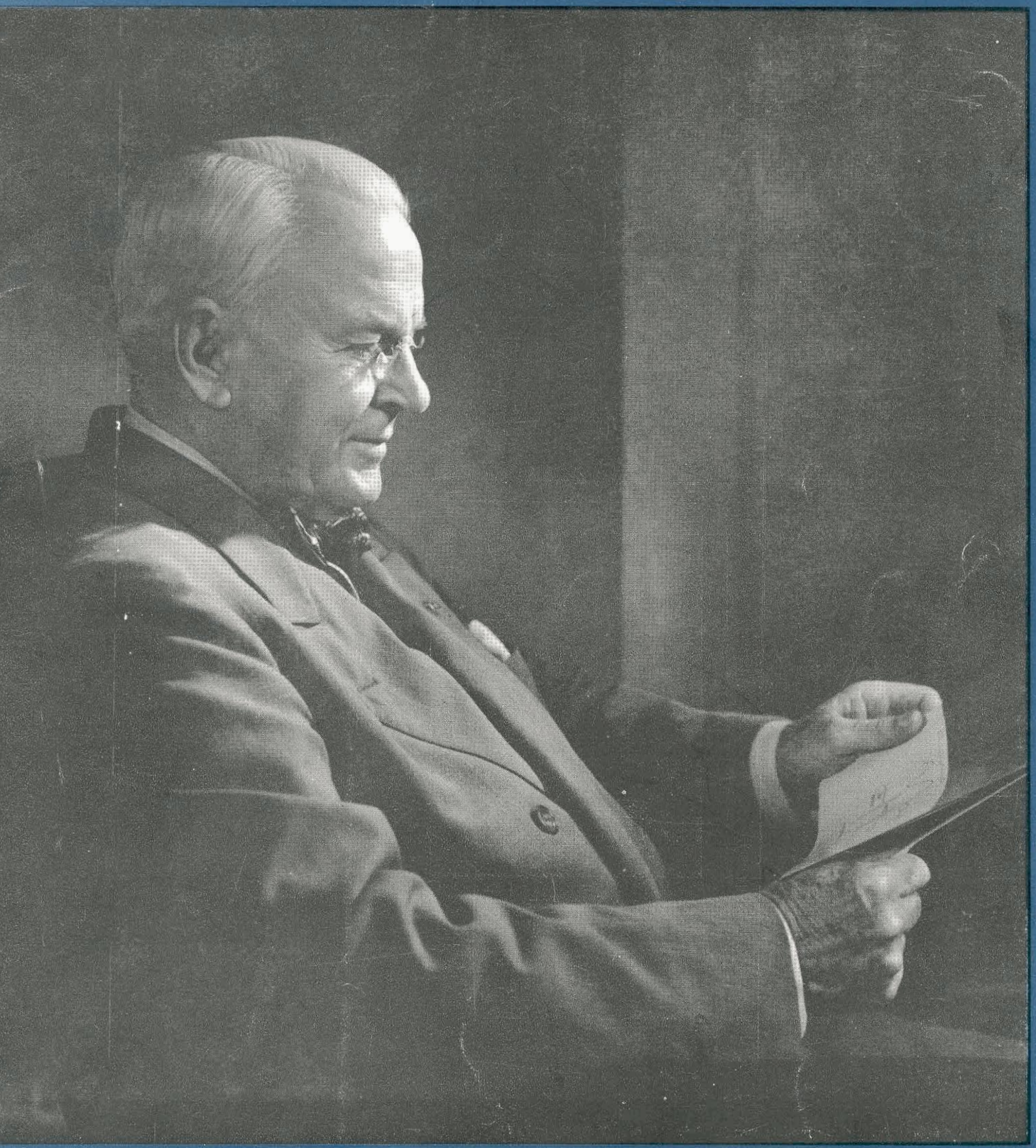
ENGINEERING | AND | SCIENCE

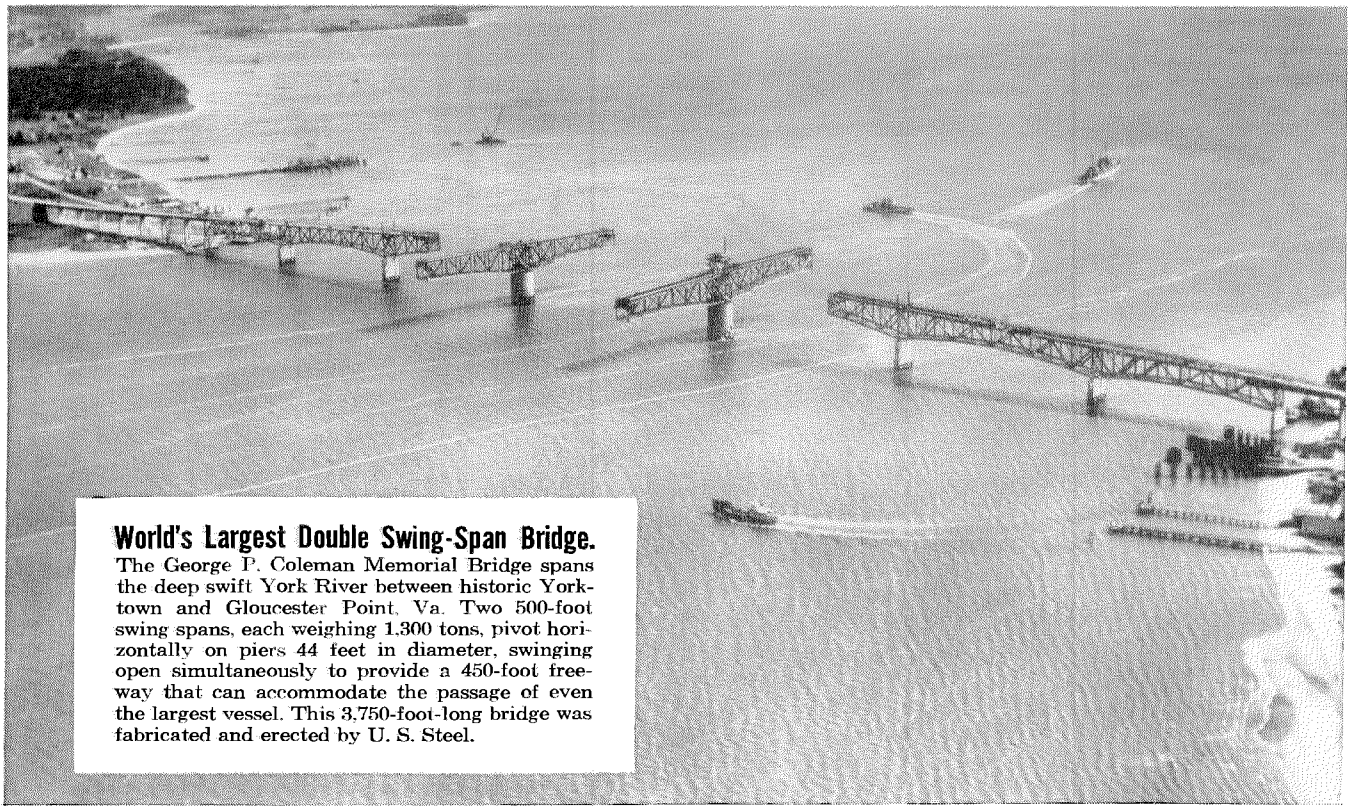
JANUARY / 1954



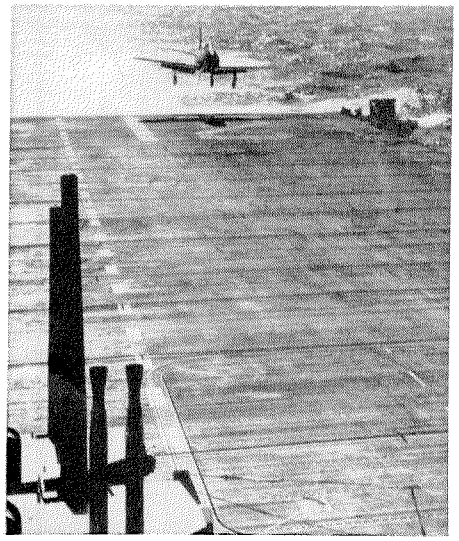
R. A. Millikan . . . page 7

PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

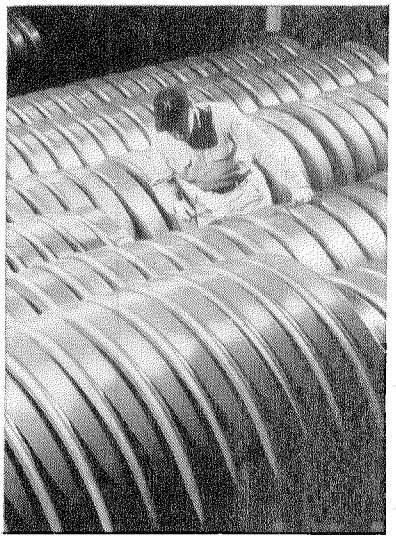
Only STEEL can do so many jobs so well



World's Largest Double Swing-Span Bridge.
The George P. Coleman Memorial Bridge spans the deep swift York River between historic Yorktown and Gloucester Point, Va. Two 500-foot swing spans, each weighing 1,300 tons, pivot horizontally on piers 44 feet in diameter, swinging open simultaneously to provide a 450-foot freeway that can accommodate the passage of even the largest vessel. This 3,750-foot-long bridge was fabricated and erected by U. S. Steel.



Landing at Sea. When a fighter pilot lands his plane on a flattop, one of his biggest problems is *stopping* the plane. To help him, a hook attached near the plane's tail engages one of the galvanized wire cables, mounted on spring brackets, that stretch across the deck. The resiliency of the cable, plus the bracket action, helps the plane to stop promptly and safely.



Ready to Roll. Trains move faster today, they carry heavier loads, they cover longer distances. This puts a premium on durability and safety in the *wheels* they roll on. U. S. Steel has been making wrought steel wheels for 47 years, has helped to bring the art of wheelmaking to its present high level.

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A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from J. M. Wallace, Manager, Meter Div.,
Westinghouse Electric Corporation
University of Pittsburgh, 1935

To the man who wants more than a job

You and I know that getting a job is not a problem these days. Industry needs thousands of young engineers.

But the man who wants more than a job might well pause and consider just how he is going to find his special opportunity. It cannot be found everywhere.

The man I'm talking about wants interesting work with a future, yes—but also something more. He is determined to help make the world a better place in which to live—and wants a job that will enable him to do this. He is co-operative in his work, but demands the dignity of being treated as an individual. This man had high purpose when he elected a career as an engineer.

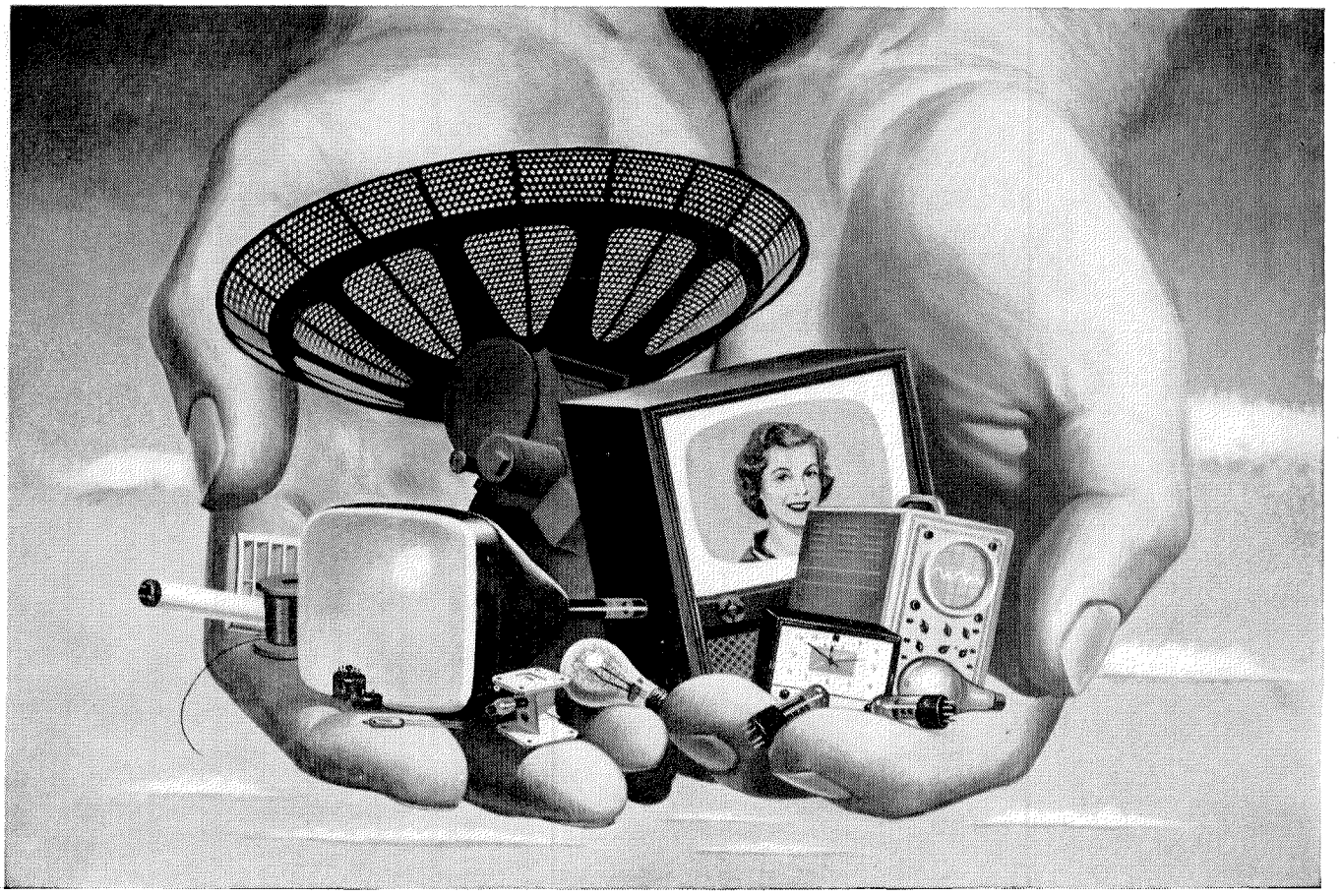
I know this man. He's many men at Westinghouse. He's an engineer's engineer.

You, who want more than a job, are this man, too. You will be among your own at Westinghouse. G-10273

YOU CAN BE SURE...IF IT'S
Westinghouse

For information on career opportunities with Westinghouse, consult Placement Officer of your University, or send for our 44-page book, *Finding Your Place in Industry.*

Write: Mr. S. H. Harrison, Regional Educational Co-ordinator, Westinghouse Electric Corporation, 410 Bush Street, San Francisco, Calif.



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This year will see the completion of additional new plants and laboratories, as another phase of a continuing expansion program which has doubled plant and equipment in the past few years.

As a graduate engineer, you'll naturally find a wide range of opportunities in every phase of engineering at Sylvania. And you'll find yourself making rapid headway as the company continues to add new facilities, new fields.

A stimulating atmosphere of accomplishment and opportunity — plus size, growth, and diversity — make Sylvania, a company of young men where the executive level averages 45 years of age, an ideal place to build a satisfying career in engineering.

For detailed information, see your College Placement Office or send for our comprehensive brochure, *"Today and Tomorrow with Sylvania"*, by writing to Supervisor of Technical Employment.

Opportunities, too, at Sylvania's 16 research and development laboratories.

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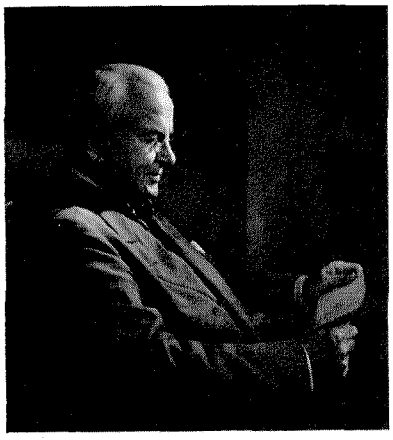
IN THIS ISSUE



This month's cover picture, a study of the late Robert A. Millikan, was taken by the famous Canadian portrait photographer, Yousuf Karsh, in 1950.

Dr. Millikan, head of Caltech for 24 years, died after a short illness on December 19, 1953—a few months after the death of his wife on October 10.

On pages 7 to 16 of this issue are some biographical notes on Dr. Millikan, some pictures of various phases of his career, and a tribute from his pastor, The Reverend Curtis Beach of the Neighborhood Church of Pasadena. Dr. Beach's tribute was delivered at the funeral service held for Dr. Millikan on December 23.

On page 17 of this issue you'll find the third article in a series on the Caltech Alumni Survey. This month Dr. John R. Weir discusses some of the opinions and civic activities of our alumni. Next month he reports on alumni incomes. This series will run to five or six parts in all, and already we have a number of requests for reprints of the complete series. These reprints will probably not be available until March or April. but we'd like to suggest that anyone interested in having copies at that time leave an order with us in advance.

PICTURE CREDITS

Cover	Karsh, Ottawa
p. 8	Will Connell
p. 14	Wes Wendland
p. 15	Ernest Kleinberg

JANUARY 1954 VOLUME XVII NUMBER 4

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STAFF

Publisher.....Richard C. Armstrong '28
Staff Photographers.....Byron Johnson, Jr. '56
Tom Bergeman '56
Editor and Business Manager.....Edward Hutchings, Jr.
Editorial Consultant.....Professor of English George R. MacMinn

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Printed in Pasadena PP

The special character of the application of an electronic digital computer for airborne automatic controls is reflected principally in the input-output units.

MORE THAN 100 TIMES FASTER THAN THE HUMAN BRAIN

The physical quantities defining the state of the system—such as altitude, rate of climb, heading, and other vital information—are measured by instruments whose outputs are usually in the form of mechanical displacements or voltages. These analog quantities are converted into digital numbers that are processed by the computer; it performs in "real" time the computations corresponding to the mathematical representation of the control problem. The results of these calculations are numbers representing the signals used to control the system. These output numbers are converted into the analog-type signals used in the control operations.

At Hughes Research and Development Laboratories, where the subminiature airborne digital computer was pioneered, analog-digital input-output systems have been developed for several applications.

For example, in the conversion of direct-current voltages to binary numbers, the many input voltages are digitalized in sequence by a comparison with a precisely linear saw-tooth waveform, gated once per revolution of the drum to successive inputs. Time intervals are produced which are used to control a gated binary counter. Resulting binary numbers are stored in the memory for subsequent use by the computer. Output binary numbers each control the symmetry of a square wave recorded on a drum channel during the output sampling periods. Reading heads continuously present the waveforms to the respective output channels where they are standardized by regulated-current switch tubes and are filtered to establish the direct-current components. Several such waveforms may be time-shared on a single drum channel by encoding.

A major effort at Hughes is also devoted to adapting electronic digital computer techniques to business data processing and related applications—uses destined for far-reaching peacetime application.

ENGINEERS AND PHYSICISTS

Activities at Hughes in the computer field are creating positions in the Laboratories. Experience in the design and application of electronic digital computers is desirable, but not essential. Engineers and physicists with backgrounds of component development or system engineering are invited to apply.

Address:

SCIENTIFIC
AND
ENGINEERING
STAFF

HUGHES
RESEARCH
AND DEVELOPMENT
LABORATORIES

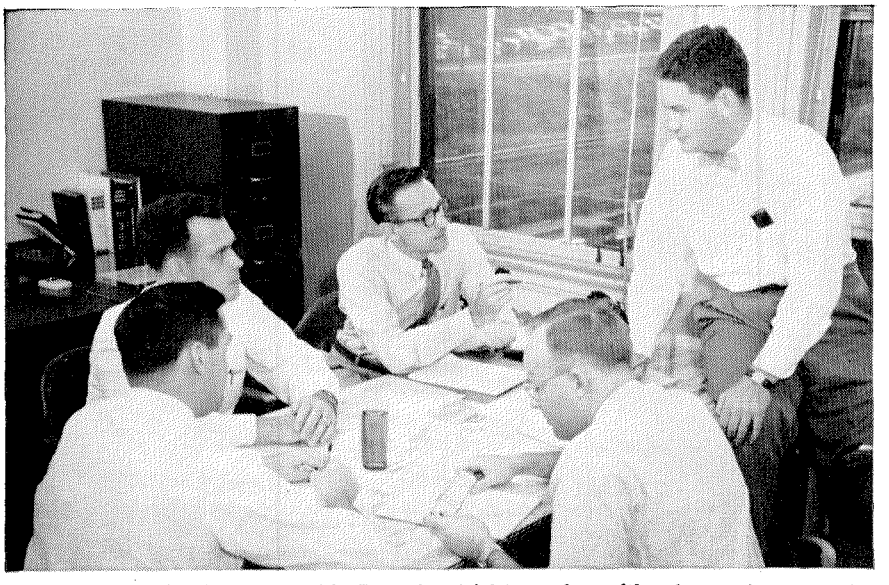
Culver City, Los Angeles County
California

Input-output units (above) of the Hughes airborne electronic digital computer. (Left) Operation of the pilot's direction indicator is discussed by W. S. Shockency (left), Radar Laboratory, and M. L. MacKnight of the Advanced Electronics Laboratory.

THE DU PONT DIGEST

Plant Development

Offers Training and Opportunity



John Purdom, M.S. in Ch.E., Ohio State '48 (*right*), confers with other engineers on the progress of a new plant.

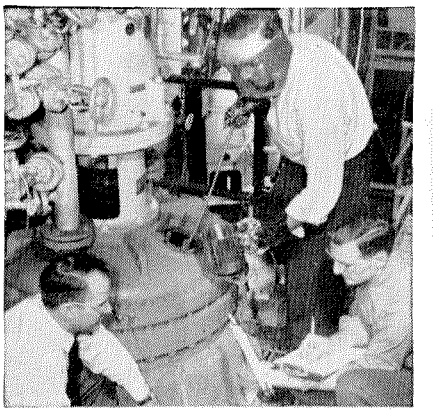
A young chemical engineer recently had his first assignment in a *Plant Development* group at Du Pont. He was part of a team assigned to improve recovery of adipic acid, a nylon intermediate, from plant-waste streams.

First, he made a literature survey for possible leads. Three recovery methods came under consideration: *solvent extraction*, *crystallization*, and a combination *distillation-crystallization* process. He helped to set up a laboratory program to compare and evaluate them.

Preliminary results were somewhat inconclusive. It was decided to go ahead with semi-works tests, while an organic chemist completed the laboratory work.

Next, the young chemical engineer joined forces with a mechanical engineer to design a semi-works plant to evaluate each method. In this plant, all vital points were checked and rechecked: materials of construction, steam and water requirements, heat-transfer coefficients, yields, product quality, and pollution problems.

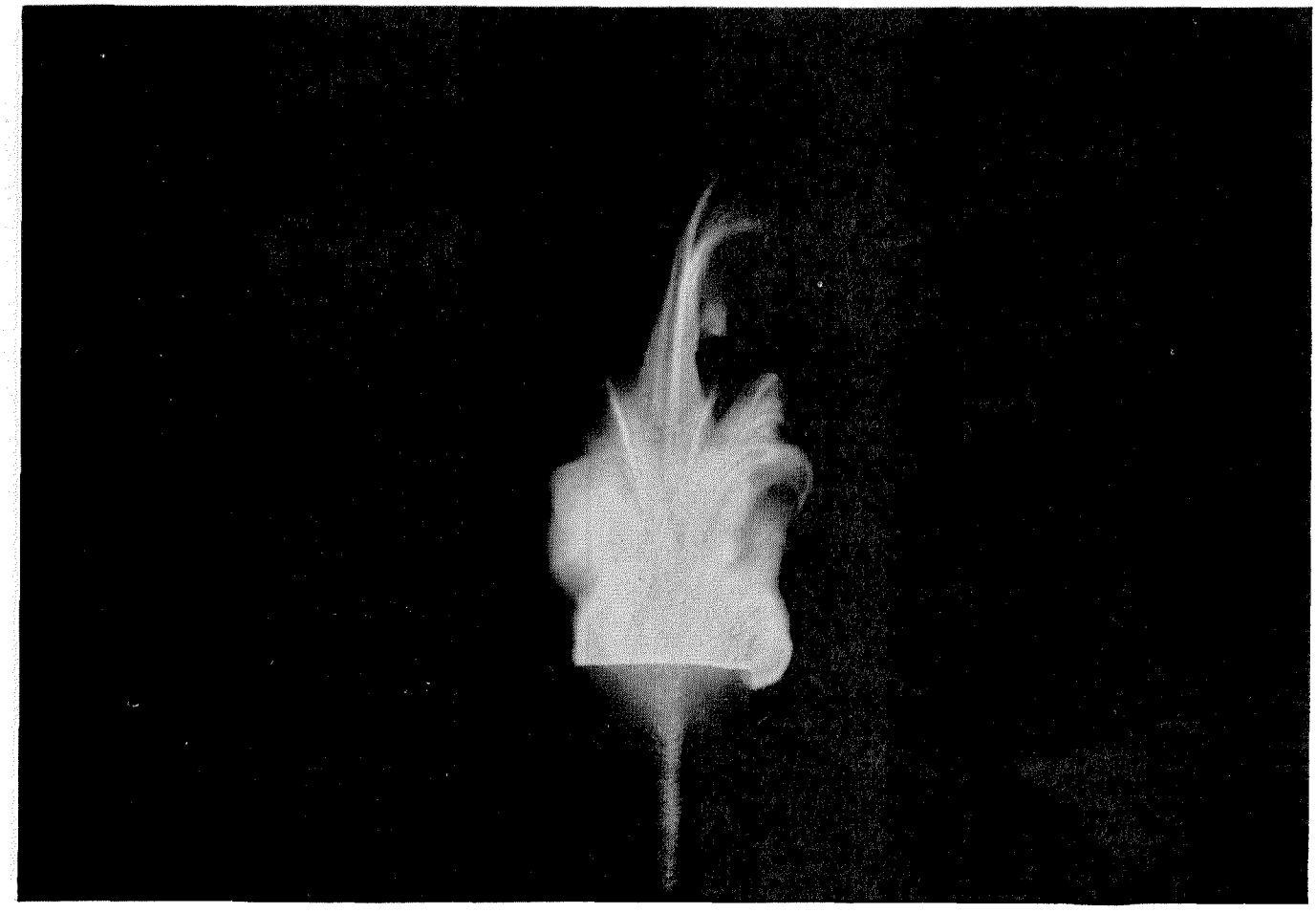
The semi-works data revealed that the *distillation-crystallization* process was the most economical, and also gave the best product quality. Usually, the next step would be construction and operation of a pilot plant. But this time, engineers from the *Production Division* arranged for a limited-scale plant test, using a spare batch still and a crystallizer on a part-time basis. Two months of testing confirmed the previous data—the new *distillation-crystallization* process recovered adipic acid efficiently, and would reduce costs considerably. The plant is now using this process successfully.



Robert Thomson (*left*), B.S. in Ch.E., Univ. of Va. '50, **David S. Rumsey** (*center*), M.S. in Ch., Univ. of Mich. '48, and **Rene M. LeClair** (*right*), M.S. in Ch. E., M.I.T. '51, test samples on an experimental batch unit.

That's how one young chemical engineer started his career in a typical Du Pont *Plant Development* group. The job of such groups is to make processes and equipment more efficient, to adapt products to new uses, and to improve product quality.

Plant Development work not only offers opportunity in itself but valuable training for other fields.



million watt spark plug . . .

Calling this jet engine ignitor a million watt spark plug is an understatement. Actually this picture shows a 1,500 kw discharge that occurred in 25 microseconds.

One of a series of photographs taken as we vary voltages and ignition system design, it helps us study the arc size and the penetration of the discharge into the combustion chamber. These and other studies provide the knowledge necessary for the design of dependable ignition systems — systems that will start combustion at 45,000 foot altitude and −65° temperature.

Good ignition is important. Yet ignition research is only one small phase of our development program.

But this work does suggest how completely we explore technical areas to produce dependable aircraft engines. And it illustrates the wide variety of tools and techniques we use to solve difficult problems.

Here, emphasis is put on "getting the facts" — *all the facts.* This makes good sense to recent graduates who want to do real engineering — explains why so many are attracted to a career at Pratt & Whitney Aircraft.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

ROBERT A. MILLIKAN

1868 - 1953

"He strove always to make the world a better place in which to live, and he contributed far more than most men to this end."

DR. ROBERT A. MILLIKAN died on December 19, 1953, after an illness of several months. He was 85 years old.

"Dr. Millikan was one of the great pioneers and leaders of American science and of American higher education," said President DuBridge, in a tribute to his predecessor. "His name will always be linked with those of Wilhelm Roentgen, Madame Curie, J. J. Thomson, Lord Rutherford, Max Planck, Niels Bohr and Albert Einstein as one of those responsible for the revolution of modern physics.

"He led in creating in Pasadena one of the world's great centers of scientific research. The host of students whom he inspired, first in Chicago and later at Caltech, occupy positions of leadership in American science and in industry.

"Robert Millikan was a great man, a thoughtful man, a godly man. He strove always to make the world a better place in which to live, and he contributed far more than most men to this end."

Robert Millikan was 53 years old when he came to Caltech in 1921 as chairman of the Institute's Executive Council and director of the Norman Bridge Laboratory of Physics. He had already had a full and a distinguished career in teaching and research at the University of Chicago, where he had been for 25 years. Nevertheless, at 53, he embarked on a challenging new career—and made as great a success of this as he had of his many others. Under his direction the California Institute of Technology became one of the world's leading scientific institutions.

Dr. Millikan retired as chief administrative officer of Caltech in 1945 and became vice-president of the Institute Board of Trustees and professor emeritus of physics. He continued his research and writing. During the summer of 1947 he made cosmic ray studies which took him from Texas to Canada. And, until his final illness, he kept regular office hours at the Institute—his one concession to his age being to spend an eight-hour day there instead of the 16-hour one which used to be his standard.

Actively engaged in physics research since 1895, R. A.

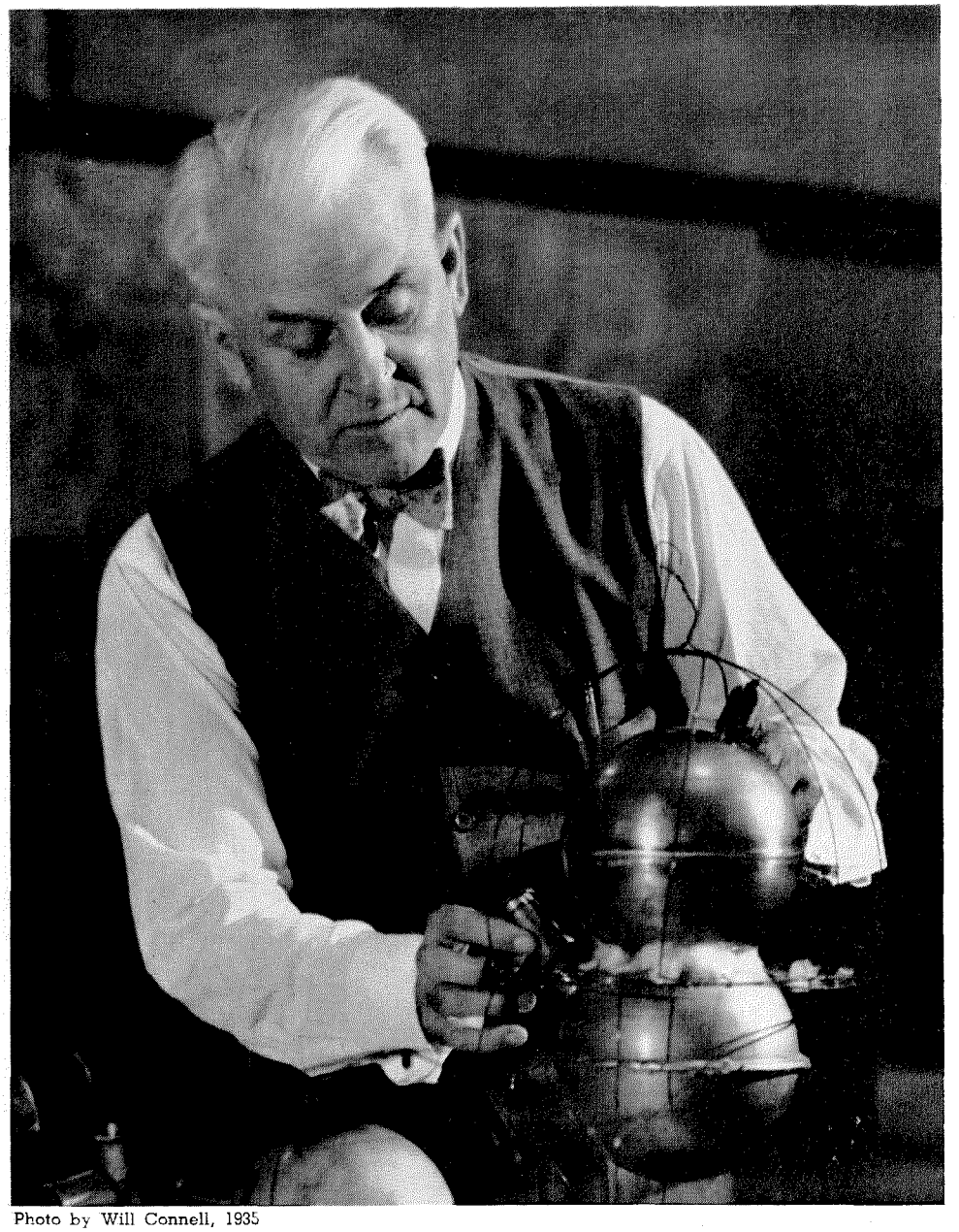


Photo by Will Connell, 1935

He performed a great service to science in calling attention to the significance of cosmic rays.

Millikan's name is synonymous with the development of 20th century physics in America. As President DuBridge has said:

"The present great strength and great activity of American physics—indeed of American science—are due in large measure to his achievements, his leadership, his influence, his keen vision in helping to establish on a national scale the firm foundation on which a thriving science could flourish."

Though he had a score of scientific contributions to his credit, Dr. Millikan became most widely known for his work on the isolation and measurement of the electron, for the photo-electric determination of the fundamental constant known as Planck's constant, and for the investigation of the character and distribution of cosmic rays.

His proof that electricity is composed of particles called electrons, that all electrons bear precisely the same electric charge, and his accurate measurement of that charge is one of the classic experiments of modern physics—and one which provided a foundation for modern theories of electricity and the structure of atoms.

The Nobel Prize

His precision measurement of the ratio of the energy of a photo-electron to the frequency of the light that ejects it reinforced the evidence for Einstein's theory of the photo-electric effect (that light, like matter, is atomic in structure and exists in particles or chunks of a definite size) and was an important step in establishing the photon theory of the nature of light. This work, along with his determination of the electronic charge, led to his selection in 1923 as the second American to receive the Nobel Prize in physics.

He performed a great service to science in calling

attention to the significance of cosmic rays (it was he, incidentally, who named this penetrating radiation in the atmosphere) and, with the help of his students, using them effectively for revealing new elemental components of matter.

Robert Andrews Millikan was born in Morrison, Illinois, on March 22, 1868. He was the son of the Rev. Silas Franklin Millikan, a Congregational minister who preached for 40 years in Illinois, Iowa and Kansas, and the former Mary Jane Andrews, who had been dean of women at Olivet College in Michigan. Robert was the second of six children.

Between the ages of seven and eighteen he lived in Maquoketa, Iowa, and was graduated from the Maquoketa High School in 1885. The next year he entered Oberlin College (his parents' alma mater) in Ohio, where he received his A.B. degree in 1891 and his A.M. in 1893.

Introduction to physics

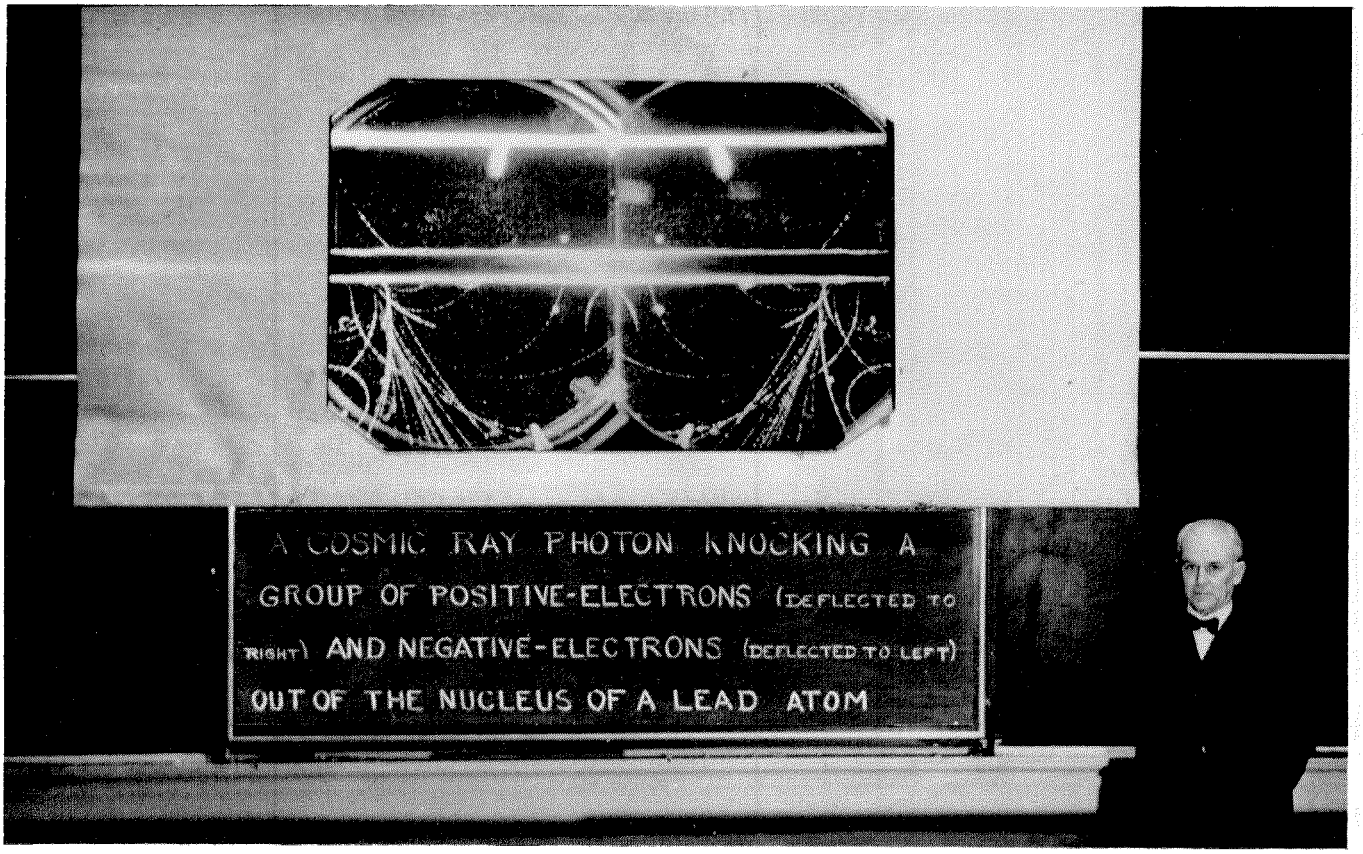
At Oberlin his major subjects were classical languages and mathematics. He was a good gymnast and athlete, and he worked as student director of the college gymnasium. He was, in fact, planning on a career in physical education when, in his junior year, he was asked to teach a class in elementary physics. ("Anyone who can do well in Greek can teach physics," he was told.) He had only had a one-semester course in the subject himself—and had considered it a complete loss because the textbook was dull and unintelligible—but as he studied on his own to prepare himself for teaching, he became completely absorbed in the subject.

Graduate studies

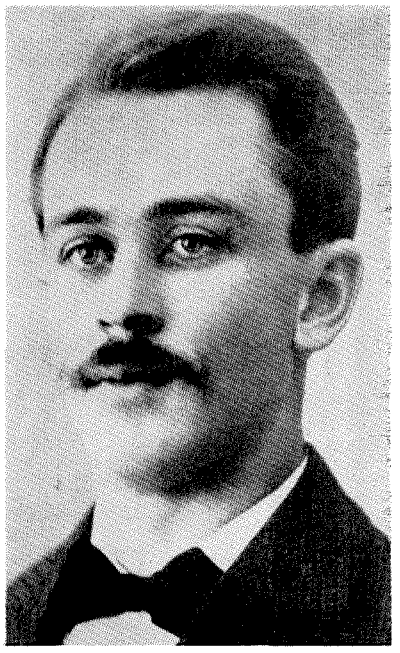
His interest grew during his next four years of part-time teaching and in 1893 he entered Columbia University for graduate work in physics. He was the only graduate student in this field. After receiving his Ph.D. in 1895, he spent a year abroad at the Universities of Jena, Berlin and Goettingen.

In 1896, at the age of 28, he was invited by Dr. A. A. Michelson, later the first American Nobel prizewinner in science, to come to the University of Chicago as an assistant in physics. By 1910 he had risen to professor of physics.

He was married in April, 1902, to Greta Blanchard of Oak Park, Illinois, whom he met while she was a student at the University. Mrs. Millikan died at their home in San Marino on October 10, 1953. They had three sons: Dr. Clark B. Millikan, professor of aeronautics and director of the Guggenheim Aeronautical Laboratory at Caltech; Dr. Max F. Millikan, professor of economics and director of the Center for International Studies at the Massachussets Institute of Technology; and the late Dr. Glenn A. Millikan, a physiologist who was fatally injured in a mountaineering accident in 1947.



R. A. Millikan giving a lecture in 1933, explaining how his students (in this case Dr. Carl Anderson) were using the cosmic rays to reveal new elemental components of matter.



Above: Robert Millikan's parents, the Reverend Silas Franklin Millikan and the former Mary Jane Andrews.

Left: Millikan as a young man.

Much of Dr. Millikan's time during his early years in Chicago was spent in reorganizing the undergraduate courses in physics—emphasizing laboratory experiments and problem-solving, and correlating classroom and laboratory work. These pioneering methods were widely adopted in this country, as were the new textbooks he and his colleagues found it necessary to write.

As time passed he was able to devote more of his efforts to his research and to non-academic endeavors. He acted as a consultant in many fields of industrial research and was one of the leaders in the foundation of the National Research Council, of which he became vice-chairman and executive officer. This body was organized in 1916 by the National Academy of Sciences to mobilize American scientific resources for the government and soon became a vital force in the nation's war effort.

War activities

Dr. Millikan was called to Washington in connection with war activities in March, 1917, and remained there until 1919. The National Research Council was designated as the department of science and research for the Council of National Defense, and Dr. Millikan also served on several other C.N.D. bodies, notably the General Munitions Board. He served throughout the war as one of the three civilian members of the Navy's Anti-Submarine Board and in July, 1917, was commissioned in the Army Signal Corps, serving as Lieutenant Colonel in charge of the Science and Research Division of the Bureau of Military Aeronautics. As a contemporary wrote, "There was hardly a single important military development of a scientific nature to which Millikan did not give personal attention."

He returned to the University of Chicago in 1919, and left to join Caltech two years later. He agreed to come to the Institute as director of the new Norman Bridge Laboratory of Physics—then one of the largest laboratories in the world devoted to research in pure physics—but he refused to accept the Caltech presidency. Instead, as he suggested, an Executive Council of trustees and faculty members was established to govern the Institute. Dr. Millikan became its chairman.

Paying tribute to Dr. Millikan on his 80th birthday in 1948, President DuBridge said:

"His new tasks (after coming to Caltech) were carried forward with such zeal, vigor and effectiveness that one who examines the history of his administrative achievements during the two decades after 1921 could

only be astonished that a single man could carry such a burden even though he gave it all of his time and attention."

His years at Caltech were among the most productive of his scientific career. And the Institute grew in stature as the ideals formulated by the astronomer George Ellery Hale, the chemist Arthur Amos Noyes, and Dr. Millikan began to be realized: A small institution devoted wholly to pure and applied science, based on the thesis that educating creative scientists could be accomplished only in an atmosphere of research.

The Chief

Many outstanding scientists were attracted to the Institute but most of all, said Dr. DuBridge, "these men were held together by the personal magnetism of 'The Chief' who personified these ideals."

Funds became available as needed, he added, "because Dr. Millikan and his associates acquired an extraordinary facility for capturing the imagination of leading men in the community, retaining their full confidence, and eliciting the essential support needed to meet urgent requirements to attain important goals."

In short, said Dr. DuBridge, "in his educational administration, as well as in his scientific work, Dr. Millikan's chief characteristic was imagination. His chief joy was entering new and unexplored fields. His greatest attributes were . . . vision and wisdom."

He was an exceptional teacher of research physics, as his colleague, Professor Paul S. Epstein of Caltech, has noted: "We find as his close associates, growing to manhood and fame in intimate collaboration with him, far more eminent physicists than can be accounted for by the law of averages. On the strength of this record, (he) must be classed as one of the most successful teachers in the history of science."

Honors and awards

His honors were many. He was awarded 25 honorary degrees, seven of them by foreign universities. He received, among numerous other awards, the Hughes Medal of the Royal Society of Great Britain, the Faraday Medal of the London Chemical Society, the Oersted Medal of the American Association of Physics Teachers, and the decoration of Commander of the French Legion of Honor. He was awarded the Presidential Medal for Merit for his outstanding services during World War II.

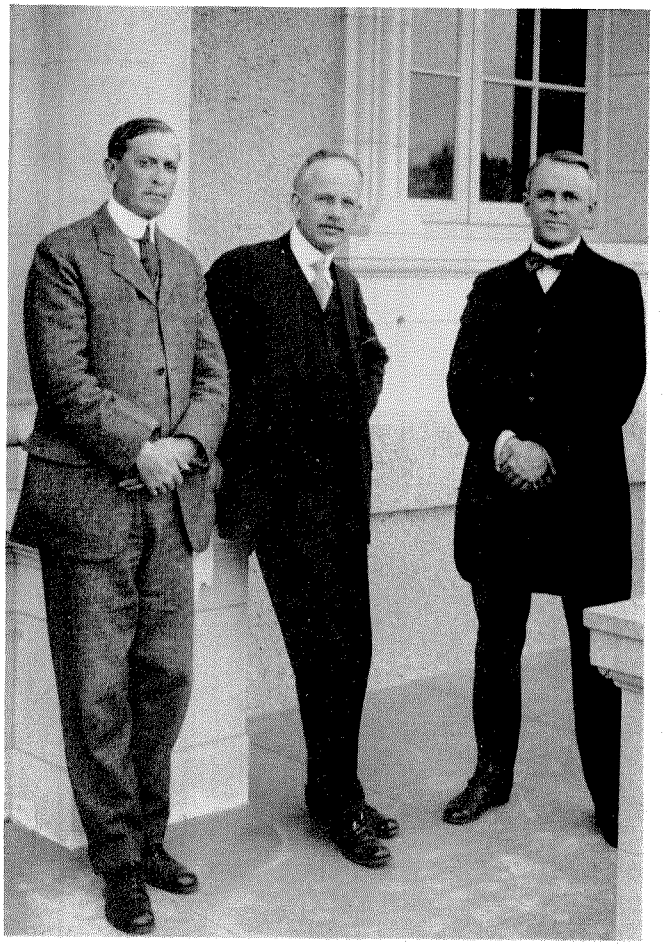
He was a member or honorary member of many American and foreign learned societies and had held various offices in the National Academy of Sciences, American Physical Society, American Philosophical Society and American Association for the Advancement of Science.

Dr. Millikan was active for many years in civic affairs in Los Angeles and Pasadena. He was chairman of the Board of the Henry E. Huntington Library and Art Gallery in San Marino, a member of the Board of the Neighborhood Church in Pasadena, and a member of the Advisory Committee of the Los Angeles County Hospital. He received the highest honor of the City of Pasadena, the Arthur Noble Award, conferred for outstanding community service.

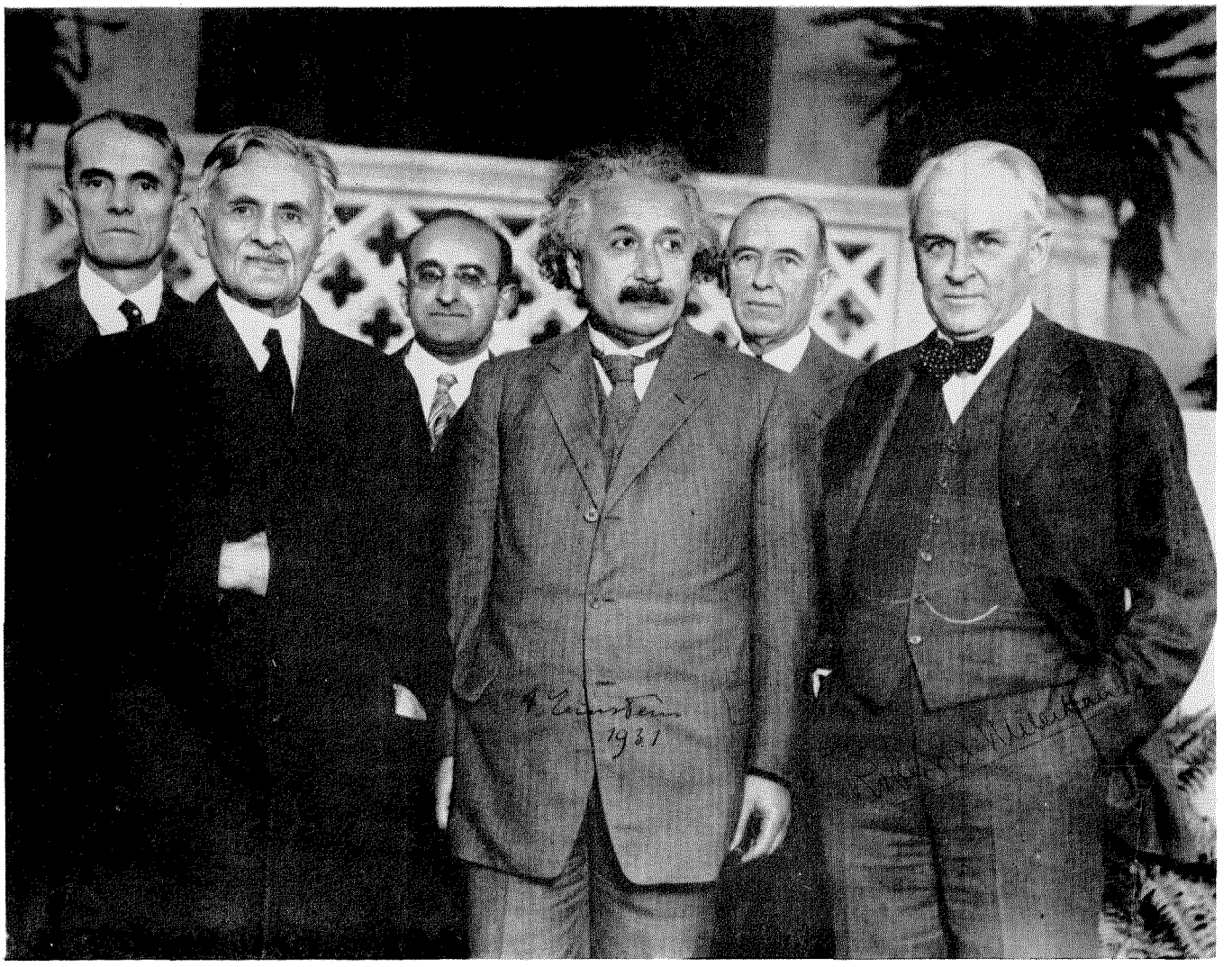
He was the author or joint author of a score of books, the first, *A College Course in Physics* published in 1898. This was followed by a dozen other textbooks for secondary school or college use, some of which are still standard works. He also wrote a number of books of a philosophical nature, such as *Evolution in Science and Religion*, *Science and the New Civilization*, and *Time, Matter and Values*. His latest book was his autobiography, published in 1950.

Religion, to him, was not the antithesis but the complement of science. "Human well-being and all human progress," he wrote in his autobiography, "rest at bottom upon two pillars, the collapse of either one of which will bring down the whole structure. These two pillars are (1) the spirit of religion, (2) the spirit of science (or knowledge)."

"The purpose of science," he wrote—quoting a statement he had helped prepare, in 1923 with a group of leaders in science, religion and public affairs—"is to develop, without prejudice or preconception of any kind, a knowledge of the facts, the laws, and the processes of nature. The even more important task of religion, on the other hand, is to develop the consciences, the ideals, and the aspirations of mankind."



Arthur Noyes, George Hale and Robert Millikan in 1921 —shortly after Millikan became head of Caltech.



A. A. Michelson, Albert Einstein and Robert Millikan, at the Athenaeum, 1931. In the back row are Walter Adams, director of the Mt. Wilson Observatory; Einstein's assistant; and Max Farrand, director of the Huntington Library.

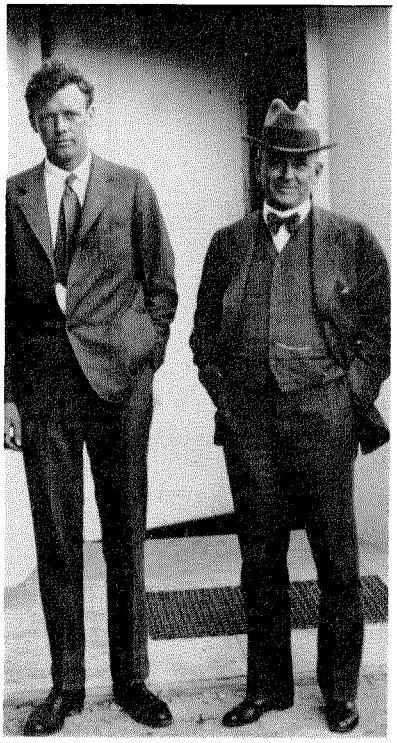
DISTINGUISHED COMPANY

Mr. and Mrs. Herbert Hoover

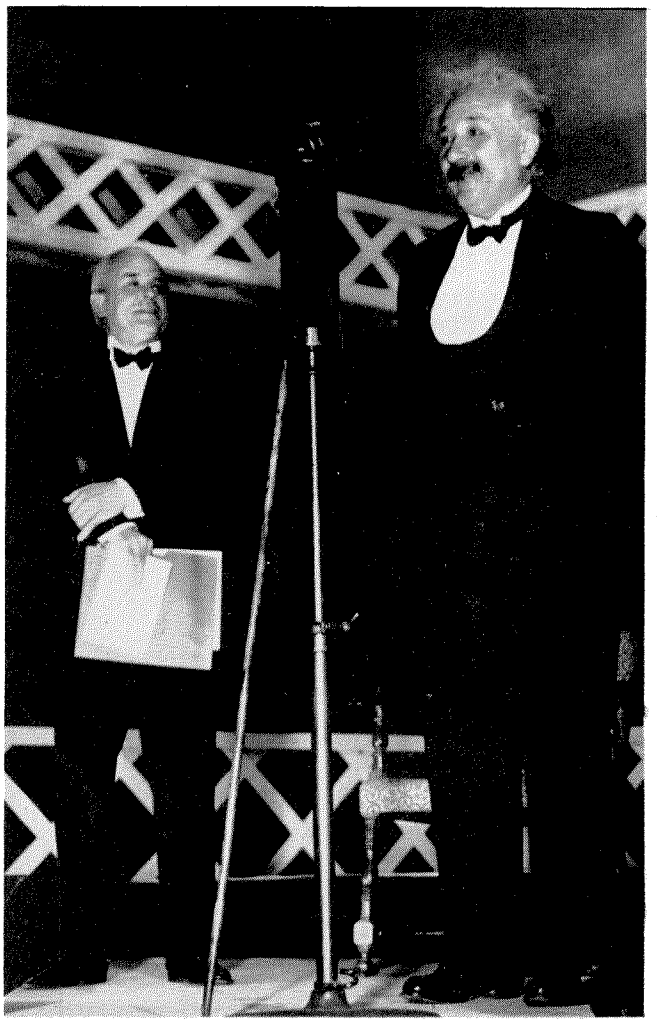
A man with as many interests as Robert Millikan meets a good many different kinds of people. The pictures on these pages, from Dr. Millikan's own collection, record a few of these meetings.

G. Lemaitre, 1933

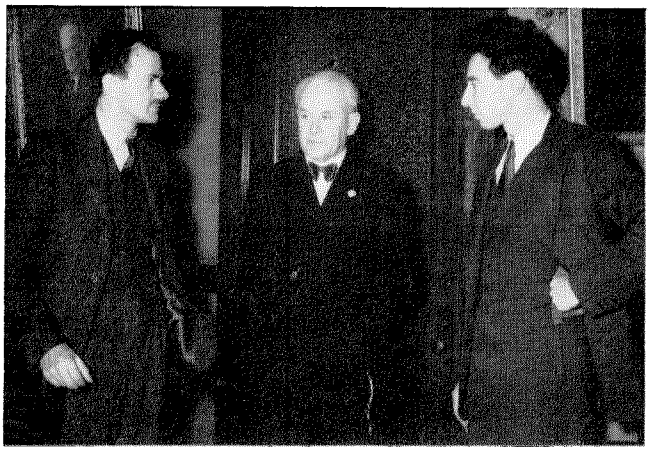
Sir James Jeans, 1931



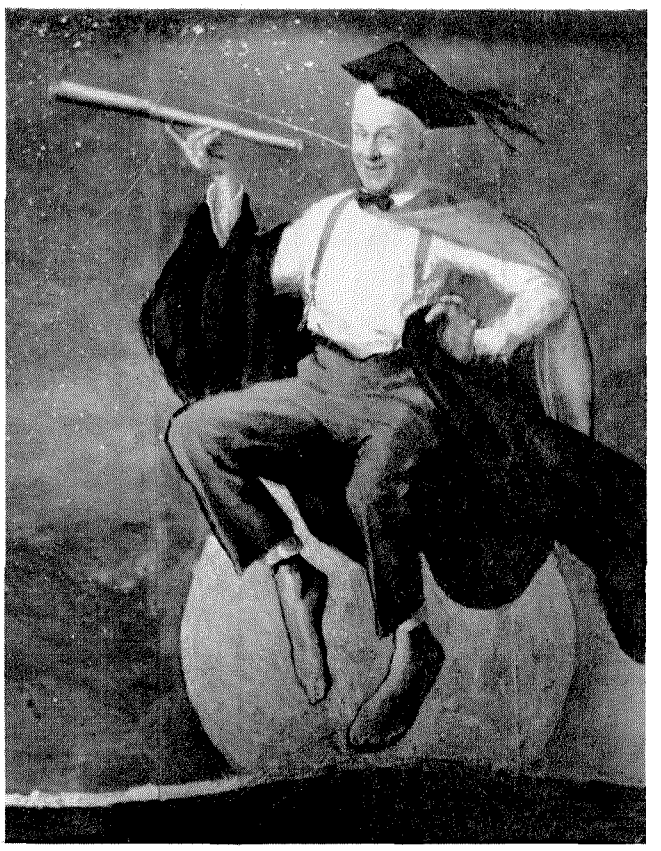
Charles Lindbergh, Jr.



Albert Einstein →



Paul A. M. Dirac and J. R. Oppenheimer, 1935



Above: The famous caricature by Arthur Cahill, done in 1936. A huge (12' x 15') colored crayon drawing, it hangs in the basement of the Athenaeum on campus.

Below: Luncheon at the Huntington Library in 1947—two years after his retirement as head of Caltech—with James R. Page and William B. Munro.

energies made available by the development of nuclear physics. So we asked the Caltech alumni their opinions on government promotion and subsidy of research in the fields of social and physical science.

Fifty percent of them agree that this support should be given in the physical sciences, hut only 42 percent think it should be given in the social sciences. Thirty-nine percent think it should not be applied to the physical sciences, whereas 43 percent think it should not be applied to the social sciences. The difference is small, but it is rather surprising in the light of the constant pressure on Congress to appropriate additional funds for basic research in the sciences.

Our alumni, then, have not completely sold out to science and the scientific method, either as a way to explain all of the worth-while and important concepts in life, or as an activity that should have the complete and all-out support of the federal government.

So much for the Caltech alumni as scientists. Where do they stand on other matters of opinion? Are they isolationists or internationalists? Are they for or against the New Deal? Where do they stand on civil rights?

The Internationalist and the Isolationist

Several of the items in the opinion part of the questionnaire dealt with these questions. The chart on page 17 groups six statements which might be taken to indicate internationalist or isolationist sentiments. No one of these statements could be taken as an adequate criterion by itself, and a good argument might be made for answering several of the items in either direction. However, we do come closer to an adequate description if we first tabulate the original statements and then word them in such a way that agreement is always in the direction of Internationalist. The Caltech alumnus who agrees with five or all six of the statements can then be called an Internationalist; the graduate who agrees with none, one, or two is an Isolationist; and the remainder are In-between. By this standard, 39 percent are Internationalist and 17 percent are Isolationist. Compared with U. S. graduates, the Caltech alumni are more Internationalist and less Isolationist.

As might be expected, age has an important influence on the graduate's opinion of the United States' role in world affairs. The older one becomes, the more one swings toward isolationism; while only 12 percent of our alumni under 30 are isolationist, 31 percent of those over 50 are.

Isolationists	CIT	U.S.
Over 50	31%	31%
40 to 49	21	24
30 to 39	15	20
Under 30	12	18

The problem of race prejudice

Four of the opinion statements presented to the alumni for agreement or disagreement concerned the problem of race prejudice, or the place of minority groups in America. The chart below shows how our graduates replied to these statements. Obviously there is some question whether these figures actually represent the way our graduates feel and act, as there is bound to be a certain amount of lip service paid to the ideal of complete tolerance. However, the same considerations apply to the figures for the U. S. graduate, so we can still make the point that seems most significant here—namely, that the Caltech alumni when compared with college graduates in general are consistently more tolerant and less prejudiced on every statement.

The tolerant and the prejudiced

Here again we can combine the replies to these statements in the same manner that we did for Internationalists and Isolationists. In this case, let us say that agreement with all four indicates a tolerant attitude on these matters, agreement with three is in-between, and agreement with none, one, or two indicates prejudice. If we do this, it turns out that 53 percent of our alumni are tolerant and 19 percent are prejudiced. If we break these figures down by age and compare them, we find a steady progression from tolerant to prejudiced atti-

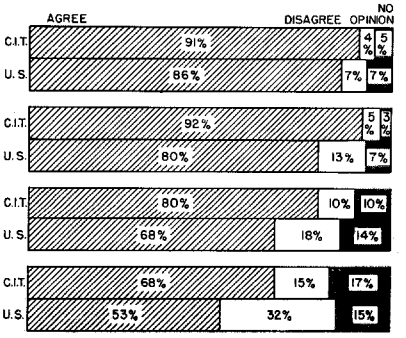
ALUMNI OPINIONS ON MINORITIES

Children of minority groups or other races should have equal opportunity in social, economic and political affairs.

All Americans—Negroes, Jews, the foreign born and others—should have equal opportunity in social, economic and political affairs.

It is not true that foreigners usually have peculiar and annoying habits.

It is not true that agitators and trouble makers are more likely to be foreign born citizens than native Americans.



THE CALTECH ALUMNI

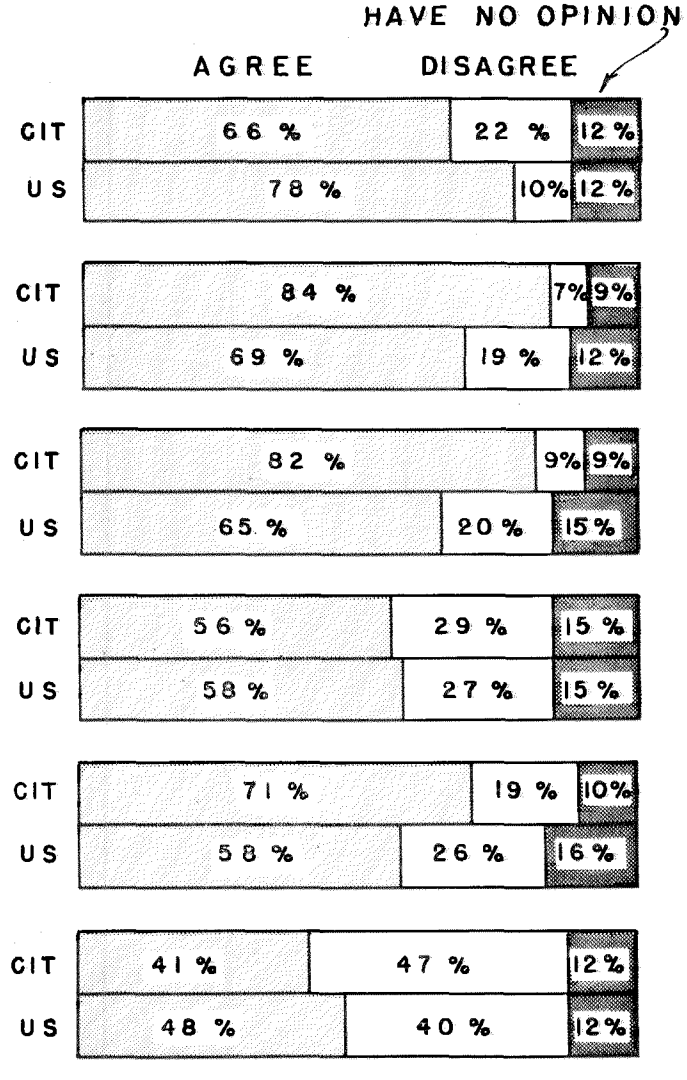
III. Opinions and Civic Activities

THE CALTECH ALUMNI were trained in science and scientific thinking: therefore their views on scientific matters should be of considerable interest to the rest of the world. A majority of them, 79 percent, feel that "There are many worth-while and important concepts which cannot be proved scientifically." We have already (*E&S*—December 1953) found two-thirds of them disagreeing with the statement, "Religion has little to offer intelligent, scientific people today." Apparently the great majority of our alumni do not believe that science and the scientific method can provide the answers to all the questions of life.

For several years now the papers and magazines have been filled with discussions and speculations about the many fundamental changes in our economic and social order which will be brought about by the harnessing of atomic energy—with the expectation that there will be fundamental changes. Sixty-one percent of our alumni agree. However, a more startling result is that 30 percent, or almost one in three, do not agree with this view! This points to either a considerable difference of opinion or difference of information among the men who should be most aware of the ultimate effects of the harnessing of atomic energy.

The Caltech alumni are graduates of the physical or the biological sciences rather than the social sciences. However, many scientists in both of these fields seem to agree that our knowledge of the physical world has outstripped our knowledge of the social world. They also say that the social sciences have not developed rapidly enough to devise methods and techniques for the proper social and cultural utilization of the tremendous

ALUMNI OPINIONS ON INTERNATIONAL AFFAIRS



A TRIBUTE TO ROBERT MILLIKAN

by

THE REVEREND

CURTIS BEACH

Pastor of the Neighborhood

Church of Pasadena

"ESCORTED by great thought, this star of virtue revealed to us blind mortals the hid eternities." These words which Michelangelo wrote in tribute to Dante seem to be a worthy tribute to Robert Andrews Millikan. "Escorted by great thought," he *was* a "star of virtue," and he did help us to open our eyes, and see "*the hid eternities.*"

No one is unfamiliar with his work as a scientist. Through his researches in the field of physics, he has helped men to know more of the nature of this universe, our home. But his interest was not bounded by the laboratory. His knowledge was encyclopedic; and there was no subject concerning the development of human culture with which he was not familiar.

This universe which he explored he saw as primarily spiritual. He approached it with the reverence of a man of God. To him the universe was but the outer garment of the cosmic Mind. He liked to speak on the harmony of science and religion, for to him science was but one avenue to the God who must also be known through faith. He gave much of his time to helping others see this harmony, and to understand that knowledge and religion can never have a conflict between them.

His faith was expressed in the words of Einstein which he loved to quote: "It is enough for me to contemplate the mystery of conscious life, perpetuating itself through all eternity—to reflect upon the marvelous structure of the universe, which we can but dimly perceive—and to try humbly to comprehend even an infinitesimal part of the Intelligence manifested in nature."

He continually gave himself for others, in countless ways. The breadth of his concern for other human beings embraced all humanity. It is expressed in the "standard of duty," which he often quoted from Montesquieu: "If I knew something beneficial to myself, but harmful to my family, I would drive it out of my mind. If I knew something advantageous to my family, but injurious to my country, I would try to forget it. If I knew something profitable to my country, but detrimental to the human race, I would consider it a crime." To him, the largest duty was to the world.

But to us who knew him well, especially in the little church which he loved, perhaps the chiefest mark of his greatness was his humility. Never ostentatious, he wore his laurels easily, never feeling other than just one among men. Of all virtues, the one which he prized and practiced most fully was sincerity. That was why men so truly loved him.

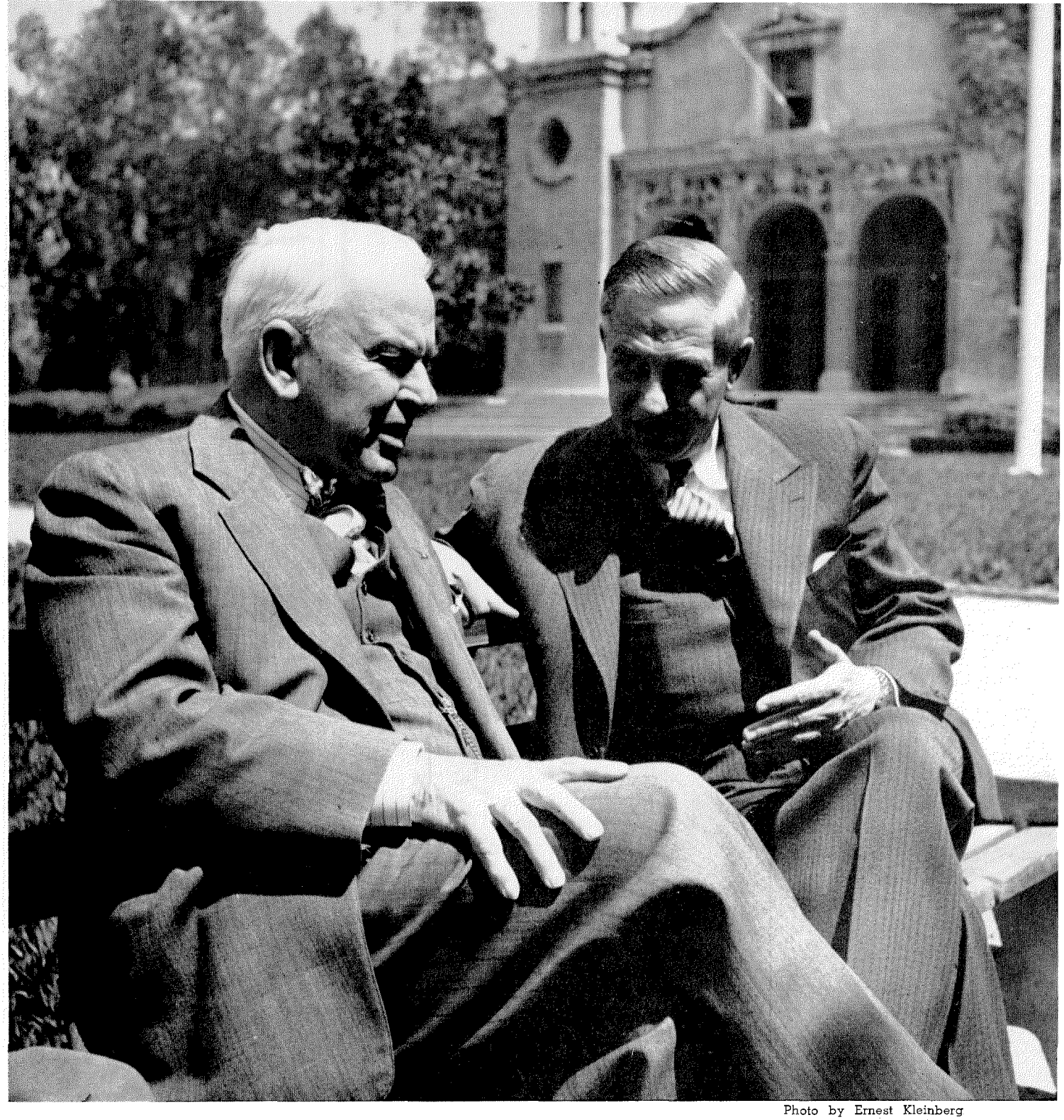


Photo by Ernest Kleinberg

Conference on the campus with President DuBridge, his successor as head of Caltech — in April, 1951.

ALUMNI OPINIONS ON GOVERNMENT

	AGREE	DISAGREE	NO OPINION
Democracy depends fundamentally on the existence of free business enterprise.	C.I.T. 71%	23%	6%
	U.S. 72%	18%	10%
The best government is one which governs least.	C.I.T. 60%	32%	8%
	U.S. 52%	35%	13%
Government planning should be strictly limited for it almost invariably results in the loss of essential liberties and freedom.	C.I.T. 65%	28%	7%
	U.S. 51%	36%	13%
Individual liberty and justice under law are not possible in Socialist countries.	C.I.T. 36%	50%	14%
	U.S. 46%	33%	21%

tudes with increasing age. However, even at 50 our alumni are considerably less prejudiced than the U. S. graduates of the same age.

Prejudiced	CIT	U.S.
Over 50	37%	47%
40 to 49	22	34
30 to 39	15	29
Under 30	17	24

Every man for himself?

The final group of opinion items to be discussed is concerned with statements about government. They are listed in the chart above, together with the percentages of agreement and disagreement among the Caltech and the U. S. graduates. We have chosen to call agreement with these statements "anti-New Deal." Not that they are exact measures of pro- or anti-New Deal sentiments; such a series of statements would, in fact, be impossible to obtain. In general, though, a strong anti-New Dealer would be inclined to agree with all of these statements and a strong pro-New Dealer to disagree. So we have defined an individual who agrees with three or four of these statments as an anti-New Dealer and a person who agrees with none, one, or two as pro-New Deal.

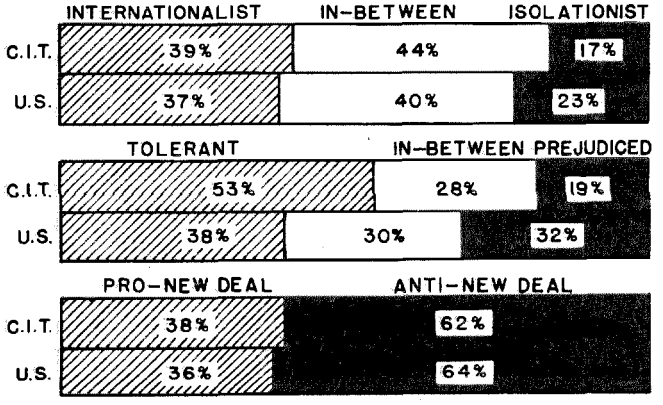
When this breakdown is made below it turns out that our alumni are markedly anti-New Deal (62 percent). Only 38 percent are classified as pro-New Deal. These are about the same percentages as Havemann and West found among U. S. graduates.

Neither the Caltech alumni nor the U. S. college graduates could be called radical—particularly when opinions like these are obtained in the face of 20 years of political emphasis in the opposite direction. On the other hand, preferences for individual initiative, freedom of academic and social mobility, and a sink-or-swim, every-man-for-himself philosophy are just what one would expect from college graduates. For they are the segment of the U. S. population most apt to have the background, the intelligence, the education, the resourcefulness and the resolution prerequisite to achieving maximum life satisfaction under such conditions.

As usual, age makes a difference. The older one becomes the more one's sentiments become anti-New Deal. Thirty-eight percent of our alumni under 30 are anti-New Deal, in contrast with 79 percent of those over 50.

Anti-New Deal	CIT	U.S.
Over 50	79%	80%
40 to 49	61	71
30 to 39	48	62
Under 30	38	49

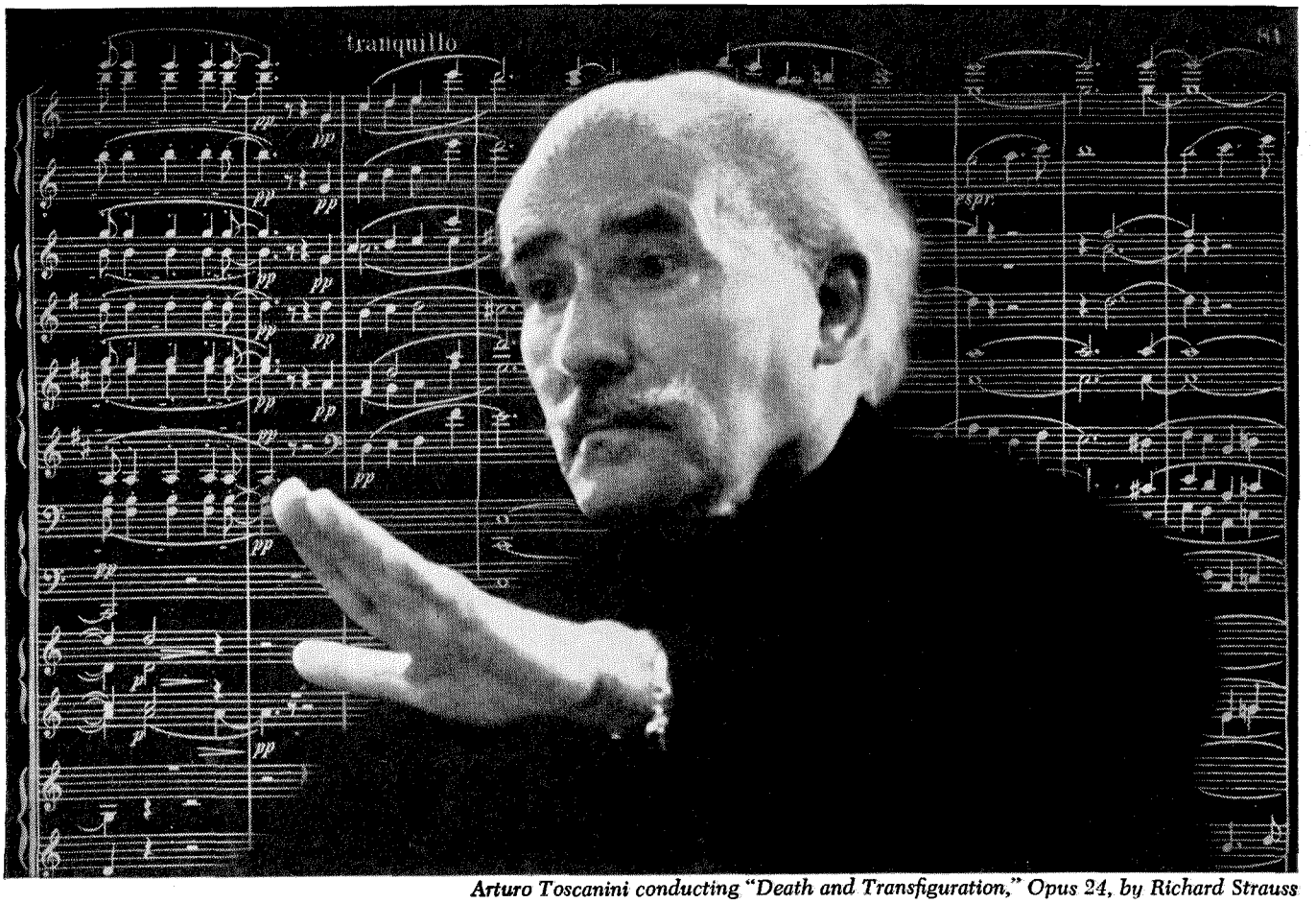
ALUMNI OPINION IN THE U. S. AND AT CALTECH



Minds of their own

The chart at the left summarizes all these figures. U. S. college graduates are internationalist, tolerant and anti-New Deal. Caltech graduates are similar—but different. They are a little more internationalist, much more tolerant, and a little less anti-New Deal. Can anything be made of these differences? We think so.

Our Caltech alumni are Protestant—even more so than college graduates in general. So our alumni opinions should differ from U. S. graduates' opinions in the direction of the opinions of Protestants. But Protestants



Arturo Toscanini conducting "Death and Transfiguration," Opus 24, by Richard Strauss

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RCA Victor High Fidelity is the result of 50 years of leadership in recorded music, phonograph research and development of radio and motion picture sound. It is a new dimension in sound created by the perfect union of recorded music and the phonograph.

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"Victrola"® phonographs, Victor records, and "intermatched" high fidelity equipments for those who want to assemble their own units—all are designed to work together to bring the brilliance of the original performance into the home. Now, with RCA High Fidelity instruments, you can hear the full gamut of the orchestra—from the shimmer of the cymbals to the beat of the tom-tom. Your favorite music sounds just as if you were in the presence of the recording orchestra and artists.

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The nation-wide interest in high fidelity reflects a growing taste for the highest quality music. Developments by RCA scientists and engineers now let you enjoy this new musical experience. Visit your RCA Victor dealer and hear the new Hi-Fi models of "Victrola" phonographs, Victor records and "intermatched" components.

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- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

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Also many opportunities for Mechanical and Chemical Engineers and Physicists.

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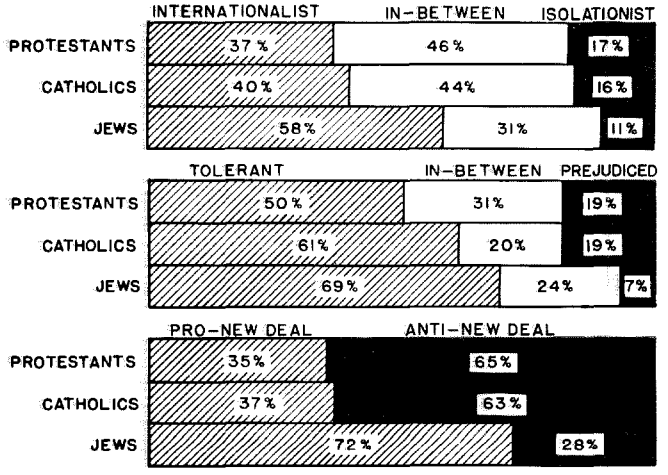
RELIGION AND OPINIONS OF CALTECH ALUMNI

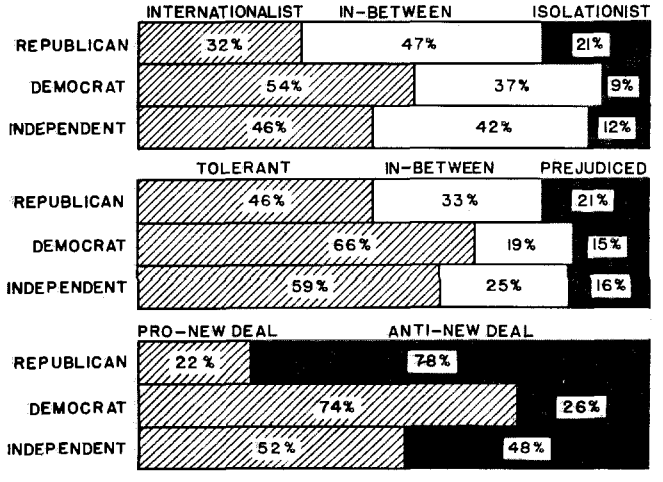


—of the three religious affiliations tabulated on the chart above—are the *least* internationalist and tolerant, the *most* anti-New Deal. The Caltech alumni are just the opposite, in every case. Apparently they are not "good" Protestants.

Similar considerations hold for political affiliations. The Caltech alumni are preponderantly Republican—again more so than the U. S. graduates. So our alumni opinions, when compared with the U. S. graduates' opinions, should be more like the opinions of Republicans. But again they fail to be so! As the chart below shows, among the political affiliations we have tabulated, the Republicans are the *least* internationalist and tolerant, the *most* anti-New Deal. Again they are just the opposite of what we would expect. Apparently they are not "good" Republicans either.

Instead of our more Protestant, more Republican graduates being less internationalist, less tolerant and more anti-New Deal than U. S. grads, they are just the opposite. Is it a matter of the youth of our alumni? Undoubtedly this is a partial explanation—but only a partial one, for these differences hold at any age. The rest of the explanation may be attributed to the independence of thought already commented on (*E&S*—December 1953).

POLITICS AND OPINIONS OF CALTECH ALUMNI



The Caltech alumni are just simply not intellectual sheep. They may identify themselves as Protestants or Republicans, but they have little hesitation in departing from the fold if in their opinion the facts so dictate. Which is as it should be. This is just the sort of independence from conformity and dogma that we think a Caltech education ought to produce.

Leaders who don't lead

So far, so good. Caltech alumni are young, active, self-reliant, well educated, tolerant and internationalist. They have prestige and status, independence of thought, and the scientific training helpful in devising new solutions for old problems.

Such blessings imply considerable responsibility. The scientists and engineers are the new leaders in America. Are the Caltech alumni assuming this leadership? Here is another important question for which we have no adequate answer. But we do have data which will throw some light on the question. Our alumni were asked to indicate the number of civic affairs in which they had participated. Havemann and West considered this matter from the standpoint of the specialists (doctors, lawyers, and dentists), who majored in their undergraduate studies in humanities and social sciences, versus those who majored in pre-professional courses. They tabulated the participation in community activities of these two groups, with the following results:

The Number of Doctors, Lawyers, and Dentists Reporting Seven or More Civic Activities

Those who majored in the humanities or social sciences	42%
Those who majored in pre-professional courses	30%

Among our Caltech alumni only 17 percent report seven or more civic activities. This is a rather meagre contribution to community affairs from a group that should be in the forefront of such activities. Of course, we must keep this matter of age in mind. Our alumni are young, and it takes time to accumulate sufficient economic and social security to have the time and opportunity to assume community leadership. Yet our older alumni do not seem to assume this leadership to any great extent. While 6 percent of our alumni in their 20's engage in 7 or more civic activities, and 17 percent of those in their 30's, only 31 percent of those in their 40's do so, and 32 percent of those in their 50's.

But the goal remains. And it seems to us it is the responsibility of the well-trained and clear-thinking Caltech alumni to make a contribution to the community commensurate with their training, capacity and influence.

This is the third of a series of articles on the alumni survey. Next month Dr. Weir, the man responsible for the survey, will discuss alumni incomes.

Awards that foretell your gain

Chemicals from coal hydrogenation...

...acclaimed the 1953 *Chemical Engineering Achievement!*

IN 1933 Carbide received the first Chemical Engineering Achievement Award. This recognized the beginning of commercial production of much-needed chemicals from petroleum and natural gas—which proved to be the beginning of the American petrochemical industry.

HISTORY REPEATS—Now, just twenty years later, Carbide has received the 1953 Chemical Engineering Achievement Award for "the first successful production of chemicals from coal by a high pressure hydrogenation process."

In minutes, coal becomes gases and liquids rich in needed chemicals—"one of the major contributions in this century to the well-being of us all."

Some of these chemicals are used in making plastics, synthetic rubber, pharmaceuticals, vitamins, and many other things. Others are completely new and hold great promise.

FOURTH RECOGNITION—Carbide is the first two-time individual recipient of this award. It also is the fourth time the people of Carbide have been recognized, for they shared in two previous group awards—in 1943 for synthetic rubber, and in 1946 for atomic energy.

TRUE SIGNIFICANCE—As in all Chemical Engineering Achievement Awards, coal hydrogenation was recognized not as the accomplishment of any one individual but as the result of the cooperative efforts of many.

The people of Union Carbide appreciate the recognition of their achievement by the distinguished Committee of Award, composed of senior chemical engineering educators.

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LINDE Oxygen
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ALUMNI NEWS

Alumni Fund and Scholarships

THE ALUMNI FUND campaign begins next month. Our new goal is to raise $75,000 to provide an endowment for undergraduate scholarships. As announced in the December issue of *E&S*, attainment of this goal will make it possible for each class to have one Alumni Scholar.

If the alumni contribute generously enough now it will be possible to provide for an Alumni Scholar in the freshman class enrolling next fall. Thus alumni can both donate to a project and see it as a going concern in the same year.

There is no question that the Institute needs extension of its scholarship program, and here is one place we can all provide tangible help. We feel there is no more fitting expression of this need than the accompanying letter from President DuBridge.

—Robert R. Bennett & Allen Ray
Directors in Charge of the Alumni Fund

December 4, 1953

To the Caltech Alumni:

It is with the greatest pleasure that the faculty and administration of the California Institute received the news that the Alumni Association intended to make the next goal of the Alumni Fund an endowment for scholarships. It would be hard to think of a more worthy or a more important project which the Alumni could undertake.

Caltech is a quality school. We are not interested in increasing our enrollment and we have far more applicants than we can possibly accept. It is, however, terribly important to us that the best of these applicants for admission actually come to the Institute. When one of these top applicants fails to come to Caltech for financial reasons he leaves a hole which is not adequately filled by admitting someone of lower qualification. A student already admitted to Caltech who is forced to withdraw for financial reasons leaves a similar hole.

The resources of Caltech are aimed at the top student and they are adequate to give the best possible educational program to such students. These resources are partly wasted when the top students who best can use them do not come or remain at Caltech for financial reasons.

Of course every student attending Caltech is the recipient of a handsome scholarship. The cost of education here is far greater than the $600 a year which the student contributes. Many people over many years have contributed the funds which make it possible for Caltech to operate a program whose quality is so high for its cost. The Alumni, by contributing scholarship funds, are eliminating the last barrier for our attainment of a student body selected solely for personal and intellectual qualities and not on the basis of the family financial resources.

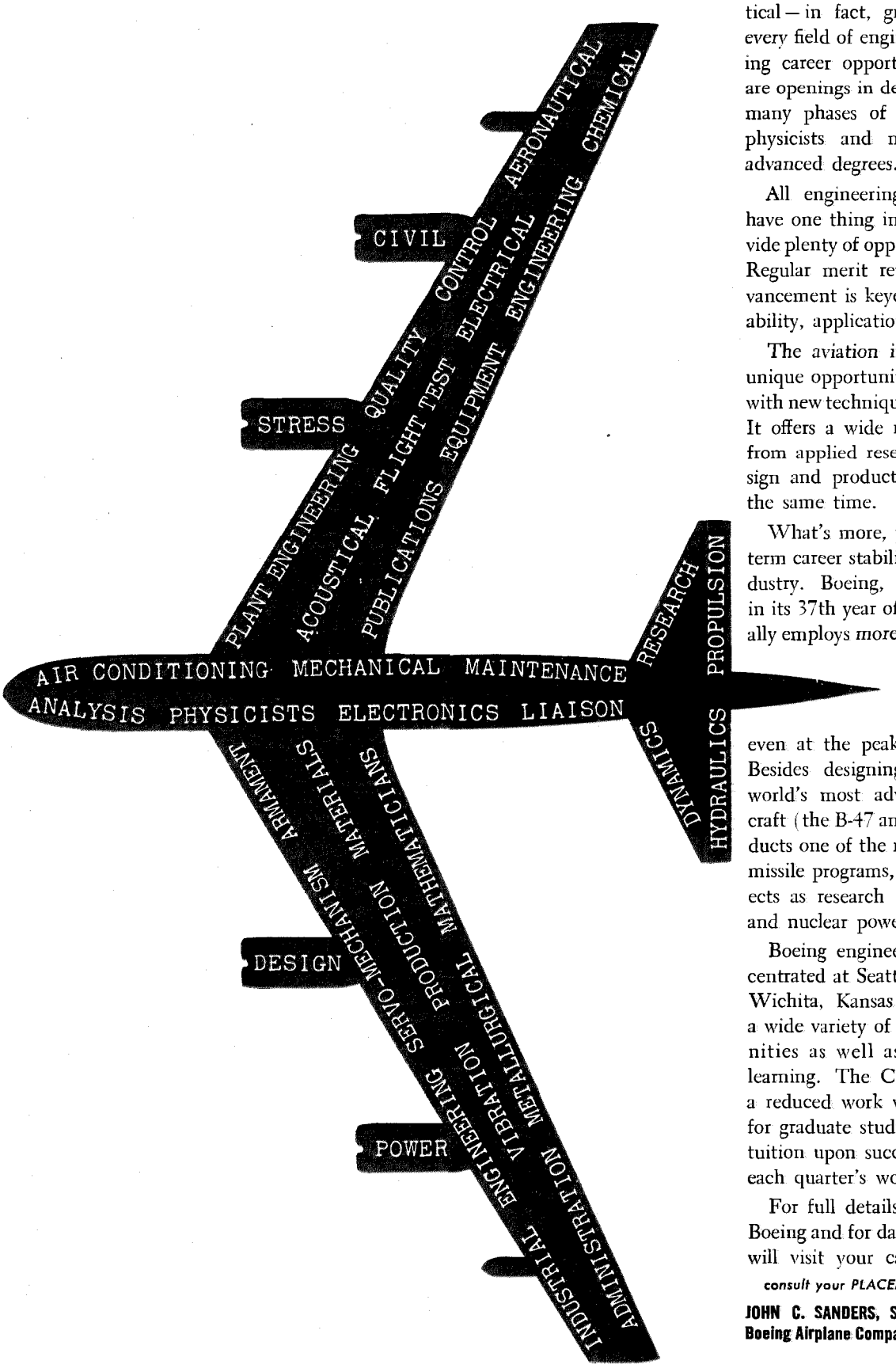
Many an alumnus has himself received a scholarship grant while a student. Every alumnus paid less than the cost of his education. This new project of the Alumni Fund gives to each alumnus a chance to help able students of the future in the way he was helped in the past.

I congratulate the Alumni on their far-sighted generosity. I am confident that their fund will be as successful in meeting this new goal as it was in meeting the last one.

Sincerely yours,

L. A. DuBridge

Engineers of virtually EVERY type are needed on the Boeing team



Mechanical, electrical, civil, aeronautical — in fact, graduates in virtually every field of engineering—find rewarding career opportunities here. There are openings in design, research, in the many phases of production, and for physicists and mathematicians with advanced degrees.

All engineering careers at Boeing have one thing in common: they provide plenty of opportunity to get ahead. Regular merit reviews are held. Advancement is keyed to your individual ability, application and initiative.

The aviation industry offers you a unique opportunity to gain experience with new techniques and new materials. It offers a wide range of application, from applied research, to product design and production, all going on at the same time.

What's more, you can expect long-term career stability in the aviation industry. Boeing, for instance, is now in its 37th year of operation, and actually employs more engineers today than even at the peak of World War II. Besides designing and building the world's most advanced multi-jet aircraft (the B-47 and B-52), Boeing conducts one of the nation's major guided missile programs, and such other projects as research on supersonic flight, and nuclear power for aircraft.

Boeing engineering activity is concentrated at Seattle, Washington, and Wichita, Kansas — communities with a wide variety 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 reimburse tuition upon successful completion of each quarter's work.

For full details on opportunities at Boeing and for dates when interviewers will visit your campus,

consult your PLACEMENT OFFICE, or write:

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

BOEING

PERSONALS

1920

Elbridge A. Goodhue died in St. Louis, Missouri on June 9, 1953. He was an associate professor of mathematics at the School of Mines and Metallurgy of the University of Missouri.

1925

Thomas P. Simpson is now assistant director of manufacturing of the General Petroleum Corporation in Los Angeles. Tom joined General Petroleum in 1924, but was transferred to the Socony-Vacuum Oil Company in 1935, where he has been director of the research and development laboratories at Paulshoro, New Jersey for several years.

1926

Arnold S. Lutes, Ex., is currently employed by the Oerlikon Tool and Arms Corporation of America at their new plant near Asheville, North Carolina. They are engaged in the development and production of rockets, guns, shells, machine tools, ballistic instruments and office computing equipment. Arnold is chief of the rocket and range section under Col. L. A. Skinner, vice-president and manager of the department of engineering. Col. Skinner may be remembered as Ordnance Liaison Officer for the Jet Propulsion Laboratory.

1927

James Boyd was recently appointed chairman of the National Science Foundation's Committee on Mineral Research. He now lives in Scarsdale, New York.

1932

Guy Waddington, Ph.D., working in the Bartlesville, Okla., petroleum experiment station of the Bureau of Mines, recently received from Interior Secretary McKay the department's highest honor—the distinguished service award with gold medal. Guy was chosen for his contribution to science as a physical chemist and as chief of the thermodynamics branch of the experiment station. An outstanding contribution under his direction at the station has been the development of a calorimeter with which heats of combustion of sulfur compounds have been obtained with great accuracy.

1935

Jackson Edwards, Engr., was elected to membership in The Representatives of Electronic Parts Manufacturers. He operates his own business in Hollywood uuder the name of Jackson Edwards & Co., and represeuts a group of eastern manufacturers of technical electronic equipment. The Edwards have two daughters and live in the Hollywood Hills.

George Tooby recently sold the consulting engineering practice which he operated for ten years at River Falls, Wisconsin, under the name of George Tooby & Associates. He is now executive vice president and general manager of the Western Condensing Company, which operates 36 plants in the dairy industry in the northern United States and Canada.

1936

Lt. Gen. Leon W. Johnson, M.S., was appointed Senior Air Force Representative to the Military Staff Committee of the United Nations in July of last year. In March, he was elected president of the Congressional Medal of Honor Society, Inc. He also received the Distinguished Service Medal Award for work done with the Third Air Force in England during the period August 1948 to February 1952.

David Harker, Ph.D., is director of the protein structure project at the Polytechnic Institute of Brooklyn. He is also chairman of the U. S. National Committee on Crystallography in 1954, and alternate delegate for the U. S. to the Assembly of International Union of Crystallography, in Stockholm in 1951 and in Paris in 1954. Dave also reports that his daughter, Tatiana, was married in October.

1937

Hugh M. Gilmore, Jr., Ex., is now in the accounting department of the Atlantic Coast Line Railroad in Wilmington, N. C. Prior to this he was a high school teacher in mathematics and science in both California and North Carolina, but finds this new field much more lucrative. His outside activities include the Wilmington Choral Society and managing the Sword and Mask, a newly formed fencing club.

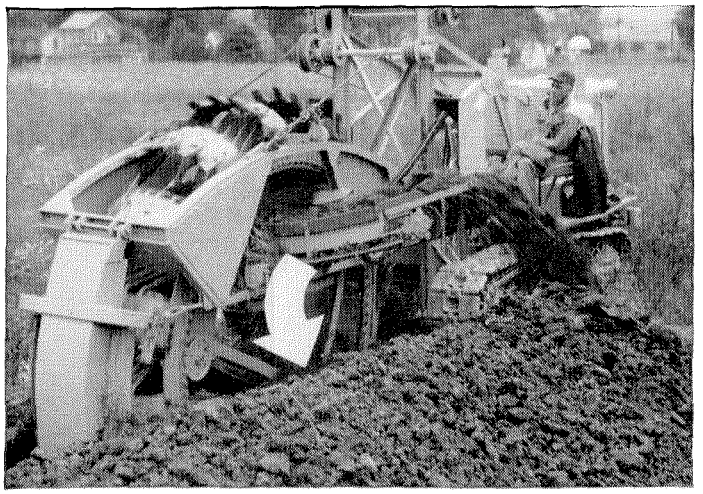
Irving Berler, M.S., was recently promoted to research engineer at the Sperry Gyroscope Division at Great Neck, New York. Irv is married and has a son.

1939

Warren E. Wilson, M.S., became Director of the Engineering Sciences Division, Office of Ordnance Research, at Duke University on September 1, 1953. He succeeded *Newman Hall*, Ph.D. '38, who held the position during the preceding year. From July 15, 1948 to August 31, 1953 Warren was president of the South Dakota School of Mines and Technology.

Victor Wouk, Ph.D., says the Beta Electric Corporation in New York City—of which he is president and chief engineer

Another page for **YOUR BEARING NOTEBOOK**

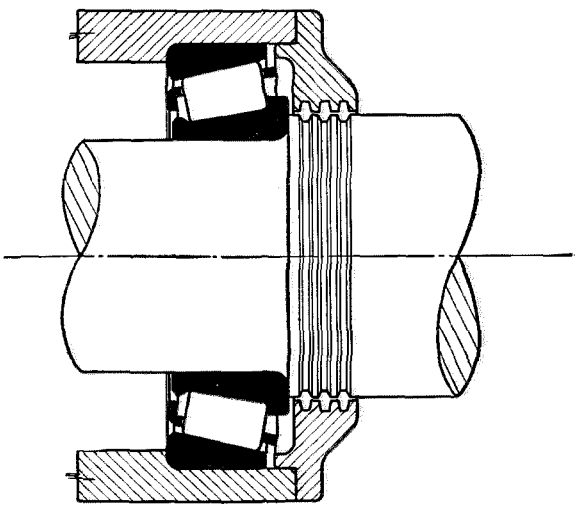


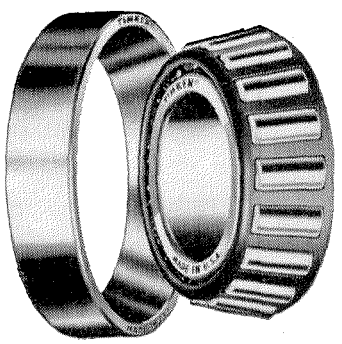
How to keep buried wheels turning smoothly

Hidden under the pile of dirt (see arrow) is a 4-wheel truck that backs up this ditch digger's whirling buckets. To prevent breakdowns, the wheel bearings had to be able to absorb the shocks of boulders and the digging action itself. And they had to be protected from the dirt. The engineers who designed this application licked both problems by mounting the truck's wheels on Timken® tapered roller bearings. Timken bearings absorb the shocks because they have tough, shock-resistant cores under hard, wear-resistant surfaces. And Timken bearings make closures more effective.

How TIMKEN® bearings help keep dirt out—lubricant in

Timken bearings make closures more effective because they hold the housings and shafts concentric. As a result, dirt can't get in—lubricant can't get out. Maintenance is minimized. Continuous, trouble-free operation is assured.





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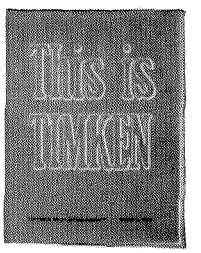

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST ⊣◎⊢ LOADS OR ANY COMBINATION ✳

Leonardo da Vinci's Flying Machine

In the time of Leonardo da Vinci, men had to take great risks to further the progress of science. The attempt at flight pictured here was made in 1505—with near-fatal results.

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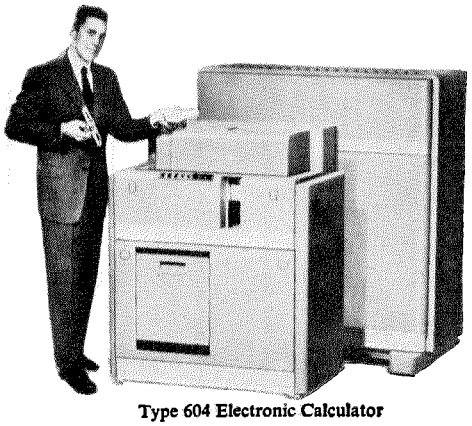

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IBM Machines help tell aeronautical experts the flight characteristics of an unbuilt plane; geologists where to drill for oil; business men where to look for sales and profits . . . and IBM engineers how to design better IBM Machines.

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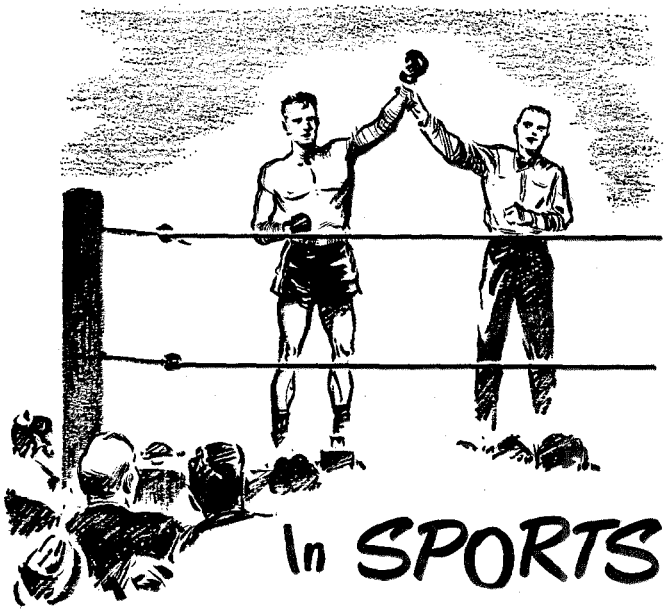

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are close kin to the excitement of working with a company
which competes with its own achievements.

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engineered by men who never lose the thrill of winning.

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in Sikorsky's never-ending quest of perfection.
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are busy fitting this most versatile of aircraft
to ever more demanding military and peacetime uses.

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scratched the surface of its potentials, then Sikorsky may be for you. Promising
engineers find a good beginning – a winning future – at Sikorsky.
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for more information.

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PERSONALS . . . CONTINUED

—has taken about 50 percent more space, has increased its engineering staff 50 percent, and its production personnel 50 percent since last year. He reports they are even building equipment for Caltech now.

Charles M. Brown, who was senior engineer in the development laboratories of the Bendix Aviation Corporation, is now chief engineer with Electromec, Inc. in Burbank.

1941

Reuben P. Snodgrass, M.S. '42, has been chief engineering test pilot for the Sperry Gyroscope Co., Ronkonkoma, N.Y., for two years. He represented Sperry at the International Air Transport Association meeting in Copenhagen, Denmark, in 1952, and delivered a paper on aircraft weather operation problems. The Snodgrass family now includes three children —one boy and two girls. The most recent, a girl, was born in July, 1953.

1942

Robert Golden, M.S., is head of the Criteria and Loads Group at the Bell Aircraft Corporation in Niagara Falls. He and his wife, Steveda, are living in their new home at Snyder, New York.

Richard M. Noyes, Ph.D., is teaching physical chemistry at Columbia University and trying to keep a research program going at the same time. Dick's wife recently returned from a year in a tuberculosis sanatorium, so he says they don't get out on the Appalachian Trail as much as they used to. Though the East has some pretty country, Dick says they still cast longing eyes toward the West.

John T. Bowen, M.S. '46, PhD. '49, is a development engineer for Carbide and Carbon Chemicals Company in New York, working on remotely guided coal mining equipment.

1943

Ralph Allrud says he finally ended his thoroughly explored bachelor days and got married last May to Romola Robb, who is an actress in New York. They flew to Ralph's parents' home in Pasadena for the event and honeymooned in San Francisco and southern California. For the last three years Ralph has been an account executive with Blair TV—a station representative firm—handling sales for, among others, KTTV in Los Angeles. They are currently designing their own home, to be built in Connecticut next year.

Richard Schamberg, Ph.D. '47, and his wife announced the birth of a second daughter, Ellen Frances, last September. Dick is technical assistant to the chief of the aircraft division of the Rand Corporation in Santa Monica.

Neville S. Long has been appointed construction engineer for the $8,000,000 Santa Felicia Dam. The bond issue for the construction was recently approved by the people of the United Water Conservation District in Santa Paula, Calif. Neville and his wife also report a third addition to the family—a daughter, Margaret Anne, born last May.

Willard R. Scott, Jr., after three years with the California Research Corporation in La Habra, California, has left to become director of research of the Crest Research Laboratories, Inc. at Crest's Seattle laboratory.

1945

Kenneth M. Shauer is in the New York office of the Westinghouse Electric Corp., working as a marine application engineer. He's also taking night courses at the New York University Graduate School of Business Administration, aiming for an M.B.A. Ken was married on May 3, 1952 to Sarah Ann Babcock of Pelham, N. Y., and the Shauers now live in New Rochelle, N. Y., with their eight-month-old daughter, Cynthia.

Lt. R. F. Schmoker is now public works officer of the U. S. Naval Supply Depot in Scotia, N. Y. He also reports a recent addition to his family—Nancy Lee, born August 21, 1953. Her sister, Linda Suzanne, is now seven years old.

Richard A. Dean received his Ph.D. from Ohio State University at the fall quarter convocation held on December 18.

John B. Lyon, Jr. has joined the radar laboratory of Hughes Research and Development Laboratories in Culver City, Calif.

Roland W. Ure, Jr., M.S., is still working on his Ph.D. in physics at the University of Chicago. He and his wife had a baby girl, Marjorie Louise, on August 16.

John N. Harris, M.S. '50, is now on the staff at the Lincoln Laboratory at MIT, and is living in Concord, Mass .

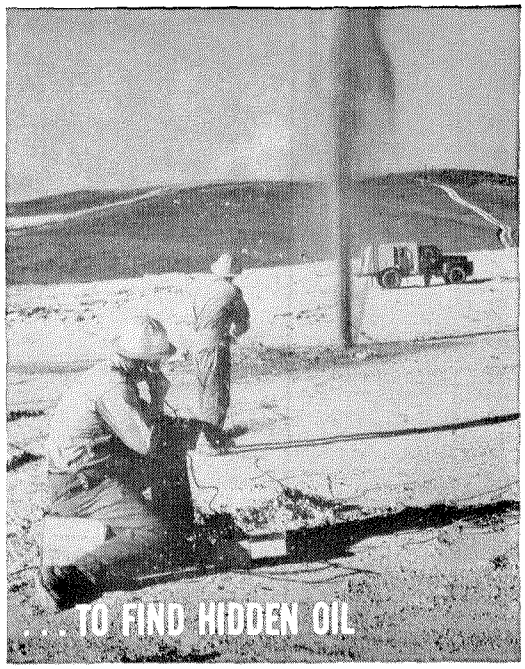
1946

C. W. Dick, who now signs himself *Ex-Lt., USNR*, was released from Naval duty last July, after having been recalled in 1951. He served in Korea and the Pacific as a destroyer-minesweeper engineering officer, and as staff operations officer for Mine Division Eleven. He has now returned to General Electric (his former employer), and is working in Schenectady, in the company's utility engineering section.

Norman R. Greve, now an associate of the C. G. DeSworte Structural Engineering firm in Long Beach, writes that his second daughter, Loraine Elyse, was born last August 23. Linda is now three years old.

1947

David L. Douglas, still working as a research associate in the chemistry section of the Knolls Atomic Power Laboratory in Ballston Lake, N.Y., reports the ar-



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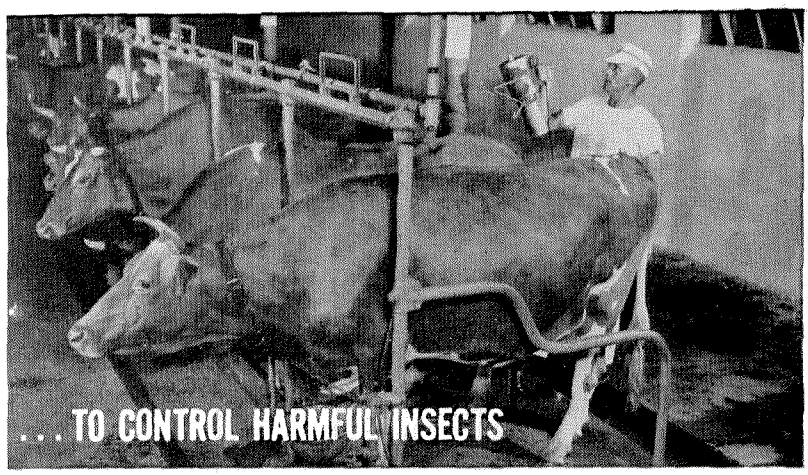

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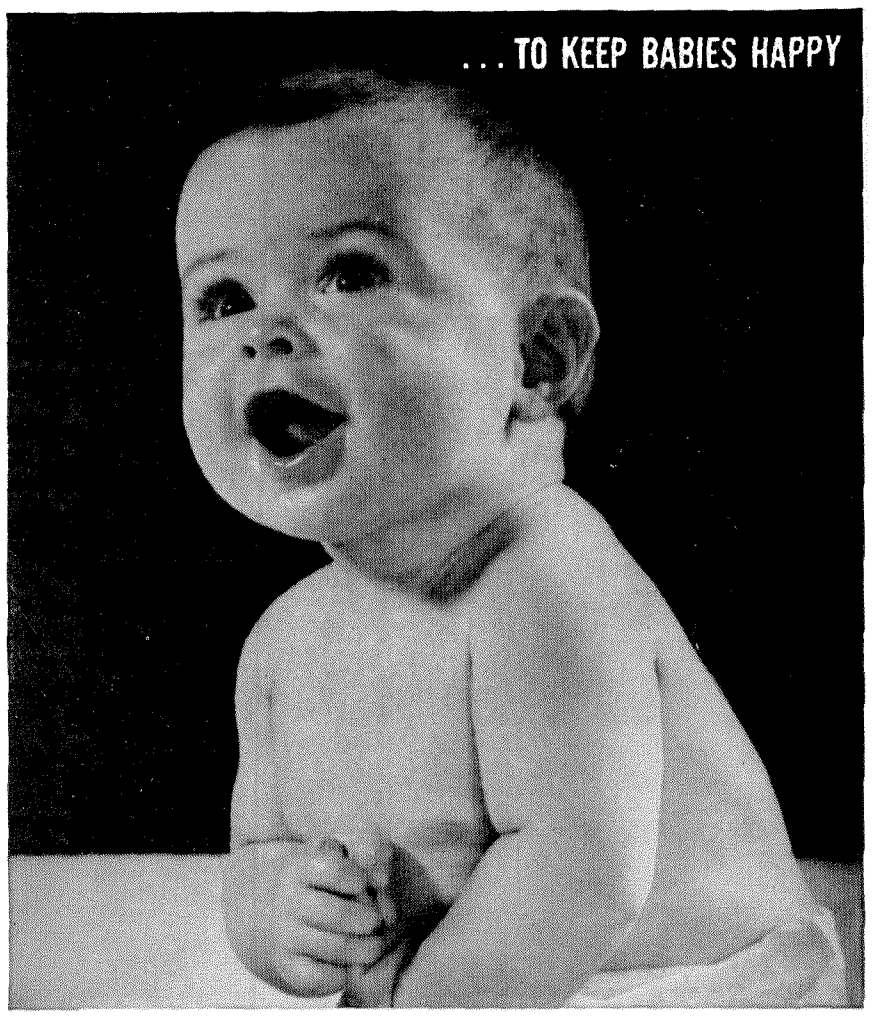

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PERSONALS . . . CONTINUED

rival of Julia Douglas on December 19.

Arthur Vieweg, working for the Fluor Corporation in Los Angeles, has been loaned to the General Electric Company's Knolls Atomic Power Laboratory as a consultant for a one-year period.

1948

Robert Heppe writes that he's married and living in Nutley, N. J., where he works on developing servo systems at the Federal Telecommunication Laboratories. Chief spare time activity of the Heppes these days is working for United World Federalists.

Richard A. Ferrell, M.S. '49, returned in September, with his wife Miriam, from nearly two years on an AEC postdoctoral Fellowship in Goettingen, Germany, where he carried on nuclear research at the Max Planck Institut fuer Physik, under Prof. W. Heisenberg. Dick is now teaching and doing research at the University of Maryland, where he's an assistant professor.

Charles Susskind, research associate in electronics at Stanford University, recently received the Clerk-Maxwell Premium for 1952 from the British Institution of Radio Engineers. The 20 guinea ($60) prize goes annually to the author who presents the most outstanding paper published in the Institution's journal during the previous year. It's the first time the premium has been awarded to an American scientist. The prize-winning paper, entitled "Obstacle-Type Artificial Dielectrics for Microwaves," was published in the Journal of the British I.R.E. in January, 1952.

1949

Rolf Sinclair finished work for his Ph.D. in nuclear physics at Rice Institute, Houston, Texas, in August. Now in the electronics and nuclear physics department of the Westinghouse Research Laboratories in East Pittsburgh, Pa., Rolf is working on neutron scattering problems. However, his main problem, he says, is how to survive his first northern winter.

Donald C. Stinson, M.S., is associated with the microwave laboratory of Hughes Research and Development Laboratories in Culver City.

William V. Wright, Jr. is now affiliated with the advanced electronics laboratory of Hughes Research and Development Laboratories in Culver City.

Augusto L. Soux, M.S. '53, is now in Grenoble, France, where he will work for two years at the hydraulics laboratory of Neyrpic. After this he will continue working with the company in South America—perhaps in his own country, Bolivia.

1950

Peter T. Knoepfler writes that he's still going to Cornell U. Medical College in New York, expects to get his M.D. in June, 1955. He mentions seeing *Jesse Weil* 52, who is doing graduate work at Columbia University.

Robert L. Nelson, M.S., Ph.D. '52, is still with the Stanolind Oil Co., as assistant party chief on a seismic prospecting crew, but has moved from Bismark, North Dakota, to Billings, Montana. "Like it here better than anyplace so far," Bob says, "—if only we could get a little winter to try on for size."

Bernard Strauss reports that the biggest event for the Strauss family last year was the arrival of David Wilson on August 9. His sister Leslie is now three years old. Bernie is teaching and doing research at Syracuse University.

Capt. Peter Grosz, Jr., MS '50 was assigned to the United States Military Academy at West Point as a physics instructor in June, 1953. The assignment followed his successful completion of the Engineer Officers' Advance Course at Fort Belvoir, Virginia.

1951

David G. Elliott, M.S. '52, left his job as research engineer at the Jet Propulsion Laboratory in Pasadena last September to start working toward his Ph.D. at Purdue University.

1952

Alexander Dessler writes that he's still at Duke University in Durham, N.C., doing research in low temperature physics, and hoping to get his Ph.D. in about two more years. The Desslers' first child, Pauline Karen, was born on July 29.

Stanley Groner, writing from Glendale, belatedly reports his marriage on June 28, 1953 to Phyllis Joyce Soskin.

LOST ALUMNI

The Institute has no record of the present addresses of the men whose names appear in the list below. If you find your own name here—or that of someone you know—please drop a card, giving the current address, to the Alumni Office, C.I.T., 1201 E. Calif. St., Pasadena 4.

1906
Norton, Frank E.

1911
Lewis, Stanley M.

1912
Humphrey, Norman E.
Soyster, Merwin H. 'ex

1918
Pease, Francis M.

1920
Smith, David F.

1922
Beman, Willard J.
Bruce, Robert M.
Cox, Edwin P. MS
Fagin, Verne A. 'ex
Ries, Emil D. MS

1923
Skinner, Richmond H.

1924
Eckermann, Carlton H.
McKaig, Archibald
Michael, Arthur F.
Miller, Palmer
Tracy, Willard H.
Young, David R. 'ex
Yu, Sien-Chiue PhD

1925
Bailey, Emerson
Merrill, Robert A. 'ex
Smith, Dwight O.

1926
Barnes, Orrin H.
Chang, Hung-Yuan
Foster, Alfred
Hiang, Jen Chieh
Huang, Y. H.
McCarter, Kenneth C.
Schueler, Alfred E.
Ward, Edward C.
Yang, Kai Jin

1927
Jackson, William D'A. 'ex
Kaye, George R.
Langer, R. Meyer PhD
Moore, Bernard N.
Peterson, Frank F.

1928
Chou, P'ei-Yuan PhD
Clark, Alexander
Martin, Francis C. MS
Morgan, Stanley C. MS

1929
Briggs, Thos. H., Jr. MS
Elder, John D. PhD
Kuert, William F. 'ex
Lynn, Laurence E.
Nagashi, Masahiro H.
Nelson, Julius
Reed, Albert C.
Robinson, True W.
Sandberg, Edward C. MS
Sarno, Dante H. 'ex
Wiley, Charles A. 'ex

1930
Allison, Donald K.
Brandon, Huto
Chao, Chung-Yao PhD
Ellis, Eugene
Horton, Warren B. 'ex
Janssen, Philip
Kelley, William
Moyers, Frank N.
Russell, Lloyd W.
Suzuki, Katsunoshin
White, Dudley
White, F. H. Jr. 'ex
Wilkinson, Walter D. Jr.
Zahn, Franklin Jr.

1931
Gregory, Carter H.
Matison, Harry
Voak, Alfred S.
West, William T.
Woo, Sho-Chow PhD
Yoshika, Carl K.

1932
Fraps, A. W. MS
Griswold, Edward A. 'ex
Lyons, Patrick B.
Marshall, Donald E. MS
Patterson, J. W. PhD
Schroder, L. D. MS
Thiele, Carl L.
Watson, George G.
Wong, David Y.

1933
Applegate, Lindsay M. MS
Ayers, John K.
De Militia, Joseph
Downie, Arthur J. 'ex
Hsu, Chuen-Chang MS
Kitusda, Kaname MS
Larsen, William A. MS
Lockhart, E. Ray
Magden, John L. MS
Michal, Edwin B. MS
Murdock, Keith MS
Pauly, William C.
Plank, Dick A.
Rice, Winston H.
Schlechter, Arthur H. MS
Shappell, Maple D. PhD
Smith, Warren H.

1934
Carrick, Thomas H. 'ex
Core, Edwin J.
Liu, Yun Pu PhD
Lutes, David W.
Marmont, George H.
Nivens, Francis A. 'ex
Radford, James C.
Read, John PhD
Willard, Kenneth A. MS

1935
Becker, Leon
Ehrenberg, Gustave Jr.
Gelzer, John R.
Gross, Siegfried T. MS
Harney, Patrick J. D. MS
Huang, Hsia-Chien MS
Jackson, Oscar B. MS
McCoy, Howard M. MS
McNeal, Don MS
Obatake, Tanemi

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

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

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Parr, Warren S. MS
Rivas, Dagoberto
Romer, Alfred PhD
Schwartz, Jack W.
Scott, Claude T.
Wilson, Harry D. 'ex

1936

Bassett, Harold H. MS
Breen, John M. 'ex
Chu, Djen-Yuen MS
Cohen, Jeffrey S.
Creal, Albert
Hartlein, Robert I.
Kelch, Maxwell MS
Kurihara, Hisayuki
Lawrence, Franklin R. 'ex
McKillip, John C. S. MS
Ohashi, George Y.
Onaka, Takeji MS
Van Riper, Dale H.
Weber, Bruce T.

1937

Dusel, Alvin K. 'ex
Easton, Anthony MS
Fan, Hsu Tai MS
Jones, Paul F. MS
Jones, Robert C.
Maginnis, Jack MS
Mason, Jack 'ex
Miller, Shirley S. MS
Moore, Charles K. MS
Munier, Alfred E. MS
Murphy, Joseph N. MS
Nojima, Noble
Odell, Raymond H. MS
Park, Noel R.
Parry, H. Dean MS
Penn, William L., Jr.
Quinn, Eugene H. MS
Rechif, Frank A.
Rinehart, John S. MS
Servet, Abdurahim MS
Shaw, Thomas N.
Smith, Joe M.
Tsubota, George Y.
Yin, Hung Chang PhD
Yuan, Shao-Wen MS
Cheng, Ju-Yung MS

1938

Davidson, Robert C.
Evans, Harry D. MS
Gersbzohn, Morris MS
Goodman, Hyman D. MS
Hughey, Albert H. MS
Jetter, Ulrich MS
Kanemitsu, Sunao MS
Lowe, Frank C.
Moorman, Thomas S. MS
Ofsthun, Sidney A. MS
Okun, Daniel A. MS
Scoles, Albert B. MS
Stone, William S. MS
Tilker, Paul O.
Tsao, Chi-Cheng MS
Wang, Tsun-Kuei MS
Watson, James W.

1939

Asakawa, George
Burns, Martin C. MS
Carter, Robert T.
Coates, Leonidas D. MS
DeLong, James H. Jr. MS
Hendry, Noel W. MS
Jackson, A. M. Jr. MS
Jones, Winthrop G. MS
Liang, C. Chia-Chang MS
Morikawa, George K.
Neal, Wilson H. MS
Poon, Yuk Pui AE
Robertson, Francis A.
Shields, Alex M. 'ex
Sinclair, George W.
Tatom, John F. MS
Yood, Bertram MS

1940

Akman, Mustafa S. MS
Batu, Buhtar MS
Brasch, Martin F.
Brettell, Geo. A. Jr. MS
Green, William J. MS
Hofeller, Gilbert W.
King, James L. MS
Nagle, Darragh E.
Pai, Shih-I PhD
Paul, Ralph G.
Scarborough, W. Bertram
Tao, Shih Chen MS
Wang, Tsung-Su MS
Wild, John M.

1941

Bruce, Sydney C. MS
Buchzik, Charles M.
Clark, Morris R.
Damberg, Carl F. AE
Dieter, Darrell W. MS
Feller, Walter E. MS
Frank-Jones, Glyn
Green, Jerome
Guerin, Jack T.
Kuo, I. Cheng
Palmer, John G.
Shelton, Edward E. MS
Skalecky, Frank H., Jr.
Taylor, Francis
Truesdell, Clifford A.
Vartikian, Onick
Whitfield, Hervey H. MS
Wolfe, Samuel
Yui, En-Ying MS

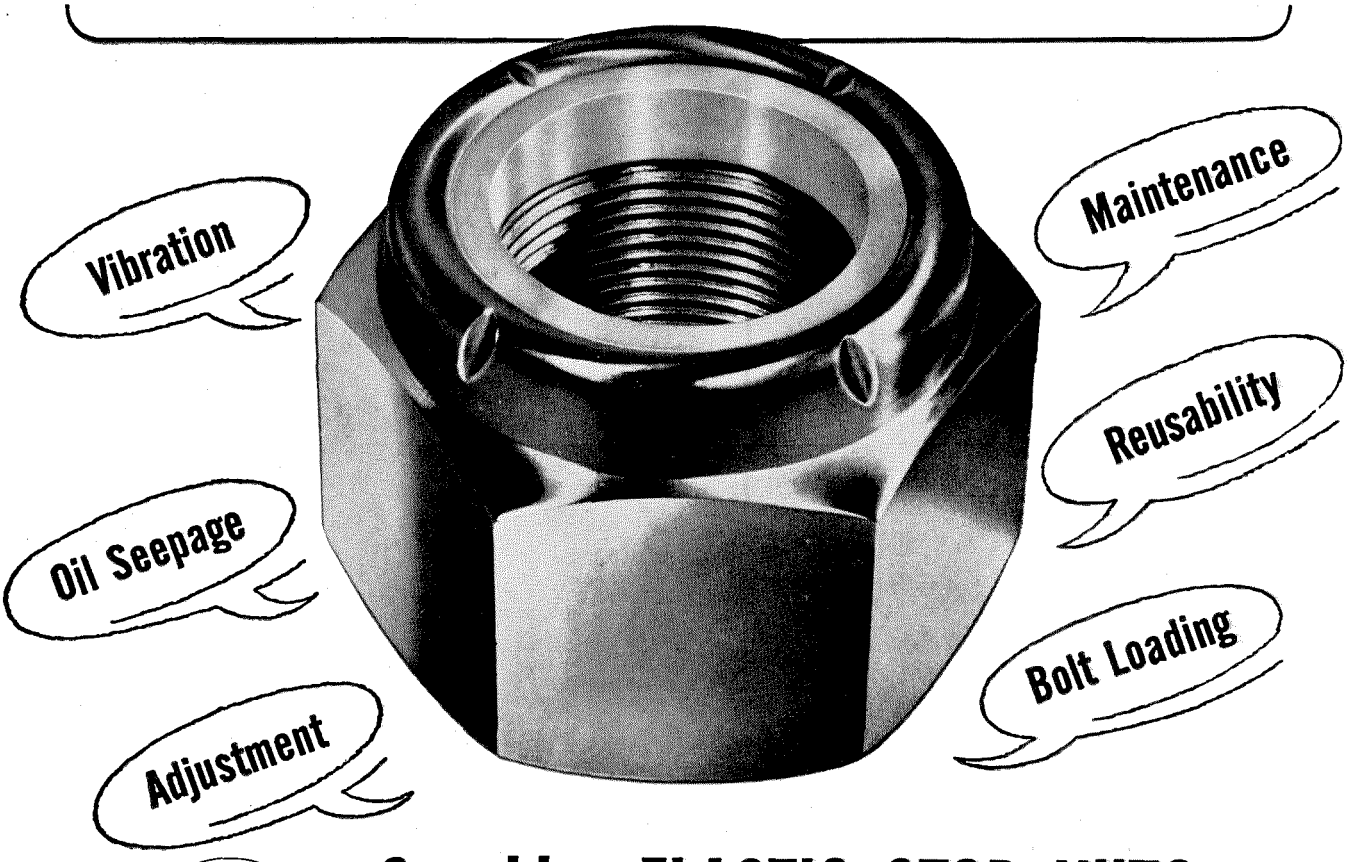
1942

Bebe, Mehmet F. CE
Bergh, Paul S.
Callaway, William F.
Chastain, John A.
Cunningham, Robert E.
Given, Frank I.
Go, Chong-Hu MS
Hoagland, Clifford C.
Levin, Daniel MS
MacKenzie, Robert E.
Muratzade, Enver M. CE
Sternberg, Joseph
Woods, Gordon K.

1943

Angel, Edgar P. MS
Bethel, Horace L. MS
Bridgeland, Edgar P. MS
Brownson, Jackson C. MS
Bryant, Eschol A. MS
Burlington, Wm. J. MS
Bushell, Redgnald D. MS
Colvin, James H. MS
Daniels, Glenn E. MS
Edelman, Leonard B. MS
Enikeieff, Oleg C.
Gould, Jack E. MS
Hamilton, William M. MS
Harless, Raymond F. MS
Hewson, Lawrence MS
Hillyard, Roy L. MS
Hilsenrod, Arthur MS
King, Edward G. MS
Koch, Robert H. MS
Kong, Robert W. MS
Leeds, William L. MS
Ling, Shih-Sang MS
Lobban, William A. MS
Lockhart, William H. MS
Lundquist, Roland E. MS
Mampell, Klaus PhD
Mataya, Jack L. MS
McClendon, Elmo W. MS
McNeil, Raymond F. MS
Mixsell, Joseph W. MS
Moore, Paul R. MS
Mowery, Irl H. Jr. MS
Nesley, William L. MS
Neuschwander, Leo Z. MS
Newton, Everett C. MS
O'Brien, Robert E. MS
Patterson, Charles M. MS
Pearson, John E. MS
Rambo, Lewis
Rhoades, W. F. Jr. MS
Rivers, Nairn E. MS
Roberts, Fred B. MS
Rupert, James W. Jr. MS
Scholz, Dan R. MS
Shannon, Leslie A. MS
Siu, Ralph Gun-Hoy PhD
Stewart, John T. D. MS
Sweeney, William E. MS
Tindle, Albert W. Jr. MS
Vicente, Ernesto MS
Waldrop, Nathan S. MS

Whenever fastening problems arise...



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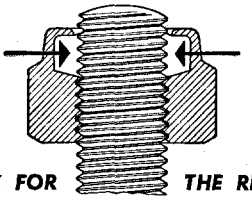

LOOK FOR THE RED LOCKING COLLAR

It is threadless and resilient. Every bolt impresses (but does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates axial play between bolt and nut threads. All Elastic Stop Nuts—regardless of type or size—lock in position anywhere on a bolt or stud, maintain accurate adjustments and seal against liquid seepage. Vibration, impact or stress reversal does not disturb prestressed or positioned settings.

Whenever fastening presents a problem—ESNA is ready with a quick answer. More than 3000 types and sizes of self-locking vibration-proof fasteners—plus the "know-how" of ESNA engineers—are available here at ESNA.

ESNA has long been known as "design headquarters" for self-locking fasteners. Accepted by Army, Navy and Air Force, virtually every aircraft built in the past decade has been Elastic Stop Nut-equipped. On the railroads, in the oil fields, on automobiles and construction equipment, Elastic Stop Nuts manufactured to exacting quality control standards, are doing specialized jobs every day.

Be familiar with the design help ESNA offers. Write us for details on Elastic Stop Nuts. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.

ELASTIC STOP NUT CORPORATION OF AMERICA


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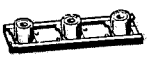
ANCHOR


HIGH TEMPERATURE


SPLINE


CLINCH


CANG CHANNEL


NYLON CAP

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

Walsh, Joseph R. MS
Washburn, C. L. MS
Weis, William T. MS
Wood, Jesse A. MS
Yung, Chiang H. MS

1944

Ahuza, Victor B. MS
Alpan, Rasit H.
Baronowski, John J. MS
Barriga, Francisco D. MS
Beek, Barton B.
Bell, William E. MS
Birlik, Ertugrul MS
Burch, Joseph E. MS
Burke, William G. MS
Chang, Howard H. C. C.
Dodge, Willard A.
Estrada, Neuk S. MS
Fu, Ch'eng Yi PhD
Golding, David R. PhD
Harrison, Charles P. MS
Hu, Ning PhD
Huggins, John C.
Johnson, William M. MS
Kern, Jack C. Jr. MS
Labanauskas, Paul J. MS
Leenerts, Lester O. MS
Maier, Mark P. MS
Medeiros, Carlos A. MS
Parker, Theodore B. MS
Shults, Mayo G. MS
Stanford, Harry W. MS
Stein, Roberto L. MS
Sullivan, Richard B. MS
Sunalp, Halit MS
Taylor, Garland S.
Titzler, Henry N. MS
Trimble, William M.
Wilson, John H.
Writt, John J. MS
Yik, George

1945

Bade, William G.
Bunze, Harry F. MS
Fredette, Raymond O. MS
Gibson, Charles E. MS
Jackson, John S. Jr.
Jenkins, Robert P.
Knox, Robert V.
Leydon, John K. MS
Lien, Wallace A. MS
Magneson, Norman J.
Nason, James K.
Nesbitt, Mason W. MS
Romney, Carl F.
Tatlock, William S.
Tiernan, Wm. F. Jr. MS
Werme, John V.
Wiedow, Carl P. MS

1946

Anderson, John B. MS
Barber, John H. MS
Brinkhaus, Harvey H.
Bromley, Edmund Jr. MS
Burdg, Charles E.
Burger, Glenn W. MS
Dyson, Jerome P.
Esner, David R.
Fong, Conrad T. O. PhD
Hoffman, Charles C. MS
Jarvis, David H. ME
Ke Yuan, Chen MS
Lewis, Frederick W. MS
Lowery, Byron O. MS
Lowery, Robert H. MS
MacDonald, Norman J.
Miller, Jack N. MS
Misner, William G.
Nurre, Vincent W.
O'Meara, Donald J. MS
Russell, Charles R. MS
Siltanen, John C. MS
Simmons, George F.
Smith, Harvey F. MS
Stein, Sherman
Tung, Yu-Sin MS
Uberoi, Mahinder S. MS
Weitzenfeld, D. K. MS
Williams, Ralph C. MS

1947

Anderson, Reed M.
Atencio, Adolfo J. MS
Brundred, Latham L. Jr.
Clock, Raymond M. MS
Dagnall, Brian D. MS
Das, Subodh C. MS
Hsu, Chi-Nan MS
Huang, Ea-Qua MS
Kamath, Mundkur V. ID
King, Emmett T. ID
King, William R. Jr.
Leo, Fiorello R. MS
Manning, Ordway T.
McClellan, Thomas R.
Monoukian, John MS
Moorehead, Basil E. A.
Powell, Orville S. ID
Rosell, Fred E. Jr. MS
Schwennesen, J. L. MS
Shackford, Robert W. MS
Smith, Alexander PhD
Swatta, Frank A. MS
Vadhanapanich, Charoen
Vanden Heuvel, G. R. MS
Veale, Joseph E. MS
Wan, Pao K. MS
Wellman, Alonzo H. Jr.
Wellman, Alonzo H. Jr.
Ying, Lai-Chao MS

1948

Barker, William A. II MS
Blue, Douglas K. MS
Burt, Frederick B.
Cotton, Mitchell L.
Crawford, William D. MS
Fay, Alfred P.
Jenista, Charles Jr. MS
Lambert, Peter C.
MacLean, Douglas J.
McCollam, Albert E. MS
Metzler, David E.
Mitchell, Edward E.
Morehouse, Gilbert G. MS
Oberman, Carl R.
Roberson, Harvey L.
Schocken, Victor PhD
Staros, Basil MS
Stewart, Robert S. MS
Swain, John Sabin
Swan, Walter C.
Swank, Robert K. MS
Walter, James W. Jr. MS
White, Harvey J. ID
Winniford, Robert S. MS

1949

Atkins, Douglas C. MS
Bass, Manuel N.
Clancy, Albert H. Jr. AE
Clendening, Herbert C. MS
Craighead, Emery M. MS
Darrow, Robert A.
Dwire, Oliver S. AE
Hughes, Richard F. MS
Krasin, Fred E.
Linderman, Harold J.
MacKinnon, Neil A. AE
Matteson, Robert C. MS
McElligott, Richard H. AE
Mitchell, Max O. MS
Petty, Charles C. MS
Rounds, James M. MS
Shaller, Charles H.
Simpson, Colin G. MS
Wallace, Richard A. ID

1950

Alexander, Joseph B. MS
Boicourt, Stanley C.
Bryan, William C. Engr.
Check, Andrew J.
Curtis, Robert N.
Hermes, Richard M. PhD.
Honda, Shigeru I.
Hottenroth, James H. MS
Li, Chung Hsien MS
McDaniel, Edward F. MS
McIntyre, Richard M.
McLaughlin, Jack E. PhD
McMillan, Robert MS
Merrifield, Donald P.
Mesara, R. Reha
Monroe, Alfred J. MS
Pao, Wen K. PhD
Porcher, Calvin E. MS
Roberts, Morton S. MS
Roddick, James A. MS
Shen, San-Chiun PhD
Stewart, Dale F.
Vivian, James A. MS

1951

Carter, Cecil V. MS
Davison, Walter F.
Dyer, Lawrence D.
Lafdjian, Jacob MS
Latta, Gordon E. PhD
Ostrander, Max H. AE

1952

Abbott, John R. MS
Carrigan, Ralph S. MS
Engholm, Bernard A.
Lunday, Adrian C. MS
Robbins, Howard M. PhD
Waters, Richard H.
Winkler, Richard S. MS

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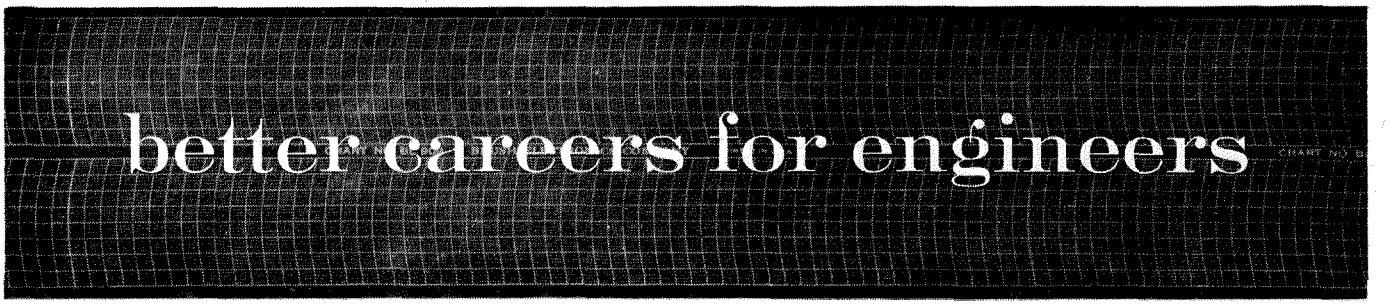
diversification:

another reason why Lockheed in California offers...



diversified production

Huge luxury airliners, cargo transports, fighters, bombers, trainers and radar search planes are rolling off Lockheed assembly lines. Twelve models are in production.

diversified development projects

The most diversified development program in Lockheed's history is under way—and it is still growing. The many types of aircraft now in development indicate Lockheed's production in the future will be as varied *as it is today—and has been in the past.*

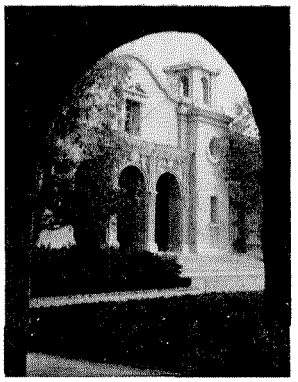
diversified living

You work better in Lockheed's atmosphere of vigorous, progressive thinking—and you live better in Southern California. You enjoy life to the full in a climate beyond compare, in an area abounding in recreational *opportunities for you and your family.*

This capacity to develop and produce such a wide range of aircraft is important to career-conscious engineers. It means Lockheed offers you broader scope for your ability. It means there is more opportunity for promotion with so many development and production projects constantly in motion. It means your future is not chained to any particular type of aircraft—because Lockheed is known for leadership in virtually all types of aircraft. Lockheed's versatility in development and production is also one of the *reasons it has an unequaled record of production stability year after year.*

Lockheed AIRCRAFT CORPORATION

BURBANK, CALIFORNIA



CALTECH CALENDAR

January, 1954

ALUMNI ACTIVITIES

January 13	Dinner Meeting
February 6	Dinner Dance Oakmont Country Club
March	Dinner Meeting
April 3	Alumni Seminar Day
June 9	Annual Meeting
June 26	Annual Picnic

ATHLETIC SCHEDULE

BASKETBALL

January 12, 4:15 p.m.
LaVerne vs. Caltech at Armory

January 16, 9:00 p.m.
Pomona vs. Caltech at P.C.C.

January 19, 4:15 p.m.
Chapman vs. Caltech at Armory

January 23, 8:00 p.m.
Caltech at Redlands

January 26, 4:15 p.m.
Cal Poly vs. Cal Tech at Armory

January 29, 8:00 p.m.
Caltech at Nazarene College

January 30, 8:15 p.m.
Caltech at Chapman

February 5, 8:00
Caltech at LaVerne

February 6, 8:00 p.m.
Caltech at Whittier

February 9, 4:15 p.m.
Caltech vs. Nazarene College at Armory

DEMONSTRATION LECTURES

Friday Evenings
7:30 p.m. — 201 Bridge

Jan. 15—"Smog" by Professor A. J. Haagen-Smit.

Jan. 22—"Transonic Flow" by Professor H. W. Liepmann

Jan. 29—"*Biology in the Arctic*" by Professor George E. MacGinitie

Feb. 5—"Inherited Diseases of Children" by Dr. Alfred Knudson

Y.M.C.A. FILM SERIES

7:30 p.m. — Culbertson Hall

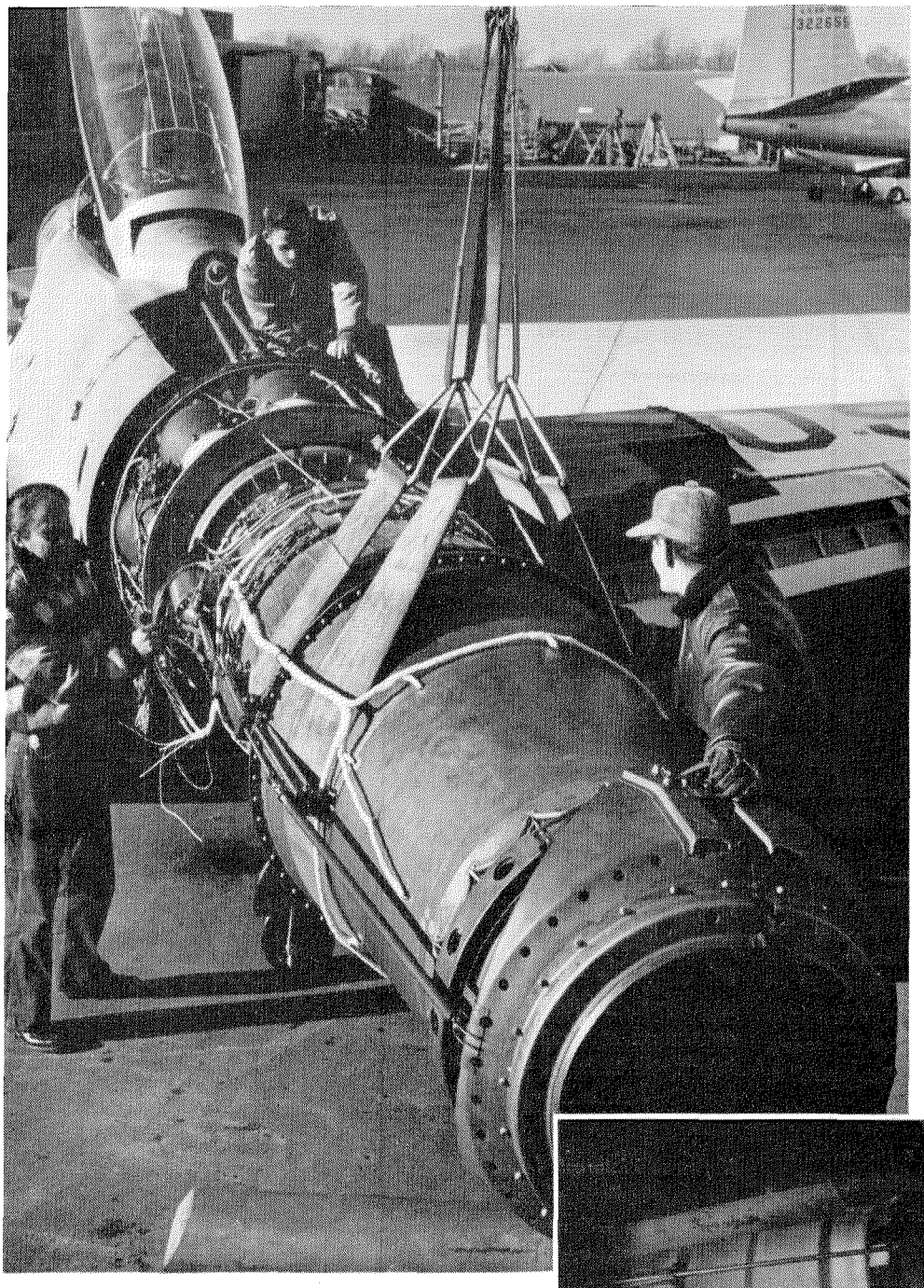
Jan. 17—"The Ox-Bow Incident"

Jan. 31—"You Can't Take It With You"

PHOTOGRAPHY AT WORK No. 6 in a Kodak Series

Photography teams with research to slash industry's corrosion bill

Camera and Film work as research tools as International Nickel Company develops new alloys which prove tougher and defy corrosion.



Each year industry saves more and more millions on its corrosion bill by using Monel*, Inconel* and other corrosion-resisting alloys of the International Nickel Company.

To develop such alloys, "Inco" maintains extensive research—research that keeps photography on the job day-in and day-out.

This is because photography provides information which can be obtained and studied in no other way. Photomicrographs show metal structure. X-ray diffraction patterns reveal the arrangement of molecules. High-speed and time-lapse movies display the workings of corrosion.

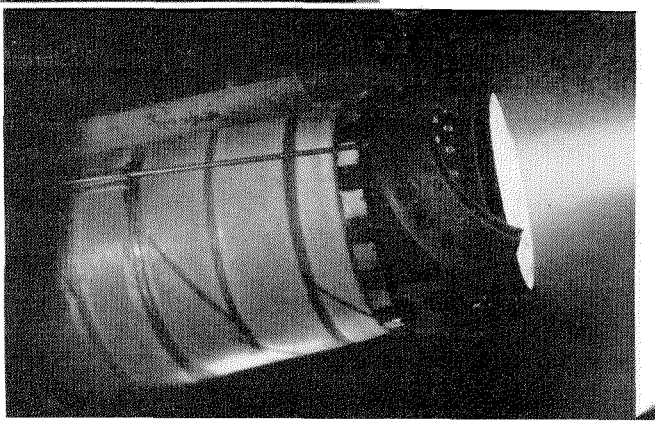
Industries, large and small, find photography an important factor in their research—just as they know it improves manufacturing, cuts costs, and speeds many business operations.

"Today so many new applications of photography exist that graduates in the physical sciences and in engineering find them valuable tools in their new occupations. Other graduates—together with returning servicemen—have been led to find positions with the Eastman Kodak Company."

If you are interested, write to Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

*Reg. trade marks of the International Nickel Co.

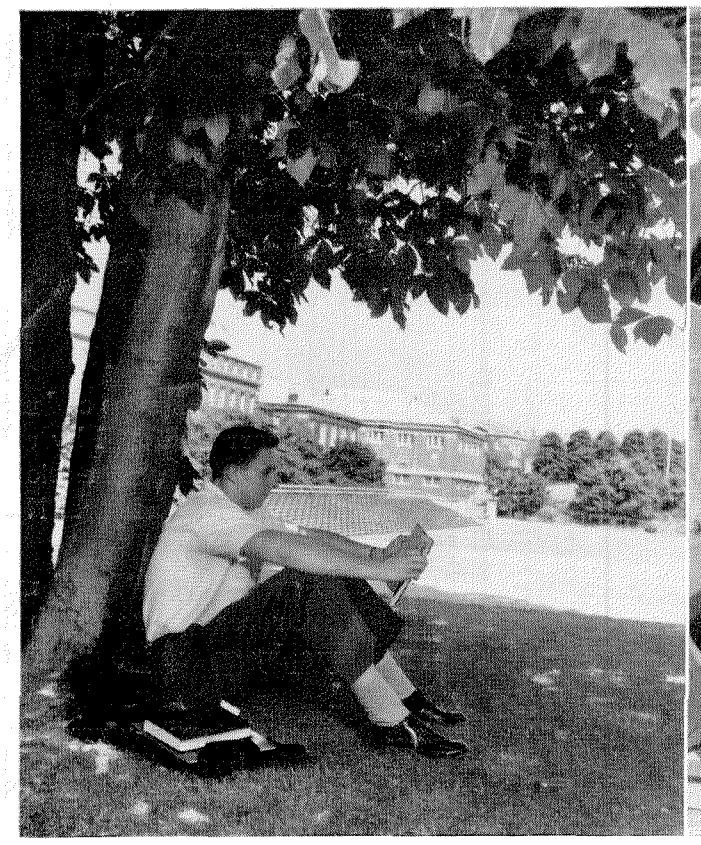
Eastman Kodak Company
Rochester 4, N. Y.



To stand up against intense heat and highly corrosive gases, vital jet engine parts such as rotor blades, afterburner, and insulation bindings are made of nickel alloys. Illustration shows a Pratt & Whitney Aircraft turbojet engine with after-

Kodak

Calif. Inst. of Technology
Pasadena, Calif.



FROM CAMPUS — TO CAREER IS A BIG STEP

When the graduate leaves the college campus to begin his career he is taking an extremely important step. For he is leaving the area of directed-development in college and entering the area of self-development in industry.

Closing the gap between his campus experiences and the realities of earning a living is not easy. The complicated maze of modern industrial society has made this transition a tough task. While the craftsmen of former years grew up with the business, the college graduate of today steps into a strange organization at a relatively high level. He has had no opportunity to understand, through a long period, the methods and operations of the concern.

During his first few years, he is finding his place in the organization—learning its policies and objectives, and at the same time shaping his professional career. He needs all the assistance and guidance he can get.

Here at General Electric, hundreds of young men have found that intensive efforts are made to "bridge the gap" between college and industry—and to help young professional people realize their goals. Through extensive training programs, classroom study programs, leadership programs, and guidance in professional development, carefully selected young men are prepared for positions of responsibility and leadership in their individual fields.

Providing college graduates with the opportunity to know the Company and find the right job in it . . . giving them high-level, flexible orientation and training . . . offering continued opportunity for professional growth are most important tasks at General Electric. Nothing is more important—for our young professional people are our biggest asset.

If you are interested in building a career with General Electric, see your college placement director for the date of the next visit of the G-E representative on your campus. Meanwhile, for further information on opportunities with General Electric write to College Editor, Dept. 2-123, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC