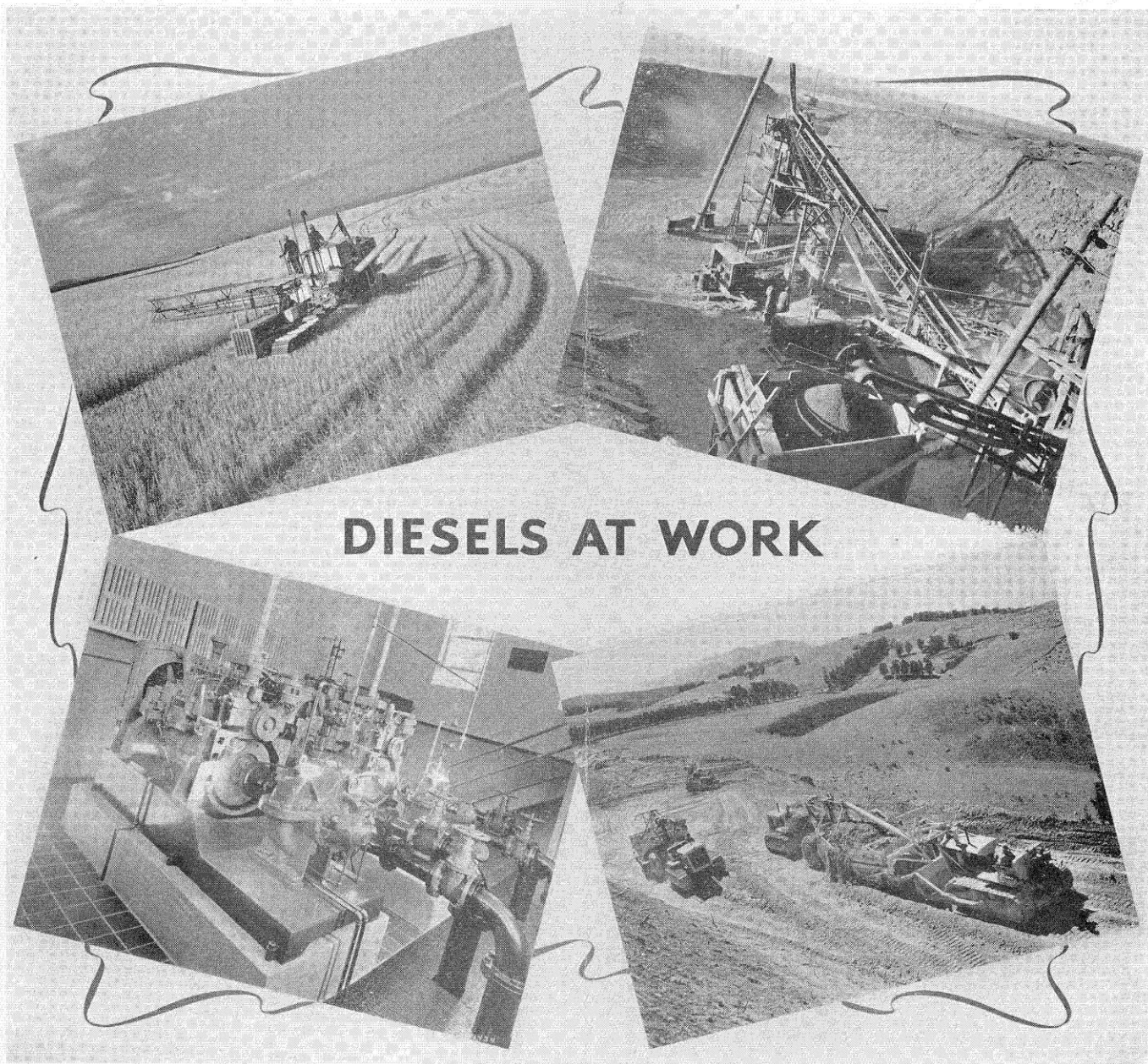


ALUMNI REVIEW

CALIFORNIA INSTITUTE OF TECHNOLOGY



DIESELS AT WORK

A LOOK AT THE DIESEL SITUATION

SEE PAGE 3

Vol. 3 No. 1

September, 1939

"We'll be
glad to come"



Every day, the telephone brings happiness and cheer to many a home. Some one thinks of some one, reaches for the telephone, and all is well.

Telephone service is exceptionally good in this country—and it's cheap. Nowhere else do people get so much service, and such good and courteous service, at such low cost.

BELL TELEPHONE SYSTEM



The Bell System cordially invites you to visit its exhibits at the New York World's Fair and the Golden Gate International Exposition, San Francisco

ALUMNI REVIEW

ALUMNI ASSOCIATION, INC.
CALIFORNIA INSTITUTE OF TECHNOLOGY

VOL. No. 1

SEPTEMBER, 1939

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THE STAFF

G. AUSTIN SCHROTER . . . '28
THEODORE C. COMBS . . . '27
FRED S. SCOTT '30

GEORGE LANGSNER, '31, *Editor*
ROBERT J. BARRY, '38, *Business Manager*

ALBERT W. ATWOOD . . . '32
JOHN E. SHIELD . . . '22
WILLIAM H. MOHR . . . '29

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Albert D. Hall, '22 *Membership*
Paul C. Schaffner, '37 *Placement*
Loys Griswold, '24 *Publications*
Theodore C. Combs, '27 *Social*
John E. Shield, '22 *Campus Relations*
Theodore C. Coleman, '26

GREETINGS at the dawn of another Alumni Association year. May it not only duplicate but surpass our last few phenomenally-successful years. Untorn by divergent factions, the Alumni Association has been built until it now occupies an enviable position in the group of similar organizations of other American colleges. Why? Because of cooperation and hard work.

As you know, there are two ways of running an alumni association. We could, like many other alumni groups not much larger than ours, hire a full-time Alumni Director and leave largely to him the management and execution of alumni affairs.

The other way, our way, is to maintain your Alumni Association in the immediate control of its Directors, each member actively assuming as his responsibility some phase of the large amount of work necessarily involved. We prefer this way as it gives you a "custom made" program designed and executed by men who have an intimate knowledge of the interests of Tech men. While the Board is willing to and do spend a very large amount of time in their individual alumni tasks, the amount of work is so large that enlistment of other members is necessary.

However, **every** member can serve in this common cause. Here

are a few suggestions for those of you who are not called upon to assume specific tasks:

1. Drop a card to the Alumni Association (Campus Office) giving any news items of interest for the Alumni Review, whether they concern yourself or other Tech men.
2. Send in **promptly** your meeting reservations.
3. If you know of a job for a Tech man, or if you want to procure a job or better your position by a shift, contact the Placement Service at the Institute.

4. Give use any suggestions you have as to how the Alumni Association can better serve you. This is your Association and we want you to get more from it.
5. Remember that we must live within our income, and that our income is derived from our nominal dues of \$2.50 per member. This issue of the Alumni Review goes to all alumni whether or not their dues are paid. Later issues, and all further announcements, go only to paid members. We're cocky enough to think that we're giving you more for your money than any similar organization, but we can't prove it unless you join and give us a chance. How about it?

CLARENCE F. KIECH, '26,
President, Alumni Assn.

FORTHCOMING EVENTS *

**San Francisco Chapter — Every Monday
Noon, Fraternity Club at Palace Hotel.**

General Meeting - September 22, 1939
"Geophysical Prospecting"—Speakers:
Herbert Hoover, Jr., and Dr. Raymond
A. Peterson, '31, Mary Louise Tea Room,
Barker Brothers Bldg., Los Angeles.

Oxy Game Homecoming - October 21, 1939
Informal after game dance, more details in the mail.

General Meeting - - - - - December
"Labor Relations"

General Meeting - - - - - January
"Color Photography"

Annual Dance - - - - - February
Seminar Week-End - - - - - March

Preliminary Plans now under way.

* Listings in bold face type are final announcements. Other events will be announced in due time, following completion of plans.

NEW BOARD

The newly elected members and the hold over members of the Board of Directors met in special session at the Annual Commencement Day Banquet to choose the officers for the coming year as listed in the masthead on page 2.

However the Board is not composed of one or two workers, but every member actively partakes in the leadership of some Alumni Association activity, for which he is responsible, and in addition attends Board meetings, which are held at least one evening a month besides any regular Association meetings.

The newly organized Board met on the evening of July 14, 1939, to discuss policy and to divide the committee chairmanships amongst themselves. The choices as described below can produce nothing but a highly successful year both in greater development of comradeship and service.

Kiech President

The selection of **Clarence F. Kiech, '26**, as president, was an outstanding choice as Clarence served as chairman of the first Alumni Seminar Week-End and acted as social chairman in preparing the fine programs of the past year.

William H. Mohr, '29, who is vice-president, a muchly deserved honor, acted as membership chairman last year when the Association achieved a larger membership than in any previous year by the dint of his hard work and constant personal solicitation. Bill will act as Athletic chairman, and as such will be the Alumni representative on the Athletic Council of the California Institute of Technology, a position for which he is ideally suited, being a three letter man and football captain in 1927, and he still maintains a lively interest in all undergraduate athletic endeavor.

Albert D. Hall, '22, carries on as treasurer in the highly successful manner he has for the past year, keeping strict budgetary control. **Allen W. Dunn, '29**, has been appointed Assistant Treasurer and a member of the Finance committee which is headed by Hall.

One of the most difficult tasks, that of membership chairman, is filled by **Paul C. Schaffner, '37**, who has proven highly capable in any tasks previously assigned to him, notably the Annual Alumni Dance at the Biltmore Hotel last February.

Albert W. Atwood, '32, who is again Secretary and Chapter Chairman, will carry on his work of enlivening alumni interest amongst those removed from Southern California. Miss Theresa Dierkes was re-elected Assistant Secretary of the Association.

Publications

Theodore C. Combs, '27, will carry on as Publications and Publicity Chairman. **George Langsner, '31**, who was Assistant Editor of the Alumni Review last year, is now Editor, and **Robert J. Barry, '38**, is Business Manager of the Review. **Raymond F. Labory, '31**, is to work under Combs on the proposed Alumni Directory to be published in February, 1941.

The position of Placement Chairman is to be filled by **Loys Griswold, '24**, who will carry on this work of vital importance to every alumnus. He will work in close contact with the Placement Service Office, doing a great deal of the necessary field work.

FOOTBALL

Sept.

22* Calif. Poly at San Luis Obispo
29* Citrus J. C. at Tournament Park

Oct.

6* San Diego Marines at San Diego
21* Occidental at Rose Bowl
27* Whittier at Whittier

Nov.

11 Pomona at Rose Bowl
18 Redlands at Rose Bowl
25 La Verne at Tournament Park

* Night game

THE COACH SAYS:

What about football again? As we all know, football depends upon two things: namely, the material at hand and the spirit in which the game is played.

As for the material this fall we will be in the dark until the first week of practice. Three of the best backfield men are in doubt, either because of the possibility of not returning or of not coming out if they do return. One more, big Dave Brown of whom much was hoped, positively will not return. The line looks better, although new men will have to be found for running guard and one end and replacements for all positions.

As for the spirit of the game, I can speak for the coach. The game will be coached and played as a game, and not as though it were a war. If we cannot play with that motive we had better leave it alone. However, it is better to show the college world that the game can be played that way, win or lose.

—W. L. STANTON.

— T —

CORRECTION

The ALUMNI REVIEW wishes to correct a statement appearing in the last issue that **Louis H. Erb, '22**, had accepted a position as Deputy Registrar of Contractors for California. Erb is still very much employed by the Pacific Telephone and Telegraph Company, and the Staff regrets any embarrassment caused him by the erroneous statement.

— T —

Cover

Upper left—

Diesel tractor pulling harvester.

Upper right—

Basalt crushing plant using diesel power.

Lower left—

Diesel powered pumps for municipal water supply.

Lower right—

Diesel tractors pulling carryall scrapers on highway grading project.

—Photographs courtesy of Caterpillar Tractor Company, Peoria, Illinois.

John E. Shield, '22, is to function as social chairman, a position for which he is especially fitted as he had charge of the Annual Field Day. He has scheduled outstanding meetings for the coming year as listed on page one.

Theodore C. Coleman, '26, who was in charge of the annual Seminar Week-End, is to head a new committee on Campus Relations, which will further contacts between Alumni and students for their mutual advantage.

ASSOCIATION GROWS

We are beginning the Alumni Activities for 1938-1940. You are reading the first issue of the Alumni Review of the new year which brings you news of old classmates, technical articles of interest, book reviews by members of the Institute faculty and many other interesting articles. **This issue of the magazine is being sent to all Alumni. Hereafter copies of the Review and notices of Alumni meetings will be sent only to paid members of the Association.**

Last year was a banner year for the Association, membership reaching a total of 1025 members, 160 more members than ever before. You will recall the many fine events and meetings held last year, such as the Seminar Week-End, the Annual Stag and Field Day, the dance at the Biltmore Hotel, the Technicolor lecture, and the Annual Commencement Day Banquet. Other 1938-1939 highlights were the publication of the Alumni Directory, excellent results of the Alumni Placement Service, and the publication of four excellent issues of the Alumni Review.

This is evidence of the Association's activities during the past year, and since "coming events cast their shadows before," the year 1939-1940 promises abundant returns to members of the Alumni Association. Why hesitate and lose out on part of the year's activities?

Annual dues are \$2.50. Life memberships are available for \$50.00 cash, or on a 5 year plan with payment of \$11.00 annually, or on a ten year plan with payments of \$6.00 annually. If you have not paid your dues as yet, send them at once to take advantage of:

1. Alumni Placement Service which aids members in securing better positions, as well as work for the unemployed.
2. The Alumni Review.
3. Monthly educational and social meetings.
4. Fourth annual Alumni dance.
5. Third annual Seminar Week-End.
6. Annual Stag and Field Day.
7. Alumni Directory of which there is a limited supply available for new members, as long as the supply lasts.

Paul C. Schaffner, '37.

Chairman, Membership Com.

— T —

CONTRIBUTOR

O. Franklin Zahn, better known as "Ozzie," was graduated from the Institute in 1930, and then was a graduate assistant at Pennsylvania State College, working in the Oil Spray Laboratory. He received the degree of Master of Science in 1932 from Penn State, and was also elected a member of Sigma Xi.

In 1932 "Ozzie" went to work for the ExCellO Corporation at Detroit, Michigan, which was the first American Company to manufacture a stock fuel injection pump for diesel engines, while the pump was in the development stages. He has worked on improvements in the pump and on applications at engine builders' laboratories in Detroit, Milwaukee and other Wisconsin plants, Chicago, and also at New York, New Jersey, and Ohio diesel plants. In 1936 he visited several diesel laboratories in Europe. At the present time he is in San Diego doing technical writing.

A LOOK AT THE DIESEL SITUATION

By O. FRANKLIN ZAHN, JR., '30

"The amazingly rapid development of the light, high-speed engine is the most outstanding single achievement in the development of the internal combustion engine" . . . this from a celebrated British mechanical engineer. However far we go in agreeing with this statement, we must admit that this progress "is a development . . . almost of the last ten years."

For a comparatively long period, from 1897 when a diesel first ran in one piece, until 1925, the diesel was a purely capital goods product, and applied as a large, heavy, slow speed unit to motorships, oil pumping stations, generating plants, submarines, and a few switching engines, etc. Then about ten years ago a small, lightweight, high speed diesel appeared in large quantities in Germany and England, and showed its face elsewhere, including this country.

Diesels were being applied to automotive applications such as trucks, tractors, and small motor boats where previously only a few experimental models existed. Since 1931 one American company alone has produced 2,500,000 horsepower in small diesels where previously it produced none. Almost all of the diesel streamliners have been put into service in the last five years.

CHANGE IN THINKING

The interesting thing about this tremendous growth is that it has come about because of a change in thinking rather than because of any changed economic condition, a change in thinking on the part of engineers the world over who dealt with the internal combustion engine. Formerly, an engineer was not considered well educated unless he "knew" that a diesel engine was inherently an efficient but slow-speed, heavy and expensive engine, practical only in large sizes. Until about 1925 the diesel remained exactly that, but today we realize that those were qualities in our thinking and not inherent in the diesel itself. Today diesels whose top speed is 4,000 R.P.M. are sold in France, whereas one-fifth that speed was considered high ten years ago. This same engine has a displacement of only 27 cubic inches per cylinder, which is less than that of any American six cylinder passenger car engine. Germany has for several years used diesels in commercial airline operation weighing two pounds per horsepower. It is true these examples are the super-

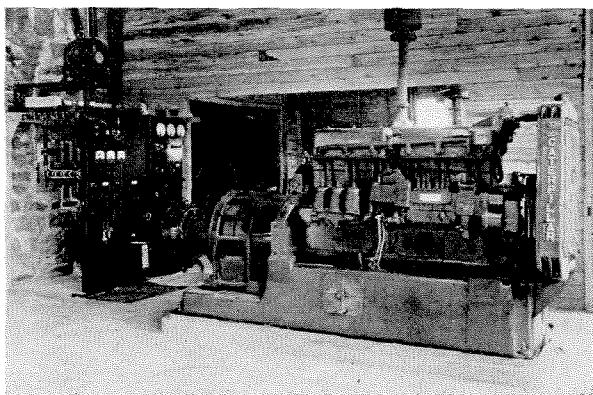
latives to date, but at least they are commercial realities and not sporadic laboratory performances.

When Americans first realized about a decade ago that the theretofore sedate diesel was capable of far more than the inhibitions which chaperoned it in the past had permitted, there was naturally a wave of enthusiastic reaction. The ballyhoo that swept over the diesel industry at the start of the present decade was hardly more conducive to level headed, orderly development than were the previous prejudices. Today, however, the diesel is being evaluated more from middle ground. We know the diesel has certain capabilities and certain limitations, not necessarily "inherent," but definitely present.

HIGH EFFICIENCY

The primary advantage of the diesel has been and still is its operating efficiency. Fig. 1 shows a comparison of fuel consumption of typical diesel and gasoline motors. Not only has the diesel a lower curve but it has a flatter curve over the load range. In a truck application where the engine operates over a wide load range the diesel shows the greatest advantage, operators finding that the diesel truck gets 80 per cent more miles per gallon than the gasoline truck, in addition to the fact that the fuel costs less. The second most important advantage of the diesel is its reduced fire hazard, a factor which was mainly responsible for the U. S. Navy converting its shore boat fleet from gasoline to diesel. Other items, as the reduced carbon monoxide in the exhaust are advantages in special applications as mines, are not important generally.

The chief disadvantage of the present diesel is its first cost. In spite of all our progress the diesel is still more expensive to build than either the large steam plant or the small gasoline engine. For this reason it is necessary for the diesel to run a minimum number of hours per year to show economy over other power. For example in England, where there is the American equivalent of a tax of 13 cents per gallon on both fuel oil and gasoline, a London omnibus must run at least 22,000 miles per year to pay as a diesel. Diesels still weigh more than the equivalent gasoline engine, be it aircraft, truck, tractor, or marine service.



Diesel Engine and 60 K.W. Generator

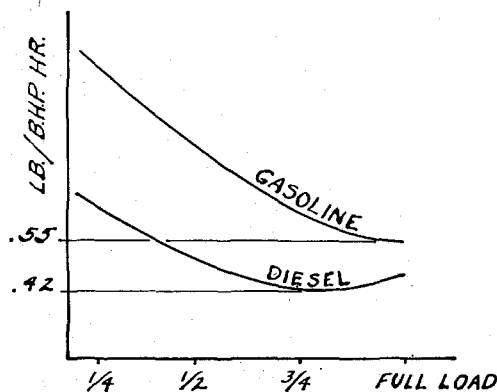


Fig. 1—Load Economy Curves for Diesel and Gasoline Engines.

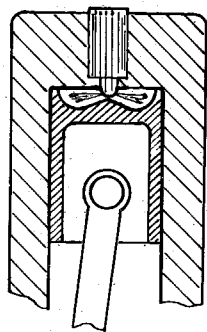


Fig. 2—Direct Injection Chamber.

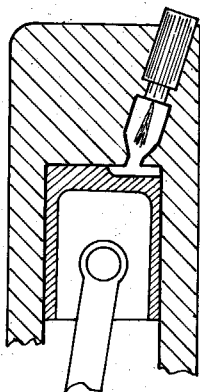


Fig. 3—Ante Chamber.

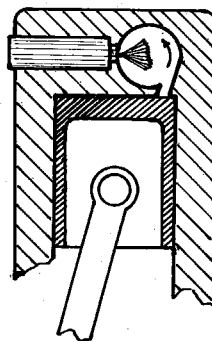


Fig. 4—Swirl Chamber.

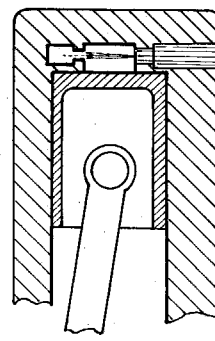


Fig. 5—Energy Cell Chamber.

In the small diesel the starting problem is quite a disadvantage. A diesel of say 75 horsepower needs about one-fourth that power to crank it at low temperatures, necessitating either a huge 24 volt starting system or a small gasoline motor with a clutch which is engaged after the gasoline motor has been started by hand.

Diesels are not only noisy, but rough, due mainly to the fast rate of combustion. This gives a big torque fluctuation, especially at low speeds, and a 75 H.P. diesel in a truck will usually require a heavier clutch, transmission, and rear axle than a 75 H.P. gasoline engine. In most cases, but not all, the servicing costs of the diesel are higher than those of the power it replaces. On streamliners running between Chicago and the Pacific Coast it is customary to shut off one engine while going down grade from the Rockies to remove all its pistons, clean the carbon, and inspect the rings. It is only by such servicing that these trains maintain their high availability and annual mileage.

The big field for the technician today is in attacking these very problems, most of which are tied in with the injection and burning of the fuel. In fact, nearly all of the important progress in getting diesels to their present usefulness has come of work on injection systems and combustion chambers. The study of this problem is somewhat new; it may be an art, but it is certainly far from a science. Most of the laboratories have been engaged in a cut-and-try *search* rather than a *research*, but even so their results are of interest.

A diesel engine is, by definition, one in which combustion starts by compression-ignition. A full charge of air is compressed to about 1,000° F., or nearly a dull red heat in metal, into which fuel oil is sprayed at a velocity of several hundred miles per hour. The amount of this fuel oil is very small by volume, being a maximum of about 1/14,000 of the cylinder displacement which in a passenger car sized engine amounts to a cube about 1/7 of an inch on a side. More than this small amount of fuel will not burn completely but will cause the exhaust gases and the engine parts to become black with carbon, and lowers the efficiency. Even to burn all of that little charge we have to break up the fuel into millions of droplets whose combined surface is several hundred times that of the hypothetical cube, hence the high spray velocity, and hence injection pressures of often over a ton per square inch.

INJECTORS EXPENSIVE

Parts to handle such small volumes and big pressures are expensive. Injection equipment for a diesel costs more than a complete gasoline engine of the same power, and it is this equipment that is largely responsible for the high first cost of the diesel engine. The situation has been rather unfortunate for the consumer; engine builders could not sell in quantities until they could buy cheaper injection pumps and nozzles, and the makers of this equipment could not sell cheaper until the engine builders bought in quantities. The net result has been that many engine builders, even though not well equipped to make parts accurate to within 20 millionths of an inch, began making their own pumps and nozzles, compromising by saving selling and handling costs. In many cases this saving was small compared to the possible saving that could be effected by having a very few companies produce in large quantities injection equipment designed for mass production. However, with production on all sides increasing, this situation is being constantly improved.

The newly announced General Motors small diesel is of interest from a cost viewpoint since this engine, while not new in a technical way, is unique in a manufacturing way. Mass production will be achieved by the high interchangeability of parts. One single cylinder injection system and one cylinder size only will be made, but these will be made into 3, 4, and 6 cylinder model engines. Thus the principal variation among all models will be length, offering big possibilities for low production costs.

COMBUSTION PROBLEM

The problem of good combustion has been one of intimately mixing the fuel and air at the proper time. Some combustion chambers are designed so that the fuel must find the air, others so that the air meets the fuel more than halfway. In the first case the nozzle must direct the fuel to all parts of the combustion space, as shown in Fig. 2. This type of chamber is used by Cummings and General Motors. Several spray orifices of only a few thousandths of an inch in diameter are used. Since their cross-sectional area is naturally fixed, the injection pressure goes up as the square of the engine speed, and it is interesting to note that pressures well over 25,000 pounds per square inch have been recorded in the G. M. nozzle.

(Continued on page 10)

ALUMNI ACTIVITIES

SEPTEMBER MEETING

The first meeting of the year is scheduled for September 22nd, and will be interesting and enlightening, as well as being somewhat out of the ordinary for most Alumni. The subject of the meeting is "Geophysical Prospecting," about which most of us could know considerably more than we do. Speakers are Herbert Hoover, Jr., head of the United Geophysical Co., and Dr. Raymond A. Peterson, '31, who is associated with him.

It will be held at the Mary Louise Tea Room, located on the top floor of Barker Bros. Building, Seventh and Figueroa Sts., Los Angeles. Free parking is available on the lot adjoining Barker Bros. on the south. The auditorium adjoining the tea room, in which the meeting will take place, will seat 250, so don't be bashful about attending.

— T —

OXY GAME

Following a custom instituted in recent years, there will be a gathering of Alumni, their wives, sweethearts, and families immediately following the Oxy game which takes place in the Rose Bowl on Saturday night, October 21st. Detailed plans are as yet incomplete, but the gathering will probably take the form of a dance. Arrangements are in the capable hands and fertile brain of past President Ed Kinsey, '26 who may spring anything.

This occasion is a "home coming" to many Alumni, so all that is necessary is to advise them where to get together. When the arrangements are completed you will be advised, — in ample time. In the meantime save the date, October 21st.

— T —

JUNE BANQUET

The annual Commencement Day Banquet of the Alumni Association was held at the Athenaeum on June Ninth and was attended by over two hundred alumni, especially honoring the reunion classes of 1914, 1919, 1924, and 1934.

The results of the annual election of officers for the coming year were announced and the retiring officers were given a huge ovation for the successful program accomplished. Guests of honor included Mr. Allan C. Balch, President of the Board of Trustees, Dr. Robert A. Millikan, Lloyd Goodmanson, student body president and basketball captain, and the captains of the football, baseball, track and tennis teams.

Prof. Franklin Thomas delivered a talk on the "Report to Engineering Committee of Institute Associates" covering the status of the engineering department which is reported more fully elsewhere in this issue.

Dr. Henry Borsook, professor of biochemistry, addressed the assemblage on "Social Consequences of Biological Engineering." Doctor Borsook described the present status of knowledge in the biological sciences and the implications of the use of such knowledge, especially of nutritional needs and vitamins.

SAN FRANCISCO

The San Francisco chapter has inaugurated the policy of holding regular weekly luncheon meetings held on Mondays at the Fraternity Club in the Palace Hotel in San Francisco, which all visiting alumni are cordially invited to attend.

At the time of the recent annual meeting of the American Institute of Electrical Engineers, the weekly meeting on June 26th had the largest attendance to date. Those present were Prof. R. W. Sorensen, F. W. Maxstadt, M.S., '25, Ph.D., '31, and F. C. Lindvall, Ph.D., '28, of the faculty, M. M. Barnes, '21, E. Koyen, x'21, L. H. Erb and H. G. Vesper, both of '22, F. J. Groat and D. F. Morrell of '24, W. B. Jones and M. C. Brunner, of '25, D. W. Keech, J. E. Kinsey, M. W. Edwards, S. Parnall, R. B. Bowman, A. B. Allyn and Maurice T. Jones of the class of '26, M. A. Baldwin, '27, A. J. Hazzard, '30, Paul Engelder and K. Pullen, both of '39, and J. H. Keyser, '40.

The San Francisco chapter held its annual Field Day on June 3rd at the Berkeley Country Club, the day being featured by a golf tournament followed by dinner in the evening, and card games.

— T —

WASHINGTON

The Washington group of the Alumni Association met on May Ninth last and were addressed by Lieut. Robert M. Losey, M.S. (My.), '35, M.S. (Ae.), '37, who is now assigned to the office of the Chief of Staff of the U. S. Army Air Corps.

Lieutenant Losey's topic was "Air Power," in which he traced the history of armament until the development of the modern high speed bomber which he said ranks with the invention of gunpowder in changing the character of warfare. After finishing his talk, a round table discussion was held.

Those in attendance at the dinner meeting were C. A. Bercaw, '18, W. Bleakney, Ph.D., '32, R. P. Bryson, M.S., '37, P. Harney, M.S., '35, and T. Southwick, '27, in addition to Lieutenant Losey.

The Washington group is planning to hold several meetings during the coming months, and any alumni near Washington or contemplating a visit there should contact Patrick Harney, 3717 Warren St., N.W., Washington, D. C.

— T —

NEW YORK

The New York group held its Annual Stag meeting at the Western University Club on the evening of June Ninth, the day of the annual Commencement exercises. The meeting was well attended and greetings were forwarded to the Institute, where the Alumni Banquet was being held at the Athenaeum.

Any alumni in the vicinity of New York are requested to contact Rea Axline, '31, The Metallizing Engineering Co., 21-07 41st Ave., Long Island City, as the group is planning a full program of interesting meetings throughout the year.

ALUMNI PROMINENT IN GOV'T. INSTITUTE

Each year the University of Southern California sponsors an Institute of Government which was held during the week of June 12th to 16th of this year. Its objective is to furnish new information to those engaged in governmental service as well as to build higher standards of public administration. Alumni of the California Institute of Technology have always played a prominent part in the proceedings, especially in the technical sections of governmental work.

In the Building Inspection Section, John E. Shield, '22 and Ernst Maag, '26 played a prominent part. Grant V. Jenkins, '24 served as a member of the committee for the Group Work and Recreation Sections. Markham E. Salsbury, '25 and Maxwell F. Burke, '27 were on the program of the Public Engineering Section, while A. P. Banta, M.S., '28 and Richard Pomeroy, '26 were on the program of the Water and Sewage Works Operators' Short Course.

In addition to above named sections, other fields of governmental operation and administration were covered such as Housing, Power Supply and Distribution, Personnel Administration, and Planning. The Institute of Government provided an opportunity for those in public service to improve their work technique, and next year's session is being awaited by those who attended this year.

— T —

In Memoriam

GRINNELL

Prof. Joseph Grinnell, '97, director of the University of California Museum of Vertebrate Zoology, died on May 28, 1939, at Berkeley, California, at the age of 62.

Professor Grinnell was one of the world's most eminent ecologists, specializing in the birds and mammals of California and Alaska. He was professor of biology at Throop for five years, and had been professor of zoology at the University of California since 1908.

At the time of his death he was editor of *The Condor* and fellow of the American Ornithologists Union, American Academy of Arts and Sciences, and of the California Academy of Sciences.

— T —

STORMS

Charles A. Storms, '23, died of cancer on August 22, 1939, at Rogers City, Michigan, at the age of 39. He is survived by his widow and four children. Until his illness, he was electrical engineer for the Michigan Limestone and Chemical Co. at Rogers City.

Mr. Storms was acquainted with his condition for some time before his passing and faced his destiny with courage as evidenced by a letter disclosing his reactions published in *Time* magazine for August 21, 1939.

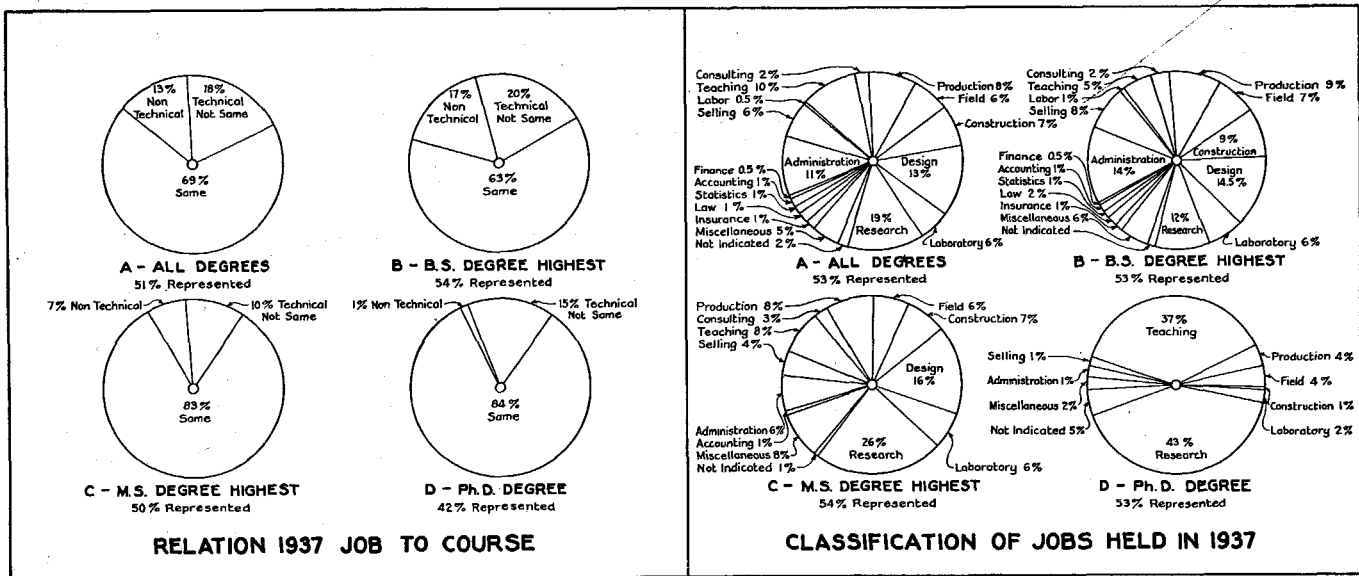
PARTIAL RESULTS OF THE 1937 ALUMNI SURVEY

By DONALD S. CLARK, '29, M.S., '30, PH.D., '34

Director of Placements

In April, 1937, a questionnaire was sent to all men who had received degrees from the California Institute of Technology during the period 1911 to 1936 inclusive. Within this period 1,872 individuals received degrees. Of these, 1,274 men received the B.S. degree without pursuing graduate work; 329

As a result of the survey much information has been accumulated, all of which it is impossible to set forth in these pages. The Editor of the Alumni Review has therefore selected certain charts and graphs which he believes will be of greatest interest to the Alumni.



men received the M.S. degree subsequent to their Baccalaureate degree; and 269 Ph.D. degrees were conferred. Some of these men were deceased, and the whereabouts of others was not known. Therefore, a total of 1,730 questionnaires were mailed. The statistics on the response to this survey are given in the following table:

	Sent	Returned	% Returns
B.S.	1190	667	55.5
M.S.	293	154	52.7
Ph.D.	247	132	53.2
Total	1730	947	54.6

The purpose of this survey was to determine what fields of endeavor the graduates had entered and how well they were doing. The questionnaire included 21 questions. For this survey each individual has been classified according to the highest degree he received from the Institute.

Relation of Job to Training

Many may wonder what proportion of the graduates stay with the type of work for which they were trained in school. This question is considered in the first chart. Of those who stopped their academic training with the B.S. degree, in 1937, 63 per cent were doing work in the field for which they were trained. The detailed record shows, as may be expected, that a larger proportion of the more recent graduates are in the field for which they received training, while the proportion for the earlier classes is less (actually about 50%). The group referred to as "Technical not Same" includes those men who were doing technical work, but in a field other than that for which they received their academic training. The same type of information is given for the M.S. and Ph.D. men. As might be expected, men who receive the higher degrees remain in the technical field.

(Continued on page 9)

ALUMNI YOU SHOULD KNOW

PHYSICIST

Carl David Anderson, '27, Ph.D., '30, is the most outstanding product of the California Institute of Technology in the scientific world. His work in the study of nuclear physics was climaxed by the discovery of the free positive electron on August 2, 1932, for which he was awarded the Nobel Prize in Physics in 1936. According to Dr. Millikan, himself a Nobel Laureate, "Dr. Anderson, too, though a very young man, has had other notable accomplishments in addition to the discovery of the positive electron. He is largely responsible for the initiation of the whole group of researches, now of world wide extent, by which the energies of cosmic rays were made directly and accurately measurable. He and Neddermeyer were the first to prove by direct photography that a gamma ray photon impinging upon the nucleus of an atom produces through that impact a positive-negative electron pair. He and Neddermeyer have also been the first to demonstrate that pair formation is not the sole mechanism determining the absorption by the nucleus of an atom of high energy photons or electrons." In addition to the award of the Nobel Prize in Physics, Dr. Carl Anderson has received the honorary degree of Doctor of Science from Colgate University, the gold medal of the American Institute of the City of New York and the Elliot Cresson medal of the Franklin Institute. His entire career has been at the California Institute of Technology where he now is Associate Professor of Physics. He is a member of the National Academy of Sciences and of the American Philosophical Society.



INVESTMENT EXECUTIVE

After a brief period of valuable experience in the commercial and engineering world, Theodore C. Coleman, '26, entered his chosen field, finance. Following receipt of his degree in Engineering and Economics, Ted served in the commercial department of Pacific Telephone and Telegraph Company, then was junior and later senior draftsman with the Los Angeles County Road Department.

In the spring of 1929, with the security business at a peak, he became a bond salesman for Blyth and Company in Pasadena. Just a year later came the well-remembered nadir. Offices were closed and only a few veteran executives were retained. But Ted, building for the future, took a brave step in arranging to open a Pasadena office for Banks, Huntley and Company. During depression years he developed the business, built an organization and served for one year as president of the Pasadena Bond Club. His success is evidenced by a series of scintillating accomplishments.

Today, Ted is vice-president in charge of sales and is a partner in the firm of Banks, Huntley and Company. Eight offices are maintained in California, two in New Mexico. Some 45 men are under his direction. He is currently director for California of the Investment Bankers Association of America, and is a director of the Cal Tech Alumni Association. At the Valley Hunt Club he finds time to enjoy tennis.



CAMPUS NEWS

TECH GRADUATES 238

Two hundred and thirty-eight students were awarded degrees at the annual commencement exercises held on June ninth on the campus lawn beside the Athenaeum. Thirty-two degrees of doctor of philosophy were given, fourteen of the candidates having been recipients of earlier degrees from the Institute, seventy-eight received degrees as masters of science, thirteen became bachelors of science in the five year courses of aeronautics and meteorology, and one hundred and fifteen received bachelor's degrees.

Of the graduating seniors, eleven were awarded Honor Keys for participation in student activities, and nine were graduated with honor by vote of the Faculty. Roderick M. McClung was the only graduate honored by both Faculty and the Student Body.

William C. Mullendore, Executive Vice-President of the Southern California Edison Company delivered the commencement address entitled, "Opportunity in the Forties," in which he touched on the American system of freedom and current trends. The Most Reverend John J. Cantwell, Archbishop of Los Angeles, delivered the Invocation and Benediction.

The degrees were conferred by Dr. Robert A. Millikan, who also delivered a report on the progress of the Institute and elaborated on the purposes of the new labor relations department.

Grand Coulee Pumps

One of the most important engineering research projects now under way on the campus are the pump testing investigations being made for the pumping installations at the Grand Coulee Dam in Washington. The project is sponsored by the U. S. Bureau of Reclamation and is directed by Robert T. Knapp, Ph.D., '29, professor of hydraulic engineering, with Donald P. Barnes, M.S., '30, as resident engineer for the Bureau.

The tests were undertaken as a consequence of the successful results of the investigations made for the Metropolitan Water District of Southern California. Whereas the Water District has eight pumping plants of 200 c.f.s. capacity for a total of 1600 c.f.s., each of the Grand Coulee pumps will have a capacity of 1600 c.f.s., and 12 units are to be constructed ultimately.

Sorensen Honored

Dr. R. W. Sorensen, professor of electrical engineering, received the award for the outstanding contribution in the field of public relations and education of the American Institute of Electrical Engineers at its annual meeting in June held in San Francisco. The award, which has not been made since 1935, was for his paper, "The Economic Status of the Engineer," published in *Electrical Engineering*.

Cosmic Ray Hunt

Dr. Robert A. Millikan, accompanied by H. Victor Neher, Ph.D., '31, and William Pickering, '32, Ph.D. '36, sailed for Australia and New Zealand last month to make an extended series of researches on the total cosmic energy brought to the earth at different latitudes, especially near the equator. In addition to work in Australia, tests will be carried on in Tasmania, Dutch East Indies, and India.

In these experiments a new type of instrument, developed by Neher and Pickering, will be used which transmits by radio signals to a ground station data gathered during the balloon flight, making unnecessary the return of the instrument. The principle involved is not new, but the method is expected to improve the accuracy of the results attained.

While in Australia, Doctor Millikan will deliver a series of twelve broadcasts for the New Zealand and Australian Broadcasting Commissions. In addition he will act in an advisory capacity on the development of industrial research.

PLACEMENT REPORT

The Alumni Placement Service during the year ending July 1, 1939, placed 166 men in positions, as compared to 146 the previous year, according to the annual report of Dr. Donald S. Clark, '29, Director of Placements. However, while the total number of placements is greater, the number of requests for applicants is less. A greater number of individuals registered as unemployed in the past year as compared to 1937-1938.

The Placement Service received 277 requests for applicants for full time positions. Men were sent to 242 of these requests, and 89, or 32% of the total number of requests were filled by men supplied from the Placement Service. During the past year 205 men were registered as unemployed, as compared with 138 for the previous year, while 41 were listed as unemployed as of July 1, 1939, against 31 on July 1, 1938, exclusive of the classes of 1938 and 1939.

CAMPBELL ELECTED

Dr. Ian Campbell, who is associate professor of petrology, has been elected to serve a five year term on the Executive Council of the Pacific Division of the American Association for the Advancement of Science, succeeding Dr. W. V. Houston.

Sturtevant Co-Author

Dr. A. H. Sturtevant, professor of genetics, is the co-author with Prof. G. W. Beadle of Stanford of a new textbook, "Introduction to Genetics," published by the W. B. Saunders Co., Philadelphia. Extensive use is made of recent studies on *Drosophila* at the Institute.

ENGINEERING OBJECTIVES

The Engineering Committee appointed by the Board of Trustees last January, as reported in the March issue of the *Alumni Review*, is making a study of engineering research and education at the Institute, and has received for its consideration a report from the members of the engineering staff.

The maintenance of a position of unquestioned eminence in both undergraduate and graduate instruction and the attainment of a position of unquestioned eminence in a few selected fields of basic engineering research are the aims of the Institute as reiterated by the engineering staff in its report to the Engineering Committee of the Institute Associates.

The present excellent standing which the engineering course has attained, notwithstanding its relative youth, rather meagre equipment, and small engineering faculty, is due to a consistent adherence to high scholastic standards and to the fortunate association with distinguished departments in the fundamental sciences, according to the report.

In order that the engineering courses, undertaken by 65% of the undergraduates, 75% of the candidates for the master's degree and 25% of the candidates for the doctorate, may compare favorably with the science courses and with other leading engineering colleges, the instruction staff should be strengthened, especially by the engagement of visiting lecturers pre-eminent in their fields.

Physical Needs

The need for additional physical facilities is most pronounced, as there is a serious shortage of suitable classrooms and much of the limited engineering equipment is obsolete. The limited number of items of modern equipment have been used to the utmost by staff, students, and industry and have resulted in some outstanding accomplishments.

The engineering staff pointed out that acute need exists for modern and more ample equipment for materials testing and the study of strength of materials, internal combustion and steam engineering, air conditioning and refrigeration, heat transfer, hydraulics and fluid mechanics, sanitation, physical metallurgy, electronics, and aerodynamics. The building for mechanical engineering would logically tie on to the present boiler plant and should be symmetrical with and parallel to the Guggenheim laboratory, while the buildings for materials, civil engineering and hydraulics could flank the driveway entering from San Pasqual Street. Space vacated in Throop Hall would provide much needed room for expansion of the electrical engineering department. Use of new equipment by industry would partly compensate for its cost.

VITAMIN B-1

John B. Hatcher, '37, is doing research at the Institute on the tracing of the course of Vitamin B-1 in the human system. In order to follow the vitamin it was made 'visible' by producing Vitamin B-1 from sulfur made radio-active by the cyclotron at the University of California, which was done by Dr. Edwin McMillan, '28. Hatcher uses himself as a 'guinea pig,' taking approximately two or three milligrams of the radioactive Vitamin B-1, and following the course through his body by means of Geiger counters.

1937 ALUMNI SURVEY

(Continued from page 6)

The next item of interest is the type of work in which the graduates were engaged at the time the survey was made. This information is given collectively in the second chart, which is self explanatory. It is of interest to note that 14 per cent of the men who received the B.S. degree were in administrative positions. With the higher degrees a larger proportion of the men were found in teaching and research.

The General Course, which was discontinued several years ago, contributed most heavily to the fields of accounting and statistics. Men in administrative positions pursued the courses in Mechanical, Electrical and Civil Engineering while attending the Institute. Those engaged in construction came principally from Civil Engineering. The principal source of men with the B.S. degree who were in research was Chemical Engineering. Graduates of the Mechanical and Electrical Engineering courses make up a large portion of those who were in the selling field. Most of the B.S. men who were in the field of teaching took their work in Physics and Electrical Engineering.

Starting Salaries

It is of considerable interest to study the variation of starting salaries from year to year. This information is given in the second graph. The results are given insofar as there was sufficient data. The medians were obtained from the distribution curves for each class. The effect of depression is easily recog-

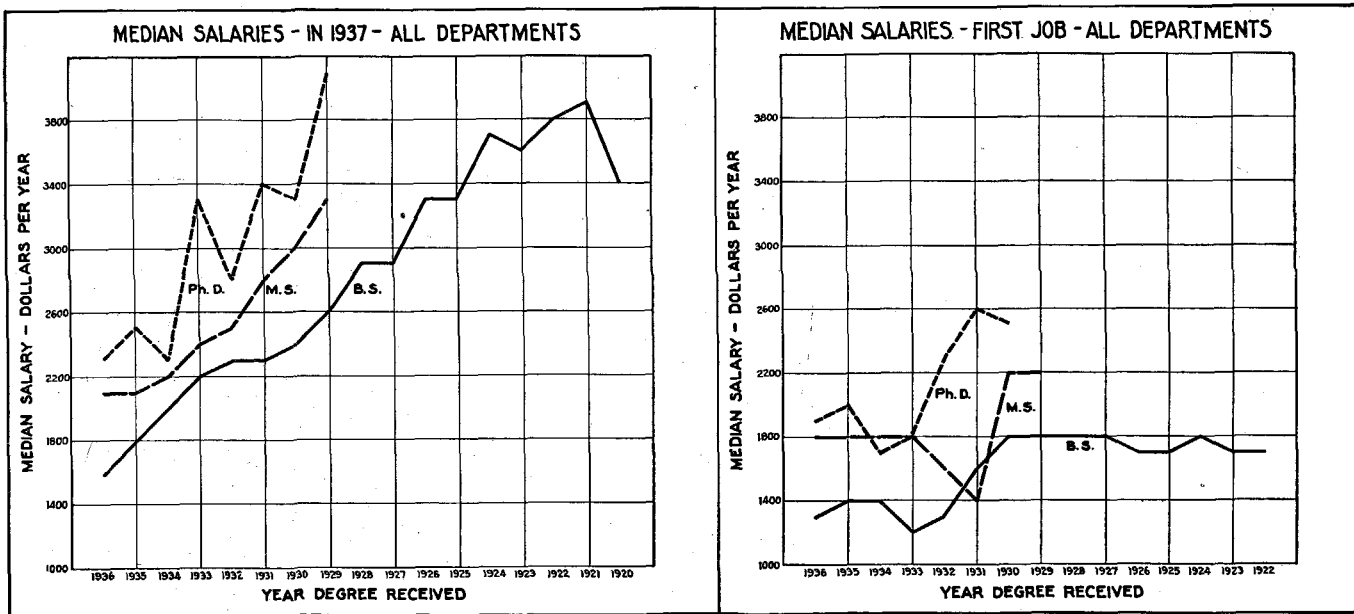
nized, and it may be significant to note that up to 1936 starting salaries had not returned to pre-depression values.

Each member of a particular class is interested to see how his salary compares with the median salary of his classmates. The median salary for each class is presented in the first graph. The range of salaries is from less than \$1,000 per annum to more than \$5,000 per annum. About 10 per cent of the men reporting were receiving in excess of \$5,000 per annum.

The results of this survey seem to indicate that graduates of the California Institute of Technology are in as good positions as graduates of other institutions. When considering these results it must be remembered that the data is only a sample of each class, and whether it is representative is a matter of some speculation.

Consideration should also be given to the fact that the California Institute of Technology is relatively young, and since 1911 many changes have occurred in curriculum and policy. The Institute has been and still is growing, and its reputation has been and is in the process of being made by its graduates. A survey several years from now may be more illuminating and a more accurate representation of progress.

Appreciation is extended to the alumni who so willingly filled out and returned the questionnaires, thus making this survey possible.



DIESEL SITUATION

(Continued from page 4)

The type of chamber in which the air also seeks out the unburned fuel droplets is called the "divided chamber" as distinguished from the "direct" type just mentioned. Fig. 3 is a divided chamber of the ante-chamber or precombustion chamber design, and is similar to that manufactured by Caterpillar and International Harvester. More of these engines have been built in this country by these companies than all others combined. Here we have a chamber in which the object is to provide a high air velocity through the throat connecting the two halves to mix the fuel and air before and during combustion. A single orifice nozzle is used. Fig. 4 shows a form of the rotational swirl type of chamber, similar to the designs made by Fairbanks-Morse, Hercules, and Waukesha in this country. As the piston rises, the air rushing through the throat into the spherical chamber gives itself a high rotational swirl, into which a single spray is injected. It has been found that the R.P.M. of the air should be about 25 times that of the engine. Over 2,000,000 horsepower of the swirl type are in use today throughout the world.

Fig. 5 shows the energy-cell chamber and is the design built by Buda, and by Chrysler and Mack Truck in their recently announced diesel trucks. Here a very narrow spray shoots across a gap over the center of the piston into a cell which contains only a small part of the total air of the chamber. High air velocities begin after combustion first starts, and a jet of burning gas meets the rest of the spray from the nozzle and mixes it with the remaining air. Pressures well over 1,000 pounds per square inch occur in the cell only.

The direct injection chamber has the advantage of a lower heat loss from the gas to the cooling water, since the ratio of surface to volume is lower than in the divided chamber and the turbulence is less. Because of this the economy of the direct type is usually higher and cold starting is easier. To assist starting in the divided type a "glow plug" is often used. This is a small loop of resistance wire which is placed near the spray and heated electrically red hot before the starter button is pushed.

Most diesels running over 2,000 R.P.M. are

of the divided type, since that design provides an air turbulence that increases with speed, thus keeping the combustion period somewhat constant in terms of crank angle. The divided chamber is thus a more "flexible" engine, but more than that, it is often the quieter and smoother of the two since the mixing of air and fuel can be better controlled. Where the entire burden of mixing is not put on the injection system, injection pressures can be lower and the system made cheaper. Also, the single orifice nozzle usually used with such chambers can be made in the variable area type, so that as the speed increases excessive pressures do not result.

On the other hand, the direct injection type lends itself to 2 stroke design very well, and by this means rather than by mere high speed more power can also be obtained per unit weight of the engine. Several manufacturers of large diesels, and General Motors in the small field, make use of the 2 stroke principle, adding a blower to the engine to scavenge out the exhaust gases and in some cases to give a supercharge. Since in the diesel we are scavenging with pure air the problem is greatly simplified over that of the 2 stroke gasoline engine where much of the incoming mixture was lost in the exhaust with the burnt gasses it was attempting to push out.

DIESEL FUTURE

What of the future of the high speed diesel? In the railroad field it seems destined to supplant the reciprocating steam engine, now that it is a lightweight powerplant, as surely as it has this engine in the marine field. However, we have given it every known advantage in the form of a special lightweight, streamlined train, and it competes against locomotives that are our most inefficient prime movers thermodynamically in use today. Shortly we are to see how it stacks up against really modern steam railroad equipment.

For aircraft use, the spark ignited engine has so far been two jumps ahead of the diesel on specific weight. In the laboratory it is using "safety fuels" which compare well with diesel fuel oil for fire safety. In

the laboratory it is also ahead in efficiency; a standard aircraft engine, using 100 octane fuel instead of gasoline, and special pistons and supercharger gears has shown an economy of 0.35 pounds per brake horsepower hour. As to specific output, spark ignition test engines have produced 540 lb./sq. in. brake mean effective pressure. In the face of such spectacular performances there is little incentive for diesel aircraft development, although a number of excellent engines have been built commercially the world over that a few years ago would have been satisfactory for American aircraft use.

As for passenger car applications, at present the diesel is too expensive in first cost to be economical, even with the present price differential between gasoline and fuel oil. Possible economy would seem to be its sole advantage for such use. Some years ago an American automobile manufacturer offered diesel power as an option, but apparently without success for the option was soon withdrawn. In Europe such cars are available, five manufacturers are offering diesels suitable, by European standards, for passenger cars. The advantages for taxi service in Europe, where gasoline costs several times what it does here, seem excellent. Americans have been spoiled by fine gasoline motors, and even the best of diesels when installed in a passenger car seems at low speeds rather rough and noisy, though at high speeds it is impossible to detect the difference.

The next big field for the American diesel would seem to be the light truck. The engines for these may not be more efficient than the diesels available in the past, but they will be cheaper. Until the diesel is satisfactory for this field it probably will not be so for passenger cars.

Besides becoming cheaper, the diesel will continue to become cleaner burning, more flexible, smoother, lighter, and easier to start. American ingenuity will continue to "make it better and cheaper." Some men today say we know too many facts about effects, too few about causes. Others say we know all the facts we need but don't know how to use them. The improved diesel of tomorrow will probably be indebted to both these groups.

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BOOKS

REFUGEES FROM THE DUST BOWL

THE GRAPES OF WRATH

By JOHN STEINBECK

FACTORIES IN THE FIELD

By CAREY McWILLIAMS

Reviewed by Prof. William Huse

It is a fortunate coincidence that these two books were published within a few weeks of each other. Dealing with the same general material—migratory farm labor in California—they furnish an interesting contrast between the method of the novelist and the factual analyst. Furthermore, they supplement each other. Mr. Steinbeck is concerned with the human values of a single family, while Mr. McWilliams supplies the background which makes the vicissitudes of that family understandable in terms of social and economic forces.

Perhaps it is more than coincidence that is responsible for the almost simultaneous appearance of both these books. They may be symptomatic of a rapidly increasing awareness of the migratory labor situation as one of the most urgent problems which confronts the state of California, and a concern over finding a real solution.

Whoever has seen on the highway an ancient automobile stalled or wheezing uncertainly along, its sides hung with battered household effects, and an incredible number of people stowed among bedding-rolls, has seen the subject of Mr. Steinbeck's novel. He introduces us to the Joad family while they are still in Oklahoma. Dispossessed by drought and mechanized farming, they join the horde of westward migrants. Three generations of them load their meager possessions into an ancient truck and start for California. They look forward to a promised land where there will be plenty of work in the orchards or in the cotton or vegetable fields, and where they will be able eventually to realize their modest utopia of a cottage with screens and land of their own to work.

The first section of the story, which describes their preparations for leaving Oklahoma and the start of their westward trek, has a grotesque, earthy humor which is reminiscent of Erskine Caldwell's *Tobacco Road* and *God's Little Acre*. But as the family proceeds westward, the tone becomes more somber; and their story is one of increasing tragedy as their hopes are cruelly disappointed and the family group disintegrates.

The values that Mr. Steinbeck finds in them are first of all courage, and next to courage a common humanity which unites them in sympathy and generosity with others as unfortunate as they. Their courage is best exemplified in Ma Joad, who refuses to give up hope even in the face of the most staggering disappointments; their humanity, in their willingness to share whatever they have, however meager, with anyone in distress.

As brief a review as this cannot convey the power of individual scenes, the range and vividness of character presentation, or the passionate sincerity with which Mr. Steinbeck unfolds this saga of social injustice. But in spite of the unquestionable power of the story, it has, to my mind, the defect which is almost inevitable in

propaganda fiction. Such fiction, if it is to engage our sympathies, must present its problems in terms of specific human beings. But at the same time, the activities through which its characters move must be sufficiently representative so that they convey a whole general situation. The result is that the characters tend often to lose their reality as individuals and become symbols of larger forces or relationships. This defect appears most strikingly, I think, in the preacher who accompanies the Joads on their hejira; and it certainly is responsible for the pathos of the last episode.

Complex Forces

The complex of social and economic forces which is to blame for the plight of the Joads and their thousands of fellow-refugees from the dust-bowl is the subject of Mr. McWilliams' analysis in *Factories in the Field*. A long interest in the problem of migratory labor in California, and his experience as California Commissioner of Immigration and Housing give weight and authority to his analysis. His fundamental thesis is that the migrant hordes from the Dust Bowl present only a further and more acute manifestation of a problem which has been a characteristic of California economy since the middle of the 19th century. The problem is caused, he believes, by large-scale land-holding in the state, which has made farming essentially an industrial enterprise, with a labor problem like that of any other large industry, only more difficult because of the seasonal nature of the work.

Hitherto, the problem has never been really acute because it has mainly involved aliens — Chinese, Japanese, Filipinos, Hindus — who were relatively powerless to resist repression and exploitation. But with the coming of the dust-bowl emigres, Mr. McWilliams points out that the expedients of the past will no longer suffice. For one thing, there are far larger numbers of people to be dealt with. But more important, they are Americans. Trying to ignore them by asserting that they are of inferior stock is as futile as trying to dispose of them by denying them relief. And they are not likely to submit indefinitely to the terrorism of local vigilantes and the denial of their constitutional rights. In Mr. McWilliams' view, the only solution must come through eliminating the cause of the whole migratory labor problem — that is, by breaking up large landholdings and de-industrializing California agriculture.

Whatever the ultimate solution, both of these books under discussion perform a valuable service. Mr. Steinbeck's *Grapes of Wrath* has already had, at a very conservative estimate, over half a million readers; he has made them aware, in a dramatic and forceful fashion, that an urgent problem exists. With public opinion thus mobilized, the way is prepared for such analyses as *Factories in the Field*, which are essential if any humane, equitable solution is ever to be found.

NEWS OF CLASSES

Conducted by George Langsner, '31

Have you any bit of news about yourself or fellow Tech men? Marriages, births, promotions, job changes, papers published, honors received are all items of interest to the rest of us so write your information on a penny postcard and address it to the Editor, CALTECH ALUMNI REVIEW.

1918

M. J. Dowd, Chief Engineer and General Superintendent of the Imperial Irrigation District, addressed the annual convention of the American Society of Civil Engineers in San Francisco last July on "Silt Problems of the Imperial Irrigation District Resulting from the Completion of Hoover Dam."

Frank Capra has organized Frank Capra Productions, Inc., in association with Robert Riskin. Capra and Riskin teamed together for six years turning out such successes as *It Happened One Night*, *Mr. Deeds Goes to Town*, *Lost Horizon*, *You Can't Take It With You*.

1920

Harry P. St. Clair, who is with the American Gas and Electric Service Corporation, addressed the annual convention of the American Institute of Electrical Engineers in San Francisco in June on "The Use of Multi-Winding Transformers for System Voltage Regulation."

1921

Dr. Arthur L. Klein, who is associate professor of aeronautics at the Institute, addressed the Los Angeles section of the American Society of Mechanical Engineers last May on the design of equipment and apparatus used in aeronautical testing and research.

1922

Kellogg Krebs, x22, has been appointed assistant resident manager of the Azusa, Calif., office of the American Cyanamid and Chemical Corporation.

Linne Larson was recently promoted to Captain in the Engineer Reserve Corps, U.S.A., and recently completed a tour of active duty at March Field, California, with the 604th Engineer Battalion.

1924

Oliver W. Kilham has been appointed chief engineer of the American Pipe and Steel Corporation at Alhambra, California. **Colin W. Timmons**, x23, is president of the Corporation.

1925

Neal D. Smith has been appointed City Manager of Ontario, California, and he will also act as City Engineer, head of the Water Department, and Superintendent of Streets.

1926

J. Edward Kinsey has been named as a member of the executive committee of the Los Angeles Community Chest, and will again head the Business Division in the forthcoming campaign.

Ivan Farman, who is a 1st Lieutenant in the U. S. Army Air Corps, received his master's degree in meteorology at the Institute in June and has been assigned to

March Field, California, where he is Weather Officer.

1927

Dr. John H. Maxson, who is assistant professor of geology at the Institute, was married to Miss Helen Ward in Pasadena on September 6th.

Dr. Carl D. Anderson spoke over the Columbia Broadcasting System network on June 5th on a Science Service program from Washington, D. C., discussing cosmic rays and the positron.

Dr. Frank A. Nickell, geologist for the U. S. Bureau of Reclamation, discussed the geology of dam sites at the recent convention of the American Society of Civil Engineers in San Francisco.

Florent H. Bailey, who is with the Pantepec Oil Company at Caracas, Venezuela, flew to Miami and visited the Institute to interview civil engineering and geology graduates for his company.

Borice Z. Boris is the father of twins, Alan and Barbara, born on August 7th in Los Angeles.

1928

Arnold O. Beckman, Ph.D., has been elected a councilor of the Southern California Section of the American Chemical Society.

Carlos L. Corcuera, x28, is manager of refineries for the Mexican government, and as such was mentioned in the recent Saturday Evening Post article, "What Has Happened to Mexico's Oil." One of his assistants at the Aguila refineries is **Alfonso C. Bulnes**, x33.

Joseph Ficklen, chemical engineer for the Travelers Insurance Company, is author of a book, "Some Methods for the Detection and Estimation of Poisonous Gases and Vapors in the Air," which is published by Service to Industry, Hartford, Connecticut.

G. Austin Schroter, x28, manager of Mines and Exploration of the Filtrac Corporation, presented a paper on recent trends in absorbent clay technology at the Golden Gate meeting of the American Ceramic Society in San Francisco, August 11th.

Edward Joujon-Roche is the father of a daughter, Ann, born on July 21, 1939.

Philip Durfee is on active duty with the U. S. Army Air Corps as a first lieutenant and is stationed at Hamilton Field, near San Francisco.

Albert E. Lombard, Jr., received his doctor's degree from the Institute in June, and he has been appointed assistant professor of aeronautics at the Institute.

1929

Samuel Olman is now on the engineering staff of C. F. Braun and Company at Alhambra, Calif.

Harlan Asquith has accepted a position in the design department of the Vega Aircraft Corporation at Burbank, Calif.

William H. Mohr has been promoted to a captaincy in the Engineer Reserves, and recently completed a tour of duty at March Field, California.

Robert T. Knapp, Ph.D., professor of hydraulic engineering at the Institute, de-

livered a paper on "Design of Curves for High Velocity Open Channels" at the annual convention of the American Society of Civil Engineers, a topic which he discussed at the Alumni Seminar last March.

Reymond Kircher, who is with the Bell Telephone Laboratories, was a recent visitor to the Institute.

Nicholas M. Oboukhoff, Ph.D., who is research professor of electrical engineering and professor of mathematical physics at Oklahoma Agricultural and Mechanical College, addressed the Fifth International Congress for the Unity of Science meeting at Harvard University early this month on, "Empirico-Logical and Teleological Factors in Engineering." Professor Oboukhoff has recently been appointed a member of the Committee on Research of the American Institute of Electrical Engineers, and is the author of a paper entitled, "A Method of Designing Medium and High Frequency Alternators. The Experimental Predetermination of the Ratio of Maximum to Minimum Induction Flux," published by the Engineering Experiment Station at Oklahoma A. & M. College last June.

Thomas H. Evans, who is assistant professor of civil engineering at the University of Virginia, vacationed in California.

J. Clark Sutherland, who is geologist for the Pacific Clay Products Company of Los Angeles, has been appointed Pacific Coast representative of the Committee on the Geology of Industrial Minerals of the National Research Council. The Committee has been established as part of the program to gain and disseminate information on the industrial minerals particularly those of a strategic value in time of war.

1929

Lawrence J. Grunder has been elected councilor of the Southern California section of the Society of Automotive Engineers for the coming year.

Willard A. Findlay sailed early this month for Karachi, India, where he will be geologist for the Standard Oil Co. of California. Findlay has previously seen duty in Australia and Portuguese East Africa.

1930

Francis D. Bode has returned to his duties as instructor in geology at the Institute after being on leave for two years doing geological mapping and exploration in North Africa. The greater part of his work was in Ethiopia, following the Italian occupation, with the last six months being spent in Egypt.

Robert W. Wilson is now an instructor in geology at the University of Colorado, and was in charge of classifying fossils uncovered in the vicinity of Lake Mead for the National Park Service during the summer.

R. Stanley Lord, assistant hydraulic engineer for the Water Resources Branch of the U. S. Geological Survey, has been transferred to the Washington headquarters of the Survey.

Donald P. Barnes, M.S., of the U. S. Bureau of Reclamation, discussed hydraulic testing at the recent convention of the American Society of Civil Engineers.

Robert Ramey, x30, was married to Miss Muriel Rolls in San Francisco on June 3rd.

1931

Sam Eastman wishes to announce that the firm of Dozier Graham Eastman, specializing in advertising and merchandising counsel on industrial and technical products, has moved its offices to the Bendix Building in Los Angeles.

George Rice, III, was married to Miss Onis Danielson in Los Angeles on June 18th.

1932

Brian Sparks, who is a co-pilot for Pan-American Airways, on the Transpacific route, addressed the student body of the Institute last May on "Flying the Pacific."

J. H. A. Brautz, Ph.D., engineer of the U. S. Bureau of Reclamation, delivered a paper on "Determination of Stress by the Use of Indirect and Mathematical Methods" in the Symposium on Masonry Dams at the recent convention of the American Society of Civil Engineers, and discussion on his paper was led by **Carl H. Heilbron, '25**, associate engineer, U. S. Engineer Office, Los Angeles.

William H. Claussen is the proud father of a daughter, Jane, born on July 27th.

1932

William Bergren is assistant conductor of the Pasadena Musical Festival Chorus which presented a performance of Handel's oratorio, "Jephtha," at the Pasadena Civic Auditorium last June.

1933

Louis A. Pipes, who is a member of the engineering faculty at Harvard, presented a paper on "Transformation Theory of General Static Polyphase Network" at the annual convention of the American Institute of Electrical Engineers.

Gregory K. Hartmann received his doctor's degree from Brown University last June.

1934

Robert P. Sharp has been doing research work in the Ruby Mountains of Nevada during the summer under a grant from the Geological Society of America.

Roland Escherich was married to Miss Jeane Cortner on July 21, 1939. He is a member of the firm of Escherich Bros., who are the contractors on a \$200,000 group of buildings for the U. S. Army Air Corps at March Field, California.

Ray E. Kidd was married to Miss Dorothy Ingalls in Scotia, N. Y., on June 7, 1939.

Walter Howland and **Gilbert McCann** received their doctor's degrees from the Institute in June.

1935

Norman B. Dewees was married to Miss Sally Redington on June 24th, in Pasadena.

Nelson P. Nies received his doctor's degree from Western Reserve University in June, and is teaching at the Polytechnic Institute of Brooklyn.

James B. Stoddard was married to Miss Florence Estill Alden in Los Angeles on July 12, 1939.

Frank J. Malina, M.S., was married to Miss Lillian Maty Darcourt in Pasadena on June 24th.

Horace Davenport and **William McLean** received their doctor's degrees from the Institute in June.

Wallace Johnson is now machinery sales engineer for the Moore Machinery Co. in Los Angeles.

Robert John Hallanger was married to Miss Virginia Van Arsdale in Riverside, California, on September 9th.

Claude T. Scott was married to Miss Lynn Hargett in Yuma, Arizona, on June 23rd.

1936

Everette E. Griffith was married to Miss Dorothy Doig Donaldson in Pasadena on June 30th.

Thomas Lauritsen, who received his doctor's degree from the Institute in June, has been awarded a traveling fellowship and is doing advanced study at Copenhagen under Dr. Nils Bohr, one of Europe's most brilliant theoretical physicists.

Paul H. Hammond was married to Miss Olena Estella Beardsley in Visalia, Calif., on April 9, 1939.

Wilson H. Bucknell was married to Miss Jean Snow of Lynwood, Calif., on April 22, 1939.

Peter Serrell was married to Miss Kathleen Ainslie Macleish of Santa Barbara, on August 19, 1939.

Bruce L. Hicks received his doctor's degree in June at the Institute and is now on the physics staff of the University of Wyoming.

Robert Dilworth and **Reuben Wood** received their doctor's degrees at the Institute last June.

1937

Robert M. Dreyer, M.S., who received his doctorate at the Institute in June, is now an instructor in geology at the University of Kansas.

Bruce Morgan was married to Miss Evelyn Bean of South Pasadena, in Dallas, Texas, on May 3rd.

A. E. Harrison, M.S., delivered a paper on "Ionization Time of Thyratons" at the recent American Institute of Electrical Engineers convention in San Francisco.

Carl Johnson is now a junior engineer in the Rivers and Harbors Section of the U. S. Engineer Office at San Francisco.

Robert Park is working on the Gulf Coast as a geophysicist for the Standard Oil Company of Texas.

Martin J. Poggi is now with the Consolidated Aircraft Corporation at San Diego.

Robert Mahoney, who is employed by the U. S. Vanadium Corporation, has been assigned to the newly established public relations department to do safety work, and is now visiting various plants to familiarize himself with operations.

Joseph J. Peterson was married to Miss Shirley Marie Martin of Pasadena, on August 19th. The couple are on a honeymoon trip to the Philippine Islands to visit Peterson's parents, and will return to Peoria, Illinois, where he is employed by the Caterpillar Tractor Company.

J. Ridgeley Leggett, who is a party chief for the Mott-Smith Corporation, has been transferred from Egypt and is now working at Ramadi, Iraq.

Jack George is a graduate student in geology at the University of California at Berkeley.

John R. Austen was married to Miss Helen Elizabeth Taylor at Easton, Pennsylvania, on August 19th.

1938

Robert Davidson was married to Miss Ruth Gwin in the Chapel at Occidental College on June 23rd.

John R. Baker is now on the engineering staff of the Baker Oil Tool Company.

Philip F. Shepherd is with the Shell Development Co. at Berkeley.

George H. Osborn is working for the Signal Oil Co. engineering staff at Long Beach.

George B. Holmes is now a student at the Harvard Graduate School of Business Administration.

Eugene Eyster, Ph.D., has been awarded a National Research fellowship at the University of Michigan.

Saul Winstein, Ph.D., is at Harvard under a National Research Council fellowship.

Carl F. Friend was married to Miss Jane Lou Hare in Glendale, Calif., on May 23rd.

Herbert Bailey Ellis was married to Miss Ellen Hutchinson of West Orange, N.J., in Los Angeles on June 23rd.

Daniel L. Gerlough was married to Miss Jean Claire Shearer in San Francisco on August 3rd.

Albert Jurs and **William Freed** are now baching together in Philadelphia.

August Segelhorst was married to Miss Martha-Lee Stone of Pasadena on September 9th.

1939

Norman H. Horowitz, Ph.D., has been awarded a National Research Council fellowship and is working at Stanford and the Hopkins Marine Laboratory.

Richard H. Hopper, Ph.D., is a geologist in Sumatra for the N. V. Nederlandsche Pacific Petroleum Matschaapij, a joint subsidiary of the Standard Oil of California and of the Texas Company.

Homer Smith Youngs was married to Miss Ann Ellwood Lewis in Pasadena on July 7th.

Kenneth Macleish has a physics fellowship at the University of California.

Josiah Smith, Robert Tangren and **James Braithwaite** are continuing studies in aeronautics at the Institute.

Charles Pettingall is working for the Lockheed Aircraft Company at Burbank, California.

Paul Smith is with the Douglas Aircraft Company at Santa Monica.

Roderick McClung is a research assistant in mechanical engineering at Iowa State College.

Paul Engelder is under contract with the St. Louis Browns and has been playing with the Albuquerque baseball team.

Marcus Hall is a student at the Harvard Graduate School of Business Administration.

Jack Goodell is taking the test course of the General Electric Company at Schenectady.

Francis Robertson is working for the American Potash and Chemical Corporation at Trona, Calif.

Charles Bauer is a chemist for the Proctor and Gamble Company at Long Beach, Calif.

TECH GEOLOGIST REACHES SUMATRA

Tech geologists continue to spread to the four corners of the Earth, and **Richard Hopper, Ph.D., '39**, in a recent letter cleverly details a typical experience.

Hopper, who sailed for Medan, Sumatra, N.E.I., after Commencement, has perhaps been more fortunate than some, in that he had an opportunity to inspect the conditions in both Japan and China brought about by the 'China incident.' He found the buildings in Tokio, Kobe, Osaka, and other Japanese cities plastered with anti-British slogans, and the British Crown Colony of Honkkong teeming with Chinese refugees.

According to Hopper, over 300,000 undernourished and filthy refugees are in Hongkong. At night these wretched people sleep on sidewalks and in gutters, and each night takes heavy toll in victims of starvation and cholera.

In Medan, located on the northeastern coast of Sumatra, conditions are in startling contrast. Under the benevolent rule of the Dutch, the natives are clean, happy, and prosperous. Buildings are modern, parks are numerous, and the climate delightful. In fact, says Hopper, Medan is about the size of Pasadena, and perhaps just as modern. Bicycles and bullock carts are the favorite modes of transportation, with a few three-wheeled Dutch and German cars. Dick believes that the American suspender manufacturers should prosper in Medan, since the native sarongs seem to stay in place with no visible means of support.

Professionally, Dick's first job is in the jungle two hundred miles South of Medan, and he feels that his first geological map will be characterized by a large black line, running from left to right, labeled **Equator**. The approved method for the geologist to traverse the bush, is to follow the numerous elephant trails and streams, after a preliminary aerial reconnaissance.

The Dutch frown upon guns, and since Sumatran ivory is the most valuable in the world, Dick feels that he may be able to strangle one of the small native elephants, and recover the ivory by way of a slight bonus.

Jungle Immunity

In regard to jungle denizens, it appears that tigers are not hesitant about seizing natives, but the smell of the white man renders him relatively immune. Hopper feels that because of this, it may pay to wear the same shirt for the entire duration of any field trip . . . as anti-tiger bait.

With the exception of the king-cobra, the most poisonous reptile known, the other animals are quite tolerant of white geologists. Dick writes, ". . . the orang utans are of the type that will give you a pat on the back, and an encouraging smile, while you examine an outcrop. Elephants probe into your pockets for peanuts while you are taking dip-and-strike. Leopards rub against your legs and purr. Rhinoceroses maintain a hands-off policy, and pythons scarcely look up from their work as you pass."

Communications with base camps or main office is maintained by short wave radio, but Dick feels that by the time this story is in press, his feeble crys may not carry over his field radio, except as a low "belch from deep within some tiger who has managed to eat his first white meat by holding his nose . . ."

LETTERS

Carlton Hotel
Amsterdam
June 29, 1939

Dear Editor:

My Cal Tech class ring is noticed quite frequently here in Europe, and I am always glad to tell people where I received it. Most aviation people know Cal Tech well by name, if they haven't been there personally.

The weather here cannot compare with that in California . . . However, there are occasionally days without clouds and rain, and I am able to get sunburned while sailing on one of the many lakes or canals in Holland.

Preparations for war are in evidence everywhere, but the people in general are going about business and pleasure much the same as before. Around most airports you will find gun emplacements, if not the actual guns, while in London, the parks are being dug up for the installation of bombproof shelters. Many of the downtown buildings in all cities here are converting their basements into bombproof shelters. With it all, the flowers are as lovely, and the canals and buildings are as picturesque as ever, and I am having an enjoyable time. My duties as Technical Advisor to the Factory Representative of the Lockheed Aircraft Corp. keep me very busy.

With best personal regards,

Charles F. Thomas, '35.

% The Caribbean Petroleum Co.
Maracaibo, Venezuela
July 10, 1939.

Hello Everybody!

I was glad to receive your letter about commencement activities, even if I could not take advantage of them, and containing a bill for dues as it did. If you can give me credit on the latter for a short time, I shall be glad to join. My desire for credit comes not from lack of money, but from lack of facilities for exchange in the particular part of the jungle in which I am stationed.

In the meantime, I would appreciate very much your sending me whatever publications you may have with news of my old friends and school. I am somewhat out of touch with the association as this was the first letter forwarded to me in my two years of isolation.

Sincerely,
R. A. McRae, '35.

Union Oil Co. of Calif.
Singapore, S. S.
August 4th, 1939.

Dear Association:

Thank you for your letter which, I regret to say, arrived too late to enable me to make the necessary arrangements to attend the Commencement Day Banquet this year. I would have received it during July instead of August, had I not been travelling in the wilds of Siam at the time. However, I am pulling things together here and hope to be able to make the banquet next year,

which I note is a "Re-Union Year" for the class of 1930.

Work out here is interesting, since it takes me to India, Burma, Ceylon, Sumatra, Java, Bali, the Celebes, Siam (just renamed "Thailand"), French Indo-China, North Borneo, the Philippines, and Hongkong as well as British Malaya (where I have my headquarters). It's no place for a person who cannot live reasonably happily in a continual bath of perspiration, however, and if you are prejudiced against insects and bugs in general, this is a good place to stay away from. The tigers, pythons, cobras, etc., are overrated as menaces, but the ubiquitous mosquito and cockroach make life a trifle burdensome at times.

If you have any other Tech men on your mailing lists anywhere in the oriental tropics, I would like to have their addresses and might look them up if the occasion presented.

Sincerely,
Robert I. Stirton, '30.

Northwood,
Middlesex,
England.
July 10, 1939.

Dear Editor:

From time to time I have received letters regarding the Cal Tech Alumni Association, and have felt rather guilty that I have not responded. I am afraid 8,000 miles separation has reinforced my natural laziness so that I have never made sufficient effort.

However, as I recently acquired three one dollar notes which cannot so easily be spent in this country I have managed to restrain my inclination to spend them and send them along herewith as a subscription to the Alumni Association. Very best wishes for its future prosperity and should any members visit England I shall be happy to meet them.

Sincerely,
John Read, Ph.D., '34.

1939—Contd.

Perry Brown is working in the engineering department of the Pomona Pump Company at Pomona, Calif.

Fred Hoff and **Harry O. Davis** are employed by the Sterling Motors Company.

V. K. Crawford is now an applied chemist for the General Petroleum Corporation.

James McKinlay is working for the Douglas Aircraft Corporation.

Howard Craft and **Ray V. Gerhart** are employed by the Gilmore Oil Company.

Kenneth Collins was married to Miss Billie Crain of Altadena on September 16th in Pasadena, and the couple will make their home in Pittsburgh, Pennsylvania.

STUDENTS TO BE FLIERS

The Civil Aeronautics Authority announced on Sept. 10th that students at the California Institute of Technology would be eligible to participate in the government's civilian pilot training program, the Institute being one of the 166 educational institutions certified to help with the campaign to instruct 11,000 young men in flying during the coming school year.

1939 CLASS ROSTER

DOCTOR OF PHILOSOPHY

Addicott, F. T.
Arnold, H. A.
Beeson, C. B.
Budenholzer, R. A.
Christensen, N. A.
Chu, D. Y.
Davenport, H. W.
Dilworth, R. P.
Dreyer, R. M.
Fine, P. C.
Foster, M. G.

Hicks, B. L.
Hopper, R. H.
Horowitz, N. H.
Howland, W. L.
Krohnacker, F. D.
Krohnacker, F. D.
Lauritsen, T.
Lambert, J. A. E.
Lombard, Jr., R. H.
Macknight, R. H.
McCann, Jr., G. D.
McLean, W. B.

MASTER OF SCIENCE IN SCIENCE

Physics

Armi, E. L.
Gregory, C.

Olds, R. H.
Vargas, Jr., J. A.

Chemistry

Albrecht, G. A.

Hepner, F. R.

Chemical Engineering

Cardwell, Jr., W. T.
Gullekson, E. E.

Taylor, Jr., H. S.
Wald, Jr., G.

Geological Sciences

Cabeen, W. R.
DeLong, Jr., J. H.
Dougherty, J. F.

Hoy, R. B.
Urick, R. J.
Wilson, H. D. B.

Mathematics

Levit, R. J.
Lilleland, O.

Yood, B.

Biology

MASTER OF SCIENCE IN ENGINEERING

Electrical Engineering

Havens, B. L.
Jones, W. G.
Lentz, J. J.

Stevens, J. F.
Unholtz, K.
Weinstein, J.

Mechanical Engineering

Beafield, B. F.
Duncan, S. F.
Gongwer, C. A.
Hudson, D. E.

Serrell, P. V. H.
Shapiro, H. B.
Sharp, H. W.
Wetmore, W. O.

Civil Engineering

Bonell, W. H.
Carrick, H. H.
Dorwart, G. M.

Sheppard, H. R.
Sidler, A. W.
Wilson, W. E.

Aeronautics

Ashkunas, I. L.
Beardsley, G. F.
Coates, Jr., L. D.
Fan, H. T.

Piper, C. N.
Tsubota, G. Y.
Wang, T. K.

Meteorology

Burns, M. C.
Dahl, L. F.
Easton, R. L.
Farman, I. L.

Stephens, F. B.
Tatom, J. F.
Yates, D. N.

EARTH LIKE GLASS

At the meeting of the Geological Society of America early in August, Doctors Beno Gutenberg and Charles F. Richter, Ph.D., '28, announced that the earth is like glass fifty miles down. From their seismological studies they have determined that the layered structure is continued to the depths of the earth, and that seismograph records show that vibrations reaching a depth of about fifty miles had a decrease in speed, rather than the expected increase in speed with depth. This disturbance would result if the vibration had encountered a zone of sudden change from crystalline to a glassy structure.

GEOLOGISTS ON MINING COMMITTEE

J. Clark Sutherland, '29, geologist for the Pacific Clay Products Company, and G. Austin Schroter, '28, manager of Mines and Exploration, Filtrrol Corporation, have both been appointed to the Mining Committee of the Los Angeles Chamber of Commerce.

Sutherland is serving on the Non-Metal-

lic Sub-Committee, and Schroter is on the Legislative Sub-Committee for the Study of Labor and General Regulatory Legislation.

The Committee is made up of leading mining and oil executives of Southern California, in order to study and recommend on State and National legislation which may affect the mining industry, matters of taxation and regulation of engineers, non-metallic and strategic minerals, public lands, gold and silver, reciprocal trade and excises, and other matters pertaining to the mining and oil industries of the Western states.

COMBS ON TOUR

Theodore C. Combs, Jr., '27, who is a member of the Board of Directors of the Alumni Association, left Los Angeles this month on a business tour of the Atlantic Seaboard in the interest of the West Coast Lumbermen's Association for which he is field engineer at Los Angeles. Combs will promote the use of pre-cut framing for wood dwellings, a recent major development in housing for which he is largely responsible.

While he is on tour, Combs will attend meetings of Alumni groups in the interests of the Association discussing the problems and desires of the groups and their relationship with the main body of the membership in Southern California.

WIND TUNNEL GRADES SOILS

The use of a wind tunnel to classify soils and sand according to particle size has been accomplished by the United States Soil Conservation Service working at the Institute. The procedure is to suck a stream of air through a 12 foot tunnel, with the soil and sand mixture flowing into the air stream at the intake end and carried by the air current. Heavy particles fall first, the fine particles being carried furthest before deposition in trays.

Twenty different trays are used to catch the particles, the smallest of which corresponds to those passing a 250 mesh screen, equivalent to an average diameter of 27 ten-thousandths of an inch. The study of particle size and distribution is important in soil erosion and conservation work, and also in the silting of dams and lakes.

(Cut out on this line and paste in your 1939 Alumni Directory.)

RESERVE ENGINEER OFFICERS' CAMP

At the annual Reserve Engineer Officers Camp held at Camp Ord, Presidio of Monterey, from August 14th to 26th, Cal-Tech alumni were prominently represented. **Captain Theodore C. Combs, Jr., '27**, delivered one of the most interesting lectures at the camp on "Aerial Photography and Mapping."

The following alumni in the Engineer Reserves attended Camp Ord this year:

49th Engineers

Capt. J. W. Dunham, '29
Capt. J. E. Shield, '22
1st Lieut. W. H. Krelle, '27

349th Engineers

Capt. T. C. Combs, '27
Capt. J. C. Krouser, '25
1st Lieut. R. A. Philco, '27
1st Lieut. O. F. Reinen, x29
1st Lieut. E. H. Ross, '28

444th Engineers

1st Lieut. A. W. Dunn, '29
2nd Lieut. J. C. Monning, '33

589th Engineers

2nd Lieut. R. Creveling, '27

FOG ASSISTS RAY RESEARCH

Production of fog in scientific instruments enables scientists to study cosmic rays, according to **Robert M. Langer, Ph.D., '27**, in a paper presented at the Stanford University meeting of the American Physical Society last July.

"There may be excess moisture in the atmosphere and rain may threaten for a long time before droplets begin to fall," said Doctor Langer. "The condensation of water vapor from the air on to the drops happens rapidly enough at first; but so much heat is given out in the process that the droplet warms up until the evaporation from it just about equals the condensation upon it. Unless this heat of condensation is dissipated the droplet will stop growing before it can be seen. The best way to dispose of the heat is to pass it into the surrounding air."

Cosmic rays are studied by making the rays visible through the creation of paths of artificial rain drops by the rays in the Wilson cloud chamber. The idea, said Doctor Langer, is to produce a fog along the path of the cosmic ray, and it takes a full second for fog drops in a cloud chamber to attain full growth.

ICE FORECASTS

Development of a new forecasting technique that warns of approaching ice, thunder, and lightning storms was described by **Irving Krick, Ph.D., '34**, associate professor of meteorology at the Institute, before the recent convention of the Pacific Coast Electrical Association meeting in Pasadena.

Predictions can be furnished two days in advance, with a definite warning 12 hours before the arrival of an ice storm, with the exact area of the storm determined. Ice storms are particularly prevalent in the East during the spring, according to Doctor Krick. Thunder and lightning storms, which often disrupt communication systems, can now be predicted by the "air-mass" analysis data secured from instruments at the Institute correlated with that of other stations, he said.

Average forecasting at the California Institute of Technology is better than 95% correct, said Krick, which is the highest attained, and government forecasts do not include ice, thunder, and lightning service.

— T —

**ARE YOU A MEMBER
OF THE ASSOCIATION?**

(Cut out on this line and paste in your 1939 Alumni Directory.)

BACHELOR OF SCIENCE (FIVE YEAR COURSE)

Aeronautics
Bellevy, S. E.
Egler, A.
Eischer, H.

Frederick, J. L.
Kypal, D.
Nagumatsu, B. S.

Powell, W. B.
Valenzuela, J. L.
Widmer, R. H.

Alme, E. A.

Meteorology
Norquest, K. S.
Sanders, R. A.

Streckevand, P. H.

BACHELOR OF SCIENCE (FOUR YEAR COURSE)

Science
Asakawa, G.
Battie, J. A.
Betz, W. E.
Hishop, R. H.
Carter, R.
Cratt, C. H.
Crawford, V. K.
Dibble, Jr., B.
Englander, H. S.
Evyang, J. C.
Finn, D. E.
Frankton, Jr., W. H.
Gerhart, R. V.
Gombotz, J. J.

Science
Griffiths, J. R.
Ingnalls, F. C.
Kegon, R. C.
Kolb, L. L.
Kyle, R. M.
Laventell, L. S.
Levet, M. N.
MacLish, K. G.
Parker, E. H.
Leat, Jr., J. M.
Pinney, E. J.
Pollen, Jr., K. A.
Radovich, F.

Rainwater, L. J.
Rasmussen, Jr., V. K.
Regan, Jr., L. J.
Robertson, F. A.
Rondebush, B. V.
Ruhls, S.
Ruckerlo, R. J.
Scott, D. H.
Stef, T.
Smith, I. E.
Stones, J. W.
White, R. W.
Younger, V. E.
Younes, H. S.

Anderson, Jr., N. H.
Antonenko, B. P.
Bauer, Jr., C. H.
Beard, L. R.
Beck, D. W.
Black, J. W.
Borgeson, L. G.
Brushaw, R. R.
Brace, K. R.
Brathwaite, J. W.
Brown, Jr., C. H.
Brown, P. H.
Brown, W. L.
Brown, W. J.
Carliste, F. L.
Carstaphen, C. F.
Collins, H. K.
Connell, R. B.
Crozier, G. O.
Davis, Jr., H. O.
Devirian, Jr., P. S.
Diehm, W. A.
Engelder, P. O.

Engineering
Eischer, R. A.
Fraser, S. M.
Gassaway, J. S.
Goodell, J. H.
Goodin, Jr., H. A.
Green, A. P.
Green, W. M.
Griswold, E. A.
Hall, M. A.
Hance, H. V.
Hannon, A. L.
Hansler, R. L.
Hieble, E. K.
Hoff, F. C.
Holtz, G. M.
Hoyt, D. E.
Kimball, R. B.
Konecni, J.
Lawrie, D. G.
Lawson, W. G.
Lee, C. M.
Longfelder, H. J.
Mathew, T.
McClung, R. M.
McCreery, F. E.

McKinlay, J. H.
Merrick, W. D.
Morkawa, G. K.
Norton, Jr., W. M.
Oakley, S. W.
Osborn, J. E.
Paul, C. H.
Pettigall, C. E.
Pond, R. K.
Ritchey, J. C.
Hoot, W. A.
Hopp, W. F.
Schneider, C. J.
Shuster, G. M.
Singular, G. W.
Smith, J. E.
Smith, R. L.
Smith, R. L.
Snyder, W. M.
Strong, Jr., H. D.
Sullivan, E. F.
Thompson, R. F.
Winchell, R. W.
Zakerman, I. G.

* Deceased



"But, Grandpa...."

"YOU never had to go to a luncheon, then to a bridge party, and then rush home to press a dress so you could go to the movies. Times have changed since you courted grandma. Things are more—more—"

"COMPLICATED'S the word you want, Bet. You do seem to do a lot of running around. But then, you don't have to pump and tote water, or churn butter, or bake bread, or clean a lot of oil lamps, or stoke the stove for that iron you're using. Why, when your grandmother wanted to go to town, I used to spend a half a day taking her. And you drive in for a movie! Most of the things you do, we didn't have time for."

IF LIFE seems more complicated today, it's because we have time to undertake more things we *want* to do—because the routine duties of life have been made simpler and easier. Meals cooked at the turn of a switch, water available at the turn of a faucet, washboard and carpet beater banished—these are some of electricity's contri-

butions to progress. General Electric scientists and engineers, by finding still more ways for electricity to shoulder the routine and unpleasant duties, help provide for the people of America still more time to enjoy a richer, happier, and fuller life.

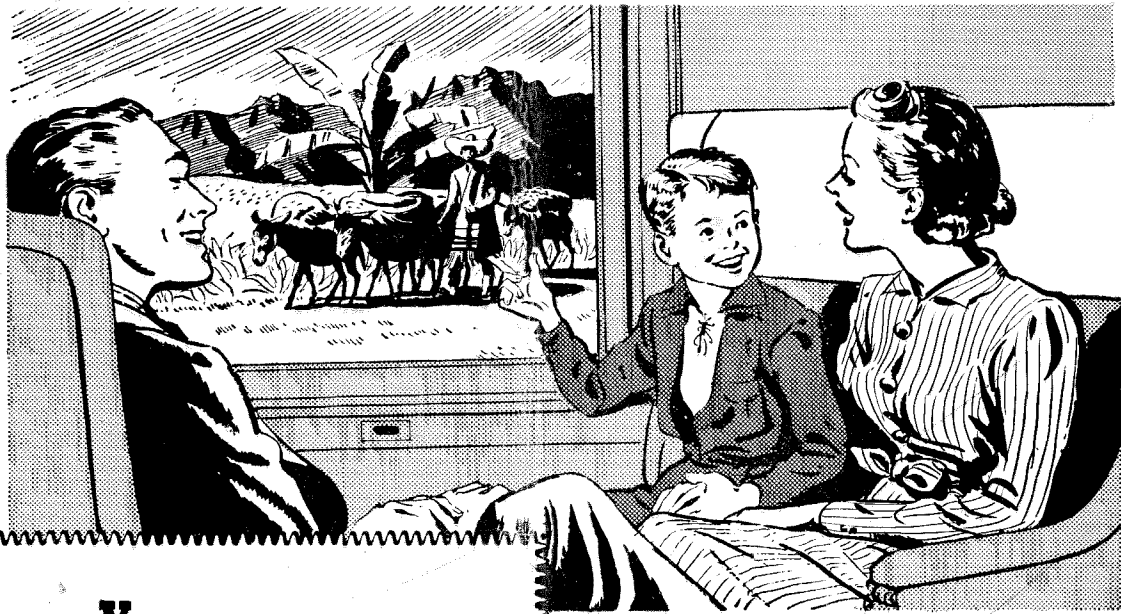
G-E research and engineering have saved the public from ten to one hundred dollars for every dollar they have earned for General Electric

GENERAL  **ELECTRIC**

90-164C

NEW YORK WORLD'S FAIR — SEE THE G-E "HOUSE OF MAGIC" — SAN FRANCISCO EXPOSITION





You can see
MEXICO
 in a short vacation

EVEN IF your vacation is only two weeks, you can enjoy a thrilling trip to colorful, romantic Mexico if you go on the train.

In two weeks you can go to Mexico City and back by train and have a *whole week* left for stop-overs and sightseeing. You don't have to worry about highway conditions, or where to eat or where to sleep. Air-conditioning keeps you cool. And round trip fares are *low*. Here is some of the fun that's waiting for you on your trip down Mexico's picturesque West Coast...



ON THE WAY, every view is a fascinating picture: wide stone fences bounding vast historic ranchos, cathedrals, burros, sleepy villages where everyone turns out to welcome the train.

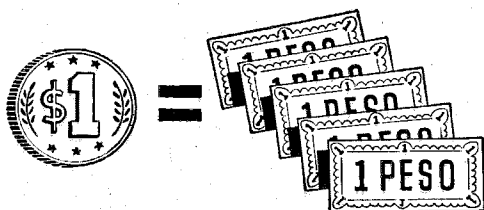


MAZATLAN, a "South Sea Island" village drowsing beside the blue Gulf of California. Here on warm, tropical nights, wandering musicians serenade you with Mexican folk songs.



GUADALAJARA, high on the Mexican plateau, overnight from Mexico City. In its busy street markets you'll find rare bargains in pottery, sarapes and the famous bubble glass.

Your money goes further in Mexico!



At the current rate of exchange—lowest in years—a dollar buys 5 pesos.

MEXICO CITY—\$85.50
 ROUNDTrip

This fare good in air-conditioned Pullmans (plus berth charge) Los Angeles to Mexico City and back. Stop over anywhere along the way. Return limit 30 days. Convenient through Pullman service to Mexico City, leaving Los Angeles thrice weekly.

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Southern Pacific

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