ENGINEERING AND SCIENCE

MONTHLY

APRIL • 1946

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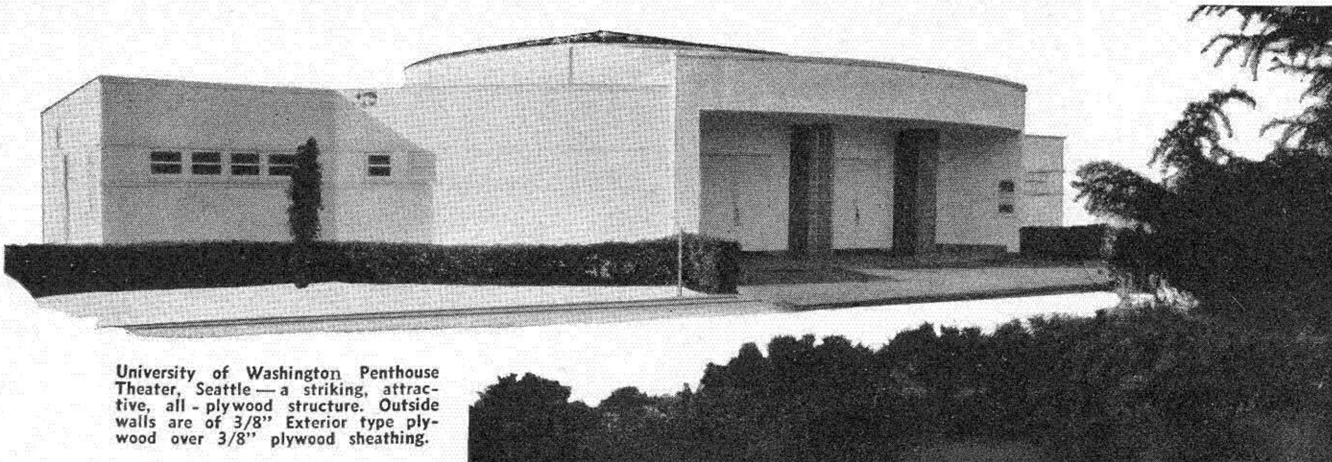

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BY-LINES

JAMES R. PAGE

James R. Page, President of the Board of Trustees of California Institute of Technology, has been an Institute trustee since 1929. He is also a member of the California Institute Associates and was president of that group from 1933 to 1937. A long-time resident of Los Angeles, Mr. Page has been prominently identified for many years with both the financial and civic affairs of the community. Mr. Page is a partner in the firm of Page, Hubbard and Asche, and a director of several southern California corporations.

• • •

CAPTAIN JOHN T. HAYWARD

Captain John T. Hayward, who was graduated from the United States Naval Academy in 1930, enlisted in the Navy at the age of fifteen and was appointed to the Academy by former President Calvin Coolidge at the age of sixteen. He was graduated from the Navy's Flight School at Pensacola in 1931. During the war he commanded a Navy bomber squadron, VB-106. In recognition of his services Captain Hayward has been awarded the Distinguished Flying Cross with a Gold Star and Oak Leaf Cluster, the Army Distinguished Unit Citation with Oak Leaf Cluster, the Purple Heart, and the Distinguished Order of the British Empire. At the present time he is the Experimental Operations Officer at the Naval Ordnance Test Station, Inyokern, California.

• • •

WILBUR C. THOMAS

Wilbur C. Thomas (1897-1946) received his B.S. degree from Throop College of Technology in September, 1918. At the time of his death — February 27, 1946 — Mr. Thomas was employed by the Southern California Telephone Company, serving as Toll Plant extension engineer.

• • •

HORTON H. HONSAKER

Horton H. Honsaker received his B.S. degree from the California Institute of Technology in 1921. Subsequently, he was employed by the Southern California Telephone Company where he has been engaged in transmission, outside plant, and plant extension engineering. For the past few years he has been an engineer in the Toll Plant extension group of the chief engineer's organization, dealing with the long term toll circuit program.

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Cover Caption:

Atomic ruins of what was once the largest Catholic church in Japan, with a seating capacity of 6,000 people.

ENGINEERING AND SCIENCE

Monthly

The Truth Shall Make You Free

CONTENTS FOR APRIL, 1946

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ENGINEERING AND SCIENCE MONTHLY

Edited at California Institute of Technology

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Vol. IX, No. 4 April, 1946

A Record of Achievement

By JAMES R. PAGE*

IT IS just twenty-five years ago that Dr. Robert A. Millikan assumed in 1921 his post of leadership at the California Institute of Technology. And if there is any truth in the saying that an institution is the lengthened shadow of a man, that truth has been abundantly exemplified in this case. During the past quarter of a century Dr. Millikan has been the center and soul of all our activities at this institution. For the progress which the California Institute has made during this quarter of a century he is in large measure responsible.

This progress has been remarkable. Twenty-five years ago there were only three buildings on the campus—Throop Hall, the Gates Chemical Laboratory, and that relic of primitive days which is now known as the Old Dormitory. Today there are nearly thirty permanent buildings, on and off the campus, representing an investment of over thirteen million dollars. The endowment funds of the Institute in 1921 amounted to considerably less than one million dollars; today they are more than sixteen millions, together with an additional nine or ten million which is, as the lawyers say, "vested in expectancy". In other words, it is slated to come to us when various wills are probated and trusts terminated. The student body enrolled in the 1921 catalogue numbered 448, of whom only 36 were graduate students; in the last year preceding the recent war, this enrollment had risen to 940, of whom no fewer than 322 were in the Graduate School, an increase of more than tenfold.

Meanwhile the faculty has been tripled in size and more than tripled in quality. As for the prestige and reputation of the place, I don't think that I will be charged with immodesty if I venture to express a belief that these have certainly not declined during the intervening years.

Now you can depend upon it that all this expansion in plant, endowment, faculty, and scholastic standards was not achieved without aggressive and clear-headed leadership. This institution owes more to Dr. Millikan than it can ever put into spoken or written words, and on this occasion, the first Commencement following his retirement from the chairmanship of the Executive Council, the Board of Trustees has given me this opportunity to place on public record its high appreciation of his services as an educational leader and its affection for him as a man.

Those of us who have worked with Dr. Millikan during these years of his leadership have never failed to recognize his amazing array of human qualities. The breadth of his academic interests, his keen sense of educational values, and his faith in high educational standards, have been combined with boundless energy and enthusiasm. He has been a super-salesman for any project to which he set his hand. His patience and good nature, moreover, are inexhaustible, or nearly so. There are few men, even supermen, who for a full quarter of a century could keep students and alumni, faculty and trustees, all working happily together while at the same time extracting an average of more than a million dollars per year from educational foundations, private benefactors, industries, associates and a dozen other sources. Let Dr. Millikan rest assured that neither this nor any other institution is apt to stumble upon the likes of him again. Meanwhile, in his new capacity as Vice President of the Board of Trustees, the Institute expects to utilize his interest and energies during the years yet to come.

This is our first Commencement since hostilities came to a close. For four years the California Institute found itself converted from an educational institution to a war industry. Now, since V-J Day it finds itself, like other war industries, in the throes of reconversion. In the years before Pearl Harbor the annual budget of the Institute was about a million and a quarter dollars. Under the impact of war research and experimental production it shot up to twenty times that figure. Perhaps it may surprise some of you to know that during the past four years, the California Institute has done work for the armed forces amounting to more than eighty million dollars and quite a bit of this work is still going on. Its peacetime payroll included something less than 400 names; at the peak of the war effort these names reached almost 5,000. We had nearly 1,000 civilian students when the war started, but these quickly melted away to a mere handful of freshmen and foreigners while their places were taken by young men assigned to the Institute for training by the Navy, the Army, and

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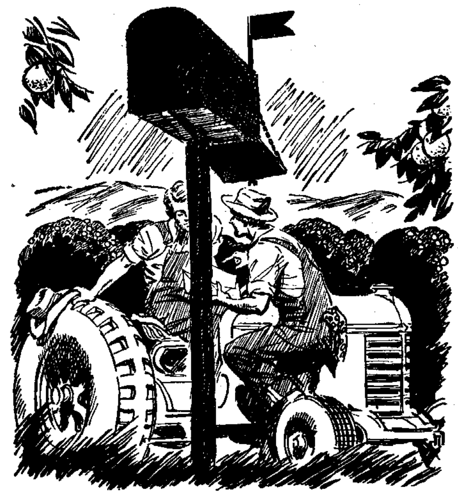
*Presented at Commencement, February 22, 1946.

Union Oil Owners' Net Profits Average $258 in '45



1. In 1945, after meeting all their obligations, the owners of Union Oil Company had a net profit of $8,747,992. Now most of us will admit that 8¾ million dollars is a lot of money. But many of us *don't* realize that Union Oil's profits—like America's taxes—are divided among ***a lot of people.***

2. For Union Oil Company is owned not by 1 man or 2 but by 33,938 individual Americans – enough to make a city almost the size of Santa Barbara, Calif. Divided among that many owners, the net profits actually amounted to just $257.76 per stockholder.

3. Even this sum wasn't all paid out in dividends. $4,081,722 was left in the business. Dividends paid out–money that actually went to the owners – averaged just $137.49 per stockholder–$11.46 per month. Wages paid out averaged $3,283 per employee – $274 per month.

4. In other words, while Union Oil today consists of about 154 million dollars' worth of oil wells, refineries, service stations, etc., the company is owned—and the profits are shared – by ordinary Americans like you and your neighbor next door.

5. 76% of these owners live in the West–62 in Spokane, 8 in Grants Pass, Oregon, 190 in Bakersfield, Calif., etc. 2,155 are Union Oil employees. The average stockholder owns 137 shares. Some hold fewer, some more; but the largest owns less than 1¼% of the total shares outstanding.

6. So it is not the investments of a few millionaires, but the combined savings of thousands of average citizens, that make Union Oil – and most American corporations–possible. Without some such method of financing heavy industry, American mass production, with *free competition,* could never have been accomplished.

UNION OIL COMPANY

OF CALIFORNIA

Those desiring more complete information on the material in this advertisement may refer to the formal Annual Report to Stockholders and Employees which we will gladly furnish on request. We would also appreciate any comments or suggestions. Write: The President, Union Oil Company, Union Oil Building, Los Angeles 14, California.

AMERICA'S *FIFTH* FREEDOM IS FREE ENTERPRISE

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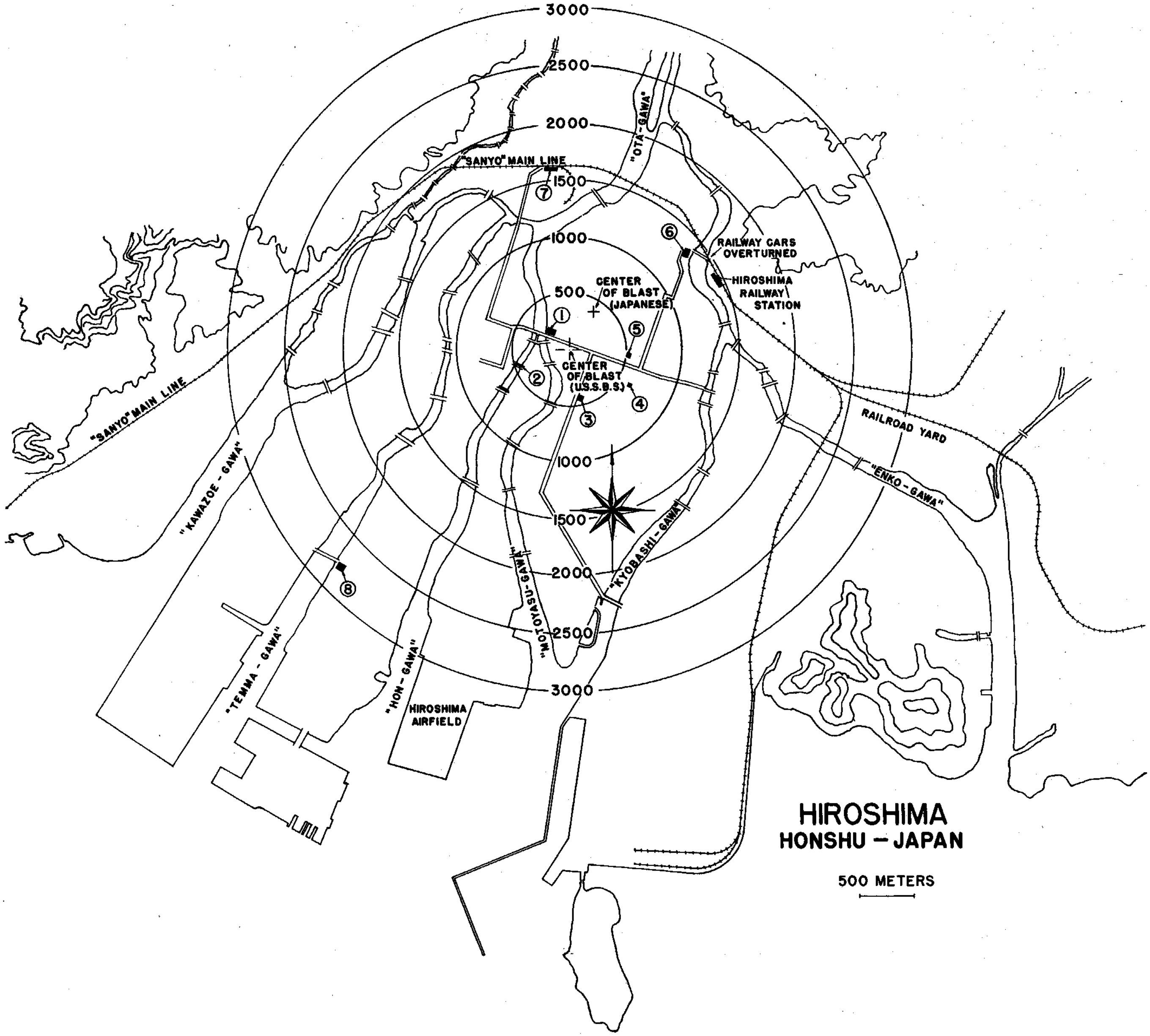

Symbols of a Changing World

By J. T. HAYWARD, Captain U.S.N.

IT WAS my fate to fight the Japanese during the hard, bitter days of Guadalcanal on the tortuous road back after the disaster of Pearl Harbor. Those days were grim and bitter, but many hours of thought were given to just what Japan and the Japanese were like. Our impressions gained by listening to Tokyo Rose as she played Artie Shaw's "Begin the Beguine" for us were of one type, while those gained in actual combat were of another. The blown-off heads of the Japs who had committed suicide rather than surrender also gave rise to the perpetual question, "What kind of people are these?" So it was with great interest and enthusiasm that I started on my trip to the home islands of Japan.

GEOGRAPHY

Japan's geographic position was a source of tremendous strength during the war. The Japanese leaders were astute students of geography. They realized that if they could get possession of the Philippines and the Dutch East Indies they could control the eastern half of Asia. And so their first drives in the early stages of the war reached these objectives. Through smart utilization of geography the Japanese likewise made our job much harder. Our men and supplies for China had to go

FACING PAGE:

FIGS. 1-8, inclusive. See corresponding numbers on map above. FIG. 1. Building approximately 250 meters from center of blast. FIG. 2. Bridge across Hon-Gaiva 500 meters southwest from center of blast. FIG. 3. Bank building 400 meters south of center of field. FIG. 4. Jewelry store 650 meters southeast of blast center. FIG. 5. Church 500 meters east of center of blast. FIG. 6. Barracks—Boys' Military School 1,300 meters northeast of center of blast. (See Page 6 for Figs. 7 and 8).

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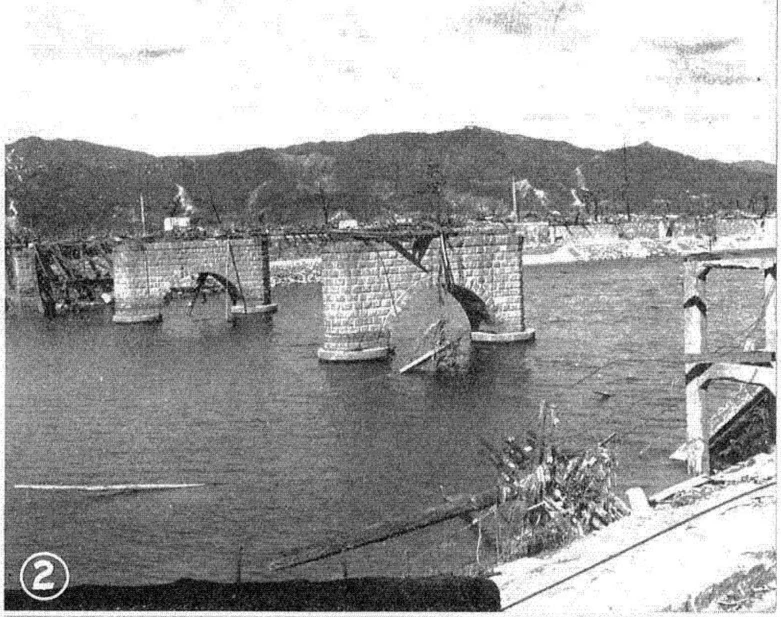

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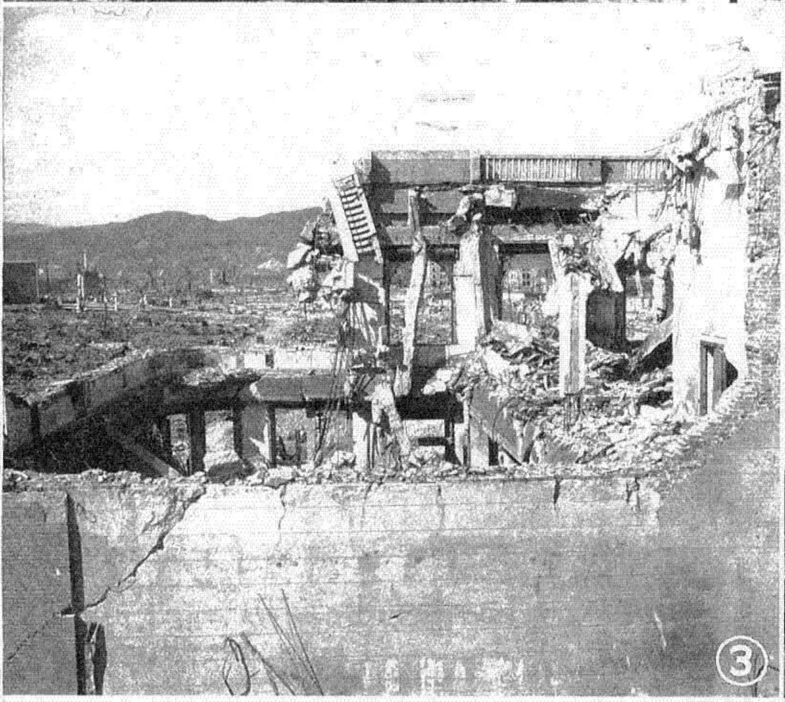

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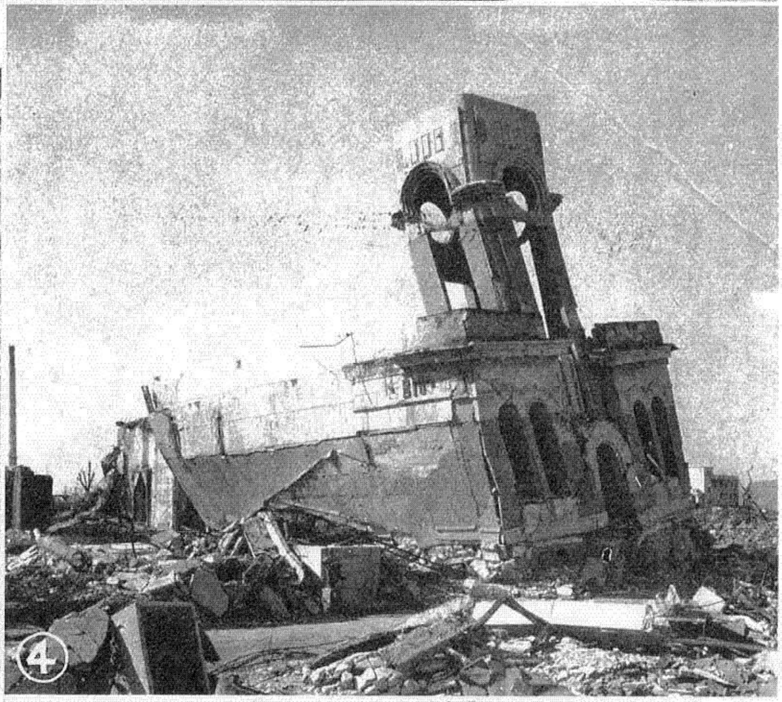

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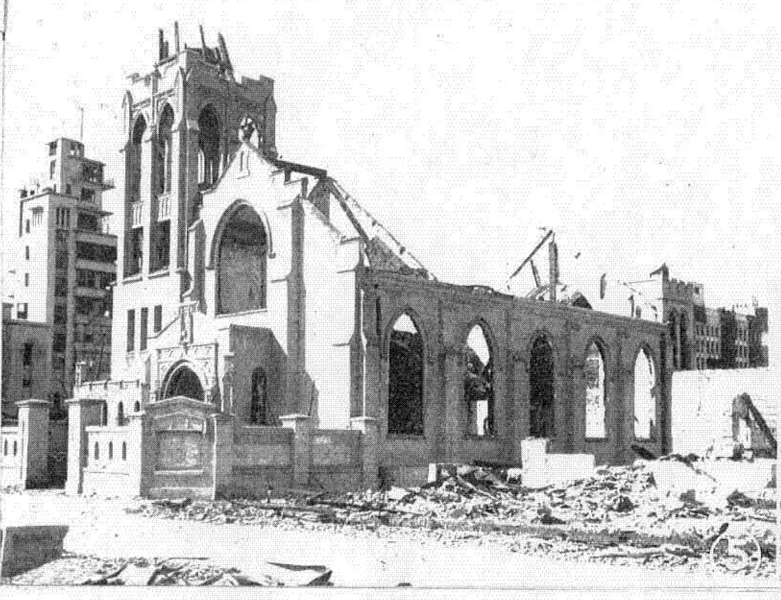

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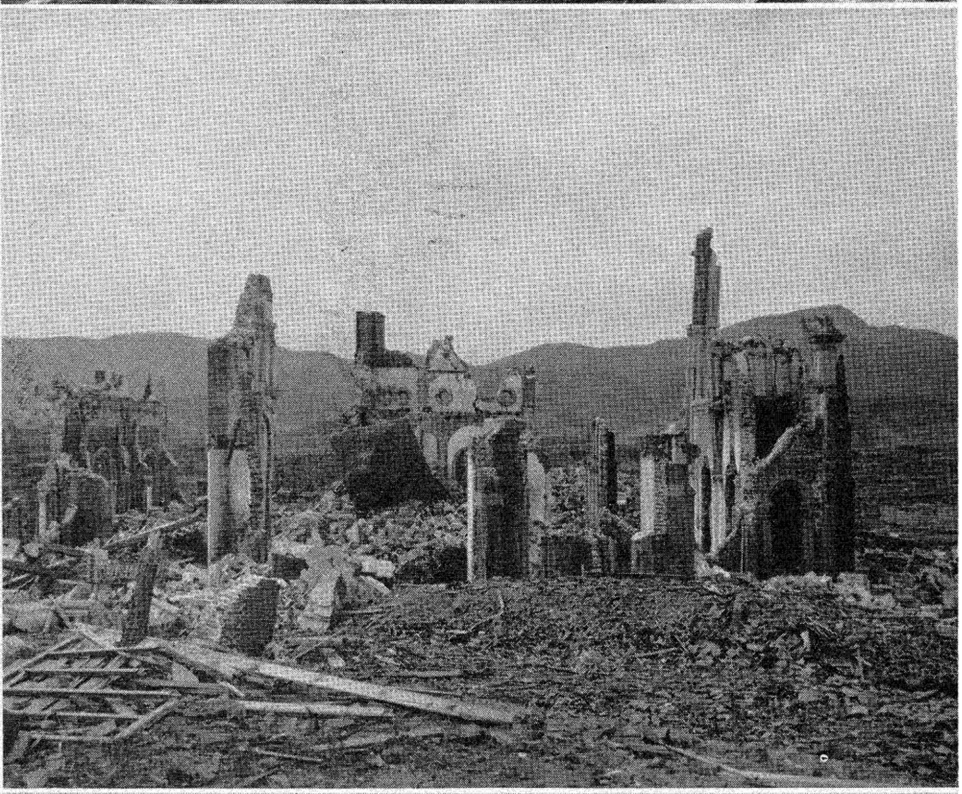
a quiet, meek, self-effacing, obedient little Jap at home becomes a raging beast when he goes to war. The explanation lies in his upbringing, the society in which he lives, the type of government which rules him, and the religious faith he follows. This brief and necessarily incomplete study is an attempt to clear up this seeming double nature of the Japanese so that his conduct may become understandable, even if it remain unpardonable.

As a member of the Strategic Bombing Survey in Japan, I had the good fortune to be able to see practically the entire country. While most of my work was of necessity centered in Hiroshima and Nagasaki, I was able to interrogate the highest commanders of the Japanese Army and Navy and the lowest peasants. To say that I understand the Japanese would be a great over-statement. However, I believe I now have a much better insight than formerly into their nature and a better understanding of why certain things occurred during the war that were then completely baffling to us.

It is dangerous to assign the characteristics of an individual to the nation. The Japanese differ among themselves less than do the people of any other large nation. America, for example, is a great mixture of races from all corners of the globe, and there is no such thing as a typical American. Our people do not have a common racial background. Our language had to be learned by millions of those who emigrated to our shores. But 70 million of the 72 million people who live in Japan proper are pure Japanese whose ancestors have lived in Japan for 2,000 years. From its earliest days Japan's life has revolved around the family. It is hard for us with our belief in the individual as the basic unit in our religious, social, economic, and political life to understand the tremendous difference produced by emphasizing the family. In Japan the individual is literally nothing, the group is everything. It may be a family, it may be a council, it may be a clan, it may be the Army or Navy, but it is always a group which exerts the power and the individual is lost in it. We are used to

AT RIGHT:

UPPER: Second floor of reinforced concrete building used as machine shop, approximately 1,500 to 2,000 meters from center of blast at Nagasaki. CENTER: Mitsubishi Torpedo Plant at end of valley approximately 4,000 meters from the blast at Nagasaki. LOWER: Looking west from directly underneath where bomb exploded at Nagasaki.



the leadership of strong men, outstanding personalities, who by their personal charm, magnetism, gifts or talents, draw men after them. Our history is full of great men. Japan can point to only a few, because leadership is wielded not by the individual but by the group. The effect is, of course, to destroy individuality and initiative and to force everybody into a common mold, and even if an individual should manage to maintain his independence of thought and break away from the repression of the group, he is crushed by the autocratic rulers above him who have always been determined to stamp out every trace of free thinking. The stifling of his individuality makes Fukuda San feel absolutely dependent upon his family or his group. He feels insecure at all times; he is afraid to think or act on his own judgment. In moments of stress he is likely to become panic-stricken or hysterical. He has no inward sense of his own power and authority; he hates to be alone.

It is evident from interrogation of many of the university graduates among the Japanese that the people have been bitter against their military leadership. These persons of superior training do not believe that the present wartime generation can be educated to democratic concepts and ideals. According to one Japanese Princeton graduate, it will be necessary for us to occupy Japan for at least twenty years to carry out the terrific job of re-educating a whole new generation of the people so that we may safely withdraw from the country.

FIRE-BOMBING

It is evident from observation of large cities such as Tokyo, Yokohama, and Kobe, that the fire-bombing of Japan was an outstanding success. The only major Japanese city that was not burned out was Kyoto, which is the old capitol. The stories of the frantic preparation of the Japanese to make their cities less vulnerable to fire were pure fiction. It was evident on all sides that no real government effort had been made to promote civilian defense and save civilian lives. Death is wonderful; it is great to die for the

(Continued on Page 14)

AT LEFT:

UPPER: Looking from wreckage of reinforced concrete modern structure, approximately south over what remains of city of Nagasaki. Note small cub landing strip.
CENTER: Rear of church at Nagasaki, looking toward the blast.
LOWER: Third floor of reinforced concrete building used as machine shop, approximately 1,500 to 2,000 meters from center of blast at Nagasaki.

THE FIRST TRANSCONTINENTAL TELEPHONE CABLE

By W. C. THOMAS and H. H. HONSAKER

As PART of the Bell System's program for establishing a nation-wide coaxial cable network, the Southern California Telephone Company, along with the long lines department of the American Telephone and Telegraph Company, has received approval from the Federal Communications Commission for the placing of an eight-coaxial cable from Phoenix to Los Angeles. Each pair of coaxials in the cable can be arranged to provide up to 480 new telephone circuits into Los Angeles for use to the West Coast.

About a year ago the American Telephone and Telegraph Company announced a five year coaxial cable program involving 6,000 to 7,000 route miles of construction. The rapid pace at which the job is going forward has been dictated by the steadily increasing need for more telephone circuits between the nation's business centers.

Southern California Telephone Company engineers are actively proceeding with the engineering of their section between the Colorado River near Blythe, California, and Los Angeles, which will cost approximately $5,000,000. The cable crews already have worked westward on the new all-cable West Coast route to the vicinity of Fort Worth and Dallas. The aim is to reach Los Angeles in the spring of 1947.

In addition to its use for long distance telephone service, coaxial cable is capable of transmitting the very broad bands of frequencies required for television. The coaxial cables now being placed are therefore suitable to form the backbone of future nation-wide television program networks.

The five-year coaxial cable program as now visualized is shown in *Fig. 1.*

THE COAXIAL SYSTEM

When a telephone circuit is mentioned, the average person thinks of a pair of wires, either on one of the open wire leads or in a telephone cable. For a coaxial system, however, a copper tube about the size of a large lead pencil *(Fig. 2)*, with a copper wire suspended in its center by means of insulating disks spaced about ¾ inch apart, is used instead of the conventional pair of wires. The tube and the central wire are called a "coaxial" because they have the same axis.

Transmission over this novel type of conductor employs frequencies also used for radio. The impulses are wire-directed and travel through a space which has been segregated electrically from all the rest of the space in the world by the tube. The tube not only guides these impulses but protects them from fading, static, and other similar troubles of ordinary radio transmission.

The nature of coaxial transmission is such that it is necessary to use one tube for transmission in one direction and a separate tube for transmission in the other direction. Other pairs of coaxials in any particular cable may be similarly used for other circuits as spares, or may be energized as stand-bys to be used as substitutes for working coaxials which are in trouble or require routine maintenance.

Simple as they are, these coaxials in pairs are capable of carrying 480 separate telephone circuits with equipment now available. If not needed for telephone use, a single coaxial, suitably equipped, can carry a one-way television channel. For 480 telephone circuits, a band

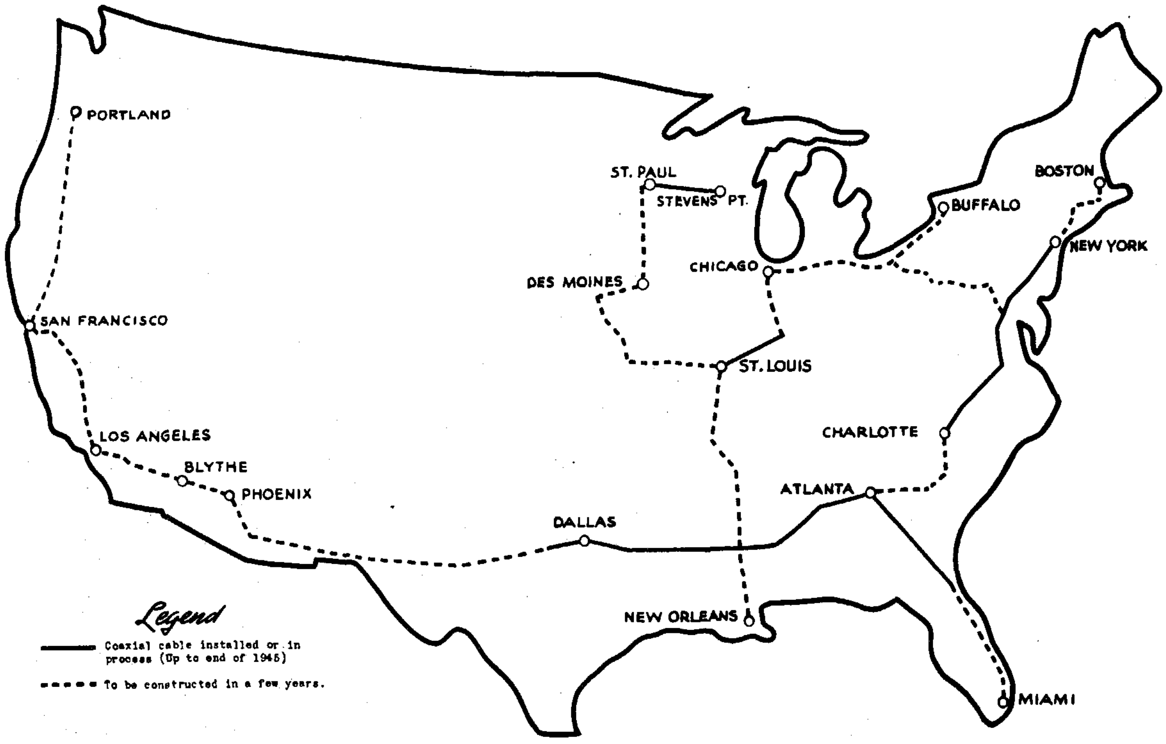


FIG. 1.

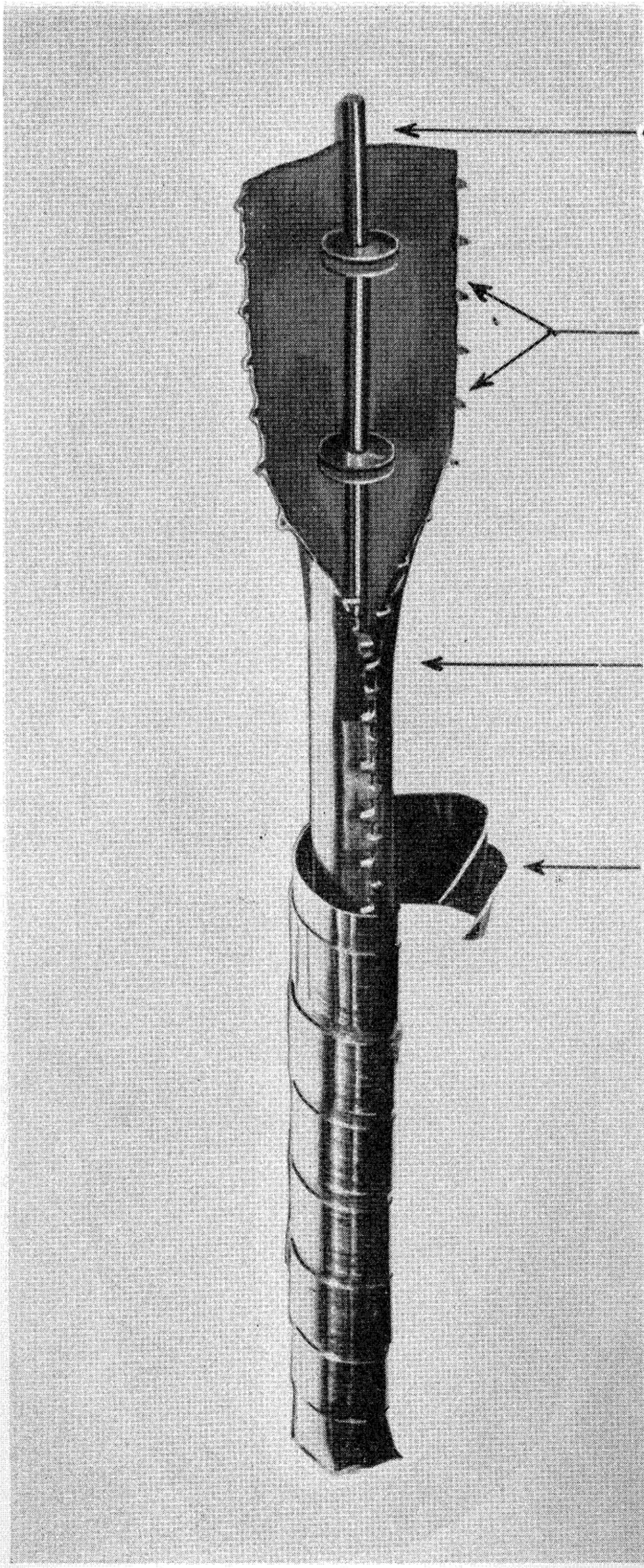


FIG. 2—Exploded view of a coaxial.

width slightly over 2,000,000 cycles is used; for television, this band is raised to nearly 3,000,000 cycles. Bell Laboratories' developments are under way, looking toward a future system capable of transmitting a band of 7,000,000 cycles. With this system it will be possible to transmit a 4,000,000 cycle band for television, plus 480 telephone channels, simultaneously over the same coaxials, or to transmit a broader television band if the standards of television should be so raised as to require it.

TEMPERATURE PROBLEMS

Coaxial systems are particularly susceptible to temperature changes, and wide variations of transmission may result from this cause. To avoid temperature difficulties as much as possible, cables are usually placed in the ground, instead of in aerial construction. To compensate for any variations which still remain, special narrow band pilot frequencies are included in the frequency band regularly transmitted. These pilot frequencies are sent out initially at a fixed volume, and their levels are automatically measured at control stations spaced along the route. If, for any reason (including temperature changes) deviations are found to exceed a predetermined amount, all circuits are automatically adjusted.

CABLE MAKE-UP PROPOSED

In the Phoenix-Los Angeles section, the cable proposed will contain eight coaxials, each 0.375 inches in diameter, together with sixteen paper insulated pairs of wires which will be used for alarm and maintenance purposes.

Fig. 3 illustrates a coaxial cable somewhat similar to that to be used in sections of the route where the cable is to be buried.

In the initial job it is planned to equip one pair of coaxials for 252 circuits. A second pair of coaxials will be used for stand-by purposes, leaving four additional

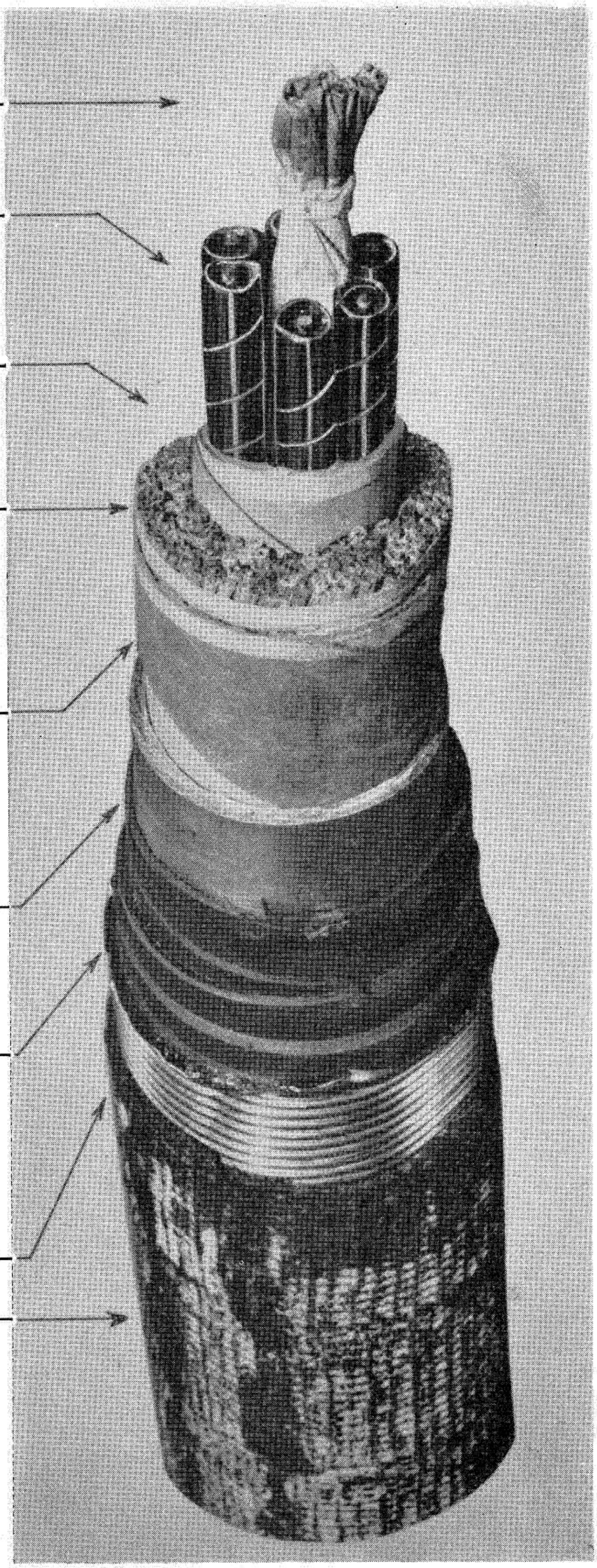


FIG. 3—Cross section view of typical coaxial cable.

coaxials to be equipped later as circuit requirements materialize.

GENERAL DATA

The section of the route between the Colorado River and Los Angeles will be approximately 240 miles in length. From the river to Whitewater, some fifteen miles east of Banning, the cable will be buried. Much of the buried cable will be placed directly in the ground* by plow (see *Fig. 4*), but considerable trenching by hand or machine digging will be necessary because of the nature of the geological formation.

*See article, "Buried Voice Channels", by Max B. Alcorn, *ENGINEERING AND SCIENCE*, January, 1945.

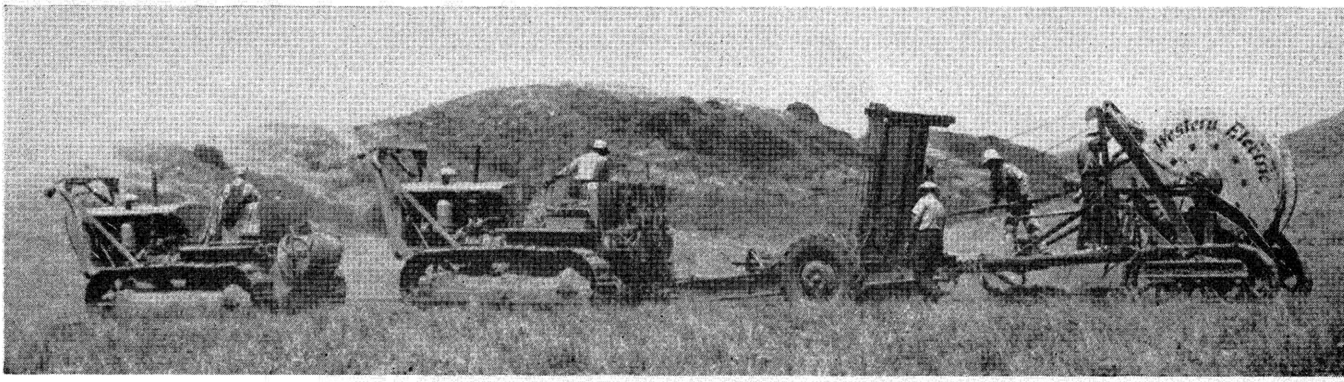


FIG. 4.—Tractors and cable-burying plow which deposits the cable 30 to 36 inches deep.

In general, the cable will be buried by the plow at a minimum depth of 30 inches. Through washes, or where erosion problems exist, or in rocky terrain, the cable may have to be buried to a depth of 10 feet or more.

From Whitewater to Los Angeles the cable will be placed in an available duct in the existing underground vitrified clay conduit system via Banning, San Bernardino, and El Monte.

BUILDINGS

A total of thirty-two buildings will be involved in the Southern California Telephone Company's portion of the project. These will vary from the four-story building to be erected at 434 South Grand Avenue in Los Angeles, which will be used in part for the terminal equipment, to small booster stations required at a spacing of about eight miles. In addition to using several present buildings along the route, twenty-seven of these small booster stations and a larger building at Blythe will be constructed. The small booster stations will be about 7 feet by 9 feet, inside dimensions. To avoid temperature variations as much as possible, they will be constructed with hollow masonry walls and insulating material.

REPEATERS AND POWER

At each booster station a repeater (amplifier) will be provided for each of the four coaxials to be equipped initially. These are for the two eastbound and two westbound coaxials (regular and stand-by), as previously described. Each repeater amplifies the entire frequency band transmitted in its coaxial, and in this respect the practice differs from that followed in the usual type of voice frequency long distance cable, which requires a repeater for each circuit at about forty-mile intervals.

Each coaxial repeater is hermetically sealed in a copper box about 5 inches by 5 inches by 7 inches, so arranged that the whole amplifier may be readily plugged into, or removed from, the circuit. The repeater within the copper box provides three stages of amplification with two tubes in parallel for each stage, either tube being capable of carrying the entire load in event of the failure of its mate.

Commercial sixty-cycle power will be available, together with emergency power sources, at the larger attended stations at Los Angeles, Whitewater and Blythe. Power for the repeaters at the intermediate booster stations will be supplied from these offices, using the central conductors of two coaxials as the two sides of the supply circuit. Since each of the power supply points will provide power to the adjacent booster stations within a distance of approximately fifty to eighty miles on either side, and the power circuits of the amplifiers involved are all essentially in series, arrangements must be made to provide approximately constant current from supply offices. One of the effects to be compensated for is the resistance variation caused by temperature changes.

Los Angeles, Whitewater, Blythe, and Phoenix being attended offices and suitably located for control points, these will be used as "Switching Main Stations". The regular and stand-by coaxials, including their respective repeaters at the intervening booster stations, are lined up as complete units between these switching points, and in the event of trouble affecting transmission on a working coaxial, relays at the "Switching Main Stations" at the ends of the section in trouble will operate automatically to switch in the stand-by coaxial and switch out the coaxial in difficulty, so that the trouble may be located and corrected.

CABLE—PROTECTION FEATURES

Every effort must be made to exclude moisture from the cable, since a small amount of moisture may put circuits out of service. To protect the cable from the entrance of moisture, and to provide a means of detecting a break in the sheath before a service interruption occurs, the cable will be maintained under gas pressure. Nitrogen gas, being inert and relatively inexpensive, is used for this purpose. If the pressure should drop a predetermined amount, an alarm is sounded in the control office through an electrical circuit arrangement. By making accurate pressure measurements at a number of points along the cable and plotting a curve against distance, maintenance men can determine the location of a leak fairly closely. In the case of a very small leak the gas pressure, which is ordinarily about 9 pounds per square inch, will keep water out for some time, providing the water pressure does not exceed the gas pressure.

In the Whitewater-Los Angeles section, where the cable is placed in conduit, the copper jacket and thermoplastic layers, as shown in *Fig. 3*, will be omitted. However, in the buried section between the Colorado River and Whitewater a number of additional hazards must be provided for.

The corrugated copper jacket, together with the thermoplastic insulating layers between it and the lead sheath, serve to minimize the danger of damage due to lightning. The copper jacket provides protection against the effects of corrosive soils and also rodents. If ordinary lead-covered cable is buried in the ground, it has been found that rodents, particularly gophers, have the disconcerting habit of chewing on the lead sheath, thus making holes which admit moisture.

LOOKING FORWARD

During the last few years there has been a tremendous growth in toll circuit requirements, particularly between the West Coast and the large centers in the East, due principally to activities in connection with the war effort. Whereas there were only 167 toll circuits connecting the West Coast with the East in 1940 this figure grew to over 1,200 at the end of 1945, and it is expected to be over 1,500 by the end of 1946. Almost half of these circuits terminate in southern California. Although the war has ended, continued increasing demand for telephone circuits is expected, but at a slower rate than during the war period. Coaxial cable is a very useful tool for meeting such heavy demands. As previously described, it may also serve to provide for a nationwide network of interconnecting television stations.

Is International Control of Atomic Energy Feasible?

By RICHARD M. NOYES

A report of the Joint Conference of the Committee on Atomic Energy of the Carnegie Endowment for International Peace, the Federation of Atomic Scientists, and the Commission to Study the Organization of Peace, held in New York City, January 4 and 5, 1946.
This article was written before the issuing by the State Department of the Lilienthal report on international control of atomic energy. This excellent report discusses many of the problems raised below and through the use of "denatured" plutonium envisages the possibility of somewhat larger power developments than were contemplated at the New York conference.—Editor.

EVER since the news of the atomic bomb broke on August 6, 1945, we have all been reading and hearing an undiminished flood of comment and discussion regarding its ownership and control. Such discussion constitutes the vital essence of democracy and is not to be disparaged, although it soon becomes apparent that many people are trying to reach conclusions without sufficient factual background.

With the avowed purpose of studying the possibility of atomic control in terms of existing technical and political situations, a knowledgeable group of men met in joint conference in New York City on January 4 and 5. The conference was arranged by the Committee on Atomic Energy of the Carnegie Endowment for International Peace, the Federation of Atomic Scientists, and the Commission to Study the Organization of Peace. It was organized as a round table discussion in which men from various bomb sites (such as Los Alamos, Oak Ridge, and Chicago) met with professors of law and economics who had been special consultants on missions to foreign capitols and to the United Nations Conference at San Francisco. As a representative of the Association of Pasadena Scientists, the writer had the rare privilege of attending the conference. It is impossible in a short article to present an adequate summary of two days of highly intensive discussion, but a few of the more important points can be mentioned.

During the first session the scientists led the discussion of the question whether control of atomic energy installations would be technically feasible, provided it were politically possible. At subsequent sessions the current international political situation was reviewed, and the necessity for modifications in the Charter of the United Nations was discussed at some length.

The mining engineers presented the most optimistic report of any at the entire conference. Guided by mining experience with gold and diamonds, and the history of the international control of the narcotic trade, they reached the conclusion that it would be feasible for a staff of moderate size to check operations of known uranium mines and to account for virtually all of the ore removed. This work, they reported, to be completely effective should be supplemented by periodic aerial surveys for indications of mining activity at new sites, and spectrographic analyses of samples from all mines handling large tonnages of ore, in order to insure that uranium was not being extracted as a by-product.

Discussion of atomic power installations was limited to consideration of those handling separation of uranium isotopes by gaseous diffusion, and to the manufacture of plutonium in piles.

Although the leaders of the discussion were obviously hampered by their inability to reveal pertinent information, the general belief was expressed that a diffusion plant would be very difficult to construct in secret because of the necessity for large numbers of key items, but that a plant could probably be operated without detection once it was constructed. The scientists believed that it would be almost impossible to prevent a moderate diversion of fissionable material in a diffusion plant supposedly operating legally under international control. Because of these conclusions, the need for the initiation of international control at the earliest possible moment was emphasized.

The final decisions with regard to plutonium manufacture were very similar to those for diffusion separation, except that it was considered less likely that a hidden plutonium plant could operate without detection. It was recommended that at least for the next generation, no country be allowed piles capable of producing a total of more than 25,000 kilowatts of atomic power. Such installations were deemed adequate for research, and medical and small-scale developmental uses, and it was believed impossible to divert enough of this material to produce a decisive number of bombs.

It was the general consensus of opinion that although inspection and control of no one material or process could be completely effective, illegal manufacture of atomic bombs could very probably be detected by independent procedures. Provided that international inspection and control of several of these procedures were politically possible, it was believed that there would be no possibility of a nation's manufacturing a decisive number of bombs in secret.

The second session of the conference was devoted to reports on attitudes of various governments, especially of the members of the "Big Three", to the current situation. The last two sessions were concerned with what could be accomplished within the framework of the United Nations Organization and how the Charter should be modified in order to accomplish control.

It was pointed out that the United Nations Organization as such had no authority to institute inspection procedures in the territories of any of its members, but only in those areas assigned as dependencies under the trusteeship plan. It was also emphasized that at the present time piracy was the only crime for which a man could be tried in the court of any and every nation, and that international control of atomic energy would require a modification of international law to permit the control commission to institute legal proceedings against individuals rather than against states. If any plan for inspection and control of atomic energy were adopted it would have to be in the form of a treaty ratified by the individual members and not in the form of a binding regulation passed by a majority of either the Assembly or the Council.

The final conclusion reached by the conference was that a nation bent on aggression could not be stopped by the present system, and that to enforce atomic control it was necessary to have a limited world government in the sense that there must be a legislative assembly with no veto, limited taxing power, and the authority to institute legal proceedings against individuals. Such regulations would apply primarily to control of atomic energy but would probably have to apply to other problems as well. It was judged that Britain might accept such a situation (on the basis of public statements by Mr. Eden and Mr. Bevin) but that the United States and Russia might raise objections.

The conference obviously did not solve any of the world's problems, but it did serve to indicate the technical possibilities and limitations on control of atomic energy and the nature of the political changes necessary to make such control possible. By thus defining the situation to be faced, the conference served to clarify our thinking on this matter which so vitally concerns us all.

SAN FRANCISCO CHAPTER MEETING

Reported by Ted Vermeulen '36

A RECORD attendance of fifty-four alumni in the San Francisco Bay area took part in a dinner meeting Friday, March 29, at the Hotel Claremont in Berkeley. The address of the evening was given by Edwin M. McMillan '28, professor of physics at the University of California, who had an important part in the atomic bomb development at Los Alamos and also worked on radar and on submarine detection during the war. Dr. McMillan discussed the nature of the different nuclear particles now known and the types of the different nuclear particles now observed.

The following alumni were present:

R. E. Alderman '25
M. A. Baldwin '27
S. A. Bamberger '33
J. Y. Beach '36
A. S. Bishop '43
R. H. Bishop '39
R. B. Bowman '26
W. H. Claussen '32
R. B. Connelly '39
E. G. Crawford '33
J. D. Davis '34
H. H. Deardorff '30
W. L. Dickey '31
Ed Dorresten '24
L. H. Erb '22
Virgil Erickson '37
E. M. Farly '26
R. G. Folsom '28
L. D. Fowler '23
T. O. Gerlishe '19
N. L. Hallanger '34
R. J. Hallanger '35
J. J. Halloran '35
J. C. Harper '40
D. A. Harries '23
A. J. Hazzard '30
B. B. Johnson '31
W. J. S. Johnson '35
R. C. Jones '37
A. E. Jurs '38
P. H. Kafitz '42
H. E. Larson '27
G. E. Liedholm '31
J. F. Mayer '40
F. J. McClain '34
J. F. McGarry '31
W. W. Moore '33
A. E. Myers '29
D. S. Nichols '28
A. Polgar
D. J. Pompeo '26
W. G. Reynard '31
T. R. Sandberg '37
Q. M. Shultise '39
C. P. Smith '34
W. T. Stewart '41
F. B. Stitt '36
F. E. Strauss '33
Ted Vermeulen '36
H. G. Vesper '22
W. A. Wickett Ex-'37
H. M. Winegarden '24

Howard Vesper invited the chapter to hold its annual sports day at his home in Oakland, "Cactus Rock", again this year. The date was set for Saturday, May 25, and alumni in this area are looking forward to this outing as an outstanding event of a successful year.

Symbols of a Changing World

(Continued from Page 8)

Emperor. This was the theme followed all the way from the battlefields to the little man in the street who died in the bombing raids.

Another outstanding operation of the war was the mining of the home waters surrounding the Japanese empire. Interrogation of the Japanese mine experts brought out the fact that they had no known method of sweeping these mines and that the loss of shipping was terrific. Ships were forced to sail over known mine fields. During the months of April, May, June, and July of 1945, mines sank 65 per cent of the shipping that was lost. Throughout the war Japan's lack of shipping had been a severe handicap.

It was evident, too, that the work of our submarines had been even better than we had hoped for. Our submarines sank 45 per cent of the entire tonnage that was lost by Japan during the war. The Japanese started with approximately 7,000,000 tons of merchant shipping, built 4,000,000 tons, and ended with approximately 1,000,000 tons of which 500,000 tons were damaged. It was evident that Japan had lost the war at least a year before she actually surrendered. On V-J Day, she had only 1,000,000 gallons of gasoline in the empire, with no prospect of getting any more. She had had no Navy for almost eleven months, since the second battle of the Philippine Sea. Of her 14 battleships, Japan had lost 12, including her best and newest, the Yamoto and the Mushasi. She built 18 carriers and lost 18 during the war. She had but 4 remaining, only 1 of which was able to put to sea. Her losses included 33 cruisers, 157 destroyers, and 87 submarines. So it is readily seen that she had suffered complete destruction of her Imperial Navy, and there was practically no defense left or any method by which the Japanese could control the sea in order to import the necessary goods for sustaining the war effort. There was no love lost between Japan and Germany, although the Japanese were using many inventions developed by Germany. The Germans had made Japan pay through the nose for the trade secrets involved, and one of the experiences that made Japan most bitter against Germany was the discovery by the Japanese that our induction mines, which we had copied from the Germans and they had captured on the Shortland Islands, were duplicates of those that Germany had sold them.

It was apparent from talking with the Japanese scientists at the Imperial University at Tokyo that the Japanese military had made practically no use of their talents. The only exception to this practice was the Japanese Navy Department's request that the physicists at the Imperial University aid in solving the mine problem. However, as was customary, the entire problem was not given to the University but only a small piece, which was not sufficient for an intelligent attack of the problem. Throughout Japan only very few people were "in on" the complete plans for the war. No one trusted anyone, or if anyone did trust another, he didn't give him all the information involved. It was surprising to find senior captains of ships that had been in major engagements who did not know the entire battle plan.

The results obtained by our dive bombers at the battle of Midway were confirmed by interviews with Captain Aoki of the Akagi, which went down at the battle of Midway. The other three carriers, the Hiryu, the Soryu, and the Kaga, were also sunk in the same engagement. Captain Aoki stated that the Japanese were surprised by our carrier planes, which they thought were down in the Solomon Islands. He expressed great fear of our dive bombers.

ATOMIC BOMBING

It will never be known accurately how many people died, either at Hiroshima or Nagasaki. Upon arrival in Hiroshima we found the devastation so appalling that it was impossible to visualize what the city had been like prior to the bombing. The same devastation, though not quite so impressive, was seen at Nagasaki. Because of the topography of this city, the extensiveness of the blast was not visible. Nagasaki lies in a valley, running approximately north and south, with many valleys and surrounding hills, while Hiroshima is—or was—a city lying on a flat plain with three rivers flowing through it.

In examining the survivors of the atomic bombing it was noted that blast victims as far away from the bomb as 2,200 meters (nearly 1¼ miles) exhibited flash and radiation burns. Outside of the 2,200 meter area, flash burns only were evident on survivors. The answer to the question as to whether primary fire had been caused by the explosion was given by victims, who in numerous cases testified that their clothes had burst into flame. While it is impossible for everyone in the world to view what was Nagasaki and Hiroshima, the pictures showing the devastation wrought by the atomic bombs should be published throughout the world in order to bring home to all concerned that the next war could be the end of what we know as civilization.

A Record of Achievement

(Continued from Page 3)

Air Corps. Nearly 2,000 of these were sent here for training over periods ranging from three months to three years.

Of course this shift to a war program upset the normal work of the Institute. Most of the regular peacetime activities had to be suspended. Laboratories and shops were turned over to war research and production. Members of the faculty were summoned from their classrooms and assigned to work of high responsibility and secrecy connected with government war contracts. Halls and corridors became crowded with the desks of accountants, auditors, computers, and filing clerks. The campus became strangely bedecked with femininity as hundreds of young women were requisitioned to manipulate typewriters and adding machines, and even to do mechanical work in the laboratories. Dormitories built for 300 civilian students were stretched to house nearly twice that number of naval trainees. In addition, numerous buildings off the campus had to be built or leased to accommodate the overflow of war work. At any rate the California Institute did everything that the government asked it to do and did it willingly.

Now we are confronted with the task of reconversion. As soon as practicable the normal peacetime program of instruction and research will be resumed. There will be changes, possibly a good many of them, in order to keep the Institute abreast of the times; but it is not contemplated that there shall be any radical departure from the landmarks which have guided the course of progress in the past. Twenty-five years ago, on November 29, 1921, the Board of Trustees set forth in a series of resolutions this general picture of what they hoped the California Institute would some day grow to be. It is interesting to re-read these resolutions after the lapse of a quarter of a century and see how largely the original objectives have been reached.

Briefly, the plan of 1921 laid emphasis on the following features: (1) a limited and carefully-selected student body; (2) emphasis on training in the basic sciences of physics, chemistry and mathematics as the essential preliminary to a sound engineering education; (3) an adequate place in the curriculum for the humanities; (4) the active encouragement of research in all departments, and, finally, the concentration of the Institute's financial resources on a relatively few fundamental subjects rather than an expansion into all the fields of human knowledge, —in other words, the policy of trying to do a few things well rather than many things indifferently.

These are still the chart and compass which guide both the faculty and the trustees. But the lapse of time, and more especially the developments of the past four or five years, have suggested the need for an even greater emphasis on certain fields of scientific research. One of these is the field of nuclear physics, a branch of physics in which the Institute has pioneered in the past but must now go a good deal farther. The appointment of Dr. J. Robert Oppenheimer to a full-time professorship will greatly strengthen the Institute's staff in the domain of atomic research. On the other hand, the loss of Professor William V. Houston, who leaves us to become president of a sister institution, the Rice Institute in Texas, will be severely felt. Dr. Houston, who has been with us since 1931, leaves a gap which will be hard to fill. He goes to his new post with the good wishes of everyone connected with the California Institute. Similar good wishes are extended to Professor Ira S. Bowen who has recently become director of Mount Wilson Observatory.

In this connection it may be permissible to mention that plans are now under way whereby the Mount Wilson Observatory and the new Institute Observatory at Palomar will be operated as a joint enterprise when the new 200-inch mirror is finally installed at Palomar. Barring unforeseen delays this giant block of glass, the completion of which has been so badly delayed by the war, will be in place within the next year or so. Together, these two observatories will make southern California pre-eminent in its facilities for research in the fields of astrophysics.

Among other notable new appointments to the faculty, it is appropriate to mention the coming of Dr. George W. Beadle, a distinguished scholar who assumes the chairmanship of the Division of Biology. Other noteworthy additions to the teaching and research staff are under consideration and will be announced in due course.

Meanwhile the Institute has lost by death two of the most outstanding men in its academic circle—Thomas Hunt Morgan, Emeritus Professor of Biology, and Harry Bateman, Professor of Mathematics. Among geneticists of his time, Dr. Morgan was *facile princeps.* Winner of the Nobel Prize in Medicine, he deservedly received recognition from universities and learned societies in all quarters of the globe. At the California Institute his exalted standards of scholarship, his wise judgment in matters of academic policy, and the charm of his personality gained for him in high degree the admiration and affection of everyone with whom he came in contact. The recent death of Professor Bateman has likewise removed from our academic circle a scholar of world-wide reputation in his field, whose eminence was attested by his election, some years ago, as a Fellow of the Royal Society of London.

Some problems of serious urgency must be given attention by the Trustees within the immediate future. One is the increase of faculty salaries. Since 1940 the general scale of salaries has been increased by only ten per cent on the average. Meanwhile, the cost of living has advanced by perhaps three times this percentage. To hold the distinguished members of the staff that we now have, as well as to make positions at the Institute attractive to new appointees whom we desire to bring, it is essential that there be an upward readjustment. Such action, it would seem, cannot be very long delayed. The Institute is in competition not only with the great universities of the country but with the steadily increasing demand of the large industries for highly-qualified scientists in their research departments. The allurements of life in southern California give us some advantage in the quest for men from other parts of the country; but there are limits beyond which this climatic advantage cannot safely be counted upon.

Another problem concerns the housing of our undergraduate students. Many years ago it was agreed that great advantages could be derived from the housing of the entire undergraduate body on the Campus, and land was set aside for that purpose. Through the generosity of various friends of the Institute a good start was made in this direction by the building of four dormitories in which approximately half the entire student body could be accommodated. Now it seems opportune to consider whether the time has not come to take care of the other half in the same way.

The problem, of course, is one of ways and means. Everyone is agreed that the benefits derived from having the entire student body living on the campus are beyond question. The loss of time involved when students come to their classrooms and laboratories from a distance, often from a considerable distance, is substantial. This time can be better devoted to study and recreation than to covering the roads twice a day in a car which may or may not be "hopped-up."

There is also the even greater benefit which comes from closer association with one's fellow students and the greater facility which is provided for observing the amenities of life.

To complete the original plan by the erection of four additional student houses, accommodating the present off-campus group of 300 or thereabouts, would cost approximately a million dollars. It is worth considering whether, in case this money cannot be obtained otherwise, the project should not be considered as an investment for some of the Institute's endowment funds. The yield on bonds and stocks has now dropped so low that it would not seem insuperably difficult to make a housing project on the campus reasonably profitable. Some other institutions have made it so. The plan would involve loading the dormitory rentals with an overhead of say five per cent for interest and depreciation; but even with this addition the cost of living on the campus would not be greater than that which students have to pay for rooms a mile away. This proposal has not yet been formally considered by the Trustees, and it may not commend itself to them; but it seems to be worthy of study from all points of view, academic as well as financial.

There is a common impression that the California Institute of Technology is a rich and heavily endowed institution. Doubtless it is better off than some other institutions of its size; but its expenses are much greater for two reasons, first because of its large proportion of graduate students (normally about one-third of the whole) and, second, because of the strong emphasis placed on research in all its departments. Research gives both strength and prestige to an educational institution—but it costs money, lots of it.

For various reasons it would be difficult to estimate what the California Institute spends each year on research, because members of the staff who are engaged in research also do some teaching and they do not punch a time-clock on their respective duties; but it would probably not be far wide of the mark to say that one-half of the Institute's regular expenditures go for the promotion of research in one form or another. That is a substantial amount, but it is well worth what it costs. If there was ever any doubt concerning the value of scientific research to the nation's well-being, that doubt has been fully dissipated during the past four years.

During the past few weeks a generous gift of $200,000 has been pledged by the Earhart Foundation for the construction of a temperature-controlled plant laboratory. In addition this Foundation has offered to give $6,000 per year for four years towards the cost of operating the laboratory. This new facility will make it possible to study the growth and behavior of plant life under any conditions of temperature that may be desired. Such research, it is believed, will prove to be of great economic value.

In any institution of higher education there are five points of view which have to be kept in mind; namely those of the student body, the faculty, the trustees, the alumni, and the general public. These sometimes get to be at variance, and without skillful handling they are sure to do so. The students would like less work, the faculty more pay, the alumni more extracurricular activities, and the trustees more endowment income to balance the budget. Successful leadership is leadership that can satisfy these diverse elements and keep them all working harmoniously together. It is the great good fortune of the California Institute to have had this kind of leadership during the past twenty-five years, and it is our earnest hope, in these days of administrative reorganization, that we may be similarly blessed during the years that are ahead.

GOLDSWORTHY TO HEAD STUDENT HOUSES

LIEUTENANT Colonel Elmer Colin Goldsworthy has recently joined the C. I. T. staff as Headmaster of the Student Houses. In this capacity he has primary responsibility both for the general behavior and conduct of the house members, as well as for the development and betterment of the houses themselves as cultural and maturing influences in the lives of the undergraduates.

Colonel Goldsworthy, a native Californian, received his Ph.D. in mathematics from the University of California. In World War I he served with the British Army from 1914 to 1920, first as a member of the famous Princess Patricias, Canadian Light Infantry, and later with the Royal Flying Corps. In World War II Colonel Goldsworthy entered the U. S. Army Air Force as a captain in September 1942. He was Director of Training, Army Air Force School of Applied Tactics. At present he is on terminal leave.

Colonel Goldsworthy also brings to his new work a wide experience in education. From 1923 to 1942 he was instructor, assistant professor of mathematics, and assistant dean of undergraduates at the University of California.

C.I.T. NEWS

EARHART FOUNDATION TO PROVIDE PLANT LABORATORY

A GIFT of $200,000 pledged by the Earhart Foundation will make possible a new temperature-controlled plant laboratory at the California Institute of Technology. An additional grant of $6,000 per year for four years will be contributed by the Foundation toward the operating cost of the laboratory.

The new facility which is now being designed by the staff of the C. I. T. building and grounds department will contain six glass-covered laboratories. The temperature and humidity of each laboratory will be independently controlled on a cyclic basis. This type of control will permit predetermination of varying degrees of temperature and humidity for an advance period of twenty-four hours and will enable plant physiologists to study the growth and behavior of plants under any conditions of temperature that may be desired.

To obtain the temperature required, a fifty-ton refrigeration plant will be incorporated in the structure. This feature of the design is being executed by the firm of Hess, Greiner and Polland, consulting engineers.

When the new laboratory is completed it will supplement and expand the work now being done in the field of plant physiology under Dr. Frits W. Went and Dr. James F. Bonner. It is believed that results obtained from research in the new laboratory will be of great economic value. Location and date of construction of the new plant laboratory have not been announced.

DR. BEADLE TO HEAD DIVISION OF BIOLOGY

DR. GEORGE W. BEADLE will become Professor of Biology and Chairman of the Division of Biology at the Institute on July 1.

Dr. Beadle was born at Wahoo, Nebraska, on October 22, 1903. He received his B. S. degree from Nebraska in 1926 and his Ph.D. from Cornell in 1930. He was National Research Fellow at the California Institute from 1930 to 1932, Institute Research Fellow from 1932 to 1935, and Instructor in Biology from 1935 to 1936. In 1936 he went to Harvard for one year as assistant professor of genetics, and since 1937 has been professor of biology at Stanford. He is a member of the National Academy of Sciences, and is president of the Genetics Society of America.

Dr. Beadle is the only person who has been extensively concerned with studies on all three of the organisms that are of major importance in the development of theoretical genetics—maize, drosophila, and neurospora. His work at present is with the last-named organism (commonly known as the "pink bread-mold"), and has resulted in powerful methods of studying the biochemistry of intact organisms—methods that involve a combination of the techniques of genetics and biochemistry.

Correction

The February issue of *Engineering and Science* erroneously reported that the Douglas El Segundo Plant and Mr. E. H. Heinemann, its chief engineer, were still associated with the Northrop Corporation. Mr. Heinemann is chief engineer of the Douglas El Segundo Plant.

JET ROCKET SOARS 43 MILES

AS a step forward in exploration of the outer atmosphere, development of a jet-propelled rocket able to soar 43½ miles above the earth's surface was disclosed at the California Institute of Technology.

Powered by the oxidation of liquid hydro-carbon, the 16-foot long projectile is equipped with supersonic instruments in its nose capable of recording weather information in the upper stratosphere at an altitude of 230,000 feet.

Under the direction of the Army Ordnance Department, which developed the rocket for the Signal Corps, the projectile was tested recently at the White Sands Proving Grounds near Las Cruces, New Mexico. After completing its flight into space, the rocket parachuted to earth and readings were made from the instruments.

Dr. Frank J. Malina, acting director of the Caltech jet-propulsion laboratory, is credited with guiding development and building the rocket, which was veiled with wartime secrecy under the code name of "WAC Corporal" from its inception in 1944.

The Douglas Aircraft Company worked with scientists on the project, manufacturing and assembling special parts for the projectile.

BOWEN TRANSFERS TO ASTRONOMY

ON January 1, Dr. I. S. Bowen, Professor of Physics at the California Institute of Technology since 1931, became the director of the Mount Wilson Observatory of the Carnegie Institution of Washington, succeeding Dr. Walter S. Adams upon his retirement after forty-two years of service at the Observatory.

It has been announced that, upon completion of the 200-inch reflector for Palomar Mountain, the operation of the new telescope will be a joint undertaking of the California Institute of Technology and the Carnegie Institution of Washington. Dr. Bowen will become the administrative head of the joint project, as well as director of the Mount Wilson Observatory.

After studying at Oberlin College and the University of Chicago, Dr. Bowen came to C.I.T. as instructor in 1921 and received his doctorate in 1926. He remained as a member of the faculty and was advanced rapidly to full professorship in 1931.

Dr. Bowen is well known both in the realm of physics and of astronomy. In physics his researches have been particularly fruitful in the field of spectroscopy, and because of his studies of spectral lines which cannot be produced in the terrestrial laboratory his interests have been extended to the great laboratories of the stars and nebulae. His work has been of a fundamental character bearing upon the behavior of the atoms under different conditions of temperature, pressure, and excitation. His wide knowledge of the origin of spectral lines enabled him to attribute to oxygen and hydrogen the prominent lines observed in the gaseous nebulae, thus solving one of the problems which had baffled astronomers for years.

Researches into the nature of substances in the nebulae and in the corona of the sun have recently won new honors for Dr. Bowen. He has been selected for an award of the Potts Medal of the Franklin Institute for 1946, with Dr. Stanford A. Moss, General Electric consulting engineer, of Lynn, Massachusetts, and Dr. Bengt Edlen, of the University of Lund, Sweden. The medals were presented at the annual ceremonies, April 17, by Charles S. Redding, president of the Franklin Institute.

PERSONALS

IT WILL be helpful if readers will send personal items concerning themselves and others to the Alumni Office. Great interest has been shown in these columns, but more information is required. Do not hesitate to send in facts about yourself, such as change of position or location, present job, technical accomplishments, etc. Please help.

—Editor.

1922

MAJOR FREDERIC A. MILLERD has returned home after nearly four years of service in the Army overseas and in this country. While in combat, Major Millerd worked on air intelligence in his outfit and at other times did extensive Army Judge Advocate work.

LINNE C. LARSON, Major, Corps of Engineers, is now on inactive status and is associated with Taylor and Taylor, consulting engineers in Los Angeles.

1923

J. R. (JACK) NORTH, who has been with The Commonwealth & Southern Corporation, Jackson, Michigan since 1924, is at the present time chief electrical engineer in charge of the design of substations and lines, selection and application of equipment, system and technical studies. Jack has been very active in AIEE work and is now a director of the Institute. His hobby is flying. Prior to the war he owned two airplanes, one of them a Fairchild 24-Warner.

1927

CAPTAIN FRANK S. HALE is at present on terminal leave and has accepted employment with Clarence P. Day, contractor, in Pasadena. At the beginning of the war, Captain Hale was stationed at Port Townsend, Washington, as Area Engineer for the Army Engineer Corps, constructing housing, fortifications and air fields. Later he was attached to the First Army in England, France, Belgium and Germany, and served twenty-three months overseas.

1930

ROSCOE DOWNS, project manager for the contractors, Bress-Bevanda and Macco Company, has just completed at San Bernardino construction of a reinforced concrete channel to carry the flood flows of Lytle Creek from above Foothill Boulevard approximately three miles to the Santa Ana River east of Colton. The channel is 40 feet wide, with vertical walls from 20 to 25 feet high. The project is one of the parts of the flood control program of the U. S. Engineers. Downs entered the employ of Mr. Bressi at graduation and has been advanced to a position of top responsibility.

1931

W. FRED ARNDT visited the Institute February 19 on his way to the San Diego U. S. N. Electronics Laboratory. Fred is employed at the U. S. N. Sound Laboratory, New London, Connecticut as head of the submarine department.

WALTER L. DICKEY, until recently a Commander in the Civil Engineer Corps of the Navy, has become chief engineer of the San Francisco contracting firm, Erbentraut and Summers.

1933

DOCTOR SIDNEY WEINBAUM, formerly with the Curtiss-Wright Research Laboratory, Buffalo, New York, is now employed at the Institute in the Jet Propulsion Laboratory.

T. S. MITCHEL, formerly Lieutenant-Commander in the U.S.N.R. stationed on the east coast with the Lighter-than-air Branch of the Navy, has taken a position in the mechanical engineering department of the Shell Oil Company, Inc., located in Long Beach, California.

1934

DOCTOR E. B. DOLL has accepted a position with the North American Philips Co. in Irvington, New York. He is to head a circuit development and analysis group in the laboratory. Dr. Doll resigned from the University of Kentucky last Fall.

JAMES McRAE has returned to the Bell Telephone Laboratories which he left in April, 1942, when he accepted a direct commission in the Signal Corps and began active duty. His work for Colonel Rives and Colonel Downing in the Office of the Chief Signal Officer was primarily concerned with coordinating the development program of Signal Corps Airborne radar and radio counter measures. In Washington, he also served on the counter measures, radar, and procurement precedents committees of the Joint and Combined Communications Board. He made a trip to England during this period in order to study radio and radar counter measures at Malvern and London. In June, 1944, he transferred to the Signal Corps Engineering Laboratory, Bradley Beach, New Jersey as Chief of the Engineering Staff serving part of the time as Deputy Director of the Engineering Division.

1936

J. A. BONNELL has accepted a position with Bowen, Rowe, Rule and Bowen, engineers, in Los Angeles, California.

W. E. "WALLY" SWANSON has recently resigned as assistant head, Operations Division of the Sacramento District, U. S. Engineers, to accept a position as engineer for the Gibbons and Reed Construction Company, whose main offices are in Salt Lake City, Utah. At present Wally is temporarily located in Las Vegas, Nevada, on construction activities in that area. He had been with the U. S. Engineers since November, 1937, in various district and division offices on the west coast and held the rating of Senior Engineer (Civil) since January, 1943.

1937

R. M. MAHONEY is manager of industrial relation departments, United States Vanadium Corporation, Unit of Union Carbide and Carbon Corporation at Grand Junction, Colorado.

JACK W. GEORGE was released from the U. S. Army in February and plans to resume work with the U. S. Vanadium Corporation at Winnemucca, Nevada, where his family will join him.

MARTIN POGGI was married to Miss Janet Brandon at Seattle, Washington on October 11, 1945.

GORDON BUSSARD has been transferred to the main personnel division office of the Du Pont Company, Wilmington, Delaware. After graduation, Mr. Bussard accepted employment with the Spruance Cellophane plant in Richmond. In 1938 he was transferred to the newly-formed nylon division at the Experimental Station located at Seaford, Delaware. In 1941 he assumed duties at Martinsville where he has been since his recent promotion.

MARTIN H. WEBSTER, a Lieutenant in the Air Force has been separated from Service. He was a legal officer at Wright Field. Mr. Webster has opened offices in Los Angeles where he is practising law and specializing in federal and state taxation.

1938

DAVID SHERWOOD was recently made Development Supervisor, United States Naval Sound Laboratory at New London, Connecticut.

1939

MAJOR PAUL ENGELDER is now on a civilian status, having served five years overseas in the Pacific area. Paul has returned to the Institute for graduate work in Electrical Engineering and will serve as Resident Associate in Ricketts House.

M. N. LEVET is now employed by Lane Wells and Company of Los Angeles, California.

WILLIAM M. GREEN is the father of a daughter, Barbara Taylor Green, born in Denver on February 8, 1946.

HOMER S. YOUNGS left for Washington, D. C., where he will be in charge of shippers research division of Air Transportation Association of America.

LOUIS L. KOLB recently was promoted to the rank of Lieutenant-Colonel and is now enjoying terminal leave, intending soon to be associated with the Krick Weather Service at the Institute. Louis served about three years on the Alaskan Air Route which extended from Great Falls, Montana, to Nome, Alaska. Mrs. Kolb and their two sons, three years and eighteen months respectively, are living in Los Angeles, California.

WALTER DIEHM, formerly associated with General Electric Company, San Francisco, California, is now enrolled at Stanford University, Palo Alto, California.

1940

ENSIGN DAVID WHITTLESEY, assigned to an escort carrier on relief duty, is to start terminal leave in May. Dave is the father of a daughter, Joy, ten months of age.

KEITH E. ANDERSON, having been discharged from the Army, resigned his U. S. Geological Survey appointment to become ground water engineer with the Missouri Geological Survey in Rolla, Missouri.

YOSHINAO NAKADA, formerly with Office of Strategic Services, is now on a civilian status and intends to locate in Los Angeles, California.

GERALD P. FOSTER is attending the Graduate School of Business at Stanford University in Palo Alto, California.

1941

WILLIAM L. DENISTON accepted a position with Stone and Webster Engineering Corporation and assumed his duties in February.

BERL LEVENSON, who was in the Eighth Air Force in England for twenty-five months doing radar work, is now separated from Service and is living in Los Angeles, California.

R. E. KINGSMILL is now employed by General Electric Supply Corporation of Los Angeles. He is selling electrical supplies and power apparatus.

ARMY CAPTAIN HARRY W. LEW, China Theater Signal Officer and Miss Doreen To, of the Army's Personnel Section, were united in marriage on January 19, 1946. Captain Lew was employed by the U. S. Naval Research Laboratory in Washington, D. C. prior to entering the Armed Forces. A proud wearer of four overseas stripes, Captain Lew expects to return to the United States within a few months with his bride. They will make their home in California.

1942

ROBERT HALL, formerly with General Electric Research Laboratory at Schenectady, New York, came back to the Institute on March 4 on a National Research Council Fellowship (pre-doctoral).

ENVER MURATZADE has been appointed lecturer in hydraulics at Roberts College, Istanbul, Turkey.

ROY C. VAN ORDEN has recently been employed by the city of Los Angeles as a structural engineer.

ARLO JOHNSON has accepted a position as assistant professor of aeronautical engineering at the University of Illinois, Champaign, Illinois.

SECOND-LIEUTENANT CARL SAVIT recently visited the Institute on a thirty-day leave. He hopes to return to the Campus for advanced work when released from Service. Carl is stationed at Wright Field where he is engaged in mathematics research in electronics.

LIEUTENANT OTHNIEL HORNE is now on terminal leave, having spent the past three years in the Air Force at various middle west locations.

PAUL VEENHUYZEN, formerly a Navy Lieutenant, has been separated from Service and is now working at the General Electric Company in Los Angeles, California. Paul lives in Long Beach, California.

1943

HAROLD DEWDNEY having returned from overseas duty, visited the Campus in late February. Harold was a Sergeant with the Royal Canadian Engineers. In England, Belgium, Holland and Germany he built semi-permanent bridges (Bailey Bridges on pile piers). He also surveyed the longest Bailey Bridge in the world at Zwolle, Holland, over the Ijssel River.

LIEUTENANT (j.g.) MAURICE BECKSTEAD arrived home from the east recently on his terminal leave and is now engaged in farming. Maury was stationed for some time as torpedo instructor at San Diego Naval Base.

DWIGHT BUETTELL, a radio technician in the Navy since June, 1944, is now released from service and has just returned to the States from China on a troop transport. Dwight was formerly with Douglas Aircraft, working in their research department.

LEON TRILLING was married on February 17, 1946, to Miss Edna Goldberg of Los Angeles, California.

LIEUTENANT EDGAR FLAVELL, Air Corps, has been transferred to the Pacific theatre for occupational purposes.

LIEUTENANT (j.g.) WAYNE BROWN has returned from Pearl Harbor where he spent five months in ordnance work and is now on inactive status. Wayne is married and has a son eighteen months of age.

HOLLIS HANCHETT, a former Lieutenant in the Air Corps, is now on inactive status. Hollis flew B-29's against Japan and served eleven months in the Pacific area.

DONALD H. POTTS was married to Miss Betty L. McFarland of South Pasadena on February 22, 1946. Don has been an Instructor in Mathematics at the Institute and has also been working for his doctor's degree.

WILLIAM FAIR, formerly with Sperry Gyroscope Company, is now enrolled at Stanford University, Palo Alto, California.

1944

ENSIGN JOHN R. UKROPINA is assistant engineer on the U. S. S. *Fiske* now on Atlantic duty.

LIEUTENANT W. A. DODGE, JR. is on active duty with the Eighth Army Headquarters in Yokohama.

ENSIGN THOMAS A. CARTER visited the Institute the latter part of February, having come off the carrier Makin Island, on Pacific duty. Tommy was awaiting transfer to a destroyer in the Atlantic area.

RICHARD J. SOIKE has been promoted to the rank of lieutenant (j.g.) and is still on the same ship that he has been assigned to for the past eighteen months—the U. S. S. *President Hayes.*

ENSIGN WILLIAM R. DAVIS, who has been working in radar at the Philadelphia Navy Yard, has been released from Service and is thinking seriously of returning to the Institute. Bill was married on April 4 at Annapolis to Miss Catherine Gould of Glendale, California.

ENSIGN JAMES KERR, formerly with the Seabees at Okinawa, has been released from Service and is living in Oakland, California.

LIEUTENANT (j.g.) WILLIS BUSSARD has been detached from the submarine U. S. S. *Gabilon* which was decommissioned and laid up in the Reserve Fleet. Willis visited the Campus on February 16, while he was awaiting orders from San Francisco.

LIEUTENANT HARRY N. TITZLER has been assigned to the Far East Service Command Headquarters, Manila. This command is responsible for the supply, repair, maintenance, salvage, and disposal of all AAF aircraft and equipment in the Far East.

RAYMOND F. BERBOWER has secured a position with the engineering division of the Long Beach Harbor Department, Long Beach, California.

ENSIGN WILLIAM T. COLLINGS was married to Miss Patricia Rogers of Milwaukee, Wisconsin, on February 2 in the Camp Endicott Chapel, Davisville, Rhode Island.

1945

DONALD K. TRAVERSE, commissioned an ensign in November, is now attached to the U. S. S. *New Kent* in the Pacific area. Don was married to Miss Mary Patricia Young this past year.

LARRY HALL is taking Naval Air Force training in Illinois.

ENSIGN ROBERT E. LEO, who has been an instructor in radio communications at Terminal Island, is now separated from Service.

THOMAS F. DIXON, a former lieutenant in the Navy, is now on terminal leave. His last station was the Bureau of Ordnance at Washington, D. C. where he did research in rockets and rocket propellents. Tom is now located at North American Aviation Inc. doing jet propulsion research.

1946

JOHN E. FLEMING and Miss Zemula W. Pierce were united in a formal wedding ceremony at St. James Episcopal Church in South Pasadena, California on February 23.

DONALD HASS, of our recent graduating class, has accepted a position with the United Geophysical Company in Pasadena.

Fill in and send to:

News Editor, Engineering and Science Monthly
1201 East California Street, Pasadena 4, Calif.

Name________________________ Class______

Home address________________________

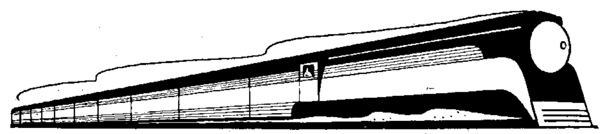
Information about myself (marriage, position, type of work, change of position or location, etc.)

Information about another alumnus

Name________________________ Class______

Once again we can say

"NEXT TIME, TRY THE TRAIN"



At long last we can see our way out of the woods. No longer is there a backlog of veterans waiting for transportation to their homes. The peak movement seems to be definitely over.

We want to sincerely thank all the civilians who refrained from traveling to make room for these men. And we want to point out that now *some* space is available on *some* Southern Pacific trains for you who wish to travel.

In other words, we can now invite you to "Next time, try the train", but as yet we can't say it very loud.

There are now quite a few seats available in coaches and chair cars. Sleeping car space is tighter in comparison, but considerably more plentiful than it was, especially on certain trains.

With our heavy war load easing, we will soon speed up trains on our Four Scenic Routes to the East and return the lounge cars and other refinements in service that we had to discontinue during the war. Already all Southern Pacific trains are serving three meals a day.

Please call us if you're planning a trip anywhere. We'll do our best to get you the reservations you want. *(Relaxing of ODT regulations now makes it possible for you to make reservations as far in advance as you wish.)*

Meanwhile we are going full speed ahead with plans for new streamlined trains that will be the finest the world has ever seen.

S•P

The friendly Southern Pacific