ENGINEERING | AND | SCIENCE

NOVEMBER / 1950

Freshman Camp . . . page 11

PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

What Happens When 150,000,000 People Say:

"I WANT!"

THE STORY OF OIL

COLONEL Edwin Drake's oil well, drilled in 1859, produced only 20 barrels daily . . .

But it gave people a taste of the benefits of petroleum—and a great industry was off to a flying start!

The first drilling rigs—first refining equipment—were adequate for that early demand.

But invention of the automobile, airplane, Diesel engine and other great machines in turn demanded great invention in oil—and old-fashioned equipment gave way to scientific research laboratories, modern refineries, pipelines, tankers and tank cars.

Each year demand made them bigger and better!

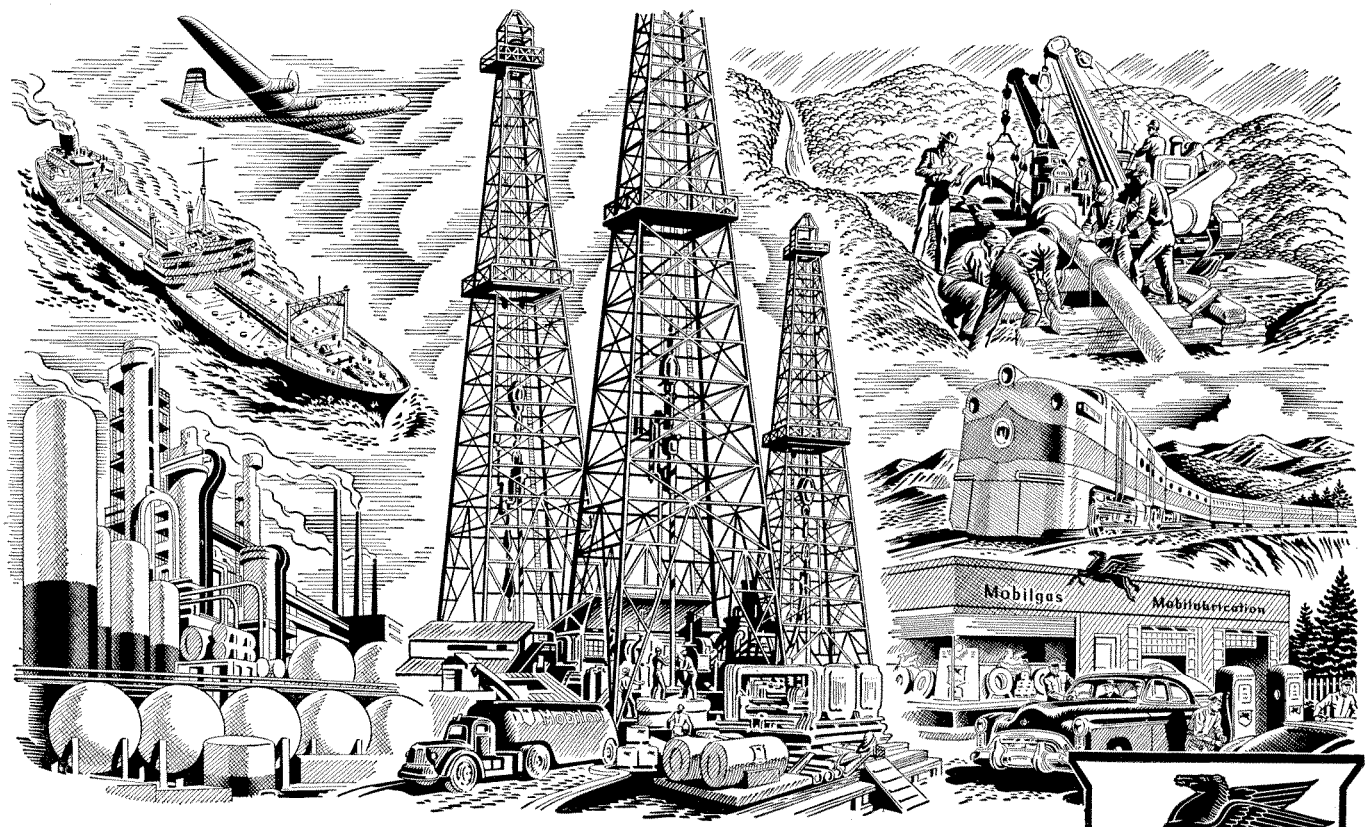
Today, thousands of oil companies with oil fields, refineries, bulk plants, service stations and cost-cutting transportation systems—deliver over 1,840,000,000 barrels of petroleum yearly—meet U.S.A.'s demands for *value in oil.*

And, today, the responsibilities of Socony-Vacuum, one of the oldest companies in the industry, are constantly mounting . . .

Unprecedented demand for petroleum products calls for expansion in every phase of our efficient, coordinated operation . . .

46,400 independent "small" businessmen must be kept *competitive*—supplied with what it takes to provide a *big money's worth* for you—a good living for themselves.

When 150,000,000 Americans say, *"I want,"* it takes businesses of all sizes to deliver!



DEMAND DETERMINES BIGNESS

The Flying Red Horse Companies

SOCONY-VACUUM OIL COMPANY, INC. • MAGNOLIA PETROLEUM CO. • GENERAL PETROLEUM CORP.

SOCONY-VACUUM

BOOKS

DIANETICS: The Modern Science of Mental Health
by L. Ron Hubbard

Hermitage House, New York, $4.00

Reviewed by Charles E. Bures, Assistant Professor of Philosophy and Psychology

DIANETICS PROMISES anyone a new personality and a new life at the cost of little effort and even less knowledge. This promise alone, well-publicized, is enough to attract a wide and enthusiastic public. What is Dianetics and how important is it?

The main popular emphasis has been on the practice of Dianetic therapy, but Hubbard's sketchy theoretical facade for this practice might well be outlined first . Briefly, Hubbard claims that the mature adult has three minds: reactive (engramic), analytical (conscious), and somatic (motor-effector). The reactive mind begins, presumably, with conception. It records physical pain or painful emotion (*whose?*) in the cell tissue of the zygote and of succeeding developmental stages. And it "thinks only in identities." *(What does "thinking" mean here?)*

The recordings of the reactive mind are called engrams, and it is stated that none are ever lost. Engrams may be pre-natal or post-natal. Some pre-natal engrams are caused by pain resulting from physical contact. Others are the recording of verbal interchanges, somehow "overheard" by the pre-natal denizen, and presumably recorded if they are detrimental to his welfare. Engrams can be reactivated by similar circumstances, and then operate as inhibiting commands on all other human functions.

How is it done?

Hubbard offers no evidence as to how speech can be recorded on cell tissue (later to be reclaimed and verbalized), nor does he attempt to explain how physical pain alone, after being recorded, can function as a command. In fact no acceptable evidence exists for such phenomena, assuming even minimal meaning.

With the maturation of the nervous system, analytical mind develops. It includes the center of awareness, all computational ability and all standard memory experiences which are not engramic. *(Note the implication that all important rational functions of this mind are computational.)* We are told that Dianetics has discovered that analytical mind is "inherently perfect" (errorless). Only the aberrative effects of engrams prevent our using this perfect, errorless instrument of rationality for a fuller, richer life. Engrams are the single source of all irrationality, all psychosomatic illness, all unethical behavior. (More recently it has been reported that the group contends that all disease is psychosomatic unless proved otherwise!)

Dianetic therapy requires an auditor and a patient. One of the alleged discoveries of Dianetics is the ability of anyone to *return* along his time track to contact earlier recordings. This is not standard remembering, it is claimed. In a relaxed state (reverie) the auditor tells the patient to return to engrams, to reduce them by repeating their content until they disappear. They appear refiled in the standard memory bank of analytical mind, accessible to remembering.

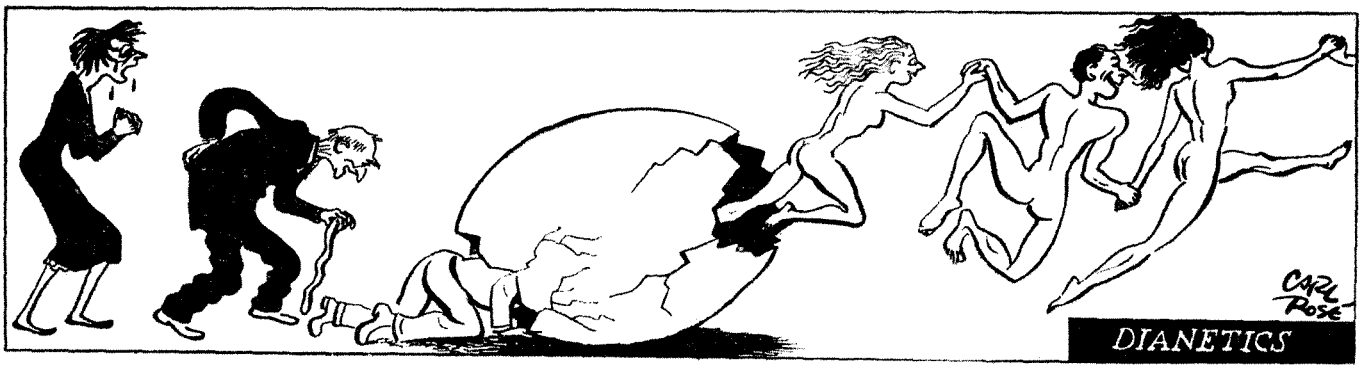
In the clear

With all engrams erased and refiled one becomes a "clear"; if only the more serious engrams are erased, one becomes a "release." *(Does a clear have to be retrained or is his perfect rationality immediate?)* Since engrams are the *sole* source of aberrations, the clear is presumably an errorless computer, ethically good and optimally healthy. Hubbard writes as if he is speaking from study of a number of cleared cases, but no data are given on the size of his sample, if any.

A wider context for this system is provided. The single fundamental principle is Survival, the "dynamic principle of existence." This dynamic principle has four separate dynamics: survival of self, offspring, group and Mankind. Rational behavior is the harmonizing of these four dynamics. The drive for survival is inherent in the individual. Hubbard states, "It is a new thought that Man is motivated *only* by survival." This is one of many new thoughts rediscovered by Hubbard.

A reward (pleasure) is provided as an incentive for the survival drive —even though this drive is inherent and necessitous. Yet the ethical theory is summed up: "The best solution to any problem is that which

CONTINUED ON PAGE 2



Reproduced by permission of The New York Times Book Review

BOOKS

CONTINUED FROM PAGE 2

will bring the greatest good to the greatest number of human beings." To effect all of these things calls for a pre-established harmony!

Criticism of Dianetics should begin with the main point of emphasis, practice. It is urged above all else that anyone who will try Dianetic therapy will be convinced, for "It works!" One basic confusion evident in this contention is the identifying of practice and confirmation (validation). This confusion is not an exclusive possession of this system. It fits well into the practical temper of American culture, where the term "theory" is often a smear term. This is a misreading of pragmatism, and in the extreme it is a false identification of knowledge and value.

Practice in psychotherapy is control of a psychological situation toward a goal. Values enter the picture in the form of a preferred goal, e. g., improvement of human effectiveness. Knowledge enters in terms of the control process and the prediction that such controls will attain the goal.

The criteria for Dianetic method and the alleged results are described and explained by means of certain concepts. Since Hubbard regards his system as an autonomous science of mind, it is clear that his sole source of data is the introspective reports of patients undergoing therapy. This is the main implication of the "It works" attitude. Systems based *entirely* on introspective reports are regarded by careful students of psychology as uncontrollable. They have no predictive value for *behavior* of the whole person. What happens is that behavioral terms are smuggled in. But this is psychology, and Hubbard states that Dianetics is *not* psychology.

Obviously, in Dianetic therapy something happens. The terms of Dianetics do not give us any information as to *what* happens, because two fundamental steps are omitted. First, the concepts must be operationally analyzed to give them meaning. Hubbard seems completely innocent of this requirement. Further, when we know what we are talking about, then we must accumulate objective evidence for confirmation of our assertions. Evidence already exists for such phenomena, but Hubbard is so convinced that his discoveries are new and original that he will have none of the old evidence, nor does he give any for his contentions.

"It works"

Despite many statements that the system rests on precise axioms, demonstrated natural laws, measurable entities, scientific facts, no reliable evidence supports these claims. Instead, we are told "It works." Evidence exists that Hubbard regards professional scholars as obstructionists and dolts. For whatever motives, it was more profitable and safer to issue an undocumented volume, with promissory notes on evidence. Believing himself in possession of many incredibly simple discoveries, Hubbard apparently also felt that the usual scientific amenities were unnecessary. This in the face of qualified opinion that amateurish meddling with human minds is dangerous.

Since Hubbard has denied to critics that his system rests on a mechanical analogy, it is instructive to point out that engineer Hubbard relies heavily on the analogy of computing machines. The mathematical biophysicists and the cyberneticists have recently attacked phases of psychology and sociology by means of neurological or mathematical models. This approach does have some heuristic advantages, but it must be handled with caution. Such theoretical models are greatly over-simplified today. They are working hypotheses, not yet "scientific facts." For one thing, such models are usually based on microscopic (neural) events. Human behavior, especially of the whole person, is macroscopic. No existing model, based on an analysis of microscopic events, does justice to macroscopic data.

Hubbard's concept of analytical mind is undoubtedly such a model. There is little doubt that he confuses his model with observable macro-level behavior. This tricks him into a thoroughly out-moded instinctivist position, with all major postive components inherent in the individual. It has taken careful scientists two generations to overcome a similar nineteenth century position.

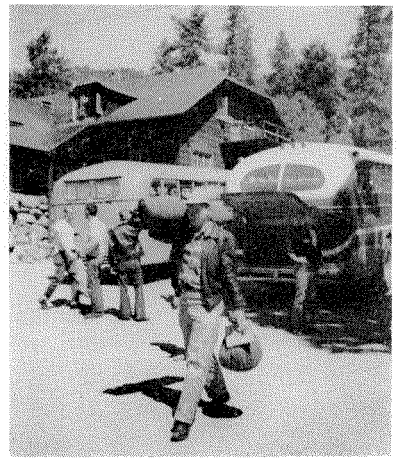
Hubbard confuses the idealized perfection of a computing machine with analytical functions of the mind, hence we have errorless rationality in the "clear". Error, then, can be attributed to a single source, the engram. Hubbard can believe that human salvation is so very simple only because the complex problems are hidden to him by his instinctivist solution. Others, more aware of the results of the last century, know that relinquishing instincts, through sound operational analysis, introduces all the complexity of socialization and cultural relativity.

Reminiscent of the early days of psychoanalysis is the manner in which Hubbard seeks to secure his system against attack. To the early orthodox analysts—and even to a few today — criticism indicates unconscious resistance. The critic needs analysis to see the light. To Hubbard, any critic must have aberrant engrams. This is a confusion of psychological states with logical principles of validation. This stand also violates a basic scientific tenet, namely, that data must be open to alternative explanations. Hubbard's position gives a closed system of undeniable evangelical advantages, but

CONTINUED ON PAGE 32

ENGINEERING AND SCIENCE

IN THIS ISSUE



ON THE COVER

The young man on this month's cover is a very tender freshman. He has just stepped off the bus into the sharp sunlight of Camp Radford, in the San Bernardino Mountains—the Institute's new student camp. At first glance he may merely seem to be heading for the cabin to which he has been assigned for the next three days, so he can unload his bedding and gear. Actually, he is doing a good deal more than this—he is beginning his college career.

On pages 11-15 of this issue you'll find some pictures of the early days of the class of '54—some of the things they did at freshman camp, and some of the things that were done to them, back on campus, as they went through their initiation by the class of '53.

SCIENCE AND FREEDOM

President DuBridge's article on page 5, "Science and the Spirit of Freedom," was adapted from a speech delivered at the inauguration of Gordon Gray as President of the University of North Carolina (the pioneer state university of America, by the way) on October 9.

CONTINUED ON PAGE 4

PICTURE CREDITS

Cover	Wm. V. Wright
p. 2	Cartoon by Carl Rose
pps. 8-10	Cartoons by Robert Osborn
pps. 11-13	Wm. V. Wright
pps. 14-15	Charles Davies
p. 16	Edna Sommer
p. 17	J. R. Eyerman

NOVEMBER 1950 VOLUME XIV NUMBER 2
PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

CONTENTS

STAFF

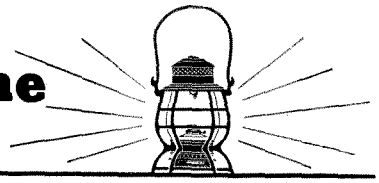
Publisher.....Harry K. Farrar '27
Editor and Business Manager.....Edward Hutchings, Jr.
Student News.....Robert Madden '51
Staff Photographers.....Wm. V. Wright '51, Charles Davies '53
Editorial Consultant.....Professor of English George R. MacMinn

PUBLICATIONS COMMITTEE

Chairman.....Harry K. Farrar '27
Members.....Richard H. Jahns '35, Martin H. Webster '37

Published monthly, October through June, at the California Institute of Technology, 1201 East California St., Pasadena 4, Calif., for the undergraduates, graduate students and alumni of the Institute. Annual subscription $3.00, single copies 35 cents. Entered as second class matter at the Post Office at Pasadena, California, on September 6, 1939, under the act of March 3, 1879.

The Main Line



NOVEMBER, 1950

Last month and the month before we acceded to the superior wisdom of the famous Chinese philosopher who contended that one picture can whip mere yakity-yak in straight falls.

Consequently we substituted full pages of pictures of our newest two trains—the great new *Sunset Limited* between Los Angeles and New Orleans, and the swank all-room *Cascade* between Portland and San Francisco—for our customary column of chit-chat. Now we're back in business at the same old stand.

Streamliners Galore

It has reached the point where streamliners, to us, are like measles to other people. At any rate, we're "all broke out" with them now. With the new *Sunset Limited* and *Cascade* climaxing the passenger end of our great $316,000,000 improvement program, we can take you all over the place in modern, luxurious comfort. Just look at this streamliner line-up!

For romping up and down the Pacific Coast: Between Los Angeles and San Francisco take your pick of the luxurious, all-Pullman *Lark* or economical Chair Car *Starlight* overnight; or the spectacular, low-cost *Coast* or *San Joaquin Daylights* by day. (Don't forget the *Sacramento Daylight* and streamlined overnight sleeping car service on the *West Coast* between Sacramento and Los Angeles.) Between San Francisco and Portland, choose the swift, scenic *Shasta Daylight* with its low-cost luxury ride, or the new *Cascade*, which shares with the *Lark* the title, "finest overnight sleeping car train in America." No extra fare on any of these.

To the East, too

If you're going east, you can't do better than one of these: From San Francisco ride the extra fine, extra fast, extra fare *City of San Francisco* or the smooth, no-extra-fare *San Francisco Overland*, with its breath-taking daylight trip over the High Sierra. Choice of Pullmans or Chair Cars on both of these—fastest two trains to the East from the Golden Gate.

From Los Angeles there's the smooth-gliding, low-altitude *Golden State* to Chicago via the Southwest winter playground country. Pullmans or Chair Cars. Moderate extra fare.

Or go east the really new way—via New Orleans on the new *Sunset Limited* from Los Angeles. All-room Pullmans. "Sleepy-Hollow" Chair Cars. Moderate extra fare.

That's a flock of streamliners—but for good measure we'll throw in another. Anytime you're deep in the heart of you-know-where, try a swift ride on our mile-a-minute *Sunbeams* between Houston and Dallas. They're the Texas equivalent of our California *Daylights*.

Fat Tuesday

If it actually is later than you think, you'll appreciate a reminder of the Mardi Gras celebration in New Orleans. No harm in planning now to be on hand between January 28 and February 6 of 1951 for the parades, feasting and general hoop-de-doo.

Color Book

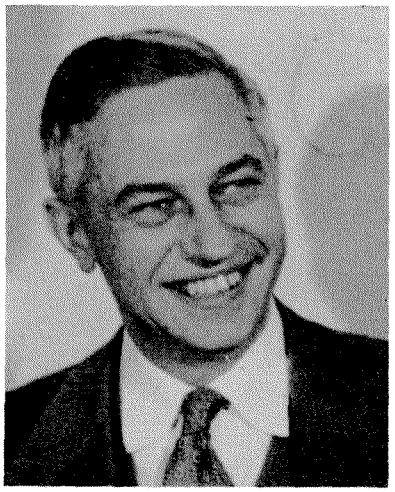
Incidentally, if you'd like to have a full-color preview of a trip to New Orleans on the new *Sunset Limited*, just drop a card to Mr. F. Q. Tredway, Room 735, 65 Market Street, San Francisco. He'll send you one of the prettiest color books about the train, route and scenery you've ever seen. Absolutely free. You can't tell the Audubon Dining Room from the French Quarter Lounge without a color book.

My! How We've Grown!

Thumbing through some old records the other day we ran across some interesting figures on our parent company, the Central Pacific Railroad. Back in 1883 we did a gross business of $24,744,421, and we paid out $442,727 in taxes. Last year we did a gross business of $537,518,704. That was an increase in 67 years of 1995%. However, it wasn't all gravy. We paid out $53,058,644 in taxes. *That* was an increase of *eleven thousand eight hundred eighty-four percent.* We pass this information along in the hope of making you feel better about your own tax burden.

S·P The friendly Southern Pacific

IN THIS ISSUE CONTINUED



DuBridge

In this timely article Dr. DuBridge discusses, with vigor and clarity, some of the most vital issues of the day.

THEORY OF GAMES

The study of games is tantamount to a study of human behavior in a given economic situation. Though the theory of games is far from complete, it is of steadily increasing interest. On page 8 H. Frederic Bohnenblust, Professor of Mathematics at the Institute, discusses some of the simple principles on which the theory is based.

Anyone who wants further information on the theory of games might note that Dr. Bohnenblust is scheduled to discuss the subject in a Friday Evening Demonstration Lecture at the Institute—201 Bridge, November 10, at 7:30 p.m.

Anyone who wants even *further* information should find it in John McDonald's popular book, *Strategy in Poker, Business and War* (W. W. Norton, New York, $2.50).

DIANETICS

Dianetics, which must be just about the biggest thing since Dale Carnegie—or maybe Emile Coué—is, as you probably know, a young and active "science of mind." As such, it has stirred up a certain amount of excitement among science-minded young men—including a good many students at this institution. To date, the theory of Dianetics is largely, if not entirely, confined to a single book, written by its originator, L. Ron Hubbard—until recently a top-notch science-fiction writer. On page 1 of this issue, Charles E. Bures, Assistant Professor of Philosophy and Psychology at the Institute, reviews this book—and in the process, we think, makes the clearest evaluation we've seen of the theory and practice of Dianetics.

SCIENCE AND THE SPIRIT OF FREEDOM

An essential element in the strength of America is a strong science. But to be strong, science must be free—and freedom of science is in present danger. Let us not sacrifice that freedom in a misguided attempt to preserve it.

by L. A. DuBRIDGE

TEN YEARS AGO THIS FALL as university faculty and student groups assembled for the opening of the first semester it was noticed that some of the professors of the science departments had not returned. They were on leave of absence, it was learned; and there was frequently an air of mystery as to their whereabouts. As the weeks went by more and more scientists quietly left their posts and by the spring of 1941 a major exodus had occurred—an exodus which was to mount to such proportions that by 1944 there was scarcely a university science department in the country whose faculty and graduate student groups had not been cut to ribbons.

And in the meantime, behind closed doors in laboratories throughout the country, there developed one of the most astonishing dramas of human history. News of what was going on did not reach the public until the war was over. Then the American people received the astonishing news that a large group of college professors—and largely very young ones, too—had helped mightily to win the war and bring it to its dramatic conclusion.

The astonishing way in which these few thousand scientists brought highly abstruse scientific knowledge and techniques from the laboratory to the battlefront has been told so often and in such detail that many people have become tired of hearing about it. I assure you that I do not intend to add to their weariness, in spite of the fact that a case can be made for the statement that much of the story has been blurred and even distorted during the past five years.

But my concern today is not for the story of what happened, but the conditions which made it possible. For these conditions must be preserved, not only because they are necessary to preserve our strength in case of a future military emergency, but because the same strength is essential, whatever lies ahead—be it peace or war, or something else which is neither.

What was it that we, as a nation, had in 1940 which made it possible to avoid disaster and eventually win the victory of 1945? Whether we speak of the field of science, or of industry, or of the military, the essential thing that we had in 1940 may be summed up in one word: *strength*. It was a latent strength, a strength we ourselves did not know we had. It was a strength which had been grievously endangered by the great depression of the early 30's, and by neglect in the late 30's. But the strength was still there, waiting to be called forth.

This strength, this latent energy, existed, of course, in many forms. It existed in the form of virile laboratories of science and technology, in the form of a great and well-managed industrial plant, in the form of a great country blessed with rich agricultural and mineral resources. But most of all, it existed in the hearts and minds of 130 million people—people who were willing to sacrifice whatever was necessary to preserve their democratic traditions.

And just here lies the key to the source of all that strength. It was a strength born of freedom, a strength nurtured and brought to its full power by freedom, and a strength which could be energized to its full capacity to fight for that freedom.

It is not a new thing to point out that freedom is both the goal and the source of vitality of American democracy. But it is, nevertheless, a fact which is being forgotten or ignored in these days. And it must *not* be forgotten or ignored. Our very existence may depend on not forgetting it. Certainly our battle to preserve freedom can hardly be won if we forget either what we are fighting for, or what is our most effective weapon.

The scientists are especially sensitive about this matter

of freedom. Some people think they are *too* sensitive. But the scientists, like others engaged in intellectual pursuits, know that freedom is their life blood. Without freedom there simply isn't any science; there isn't scholarly inquiry of any kind.

Of course, we all know that freedom is an essential feature of the life of any American citizen—freedom to come and go, to buy and sell and own property, to vote for whom he pleases, to work at the job he chooses, to believe and speak and read and listen and think and worship as he chooses.

The scholar prizes these freedoms also—but he prizes another freedom which is of less concern to many others—intellectual freedom. Intellectual freedom means freedom to think, to investigate, to reach his own conclusions, to communicate conclusions to others, to criticize the conclusions of others.

This freedom to express ideas is one of the most precious of all our freedoms. For *only* from new ideas comes progress.

There are today great areas of the world in which freedom of all forms is suppressed, and especially this intellectual freedom. Every dictator knows that the first freedom he must suppress is intellectual freedom—the freedom of research, the freedom of speech, of publication, of opinion. The free exchange of ideas and the free discussion of opinions and of beliefs is ultimately fatal to a dictatorship, and every dictator, of both ancient and modern times, has seen to it that such dangerous freedoms were suppressed.

Science under dictatorship

The way in which science collapses under a dictatorship is dramatically illustrated by Hitler's Germany and Stalin's Russia. Hitler went to great lengths to suppress intellectual freedom in Germany. As a result scientists and other scholars deserted the German universities, or were driven out of them, by the hundreds. America profited greatly from this exodus, for some of our most brilliant scientists today came in as refugees from German or Italian persecution. And at the same time Germany fell precipitately from its position as one of the top leaders in science in the 1920's to a position of utter mediocrity by 1939, a fact which was of paramount importance in her eventual defeat.

Russia on the other hand was never, as a nation, a great leader in science, though she did have a number of brilliant scientists. But Russian influence on science today is almost at the zero point, largely because the iron curtain prevents any exchange of knowledge with other countries. What information does emerge shows pretty clearly that scientists whose ideas are not strictly in accord with the party line have been purged in one way or another. If Soviet Communism ever had any appreciable number of friends among the scientists and other scholars of this country, that number has certainly today reached the vanishing point. The principles and practices of the Soviet dictatorship are the utter antithesis of all that makes scholarship possible. They are, of course, also the utter antithesis of everything else that makes life worth while. It is for this reason that America stands united in its opposition to the spread of Soviet imperialism and the Communist ideology on which it rests.

But as we battle to defend our freedom from threats from beyond our borders, we must also battle to defend it from attacks at home.

There are two dangers we face here at home—two dangers which threaten us from opposite directions. And just as every military commander is familiar with the dangers of fighting a war simultaneously on two fronts, so we must be careful that, in giving too great attention to either enemy, we are not caught unawares and overwhelmed by the other.

The danger we face at home

The first and most obvious danger we face here at home is the danger posed by the conspiratorial activities of the agents of a foreign power. The same imperialism which threatens us with its military power abroad seeks also to confuse, to disrupt, to sabotage, and to sap our strength within our own borders. There is no question but that there are many thousands of men and women in this country who are sworn to uphold at all costs the cause of Soviet imperialism and of Communist ideology. They seek to discredit America and its ideals, to confuse our people through lies and distortions, to obstruct at every turn our efforts to keep the western world safe for democracy. Though in numbers this company of men and women is but a puny force in the face of 150 million loyal Americans, they can still do great damage. They use our traditions of freedom to protect themselves while they seek to discredit and destroy those freedoms. In case of a military emergency they would not hesitate to use every form of sabotage to impair our efforts to fight. The Communists of this country constitute a vicious and highly organized group and we face a serious problem in our task of reducing them to impotence.

How do we do this?

That is a question I shall leave to experts. For just here lies the second danger of which I spoke. It is all too easy to adopt laws and practices and regulations which, while *aimed* at the Communists, will ensnare a dozen or a hundred innocent people for every guilty one who is trapped. And if we follow that line, we will have scrapped the basic American principles of justice—and it is the Communists themselves who will be the ones to profit, for they will be able to shout to the world that the American ideals of justice are a hollow mockery.

While we all despise the ideology of Communism, we must find a way to keep it from spreading without falling into the trap of labelling *all* ideas with which we do not happen to agree as being Communist. We do not want Communist propaganda to intrude itself into our schools and colleges, but the challenge is to find a method to prevent this, which does not at the same time

suppress all expression of unconventional ideas and opinions. We fight Communism because we love freedom. Are we forced to sacrifice our freedom in our fight to preserve it? I believe not! But I believe there is a danger that we may.

I believe that there are methods of fighting Communism intelligently, of fighting it by using and not by destroying the tools and techniques of democracy and of freedom. And yet, today we often see those who advocate one method of fighting Communism charging those who advocate another with being Communists themselves. I realize that I, myself, run that risk today—of being called a "red" because I assert that not *all* methods of fighting reds are equally intelligent or effective.

This danger of losing our essential freedoms in misguided attempts to fight for them is present in a critical degree in our universities. Our universities have been the citadels of intellectual freedom. Free discussion of ideas is the life blood of the search for truth. We, in the universities, believe that the way to defeat a bad idea is not to jail the propounder—or even to make him sign an oath that he never had the idea!—but to expose the fallacy of the idea and then to state the truth. Those who have studied the history of European and American universities know that the struggle for intellectual freedom has been a long and painful one, and that we who inherit the fruits of the eventual victory must never give up the fight to preserve what has been won.

There are some, of course, who charge that professors are so fond of their intellectual freedom that they will even protect Communists in order to preserve it. This is a vicious falsehood. We fight to preserve freedom because we believe it is our best weapon against Communism. We believe not only that it is unnecessary to destroy freedom to fight Communism, but that it would be fatal to do so. Freedom made America strong. Freedom will keep it strong. And a strong America is the only bulwark in the way of a Communist world.

A strong science is a free one

As I have said, an essential element in the strength of America is a strong science. And the only science which can possibly be strong is a science which is free. Up until 1940 science in America was free; consequently it was strong; and consequently it could help win the war.

And what of 1950? Now I am not an alarmist who says that the freedom of science is gone. It has no more gone than has any other freedom—yet. But like other freedoms, it is in danger. And it faces the same danger as other intellectual freedoms—that we will foolishly sacrifice it in a misguided attempt to preserve it.

At the end of the war the public learned that certain basic discoveries in science which had been made before the war, in some cases long before, were used as a basis on which to devise valuable weapons of war—radar, proximity fuses, rockets and atomic bombs. The details of how those weapons were made have been properly kept secret. But some people would go farther and suggest that the principles of science should also be kept secret. They do not realize that science and secrecy are mutually exclusive; if you have the one you can not have the other. If you keep everything secret, you discover that you have nothing to keep secret. Secrecy is the antithesis of all intellectual freedom and it must, therefore, be kept restricted to the minimum possible area.

Science and military technology

There is confusion on this point because of the failure to distinguish between science and military technology. Military technology is the design of weapons and techniques of warfare and activities in this field must obviously be kept secret. Science is the search for knowledge and in this field secrecy is not only undesirable but impossible.

But science faces a more subtle and more terrible danger. We now know that during the war one Canadian and one English scientist were Communists and passed secret information to Soviet Russia. These were profoundly disturbing and disheartening revelations. Could there have been others who did likewise? Are there others now? Naturally many people have been nervous about these questions. Charges and countercharges have been freely exchanged. Unfounded accusations have been made. Men have been dismissed from their jobs—because a college roommate had belonged to the Communist Party back in 1937. Others have been vilified because they defended their friends against charges and insinuations which they knew to be unfounded. And so it goes.

But what are the facts?

If we peer carefully through the smoke and haze we find this solid fact; namely, that not one single *American* scientist who was engaged in secret work during or since the war has ever been proved guilty of, or even indicted for, espionage or treason. Not one!

A few were Communists in 1937-38, as students. But as far as is now known, the thousands of American scientists who have been engaged in military work were 100 per cent loyal and 100 per cent reliable. Apparently, not one of them even accepted a bribe in connection with a war contract! That is a proud record, indeed. And yet many people seem to believe that scientists are a dangerous lot, not to be trusted at all, upon whom all sorts of special restrictions should be placed. Does that contribute to a free science and a strong science—a strong science upon which our very existence might some day depend? Obviously not!

Again, let us remember, freedom is the goal for which we fight, and it is also an essential weapon with which to fight, an essential element of our strength. We can find ways to fight the enemy we face without destroying freedom. Indeed, we can no longer fight effectively—and our reason for fighting will already be gone—if our freedom has vanished.

THE THEORY OF GAMES

The study of games is tantamount to a study of human behavior in a given economic situation. Here, in simplified form, are some of the basic principles on which the theory of games is based.

by H. FREDERIC BOHNENBLUST

THREE CENTURIES AGO Pascal and Fermat investigated certain games of chance. Their attempt to find the laws governing chance moves led them to formulate the foundations of the theory which, in the course of time, evolved to the present day theories of probability and statistics.

Game theory can be said to have its origin in the work of Pascal and Fermat, but it is probably fairer to say that it dates back only about twenty years. At that time the mathematician John von Neumann undertook a systematic study of games. He gave a precise definition of what games came under his theory, and was particularly interested in investigating the interaction between the conflicting interests of the different players. What should be the behavior of a player? What can he be certain to achieve, and to what extent can his winnings be reduced by the plays of his opponents?

The significance of the theory of games goes far beyond a study of social games. When you consider that a game is a succession of moves, requiring each player at each stage to make a choice between several possible courses of action, and leading eventually to a certain pay-off for the different players, it is apparent that the study of games is tantamount to a study of human behavior in a given economic situation. However, serious difficulties of an economic—rather than mathematical—nature occur: it is difficult to isolate the economic situation, to delineate the possible courses of action and to evaluate the pay-off.

On these grounds the applicability of von Neumann's work to economics has been attacked. Even within a strict mathematical framework, the theory is far from complete. Nevertheless, the theory of games is here to stay and it is a rewarding effort to try to understand the simple principles on which it is based.

A complete definition of a game cannot be given here. It will suffice to mention that certain moves may be chance moves with known probabilities (the spinning of a roulette wheel, the shuffling of a deck of cards), and that others may be deliberately chosen from among the possible moves by the different participants in turn. The resulting choice, whether of a chance move or a deliberate move by a player, may be known to some, one, or even none of the players.

The rules of the game determine what will bring the game to an end, and what will be the actual pay-off to each participant. This outcome has a certain importance to each player. It is assumed that this importance can be measured by a number which represents the true interest of the player in the actual outcome. The game theory is concerned only in this final pay-off and will thus assume that each player is solely interested in

The cartoons on these pages are by Robert Osborn, and have been reproduced—by permission—from the book, STRATEGY IN POKER, BUSINESS AND WAR, *by John McDonald (W. W. Norton, New York, $2.50)*

achieving as high a value for his final pay-off as he possibly can.

In an economic set-up, the actual outcome will involve generally varying amounts of different utilities, and the reduction to a numerical final pay-off function is a complex problem. (The reader should refer to the introductory chapter of the *Theory of Games and Economic Behavior* by John von Neumann and Oskar Morgenstern for the background necessary to the construction of a numerical pay-off function.)

In order to simplify the study of games it is found convenient to try to reduce any given game to a certain standard form.

Standardized game

In theory, at least, all the possible ways of playing a given game can be listed explicitly, and each player can give, ahead of time, specific instructions to a double (or machine) describing how he intends to play the game. Such a set of instructions must be complete enough to provide for every contingency which can arise in the course of the game as a result of the chance moves and the plays of the opponents. The instructions replace the player, who need not even be present when the game is played.

A set of instructions is called a strategy, or more exactly, a pure strategy, for the player in question. A thoughtful friend can collect all the possible strategies of one player in a formidable tome, one to a page. Then the player need only glance through the book, point to a page, and let his deputy play the game.

If each player has listed his strategies, the game takes on the following simple form: each player chooses a page number from his book; this number is communicated to the umpire, but not to the other players; the umpire plays the game out according to the instructions received and the outcome is decided. Any game is thus reduced to a standard type. It is simple, theoretically, but complex practically, since even simple social games possess a high number of strategies.

The role of each player

The purpose of reducing a game to a standard type is to simplify the role of each player to making only one deliberate move—namely the choice of his page number. The game has not been changed in any way, but we have gained a clear understanding of the role of each player.

The job of the umpire is not yet fully automatic. In playing out the game he must still spin a roulette wheel (or shuffle a deck of cards) at each occurrence of a chance move. But the theory of probability teaches us that a succession of chance moves can be replaced by one chance move without changing the game. It teaches us more. This one chance move can be eliminated if the various pay-offs to which it leads are replaced by their expected value. For example, if the chance move is the throw of a perfect die with a pay-off of 2 dollars for the faces 1 or 2, and of 5 dollars otherwise, the expected value is equal to 2 x 1/3 plus 5 x 2/3 equals 4 dollars.

The game is now fully standardized. Let us consider, for example, a two-person game between two players, A and B. Let the rectangular array at the bottom of this page show the pay-off for the player A, and let a similar array be given for the second player.

In the illustration each player is assumed to have three strategies. The horizontal rows correspond to the strategies of A, and the vertical columns to those of B. The number 6 in the second row and first column tells, for instance, the pay-off to A should the first player A use his second strategy, and B his first strategy.

The sure thing

If from each row the least number is picked, the numbers —2, —1, 1, are obtained. The largest of these, 1, has a fundamental significance for A. He is certain to be able to achieve this amount. Yes, he need only decide to play his third strategy. Is he afraid that his nervousness or lack of a poker face will give him away? No, he can tell B beforehand what he is going to do and does not care whether B believes him or not. If no chance moves occur in the game, his certainty is absolute. In the presence of chance moves, the numbers in the array, as explained above, are not the actual pay-off, but are expected values, and it is only in the sense of an expected value that A is certain to achieve 1.

By removing himself one step further from the game, A actually can be certain to achieve more than 1. Rather than commit himself to a definite strategy, he can fix the probabilities with which the different strategies should be played, and let a chance move pick the strategy.

An assignment of probabilities to the strategies is

A \ B	FIRST	SECOND	THIRD
FIRST	0	2	-2
SECOND	6	-1	5
THIRD	4	1	3

called a mixed strategy. In the example considered, A can decide to play his first strategy with probability zero (i.e. not at all), his second strategy also with probability zero, and the third with probability one. This, of course, is equivalent to the definite choice of the third strategy. But he is not restricted to that choice.

He may, for example, decide to play his first strategy with probability 1/3, his second one with probability zero and his third one with probability 2/3. His expectation against the three defenses of B become 8/3, 4/3, 4/3, and, as an expected value, he is certain to achieve at least 4/3 instead of 1.

Naturally the player A can try to vary his mixed strategy until the guaranteed expected return is as high as possible. This so-called optimal mixed strategy can be determined mathematically. In the example under discussion it is the mixed strategy which has just been used.

Analyzing the zero-sum game

The analysis to this point has distinguished clearly the salient features of the game: the player chooses the mixed strategy; the mixed strategy determines—by a chance move—the pure strategy; and the pure strategy plays the game. In a two-person game each person has an array like the A that has just been discussed. A zero-sum game is one in which the array of the second player happens to be the negative of that of the first player. The analysis has proceeded far enough to analyze such games.

In these games the gain of one player is the loss of the other player. The interests of the players are strictly opposed; thus the interest of B is to minimize the numbers in the array of A. In the example, the mixed strategy of B which assigns the probabilities 0, 5/6, 1/6 to the pure strategies of B, leads to the expected values 4/3, 0, 4/3 against the three possible defenses of A. Thus B can be certain to prevent A from getting more than 4/3. It is remarkable that in both cases, for A and for B, the same number, 4/3, is obtained. This is not an accident for the numerical example considered. A fundamental result of the theory shows that for any two-person zero-sum game there exists a *unique* number v with the following property:

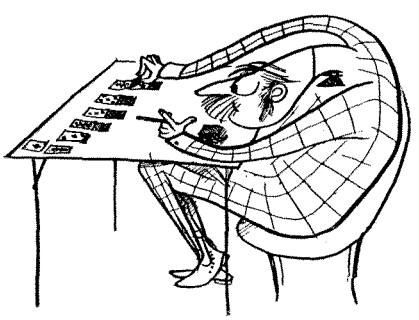
The first player A has at least one mixed strategy which guarantees him the expected value v against any defense of B. The second player B has at least one mixed strategy which guarantees him the expected value $-v$ against any defense of A.

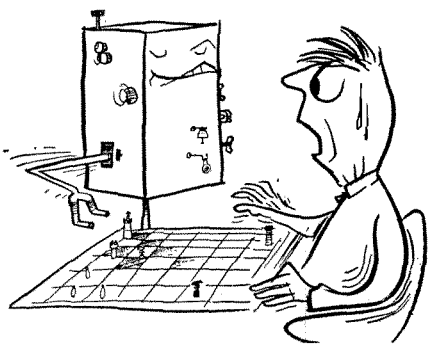
Either player is willing to tell his opponent before the game the mixed strategy he is going to play. He cannot unwittingly betray himself by informing his opponent of the actual strategy which will be played, since he does not know it himself. It seems natural to define v to be the value of the game for the first player and $-v$ the value for the second one. If v is equal to 0 the game is fair; if v is positive, the first player is favored.

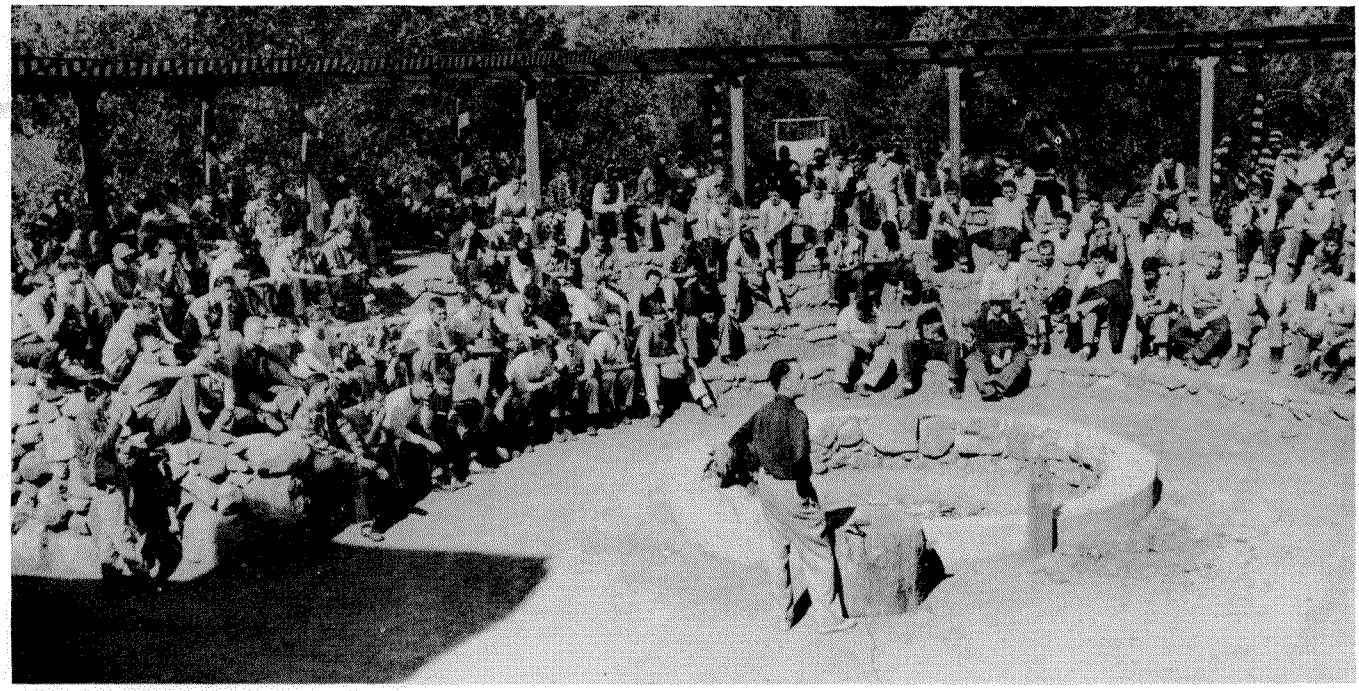
It may be well to summarize the reasons for calling v the value of the game. The player A can achieve v, but cannot reasonably expect more, since B can prevent his doing so. But why be reasonable? The unreasonable player achieves nothing beyond leaving himself open to a possible loss, particularly if his opponent should discover in time the mixed strategy or pure strategy he has chosen. However, a player may have good reason to believe his opponent too obtuse to play in an optimal way. He may be so convinced that the opponent will not use certain moves as to act on his conviction. Then the game is changed. The player should analyze the new game with these moves excluded.

The theory of two-person non-zero-sum games and of games between more than two players becomes more involved. The interests of the players are not in strict opposition, but may overlap. Some players may enter into coalitions. The coalitions act as one player and the joint winnings are distributed among the players of the coalitions according to some fixed agreement.

The complications are too numerous to be discussed in detail here. I will mention only that in three-person games the existence of "stable" coalitions can be established; stable, in the sense that the players in a coalition are afraid to break away for fear of ending in a still more unfavorable position. The dynamics by which stable coalitions are reached is, however, not understood. In games of more than three persons even the existence of stable coalitions is unknown. Many problems remain to be solved to make the theory complete. But even as it stands, it is captivating and contains many elegant and sound mathematical ideas which already have been applied to other fields.







Prof. Hallett Smith extends a welcome at New Student Camp, held from Sept. 22-24 in the San Bernardino Mountains

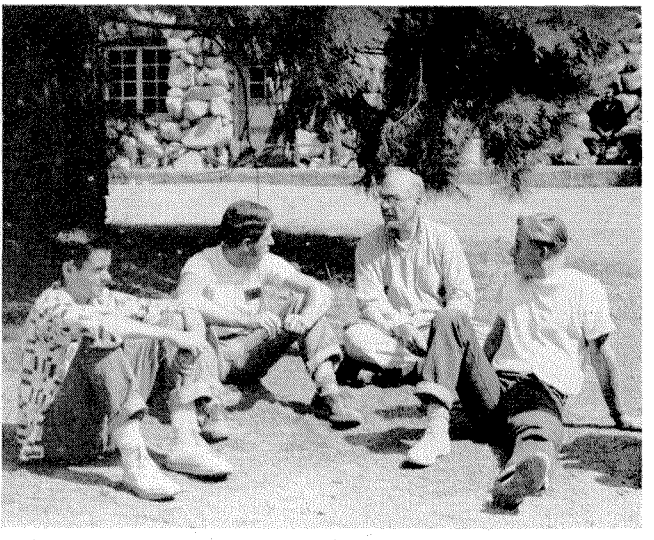
THE EARLY DAYS OF THE CLASS OF '54

From the glad hand at Freshman Camp
—to the mortification of Initiation

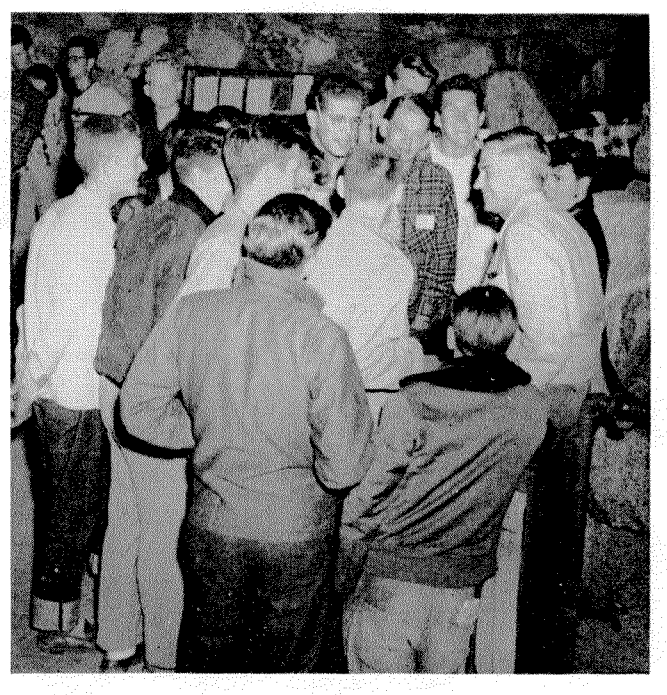
Calisthenics were not on the program; this is the class of '54 learning Tech's E^x cheer.

Freshmen assembled in the fire circle for morning and afternoon sessions, to hear—with mixed emotions—faculty and student leaders tell them that life at Tech wasn't going to be anything like as tough as advertised.

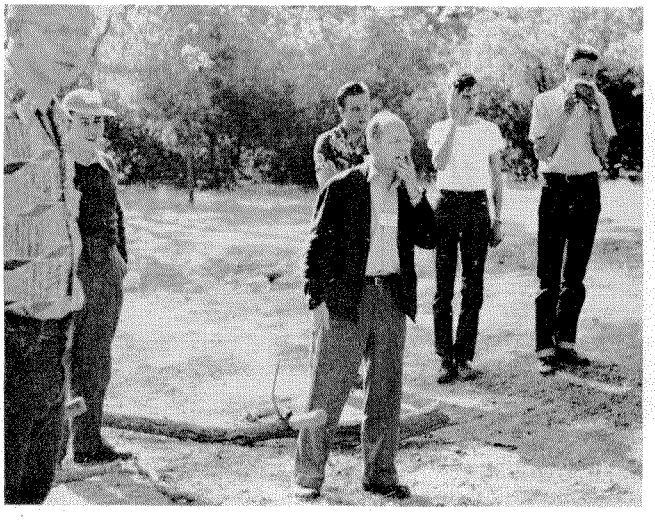
The faculty listened to most of the talks from the vantage point of a grassy knoll, far-enough removed from the fire circle to make all speakers inaudible. Above, Bohnenblust, Newton, Davidson and Beadle, in deep concentration.

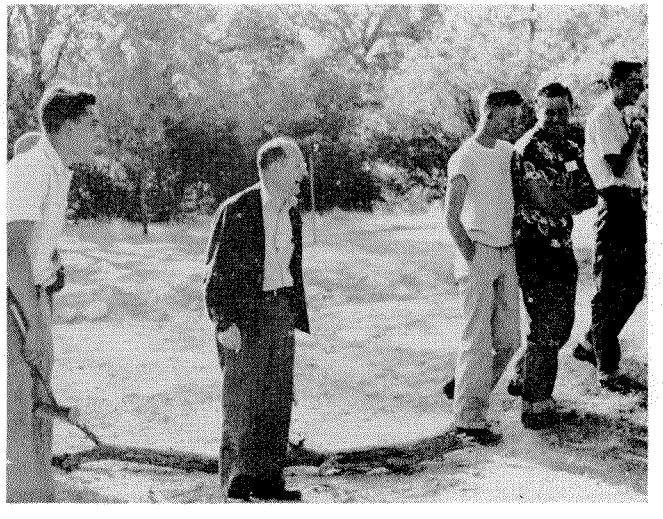


More than anything else, New Student Camp gives Freshmen a chance to get to know the men they will be studying under for the next four years. At the left, above, Winchester Jones, Registrar and Professor of English, spellbinds a group of students. Right, above, English Professor Harvey Eagleson expands on his summer trip abroad. And, to the right, President DuBridge faces a barrage of questions, as students crowd around him outside the Lodge, after his evening talk on the state of the Institute.



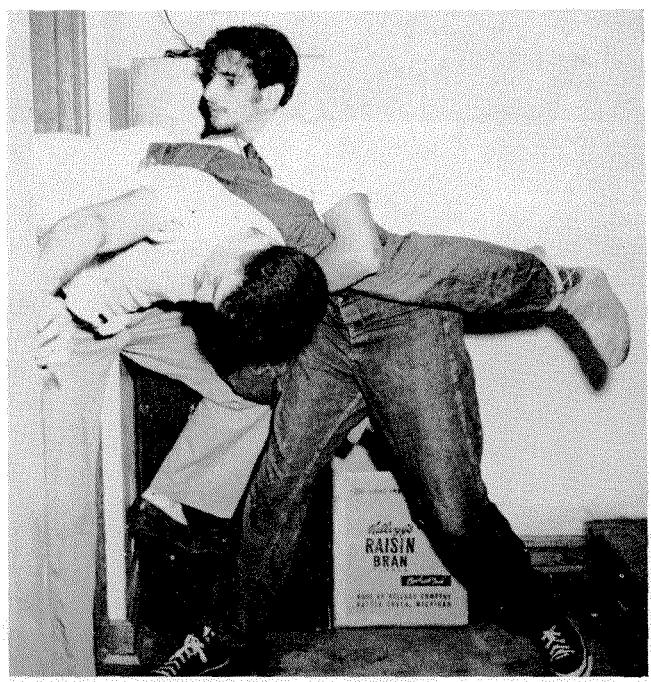
Mountain golf is one of the unique features of the camp. This bastard game, played with croquet mallets and balls on a rocky, hilly, grassless golf course, combines the worst features of an assortment of sports. Below, Don Clark, Associate Professor of Mechanical Engineering, expresses two emotions which are called into constant play by mountain golf—anxiety (left) and amazement (right).





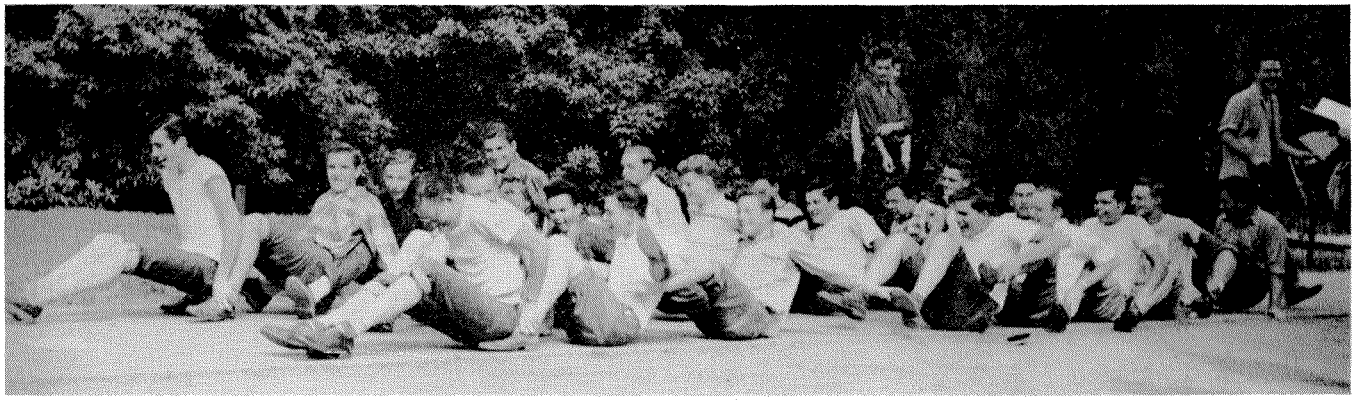
A valiant little crew of Fleming freshmen, sent on a suicide mission to Ricketts, founders in the heavy seas at the enemy's doorway.

INITIATION SETS IN

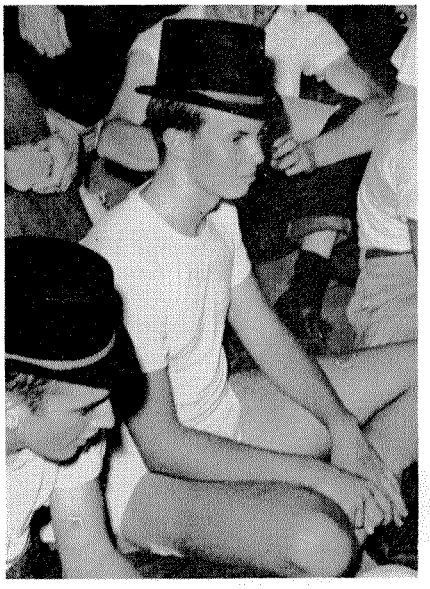


The horizontal leg belongs to a freshman, being directed to the shower. All other extremities are sophomores'.

Overwhelmed, this freshman pays for his resistance. Tied hand and foot, he is to undergo the Blacker water torture.

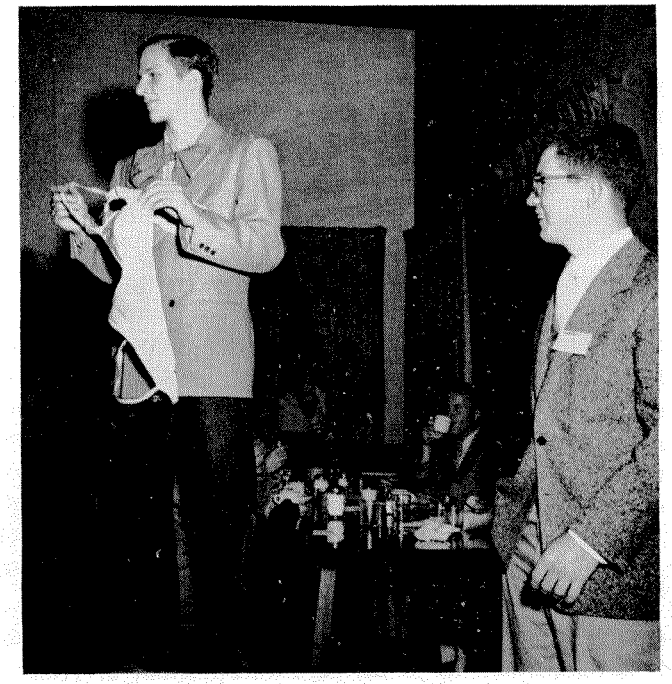


The Throop Club rowing team tries a dry run along the olive walk—and gives the sidewalk a superlative cleaning.

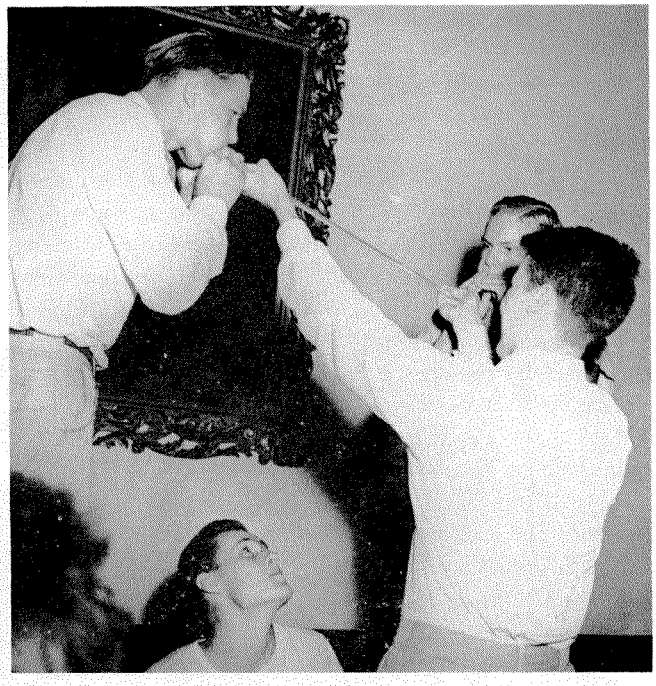


Left—Dabney freshman is left with little besides his hat and his embarrassment after having to remove all articles of clothing containing the color red.

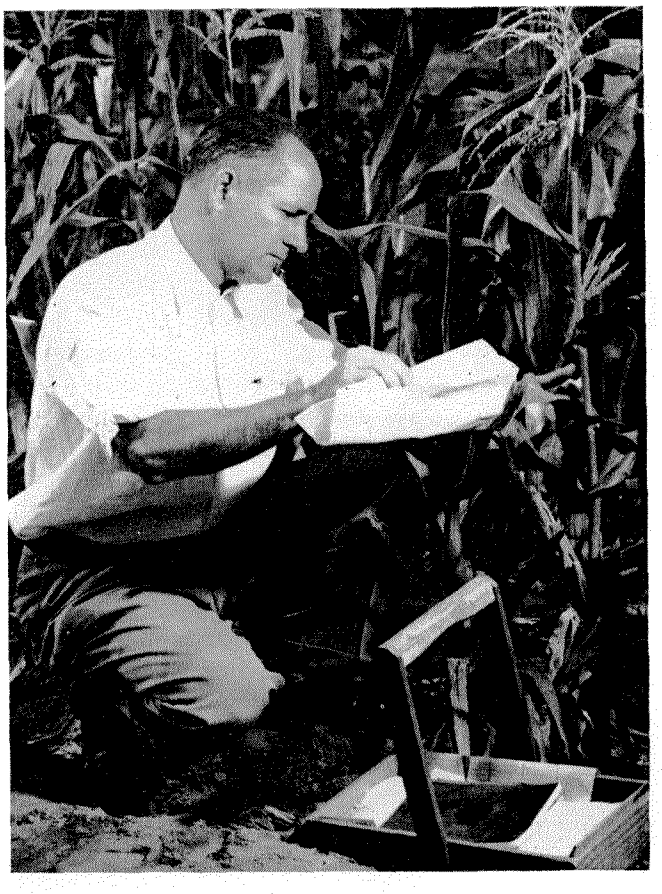
Right—Blacker freshman, feeling that the standard red bow-tie is undersized, wears a jumbo version, held up by ruler and clothes pins.



End of a successful foray. Freshman publicly delivers requested article, privately admits buying it in drugstore.



Freshmen blow raw egg through glass tube. Loser wins egg. If blowers break tube middleman below gets works.



THE MONTH AT CALTECH

Dr. George W. Beadle—pollinating corn at the Biology Division's Experimental Farm in Arcadia

Lasker Award

GEORGE W. BEADLE, chairman of the Institute's Biology Division, was awarded the 1950 Lasker Award last month for his "outstanding and fundamental contributions to the understanding of genetic control of metabolic processes."

The award, given annually by the American Public Health Association, was established five years ago by the Albert and Mary Lasker Foundation, and consists of a $1,000 grant, a bound citation and a gold statuette. This is the first time it has been won by a West Coast scientist.

Before 1941 there were some indications that genes controlled chemical reactions, but this was not a widely accepted fact. In that year, though, Dr. Beadle, working with Dr. E. L. Tatum at Stanford University, made the significant discovery that the synthesis of vitamins and amino acids in the living cell is under the control of the genes. In other words, he found that each of the biochemical reactions of a cell is governed by a particular gene. In making this discovery he used the bread mold *Neurospora Crassa*, and he has been identified not only with the discovery but with the addition of this new tool for genetic research ever since.

The discovery, of course, opened up a whole new field of research which has led to new knowledge of genes themselves, to new knowledge in biochemistry, and even in bacteriology—where, for the first time, it made possible the study of bacterial genes.

During the recent war, the application of genetic principles resulted in a four-fold increase in penicillin production, as well as the development of new means for assaying vitamins and amino acids in foods and tissues.

"Fulfillment of the implication of these pioneer studies," says the Lasker Award citation, "will undoubtedly lead to an understanding of human constitution as related to the vital problems of host resistance and susceptibility in both metabolic and infectious disease."

Dr. Beadle, born in Wahoo, Nebraska, in 1903, was graduated from the University of Nebraska in 1926, received his master's degree there in 1927, and his Ph.D. at Cornell University in 1931. He then came to Caltech as a National Research Council Fellow, where he worked under the great geneticist and Nobel Prizewinner Thomas Hunt Morgan, then head of the Institute's Biology Division.

In 1935 Dr. Beadle went to Paris to work with Dr. Boris Euphrussi, of the University of Paris, whom he had met at the Institute. In 1936 he taught at Harvard, then moved to Stanford University in 1937, where he remained until he came to Caltech in 1946 as head of the Biology Division, succeeding T. H. Morgan and carrying on the strong genetics tradition of the Institute.

Industrial Associates

ON FRIDAY, NOVEMBER 17, the first meeting of the Industrial Associates of the California Institute of Technology will be held at the Institute.

Members of this group now include the Douglas Air-

craft Company, Inc., E. I. du Pont de Nemours and Co., Inc., Lockheed Aircraft Corporation, North American Aviation, Inc., Socony-Vacuum Laboratories, Standard Oil Company of California and Union Oil Company of California. Representatives of these companies will attend the November 17 meeting, at which members of the Institute staff will report on new research here.

Dr. Linus Pauling, Chairman of the Division of Chemistry and Chemical Engineering, will discuss *Properties of Alloys in Relation to Their Structure*. Dr. Frederick Lindvall, Chairman of the Division of Engineering, will talk on *Computers*. Dr. Robert Bacher, Chairman of the Division of Physics, Mathematics and Astronomy will discuss *High-Energy Physics*. And Dr. George Beadle, Chairman of the Division of Biology, will speak on *Smog and Crop Damage*.

The Industrial Associates officially came into existence on July 1, 1950, but it actually had its beginnings long before then. World War II showed how quickly the fundamental research carried on in U. S. colleges and universities could be used to develop new weapons, new machines and new materials. At the end of the war, then, many large corporations realized that it would be good business to support the universities where fundamental research is carried on, and they began to allocate money to these universities over and above the amounts they were already devoting to fellowships and specific research contracts.

In December, 1948, E. I. du Pont de Nemours and Co. transmitted a grant of $10,000 to the Institute, as one of ten institutions in the country selected for what is expected to be an annual grant for a period of years. A few weeks after that, the Standard Oil Company of California contributed $25,000 to the Institute, with assurance that similar grants would continue for three years.

With these indications of business interest, the Institute proceeded with the development of a plan under which business might make allocations of funds to the Institute and receive concrete benefit in return. The outcome of this work was the organization of the Industrial Associates of the California Institute of Technology last July.

Under the terms of membership, an Industrial Associate is allowed access to fundamental research in all Divisions of the Institute. Regular and special publications are sent to the company. Representatives of the company are invited to semi-annual seminars at the Institute where new developments in science and engineering will be presented, and these representatives are also given the privilege of a limited amount of consultation with the Institute staff on problems of mutual interest.

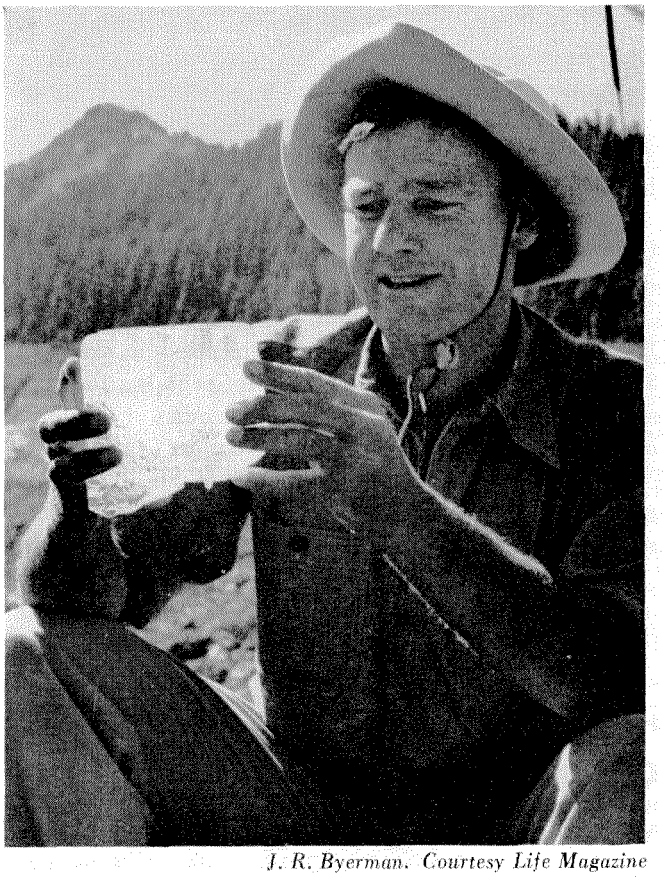
In return for these services by the Institute, member companies pay a fee ranging from $10,000 to $50,000 a year, depending upon the size of the company and the extent of its interest in Institute research. This fee is considered by the companies as analogous to a consulting fee for technical information, and is charged as business expense. Fees paid by the member companies have now reached the level of $85,000 a year, and it is likely that this amount will increase for some years to come.

In addition to the seven corporations who are now members of the Industrial Associates, four others have signified their intention of joining, and a number of others have the plan under consideration.

Great Teacher

BY SOME INTRICATE (naturally) and secret (apparently) process involving a poll of student governing bodies at 52 leading U. S. colleges, *Life* Magazine recently selected 8 Great Teachers of 1950. Among the 8: Caltech's Robert P. Sharp, Professor of Geomorphology.

Said *Life*: "To keep in shape for his back-packing geology field trips, Professor Sharp of the California Institute of Technology jogs around the cinder track almost every day that he is on the Pasadena campus. Few of his students ever go this far, but Sharp's enthusiasm is contagious, and his sophomore geology course is one of the favorites on the Cal Tech schedule. It is credited with attracting many unsuspecting students into the lifetime study of geology. Though only 39, Professor Sharp has been identified with the Cal Tech campus for 20 years, first as a football quarterback and today as an international authority on geomorphology, which is con-



J. R. Byerman. Courtesy Life Magazine

Life study: Great Teacher, piece of glacier ice, and hat

cerned with the study of land forms and shapes."

Early in August, and right up against a deadline, *Life* decided to send a photographer out to the Caltech campus to get a picture of Sharp for this feature. It being summer, Sharp was far from the campus, working in the Trinity Alps in Northern California. He could not be reached by phone or wire, though a letter might be sent him c/o General Delivery, Weaverville, California—with no guarantee when or whether it would be called for. As it turned out, Sharp *didn't* call for the mail that included *Life's* palpitating letter for three weeks.

Eventually, though, the *Life* photographer caught up with Sharp—who, by this time, had moved on to work with a group of students on Emmons Glacier on Mt. Rainier. Sharp was duly shot and, as in the picture below, duly appeared before *Life's* readers — easily distinguishable from the other Great Teachers, who appeared in their coats, vests, ties or classrooms. He was also distinguishable, of course, by the hat he has worn in the field for upwards of 10 years. Fortunately, the *Life* picture records this worthless old curio for posterity, because at any moment now it is liable to burning by Mrs. Sharp.

U.S.P.H.S. Grants

THE U. S. PUBLIC HEALTH SERVICE last month announced grants of nearly $75,000 to Caltech researchers, to carry on projects for which grants were alloted last year.

Dr. Linus Pauling, Chairman of the Division of Chemistry and Chemical Engineering; Dr. Carl Niemann, Professor of Organic Chemistry; and Dr. Dan H. Campbell, Professor of Immunochemistry were given a flat sum of $30,000 for research in the chemistry of the blood.

Dr. Pauling and Dr. Robert Corey, Professor of Chemistry, were given $19,980 for studies of X-ray diffraction and the structure of protein molecules.

Dr. Herschel K. Mitchell, Associate Professor of Biology, and Dr. Carl Niemann received a grant of $10,740 for work with amino acids involving the substitution of fluorine for hydrogen and studies of the effect of the acids on the metabolism of various organisms.

Dr. Henry Borsook, Professor of Biochemistry was given a grant of $9,504 for research in estimating the relationship of Vitamin B-12 to metabolism.

Dr. Anthonie Van Harreveld received $4,190 for work in determining the relationship of oxygen supply to the functioning of the nerve cells.

Huntington Library Addition

CONSTRUCTION GETS UNDER WAY this month on an underground addition to the Huntington Library in San Marino which could serve as a bomb shelter in case of an emergency. The building will cost close to $250,000, have one story above ground, and two below. R. R. Martel, Professor of Structural Engineering at the Institute; as well as Wesley Hertenstein, Superintendent, and Ernest E. Hugg, Assistant Superintendent of Buildings and Grounds at the Institute served on the committee which worked out the design of the new building.

Student Registration

STUDENT REGISTRATION at the Institute this year totals 1070—645 undergraduates and 425 graduate students.

Of the 645 undergrads, 174 are freshmen, 151 sophomores, 153 juniors and 167 seniors. About 437 of the undergrads come from California, 178 from other states and 30 from foreign countries.

Of the 425 graduate students, 138 come from California, 227 from other states, and 60 from foreign countries.

The student body comes from 42 states (with no representatives from Maine, Delaware, South Carolina, South Dakota, West Virginia or Mississippi), Alaska, and 35 foreign countries.

Parents Day

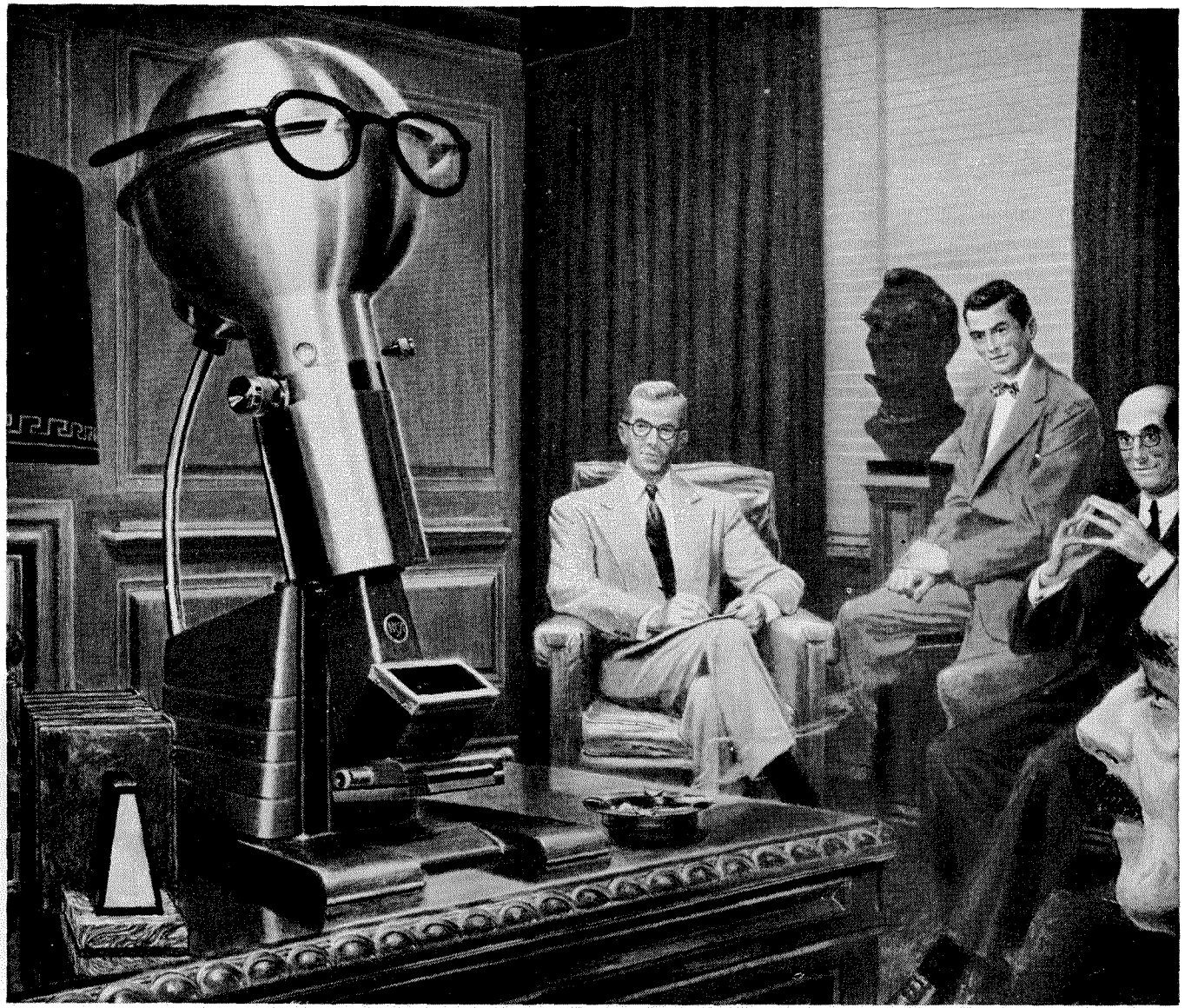
MORE THAN 150 mothers and fathers of freshmen and new students visited the campus on Parents Day, October 21. The program was sponsored by the Caltech Service League in cooperation with the Institute, and included talks by the Deans, by ASCIT President Ulrich Merten and by President DuBridge, as well as guided campus tours, luncheon and afternoon tea at the Athenaeum and a freshman football game with Occidental. Some of the hardier parents stayed on until evening and went to the varsity game at Occidental. An all-around success, Parents Day will probably go on the books now as an annual event.

Kerckhoff Explosion

HOWARD J. TEAS, Research Fellow in Biology, in corn genetics, was seriously injured on the evening of October 9 in an explosion which occurred in his laboratory in Kerckhoff, while he was transferring compressed air from a large cylinder to two smaller ones. Apparently the smaller tanks gave way under pressure, and blew out their ends. Teas, with a severe cut on his right leg, and injury to his left eye, was taken to the Huntington Hospital. By the end of the month, however, he was on the mend, due to return to work in November.

Palomar in Print

THE NATIONAL GEOGRAPHIC Magazine for September carried a 20-page story on Palomar and the Sky Survey, a joint research effort of the National Geographic Society and the Institute . . . And the October 16 issue of *Life* included an exhaustive story on Cosmology, largely based on research at Palomar.



Portable electron microscope, developed by RCA, widens research in universities, industries, hospitals.

The new instructor gets a hearty welcome

You've read, in both newspapers and magazines, about the powerful electron microscope. Now this amazing "instructor" of scientists, physicians, and engineers becomes even more useful—in more research fields.

Through principles uncovered at RCA Laboratories, RCA engineers have developed a compact "table model" electron microscope, at a price which makes it practical for use in an increased number of universities, industries, hospitals, clinics. So simplified is the new instrument that even a high school student or unskilled laboratory technician can quickly learn to use it!

Magnifications of 6000 times can be obtained directly in RCA's portable electron microscope—four times that of ordinary light microscopes—and photography lifts this to 30,000! A new "instructor," yes—and one that gets a very hearty welcome.

* * *

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

Continue your education with pay—at RCA

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

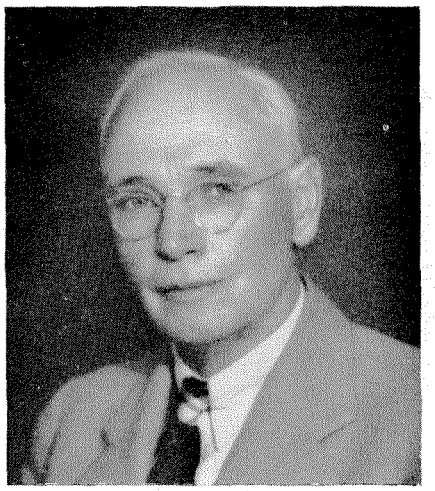
- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television



A TRIBUTE TO

WILLIAM HOWARD CLAPP

1874-1950

The tribute to Professor Clapp which appears below was prepared by one of his colleagues (Franklin Thomas, Professor of Civil Engineering and Dean of Students) and one of his students (Donald S. Clark, now Associate Professor of Mechanical Engineering). It was delivered at memorial services held for Professor Clapp in Pasadena on August 12.

"The California Institute of Technology was fortunate to have had among the members of its early faculty a man of the character of William Howard Clapp. During those days of small numbers and intimate association, universal acquaintance and close friendships among the faculty and between faculty and students were the easy and general results of those conditions. Professor Clapp joined the faculty during the first year of occupancy of the present campus and continued until health conditions caused his retirement in 1944.

"The nobility of Howard Clapp's character was personified also in his wife, Mary, who was beloved by all who knew her. Their devotion to each other and their satisfaction in the gratifying attainments of their sons, George and Roger, were an inspiration to their many friends.

"Professor Clapp developed the instruction at the Institute in the important subjects of machine design and physical metallurgy. Many students who were trained by him through the years have achieved conspicuous success as a result of his instruction, guidance, and inspiration. He had unusual foresight and judgment in identifying directions in which investigations and study would coincide with what later proved to be significant trends in industry and engineering education. Evidence of this facet of his nature is shown by his pioneer work as author, in collaboration with a former student, of *Engineering Materials and Processes*. The quality and timeliness of this book caused its widespread use through several reprintings and its continued use today.

"The esteem in which he was held by his associates in the American Society of Mechanical Engineers was shown by his election as Chairman of the Los Angeles Section of the Society and also to the presidency of the council representing all affiliated engineering organizations in the Los Angeles area.

"As a colleague, Howard Clapp made association with him a pleasure and an inspiration. He was cooperative, yet always provided independent judgment. He was aggressive, but with good humor. He was sympathetic, but insisted upon effort and performance. While many superior qualities were outstanding in Howard Clapp's personality, probably those which rose above all others were his intellectual and personal integrity. He was a man of exceptional physical and mental energy. It may have been his love of Nature as found in various earth formations which caused him to choose Mining Engineering as the field for his technical education at the University of Minnesota. This interest stimulated him to do much hiking in the Sierra Mountains a generation ago when the trails preceded the highways as a means of access to the attractions of our neighboring mountains.

"As a teacher, Professor Clapp exhibited a rare combination of leadership, friendliness, patience, and enthusiasm. The clarity with which he presented his subject matter coupled with his extensive contact with industry made his classes alive, full of interest, and of specific utility. He was proud of his students, and those who were privileged to study with him had a strong feeling of not only friendship, but fellowship. One could always depend upon Professor Clapp to be fair in his dealing with students. The encouragement he gave to students to live a well-rounded life was exemplified in his own life.

"Professor Clapp derived a great deal of satisfaction from the privilege which was his to be a member of the pioneer group to serve during the early development period of the California Institute of Technology. To that development he made a very important contribution by his professional competence and teaching ability as well as by the constructive influence of his robust and genial personality upon many college generations of students."

"Snug Harbor"

JUST AS SNUG HARBORS offer ships protection from stormy seas, there are protective coatings today that guard them against sleet, snow, salt spray—and other damaging forces.

There is a plastic coating for ships' hulls that eases the age-old problem of barnacles and rust. Vessels stay in service twice as long between costly lay-ups in drydock for cleaning and painting. Top-side and below, there are long-wearing coatings to keep the modern craft ship-shape.

Tankers at sea—and tanks ashore—get double protection, inside and out, from plastic coatings. Contents stay clean and pure, never touching the tank wall. The tank itself is safe from attack by water, acids, alkalies, or other chemicals.

These sea-going coatings are made of the same kinds of plastics that serve us so well in industry and in our homes. In a triumph of synthetic chemistry, these ever-useful basic materials are produced for us from organic chemicals.

The plastics and chemicals for these improved coatings are but a few of the hundreds of better materials supplied by the people of Union Carbide to serve shipping and many other industries.

FREE: *If you would like to know more about many of the things you use every day, send for the illustrated booklet "Products and Processes." It tells how science and industry use UCC's Alloys, Chemicals, Carbons, Gases, and Plastics. Write for free booklet F.*

UNION CARBIDE
AND CARBON CORPORATION
30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

Trade-marked Products of Divisions and Units include

BAKELITE, KRENE, VINYON, and VINYLITE Plastics • LINDE Oxygen • PREST-O-LITE Acetylene • PYROFAX Gas
NATIONAL Carbons • EVEREADY Flashlights and Batteries • ACHESON Electrodes
PRESTONE and TREK Anti-Freezes • ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • SYNTHETIC ORGANIC CHEMICALS

Richard Anthony Proctor

CARICATURES OF MEN OF SCIENCE

by E. C. WATSON

THE BRITISH ASTRONOMER, Richard Anthony Proctor, was a popularizer rather than a creator of astronomical science. His writing excited a wide influence in familiarizing the public with the main facts of astronomy and he was well known as a popular lecturer not only in England but in America and Australia as well.

The caricature of Proctor at the left, and the written account below, appeared in *Vanity Fair* for March 3, 1883, when Proctor was 45 years old. He died in New York five years later, having settled in America in 1881.

"When Mr. Proctor went to Cambridge College over twenty years ago, he had no thought of becoming a prophet. He had learned several languages more or less efficiently, and he had excellent mathematical capabilities. After beating all the best men of his year, and proving that he could be Senior Wrangler if he chose, he grieved the academic heart by deciding not to choose. Rowing and riding seemed to him very much better than thermodynamics and curves as objects of human interest; so he rowed and rode instead of earning the affection of coaches.

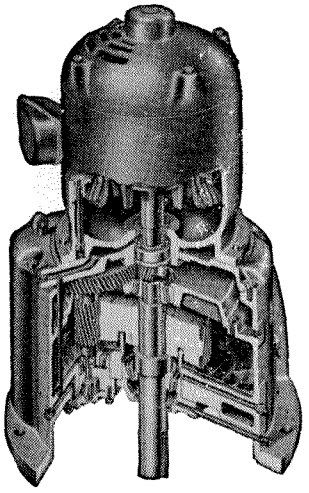
"The moral proceedings of Messrs. Overend and Gurney startled him in the midst of his athletic career, and he saw that the universe contains many things besides outriggers and hacks. Having lost his fortune, he settled down to steady work, and, to beguile the world, he wrote a little treatise on cycloids which is the best thing of its kind ever done by an English mathematician. Eighty people in the world rushed upon this book and bought it; but, so far from being satisfied with this unprecedented appreciation of his years of labour, Mr. Proctor declared that he would have a larger audience. He therefore devoted himself to astronomy, and became the secretary of the Royal Astronomical Society—to the enormous dismay of the fogies.

"He has lectured in America and Australia; he has written innumerable essays of the brightest and clearest kind; he has sketched, modelled, gone into training, started a newspaper, and married an American lady. These feats caused the fogies to esteem him a heterodox.

"At present he is editor of *Knowledge*, and his journal seems to please many people. He is a five-and-forty years of age, he has invented a new theory of the universe, and he is afraid of growing fat."

One of a series of articles devoted to reproductions of prints, drawings and paintings of interest 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.

Another page for **YOUR BEARING NOTEBOOK**

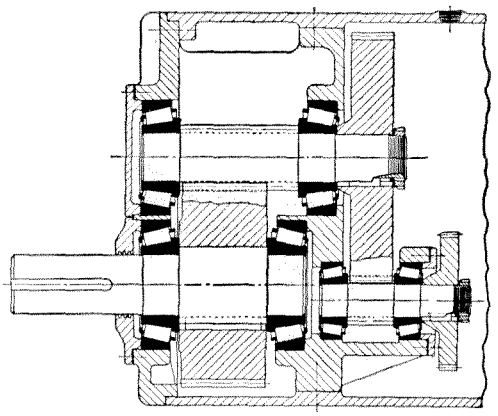


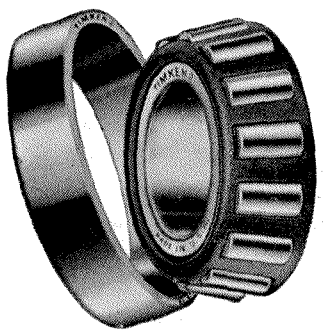
How to help a gearmotor take care of its teeth

To minimize wear on the teeth and to insure smooth, quiet operation, reduction gears in motors like this must be held in perfect mesh, no matter what the load. That's one reason why engineers mount the gear shafts on Timken® tapered roller bearings. Timken bearings hold the shafts in accurate alignment. Gears are kept perfectly positioned, with each tooth meshing smoothly and carrying its full share of the load.

Gears mesh smoothly, wear longer, with shafts on TIMKEN® bearings

Here is a typical gear-case countershaft showing a common method of mounting Timken bearings. Due to the line contact between the rolls and races, Timken bearings give the shaft maximum support. There's less chance of deflection under load. The tapered bearing design takes both radial and thrust loads in any combination. End-movement of the shaft is kept to a minimum. Gears wear longer—work better.





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

Want to learn more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

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

THE BEAVER

Some Notes on Student Life

THE BEAVER SAT in the middle of his room completely surrounded by the vast accumulation of the previous years. After all, you could not live an academic life and not collect a few books, notes and other trivia. As he attempted to organize the stuff, he observed that the room had been shrunk—by the heat of the summer, no doubt. This remarkable phenomenon could probably be explained by a few calculations on heat coefficients, but the Beaver's musing was overcome by the necessity for storing this trash. The problem was neatly solved by heaving it all into the closet and quickly sliding the door shut.

Refusing to contemplate the matter further the Beaver dug up an old pipe and strolled into the lounge. Many sun-tanned faces turned to greet him, and raucous shouts revealed old friends. A long series of stories regarding the summer adventures of the recent grads and the men who had not yet arrived eventually led around to the subject of frosh.

From Student Camp to Chess

It was obvious to the old boys that the frosh were back from student camp. The Beaver counted four chess games in progress. He chuckled paternally, realizing that all frosh had always played chess the first few weeks. They had been pleasantly surprised by the studied informality of the new-student camp and had enjoyed being on equal terms with many of the members of the faculty and all of the big wheels of the student body. But now the frosh were about to embark on a very new and very different kind of life from any they had ever known before, and they were understandably nervous. So they played chess.

Registration brought the usual sore wrist; there were more cards, papers, and sheets to be filled out than ever before. It was astounding to realize how many people wanted to know the whereabouts of every student on the campus at all times of day.

For some of the students, another worry had been added—that of the draft board. The line which divided the class into the upper and the lower half became more of a subject for discussion than the 50-yard line, because of the Selective Service ruling that deferments would be granted students in the top half of their class. The registrar's office took on the aspect of the New York Stock Exchange as students lined up in order to get the all-important information. And approximately one half of the class loudly regretted not having taken up the study of basket weaving at Podunk University.

But this doting on Grade Point Averages was a most unstable condition which the Beaver was sure could not last. He was right. A rash of exchange dances broke out (wherein the Tech man is found gamboling after the fair sex). After the first week of classes, most of the lounges were in the familiar state which accompanies such affairs. The frosh stood by in complete confusion. It would be a short time yet before they would be able to cavort with the complete abandon of the sophomore.

From Registration to Rotation

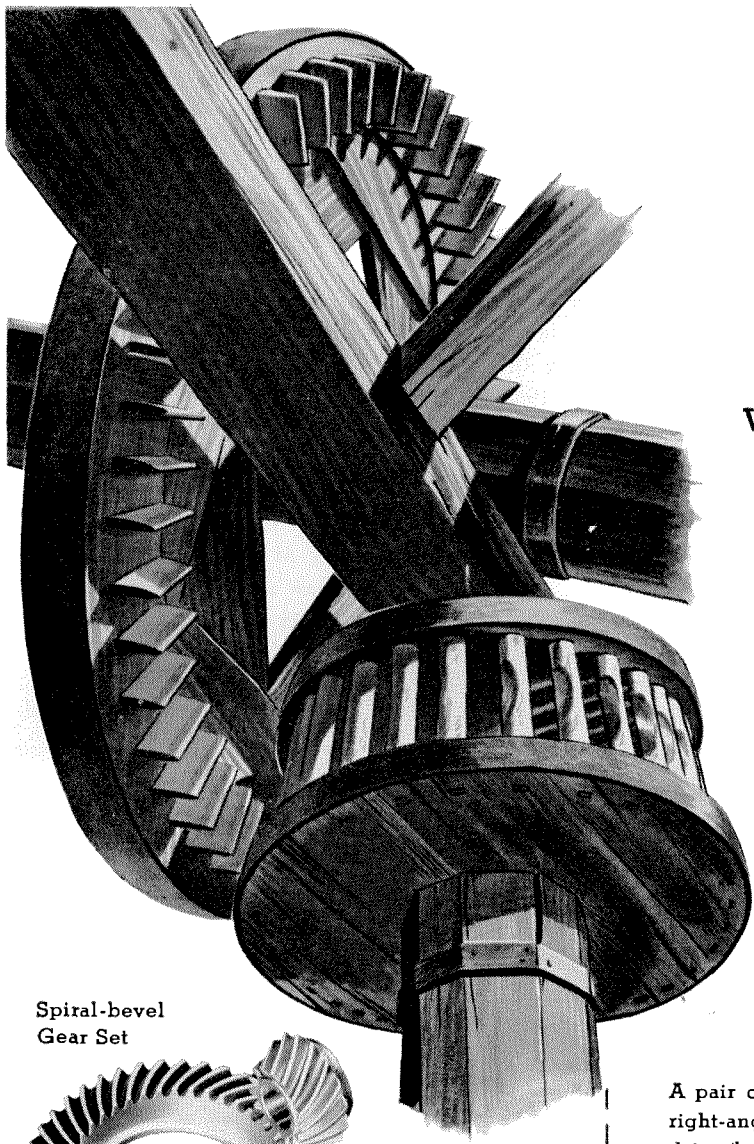
The familiar ritual of rotation was begun almost immediately after the start of classes. The Beaver thought that the proselytism of the frosh was greater this year than ever before. Some of the houses put on shows that put vaudeville to shame; others, more subtle, had guests extol the virtues of the house where they themselves had spent four of the happiest years of their lives. The majority of the frosh, however, remained adamant to this wooing and stayed where they had been put by Mr. Tanham, Master of the Student Houses, secure in the knowledge that they would, in all probability, be happy in any one of the four houses.

The Beaver could not suppress a smile as to the manner in which the sophomores conducted themselves. It would have been a wise frosh indeed, who could have deduced the nature of the week that was to follow rotation. Even now the familiar gigantic red bow ties of Blacker as well as the top hats and enormous cigars of Dabney could be seen lending a rather incongruous atmosphere to the campus.

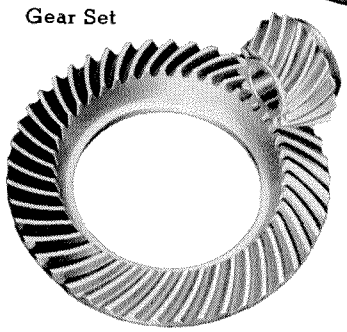
From Chess to Limits

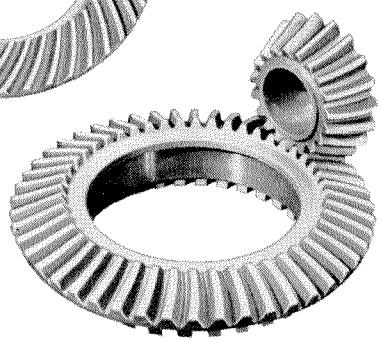
With the first few weeks under his belt, the Beaver rejoiced in the warm sun of the courtyard as he wrote a letter or two and fondly surveyed the new crop of frosh. They had stopped playing chess and were now engaged in the mysteries of limits.

The Beaver ambled into his room to inquire into the physical sciences, for he was already more than a month behind in his work. As he opened his closet to look for last year's physics book he was met by a deluge of trash. He heaved a sigh and began to put things in their proper place. The new year had indeed begun. He might as well tack up the pin-ups and wash the beermug.

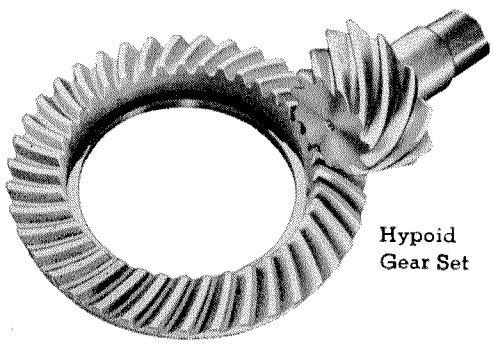


Spiral-bevel
Gear Set

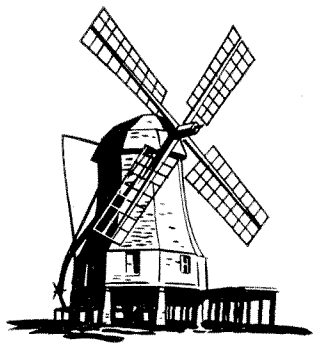




Zerol
Gear Set



Hypoid
Gear Set



wheels of western progress

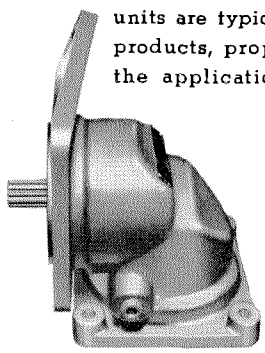
GEARS

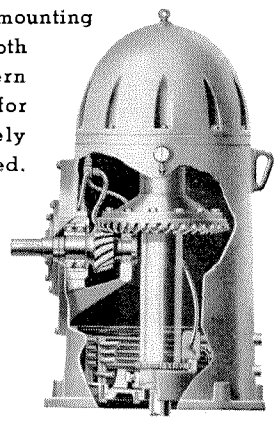
bevel gears . . . are the normal choice for transmitting power between nonparallel shafts. Bevel gears of all kinds—as well as every other known type of gear—are manufactured in our extensive west-coast facilities.

different types Commonly used bevel gearing includes straight bevel, spiral bevel, Zerol and hypoid. Selection of type is normally based on the requirements of the equipment, with consideration given to loading, speeds, sound level, rigidity, configuration of mechanism, etc.

sample applications

A pair of spiral-bevel gears is used in this heavy-duty standard right-angle vertical pump drive (below right). The small right-angle drive (below left), which employs Zerol gears, is also a pump drive, in this case specially developed for mounting directly on an aircraft engine. Both units are typical Pacific-Western products, properly designed for the application and accurately manufactured.





in the West, it's Pacific-Western Gear Products

For help in any problem of mechanical-power transmission, be sure to consult a specialist in the design, production, and application of gears and geared products. Call or write your nearest Pacific-Western office.

5033

AGMA MEMBER

WESTERN GEAR WORKS

Manufacturers of **PACIFIC-WESTERN** Gear Products

Pacific Gear & Tool Works

Plants at:
Seattle
San Francisco
Lynwood
(Los Angeles County)
Representatives:
Portland
Denver
Houston

ALUMNI NEWS

Plane Crash

ODELL CARSON AND DON SHEPARD, both in the class of '50, were killed last month when their light plane crashed in the Columbia River, near the Hanford Atomic Energy Works in Richland, Washington, where they had been working since graduation. With two other junior scientists at the Hanford Works—who also died in the accident—they were returning from a week-end trip home to the Los Angeles area when the single-engine plane, piloted by Don, went down, a mile short of their destination, while they were attempting a landing in a thick fog.

Director Macartney

EVERETT J. MACARTNEY was named last month as a Director of the Alumni Association, filling the vacancy caused by the recent death of Robert J. Hare.

Ev received his B.S. in Mechanical Engineering in 1943. As an undergraduate he served on two A.S.C.I.T. Boards of Directors—as Second Representative-at-Large and as Athletic Manager—and he was Senior Class President.

He made Varsity letters in football and track, and was captain-elect of the '42 football squad. The war resulted in the temporary suspension of football, however, and the '42 team was one of those which suffered. He was a member of Ricketts House, the Beavers, and the Varsity Club, and holder of two Honor Keys.

Upon graduation Ev entered active duty with the Naval Reserve, and was accepted for submarine duty following Officers' Indoctrination School. He served out the war on the *U.S.S. Thornback* and *U.S.S. Carp* and in 1946 he was placed on inactive duty as a Lieutenant.

Since 1947 he has been employed by Standard Oil of California at the El Segundo Refinery in various capacities within the refining and engineering department.

Since 1948 he has served as a vice-chairman on the Alumni Fund Committee.

ASME President

J. CALVIN BROWN, ex-'17, has just been elected president of the American Society of Mechanical Engineers for 1950-51. An attorney at law as well as a mechanical engineer, he received the degrees of LL.B. and LL.M. at the Hamilton College of Law in Chicago. He specializes in patent, trademark and copyright litigation before the United States Courts.

Brown is a member of the bars of the U. S. Supreme Court and of the highest courts—both State and Federal—in California, Illinois and the District of Columbia.

He has held a number of offices in the ASME since he became a member of the Society in 1928, has also been president of the Los Angeles Engineering Council

ALUMNI ASSOCIATION OFFICERS

PRESIDENT
G. K. Whitworth '20

VICE-PRESIDENT
R. P. Sharp '34

SECRETARY
D. S. Clark '29

TREASURER
H. R. Freeman '25

BOARD OF DIRECTORS
R. C. Armstrong '28
Theodore Coleman '26
Everett J. Macartney '43
John E. Sherborne '34
Donald C. Tillman '45
A. C. Tutschulte '31
William O. Wetmore '37

ALUMNI CHAPTER OFFICERS

Chicago Chapter:

PRESIDENT Jack M. Roehm, M.S. '35
Hagen Lane, Flossmoor, Ill.
Pullman-Standard Car Mfg. Co., 1414 Field St., Hammond, Ind.

VICE-PRESIDENT Le Van Griffis '37
11141 S. Longwood Dr., Chicago 43
Armour Research Foundation, 35 W. 33rd St., Chicago 16

SECRETARY-TREASURER Eben Vey '41
5125 S. Kenwood, Chicago 15
Illinois Institute of Tech., 3300 S. Federal St., Chicago

San Francisco Chapter:

PRESIDENT R. I. Stirton '30
745 Alvarado Road, Berkeley
Oronite Chemical Co., 38 Sansome St., San Francisco

VICE-PRESIDENT Jerome Kohl '40
1149 A High Court, Berkeley 8
Tracerlab, Inc., 2295 San Pablo Ave., Berkeley

SECRETARY-TREASURER R. R. Bowles '41
7960 Terrace Drive, El Cerrito
Calif. Research Corp., 576 Standard Ave., Richmond

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

New York Chapter:

PRESIDENT Richard K. Pond '39
95 Forest Road, Fanwood, N. J.
Westinghouse Electric Co., 150 Pacific Ave., Jersey City, N. J.

VICE-PRESIDENT Mason A. Logan '27
17 Pittsford Way, Summit, N. J.
Bell Telephone Labs, 463 West St., New York City

SECRETARY-TREASURER Erwin Baumgarten '40
302 E. Front St., Apt. B-16, Plainfield, N. J.
Calco Division, American Cyanamid Co., Bound Brook, N. J.

Washington, D. C., Chapter:

PRESIDENT James Boyd '27
Bureau of Mines
Department of the Interior
Washington 25, D. C.

SECRETARY-TREASURER P. G. Nutting '36
5112 Connecticut Ave., N.W.
Washington 8, D. C.

of Founder Societies, chairman of the Patent Section of the Los Angeles Bar Association, president of the Los Angeles Patent Law Association, as well as a member of the Society of Motion Picture Engineers, Society for the Advancement of Science, and California Water and Power Resources Committee—among others.

Chapter Notes

On Friday, October 13, Eben Vey '41, Secretary of the Chicago Chapter; William A. Lewis, Jr. '26, Ph.D. '39, Dean of the Graduate School of the Illinois Institute of Technology; and Robert L. James '36, Research Associate of the Illinois Institute, were hosts at a luncheon at the Faculty Club of the Illinois Institute for Dick Armstrong '28, the Caltech Alumni Association director in charge of chapters . . . Most recent meeting of the Chicago Chapter was timed to coincide with a visit from Dean Franklin Thomas.

The Washington, D. C. Chapter met on October 20 at the Roger Smith Hotel to hear a talk by Dr. H. P. Robertson, now on leave from the Institute to serve with the Department of Defense in Washington . . . 1950-51 officers of the chapter elected at this meeting: James Boyd '27, Perley G. Nutting '36.

Kickoff Luncheon and Open House

THE ANNUAL OCCIDENTAL-CALTECH Kickoff Luncheon, held at the Athenaeum on October 20, the day before the Oxy-Caltech game, was as lively as usual this year. The lunch was good, the speeches were brief and the Oxy band must certainly have been the loudest musical organization ever to perform in the Athenaeum.

The pessimistic tone adopted by most of the Caltech speakers, in discussing the team, was unfortunately justified by the result of the game next day: Oxy-20, Caltech-7. At the Kickoff Luncheon, however, President DuBridge spared himself any possible disappointment by referring to the approaching game as the annual contest "to determine which school develops brawn, and which develops character."

The Alumni Open House held in Dabney Lounge after the Oxy game was a rousing success, drew 75 couples, who enjoyed the refreshments and dancing until the doors were closed at 1 a.m.

Help Wanted

THE ANNUAL ALUMNI SEMINAR won't be held until April 15, but that doesn't mean that the committee in charge of the day isn't already at work. In fact the Seminar Committee needs some spare hands. Maybe you'd like to serve? It takes a lot of manpower to work out all the arrangements for the Big Day.

If you'll call the Alumni Office at the Institute (SY 6-7121) and let them know you're interested, Gerald Foster '40, Seminar Committee chairman, will get in touch with you later and tell you what jobs are still open. Thanks.

Will You Be in the New Directory?

Please fill spaces below. Check address desired in Directory.
Note year received in space for each degree obtained at Tech.

B.S.....M.S.....

Name.....Engr.....Ph.D.....

☐ Home Address.....

City.....Zone.....State.....

Employer.....

☐ Business Address.....

City.....Zone.....State.....

Present Position.....

ONE OF THE BIGGEST JOBS the Alumni Association has taken on this year is the publication of a new, and sorely needed, Alumni Directory. There hasn't been one since 1948.

Last month cards went out to all alumni, asking them to check off certain information about themselves for purposes of the new directory. Did you get your card? If *not*, will you fill out the duplicate card above? Send it to: Alumni Office
California Institute of Technology
1201 E. California St.
Pasadena 4, California

If all cards are returned by November 15, there's a chance you'll have your copy of the new directory by January 1.

PERSONALS

1919

Fred A. Marshall, ex '19, has become San Francisco representative for Carter & Co., Pacific Coast Distributors of National Securities and Research Corporations Series of Investment Funds. His territory extends north from Bakersfield to Canada, east from Bakersfield to Albuquerque, east from Seattle to include North Dakota, and then south to Albuquerque. For the previous five years he worked the same territory for another investment fund wholesale distribution company.

1924

E. Harold Gandy, Sales Engineer for Sterling Electric Motors in L. A., reports two new additions to the Gandy clan. On September 1 son Bob, now a senior at Occidental, was married to Jean Marie Sanderson. On September 7, son Dick and his wife became the parents of a baby boy—the first Gandy grandchild.

Robert S. Ridgway, now in his "anniversary year" (25th) with Standard of California, had a six-week business-and-pleasure trip with his family this summer, which took them by plane to Detroit, by car through Canada and New England, then down the East Coast and back home. Bob is the Mechanical Engineer for the Natural Gasoline Department of Standard of California. He has a daughter 17 and a son 12.

F. Douglas Tellwright, who has been Assistant Vice-President of AT&T in New York for the past year, has returned to California as Vice President in charge of Public Relations for Pacific Tel & Tel in San Francisco.

1927

Dave Gardner writes that he's still Assistant Division Engineer with the Santa Fe Railway at Winslow, Arizona. His son Bill is a sophomore at Tech this year.

1928

Col. Kenneth R. Crosher, USAF, is presently assigned as Senior Air Instructor to the 62nd Fighter Wing of the California National Guard. He's stationed in Burbank.

Richard C. Armstrong, M.D., has recently been appointed Assistant Professor of Ophthalmology at the College of Medical Evangelists in Los Angeles. It's a nice job, he says—part-time and no salary.

Incidentally, Tech students who complain because faculty members can't see well enough to recognize the right answers on exam papers might be interested in the rumor that some of these staff members receive their eye care from Doc Armstrong, who practices Ophthalmology in Pasadena.

Ernest E. Sechler, M.S. '30, Ph.D. '33, Profesor of Aeronautics at Caltech, was recently made a member of the Subcommittee on Aircraft Structures of the National Advisory Committee for Aeronautics. He's also in the throes of building a new home in San Marino.

1930

Norris Johnston, Ph.D., was married on August 17th to Janet Elizabeth Spicer, in Dallas, Texas. The Johnstons are now at home at 10403 East Bexley Drive, Whittier.

1932

Howard W. Finney, C.P.A., is Assistant

ALUMNI CALENDAR
1950 - 51

ALUMNI SQUARE DANCE

Friday, December 1

8 p.m.

Elks Temple, 400 W. California St.
Pasadena

Bill Mooney—Caller

Secretary-Treasurer of the Flying Tiger Line, worldwide air freight organization, in Burbank.

Worrel F. Pruden, M.S. '33, who has been with the Consolidated Western Steel Corporation and its predecessors for 16 years—during which time he advanced to the position of Chief Engineer—was transferred last month to another subsidiary of U. S. Steel. In the new position of Assistant Chief Engineer of the Columbia Steel Corporation, his headquarters will be moved from Los Angeles to Oakland.

1935

Nelson P. Nies, M.S. '36, research chemist for the Pacific Coast Borax Company in Pasadena, comes up with a late news bulletin: the Nies' had a daughter, Nancy Allison, born on June 18, 1949.

1936

Willard L. McRay, M.S. '38, Ph.D., '40, is Associate Professor of Chemistry currently doing a stint as Chairman of the Department of Physical Sciences at the University of California's Santa Barbara College. With a colleague, he has an ONR grant to study the metabolism of T. cruzi, the organism that causes Brazilian sleeping sickness.

1937

Charles K. Alexander, Ph.D. who had been Professor of Mathematics at Occidental College since 1936, died at his home in Altadena last month. He was 39 years old.

Wendell B. Miller was transferred last month from the Alhambra office of Pacific Tel & Tel, where he was Senior Engineer in the Outside Plant Department, to the Chief Engineer's Office in Los Angeles, as a Senior Engineer in the Inventory and Costs Group.

Theodore M. Bolen, M.S., USAF Ret., is now living in Spanaway, Washington, working as a salesman for the Lincoln National Life Insurance Company.

George M. Dorwat, M.S. '39, writes that he is now working as a Petroleum Engineer for Standard of California in Taft.

1939

Col. Townsend Hills, USAF, M.S., has been transferred from Randolph Field to the Perrin Air Force Base in Texas. He's Wing and Base Commander at this Basic Flying Training School.

Philip E. Smith was married on June 10 to Barbara Mallotte in Forest Hills, N. Y. The Smiths are now living in Bayside, Long Island, and Phil is still serving as manager of the Eastman Kodak Processing Lab in Flushing, N. Y.

1940

Eric G. Laue, M.S. '46, and his wife are proud parents of a son, Thomes Maxon, born in San Gabriel on September 26. Young Tom has a brother Douglas, who is 3½; and their father, formerly research engineer for the A. O. Smith Corp., is now at J. P. L.

Bob Grigg writes to say that with the arrival of Gloria last May 20 the Grigg offspring now total three—two girls and a boy. Bob is still with Pacific Tel & Tel in Los Angeles, where he is chiefly concerned with microwave propagation studies and engineering of radio systems.

Fred Brunner, M.S. '41, lays claim to a new record for the class of '40 with his four sons. The latest, Chris, was born on July 21. The others are Fred, 7, John, 5, and Tom, 2. Fred Sr. has been with C. F. Braun & Co. in Alhambra for the past five years, is now district sales engineer in the Alhambra office.

1941

George B. Harr, still living in Pasadena, is working for the Firestone Tire & Rubber Co. in Los Angeles, where he's in charge of technical aspects of the Industrial Products Division. George has been pretty active in skiing and mountaineering in recent years. He belongs to the National Ski Patrol and skis every skiable weekend in this area or in Sierra. He's a member of the Rock Climbing Section of the Sierra Club too. He climbs in the Tetons in Wyoming, and in Yosemite as well as locally, and has made several first ascents in the Canadian Rockies and the Sierras. Still a bachelor, he says, adding—after handing us all the above information—"obviously."

James R. Garrett is now Assistant Professor of Mathematics at the Georgia Institute of Technology in Atlanta.

1942

Jack Alford has been rocking along at a pretty lively clip lately. On May 25 his daughter, Margaret Ann, was born. On June 9 he received his Ph.D. from Tech. On June 15 he became a Research Fellow in Engineering here. And on the same day the Alford clan moved into a new home in Arcadia.

Lt. Warren Gillette, USN, received his M.D. from George Washington University in June, is now an interne at the Naval Hospital in New Port, Rhode Island.

J. C. Schwarzenbach, M.S., is president of his own company, U.S. Propellors, which not only makes aircraft propellors, but an electronic piano and a good deal of wind-tunnel equipment as well. He's married, lives in Altadena, and has two children, but still manages to ski and climb some mountains.

1943

John R. Spencer writes from Austin, Texas that he's Assistant Professor in the Petroleum Engineering Department of the University of Texas, and also the father of a son, Stuart, born on June 10. At the time of writing, Stuart was three months old and tipped the beam at something like 17 pounds and 5 ounces, which was causing his happy old man to mumble something about future Tech football material.

George T. Felbeck, Ph.D., was married in September to Mary Elisabeth Nichols in Dedham, Mass. By now the Felbecks should be settled in their new home in Wernersville, Pa.

David E. Shonerd is at the Jet Propulsion Laboratory GALCIT as a Research Engineer in the Air-Fuel Combustion Section. He received a Guggenheim Jet Propulsion Fellowship for Graduate Study at Tech this year.

Kenneth L. Powlesland writes from San Leandro that he's been transferred by Standard of California to a newly-formed company, the California Research and Development Co., in Livermore. Ken's present parental status: two diaper-bearing children.

1944

Richard E. Kuhns writes that he works for the L. A. County Engineer in the Sanitation Division, lives in Alhambra Terrace, has a new baby daughter named Cathy Lee, and belongs to Pasadena Volunteer Construction Battalion 11-3.

William P. Blair left U. S. Rubber in June and took a six-week summer course at Occidental College, then spent four weeks as counselor at a Boy Scout Camp before returning to Occidental as a Graduate Special Student majoring in Sociology and Psychology.

Joseph M. Phelps, M.S. '47, is working as a design engineer for C. F. Braun & Co. in Alhambra. He's a registered civil engineer in the State of California, a Junior A.S.C.E., married and has two children.

Maurice Rattray, M. S. '47, is now an Assistant Professor at the Oceanographic Laboratories of the University of Washington in Seattle.

Fred W. Morris Jr., who has been on the USC faculty for the past three years has now resigned to take a permanent civilian appointment with the Signal Corps Engineering Laboratories in Monmouth, New Jersey as an Electronic Scientist. He has been a consultant for the Army Signal Corps for several years. Incidentally, Fred is co-author with Rodney D. Lewis of a textbook *Electrical Circuits*. It's being published by D. Van Nostrand in New York. And not at all incidentally, Fred was married last year to Nancy Thompson, an artist, in Los Angeles.

1945

William T. Collings has recently moved from Long Beach to Milwaukee, Wisconsin, where he is designing engineer for Khig and Smith, engineers and contractors for industrial buildings. Daughter Christine is now a year old.

John Dill McKenney was married on September 16 to Joan Sawyer in Pasadena.

Charles M. Davis is now Graduate Fellow in Electrical Engineering at the University of Iowa, where he's working for his doctor's degree.

1948

Irwin Louis Markowitz was married in Alhambra recently to Mabel Bell, who has been working as a nurse at the Huntington Hospital in Pasadena.

Thomas Lang is now working as a stress analyst at North American Aviation in Los Angeles.

1949

Donald E. Hibbard of South Pasadena and Maritza Medina were married in Mexico City last month. The bride is a graduate of the Anoakia School for Girls.

Robert L. Fisher spent the past academic year in the graduate school at Northwestern University in Evanston, Illinois. This year he's continuing his studies at the Scripps Institution of Oceanography in La Jolla.

1950

William Freed and Peggy Barney of Pasadena announced their engagement last month. They plan to be married in January.

William C. Culbertson is working as a geologist with the Coal Resources section of the Fuels branch of the U. S. Geological Survey in Miles City, Montana. Right now he's engaged in a project to try and determine the amount of strippable coal in southeastern Montana, in connection with the Missouri River Basin project.

Don Baker and his wife are spending the year in Norway, where he's doing graduate work at the University of Oslo.

Pete Howell writes that he had a summer job at the Navy Test Station in China Lake, went home to Des Moines for a short visit, then headed for the University of Minnesota and graduate work in chemistry. Two other Techmen of the class of '50, *Myron Arcand* and *Floyd Humphrey*, are also at Minnesota. All three have teaching assistantships in the Chemistry Department.

one that is confused and essentially meaningless.

Hubbard openly disavows metaphysics and mysticism, yet he makes Bergson's "life force" the foundation of his whole viewpoint. He seems unaware that this is a wholly discredited metaphysical concept, inapplicable by scientific standards of operational analysis. The author mentions that Darwinian evolution was his first inspiration toward Dianetics, but with his instinctual and metaphysical basis, it is not strange that he ignores natural selection.

This book is carelessly written. Even some of the adherents to Dianetics admit this. A typical careless statement is the following: "Dianetics is *not* psychiatry. It is *not* psychoanalysis. It is *not* hypnotism. It is a science of mind and needs about as much licensing and regulation as the application of the science of physics."

This has been excused by some as simply enthusiastic propaganda. But internal evidence shows that this is an attempt to inflate the originality of the thesis at the expense of more solidly established knowledge, and possibly to sidetrack criticism from the directions indicated. Such insulation can only lead to a cul-de-sac by eliminating both validating evidence and the prediction of the behavior of the whole person.

Novelty is not enough

Controversy over this book indicates a widespread popular belief that novelty alone entitles a thesis to serious consideration. Partly this arises out of the publicized open-mindedness of the scientific attitude.

Novelty is of two kinds: novelty of data and novelty of theory (or explanation). Hubbard claims great originality for his data. Are his data novel? Qualified scholars believe they are an uncritical rehash of known facts in new terminology. Novel terms do not guarantee novel data. Here is where careful meaning analysis is paramount. After meaning analysis has settled whether data are novel, then we may ask if the explanation is novel.

Alternative explanations of empirical facts are always possible. Here recognized experts have a prior right to be heard over one who advances an insufficiently supported hypothesis. Counting noses of adherents is not evidence. Hubbard protests that he is scientific, but his main support consists of the lame position that others have made complex what is really a simple matter. Some mastery of the constructive achievements of other scholars is necessary, and this is a naive book because it reveals a profound innocence of the major advances of the past century.

A characteristic feature of Hubbard's writing is the exaggeration of his own originality by implying that his predecessors were virtual morons. Here is a random selection that speaks for itself:

Hubbard remarks that, while it has long been felt that facing reality is necessary for sanity, no one had conceived that perception is the line of communication to reality. Again, he holds that the value of recall for the business of living has occupied scant attention. Finally, for the biologically literate: "it has been poorly considered in the past that a set of survival characteristics in one species would not be survival characteristics in another."

Such opinions are typical, not exceptional.

What's it worth?

This author is so out of touch with contemporary achievements in the fields into which he ventures that, in the reviewer's opinion, this work does not merit serious attention. It is given critical attention here only because of the uncritical following it has attracted. If there are any suggestions of value in this movement, they will be supported by continuity with past efforts, not by evasion of intellectual responsibility.

In summary, Dianetics mistakes a highly over-simplified model for a solution to important human problems. It disregards operational analysis and search for adequate controlled evidence in the proper directions. Because of its archaic metaphysics, its outmoded exclusive emphasis on survival, and its discredited instinctivism, it pays only lip-service to the established social and cultural contributions to human personality. Its assumption of inherently perfect rationality masks for the gullible the effort, the learning and the critical attitude that are necessary for a balanced rational approach to life problems. Everything attempted here has been done better by others and with a proper sense for the protection of the uninformed.

How much magic can a square inch hold ?

Just a frame of movie film—but think what it can hold. Accurate detail, motion, sound, even lifelike color and much more—miracles that work magic in entertainment, and in business and industry as well.

Here, in a tiny area far too small to examine easily, photography has captured a moment of life faithful in its finest detail—captured it complete with sound—conversation and music. And all this that's been recorded can be endlessly duplicated so that all the world can thrill to its beauty and drama at the same time and in the language of any land.

Such are the wonders of photography. They are wonders that serve entertainment—can serve science, business, and industry in countless ways as well.

For example, motion pictures can present your product or services graphically and colorfully. They can explain production methods—dramatize safety measures—train salesmen. They can spark interest and understanding in the classroom.

With pictorial animation they can make difficult processes clear. They can make time go fast, go slow, or even backward, to facilitate a study or improve a demonstration. All of this because of the inherent magic in photography.

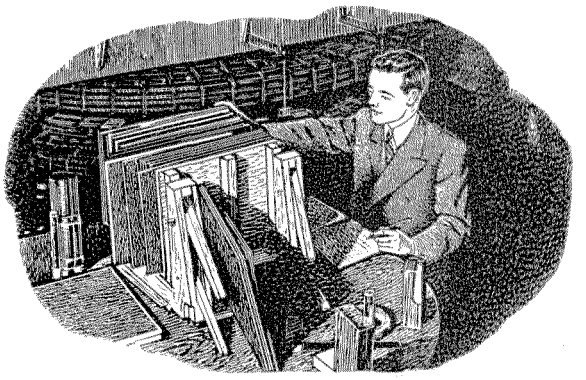
You can use this magic in your occupation. When you meet problems in production, management, or sales, it will pay you to find out how they can be handled better, faster, and more accurately through photography.

Eastman Kodak Company, Rochester 4, N. Y.

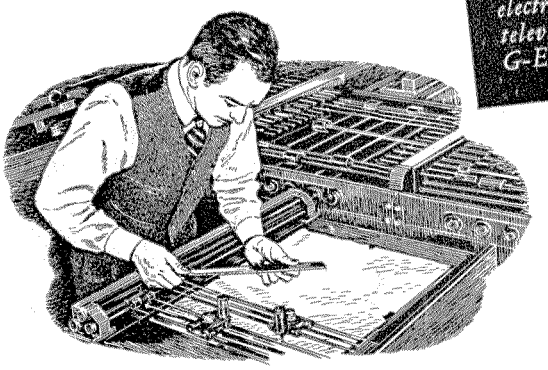
ADVANCING BUSINESS AND INDUSTRIAL TECHNICS

Functional Photography

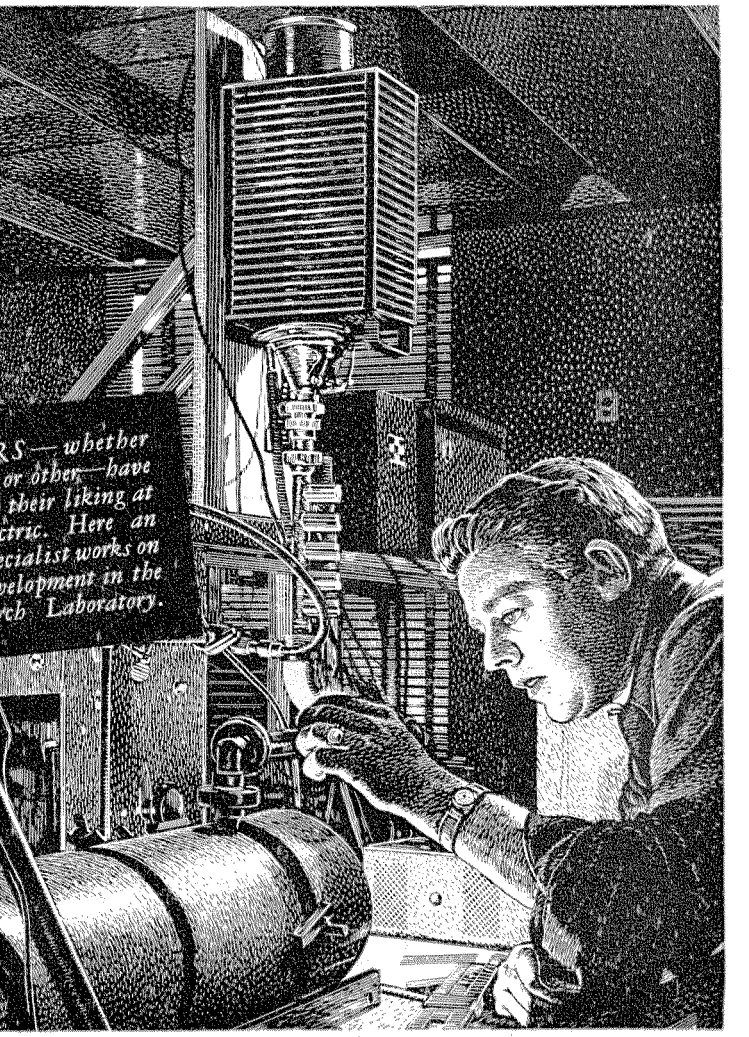
Kodak
TRADE-MARK



PHYSICISTS at G.E. find opportunities in the Company's atomic research projects.



MATHEMATICIANS work on such G-E developments as the differential analyzer and other computers.



ENGINEERS—whether EE, ME, CE or other—have found work to their liking at General Electric. Here an electronics specialist works on television development in the G-E Research Laboratory.

General Electric's corps of scientific, engineering, and technical specialists has more than doubled since 1941

Products, like streams, rise no higher than their source. At General Electric the source of new and better products is our corps of scientists, engineers, physicists, chemists, and other technicians, recruited from American colleges and given further opportunities for study and training in long-established G-E courses.

In the years since 1941, General Electric has increased this corps of technical graduates from less than five thousand to more than ten thousand.

These men and women have found themselves needed in the Research Laboratory, the Knolls Atomic Power Laboratory, and more than twenty other G-E laboratories . . . in the engineering and developmental staffs of nine G-E Operating Departments, ranging from the manufacture of heavy industrial equipment to the making of lamps and chemicals . . . in manufacturing and sales . . . in such new undertakings as jet engines, radar, silicones, gas turbines for locomotives and electric power generation.

At General Electric, prime importance is placed on recognizing and developing talent and skill, on providing incentives for creative thinking, on keeping ahead in electrical research, engineering, and manufacturing.

You can put your confidence in—

GENERAL ELECTRIC