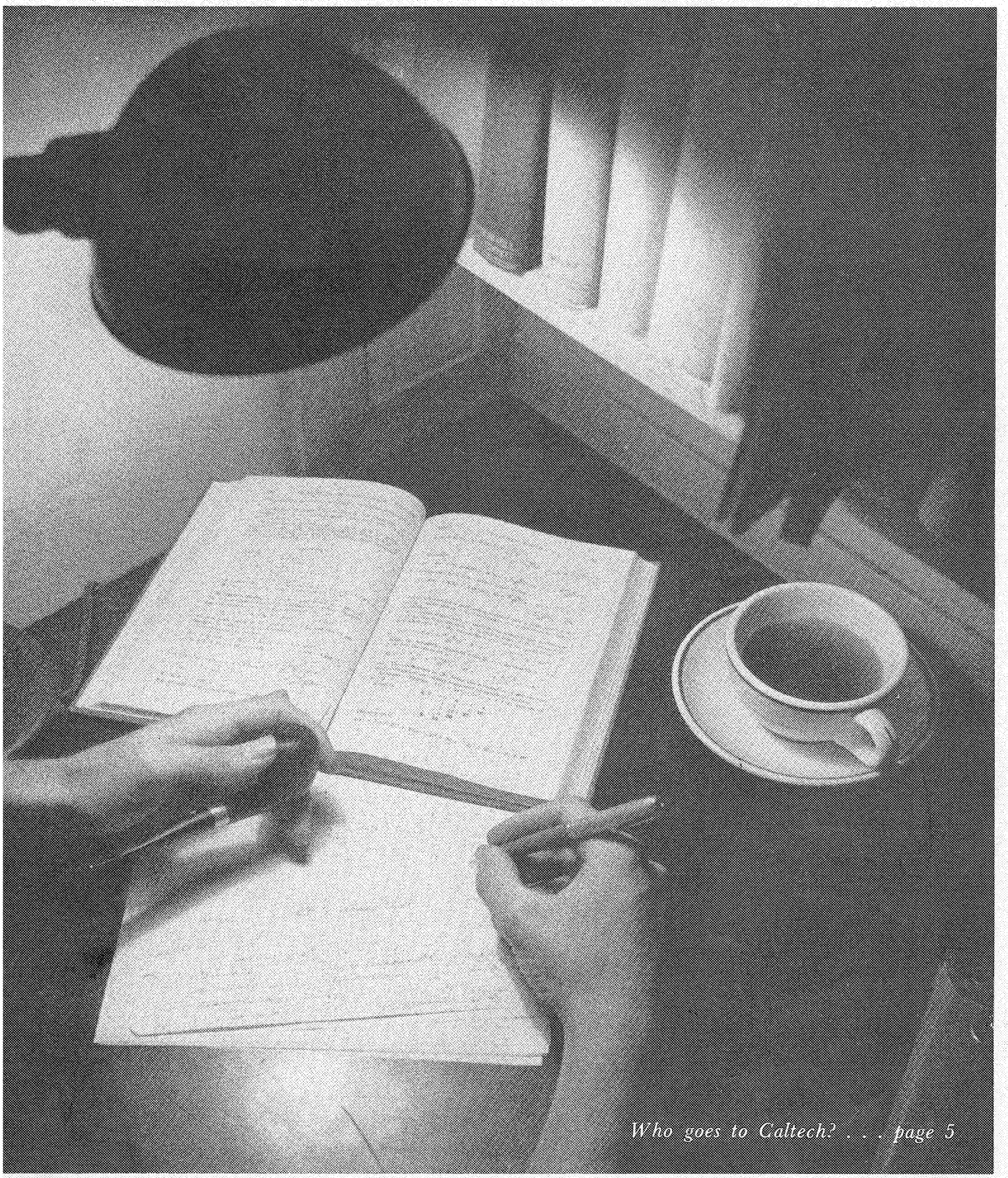
ENGINEERING AND SCIENCE

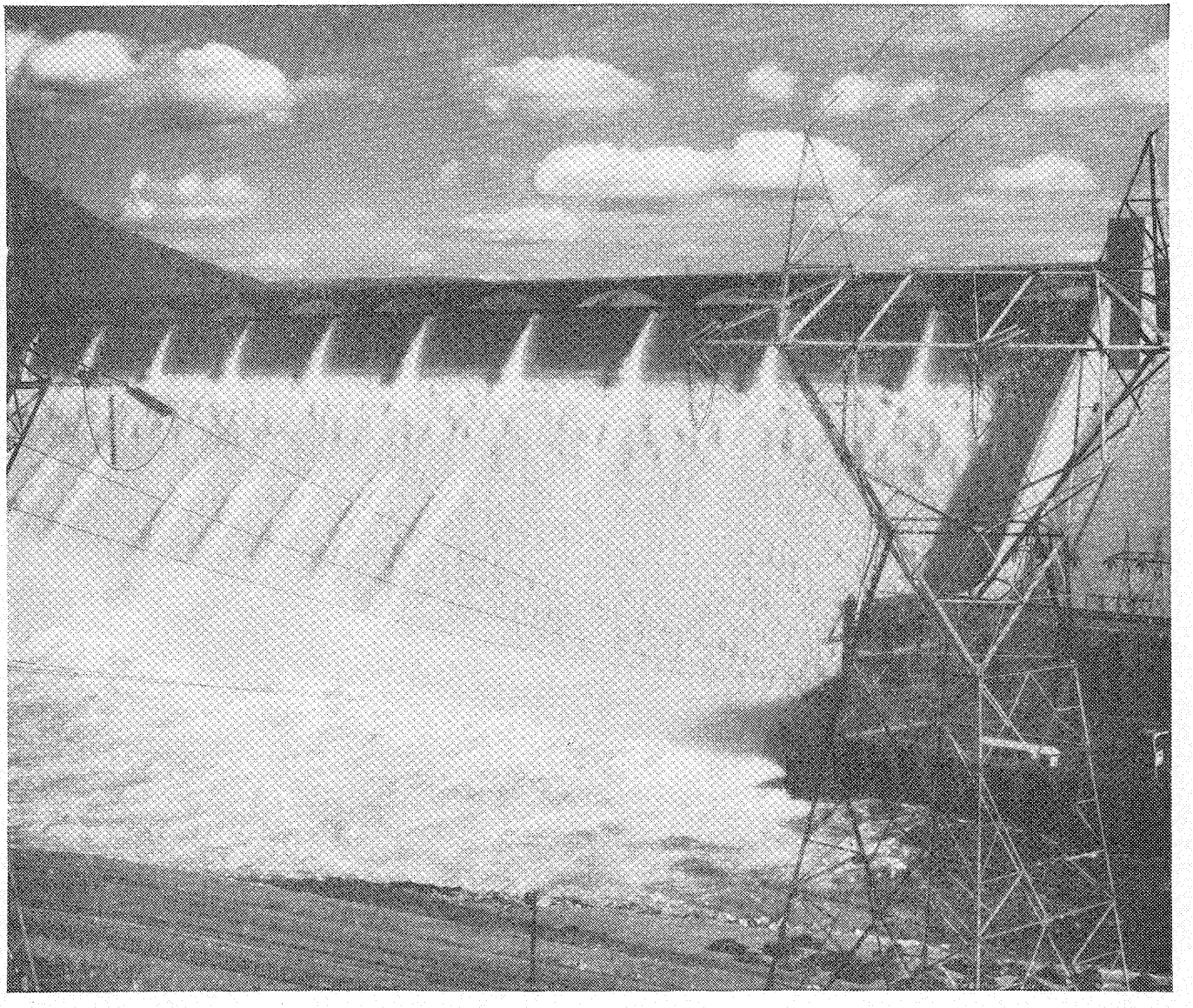
December, 1949



Who goes to Caltech? . . . page 5

PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Making the "juice" that makes life easier!



DIRECTLY and indirectly, the average family in America consumes more electricity yearly than families in any other country in the world. The demand for more "juice" has grown with unbelievable rapidity, and it's *still* growing. By 1955, the electrical generating capacity of our nation is expected to reach 90 million kilowatts!

Steel is a vital material in the production of electricity. Central power stations and great power dams are made of steel and concrete. Special steels are required for turbines and other generating machinery. Steel towers carry steel-reinforced transmission lines across mountain and prairie alike.

Helping to meet America's constantly growing demands for more "juice" is only one of the big jobs ahead for United States Steel. There are many others. And they all call for the services of thousands of carefully-trained, technical specialists. For steelmaking today is a precision operation, as dependent for success on the knowledge of metallurgical, mechanical, chemical, electrical, mining, civil and ceramic engineers, as upon the plant workers themselves.

To assure employees opportunity for maximum personal development and provide a sound foundation for advancement in the organization are fundamental objectives of U. S. Steel. Employees participating in educational activities of U. S. Steel comprise a group exceeded in size only by the student bodies of a few of the nation's largest universities. In these educational programs, particular attention is given to the development of college graduates and other technically trained men.

For men who can qualify, a career with United States Steel offers a promising future.

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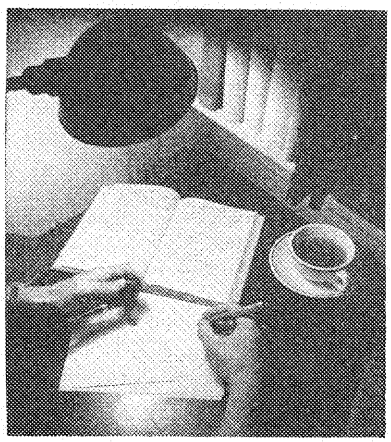
UNIVERSAL ATLAS CEMENT COMPANY · VIRGINIA BRIDGE COMPANY

UNITED STATES STEEL



ENGINEERING AND SCIENCE MONTHLY

VOL. XIII CONTENTS FOR DECEMBER NO. 3

In this issue

The California Institute of Technology has one of the lowest academic failure rates to be found among the colleges of this country.

As any undergraduate, or alumnus, can tell you, this is definitely not due to any "pipe" course of instruction. It *is* due in large measure to the Institute's Admissions Committee, whose hard-working members have, over the years, evolved a highly satisfactory system for selecting young men for Caltech who are likely to use Caltech's training to the best advantage.

On page 5 of this issue, Winchester Jones, a member of the Admissions Committee since 1930, and Dean of Admissions since 1940 (he also manages to serve as Registrar and Associate Professor of English) tells something of how this committee works—of the kind of men it looks for, and what it does when it finds them.

Transportation

Martin Webster, author of "Transportation—A Civic Problem," on page 11, was graduated from Caltech in 1937 with a B.S. in mechanical engineering. In 1940 he received his LL.B. from the Harvard Law School. He was associated with a Los Angeles law firm for 2½ years, served in the army for 3½ years and came out a lieutenant in the Air Corps. He is now practicing law under the firm name of Webster, Horgan & Kline in Los Angeles. The firm engages in general practice, but Mr. Webster specializes in tax and business law problems.

PICTURE CREDITS

Cover—Ralph Lovberg '50

pps. 6, 8—Ralph Lovberg '50

pps. 16, 17—Ralph Lovberg '50

p. 18—Bill Wright '51

p. 19—(top) Bill Wright '51

(bottom) Bob Parnes '52

ENGINEERING AND SCIENCE MONTHLY
Published at the California Institute of Technology

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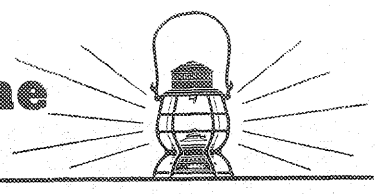
The Main Line



DECEMBER, 1949

Here it is practically Christmas time again. Like a lot of little boys, we're getting some new trains for Christmas—although they won't all be in service on December 25.

As a matter of fact, we've been so excited about the new *Shasta Daylight* between Portland and San Francisco, and the new, overnight *Starlight* between San Francisco and Los Angeles, that we've almost overlooked something. The car builders have been unobtrusively filling our order for new chair cars, Pullmans, lounge cars, dining cars etc. right along.

It never seems quite as exciting to put new cars on an established train as it does to start out with a whole brand new train—but the end result is about the same. Our trains are getting better all the time, on all of our four scenic routes.

New Sunset Limited

But our biggest splash is still to come. When the new *Sunset Limited* arrives it'll be Christmas in early summer. Five comp'etely new streamliners—$15,000,000 worth of luxurious equipment—will skim between Los Angeles and New Orleans every day in only 42 hours. No extra fare. Watch for it.

Coup de Grace

Going back to the *Shasta Daylight* for a moment, we have a report of what seemed to us to be a cute compliment for the train. It's a true story, too. We didn't make it up.

A lady friend of ours was reconstructing her face in one of the *Shasta Daylight's* spacious powder rooms when another woman came in, sat down with a sigh of complete satisfaction and said, "My, isn't this a beautiful train?"

"It certainly is," our friend agreed.

"I don't see how they could do a *thing* to make it more perfect," the stranger added. And then, after a moment's reflection during which she must have concluded that *nothing* could be absolutely perfect, she finished lamely with, "Of course, I suppose they *could* give free hand lotion in the restrooms."

Bowl Bound?

While we always knew that our trains go to the best places, even we were a bit surprised at the number of New Year's Day "footbowl" games you can go to on S.P. trains. There are the big three, of course: Rose Bowl in Pasadena, Sugar Bowl in New Orleans and the East-West game in San Francisco. But did you know that we also serve the Cotton Bowl at Dallas, the Sun Bowl at El Paso, the Oil Bowl at Houston, the Harbor Bowl at San Diego, the Salad Bowl at Phoenix, and the Cattle Bowl at Fort Worth? Well, we do—and we're the best way to get there, too. No traffic to fight—no weather to worry about.

Upsy-Daisy

Now that winter's here, so is the world's largest ski lift. Squaw Valley, smooth new ski spot near Truckee on our Overland Route is going full blast. *Double* chair lifts mean you can talk to somebody during the 18-minute, 8,200-foot ascent. There are two part-way stations for beginners, and in case you lose your nerve entirely you can stay put and ride the lift back to the starting point. Sightseers are doing it all the time. Cost-wise you can practically write your own ticket. Rates from $1 per night with your own sleeping bag to you-name-it at swank open-all-winter Tahoe Tavern. Ask your S.P. agent about train service to Squaw Valley, Norden, Soda Springs, Reno and the Sugar Bowl. Plenty of room for your skis.

Hot Spots, Too

If all that cold white stuff doesn't appeal to you, drop a note to Mr. F. Q. Tredway, Room 735, 65 Market St., San Francisco. He has a new "List of Resorts and Guest Ranches" along Southern Pacific Lines in Southern Arizona and the Southwest. It tells names, prices and locations, and he'll send it to you along with a picture-crammed folder about how to take a vacation in those parts. (It's easy—you don't do anything and the vacation comes to you.)

Merry Christmas and Happy New Year, too.

S·P The friendly Southern Pacific

LETTERS

WATER FIGHT

SIRS: Your October 1949 issue carries a story by Franklin Thomas concerning the fight over Colorado River water. I hardly expect that a California publication will carry Arizona's side of the fight, however meritorious that side may be. However, there are certain statements toward the end of the article which should be challenged.

The Central Arizona Project is a self-liquidating project, feasible from both economical and engineering standpoints, regardless of Mr. Thomas' opinions. To assure Californians that their rights will not be violated, Arizona has agreed that the irrigation features of the Project cannot even be begun until water rights are settled through Supreme Court adjudication. Arizona has presented extensive statistics of an unbiased nature to prove that this Project, contrary to the propaganda emanating from the Imperial Irrigation District, does not threaten the water supply of Southern California. Arizona is part of the economic domain of Southern California, and has no desire to injure that area.

Howard J. Smith
Executive Secretary
Central Arizona Project Association
Phoenix, Arizona

Mr. Smith's letter, like Mr. Thomas' article, seems to provide a confirmation—if any were needed—that a controversy over Colorado River water does exist.

Says Franklin Thomas:

Though Mr. Smith claims that the Central Arizona Project is feasible, nearly all government agencies, including the Budget Director—but excluding the Bureau of Reclamation—say it is not.

Mr. Smith does not deny that the land benefitted would pay none of the construction costs and only part of the operating costs. Nor does he deny that even the interest on the money proposed to be advanced from the Federal Treasury would be diverted to subsidize the irrigation instead of going to the Treasury. His standard of feasibility is decidedly warped from that of a self-liquidating project which repays for its benefits.

As to the reference to the Imperial Water District — the Metropolitan Water District's right in the river is junior to that of Imperial, so if any of California's water is alienated it will be the Metropolitan Water District and the Coast cities which will be affected.

BOOKS

MECHANICAL ENGINEERING PRACTICE

by C. F. Shoop and G. L. Tuve

McGraw-Hill, N.Y., 513 pp. $4.50

Reviewed by Peter Kyropoulos
Assistant Professor of
Mechanical Engineering

The fact that this book is in its fourth edition since it first appeared in 1930 indicates that it is well received and that its authors are trying to keep it up to date. This is not an easy task when it comes to a laboratory text, but in general the authors have been successful.

A number of new chapters and individual items have been included for the first time in a laboratory text (oscilloscope; noise measurement; a chapter on properties of fluids; automatic control; heating, ventilating and conditioning — to mention the major additions). The section on report writing has not been changed. It is brief but good.

After these general and favorable comments, it is in order to point out what the reviewer thinks are perhaps minor but not unimportant omissions.

The book claims to be intended primarily for use in engineering schools, but also as a reference for the student after graduation. In either case, more references and precise references are needed. It is the reviewer's experience that the average engineering student is utterly helpless when confronted with the necessity of looking up original literature. A reference book ought to be full of references where more detail can be found. The whole problem of electronic pressure pickups is covered in 14 correct but sketchy lines. Mechanical indicators and PV diagrams are given 13 pages. It is understandable that not all the gruesome detail of high speed engine indicators is presented, but a list of references would be highly desirable.

While on the subject of engine indicators, one general lack comes to mind: the complete absence of an appraisal of accuracy or methods for such appraisal (exception: fluid meters). The reader remains in the dark as to the difficulties of getting indicated work from diagrams. On page 468 (in the section on engine testing) the ASME Code is quoted as prohibiting the use of an indicator above speeds of 400 rpm. Yet Figure 40 presents an indicator supposedly good up to 2,400 rpm. For once the ASME Code is right.

In the section on dynamometers, no mention is made of the speed-power absorption characteristics of the different types. This is important "after graduation" in selecting the proper dynamometer for a given purpose. True, this is no problem in the school laboratory with its usual tailor-made experiments, but it is vital for the understanding of the art of dynamometry. Large Prony and rope brakes should be thrown out of the instruction laboratories as well as the text. Instead it would be nice to see a few do's and don'ts of adapting electric motors for use as dynamometers.

The chapter on oiling devices could well be left out. The same goes for the section on reciprocating steam engines. This type of engine is in engineering what the platypus is in zoology.

Chapter on oils, friction and lubrication: In the classification of oils the use of "compounds" is misleading. In modern practice a "compound oil" is one containing additives. It has escaped the authors' notice that the bulk of lubricating oils are no longer obtained by fractional distillation, but by solvent refining. No definition on premium and heavy duty oil is given. Again the lack of proper references is annoying. There is a whole book on petroleum testing issued by the ASTM. Reference to this collection would be preferable to the occasional listing of ASTM number designation alone.

The section on viscosity is fine but the subject could be approached in a more fundamental manner. The Saybolt viscosimeter is going out fast and the Ostwald viscosimeter in one form or another is becoming the standard. It is a very nice application of laminar flow and can serve well as an experiment both in viscosimetry and fluid mechanics. Likewise, the torsion viscometer can be used to show that this instrument yields the absolute viscosity for physical reasons. The falling ball viscosimeter (Hoeppler) can be used in the laboratory to find the viscosity of gases, to mention only one good reason for using it. The text gives none.

The SAE classification of oil viscosities is given in tabular form which is not revealing. A plot of vis-

cosity vs. temperature (ASTM chart) would show its usefulness by making it apparent that the SAE numbers define adjoining bands of viscosity ranges — a function which in turn prevents specification writers from pinning the lube-oil refiner down to a single line or value of viscosity.

In the section on the Orsat analyzer there should be a discussion of the likelihood of errors and their strong effect on the F/A calculation. Later on the Orsat analyzer is recommended for measurement of F/A ratios in internal combustion engines but not a word is said about the inherent error due to the unavoidably overestimated amount of N_2. This actually means that charts must be used in preference to calculation from the analyzer data. The reviewer is aware of the fact that school laboratories generally avoid the subject — which prolongs the lives of instructors and is prone to make asses of the students "after graduation."

The reviewer should apologize at this point for going over a book with a fine-toothed comb. It is done because he is constantly grappling with laboratory instructions and is, therefore, rather fussy. To reassure the alarmed authors he should also mention that he will keep on using the text in preference to others.

EARTH ABIDES

by George R. Stewart

Random House, Inc., New York,

373 pp. $3.00

Reviewed by Eric T. Bell
Professor of Mathematics

Doubtless many readers of this magazine are familiar with two of Stewart's earlier books, *Storm*, and *Fire*. Although he is a professor of English at U.C. (Berkeley), he sometimes writes like an engineer. But for this, his latest book might have been pure corn. It is not, although the dual themes are as old as Genesis and have been worked over in numerous variations many times. Not a flood but a swift and deadly new disease wipes out all but a few of the human race. Ish (for "Isherwood") is the Noah of this "Great Disaster." As material civilization begins to crumble, Ish gradually devolves into a kind of Adam who, inevitably, finds his Eve, Em (for "Emma"), a level-headed lady with Negro blood, and nature takes its time-worn course. Em is hailed by

CONTINUED ON PAGE 23

Each year 180 freshmen are selected for admission to Caltech. Here, the Institute's Dean of Admissions tells how — and why — they are chosen.

How Caltech Selects Its Students

by L. WINCHESTER JONES

THE CALIFORNIA INSTITUTE catalogue, under the heading of *Educational Policies*, quotes as follows from a statement by the Board of Trustees: "The primary purpose of the undergraduate school is to provide a collegiate education which will best train the creative type of scientist or engineer so urgently needed in our educational, governmental, and industrial development."

Ignoring the remark of one professor who says that the catalogue is his favorite work of fiction, it is obvious that the foregoing objective can be attained only by offering the proper kind of training to people who can use it to the best advantage. Just what constitutes the proper kind of training is fortunately not the subject of this article. The Admissions Committee is concerned only with the problem of deciding who can use it to the greatest advantage.

Leaving out the period immediately following the war when the number of those desiring admission rose into the thousands, the California Institute receives about 600 completed applications a year for admission to the freshman class, out of which must be culled the 180 individuals which the Admissions Committee thinks are most likely to become the creative type mentioned above. Immediately certain questions arise which demand an answer, if only a temporary one subject to change in the light of further experience.

What is meant by a creative type? Are the desire to create and the possession of the ability to learn and the imagination essential to creation enough—or must such qualities as persistence, steadiness, and persuasiveness be included, along with at least some competence in organizing group activities? What are the needs of education, government, and industry in terms of creative scientists and engineers? Is our prospective graduate to work in a laboratory with a small group of equals, or will he be expected to supervise the activities of numerous assistants and to sell his ideas to a board of directors?

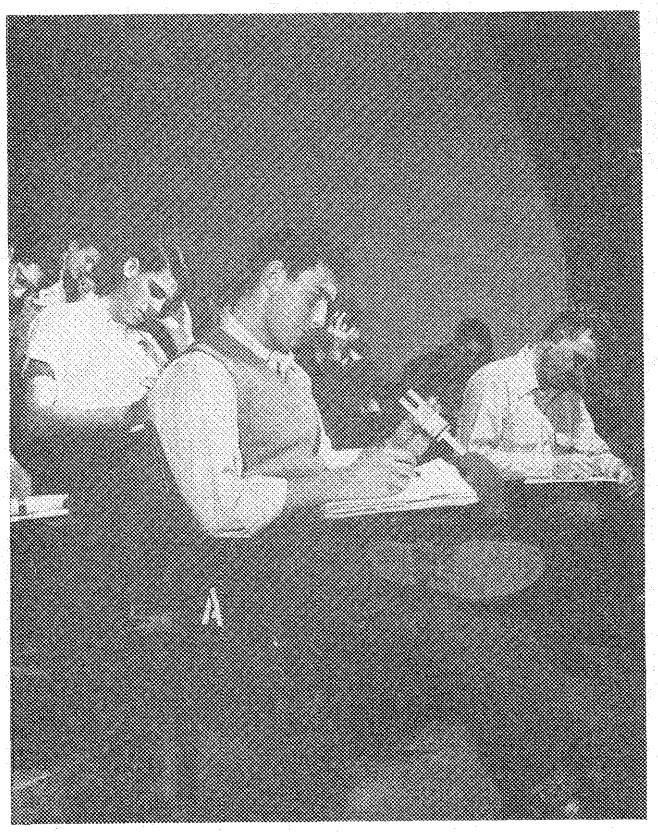
Many would claim that we are talking about two kinds of job responsibilities so widely different that we are not likely to find the qualities necessary for both combined in a single individual. The man who enjoys working individually or in small groups on creative research in the field of ideas and things is not likely to be happy or successful as an organizer, supervisor, or salesman—even of ideas. Conversely, the executive type who likes to work with people will prefer to devote his creative powers to building an organization rather than to solving problems in nuclear physics or thermodynamics.

According to this convenient division the answer to the admissions problem at the Institute is comparatively simple. The creative type of scientist or engineer for whom we are looking is really of two types distinguishable by differences in tastes and interests which will in most cases have become apparent by the last high school year, and which will be revealed by school and entrance examination grades and by information on the application blank covering extracurricular activities and spare time projects. If we supplement this information with personal interviews and discussions with teachers it should not be too difficult to separate the sheep from the goats and admit the proper number of each to make a well-balanced flock.

A mixed flock — or all one breed?

There are two difficulties with this conception of the problem. First, every aspirant for a bachelor's degree must meet the same rigorous standards in the same basic science subjects, especially in the first two years, regardless of whether he is destined to become a research mathematician or a vice-president in charge of sales. Presuming that the Admissions Committee has done a reasonably good job of selection on the basis of scholastic ability, this should not be too difficult for those whose interests are almost exclusively academic; but those who feel the necessity of expressing themselves in extracurricular activities and to whom college means, at least in part, an opportunity for such expression may find themselves in difficulty. They may have to choose between a degree of concentration on studies which to them appears stale and unprofitable and a transfer to another college where the academic pressure is not so great. Whichever choice they make, they are apt to regard the Institute with mixed feelings, and their experiences create a reputation which discourages applications from others of similar tastes and aptitudes.

The second difficulty is even more fundamental. Not even the most enthusiastic worker in pure research can be sure that he will escape the burdens and responsibilities of the executive. A few may go through life happily concentrating on activities of their own choosing, but to most of those who make valuable contributions to progress in engineering or science there will come opportunities to head important developmental projects in the fields of education, government, or industry involving knowledge and skill which they are perhaps uniquely fitted to furnish. Such opportunities



The Admissions Committee has been reluctant to abandon that old standby, the subject-matter achievement test.

often carry with them a kind of obligation to accept which is not easily shrugged off because one might prefer to be let alone. On the other hand, if the man best fitted by technical knowledge and skill to head a project belongs to the type that tends to avoid experiences connected with organization, management, and persuasion his leadership is not likely to be successful if the project is at all extensive. Moreover, the same can be said of leadership in technological developments placed in the hands of those whose executive tendencies have led them to slight the stricter disciplines in scientific fundamentals.

A combination of talents

What is needed, then, is a combination of thorough technical training underlying genuine scientific aptitude, with an understanding of, and at least some interest in, those qualities which are essential if a man would undertake to direct the efforts of others.

It seems hardly necessary to point out that such a combination of talents in the same individual does exist in a significant number of cases. The technical developments during and since the war have only served to bring to popular notice what has been true for years; namely, that the men who can head our large cooperative enterprises for technological advancement are not only great organizers and great managers, but outstanding engineers and scientists as well. Somehow, somewhere, they learned to be both.

It is certainly not the purpose of the Admissions Committee of the California Institute to ignore the student who by desire and temperament is fitted to work exclusively in the realm of ideas and things. Neither would it be very intelligent to concentrate on the executive type which is unwilling to meet the challenge of scientific discipline; but if we are honestly trying to train the creative type of scientist and engineer so urgently needed in our educational, governmental and industrial development, we must recognize that it is human nature to follow those who know how to beckon attractively and to ignore those who hide their lights under bushels of concentration. It is the object and the hope of the Admissions Committee that those it selects will have the spark that can be kindled into light and that they will know how to emerge from under the bushel that they may give light to all the house.

The realization of this ideal in even a majority of the 180 freshmen selected annually would require a very large amount of available material from which to choose, and an even larger degree of omniscience on the part of those who do the choosing. Neither of these conditions prevails at the California Institute, but the ideal is nevertheless worth striving after by every means we can devise.

How students are selected for admission

What are some of the means by which students are at present selected for admission to the Institute? First it should be said that they are neither new nor spectacular. The Admissions Committee has studied a number of tests designed to reveal aptitude and interest without examining knowledge in a specific field, which, it is claimed, should be vouched for by the applicant's high school record. Considering the wide variation between secondary schools not only in grading standards but in the content of the courses themselves, and knowing that a firm grasp of mathematics and the sciences at the secondary level is essential to success at the Institute, the Committee has been reluctant to abandon some form of that old stand-by, the subject matter achievement test. The secondary school record is of great importance, but to use it as the sole basis for judging an applicant's ability to handle problems in mathematics and physics, or to organize and present his ideas in writing would, in the opinion of the Committee, incur the risk of too large a number of failures in the first year.

Nevertheless, the secondary school record is the first thing scrutinized by the Committee. If a student has not done well in school there is very little chance that he will suddenly develop the interest or the ability to meet college standards. This does not mean that he must be a "straight A." A "straight A" who was at the same time well adjusted to the life around him would make an ideal candidate. If his grades have resulted mainly from a pious concentration on school work in order to dodge the necessity of making this adjustment, the Committee would greatly prefer a better-rounded individual with a less spectacular classroom record. For the benefit of those who ask, "Are geniuses then excluded?" it should be added that geniuses are not necessarily or often queer, and most certainly queerness is not an infallible sign of genius. Where we are convinced of his genuineness we will gladly welcome the genius, but we are not in the market for freaks. A candidate for admission must present a record showing that, especially in his last two years of high school, he has done better than average work, but he does not have to stand at the very top of his class.

For many years the Institute gave entrance examinations made out and corrected by members of the faculty. As more and more applications were received from points distant from Pasadena the administration of the tests became an increasingly difficult problem. An applicant living too far away to come to the campus had to persuade one of his teachers to proctor the examinations

for six hours on each of two Saturdays—a somewhat excessive demand on the teacher's free time. If an applicant were refused here he could not use the tests for entrance elsewhere, and for this reason a substantial number of good men each year who disliked putting all their eggs in one basket probably preferred to take examinations which had a more universal application. The Institute tests were of a kind which called for careful scrutiny of each problem on the part of those who did the grading, and as the number of examinees grew it became increasingly difficult for a department representative on the Admissions Committee to grade his particular set of papers in the time allowed. To have parcelled this work out among a group of younger assistants would have impaired the quality and uniformity of the grading.

These are among the reasons why the Institute will use the tests of the College Entrance Examination Board, commencing with the class to be admitted in 1950. These tests were selected after careful investigation and after studies had been made which included the administration of College Board Examinations to an entire entering class which had, of course, previously taken the Institute tests. The results of the two sets of tests were compared with the grade-point averages of these men at the end of the first year at Tech, and while both tests proved to be good predictors of the degree of success here, the Board examinations were somewhat better.

Alumni pitch in

At this point it is appropriate to mention with gratitude the hard and excellent work done by a number of Tech graduates who established examination centers and arranged for supervision of our tests in Boston, Chicago, New York, Philadelphia, San Diego and San Francisco. If our alumni were more widely scattered and if applicants did not sometimes turn up in the most extraordinary places, the administration of our own tests would not be a problem.

It is impossible to predict at this time just what effect the shift to the College Boards will have on applications. It is expected that these will increase somewhat, especially in the East and Midwest, where the Boards are taken as a matter of course by a very large number of those who intend to go to college. The fee of $12 which the Board charges for the full set of tests required by the Institute may discourage some, but we believe that this defect is outweighed by the far greater convenience with which applicants can arrange to take the examinations.

The College Board tests which an applicant must take for admission to the Institute are the three-hour morning program which consists of an aptitude test in mathematics and in verbal ability, and an afternoon program of achievement tests in physics, chemistry, and advanced mathematics, each requiring one hour. It is regrettable that a special test in English cannot be included, but this subject is perhaps adequately covered in the verbal section of the morning program. The mathematics section of the morning program is not sufficient for our purposes, because it is intended to reveal general aptitude rather than to indicate actual performance at a certain level as does the afternoon achievement test. Moreover, this subject is the one with which most Tech freshmen are likely to have difficulty, and it will be valuable to have this additional information.

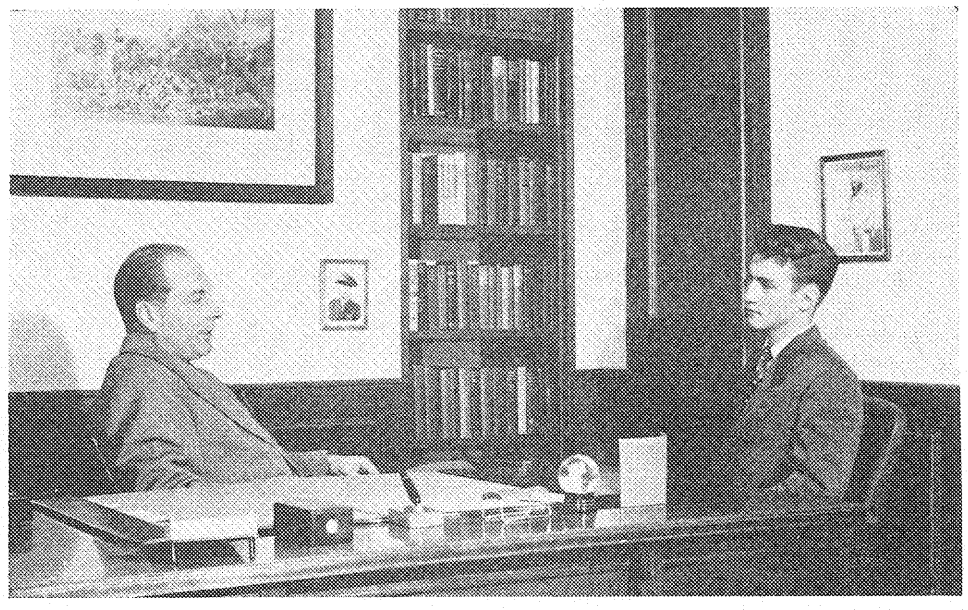
The question now arises as to the weight which the Admissions Committee gives to these examinations. Experience with the Institute examinations formerly given has shown that out of a group of say 500 examinees the lowest 30 percent probably cannot make passing grades at Tech and can be eliminated on the basis of the examination grades alone. The top 10 percent have a good chance of making outstanding records. This leaves 60 percent, or 300 individuals, about whom it is difficult to make predictions solely on the basis of the examinations. Comparisons of test grades and performance in the first year at Tech have shown that while in general those in the upper brackets of this large middle group do better academically than do those near the bottom, there is a large number of individuals whose records at Tech are much better or much worse than the test grades indicated. If in this group the examinations were almost the sole criterion for admission a very significant number would be turned down who, on the basis of actual performance in college, might have made far better records than many who were selected. Concerning those whose test results place them in this category, more information is needed if the best material is to be picked. There is no reason to believe that the switch to the College Boards will materially alter this situation.

The percentages given above are not, of course, exact nor are they constant from year to year, but within the general areas indicated they have proved to be a very satisfactory way of separating those who in all probability could not succeed in our work from those who should be given further consideration. If 30 percent seems like a small number to eliminate by means of the entrance examinations, it should be remembered that the candidates have already been fairly well screened on the basis of secondary school records and by their school advisors, who are likely to discourage the poorer students from making application.

When the examination results are known, the Admissions Committee is still faced with the problem of selecting 180 men from among the top 350 remaining out of our hypothetical 500 examinees. What further information on these men can be secured? One immediately thinks of letters of recommendation, and these can be of great assistance, especially if they come from those who know something of our work and the kind of student for whom we are looking. Of much greater value, however, is a personal interview with the student himself, and not only with the student but also with his teachers who have had an opportunity to observe his characteristics and his aptitudes from day to day over a period of a year or more.

The interviewer on the spot

The position of the interviewer is a delicate one. In his relations with an applicant he must try to remove, or at least to penetrate as far as possible, the barrier which the student's shyness and anxiety will inevitably raise between them. This shyness can assume a number of outward manifestations, the least difficult of which are the awkwardness and mental numbness usually associated with the word. Last year I interviewed two men at the same school and considerably astonished the principal when I told him something of my conversation with each. The man who the principal had feared would ruin his chances because of the physical and mental awkwardness which came over him in moments of that kind, and who did come into the room looking as though he had been frozen into a cake of ice at a particularly bad moment, loosened up and gave a very good account of himself. The other applicant gave a first impression of possessing far greater poise, but throughout



Members of the Admissions Committee conduct personal interviews to determine the suitability of candidates for admission to the Institute. Dean Jones is interviewing prospective student at left.

the interview he refused to emerge from his chosen disguise, an attitude and bearing not unlike those of the British officers in whiskey advertisements, and the grace and affability of a secretary of state about to be photographed with Vishinsky, and he revealed just as little of himself. The first thing an interviewer must get rid of is any susceptibility to prejudice created by first impressions.

In his conversations with teachers and with school administrators the interviewer must likewise be wary. He is trying to do three things: first, to test his own judgement by securing the honest opinions of those who should be in a far better position to know something of an applicant's real qualifications; second, to size up the school and the value to be placed on what he is told; and third, to leave behind him a sufficiently good impression of the California Institute so that in the future more good men will be encouraged to apply.

The first of these tasks will be satisfactorily accomplished only if the interviewer gains the confidence of those to whom he is talking. He must convince them that he is as much interested in the welfare of the applicant himself as they are; otherwise on any issue about which there is doubt he will get non-committal answers at best.

In sizing up the school and the teachers or administrators with whom he comes in contact he must determine whether, for example, in a large school there are really sufficiently close relations between students and faculty to give an opportunity for personal judgements, or whether the student under discussion is just a name in a roll book and a card in an efficiently indexed file. All school administrators are between two fires. Parents who send a child to be prepared for college are not pleased when junior fails of admission. On the other hand, colleges which have had unfortunate experiences with the recommended graduates of a given school are apt to be chary about admitting more. Very few schools indeed will try to play one side at the expense of the other. Most teachers, councilors, and other administrators are sincerely interested in the future success of the student himself, and they are quite properly also sympathetic. They want to give him every chance. When the case is not a clear-cut one either way, the degree of recommendation becomes a nice matter of judgement, and the quality of judgement can vary widely from one school to another.

In trying to create the impression he would like to leave behind, the interviewer himself is in the midst of a number of fires. He cannot trespass unduly on the time of those he meets, and most of the time at his disposal will, of course, be devoted to sizing up the applicant. Yet it is important that those to whom students come for advice should know what kind of man Caltech wants. They should also know that Tech is not beating the bushes for mere numbers of applicants. We have plenty of those. What we have not in plenty—what no college that is worth the price of admission has in plenty—is a throng of applicants all of whom measure up to the ideal. God forbid that we ever should have! When we do, it will mean that we have given up trying and lowered our sights; and when this happens, the average of what we do get will be proportionately farther from the ideal.

For an interviewer to state our attitude in these words would, of course, scare most school authorities out of ever encouraging anyone to apply. What he must make clear is that our ideal is not necessarily the "straight A," not necessarily the genius, but the man who, whatever else he may be, has the brains and the fortitude, and who will someday have the influence necessary to make his creative ideas stick. He must, of course, have demonstrated in his secondary school work that he has sufficient facility in mathematics and physics to do satisfactory work in courses which are as difficult at the California Institute as they are in the engineering or science majors at any other reputable college. Equally important, he must have a real interest in preparing for a career in engineering or science. If there is a reasonable chance that he has these qualifications, we hope that his teachers and advisors will urge him to apply and to see what he can do on the examinations in relation to others who also take the tests. If there remain any doubts, they can be gone into at the time of the interview.

When an interviewer has made all this clear in ten or a dozen words he will find that he is already late for his next appointment a hundred miles away. His most difficult task may, however, still remain to be done if he feels that the student he has just seen will not measure up to admission standards. When this feeling is more or less in tune with what has been expressed during the discussion of the student's qualifications there is no problem, but if there is a strong school recommendation,

the interviewer must tactfully pave the way for the rejection letter he is fairly sure must be sent.

On the way to his next destination he will have time to sort out his ideas. Did the applicants at the last school seem to possess the desired personal qualities already developed or likely to develop in the future? Was there a reason why the low grade earned by student A in the physics examination should not be taken as a measure of his grasp of the subject? Are the standards of this school such that its medium grades are the equivalent of higher grades at other schools? Can the judgements of its staff be relied upon in the face of an unfavorable examination record or a poor impression created by the student? On the basis of the interviewer's impression should applicant B be pushed into the accepted group in spite of a relatively weak academic record, and is applicant C just an examination hound whose only real ability is to regurgitate information on demand, and should he, therefore, be eliminated in favor of a man with a poorer record but better all-around potentialities?

The final analysis

In attempting to decide questions like these the Admissions Committee meets every day for two weeks after its members have completed the interviews. Every applicant is carefully discussed until the Committee feels it can reach a decision on two points. Can this man use to the best advantage the kind of training afforded at the California Institute? Is he the best man we have available for one of the remaining places in the entering class? That some of those admitted do not turn out to be the best goes without saying, and those who must be turned down should have the satisfaction of knowing that the Committee is far from infallible. In one thing the Committee can take some pride. The California Institute has one of the lowest academic failure rates to be found among the colleges of this country.

It might be thought from the foregoing that Caltech is interested only in applicants for admission to the first year, but transfer students are equally welcome because good men are just as likely to come to us from other colleges as they are directly from high school. To enter the California Institute a transfer must have covered the substantial equivalent of the first year or the first two years at Caltech by June of the year in which he desires admission, and he must have earned good grades. Regardless of the college he has previously attended, he must take the transfer entrance examination given by the Institute early in June of each year. His standing on these examinations will be the largest single factor in determining his admission.

This article has been an attempt to summarize the problems and policies of admissions at Caltech. These problems and policies are intensely interesting, at least to those responsible for them, and they are of fundamental importance to the well-being of the college. But the work of the Admissions Committee is only the middle link of a three-link chain. Before the Committee knows of his existence a student must make application, and even after he has been admitted there may be factors which prevent him from turning up on registration day.

First, what about applications? The reputation of the Institute is such as to assure an adequate supply from which to select 180 good students, even if nothing more were done. But bearing in mind our ideal, what we want each year is 180 better men, and the greater the number and diversity of those who apply, the more chance we have of getting them. To increase the supply we must spread information as to what kind of student we want, what we can do for him while he is here, and how our particular kind of training will help him after graduation to achieve the objectives in which he is interested. We must sometimes try to dispel illusions such as that only a goggle-eyed grind can hope to earn passing grades, that there is no time or opportunity for extracurricular interests, that we do not offer courses at the undergraduate level, or that we have never won a football game. We must pay particular attention to geographical distribution. Our present ratio of out-of-state and foreign students to those from California is high, but we would like to see it increase. A student body which reflects the ideas, tastes and prejudices of only one locality denies its members a breadth of experience that is an extremely important element in college education.

Fortunately we do not have to sell anything or persuade anyone; we have only to inform. To do this we must, like most colleges which are able to select their students and which are, therefore, faced with similar problems, rely mainly on our alumni and on members of our staff. Any college values its reputation for scholarship and productivity, but this is often not sufficient in itself to encourage further inquiry. To a high school senior such a reputation is vague and somewhat formidable. It conveys no idea of the homely details of undergraduate life in which he is very much interested. It implies great opportunities but does not relate them to the individual. His teachers and advisors sincerely want him to enter the college which will offer him the best chance to develop his particular interests and aptitudes, but they too must have some knowledge of details if they are to be in a position to suggest.

What scholarships would do

The last link of our admissions chain which begins with the urge to send in an application is the one which ends on registration day. In order to have a freshman class of 180 it is usually necessary to admit about 220. By far the largest number of cancellations result from the final realization that the applicant or his parents just cannot meet the costs and be fair to other members of the family. Too often some of our best selections are included in this group. The further from Pasadena an applicant lives, the greater is the over-all cost of attendance, and this has its effect on geographical distribution. The answer, of course, is more scholarships large enough to make up the difference between attending Caltech and a non-tuition college closer to home—or even to make possible the attendance of a few outstanding men whose only resources are their own earnings. To the members of the Admissions Committee who have seen some of their best prospects prevented from entering because there just wasn't enough money, the matter of increasing scholarships is of primary importance.

The attempt to select students who will make the most of a college education is certainly one of the most stimulating and interesting occupations a man can engage in. If the process is to be successful there must be numbers from which to select, wisdom in selection, the elimination of the financial barrier where outstanding men are concerned, and finally, if the whole thing is to have any meaning, an atmosphere and a quality of training predominant in the college itself which will best enable a man to develop into the kind of engineer or scientist, and the kind of citizen that this world so urgently needs. Of these requisites the Admissions Committee of the California Institute is certain only of the last.

Caricatures of Men of Science

by E. C. WATSON

SIR WILLIAM ROBERT GROVE (1811-96) is best known today as the inventor of the voltaic cell which bears his name, and as author of *The Correlation of Physical Forces*, a book which helped greatly in establishing the principle of the conservation of energy.

Grove's caricature (above) appeared in the October 8, 1887 issue of *Vanity Fair*, as one of that magazine's remarkable series devoted to nineteenth century men of science. It was accompanied by this lively text:

"Seventy-six years ago there was born to a worthy Justice of the Peace at Swansea an embryo Judge of the High Court, whose name they called William Robert. As to the details of his early years the oldest history is silent, but we know that he took an Oxford degree some twenty years later, and that he was called to the Bar in 1835. From that time Mr. Grove's career was rendered brilliant, first by galvanic electricity, and later by scientific exposition of the law on behalf of commercial clients. Soon after he entered upon his profession his health took an indifferent turn, by reason of which he was led away for a time from the strait paths of law to the more fascinating studies of electricity and chemistry, with the happy result that he gave to the world the evil-smelling battery which bears his name. This was a great step towards scientific fame, and Mr. Grove now became a Professor, a Fellow of the Royal Society, a President of the British Association, and an authority on the decomposition of water, the continuity of natural phenomena, the correlation of physical forces, and many other high-sounding luxuries of the scientific world. It was now time for Mr. Grove to return to his first love; which he did, very shrewdly making of his scientific fame a very excellent stepping-stone to Knighthood and the Bench. In those days science was an unknown quantity in the forum, for none of its frequenters had any; but Mr. Grove changed all that, and soon proved to the satisfaction of the litigating public that no patent or other case which might involve any scientific or chemical process was complete without him, a fact which the Government realised in the course of years, and so placed him upon the Bench in 1871—some fifteen years later than he should have been placed there.

"Mr. Justice Grove thenceforth proceeded to dispense a mixture of equal parts of science and law to an ordinary public, with considerable discrimination and some success, and his dispensation was continued until last month, when he retired from public life full of honours and of years. He might have been a better Judge had he been made one earlier in life, but it is no fault of his that this was not the case. He has always been noted for his industry, and for an amount of imperturbable good humor which has made him a general favourite with the Bar, and kept him so, even when his faculties had become slow and his science old-fashioned.

"Sir William is a very nice, agreeable old gentleman of the olden school, who has outlived most of his contemporaries, and everyone now wishes him to enjoy his well-earned repose. With one possible exception, he has never been known to make an enemy, but he has plenty of friends, and deserves them all. It is doubtful whether his name will live longest in law or in science; but it is a fact that all his science never enabled him to master the intricacies of the Judicature Acts. By his retirement he has shown himself to be possessed of much sound sense."

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

Transportation--A Civic Problem

Everyone concedes the need for a solution to Los Angeles' ornery transportation problem. Then why such bungling and delay? Here are the facts — and the hope for the future.

by MARTIN WEBSTER

UP through the streets and vacant lots of Los Angeles, through back yards, and plots from which houses have been moved by trucks, threads the Hollywood Freeway project (see above). This $25,000,000 highway will be more than 96 feet wide and will accommodate eight lanes for vehicular traffic. Construction is proceeding apace. But the highway has a center strip too narrow for conventional rail traffic; instead there is provision for bus turn-outs.

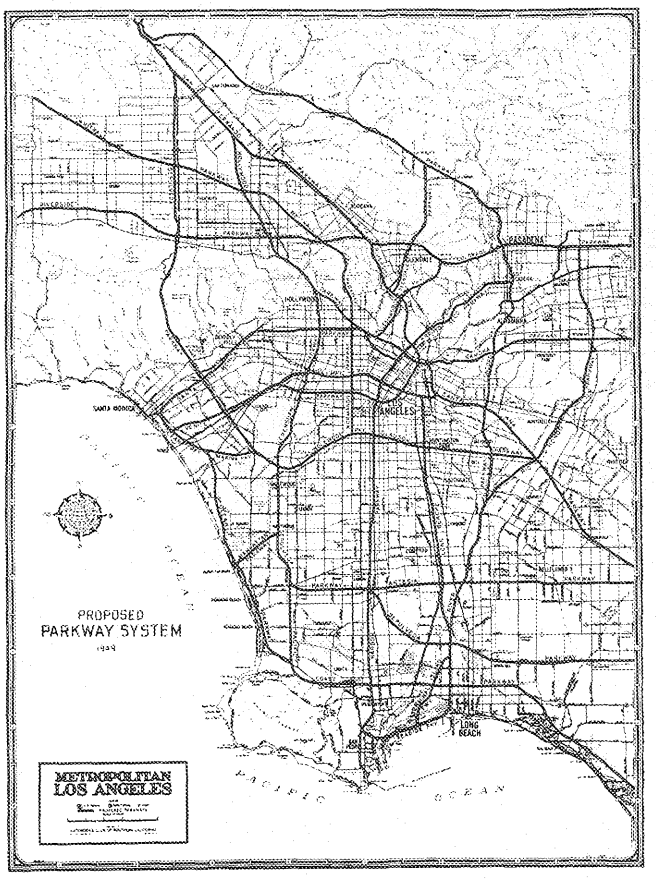
This simple statement represents a bitter conflict which has been developing in Los Angeles for a number of years — and which is very little nearer solution now than it was ten years ago.

An ever increasing population in the Los Angeles area has created a transportation problem without parallel. The problem stems from the growing number of people living on the periphery of metropolitan Los Angeles who commute to the downtown area. There are more than 2,000,000 people living within the city limits today—more than 4,000,000 in the metropolitan area. Estimates put the 1970 Los Angeles population at 6,000,000 and automobile registrations at 3,000,000.

Super-highways alone will not solve the problem. Additional automobiles or busses can only add to the traffic in the downtown area. And even so, completion of the 613 miles of projected freeway is estimated for no earlier than 1960.

These facts are pretty well conceded. The total solution of Los Angeles' transportation problem consists of freeways—*plus*. Determination of this plus factor has been — and still is — marked by conflicting theories, disputes and delays.

For 24 years, studies made in Los Angeles have recommended rail rapid transit installation as the in-



The Los Angeles area will be shot through with super-highways when proposed plans are carried out, as in the parkway map at the left. But super-highways alone are not going to solve Los Angeles' transportation problem.

gredient which, supplementing freeways, would produce a well-balanced transportation system. The present interurban rail transportation system in metropolitan Los Angeles consists of tracks running without real rights of way (except in one or two isolated instances, such as the double track rail line in the center of the expressway through Cahuenga Pass in North Hollywood). For the most part, interurban tracks run at street level. The trains are delayed by vehicular and pedestrian traffic, by traffic signals, by intersecting streets and grade crossings. The equipment is largely deteriorated; 44 cars bought between 1907 and 1913 are still in use. Since 1916, the company operating the interurban rail system has had only five profit years, four of them during wartime. Its president recently stated, "We do not propose to subsidize the public by further continuing our losses." The result has been a long-threatened breakdown in interurban rail travel. This breakdown and anticipated population increases prompted the recommendation, made as long as 24 years ago, that a real rail rapid transit system be created.

In September, 1947, a subcommittee of the Los Angeles Chamber of Commerce, known as the Rapid Transportation Action Group, was formed to breathe life into the search for a total solution to Los Angeles' problem. This subcommittee, dubbed RTAG, has made headlines ever since its appointment. The extent of its actual progress has been a good deal less newsworthy however.

When three parkways meet it takes a four-level construction to unscramble them. This model shows the four-level intersection of the Hollywood, Harbor and Arroyo Seco Parkways in Los Angeles; it can be seen under actual construction in the foreground of the picture on page 11.

In February, 1948, with startling suddenness, RTAG announced its plan. It proposed State legislation creating a county rapid transit authority which would vote $310,000,000 of bonds. The money raised would be used to construct nine miles of subway beneath the downtown business district, and a surface rail rapid transit system running in the center of projected freeways. Operation of the system would be by a private utility. If the Los Angeles City Council approved the plan, Governor Warren would call a special session of the legislature.

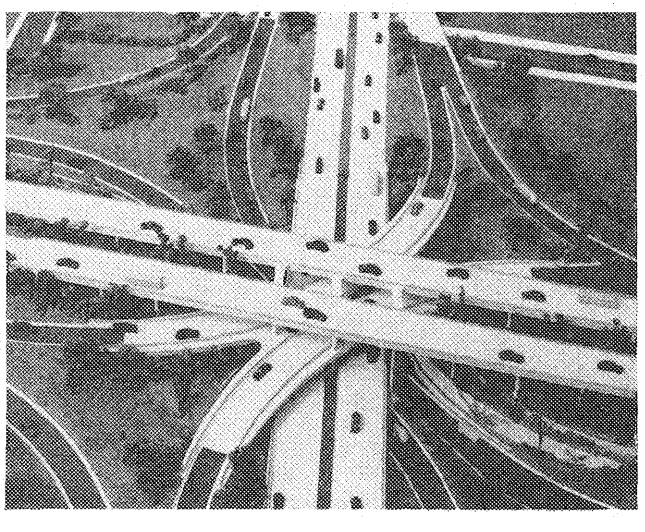
But one member of the Council balked at the requirement of operation by a private utility, and the approval theretofore considered routine was withheld. This gave time for more study of the RTAG plan by neighboring cities, and opportunity for more loudly-voiced complaints. One indication of the quality of the plan was the revelation that its proposed freeway from Los Angeles to San Pedro might ruin three hospitals. It would pass within seven feet of the Orthopaedic Hospital, cutting off its entrance; it would go through the Nurses' Home of the California Hospital; and it would swing within a few feet of the Methodist Hospital.

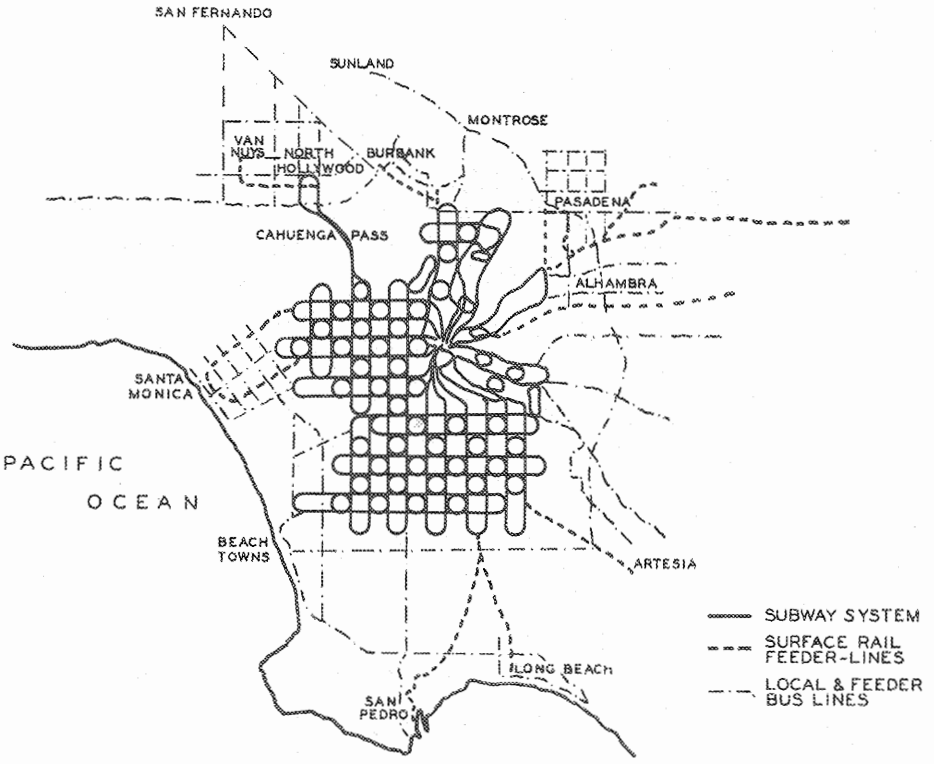
The problem takes time and study

Even the RTAG realized the need for more time and study. It recommended passage of a bill through the State legislature which would set up a "metropolitan rapid transit district" to study the problem. Such a bill was introduced in the Legislature in January, 1949, this time with provision for public operation. Passage was reasonably assured, and the bill was referred to the Los Angeles City Council for endorsement. But again this unpredictable body turned thumbs down, and the legislation died.

The transportation muddle can be brought up to date with notice of a recent $300,000 appropriation by the Los Angeles County Board of Supervisors for a survey of rapid transit needs in the county.

How can all of this be explained? Everyone concedes the need of a solution to the problem; why such bung-





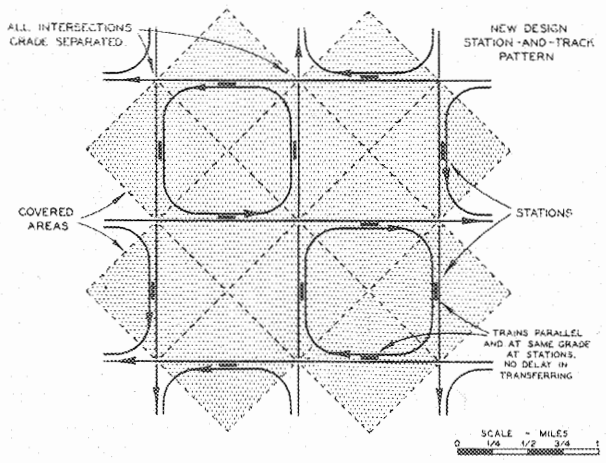
Engineer Henry A. Babcock's proposed mass transportation system for Los Angeles includes a subway system for highly-populated areas, with bus and surface rail systems serving as feeder lines in outlying districts.

ling and delay? The answer would appear to be the lack of a well-engineered plan, and the existence of a number of competing and overlapping factions:

(1) The "bus group." It maintains that freeways with provision for automobile and bus traffic are the only solution to the problem. This group has been said to be led by the Pacific Electric interests, which—faring badly on passenger rail transportation and well on busses—are anxious for a universal switchover to busses.

(2) The "rail group." It claims that busses merely aggravate the problem in metropolitan Los Angeles, and advocates instead the use of the center strip of freeways for rapid rail transportation feeding out of a subway network under Los Angeles.

(3) The "subway group." It conceives of the subway as playing a larger part in intraurban travel than the rail group would give to it. It's a small group, and its greatest proponent is Henry Babcock, a Los Angeles consulting engineer who has well-conceived ideas of a total solution which envisages a unique network of integrated subway operation.



(4) The "monorail group." This group, also small in number, claims that suspended rail transportation over the freeways will, at the least, solve the interurban travel problem.

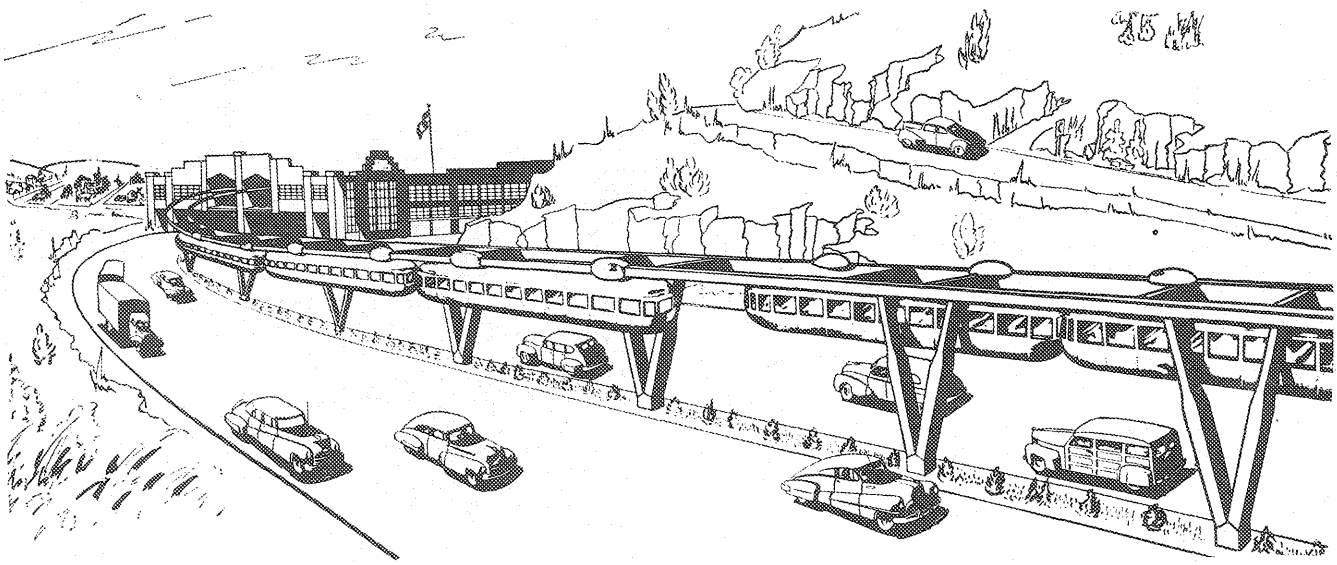
It should be reasonably apparent that in the areas where these groups do not definitely conflict, they certainly do overlap. Thus, while subways may not be the total solution, subways plus monorail—plus freeways—might be the answer. Busses as feeders and some surface rail transit through the center of future freeways may add to the completeness of such an answer.

"Special interest" hurdles

But achievement of such a resolution of conflict and overlap is no easy job. There is first a kind of "special interest" political hurdle to overcome. Take the Assembly bill recently killed by the Los Angeles City Council. This bill was ballyhooed as merely an "enabling act," an act to set up a transit district which could study the problem. But buried within it were provisions limiting the total borrowing that the district could authorize to 15 percent of the assessed valuation in the district. This meant that subways, on any extensive scale, would almost automatically be excluded from any plan the transit district might decide upon. The bill also contained conditions as to voting power which endowed the city of Los Angeles with a franchise greater than smaller outlying communities could tolerate.

Another illustration of this "special interest" political hurdle is the activity of real estate groups located outside of the downtown Los Angeles area, but within its metropolitan area. These groups are opposed to develop-

The heart of the proposed Los Angeles subway system (above) is a series of single-track loops like these at the left. Each loop covers a square mile, with platforms at the quadrant points of the loop. No one in the subway area would have much more than a half-mile to walk.



Monorail, a carrier suspended from, and running along, an overhead rail, could be built on center strip of freeways.

ment of transportation facilities with downtown Los Angeles as the focal point, since it would divert patronage from neighborhood shopping and business facilities.

The political hurdle of competing urban communities must also be overcome. Long Beach and San Pedro, for example, are arch enemies. Transportation facilities from Los Angeles to one, without provision for the other, are sufficient to rouse internecine conflict.

Finally, there is the hurdle of competing ideas. Given an unlimited supply of funds, the subway group, for one, could produce a total solution independent of freeways. But funds are limited, and even the subway group would concede that interurban travel over long distances would best be accomplished through other transportation media. This opens the area of combat to busses, monorail and surface rail transportation all over again.

After 24 years—still a problem

Thus, after over 24 years of study, and after years of political wrangling, the problem still remains unsolved. The situation isn't entirely hopeless, but its solution will require straight—and, more important, selfless—thinking. Meanwhile, for better or worse, freeway construction continues without provision for rail transportation within its center strip.

Two phases of this discussion would seem to merit special attention. Both are unique in this country, and of great interest to transportation circles.

The first of these is the so-called "subway plan." Henry A. Babcock, its designer, is an engineer who approaches the local problem from a scientific point of view. It is necessary, he says, to ask and receive answers to two basic questions before one may feel that the transportation solution is at hand.

What role do we want mass transportation to fulfill in this area? Do we simply want to supplement the automobile, or do we want a self-sufficient integrated transportation system? Babcock's answer is, of course, that the ideal role would be fulfilled by a self-sufficient public transportation system, independent of the automobile. Particularly to those families living on marginal income and less (the great public for whom all transportation systems should be designed) this makes sense.

Mr. Babcock's second question is on an equally practical level. Is our problem, he asks, primarily one of moving people between population centers—or isn't it rather the problem of collecting passengers, wherever they may be, and delivering them to any one of a large number of possible destinations?

A perfect solution?

Given these premises, Mr. Babcock has developed what seems to him and a small group of followers to be a perfect solution to the problems as he sees them. In highly populated areas, he envisages a system of single track loops. Each loop covers a square mile, and requires 3.1 miles of single track. As shown (p. 13), there is one platform placed at the quadrant points in each loop. The operation of each loop is synchronized with the operation of adjacent loops. This loop system is combined with a so-called belt system, so that with a maximum of three transfers, one can travel from any given point to any other given point in the system. The whole system is operated automatically and is self-regulating. If one train in the loop slows down due to extra-long loading time, for example, the whole system slows down in synchronization. A switching system enables replacement and repair of cars within any loop.

It may readily be seen that Babcock contemplates a network system within a heavily populated area—as distinguished from most rail transit plans, which are based on a radial or spoke system centering in a single important terminus. The advantages of the subway plan as Babcock conceives it should be obvious, for no greater coverage could be obtained with such minimal inconvenience to passengers. His loop and belt subway system provides for transportation facilities for 2,000,000 persons living within an area of 175 square miles, with no more than slightly over a half-mile of walking for anyone within that area.

Moreover, Babcock has thought of his construction problems. Preformed concrete forms can be dropped into mechanically-cut troughs; all wires, conduits, pipes, and mains would be cut through at random, and the breaks rejoined through flexible lines which would run up the side and along the top of the concrete forms forming the subway tunnel.

All of this sounds, of course, at once dramatic and appealing. Opponents center their attention principally on the economics of Babcock's plan. Estimated costs run as high as $1,250,000 per mile, and for the whole project

between $800,000,000 and $1,000,000,000.

Babcock's estimates envisage a lower cost per square mile covered than any other proposed system. And Babcock's supporters consider the financing arrangements for such a system entirely feasible. But the sum of $800,000,000 to $1,000,000,000 is far above any anticipated to be spent in the area, and has thus far served Babcock's opponents well in relegating his plans to a relatively non-competitive level.

The case for monorail

Relying on the economics of the situation is a totally different type of rail transit system, advocated principally by Mr. George Roberts, head of Pacific Monorail Systems, Inc. Only one passenger monorail line is currently in existence, and it has been running for 48 years. This seven-mile line is located in Elberfield, Germany, has carried nearly a billion passengers, and has established a remarkable safety record. During one 25-year period, there was only one passenger fatality —a man who jumped out of a window. The Department of Commerce has stated within the past three years that "for service and income, the line holds the best record of any transportation system in existence."

Monorail is nothing more than a carrier suspended from, and running along, a single overhead rail. It has received the attention of the consulting engineering firm of J. M. Montgomery & Co., Los Angeles, and has been pronounced not only mechanically feasible here but entirely sound economically.

The basic advantages of the system are:

(1) It may be projected within the center strip of freeways presently under construction, with no widening necessary.

(2) Average speeds could be developed exceeding present scheduled speeds by over 100 percent. On a test route surveyed, traveling time between termini 17 miles apart would be 27 minutes (allowing for eight stops) as compared to a presently-scheduled time of slightly more than one hour by bus.

(3) Operating safety would, according to present estimates, be exceptionally good. A reduction of litigation and insurance costs would result.

(4) Operational costs per passenger mile would be relatively low, because of the low man-hour-per-passenger-mile requirements of the system. Five cars, each carrying 100 persons, could be operated by two men.

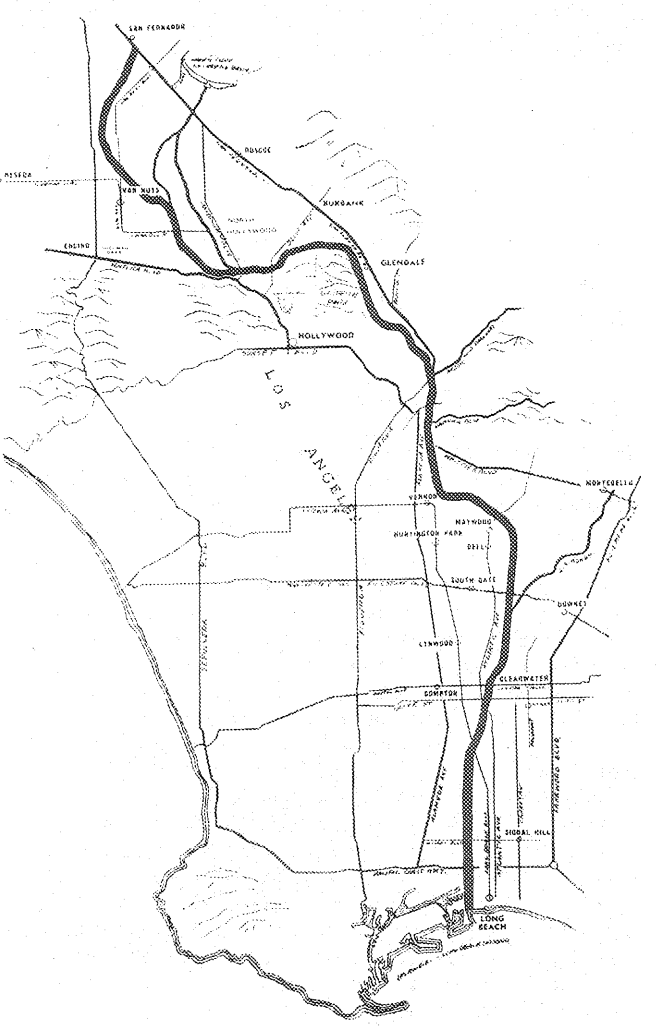
(5) Through low requirements for land (the supporting towers can be designed for a strip 12 feet wide), and reinforced concrete construction, the average cost has been estimated—along a typical test route—to be $834,000 per mile, a figure competitively below any other comparable system.

Opponents of monorail are, however, not without ammunition. One admittedly weak point is the switching system which would have to be developed at termini. This mechanical problem has, however, been analyzed and a solution proposed by the J. M. Montgomery Co.

More basic, however, is the observation that the system is primarily interurban. When we turn back to the Babcock postulates, that the role of mass transportation is an integrated public system, and that the major problem is not transportation between termini but picking up loads in heavily populated areas where termini would normally be located, it is apparent that monorail is no total solution. For monorail is primarily designed for transporting large groups between one heavily populated area and another located some considerable distance away. Frequent stops would destroy speed, one of monorail's chief advantages; hence, the ideal operating conditions for monorail would have stations no less than about two miles apart, and preferably even more widely separated. But this arrangement conflicts with transportation requirements of the masses, unless feeder systems of busses—or subways—act as supplement.

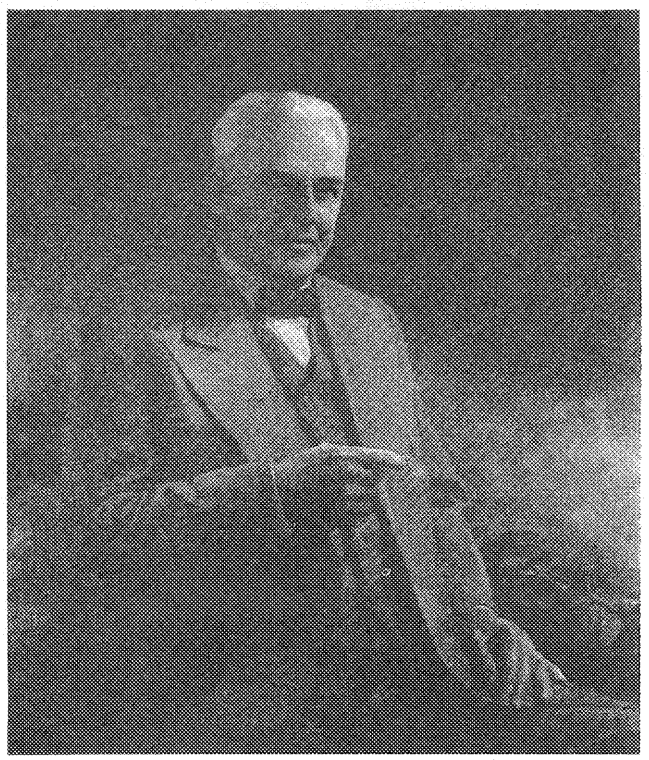
This survey is written without emphasis on technical problems and is admittedly somewhat cursory. Even this treatment should make it apparent, however, that there is a real problem, and that its solution—like the solution of so many other current problems—rests on compromise and not on stubborn adherence to one single notion bred of politics, selfishness, or shortsightedness.

It is to be noted that the native common sense of the masses, and their leaders, has compelled a fresh attack just now beginning. A University Presidents Committee —headed by Dr. Clarence Dykstra of UCLA, and with Caltech's Dr. Lee DuBridge as a member—has now been set up to seek an adequate total solution. The committee will advise the Los Angeles County Board of Supervisors on a mechanism for making a competent study of the problem and for drawing up plans for a solution. Objectivity would seem to be at hand at last, and with it Los Angeles' first real chance for an adequate, modern transportation system.



Monorail is primarily interurban, designed to transport large groups between one heavily populated area and another, as in this proposed Long Beach-San Fernando line.

THE MONTH AT CALTECH



Millikan portrait

■ A new portrait of Robert A. Millikan (above) hangs in the first-floor corridor of Bridge. Painted by Arthur Cahill, who has done at least two other "official" portraits of Dr. Millikan—not to mention the unofficial one which hangs in the basement of the Athenaeum—the recently-completed portrait will remain permanently at the Institute.

Smog in the Plant Lab

■ In recent years many crop and garden plants in the Los Angeles area have begun to suffer from a new type of plant injury. Vegetables like romaine, endive, and spinach developed brown, dried spots on their leaves. In recent months the damage became so extensive that crops were unsalable, and in some areas the profitable culture of these vegetables became almost impossible.

Preliminary investigations put the blame on smog. At a symposium on air pollution at the Hotel Huntington last month, Dr. Frits Went, Director of the Institute's Earhart Plant Research Laboratory, reported on studies now being conducted which corroborate the original findings.

In the Earhart Laboratory a number of plants which are susceptible to smog and gas injuries (spinach, endive, romaine, beets, gladiolus, alfalfa, barley, and tobacco) are being subjected to known concentrations of gases which are known to occur in smog. Clear differential effects have been observed already. Eventually it may be possible to identify the constituents of smog which are harmful to plants, and to develop a more or less quantitative and objective test for smog.

"It can be assumed that most gases injurious to plants would be harmful to animals as well," says Dr. Went, which is why an attack on the smog problem from the plant angle seems to him particularly worth while.

Taking a long range view, Dr. Went explains that air pollution is at least partly caused by man's upsetting the natural cycle of assimilation and dissimilation.

"Instead of letting microorganisms decompose plant and animal remains," he says, "we burn them in a usually very ineffective way. Thus we not only produce air pollution, but also rob the soil of its natural source of fertility: humus."

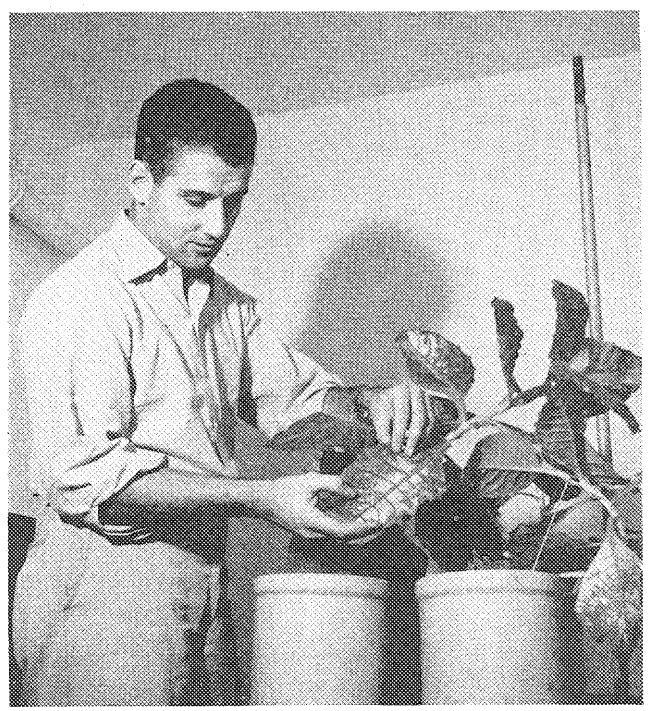
His solution: the organization of city-wide composting of refuse, hedge clippings, leaves and other combustible materials. If the system were well-organized collection and production costs could be paid out of the sale-value of the compost produced. And our soils, depleted of organic materials, could be improved.

Light on bacteriophage

■ Dr. Renato Dulbecco, who joined the Biology Department this fall as Senior Research Fellow in Biophysics, recently reported on experiments in which light had been used first to "kill" organisms, then to bring them back to life again.

The experiments were begun last year at Indiana University, where Dr. Dulbecco was working in the Department of Bacteriology, on an American Cancer Society grant directed by Dr. S. E. Luria.

In the fall of 1948 Dr. A. Kelner, working with spores of streptomyces at the Carnegie Institution for Genetics in Cold Spring Harbor, New York, discovered



Tobacco plant in Earhart Lab shows effect of smog gases.

that light in the visible range was capable of reactivating material which had been rendered inactive by ultraviolet radiation.

Several weeks after Kelner's discovery Dr. Dulbecco accidentally observed a similar phenomenon in bacteriophage (bacterial viruses) in his Bloomington, Indiana laboratory. Plates of nutrient agar containing UV-inactivated phage and sensitive bacteria had been left for several hours on a table illuminated by a fluorescent lamp. After incubation it was noticed that the number of plaques was higher on these plates than on similar plates incubated in darkness.

Subsequent experiments revealed that the phage could be "killed" by ultraviolet light of short wave length, and after 24 hours or more, could be "revived" by light of longer wave length. After they were restored to life the phage became as active as ever in halting the growth of bacterial cells.

One of the simplest organisms we know, bacteriophage are viruses present in the human body, which attack bacteria. They literally explode bacteria and eat up the cells. In Dr. Dulbecco's experiments it is significant that bacteriophage can be "restored to life" only when they have penetrated the cells they attack.

"We are more interested in the growth of the organisms than in killing them," Dr. Dulbecco says. "If, in the presence of the reactivating light, the inactivated viruses are placed in the cells, the viruses take control of the growth process like active viruses, and impress their pattern, instead of the cell pattern, on the growth." How this growth occurs, of course, is the nub of Dulbecco's research. So far unable to explain *how* light revives the bacteriophage, Dr. Dulbecco is equally unwilling to make any predictions as to the possible importance of the research results. Similar studies, however, are now under way in a number of other laboratories throughout the country.

Concentrated B-12

■ Five Caltech scientists reported in the magazine *Science* last month on a new process for concentrating Vitamin B-12 from commercially available sources. Vitamin B-12, at present, is of greatest importance in the treatment of pernicious anemia—a disease that affects some 50,000 people in the U. S. each year. Recently B-12 has been found to be as much as 9,000 times more powerful than previous treatments for the disease.

First synthesized in 1947 at the Merck Chemical Company, Vitamin B-12 has always been difficult, and expensive, to obtain. The scientists responsible for developing the new process are all members of the Biology Department at the Institute—Henry Borsook, Clara L. Deasy, A. J. Haagen-Smit, Geoffrey L. Keighley, and Peter H. Lowy. The research was done under a joint contract with the Office of Naval Research, the Navy Department and the Atomic Energy Commission.

New comet

The 48-inch Schmidt telescope at Palomar Observatory started its five-year photographic survey of the universe last month (E & S, July '49) and promptly discovered a new—or lost—comet. Though the object was first suspected to be a minor planet, subsequent photographs revealed a tail. It isn't certain yet whether the object is a large comet at a great distance or a smaller comet close to the earth. It was identified by Dr. Albert G. Wilson and his assistant, R. G. Harrington.

Honors and awards

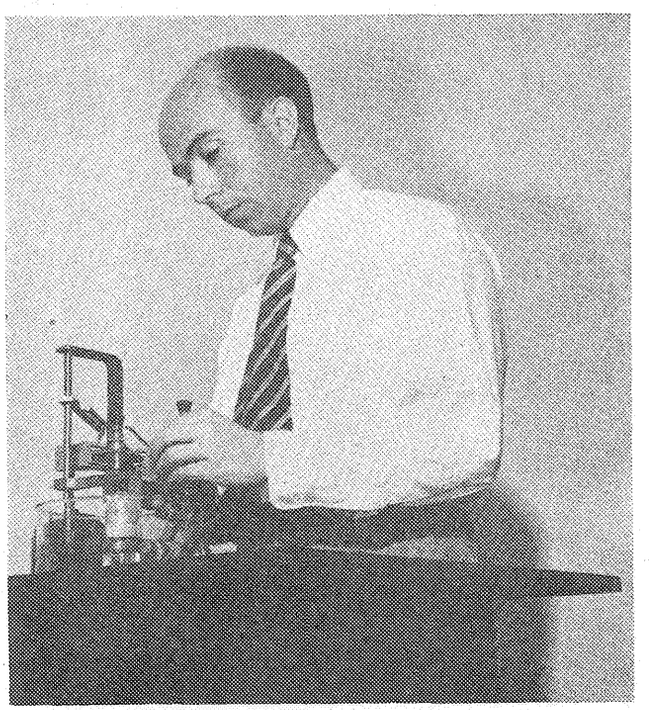
■ Professor L. Zechmeister was recently awarded the Claude Bernard Medal for his investigations in the field of biochemistry by the French Society of Biological Chemistry in Paris. Just 15 years ago he was awarded the Pasteur Medal by the same organization.

■ Prof. Warren P. Spencer, Gosney Research Fellow in Biology, has been awarded the 1949 Leidy Medal by the Academy of Natural Sciences of Philadelphia for "his distinguished studies on the occurrence of visible mutations in native Drosophila (fruit fly) populations, for his determinations of the frequencies of iso-alleles (minor variations in the standard form of a gene) in natural populations, for his contributions to population genetics . . . and for his stimulating undergraduate teaching."

Prof. Spencer, who is on leave from the College of Wooster, Ohio, has done genetic research at the Institute before, as a National Education Fellow in 1937.

■ Dr. Myron H. Nichols, who joined the faculty this fall as Associate Professor of Electrical Engineering, has received a $4,000 grant from the Research Corporation to make basic studies on the emission of electrons from hot metals, as in radio vacuum tubes.

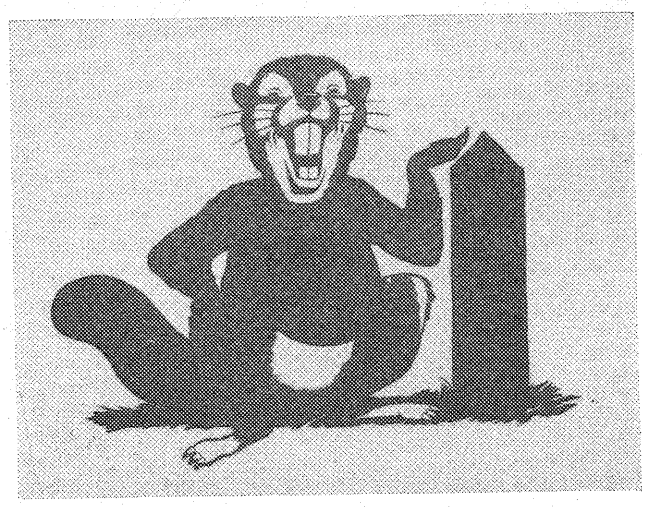
■ Caltech students registered a clean sweep this year in the Annual Student Papers Contest sponsored by the Southern California Section of the American Institute of Mining and Metallurgical Engineers. First prize winner in the Graduate Division was Charles W. Allen, who submitted a report on the stratigraphy and structure of a part of the Puente Hills. Second place went to William R. Muehlberger, B.S., M.S. '49, whose entry dealt with the problems of origin of the granites at Barre, Vermont. First prize in the Undergraduate Division was taken by Thomas R. Fahy, '50, with a report on the geology of the Sunland area. Don E. Hibbard, '49, with a paper on the geology of the Pacoima Hills, received second prize.



Dulbecco brings "dead" bacteriophage back to life.

THE BEAVER

Some Notes on Student Life



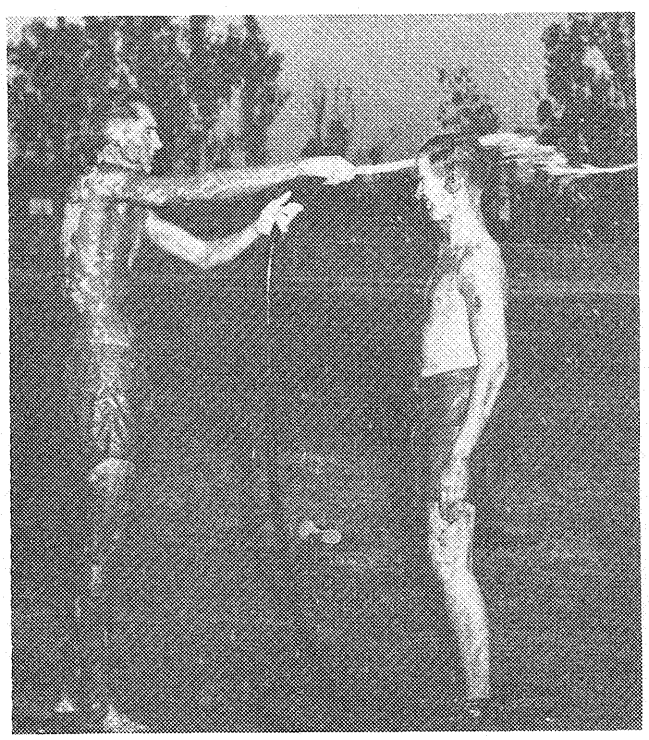
FEELING a certain love for the underdog, the Beaver made his way out to Tournament Park hoping that the frosh might win the Mudeo this year, despite the fact that there had been only two frosh victories since the muddy dawn of the sport. The Mudeo had originated in the primeval years of Tech as a Pole Rush, where sophomores defended a 12-foot greased flagpole from frosh attempts to retrieve a flag at the top. Considerable mayhem always ensued, so this amusement was eventually replaced by pushballs and mud. Then, too, the intrepid frosh who climbed to the top of the groaning human pyramid usually arrived there only by sacrifice of his clothing. The Beaver wondered if the strong innate modesty of Pasadenans (who always came to watch) had not been the real reason for the abandonment of the Pole Rush.

A great shouting ring of Techmen surrounded the slimy pit as the Beaver approached, watching with awe the brown amphibious creatures struggling in the center. Uniformly bemired from head to foot, they lunged and plunged through the thick ooze, impartially spattering students, faculty, and photographers around the pit. The Beaver noted that all the big, useful frosh for this sort of thing were standing around watching. The sophs certainly had a strong advantage in the Mudeo ban for varsity men, since probably four times as many frosh were out for sports as sophs.

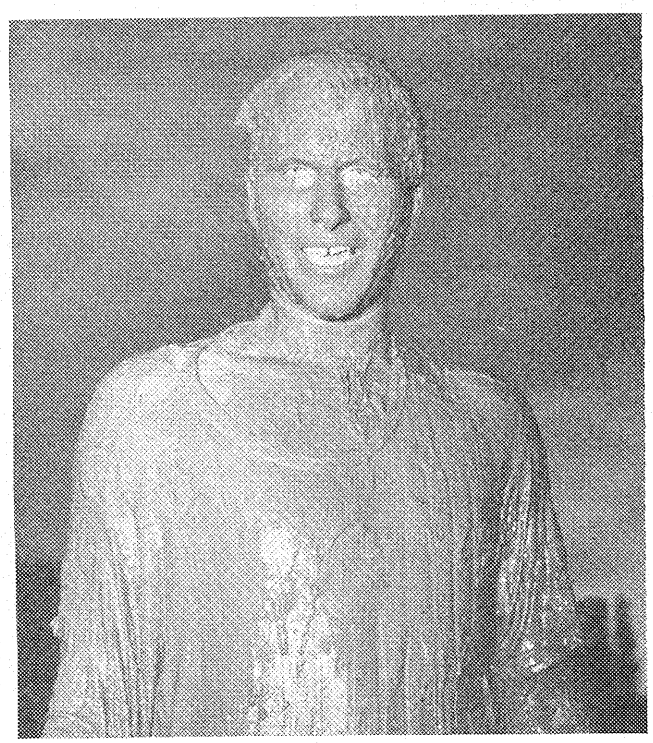
The junior judges were clever this year. When the last event was finished, not one judge was in sight. Their cunning in getting away had been very smooth, but short-lived, for soon muddily victorious sophs and frosh were to be seen returning from the bushes carrying judges. Each judge was held by outstretched hands and feet, and delivered to the sacrificial pit face first, horizontally, like a battering ram. Tradition would have its tribute, the Beaver decided, for the sophs won 5-2, the judges were quite properly baptized, and the frosh would foot the bill for the coming dance.

Pajamerino

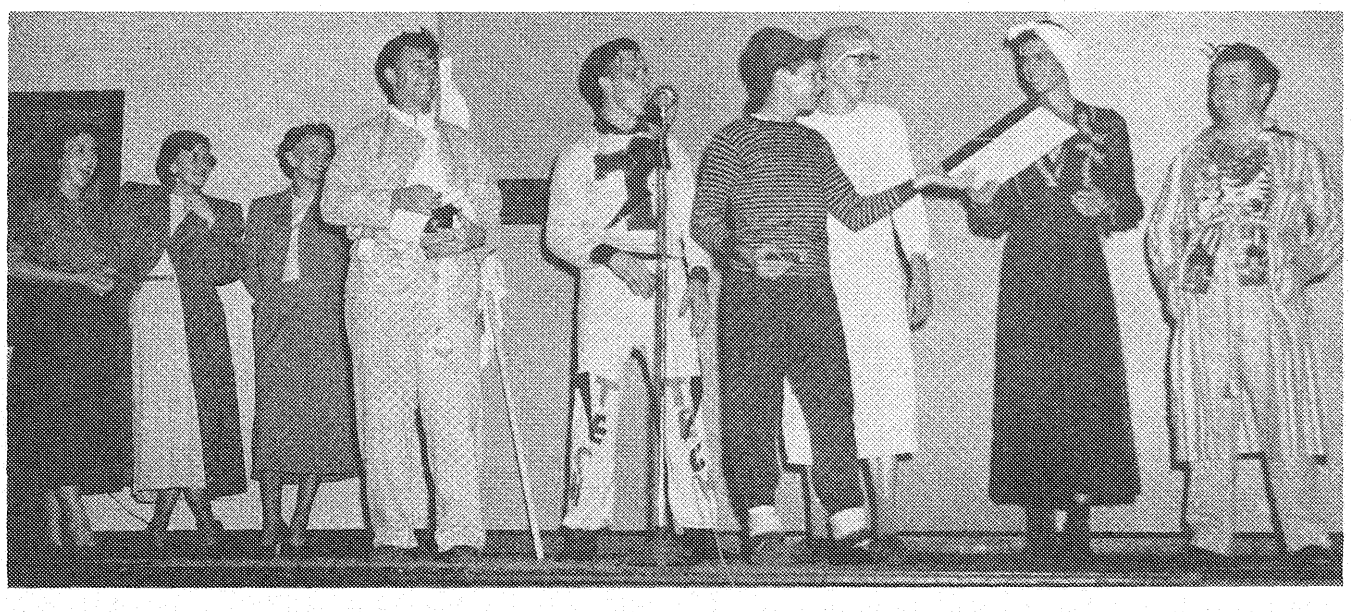
■ Tradition had its tribute before the Oxy game, too. Always reverently impressed by the deep workings of the engineering mind, the Beaver had wandered into Fred Eisen's room to inspect a radio set-up, capable of directing fire from the battleship *Missouri*, which was tuned in to give every conceivable form of alarm to the House in case the bonfire was attacked. He was crestfallen to find that the baleful mechanism couldn't instantaneously spirit men over to Tournament Park in the event of attack, and was literally staggered later in



After the Mudeo: A handy hose takes off the top layer.



After the Mudeo: A junior judge steps out of the pit.



The best-dressed men in the Pajamerino receive prizes in P.C.C. auditorium, while the judges (left) look on.

the evening to find out how tough it was to run full-tilt all the way over there when the alarm finally did go off.

The night of the Pajamarino itself he had been caught up in the frenzy of collegiate spirit and had tramped noisily along in the parade, and afterwards, had joined a great pajama-clad crew in the favorite tavern to sing and wet down raw, shouted-out throats with brew.

Interhouse Dance

■ With fascination the Beaver watched the gangs of workers remaking the lounges for the Interhouse Dance into a series of strange otherworldly creations, from Cairo to Saturn to complete surrealist abstraction. It amused him to remember that after all this tremendous effort, there would be such a crowd at the dance, and after 11:00 p.m. the lights would be so low, that the decorations would not be much observed.

Last year everyone had worked like slaves for a full week, on the promise of getting pictures in *Life*, and hope had not died out even by last April that "they may still print it." It amazed the Beaver to watch the abandon with which everyone tore up the houses, commandeered bedspreads for ornamentation, and totally remodeled lounges and dining rooms. He wondered what dictatorial powers the social chairman must have to command such havoc, but the truth was that everyone seemed to enjoy the work. Still, such an extensive engineering project must be organized, and he gave great credit to the social wheels Arcand and Pyatt, Matzner and Klarfeld, Corbato, Schroeder, and Cockel for ingenuity above and beyond the call of duty, and below and within the call of budget.

Having paid his accolades and feeling very proud of his fellow House members, he started to leave, but was stopped by the evil eye of the social chairman and handed a hammer and nails. "Tyrant!" the Beaver muttered, hammering together a bandstand. But at dinner time he was still busily working.

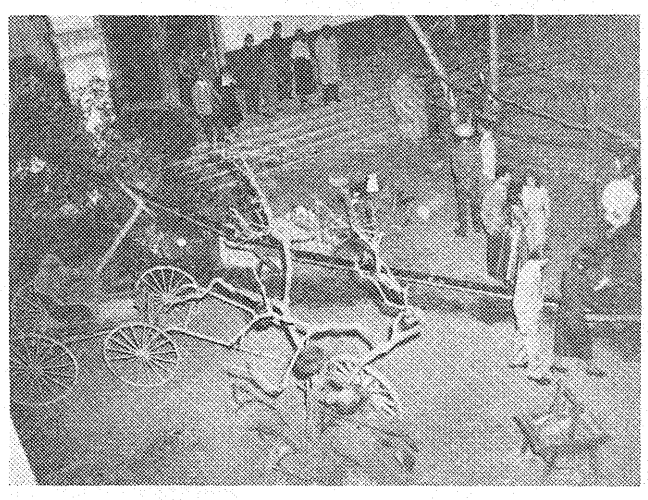
Blue slips

■ There was something underhanded about the way blue slips sneaked up on a man and hit him when he wasn't looking. A great gloom had settled on the Beaver, who had just come into the House lounge looking for a perfumed letter from Nancy and had found in his box only the little brown envelope with the blue note in it.

At the beginning of the year he had come back from summer, tanned and strong of will, eager to apply himself to all the interesting courses he was going to have. He had made up elaborate study schedules and notebook systems and had a great appetite and enthusiasm. Of each new prof he thought, "Ah, this guy is good; I can really get down to work for him . . . and learn something." Then slowly, irresistibly, the work began to pile up. Weeks passed. Assignments grew like demons. The squirrel cage was soon running full pace. How had he ever believed these profs were going to be so inspiring? How had he ever been so ingenuous in the balmy days of early October? The last of the Great Resolutions crept away and he stared blue slips in the face once again.

It was small comfort to know that there is a distinct limit to the number of blue slips a man can get in one term. The Skip Inn was salvation to the Beaver and his comrades who had formed an impromptu Mutual Pity League. They all earnestly agreed that they had to really buckle down. Discipline! That was the watchword from now on. They all ordered another beer.

—Jim Hendrickson '50.



Blacker court becomes gold mine for Interhouse Dance.

ALUMNI NEWS

Frank Jewett
1879-1949

FRANK BALDWIN JEWETT, one of the Institute's most distinguished alumni, and one of the nation's most distinguished electrical engineers, died in Short Hills, New Jersey, on November 18.

Dr. Jewett was one of the three members of the California Institute of Technology Advisory Council—along with Vannevar Bush, president of the Carnegie Institution of Washington; and Gano Dunn, president of the J. G. White Engineering Corporation.

Frank Jewett was one of the first male babies born in Pasadena, in 1879, when the city was little more than a cluster of ranches. And he was one of the earliest graduates of Throop Polytechnic, the forerunner of the present California Institute of Technology.

After his graduation in 1898 he studied for his Ph.D. under Dr. R. A. Millikan at the University of Chicago, then joined the faculty of the Massachusetts Institute of Technology as instructor in physics and electrical engineering in 1902.

In 1904 Dr. Jewett entered the new field of industrial research, as a member of the engineering staff of the American Telephone and Telegraph Company. He rose rapidly to the position of chief engineer and was subsequently (1916) made vice-president in charge of development and research for A.T.&T., as well as vice-president of the Western Electric Company, pioneer developer and manufacturer of telephone equipment.

In 1925 Dr. Jewett became president of the Bell Telephone Laboratories, one of the world's foremost research organizations. In this post, which he held until 1940, he directed all major telephone developments of the era—including the introduction of transcontinental and dial telephone systems. From 1940 until his retirement in 1944 Dr. Jewett served as chairman of the board of the Bell Laboratories.

In the first world war Dr. Jewett served as a lieutenant-colonel in the Army Signal Corps, and received the Distinguished Service Medal for his work in communications organization. In World War II he was a member of the National Defense Research Committee, and of President Roosevelt's Science Advisory Board. His work on submarine detection was particularly outstanding.

From 1939 to 1947 Dr. Jewett was president of the National Academy of Sciences—the first engineer elected to that office in the academy's history. He was also a member of the National Research Council, president of the American Institute of Engineers, and a trustee of the Carnegie Institution of Washington—to mention a few of the numerous offices he held at various times. He received honorary degrees from 15 colleges and universities. He was, as Dr. Millikan once said, "probably the most distinguished graduate of the Institute."

PERSONALS

1917

Alexander Kensey was made president of the Coast Envelope Company in August. He has just completed 32 years of service with the firm, which has manufacturing plants in Los Angeles and San Francisco, and employs some 200 people.

1920

Mark A. Sawyer has been on the sick list, due to a heart attack, since the latter part of July. Now well on the road to recovery, he expects to be back on the job —Outside Plant Engineer of the Pacific Tel. & Tel. Co.—by the end of the year.

1922

Hallan N. Marsh, General Petroleum Corporation production engineer, was cited by the American Petroleum Institute "for distinguished service" at the Institute's annual meeting in Chicago last month. The citation detailed his 21 years of service to the Institute's standardization program for oil field equipment. He is currently National Chairman of the Committee on Standardization of Pumping Equipment and Engines.

Hallan, who lives in Huntington Park, has been with General Petroleum since 1923.

Linne C. Larsen attended a conference at the Fairbanks-Morse plant in Beloit, Michigan, last month, where some 150 consulting engineers inspected a new trash pump F-M is about to introduce. On this junket Linne had a chance to visit Ed Groat '22, now vice-president of the Kelco-Burnett Electric Co. in Chicago. Ed's son Russell is attending Oxy, where he has been playing on the frosh football team.

1926

Nephi W. Cummings, Ph.D., who headed the science department of San Bernardino Valley College from 1927 to 1944, died on October 31 after a heart attack. An authority on water evaporation and its relation to soil conditions, Dr. Cummings had continued his research after his retirement from teaching.

1933

J. Lawrence Botsford, Ph.D. is now Associate Professor of Mathematics at the University of Idaho in Moscow (Idaho).

1935

Col. Howard M. McCoy, M.S., former Chief of Intelligence Department, Air Materiel Command, Wright Field, has been transferred to Washington, D.C., for a year's study at the Army Industrial College.

Harold Schiller was married on February 6 of this year to Miss Lottice Ourin. The Schillers now live in Long Beach, where Hal just recently opened an unusual laboratory on Terminal Island, devoted to the study of the deterioration of materials of construction and use under marine conditions. The lab will also cater to the wood preservation industry, specializing in the problems of marine piling preservation. "If I don't go broke," Hal says philosophically, "I'll probably be successful."

1936

Deane E. Wooldridge, Ph.D., who worked at the Bell Labs in New York for ten years is now director of electronic research and development for the Hughes Aircraft Company.

Everett B. Henderson is the father of a boy, Donald Braun, born on October 27.

1937

LeVan Griffis, M.S. '38, Ph.D. '41, is now Professor and Chairman of Mechanics at the Illinois Institute of Technology and the Armour Research Foundation. On October 16 the Griffis's welcomed their fifth child (fourth son) Todd Harold. LeVan is ready to welcome any and all alumni to visit Technology Center when they're in Chicago.

Arthur E. Harrison, M.S., Ph.D. '40, returned to the West Coast from Princeton, New Jersey in September, 1948. He is now an associate professor in the Electrical Engineering Department at the University of Washington in Seattle. During the past summer he divided his time between the Microwave Laboratory at Stanford and a vacation in the High Sierra country. He is on the entertainment committee for the ASEE convention in Seattle next June and is already offering to arrange anything except the weather.

Lawrence Fleming writes from Falls Church, Virginia: "Here's the whole story, Married Frances Heaney, Oxy '34, in November 1937. Son Jimmy born 1944. Have worked as Examiner, U.S. Patent Office, 1937-42, Electrical Engineer, Naval Ordnance Laboratory 1942-48, and am at present Senior Engineer, in Electronics Division, National Bureau of Standards, Washington, D.C.

Andrew A. Fejer, M.S. '39, Ph.D. '45, Professor of Aeronautical Engineering at the University of Toledo, was appointed Head of the Department of Aeronautical Engineering on September 1.

Nathan Scott, Ex-'37, composer-arranger for Republic Studios in Hollywood was guest speaker at the Y Forum held at the Institute on November 21. He spoke on "Music and the Movies." Scott got his degree from the University of California in 1937, went to work for NBC, and in 1942 became musical director for the Blue Network. He has been with Republic Studios since leaving the Army in 1946.

1938

Stephen J. Jennings became a father (first time) last March 25—a boy, Stephen Jr.

Leroy B. Kelly has also become a father—a girl, Cynthia Anne, born May 11 in Pasadena. Leroy is still with U.S.-N.O.T.S. in Pasadena, as head of the Applied Research Branch, Propulsion Division, U.O.D.

1940

L. Ivan Epstein, M.S. '41, is working for Bausch & Lomb in Rochester, New York. "Have a foreman's job classification," he says, "but only one assistant computing for me."

Robert S. Neiswander has resigned his position with Link Aviation to become Chief Electronics Engineer for the Stanley Aviation Corp. (President is Robert M. Stanley '35).

1941

Robert S. Rasmussen, Ph.D. died October 16 in Berkeley after an illness of three months.

1942

Carl Savit and his wife announce the birth of a son, Mark Noah, on October 10.

George P. Sutton, Supervisor of Propulsion Development for the North American Aviation Corp. in Downey, has been elected President of the Southern California Section of the American Rocket Society.

Henry W. Menard, Jr., M.S. '47, received a Ph.D. from Harvard in June.

1943

William Hovanitz, Ph.D., is now Professor of Biology at the University of San Francisco. He is living in Mill Valley.

N. Orvis Frederick is a petroleum engineer in Oklahoma City, and the father of two small boys.

1944

Wesley R. Sandell received his Masters degree in Business Administration from Harvard in June.

Paul H. Winter is an engineer for the Department of Building and Safety, City of Los Angeles. He has two children—aged 3 months and 23 months.

Robert M. Weidman has interrupted his graduate study at the University of California to teach geology for a year at Fresno State College. He received an M.A. in geology from Indiana University last summer.

Richard B. Riddell, M.S., is living in Boston and working for a Masters degree at the New England Conservatory, where he received his B.Mus. this year. He has made professional appearances as a singer in Boston and Denver. He received a B.A. from the Univ. of Denver in 1947 and worked with the Lummus Co., also in Denver, through 1948.

Ronald S. Johnson and his wife announce the arrival of a daughter, Carol Anne, on October 27. They are living in Ann Arbor, Michigan.

Wheeler J. North, not content with a B.S. in Electrical Engineering, is back at the Institute working for the corresponding degree in Biology—to be followed by work for a PH.D. (also in Biology). He intends to study the aging processes in animals and possibly in humans.

F. Otis Booth, Jr., and his wife were written up in the November issue of *The American Home* "as positive proof that the younger generation has not grown soft." They've just built—with their own hands—a six-room house on Pasadena's South Oak Knoll Ave. He recently finished up a graduate course in Business Administration at Stanford.

1945

Lt. Col. Laurence D. Ely, M.S. is stationed in Wiesbaden, Germany as an Aeronautical Engineer.

Leslie H. Levin was among those receiving a Masters in Business Administration from Harvard in June.

We've received another interesting letter from *Robert E. Leo* (Personals, May '49) saying that he had just returned to Arabia after a three weeks vacation in Italy. It was really more than a vacation, though, as he was married in Florence, Italy, on October 5 to Miss Cobi Kapteyn of Sassenheim, Holland.

"We had an enjoyable and interesting time visiting St. Peters, the Forum, etc. in Rome; the old churches, and the art exhibits of Florence; and the many fascinating things in Venice, Piazza San Marco; the Grand Canal by gondola, etc. Besides the ancient items of interest, it was an experience to taste the Italian cooking; and to appreciate the friendliness and good manners of most of the Italians. We ran into mountains of red tape with the American and Dutch counsuls, the church, and the civil authorities to arrange the marriage, but through dispensations from Vatican City and the high tribunal of Florence, many letters and cables, much waiting, and the constant help of a few friends we accomplished the many-times-seemingly-impossible and were married in the limited time at our disposal.

"Am now the night supervisor here at radio station 'HZA' which is run by the Arabian America Oil Co. to provide contact with the incoming tankers that load at Ras Tanura; the various geology and exploration camps in the outlying regions of the Arabian desert; and with the company planes, two of which, the 'Camel' and the 'Gazelle'—both DS-4's—fly between Dhahran and New York."

John S. Jackson, Jr. is teaching physics at Campbellsville College, Campbellsville, Kentucky and is married to a "very beautiful blonde from Louisville."

1946

Robert F. Sensibaugh has received a Masters degree in Business Administration from Harvard.

1947

L. Edward Klein, M.S. is engaged to Miss Crockett Leslie of St. Louis—where he's now living.

Robert Bearson and *Langdon C. Hedrick* both received Masters in Business Administration at Harvard's June Commencement.

Charoen Vadhanapanich is at UCLA working for a Ph.D. in Meterology.

1948

Arthur N. Cox, Ph.D. is doing graduate work in the Astronomy Department at the University of Indiana.

Heinz G. Pfeiffer, Ph.D., is a Research Associate in the chemical division of General Electric's research laboratory in Schnectady, New York.

Robert Phillips is a second-year graduate student at Tech, majoring in chemistry and minoring in biology. He and his wife have a 19-month-old daughter, April.

George Feigen, Ph.D., has moved from USC to Stanford, where he will be Assistant Professor in the Physiology Department.

1949

Norman S. Domenico, M.S., was married this fall to Miss Shirley De Sabato in Denver.

Samuel Fong, *Hugh Carter* and *Wayne Herzig* are "batching" together in Sacramento. All three are employed by the state as mechanical engineers in the Division of Architecture.

Robert H. Blacker, Ph.D., has been awarded a two years research fellowship by the Imperial Chemical Industries Research Foundation, for further study at the University of Cambridge, England. He and his wife left for England this fall.

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Ish as "The Mother of Nations." She is not quite that, but the few survivors who gather round Ish do make a very impressive start toward repopulating at least the San Francisco Bay region. Romantic love is out. Capital punishment is in, but is imposed only once by "the tribe," the crime being "Cupid's diseases."

The vast stores of canned, glassed, and bottled goods remained for long as fresh as ever. So did the jeeps, more or less. As a consequence, Ish and his clan became parasites on a dead civilization. Ish foresaw that this could not last long, and taught the young men of the tribe to make use of the reliable bow and arrow. This is Paradise Regained. It is just as if World War III had been fought.

Some of the most graphic descriptions concern the gradual failure of the public utilities. The electric light and water plants were functioning without human guidance long after the race had all but completely perished. But these too finally went under and nature took over. Without human repression the rats, grasshoppers and others literally went to town. When they had eaten themselves out of vegetation and packaged supplies, they departed for the country. Ish and his fast-growing tribe adapted themselves to a primitive life. At first Ish had thought to preserve something of the old American civilization and build on that. But, encouraged by Em, he talked himself out of the idea. "Men come, and men go, but Earth abides." Ish lived to a great age. He died, "The Last American," on the San Francisco Bay Bridge. And where could any American die better?

There is a certain fugal quality about the narrative. It is Ish who unifies it all. Anyone with a technological or scientific background will appreciate the mastery with which the author handles his materials.

MALE AND FEMALE
by Margaret Mead
William Morrow & Co., N.Y.,
477 pp. $5.00

Reviewed by Hunter Mead
Professor of
Philosophy and Psychology

Any book with the title *Male and Female* is certain to have readers, and when its author is one of the most widely known social anthropologists in America, a very large audience is assured. Margaret Mead's latest book can definitely be depended upon to enhance her reputation among educated laymen, whether or not they actually read it or understand it. Like Dr. Kinsey's celebrated opus I, *Male and Female* can be relied upon to fill in conversational lags all this winter and beyond.

This is by no means a popular or readable volume, however. Although it lacks the many pages of bewildering statistics which made Kinsey's book the most widely unread best-seller of recent years, there are large hunks of undigested anthropology which should prove no less discouraging to the untrained reader. Some of this material could have been better organized, but even in its present lumpy form it is worth the time of any thoughtful person who wishes to enlarge his horizons and sharpen his insight into our American culture.

In essence, *Male and Female* is a comparative study of the way seven different South Pacific cultural groups prepare their children for playing the roles of adult males or females. The term "comparative" should be emphasized. Not only does Dr. Mead constantly stress the contrasts and similarities among the seven cultural groups, but when analyzing American life and American preparation for adult socio-sexuality, she still manages to maintain an objectivity typical of the comparative method at its best.

Many of the comparisons between American training for adult maleness or femaleness and South Pacific training are implicit and subtle, but nonetheless thought-provoking, and even disturbing. Margaret Mead clearly suggests that some of her aboriginal groups do a better job of it than America does.

In part, the inadequacy of the American preparation for adulthood comes from our still powerful puritanism, which makes it impossible for the child and adolescent properly to learn the "ways of the body." The major obstacle, however, which often excludes Americans from adequate preparation for their adult roles of men and women is our general cultural uncertainty as to just what it is to be a male or a female in our society.

Margaret Mead's analysis of this confusion is a major part of the book, perhaps its most important part. If this somewhat helter-skelter volume can be said to have a "message," it is the plea that American men and women make a clear-headed effort to determine their real role in these United States, and above all that they cease "competing" with one another. This is not an anti-feminist reactionaryism, but rather a blunt reminder that people can be happy and efficient only if they are first full-fledged males or females, and second, members of some occupational or social group. Margaret Mead does not argue that women belong in the kitchen or the nursery, but she does deny that they need to masculinize themselves because they work alongside men in industry, commerce and the professions.

This is a meaty, controversial, idea-packed book, which stands as a challenging invitation to all who like to think.

RED FLANNELS AND GREEN ICE
by Arthur Pocock
Random House, Inc., New York,
272 pp. $2.75

Reviewed by Robert P. Sharp
Professor of Geomorphology

Red Flannels and Green Ice, a first book by a former Tech graduate student, is a light, jaunty, and sometimes downright funny account of a war-time patrol by the Coast Guard cutter *Laurel* to Labrador, Northern Quebec, Baffin Island, and Greenland. This is no descriptive travelogue, but rather an account of the experiences and impressions of Pocock and his shipmates. It is told in a manner designed to wring every last twitter from each situation. Titles of the first seven chapters indicate the nature and content of the book: 1. Pregnant Seals and Other Notes. 2. You're Going to Greenland—Oh, Goody. 3. How to Be a Stinker. 4. Of Women and Fish. 5. You Can't Take It With You. 6. Navel Maneuvers. 7. Sex Life in a Deep Freeze.

Initially, Mr. Pocock's amazingly facile mind and glib pen are entertaining, but after a few chapters one is bemused instead of amused. Nonetheless, occasional remarks are undeniably funny, such as that describing the seal skin trousers worn by Greenlander women as being so low slung that cutting two inches off the top would convert them to hip boots. Good writing punctuated by witty or humorous remarks is enjoyable, but punctuation by itself is tiresome. Some of the best passages are those pertaining to experiences involving some degree of danger—which seem to have sobered the author.

At present, Mr. Pocock is working as a geologist in Saudi Arabia. He is probably well along on his second book, and if the letters received from time to time at the Division of Geological Sciences are a sample, it will be better than the first. The author shows promise, and it may well be that *Red Flannels and Green Ice* was selected by Random House as winner of its Serviceman's Prize Contest on the basis of this promise.

SCIENCE IN THE NEWS

1949 Nobel Prizewinners

■ *Physics*—Dr. Hideki Yukawa, 42, now Visiting Professor of Theoretical Physics at Columbia University, for his mathematical prediction—14 years ago—of the meson, the atomic particle whose existence was proved experimentally by Caltech's Carl Anderson in 1936. (Anderson's discovery of the positron won him the Nobel Prize in Physics in 1936). Dr. Yukawa is the first Japanese ever to receive a Nobel award.

Chemistry—Dr. William Francis Giauque, 54, Professor of Thermodynamics at the University of California, for his studies of the behavior of matter in temperatures close to absolute zero.

Physiology and Medicine—Joint award to Dr. Walter Rudolph Hess, 68, Director of the Zurich University Physiological Institute, for his discoveries of how certain parts of the brain control the organs of the body; and to Dr. Antonio Caetano de Abreu Freire Egas Moniz, 75, Professor Emeritus of Neurology at Lisbon University, for developing the surgical technique known as prefrontal lobotomy—a brain operation which opens up new possibilities for the cure of mental illnesses.

The 1949 Peace Prize went to Lord Boyd Orr, 69, of Scotland, former Director General of the United Nations Food and Agricultural Organization, President of the Movement for World Government.

Orlon: coming up

■ Late next year E. I. duPont de Nemours & Company will start commercial production of a new synthetic fiber called orlon. In exhaustive tests orlon has proved to be "the most resistant of all man-made fibres." It's resistant to sun, heat, and acids. It washes easily, dries quickly, and holds its shape. It's shrinkproof, mothproof, and a lighted cigarette won't set it on fire. In its strength and lightness it approaches nylon, duPont's earlier major success in the chemical yarn field. In most of its other properties—including probable cost—it falls somewhere between nylon and rayon.

Orlon was first developed during the war as a possible product for use in the South Pacific, where other materials—with the exception of nylon—rotted away in hours or days. Its first uses are likely to be in automobile tops, tents, tarpaulins, filter cloths for chimneys, curtains, and protective work clothes. Later on, it will probably compete with nylon in men's and women's clothing.

Orlon fiber is made from polyacrylonitrile, a plastic formed by the polymerization of acrylonitrile. Made from such basic materials as limestone, coal, petroleum, natural gas, water and air, acrylonitrile is one of the intermediate products in making synthetic rubber.

Revolution in printing

■ Another new electronic device which threatens to revolutionize the printing industry was introduced in Cambridge, Mass. this fall. The machine has a standard typewriter keyboard, and any competent typist can operate it. By twisting a dial you can select any size type you want. An automatic justifying device makes all lines come out even. Though you can see what you're writing, the machine has a "memory" which stores up letters until a complete line has been punched. Mistakes can be corrected by pushing a button which "rubs out" the error in the storage chamber.

At the end of each line the letters are taken electronically from the storage chamber and coded, then transmitted to a decoding device where they bounce out in their natural form. They flash against an unexposed film and are photographed. The film can be developed instantly and engraved on a printing plate, ready for the presses—eliminating the long series of intermediate steps necessary in present printing methods.

Dr. Vannevar Bush, president of the Carnegie Institution of Washington, who has long been active in the development of graphic arts techniques, predicts that the new composing system will be "sure to cause some disruption" in the printing industry, but that disruption is "the penalty we pay for progress."

The machine, based on inventions by two French scientists, Rene A. Higonnet and Louis Moyroud, will be manufactured and sold by the Lithomat Corp.

World War IV

■ The story goes round, says *The New Republic*, that Albert Einstein was asked by an admirer what weapons would be employed in World War III. Expressing ignorance, he said he could only speak for World War IV. "And what will they use then?" asked the breathless questioner. "Rocks," said Einstein.

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Get a Close-Up OF THE BASIC INDUSTRY OF YOU[illegible]E!

by R. S. FLESHIEM
Manager Electrical Department
ALLIS-CHALMERS MANUFACTURING CO.
(Graduate Training Course—1904)

WHEN YOU GET into daily working contact with an industry, you may find it offers specialized opportunites that you hadn't known about before. That's why it's not always possible—or wise—to pick *your* final spot in industry until you've had some all around first-hand experience.

R. S. FLESHIEM

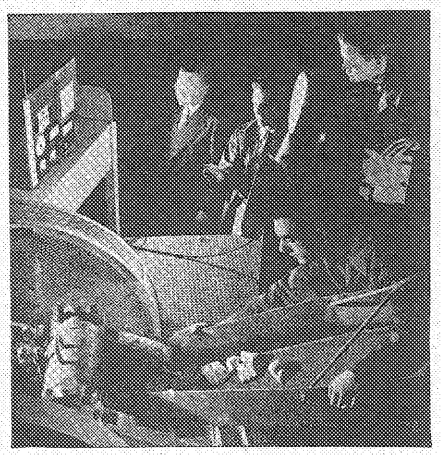
I want to suggest a good way to *get* a close-up of the industries that appeal to you.

Naturally, I can talk with most assurance about the electric power industry. But the same principles apply to others.

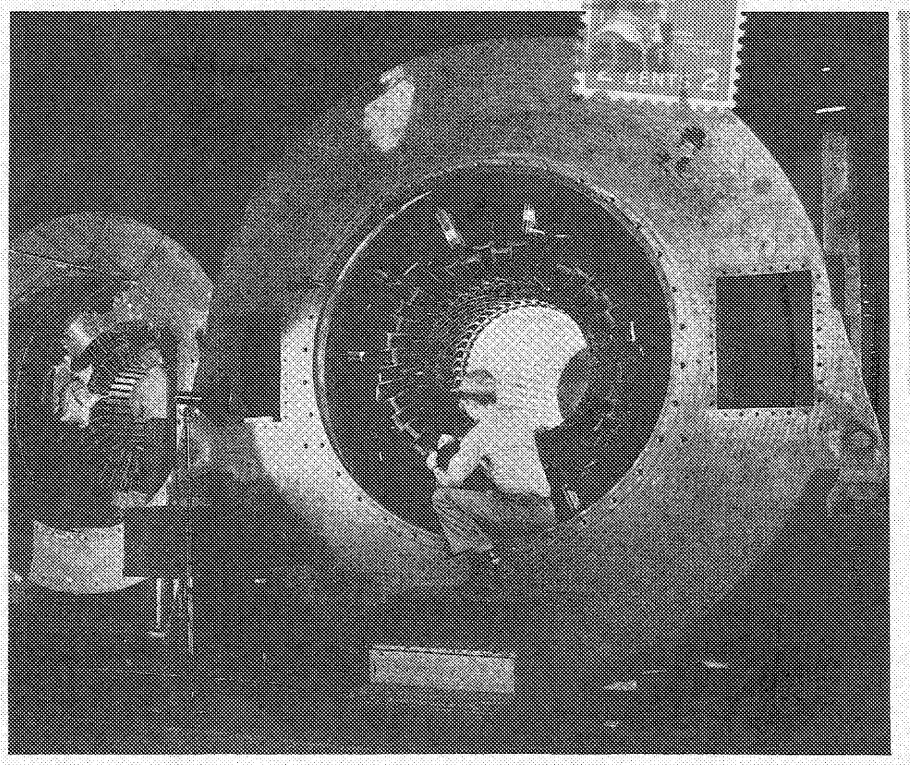
When I got my engineering degree from the University of Michigan, the electric power industry was a fast-growing youngster. I decided to go to Allis-Chalmers, where I joined the company's first Graduate Training Course in 1904. I was sent to Cincinnati and started in the old Bullock Electric Mfg. Co. plant that Allis-Chalmers had purchased that same year. Bullock, incidentally, started in 1884—one of the real old-timers in the electric industry. It was the start of the present Allis-Chalmers Electrical Department.

Opportunities Are Increasing

The industry was growing fast at the turn of the century, but it's growing even faster now. Opportunities were never greater—or more varied.



Studying power and capacity factors in ore crushing, in Allis-Chalmers' complete basic industries laboratory. Camera-recorded data will be applied to commercial mining operations.



Inside View of a hydrogen-cooled steam-turbine generator. A-C Graduate Training Course students may follow important electric power equipment from blueprint to installation.

Today we have Graduate Training Course engineers applying their ability and training to the problems of machine design—research and development—manufacturing and production—sales—application engineering. Here we're working with electric power generation, control and utilization—with advanced industrial uses of electronics—with research in D. C. transmission. We're in intimate touch with the electric power industries—with transportation—with steel, metal working and other big power users. And I know that the field is just as broad in the other major industry departments here at Allis-Chalmers.

What Industry Interests You?

I firmly believe that Graduate Training Course engineers have a unique opportunity at Allis-Chalmers. They have the opportunity here to explore thoroughly not one, but many basic industries if they choose. This company produces the world's widest range of major industrial equipment, and every department is open to the graduate engineer. That includes electric power, mining and ore reduction, cement making, public works, steam turbines, pulp and wood processing. It also includes the full range of activities within each industry: design, manufacturing, sales, research, application, advertising.

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At the completion of the Graduate Training Course, you've had a close-up of many industries. You're ready to take your place in the work of your choice.

Write for details of the Allis-Chalmers Graduate Training Course—requirements, salary, advantages.

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

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