us what discoveries you want made and how much it will cost to make them and how valuable they will be, and *then* we will decide whether to supply the money." And how helpless one feels in trying to explain that that is like asking one to provide a photograph of what an inhabitant of Mars would look like—if Mars had an inhabitant. It is *so hard* to describe the unknown! It is even hard to convince some people that there are things still unknown. It is hard to explain how one seeks the unknown. For example, how could anyone have proposed in 1938 to undertake a project to discover nuclear fission when the very idea of fission was not in existence? That discovery, like most others, came out of general research work, seeking not a particular end—but merely to learn more.

### Financing discovery

How, then, can one finance discovery? I have already outlined the steps—one must find good people, have faith in them and help them do what they want to do. To a Congressman that seems like a frivolous waste of taxpayers' money. But Congressmen and taxpayers must learn that it is the most important use they can make of a few million dollars a year.

Now, of course, scientists do not work completely in the dark. It isn't as though they had *no* idea what they were looking for. One explores the unknown by starting with what is known. We know a little about nuclear physics—and we understand only a little of what we know. It is obvious we should seek to learn more, to understand more. Every nuclear physicist can pose enough questions to keep himself busy answering for a lifetime.

As it happens, nuclear physics, having proved to have "practical value", is now receiving fairly adequate support.

But let us take low-temperature physics. Physicists can now attain in the laboratory temperatures as low as a few millionths of a degree above absolute zero. That ought to be close enough, you might say. But it isn't! Every tiny fraction of a degree reveals new information—and opens up endless questions of how matter behaves when *all* its thermal energy has been removed. Does it have other kinds of energy left? Are the molecules really "at rest" at absolute zero? Do all substances become perfect electrical conductors near the absolute zero as some do? Liquid helium, at very low temperatures, becomes a wholly new type of substance, never seen before. It is neither solid, liquid nor gas. It looks like a liquid, but spontaneously leaks out over the sides of any vessel in which it is put. The study of this curious stuff is causing basic revisions in our theories of matter.

Of what practical value will it be to learn about these things? I haven't the faintest idea—because I don't know what things will be discovered in finding the answers. I do know that understanding how matter behaves at low temperatures will certainly help understanding how it behaves at high temperatures. And it is *understanding things* that leads to inventing new uses for them.

### Discovery of new knowledge

Let us take another example. We know a little about the chemistry of living things—very little, in fact. I think I need not argue the value of knowing more in this field. You and I are just big (or little) chemical factories and chemical machines. If these machines never got out of order, we might not be so curious about their workings. But they *do* get out of order—and when they do, it usually *hurts!* So we have powerful incentives for learning more. A good deal of money is available to those working this field. The only difficulty is that too often a worker, before he gets the money for his research, must prove that the things he has not yet discovered will be of value in the cure of cancer, or polio or some other disease. This is bad. It is quite right for money to go into some research which has to do *directly* with the study of a disease. But more should go for supporting the discovery of new knowledge, for helping good men find answers to questions *they* think are important, even if the application to a disease is not evident. Some really new discovery may provide at one stroke the cure for a dozen diseases—as did penicillin. And the discoverer might not be working on a cure for any disease at all.

### Earthquake as a scientific tool

In some fields of science the areas of discovery and of practical value lie very close together. The problem of the nature and structure of the interior of the earth, for example, has always been a challenging mystery—a mystery still largely unsolved. We can drill an oil well down 16,000 feet into the earth's crust—and we have learned much from this and other methods of looking at the earth's skin. But 16,000 feet is only three miles—and it is about 4000 miles down to the earth's center. What lies below the reach of our drills? How can we begin to find out? The tool that is used is a surprising one—the earthquake. To the ordinary person an earthquake is something that shakes down houses and buildings and starts fires—something terrifying and wholly bad. To a geophysicist an earthquake is just a procession of waves in the earth, spreading out in all directions like the sound waves from a bursting bomb. These waves travel in the earth. Some go through the crust, some are reflected from deep-lying structures, some go clear through the center of the earth, being bent or reflected in complex ways during their journey. These seismic waves thus constitute subtle probes which yield up secrets of the earth's interior. Geophysicists even start small earthquakes of their own by exploding buried charges of TNT, to get information on rock formation, often useful in the search for oil. But it takes a really big natural earthquake to generate waves intense enough to go clear through and around the earth.

## The physicist and the earthquake

Hence it was that in 1952, when a severe quake shook Tehachapi, California, a swarm of geophysicists—mostly from Caltech—descended on the area to set up instruments to record all the aftershocks that they knew would come. Their enthusiasm for the job gave the local inhabitants the distressing feeling that these visitors were actually *glad* there had been a quake. In watching the gleeful pride with which they now exhibit the miles of records they have obtained of the thousands of small tremors that followed the main one, I am convinced they *were* glad the quakes occurred. More has been learned from that one series of quakes which has been going on now for nearly two years, than in all previous quakes put together. Modern instrumentation is revealing things never before suspected.

What is being learned? First, more about the structure of the earth—of its surface rocks and of its central core. Second, more is being learned about earthquakes themselves—the nature of the complex earth motions that occur. And this knowledge will better enable us to study the effects on structures, and thus to design buildings which will stand up and hold together under these motions. Finally, these wiggly lines on sheets of paper that constitute the records of earth motion give the scientist information about the strains in the earth's crust that *cause* earthquakes—thus giving hope that some day in the distant future in certain special locations it may be possible to predict whether an earthquake is likely soon to come.

## Discoveries from astronomy

To jump to another field; some men study the stars! Why on earth should anyone spend money on studying the stars? Curiously enough, men have been willing to spend money on astronomy for hundreds of years. Long before the nuclear physicists dared think about asking for a million dollars to build a cyclotron, astronomers were building or using giant telescopes costing many millions. Why? There have been practical results, of course. All of navigation and time-keeping are based on astronomy. Helium was first discovered in the sun—and in the sun was discovered the first thermonuclear reaction. The sun and all other stars are indeed just giant continuously operating H-bombs.

## Curiosity forces study

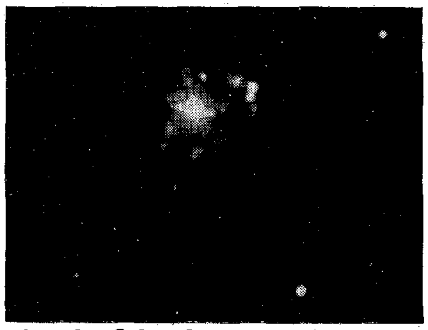
But I think we would encourage research in astronomy even if there had been no "practical" results. The stars in the heavens stand as a continual challenge to man's divine curiosity. Those stars—what are they? What do they mean? What is beyond them? What are they made of? What keeps them shining? How did the universe begin?

These questions, in my opinion, illustrate the most important of all reasons for studying science. Man's unquenchable curiosity *forces* him to study it. Some men are challenged by the mysteries of the stars, some by the mysteries of the atoms, others by the mysteries of living things, including ourselves. Pity the poor man who is challenged by none of these mysteries! He is the man who also can't understand why men try to climb Mt. Everest, or why they explore the South Pole or the bottom of the sea. Pity the man who does not feel—in a vicarious way at least—the challenge of the unknown. He does not know that the chief way in which men differ from the beasts is in their urge to explore, to know, to understand.

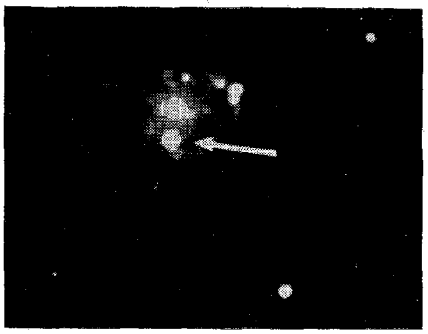
I realize that today I am talking to a group of "practical" men who do not waste time and money on useless things. You are men for whom the most derogatory of all epithets is "impractical." You have only contempt for the impractical dodos who clutter up the world—your business, your community, your government. You, as business men, avoid them like the plague. They lose money for you.

## A plea for the dreamer

And yet I have the nerve to come before you and plead for the impractical guy—the dreamer. And I do it on the paradoxical grounds that it is *not* always practical to *be practical;* indeed, being impractical is often eminently practical. Or, to abandon a mere play on words, what I am trying to say is that new ideas in the field of science, which may appear to be without *immediate* usefulness, may turn out to have a profound effect on tomorrow's world. We ought to go out of our way to encourage such new ideas. We should invest money in them. As we bring to practical use today the new ideas of yesterday, let us do what we can to creat those conditions which will nurture more new ideas which will come to fruition tomorrow, or possibly the day after. We shall not be able to foretell which ideas will be most valuable, or when. We must have faith that new understanding will be useful. And, in any case, we must believe knowledge is good for its own sake.



*48-inch Schmidt photo of spiral galaxy NGC 5668, taken in 1952.*



*48-inch photo taken this month shows stellar explosion.*

*200-inch photo of NGC 5668, taken the day after Wild made his discovery, gives clear view of supernova, or stellar explosion.*

# STELLAR EXPLOSION

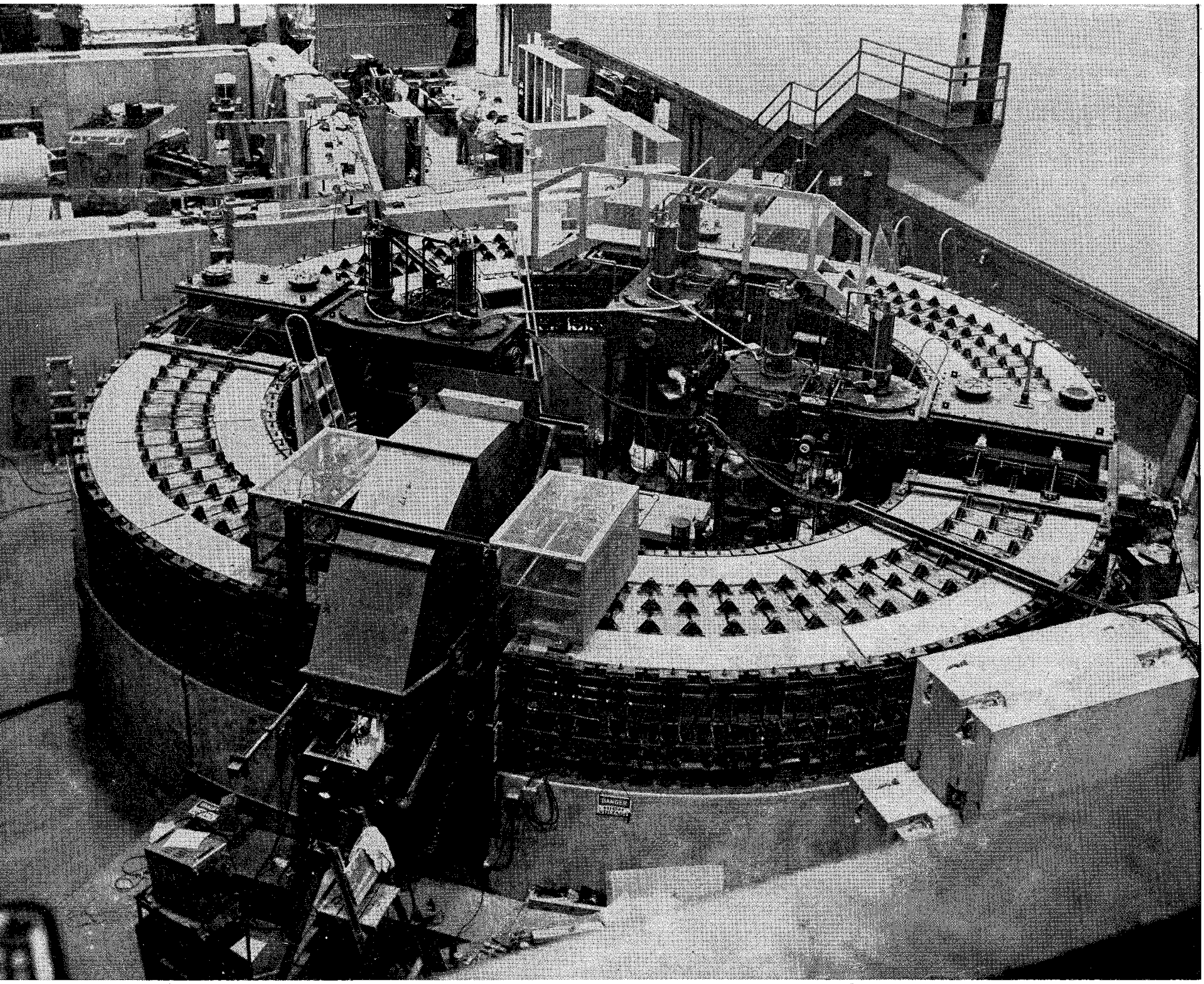
**Researcher in astrophysics discovers a supernova — a bright star burning 100 million times brighter than the sun**

A TITANIC STELLAR EXPLOSION that occurred eons before primitive man first noticed the stars has been discovered by a Caltech research assistant in astrophysics. Only now are its effects available for studies that add to our knowledge of the world we live in.

The explosion was first recorded photographically last month by Paul Wild, working with the 18-inch Schmidt telescope at the Palomar Observatory. It took place in the spiral galaxy known as NGC 5668, and produced what astronomers call a "supernova," an exceptionally bright star that Wild found in an area where none had been observed before.

A number of studies was launched immediately, because supernovae usually fade out not long after they burst forth. One of the studies was the 200-inch Hale telescope photograph shown above. Spectrographic studies by astronomer Milton L. Humason show that NGC 5668 apparently is hurtling away from us at a speed of roughly 1000 miles a second. It is now roughly 20 million light years away. It has, therefore, taken this long for the light to arrive to tell us that something had happened in NGC 5668—something that made a hitherto unseen star burn a hundred million times brighter than our sun.

This is not the most brilliant supernova known. Astronomers Fritz Zwicky and Josef J. Johnson observed several brighter ones during a systematic search from 1936 to 1941. However, more information may be derived from the "new" supernova than from previous ones by studying it with the 200-inch telescope.

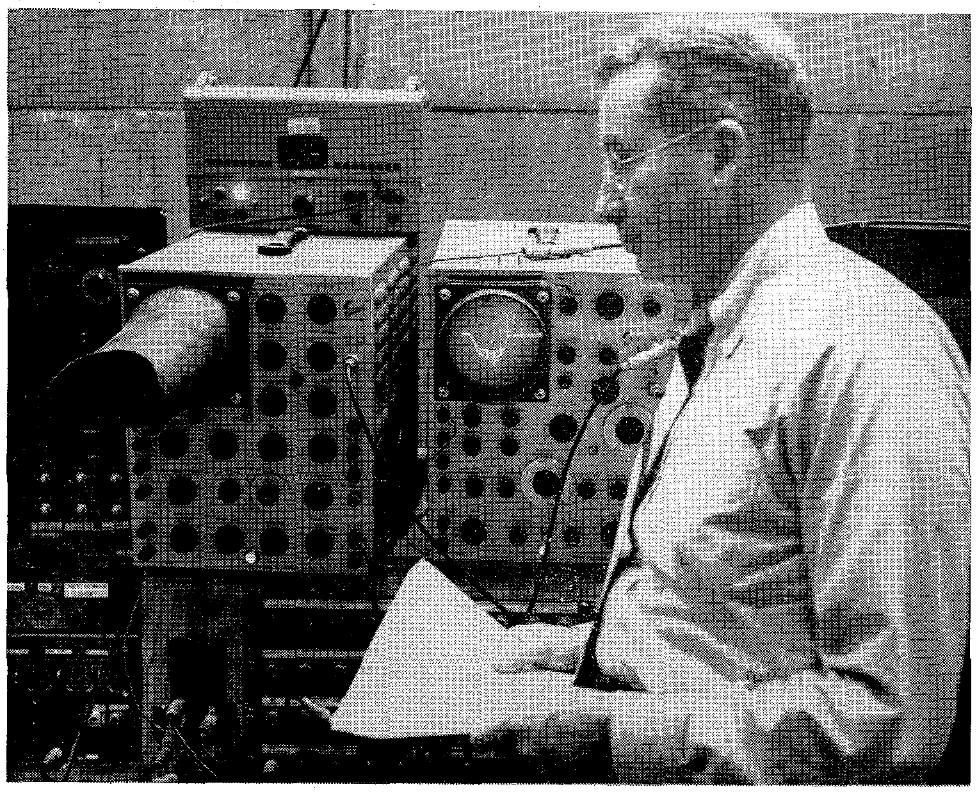


# THE SYNCHROTRON

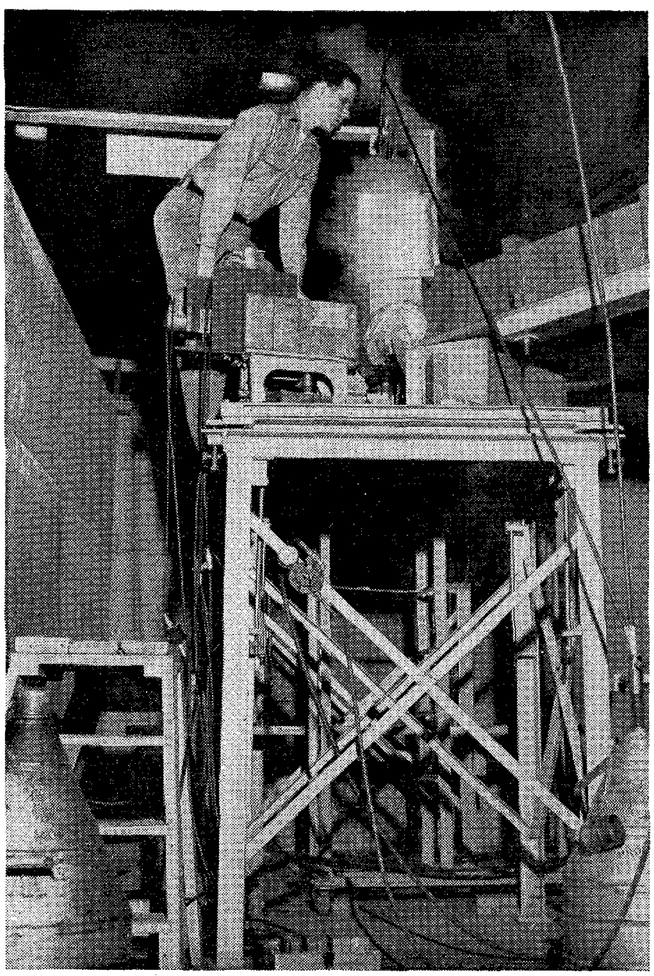
CURRENT WORK on the Caltech synchrotron will increase its power from 500,000,000 to over 1,000,000,000 electron volts to study the simplest atomic nuclei, those of hydrogen and deuterium or heavy hydrogen.

Electrons—negatively-charged particles of matter—are shot into the synchrotron by an electron gun in bursts of about 1000 billion particles at each pulse. Held in place by a powerful magnetic field, the electrons circle the "racetrack," while their energy is kicked to a higher level each time around, as they pass through a radio frequency cavity.

They enter the synchrotron at 94 percent of the speed of light, and at their peak reach a speed of only 60-millionths of one percent less than the speed of light. For research, this electron beam bombards a thin copper target to produce ultra-high energy X-rays. These, in turn, are used to bombard various other materials, particularly the two types of hydrogen.

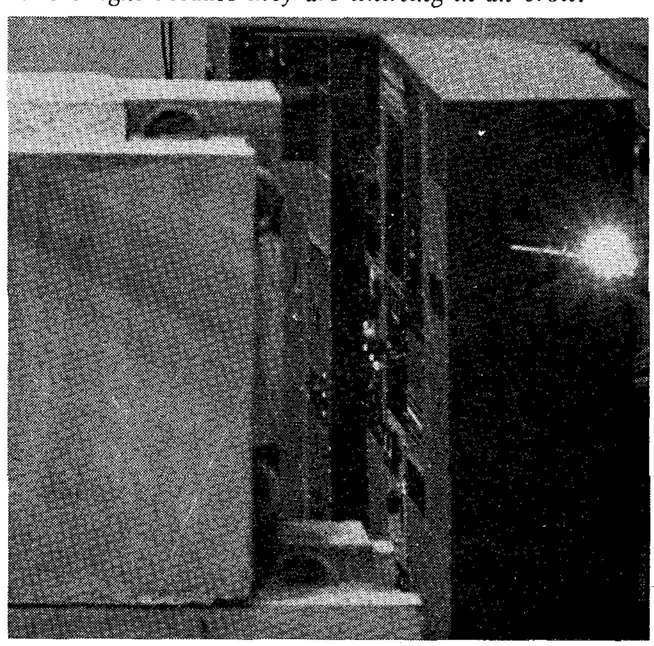


*Dr. Robert F. Bacher, chairman of Caltech's Physics Division and director of the synchrotron project, checks records of excitation curves of the synchrotron. The oscilloscope in the background shows the output of the ionization chamber in the half-billion-volt X-ray beam.*



*Graduate student David Oakley pours liquid nitrogen into a gas target in the X-ray beam, where it acts as a coolant.*

*Small mirror at side of synchrotron blinks each time* 500,000,000-*volt pulse of electrons rounds the "racetrack." Brilliant white flash occurs as electrons give off visible light because they are whirling in an orbit.*



# WHY DO WE LAUGH AND CRY?

**A philosopher interprets the meaning of laughter and tears**

by ALFRED M. STERN

IN TRYING TO ANSWER the question, "Why do we laugh and cry?" I do not want to inquire into the psychological motives of people's laughter and tears. The meaning of my question is: How can the psychological phenomena of laughing and crying be interpreted philosophically? How can we conceive rationally these two polar manifestations of our psychism, which are so typically human and, nevertheless, so deeply irrational?

In my theory, laughter is interpreted as a value judgment, an instinctive, negative value judgment concerning a degradation of values. This judgment is not expressed in words, but in the inarticulate sounds we call laughter.

Laughter, however, is not only our *reaction* towards a degradation of values. Sometimes it is also an *action* provoking a degradation of values or, at least, trying to provoke it. When we laugh at a person, or a thing done by a person, although no value degradation can be found in them, we try to degrade their value. And often we succeed.

There is a French saying, *le ridicule tue,* the ludicrous kills. Of course, it does not kill physically, but it may kill morally, axiologically;* it may kill values, and then laughter may have tragic consequences.

If we laugh at a serious person or his work, this person is offended. And he is right to be offended, for instinctively he recognizes in this laughter an attempt to degrade his value or that of his work in the eyes of other people.

The phenomenon of weeping is closely related to that of laughing. The basic difference between the two became obvious to me when I tried to interpret two souvenirs of my childhood. I remember a walk with my father and one of his colleagues, Mr. F., in an Austrian summer resort. I was about seven years old. A torrential rain had just ceased, and the ways were soaked and muddy. Suddenly, Mr. F. slipped and fell into a dirty puddle. He rose immediately, wet and full of mud, while my father roared with laughter.

I did not understand this laughter at the time, nor the fact that Mr. F. became very offended. Years later I learned that my father did not like Mr. F., who indeed, was not very worthy of affection.

Now, interpreting my father's laughter axiologically, I come to the following conclusion: Falling into a puddle and rising wet and covered with mud, the human personality, supposedly the source of all spiritual values, changes for a moment into a simple thing, into a physical object, subjected to gravity and other mechanical forces,

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* *Axiology* is the technical term, derived from the Greek, to designate the theory of values.

like all unintelligent passive objects of a nature exempt from values and hierarchies. By this change from an evaluating subject into a value-free object, the human person suffers a transitory degradation of his value, and the laughter he provokes by behaving like a dull lifeless thing is an instinctive negative value judgment, criticizing and chastising that degradation.

Perhaps my father would not have laughed if he had had some affection for and sympathy with Mr. F., for, as Emerson remarks, affection and sympathy may prevent us from noticing the ludicrous. Axiologically speaking, this means that some affection would have prevented my father from seeing in Mr. F., fallen in the puddle, only a passive object, subjected to value-free mechanical forces, degrading the value of what man is supposed to be: the center of emanation of spiritual values. If Mr. F. was offended, he recognized in my father's laughter an instinctive negative value judgment, prejudicial to his human dignity.

The philosophical significance of the phenomenon of crying was revealed to me by the analysis of another childhood souvenir. One day—I was about nine years old—my mother brought me to school. On the way we saw a man stumbling and falling on the paving stones. Some passers-by laughed, but immediately ceased laughing, because the man did not rise again. My mother asked me to wait a moment in a doorway, in order to spare me afflicting impressions, and went, with other persons, to help the unknown man. A few minutes later she returned, crying. The man had fractured his skull and was dead.

Only now do I understand, philosophically, the difference between these two events.

What had aroused my father's laughter had been a *degradation of values.* What had caused my mother's tears had been a *loss of values.* Even without knowing the man, my mother, instinctively, must have interpreted his death as a loss of values, for every human life represents an ensemble of values: moral values, intellectual values, esthetic values, religious and social values—in short, spiritual values. And death means a loss of those specific values united in a certain human person. Not only a loss of values, but also the fact that they are threatened or unattainable may provoke our tears.

In a general way, we may affirm:

We *laugh* at *degraded values,* or in order to degrade values, but we *weep* about *threatened, lost,* and *unattainable values.* If the laughter about the comic is the instinctive expression of a *negative* value judgment concerning a degradation of values, weeping is the instinctive expression of a *positive* value judgment on threat-

*Dr. Alfred M. Stern is Associate Professor of Languages and Philosophy at Caltech. His article is adapted from an Athenaeum lecture—which was, in turn, adapted from his book,* PHILOSOPHIE DU RIRE ET DES PLEURS, *published in Paris.*

ened, unattainable, and lost values. Weeping, thus, always refers to things positively appreciated.

We may say that the tears of fear and anxiety express positive value judgments on values considered as threatened, while the tears of nostalgia, affliction, and mourning express positive value judgments on lost values. The tears of frustration, anger, and rage express positive value judgments on unattainable values.

This situation seems to involve a paradoxical element, for although expressing *positive* value judgments, weeping is considered a *negative* vital value, and we don't like to weep. And although expressing *negative* value judgments, laughing is considered a *positive* vital value, and we like to laugh. As far as weeping is concerned, this paradox is easily solved. Although we express by our tears that we appreciate certain things in a positive way, it is evident that what we weep about is the menace, the unattainableness, or the loss of those positive values. The menace, the unattainableness, and the loss of positive values are evidently negative values. Therefore, weeping is considered a negative value, and we don't like to weep.

## The paradox of laughter

But how about laughter? We like to laugh and consider it a *positive* vital value, although it expresses a *negative* appreciation. This seems paradoxical. But we have to admit that we do not dislike uttering negative value judgments from time to time. He who expresses a negative value judgment—be it rationally or instinctively, as in laughter—criticizes a degradation of values, committed by somebody else—except in the cases where we laugh at ourselves, chastising ourselves for a degradation of values *we* have committed.

The word "to criticize" comes from the Greek *krités*, meaning judge. He who criticizes, uttering a negative value judgment—either in rational concepts and articulate words or in the irrational, inarticulate sounds we call laughter—considers himself the judge of the one he criticizes; and this gives him an agreeable feeling of superiority.

But this is only one of the reasons we like to laugh, and certainly not the most flattering for *homo sapiens*. I think there are other reasons, which seem to me more important. They are linked to the double character of laughter: laughter as a criticism of society with respect to the individual, on the one hand, and, on the other hand, as a criticism of the individual with respect to society. From this latter angle laughter would appear as a kind of self-liberation of the individual from the coercive influence which the social group exerts on him, by virtue of its imperious system of values.

Society laughs at human weaknesses expressed in individuals, for human weaknesses are degradations of human forces, which have a positive value and which society tries to preserve. Therefore, society chastises by its laughter those human weaknesses whose degradation the individual could avoid.

If our fellow men laugh when we commit a stupidity, this laughter is a mild punishment and a warning, by which society wishes to tell us: "Be careful, you just degraded *intellectual* values, which are the privilege of man. Watch yourself, be more attentive and industrious, and you will avoid such humiliating incidents."

We view here a pedagogical aspect of laughter—its corrective function, which serves to show its social usefulness.

Society also chastises by laughter any minor degradation of *moral* values committed by its members, such as roguery, cheating, boasting. But we would not laugh at any moral default of a more serious character, like unfaithfulness, hypocrisy, calumniation, or treason, because they no longer constitute *degradations* of moral values, but *losses* of moral values, which may provoke tears.

Most rarely and only with uneasiness do we laugh at degradations of *esthetic* values, as they appear in ugly persons. When laughing at an ugly person, that is, a person who, by his mere physical appearance, degrades certain esthetic and sometimes vital values, we have a bad conscience, because the person is not responsible for his ugliness. It escapes his will, it is his nature.

Thus, the criticism expressed in laughter would not exert its corrective function. When laughter, a social and axiological manifestation, clashes with nature, it is an empty blow. Nature is stronger. Being pedagogically and socially useless, laughter about the degradation of esthetic values as it appears in human ugliness is not sanctioned by society. It is even condemned and rejected as indecent. And this, too, can be explained axiologically. For in laughing at the expense of an ugly person, we risk hurting him morally and provoking a loss of his self-confidence.

In this case, our punishment of the *degradation* of *esthetic* values, as it appears in his ugliness, would provoke a *loss* of *moral* values, and tears may be the reaction of the victim. This would be especially true with respect to ugly girls or women, for in the hierarchy of values of the feminine sex the esthetic value of physical beauty occupies a higher place than in that of the male, since the personal destiny of a woman depends to a large extent on her physical appearance.

## "Indecent" laughter

But if, for these reasons, society condemns as "indecent" our laughter about human ugliness, it encourages our laughter at any degradation of esthetic values which results not from nature but from willful human activity. Society encourages us, for instance, when we chastise by our laughter those true or pretended degradations of esthetic values which it calls "degenerate art." It allows us also to laugh at the clown.

In order to understand the axiological relations between the individual and society we have to distinguish among individual, collective, and universal values. It has been contended that, since they are relations between objects and appreciating subjects, *all* values are individual. But this contention is shortsighted, for it overlooks the fact that only those values are individual which depend on the individual peculiarities of the appreciating subjects, while the values which are independent of the individual peculiarities of those who affirm them may be termed objective values.

Among the latter I distinguish between collective and universal values, defining as collective those values which depend upon the collective peculiarities of the group that upholds them—for instance, a class or a political party; and as universal those values which are independent both of the individual and the collective peculiarities of those who affirm them.

The majority of individuals, collective groups within society, and society as a whole tend to present their individual or collective values as universal values. This explains the state of axiological warfare which exists between the individual and the society, the individual and particular collective groups, the individual and the individual, and among the different collective groups within society. Laughter is one of the most powerful weapons in this axiological warfare. In order to protest against the claim of universality of a merely individual or collective value, the adversary has only to degrade, that is, to ridicule it.

## Society's system of values

The majority of individual and collective values are dictated by particular interests and tastes. But in society the different particular interests and tastes compensate one another, so that what comes up to the surface consists of only the most general appreciations. This is why the system of values of society implies most of the universal values, and especially those which are necessary for the conservation of society. Hence, society tries to preserve them and to protect them with special sanctions. The mildest of these sanctions is the laughter with which society punishes whoever degrades values belonging to the system of values that it is interested in preserving and protecting.

The ideal society would be that one whose system of values would include nothing but values of universal validity. However, any actual society is always more or less distant from that ideal. During periods of degeneracy, the number of collective values of a ruling party, or of the individual values of a dictator, exceeds that of the universal values in the axiological system of a given society. This society is not always an honest administrator of universal values.

The criticism of society is mostly directed against the collective values of certain particularistic groups within itself and against the individual values of certain original persons. Wishing to preserve its own system of values intact, wanting to increase its authority, and trying to impose it upon everybody, society uses laughter in order to degrade any competing system of values, that is the systems of collective values of certain particularistic groups or the systems of individual values of certain too individualistic persons.

In order to escape this punishment of laughter, which would isolate them socially, the particularistic groups and individuals may give up their specific value conceptions, too ostensibly different from those of the majority. By its laughter or even by the menace of this laughter society will then have exerted an *assimilatory* function.

This dangerous character of the laughter of society at the cost of individuals and particular groups explains the reaction of the individual and of the particular groups toward society, the revenge they take in laughing at society, in trying, by their laughter, to degrade the system of values of society by which they feel themselves oppressed.

This is the second basic aspect of laughter I have mentioned: that of a criticism of the individual toward society. From this angle laughter would appear as a kind of spiritual liberation of the individual from the coercive influence society exerts on him, by virtue of its imperious system of values. In laughing at certain values sustained by society, the individual tries to degrade them, and thus affirms his personal sovereignty towards society. The positive value we ascribe to this laughter would then be derived from the freedom of appreciation, reconquered by the individual from an axiologically oppressive society.

The specific weapon the individual forges in this warfare of laughter against society is the joke. There exist as many classes of jokes as classes of values. There are jokes degrading intellectual values, others degrading moral values, esthetic values, religious values, vital values, instrumental values, economic values, etc.

## The off-color joke

The number of anecdotes drawing their comic effects from a degradation of those moral values which characterize the erotic life is especially noticeable. On the one hand, we have the vigorous sexual passions; on the other hand, the rigorous restrictions of these passions by ethics, religion, social conventions, and penal prohibitions. The individual can not escape the social pressure exerted by these conventions and taboos. He can violate them only at the risk of social and sometimes even of penal sanctions. The individual takes his revenge in trying, by means of jokes and anecdotes, to degrade those moral values of erotic life which the social and moral conventions and legal prohibitions try to protect. The laughter resulting from those degradations is for the individual a kind of symbolic liberation from a social pressure from which he suffers.

When the individual ceases to suffer from the effect of those conventions and prohibitions, he is no longer so eager to degrade their value. Therefore, it is neither the old ladies nor the old gentlemen who tell us the most piquant stories.

There are many kinds of laughter which have nothing to do with the comic. Let me mention here only two of them: the laughter of joy, closely linked with tears of joy, and the smiles of modesty, politeness, etc. These kinds of laughter beyond the comic can be explained not by degradation, but by another phenomenon which I call devaluation. By devaluation I mean any quantitative diminution of a positive or negative value, which does not necessarily imply a qualitative degradation. In diminishing, for instance, the negative character of a negative value, I do not degrade it, because it does not suffer any deterioration of its quality. I simply devaluate it quantitatively.

## The smile of modesty

There is a great variety of smiles: the smile of modesty, of courtesy, of welcome, of encouragement, of pity, of irony, of embarrassment, and so on. I have tried to explain all of them by using the concept of devaluation.

Let me only take the example of the smile of modesty. If one pays a compliment to a pretty lady, to a great artist or scientist, these persons react, in general, with a smile. Is it a smile of joy? Rarely, unless the lady is in love with the man who pays her the compliment, and the artist or scientist considers the flatterer a true connoisseur. But in general the smile by which we respond to a compliment is a smile of modesty, expressing a social convention rather than a true feeling. I have tried to understand this phenomenon axiologically and found that whoever responds with a smile of modesty to the compliment of another person tries to devaluate his own value, to minimize it in the eyes of the partner or partners.

In general, the smile of modesty is not sincere, it is a social fiction, but it is an important one in human relations. Whoever refuses to respond with a smile of modesty to a compliment is immediately considered as arrogant. People say of him: "This man is very sure of his value."

And if it is a lady who accepts a compliment without a smile of modesty, she is immediately condemned, especially by the feminine witnesses of the scene. Refusing to devaluate by a smile—at least fictitiously—the esthetic value which was ascribed to her by the compliment, the lady certainly exposes herself to all kinds of criticism.

"Look at her!" the other ladies will say. "She takes this seriously; she really believes in her superiority!"

And the ladies who are less pretty than she will comment: "Besides, her legs are far from perfect!"

But in allowing a smile of modesty to glide over her lips, the lady makes "as if" she devaluated the esthetic value of her beauty, and thus she will be pardoned for possessing it.

I said earlier that we weep about threatened, lost, and unattainable values. But how about the tears we may shed in reading or attending the performance of a tragedy? Since the events presented in a tragedy are purely fictitious, the values involved in it do not seem to be really lost or threatened or unattainable.

Aristotle was right in insisting on the fictitious character of the events presented in the tragedy and of the *dramatis personae*. But in my opinion we have to realize that the *values* involved in the tragedy are not fictitious at all. The mode of existence of values is that of validity, and this is a domain beyond the distinction between the real and the fictitious. Values which proved their validity in the fictitious experiment of artistic imagination have at the same time proved their validity in life, for an ideal validity is, at the same time, a real one. From this springs the gravity of the fictitious experiences of the artistic play, for its axiological results are valid for life itself.

If the tragedy shows, in an imaginary realm, that certain values are threatened, unattainable, or lost, if it shows the precariousness of these values on an ideal plane, then their precariousness is also demonstrated on the plane of reality. Thus, the tears we may shed at a tragedy are justified, axiologically.

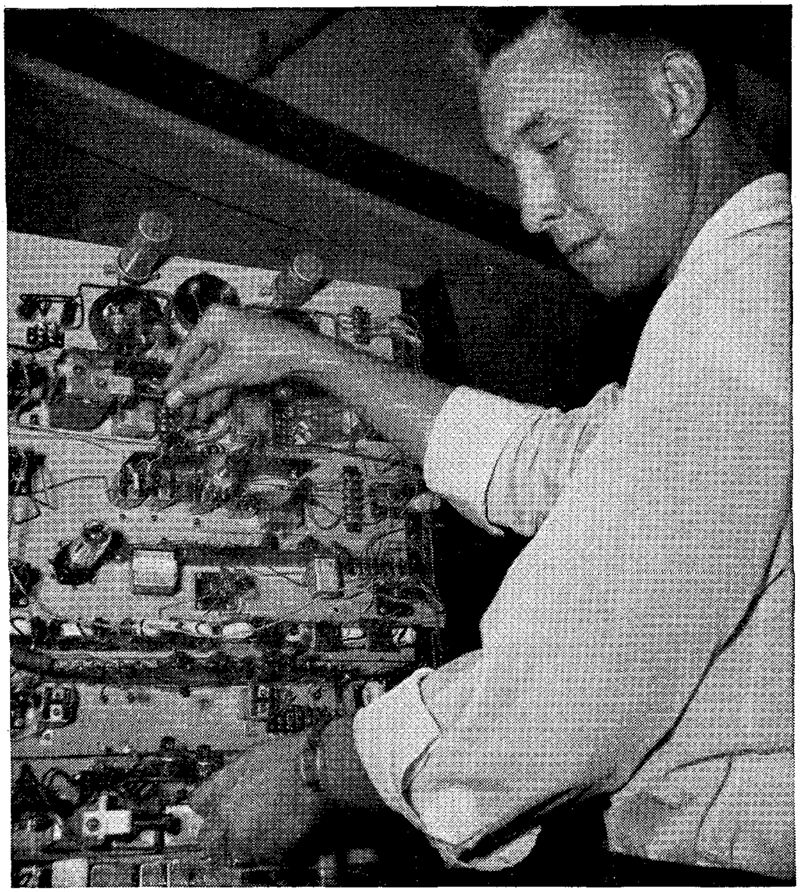
We may say with Kant, that man is a citizen of two worlds. Not of a metaphysical and an empirical world, as Kant affirmed, but of the world of values and the world of value-free physical, causal occurrences. I think that during his whole life man balances on the edge between these two worlds. He sacrifices a good deal of his energies to the effort to remain well equilibrated within the world of values, so that he may not fall into the axiological emptiness of the natural world of blind causes, toward which he is pulled by a kind of gravity, since, with a part of his being man belongs to this natural world of physical things and causes. This effort is justified, for the laughter he provokes by degrading human values sounds badly to the ears of the victim of such a fall into the axiological emptiness of brute nature.

## Living in two worlds

We are citizens of these two worlds also as far as the tragic is concerned: for the collisions between the spiritual world of values and the world of value-free natural occurrences are responsible for most of the losses of values which characterize our tragic existence and which make us cry. The causal world of natural occurrences is totally indifferent toward values; it destroys them, without taking into account their positive or negative character, their superiority or inferiority. In the clashes between the world of natural occurrences and spiritual values, the highest positive values often perish on the field, and the negative values survive.

Since man is a citizen of two worlds—that of values and that of natural, causal occurrences—he is the battlefield of their terrible collisions. If there is in the world an inexhaustible source, it is that of tears. The clashes among antagonistic values and their collisions with the world of natural occurrences never cease to nourish that source of the bitterest of all liquids.

# A CAMPUS-TO-CAREER CASE HISTORY



Bob Wilson uses a "breadboard" circuit, studying the electrical properties of a carrier system

## "My first assignment at Bell Labs"

Fresh out of school, Bob Wilson, '53, was put to work on a Transistor project at Bell Laboratories. He explains why he never had time to be awed.

(*Reading time:* 39 seconds)

"In some ways it was hard to believe. I had received my B.E.E. at the University of Delaware in June, 1953, and a week later I was working in the world-famous Bell Laboratories.

"But I didn't have time to be awed because they put me right to work. They gave me responsibility fast.

"My group was working on the experimental application of transistors to carrier systems. My assignment was the electrical design of a variolosser for the compressor and for the expandor to be located in the terminals.

"The supervision I received and the equipment I had were tops. I quickly discovered that I had to rely on my ingenuity as much as on the college courses I had taken. Perhaps that's one reason for the great new discoveries continually turned out by the Labs.

"Now I'm in the Communication Development Training Program, continuing my technical education and learning what all the Laboratories sections do and how their work is integrated.

"In a year I'll be back working with the group with which I started."

• • •

**Assuming responsibility fast is a common experience among the engineering, physical science, arts and social science, and business administration graduates who join the Bell System. Bob Wilson went with Bell Laboratories. There also are job opportunities with the operating telephone companies, Western Electric and Sandia Corporation.**

**BELL TELEPHONE SYSTEM**

# THE MONTH AT CALTECH

## National Academy

Dr. Horace W. Babcock, astronomer, and Dr. Richard P. Feynman, physicist, have been elected to the National Academy of Sciences, one of the highest scientific honors in the nation. Dr. Babcock is a staff member of the Mount Wilson and Palomar Observatories; Dr. Feynman professor of theoretical physics at Caltech. Their election brings Caltech staff membership in the Academy to 26.

Dr. Babcock has been with the Observatories since 1946. Previously he had been an assistant at Lick Observatory, an astronomy instructor at the University of Chicago (Yerkes and McDonald Observatories), a research associate at the Radiation Laboratory for military radar research at the Massachusetts Institute of Technology, and for four years had engaged in wartime research at Caltech in which he contributed greatly to the development of a rocket-aiming sight for aircraft.

Perhaps his most important astronomical research contribution has been the discovery and intensive investigation of magnetic fields in stars by means of spectroscopy. Studying a phenomenon known as the "Zeeman effect," he has found magnetic fields in some 40 stars and learned a great deal about their properties. He has recently engaged in similar studies of the sun. Skilled in instrumentation, he has produced exceptionally fine optical gratings and developed a number of electronic instruments to improve astrophysical observing.

A native of Pasadena, he was graduated from Caltech in 1934 and got his PhD from the University of California four years later. His father, Harold D. Babcock, a retired Mount Wilson astronomer, is also a member of the National Academy of Sciences.

Dr. Feynman, winner of the $15,000 Albert Einstein Award and Gold Medal this spring *(E&S—April 1954)* for outstanding contributions to knowledge in the natural sciences, came to Caltech in 1950 after five years with the Laboratory of Nuclear Studies at Cornell University. During the war he was a group leader at the Los Alamos Laboratory and made important contributions to the development and understanding of the atomic bomb.

Considered one of the world's outstanding young theoretical physicists, he is perhaps best known for his quantum theory of electricity and magnetism, which forms a basis for present understanding of the interactions of atoms with radiation fields. His current interest is in the field of low temperature physics, specifically the theory of liquid helium.

A native of New York, he received the BS degree from M.I.T. in 1939 and the PhD from Princeton in 1942.

Caltech members previously elected to the National Academy include:

Carl D. Anderson, Robert F. Bacher, Richard M. Badger, George W. Beadle, Eric T. Bell (emeritus), Hugo Benioff, James F. Bonner, Max Delbruck, J. W. M. DuMoud, Lee A. DuBridge, Paul S. Epstein (emeritus), Beno Gutenberg, D. Foster Hewett, Charles C. Lauritsen, Carl G. Niemann, Linus Pauling, H. P. Robertson, A. H. Sturtevant, Theodore von Karman( emeritus), Frits Went, Oliver R. Wulf, and Don M. Yost. Mount Wilson and Palomar Observatories staff members: Ira S. Bowen and Seth B. Nicholson.

## Guggenheims

Three Caltech faculty members were awarded Fellowship grants by the John Simon Guggenheim Memorial Foundation this month—Dr. Albert E. J. Engel, associate professor of geology; Dr. William A. Fowler, professor of physics; and Dr. Norman H. Horowitz, professor of biology.

Dr. Engel plans to use his grant for laboratory studies as well as for field work next year in the Caribbean and Red Sea areas, the Pyrenees, and the Italian and Swiss Alps. He will continue his research on the changes undergone by some of the oldest sedimentary rocks. He hopes to establish initial characteristics of rocks more than a billion years old to provide clues to the nature of the ancient seas, earth, and atmosphere. A graduate of the University of Missouri, he got his PhD from Princeton in 1942 and joined the Caltech staff after six years with the U. S. Geological Survey.

Dr. Fowler intends to continue his studies of the nature of forces in the atomic nucleus. His major fields of interest have been the structure, energy levels, and transmutation of light nuclei; artificial radio-activity; sources of the energy of the stars; and instrument development. He was graduated from Ohio State University in 1933 and has been on the Caltech staff since he received his doctorate here in 1936.

Dr. Horowitz will use his grant for research in the genetics laboratory of the University of Paris (Sorbonne) starting next September. He plans to continue his study of the role of genes, the units of heredity, in the production of enzymes. He received his BS from the University of Pittsburgh and his PhD from Caltech in 1939, then spent two years at Caltech and five at Stanford, and returned to the Institute in 1946.

## Trustee

DR. LAWRENCE WILLIAMS, Pasadena physician, has been elected a member of the Caltech Board of Trustees, filling the vacancy created by the death of Carl F. Braun (*E&S*—February 1954).

Dr. Williams is on the senior attending staff of the Los Angeles County General Hospital and the Huntington Memorial Hospital, where he is chief of staff. He is also associate professor of medicine at the University of Southern California. A member of the Los Angeles County Medical Association, he is its delegate to the California State Medical Association, and a fellow of the American Medical Association. He has been a practicing physician in Pasadena since 1939.

## Philosophical Society

DR. CHARLES C. LAURITSEN, Caltech professor of physics, has been elected to the American Philosophical Society, the oldest and one of the most distinguished learned societies in America.

His election at the society's annual general meeting in Philadelphia this spring brings Caltech membership in the society to 12.

The society was started in 1743 by Benjamin Franklin. Its purpose is the promotion "of useful knowledge and the advancement of the liberal arts and sciences." Its resident membership is limited to 500 persons "who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of learned professions, or in the administration of affairs."

Professor Lauritsen, a native of Denmark, received the PhD degree at Caltech in 1929, and has been a member of the faculty since 1930. He was one of the first physicists in this country to engage in productive research in nuclear physics, using artificially accelerated particles.

Other Caltech staff members in the American Philosophical Society include Drs. Carl D. Anderson, Walter Baade (Mount Wilson and Palomar Observatories), Robert F. Bacher, George W. Beadle, E. T. Bell (emeritus), Ira S. Bowen (Observatories), L. A. DuBridge, Theodore von Karman (emeritus), Linus Pauling, H. P. Robertson, and A. H. Sturtevant. Retired Mount Wilson astronomers Walter S. Adams and Frederick H. Seares are also members of the Society.

## John Pellam

DR. JOHN R. PELLAM, an outstanding investigator in the field of low temperature physics, his been appointed Caltech professor of physics, effective July 1.

Dr. Pellam, chief of the Cryogenic Physics Section of the National Bureau of Standards, is noted for studies of liquid helium which he has carried close to absolute zero. His work has earned him the Department of Commerce Silver Medal for "outstanding contribution to science through experimental and theoretical investigation of the properties of liquid helium." Last January he received the Washington Academy of Sciences Award for achievement in the physical sciences and in February he was given an Arthur S. Flemming Award "in recognition of his outstanding technical ability."

Dr. Pellam was graduated from the Massachusetts Institute of Technology in 1940 and received his PhD there in 1947.

In 1941-42 he was a research associate at Harvard University, investigating underwater sound. From 1942 to 1945 he was a member of the Navy's Operations Research Group and served as scientific adviser to the anti-submarine forces in North Africa. His war work earned him a Presidential Certificate of Merit.

Before joining the Bureau of Standards staff in 1948, Dr. Pellam was with the Research Laboratory of Electronics at MIT, where he did considerable work in ultrasonics.

## Astronomical Society

DR. WALTER BAADE, staff member of the Mount Wilson and Palomar Observatories, last month received the Gold Medal of the Royal Astronomical Society "for his observational work on galactic and extragalactic objects."

This is the latest of several honors conferred on Dr. Baade. In January he was made an honorary member of the Royal Astronomical Society of Canada. Last year he was made a foreign member of the Royal Netherlands Philosophical Society and was elected to the American Philosophical Society.

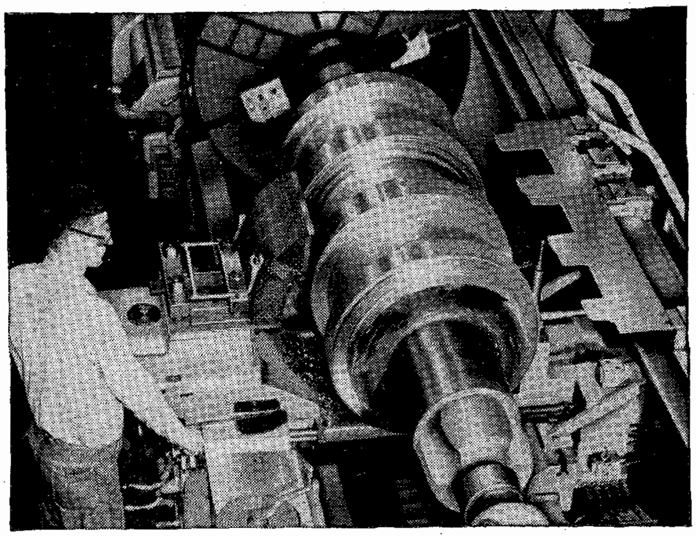
He has also been appointed to the honorary Charles M. and Martha Hitchcock professorship at the University of California. In this capacity he will be in residence at Berkeley during the month of May and will deliver a series of public lectures, "Galaxies, Their Composition and Evolution."

## Plant Administrator

WESLEY HERTENSTEIN, superintendent of Caltech's Buildings and Grounds, was elected President of the Association of Physical Plant Administrators of Universities and Colleges, which held its 41st annual meeting on the Caltech campus this month.

Hertenstein received his BS degree in civil engineering from Caltech in 1925. After six years as a design engineer with the Pasadena Water Department, he came to Caltech as Buildings and Grounds superintendent in 1937.

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



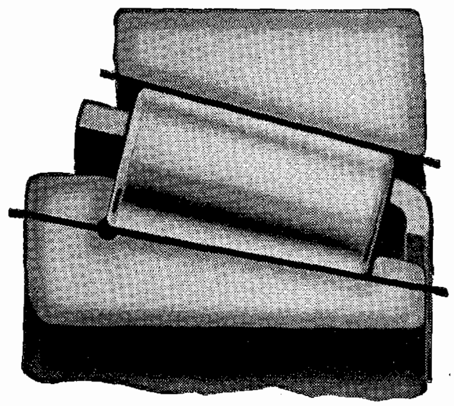
## How to hold a heavily-loaded lathe spindle in accurate alignment

This big lathe machines rolls for steel mills. The roll is rotated by the lathe spindle and it must be machined to very accurate dimensions. So the lathe manufacturer, LeBlond Machine Tool Company, mounts the spindle on Timken® tapered roller bearings. Despite the great weight on the spindle, the Timken bearings hold it precisely in place—because they are made so accurately and have such high load capacity.

---

## Why TIMKEN® bearings have high load capacity

This picture shows why Timken bearings have such high capacity—the load is carried on a *full line contact* between the rollers and races in the bearing. Note also the tapered construction. This permits the bearing to be tightened up (pre-loaded, we call it) to prevent chatter in rotating parts like the machine tool spindle above.



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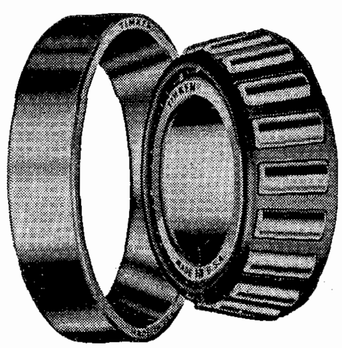
**TIMKEN**
TRADE-MARK REG. U. S. PAT. OFF.
*TAPERED ROLLER BEARINGS*



## Want to learn more about bearings or job opportunities?

Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.


**NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION**

# STUDENT LIFE

## Big T

AT LEAST IT MAY be said of third term 1954 that it brought one real accomplishment. The old "T" that had been carved into the slope of Mount Wilson by the class of '16 had got to the point where something just had to be done, and the freshman class, led by Class President Dick Morse and two dozen hard workers, finally did it.

The T party was held on Sunday, April 11, with the connivance of the Forest Service and maybe even the administration. Someone forgot the key which would open the gate on the old toll road, so that the work party started off with a two-hour climb, but the frosh survived this ordeal undaunted and went ahead with the task at hand.

The area, which is located on an irregular hillside and actually is T-shaped only from the immediate vicinity of Throop Hall, was carefully trimmed of overgrowth and strung with irrigation ditches.

The fickle southern California weatherman responded with two weeks of smog, so that it was May when the handiwork was finally visible from Tech. But on a clear day now you can see that the old T never looked whiter or neater.

## The show goes on

THE DRAMA CLUB resorted to Moss Hart for its annual production ("highlight of the season"), presenting two sterling performances of "Light Up the Sky." Four girls were brought in from outside to fill the important roles (the feminine ones), while Bob Ryle and Marvin Bienstock led the male cast. The play was held at a junior high school auditorium on May 7 and 8, and was performed with a minimum of miscues and embarrassing moments.

The play produced a sidelight of almost as much interest as the production itself. There is a minor role in the play, that of Sven, a Swedish valet who speaks only one line, but is thereby qualified to attend the infamous cast party (and reportedly also was privileged to spend the first act alone backstage with the leading lady). To fill this very desirable role the Drama Club resorted to unusual means.

A "diathlon" was held in Ricketts Court the week before the play, in which one nominee from each house competed for the coveted role. The first event was an innovation on the crew race; the contestants were to drink twelve full ounces (that's a lot) through a straw for time! What little strength the contestants had left was expended in the second event, a "navel race." The four lucky ones assumed a crab-like position on their backs, and raw eggs were broken on their bare stomachs. The idea was to crab-walk about twelve feet while keeping the yolk over the belly (pardon the expression) button.

Fleming's Bob Norton and Dabney's Don Seldeen were tied after the completion of these two events, and the judges—namely, the four actresses in the play—decided to hold a beauty contest as a tie-breaker. So the two men paraded up and down until it was obvious to all that Seldeen was the more beautiful, and he was awarded the role.

*—By Marty Tangora '57*

## Ditch Day

FROM SENIOR TO SENIOR the word was whispered. The secret was to be well kept this year. No underclassman would know when Ditch Day was to occur.

On the eve of The Day, like grains of sand, the seniors began trickling out of the student houses—to get their cars of the way before the juniors got at them. But, as usual, the juniors had already *been* at them—and had stolen the rotors from the distributors of just about every senior's car.

There was nothing for the seniors to do but steal rotors from other undergraduates' cars, and while they were at it they got enough spares to fill a small sack—which they took along with them to the beach.

Most of the seniors slept on the beach that night, and spent the next day loafing there. Back on campus, of course, the student houses were alive with activity. Locks were being picked, cement was being mixed, and fiendish devices conceived by the seniors to keep all others out of their rooms were being worked on.

Come six o'clock in the evening the prodigals started returning, many with tools in hand with which to re-enter their rooms. In Blacker Court the seniors' ties made brilliant garlands over the trees. In Dabney a pile of beds and mattresses greeted the travelers.

With experience born of long practice the seniors re-entered their rooms. Some were miraculously untouched. Others were occupied by large weather balloons filled with hundreds of gallons of water. In Ricketts one entire senior alley was walled off by cinder blocks and mortar. (Since the cement hadn't had ample time to dry, the wall was quickly breached). In Fleming an icebox was installed in one room, crammed full of wire-fencing and assorted iron pipe; the whole unit welded together with several wheelbarrows-full of cement.

As night fell and supper was over, knots of students assembled to discuss what had happened to whom. The Resident Associates wearily went to sleep after a day of trying to keep everything within bounds. Here and there a large concrete block rested, or a motor, or a pile of rubble—quiet reminders of the day's work. And here and there, far into the night, a senior scurried through the darkness, still looking for parts of his bed or room.

*—Gerald Dudeck '54*


*Foreground:* Boeing RB-47E, world's fastest day-or-night long-range reconnaissance plane. *Background:* Standard B-47E six-jet bomber.

# What do you want most in an engineering career?

**Is it room to grow?** Then join a company that's *growing*. Boeing, for example, has grown continuously throughout its 37-year history of design, production and research leadership. There's always room up ahead—and Boeing promotes from within. Regular merit reviews are held to give you steady recognition.

**Do you want long-range career stability?** Boeing today employs *more* engineers than even at the peak of World War II. Here you'd work on such projects as pilotless aircraft, research on supersonic flight and nuclear power for airplanes, on America's first jet transport, and the world's outstanding jet bombers.

**Do you want variety of opportunity?** Aviation is unique in this respect. It offers you unmatched variety and breadth of application, from applied research to production design, all going on at once. Boeing is constantly alert to new materials and new techniques, and approaches them without limitations. In addition, Boeing's huge subcontracting program—requiring engineering co-ordination—offers you contacts with a cross section of American industry.

Boeing engineering activity is concentrated at Seattle, Washington, and Wichita, Kansas—communities with a wide range of recreational opportunities as well as schools of higher learning. The company will arrange a reduced work week to permit time for graduate study and will also reimburse tuition upon successful completion of each quarter's work.

There are openings in *all* branches of engineering (mechanical, civil, electrical, aeronautical and related fields) for DESIGN, PRODUCTION and RESEARCH. Also 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, Wash.**

**BOEING**

# ALUMNI NEWS

## Annual Meeting

THE ANNUAL BANQUET and Meeting of the Alumni Association will be held on Wednesday, June 9, at the Pasadena Elks Club. A reunion of the classes of 1914, 1919, 1924, 1929, 1934, 1939, 1944 and 1949 will be held at the banquet. Dinner at 6:30 p.m. will be preceded by a social hour at 6 p.m.

## Family Picnic

THE ANNUAL ALUMNI Association Family Picnic will be held Saturday, June 19, at the Police Academy in Los Angeles, 1880 North Boylston Street (on the edge of Elysian Park.) Admission price of $2.90 for adults, $1.85 for children under 8 years, includes all the beer and pop you can drink, plus a fine barbecue dinner at 5 p.m. Come at noon and enjoy yourself with badminton, volleyball, tennis, softball, or swimming (extra charge for use of swimming pool).

## Alumni Directory

A NEW CALTECH ALUMNI DIRECTORY came off the press early this month and a check discloses that there are 6400 living alumni scattered throughout the 48 states and 49 foreign lands. However, more than 57 per cent of the graduates live in California.

The directory lists some 3700 alumni in the state. Studies of former graduating classes have shown that a large percentage of the students who came from out-of-state high schools settled in California—particularly southern California. The Pasadena-Los Angeles metropolitan area alone accounts for more than 2800 of the California total.

Listed abroad are some 275 alumni in such far-flung locations as Afghanistan, Chile, Egypt, Iceland, Indonesia, Iran, and the Union of South Africa. Another 65 are listed with only Army or Fleet Post Office addresses.

Kenneth F. Russell, '29, vice-president of the Caltech Alumni Association, was in charge of preparing the directory. In tribute to his work, the Board of Directors of the Alumni Association has passed a resolution expressing to him "the sincere appreciation of the Association and the Board of Directors for his outstanding contribution and performance."

## National Academy

DR. WOLFGANG K. H. PANOFSKY, PhD. '42, was elected to the National Academy of Sciences at the organization's 91st annual meeting in Washington, D.C., last month. Election to the National Academy is in recognition of outstanding achievements in scientific research. Member-

ship is limited to 500 American citizens and 50 foreign associates, and Dr. Panofsky's election brings Caltech alumni membership in the organization to 21. There are also 26 Caltech staff members in the Academy. (See page 20).

Dr. Panofsky, professor of physics at Stanford University, was graduated from Princeton University in 1928 and received his PhD at Caltech in 1942.

For three years he headed a war research project for the Office of Scientific Research and Development. In 1945 he became an Atomic Energy Commission consultant at Los Alamos and a staff member of the University of California and its Berkeley Radiation Laboratory. He joined the Stanford faculty in 1951.

He has made contributions in many fields of physics, including X-rays and the physical constants, ballistic shock waves, high energy accelerator design, instrumentation in nuclear physics, properties of mesons, and the study of nuclear forces. Among his leading contributions was the interpretation of experiments that gave the first evidence of the existence, lifetime, mass and other properties of the neutral pi-meson in research with the Berkeley cyclotron.

Caltech alumni previously elected to the National Academy of Sciences, aside from those on the Caltech staff, include: Robert B. Brode, PhD '24, Sterling B. Hendricks, PhD '26, Edwin M. McMillan, PhD '32, Joseph E. Mayer, '32, Kenneth S. Pitzer, '35, William B. Shockley, '32, E. Bright Wilson Jr., PhD. '33, and William G. Young, PhD '29.

### SHAPE Exercise

Dr Lynn H. Rumbaugh, PhD '32, President L. A. DuBridge and Professor H. P. Robertson of Caltech's physics department were the only three American civilians participating in a five-day exercise on strategy and tactics, held April 26 to 30 at SHAPE headquarters in Paris, France.

The occasion was one of the periodic exercises held by the staff of SHAPE under Gen. Alfred M. Gruenther. A planning board prepared detailed material on a mythical country, with its own geography, cities, citizens, and customs, which served as the setting for the theoretical military problems that were studied.

Dr. Rumbaugh is associated with the Operations Research Office at Johns Hopkins University.

# "Allis-Chalmers Graduate Training Course Was Just What I Needed,"

**says LOWELL E. ACKMANN**

*University of Illinois—B.S., E.E.—1944*
*and now manager, Peoria, Ill., Branch Office*

"MY EXPERIENCE with machinery in the Navy during the war convinced me I needed a training course. There was so much equipment on board that was a complete mystery to me that I became very 'training-course minded'.

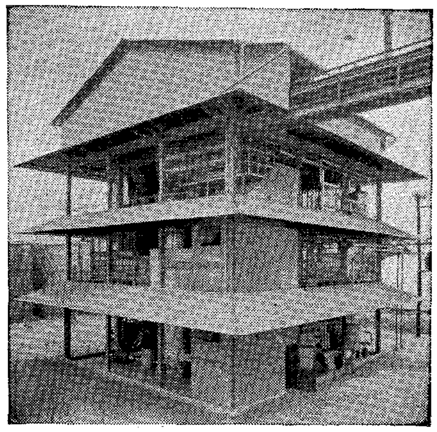
"After investigating many training courses, the one at Allis-Chalmers looked best to me then—and still does.

"In my opinion, the variety of equipment is what makes Allis-Chalmers such a good training spot.

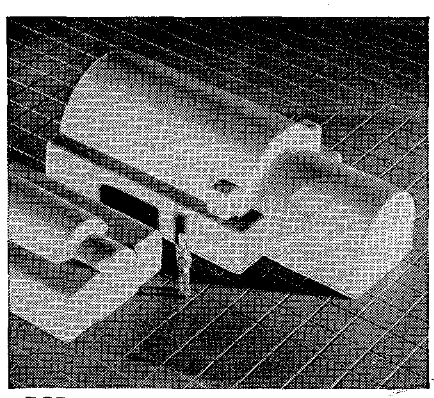
"No matter what industry you may be interested in, Allis-Chalmers makes important, specialized equipment for that industry. Electric power, steel, cement, paper, rock products, and flour milling industries—to name a few, are big users of A-C equipment.

"Before starting on the Allis-Chalmers Graduate Training Course, I thought I would like selling, preferably technical selling but, as is often the case, I didn't know for sure. This course, together with some personal guidance, helped me make up my mind. That, too, is an important advantage of the GTC program.

"But whether you want to be a salesman or designer, production engineer, or research engineer, Allis-Chalmers, with its wide variety of equipment and jobs, is an ideal place to get off to a good start—without wasting time."



**PROCESSING**—Allis-Chalmers built solvent extraction plant processes one hundred tons of rice bran per day at oil processing plant in Texas.



**POWER**—Models show comparative size of generators having the same rating with and without super-charged hydrogen cooling. Allis-Chalmers is first to supply super-charged hydrogen cooling.

## Facts You Should Know About the Allis-Chalmers Graduate Training Course

**1.** It's well established, having been started in 1904. A large percentage of the management group are graduates of the course.

**2.** The course offers a maximum of 24 months' training. Length and type of training is individually planned.

**3.** The graduate engineer may choose the kind of work he wants to do: design, engineering, research, production, sales, erection, service, etc.

**4.** He may choose the kind of power, processing, specialized equipment or industrial apparatus with which he will work, such as: steam or hydraulic, turbo-generators, circuit breakers, unit substations, transformers, motors, control pumps, kilns, coolers, rod and ball mills, crushers, vibrating screens, rectifiers, induction and dielectric heaters, grain mills, sifters, etc.

**5.** He will have individual attention and guidance in working out his training program.

**6.** The program has as its objective the right job for the right man. As he gets experience in different training locations he can alter his course of training to match changing interests.

For information watch for the Allis-Chalmers representative visiting your campus, or call an Allis-Chalmers district office, or write Graduate Training Section, Allis-Chalmers, Milwaukee 1, Wisconsin.

**ALLIS-CHALMERS**

C-5676

# PERSONALS

### 1918

*Donovan B. Nutt* has been very ill for the past several months, but is now able to be up and around his home. He is working for the Standard Oil Co., in El Segundo, Calif.

### 1922

*Howard G. Vesper* of Oakland, Calif., was elected President of the Industrial Research Institute at a recent meeting in San Francisco.

*Ray W. Preston* writes from Portland, Oregon, where he has his construction engineering business, that he's been "busy working on all types of planning and construction from cradle to grave—planning and building a premature infant section in a new 14 story hospital, grade schools, high schools, penitentiary juvenile farm and adult cell blocks, and an 8-story apartment home for retired persons."

### 1928

*Harvey E. Billig Jr.*, M.D., F.I.C.S. Medical Director of the Billig Clinic, Los Angeles, and Professor of Physical Rehabilitation, Pepperdine College, Los Angeles, flew down to South America last month to address the 9th International Congress of the International College of Surgeons in Sao Paulo, Brazil. His talk was on "Diagnostic and Prognostic Electromyography in Traumatic Peripheral Nerve Damage." He was also invited to speak to the Society of Neurologists in Montevideo, Uruguay. During the last war, Dr. Billig was assigned by the Navy to work at Caltech with Doctors Wiersma and Van Harreveld in Nerve Physiology.

*L. E. Swedland* has recently left RCA, and is now affiliated with the General Electric Company, at Electronics Park, in Syracuse, New York, as manager of Design Engineering, Cathode Ray Tube Sub-Dept.

### 1929

*Richard M. Sutton*, PhD, chairman of the physics department at Haverford College, Pa., received the Oersted Medal of the American Association of Physics Teachers "for notable contribution to the teaching of physics" in January. This medal was awarded to R. A. Millikan in 1940.

This summer Dick will be lecturing in physics at Columbia University. In addition to co-authoring a recent physics text and a book on demonstration lecturing, he had an article on Solar Eclipses in the Feb. 1954 issue of *Scientific American.*

*James W. Dunham* of the R. M. Parsons Co., Los Angeles, is now in Pakistan on a two-year contract with the U. S. Foreign Operations Administration (Point Four). Jim, who arrived in Karachi two months ago, will advise on the engineering features of a new two-and-half-million dollar fishing harbor which the Pakistan government is constructing in this capital city and chief port, with economic and technical assistance from Point Four.

Once the project gets underway and construction begins, he will assume responsibility for over-all supervision. Jim has had 24 years' experience in harbor and shore engineering and construction with the U. S. Army Corps of Engineers, most of it in California. Among the projects with which he has recently been associated are the investigation into the potentialities of a harbor for small craft at Port Hueneme, and the development of the harbor at Redondo Beach.

### 1930

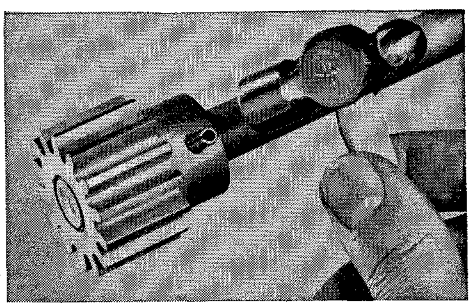
*L. Sprague de Camp*, Wallingford, Pa., has been busy as the proverbial beaver,

CONTINUED ON PAGE 36

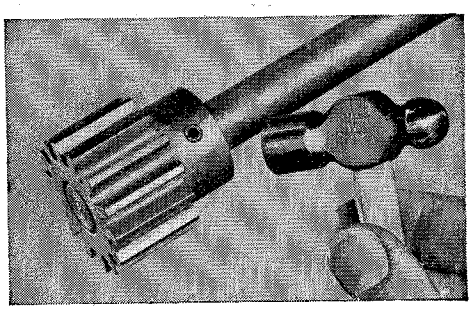
# Where will you use this simple fastener?

No threading, peening or precision drilling with ROLLPIN

Rollpin is driven into holes drilled to normal production-line tolerances.



It compresses as driven.



Rollpin fits flush . . . is vibration-proof.

Rollpin is the slotted tubular steel pin with chamfered ends that is cutting production and maintenance costs in every class of industry.

This modern fastener drives easily into standard holes, compressing as driven. Its spring action locks it in place—regardless of impact loading, stress reversals or severe vibration. Rollpin is readily removable and can be re-used in the same hole.

* * *

*If you use locating dowels, hinge pins, rivets, set screws—or straight, knurled, tapered or cotter type pins—Rollpin can cut your costs. Mail our coupon for design information.*


**Elastic Stop Nut Corporation of America**
**Dept. R16-CM, 2330 Vauxhall Road, Unon, N. J.**

**Please send me the following free fastening information:**

- ☐ Rollpin bulletin
- ☐ Elastic Stop Nut bulletin
- ☐ Here is a drawing of our product. What fastener would you suggest?

Name__________ Title__________

Firm__________

Street__________

City__________ Zone_____ State_____

# Austin Bush, Rensselaer, '50, Helps Develop New Pump

**AUSTIN BUSH,** inspecting stuffing box assembly on boiler feed pump.

## *Reports interesting project engineering assignments at Worthington*

"Despite its size as the leading manufacturer in its field," says Austin Bush, "I have found Worthington pays considerable attention to the interests of the individual. The company's excellent training program consists of several months of working with the various types of equipment manufactured, augmented by technical lectures, and talks on the organization of the corporation.

"Following this training, I was given an opportunity to choose the department in which I wanted to work—engineering, sales, or manufacturing. My choice was the engineering department where I have already been assigned to several interesting projects.

"In addition to the training program, the members of our engineering department hold monthly seminars at which engineering topics of general interest are discussed.

"Opportunities for advancement are good, and pleasant associates make Worthington a fine place to work."

When you're thinking of a good job, think *high*—think *Worthington.*

***FOR ADDITIONAL INFORMATION,*** see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, New Jersey.

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The Sign of Value Around the World

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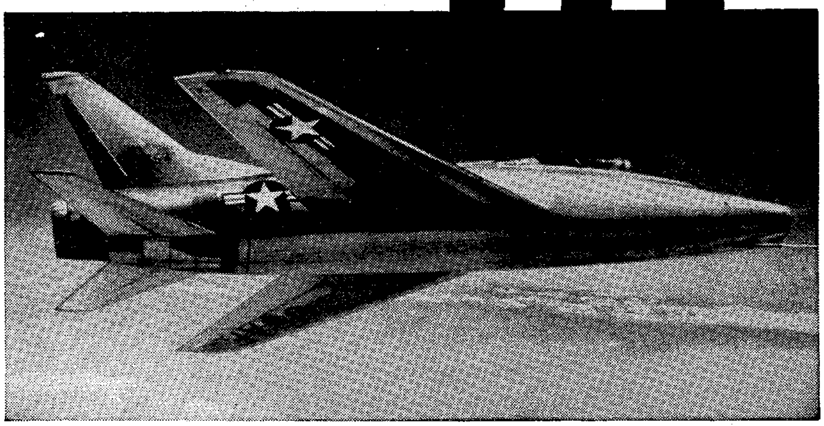
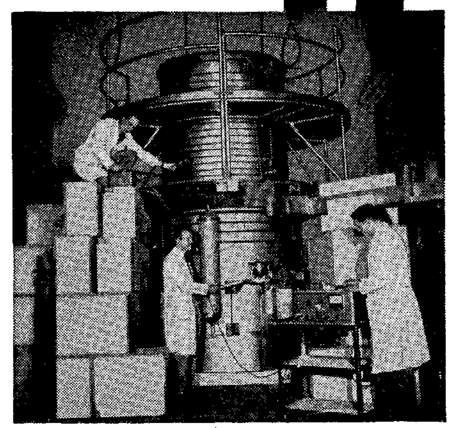
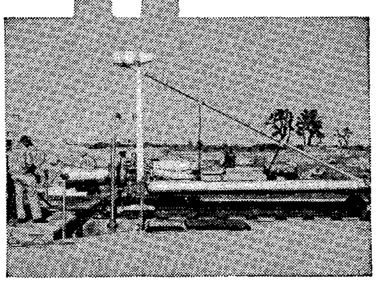




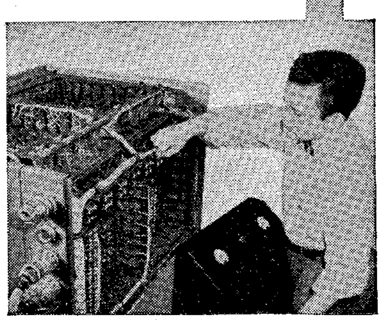
# DIVERSITY CREATES OPPORTUNITY



Although best known for design and production of world-famous aircraft like the Korea-famed F-86 *Sabre* Jet and the new, record-smashing F-100 *Super Sabre* . . . North American Aviation also offers engineers excellent opportunities in other technical fields.

North American needs engineers with imagination and technical ability to help design and build the aircraft of the future.
Other fascinating careers are created daily in its rapidly developing guided missile, jet, rocket, electronic and atomic energy programs.

When you are ready to enter the engineering profession, consider the well-paid opportunities at North American. Meanwhile, write for information on your future in the aircraft industry.



***Contact:* Your College placement or write:**

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*in aircraft . . . atomic energy . . . electronics . . . guided missiles . . . research and development* turning out a list of titles that sounds like intriguing reading. For instance: *Lands Beyond*, 1952; *The Continent Makers, Science-Fiction Handbook, The Tritonian Ring and Other Pusadian Tales, Tales From Gavagan's Bar*, and *Sprague De Camp's New Anthology*, all published in 1953. This year he has added *Lost Continents* to the list. Aside from all this, Sprague acquired a second child (second son) in June, 1951, and made a trip to Europe with his wife and older son in the fall of 1951.

### 1932

*Colonel Bill Shuler* writes from the Army War College in Carlisle, Pa.: "About to graduate here in June. My new job will be Chief of Construction, G-4, Department of the Army, Pentagon."

*William Shockley*, PhD, research physicist at the Bell Telephone Laboratories, is at Caltech as visiting professor of physics this term, and has delivered a series of lectures on "Fundamental Energy Band Problems in Semiconductors". Bill worked with the Bell Laboratories research group that developed the point-contact transistor, first announced in 1948. Independently, he designed the junction transistor, a type that provides greater amplification and requires less power. During the war he served in the Navy as research director of Columbia University's anti-submarine warfare operations research group, and as expert consultant to the Office of the Secretary of War.

### 1933

*Benarthur C. Haynes*, MS, passed away the last of April in Washington, D. C. Benarthur was Chief of the Observation Section, U. S. Weather Bureau, and lived at 6707 Barr Road, Washington 16, D.C.

### 1934

*Edgar J. Wheeler* paid a recent visit to the campus, renewing acquaintances. He reports that he is a civilian engineer with the U. S. Air Force—as Director of Planning at Randolph Air Force Base, Randolph Field, Texas.

*Fred H. Nicolia*, associated with the Texas Company, Pacific Coast Division, has transferred from the geological department to the geophysical division in Houston, Texas, and is working with *D. H. Scott*, '39. Fred recently ran into *A. O. Spaulding* '49, who was transferred from Ventura, Calif., to Houston by Shell Oil Co.

### 1936

*S. K. Haynes*, PhD, is now Professor of Physics at Vanderbilt University at Nashville, Tennessee. He is also vice president of the southeastern section of the American Physics Society for 1953-54.

### 1938

*E. F. Osborn*, PhD, Dean of the Mineral Industries College at Pennsylvania State University, enjoyed a visit to Caltech last spring—his first since leaving Pasadena in 1937. E. F. had a fine time discussing old days at Caltech with *Dick Jahns*, '35, as well as their mutual experiences while serving on the same program at the Gordon Conference.

### 1940

*John Day* is another Caltech grad making a name for himself in the electronics field. Recently appointed chief television engineer for Kalbfell Laboratories at San Diego, he will assume all responsibility for development and engineering work on the new Kay Lab camera systems and associated equipment, as well as supervising work on the futuristic television intercommunications systems for industry.

John has had extensive experience in many phases of electronics. He has been employed by Paramount Pictures as an electronics engineer. At the Naval Research Laboratory in Washington, he was associated with early work by the Navy on radar equipment, designing many receivers for original American production of radar equipment. The Navy also had John working at their Electronics Laboratory in San Diego, where he contributed many new designs in the fields of computers and data analyzing equipment.

*G. R. Brown* has moved to Ft. Worth, where he is now the West Texas Division Petroleum Engineer for the Texas Co. He writes: "Although I am not the president of the Texas Co. yet, I do hold that office this year in the local Petroleum Engineers Club. Everything else seems to be running along smoothly without much excitement."

*S. Y. Ch'en*, PhD, has received welcome news from the President's Office at the University of Oregon. He's going to be promoted to a full professorship in physics by the next academic year.

## 1941

*Lt. Colonel Frank G. Casserly*, U. S. Marine Corps, has just completed one year in Korea, where he was signal officer of the 1st Marine Division. His present duty station is Pearl Harbor, as assistant communication-electronics officer for Fleet Marine Force, Pacific.

*Dale E. Turner*, in Midland, Texas, is enjoying his work as seismologist for the Superior Oil Co.

## 1942

*John J. Rupnik*, in Tulsa, Okla., sends in a fast run-through of his activities since leaving Caltech. He worked four years for the United Geophysical Co. in Pasadena—having charge of their offshore seismic crew—then went for a year with the Sun Oil Co. in Beaumont, Texas, as seismic supervisor, in 1945. He next joined Sinclair Oil & Gas in Tulsa, as seismic supervisor in their special services group; working in Louisiana, Mississippi, Texas, Oklahoma, Wyoming and Alberta, Canada, and also supervising part of their Ethiopian work out of the Tulsa office.

After five years John resigned to join the firm of Manhart, Millison & Beebe as geophysicist in 1951, and is now one of four junior partners. The company specializes in program management for oil exploration, and in drilling also.

*Roy C. Van Orden* is still employed by the A. C. Martin Co. in Los Angeles as assistant structural engineer. He teaches two nights a week at the USC School of Graduate Engineering—and to keep busy further, he's writing a thesis to earn a professional degree from USC this June.

## 1943

*Jack D. Stone* is still with the Fluor Company, but he has transferred from project engineering in Los Angeles to the Houston sales office, as Project Coordinator of the Midcontinent division. *Ernie Moncrief* '37, as vice-president, and *Bill Chapin* '41 as chief process engineer, manage Fluor's Midcontinent Engineer division.

# PERSONALS . . . CONTINUED

*Bob Benson* has been appointed manager for a new Western division of Gyromechanisms, Inc., of Halesite, Long Island, N. Y. For the past two years he has been Chief Engineer of American Gyro Corporation. The new division at 11941 Wilshire Blvd., Los Angeles, will handle sales, service and development engineering. Bob is married, trying to feed two children, living in Pacific Palisades and "would like to hear from some of you old snakes."

*Dr. L. W. Merryfield*, MS, expects to complete his training in internal medicine this June at the Seattle Veteran's Hospital, where he is currently a Fellow in endocrinology and metabolic diseases. He then plans to set up private practice in or near Seattle.

### 1944

*Thomas B. Norsworthy* is still with Taylor-Norsworthy, Inc., Dallas, Texas, advertising agency, as General Manager and Executive Vice President. He is married and has a two-year-old son.

### 1945

*Lt. jg R. F. Schmoker*, Civil Engineering Corps, Navy, has been named Public Works Officer at the USNSD, Scotia, N.Y. Enlisting in 1942, he was stationed at NAAS, Ream Field, and NAAS, Brown Field, in southern California and was then appointed maintenance superintendent of the Naval Air Station, San Diego. This was followed by two years as Public Works Officer at the Naval Air Station, Honolulu. Bob was instructor in physics at the U. S. Naval Academy for three years before coming aboard the *Scotia* last summer. He has just returned from a course in Atomic, Biological and Chemical Defense at Fort McClellan, Alabama, where he did himself and the Depot proud by getting the highest rating in his class.

*Merritt A. Williamson*, MS, celebrated the arrival of his fifth daughter last September and in August received his MBA degree from the University of Chicago. The research activity of Burroughs Corporation, where he has been Research Director since joining the corporation in 1952, has moved from Philadelphia to Paoli, Pa. Merritt writes that he lives about 2½ miles away on three acres in the country.

### 1947

*Charles W. Baugh*, MS, is working as senior engineer in the advanced development laboratory on color TV, at Westinghouse Electric Co., Metuchen, N. J., having moved there from Mentor, Ohio. His latest family addition is Donald—making six in all.

### 1948

*George Holzman*, PhD, research engineer in Shell Development's petroleum refining department at Emeryville, Calif., will begin a two-year assignment with Shell Oil's manufacturing-research department in New York about June 1st. Besides spending three years previously as a research assistant here at Caltech, George spent one year as a research associate at M. I. T.

*John A. Burton*, MS, writes: "Left Caltech in 1948 to return to Vancouver, my home town, to work for a year. Moved to New England to work for Improved Machinery, Inc. and also became a married man; my family now consists of my wife Phyllis (also of Vancouver) and two sons. Became assistant chief engineer with Impco; then in 1953 decided to return West. We bought an 18-ft. trailer and towed it 7000 miles via Grand Canyon to Seattle, Wash. I am now employed in the central engineering office of Crown-Zellerbach Corp."

*Warren Marshall* is on the home-stretch of a two-year tour of active duty with the Navy—has a little over 100 days to go—stationed at Whidbey Island, Washington, and recently was promoted to lieutenant. However, he will bee-line back to the Shell Oil Co. and his position as exploitation engineer when through. Warren writes: "Whitbey Island is strictly a Northwest Outpost. The fishing is miserable; duck hunting is poor; it's too cold to grow a garden in the summer; it rains 193 days per year; it's overcast 47% of the time; there is no Poker, Beer and Athletic Association: carry me back to southern California." The current tally of his family is two girls and a boy, with Gail an addition in March.

*James R. Thorpe Jr.*, has left Hughes Aircraft to go into his own business and is now manager of The Bishop's Lodge, Santa Fe, N. M.

### 1949

*George H. Bowen* has left Oak Ridge National Laboratory to accept a position as assistant professor of physics at Iowa State College. The recent addition of a girl to his family brings the total to three —one boy, two girls.

*Dr. Conway Snyder*, PhD, working at the Oak Ridge National Laboratory, gave a talk in Dallas, Texas, recently on the physical and engineering aspects of space travel. It was the first in a series of lectures sponsored by the Oak Ridge Institute of Nuclear Studies.

*Dennis V. Long* was married to Marilyn Thompson on October 3, 1953. Dennis works as regional manager with the Construction Equipment Division of the Worthington Corp., in Los Angeles.

*Allen E. Puckett*, PhD, former Section Chief in the Wind Tunnel at the Jet Propulsian Laboratory in Pasadena, has now been appointed Chief of the Systems Analysis and Aerodynamics Department of the Hughes Aircraft Co. Allen has also been reappointed chairman of the sub-committee on High-Speed Aerodynamics in the National Advisory Committee for Aeronautics.

## 1950

*Capt. William P. Schneider,* stationed at Kileen Army Base, Texas, has had his orders to Far East Command in Korea or Indo-China. He married Nancy Harvey in 1950 and has a son, William, born in 1953.

*John K. Inman* expects to finish working for his PhD in biophysical chemistry in June, 1955, at Harvard. He and Nancy, his bride of this April, are living at 9 Rice St. in Brookline, Mass.

## 1951

*James R. Brown,* PhD, as group leader in the Experimental Physics Section of the Westinghouse Atomic Power Division in Pittsburgh, Pa., is supervising work pertaining to the use of nuclear reactors for the generation of electrical power. Jim now has two daughters.

*Marshall Klarfeld* has been transferred to Pittsburgh, Pa., after two years in New Jersey with the Up-Right Scaffolds Co. He is their factory representative with a territory covering four states.

*Paul L. Armstrong, Jr.* writes a short note from Ann Arbor, Michigan, where he is back at the books, studying chemical engineering. After graduation from Caltech Paul entered the Navy, leaving as a jg in 1953. That was a big year for Paul. He returned to civilian life as a married man, and, just to celebrate, the new Mr. and Mrs. spent two months in Europe before settling in Ann Arbor.

*Al Thiele,* working at the General Electric Hanford Works, Richland, Wash., had a memorable birthday last year—ushering in a new son on April 13, 1953.

*Scott Lynn,* BS '50, MS, was married to Annette Prins on May 8 in the town hall of Delft, Holland.

*Jim Enslow* has just finished working overtime at the A. O. Smith Corp., in Milwaukee, on a program designed to give management a more accurate method of efficiency rating for the automotive divisions. Jim's spare time used to be occupied by activity in Young Republican Clubs, but these days he's working with a non-partisan county group, collecting signatures for the recall of Joe McCarthy.

*Gibson Oakes,* BS '50, MS, recently joined Boeing Aircraft in Seattle. He is working with the Systems Analysis Staff Unit as a research engineer on structural problems arising from aerodynamic heating. Gibson had worked previously for North American Aviation as a structures engineer. He's married, has a daughter almost four years old.

## 1952

*Al Jackson,* MS, is an instructor at Cornell University, teaching in the field of Feedback Control Systems and Analog Computers. He is also working towards a PhD in EE and is almost as busy as he was at Caltech. He has two girls—the youngest, Jill Sharon, born last year. They like it in Ithaca, N. Y., but "could use a little of that California sunshine in the winter."

*James La Fleur* married Carolyn Gannon April 23 in San Marino. He is working as Engineering Analyst at AiResearch Manufacturing Co., Los Angeles.



# SCIENCE WRITERS

From May 1, 1954 to May 1, 1955 **Engineering and Science** will pay for all acceptable articles by Caltech undergraduates and graduate students at the rate of $10 per published text page—or roughly a cent a word.

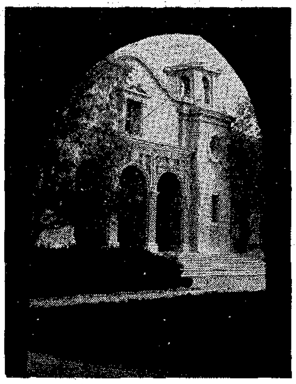
**E&S** articles should be based on some phase of scientific or engineering research, or some individual, connected with Caltech. They may run from 1,000 to 5,000 words. They should be typed, double-space.

But we are not just looking for more **E&S** articles. Our real aim is to encourage more science writing by the people who are in many ways best equipped to write it.

So—all articles submitted to us by Caltech undergraduates and graduate students—whether they are accepted for publication in **E&S** or not—will be entered in a Science Writing Contest.

On May 1, 1955 these articles will be sent to the editors of **Scientific American,** who will choose a $100 first-prizewinner, and a $50 second-prizewinner.

For further information, to register your topic—or even your interest—check the **E&S** office, 400 Throop.



# CALTECH CALENDAR

June, 1954

## ALUMNI ACTIVITIES

| | |
|---|---|
| June 9 | Annual Meeting |
| June 19 | Family Picnic |

## COMMENCEMENT ACTIVITIES

| | |
|---|---|
| June 10 | President's Reception, 4-6 p.m. President's House |
| June 11 | Commencement Exercises, 4:30 p.m. Athenaeum lawn |



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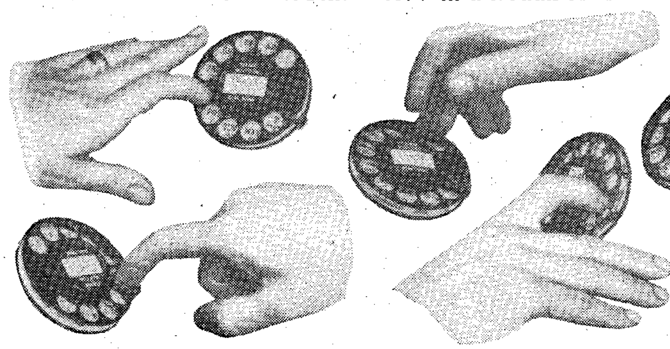

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