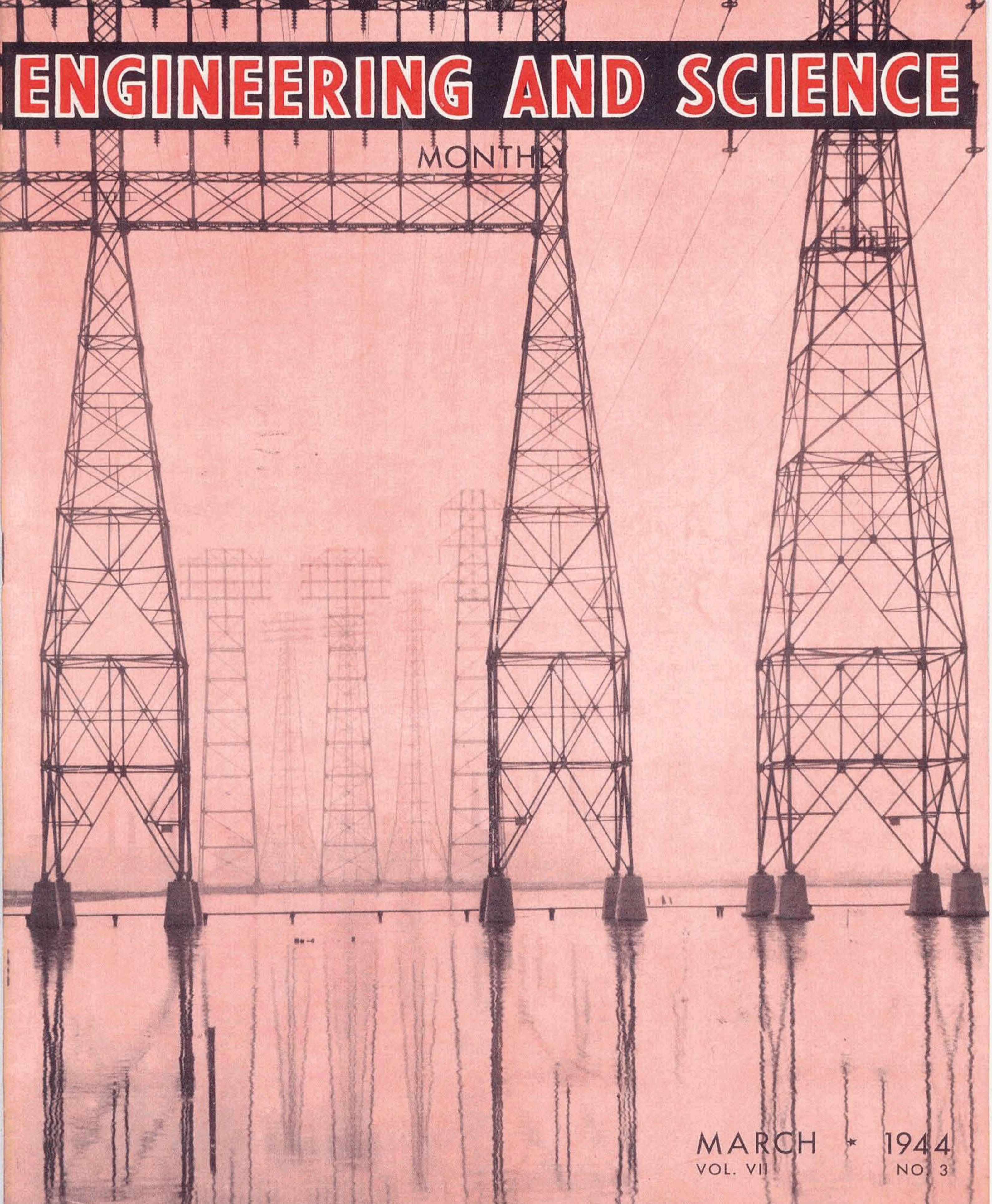
ENGINEERING AND SCIENCE

MONTHLY



MARCH ★ 1944
VOL. VII NO. 3

PUBLISHED BY CALIFORNIA INSTITUTE OF TECHNOLOGY ALUMNI ASSOCIATION

How Concrete Serves in Navy Medical Center

The Navy Medical Center near Washington is a gleaming white monumental group *dominated by a 20-story tower. A facing* material which would provide architectural beauty and resist soiling and weathering was a requirement of the designers.

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The buildings in the Navy Medical Center group were designed by the Bureau of Yards and Docks, Rear Admiral Ben Moreell, Chief of Bureau. Frank W. Southworth, project manager for the Bureau of Medicine and Surgery, Ross T. McIntire, Surgeon General of the Navy. Paul P. Cret of Philadelphia, consulting architect. John McShain, Inc., *contractor. Capt. Hugo C. Fisher,* U.S.N., officer-in-charge for the Navy Department.

BUY WAR BONDS TO SPEED VICTORY

BY-LINES

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Professor Gray was graduated from the University of Pennsylvania in 1930 and continued with post-graduate and research work until 1936. He taught a year at the Wharton School of Finance and Commerce, and from 1937 to 1940 at the University of Connecticut. Since 1940 he has been head of the Industrial Relations and Production Engineering Section of the Institute.

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Lieutenant Colonel Combs received his B. S. degree in civil engineering from Caltech in 1927. Before his entrance into military service in 1940 he was the representative of the West Coast Lumbermen's Association for the southern California territory. At the present time, Colonel Combs is control officer and assistant executive officer at the headquarters, Engineer Unit Training Center, Camp Claibourne, Louisiana.

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ENGINEERING AND SCIENCE

Monthly

The Truth Shall Make You Free

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ENGINEERING AND SCIENCE MONTHLY

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Vol. VII No. 3 March, 1944

Organization of Engineers for Collective Bargaining

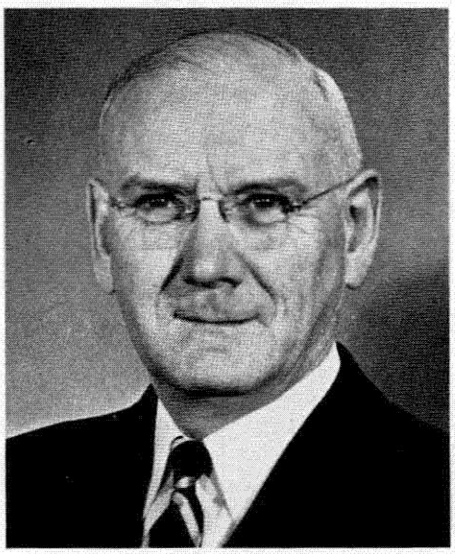
BY FRANKLIN THOMAS

IF 10 years ago the forecast had been made that in 1943 the 91-year-old American Society of Civil Engineers would then take steps whereby some of its employee members might form a collective bargaining group, none would have regarded the idea as so improbable of adoption as the members of this professional society. Nor would it have been considered a more likely probability that in the year just closed, as a result of federal legislation and interpretations of the National Labor Relations Act of 1935 by administrative agencies, employed professional engineers in positions of responsibility would be required to join a union composed largely of sub-professional persons related to the manual trades, in order to hold their positions. As a result of the development of several situations of the latter nature in various parts of the country, the former action was recently taken by the American Society of Civil Engineers.

Out of the expansion of union activity in the period of war-plant construction there arose a number of situations wherein professional engineers found that collective bargaining rights for them were being claimed by unions with which they did not wish to be affiliated. Committees of the Society have been investigating the effects of these developments upon the membership and a member of the headquarters staff has devoted full time to such problems.

In the course of the construction of the large Sunflower Ordnance Plant in Kansas, A. F. of L. local of the International Federation of Technical Engineers, Architects and Draftsmen's Unions—composed largely of sub-professional employees—applied to the War Labor Board for designation as the bargaining agent for all technical engineers engaged on the project. An election was set and there being no other organization or agency involved, the I.F.T.E.A. & D.U. was declared the collective bargaining agent. Belatedly, a group of the engineers of the project successively requested in vain of the Panel of the War Labor Board that they be not represented by the I.F.T.E.A. & D.U., and that an independent group of the professional engineers be recognized as their representatives. In connection with the latter request, an appeal was made to the Society by the engineers for counsel and assistance in maintaining their professional identity. Aid was given in clarification of issues and in the preparation of legal briefs but the decision rendered later by the Labor Board Panel denied the requests for separate classification.

The principal lesson which could be drawn from the rulings of the Labor Board Panel was that for any group to qualify for separate consideration in collective bargaining, it must have an organization appropriately constituted. Persons making approaches to the Labor Board as individuals are given no consideration; nor is an organization which comes into being after bargaining rights have been assigned to another.



PROF. FRANKLIN THOMAS

It is pertinent to point out that the War Labor Board in a number of instances has upheld the right of employees of professional grade to separate classification and group representation when such classification has been requested by an employee organization. The Technical Employees Association of Detroit and the Tennessee Valley Authority Engineers Association are two which served the purposes of the professional engineers comprising them. Similar professional classification was accorded to a group of chemists employed by the Shell Development Company at Emeryville, California. It is in situations where no such organizations exist or where the professional employees fail to act that non-professional workers have claimed and have been granted bargaining rights for all technical employees.

Having available to it knowledge of these policies affecting employed engineers, the Society's Committee on Employment Conditions formulated, and the Board of Direction adopted a plan under which the 64 local sections of the Society could serve as the sponsors of local collective bargaining agencies where such groups seem to be desirable.

The plan adopted for the American Society of Civil Engineers embodies the principle of the National Labor Relations Act that the collective bargaining group shall be composed solely of employees and shall be free from employer domination. The procedure undertaken is for the respective local sections to adopt amendments to their constitutions which shall provide for the formation of a local collective bargaining agency from the employee members of the section and such other professional engineers not members of the section as may wish to become members of the bargaining group and pay somewhat higher dues than are paid by members of the section, "preferably not to exceed $5 per year." From the employee group there shall be elected a "Committee on Employment Conditions" which as "The bargaining committee shall have the duty and power to direct all activities looking toward the acquisition of adequate compensation and satisfactory working conditions for all professional engineering employees resident within the geographical limits of the Local Section—and shall administer its functions in accordance with the general direction of those professional engineering employees who have paid the dues stipulated."

The basic definition adopted for this undertaking is:

"The designation 'professional engineering employees,' used in the sense that persons capable of being so designated may join with others similarly capable of being so designated for the purposes of collective bargaining separately from any other group composed of persons not capable of being so designated, shall be that of only those who, excepting employers or those to whom employers have delegated managerial responsibility with respect to employment conditions, possessing an intimate knowledge of mathematics and the physical sciences gained by technological and scientific education, training and experience, and in a position of trust and responsibility, apply their knowledge in controlling and converting forces and materials to use in structures, machines, and products, and whose work requires the exercise of discretion and judgment, is creative and original and of such character that the output cannot be standardized; and those who, without the experience set forth, but having been graduated from an approved educational institution and having received the degree of Bachelor of Science or its equivalent, in Engineering, are engaged in engineering work."

The American Society of Civil Engineers has committed itself to this program with substantial support. It will maintain a "field representative" in each of four geographical areas. They are to advise, counsel, assist and provide correlation for the local bargaining group.

Whether the other major engineering societies will deem it necessary to take comparable steps of the radical nature taken by the American Society of Civil Engineers will probably depend upon the extent to which their members are affected by encroachment and possibly upon the results following the action taken by the Civil Engineers. However, a courageous effort has been made to preserve the professional viewpoint with which most young engineers approach their careers.

The Engineer in the Labor Picture

BY ROBERT D. GRAY[1]

THE painting of the labor picture to show the place of the engineer in it would require a giant canvas. On such a canvas would appear the hundreds of large employers and the thousands of small employers in this country. In addition, this canvas would show the millions of employees working or desiring to work for wages. In other places in this painting would appear the unions or organized labor. In drawing this picture it is especially important that a distinction be made between labor with a small "l" meaning all workers, and Labor with a capital "L," meaning organized groups. The government would also have to be represented, and the dual role of government must be indicated. On the one hand the government itself is a large employer of labor, and, on the other hand, government regulates many of the employer-employee relationships. It is important to realize that the government as an employer and government as a regulator of other employers follows very different policies and practices. To some it may appear that the government has two separate entities, and to others it may appear that the government is merely suffering from a split personality. Finally, this labor picture must include the public which not only is affected by labor problems but which in the long run determines the solution of labor problems.

In making such a sketch it would become apparent that many individuals would appear in more than one location. Thus, the employers and employees constitute a large part of the general public, and the general public should stand in the background of government for the eventual determination of sound policies.

But if we took the time required to make this complete picture, we would not understand how the present situation developed and the picture would be obsolete by the time it was completed. We should, therefore, use the technique of motion pictures rather than painting in order to present the dynamic character of our labor problems.

It must be recognized that the labor problem includes a large number of somewhat independent but largely interdependent specific problems such as employment, training, wages, security, safety, grievances, and labor organization. The complete discussion of these various problems would require volumes. It is necessary, therefore, to limit discussion in this paper to a small part of the labor problem, but the part which affects engineers most directly: a consideration of the general problems of organization of employees and the background of the present efforts for organization of engineers.

ADAM SMITH'S VIEW OF UNIONS

Organization of employees is not a new, or "New Deal," phenomenon. The problem of employer-employee relationship began in the distant past when one person started to work for another. The need for organization of employees became apparent quickly although at the beginning such organizations were illegal. For what may be considered one of the best statements of the need for labor organization, let us begin our motion picture with the employer-employee relationship described in that classic of classics in economics—"The Wealth of Nations," by Adam Smith. In discussing relationships between employers and employees Adam Smith recognized the mutual dependence of employer and employee. The employer needed the employee in order to facilitate

(*Continued on Page* 15)

[1]Paper delivered before the January 26, 1944, meeting of the Alumni Association, California Institute of Technology.

Engineers for the American Service Forces

BY THEODORE C. COMBS

WRITING from the war front not long ago, Ernie Pyle said: "The engineers were in it up to their ears."—a homely restatement of the current truism that this is a technician's war. The Army engineer, as a builder and a man of science, has a part, directly or indirectly, in every battle of today. Small wonder, then, that General George C. Marshall, Chief of Staff, U. S. Army, reported to the nation on September 8 of last year: "The Corps of Engineers has been increased by 4,000 per cent" (between July 1, 1941, and June 30, 1943).

These figures reflect the importance of the technician in khaki. The mission of the engineer is to slow the advance of the enemy and speed the progress of our own troops. In accordance with its mission the Corps of Engineers provides troops for all three divisions of the Army: Army Service Forces, Air Forces, and Ground Forces. For the Air Forces, there are the Aviation Battalions and Regiments. Every division of infantry employed by the Ground Forces has its combat engineer component, and the armored divisions, too, have their engineers.

It is with the Army Service Forces and the engineers therein that this article concerns itself primarily as a matter of familiarity to the writer, who has served for the past 18 months in the Engineer Unit Training Center, Camp Claiborne, Louisiana. There the bulk of U. S. Engineer troops for employment overseas with the service forces have been trained, and the Center at this writing comprises the largest single concentration of engineer soldiers in the nation, and probably the world.

The story of transition—civilian to engineer—that is taking place daily at the E.U.T.C., the molding of the civilian technician into the military engineer, is one well worth telling here.

Take the typical case of a mythical soldier inducted for the purpose of this article, a George Johnson, educated for two years, say, at California Institute of Technology and now a salesman. He left college before graduation for any reasons the reader cares to assign, spent some time on a surveying crew, then entered a more lucrative field of selling before entering the Army. On the day that Mr. Johnson walked into the induction station of his home town, raised his right hand, and took the oath of allegiance, he left his civilian identity behind him, to become Private Johnson, a member of the U. S. military team. Therein lies our story.

INDUCTION AND RECEPTION

From the induction station, the new recruit is hurried to the reception center nearby, where he discards his civilian clothes for the garb of a soldier. There he begins the series of inoculations against disease, sleeps for perhaps the first time in an Army barracks, learns the rudiments of drill, draws the "GI" clothing he will wear during the days to come, and becomes an advocate or antagonist of army fare. Included too in the neophyte's experiences at reception center is an interview with a member of the classification section, whose duty it is to see that the Army's men are utilized to the best advantage.

Let us assume that Private Johnson possesses the qualifications desired in a surveyor, and that he is classified in that category as a "228" with appropriate entry and punching being made on his qualification card. Meanwhile, comes a requisition for surveyors and other specialists to be employed in a series of units about to activate at the E.U.T.C. Private Johnson is soon on a troop train, speeding toward Camp Claiborne, Louisiana.

On his arrival at Claiborne, a military band of the Engineer Unit Training Center plays him and his train companions a welcome to the installation that will be their training site for at least the next 13 weeks to come. But even before his arrival at Claiborne, he has actually become a part of the E.U.T.C. A classification crew of the Center meets the train an hour or so earlier at a convenient stop and picks up the stack of qualification cards, "Forms 20." As the train travels toward Claiborne, the classification crew, riding in a mobile office and equipped with a list of specialist vacancies, sorts the cards by mechanical means and rapidly but accurately makes appropriate assignments—each square peg in a square hole in so far as is possible. By the time the train pulls into Claiborne, the classification crew is there with a typewritten list of assignments. The men line up and move to designated trucks as their names are called. "Johnson, George—to Company C, 1200th General Service Regiment." So Johnson, surveyor, together with an auto mechanic and a bulldozer operator and others whom he met on the train, helps to fill the needs of Company C.

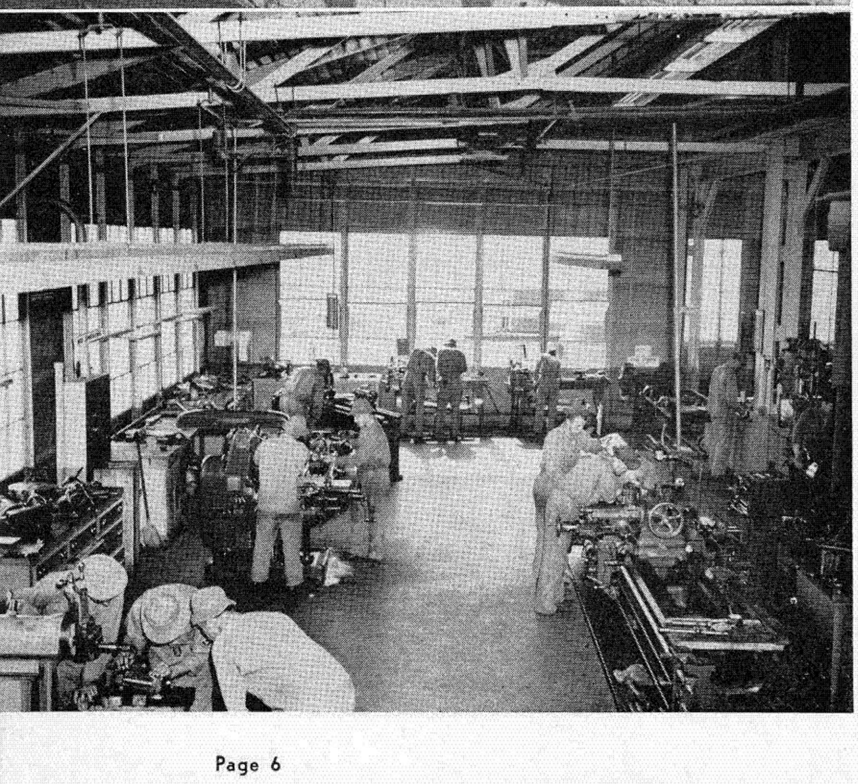
They are taken by truck to the 1200th Regiment, with which, in all probability, they will serve for the duration of the war and will insist is the best damn outfit in the Army. Johnson's first view of Camp Claiborne from that truck is one of the many reminders to come that the machinery of war is not built for beauty, but rather for function. The camp lies in the heart of a segment of cutover timber land of Louisiana, and the engineer section of the camp is comprised in the main of standard theater-of-operations construction—tarpapered, temporary structures that offer service without excess decoration.

The newcomer is quartered in an 18-man hut and is issued a standard Army cot, sheets, blankets, and comforter. The next thought, as it is with any soldier, is food, and Private Johnson begins his first meal at the E.U.T.C., eating the standard Army ration shared by his fellow soldiers the country over. Thus his identity as a member of a military team begins with his food and lodging, and with the clothing he wears, for all are in accordance with the Army standard design.

In training too he loses his personality as the relatively rugged individualist each civilian is. He must learn to act with a group and for a group, and that maxim will hold true from the 12-man squad of which he is a member up to the largest theater of operations he may enter when his training is through.

TEAMWORK

The ways he acquires his teamwork are varied, basic and time-tried. During the first five weeks of his stay at the Engineer Unit Training Center, Private Johnson and the other men of his organization undergo the same type of basic training to which all units of the Center are subjected. On his agenda is close-order drill, to teach him how he and his fellow engineer soldiers can move as a



unit from one locale to another, with a maximum of precision and minimum of confusion. This and a variety of other activities develop stamina, discipline and alertness. In a few weeks, he will be tough—tough enough for "impossible" jobs overseas.

He masters the basic weapons of an engineer, the M-1 (or Garand) rifle, the lighter carbine, both heavy and light machine guns, rocket launcher or "Bazooka," anti-tank grenades, and hand grenades, for although engineer troops employed by the Army Service Forces are primarily construction troops, they must be prepared to fight in defense if not offense in these days of fast-moving warfare.

He learns by first-hand experience how to use his gas mask, and how the mask protects him from noxious vapors, smokes, and liquids. A few whiffs of the real thing lend respect, and a surprise "attack" speeds up his masking.

Scouting and patrolling, map reading, extended-order drill (the employment of the squad or larger units in infantry attack or defense) give to Private Johnson and his fellow soldiers the fundamentals of self- and unit-protection. A tour of duty walking a guard post supplements his knowledge of protection for his unit.

He builds, side-by-side with others of his company, obstacles to slow or stop the advance of tanks and similar armored vehicles, and watches a tank charge against his handiwork. He studies the principles of camouflage for himself and his equipment. He learns the use of such basic engineer tools and equipment as the power saw, the bulldozer, the power hammer, carpenter chest, power auger, and the more humble pick and shovel, for although he is a surveyor he is also a member of a team which does many things. Private Johnson's military education is enhanced by sessions at the rigging area, where he learns the intricacies of an almost lost art of knots and lashings and hasty rigs.

To do the demolitions work that he will be called to accomplish in the theater of operations, the engineer must have a knowledge of these more lethal tools of his craft. Accordingly, the E.U.T.C. trainee learns the use and properties of explosives such as TNT, dynamite, nitro-starch, and others less familiar to the laity. He aids in the various tasks of constructive and destructive demolitions.

SPECIALIST TRAINING

Thus passes swiftly the period of basic training, five weeks of learning as an individual and as a member of a team. It is from here on out that the training given the various types of units at the E.U.T.C. varies. During the next eight weeks, or technical-tactical period, each unit sends out a selected group of men to specialists' classes or schools, the former within the E.U.T.C. and the schools outside Camp Claiborne, generally at a large plant in some large city in the United States or at another military installation. Private Johnson, being a transitman, will receive a refresher course and some advanced training. Meanwhile, his teammates of the regiment will be

AT LEFT:

Upper view: Ponton bridge nearing completion. *Center view:* Firing a 22-caliber rifle on anti-aircraft range. *Lower view:* Showing one small corner of the E. U. T. C. heavy shop training subsection. (All illustrations are made from official U. S. Army photographs, E. U. T. C. Laboratory.)

learning the employment of their specialties, whether they be mechanics, carpenters, construction foremen, welders, quarrymen, truck drivers. For the less skilled, this period will be filled with further learning of the type of engineer subjects studied in basic training. If the specialist schooling does not fill the eight weeks of the tactical-technical training, the specialist too will rejoin his organization as it masters such subjects as bridge building of both fixed and floating types, structures capable of bearing upward from 10 tons to limits not yet disclosed to the general public. Mines and booby traps as used in both offensive and defensive operations are studied in the field during this tactical-technical period. The trainee also spends time at a roads area, learning the patching of bombed or otherwise demolished roadways, construction of various surfaced roads, corduroy surfaces, landing mats for airfields, and the like—work which in all probability will fall to the lot of any typical Engineer Regiment employed overseas by the Army Service Forces. In this as in all E.U.T.C. training, the stress is on working together, teamwork.

Many of the basic subjects are continued in this second phase of training at the E.U.T.C., as the defense against mechanized attack and chemical attack, and the like. Marches and bivouacs, night operations, and a trip across the infiltration course give a preview of life overseas. The infiltration course is a small plot of ground marked by what appear as the shell holes of a battlefield, criss-crossed by barbed wire, where machine guns fire live ammunition above the heads of the advancing trainees (provided they hug the ground close enough) and where small charges of explosives are set off nearby, to simulate shell bursts.

APPLICATION

Then one day the first 13 weeks of training are over, and the unit moves into bivouac at a forested area beyond the limits of Camp Claiborne. There it lives under field conditions and is engaged in advanced unit training and tasks such as it will face overseas, until the call comes for the unit to move out, toward the port of embarkation. There comes then a period of packing and crating of equipment, of processing men and records, and of determining that every item of a lengthy check list is fulfilled. Some day the unit moves to the train that will carry it from Camp Claiborne. Once again, band music is played for Private Johnson (perhaps by now a sergeant, in keeping with his value to the regiment as a surveyor) and for the men who will build and fight beside him. The band plays as he leaves his area in the E.U.T.C., and plays as he boards the train and heads for the staging area and port of embarkation and theater of operations to apply the training undergone at Camp Claiborne.

That training is unit training, from which the Engineer Unit Training Center takes its name. In such schooling, the members of an organization take a maximum of their drills as a unit; even while the individual is acquiring skill, he is associating with the men who will be beside him in the theater of operations. This system is distinguished from replacement training, in that in the latter, the trainee, after his basic period is over, is separated from those who went through the cycle with him, and sent as an individual to join an outfit either newly activated or one that has a vacancy.

Private Johnson, the ex-surveyor now a member of a group trained to work together in all operations, has met many varieties of men at the E.U.T.C. in his stay there. He has met skilled construction men from every walk of life, mechanics, cooks, clerks, linemen, welders, bricklayers—the builders of a nation. Their ranks have been supplemented by men whose skills were not directed to construction or engineering work in civilian life, but who have mastered military engineering through their training at the E.U.T.C.

OTHER TRAINING

Not all were in training with an engineer regiment, as he was, for about a dozen different types of organizations have been activated at the Engineer Unit Training Center since it was organized on April 15, 1942, and an undisclosed number of each type have learned to work as a unit at Camp Claiborne since that day. It can be said, without disclosing information of potential value to the enemy, that the great bulk of U. S. Engineer Corps troops designed primarily for employment by the Army Service Forces have been trained at the E.U.T.C.

Of these, the General Service Regiments have been a sizable portion of these troops. The General Service Regiment is described by the Technical Information Branch, Office Chief Engineers, as the "nucleus of engineer service organizations. . . . The work it does is suggested in the over-all mission of engineer troops. In theaters of operations, this mission, aside from combat, includes such major tasks as permanent bridging, construction and re-

AT RIGHT:

View showing engineer-soldiers spacing stringers on standard trestle bent bridge (H-15) utilizing salvaged lumber. Note old nail holes in scabbing and braces, from earlier use of the lumber by similar E. U. T. C. troops.

pair of primary roads, provision of port and landing facilities, construction of air bases and advance landing fields, maintenance and operation of inland waterways, construction and major repair of railroads, and in general the construction, repair and maintenance of all structures of every character throughout the theater except telephone and telegraph systems and other signal communications."

Of similar mission and capabilities is the Engineer Special Service Regiment, which is organized to undertake large construction and rehabilitation tasks that require a higher degree of technical skill. It is contemplated that the personnel of the regiment will be reinforced with local civilian labor wherever feasible, or with other military units attached to form a large construction force. Military tasks that are suitable for a Special Service Regiment include: clearing sunken ships from harbors, repair of port and harbor facilities, building or repair of major water-supply facilities, construction of power plants, transmission lines, highways, railroads, and railroad terminals. An unusually large number of senior noncommissioned officers to supervise civilian or military workmen is another characteristic of this type of organization.

Another key unit trained at the E.U.T.C. is the Heavy Shop Company, whose mission is fifth echelon maintenance of equipment for which the Corps of Engineers has maintenance responsibility. Such service may be stated in laymen's terms as complete overhaul, rebuilding and repair of a wide variety of equipment, from delicate engineer instruments to heavy construction machinery.

Third and fourth echelon maintenance are the mission of maintenance companies trained at the E.U.T.C. The repairs undertaken by such a group include the replacement of assemblies, and may be conducted "on the spot" in a mobile shop, or at the company's base of operations, farther from the forward areas.

Engineer Forestry Battalions and Companies will be employed in the theater of operations to log medium-size timber and manufacture lumber for construction. The organic equipment includes logging trucks and trailers and portable sawmills. Personnel includes head sawyers, millwrights.

Most recent of all E.U.T.C. trained units in the public eye are the Petroleum Distribution Companies. Such organizations, including some from Camp Claiborne, have pioneered in pipeline supply of both petroleum products and water in recent campaigns in lands bordering the Mediterranean. These companies utilize a portable, lightweight pipeline capable of pumping (through four-inch conduit) 200 barrels or more of liquid per hour, if a minimum pressure differential of 200 pounds is maintained between pumping stations. For a six-inch line, the output is 400 barrels per hour. One mile of the line, including a pumping station, weighs only 13 tons. The stations utilize a reciprocating or centrifugal pump, and with the former a semi-automatic hydraulic control can be used, to maintain a uniform flow of liquid along the line.

Engineer Depot Companies receive, store and issue the many items of engineer equipment required in the theater of operations. The companies may be found in the engineer section of a general depot, or operating a small engineer supply point.

Heavy engineer equipment, as issued by the depots, is made available for construction units by Heavy Equipment Companies, which also provide operators for that equipment if necessary. By taking charge of such items as large cranes and shovels, pile drivers, and the like, the equipment companies act as an issuing pool for items that a construction unit may not need at all times, hence making for increased mobility of such construction units.

Engineer Parts Supply Companies are trained at the E.U.T.C. for the mission that their name implies, and may form a part of an engineer depot or the engineer section of a general depot.

Dump Truck Companies are usually attached to larger engineer units to provide transportation of bulk materials. Another small unit, the Engineer Fire Fighting Platoon, is trained and equipped to combat blazes in such installations as supply depots. Engineer Gas Generating Units, small organizations, are schooled at Camp Claiborne to generate by mechanical process oxygen and nitrogen, and by chemical process acetylene for use in welding, and the like.

Engineer Utility Detachments train at the E.U.T.C. for operation and repair of the utility installations of important overseas installations. In occupied areas, the detachments may make repairs of the utilities in cities abandoned by the enemy and operate them until the civil population can provide its own utility men.

ORGANIZATION

These and other types of engineer organizations are trained at the Engineer Unit Training Center. The Center was organized under the command of Brigadier General John W. N. Schulz, who, after 18 months of service at Camp Claiborne, was recently transferred, and has been replaced by Brigadier General Don G. Shingler. From the starting goal of equipping and organizing a dozen Special and General Service Regiments and ten Dump Truck Companies, the Center has grown in magnitude and importance. Details of organization and operation are altered from time to time as necessitated by the exigencies of the war effort.

At this writing, the staff of the E.U.T.C. includes Colonel Holland L. Robb, as Executive Officer; Lieutenant Colonel John H. Miller, Director of Administrative Division; Lieutenant Colonel K. D. Willoughby, Director Personnel Division; Lieutenant Colonel R. G. MacDonnell, Director Training Division; and Major W. H. Ward, directing the Supply and Service Division. Colonel Edwin P. Ketchum commands the First Provisional Training Brigade, and the Second and Third Brigades are commanded by Colonel R. M. McCutchen. The writer, formerly Director of Supply and Services, is serving as Assistant Executive Officer and Control Officer. The services of these officers are supplemented by those of many others of the E.U.T.C. Headquarters Staff, and with enlisted men and officers of the many units in training there, to form an enviable total of construction, engineering and military experience.

Training facilities are those of a sizable, well-balanced industrial community, together with those of solely military significance. Students in the heavy-equipment school occasionally break up equipment, which the students in the heavy shops repair even to the extent of manufacturing parts. The Forestry Companies manufacture lumber which is utilized in the carpenter school, in bridging and in general construction training. Gas Generating Units furnish oxygen to the station hospital and gas to the shops and welding school.

THE RESULT

With such a group of officers and men, the many facilities, and the smoothly operating procedures of the Cen-

(*Continued on Page* 20)

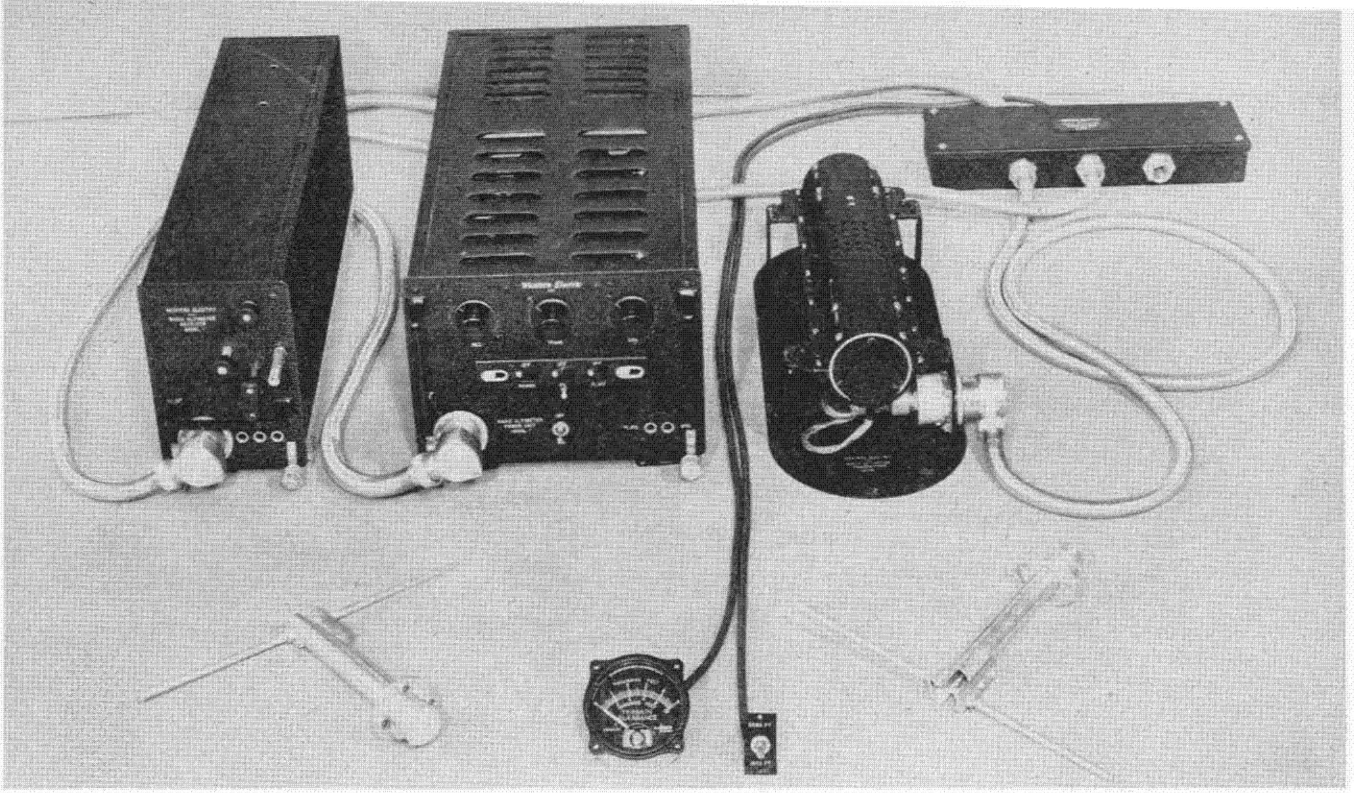


Fig. 1—Left to right: receiver, power unit, transmitter.

RADAR'S PEACEFUL COUSIN

BY WARREN AMSTER

BEHIND the word "Radar" is the story of a revolution in the waging of aerial war. The planning, the tactics, and the participating aircraft of a modern air offensive are designed to cope with radar-directed defenses. Heavy bombers have been driven up to 30,000 feet by the accuracy of radar-aimed anti-aircraft fire. They may be forced even higher. The elaborately planned and precisely executed diversionary raids that accompany a major bombing mission are for the purpose of confusing otherwise virtually impenetrable defenses. And the revolution has taken place suddenly. Changes and experimentation in both German and Allied air tactics reveal the lack of experience on both sides in the new type of warfare. Many lessons have been learned, and there are many more to come. Peace will permit the discharge from military service of devices that will have a tremendous effect on commercial aviation. For some day radar will resume its original role of speeding aerial cargoes and saving passenger lives.

Radar started out peacefully enough. Between 1928 and 1938 several laboratories investigated the phenomenon of radio-wave reflection. Most of these experiments were attempts to develop commercial equipment for airline use. And most of the attempts failed. The technical problems involved in developing the equipment proved too complex for most investigations with the limited resources usually allotted for such projects. Successful radar-type equipment is almost entirely a product of war-inspired research. A notable exception is the Western Electric terrain clearance indicator, developed by the Bell Telephone Laboratories around 1938.

As its name implies, the Western Electric instrument shows a pilot his distance from the ground. It fills a long-felt need in the aviation industry, which has never had an instrument for just this purpose. The airlines which had encouraged the development were contemplating general installation in their transports when the war interrupted their plans. Publication of information about the equipment ceased abruptly, and improvements since 1939 are military secrets. The 1939 product had only one serious fault. Its maximum reading was 5,000 feet, not enough for routine airline operations. Otherwise its performance was altogether satisfactory. Recent information indicates that models currently in use with the armed forces are greatly improved. Early postwar products will be even better, and they may well operate up to the range of a conventional altimeter.

BAROMETRIC ALTIMETER

The instrument that the terrain clearance indicator augments and may eventually replace is the barometric altimeter. Any such general replacement probably will be slow because the barometric-type instrument is simple, relatively cheap and, most important, light in weight. It can indicate any height to which it can be carried. At moderate altitudes a good altimeter with a careful setting gives a very accurate reading. But even with the best instrument, the barometric altimeter has several inherent faults.

Varying weather conditions cause fluctuation in the pressure of the atmosphere. Flying complicates this condition by moving the altimeter through different types of weather. Radio contact with the ground is necessary to make required corrections on the altimeter. Any mistake in setting shows up as a constant error in true height except at very high altitudes. This does not matter much if the altimeter shows that the plane is 25 feet higher than a true altitude of 10,000 feet. But in bad weather when a plane is flying close to the ground, and the altimeter shows that the plane is 25 feet higher than it really is, the error can be the difference between landing and crashing. Adding to this danger is the appreciable lag in reading of the conventional altimeter. After a normal

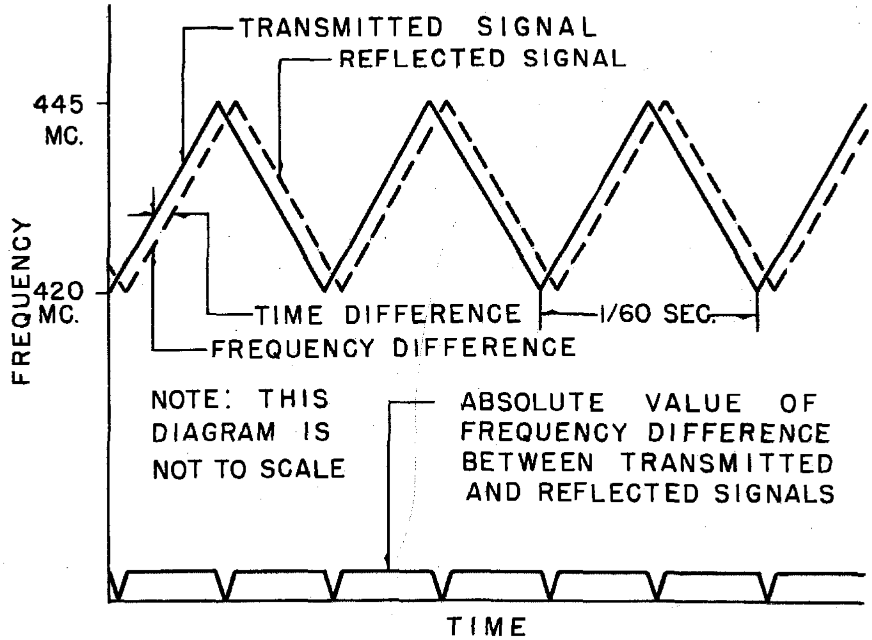


Fig. 2—Diagram showing frequency modulation wave form.

landing a barometric instrument will still indicate altitude and then gradually settle to a zero reading. Most of these undesirable operating characteristics can be improved by changes in instruments, improved ground-to-plane communication, and better route-marking systems. However, there is one difficulty with the barometric altimeter that cannot be overcome. Because it is dependent on the pressure of the atmosphere for its reading, the barometric altimeter indicates height above sea level, not height above ground. Should a pilot get lost in mountainous country, he can easily fly into a peak still thinking that he is 5,000 feet from the nearest ground. A barometric altimeter shows only whether a plane is high enough to clear the tallest obstruction in the vicinity. Maintaining such an altitude is sometimes difficult and uncomfortable except in special aircraft. In bad weather the problems of blind landing are also of great importance. All the bad characteristics of the barometric altimeter combine to make it almost useless for this purpose. In an effort to obtain an improved type altimeter, a great deal of work has been done to develop altimeters not based on the barometric principle.

REFLECTION PRINCIPLES

For many years ships have used the echo of sound to determine the depth of water below them. Sound travels slowly enough so that simple stop-watch timing gives the desired accuracy. The same principle might conceivably be used for aircraft. However, the high noise level of an airplane in flight is enough to discourage most investigators from trying to use sound reflection for altitude determination. Also, the speed of modern aircraft is near enough to that of sound in air to result in a serious lag in true reading. Experiments with sound as a reflection medium have been unsuccessful for just these reasons. A logical next step was the use of radio waves as a reflection medium. A great many complications immediately become apparent. Ordinary broadcast-band and short-wave radio signals cannot be used for the type of instrument required in aircraft. The waves are too long. A signal transmitted from a low-flying airplane would reflect from the ground before a full wave had been broadcast. Ultrashort wave signals are needed. Besides the advantage of the length of the wave, ultrashort wave signals have another property that makes them very desirable. The high frequency provides room for an ample spread in the frequency-modulated signal required in this type of instrument.

Frequency modulation makes possible the continuous-reading feature of the terrain clearance indicator. The type of modulation is slightly different from most applications of frequency modulation, but the basic principle remains the same. As with all frequency modulation, the strength of the broadcast signal remains constant and the frequency is varied. In this application the fact that the modulation is not affected by changes in signal strength assumes tremendous importance. The strength of the reflected signal depends not only on the height of the airplane but on the nature of the ground below. Because of the frequency modulation, no errors in reading result from the changes in signal strength. The receiver responds to changes in frequency only. However, the signal strength must be above a certain minimum value in order for the receiver to detect it. It is this minimum reflected-signal strength that limits the effective range of the terrain clearance indicator.

OPERATION

The Western Electric instrument is made in three basic units as shown in Fig. No. 1. Receiver, transmitter, and power unit can be located at any convenient place in the airplane, and the indicator is placed on the instrument panel. The transmitter and receiving antennae are alike. They are located about 12 feet apart on the underside of the wing and one-quarter wave length below the metallic wing skin. This location produces a desirable reflection of the transmitted signal in a downward direction. The transmitter operates on a frequency that varies from 420 to 445 megacycles. This variation is produced by rotating the tuning condenser with a small synchronous motor driven by a separate, 60-cycle oscillator. The frequency time variation has a saw-tooth pattern. With this type of modulation the frequency change is directly proportional to time. The time it takes for the signal to travel to the ground and be reflected back to the airplane is proportional to the height of the airplane. It is the frequency difference between the transmitted and reflected signals that is measured and changed into height readings. Fig. No. 2 shows graphically the wave pattern of transmitted and reflected signals. The receiving antenna receives a weak signal directly from the transmitter as well as the reflection from the ground. The direct signal is intentionally reduced in strength to near the magnitude of the reflected waves. The frequency difference between these two signals produces a beat frequency capable of very precise measurement. In this way, the very short time required for the signal to travel to the ground and return is evaluated indirectly by a measurement of an audio frequency.

The amplifier incorporated in the receiver has the special characteristic of increasing the amount of amplification with increased frequency. Since the beat-frequency increases with altitudes, and the signal strength decreases, a fairly uniform output from the amplifier is obtained over a wide altitude range. In this way, the beat-frequency signal receives the greatest possible amplification without overloading the equipment at low altitudes. To prevent fictitiously high readings due to harmonics of the fundamental beat frequency, controlled negative feedback is introduced around the amplifier. At this stage the signal is strong enough to be fed into the indicator.

The dial that appears on the instrument panel of the airplane is an electronic frequency counter, calibrated directly in feet of altitude. Its function is to indicate the frequency of the interference between the signals picked up by the receiving antenna, and to translate this beat-frequency into feet of altitude. A semi-logarithmic scale provides increased accuracy in reading at low altitudes. In order to obtain even greater accuracy, two ranges are used. A switch provides selection of a zero to 1000-foot or a zero to 5000-foot range.

When ready for installation, the complete equipment weighs about 65 pounds. In operation it draws 26 amperes at 12 volts from the aircraft electrical system. Standard radio-wiring connections are used between units with the exception of the antenna connections. Here, concentric transmission lines are used and it is desirable to keep them as short as possible. An installation suggested by the manufacturer places the transmitter, receiver, and power supply in the baggage compartment behind the pilot, and the indicator and range switch on the instrument panel.

PERFORMANCE

Testing of the equipment was carried out in a standard, airline transport over a wide variety of ground surfaces. The transmission pattern of the effective signal was found to be a hemisphere below the airplane. This transmission pattern results in a true, ground-clearance reading even when the airplane is in a steep bank or flying level over irregular ground. Fig. No. 3 shows this characteristic graphically. The other performance characteristics of the instrument also are desirable. Any errors in reading are in per cent of true reading, if the equipment is properly installed and adjusted. With all separate errors in the same direction, a maximum of nine per cent is possible. There is no lag in reading at any time. The operation of the equipment causes no interference with ground-to-plane radio, and under ordinary circumstances terrain clearance indicators of adjacent aircraft will not interfere with each other. The maximum possible reading is determined by the type of terrain under the airplane.

Over most smooth ground the accuracy is excellent up to 5000 feet. Water is the best reflecting medium, and sandy ground without vegetation is next. Rough ground, buildings, forests, and "radio dead" ground cause the maximum effective reading to decrease. The result is either fluctuating readings, or short periods when there is no reading at all. However, up to 2500 feet the accuracy is excellent over any type of terrain. Fortunately, any error due to bad ground characteristics results in a fluctuating or fictitiously low reading. No combination of circumstances can cause a steady reading that is above the true ground clearance. The radio equipment is designed to handle reflected signals up to 16,000 feet. Above 5000 feet the needle goes off the scale at the high end, and it remains off the scale until the altitude is near 15,000 feet. Here, though it may drop back on scale momentarily, it cannot give a steady, fictitious reading.

At low altitudes the terrain clearance indicator has some interesting characteristics. In an airplane flying over a city at a moderate altitude, the needle wavers somewhat, indicating the height difference between street level and the roofs of buildings. Over flat country the needle jumps whenever the airplane passes over a building or tree. A ship causes the same effect when the airplane is flying over water. This phenomenon results from the slightly directional nature of the transmitted signal. In landing, the contour-following characteristics become very pronounced, and the needle indicates the ground contour quite precisely. Any airplane which is dangerously close below another is clearly indicated on the dial of the upper airplane. Cloud formations do not cause a false reading.

This simplified description of the Western Electric terrain clearance indicator and its operation does not attempt to suggest the number and the difficulty of the problems encountered in its development. However, the difficulty of the over-all problem is shown by the fact that the Western Electric equipment is the first commercial product of its type to be announced. Some of the individual research problems encountered were particularly

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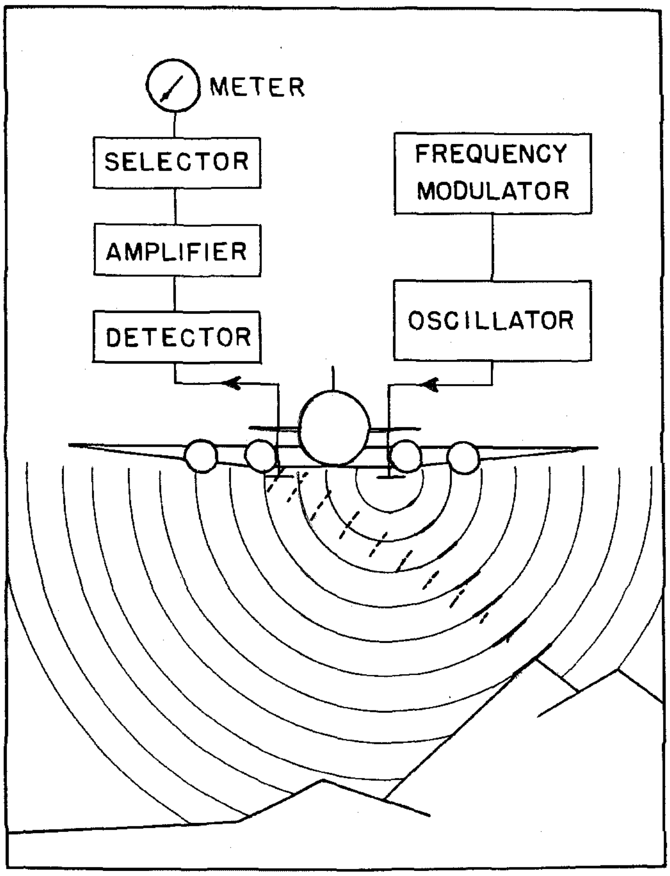

Fig. 3—Diagram showing circuit and transmission pattern.

Cold-Starting Aids for
AUTOMOTIVE DIESEL ENGINES

BY CARLTON H. PAUL

COLD starting is by no means the least of the problems encountered in designing a high-speed Diesel automotive engine. The ability to start is naturally a prerequisite for an engine whose performance is to be considered satisfactory, and this starting must be accomplished consistently in all types of weather. During the past few years, the laboratories of the various engine manufacturers have found numerous methods of aiding cold starts, but the problem is still of major importance to both the manufacturers and the armed forces. The purpose of this paper is to present some of the most successful of these cold-starting aids.

Primarily the characteristics of the engine must be such that ignition temperatures for the fuel will be reached in the combustion chamber when the engine is cranked at its minimum starting speed. All of the aids to starting, then, will endeavor to raise the air temperatures to these auto-ignition temperatures. This may be accomplished by:

(a). Cranking the engine faster so that the comparative heat loss in the combustion chamber will be less;

(b). Using fuel oil or doped fuels with a low auto-ignition temperature; or

(c). Applying heat.

In connection with the first item, it will be of interest to note that combustion systems of the quiescent type are inherently easier to start than the turbulent type, due to the fact that there is less heat loss through the cylinder walls. Thus a direct injection engine will start more readily than one with a turbulence chamber.

Assuming, then, that any one or all three of these aids must be used in cold weather, let us examine some of the most promising possibilities of each. In such cases, it will, of course, be necessary to hold two of the three variables constant while examining the third.

CRANKING SPEED

With the type of fuel and the injected fuel quantity held constant, and with no heat applied from an external source, the engine will have a minimum or critical cranking speed at a given ambient air temperature, below which it will not start. This is because the heat of compression minus the heat lost in the cylinder does not reach the auto-ignition temperature of the fuel. Now as the engine is cranked at some speed greater than the critical, the ignition temperature will be attained and firing occurs. Thus the problem arises of how to increase the cranking speed. A curve of cranking torque versus cranking time at a constant temperature is shown in Fig. No. 1, and one of cranking torque required to motor the engine at a constant speed at various temperatures is shown in Fig. No. 2. It will be noticed that the torque requirements are at a maximum at break-away when the oil films are being sheared and that the torque is an inverse function of the temperature. These demands of a particular engine must be estimated and consequently a cranking motor of suitable output selected.

The electric motor has become the most widely accepted cranking mechanism for the automotive Diesel, primarily because of its small size, light weight, and high torque output. It does have the disadvantage of being unable to produce sustained cranking for more than a few minutes because of discharging the batteries. Cartridge starters have also been used, but have not found favor because of the short cranking period per cartridge and because they apply high instantaneous loads on the engine parts. Small gasoline engines also are used on some Diesels. They are relatively heavy and bulky, but do have the advantage, and an extremely important one at subzero temperature, of being able to crank the Diesel for a long period of time. The above-mentioned cranking torque is directly a function of the viscosity of the lubricating oil and it must be assumed that the correct grade of oil will be used at the low temperatures. The cranking torque may be reduced considerably by diluting the lubricating oil with kerosene or a similar agent, but such a solution is not satisfactory when the engine becomes warm unless the dilutant is volatile. It is interesting to note in this connection that some aircraft gasoline engines use this dilution method in cold weather. A certain percentage of gasoline is used to dilute the oil before the engine is shut off and the next time it is started the highly volatile gasoline is vaporized off the lubricating oil as it becomes warm, leaving the oil in its original state of viscosity.

At subzero temperatures, however, it will be found impractical to select a starting motor of sufficient capacity to assure starting without other aids, because of the size and weight of the motor and auxiliary equipment, such as batteries. Consequently, other starting aids must be found.

FUEL OIL

The proper selection of fuel oil or the use of doped fuels will materially aid the starting. First of all, the fuel oil must be able to flow freely at the starting temperature. It is fortunate in this respect that the viscosity of most fuels varies inversely with the cetane number, which has been found to be the most significant variable as far as starting is concerned. The cetane number is a measure of the ignition quality of the fuel. A curve, showing the cetane number plotted against the ambient temperature, is given in Fig. No. 3. It will be noticed that the effect of the cetane number covers a relatively short temperature range.

In laboratory tests, fuel dopes have been added to the intake air and some have been quite successful as an aid to starting. The most promising include amyl nitrate, chloropicrin, ethyl disulfide, and ethyl ether. From starts obtained with these additives it was found that they essentially increase the cetane number of a given fuel by as much as 60 to 70 cetane numbers. The additives are not mixed with the fuel actually to produce a high cetane number, but rather are put in the inlet manifold. The starts thus obtained could be used to extrapolate the curve in Fig. No. 3, with the result that for the same starting time a fuel of approximately 150 cetane number would be necessary for an equivalent start. Engines have been started in ten seconds at -10 degrees F. with the addition of small amounts of ethyl ether in the inlet manifold. Although this has not been done in field use, the finding suggests the practicability of a small carburetor which is attached to the inlet manifold and in which small vials of ether may be placed to aid starting under extreme weather conditions. The reason for the effectiveness of this compound is readily understood from the fact that the auto-ignition temperature of ethyl ether is about 350 degrees F., while that of a high cetane fuel oil is approximately 600 degrees F.

The injection of a quantity of fuel in excess of that injected at full load on the engine has also been found beneficial, particularly at the lower cranking speeds. The amount of this excess fuel seems to depend upon the type of engine. For some turbulence chamber types it varies from about 30 per cent to 85 per cent more than full load injection.

APPLICATION OF HEAT

By far the most successful aid to starting, however, is the application of heat. This may be done in several ways, such as by preheaters, by intake air heaters, and by increasing the heat of compression.

Preheaters refer to devices by which heat may be applied to the motionless engine. Preheating may be accomplished by an electrical immersion heater in the coolant or by a fuel-burning compartment heater which may heat the coolant or directly heat the entire engine. The immersion type preheater offers a considerable drain on the batteries and is not as satisfactory as the compartment heater in over all usefulness. The compartment heater is generally considered the most satisfactory aid to starting in use at the present time because it can keep the whole power unit warm. The batteries thus retain a higher charge, the lubricating oil offers better lubrication and less resistance to cranking, and the over all starting ability of the engine is different from summer operation only in that the intake air during cranking is cold. The fuel oil burning compartment heater may have an electrically driven motor to run its fuel pump and blower, which will, of course, use a small amount of electricity. But the blower will apply the heat to all parts of the engine and the engine compartment, including the lubricating oil system.

It has been found that if a winter hood (canvas cover extending over hood and down to the ground) is put over the engine immediately upon stopping and while the engine still retains a considerable amount of heat, a small wick-type heater placed in the compartment will supply sufficient heat to keep the engine in good starting condition for many hours. This arrangement has been used with good results in weather as low as -40 degrees F.

Heating the intake air has almost become a prerequisite to consistent starting in subzero temperatures. For an engine with any fixed compression ratio, the temperature rise due to compression will be a function of the cranking speed. Consequently, as the ambient air temperature is reduced at a constant cranking speed, the compression temperature is also reduced until at some point this temperature does not reach the ignition temperature of the fuel.

Two separate methods are widely used to heat this air. One is to place electrical "ribbon" coils between the inlet manifold and the intake port, while the other utilizes a

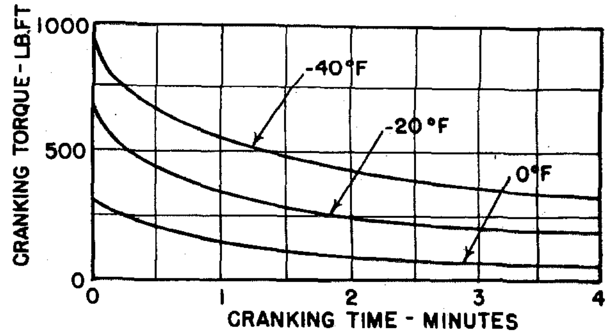

Fig. 1—Cranking torque curves (constant speed, specific lubricating oil).

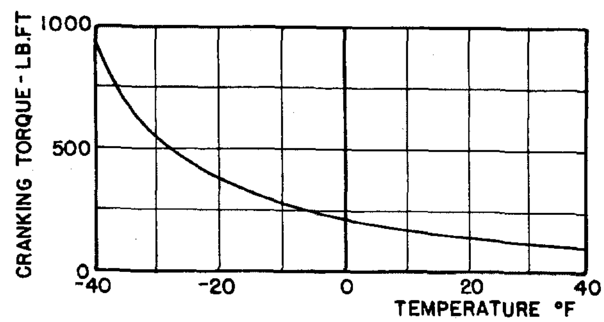

Fig. 2—Cranking torque curve (constant speed, specific lubricating oil).

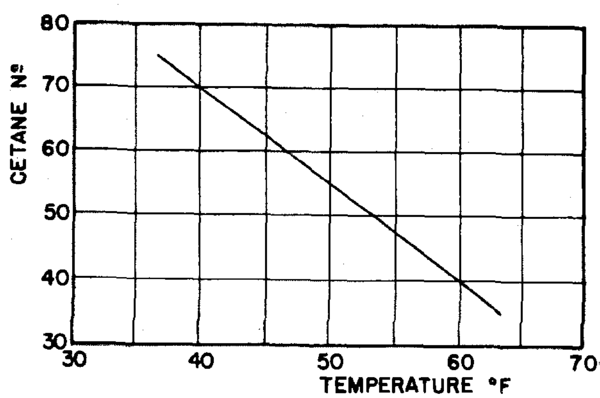

Fig. 3—Cetane vs. temperature (constant speed).

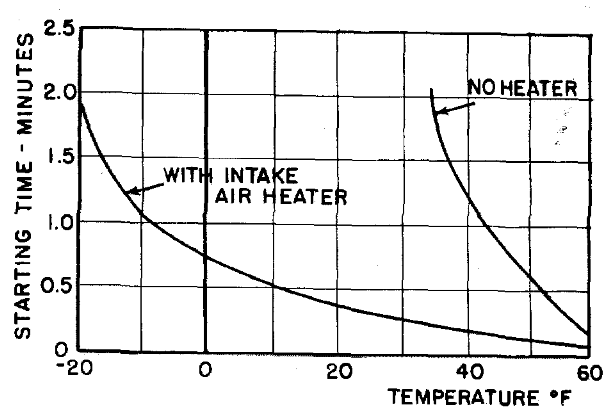

Fig. 4—Starting curves.

fuel oil spray which is burned in the inlet manifold. Both types work satisfactorily, but each also has its disadvantages. In the electrical heater an immense amount of energy must be used to obtain good performance. This electrical input will range up to five or six thousand watts for a medium-sized automotive engine and difficulty is often experienced in keeping the coils from burning out. This is a tremendous drain on any standard sized battery. Also, the coils offer a certain amount of restriction to the inlet air, which is undesirable while the engine is in operation.

The best starting is probably experienced with the use of the "flame-thrower" type of heater. This unit mixes air with fuel and sprays the atomized mixture past a sparking electrode into the inlet manifold. (A blow torch works equally well.) The only difficulty experienced lies in getting enough flame into the manifold to heat the air sufficiently and yet not so much that all the intake oxygen will be burned before reaching the cylinders. Proper adjustment of the unit usually will rectify this problem. This type of unit has been proved quite successful in field use. A typical curve of starting time versus temperature is shown in Fig. No. 4. These curves readily indicate the necessity of the heater.

The last method of applying heat to the aircharge (and probably the least used as far as starting is concerned) is to raise the temperature of compression. This may be done in several ways, which will be briefly noted here as a matter of interest. First, increasing the compression ratio obviously will raise the temperature. However, this is undesirable because of the high peak pressures imposed on the cylinders when the engine is in operation. Another method which effectively increases the compression ratio and which works very well on some engines, is to close the intake valve at "bottom dead center." Most engines have this valve close from 30 to 40 degrees F. "after bottom center" and as a result lose a certain amount of compression. For example, if an engine whose ratio was theoretically 15 to 1 had its intake valve close 45 degrees F. "after bottom center," its actual ratio might be about 12.5 to 1. This would make a considerable difference in the compression temperature.

CONCLUSION

With all these aids in mind, the final conclusion reached is that the application of heat is necessary for reliable starting. To keep the engine warm is possibly the best solution, so that the cranking requirements will not be great. The weight and size of the starting equipment can thus be reduced, and it is probable that the engine life will be increased by eliminating the possibility of scuffing pistons and cylinders because of improper oil films during the cranking period.

Radar's Peaceful Cousin

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interesting, and their solution showed great engineering skill and ingenuity.

DEVELOPMENT

No one organization is responsible for the entire development of the principle or for the product itself. Pioneer work was done by Dr. W. L. Everitt of Ohio State University in 1928 and 1929. However, the electronic units required to generate the high frequencies necessary were not available at that time, and no commercial model resulted directly from his work. The final development work was done largely by Lloyd Espenscheid and R. C. Newhouse of the Bell Telephone laboratories. The first public demonstration of the commercial product was in 1938. With the threat of war, the equipment was turned over to the armed forces, and the know-how that had come from its development was applied to research on radar.

The improved instruments that have been developed for the armed forces are based on the same principle as the commercial model. No specific information about them is available. However, it is known that the basic operating principle of this type of radio-reflection instrument is different in detail from the true radar. The difference is significant because the Western Electric type of device operates accurately at much shorter distances than a device based on the true radar principle. Postwar terrain clearance indicators will probably be a great improvement over those in service today, but the principle will be basically the same.

Several improvements were tried on the commercial model, but they were not reliable enough to use in regular operation. Further development will undoubtedly lead to improvements that will greatly increase the usefulness of the instrument. A minimum-altitude warning device is desirable for routine airline flying. Such a device must give a warning when the plane is closer to the ground than a predetermined distance. This feature would also serve as a collision warning. Another desirable improvement would be an increase in the effective maximum reading. At high altitudes there is little need for an instrument to indicate obstructions in a hemisphere below the airplane. By beaming the transmission downward, a marked increase in effective reading can be achieved. The use of true radar at extreme altitudes might provide a practical solution, if the installation does not become too cumbersome. Improvements in equipment should reduce both the weight and the power required. At present the instrument draws more power than light aircraft readily can provide. Weight reductions are possible on all units, and mass-production manufacturing methods should reduce the price enough to make every private flyer a potential owner.

THE FUTURE

Postwar aviation will not be the infant industry that it was in 1939. It will be a giant, powerful by all the criteria of industrial greatness. And this giant will not be content to grope blindly in the fog or to suspend operations at the sign of bad weather. The technology of radio direction and range finding has advanced to the point where all-weather flying is possible with large aircraft. Light, private aircraft need fear only violent weather. Devices such as frequency modulation ground-to-plane phone, radar, range beams, and instrument-landing radio-glide paths will be at the disposal of commercial aviation in the future. These radio navigation aids all require ground installations and ground cooperation with aircraft in flight. Unlike ground aids, the terrain clearance indicator is a part of the airplane, and it operates without outside assistance. For the private flyer as well as the commercial pilot, the added safety and simplicity that this instrument brings to flying will be of tremendous importance. In the future, the dial of a Terrain Clearance Indicator may well become as familiar as today's speedometer in the family sedan.

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The Engineer in the Labor Picture

(*Coninued from Page* 4)

the manufacture of goods and services in the anticipation that eventually the employer would make a profit from the business. The employee was dependent upon the employer for employment from which the employee would receive wages and with which the employee would purchase the necessities of life. It was, therefore, apparent to Adam Smith that the employer and employee were both interested in the success of an enterprise.

But Adam Smith did not limit his picture by merely pointing out that the employer needed his employee and that the employee needed his employer. Recognizing a fundamental difference in the need of one for the other, Adam Smith pointed out that the need of the employee for his employer was more immediate than the need of the employer for the employee. The employer, according to Adam Smith, usually had some reserves. If the employee would not work on a given day, or even if the employee would not work for a short period of time, the employer was inconvenienced, it was true, but he was not necessarily reduced to the question of how could he survive. Frequently the employer could even wait for several years. On the other hand the employee needed the employer currently. The employee usually had no reserve; if employment was not forthcoming regularly, the employee faced the basic problem of survival. It was, therefore, apparent that the bargaining power of the individual employer was much greater than the bargaining power of the individual employee, and the employees were forced to organize in an attempt to equal the bargaining power of the employer.

Furthermore, according to Adam Smith, the immediacy with which the employee needed his employer was so great that the employees were inclined to use violence to achieve their goal. This drive to use violence was further intensified by existing laws which prohibited the formation of unions and the use of the strike. Being forced to violate the law in engaging in any strike, the employees had little compunction in violating other laws at the same time.

Eventually, and only as the result of specific legislation, unions were legalized. But for many years after lawfully organized unions were permitted, it was also lawful for employers to interfere with the organization of their employees and even to prohibit membership in unions as a condition of employment. It was only in 1932 that the so-called "Yellow Dog" contracts were outlawed. Subsequently, the National Industrial Recovery Act and the Wagner or National Labor Relations Act gave employees the right to bargain collectively through representatives of their own choosing, and at the same time specifically forbade employers to interfere with the organization of their employees.

Although the situation has, therefore, changed to some extent since the time of Adam Smith, it is still true that employers and employees are mutually dependent upon each other, and it is likewise still true that the employee has a more immediate need for his employer than the employer has for his employee.

HISTORICAL APPRAISAL OF UNIONS

The history of the growth and development of trade unions in all parts of the world supports the following conclusions. In the first place, membership in trade unions tends to fluctuate in accordance with the fluctuation of the business cycle. Specifically, unions grow in membership during the upswing of the business cycle, and decline in membership during the ensuing depression. At no time, however, does organized labor disappear completely. Secondly, attempts to outlaw unions and attempts to drive the organized labor movement underground merely result in increased violence in labor disputes. Third, because of the human errors on the part of management, unions will play an important role in any system of free enterprise. It is only under some form of totalitarian government that unions can be suppressed. Fourth, the unions exert more influence in the economic system than the number of union members indicates. Most collective agreements cover non-union as well as union employees of a given company. In addition, non-union employers tend to base wages, hours, and other working conditions at or above the level prevailing in the unionized companies. Fifth, no employer can influence his employees to remain unorganized merely by paying higher wages or operating shorter hours than union plants. The urge for organization springs from psychological as well as material causes. In any aggregation of individuals, many minor irritations or frictions will develop. It is most difficult to discover and correct the minor irritations when no organization of employees is present. It should be noted that during the 'Twenties especially, many companies found it desirable to form plans of employee representation or works councils in order to settle the day-to-day grievances.

CURRENT FUNCTIONS OF UNIONS

From this brief statement of the growth of labor organizations, we are led to an examination of the function of unions. Although there have been some organizations of workers formed for the purpose of overthrowing the existing economic system and substituting a different one, and although there may be some members of organized labor who have such views, the major unions existing today, and those which will continue, desire to maintain and strengthen the present economic system. Within this economic system such unions hope to derive for their members the four fundamental goals of higher wages, shorter hours, better working conditions, and the prompt and favorable settlement of specific grievances.

From the employer's point of view, the unions can perform a function which will be of assistance to management. With proper organization and under effective leadership, the unions can provide a return channel of communication between employer and employee. The employer's organization — the hierarchy of foreman, superintendent, general manager, and vice president—operates effectively in transmitting orders from top management to individual workers. This organization may also transmit policies, but frequently the milk of human kindness in the basic policies of top management has curdled by the time it is transmitted from foreman to worker. Such conditions cannot be brought to light by the line-and-staff organization set up by management. It is only through some organization of employees that top management may learn where its policies have soured or where there is a wide variation between policy and practice.

The development of this second channel of communication from employees to management may develop from its original, but somewhat negative, use in settling grievances into a positive instrument of labor-management cooperation, or into what is sometimes referred to as industrial democracy. During the war there have been many attempts to establish within various companies joint committees of employees and management for the purpose of discovering methods of improving and increasing production. These committees have been called many things, but their most polite names have been War Production Drive Committees, Labor-Management Committees, or Union-Management Committees. It appears that most of these committees have failed to perform to the satisfaction of the company, the union, the government, and the public. In the widespread failure of these plans it is easy to overlook the previous success of labor-management cooperation. These recent failures appear to have resulted largely from the fact that these committees were usually forced upon either the union or the company. It should be apparent that such cooperation cannot be expected to work satisfactorily during the first year, or even during the first few years, after collective bargaining is established in a given plant. Labor-management cooperation should be the logical outgrowth of a somewhat lengthy and comparatively peaceful period of collective bargaining. Such committees can only function effectively when there is mutual respect and confidence between the management of the company and the officers and members of the union. Labor-management cooperation is the eventual and long-time function of unions which will stress the mutual dependence of employer and employee after the difference in immediacy of need has been offset by approximate equalization of bargaining power.

LABOR LEGISLATION

The laws affecting relationships between employers and employees are many and varied. If there is any pattern in our labor legislation it approximates that of a crazy quilt. In order to understand these varied pieces of legislation, it must be understood at the beginning that there is one group of laws affecting industrial relations of railroads and another affecting industrial relations in other industries. The labor legislation affecting railroad managements and employees will not be discussed here. The general legislation mentioned below is of little interest to this special case.

The specific federal legislation which affects industrial relations in most industries except railroads is based on the constitutional authority of Congress to regulate interstate commerce. The administrative agencies set up under these acts have stretched the definition of interstate commerce, but many of these extensions by the administrative bodies have not been confirmed by decisions of the Supreme Court.

National Labor Relations Act: There are two pieces of legislation which have some bearing on the problem of labor organization. The first and more important of these is the Wagner or National Relations Act of 1935 establishing the National Labor Relations Board composed of three members. This Board and its Regional Directors have no jurisdiction over matters such as wages, hours, or working conditions; it is specifically forbidden to arbitrate or conciliate disputes. The only disputes between employers and employees which can be handled through this Board are those over unfair labor practices by employers, the definition of an appropriate bargaining unit, and the choice of bargaining representatives. Frequently this latter activity results in the holding of an election among the employees of a plant to determine which if any union should represent the employees.

In considering the operation of any law, it is not as significant to attempt to interpret the law itself as it is to interpret the decisions made under the law. This means that one cannot say what a law means until the courts have interpreted it. In other cases where a law establishes an administrative group such as the National Labor Relations Board to administer an act, one does not know what the act means until the board has established its own interpretations and the courts have confirmed these interpretations.

There has been a considerable turnover among the three members of the National Labor Relations Board, and turnover of policy has followed closely on turnover of the Board. For a short while, for example, the National Labor Relations Board held that it was proper for management itself to join unions to bargain with itself. The Board held that supervisors were employees and, therefore, entitled to the protection of the Act. In the last year, however, the Board has reversed its policy and has refused to recognize unions of foremen and supervisors. This reversal of policy was influenced largely by the realization on the part of two members of the Board that management can hardly bargain with itself, and that foremen and supervisors are really a part of management.

Most engineers, however, do not hold supervisory positions. This is especially true in a large engineering department. In such cases the engineers are not engaged in the hiring or firing of other employees nor are they part of the management of the company. Only the chief engineer or the head of the engineering department would come in this category. The bulk of the employees in the engineering department are classed as professional employees. As such they are, I believe, entitled to the protection of the National Labor Relations Act although this matter has not been finally adjudicated by the National Labor Relations Board. In most contracts the employees of the engineering department are specifically excluded. However, it must be recognized that there is a growing pressure for unionization of such employees.

Wages and Hours Act: Another Federal Act which should be examined is the Wages and Hours, or Fair Labor Standards Act of 1938. The purposes of this Act are to establish a minimum rate of pay for employees engaged in work affecting interstate commerce and to require the payment of one and one-half times the regular hourly rate for work performed in excess of 40 hours per week.

This Act has an important bearing on compensation of engineers because it excludes from its requirement for overtime compensation, "any employee engaged in a *bona fide* executive, administrative, or professional capacity."

The definition of a professional employee is as follows:* any employee who is—

(A) Engaged in work—
1. Predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work, and
2. Requiring the consistent exercise of discretion and judgment in its performance, and
3. Of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time, and
4. Whose hours of work of the same nature as that performed by non-exempt employees do not exceed 20 per cent of the hours worked in the work week by the non-exempt employees; provided that where such non-professional work is an essential part of and necessarily incident to work of a professional nature, such essential and incidental work shall not be counted as non-exempt work; and

* United States Department of Labor, Wage and Hour Division, *Regulations Defining and Delimiting the Terms "Any Employee Employed in a Bona Fide Executive, Administrative, Professional, or Local Retailing Capacity, or in the Capacity of Outside Salesman,"* Title 29, Chapter V, Code of Federal Regulations, Part 541, December, 1940.

5. (a) *Requiring knowledge of an advanced type in a* field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study, as distinguished from a general academic education and from an apprenticeship, and from training in the performance of routine mental, manual, or physical processes; or

(b) Predominantly original and creative in character in a recognized field of artistic endeavor as opposed to work which can be produced by a person endowed with general manual or intellectual ability and training, and the result of which depends primarily on the invention, imagination, or talent of the employee, and

(B) Compensated for his services on a salary or fee basis at a rate of not less than $200 per month (exclusive of board, lodging, or other facilities); provided that this subsection (B) shall not apply in the case of an employee who is the holder of a valid license or certificate permitting the practice of law or medicine or any of their branches and who is actually engaged in the practice thereof.

In interpreting this definition it must be realized that the individual under consideration must meet all of the tests and not one or some of them. There are comparable definitions for executive and administrative employees who also do not receive time and one-half payment for hours worked over 40 in any one week.

It should further be recognized that these standards prescribed by this Act and the Wage and Hour Administrator are minimum standards. As far as this Act is concerned, therefore, employers may pay higher minimum wages, pay overtime for hours worked over a smaller number than 40 in a week, and may even pay overtime to all of its employees. This Act does not forbid such practices, but it does not require them. The Act does not affect the organization of employees or disputes between employers and employees.

State Legislation: Activities of firms engaged in intrastate commerce are subject only to state legislation affecting employment relations and conditions. It must be realized, however, that firms engaged in interstate commerce must also conform with state laws if the state laws set higher minimum conditions than those imposed by federal act. An examination of state legislation, however, must be omitted from this discussion.

Special Wartime Legislation: Employer-employee relations are further complicated by special wartime legislation and agencies. Because of the emergency these special pieces of legislation affect all employers regardless of whether they are engaged in interstate commerce or not. It must further be realized, however, that even these wartime acts do not apply to the railroad industry.

Under this category of special wartime agencies, it is most important to examine the structure and function of the National War Labor Board which was established by Executive Order No. 9017 issued January 12, 1942.

The National War Labor Board consists of 12 members—four representing the public, four representing the employees, and four representing the employers. The function of this Board is to settle labor disputes which cannot be settled in any other manner.

From the outset the National War Labor Board was confronted with the necessity of developing a national wage policy. A temporary solution was found in the formula of the "Little Steel Decision." Subsequently the activities of the National War Labor Board were expanded to include not only the settlement of disputes between employers and employees but to assist in the stabilization of wages by handling requests to increase wages in conformity to the stabilization program of Congress and the President and the "Hold-the-line" Order of the President. The Board has also established Regional War Labor Boards which handle the same functions as the National War Labor Board and are based upon the tripartite panel plan with public, employer, and employee representatives.

It should be noted that usually the National War Labor Board and the Regional War Labor Boards handle practically all disputes between employers and employees except disputes arising over what union should represent what employee. Although in some cases the Board has decided this question too, there has been established recently a definite policy to leave such disputes to the National Labor Relations Board if the company is engaged in interstate commerce. In other cases the National War Labor Board will handle these disputes also.

The salaries of most engineers, however, come under the jurisdiction of the Commissioner of Internal Revenue. In the regulations issued by the Office of Economic Stabilization, which implements the Economic Stabilization Act, the National War Labor Board was given jurisdiction over all wages defined as payment on an hourly, daily, or unit basis, and over all salaries not in excess of $5,000, if employees receiving such salaries are not classed as executive, administrative, or professional, in the meaning of such definitions under the Wages and Hours Act. In addition, the National War Labor Board has jurisdiction over salaries not in excess of $5,000 even for executive, administrative, or professional employees when such employees are represented by a *bona fide* collective bargaining agency. The Commissioner of Internal Revenue was given jurisdiction over all salaries over $5,000 and salaries of less than $5,000 for executive, administrative, and professional employees not included in a collective bargaining agreement. It appears, therefore, that the salaries of most engineers are included in the jurisdiction of the Commissioner of Internal Revenue since they are executive, administrative, or professional employees and not part of a collective bargaining unit.

ORGANIZATION OF ENGINEERS FOR COLLECTIVE BARGAINING

There are several current efforts being made to organize engineering employees. The American Federation of Labor has chartered the International Federation of Technical Engineers, Architects and Draftsmen's Unions, and the Congress of Industrial Organizations has chartered the Federation of Architects, Engineers, Chemists, and Technicians. Both of these groups are relatively small at present. In addition, it is reasonable to expect that other unions will attempt to expand their coverage to include the engineering employees. Thus in the steel industry the United Steel Workers of America might attempt to bargain for the engineers, in the aircraft and automobile industry either the International Association of Machinists (A. F. of L.) or the United Automobile, Aircraft and Agricultural Implement Workers of America (C.I.O.), in the oil industry the Oil Workers' International Union.

This variety of bargaining representatives emphasizes the widespread conflict between the craft and the industrial types of labor organizations. In a craft union, membership is limited to employees performing a given type of work. In an industrial union, membership is limited to employees of a given industry. The craft union type of organization means that management must deal with a large number of unions in a given plant. In the past the craft union type of organization resulted in the

(*Continued on Page 18*)

C. I. T. NEWS

DEATH TAKES JAMES A. B. SCHERER

DR. JAMES A. B. SCHERER, president of Throop College of Technology from 1908 to 1920, died in Santa Monica on February 15, 1944. Death came after a long illness.

Dr. Scherer was born in Salisbury, North Carolina, May 22, 1870. He held degrees from Roanoke College, the University of South Carolina and Pennsylvania College. During his lifetime Dr. Scherer was an historian and a prolific writer, as well as a college administrator. In earlier years he taught school in Japan where he was married in 1897. In World War I, he was active in war work, being a member of both National and State Councils of Defense and a special representative of the United States Shipping Board. After leaving Caltech he was director of the Southwest Museum for a number of years. Thereafter he devoted himself to lecturing at various universities and colleges, to writing, and to travel.

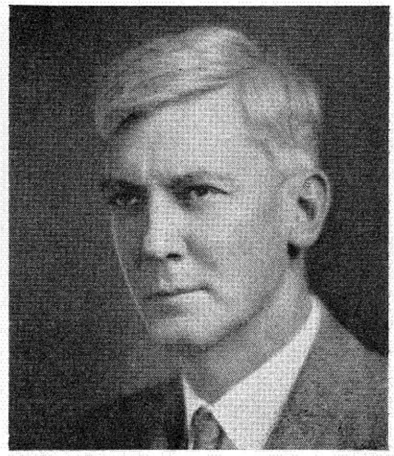
JAMES A. B. SCHERER

Dr. Scherer is survived by his widow, Mrs. Bessie Brown Scherer, a daughter, Mrs. Isobel Mosher, and a son, Dr. Paul A. Scherer, who is now in Washington as head of the transition office of the National Defense Research Council.

In a tribute to Dr. Scherer, Dr. Robert A. Millikan stated, "Dr. Scherer did a great job in the early days of the development of California Institute of Technology. He was essentially a crusader who shared the vision of the trustees as to possibilities here in the way of serving the interests of this community and this nation, and when there was as yet practically no money in sight needed to do the job, he kept beating the tom-toms as to the opportunities and possibilities that lay ahead. At that stage, it took such a man as he was, a man of great enthusiasm, of great devotion, of great talent as a public speaker and also as a writer, to keep the flame going in this community under discouraging circumstances and with a pathetically small supply of fuel in sight to feed that flame. He did a yeoman's service at the most critical hour which any institution ever goes through, an hour at which the great majority of similar enterprises flicker and die. All honor to one of southern California's pioneers."

DEAN HINRICHS PASSES

LIEUTENANT Colonel Frederic W. Hinrichs, Jr., dean of upper classmen at the California Institute of Technology, passed away February 16, at a Pasadena hospital after a brief illness. Colonel Hinrichs was born in Brooklyn, New York, November 3, 1878. He received the Bachelor of Arts degree from Columbia University as of the class of 1899. In 1898 he was appointed to the United States Military Academy at West Point, and upon his graduation in 1902 was commissioned a second lieutenant of artillery. He later transferred to the ordnance branch of the Army, in which service he remained until his retirement as a captain in 1910. From 1910 to 1917 he held the position of associate professor of applied mechanics at the University of Rochester. Upon the entrance of the United States into the last World War, in 1917, he was recalled to active duty in the Army and served until his final retirement in 1919, with the rank of lieutenant colonel.



FREDERIC W. HINRICHS, JR.

In 1920 he joined the staff of the California Institute as professor of applied mechanics, and in 1923 was appointed dean of upper classmen, holding both of these positions at the time of his death.

Colonel Hinrichs was a member of the Association of Graduates of the U. S. Military Academy, the Army Ordnance Association, Phi Delta Theta fraternity, the American Legion, the Sons of the American Revolution, and, in Pasadena, the Annandale Golf Club, the Pasadena Town Meeting, the Twilight Club, the Athenaeum, and the Board of the Neighborhood Church.

He is survived by his wife, Marie Honeycutt Hinrichs, his son, Colonel John H. Hinrichs, and by five grandsons, John H., Jr., and Robert, sons of Colonel John H. Hinrichs; and Frederic W., IV, Leslie Witherspoon, and Malcolm Speer, sons of the late Lieutenant Frederic W. Hinrichs, III, U.S.N.R.

The Engineer in the Labor Picture

(Continued from Page 17)

organization of skilled trades but made little advance in the semi-skilled and unskilled classifications. The industrial type of labor organization, on the other hand, has secured the bulk of its membership from the unskilled and semi-skilled classes and has tended to raise minimum wages, often with no increase in wages for the skilled group. This results in a narrowing of the wage differentials and fails to benefit the skilled workers who have more bargaining power than the semi-skilled and unskilled groups.

It is of special interest to engineers, and to those engineers who are professional employees rather than executive or administrative employees, that the American Society of Civil Engineers has established committees on employment conditions which can become *bona fide* collective bargaining agencies.**

The eventual character of these committees, like the character of any other group of individuals, will depend largely upon the men who join. In addition, the character of the group will be affected by the attitude of management toward it. If the activities of this group are opposed as intensively as organizations of other employees have been fought in some cases, it is likely that the employees will quickly learn how to fight back. It has been observed that unions reflect the managements with whom they deal.

** See editorial by Professor Franklin Thomas, page 3 of this issue, *Engineering and Science Monthly*.

WINS CREDIT FOR ROCKET GUNS

FROM an advanced Allied headquarters in New Guinea came credit for the Californita Institute of Technology in the disclosure that the new secret weapons that blasted invasion paths of Americans in New Britain were "multi-barreled rocket guns."

"Consisting of rocket tubes mounted in banks on 'ducks'—amphibious trucks—and other small craft, their blazing barrages paved the way for successful landings on Arawe and Cape Gloucester in western New Britain," wrote Ralph H. Teatsorth, United Press correspondent.

The newspaper story went on to say that during experiments in 1942 at the California Institute of Technology the idea was conceived of mounting rocket tubes on "ducks" for use in landing operations.

War Correspondent Teatsorth stated that he witnessed the first use of rockets in an amphibious landing when he rode into Arawe Harbor December 15 on a "duck." Two hundred and forty rockets were fired in four minutes, blasting every square foot of landing beaches. There was a great swish and burst of flame as they were fired, but it was not hard on the ears like a naval barrage. Lieutenant W. Donald Beaver who commanded the "duck" said that they were going to prove that the rocket is a great weapon.

BASKETBALL

By HAROLD Z. MUSSELMAN*

AFTER a mid-season slump, the Caltech basketball team rallied to win five of the last six games, and finished the season with a record of seven victories and eight defeats.

Playing a schedule of 15 games with the strongest teams in southern California, the summary is more impressive than it may appear at first glance. The Beavers trounced Redlands twice, split even with U.S.C., U.C.L.A., Occidental, Pepperdine and Camp Santa Anita, dropped two to Los Alamitos Naval Air Base and bowed to March Field Army Air team in the single game played them. Even though the Southern California Conference has been suspended for the duration, the engineers, nevertheless, claim the unofficial Conference championship in winning three out of four games with Conference opponents.

*Acting director of physical education.

The major teams in southern California were very evenly matched this year, and in all Caltech games, the final scores were close, with the victory going to the team that was "hot." In only three games were there more than 10 points between Tech and the opponents, while two games were won by two points.

Coach Carl Shy produced the finest basketball team in the history of the school. All the members of the squad were fine floor men, good ball handlers and excellent shots. Co-Captain Dean Chapman, while a marked man in every contest, retained his high scoring laurels with an average of 15 points per game. But for the first time other men helped carry the scoring load, for diminutive Hugh West averaged 11 points and Co-Captain Paul Nieto seven.

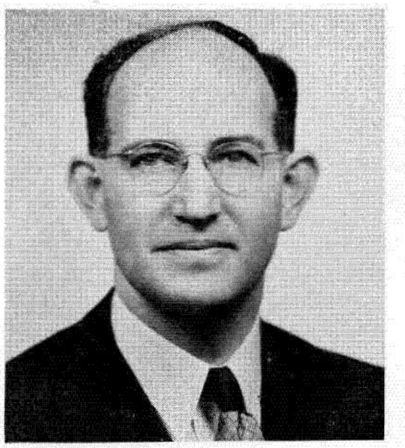
Letters were awarded to 10 men—Co-Captain Dean Chapman and Hal Ball centers; Hugh West, Stuart Bates, Willard Smith and Bernard Wagner forwards; and Co-Captain Paul Nieto, Jerry Lamb, Ross Dana and Jack Cardall guards. All except Chapman are V-12 men. Chapman and Smith graduated in February, while Lamb and Dana will have graduated before another basketball season rolls around.

The results of the games are:

Cal Tech	49	Camp Santa Anita	34
Los Alamitos	62	Cal Tech	56
Cal Tech	43	USC	35
UCLA	58	Cal Tech	41
Camp Santa Anita	51	Cal Tech	41
Occidental	66	Cal Tech	47
Los Alamitos	65	Cal Tech	58
USC	41	Cal Tech	36
Pepperdine	48	Cal Tech	47
Cal Tech	55	Redlands	50
Cal Tech	38	UCLA	36
March Field	66	Cal Tech	56
Cal Tech	48	Occidental	40
Cal Tech	41	Redlands	39
Cal Tech	50	Pepperdine	40

INDUSTRIAL RELATIONS SUPERVISOR

Lee W. Ralston, '27, former supervisor of trade and industrial teacher training for the California State Department of Education, has been named supervisor of industrial relations for the manufacturing and repair department, Westinghouse Electric and Manufacturing Company. In his new post, Mr. Ralston will be responsible for company-employee relations at the headquarters at Emeryville, and also the branches located at Los Angeles, Portland, Seattle and Salt Lake.



LEE W. RALSTON

After receiving his B.S. degree in mechanical engineering from the California Institute of Technology, Mr. Ralston took graduate courses in vocational education at the University of California at Los Angeles and at Berkeley. In 1927 he joined the Standard Oil Company of California, leaving in 1937 to become dean of Coalinga Junior College. He joined the California State Department of Education in 1941, serving there until he joined Westinghouse.

CAMPUS FIRE DEPARTMENT

The Caltech campus is now equipped with a fire station which was originally established as a civilian defense measure, but which is now to become a permanent feature of the grounds. The fire house, which was recently constructed, houses two fire trucks and an inhalator apparatus. One of the trucks, donated by the Pasadena Fire Department, pumps 750 gallons of water per minute; the other truck, which is the property of the Office of Civilian Defense, pumps 500 gallons of water per minute.

The fire crew, under the leadership of Ray Kingan, has been designated by the Chief of the Pasadena Fire Department as one of the most efficient in the city. There are 60 V-12 men and 16 graduate students in the crew and they hold weekly fire drills. Each man is assigned definite duties, and many of them have received extensive training in fire fighting and inhalator operation from the City Fire Department. Each man is equipped with a gas mask.

There are occasional city-wide drills in which the campus fire department is called upon to go to various parts of the city. There has been no occasion as yet for the crew to put out a fire on the campus, but in that event it should be brought under immediate control with the excellent equipment and an efficient crew available.

Engineers for the American Service Forces

(*Continued from Page* 8)

ter, Private Johnson and brother soldiers from many walks of life and every section of the nation are metamorphosed from civilian individualists to engineer soldiers, members of a military team. If all goes well, each should emerge from his tour of military duty a better man physically and professionally, strengthened by outdoor life and exercise, fortified by new construction experience and the ability to work smoothly as a member of a unit. Many will be better equipped for the pursuit of peacetime occupations after the war than before.

The Corps of Engineers and the Army Service Forces have benefited too, by enlisting the strength, knowledge, and support of a technical American, who can say, with pride, "We engineers were in it up to our ears," as evidenced by favorable reports from former E.U.T.C. units now well distributed throughout the world.

YEARBOOK ANNOUNCEMENT

Due to wartime conditions the *Big T* will not be published this year. However, a 48-page booklet will be printed which should be of interest to all alumni. It will feature pictures of the V-12 activities on the campus, the usual student body pictures, and the graduation ceremony. Anyone interested in obtaining a copy of this yearbook may do so by sending one dollar to the Yearbook Editor in care of the Institute.

ALUMNI SEMINAR

The date of the 1944 Seminar is Sunday, April 16. Due to travel difficulties the Seminar Board decided to hold the event for one day only with a program similar to the 1943 Seminar.

Four interesting lectures are being planned. Since the lecture rooms can accommodate only 200 persons, visitors may not be invited this year. Lunch will be served at the Athenaeum. Save the date, and plan to be there.

CALTECH MEN IN SERVICE

The following list is known to be incomplete and inaccurate. Please send corrections immediately to the Alumni Office, 1201 East California Street, Pasadena 4.

Name	Class	Rank	Service	Location
Ackerman, J. B.	'38	Major	U.S.A.	Washington, D. C.
Albach, W. H.	'37	Lt.	U.S.N.	*
Altee, W. H.	'29	Major	U.S.A.	N. Carolina
Alford, J. I.	'42	Lt.	U.S.N.R.	San Diego
Allen, P. H., Jr.	'42	Ens.	U.S.N.R.	*
Allyne, A. B.	'26	Major	U.S.A.	Dallas
Altmaier, R. D.	'42	Ens.	U.S.N.R.	Washington, D. C.
Altman, W. W.	'27	Lt. Cmdr.	U.S.N.R.	Livermore
Anderson, D. W.	'32	*	U.S.A.	*
Anderson, M. M.	'31	*	U.S.N.R.	*
Andrews, R. A.	'42	*	U.S.A.	Glendale
Antonenko, B. P.	'39	*	U.S.A.	Illinois
Arnold, D. R.	'43	Ens.	U.S.N.R.	Washington, D. C.
Arnold, J. K.	'41	Capt.	U.S.A.	Hawaii
Ashley, C. L.	'26	Lt.	U.S.N.R.	*
Ashworth, T., Jr.	'41	*	U.S.N.	Killed, Navy plane crash 10/41
Atherton, T. L.	'25	1st Lt.	U.S.M.C.	San Diego
Atkins, E. R., Jr.	'43	*	U.S.N.R.	*
Atkinson, T. G.	'42	Ens.	U.S.N.R.	Virginia
Aultman, W. W.	'27	Lt.	*	San Francisco
Baird, R. C.	'40	*	U.S.A.	*
Barnes, D. P.	'30	Lt. Col.	U.S.A.	Iowa
Barnes, O. H.	'26	*	U.S.A.	Overseas
Barnes, S.	'36	1st Lt.	U.S.A.	Washington, D. C.
Bartlett, E. R., Jr.	'42	Ens.	U.S.N.R.	*
Bashor, R. H.	'43	*	U.S.N.R.	Overseas
Baskin, A. C.	'37	Lt.	U.S.N.	*
Bassett, J. V.	'41	*	U.S A	*
Bauer, F. K.	'42	*	U.S.A.	Santa Anita
Beakley, W. M.	'35	Lt.	U.S.A	*
Beardsley, G. F.	'39	*	U.S.N.R.	*
Beckstead, M. W.	'43	*	U.S.N.R.	*
Benioff, B.	'22	*	U.S.A.	*
Bennett, E. P.	'38	*	U.S.A.	*
Bennett, R. L.	'43	*	U.S.A.	*
Benton, R. S.	'37	Ens.	U.S.N.R.	New York City
Bergren, W. R.	'32	1st Lt.	U.S.A.	Georgia
Bernstein, T. I.	ex-'33	*	U.S.A.	California
Berry, F. A., Jr.	'37	Lt.	U.S.N.	*
Berry, W. L.	'29	*	U.S.A.	*
Best, C. W.	'36	*	U.S.A.	Utah
Bewley, J. W.	'43	*	U.S.N.R.	*
Biglow, J. O.	'40	Lt.	U.S.N.	*
Billman, G. W.	'41	Lt.	U.S.N.R.	*
Blayney, J. A.	'43	*	U.S.A.	North Carolina
Blue, J. H.	'37	Capt.	U.S.M C	Overseas
Blumenthal, W. D.	'42	*	U.S.A.	*
Bolen, T. M.	'37	Lt.	U.S.A.	Salinas
Bolster, C. M.	'36	Cmdr.	U.S.N.	Washington, D. C.
Bonell, J. A.	'38	1st Lt.	U.S.A.	Ft. Lewis
Boothe, R. H.	'36	Lt. (j.g.)	U.S.N.	California
Bower, M. M.	'27	Major	U.S.A.	Washington, D. C.
Boyd, J.	'27	Lt. Col.	U.S.A.	Washington, D. C.
Bowler, G. E.	'32	Lt.	U.S.N.	*
Bracken, G. R.	'43	*	U.S.N.R	*
Bragg, R. M.	'43	*	U.S.A.	Florida
Brice, R. T.	'37	Lt. Col.	U.S.A.	Overseas
Bridgland, E. P.	'43	Flt. Lt.	R.C.A.F.	Canada
Brose, F. M.	'40	*	U.S.A.	Arizona
Brown, E L.	'43	*	U.S.A.	*
Brown, G. H., Jr.	'43	*	U.S.N.R.	*
Brown, W. A.	'41	*	U.S.A.	*
Brown, W. H.	'43	*	U.S.N.R.	*
Bruce, S. C.	'41	*	U.S.A.	Texas
Brunner, M.	'25	Lt. Col.	U.S.A.	Virginia
Buchanan, J. W.	'43	*	U.S.A.	*
Burleigh, R.	'40	*	U.S.N.	*
Bungay, R. H.	'30	Capt.	U.S.A.	*
Bunker, E. R., Jr.	'43	*	U.S.A.	*
Caldwell, N. H.	'41	*	U.S.A.	*
Callaway, W. F.	'42	Lt. (j.g.)	U.S.N.R.	Overseas
Capra, F. R.	'18	Col.	U.S.A.	Overseas
Carberry, D. E.	'30	Lt.	U.S.N.	San Francisco
Carlmark, C. W.	'41	*	U.S.A.	*
Campbell, R. S.	'37	Lt. (j.g.)	U.S.N.	Overseas
Campbell, D. C.	'41	Lt.	U.S.N.R.	Maryland
Carlton, J.	'39	Lt.	U.S.A.	Texas
Carr, E. A.	'42	Lt.	U.S.N.R.	*
Carrick, T. H.	'34	Capt.	U.S.A.	Montana
Carstarphen, C. F.	'39	Lt.	U.S.N.R.	Overseas

Carter, C. L.	'43	*	U.S.A.	*
Casserly, F. G.	'41	Capt.	U.S.M.C.	S Carolina
Chastain, J. A	'42	Lt. (j.g.)	U.S.N.R.	Vallejo
Childberg, G. L.	'28	1st Lt.	U.S.A.	New Jersey
Christianson, W. L.	'43	*	U.S.N.R.	*
Clingan, F. M.	'42	Ens.	U.S.N.R.	*
Coates, L. D.	'39	Lt.	U.S.N.	*
Combs, T. C.	'27	Lt. Col.	U.S.A.	Louisiana
Corbin, H. A.	'29	Lt. (j.g.)	U.S.N.R.	N. Y.
Crawford, E. G.	'33	Cmdr.	U.S.N.R.	Overseas
Daams, G.	'40	*	U.S.A.	California
Dall, G. R.	'42	*	U.S.A.	Connecticut
Dane, P. H.	'34	Lt. Col.	U.S.A.	Ohio
Darling, M. D.	'27	Major	U.S.A.	Texas
Dazey, M. H.	'43	*	U.S.N.R.	*
Desmond, J. M.	'34	Lt.	U.S.A.	Massachusetts
Dessel, F. W., Jr.	'40	Ens.	U.S.N.R.	Overseas
Detmers, F.	'33	Sgt.	U.S.A.	N. Y.
DeVoe, Jay J.	'22	*	U.S.A.	Missouri
Dewdney, H. S.	'43	*	Canadian Army	Canada
Dilworth, J. A.	'40	*	U.S.A.	Alabama
Dixon, B. A., Jr.	'38	*	U.S.N.R.	Washington, D. C.
Dobbins, W. E.	'41	1st Lt.	U.S.A.	Overseas
Du Fresne, A. F.	'38	2nd Lt.	U.S.A.	Overseas
Dunbar, O. C.	'35	Capt.	U S.A.	Florida
Dunn, A. C.	'29	Major	U.S.A.	N. Carolina
Dunn, S. A.	'43	*	U.S.N.R.	*
Dunn, W. C.	'34	*	U.S.N.R.	Maryland
Durrenberger, R. W.	'41	*	U.S.A.	*
Easley, S. J.	'41	*	U.S.A.	Sacramento
Edwards, G. L.	'41	Ens.	U.S.N.R.	Massachusetts
Edwards, M. W.	'26	1st Lt.	U.S.A.	Pasadena
Elliott, T. D.	'42	Ens.	U.S.N.R.	*
Ellis, A. T.	'43	Pvt.	U.S.A.	Missouri
Ellison, W. J., Jr.	'37	Lt.	U.S.M.C.	Ft. Lawton
Ellsworth, R. E.	'41	Major	U.S.A.	California
Elmer, D. A.	'43	Ens.	U.S.N.R.	Pasadena
Engelder, A. E.	'35	*	U.S.A.	*
Engelder, P. O.	'39	Capt.	U.S.M.C.	Overseas
Evans, B. G.	'23	*	U.S.M.C.	Florida
Evans, T. H.	'29	Major	U.S.A.	Washington, D. C.
Farman, I.	'26	Col.	U.S.A.	N. Carolina
Fischer, C. F.	'40	*	U.S.N.	Overseas
Flavell, E. W.	'43	Cadet	U.S.A.	Connecticut
Fleck, F. A.	'42	2nd Lt.	U.S.A.	Texas
Fleming, M. K., Jr.	'36	Lt.	U.S.N.	*
Fleming, R. E.	'40	*	U.S.A.	*
Forward, R. B.	'38	Lt.	U.S.N.	Washington, D. C.
Foster, G. P.	'40	Lt.	U.S.M.C.	*
Francis, R. M.	'43	Lt.	U.S.N.R.	*
Fulton, R. F.	'39	Lt.	U.S.A.	Colorado
Gally, S. K.	'41	Ens.	U.S.N.R.	Massachusetts
Garner, H. K.	'43	*	U.S.A.	*
Gentner, W. E.	'40	Lt.	U.S.N.	*
Gibbons, R. M.	'42	Cmdr.	U.S.N.	Philadelphia
Gillette, W.	'42	Ens.	U.S.N.R.	*
Gilmore, H. M., Jr.	'37	Lt.	U.S.A.	N. Carolina
Given, F. I.	'42	*	U.S.A.	*
Glockley, R.	'26	Capt.	U.S.A.	N. Carolina
Graham, H. K.	'43	*	U.S.A.	*
Gramatky, F. G.	'28	Capt.	U.S.A.	*
Graul, D. P.	'37	Capt.	U.S.A.	Maryland
Green, W. M.	'39	2nd Lt.	U.S.A.	*
Griffin, R. H.	'31	*	U.S.A.	Seattle
Grimes, W. B.	'29	Lt. Col.	U.S.A.	Overseas
Griffith, G. D.	'43	*	U.S.N.R.	*
Gruen, H.	'43	*	U.S.A.	*
Guillou, A. V., Jr.	'40	*	U.S.A.	Overseas
Gulick, H. E.	'34	Lt.	U.S.A.	Yuma
Hale, F. S.	'27	*	U.S.A.	Virginia
Hall, E. A.	'41	*	U.S.A.	*
Hall, R. F.	'42	Ens.	U.S.N.R.	*
Hall, W. A.	'42	Ens.	U.S.N.R.	*
Halpenny, W. H.	'43	*	U.S.N.R.	*
Hanchett, H. K.	'43	*	U.S.A.	*
Hanger, W. M.	'43	Cmdr.	U.S.N.	New Jersey
Hanson, L. A.	'42	*	U.S.N.R.	*
Hardin, P. V.	'43	*	U.S.A.	*
Harper, T. S.	'37	*	U.S.N.R.	Rhode Island
Harris, H. R.	'22	Col.	U.S.A.	*
Harrison, K. J.	'18	Lt. Col.	U.S.A.	Phoenix
Harshberger, J. D.	'34	*	U.S.M.C.	Virginia
Hatcher, D.	'34	2nd Lt.	U.S.A.	Colorado
Haymond, C. D.	'43	*	U.S.A.	New Jersey
Hebel, F.	'34	Lt. (j.g.)	U.S.N.	Killed at Pearl Harbor 12/7/41
Hayward, R. E.	'38	Cadet	U.S.A.	Texas
Hendrickson, W. J.	'42	*	U.S.A.	Ann Arbor
Hiatt, J. B.	'41	*	U.S.N.	Arizona
Hills, J. P.	'39	Lt.	U.S.A.	*
Hines, M. E.	'40	*	U.S.A.	*
Holser, W. T.	'42	*	U.S.N.	Terminal Island
Holzman, B.	'31	Lt. Col.	U.S.A.	Washington, D. C.
Honnell, P. M.	'40	Lt. Col.	U.S.A.	New York
Hopper, R. H.	'39	1st Lt.	U.S.A.	Overseas
Horne, O.	'42	*	U.S.A.	*
Hotchkiss, T. M.	'25	Lt.	U.S.N.R.	San Pedro
Howell, W. J.	'40	Lt.	U.S.M.C.	N. Carolina
Hunt, C.	'42	Ens.	U.S.N.R.	Overseas
Ingersoll, H. V.	'26	*	U.S.A.	Overseas
Jack, S. S.	'38	Capt.	U.S.M.C.	*
Jackson, A. M.	'38	Lt.	U.S.N.	*
Jaeger, V. P.	'27	Lt. Col.	U.S.A.	Oregon
Johns, R. R.	'43	*	U.S.N.R.	*
Johnsen, E. G.	'43	*	U.S.A.	*
Johnson, W. S.	'26	Capt.	U.S.A.	California
Jones, G. A.	'41	*	U.S.N.R.	*
Jones, O. K.	'41	Major	U.S.A.	Overseas
Jones, P. S.	'36	*	U.S.A.	Overseas
Jones, W. B.	'38	*	U.S.N.R.	*
Jones, W. L.	'43	*	U.S.N.R.	*
Joujon-Roche, J. E.	'28	Major	U.S.A.	Virginia
Kane, R. F.	'43	*	U.S.N.	Oregon
Keachie, E. C.	'32	1st Lt.	U.S.A.	San Francisco
Keller, S. H.	'38	Lt. (j.g.)	U.S.N.R.	Mississippi
Kemmer, P. H.	'33	Col.	U.S.A.	Ohio
King, J. L.	'40	Capt.	U.S.N.	Pasadena
Kinley, J. C.	'37	Lt. (j.g.)	U.S.N.R.	Overseas
Kinsler, L. E.	*'31*	*Lt.*	*U.S.N.*	*Annapolis*
Klein, J.	'43	*	U.S.N.R.	*
Kolb, L. L.	'39	*	U.S.A.	Overseas
Krick, Irving P.	'34	Lt. Col.	U.S.A.	Washington, D. C.
Landau, A.	'42	2nd Lt.	U.S.A.	Maryland
Larabee, O. S.	'25	Lt.	U.S.A.	Washington, D. C.
Larson, E. R.	'42	*	U.S.N.R.	*
Larson, L. C.	'22	Capt.	U.S.A.	Los Angeles
Lassen, H. A.	'43	*	U.S.N.R.	*
Latter, R.	'42	Ens.	U.S.N.R.	*
Lawrence, B.	'41	Ens.	U.S.N.R.	*
Lee, Smith	'21	Major	U.S.A.	Los Angeles
Leggett, J. R.	'37	Ens.	U.S.N.R.	Maine
Levenson, B. D.	'41	2nd Lt.	U.S.A.	Overseas
Levet, M. N.	'39	Lt.	U.S.A.	Pennsylvania
Levin, G. B.	'40	*	U.S.A.	*
Levine, R. P.	43	Cadet	U.S.A.	N. Carolina
Lew, Harry W.	'31	*	U.S.A.	Florida
Lewis, E. B.	'42	*	U.S.A.	*
Lind, C. F.	'32	Lt.	U.S.N.R.	Kansas
Lingle, H. C.	'43	*	U.S.A.	*
Llewellyn, F. E.	'38	Ens.	U.S.N.	*
Loeffler, D. E.	'40	*	U.S.A.	N. Carolina
Lovering, F. R.	'24	Capt.	U.S.A.	N. Carolina
Lovett, B. B. C.	'36	*	U.S.N.	*
Lowell, A. C.	'38	Major	U.S.M.C.	N. Carolina
Lownes, E. D.	'24	Major	U.S.A.	Overseas
Lynn, L. E.	'29	Lt. Col.	U.S.A.	Virginia
Macartney, E. J.	'43	*	U.S.N.R.	*
MacDonald, R. G.	'33	*	U.S.A.	Overseas
MacKenzie, D. C.	'22	*	U.S.A.	Georgia
MacKnight, R H.	'39	*	U.S.M.C.	*
MacRostie, W.	'42	Lt. (j.g.)	U.S.N.R.	Overseas
Madley, H. H.	*'42*	*Ens.*	*U.S.N.R.*	*Utah*
Maginnis, J.	'37	*	U.S.N.	*
Maier, O. C.	'36	Col.	U.S.A.	New Jersey
Main, J. H.	'41	*	U.S.N.R.	Pennsylvania
Maloney, F. V.	'35	*	U.S.N.R.	Overseas
Marsh, R. E.	'43	*	U.S.N.R.	*
Martinez, V. H.	'42	Lt.	Argentine Navy	Washington, D. C.
Mason, H. S.	*'30*	*Pvt.*	*U.S.A.*	*N. Carolina*
Mason, M. M.	'43	Ens.	U.S.N.R.	New York
Mathews, T. E., Jr.	'32	1st Lt.	U.S.A.	Merced
Mathewson, A.	'33	Lt.	U.S.N.R.	San Diego
Matson, J., Jr.	'26	Major	U.S.A.	Hawaii
Matthew, T. R.	'39	Ens.	U.S.N.R.	Florida
Mauer, F. A.	'22	1st Lt.	U.S.A.	Ohio
Mauzy, H. K.	'30	Lt.	U.S.N.R.	Puerto Rico
Maxson, J. H.	'27	Major	U.S.A.	Washington, D. C.
McClain, J. F., Jr.	'42	Ens.	U.S.N.R.	California
McConnell, C. L.	'20	*	U.S.N.R.	*
McCoy, H. M.	'35	Capt.	U.S.A.	*
McKee, G. T.	'23	*	U.S.A.	*
McKibben, P. S.	'42	Ens.	U.S.N.R.	*
McNeal, D.	'35	Major	U.S.A.	Illinois
McRae, J. W.	'34	Major	U.S.A.	Virginia
McWethy, R. E.	'43	*	U.S.N.R.	*
Mead, O. J.	'43	*	U.S.N.R.	Indiana
Mead, R. R.	'33	1st Lt.	U.S.A.	Washington
Mechling, W. B.	'38	Lt.	U.S.N.R.	*

Melnikov, D. N.	'26	Lt.	U.S.N.R.	Virginia
Menard, H. W.	'42	Ens.	U.S.N.R.	Overseas
Mendenhall, F.	'33	*	U.S.N.R.	*
Mercereau, J. T.	'24	*	U.S.A.	Virginia
Meyer, G. F.	'42	*	U.S.N.R.	Overseas
Meyer, R. G. H.	'37	Lt.	U.S.A.	Illinois
Miller, D. D.	'40	Cadet	U.S.A.	Los Angeles
Miller, J. A.	'41	*	U.S.A.	*
Miller, S. S.	'37	Lt.	U.S.N.	*
Milletd, F. A.	'22	Capt.	U.S.A.	Idaho
Mitchel, T. S.	'33	Lt. (j.g.)	U.S.N.R.	Georgia
Mohr, W. H.	'29	Lt. Col.	U.S.A.	*
Moody, M. W.	'24	Cmdr.	U.S.N.R.	Overseas
Moore, R. L.	'42	Ens.	U.S.N.R.	*
Moorman, T. S.	'38	1st Lt.	U.S.A.	*
Munk, W. H.	'39	*	U.S.A.	*
Nestler, W. W.	'36	*	U.S.A.	Florida
Nichols, R. M.	'36	*	U.S.A.	Overseas
Novitaski, E.	'42	*	U.S.A.	*
Oberholtzer, W. E., Jr.	'36	Lt.	U.S.N.	Overseas
Oder, F. C. E.	'40	Capt.	U.S.A.	Florida
Offerman, R.	'37	Ensign	U.S.N.R.	Pasadena
Ofsthun, S. A.	'38	1st Lt.	U.S.A.	*
Olson, C. B.	'42	Lt. Cmdr.	U.S.N.	Washington, D. C.
Omsted, H.	'33	*	U.S.N.R.	Overseas
Osborn, J. E.	'39	Ensign	U.S.N.R.	*
Osborne, H. G.	'42	Ensign	U.S.N.R.	Cambridge
Osborne, J. B.	'31	*	U.S.A.	Missouri
Paller, J.	'36	Lt. (j.g.)	U.S.N.R.	Overseas
Palmer, C. S., Jr.	'40	2nd Lt.	U.S.A.	California
Parish, E. W., Jr.	'39	Lt.	U.S.N.R.	Overseas
Parr, W. S.	'35	Lt. Cmdr.	U.S.N.R.	Overseas
Patterson, G. B.	'41	*	U.S.A.	*
Paulson, J. J.	'41	Lt. (j.g.)	U.S.N.R.	Overseas
Porush, I. I.	'41	*	U.S.A.	*
Potter, W. T.	'22	Ensign	U.S.N.R.	Chicago
Pritchett, J. D.	'30	*	U.S.A.	Overseas
Ramey, R. C.	'30	Lt. (j.g.)	U.S.N.R.	*
Reid, D. C.	'43	*	U.S.N.R.	*
Renshaw, W. C.	'20	Lt. Cmdr.	U.S.N.R.	San Francisco
Richards, R. T.	'17	*	U.S.A.	Florida
Richardson, O. B.	'30	*	U.S.N.R.	Ohio
Ridenour, C. H.	'18	Brig. Gen.	U.S.A.	Overseas
Ridland, A. C.	'43	*	U.S.A.	*
Ritter, J.	'35	Lt. (j.g.)	U.S.N.R.	Overseas
Rooke, D. R.	'34	Lt.	U.S.N.R.	*
Ross, E. H.	'28	*	U.S.A.	Washington
Rowell, R. M.	'38	*	*	Missing in Action
Russell, R. L.	'33	Lt. (j.g.)	U.S.N.R.	Alaska
Ryan, F. R.	'41	*	U.S.A.	*
Sandifer, V. E.	'41	*	U.S.A.	*
Saye, R. S.	'43	*	U.S.N.R.	*
Schauer, E. H.	'42	*	U.S.A.	*
Schneider, C. J.	'39	*	U.S.M.C.	Killed in So. Pac.
Schoech, W. A.	'38	Lt.	U.S.N.R.	*
Schrader, C. G.	'40	*	U.S.N.R.	*
Schroder, L. D.	'32	*	U.S.A.	*
Schubert, W.	'41	Lt. (j.g.)	U.S.N.R.	Annapolis
Schultz, W. F.	'32	2nd Lt.	U.S.A.	Overseas
Schultz, W. O.	'32	Capt.	U.S.A.	Overseas
Schuman, D.	'37	Lt. (j.g.)	U.S.N.R.	Overseas
Schureman, K. D.	'42	Lt. (j.g.)	U.S.N.R.	Hawaii
Scoles, A. B.	'38	Lt.	U.S.N.R.	*
Scully, C. N.	'38	2nd Lt.	U.S.M.C.	*
Seymour, S.	'32	Major	U.S.A.	California
Shield, J. E.	'22	Major	U.S.A.	Hawaii
Shields, J. C.	'30	*	U.S.A.	Sacramento
Shores, V. R.	'41	*	U.S.A.	Massachusetts
Shugart, D. F.	'22	Lt. Col.	U.S.A.	N. Carolina
Shugart, H. E.	'16	*	U.S.A.	S. Carolina
Shuler, W. R.	'32	Col.	U.S.A.	Overseas
Shultise, Q. M.	'39	*	U.S.A.	New Jersey
Sidler, A. W.	'38	Ensign	U.S.N.R.	Oregon
Silberstein, R. F.	'41	Sgt.	U.S.A.	Georgia
Silvertooth, E. W.	'40	*	U.S.N.R.	Washington, D. C.
Skalecky, F. H.	'41	*	U.S.N.R.	Overseas
Smith, J. N.	'37	Capt.	U.S.A.	*
Smith, M. C.	'43	*	U.S.A.	Overseas
Smith, R. L.	'39	Major	U.S.M.C.	Overseas
Snodgrass, R.	'41	Lt.	U.S.M.C.	California
Snyder, W.	'43	*	U.S.A.	*
Sokoloff, V. M.	'26	*	U.S.A.	Missouri
Southwick, T. S.	'27	*	U.S.A.	Virginia
Spencer, N. C.	'41	*	U.S.A.	*
Spooner, W. A.	'40	*	U.S.A.	Texas
Stevens, J. B.	'40	Lt. (j.g.)	U.S.N.R.	Overseas
Stirling, C. W.	'43	Lt. Cmdr.	U.S.N.	Washington, D. C.
Stone, W. S.	'38	1st Lt.	U.S.A.	*
Stone, W. W., Jr.	'40	*	U.S.A.	*
Strickland, C. P., Jr.	'43	Ensign	U.S.N.R.	*
Strickler, R. F.	'41	*	U.S.A.	*
Strong, H. D., Jr.	'39	Ensign	U.S.N.R.	*
Stuppy, L. J.	'35	1st Lt.	U.S.A.	Hawaii
Suggs, R. L.	'33	*	U.S.A.	Texas
Sutton, R. A.	'43	*	U.S.N.R.	*
Tarbet, T. V.	'32	Lt. Cmdr.	U.S.N.R.	Texas
Taylor, G. F.	'29	Major	U.S.A.	Illinois
Taylor, J. C.	'35	*	U.S.A.	New York
Tenney, F. H.	'43	*	U.S.N.R.	*
Terhune, C. H., Jr.	'41	*	U.S.A.	Ohio
Tiemann, C. F.	'41	*	U.S.A.	*
Todd, G.	'40	Lt (j.g.)	U.S.N.R.	New Jersey
Tomamichal, J. J.	'42	Lt.	U.S.N.	Pennsylvania
Towler, J. W.	'30	*	U.S.A.	*
Trindle, J. W.	'41	*	U.S.A.	Florida
True, L. J., Jr.	'42	Lt. (j.g.)	U.S.N.R.	Washington, D. C.
Turner, W. R.	'42	*	U.S.N.R.	Washington, D. C.
Tyra, T. D.	'41	*	U.S.N.	San Diego
Urgin, N.	'34	*	U.S.N.R.	*
Urbach, K.	'42	2nd Lt.	U.S.A.	New Jersey
Van Dusen, C. A., Jr.	'37	*	U.S.N.R.	Florida
Van Dyke, G. R.	'40	*	U.S.A.	*
Van Fleet, J. R.	'38	*	U.S.N.R.	Killed 11/43 in Navy training flight
Van Horn, J. W.	'38	2nd Lt.	U.S.A.	California
Veenhuyzen, P. N. A.	'42	*	U.S.N.R.	*
Vetter, W. H.	'40	*	U.S.A.	*
Viney, A. G.	'26	*	U.S.A.	Florida
Voelker, J. F.	'26	Major	U.S.A.	Denver
Walker, R. L.	'40	Lt.	U.S.A.	Marysville
Wallace, R.	'41	Ensign	U.S.N.R.	New York
Wallman, D. H.	'36	*	U.S.N.R.	New York
Warfel, J. S.	'33	*	U.S.N.R.	Florida
Warner, H. F.	'37	1st Lt.	U.S.A.	Pennsylvania
Washburn, D. E.	'33	*	U.S.N.R.	Overseas
Watkins, J. M., Jr.	'40	Lt. (j.g.)	U.S.N.R.	Washington, D. C.
Weeks, A. D.	'43	Ensign	U.S.N.R.	Pennsylvania
Weir, G. B.	'40	Major	U.S.A.	Overseas
Whelan, T. M.	'36	Lt.	U.S.N.R.	Overseas
Wheeler, F. A.	'29	Lt. Cmdr.	U.S.N.R.	*
Whitfield, H. H.	'41	*	U.S.A.	*
Whittlesey, D. W.	'40	*	U.S.A.	Ohio
Widdoes, L. C.	'41	*	U.S.N.R.	Washington
Widenmann, J. A.	'42	*	U.S.N.R.	*
Wilking, A. P.	'33	Lt. (j.g.)	U.S.N.R.	Texas
Wilkinson, W. D., Jr.	'30	*	U.S.A.	Overseas
Willard, K. A.	'34	1st Lt.	U.S.A.	Washington, D. C.
Willits, R. M.	'43	Ensign	U.S.N.R.	Massachusetts
Wilstam, A.	'37	Lt. Cmdr.	U.S.N.R.	Killed in So. Pac.
Winchell, R. W.	'39	*	U.S.A.	New York
Wood, F. W.	'42	*	U.S.A.	Washington
Wright, E. E.	'37	*	U.S.N.R.	Mare Island
Wyckoff, P. H.	'37	Major	U.S.A.	Ohio
Young, J. A., Jr.	'43	*	U.S.A.	*
Zimmerman, D. Z.	'36	Lt.	U.S.A.	Washington, D. C.
Zipser, S.	'30	*	U.S.A.	New York

*—Information unknown.

PERSONALS

1912

J. D. MERRIFIELD is in the manufacturing business in Rocky Ford, Colo. He designs and manufactures weighing, packaging, and other types of machines for use in the sugar industry which he distributes to all parts of the country. His son, a U. S. Marine Corps pilot, who was in business with Mr. Merrifield, was killed in an airplane accident in Washington last summer.

1918

FRANK CAPRA, noted film director, has been promoted from lieutenant colonel to colonel in the Signal Corps.

BRIGADIER GENERAL CARLYLE H. RIDENOUR, commander of a bomber wing in the North African-Mediterranean theater of operations, has his moments of social relaxation as well as fighting, according to an article from the Army Air Forces Public Relations Office. Recently he was host to Major General James H. Doolittle and a group of stage and screen actors headed by Fredric March who were on a tour of American bases. He was also host to Bob Hope and Frances Langford.

1924

ROLLAND S. THOMAS is an instructor at the Woodrow Wilson High School in Long Beach, Calif., teaching machine drawing, architectural drafting, and blueprint reading, as well as war production training classes in the adult department. He introduced the first class in the locality in blueprint reading in high school. The course was introduced principally for girls who expect to enter work in war plants upon graduation from high school. Mr. Thomas has one daughter and two sons.

DOUGLAS TELLWRIGHT left San Diego a year ago to work with a joint Army-Navy agency in Washington. D. C., engaged in expediting the production and manufacture of electronic devices for both services.

1925

WALTER L. BRYANT is with the University of California Division of War Research as an engineer.

R. E. ALDERMAN was transferred to San Francisco in October by his company. the Royal-Liverpool Groups. His new capacity is agency superintendent and his territory is the 11 western states.

1926

MAJOR ARTHUR B. ALLYNE is with the Chemical Warfare Service at Edgewood Arsenal, Md., where he acts as assistant executive officer in the inspection division.

COLONEL IVAN (IKE) FARMAN now heads the Army Airways Communications Wing at Asheville, N. C. He entered the Army Air Force as a cadet, won his wings at Kelly Field, Texas, in 1929, and has since been engaged in communications work.

MARK SERRURIER is the father of a son born January 7.

1927

W. W. ALTMAN is now a lieutenant commander with the Seabees at Camp Parks, Livermore, Calif. He has been in the Aleutians.

MAJOR JOHN MAXSON is with the Office of Strategic Service in Washington, D. C.

LOUIS GAZEN is with Photo Intelligence Service in Washington, D. C.

1928

FRANK NOEL is with the Division of Highways at Stockton, Calif.

1929

GEORGE F. TAYLOR is with the Army Air Force Training Command at Chanute Field, Ill.

MILTON SPERLING is in the Navy and is located at Elizabeth, N. J.

WALLACE A. McMILLAN has been made assistant director of research of the Texas Company. He was formerly assistant superintendent of the Beacon Research Laboratories of the same company.

WILLIAM H. ALBEE of the Weather Wing, Army Air Forces, Asheville, N. C., has been promoted from captain to major. The weather wing exercises direct control over the army weather service in the continental United States and certain other areas of the western hemisphere. The air forces weather service handles training, supplies and personnel for the weather service in foreign theaters and also provides weather service for the army ground forces and army service forces.

RICHARD M. SUTTON, professor of physics at Haverford College in Pennsylvania, delivered the 17th annual Christmas week lectures to young people at the Franklin Institute, Philadelphia, under the three titles, "Longer Arms — Keener Eyes — Sharper Ears."

1930

BEN HOLZMAN is a lieutenant colonel and is stationed in Washington, D. C.

1932

BRIAN SPARKS is a technical pilot for American Export Airlines at La Guardia Field, N. Y., and is also a captain flying to Brazil and other more remote points. The airlines are operating on contract for the Naval Air Transport Service with assorted seaplanes.

CAPTAIN BILL SCHULTZ is on active duty in the Pacific.

HOWARD W. FINNEY and Miss Zelma Poulton were married on January 7 at Los Angeles.

R. J. TICKNER spent four months of last year in England and Scotland on Navy business. He met several Caltech alumni during his travels.

R. E. FOSS was recently appointed general manager of operations for the Barnsdall Oil Company's Pacific Coast division. He started as a rotary helper in 1932, became a foreman in 1936, Elwood district drilling engineer in 1937, Pacific Coast division chief drilling engineer in 1941, and chief construction engineer in January, 1943.

1933

LIEUTENANT (j.g.) RICHARD L. RUSSELL is at Attu, Alaska.

1934

LIEUTENANT DONALD ROOKE visited the campus in January. He is in the Civil Engineering Corps of the Navy.

RAY HASKINS is a specialist in castings with the Sargent Engineering Company in Los Angeles.

ROBERT P. SHARP is with the Arctic Desert Tropic Information Center and is located in Brooklyn, N. Y. It is a duty in connection with the Army Intelligence Service.

1935

F. H. ALLARDT was married during November in Miami, Fla., and is now living at Long Beach, Calif., where he is supervisor of tool design at the Long Beach Plant of Douglas Aircraft Company, Inc.

LAWRENCE BALDWIN is with the University of California Radiation Laboratory as a senior design engineer. He was married in June, 1943.

1936

M. M. McMAHON has been transferred from the Kern Division of the Southern California Gas Company at Taft where he was division engineer, to the Manufacture, Compression, and Storage Division of the same company in Los Angeles where he is office engineer.

SYDNEY BARNES is a first lieutenant now located in Washington, D. C.

1937

JAY R. BAILEY has been with Hughes Aircraft Company in Culver City for the past year and a half as a stress analyst.

JOHN P. SELBERG is with International Derrick and Equipment Company of California where he has been chief engineer since 1938. He was granted his first patent on derrick design this year. His present hobby is laying 300 feet of brick wall for the back yard of his home in Los Angeles.

HARRY CARRICK is production engineer for General Petroleum in Bakersfield, Calif.

VIRGIL ERICKSON is with Morris and Knudsen negotiating contract settlements for maintenance work on Southern Pacific right-of-ways. He lives in San Francisco, Calif.

HUGH F. WARNER is a first lieutenant in the Ordnance Department, now stationed in Pittsburgh, Pa., as contract negotiation and termination in the Ammunition Branch, Pittsburgh Ordnance District. This move terminates almost two years work on production and inspection of ordnance material in the 15 counties of Pennsylvania north of Pittsburgh, with headquarters in Butler.

1938

JOHN R. VAN FLEET was killed in an airplane accident on November 20, 1943, in southern California while on a routine training flight as a United States Navy Pilot Officer.

HENRY T. NAGAMATSU has been employed as a theoretical aerodynamicist at the Curtiss-Wright Research Laboratory, Buffalo, N. Y., since July, 1943.

CLAY T. SMITH is assistant geologist with Union Mines Development Corporation, Grand Junction, Colo.

ROBERT OLDS and Miss Marian Picton were married during January.

MAJOR ART LOWELL, U.S.M.C., is an instructor at the Marine Corps Officer Training School at Edenton, N. C.

1939

LIEUTENANT MELVIN N. LEVET is a lieutenant in the Army Air Corps with the 17th Weather Squadron.

J. W. BRAITHWAITE is supervisor of the wind tunnel section at Lockheed Factory "A" where he is in charge of all wind tunnel model design construction, and testing. He is also in charge of all Factory "A" test equipment. On November 15 he celebrated the birth of a son.

PAUL L. SMITH is production research engineer with Douglas Aircraft Company, Inc., Santa Monica. He was married in 1942 to Miss Jean Kunkel of Los Angeles.

DR. AND MRS. FREDERICK D. KNOBLOCK announce the birth of a son, Robert Thomas, born December 10, 1943, in Detroit, Mich. They have two other children, a boy and a girl.

ENSIGN JACK OSBORN is with the Seabees.

1940

LIEUTENANT RICHARD L. WALKER has been stationed with the 369th Fighting Group at Marysville, Calif.

FREDERIC ODER is head of the Weather Division, Army Air Force School of Applied Tactics, Orlando, Fla.

1941

LIEUTENANT (j.g.) JOHN J. PAULSON, U.S.N.R., is now instructing in radar.

ENSIGN ROGER WALLACE was commissioned in the N. S. Naval Reserve and sent to Ft. Schuyler, N. Y., in November. He had previously worked in the chemical engineering department at the Institute.

STANLEY SOHLER, captain of the 1940 fotball team, played first string quarterback on the Los Angeles Bulldog pro football team this fall.

1942

PAUL M. MADER is in the development department of the Naugatuck Chemical Division of the U. S. Rubber Company. He is a member of the Waterbury Civic Orchestra, sings in the local Congregational Church choir, and is active in a dramatic organization, the Valley Players.

HARRY (SAM) MADLEY is the father of a baby girl, Kathleen, born January 16.

WILLARD P. FULLER, JR., is the father of a son, Frederick Timothy, born January 18. Mr. Fuller is geologist and mine engineer for Basic Magnesium, Inc., at Gabbs, Nev.

ENSIGN WARREN GILLETTE and ENSIGN EVERETT MACARTNEY are in the Submarine Service.

LIEUTENANT AL LANDAU recently received his commission and has returned to the Aberdeen Proving Ground as an instructor.

CHARLES M. BROWN is field engineer for R.C.A. Service Company, San Pedro.

KENNETH D. SCHUREMAN is a lieutenant (j.g.) stationed in Hawaii as executive officer of a Seabee Unit. He joined the Civil Engineer Corps of the Navy as an ensign upon graduation from Tech in 1942. After a year of Navy construction work in Bayonne, N. J., he was promoted to lieutenant (j.g.) and ordered to Camp Peary, Va., for Seabee training.

LIEUTENANT (j.g.) CARTER HUNT visited the campus in January while on leave and is now on active duty in the Pacific aboard a submarine tender.