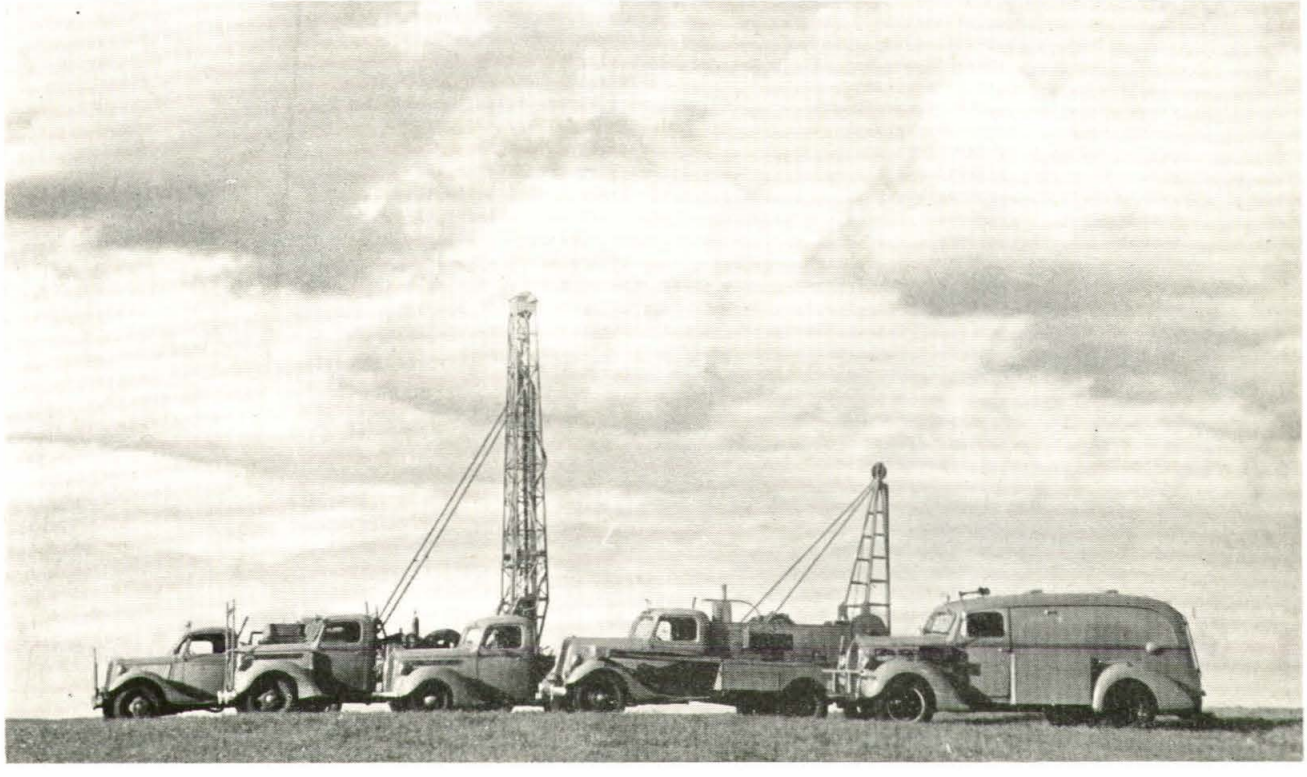
ALUMNI REVIEW

CALIFORNIA INSTITUTE OF TECHNOLOGY



Complete reflection of seismograph outfit with water truck, drill, survey car, explosives truck, and recording truck. Lower picture is a reflection seismogram showing recording of ground motion at 21 geophone positions. Numbers refer to time in tenths of seconds. A number of reflections are visible on the record.

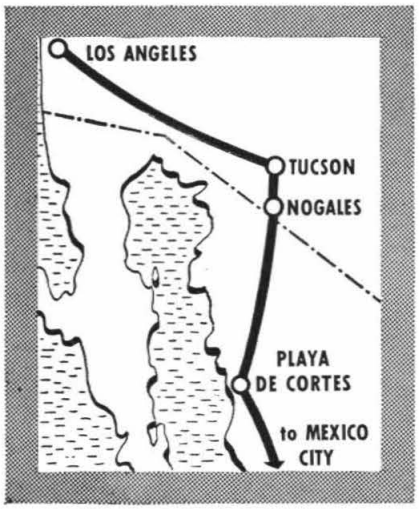
GEOPHYSICAL PROSPECTING FOR OIL

SEE PAGE 4

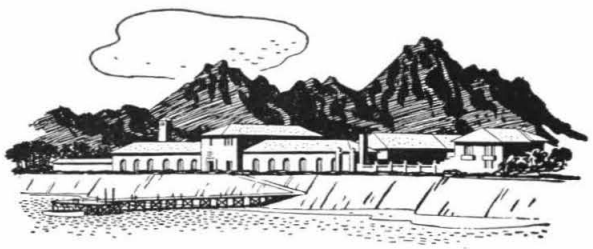
Vol. 3 No. 2 December, 1939

Discovered in old

MEXICO!



...a charming resort-hotel in a picture-book setting, a haven for rest-seekers and a paradise for sportsmen... Hotel *Playa de Cortés*.



Near Guaymas, just overnight from the border.

NESTLED beside the azure waters of Bocochibampo Bay on the Gulf of Lower California, is Southern Pacific's resort-hotel *Playa de Cortes*. Here, you may relax in the tranquillity of a peaceful foreign land and enjoy all the comforts of American living. Rooms are large, tastefully appointed. Superb hand-carved furniture, colorful drapery. Rates are $10 a day and upward American Plan.

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FREE: Send for a free copy of our illustrated booklet about *Hotel Playa de Cortes*. Address George B. Hanson, Dept. CT, 610 S. Main Street, Los Angeles, Calif.

Southern Pacific's

Hotel Playa de Cortés

Overnight from the Border, near Guaymas, Mexico

ALUMNI REVIEW

ALUMNI ASSOCIATION, INC.
CALIFORNIA INSTITUTE OF TECHNOLOGY

VOL. 3, NO. 2 | PASADENA, CALIFORNIA | DECEMBER, 1939

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John E. Shield, '22 . . . . . *Social*
Theodore C. Coleman, '26 . . . *Campus Relations*

ALUMNI Association plans for this year include the stressing of better student-alumni relationships. Judging from questions asked of some of our members who have accepted invitations from the Student Houses to attend informal discussions, many students do not know just what our Association is doing, nor do they recognize that many of the alumni are in a position to give of their time in helping these men become oriented in a complex world after leaving the Institute. Plans are afoot to compile a list of alumni capable of helping in discussions dealing with questions which may be bothering some of the undergraduates, and subjects will include general employment advice, and discussions of various vocations and hobbies. If you are contacted in such connection, give us your cooperation.

Another method adopted this year to show our interest in student activities and to offer some additional incentive toward intercollegiate competition was our presentation to the students of a large, perpetual trophy to be awarded annually to the House having the highest number of points in intercollegiate competition, judged by existing schedules evaluating all such competitive sports. This trophy has been termed the Alumni Athletic Award and will serve to show our continued interest in student activities.

Additionally, the senior class will again be our guests at the annual dance on January 27 announced elsewhere in this issue. Last year we had a large number of seniors as our guests, and we feel it helpful to even better relations with the students to continue this practice.

Every member can help in achieving our aims by making it a point to visit the campus and have a few words with some of the students, and by supporting student-sponsored activities. We can, for example, lend our help by our individual contributions to the Tech Y. M. C. A., by attending campus plays and the annual Exhibit Day, by subscribing to the California Tech, and in many other ways. Regardless of how you help, mention that you are an alumnus and help us show the students that we are backing them in every way.

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

FORTHCOMING EVENTS *

San Francisco Chapter—Every Mon. Noon. Fraternity Club at Palace Hotel.

Varsity Football Banquet, January 12, 1940
Pasadena Athletic Club, 6:30 p.m.
Tickets $1.00 per plate. Make reservations with Coach Musselman at the Institute.

Annual Dance — Jan. 27, 1940
Blue Room, Biltmore Hotel, Los Angeles.
Informal, $1.85 per couple, further particulars elsewhere in this issue.

Seminar Week End . March 16-17, 1940
Exhibit Days . . . . . April
Annual Stag and Field Day . . May
General Meeting & Commencement June

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

Editorial Comment

Campus Relations

ONE of the most significant advances to be made by the Alumni Association during the current year is the establishment of a Committee on Campus Relations, chairmanned by *Theodore C. Coleman,* '26, which has as its principal purpose the offering of assistance of any type requested by the students.

So far the students have mainly requested discussion of the proper approach in securing employment, a topic on which Coleman recently spoke informally before a meeting of the Throop Club. In the coming months it is expected that invitations will be received from the Student Houses to meet with them and to take part in round-table talks, and the Committee intends to call upon Alumni to volunteer to attend the meetings and take part in the discussions.

However, in this approach toward better undergraduate relationships the Alumni Association has adopted a passive attitude in that the Association has offered its services to any or all groups of students, and any further Alumni participation depends on the voluntary request of the student groups themselves.

By this means, we hope to foster a better relationship between undergraduates and the Alumni, by giving the latter an opportunity to aid in the orientation of the students.

T

New Buildings

THE completion of the Seeley W. Mudd and the Charles Arms Laboratories of the Geological Sciences, located on the southwest corner of the campus, marks another milestone in the progress of the Division of the Geological Sciences.

The Seeley W. Mudd Laboratory of the Geological Sciences is the gift of Mrs. Seeley W. Mudd as a memorial to her husband, who was a very eminent mining engineer. The funds for the Charles Arms Laboratory of the Geological Sciences were provided by Mrs. Robinson and her husband, the late Henry M. Robinson, for many years a trustee of the Institute, as a memorial to her father, who was a successful owner of mines.

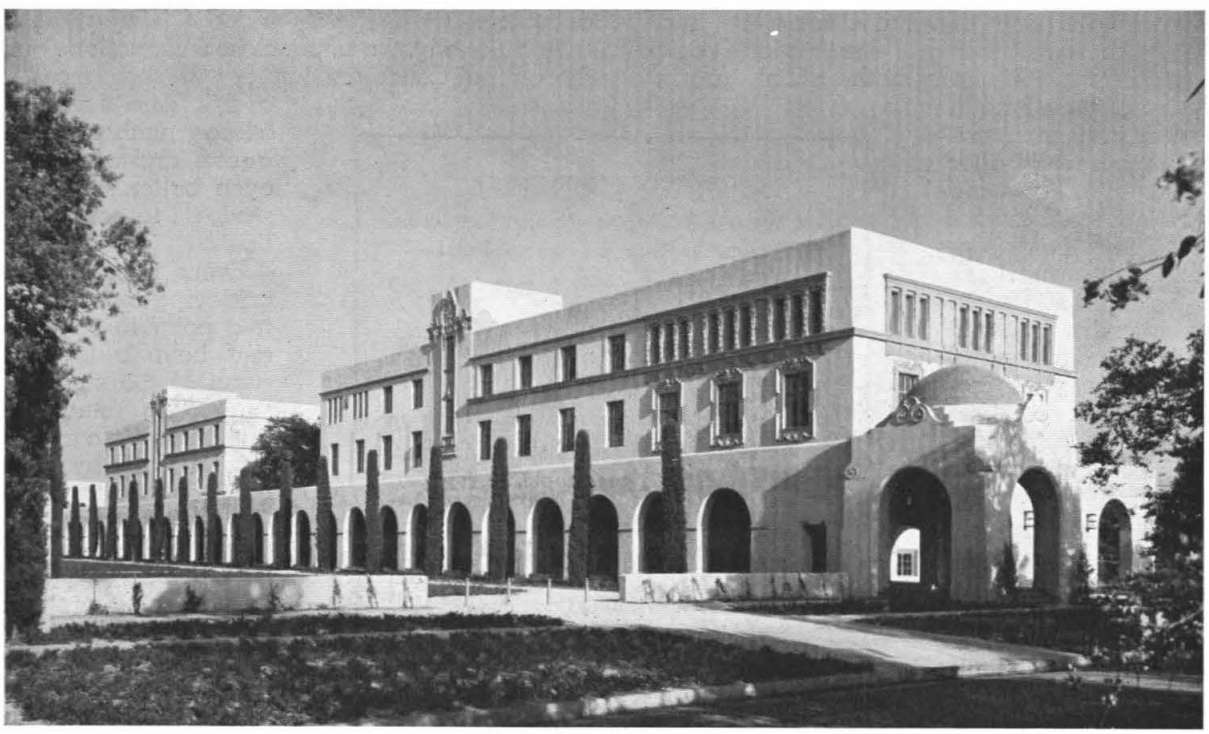
The Division of the Geological Sciences, though previously handicapped by the lack of physical facilities on the campus, has forged to the forefront in its fields of endeavor, many notable advances having been made in structural geology, petrology, mineralogy, paleontology, and geophysics by members of the staff and by graduates of the Division in the thirteen years since its establishment.

T

Future Growth

WITH the gradual utilization of all available building areas on the campus, provision must be made for future growth of the Institute. This is the tenor of a report made by a special committee to the Board of City Directors of Pasadena. This report recommended that the area north of the campus bounded by Wilson and Hill Avenues and the prolongation of Lura Street be zoned to allow occupancy by collegiate institutions, and that the southwest corner of California Street and Arden Road be zoned likewise.

The zoning of the Arden Road corner, already owned by the Institute, which adjoins Tournament Park, would provide a suitable site for the proposed gymnasium, and would be one step further towards securing this much needed undergraduate facility. It is sincerely hoped that the zone change will be acted upon favorably by the City.



The New Laboratories of the Division of the Geological Sciences.
Left: *The Charles Arms Laboratory.* Right: *The Seeley W. Mudd Laboratory.*

GEOPHYSICAL PROSPECTING FOR OIL

By RAYMOND A. PETERSON, '31, PH.D. '35

United Geophysical Company, Pasadena

The problem of locating oil is one of ascertaining the structural and stratigraphic relationships of the rocks near the earth's surface, and of correctly interpreting these data. This interpretation is based on a group of theories concerning the origin and accumulation of oil which have been formulated from a large amount of past experience and observation. The weight of evidence favors the theory of organic origin of oil from the remains of animal and vegetable material buried and disseminated in basins of sedimentary deposition. By a complex series of events this material has been transformed and collected into bodies of oil and gas.

The mode and place of accumulation are governed by two factors: stratigraphy and structure. The sedimentary rocks in which oil occurs are ordinarily deposited in layers or strata of alternating types — e.g., shale, sandstone, limestone, etc. Of these, sandstone is the most important as a reservoir rock for oil and gas because of its relatively high porosity and permeability. Shale strata, on the other hand, have an important effect on the migration and accumulation of oil. Because of the difference in specific gravity between oil and water in the rocks, the oil is subjected to an upward buoyant force. In alternating layers of shale and sand, however, the oil is largely constrained by the impervious shale layers to move in the more permeable sands, and aided by the driving force of circulating water, migrates up the dip or steepest slope of the strata until stopped by some "trap." The trap may be either structural or stratigraphic in nature, or both.

OIL TRAPS

The most common type of structural trap is the anticlinal fold or dome-shaped structure, formed by the warping and folding of rocks by horizontal compression. In this case, if the permeable reservoir rock extends over the entire structure, the oil and gas migrate to the top, being trapped by the buoyant force of the water on the flanks and by the impermeable rocks overlying the sand. Here the oil and gas remain, or at least escape only very slowly.

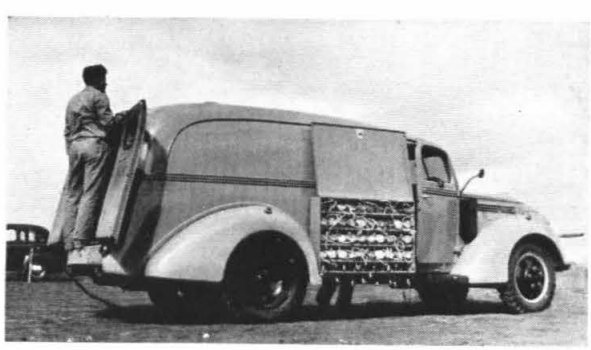
Another type of structural trap may be formed by faulting in sedimentary rocks. Oil may accumulate in upturned beds butting against impervious rock on the opposite side of the fault plane. Likewise, a trap may be formed by a fault cutting across a plunging nose-shaped fold, thus preventing further migration of oil up the structure.

In the Gulf Coast region of the United States a common type of structure is the salt dome. Here masses of salt have been forced up from considerable depth into the overlying sedimentary rocks, forming plug-shaped salt masses surrounded by the upturned beds of the disrupted sediments. Oil is then trapped in the sand members terminating against the salt, or may accumulate in arched beds above the salt plug.

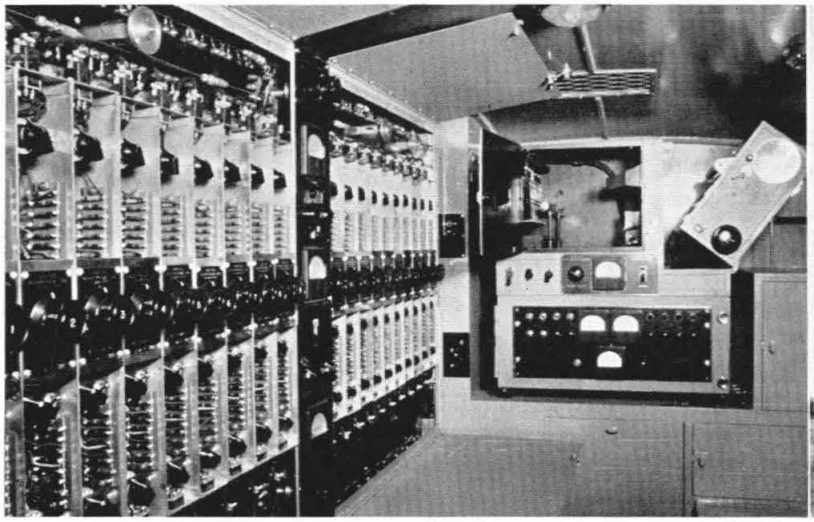
Stratigraphic traps are so-called because they have resulted from lateral changes in sedimentation at the time of the deposition of the strata. Thus coarse sands deposited near the shore of a basin may grade into finer sands off-shore and finally into impervious shales. On the other hand, near-shore sands in a slowly submerging basin may have been covered by overlapping shales as the shore line moved inland. In either case, there is a boundary, either abrupt or transitional in character, between sand and shale. Subsequently, when the sediments are deformed by warping and folding, traps for the accumulation of oil may be formed along the shale-sand boundary. For example, if the boundary cuts across a plunging nose-shaped structure, a trap may be formed where the shale-sand demarcation intersects the crestline of the fold. Likewise, a trap may be formed in a series of more or less uniformly tilted beds if the shale-sand boundary cuts obliquely up the slope of the beds and then bends obliquely down the solpe, forming a reentrant bay. The oil then accumulates in the apex of the reentrant, being prevented from further migration up the slope by the transition from sand to impervious shale.

The types of traps for the accumulation of oil described above are only a few of the many which occur. Usually the trap is much more complicated than those described, with a combination of factors present. Thus, dome-like structures are often cut by faults which affect the accumulation of oil. Furthermore, the porosity of the sand reservoir rock may vary over the extent of the structure, greatly influencing the accumulation. Accumulation is not always limited to one sand member. Often there may be a number of sand strata at various depths, some giving rise to separate accumulations of oil or gas, others containing only water.

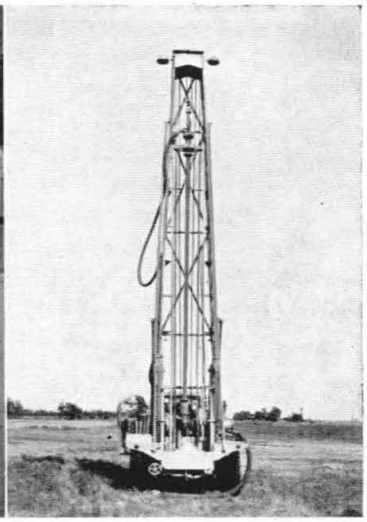
The problem of the geologist in exploring for oil is first to ascertain whether or not there are strata present which would be likely to contain oil or gas, and secondly, to locate the structural and stratigraphic traps which are the most probable locations for oil and gas accumulation. He has available two sources of information: observations at the surface of the ground, and subsurface information from previously drilled wells. The amount of information available from surface observations varies with the locality. In elevated regions, considerable areas may be exposed to observation by erosion which has removed the mantle of surface soil.



Exterior of recording truck, showing racks with geophones.



Interior of recording truck, showing amplifiers and oscillograph.



Portable shothole drill.

SURFACE MAPPING

The first step in exploration is to prepare an accurate surface map showing the rocks exposed; measuring their thickness; noting their composition (whether shale, sandstone, limestone, etc.); noting their fossil content; showing the location of surface oil seeps, if any; showing the bedding planes, and particularly the boundaries between different types of rock; showing the direction and amount of slope or dip of the bedding planes in the rocks; and showing the location of folds, warps, and faults in the rock. Where information is concealed by a shallow mantle of surface soil, it may be obtained by digging ditches or taking auger samples. Mapping is often done with the use of a plane-table, the elevations as well as locations of important points being obtained. In many places, airplane photographs serve as excellent base maps and reveal many features not readily apparent from the surface. After the surface map has been completed, subsurface contour maps on significant horizons may be constructed by extrapolation from surface data. The geologist also attempts to reconstruct the past geological history of the region, outlining former seas and basins of deposition, and noting the location and extent of sands and shales. With all this information assembled, he is in a position to make an intelligent recommendation as to the most desirable location for drilling an exploratory well.

SUBSURFACE MAPPING

A great many oil fields have been discovered by the above described procedure of surface mapping and extrapolation from surface data. However, it so happens that many areas of potential oil production are located in depressed regions which are being subjected to surface deposition rather than erosion at the present time. That is, the areas are covered by flat-lying deposits of alluvium, recent stream deposits of gravel, sand, and silt which almost, if not completely, mask the underlying rocks.

It is also many times true that even in areas where rocks are exposed by erosion, the information obtained at the surface does not give a reliable or complete indication of the structure at depth. Here the information obtained from previously drilled wells is of considerable value. In practically all drilling of wells a careful log is kept of the mud and cuttings washed from the hole. Also, at critical points actual rock samples are cored from the bottom of the hole as drilling progresses. These core samples are carefully studied as to their content of microscopic fossils, composition and mineral content, porosity, permeability, the dip of bedding planes, etc. In addition the well is surveyed electrically by recording variations in current and potential across a set of travelling electrodes lowered in the hole. This record shows in minute detail the boundaries between various strata — e.g., sands and shales — as revealed by the measured changes in resistivity and porosity of the wall rock. By comparing all the assembled data from a number of wells not too distant from each other, it is possible to correlate similar points, as for example, the top of a particular sand stratum which may be important as a reservoir rock for oil. If the wells are close enough together, subsurface contour maps may be drawn showing accurately the elevations and structure of pertinent horizons.

When wells giving subsurface information are widely separated, however, the interpolation of data between wells becomes more uncertain, and there are large areas for which the subsurface structure remains unknown. In some regions with shallow oil production, exploration is conducted by drilling a number of relatively shallow core holes, one or two thousand feet in depth, and correlating information obtained. In general, however, with the increasingly greater cost for deeper wells, it is not economically feasible to carry out detailed exploration by drilling.

GEOPHYSICAL PROSPECTING

One of the main objects of all methods of prospecting is to furnish a guide for the successful location of wells so as to minimize the number of dry holes and keep the cost of discovery as low as possible. It is in this regard that the physicist and engineer have been of invaluable assistance to the geologist. Various types of rocks show appreciable differences in physical characteristics — e.g., in density, magnetic permeability, electrical resistivity, elastic rigidity, etc. It is

(Continued on page 10)

ADSORBENT CLAYS

By G. Austin Schroter, '28

Manager Mines and Exploartion, Western Division, Filtrol Corp.

In the limited space available in the Review, it is impossible to more than touch upon the production, manufacture, and utilization of the adsorbent clays. The field is a large one, and new applications are being developed by researchers almost daily.

In chemistry, the noun *adsorption* is defined as the gathering of a liquid, gas, or dissolved substance at a surface, and this is the phenomenon most frequently utilized in applications of the bleaching or adsorbent clays.

Such clays fall into three subdivisions, based upon geology, method of preparation, and ultimate utilization, *viz*: (1) naturally adsorptive clays, (2) bauxite clays, and (3) acid-activated clays.

The geology of these clays is so complex that it will not be dwelt upon here. Suffice it to say that the seat of adsorptive action in most of these clays apparently lies in the clay mineral, montmorillonite, a sub-microscopic, crystalline mineral, with a planar space lattice. This theory, however, has never been verified.

The naturally adsorptive and activable clays occur in sections from the Ordovician to the Tertiary, with by far the bulk of the production coming from the Cretaceous and Lower Tertiary. Geographically, they are known from a point north of Lake Winnipeg, to the Gulf Coast; and from Georgia to California. Most deposits are stratiform, hence mining is either by open-cut stripping, or underground by some modified coal mining method, usually room-and-pillar mining.

PREPARATION

The naturally adsorptive clays are prepared either by fine grinding, or by crushing and screening into sized grades. A late development utilizes extrusion to form pellets and eliminate waste in fines. The active clays are prepared by controlled acid leaching, followed by counter-current washing to reduce pH, free-settling classification, grinding, and bagging. The bauxites are prepared by roasting, grinding, and bagging.

The naturally adsorptive clays (also loosely known as Fuller's earth), find their especial forte in the "percolation" treatment of petroleum oils. A sized column of meshed clay is the medium through which the oil, fat, or wax, in either liquid or vapor phase, is "percolated." The purified product issues from the tower, minus a certain proportion of the impurities and objectionable coloring matter, which are left behind in the clay. Such clays are of limited efficiency and selective action, but have moved in large volumes for the treatment of both petroleum and fatty oils.

The second class (bauxite) has only recently entered the field. Although the raw mineral may have little or no adsorptive efficiency, a careful heat treatment may develop a cheap material of limited efficiency, for the treatment of certain types of paraffinic petroleum stocks.

The third class of clays, known as activated clays after leaching with acid under controlled conditions of temperature and pressure, is perhaps the most highly efficient, as well as the most versatile material in the category. Such acid-activated clays are exported all over the world for consumption in a host of different industries. Although at least 75% of the domestic output is consumed by the petroleum industry, the remainder is enough to account for the clarity and sales appeal of practically all premium edible oils, hydrogenated shortenings, soap stocks and paint oils, some oleomargarines, etc. Many thousands of barrels of lubricating oils are annually treated with this material in refineries throughout the world.

With the activated clays, the common method of treating any given stock is by the method of *contact filtration*. In this method, predetermined percentages of finely ground activated clay are admixed with the oil, and the mixture is agitated at elevated temperatures. The oil-clay slurry is then sent to the filter press or continuous filter, from which the oil issues in purified state, and the impurities and objectionable colors remain behind in the filter cake.

An interesting development of recent years is the so-called Filtrol-fractionation of petroleum oils. In this method, the finely ground activated clay is added to the hydrocarbon oil before the latter enters the fractional distillation equipment. The slurry is then subjected to normal fractionation, and the various fractions which pass off are decolorized and purified *en transit*. By this method fractionation and contact filtration are combined into one simple operation.

CATALYST-CARRIERS

The most spectacular innovation of recent years, is the use of the activated clays for catalysts, or catalyst-carriers, whereby the heavier hydrocarbons are broken up into smaller structures to increase the gasoline yield. This enables many tars, asphalts, and refinery wastes, as well as crude oils, to be converted into *high octane* motor fuels.

In normal refining, the fuel, and other light oils, are removed from the crude by distillation, after which the heavier hydrocarbons remaining are broken up by thermal cracking into smaller structures to increase the gasoline yield. Such cracking may require pressures as high as 1,000 pounds, and temperatures as high as 1,100°F., and even under the most favorable conditions, large quantities of heavy oils and objectionable residues remain, which must be stored or cheaply sold.

In catalytic cracking, with the aid of the activated clays, pressures of 20 to 40 pounds may be used, with temperatures as low as 900°F. In addition, about 50% of the heavy residues which would remain in thermal cracking, will be converted into gasoline with a natural octane rating of 78 to 81, the equivalent of the best motor fuels on today's markets. (Continued on page 15)

ALUMNI YOU SHOULD KNOW

CHEMICAL ENGINEER

The name of Vladimir Anatole Kalichevsky, '24, to some of his friends would conjure up the vision of an energetic young officer in the army of H.I.M. the Emperor of Russia during the World War I, while to others he would represent a brilliant chemical engineer in the field of oil refining.

After a brilliant military career, in which he advanced to the rank of captain, and upon the collapse of the forces of Admiral Kolchak after the Russian Revolution, he became manager of the Topographical Department of the Chukotsk Peninsula Mining Corporation of Tokyo, Japan. He emigrated to the United States in 1921 and enrolled in the California Institute of Technology, graduating in chemical engineering in 1924.

Upon graduation he secured a position as Research Chemist with the Union Oil Company of California. He spent a short period with the Standard Oil Development Company in New Jersey, and in 1931 went to work for the Socony-Vacuum Oil Company as a Research Chemist, rising through intermediate steps to the position of General Supervisor of Research and Development Department of the Company, which is one of the largest producers, refiners, and distributors of petroleum products in the world.

He is the author of "Modern Methods of Refining Lubricating Oils," and of "Chemical Refining of Petroleum" (with Stagner), which are the standard reference texts of the oil industry. In addition, he is a frequent contributor of authoritative articles in petroleum trade journals.

OPPORTUNITIES FOR ALUMNI IN NAVAL AVIATION

By LIEUT. F. A. BROSSY, x26, U.S.N.R.
Flight Instructor, Naval Reserve Aviation Base
Long Beach, California

Through a recently expanded training program the United States Naval Reserve Aviation Training is available to more college men. Selections are now being made for flight classes which under the increased program will be convened each month throughout the year.

The training course, the value of which has been estimated at $20,000, is unique in that not only does it prepare the individual for many highly paid positions in civil aviation and the aviation industry, but pays well during training. The course includes flying in varied types of aircraft as well as complete ground school instruction in technical subjects, including navigation and overwater flying. Preference is given naval and military trained pilots by the major airlines in their employment of personnel, and those airlines whose routes are overwater naturally favor the aviator with ocean flying and navigation experience. The general consensus is that tremendous expansion will take place within the next few years in aerial transportation, particularly in trans-ocean and inter-continental routes. This expansion will increase the already growing demand for properly trained personnel in many lucrative branches. There is no doubt that the Naval Reserve Aviator, especially with an engineering degree, will find himself in an enviable position to profitably take advantage of the opportunities now offered and those that the future will bring.

The Naval Reserve Aviator begins his training at a Naval Reserve Aviation Base, in Southern California at Long Beach. Classes start the 15th of each month and the student aviator is put through a 30 day course which includes 10 hours of dual flight instruction by Naval Aviators. Students who qualify in this Primary Training, for which the remuneration is approximately $110.00, are appointed Aviation Cadets and are sent to the Naval Air Station, Pensacola, Florida, for further training.

At Pensacola the Aviation Cadet receives $105.00 per month, uniforms, quarters, medical and dental care, and is protected by a $10,000 Life Insurance Policy, the premiums being paid by the Government. His instruction consists of a complete flight training in varied modern aircraft, instrument flying and comprehensive classroom instruction in practical and theoretical aviation subjects.

The Aviation Cadet spends about one year at Pensacola and upon graduation is commissioned an Ensign in the United States Naval Reserve and is assigned for a three year period to one of the Aviation Squadrons of the U. S. Navy. This assignment includes flight duty and may take the Reserve Aviator to any part of the world where U. S. Naval activities are conducted. Remuneration is now better than $200.00 per month and the opportunities for knowledge and experience in aviation are many times increased.

At the termination of the three years of Fleet duty the Naval Reserve Aviator is paid a cash bonus of $500.00. He may now, at his volition, serve another four years of active duty as Lieutenant (junior grade) with increased pay and allowances, or return to civilian life. In this latter case he will probably become attached in an inactive status to one of the Squadrons at one of the several Naval Reserve Aviation Bases in the Country. Here he may maintain his flight proficiency, without interference with civilian pursuits, and receive $400.00 to $700.00 per year drill pay.

Some of the Caltech Alumni who have taken this training in recent years are: Frank W. Davis '36
Phillip H. Craig '33 Richard M. Rowell '38

Inquiries concerning the training may be made in person or by mail of Commanding Officer,
U. S. Naval Reserve Aviation Base,
Long Beach, California.

CAMPUS NEWS

ALUMNI OFFICE

The Alumni Office is now located in Room 120, Throop Hall.

ALUMNI AWARD

The Student Body was presented with the "Alumni Athletic Award for House Intercollegiate Competition" at the regular Monday Assembly on October 23rd by *Clarence F. Kiech,* '26, President of the Association, and *Theodore C. Coleman,* '26, Chairman of the Alumni Committee on Campus Relations.

The Award is a plaque of simple design with a raised figure symbolizing Victory. It is to be awarded to the House, or Throop Club, having the highest number of points for the preceding year in Varsity and Frosh rating, and the winner's name and year is to be engraved on the plaque. By means of the Alumni Award the Association hopes to foster interest in intercollegiate competition.

T

N.Y.A.

One of the most worthwhile New Deal Agencies is the National Youth Administration, which provides assistance to students at institutions throughout the country. The N.Y.A. provides a sum of $10 to $20 per month for needy students in exchange for the performance of work around the campus, which is desirable, but which would not otherwise be performed but for the assistants provided.

During the present school year, the National Youth Adminstration has alloted 75 units of $15 per month to the California Institute of Technology. Ninety students are benefitting from this program so far, as some of them do not need aid every month. The work which the students perform is varied, such as research assistants in the laboratories and shops, chemical preparations, geology cataloguing, improving the grounds, and clerical assistance to the Registrar, Y.M.C.A., and others.

ENROLLMENT GAINS

Increase in the enrollment for the present school year is shown by the figures released by Mr. Philip S. Fogg, Registrar. The figures are as follows:

Freshmen	160
Sophomores	146
Juniors	151
Seniors	158
Sub-total undergraduates	615
Graduate Students	271
Total	886

This compares with a total of 606 undergraduates and 256 graduate students last year.

T

THOMAS STUDIES SEWAGE PROBLEM

Franklin Thomas, Professor of Civil Engineering at the Institute, was one of three members of a special board to study the existing sewage system of the city of Los Angeles and to make recommendations as to its future construction needs.

The board submitted its report to the Board of Public Works of the city last month, and recommended that an adequate program costing $28,390,000 be started, of which $18,060,000 is the cost of the immediately necessary work, which includes a new ocean outfall, new sewage treatment plants, and the repair of existing main trunk lines.

AIR EXPERT HONORED

Clark B. Millikan, Ph.D., '28, who is Associate Professor of Aeronautics, will appear before the meeting of the Institute of Aeronautical Science in New York on December 16th and will deliver the annual lecture commemorating the first flight of the Wright brothers.

Dr. Clark Millikan, who is a former president of the Institute, will speak on "Influence of Running Propellers on Airplane Characteristics", describing research being carried out in the Daniel Guggenheim Aeronautical Laboratory.

T

IN MEMORIAM

Becker

Paul H. Becker, Jr., '42, died on November 23rd of accidental injuries sustained in the Varsity football game with La Verne College. Becker was outstanding as center on the squad and, in addition to his athletic endeavors, was an honor student. He is survived by his parents, Mr. and Mrs. Paul H. Becker, Sr., of Los Angeles.

T

Bonham

Elliot Bonham, '38, died on November 14, 1939, at Pomona, California, of a heart attack, after having been ill with a blood stream infection since last April. While on the campus he served as Exhibit Day chairman, and since receiving his degree had been with the Board of Fire Underwriters of the Pacific.

1939 **VARSITY FOOTBALL SQUAD** which will be honored at the Annual Football Banquet on January 12th for its fine spirit and sportsmanship.

ALUMNI ACTIVITIES

ALUMNI DANCE JANUARY 27th

The fourth annual Alumni dance is scheduled for Saturday evening, January 27, 1940, at the Biltmore Blue Room in Los Angeles, and an attendance exceeding the 433 couples who attended last year's dance is expected, so save the date and secure tickets early.

Rumor has it that the Dance Committee plans to have the orchestra play the hit tunes from 1920 to 1940, waltzes and the old fashioned fox-trot will be featured, so bring the lady of your dreams and dance to the tunes that were popular in undergraduate days. The Class of 1940 will be guests of the Association, continuing last year's precedent.

Tickets are now on sale at the Alumni Office, Room 120, Throop Hall, for $1.85 per couple, so mail your check now in order to permit the Dance Committee, headed by *Fred S. Scott,* '30, to plan as lavish an affair as possible.

Buy YOUR TICKETS EARLY!

T

SEPTEMBER MEETING

During the late lamented hot spell, the first dinner meeting of the 1939-1940 season was held on September 22nd at the Mary Louise Tea Room in Los Angeles which featured an illustrated lecture on recent advances in geophysical prospecting by Mr. Ralph Brandt, of the United Geophysical Company, who substituted for Herbert Hoover, Jr., and *Dr. Raymond F. Peterson,* '31, the announced speakers, who were unavoidably detained by their work in the San Joaquin Valley.

Doffing of coats and loosening of collars did little to cool the 85 perspiring engineers who braved the weather and the scramble for tables near electric fans called to mind some of the mad football pile ups during the fall season.

Mr. Brandt's discussion of geophysical prospecting was featured by the showing of a motion picture which graphically presented the methods and equipment employed, and the results achieved in the search for oil. After the talk, a spirited question and answer period added to the enlightenment of all.

NEW YORK

The California Tech Club of New York was formally organized as a chapter of the Alumni Association at a meeting held on June 9, 1939, and the following were elected as officers for the coming year:

Edwin F. Thayer, '25.....President
Rea A. Axline, '31.....Vice-President
Chester F. Carlson, '30..Secy.-Treasurer
Archie R. Kemp, '17.....Director
William Shockley, '32.....Director

On October 24th, a very successful meeting was held at the Western University Club, which shares the club house of the Columbia University Club of New York, which was attended by 38 members and guests. Dr. Joseph A. Becker, of the Bell Telephone Laboratories and a former instructor at Tech, was the speaker of the evening. He gave a talk on the "Electron Microscope", and demonstrated a microscope with a magnification of about 300,000, and showing individual ions and their thermal motions upon the tip of an exceedingly sharp needle point of tungsten. Professor Sorensen and *T. C. Combs,* '27, a director of the Association, were amongst the guests present.

Any alumni and members of the faculty contemplating a visit to New York, are requested to contact the Secretary-Treasurer, *C. F. Carlson,* '30, 6 East 45th Street, New York City, so that they can, if possible, be guests of the chapter at its meetings.

T

SEMINAR WEEK END

Plans for the third Annual Alumni Seminar to be held on the week end of March 16-17, 1940, are progressing in a highly satisfactory manner according to *Sid Bamberger,* '33, chairman of the Seminar Committee. Following the successful program of previous years, both technical and general subjects will be presented, allowing Alumni to choose from several topics for each period.

Among those assisting Bamberger on the Seminar Committee are *H. Fred Peterson,* '27, *H. P. Henderson,* '26, *Theodore C. Coleman,* '26, last year's chairman, and *Jack E. Shield,* '22, chairman of the Social Committee.

WASHINGTON MEETING

A hurry up call for a meeting on October 30th was issued to alumni in the vicinity of Washington, D.C., to honor William A. Lewis, '26, M.S., '27, Ph.D., '29, of Cornell University, who was in the city for a few days. Those at the meeting were Corliss Bercaw, '18, who acted as chairman, H. E. Cunningham, '26, H. L. Remington, '26, C. L. Gazin '27, Harold L. Smith, '37, and Patrick Harney, M.S., '35.

There have been a sudden series of transfers and changes in position amongst the Washington contingent as enumerated elsewhere in these pages. However new men are being assigned continually to this area, and the group is carrying on. Any Tech men who are assigned to positions in Washington, or are visiting the Nation's capitol, are requested to contact P. J. Harney, 3717 Warren St., N.W., Washington, D.C.

T

OXY GAME PARTY

Alumni by the hundreds took advantage of the fact that the Oxy Game was played on Saturday night, October 21st, to bring their families to see a Tech team go down fighting. The game was full of surprises, one of the greatest of which was the fact that Tech came out on the short end.

Some 280 Alumni and partners then hied themselves forth to the Athenaeum for a "get together," which proved to be not only a "get together," but a combined dance and spectacle. The dance was to tunes supervised by Miss Dierkes, — she was partial to "Ferdinand" it seemed.

The feast was hot cakes and sausages, and the spectacle, members of the Board of Directors preparing same. That their capabilities for flipping a mean flap jack had been noted for the first time, was evidenced by remarks overheard in some quarters which constituted an invitation to perfect their technique by preparing Sunday breakfasts in the sanctity of the home.

Loys Griswold, '24, furnished the music, and the arrangements were made by *Ed Kinsey,* '26, as chairman for the evening. *Jack E. Shield,* '22, is social chairman for the year.

GEOPHYSICAL PROSPECTING FOR OIL

(Continued from page 5)

possible, by making the proper physical measurements at the earth's surface, to make some deductions concerning the subsurface distribution of physical properties and, accordingly, the rock structure. These measurements and their interpretation comprise the methods known as geophysical prospecting. It is not the object of this article to describe all of these various methods in detail, but rather to give a brief and general description of some of them.

GRAVITATIONAL METHOD

The facts that various rocks possess different densities and that each unit volume of material exerts a gravitational attraction proportional to its density and inversely proportional to the square of the distance from it suggest at once the use of gravitational methods of prospecting. The variable distribution of densities in subsurface rock structures has associated with it corresponding variations in the strength of the earth's gravitational field at the surface. Localities with subsurface rock densities higher than their surroundings show a slight increase in the intensity of gravity measured at the surface, the converse being true for distributions of lower densities. As might be expected, the surface variations in the intensity of gravity are in general very small, often amounting to no more than a few parts in a million of the normal value of gravity. For this reason it is necessary to carefully account for and eliminate the effects of variations in gravity caused by other factors at the points of observation; namely, elevation, latitude, and near-by irregularities of surface topography.

The measuring instrument used must be very sensitive and capable of utmost constancy under adverse field conditions of extensive transportation and a wide range of temperature variations. Two types of instruments are used: the torsion balance and the gravity meter or gravimeter. The torsion balance is a remarkably sensitive device consisting of a set of weights mounted on a horizontal beam suspended on a vertical torsion fiber. Under the influence of a non-uniform gravity field, this assembly rotates slightly. The instrument measures among other quantities the horizontal rate of change, or gradient, in the intensity of gravity, rather than the intensity itself. The gravimeter, on the other hand, is an instrument which measures the intensity of gravity directly. It consists in principle of a mass suspended on a spring which varies in length according to the strength of gravity. Because of the almost infinitesimal size of these variations, the sensitivity of the instrument is usually increased by an auxiliary spring system which makes the device approach an unstable condition. The gravimeter is capable of detecting changes in gravity as small as one part in ten million of its normal value.

The Gulf Coast salt dome structures previously described have been particularly amenable to gravity prospecting, since the salt usually has a lower density than the surrounding sedimentary rocks. During the period from 1923 to about 1930, a number of salt dome structures were located by means of torsion balance surveys. In the last few years the torsion balance has been largely superseded by the gravimeter because of the much greater speed of operation of the latter. The gravimeter is now being used extensively for reconnaissance exploration since it can survey a large area at relatively low cost. Maps drawn with contour lines joining points having the same corrected gravity value often show a close relationship to subsurface structural features. Under favorable conditions it is possible to discern the location of folds, faults, etc. However, it is usually not possible to get a quantitative picture as to the details of structure at depth.

MAGNETIC METHOD

All materials when placed in a magnetic field become magnetized in various amounts, depending on their magnetic permeability. Thus, rock structures immersed in the earth's magnetic field become magnetized in various degrees, giving rise to variations in the intensity of the earth's magnetic field at the surface. These variations are unusually quite small, in many cases not exceeding a few parts in ten thousand of the earth's normal field. The measuring instrument used is called a magnetic field balance or megnetometer. It consists of a magnet mounted on a horizontal quartz knife edge, free to rotate about this axis. The turning moment exerted by the earth's magnetic field is balanced by the opposing moment of a counter-weight. Small variations in magnetic strength cause a measurable rotation of the system. Separate instruments are needed to measure the vertical and horizontal components of the magnetic field.

The measurements taken in the field are corrected for regional latitude and longitude variations, and for small diurnal variations. Separate maps are then prepared with contour lines joining points of equal magnetic intensity for both vertical and horizontal components. Under favorable conditions when there is sufficient contrast in the magnetic permeabilities of the subsurface rocks, the location of folds, faults, and other features may be discerned, although the interpretation is more difficult than in the case of gravity surveys. It is not possible in general to draw a detailed structural picture from the data.

ELECTRICAL METHOD

Electrical methods of prospecting depend in their operation on contrasts in the electrical resistivities of subsurface rocks. There are a number of procedures possible, but in general the method consists in driving four or more electrodes into the ground, putting a known current through two of them, and measuring the potential difference between the other electrodes. The voltage-current ratio multiplied by an appropriate constant is then a rough measure of the average electrical resistivities of the rocks underlying the electrode configuration. The value obtained depends on the spacing and the configuration of the electrodes. By taking readings for various spacings, it is possible to make an estimate of the variation of resistivities with depth. On the other hand, if the spacing is kept constant, but the configuration is moved along the surface, the readings give an indication of horizontal variations in subsurface resistivities and hence in

rock types. Under favorable conditions this method will give useful information for relatively shallow depths.

SEISMIC METHOD

The seismic method of prospecting consists in detonating a charge of explosive near the surface of the ground and recording the resulting motion of the ground at various points. Since the velocity with which the explosion wave travels is different in various kinds of rock, measurements of times of arrival of the impulse at various distances from the shotpoint can be used to outline subsurface structures. This method of prospecting was particularly successful in locating salt domes in the Gulf Coast region. Here the velocity of propagation in the salt is appreciably higher than in the surrounding rocks. In the usual method of prospecting, called "fan shooting," a series of receptors were placed about the shotpoint on the arc of a circle several miles in radius. The shot instant was usually transmitted by radio to the recording positions. Then, if any of the paths from the shotpoint to the receptors has intercepted a salt plug, those receptors would show a small lead in time of arrival over the adjacent paths. By systematic coverage of the region with a number of "fan" setups, salt plugs which were not too deep could be located.

REFLECTION SEISMOGRAPH

The natural outgrowth of the above described "refraction seismograph" procedure was the "reflection seismograph" method of exploration. In stratified sedimentary rocks the various strata differ in density and elastic constants. As an explosion wave travels downward from a shot detonated near the surface it suffers partial reflection at the boundaries between the different rock strata. As only a small fraction of the incident energy is reflected at each interface, the wave continues to travel downward, generating at the various interfaces trains of "reflections" or "echoes" which travel upwards to the surface. Since the detonation of the shot sets the ground into sustained and complicated modes of vibration, only the stronger reflections are discernible above this background motion. In practice, the number of visible reflections per shotpoint may vary from two or three to twenty-five or fifty.

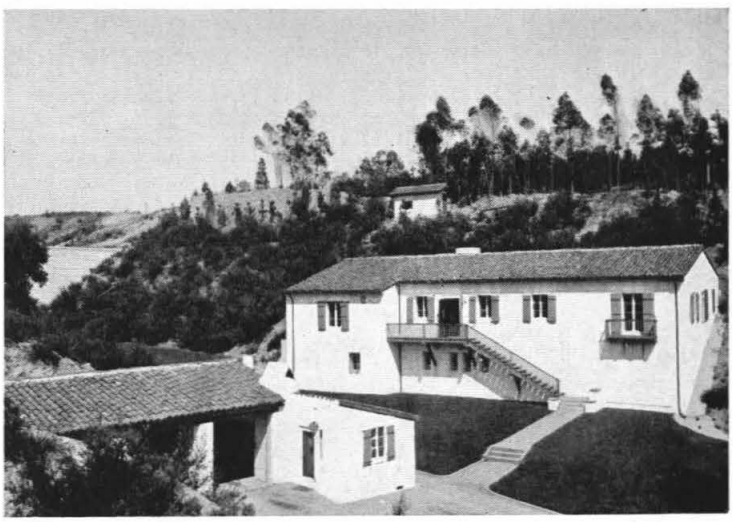
The field procedure in reflection seismograph prospecting is ordinarily as follows. A series of shotpoints are placed along a line of profile across the area to be explored at intervals varying from ⅛ to ½ mile. The shotholes are drilled by a portable shothole drill, usually to a short distance below the water table, which may be from 5 feet to 500 feet or more in depth. A charge of dynamite varying in size from a fraction of a pound to 100 pounds is loaded near the bottom of the hole, and detonated by means of an electric blasting cap. In the mean time a number of vibration pick-ups or "geophones" have been placed along the line of profile at intervals of 25 to 200 feet on each side of the shotpoint. Each of these geophones is connected electrically by means of a cable to a bank of vacuum tube amplifiers in a recording truck located near the shotpoint. The outputs of the amplifiers, which are automatically controlled to produce a nearly constant amplitude, are in turn photographically recorded by the oscillograph on a rapidly moving strip of film. Timing lines are superimposed every 0.01 second. The oscillograph is started a short interval before the shot is detonated, and the shot instant is recorded on the film, together with the motion of the ground at each of the geophone positions for several seconds after the shot.

On this record or seismogram the arrival of reflected waves can be identified by the nearly simultaneous appearance of similar pulses on all the photographic traces. By means of the timing lines the arrival of the reflected waves can be timed with an accuracy of 0.001 second, and their directions of arrival can be calculated from the difference in arrival times at the various geophone positions. From these data, the depths, positions, and dips of the reflecting interfaces can be calculated, provided the velocities of propagation in the ground are known. This velocity data is obtained by well velocity surveys. The data from the various shotpoints are combined in a vertical cross-section showing the subsurface information obtained at each station. Contour maps are then drawn showing the structure of desired horizons.

The reflection seismograph method of exploration has been very extensively used during the last seven or eight years, and has resulted in the discovery of many new oil fields. Of all geophysical methods, it is the only one which yields data in the precise form which the geologist desires — that is, the actual positions and dips of subsurface strata. However, in common with all other geophysical methods, it is an indirect method of exploration, locating structures rather than oil accumulations themselves.

Recently a method has been introduced which attempts to locate oil accumulations directly. It consists of analyzing near-surface soil samples for minute quantities of hydrocarbons which may have migrated upward from subsurface accumulation of oil and gas. Although the soil gas analysis method has had some success, it is as yet too early to predict its ultimate value as a prospecting method.

Photographs courtesy of the United Geophysical Company



Seismological Laboratory of the Division of the Geological Sciences located in the San Rafael Hills a few miles from the campus.

NEWS OF CLASSES

1911

Harold C. Hill, who is Sales Engineer with the General Electric Company at Los Angeles, recently presented a paper before a meeting of the California Natural Gasoline Association entitled, "Electrical Controls, Fractional Horse Power Motor in Natural Gasoline Plant Operation."

1915

Raymond D. Andrews has purchased an interest in Glendale Foundry and Alloys, Inc., at Glendale, California, and he is in charge of sales for the company.

1918

Frank Capra's latest picture, "Mr. Smith Goes to Washington," is arousing country-wide interest, not only for its expected deftness in telling an amusing story, but for its unfolding of the hero's faith in American democracy.

Corliss Bercaw has resigned as Sales Engineer for the Westinghouse Electric and Manufacturing Company at Washington to accept a position on the staff of the Baldwin Locomotive Works at Philadelphia, taking an active part in its new diesel-electric program.

1922

Harold R. Harris, who is vice-president of Pan-American-Grace Airways, is now located in New York City.

1923

Basil Hopper has recently been appointed Assistant Manager of Research and Development of the Union Oil Company of California.

1924

William L. Holladay is the author of an article "Blower Coils in Refrigeration," published in the September issue of the magazine, Refrigeration Engineering.

1925

Linus C. Pauling, Ph.D., who is Chairman of the Division of Chemistry and Chemical Engineering and Director of the Gates and Crellin Laboratories at the Institute, has been additionally honored by his election as Chairman of the Faculty for the 1939-1940 term.

Markham E. Salsbury, who is Junior Assistant Chief Engineer of the Los Angeles County Flood Control District, is the author of an article, "Behavior of Channel Protection Works During the Storm of 1938," appearing in the October 6th issue of the Southwest Builder and Contractor. The article was based on a paper which he delivered before the September meeting of the Los Angeles section of the American Society of Civil Engineers.

Paul C. Rivinius is an accountant with the firm of Price, Waterhouse and Company in Los Angeles.

Ed Thayer and his wife enjoyed a well earned vacation by taking a Carribean cruise, and reported that no submarines were sighted. Thayer is on the staff of the magazine, "Industrial Marketing," in New York.

Carl H. Heilbron, Jr., who is Associate Engineer in the U. S. Engineers' Office, recently passed the California state examination for licensing as a structural engineer.

Harold Graham, x25, is one of the outstanding industrial designers in Southern California; his work includes the design and execution of window displays and pretentious interior displays in Los Angeles stores, and also the re-design of industrial products to increase sales appeal and general utility. Of current interest is his animated Christmas window at Bullock's in downtown Los Angeles.

1926

Wallace Penfield, who is Engineer of the Santa Barbara County Planning Commission, addressed the Water and Soil Conservation Conference held in Los Angeles last month on "Water Conservation Problems of Santa Barbara County."

1927

Dr. John H. Maxson, who is Assistant Professor of Geology at the Institute, left Pasadena the middle of November to continue geological reconnaissance work on Lake Mead, Nevada. This project is a continuation of the previous Grand Canyon explorations, and is being carried on jointly by Dr. Maxson and Dr. Ian Campbell, who is Associate Professor of Petrology at the Institute.

Lee W. Ralston has been appointed coordinator (college president) of the Coalinga, California, Extension Center of Fresno State College, having complete charge of the Junior College at Coalinga.

Roland Reynolds is the proud father of a son, Gary Lee, born on September 9th at Pomona, California.

Dr. Carl D. Anderson is the author of an article "Cosmic Rays" in the October issue of the Griffith Observer.

Thomas Southwick, who is with the United States Weather Bureau, has been transferred to the Cincinnatti office working on the River and Flood Control program.

1928

Alex Clark has been carrying on extensive field work in Wyoming and the Rocky Mountain plateau as geologist for the Shell Oil Company.

George R. Crane, who is with the Electrical Research Products, addressed the Electrical Engineering Seminar at the Institute last month on "Some Problems in Sound Recording."

Elbert E. Miller has been promoted to Project Engineer for the new Army Bomber at the Douglas Aircraft Company's El Segundo plant.

Hart Ross is Electrical Engineer for the American Totalizer Company, and he keeps the pari-mutuel equipment at Santa Anita and Hollywood Park in operating condition.

Kenneth M. Fenwick is the proud father of a son, Douglas Kenneth, born on October 6th. Fenwick, who is employed by the California Division of Highways, has recently been appointed Assistant District Maintenance Engineer with headquarters at Los Angeles.

Charles F. Lewis, who is Sales Engineer with the Cook Heat Treating Corporation at Houston, Texas, attended Engineer Reserve Officers Camp in Texas last summer.

Francis Noel, who has been in the State Bridge Department at Los Angeles, has been transferred to the California Division of Highways, District VII at Los Angeles, and is employed as a Junior Highway Engineer.

1929

Beverly Fredendall, who was in charge of the National Broadcasting Company's exhibit at the New York World's Fair, spent several weeks as technical adviser at the company's new Hollywood Broadcasting studios this fall.

Stanley Lohman, who is with the Water Resources Branch of the U. S. Geological Survey, is in Kansas doing field work on water tables for the Survey.

John Daly, who is a seismologist for the Shell Oil Company, was transferred recently to Los Angeles, having formerly worked in the San Joaquin Valley.

Frank Thompson, who is Engineer for the California Railroad Commission at Los Angeles, is the proud father of a little girl, Gaylene Anne, born on May 2nd at Glendale.

Fred Cline, who is in the United States Engineer's Office at Los Angeles, has recently been promoted to Associate Engineer, and is in charge of hydraulic design for a portion of the flood channels being constructed by the Army Engineers in Los Angeles county.

Sid Exley, who is manager of the Harper and Reynolds Hardware Company at Los Angeles, and his wife, Ann, were some of Tech's most loyal football supporters the past season, having attended nearly all the games.

Dr. Donald S. Clark, who is Assistant Professor of Mechanical Engineering at the Institute, attended the National Metals Congress in Chicago last October.

James W. Dunham, who is Assistant Area Engineer of the Second Field Area of the U. S. Engineer's Office at Los Angeles, is the author of an article, "Unusual Tunnel Job in Relocating Glendale Outfall Sewer at River," appearing in the October 6th issue of the Southwest Builder and Contractor.

1930

Roland F. Hodder is Chief Engineer for the Gravity Service Company of Houston, Texas.

Orrin Elliot is the proud father of a son, David Orrin, born on June 22nd.

Ed Dmytrick, x30, is the youngest director at Paramount Studios, having formerly been chief cutter at the studio.

Nathan D. Whitman is now a licensed structural engineer having passed the California state examination recently.

1931

Everett G. Trostel, who is with the Union Oil Company, is an instructor in petroleum engineering in the University College of the University of Southern California. Amongst his students are **Bill Althouse, Jack Baker,** and **Bob Barry,** all of the class of '38.

Charles K. Lewis, who is Assistant Engineer in the United States Engineer's Office at Los Angeles, addressed the Water and Soil Conservation Conference held in Los Angeles last month on "Place of Water Conservation in the Work of the

(Continued on page 14)

"Didn't Little Boys Get Trains, Grandpa?"

"No, sonny, not when I was a little boy. You see, Santa Claus hadn't learned how to make electric trains, or automobiles, or airplanes then. I used to get a jackknife or a pair of mittens for Christmas. You're a lucky boy!"

BOYS and girls aren't the only lucky ones these days. Just check over the things you have, and ask yourself how many of them a family like yours could have had even a generation ago. Certainly not your radio or your electric refrigerator. Probably not your automobile, or even your electric lights. And there are thousands of other things—now available in a wide variety and at a reasonable price—that were unknown or prohibitively expensive only a few years ago.

Yes, we say we are lucky today. But it wasn't luck that made all these things available to us. It was American industry—its scientists, engineers, and workmen—who developed these new products, improved them, made them less expensive so that more millions of people can enjoy them.

More than any other one thing, the increasing use of electricity in industry has helped in this progress. For more than 60 years, General Electric has pioneered in making electricity more useful to the American people—in creating More Goods for More People at Less Cost.

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

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(Continued from page 12)

Army Engineers." He recently was promoted to First Lieutenant in the 604th Engineer Reserve Battalion of the U. S. Army.

Calvin Frye is now a Marine Engineer at the Puget Sound Navy Yard at Bremerton, Washington.

Frank Wengren, x31, was married to Miss Gladys D. Nelson on September 2nd at Santa Barbara. He recently took the California state bar examination.

Howard G. Smits is now Structural Engineer for the Harbor Hills Housing Project, near San Pedro, California, which is one of the largest California low cost housing projects sponsored by the United States Housing Authority.

Sam Eastman, who is a member of the advertising firm of Dozier Graham Eastman, is vice-president of the Southern California chapter of the National Industrial Advertisers' Association.

1932

Albert W. Atwood, Jr., was married to Miss Elaine Lynch in Los Angeles on December 9th. Atwood is with the Metropolitan Water District of Southern California, and has long been prominent in alumni affairs, this being his second year as Secretary of the Alumni Association.

Howard W. Finney is an accountant with the firm of Price, Waterhouse and Company in Los Angeles.

James R. Bradburn was married to Miss King Turnbull of Chicago on September 9th.

William Bleakney, Ph.D., has resigned his position with the National Bureau of Standards and is now with the Lockheed Aircraft Company at Glendale.

Richard A. Searle has been laying out the electrical work, since January, for the new Walt Disney Studios now under construction at Burbank, California.

Benarthur C. Haynes has resigned as Instructor in Meteorology at the Boeing School of Aeronautics, Oakland, California, to accept a position as Instructor in the Air Mass Section of the United States Weather Bureau at Washington, D.C. He will also do research work in the newly organized Research Department of the Bureau.

1933

Willis P. Popenoe, M.S., Ph.D., '36, who is Curator in Invertebrate Paleontology, has returned from the Philippine Islands where he spent the summer on oil surveys for the Island government. He made the round trip by way of the Pan-American "Clipper" ships.

Fred H. Detmers is with Technicolor Motion Picture Company in New York City.

Al F. Libby is the proud father of a daughter, Diane Feller, born on September 17, 1939.

James L. Botsford, Ph.D., is now Dean of Men and mathematics instructor at Eastern Washington College of Education at Cheney, Washington.

Maurice Donnelly, M.S., Ph.D., '35, who is in charge of a co-operative research project of the University of California and the U. S. Soil Conservation Service at Riverside, California, spent a month on the campus this fall to complete studies on the pegmatite problem.

Robert D. Fletcher has been appointed ground school instructor for the Civil Aeronautics Authority pilot training center at Brown University at Providence, Rhode Island. He was formerly a meteorologist for American Airlines, and has been teaching a course at the Massachusetts Institute of Technology.

1935

Herbert S. Ribner received the degree of Doctor of Philosophy from Washington University, St. Louis, last June, and was married to Miss Sylvia Berin of St. Louis on June 4th. He is doing development work for the Gravity Service Company of Houston, Texas, and is now living in Houston.

Albert O. Dekker has accepted a position as Associate Professor of Chemistry at Berea College, located at Berea, Kentucky.

Donald C. Webster was married to Miss Caroline Kennedy of Westwood Hills on October 17th.

1936

Eugene Bollay, M.S., has been transferred to the Knoxville Office of the U. S. Weather Bureau.

Ted Fahrner is doing field work on damsites in New Hampshire for the Federal Power Commission.

Moe Rosen is now employed as a Marine Engineer at the Puget Sound Navy Yard at Bremerton, Washington.

The engagement of **Wallace Kiger** to Miss Ilo Smith of Pasadena was announced last September, and the wedding will take place in the Spring.

1937

William L. Penn, who is employed by the Hydril Company, has been promoted recently to the position of shift foreman at the Company's Rochester, Pennsylvania, oil tool shops.

John S. Edwards, Jr., is now at the Port Ivory plant of the Proctor and Gamble Company on Staten Island, New York.

LeVan Griffis is now an instructor at the Armour Institute of Technology in Chicago.

Harry H. Carrick received his master's degree from the Institute in June and is now a Structural Engineer in the Los Angeles City Building Department.

Herbert R. Sheppard received his master's degree from the Institute last June and is now stress analyst at the Burbank plant of the Lockheed Aircraft Company.

Robert P. Bryson, M.S., is on a field trip for the U. S. Geological Survey.

Harold L. Smith is now with the Federal Power Commission at Washington.

M. H. Webster is now in his third and last year at the Harvard Law School.

Bill Wetmore recently became engaged to Miss Eleanor Cleland of Pasadena, a U.C.L.A. senior this year. He is Resident Associate at Ricketts House, while working for his doctorate at the Institute.

Edward J. Horkey was married to Miss Helen Marie Holroyd of Los Angeles last month.

1938

Hank Evans, who held a fellowship in the Graduate School of Traffic Research at Yale University last year, is now a Traffic Engineer for the Automobile Club of Southern California in Los Angeles.

Munson W. Dowd is now a Junior Engineer in the U. S. Indian Irrigation Service and is stationed at Yerington, Nevada.

John L. Merriam is now with the U. S. Soil Conservation Service and is stationed at Santa Ana, California.

Arthur W. Sidler, who received his master's degree at the Institute in June, is now working for the Engineer of San Bernardino County, California.

Richard W. Folkins received his master's degree at the Institute in June and is now working for the firm of J. S. Metzger and Sons, general contractors in Los Angeles.

Don Warren, who was Senior Bridge Engineer on the San Francisco-Oakland Bay Bridge and who has been in charge of all State bridge construction in Southern California for several years, is resigning to open private offices on January 2nd in the Architects' Building in Los Angeles. In addition to many years of experience on bridges, he has had extensive experience on major hydraulic structures. In private practice he will specialize in structural and civil engineering as it pertains to bridges and foundations.

Russell Hayward has returned to the employ of the Lane-Wells Company at Los Angeles, and has been promoted to the position of Field Engineer in the Directional Drilling and Oriented Survey Departments of the Company.

Roland Stone has accepted a position as chemist in the sales laboratory of the Filtrol Corporation in Los Angeles. He was formerly employed by the Proctor and Gamble Company.

Garn A. Rynearson has been appointed the New Jersey Zinc Company Fellow in Chemistry at Lehigh University in Behlehem, Pennsylvania.

James Balsley is teaching geology at Harvard University.

Jack Knight was married to Miss Barbara Garrison of South Pasadena on November 1st in the little Church of England in Aukland, New Zealand.

Paul A. Dennis was married to Miss Barbara Winchester of Pasadena on November 4th.

Clay Smith has done an excellent job this past season of coaching the Freshman football team, while he is doing graduate work at the Institute.

1939

Robert L. Smith is to be married to Miss Phyllis Elizabeth Roeder of Glendale on December 16th.

William L. Brown is to be married to Miss Dorothea Armstrong of Beverly Hills on December 15th at Tulsa, Oklahoma.

Herman S. Englander has returned from an extended tour of Europe, having sailed immediately after graduation.

T. Matthew is taking the training course of the Southern California Edison Company, and is now working at Santa Monica doing sales engineering work selling power to the motion picture studios.

William F. Ropp is in the Engineering Department of the Soule Steel Company at Los Angeles, doing estimating and computing.

Paul Engelder is a graduate student at the Institute and assisted Coach Musselman with the Scrub team the past season.

George Asakawa is now employed by the Okura Company in New York City.

Udene Younger is now with the United Acoustigraph Company in Los Angeles.

Russell Anderson is doing time study work at the plant of the L. A. Period Furniture Company at Los Angeles.

Carl J. Schneider and **Carl Paul** are both employed at the Peoria, Illinois, plant of the Caterpillar Tractor Company.

Walter H. Munk spent the summer on a research voyage along the coast of California for the Scripps Institute of Oceanography securing specimens of the ocean bed, which revealed the geological composition of the bed and formation of the coast lands.

The engagement of Miss Dorothy Leslie of Eagle Rock to **John Jake Browne** was announced recently, and the wedding will be held the early part of the coming year.

Leo Beard, Edgar Griswold, Robert Haussler, and **Robert L. Smith** are in the U. S. Engineer's Office at Los Angeles.

Willard Snyder and **Edward Sullivan** are Junior Engineers in the U. S. Bureau of Reclamation and are working on the Central Valley Project.

Dick Bradshaw is with the Emsco Derrick Co. of Los Angeles.

John Osborn is with the American Concrete Pipe Company at South Gate, California.

James Ritchie is with the Firestone Tire and Rubber Company at its South Gate Plant.

W. E. Wilson, M.S., is now Assistant Professor of Hydraulics at Wayne University in Detroit.

William H. Bonnell, M.S., is now working for the Lockheed Aircraft Company at Burbank, California, where he is doing stress analysis.

N. A. Christensen, Ph.D., is Dean of Engineering at Colorado State College.

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ADSORBENT CLAY

(Continued from page 6)

HIGH-COMPRESSION

High-octane, anti-knock fuels for aircraft use have been prepared, for example, by starting with gasoline of maximum octane rating, and then 'doping' it up with lead compounds and pure isooctane. With the new catalytic cracking process, raw gasoline can be re-cycled to reform into a base fuel of as high as 91 octane rating, from whence it can be cheaply raised to 100 by conventional methods.

This new development may even effect the design of tomorrow's automative engines, for now that the high-compression fuels can be manufactured by this method, automotive engineers will be enabled to design high compression motors to take full advantage of the new fuel. It is estimated that an automotive engine designed to take full advantage of 100 octane gasoline would be about one-half the size of today's engines, with no sacrifice in performance.

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DECEMBER MEETING

"Labor Relations in Industry" was the topic discussed by Mr. Arthur H. Young, Lecturer on Industrial Relations at the Institute, at the December meeting held on December 8th at the Mary Louise Tea Room in Los Angeles.

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Petroleum Geologists Meeting

The Pacific Section of the American Association of Petroleum Geologists held its sixteenth annual meeting at the Ambassador Hotel in Los Angeles on November 9th and 10th. Tech was well represented in both attendance and number of papers read. For instance *Ed Joujon-Roche,* '28, and *John Daly,* '29, both of the Shell Oil Company, were prominently represented . . . at least they were easily seen. *Dr. Francis D. Bode,* '30, presented one of the most interesting papers of the meeting, entitled, *Geological Observations in Italian East Africa.*

In the informal symposium on recent petroleum discoveries in California, *Rollin Eckis, M.S.,* '30, of the Richfield Oil Company, discussed the Coles Levee oil field, a relatively recent discovery in the San Joaquin Valley. *Loyal E. Nelson,* '36, of the Texas Company, presented an extemporaneous discussion of the South Mountain View field on the eastern side of the valley.

BOOKS

THE RAMPARTS WE WATCH

By GEORGE FIELDING ELIOT

A book review by Frederic W. Hinrichs, Jr.

Major George Fielding Eliot, long interested in military problems, and at present expert commentator on the European War for the New York *Herald-Tribune,* has undertaken a review of the foreign policy of the United States, and of its bearing on our military preparation. The book was published in 1938, and has had many printings. It appeared before the invasion of Poland by Germany, and the simultaneous declaration of war on Germany by Great Britain, France, and the Dominions of the British Commwonwealth—Canada, Australia, New Zealand, and South Africa; and for this reason it is not altogether up-to-date in some of its parts. But as this review is written, in late November 1939, it is only fair to state that the author has analyzed the general need for military preparation by the United States with great skill as far as facts available to him at the time of writing would permit.

The classic work on *A Military Policy for the United States,* by General Emery Upton, was written shortly after our own Civil War, and lay in manuscript form in the archives of the War Department until discovered, about 1902, by Elihu Root when he was Secretary of War. Mr. Root at once saw the value of Upton's suggestions, and had the material published in book form. Changes in equipment, especially in artillery and rapid fire small arms, the development of the motor-car, the airplane, the tank, and the coming of chemical warfare, have, of course, modified some of the conclusions stressed by Upton. It is as to this modification which modern conditions have brought about, that Major Eliot makes his suggestions—suggestions, in my opinion, theoretically sound and practically attainable.

The book is provided with convenient maps, of the North and South Pacific Oceans, of the North and South Atlantic Oceans, and of the Caribbean Sea and the Gulf of Mexico. The argument is largely based upon these maps, upon the distances involved between strategic points, upon the harbors available, the density of traffic involved, the defense of zones, and especially that around and leading to the Panama Canal. The reader should of course follow the plan of the book and should consult these maps frequently as Major Eliot develops his thesis.

NAVAL STRENGTH

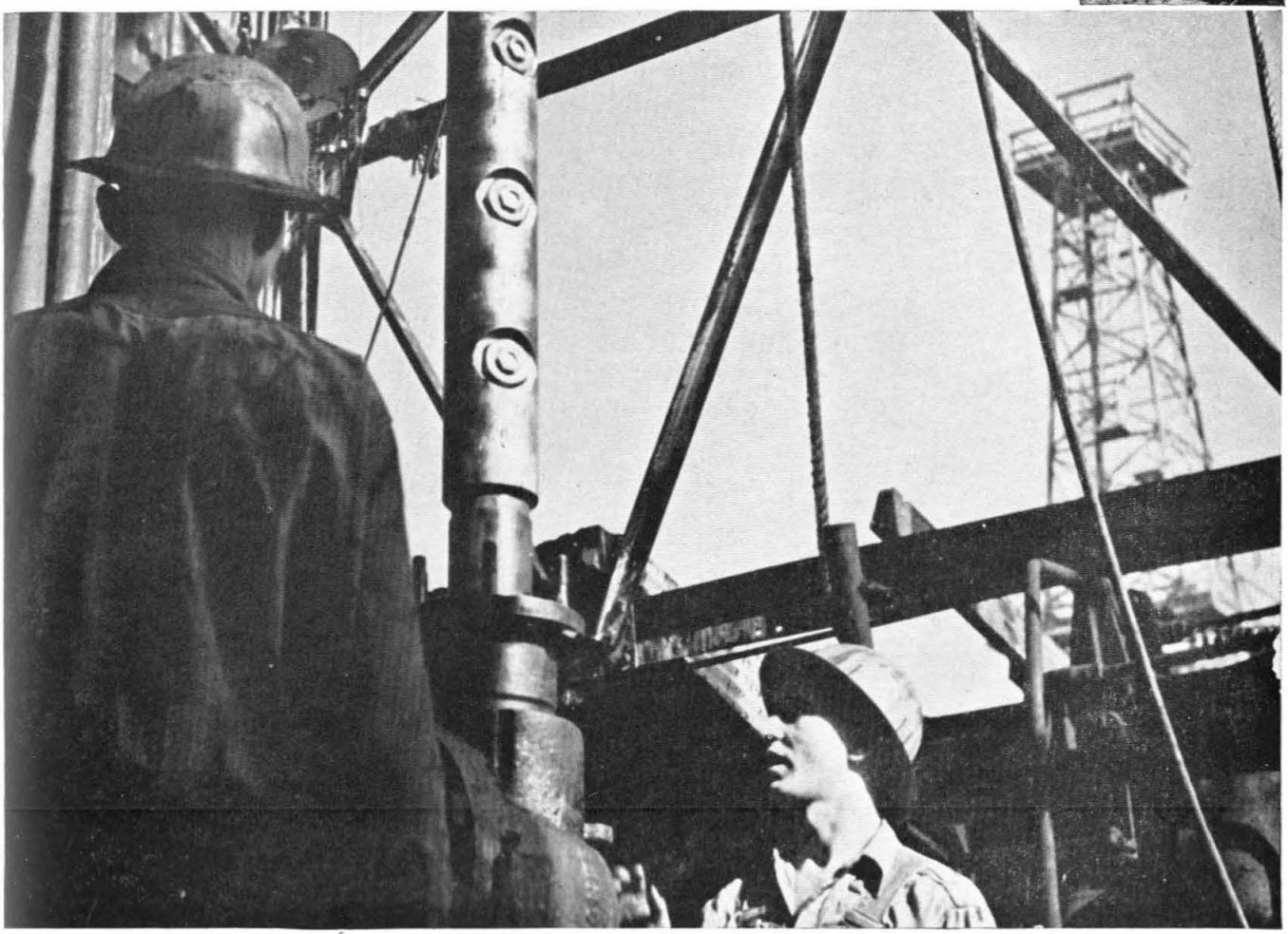
This thesis is in brief that the United States, because of its position, can best defend itself by keeping the main battle-line strength of our Navy together in either ocean, and at the same time holding beyond peradventure the Panama Canal, the "short-line" of communication between the oceans. He indicates what he considers an adequate Navy, what its composition should be, from the battle-ship class through the cruisers, destroyers, submarines, air-craft carriers, and airplanes. He points out the many-sided functions of the Navy, and makes suggestions as to training, and as to the commissioned, non-commissioned, and enlisted strength which should be assigned to the fleet.

And then he takes up the part our Army should play in his general defense scheme, for he in no way is an advocate of aggression by the use of armed force. Major Eliot indeed recognizes that armed force is constantly being used today for purposes of territorial or other national aggrandizement, but he is confident that we in America have no such aims and will avoid war when possible. On this basis, the needs of the various arms of the land forces are discussed, the personnel, and the materiel necessary and adequate, the interchange of officers between branches, and the coordination of the work of both Army and Navy by such interchange between the Services. The author concludes that we do not need an army of the size of those now with the colors in Europe, but one of approximately 650,000 men, to include Regulars, National Guard, and Reservists available for quick call to active duty. The Navy personnel is much below this, but adequate to man the powerful fleet we should maintain. At full strength, Major Eliot calls for a personnel of 135,000 men, an organized naval reserve of 35,000, backed by a volunteer reserve and a merchant marine reserve of equal strength.

We in the United States have for many years enjoyed the benefit which a strong British Navy, under a friendly foreign policy, has conferred upon us. We in our turn give a feeling of security to our neighbors in the Western Hemisphere by our relatively great strength. Canada and our Latin American neighbors to the south are vitally interested in the maintenance of sea power by a friendly Great Britain and an adequately armed United States. The ramparts we watch are primarily the waves lapping our own shores. Secondarily, Alaska, Hawaii, Panama and its approaches are in the picture. And finally, the shore-line and adjacent waters of our neighbors, north and south, are vitally a part of our plans for defense. For if any secured foot-hold, or naval or air bases were obtained in North or South America by a potential enemy, say a victorious Germany on our Atlantic coast or a truculent Japan on our Pacific coast, the gravest disarrangement of defense plans might follow.

To prevent such an eventuality, to give ourselves adequate preparation without the huge armament burdens under which Europe labors, Major Eliot makes a carefully considered proposal. Armed as he suggests, with a foreign policy aimed at friendly trade and just relations with the rest of the world, we should be able, "if compelled to do so, to inflict grievous hurt on others, while taking little hurt ourselves. . . . We can make sure that we command the seas which are the medium of contacts with other nations—those seas which are our ramparts, and upon which we must stand our watch."

PRODUCTION GOES UP
COST GO DOWN

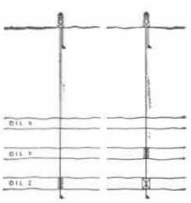


WHEN LANE-WELLS *GUN PERFORATES AN OIL WELL*

Perforating of oil well casing two miles or more below the surface was just a dream of a few short years ago when Lane-Wells engineers tackled the problem. It meant designing a gun that would fit inside pipe and yet be powerful enough to penetrate as many as three strings of heavy casing. It meant solving the problem of measurement to place each shot with deadly accuracy. It meant building controls to fire the individual charges.

How well these engineers have succeeded is proved by the fact that more than 22,000 oil wells have been Gun-Perforated by Lane-Wells since 1933 throughout the oil fields of the world.

The story of Lane-Wells Gun Perforating is available to all engineers. Write to the nearest Lane-Wells office.



Operators today drill and cement casing straight through all the producing zones. They Gun-Perforate the lowest zone and after production has been exhausted run a Lane-Wells bridging plug, perforate the next upper zone and continue to produce the well.

LANE WELLS COMPANY

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