

# ENGINEERING AND SCIENCE

*June 1950*



PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY



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U N I T E D S T A T E S S T E E L



# ENGINEERING AND SCIENCE MONTHLY



MONTHLY

VOL. XIII

CONTENTS FOR JUNE

NO. 9

## In this issue

On the cover this month is a fair representation of the 409 men who received degrees at the Institute's 1950 Commencement on June 9. You'll find more Commencement news, notes and photographs on pages 9 and 13.

### Fight for Freedom

Along with the cold war goes a white-hot battle for men's minds. The issue here is simple and clear: freedom vs. slavery. The weapons which our enemies have chosen to use in this fight include the spreading of confusion, distrust, uncertainty and disunity—and, in our fear and confusion, some of us even advocate fighting back with the same weapons.

Dr. DuBridge's 1950 Commencement address, "The Fight for Freedom," is a particularly timely reminder that the most effective way to fight for democracy is to use the tools and techniques of democracy; that freedom is not only an end but a means. "The Fight for Freedom" is on page 3.

### Earthquakes

Earthquakes have always been considered unpredictable, haphazard occurrences. But recent research by Dr. Hugo Benioff at the Institute's Seismological Laboratory now challenges this long-standing belief. The story's on page 6.

### Layoff

With this issue E & S suspends publication for the summer. Our next issue, dated October, will be in your hands on October 1. See you then.

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 p. 11—Ralph Lovberg '50  
 p. 14—Wm. V. Wright '51  
 p. 16—Wm. V. Wright '51 (top)  
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## ENGINEERING AND SCIENCE MONTHLY

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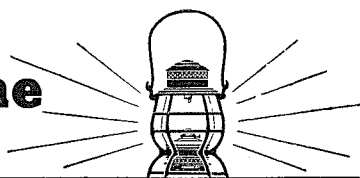
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# The Main Line



With apologies to Washington Irving, the picture above might well be captioned, "The Legend of Sleepy Hollow." At any rate, the comfortable-looking lady is ensconced in a "sleepy-hollow" chair.

In this case, however, the "sleepy-hollow" is not a legend. It's real. And it doesn't have to apologize to Washington Irving or anybody else.

## News Photo

Actually, this is virtually a news photo. It's hot out of the camera of a photographer the Budd Company engaged to give us an advance peek at one of the chair cars for our new *Sunset Limited*.

To be perfectly honest, though, one of the reasons the lady looks so comfortable is that she was hired to look that way. The car is real enough but the people aren't. Because the train won't be completed and in service until August, we had to get some models to "round out" appearances. Nevertheless, that picture is a pretty accurate indication of how things will be in the chair cars aboard the new *Sunset Limited*.

But don't take my word for it. Come August, ride it and see for yourself. Of course, the train is only part chair car. For the folks who want privacy, or who want to crawl into bed and sleep, the new *Sunset* will rise to still greater heights.

## All Rooms

Sleeping car accommodations will be all rooms. You'll have a choice of

roomettes, bedrooms, or palatial bedrooms en suite (the most spacious of all Pullman accommodations). All sleeping accommodations for two or more have their own private, fully enclosed washroom. (Bedrooms en suite have *two*.) Each bedroom has a clothes closet with lights that come on automatically when the doors are opened. (We aren't sure, but we suspect that Frigidaire must have subcontracted for this part of the job.)

## Pressure's Off

This probably won't mean much to you as a traveler, but new car deliveries for the *City of San Francisco* have now reached the point where we have one "extra" set of equipment. What it means to us is that we don't have to work quite so frantically to get the train "turned around" and ready to go out again. Now, even if we're unlucky enough to have the *City* come in late, the next departure for Chicago will still be on time. Admittedly not a world-shaking event—but we thought you might like to know.

## New Stuff

We're getting lots of other new cars, too. The *Golden State* is a 100% streamliner now between Los Angeles and Chicago. Right on the heels of the new *Sunset*, the *Cascade* between San Francisco and Portland, and the *Overland* between San Francisco and Chicago will be fully streamlined, too.

Even if there isn't any such word, by the end of the year we'll be the streamlinest railroad you ever saw.

# LETTERS

## Marshall Plan

In a talk on "World Economic Prospects" at the annual meeting of the Caltech Alumni Association in June, 1949, Horace Gilbert, Professor of Business Economics, pointed out what he considered to be the shortcomings of the Marshall Plan.

In the fall of 1949 Prof. Gilbert took a year's leave of absence from the Institute to serve on the staff of the U. S. High Commissioner of Germany, in the Office of Economic Affairs, supervising imports, exports and monetary payments made by the Republic of Germany.

In the following excerpts from a letter written to Dr. DuBridge, Prof. Gilbert takes another look at the Marshall Plan—a year later.

## Dear Lee:

Little did I think when I spoke to the Caltech alumni about a year ago that during the year to follow I would be in the middle of the Marshall Plan program over here. On the whole it has been a good year and I have had a remarkable opportunity to study and participate in the high drama of the economic reconstruction of a great industrial nation.

In this letter I propose to bring up to date the thinking I presented at the alumni meeting. First, some simple reporting.

1. The direct beneficial effects of ECA aid are even more impressive than I expected. I have visited France, Britain, Ireland, Holland, Belgium, Italy, Greece, Switzerland, and I have seen a great deal of all parts of Western Germany. The flood of food, tobacco, petroleum products, and industrial raw materials, especially cotton (these are called soft goods), has produced a condition of well-being that certainly would not otherwise have been possible. I fear that in Italy, Greece, and perhaps France, the level may be higher than any possibility of maintenance when aid is ended.

2. It has been the supply of soft goods, not capital equipment for reconstruction and advanced technology, that has raised the level of physical well being so high in so short a time. The beneficial effects of the investment program in capital equipment will only be known in years to come.

**S·P** The friendly Southern Pacific

# THE FIGHT FOR FREEDOM

by L. A. DuBRIDGE

Dr. DuBridge's 1950 Commencement Address—a timely reminder that freedom is not only an end, but a means; not only a goal to be attained, but a powerful weapon to use in its attainment.

I WISH I COULD ASSURE YOU as you leave this campus to enter upon your various careers that you have received during your stay here an education which will surely prepare you for all the problems you will face in the coming years. But you know very well that that isn't so. No educational experience that occupies but four years could do that. Even those of you who are receiving a Ph.D. after eight years of work are still of necessity only partially prepared for what lies ahead. Your preparation has been begun—not completed. This is your commencement—not the completion—of your real education.

Even if you were going out into the best and most perfect of all possible worlds, your education would not have foreseen all the possible problems with which you would be faced. Even a perfect world would be a world of change. And what that perfect world would be like in 10, or 20, or 30 years after you graduate no one could possibly foresee.

But as you well know, this is not the best of all possible worlds. In many ways, in fact, it just isn't a very nice world at all! It is a world of stress and strife; it is a world divided and discouraged; it is a world full of conflict and of confusion.

How can any education be adequate to meet the terrible problems of such a world? It cannot be adequate. It cannot even try to be adequate. All education can even aim for is to prepare your minds so that whatever problems you encounter will be a challenge which you can face with courage and not with fear.

Yet inadequate though our educational experience certainly is, we know, too, that the education we are privileged to obtain is far more necessary and far more precious in a world of conflict than it would be in a world of tranquility. In a perfectly tranquil world, education might conceivably be regarded as a luxury. In a world of conflict it is certainly an urgent necessity. For if the problems we must solve are to be solved at all, they must be tackled by toughened and trained intellects. They will be solved, if at all, not through ignor-

ance and fear, but through knowledge and courage. They must be solved by trained minds, guided by a spirit that is in tune with the Infinite.

Now I should like to take a few moments to discuss today some of the elements of the conflict and confusion in this world of today—and of tomorrow. Can we identify at least some of them so we can be clear in our thinking about them and hence, better prepared to meet them?

Uppermost in our minds, of course, is the possibility sometime in either the near or distant future of a terrible military conflict. I need not describe to this audience the potential horrors of such a conflict if it should come. Many of you witnessed at first hand the horrors of World War II. All of you know full well the technological potentialities of World War III—the potentialities which become more terrifying with each passing year. Such a war should be avoided at almost any cost.

At *almost* any cost? Why do I not say at *all* costs? There are some who *are* saying that just now. Some are saying that *nothing—nothing*—could be worse than another world war. But to most of us here in America the great words which Patrick Henry uttered in 1775 are still ringing in our ears. I hope you know them by heart.

"Is life so dear or peace so sweet, as to be purchased at the price of chains and slavery? Forbid it, Almighty God! I know not what course others may take, but as for me, give me liberty or give me death."

Yes, there are some things we in America value more highly than life; some things for which we will fight if necessary to preserve. And note carefully that those things for which we will fight are not material possessions, not political or economic power. They are our ideals; our ideals of liberty, of individual freedom, of justice. For them and for them only will we fight a modern war; those ideals we will defend at *any cost*.

Now I think no one will deny that our ideals are being challenged today. They are being challenged by some people in this country. They are being challenged by powerful forces abroad. It is on this front, indeed,

that the immediate battles must be fought—the ideological front we call it. On this front our weapons are ideas and ideals. If we can win the battle of ideas and ideals—our bullets and our bombs may not be needed. Conversely, if we lose that battle our bullets and bombs will be of no use, for we will have nothing left for which to fight.

Our bullets and bombs are most necessary to protect us against possible military aggression on the part of those who would rob us of the realization of our ideals. But let us not delude ourselves into thinking that ideas themselves are killed by bombs. In our proper zeal to maintain our military strength it would be tragic if we neglected or destroyed our intellectual and spiritual strength.

## The Battle for Men's Minds

In the military sphere we are now in a period of an armed truce—a cold war. But on the ideological front the war is white hot. Throughout most of the civilized world, the battle for men's minds is now raging. The lines of the battle are clearly and sharply drawn—in spite of systematic attempts to blur and confuse them. The issue in this battle is clear and simple. It is the issue of freedom vs. slavery.

Oh, of course, the rulers of the "people's democracy" do not admit that they advocate slavery. In a "people's democracy" everyone can vote. Indeed, everyone must vote. But when one can vote for only one party and one candidate we call that political slavery.

In a "people's democracy," we are told, the economic system is an ideal one in which each one works for the good of all. But when all property is owned by the state, when everyone works at a job assigned by the state, when private enterprise is abolished, when labor unions and collective bargaining are no more, we call that economic slavery.

In a "people's democracy," too, there are schools and universities. Scientists work in research laboratories. But when what is taught in the schools is dictated by the "party," when the theory which a scientist may expound is determined not by laboratory findings but by edict of the state—then that is intellectual slavery.

And when in a "people's democracy" those who have offended the state are shipped by the million to forced labor camps—that is just plain slavery—period.

If there are those who would suggest that this is an extreme statement of the Communist position on freedom, I can only refer them to the published statements of the leading spokesmen of the Communist Party of the Soviet Union. For example, Mr. A. Y. Vishinski in his book *The Law of the Soviet State* published in 1948 has this to say:

"In our State naturally there is and can be no place for freedom of speech, of the press and so on *for the foes of socialism.*" In another place he says these freedoms "are the property of all citizens of the U.S.S.R. fully guaranteed by the State *upon the single condition that they be utilized in accord with the interest of the toilers* (that is, of the Party) and to the end of strengthening the socialistic social order." Again—"Having extended (these freedoms) to the toilers the Soviet government did not extend them to the non-laboring stratum."

In other words, over there freedom is something which is conferred by the dictators upon those whom they select and is promptly withdrawn if, in the opinion of the dictators, this freedom is misused. Now I submit, when freedom is selectively conferred—and withdrawn—by edict and is not recognized as a natural inalienable right,

then it is not freedom at all and the very use of the word is a lie.

In the eyes of the world of science, the final proof of the abolition of freedoms in Soviet Russia came in 1948 when the Communist Party proclaimed, in essence, that the freedom of science no longer existed. In that year the fantastic theories of genetics espoused by a certain Mr. Lysenko were elevated to the position of official Party doctrine. Immediately upon this announcement, a number of Russian geneticists, knowing their future to be at stake, promptly recanted and apologized for their former advocacy of the genetical theories founded by Mendel and brought to fruition by the late Thomas Hunt Morgan of Caltech. One speech of renunciation by a Russian geneticist went as follows: "From tomorrow on I shall not only myself in all my scientific activities try to emancipate myself from the old reactionary Weisman-Morgan views, but shall try to reform and convince all my pupils and comrades." Another one said, "It is necessary to understand the chief and fundamental things, namely, that our Party has helped us to effect a profound and radical reconstruction of our science, has shown us that the Michurin theory defines the basic line of development in Soviet biological science." The Soviet newspaper *Pravda* in commenting on this situation in August 1948 berated the biologists who held to "reactionary genetics" and said, "These men forgot the most important principle in science, the Party principle."

Such words speak for themselves. Herein lies to the scientist the final absurdity of the Soviet philosophy. The Communist Party is now saying in effect that if the behavior of nature does not conform to the principles of Communism, then so much the worse for nature!

## The Issue: Freedom vs. Slavery

Let us make no mistake about it. The basic issue between Soviet Communism and American democracy, stripped of all its philosophical trappings, is simply the issue of freedom vs. slavery. If all the American people could realize this simple basic fact the battle of ideas would be won, for certainly no one in this country, who is not the paid agent of a foreign power, would have the slightest hesitation as to which of these alternatives he would choose.

But the Soviet propagandists are too clever to admit that this is the basic issue. They talk glibly of peace and freedom and democracy and the rights of the workers. They point with vituperation and with gross exaggeration to the defects of American democracy. They spread confusion, distrust, uncertainty, disunity. Without question, their effort to spread confusion has met with some success.

The question which we, the American people face, is simply this: how are we to fight this danger of becoming confused, disunited and weakened at a time when we should be clear, united and strong.

There are some who, in their fear and confusion, have proposed rather grotesque methods for fighting this Communist menace. They say that it is necessary to fight fire with fire, though what they really mean to say is that they are afraid freedom is not a strong enough weapon to fight slavery and that we must abolish our freedoms in our fight to preserve them.

But surely this is not the American way. It was Hitler's way. And was the anti-Communist dictatorship of Hitler any better than the Communist dictatorship of Stalin? If we are fighting for freedom, let us not be afraid of freedom. If we are fighting for democracy, let us fight

with tools and techniques of democracy. The last war proved that a democracy can be stronger, even on the battlefield, than a dictatorship. If it is stronger in the military field, it is certainly stronger in the field of ideas and ideals.

Let us be concrete about this and let me give as an illustration a current problem in the field of science.

A few months ago a British scientist who had participated as a member of the British team in the atomic energy development in this country was accused and convicted of spying and of treason. He is now serving a jail sentence imposed upon him by the normal procedures of British law. Scientists all over America and in Britain were deeply shocked that one of their members should turn out to be a traitor. If Dr. Fuchs had any collaborators in this country, or if there were any scientists or others in this country who committed acts of treason, I hope they will be discovered, tried and, if found guilty, suitably punished.

But let us remember this. Up to the present time, not a single American scientist who was engaged in any secret enterprise during the war has yet been convicted or even indicted or even seriously accused of spying or treason. Even Dr. Gold of Philadelphia, who it is alleged was a collaborator of Dr. Fuchs, was not engaged in the atomic energy project or any other secret project in this country. The thousands upon thousands of American scientists who worked loyally for their country during the war achieved a proud record, indeed. And during the five postwar years that record, in spite of many insinuations to the contrary, is still unscathed.

And yet, in spite of this record, we frequently hear unfounded and irresponsible charges against scientists as a body or against individual scientists in particular. To hear some people talk you would think that scientists were such dangerous characters that they should not be employed on the atomic energy project at all!

Now, no one claims that scientists are any better or any worse than any other group of citizens. And no one would try to protect any Communists or traitors among them if there be any. But scientists, because of their important role in the defense effort, have been subjected to selective and unjustified and unnecessary attack. This has done injustice to individuals, but it has also threatened the strength of science. And so we are weakened by our own fears and our own confusions.

And this fear and confusion threatens also the freedom of science and intellectual freedom generally. For in their confusion some people do not distinguish between the Communists and those who simply hold unorthodox political views. Loyal and innocent people have suffered and others now fear to speak freely. Does that strengthen our freedom? Does that advance or retard us in our fight for freedom?

### The Responsibilities of the Universities

The universities of this country, and those who are graduates of our universities, carry special responsibilities in this fight for freedom. President James R. Killian of M.I.T. in a recent address before the Los Angeles Town Hall stated it concisely in the following words:

"We (in the universities) must oppose Communism as inimical to the freedom on which American education rests. But we must also sternly oppose the use of Communistic methods of dictating to free scholars the opinions they must have and the doctrines they must teach. Only through unqualified freedom of thought and investigation can an educational institution perform its function of seeking the truth."

General Eisenhower, president of Columbia Univer-

sity, in extending invitations to colleges and universities throughout the country to participate in Columbia's coming 200th anniversary celebration, has written to us as follows:

"... there is one principle which all free universities unflinchingly must defend. This is the ideal of full freedom of scholarly inquiry and expression, the right of mankind to knowledge and the free use thereof. For many centuries the civilized world has held that this principle is essential to human liberty, welfare and progress. Unhappily it is now being subjected to serious and systematic attack in many lands. Our Trustees accordingly have concluded . . . to ask institutions of higher learning . . . throughout the world to join in reaffirmations of their faith in the freedom of inquiry and expression."

I am sure all American universities will welcome General Eisenhower's proposal.

### Freedom Is A Weapon

To the American pioneer who set out to conquer the untamed forces of a continental wilderness, freedom was a precious and important thing. More important than life itself—more important certainly than the ease and comforts of luxurious living. It was also too precious a commodity to be trusted to anyone else, either to a dictator from abroad or to a bureaucrat in Washington. And freedom was not only a commodity but also a weapon. Because men were free they could conquer the wilderness. Because they were free they could make this country a better one for their children and grandchildren.

Today we think the pioneer days are over. But are they? I believe that our pioneering opportunities have only been transferred to a new front. Today, instead of being faced with the physical task of conquering a wilderness, we are faced with the intellectual task of conquering the jungle of man's ignorance, superstition, fear and confusion. Our frontiers are not the frontiers of the forest, but the frontiers of the mind and the spirit. Our weapons are not a gun and an axe, but a trained inquiring mind and a stout but tender heart. And if freedom was essential to the pioneer of yesterday, it is even more essential to the pioneer of today. If freedom was an inalienable right then, it should be even more so today.

And in our fight for freedom it is essential to remember that freedom is not only an end, but a means. It is not only a goal to be obtained, but is a powerful weapon to use in its attainment. For if freedom is attained, the spirit of man is freed to push on toward even greater achievements. Let us not be afraid of freedom! Let us not be afraid to defend it; let us not be afraid to use it.

To you, who are about to become alumni of Caltech, the Faculty, Administration and Trustees extend their congratulations and best wishes. We hope you have learned much during your years on this campus. But we hope that the difference between what you are today and what you were when you came here will be found in more than just what you have learned. We hope that you are also better men in every sense of the word. We hope that you are not only better equipped to perform the tasks that await you, but that you have acquired a desire to perform them well and to be of service to your fellow man. We hope that your minds have been made free. We hope that you will live in a world where they can remain free. And we hope, too, that if that freedom is ever threatened you will be prepared to fight to preserve it.

# EARTHQUAKE PATTERNS

**New research at the Institute's Seismological Laboratory sheds some new light on earthquakes—and challenges some long-standing beliefs**

**L**IKE CYCLONES, landslides, volcanic eruptions and a good many of Nature's more violent manifestations, earthquakes have always been considered unpredictable, haphazard occurrences. But new research at the Institute's Seismological Laboratory now challenges this long-standing belief.

In a recent study of all great shallow earthquakes which have occurred in the world since 1904, Dr. Hugo Benioff, Associate Professor of Seismology, has found that each of these 48 quakes—no matter where it occurred—was related to the others. All the quakes, in other words, were related in some form of world-wide stress system.

Dr. Benioff further found that, though major quakes used to occur at closely-spaced intervals, with long rest periods between the periods of intense activity, they have now settled into a routine of one great shake a year.

If this was not actual earthquake prediction—the goal of all seismologists—it was at any rate another long step toward it.

Since 1904, Dr. Benioff found, the stress or strain which accumulates constantly in the crust of the earth has been released in five active periods, each consisting of a whole series of earthquakes. Each of these active periods has been followed by a quiescent interval of little or no earthquake activity, during which crustal strain again accumulated. Apparently, Dr. Benioff reasons, there is some global force, like a huge key, which alternately locks and unlocks earthquake faults (cracks in the earth's crust) simultaneously throughout the world. When the faults are locked together, strain builds up but there are no quakes. When they are unlocked they move apart, rocks begin to slide and the earth quakes.

What is this "global force" that locks and unlocks the faults? Scientists can only guess at the answer to-

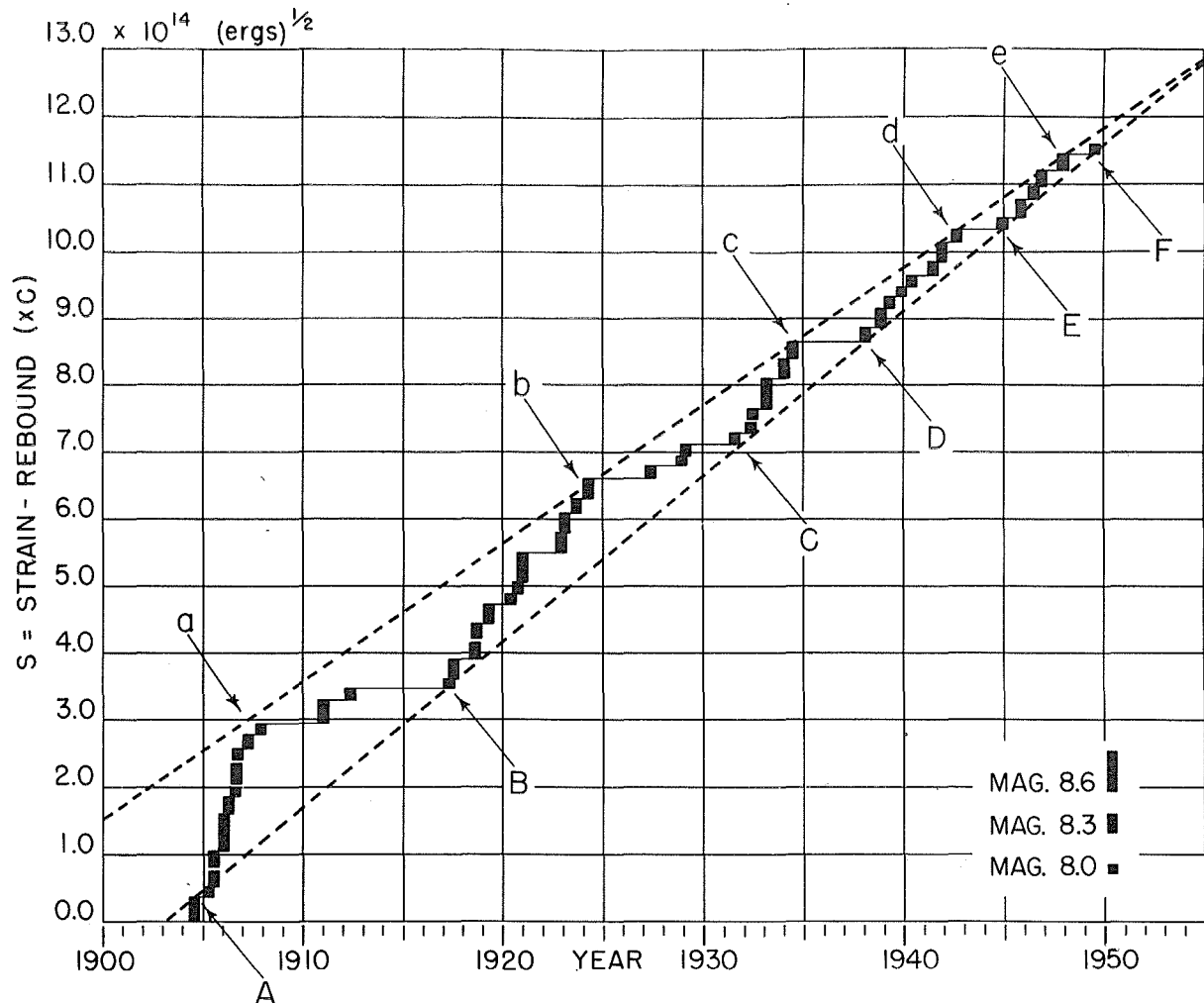
day. Possibly the earth becomes alternately smaller and larger. When it spins faster, due to slight changes in the tidal forces exerted by the sun and moon, it may become larger—so that the seams may be opened enough to unlock the tensions stored up in the faults.

In his study Dr. Benioff also discovered that strain was generated in the earth's crust at a remarkably constant rate—but it was released at an irregular rate. Major quakes used to occur at closely-spaced intervals. After a period of constant activity, there would be a long rest period of several years before activity began again. Since 1904 these periods have been getting progressively shorter. Now (since 1948) we have entered a new phase, where strain is being released at the same rate as it is generated. This means that as long as this normal regularity lasts we should have approximately one great quake a year on this planet.

The earth's crust, which is made of ordinary rocks, has considerable rigidity and strength. But it is constantly subjected to forces which cause it to be compressed in some places and dilated in others. These forces are usually resisted by the elastic strength of the crust and the frictional strength of the fault surfaces, but sometimes this strength is overpassed and there is a sudden movement of the fault blocks. The rapid movement under friction—often involving the displacement of thousands of cubic miles of rocks—sets up elastic waves which spread out in all directions. This is an earthquake—a jar to the earth's body, caused when the strained fault suddenly gives way, or snaps back or elastically recoils.

Starting with the year 1904, when reliable instrumental observations first became available, Dr. Benioff recently charted what are known as the strain-rebound characteristics of all great quakes which have occurred to date. He included only shallow (down to 45 miles)





ELASTIC STRAIN-REBOUND CHARACTERISTIC. SEQUENCE OF WORLD SHALLOW EARTHQUAKES.  
MAG.  $\geq$  8.0, SINCE 1904

*This chart covers 48 great shallow earthquakes which have occurred since 1904. It shows that most of these came during five active periods, that each of these periods was followed by a quiescent period; that the periods have been getting shorter and milder since 1904, that we are now in a phase where we can expect one major shake a year.*

quakes—which are the ones that cause most damage. And he included only major shocks—quakes whose magnitudes were recorded as 8 or higher. (Highest magnitude recorded for any quake since 1904 is  $8\frac{1}{2}$ , a figure reached by earthquakes in Colombia and Chile in 1906; Tien-Shan in 1911; Kansu in 1920; Japan in 1933. The San Francisco earthquake in 1906 had a magnitude of  $8\frac{1}{4}$ ; the Long Beach quake in 1933 a magnitude of  $6\frac{1}{2}$ .)

Because these 48 quakes occurred on so many different faults it was not expected that a plot of their strain-rebound characteristics would have any particular significance. The resulting pattern, however, was as orderly and regular as the cutting edge of a saw—with the exception that the teeth near the end were shorter and closer together (see above).

In 1904 we were in the midst of a period of violent earthquake activity which lasted until 1907. Except for two quakes in 1911 and 1912 all faults were then quiescent for almost ten years.

The next period of activity began in 1917 and continued until 1924. From 1924-1931 there was little activity. 1931-33 was another active period, followed by a quiet period from 1933-38. There was activity again

from 1939-1942. From 1942-45 there was none. Then another series of quakes occurred from 1945-48.

Since 1904 then, there have been five periods of earthquake activity, and the magnitudes of the quakes in each period are so closely related that they almost make five straight lines on the chart above. Dr. Benioff's conclusion: that the quakes are not independent, since release of strain by one shock affects the time—and presumably the strain-release—of following shocks.

The chart also makes it plain that periods of earthquake activity have not only been getting shorter since 1904—but milder too; until now strain is being released as soon as it generated, resulting in approximately annual quakes. It is impossible, of course, to conclude that earthquake activity is cyclic. The sample—46 years—is hardly large enough to warrant any such conclusion as that. If this is a cycle, however, earthquake amplitudes and periods should soon begin to increase. On the other hand, if this is merely a transient oscillation we are in now, there may be a long quiescent interval before more strain is built up and a period of activity begins again. One thing, at any rate, is certain: as long as the present situation lasts there should be fewer intense epidemics of great quakes.

# THE MONTH AT CALTECH

## Computer Symposium

■ ON MAY 12 more than 50 scientists attended a symposium at the Institute on the use of the Analog Computer for preconstruction tests of aircraft and guided missiles. The 33,000-pound computer, which has been in use for three years, is now able to check the design of a new plane from conception to completion.

Many problems, heretofore too complicated to be tackled at all, can be resolved by the big Electric Analog Computer in a relatively short time. It is especially useful for tackling structural, aeroelastic and control problems of aircraft. It can, for instance, determine in advance how an airplane wing will react—in whole or any part of it—under all types of forces. A complete analysis of wing flutter can be made, showing at what speeds it can be expected to occur, and what will happen if it does occur at that speed; what the stresses and strains will be on a wing or fuselage under all kinds of conditions; what shocks the landing gear can take; how the controls of a plane will react to varying conditions.

For the past two years the computer has been used by nearly all the Southern California aircraft companies for this type of analytical work. In fact, though the computer has been doubled in size since it first went into operation, it has been too busy to take on all the problems which have been submitted. In addition to the Institute—and the Jet Propulsion Laboratory, which uses it for analyses of guided missiles—the computer has been working for the Douglas, North American, Lockheed and Hughes Aircraft Companies; Langley Field, the Naval Ordnance Test Station, the Pullman Standard Car Company, and the Navy Bureau of Ships, among others.

## AIEE

■ CALTECH MEN AND MACHINES were the focal point of the American Institute of Electrical Engineers' convention held at the Hotel Huntington from June 12-16—the largest convention, by the way, to be held in Pasadena since the war.

Dr. Royal W. Sorensen, past national president of the A.I.E.E., delivered the address of welcome. Dr. Carl D. Anderson, Professor of Physics, delivered an address on cloud chamber studies of cosmic rays; Dr. Paul Epstein, Professor of Theoretical Physics, spoke on the life of Oliver Heaviside; Bart Locanthi, Electronics Engineer in the Analysis Laboratory, Dr. G. D. McCann, Professor of Electrical Engineering, and R. H. McNeal, EE Instructor discussed the Institute's Analog Computer.

Special features of the convention were a high voltage demonstration in the Institute's EE Laboratory and a high velocity water tunnel demonstration in the Hydrodynamics Laboratory.

## On Leave

■ AT THE REQUEST of Gordon P. Larson, Director of the Los Angeles Air Pollution Control District, Dr. A. J. Haagen-Smit, Professor of Bio-Organic Chemistry, was granted a year's leave of absence from the Caltech faculty last month to carry on advanced research on smog for Los Angeles County.



*Class of '50*

Dr. Haagen-Smit, whose research last year identified the eye-irritants in smog as organic peroxides (E & S—March '49), will be assisted in this new project by three scientists from the Air Pollution Control District and five other scientists loaned by the U. S. Bureau of Mines. His job: to find out what smog is.

## Promotions

■ PRESIDENT DUBRIDGE last month announced the promotion of 11 members of the Institute faculty, by action of the Board of Trustees.

Promoted from Associate Professor to Professor: Albert Tyler, Embryology; Dan Campbell, Immunology; Verner Schomaker, Chemistry; Robert Christy, Theoretical Physics.

Promoted from Assistant to Associate Professor: Thomas Lauritsen, Physics; Leverett Davis, Theoretical Physics; H. N. Tyson, Mechanical Engineering.

Promoted from Instructor to Assistant Professor: J. Kent Clark, English; Lester McCrery, English and Public Speaking; R. H. McNeal, Electrical Engineering; Rolf Sabersky, Mechanical Engineering.

## New Comet

■ A NEW COMET, too far away to be seen with the naked eye, was discovered last month by Dr. Rudolph Minkowski and Robert G. Harrington of the Mt. Wilson and Palomar Observatories. It was photographed by the 48-inch Schmidt camera on May 19, but was not noticed until the scientists studied the photographic plates later.

The new comet is in the constellation of Ophiuchus and is an 8th magnitude object. The faintest stars that can be seen with the naked eye are about 6th magnitude. Dr. Minkowski estimates that the comet is farther away from the earth than the sun is—which means it may be

CONTINUED ON PAGE 10

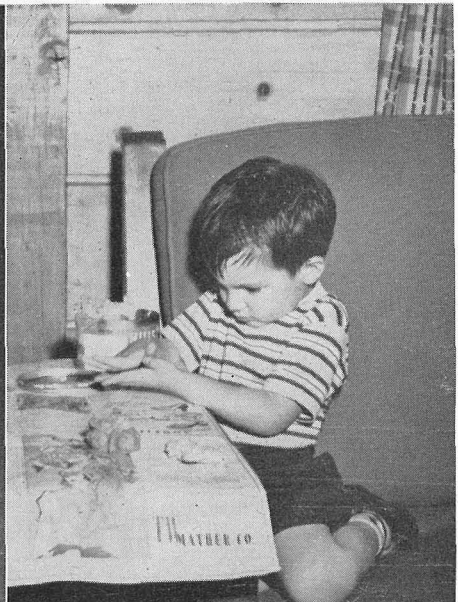


*President DuBridge delivers the Commencement Address*

# 1950 Commencement

In all, 409 students received degrees from the Institute at the 1950 Commencement on June 9—185 received Bachelor of Science degrees, 130 Master of Science, 24 Engineer's Degrees and 70 Doctor of Philosophy. The 70 Ph.D. degrees is the greatest number ever conferred at a Caltech Commencement.

James R. Page, Chairman of the Board of Trustees, presided, and the Reverend Curtis Beach of the Pasadena Neighborhood Church gave the Chaplain's Address. President DuBridge delivered the Commencement Address, "The Fight for Freedom," which appears in full on pages 3-5.



*During ceremonies Women's Club set up this nursery in Throop Club for children of students receiving degrees.*

## THE MONTH - CONTINUED

more than 93,000,000 miles away. This is the second comet to be reported by the National Geographic Society-Palomar Observatory Sky Survey which was started last summer. The first comet—in the constellation of Pisces—was discovered in November 1949.

### Board Member

■ DR. FRITZ ZWICKY, Professor of Astrophysics and member of the Mt. Wilson and Palomar Observatories staff, has been appointed a member of the Board of Trustees of the Pestalozzi Foundation of America.

The Pestalozzi World Foundation was founded in 1942 by H. C. Honegger, a music box manufacturer. Named in honor of Johann Heinrich Pestalozzi, 18th century Swiss philosopher and educator, it is a charitable organization devoted entirely to assisting children. It has branches throughout the world today, and Pestalozzi villages where orphans and other children are given haven.

In this country the foundation supports such things as polio clinics, children's wards in hospitals, boys' camps, Navajo Indian children, etc. Closely paralleling the Red Cross in organization, the foundation depends entirely on donations—in cash, food, materials and labor.

### Improvement

■ ANNOUNCEMENT WAS MADE at Commencement of a \$150,000 grant by the Carnegie Corporation to the Institute, to be used during the next five years to improve undergraduate instruction in the humanities and social sciences.

### Guggenheim Awards

■ LAST YEAR the Institute's new (1948) Daniel and Florence Guggenheim Jet Propulsion Center granted three graduate fellowships. This year the number has been doubled. 1950-51 fellowship awards went last month to Thomas C. Adamson, Jr. of LaGrange, Illinois; Eldon L. Knuth of Luana, Iowa; Robert V. Meghreblian of Los Angeles; Joseph E. Padgett, Jr. of Baltimore, Maryland; David E. Shonerd of Pasadena; and Edward E. Zukoski of Birmingham, Alabama.

Meghreblian is a second-time winner; he already holds a 1949-50 fellowship. A native of Cairo, Egypt, he left the Institute's Jet Propulsion Laboratory last year to accept the new Guggenheim fellowship at Caltech.

Adamson, a graduate of Purdue University, is currently a part-time employee of the Institute's Guggenheim Laboratory of Aeronautics. Shonerd, Caltech '43, is now an engineering analyst at the Institute's Jet Propulsion Laboratory. Knuth, a graduate of Purdue, is now working for his M.S. in Aeronautical Engineering at that university. Padgett, a graduate of Johns Hopkins, did graduate work at the Universities of Pittsburgh and Pennsylvania, and has been working in the Aviation Gas Turbine Division of the Westinghouse Electric Corp. Zukoski will be graduated from Harvard this spring.

### Stanolind Fellow

■ ROBERT L. NELSON, graduate student in geology, was awarded the Stanolind Oil and Gas Company fellowship at the Institute for 1950-51. A graduate of Williams College, Nelson received his M.S. in Geophysics from

the Institute this month, is working toward a doctorate.

The Stanolind fellowship includes a grant of \$1250 plus tuition and laboratory fees. Caltech is one of ten colleges in the country at which these scholarships have been established, and this is the fourth consecutive year the fellowship has been made available here. Others who have held it are S. T. Martner, who obtained his doctorate in 1949; and (for two years) M. E. Denson, Jr., who received his doctorate in geophysics this spring.

### Hinrichs Award

■ RALPH LOVBERG was named winner of the Frederic W. Hinrichs Memorial Award at the 1950 commencement exercises this month. The award, named in honor of Dean Hinrichs — dean of upperclassmen at the Institute from 1923 until his death in 1944 — is made annually to a member of the senior class on the basis of leadership, responsibility and contribution to the welfare of the student body.

Lovberg was president of the student body this year. He has served as an officer of his student house, as student body publicity manager, photographic editor of the *Big T*, and photographer for *E & S*. He was class president in his freshman year, was awarded an Honor Key in his senior year, and was graduated this month with honors.

### ASCIT Awards

■ AT THE ASCIT's Annual Awards Assembly on May 26 Honor Keys went to 21 students in recognition of their participation in extracurricular activities. Oliver Gardner, Ulrich Merten, Michael Sellen and Charles Steese received keys for the second year. First-time winners included C. James Blom, William Cox, Carl Fox, William Freed, James Hendrickson, Richard Libbey, David MacKenzie, Anthony Malanoski, Leon Michaelson, Robert Parnes, Noel Reed, Donald Royce, Bert Snider, Bruce Stowe, Jesse Weil and Stanley Groner.

Winner of the Tau Beta Pi Award as outstanding freshman: James LaTourette, this year's freshman class president who has been elected president of the sophomore class for next year.

Winners of the Alumni Baseball Trophy: Richard Y. Karasawa and Norman E. Gray. The Scott Tennis Trophy went to Palmer Smith; the novice award to Howard Preston.

Dabney House took the Goldworthy Interhouse Scholarship Trophy and the Ski Club Trophy, while the Interhouse Sportsmanship and Varsity Rating trophies went to Fleming House.

### Math Award

■ A THREE-MAN TEAM of Caltech undergraduate mathematics students—Julian Brody, Herbert Forrester and Richard Pierce, all seniors—was the winner of this year's William Lowell Putnam Mathematics Competition. The contest, which is open to all colleges and universities in the United States and Canada, is supported by the Putnam Intercollegiate Memorial Fund under the auspices of the Mathematical Association of America.

### Taubete Elections

■ SEMI-ANNUAL ELECTIONS of Tau Beta Pi last month took in Senior James Hendrickson; Juniors John Bjerklie, Edward Davis, Franklin Goodman, John Holmes, James Ibers, John Johnston, Thomas Layton, James McQuiston, John Rogers, Edward Stern, George Trilling, William Wright.

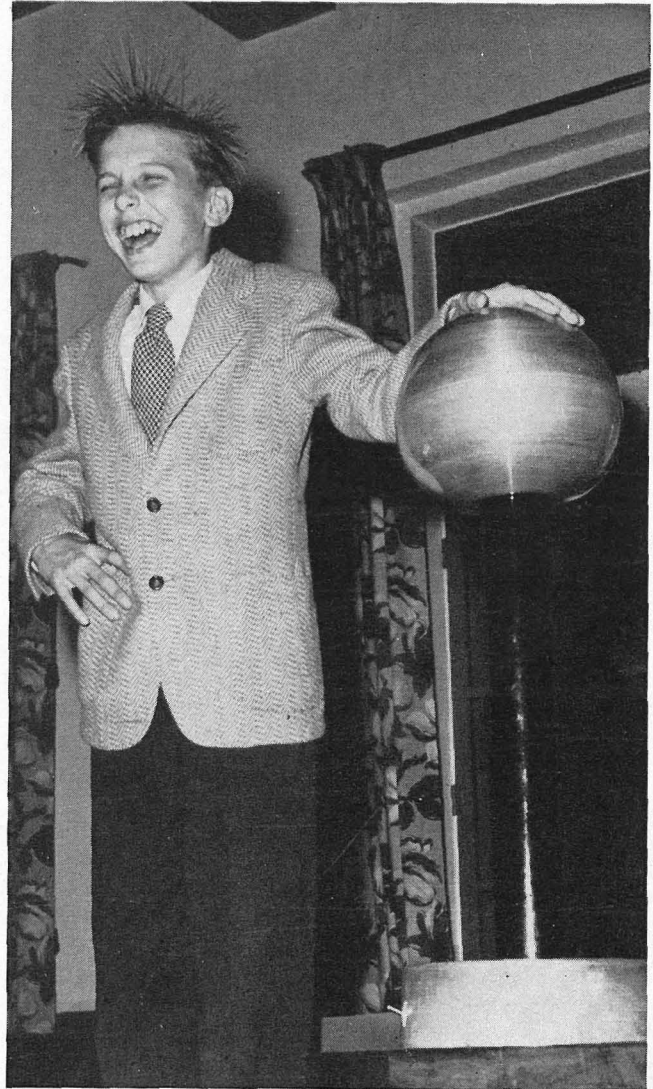


## Associates' Day

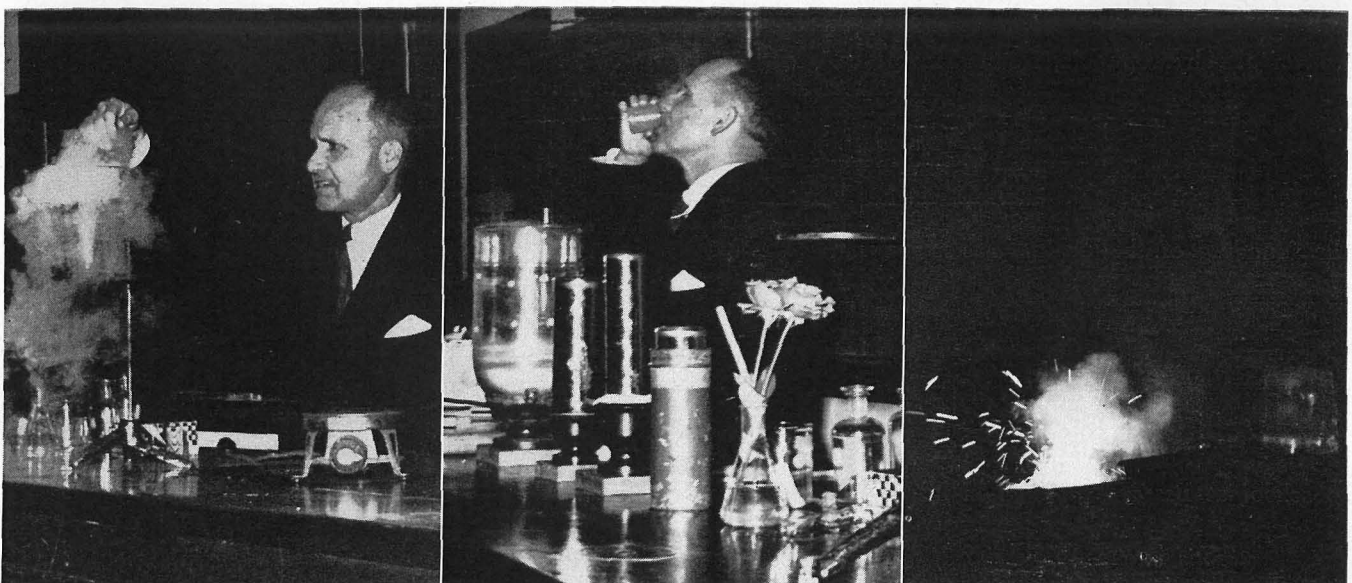
■ ON SATURDAY, MAY 20 some 150 California Institute Associates—prominent local citizens who each contribute \$1,000 a year to the Institute's support—visited the campus for the second annual Associates' Day.

President DuBridges and James R. Page, Chairman of the Board of Trustees, welcomed the Associates at a buffet luncheon in Dabney Garden. The full-afternoon program began with a series of talks in Kerckhoff, where Dr. Max Delbruck showed motion pictures of Institute research on bacteriophage; Dr. Frits Went described work in progress in the Earhart Plant Laboratory; and Dr. Linus Pauling spoke on proteins and enzymes. A second series of talks, in Arms, was given by Dr. A. E. J. Engel, who showed colored slides made from rock sections; Dr. Carl Anderson, who discussed the newly-discovered elementary particles (E & S—May '50); and Dr. Ira S. Bowen, who presented some of the recent pictures from Palomar.

Following the talks, the visitors had their choice of a laboratory tour, Dean Watson's justly-famous liquid air demonstration, or Dr. Royal W. Sorensen's equally-justly-famous high voltage show. A tour of Fleming House and tea at the Athenaeum completed the day.



*Young visitor undergoes a hair-raising experience in Fleming House, while testing the powers of home-made Van de Graaff generator which students had on display*



*Dean Watson shoots the works in his spectacular liquid-air demonstration*

## Caricatures of Men of Science

by E. C. WATSON



Louis Pasteur

**T**HERE IS NO GREATER CHARM for the investigator than to make new discoveries," said Louis Pasteur, "but his pleasure is heightened when he sees that they have a direct application to practical life."

Pasteur's discoveries must have given him great pleasure indeed. His studies in fermentation revitalized the brewing and the wine-making industries. His investigations into the epidemic which ruined France's silk producers in the middle of the nineteenth century brought the industry back to prosperity. His researches on chicken cholera, the cattle scourge, anthrax and—most important of all—hydrophobia, resulted in preventives which reduced the high death rates of these diseases to almost one per cent.

The *Vanity Fair* caricature of Pasteur on this page has been often reproduced, but to the best of my knowledge the written account that accompanied it has not. It appeared on January 8, 1887, more than a year before the founding of the Institut Pasteur in Paris, for the treatment of hydrophobia. Subsequently, similar institutes were established in many other cities of the world. M. Pasteur's reputation—as a destroyer of hydrophobia, as a chemist, and as a scientist—has grown, rather than diminished, since this tart account appeared in 1887.

"Louis Pasteur was born four-and-sixty years ago at Dole, the son of a tanner who had been a soldier, went to school at Besancon, and soon displayed a bent for

chemistry and plunged into juvenile experiments. He became learned in tartrates and paratartrates, he investigated molecular dissymmetry, fermentation, and putrefaction, and finally gave himself up to the microscopic organisms, which led him up to the further development of inoculation as a protective and curative agent in disease.

"He became famous throughout Europe as one of the first chemists of the age, and was already known to every man of science in the world, when he became also known to men in general as the inventor of the vaccinal treatment of the dreaded malady Hydrophobia. No sooner was this known than the great chemist was invaded by men of every condition and every country, and some thousands of patients, the victims of bites from dogs either mad or supposed to be mad, have now passed before the operating-table of the Rue d'Ulm.

"It cannot be said that the treatment has proved itself successful, for many of those subjected to it have subsequently died. This, however, though it may diminish M. Pasteur's reputation as a destroyer of hydrophobia, does not detract from his ability as a chemist, and there is no doubt that he is a very great man indeed. He has worked incredibly hard, and once brought on himself, by work, an attack of paralysis. He is a vivisector, yet fond of animals, and a very humane and kindly man, who, though he is greatly denounced by his opponents is beloved by all his friends."

*This is one of a series of articles devoted to reproductions of prints, drawings and paintings that mark highlights and sidelights in the history of science—drawn from the famous collection of E. C. Watson, Professor of Physics and Dean of the Faculty at the California Institute.*

# THE BEAVER



ONE AFTERNOON late in the spring term someone said there were only 456 hours of undergraduate time left for the Seniors. The Senior Beaver forgot when it was said—because at the time he had been shuffling rapidly down the olive walk, late for class, and had only snarled at the whimsical prophet who had offered the information. But later he remembered it as the first time some thought of the looming end of study, and of graduation, had really clicked with him.

Near the end of the last term, of course, all the Seniors began to realize that the Four Years were almost over. It was sort of impressive, the Senior Beaver decided, and savored waiting for the last class in each course. In fact he sat through the last class of all with ill-concealed glee, his arms folded, taking no notes—and went out of it afterwards feeling like a smug boxer who had just won a close match on points.

After all this mental gluttony the prospect of the last exams seemed even more insufferable as the Senior Beaver bent to study on Sunday night. He had faced many exam weeks before, but this suddenly looked like the most insuperable of all; to get over this last one took a certain resolution which was definitely not fostered by the feeling of successful finish which had welled up in him on Friday. Also, in this last term he had deliberately, calculatedly loafed, in the accepted attitude of spring and the auspicious Senior Term. Now he wondered in a chill of some terror if perhaps he had exceeded the invisible limits of flunking-out, where no amount of exam-study could save him. At any rate he geared his mind grimly to the remaining hours, snaked furiously, and cursed the nights for being so diabolically short.

## Momentous Occasion

THE SENIOR BEAVER stretched mightily, looked up at the sky, and felt a great weight slide from his back. The last exam was over; he had finished all his work at Caltech. This *should* be a momentous occasion—but somehow the moment didn't feel very momentous.

Probably, he decided, he had anticipated this moment too strongly for too long; now it couldn't possibly be as good as he had expected. And when he tried to capture the monumental substance the moment should have, all he succeeded in feeling was a great thirst for beer.

That evening, over a succession of pitchers of foaming brew, the Seniors talked about the past four years—

trying to find in each other's talk the realization that it was all over. They got quite drunk in the attempt.

Senior Week had a misleading quality. The Senior Beaver had expected it to produce the elusive feeling he sought: that he was really finished. Once or twice, sitting over his coffee at late breakfast, he had watched the underclassmen rushing to their various exams and felt as though he no longer had a place in the rat race. But most of the time, drinking beer, or lying on the beach, or sleeping in, he simply knew the usual vacation feeling: that you're getting away with a little freedom now but there'll be more work waiting when it's over.

There were a lot of other Seniors to celebrate with too. Already they were reminiscing like Old Grads about past pajamarinos, dances, and basketball games ("Remember the one we won with Oxy where they had to go two overtimes?"). But they were still a class, together, and their talk didn't yet have any of the background poignancy of Old Grads trying to relive their lost pasts.

In Senior Week the Seniors were still a group, homogeneous in the current fabric of their lives, not split up by post-commencement surroundings and friends and memories which would never be melted back into this one close group. And now they could only talk of getting graduated and "getting out of this place—the faster the better."

## The Finish

FRIDAY AFTERNOON the Senior Beaver descended to the Board of Directors' room with a crowd of gay, yelling Seniors, picked up his black robe and cap and put them on. He noted, with comments to the others, that the sleeves were too big and got a laugh out of this. When he joined his enrobed class in the arcade of the Houses he saw the neat rows of chairs on the wide green Athenaeum lawn, the flurry of people, the colorful clothes. As the Seniors milled around he heard over and over the ancient graduation greeting, "Hey, what are *you* doing here?" or "How did they let *you* out?"

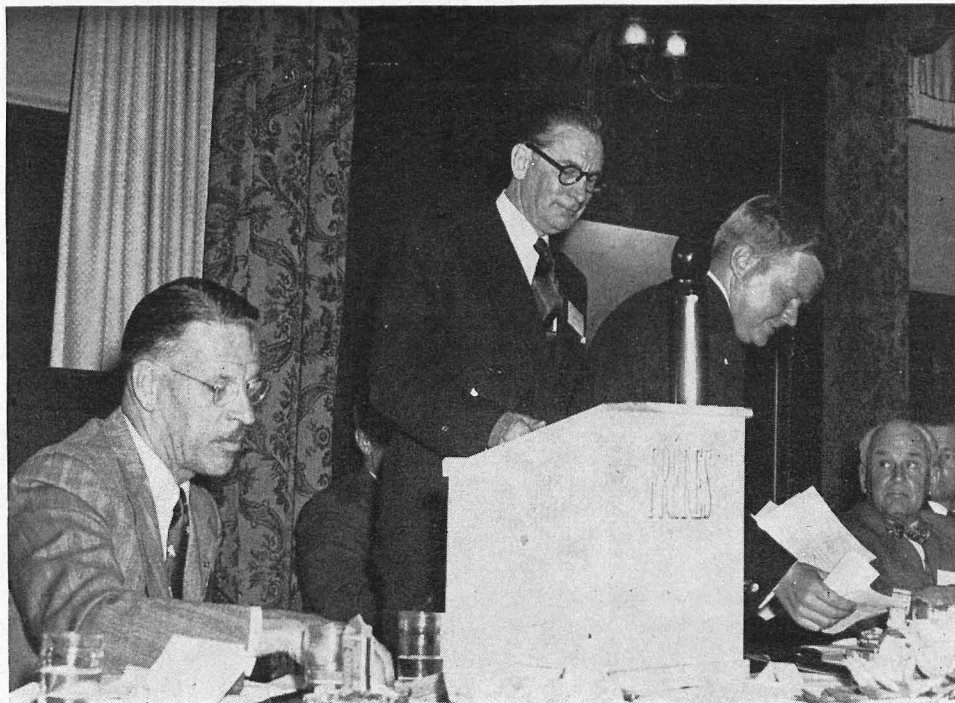
The sun was especially hot as he stood in line, waiting to march up to the front seats, and he could feel a disconcerting drop of sweat start down his back under the black robe. The program in his right hand was suddenly soaking wet. The organ processional next, and walking down the aisle in pairs past a sea of proud beaming parents' faces, bright spring clothes, purring movie cameras, into the empty rows of seats with name cards on them. Faculty coming up onto the pine-covered platform in brilliant Ph.D. robes. Now the invocational prayer and the commencement address and the consciousness of the sun's heat and how uncomfortable sitting had become. Finally somehow it's time and the Seniors file up for the black folders passed out by Dr. DuBridge.

The Beaver didn't remember focussing on anything until he was back in his seat, looking at the gilt and black letters on the diploma. When it was all over the crowd broke up into talking groups, shaking happy hands, taking pictures of robed graduates.

The Beaver roamed about, shaking hands with his classmates, saying final farewells like "See ya around," and at last got away to take off his robe. When he returned, the crowd had largely disappeared and only the vast field of disarranged chairs remained on the green grass. The House was empty and quiet and his footsteps echoed in the court. Suddenly and for the first time he realized he had finished.

—Jim Hendrickson '50

# ALUMNI NEWS



G. K. Whitworth, new president of the Alumni Association, takes over from Joe Lewis at the Annual Alumni Meeting, June 9. At left, Clark Millikan, speaker of the evening; at right, R. A. Millikan.

## Annual Meeting

**T**HE ANNUAL DINNER and meeting of the Alumni Association held on June 7 at the Los Angeles Athletic Club brought one of the best turnouts in years—275 members.

President Joe Lewis opened the meeting, and after Treasurer H. R. Freeman's annual report (which will appear in full in the October E & S), some of the distinguished guests present were introduced—including Dr. DuBridge, R. A. Millikan, Prof. Royal W. Sorensen, Dean Franklin Thomas, Prof. George R. MacMinn, Hal Musselman, and Prof. Harold Wayland.

## Reunions

■ The seven classes which were holding their reunions this year then delivered their reports—such as they were. The cream of these—which has been separated from a large amount of material of questionable taste and validity—appears herewith:

### 1915

Of the 10 original members of the class, 8 remain, and 5 are here tonight—or 62½%; a record, I imagine, that few classes will ever meet. All 5 of those here, I might add, are charter members of the Alumni Association.

—Earl A. Burt

### 1920

This is not only the 30th anniversary of the Class of 1920, but is also the 30th anniversary of Caltech. Our class started out at Throop College of Technology and spent over 3½ years there but graduated from Caltech, as the name was changed on February 10, 1920.

Out of a total of 34 alumni of this class now living, 28 are within a radius of 130 miles of Los Angeles. There are 16 of us here tonight—a 60% turnout. Of

these 16, only half have stuck to engineering or related fields. The non-engineering activities range from real estate and building to insurance and politics; we even have an ex-mayor and a deputy city attorney.

Based on the performance of those present, we have produced about 1 1/3 children and .3 grandchildren per member. And, at our age, I don't think much improvement can be expected on this score.

—Mark Sawyer

### 1925

The Class of '25, whose 25th anniversary has been celebrated this afternoon and this evening, was truly an outstanding class, whose exploits and triumphs are now being recounted to a third generation.

While still freshmen of only a few days, the class established supremacy over its rival, the Class of '24, by winning the annual Pole Rush, a he-man version of the present Mudeo.

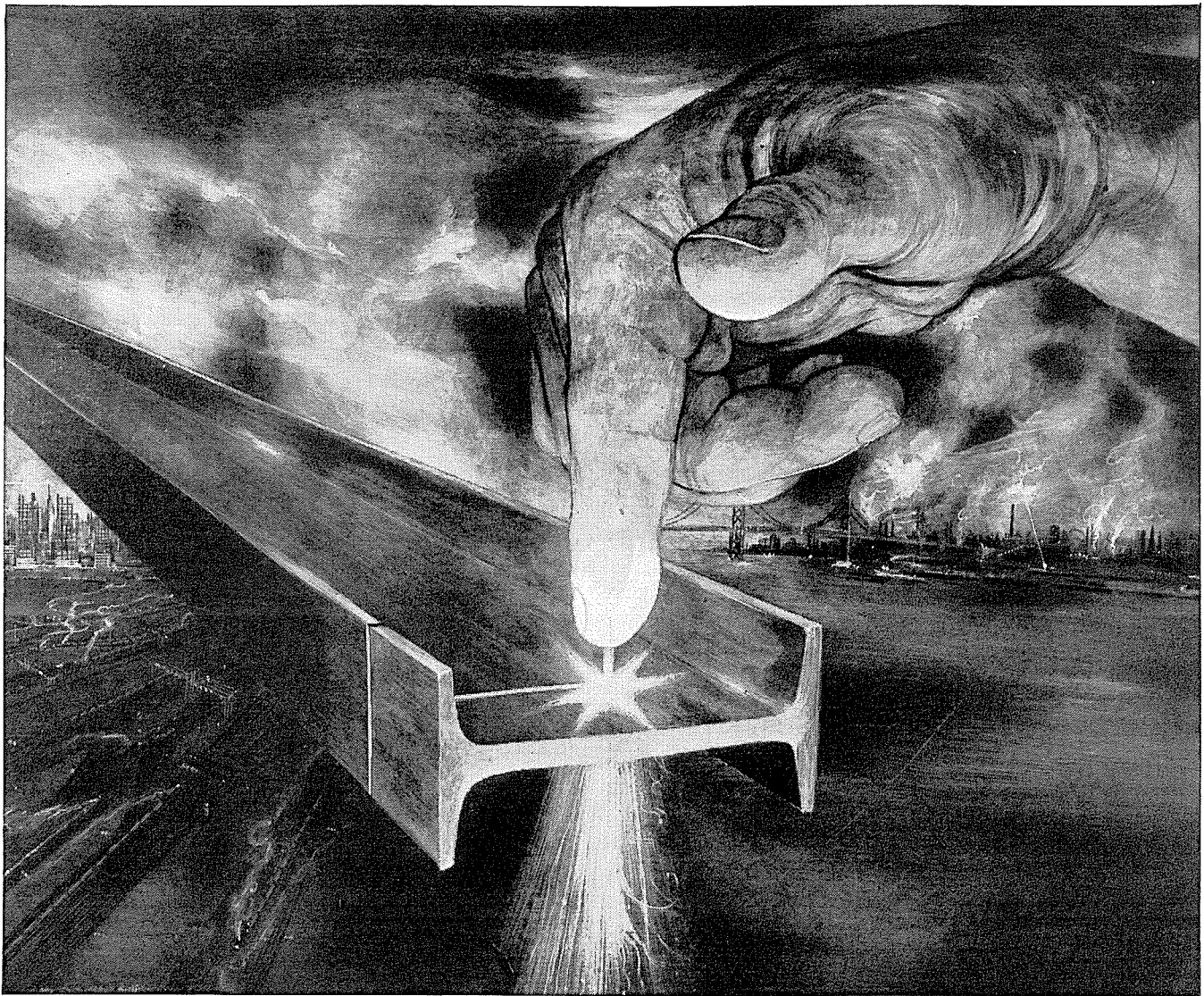
A year later the class, as sophomores, won the Pole Rush a second time—a feat never before accomplished—and therefore slapped down the frosh so diligently that the faculty found it necessary to intervene in their behalf.

In their junior and senior years, members of the Class of '25 distinguished themselves in many of Tech's activities. As juniors they contributed much toward a very successful football season—one highlight of which was the Tech-U.S.C. game in which U.S.C. was held to an 18 to 7 score.

Of 220 total membership, 77 graduated in 1925, representing almost equally the various branches of engineering then taught. Of these, 37 are still practicing engineering in some form or another. The others, who undoubtedly pay more income tax per capita, are occupied in such widely divergent fields as insurance, oil, teaching and law.

There are 31 members of the class here tonight, and from them we have gathered these vital statistics:





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ache now, just reach for an aspirin, which is really acetylsalicylic acid.

The people of Union Carbide pioneered in giving the world acetylene—its products and the equipment for its most efficient use. Today they pioneer in the development and production of many better materials . . . for the use of science and industry.

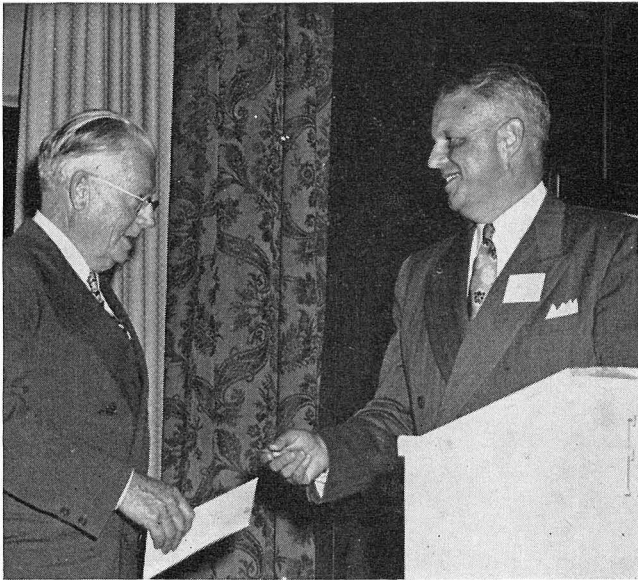
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*Dr. Sorenson receives news from Howard Vesper of creation of the Sorenson Fellowship in Electrical Engineering*

- 91% still have hair
- 50% have waist measurements of 40 or worse
- 87% are married and have averaged 2.15 children each
- 1 grandfather is in escrow
- 3% could work an elementary calculus problem
- 100% are convinced they are underpaid

—Wesley Hertenstein

#### 1945

There are 24 members of the Class of '45 here—approximately 10% of the class. Of these, 14 are married and have a total of 12 children. Most of us have stayed with our options, though 3 are going to school and learning a different field, 2 are in sales engineering, 1 is teaching, and 1 is a hotel owner. Incidentally, our class produced the greatest athletes Tech had ever seen or ever will see; our offspring production may someday give Tech some athletes of merit.

—Gene Bolster

#### President's Report

■ In a brief resume of his official annual report, Alumni President Joe Lewis noted that membership in the Association climbed to a record total of 2216 this year. This means that 45% of all Caltech degree-holders—including two out of every three bachelor degree graduates—belong to the Association. Most colleges and universities, let it be noted, feel that a 25% membership ratio is full and sufficient justification for the existence of an alumni organization.

Joe also noted that a new and badly needed Alumni Directory might be forthcoming within the year; and that the Alumni Fund for the new gymnasium totalled \$24,201.70 for this year, \$62,102.69 for the three years it has been in existence. (These figures as of approximately 9 p.m., June 7, 1950.)

#### New Officers

■ The election of officers for the Alumni Association for the year 1950-51 put George K. Whitworth '20 in as President, Robert P. Sharp '34 as Vice-President, Donald S. Clark '29 as Secretary, and H. R. Freeman '25, Treasurer. The new directors of the Association,

as well as the new 1950-51 officers of the Chapters are listed in the box on page 18.

#### Sorenson Fellowship

■ Howard G. Vesper, '22, announced the creation of a Royal W. Sorenson Fellowship in Electrical Engineering—a \$900 annual graduate fellowship to be awarded for the first time this fall. A small group of alumni—mainly electrical engineering graduates—have established the new fellowship, as a recognition of the leading role Prof. Sorenson has played in Institute life for more than 40 years. He retires from active Institute participation at the close of this academic year.

Dr. Sorenson has been on the Institute staff longer than any other member, having become head of electrical engineering at Throop Polytechnic Institute back in 1910.

The announcement of the new fellowship was a complete surprise to Dr. Sorenson. Because more than 100 alumni have contributed to the establishment of the fellowship, it would be difficult for Dr. Sorenson to thank each one of them, but to those who were at the dinner—and those who will be reading this magazine—he extends his thanks, and his heartfelt appreciation.

#### Caltech and the Supersonic Age

■ Speaker of the evening was Dr. Clark B. Millikan, Director of the Guggenheim Aeronautical Laboratory. His subject: "Caltech and the Supersonic Age."

Dr. Millikan described the extensive engineering and technological developments in supersonics in the last decade, and the part Caltech has played—and is playing—in these developments. Caltech, he explained, is interested in this field for a number of reasons—most importantly, because of its future peacetime applications, but also to develop basic research, to investigate the possibilities of space travel (which now, of course, definitely is a possibility), and finally, because of the military significance of supersonic flight.

Dr. Millikan concluded his talk with this forceful statement:



*C. B. Millikan, director of Guggenheim Aeronautical Lab, addressed meeting on "Caltech and the Supersonic Age."*

"It is, I think, universally agreed by participants and believers in our so-called Western world that the single problem of our age which transcends all others in importance is that of ensuring that we do not lose our heritage of freedom and human dignity, which has been won through so many centuries of painful effort and struggle. The communist group which controls Russia and much of what is called the Eastern world has the avowed aim of dominating and controlling the entire world. Thus our most impregnable resolve must be never to succumb to such domination even if this means engaging in another war in defense of our freedom. We must accordingly so conduct our national life as to make our chance of winning such a war, should it be forced upon us, as large as possible.

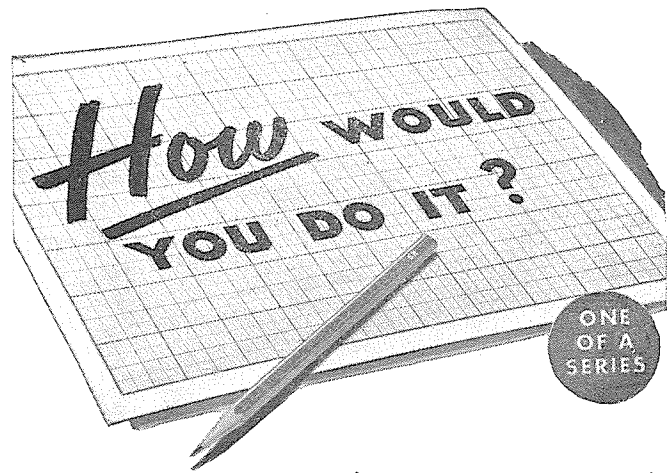
### Totalitarian Menace

"However, of almost equal importance is the problem of removing this totalitarian menace without permitting the conflict to reach the stage of all-out war. For the material and spiritual losses in such a war, even if we were eventually to win it, would be only less tragic and disastrous than would follow from succumbing to the tyranny either supinely or through military defeat. The intellectual question of how best to meet this problem has for some years divided and confused us. Many intellectuals have been blinded to the realities of totalitarian dictatorship as it actually works by the altruistic aims expressed in communist literature. Other persons, disillusioned with or suffering from the admitted injustices and weaknesses of our present democratic system, have transferred their allegiance either overtly or secretly to the communist doctrine, without realizing the hideously greater injustice and personal degradation which in practice result under its regime. And there has been sincere doubt and confusion in the minds of many men of good will as to the real nature of the problem and how it can best be met.

"It is only within the last few months that an official statement has been made by our government giving an estimate of the situation (to use a technical military phrase) and a definite policy for coping with it. This statement, made in the vitally important San Francisco speech of Secretary Acheson, is in essential agreement with the views of many who have thought much about the problem. It seems to me that the policy enunciated is based on two fundamental postulates: First, the present group of leaders in the Kremlin are implacable in their objectives of eventual total Communist domination, and of the retention of personal power, and, in consonance, are entirely ruthless and unfettered by moral considerations in their methods of reaching these objectives. Second, the monolithic tyranny which they dominate and control from Moscow is intrinsically unstable and must eventually be split and rent asunder by schism and internal pressure.

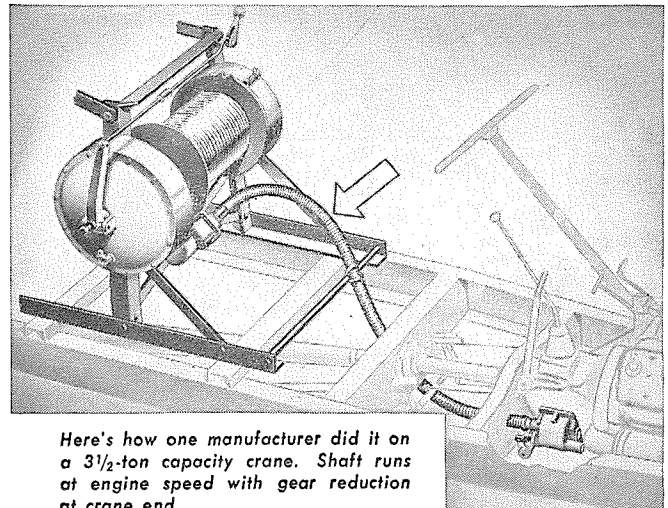
### Military Strength

"Certain consequences of these postulates seem inescapable: We must remain so strong that the Kremlin analysts, who are certainly both intelligent and able, will believe that their chance of victory, following a military attack on the West, would be slim. For if, as a result of estimates of our weakness, they believed that military aggression on their part would have a large chance of success, it is certain that no moral scruples would restrain them from attack. Further we must attempt by every possible means to exploit the instability of the regime behind the iron curtain, and



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thus to accelerate its ultimate disintegration. These means include penetration of the curtain so as to reach the masses behind with information and data to which their masters know they cannot safely be exposed, active assistance to insurgent groups, and many others.

"Thus it has finally become clear that the military strength of our country is the first essential to any reasonable hope both of avoiding the tragedy of war in the near future, and of avoiding defeat by totalitarian aggressors if war should be forced upon us. The military aspects of supersonic flight as included in the fields of Aeronautics and Guided Missiles are considered by our military planners as comprising perhaps the most important element (aside from atomic energy) of their development program. These two fields are currently receiving nearly one-half of the Department of Defense 550 million dollar annual Research and Development budget (again this does not include the atomic energy appropriations).

"Many of us at Caltech who are working in this supersonic realm accordingly feel, I think rightly, that we are not only enjoying ourselves with the fascinating scientific and technical problems which we have chosen as our life work, but are also contributing in some small way to the solution of the most vital human problem of our time. Further, those of us on whom government has called are willing, indeed anxious, to spend a considerable fraction of our time and energy to give what help we can towards the wisest and most effective use of these powerful new scientific and technical tools in the great task of preserving our precious heritage of freedom and dignity."

### Field Trip

■ THIS YEAR'S ALUMNI Field Trip was held at the Inyokern Naval Ordnance Test Station in conjunction

with a schedule of activities staged by the Navy on Armed Forces Day, May 20.

Thanks to the efforts of the entertainment committee at China Lake, the activities of the Caltech group proved to be unqualifiedly successful and enjoyable. The man primarily responsible for Caltech alumni participation in the program was K. H. Robinson '28, general chairman of the committee. Working with him to provide a smooth-flowing schedule were Carl Heilbron '25, Clarence Weinland '25, Arthur Ellings '38, and R. M. McClung '39.

To establish a meeting place for Caltech alumni, their families and guests, we took over the Anchorage, an air-conditioned building which was convenient to the various exhibits and demonstrations. Free beer, coffee and pop were served to registered members, and proved to be a well-received "extra" to the 700 people who visited the Anchorage through the day, including a number of faculty members.

About 440 people stayed for the barbecue dinner in the Michelson Laboratory cafeteria, which was followed by short addresses by station personnel and alumni and faculty representatives.

The Navy's all-out show provided an active day. The Air Force cooperated as well, and sent a flight of North American Sabres to Inyokern to demonstrate some of the capabilities of what is officially recognized as the world's fastest plane. The Navy show included firings of rockets from aircraft and from the ground, arrested landings and catapult take-offs. Throughout the day a color film was shown at the station theater, covering early rocket development work and testing which could not be shown to the visitors to the base.

All in all it was a big day for Caltech alumni and—with some 700 of us on hand—about the biggest alumni field trip since the Palomar junket.

—Phil Shepherd '38

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# PERSONALS

1918

*Earl Mendenhall* has been elected president of Sterling Electric Motors, Inc., in Los Angeles, succeeding Carl E. Johnson, who was elected board chairman. Earl has been associated with Carl Johnson for over 34 years and together they have been granted some 200 patents. His son, Earl, Jr., will be a sophomore at Tech next fall.

1923

*Dean Fowler* is just completing 27 years with General Electric. At present he is Manager of Sales for the San Jose Motor Plant, which opened about a year ago, and is building integral horsepower single-phase motors and vertical polyphase motors for the world market.

1924

*Oliver Kilham* has been appointed Assistant to the President of American Pipe & Steel Corporation, effective June 1. He is living in Altadena.

*Lyall Pardee* is Office Engineer in the Administration Division of the Bureau of Engineering, City of Los Angeles. He had a granddaughter, Pamela Jean Pardee, born last December.

*Martin Beeson*, still Senior Electrical Engineer for Los Angeles County reports

that, for an old man, he's doing o.k. The reason he's feeling sensitive about his age—his second grandson was born on May 28. Steven Lee is the name; his brother, John William, will be 2 in October.

1925

*Thomas P. Simpson*, "for the benefit of other Old Grads with sons in college," writes from Pausboro, N. J., that his son Bert has just finished his freshman year at Princeton, where he expects to specialize in Architecture; and that son Tom, who graduated from Peddie Prep this June, will matriculate in the School of Engineering at Columbia University in the fall. Tom Junior recently won the New Jersey State Golf Championship for prep and high school students. Tom Senior is still on the job as Director of Research for Socony-Vacuum.

1927

*Murray N. Schultz* is practicing dentistry in Redondo Beach and living with his 17-year-old son who is going to Dental College. Murray also has a married daughter and a 4-month-old grandson.

*Arthur H. Warner*, Ph.D., for four years a Technical Staff member of the Naval Ordnance Test Station at Inyokern, has

recently become Director of Technical Operations for the Joint Long Range Proving Ground, Cocoa, Florida. This new position carries with it the complete overseeing of the functions carried on by the technical operations facilities—including the preparation, preliminary testing, launching, and flight analysis of the guided missiles which may be tested at the proving ground.

He and his wife have two daughters: one a sophomore at Pomona, and one a senior in high school.

1930

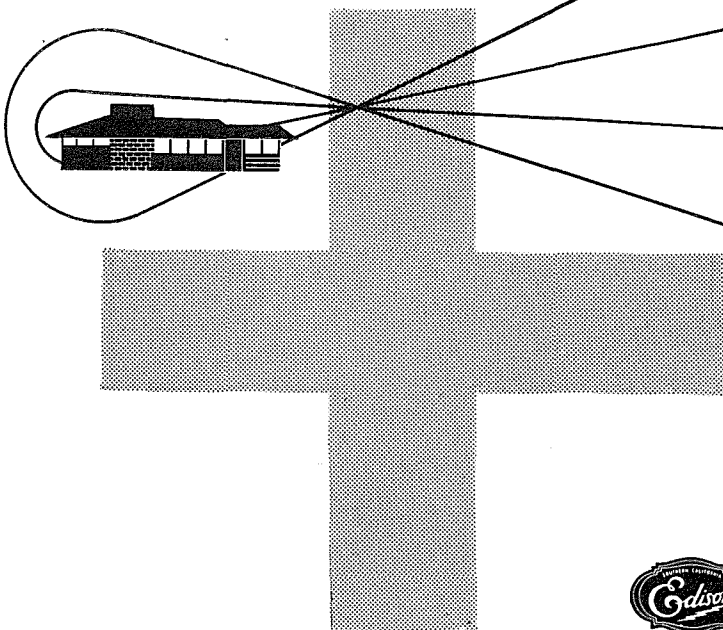
*J. H. MacDonald* brings us up to date with the news that he has "the same wife and two kids . . . and probably hold some sort of record for the Class of '30;" I have a daughter who is a freshman at Pomona and a son who'll be knocking at the door of Tech in '51.

"Made 2½ stripes in the Navy during the war in degaussing and anti-mine-warfare work—a peculiar trade for a civil engineer who was farming . . . Still farming citrus at Glendora and have a partnership in the John Hostie Co., a local shop manufacturing, wholesaling, retailing and installing irrigation equipment. Currently we're doing a lot of school and park-lawn sprinkling systems—pretty rugged hydraulics!"

1933

*Ted Mitchel* was transferred in January by the Shell Oil Co. from Division Mechan-

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*Southern California Edison Company*

ical Engineer to Senior Exploitation Engineer for some reservoir training. He was also recently elected 1st Vice-President of the coastal chapter of API.

*Harald G. Olmsted* has been appointed Chief Structural Engineer for the Los Angeles City Board of Education. He was previously employed by J. M. Montgomery & Co., Engineers & Contractors, in a similar capacity.

#### 1934

*Arza Porter*, his wife and four children (2 boys and 2 girls) are living in Glendora. He's employed at C. F. Braun & Co. in Alhambra as a Senior Designer in the Structural Group.

#### 1935

*Charles Dawson*, M.S.'37, is working as a Manufacturing Standard Engineer at Lockheed, still living in Pasadena.

*Ed Reynolds* writes that he's Superintendent of the Light Oil Operating Department at Richfield Oil's Watson Refinery. The Reynolds family now includes Bobby, 6, and Mary Lee, 4.

#### 1936

*Hugo Meneghelli* is Head of the Rocket Division at the Naval Ordnance Test Station in Inyokern. This division is charged with design and development of new rocket ordnance, including fuzes and launchers, as well as actual motor and head design. Instrumentation services for rocket tests are also furnished as is the use of a small

machine shop for making experimental parts and rocket models. The Meneghellis have two sons—Lance, 9, and Leonard, 5.

#### 1937

*Claude Nolte* is now vice-president in charge of sales of the Barton Instrument Corporation. The company manufactures rupture-proof bellows-type orifice flow meters for the chemical and oil industries. Claude is living in Altadena.

*Jack Kinley* writes from Texas that he is still with the M. M. Kinley Co. as Assistant Manager. "My work is mostly patent development. The company is an oil field service organization, with main office in Houston."

#### 1939

*Melvin Levet* is now Administrative Assistant to the Manager, Oilfield Research Division of the California Research Corporation, La Habra Laboratory.

*Udene Younger* writes that the biggest news at their house is the adoption last month of a baby boy, Olin Paul Todd Younger.

He adds, "I am still working at U.S.N. O.T.S., Pasadena, as a physicist, and building a few high-quality custom radio-phonographs on the side."

#### 1940

*Jack Tielrooy* worked for the Vega Airplane Company until December, 1941. From then until November, 1948, he was with the Shell Chemical Corporation at

Dominguez, Calif.; Dumas, Texas; Pittsburg, Calif.; and finally San Francisco. Since 1948 he has been with the Union Oil Company of California in Los Angeles. Jack lives in Fullerton with his wife and two children—Diana, 9, and Gary, 8.

*Yoshinao Nakada*, M.S. '41, writes that he has been with the Western Precipitation Corporation in Los Angeles since 1948 as a Research Physicist. He's married—no children.

#### 1942

*Mac Nyborg* has been employed as a mechanical engineer at the Naval Air Missile Test Center, Point Mugu, since 1946. He has two sons, Niels, 2, and David, 2½ months. Mac says: "Moved into our own house in the hills above Camarillo last November. Spare time devoted to paternal and horticultural activities. Techmen and Old Grads stop in for a cold beer when you're in this vicinity."

*Alden W. Ayers* is now the father of three children—Wayne, 5, Melinda, 3, and Larry, 8 months. Alden's been employed by the Filtrol Corp. of Los Angeles for the past four years, lives in Alhambra.

*Roy C. Van Orden*, who is the Associated Chief Engineer for the firm of Bennett & Bennett, Pasadena architects, became a father for the third time on April 30 when Linda Lou Van Orden was born.

*William Lester Rogers*, Assistant Chief Engineer for the Aerojet Corporation in Azusa, and his wife, have just moved into a new home at 1921 Braeburn Road in Altadena.

#### 1943

*Bill McNeely*, Ph.D., spent 1943-44 at Ohio State University on the Hoffman-La Roche Postdoctoral Fellowship, working on the structure of heparin and the synthesis of blood anticoagulants. In 1944 he came back to California and has been with the Kelco Company of San Diego as a research chemist ever since. His present work is concerned with colloids and the development of commercial products from kelp.

Bill now has two girls in addition to the one boy he had while at Tech.

#### 1944

*John Ukropina* and his wife announce the birth of their second daughter, Jan, on April 17. John is an engineer with United Concrete Pipe Corporation in Baldwin Park.

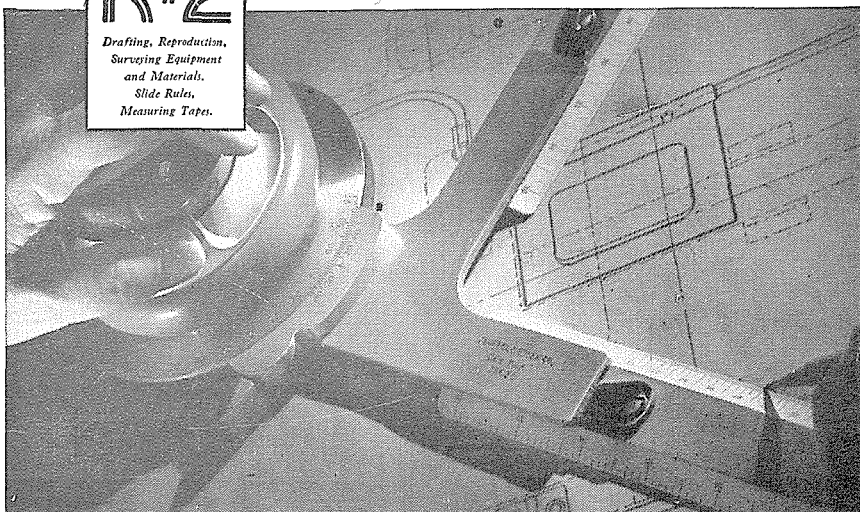
*Francis E. MacDonald* is a structural designer employed by Bowen-Rule-Bowen, Structural Engineers. He is living in San Gabriel and has a son and two daughters.

*Charles B. Miller* is an engineer for the Richfield Oil Corporation in the Pipe Line Department in Long Beach.

*Richard H. Lockett* has been working for the General Electric Co. since graduation. For the last three years he has been in their Los Angeles office. His work covers application and service engineering on airborne electrical equipment. He is living

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in Whittier and has two children—a son, 2½, and daughter, nearly 1.

*John Rempel* has been living in San Francisco since last year, where he is employed as a physicist by the Naval Radiological Defense Laboratory, San Francisco Naval Shipyard.

*George F. Smith* was married on June 3 to Miss Jean A. Farnsworth (a graduate of Scripps). They are living in Pasadena.

*George McDonald* reports that he has bought a house in Westdale Village, is the father of two boys—Bryan, 2, and Stephen, 7 months—and was recently elected Secretary of the Los Angeles Branch of the American Electroplaters Society.

*W. M. Swanson*, still at Caltech finishing up his M.E. thesis, is going to Europe for the summer as assistant tour leader with a Student Tour. He'll be back at Tech in the fall to work in the Hydro. Lab.

#### 1945

*Philip B. Smith* has just completed the work for his Ph.D. in physics at the University of Illinois.

*Bill Myers* was married on April 21 and is now living in Long Beach. He is attending the Graduate School at USC, studying Electrical Engineering, as well as teaching at Compton College in Compton.

*Joseph F. Hook* is working for a Ph.D. in Physics at the UCLA cyclotron. He's rooming with *John B. Lyon Jr.*, Caltech

'45, who is also working for his Ph.D. Joe got his M.S. at UCLA in 1949. He'll spend this summer working at Inyokern.

*Donald L. Francis*, M.S.'48, A.E.'49, is a Research Engineer at the Jet Propulsion Laboratory, in the Wind Tunnel Section, working in the fields of aerodynamics and combustion. He lives in Altadena.

*David C. Banks*, who received his B.S. in Electrical Engineering in '45, returned to Caltech for junior and senior years in Chemistry and Applied Chemistry in '47 and '48, then obtained an M.S. in Chemical Engineering in '49. He went to work then for General Petroleum at Torrance, and is now doing chemical engineering in the Process Labs at Vernon. He lives in L. A.

*Robert E. Phillips*, who expects to receive his Ph.D. in Organic Chemistry at Caltech in 1951, has been awarded an Abbott Fellowship for next year.

#### 1946

*Richard Kuck* is working on television relay engineering for the Pacific Telephone and Telegraph Co. in Los Angeles. He is married and has a 20-months-old daughter.

*Ted Neale* has been working with his dad since 1946 at Neale Advertising Associates, an advertising agency in Los Angeles. He is now an Account Executive on smaller accounts and Junior Account Executive on some larger ones.

*Hal McCann* writes from the Canal Zone

that he, *Art Teets* '45, *Ward Vickers* (a V-12 student at Tech during the war) and *Yvor Smitter* are all flourishing on their 'round-the-world cruise on the 72-foot three-masted schooner *California*. They sailed from California in April, 1949, have no timetable, but expect to take at least another year. Next stop: Galapagos, then Tahiti.

#### 1947

*Charles N. Miller* has been with the Navy Electronics Lab., San Diego, since June 1947. He married a San Diego girl in June 1946.

*Robert B. Harris*, M.S., has been Assistant Professor of Civil Engineering at the University of Michigan in Ann Arbor for the past year. He was married on December 17 to Miss Jean M. Petchell of Bismarck, North Dakota. This summer he will work in the design office of the Detroit Edison Co., then go back to Ann Arbor in the fall.

#### 1948

*Norman E. Olson* is working for the Hunter Douglas Corporation in Riverside, Calif. He joined the company in November, 1948, is now a research engineer working mainly on product development and testing.

#### 1949

*Dave Baron* and his wife announce the birth of a son on May 10.

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# BOOKS

## SCIENCE IS A SACRED COW

by Anthony Standen

E. P. Dutton, N.Y., 221 pp., \$2.75

*Reviewed by C. E. Harrold  
Research Fellow in Biology*

AT THE BEGINNING of his book Standen acknowledges his debt to the Long Island Railroad and confesses that "... the more the train was delayed the more time I had to write." One, at least, of his readers hopes that the Long Island Railroad can do something about its schedules before Mr. Standen feels obliged to burden us with a further confusion of prejudice and half-truth.

The book is intended as a blast against that monstrous regiment of educators and scientists who think that "... Science with a capital S—or rather its concentrated and distilled essence, the Scientific Method—is the universal cure-all for mankind." Standen continues, "... The idea that science is infallible and beyond criticism is a delusion and even a dangerous one. The teaching of science only perpetuates this delusion for it is always taught by scientists, who are so busy keeping up with science that they can never look at it from the outside."

The notion that science and the

scientists are infallible is dangerous. The public, of course, should be aware of the limitations of science and realize that by their very nature the theories of science at any moment are only a current approximation to the facts and will be altered as new facts are accumulated. But the public should know that this willingness to alter scientific concepts is the essence of the scientific attitude and that it was necessary to establish this essential discipline in the face of much authoritarian opposition, before the great body of scientific knowledge could grow.

### Nothing Serious

Rather than stress this important point Standen prefers to woo his readers with the specious argument that since today's knowledge about the atom makes the ideas of twenty years ago look decidedly imperfect, so, in its turn, today's knowledge will inevitably appear to be "decidedly frowsy" twenty or thirty years hence and therefore should not be taken too seriously.

He has neither honesty nor wisdom enough to inform his readers that today's ideas will become obsolete by the practice of those same disciplines which made yesterday's ideas untenable and that this is how scientific knowledge advances. Such irrelevant and fallacious arguments characterize most of the book.

It may be sad that science cannot be practised in popular terms which everybody misunderstands, but it is

a fact that Mr. Standen and many other people must recognize.

After the general assault on science the author takes his readers on a rampage through the scientific china shop, smashing one imagined idol after another. At the end of this the layman, for whose edification science is dubbed a sacred cow, will probably know nothing more about physics, biology, psychology or the social sciences (chemistry is lumped in with physics) than he did at the outset. Worse still, he may have picked up many confused and inaccurate notions about these fields of study—and here Mr. Standen has done his cause a great disservice.

*Science Is a Sacred Cow* approaches many problems which are vitally important for society today but to solve or even define such problems demands an honesty and clarity which Mr. Standen does not bring to them. Reasoned argument and statement of fact are too often replaced by tiresome buffoonery in this disappointing book. It is a sad comment on the competence or motives of the guardians of public opinion that Standen's book received uncritical publicity in one of the most widely circulated of the national weeklies. If Standen's readers, misled as they will be about the nature and consequences of science, should accept his invitation to join him in laughing at science, "the great Sacred Cow of our time", they might do well to ponder their discomfort on finding that they are the victims of their own unpleasant joke.

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3. The amount of Marshall Plan money that is going into soft goods as compared with capital equipment, varies widely among countries. In this respect Germany and France present a strong contrast: Germany is using less than 5% of its dollar aid for the latest machines, etc., from the U.S. while France is using about 30%. France is setting itself up with steel and automobile plants incorporating the most modern design.

4. The important consideration is the *total* amount of investment in capital equipment, including that using Marshall Plan funds, that is taking place. In this respect Germany and France are more nearly on a par. Germany has the industrial sophistication with which to produce her own capital equipment, while France and the other continental beneficiaries of Marshall Plan aid have not. The United Kingdom is much like Germany in this respect. In these two countries, U.S. dollars buy food and raw materials for the most part, to supply sustenance for the population and grist for the industrial mill, while an effort is being made to build up the productive capacities of the two economies to the point where they can support satisfactory standards of living. Total investment, including that paid for with Marshall Plan dollars, is going on at a good or excellent rate, in most countries.

5. Up to this point the picture I have painted reflects a satisfactory state of affairs. It is the story that

Paul Hoffman has been telling. It is probably good enough to warrant the appropriation by Congress of \$3,100,000,000 additional to finance the ECA during 1950-51.

Now I come to the second part of my comments. The real test of whether the Marshall Plan is succeeding is still in the future. A year ago, you may remember, I expressed some serious doubts about the prospects. I emphasized especially that Europe needed the U.S. market in which to sell, as much as it needed dollar aid with which to figure out some other way to earn a living. Here are my latest ideas:

**The Situation Today**

1. Little progress has been made toward the attainment of an integrated Western European economy. The explanation is principally the same as that for the U.S. protectionism: the political influence of industrial, agricultural, and labor groups that cannot, or think they cannot, compete under unprotected conditions. These ideas are strong in all kinds of countries: Britain, France, Italy, Germany, Portugal. It is a sorry reflection on democratic processes that minorities are able to hold their positions against the best interests of the clear majorities.

2. A great deal of capital investment, including Marshall Plan dollar aid, has been made in the expectation that integration could be

taken for granted. This reflects soft thinking or undue optimism on the part of some ECA officials in the echelons below Paul Hoffman.

3. Much of the capital investment of Marshall Plan funds has been in France, Italy, Austria, and Belgium, in industries competitive with Germany, Britain, and even the U.S. In this respect the ECA has assisted the interests favoring economic isolationism in these countries. If my forecast is right that these projects will prove high cost, there will be great pressure to protect them from foreign competition. This is exactly the reverse of the outcome the ECA intends.

4. The Schuman Plan for the integration of the French and German steel and coal industries is a fresh approach to the goal of Western European economic integration. It is free of the taint of U.S. dollar compulsion, and it makes use of cartel ideas which are so widely accepted over here. It is not so ideal as the straightforward goal Hoffman has been urging Europe toward, but it holds promise of succeeding where he has failed. It will be an interesting study in the emotional versus rational approaches to the solution of a problem if the Schuman Plan succeeds. I am hopeful.

In brief, then, a year ago I was pessimistic principally because of U.S. protectionism. Now I am pessimistic in addition because of the dismal prospects of Western European economic integration. The Schuman Plan offers some hope.

The eventual outcome might be

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something like this: 1) a little improvement in U.S. imports, thereby permitting Europe to pay its way by that much more; 2) a little improvement in intra-European trade, thereby gaining a part of the advantage of integration; 3) a U.S. agricultural surplus problem which might be relieved by gifts of cotton, wheat, tobacco, and corn products to Europe; and 4) a lowering of the living standard in some countries to a point more near to what can be supported. It is really too bad that better results are not in prospect; but the critical period of postwar adjustment will have been bridged not too badly.

Now, some specific points about Germany.

1. The German productive economy is on an operating basis that corresponds reasonably well with prewar. It is quite remarkable that the huge influx of refugees and expellees has created no more unemployment than exists.

2. Living standards are low, but tolerable. Housing is really bad, but the supply of savings is not adequate to maintain full employment in the construction industry. The number of automobiles is about 1/3 of pre-

war. Incomes are low and prices tend to be high. Business profits quite generally are high, but they are being reinvested in business. The cost of rubble clearance and reconstruction is being charged to current operations.

3. Industry in general is in great need of modernization, both with respect to technical design and manufacturing methods. Under Hitler capital for reinvestment was channeled into munitions production, especially state-owned plants. The know-how is here along design and manufacturing lines, but capital in general is critically short.

4. Germany's industrial prospects in relation to other Western European countries are good. Trade liberalization, however, is desperately needed. In relation to the U.S. the prospects are not good. Bridging the dollar gap by 1952 in a fashion that will permit Germany to become self-supporting with respect to food and some materials is beyond my present expectations.

5. British and French commercial rivalry with Germany is a real obstacle to our ECA program here. About 80% of German industry is

in the British zone: the carrying out of the dismantlement and the reduction of the level of industry there have cowed and embittered the Germans. The attitude of industrialists is not what it should be to parallel ECA efforts in the direction of recovery.

6. Mr. McCloy is doing a fine job at his level. The nurturing of a German government that really represents the people is a most delicate matter. Adenauer's administration does not enjoy wide popular support, but it is probably stronger than another would be. Mr. McCloy has not had time to build up a strong Office of Economic Affairs, and it is in that area that the U.S. is doing a poor job.

I hope very much that you will ask friends of Caltech who are traveling in Europe this summer to drop in to see us.

Our home address is 7 Schoenbergerfeld, Kronberg in Taunus, telephone Kronberg 310.

Horace N. Gilbert

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