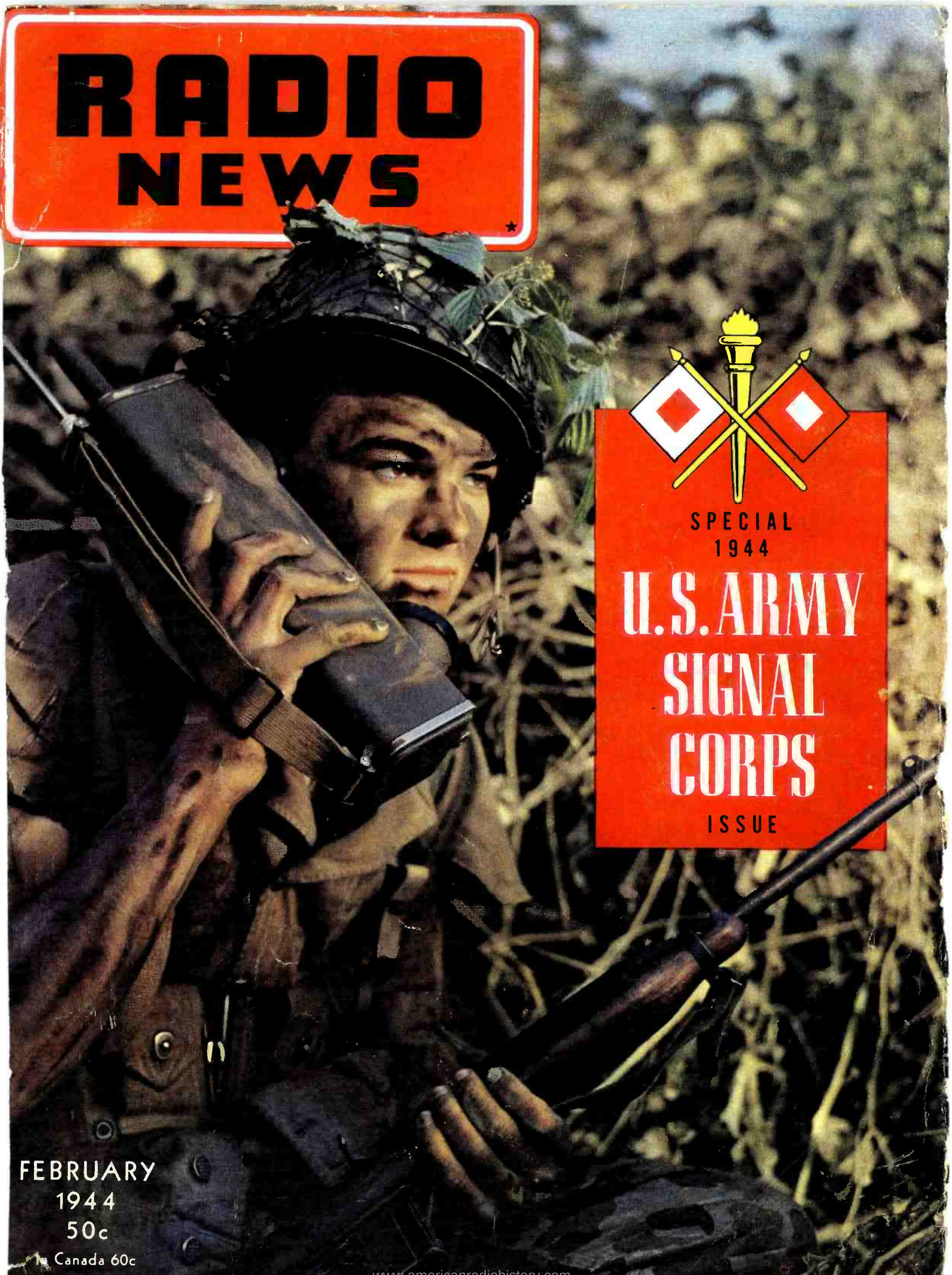
RADIO NEWS

SPECIAL 1944

U.S. ARMY SIGNAL CORPS

ISSUE



FEBRUARY
1944
50c
In Canada 60c

THE HALLICRAFTERS-BUILT SCR-299—

Another place where Belden wire goes to war

Compact, powerful equipment in the SCR-299 —permits two-way communication while scout car is traveling at high speeds.

American ingenuity and skill have given the Allied Forces another powerful war weapon—the Hallicrafters-Built SCR-299, a sturdy, versatile mobile communications unit. In this fast-moving war, with speed and coordination all important, dependable communication plays a vital part.

In the SCR-299 unit, and in many other types of Signal Corps equipment, there are hundreds of feet of Belden wire. Wire, and the copper and rubber of which it is made, is most essential to war production. Careful conservation of the wire already in service is necessary to meet wartime requirements.

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Belden WIRE

FOR RADIO AND COMMUNICATIONS EQUIPMENT

RADIO NEWS
"Reg. U. S. Pat. Off."

FEBRUARY, 1944 **Vol. 31, No. 2**

Contents

SPECIAL 1944 U. S. ARMY SIGNAL CORPS ISSUE

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Hammarlund Navy type radio components are put through a mock trip to sea to determine beforehand their ability to take it. The final proof of their quality is the excellent record established in commercial and naval ships.
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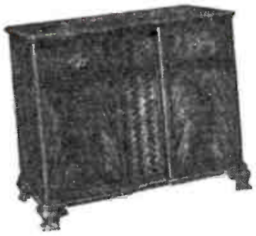
What famous name in radio is identified with America's first crystal sets, first neutrodyne sets, first sets with self-contained speakers and first FM radio-phonographs produced exclusively?

Today this name is identified with the production of military communications equipment demanding highest engineering skill and precision.



Watch for this name after the war. It will appear on the finest FM radio-phonographs ever produced in this country.

● At every important stage of radio history and achievement, the Freed-Eisemann name has come to the fore. Synonymous with *quality leadership* in the world of radio, this famous name will continue to live up to the great tradition established in the past—in the wartime production of highly complex electronic instruments, and in the post-war production of the world's *finest* Frequency Modulation radio-phonographs.

FREED RADIO CORPORATION • 200 HUDSON STREET • NEW YORK, N. Y.

Splashing through bullet-riddled beaches . . . stringing wires in the inferno of No-Man's Land . . . building a perfect chain of communications before and behind the lines. These assignments have been, and are being, brilliantly performed by the Men of the United States Signal Corps.

Micamold

The manufacturers of ***Micamold Capacitors*** grasp this occasion to send greetings to the Men of the United States Signal Corps. We gratefully acknowledge the brilliant performance of these gallant specialists . . . and take deep pride in knowing that our capacitors accompany them in battle on all fronts.

There's a
MICAMOLD CAPACITOR
for all radionic and electrical applications:

- MOLDED PAPER CAPACITORS
- OIL IMPREGNATED CAPACITORS
- DRY ELECTROLYTIC CAPACITORS
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- RECEIVING AND TRANSMITTING MICA CAPACITORS

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The Portland Vase, most renowned achievement of Josiah Wedgewood (1730 - 1795)

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In every art or craft, the work of a few masters will always be of a quality above all else of its kind . . . The name Wedgewood denotes rare excellence in pottery. The name Gobelins characterizes tapestries of incomparable beauty. So, too, in its field, the name UNITED stands for electronic tubes which are individual masterpieces . . . While electronic tubes are the very heart of countless machine-age devices, their manufacture is as dependent upon expert minds and skilled hands as is the fashioning of a fine vase or violin . . . UNITED Tubes are engineered to the most exacting specifications. They are constructed of the highest quality materials obtainable. Yet no tube can be one bit better than the skill that assembles its intricate component parts. Herein lies one reason why UNITED Tubes are in a class by themselves for efficiency and long life.

ARMY E NAVY

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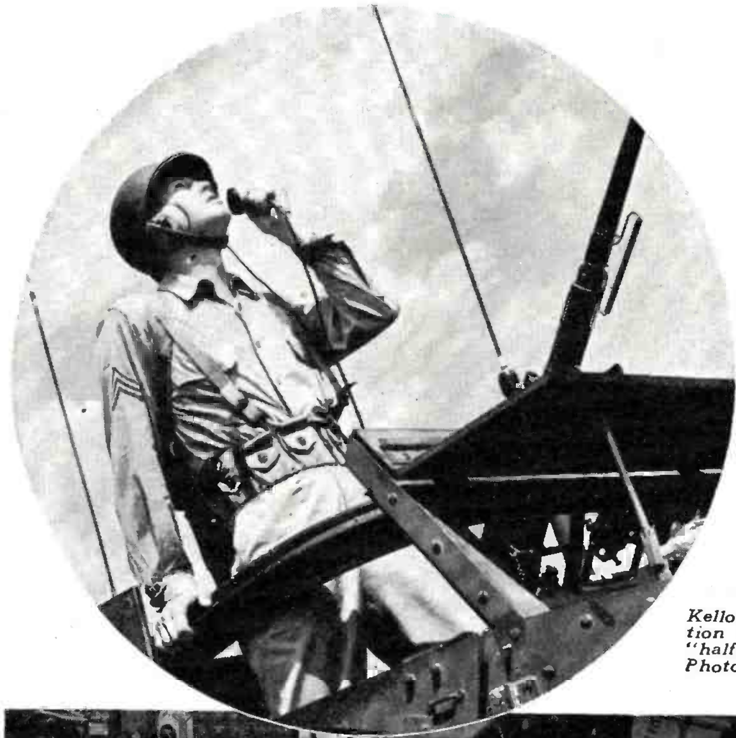
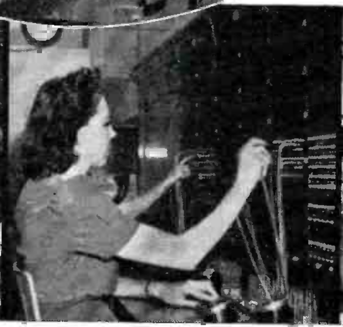
Transmitting Tubes EXCLUSIVELY Since 1934



Helping Supply the Vital Needs of THE MAN BEHIND THE "MIKE"

Kellogg microphones and other communication equipment are used in radio-equipped "half-tracks." (U. S. Army Signal Corps Photo.)

Radio operator at control panel of large Navy amphibian. (U. S. Navy Photo).



Kellogg switchboard at large Army Air Force Navigation School. (U. S. Army Air Forces Photo).

Operator at control panel of aircraft 2-way high power liaison set. (U. S. Army Air Forces Photo.)

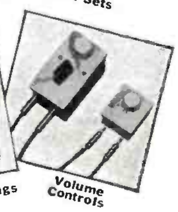
Kellogg-made microphones, headsets, etc. are widely used with field telephone and wireless sets. (U. S. Army Air Forces Photo).

A Few Examples of Kellogg Products in Military Use

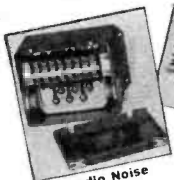
Capacitors—Wax and Oil Impregnated

Head and Chest Sets

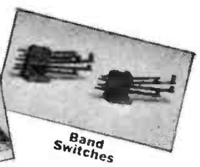
Multi-contact Plugs and Sockets



Volume Controls



Radio Noise Filters



Band Switches

Other communication equipment supplied by Kellogg includes telephone and radio earphones; field telephone and telegraph sets; hand, palm, desk and throat microphones; jacks and plugs; telephone cords; many other related and allied products.

Kellogg Communications are in the Fight on Every Front!

Behind the man behind the "mike" stretches a vast, complex network of radio and telephone equipment. To help supply the tremendous quantities of communication equipment needed in modern warfare, the Kellogg plant is busy day and night, turning out a wide variety of products ranging from tiny capacitors to complete telephone switchboards. For here at Kellogg are the required skills for such production. Here is the experience and background, gained in supplying the telephone and many other industrial fields with fine communication equipment for 47 years. Here are the facilities for precision mass production to rigid specifications. Here is a modern research, engineering and manufacturing organization qualified to work with you on any problem involving communication equipment. Kellogg Switchboard and Supply Company, 6676 So. Cicero Ave., Chicago 38, Ill.

For Everything in Communications—From Complete Systems to Single Parts

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KELLOGG

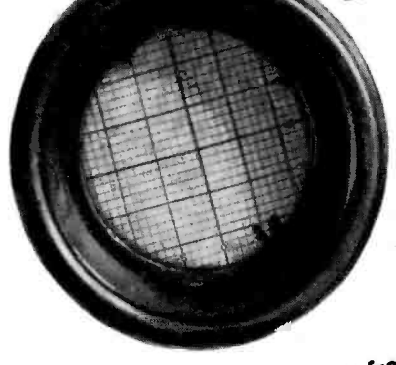
WHERE ENGINEERING AND RESEARCH BUILD

Finer Communication Equipment FOR WAR AND PEACE

It's the Little Things That Count

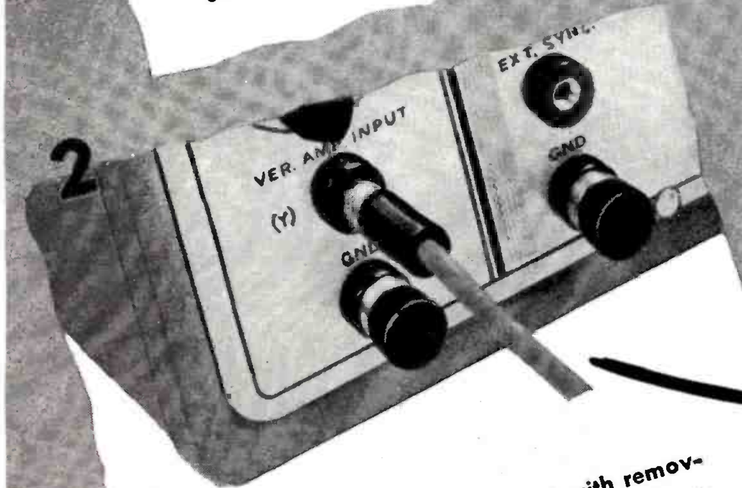
OR, WHAT MAKES THE 155-C DIFFERENT FROM OTHER 3" OSCILLOSCOPES?

1



"built-in light shield"—The front of the tube is recessed; you can see transients even in bright light.

2



"binding jacks"—Can be used with removable binding posts or with locking pin plugs. A new convenience feature.

3

"removable graph screen" to permit special observations—Place or replace it with a twist of the wrist.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4
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FREQUENCY
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HOR. INPUT
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Test and Measuring Equipment
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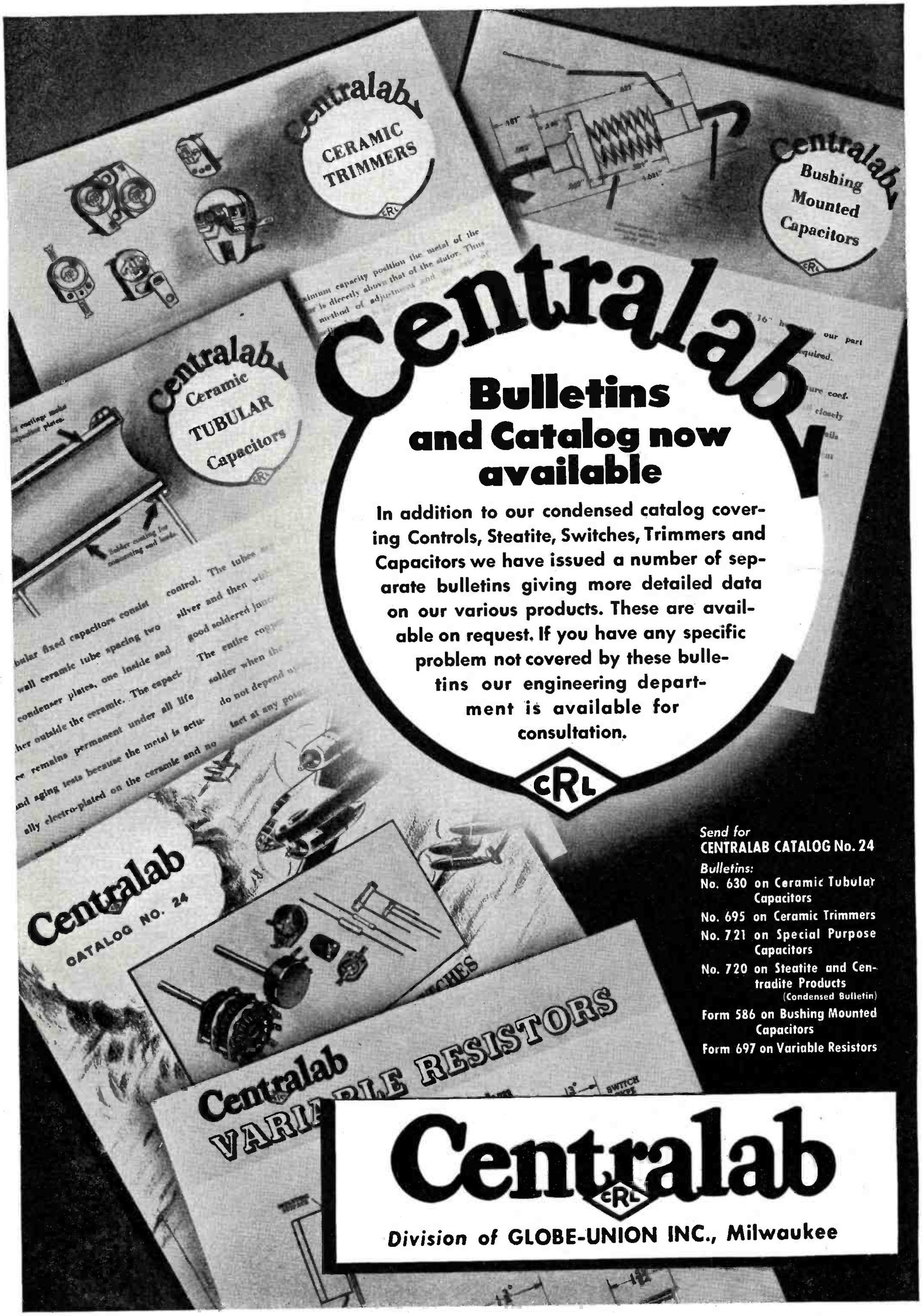
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In addition to our condensed catalog covering Controls, Steatite, Switches, Trimmers and Capacitors we have issued a number of separate bulletins giving more detailed data on our various products. These are available on request. If you have any specific problem not covered by these bulletins our engineering department is available for consultation.
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Form 586 on Bushing Mounted Capacitors
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Division of GLOBE-UNION INC., Milwaukee

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Today's Radio!

Communications are the lifeblood of today's war tempo . . . whether they're signaling "bombs away!" over the intercom system of a bomber five miles above a vital target . . . or aiding a sleek submarine as it stalks its unsuspecting prey through the silence of the deep. That is radio today. When peace comes, with it will come greater FADA skills developed by wartime lessons . . . devoted to the production of FADA radios with hitherto undreamed-of tonal faithfulness, performance and durability.

PLACE YOUR FAITH IN THE

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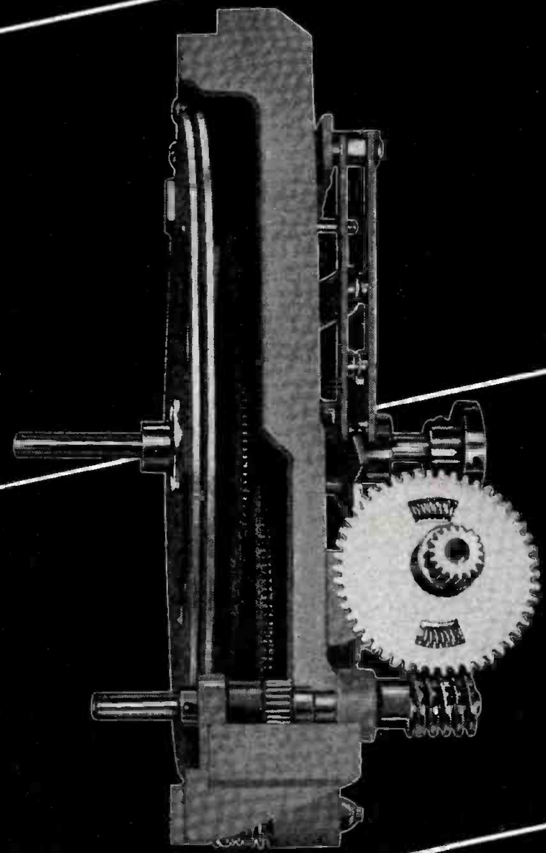
Famous Since Broadcasting Began!

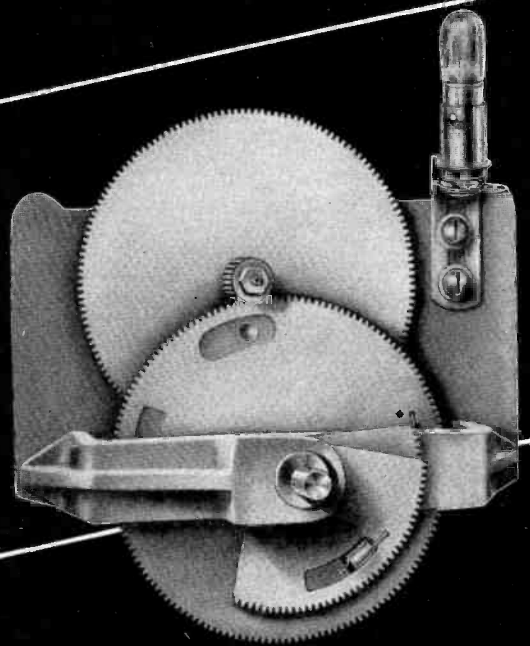
FADA RADIO AND ELECTRIC COMPANY, INC., LONG ISLAND CITY, N. Y.

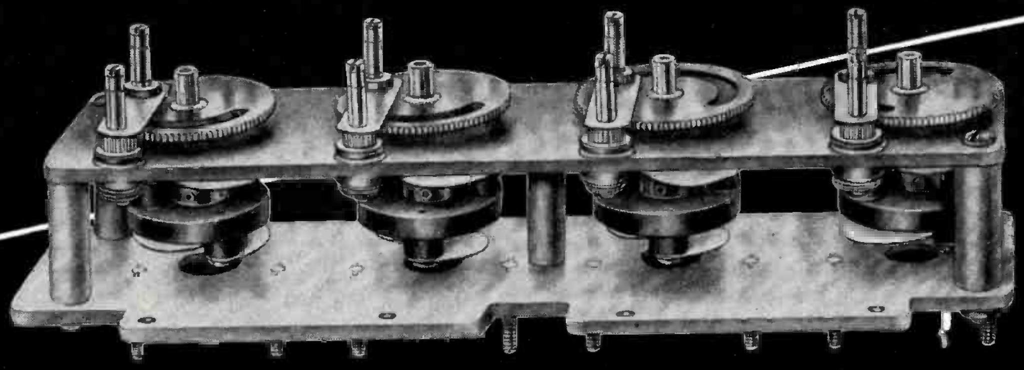
CRONAME

Electronic Controls

OPERATING MECHANISMS BUILT TO SPECIFICATIONS







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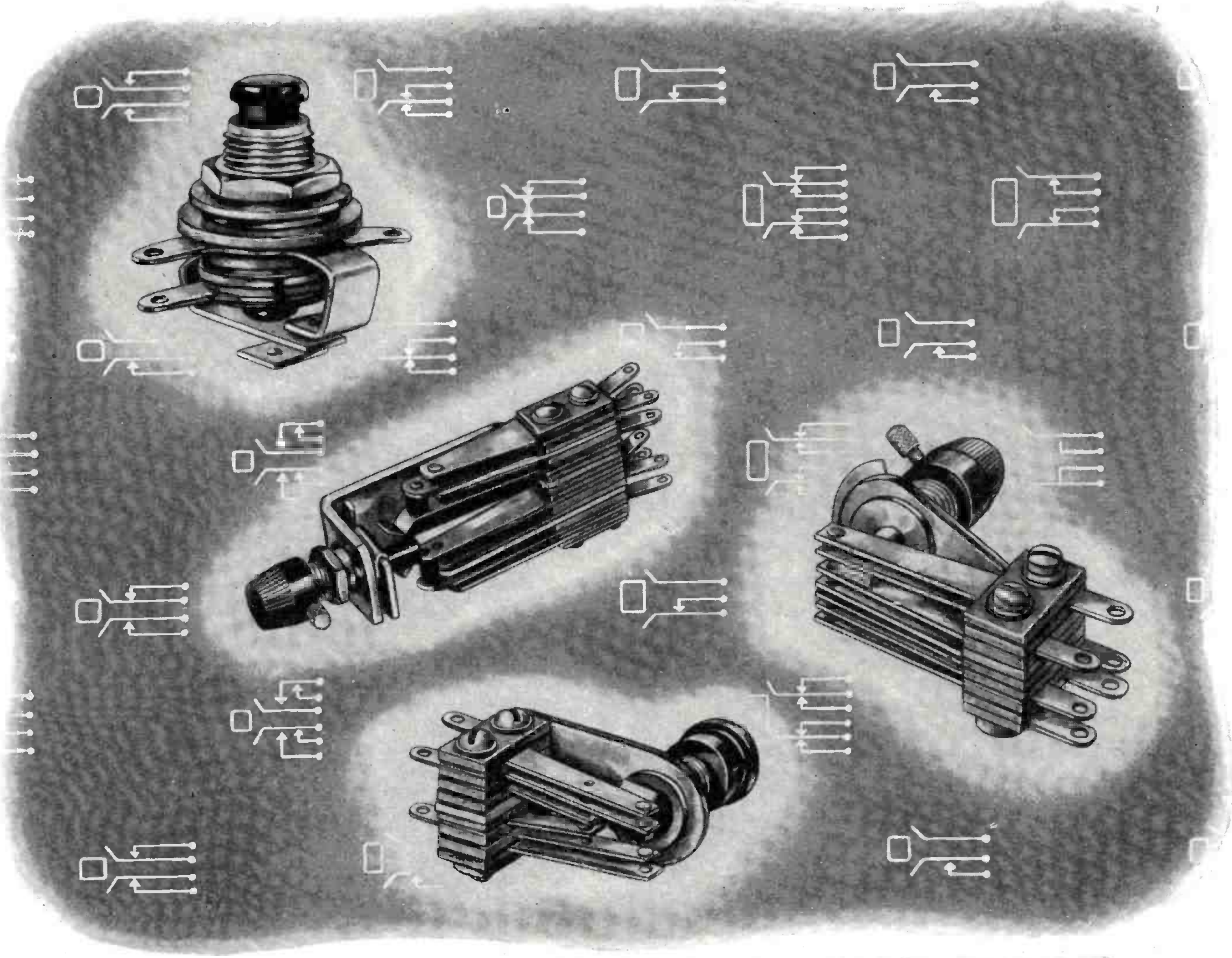
The nation's largest producer of electronic and communications equipment for war is . . .

Western Electric



FOR TOP EFFICIENCY AT THE KEY-POINT IN A CIRCUIT

UTAH SWITCHES EVERY TIME!

Where the human element and mechanical perfection must combine to provide top performance, insist on Utah Switches. They are time-tested in hundreds of electrical applications in industrial plants and on far-flung battlefronts.

There's a Utah Switch for virtually every circuit

UTAH Switches are made to fit your electrical and space requirements. Compact size, highest quality material and precision manufacture make Utah Switches everything a switch should be. Utah "Imp" push-button switches have the finest nickel silver or phosphorus bronze springs with integral contacts. Springs are fully insulated from the mounting bushing. High-grade phenolic insulation is used. They are available in three circuit arrangements: "single make," "single break," one "break make."

Also available are Utah Rotary and push-button jack switches, in long and short types. Small and compact in size, they are made to take minimum panel space. Full insulation is provided for all electrical parts.

Take advantage of Utah's extensive electrical and electronic experience. Write today for full information on Utah switches.

UTAH RADIO PRODUCTS COMPANY, 824 Orleans St., Chicago, Ill. Canadian Office: 560 King St. West, Toronto. In Argentine: UCOA Radio Products Co., S. R. L., Buenos Aires. Cable Address: UTARADIO, Chicago.

PARTS FOR RADIO, ELECTRICAL AND ELECTRONIC DEVICES, INCLUDING SPEAKERS, TRANSFORMERS, VIBRATORS, VITREOUS ENAMELED RESISTORS, WIREWOUND CONTROLS, PLUGS, JACKS, SWITCHES, ELECTRIC MOTORS

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WHEN THE CONE OF Silence is Golden!
. . AND AIRLINERS ARRIVE ON SCHEDULE
Too great commendation cannot be given to the radio range system inaugurated by the Civil Aeronautics Administration. Not so many years ago, "taking the mail through" in adverse weather called for a pilot of above-par experience. Now, by this vast, wondrous system of airways, timetables for the arrival and departure of great airliners are commonplace.
In inclement weather, the Cone of Silence plays no small part. A plane, riding the beam into port, is warned of arrival over the beacon by a sudden complete silence . . . a silence that is "golden" to an element-harried pilot.
The part played now by Electronic Enterprises, in both civil and military aviation progress can be applied to your post-war projects. E-E engineers are available for collaboration on your problems; inquiries are invited.
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"The difficult we do immediately, the impossible takes a little longer." —*Army Service Forces*

Electro-Voice DIFFERENTIAL MICROPHONES

Developed by our Engineering Department in close collaboration with the Fort Monmouth Signal Laboratories, and hailed as an accomplishment in the science of speech transmission, the *Differential Microphone* effectively shuts out all ambient noises and reverberation . . . permitting voice to come through clearly and distinctly . . . while rejecting the terrific din in tanks and the roar of gunfire.

In its present form, the *Differential Microphone* is produced as the T-45, a "Lip Mike," for use in battle by our Armed Forces and those of our Allies. Postwar developments will provide a variety of models with advantages that will be felt in many phases of civilian life.

- Frequency response substantially flat from 200-4000 cps.
- Low harmonic distortion
- Cancellation of ambient noise, but normal response to user's voice
- Self-supporting, to free both hands of the operator
- Usable when gas mask, dust respirator or oxygen mask is required
- Uniform response in all positions
- Unaffected by temperature cycles from —40° F. to +185° F.
- Ability to withstand complete immersion in water
- Physical strength to withstand 10,000 drops
- Weight, including harness, cord and plug, less than 2 ounces

Electro-Voice MICROPHONES

ELECTRO-VOICE MANUFACTURING CO., INC. • 1239 SOUTH BEND AVENUE • SOUTH BEND 24, INDIANA

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Courtesy U. S. Signal Corps.

A RADIO STAR AT $78 PER MONTH

TWO YEARS AGO he was just one of the kids in one of the homes on one of the Main Streets in one of the towns around here. A radio in his room? You bet! Couldn't get along without one. It brought him new hit tunes. Gags. Mystery stories. News.

He never dreamed, as he listened, that he'd be "on the air," with his own show . . . and the damn most important show in the world, too.

He's broadcasting now, all right. News. Big news. Movements. Actions. Progress. Supply needs. News that makes the difference between a nest of Japs wiped out or a bunch of our kids helplessly trapped.

When the history of this fight is written, there will be laurels aplenty. But count on a solid share for the Signal Corps. For the wildest imaginations of Jules Verne . . . or even the fantasies of Superman . . . are dwarfed by the exploits of our armies' "eyes," and "ears," and "heartbeat."

We are mighty proud that Pilot Radio was one of the first to apply its facilities, experience and abilities to the communication needs of the United Nations. It's thrilling, exciting, and a rare privilege to be a part of this vital link in our Victory chain.

PILOT RADIO

PILOT RADIO CORP. • LONG ISLAND CITY, N. Y.

to lift another mist from the mind of man

War's necessity mothers tomorrow's blessing. War-born electronic devices which now strengthen and sharpen a war pilot's radio signal may, some happier tomorrow, guard the glory of a symphony.

Who knows the future of these discoveries which keep our pilots in clear communication, even through the deafening crackle of a tropical storm? Who knows what undreamed comforts, undreamed glories flicker in the electronic tubes? Or in any of the modern miracles so familiar to us at Sylvania?

New sound for the ears of the world. New knowledge for the eyes of the world. More mists of ignorance swept away! Those are the potentials which inspire us, in everything we do, to work to one standard and that the highest known.

SYLVANIA ELECTRIC PRODUCTS INC.

EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK 18, N. Y.

RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES, INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES

IN ACTION ON THE HOME FRONT . . . Sylvania Fluorescent Lamps and Equipment are helping our war factories speed production. Sylvania Radio Tubes are helping bring information and entertainment to homes throughout the land. Sylvania Incandescent Lamps are serving long and economically in these same homes. As always, the Sylvania trade-mark means extra performance, extra worth.

THE GIANT OF MILITARY RADIO...
THE ARMY'S SCR-299 COMMUNICATIONS UNIT

A GIANT in performance – a giant in reliability – a giant in adaptability – a giant in winning ultimate victory is the Signal Corps' mobile radio communications unit – the *Hallicrafters* SCR-299.

Military observers, prior to our entry into the war, were unanimous in their opinion that the success of modern fast-moving "blitz" tactics were in direct proportion to the efficiency of the communications system of the armies. New tactics required new weapons to fight them and new battle fronts required new equipment to meet various conditions encountered. The factors that could be foreseen in former theatres of war were tabulated and requirements for communications equipment that would operate adequately under current conditions were used as basic specification requirements for the building of the radio set SCR-299. This radio set is the unit the *Hallicrafters Company* delivered to the Signal Corps to be used by all branches of the service and by many of the United Nations.

Military Requirements

Up to 1940, communications by such methods as the telephone, signal devices and messengers had been adequate to meet the needs of the slower-moving military machine. Germany's initial successes in a highly mechanized form of warfare were attributed to the fact that they had worked out an efficient and highly

Combat Duty

The SCR-299 was among the first equipment to land on the shores of Africa and did yeoman duty during those hectic days when the fate of the United Nations' African campaign was in the balance. It was the only means of communication for long periods of time linking Oran and England, Oran and Casablanca, Gibraltar, Algiers and Accra.

By this time our Allies had heard of this famous set that gave such phenomenal results and through "Lend-Lease" had obtained many complete units. British Generals Montgomery and Alexander used it to coordinate their successful efforts against the Germans in North Africa. General Ingles, in commenting on this fine piece of military strategy by our British Allies, said "that set (SCR-299) scurrying across sands of the deserts and over tortuous trails of mountains helped bring Rommel to his knees in North Africa..."

General Eisenhower gave due credit to the SCR-299 for the successful reorganization of the American forces and final defeat of the Nazis at Kasserine Pass.

In the invasion of Sicily and later Italy, the 299 was used with telling results. It was, as General Ingles said, "a help in keeping casualties of American forces surprisingly low."

In its travels far and wide the 299 has received grateful praise from both our own and our allied high ranking officers. Colonel Williams, Chief of Staff of the First Armored Division, said "the SCR-299 is a fine set . . . this set gives us the range we need and more."

"Down under" where the humidity is high and sun is hot the 299's are also proving their mettle. Lieutenant Colonel Edwin Stoll, Division Signal Officer in the South Pacific, upon returning home recently, reported that these transmitters were serving our forces well and that they were the main means of communication between Australian campaign headquarters and New Guinea.

Such expressions as "the best sets in the Signal Corps"; "breakdowns are infrequent"; "everybody likes them"; "a very good set"; "nothing but the highest praise for them"; "the 299 is a tremendous thing out here. It is unbeatable and very popular"; "it is just like any good ham rig – easy to operate" are common from both the officers and enlisted men on actual duty throughout the entire world.

Diversified Uses

Though the original Signal Corps requirements were for communications points up to 100 miles, these transmitters have under favorable conditions made and maintained contact over 2300 miles of land and sea.

In the original design of the complete unit the foremost thought was mobility and to this end certain other desirable features had to be sacrificed. The fact remains, however, that these units even in their highly mobile state can be and are being used as fixed stations. The short whip antenna used for road and field work is disconnected easily and the long-wire flat-top antenna substituted, for "fixed position" operation. The power supply is easily detached and moved to more sheltered spots. It is also possible to operate the unit by remote control, making it feasible for the operator to be indoors and yet get full use of the equipment.

It has truthfully been said that the victorious army is the army that "gets there fustest with the mostest." In order to accomplish such a feat, communications is one of the deciding factors for it is only by the proper coordination of all units involved that the "most" can get there before the enemy. It has been proved many times over in the present conflict that the terrific striking power of these units must work with split-second timing. Without adequate communications the numerous divisions of such an army are not and cannot be used to their full advantage. Our armies had to overcome Germany's panzer units, with their high-speed communications networks, and the SCR-299 provided the answer to this heretofore difficult problem.

quency covered by the transmitter. Commercial engineers devised a continuously variable network which, when connected to the vertical, provided the necessary matching required. The SCR-299 uses separate vertical antennae, one for each receiver, and these are approximately 10 feet long. A total of three antennae are to be seen on all units bearing the 299 designation.

A maze of replacement parts are required for the maintenance of vital communications equipment. Those included with every SCR-299 include a representative group of condensers, tubes, resistors, meters and service tools as well as complete storing facilities located under the operating bench. All replacement items are packed uniformly and are standardized for easy location.

After the mechanical considerations were met and a layout adopted for the various units, attention was given to the design of a suitable truck which would provide the necessary accommodations. It was established that one of approximately 1½ ton capacity would be required. A dual system for operation was provided for the two operators on duty at all times. Either of the two operators have complete control of all receiving and transmitting equipment.

In addition, another unit was required to transport the gasoline-driven motor generator that would be required to furnish power for the operation of the transmitter, receivers and lighting within the communications truck.

It was necessary to separate the two units in order that mechanical vibration as well as noise from the gasoline plant could be removed where it would not interfere with the transmission and reception of important communications.

An interesting sidelight on the construction of the truck was the incorporation of electrically operated heating and ventilating apparatus. Complete lighting facilities were provided and power for the operation is obtained from the gasoline plant along with the radio equipment.

Field telephones with a goodly supply of cable are carried in each unit. They are used either as interphones or may be used to control and modulate the transmitter from a remote point.

Official Nomenclature

The new version of the HT-4 transmitter became known as the Signal Corps' (BC-610) transmitter. Receivers finally supplied were the standard Signal Corps (BC-312), (342). The speech amplifier known as the (BC-614), tuning unit (BC-729) and frequency meter (SCR-211) together with the power unit (PE-95) complete the list of main items. All these finally became part of the truck and trailer unit which was given the official (SCR-299) but later became better known as the "mobile communications unit."

After assembly and pre-test at the Hallicrafters plant, the units were delivered to the Signal Corps for final test and acceptance. During these tests, this new mobile radio station was put through its paces. It received the most abusive kind of road test; was operated under the most adverse conditions that could be devised by the testing engineer. Arctic, tropic and desert conditions were simulated and the unit checked for all types of breakdowns and deficiencies. Final acceptance by the army of the SCR-299 is adequate proof of a job well done.

The production of such a versatile adjunct to the communications service can only be attributed to the close cooperation and collaboration of far-sighted Signal Corps officers and civilian engineers. To these technicians goes the full credit for a unit that, since its adoption, has served in more far removed places of the world than any other type of radio equipment.

Among this vast group of Americans working toward ultimate victory we find many pre-war amateurs who were responsible for the original design of the HT-4 transmitter and who, through their applied knowledge, gave to our armed forces this giant weapon in the battle of communications!

hallicr

WORLD'S LARGEST EXCLU
SHORT WAVE RADIO COM

reliable communications system whereby the lightning-like movements of their panzer divisions could be coordinated and timed for split-second action.

Such tactics produce an ever-changing battle line ranging over distances of many hundreds of miles as compared to the slower outmoded warfare which moved but few miles in one operation. Unless reliable, direct communications between these widely separated divisions in the field and their commanding officers could be provided, the effectiveness and efficiency of the total army would be lost.

Our technicians and particularly the communications officers could see that in the event this country should become involved in the conflict then raging throughout Europe and Asia, our armies would likewise have to be equipped with a modern means of communications to coordinate our combined ground, air, sea and armored forces for none could function efficiently without the aid of the others.

To meet the demands of those forces, a radio transmitter was required of high power, capable of communicating by voice infallibly over a distance of at least 100 miles, self-powered, sturdy enough to insure operation under all conditions, flexible enough to cover a wide range of frequencies and able to operate while in motion or at fixed locations. It had to be entirely independent in its mobility—containing repair and replacement parts to insure its continued operation while on detached missions. It had to be so designed and constructed for operation in the cold of the North, heat of the South, humidity of jungles, and in the dry heat of the deserts where sand makes operation of delicate mechanisms problematical.

The problem was to procure such a unit, test it under all conditions and produce it *in time* to give our armies the essential means of communication that anticipated needs dictated.

The HT-4 Selected

Accordingly, there was set up at the *Fort Monmouth General Development Laboratories* under Major General Roger B. Colton, now Chief of Engineering and Technical Services in the Signal Corps, a program which called for the accumulation of commercially-built transmitters having the necessary qualifications for adaptation to Signal Corps requirements. Some 20 odd sets were sent to Fort Monmouth by manufacturers throughout the country. Each was given a complete technical analysis and those found suitable were put through various exacting performance tests. After considerable experimentation, the *Hallicrafters* standard HT-4 transmitter was selected as the "basis" for the desired radio unit.

The HT-4 transmitter was first designed exclusively for amateur use and had been built commercially for several years. It was compact and stable. It was capable of delivering 325 watts of power on voice and 450 watts on c.w. (code). It was crystal-controlled but provided optional use of m.o.p.a. and was able to work over a wide range of frequencies which was one of the most sought-after qualifications of the Signal Corps.

Adaptation

The changes requested by the Signal Corps were achieved by the concerted efforts of Hallicrafters engineers working side by side with the technicians of the Corps. In order to adapt the HT-4 for military use, it was simply necessary to incorporate minor changes and to augment the basic unit with additional "gadgets" which would permit the transmitter to handle a wider range of frequencies and to standardize upon the control equipment.

The steel cabinets were strengthened and the individual units were shock-proofed so that they could withstand the terrific pounding that they would encounter when placed in standard military vehicular units. All cables, connectors and plugs were designed specially to permit the extreme flexibility of operation in motion. In addition, some component parts had to be treated specially to prevent corrosion which would be encountered in various climates where equipment would be transported.

Other minor changes were made including the addition of several relays in order to permit automatic changeover of circuits required for military operations. The engineers designed an overload relay system that proved to be completely chatter-proof. An ordinary relay would "kick out" when travelling in a unit over rough terrain. Reset controls were placed on the front panel and made readily accessible to the operators. It was fortunate that the original HT-4 transmitter was designed around two basic units: the RF deck, containing the complete radio frequency exciter, power amplifier and special switching circuits and the other which included power supply and modulator as well as power control equipment. A master oscillator was designed which provided continuous coverage without the necessity of providing a maze of crystals ground to the many frequencies which would be required for military communications. A switch located on the tuning unit controls the changeover from crystal to master oscillator.

The antenna problem was met after much experimentation by designing a vertical "whip" which was approximately 35 feet long. In order to match the antenna to the wide frequency ranges of the transmitter, a special antenna coupler had to be designed which would permit accurate loading at any fre-


Jensen
REPRODUCERS
AID THE SCR-299
IN "Winning the Battle of Communications!"
The latest development in military communications equipment deserves the best in speech reproducers ... it is natural, therefore, that Jensen speech reproducers were specified for the famous SCR-299, the high powered mobile communications unit as built by Hallicrafters. Jensen speech reproducers are serving with equal distinction in all branches of the armed forces.
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RADIO MANUFACTURING COMPANY
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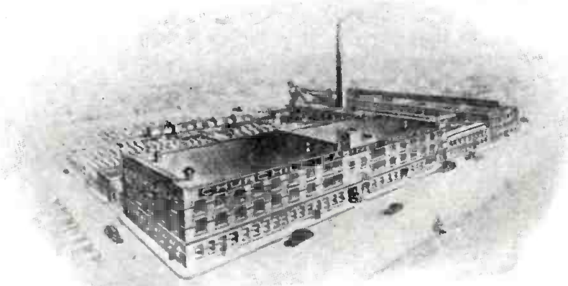
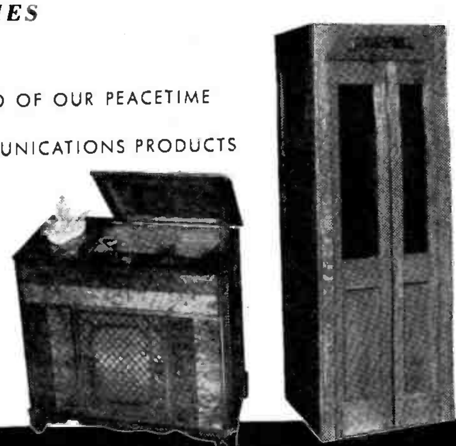


TWO OF OUR PEACETIME COMMUNICATIONS PRODUCTS



Working Together to Save Lives

SCR-543 Made by Hallicrafters
PE-108 Made by Pioneer

Stout hearted men and stout hearted equipment are winning battles for America and the Allied Nations all over the world. The special job of the SCR-543 is to provide communications for anti-aircraft artillery. It's got to be dependable. It's got to take punishment. Lives hang in the balance. We're proud of the way this communications set meets these stiff requirements.

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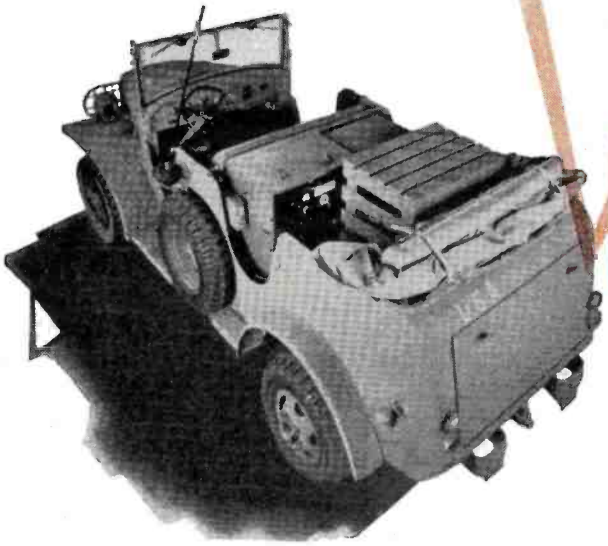

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Doing A GREAT JOB . . . . . .

contributing toward the successful operation of the Hallicrafters-built SCR-299.

That Englewood cable connectors and accessories are used in the manufacture of this mighty communications war-weapon is a fine tribute to Englewood's ability to supply fine electronic components.

ENGLEWOOD *Cable Connectors*

ADDITIONAL EQUIPMENT FURNISHED FOR THE SCR-299 BY ENGLEWOOD:

SPEAKING TUBE ASSEMBLY — *TROUBLE LAMP ASSEMBLY*
GROUNDING JUMPER AND LEADS — *POWER CABLE REEL*

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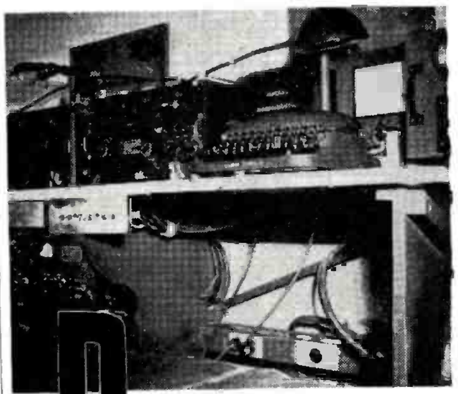

PROTECTION...

against adverse climatic conditions and rough usage is afforded the communications equipment in the Hallicrafters-built SCR-299, by Grunwald Plating.

Grunwald specializes in plating zinc, nickel, chromium, cadmium and copper and has special equipment and machinery for polishing inside surfaces.

Oxidizing and lacquering . . . Polishing and Buffing of all metals. Mechanical Plating, Pickling Stainless Steel and all metals.

Grunwald Production Specialists are at your service.

The GRUNWALD PLATING CO. Inc.

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Supplying Electrical Needs *On Time* TO THE HALLICRAFTERS

As a leading electrical wholesaler serving the Chicago area, we are proud to have contributed to the success and accomplishments of one of the Army's most valuable "weapons"—the versatile SCR-299, manufactured by The Hallicrafters Co.

It gives us great satisfaction that Efengee's experienced expediters are aiding The Hallicrafters Co., and war industry in general throughout the Chicago area, with a service that is complete, cooperative and dependable.

EFENGEE ELECTRICAL SUPPLY CO.
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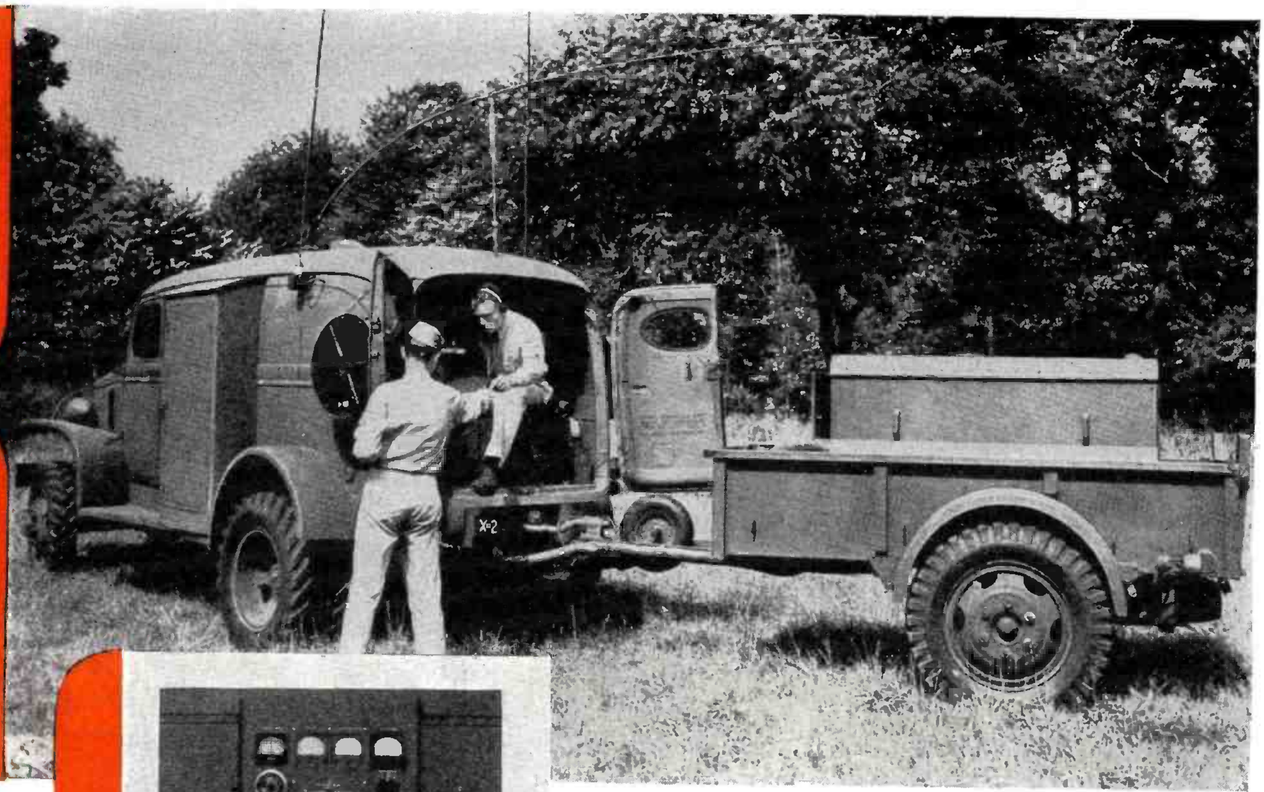

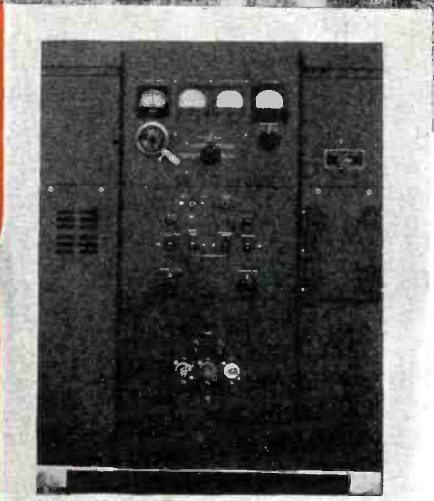

JOHNSON

Condensers
Tube Sockets
Couplings
Insulators

are used in the famous

HALLICRAFTER BUILT SCR-299

JOHNSON'S are proud of their part in furnishing many of the important components for this famous transmitter. They are proud to have been selected originally by HALLICRAFTERS to furnish these components for the HT-4—before the pressure of war made price unimportant. They are proud that this same HT-4 was used by the Signal Corps to become a part of the SCR-299—a tribute to the dependability of HALLICRAFTERS equipment and JOHNSON parts. They are proud to have been able to expand production to furnish all of these parts needed in the SCR-299 in addition to the vast numbers of parts needed by other manufacturers. And, we are proud that these are all standard parts made to the same specifications as our "ham" parts before the War.

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Today, JENNINGS RADIO enjoys a well-earned nitch in the top flight ranks of Radio manufacturers now serving the armed forces.

Tomorrow, the post-war period, will find JENNINGS RADIO far out in front with a new and improved line of Radio Tubes and Vacuum Condensers meeting the exacting needs of the new industrial-electronic world.

While today, we are devoting our entire engineering thought and output to the business of winning the war, we can, however, invite a discussion of your commercial peacetime products.

Our new catalog will be sent on request

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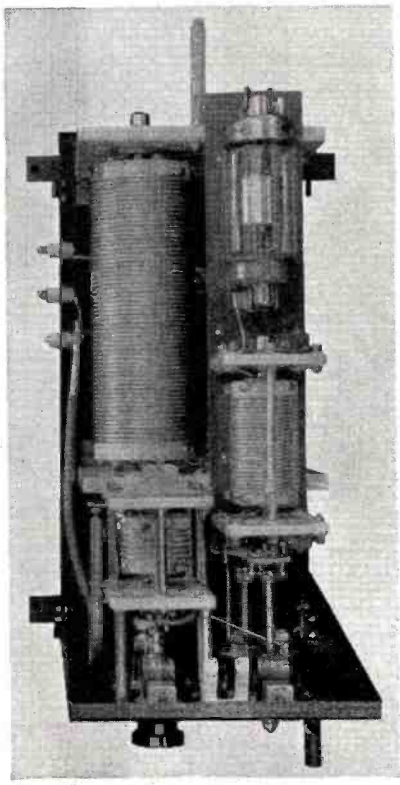
San Jose California



hallicrafters
SCR-299
is being powered by
JENNINGS
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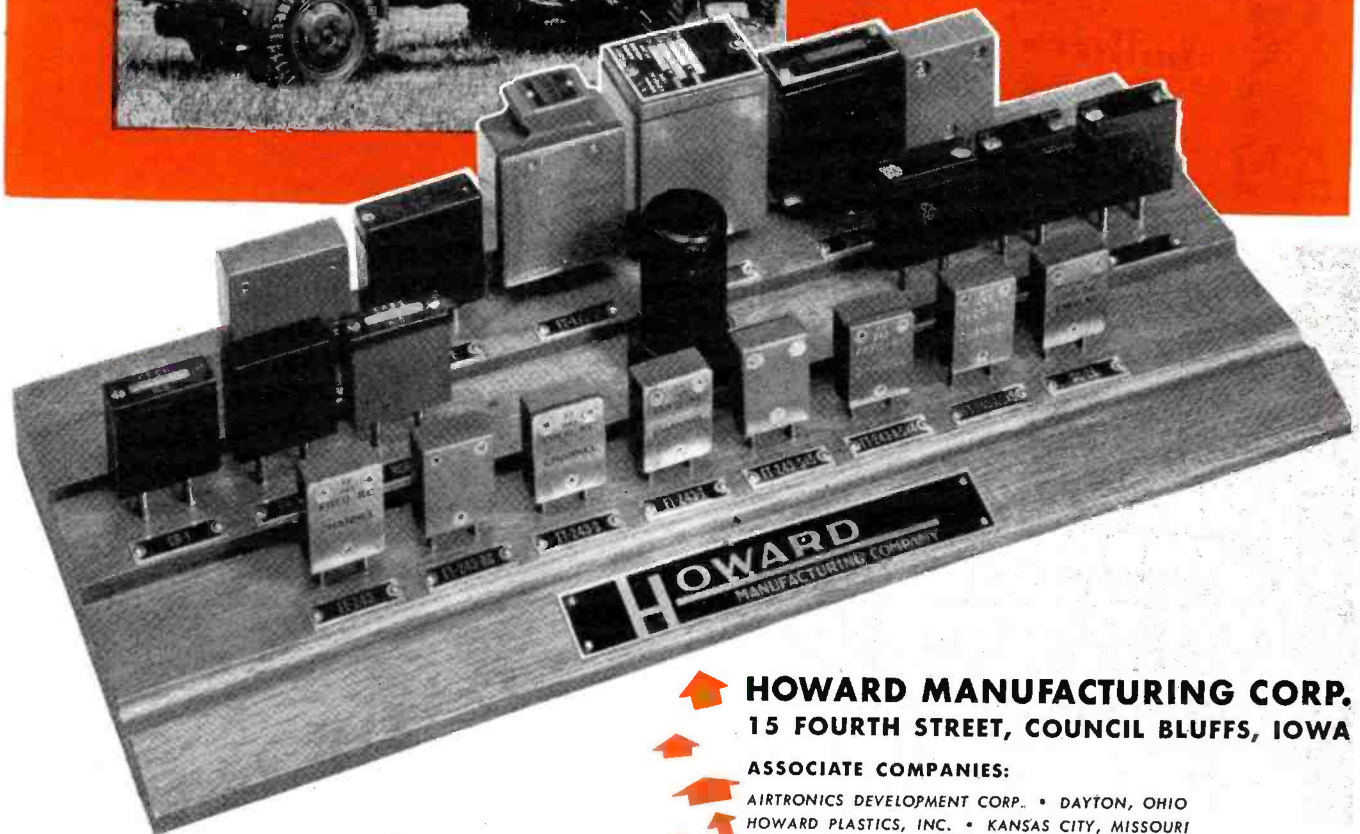
"The World's Largest Aids the World's Largest!"

Howard Manufacturing Company is the world's largest manufacturer of crystal holders, as is Hallicrafters the world's largest exclusive manufacturer of short wave radio equipment.

Today, Howard is manufacturing plastic electronic parts for the war effort and is supplying crystal holders, used in the Hallicrafters-built SCR-299 Communications Truck.

Tomorrow, Howard will be manufacturing parts for the great Peacetime Electronic Industry.



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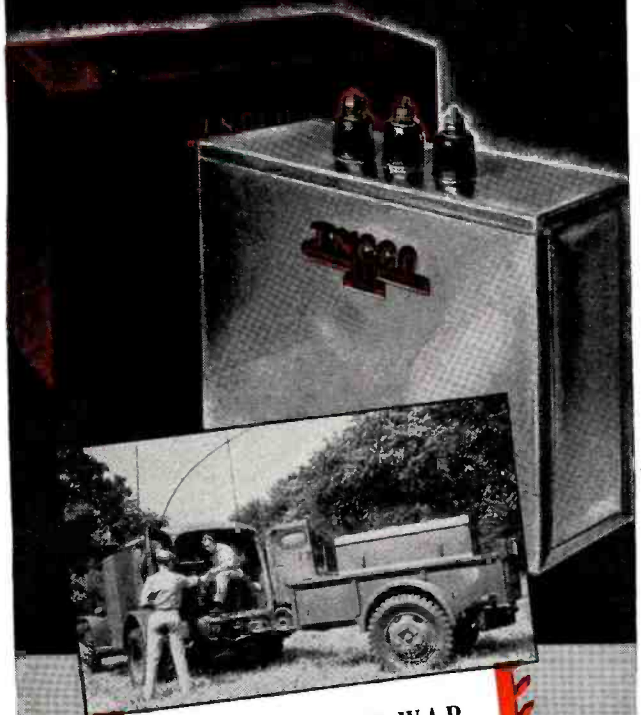

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For the Fighting SCR-299...

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By **DIALCO**

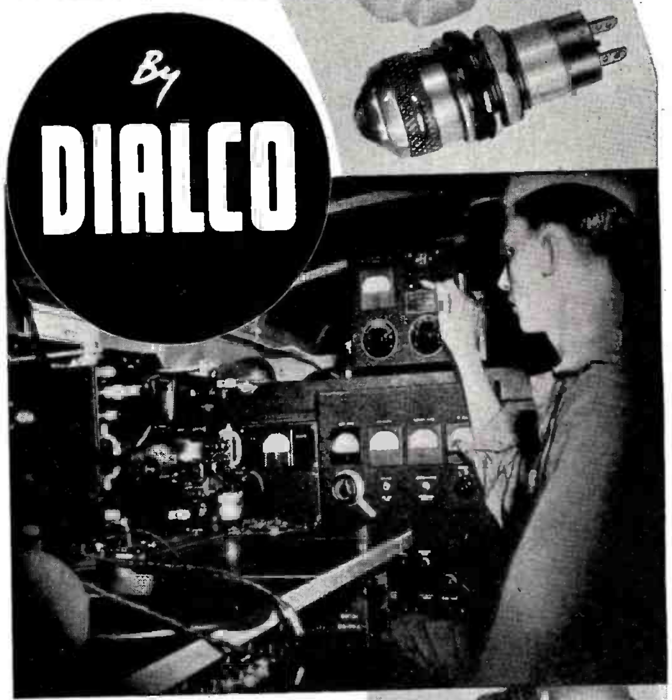


Photo courtesy U. S. Army Signal Corps

Here illustrated are a few of the types of Dialco Pilot Light Assemblies serving in Electrical-Electronic Apparatus in Planes, Tanks, Ships, etc.

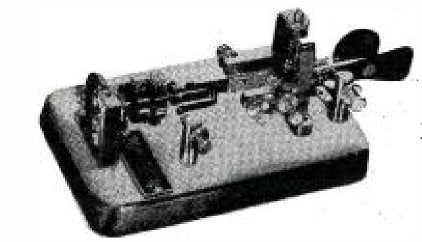
Exactly "what" and "how" may not be told. But Dialco quality and rapid-fire service are no secret . . . and it is a fact that, in the extensive Dialco line, were found the *ideal Pilot Light Assemblies to meet the exacting requirements of the Army's fighting SCR-299.*

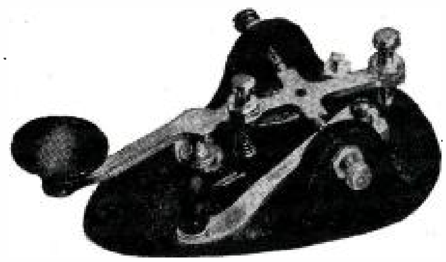
There's a Dialco Pilot Light Assembly for every known Electrical-Electronic application. Write us about your problem, and *request a copy of our 24-page catalog, now!*

DIAL LIGHT CO. OF AMERICA, Inc.

90 WEST STREET • NEW YORK (6), N. Y.

MANUFACTURERS OF RADIO TELEGRAPH APPARATUS DEVELOPED AND DESIGNED BY THE WORLD'S CHAMPION RADIO TELEGRAPHER





MS-700 MASTER OSCILLATONE

A very fine code Oscillator, encased in a beautiful bakelite cabinet.

Especially designed for individual or class code learning. Features incorporated are: Continuously variable volume control, tone adjustable from 500 to 1500 cycles; provisions for disconnecting or connecting the speaker when phones are used. Terminals are provided for head phones and any number up to 300 may be used by connecting the phones in parallel, with no other matching devices.

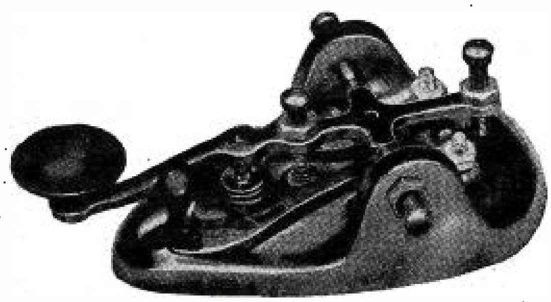
The head phone circuit is completely isolated from any direct current, permitting phones with exposed terminals to be used without danger of shock. Operates on 110 volts AC or DC current. Either a 117N7GT or 117P7GT is used.

MODEL CP800 DELUXE SPEED KEY

The finest commercial or amateur bug available. A masterpiece of mechanical craftsmanship and precision workmanship. The massive base is finished in a highly polished chrome, as well as all the metal parts of the super-structure and lever. The main and U-spring are of carefully selected blue spring steel, resulting in uniform performance in all keys. Contacts are 3/16" in diameter. This bug is fully adjustable to suit the particular feel of any operator. Equipped with connecting cord.

MODEL 200 HAND KEY

A professional telegraph key in performance and appearance, using 3/16 inch coin silver contacts. The scientifically designed key lever is balanced between two accurately machined bearing screws and the entire key is mounted on a black crackle finished metal base, equipped with a circuit closing switch.



MODEL CP-500 SPEED KEY

A professional Speed Key, designed by the world's champion telegrapher. This Bug was designed to conform with the United States Navy specifications. Finished in a battleship gray wrinkle enamel and polished chrome. It is a masterpiece of mechanical craftsmanship and precision workmanship.

Rhythmical Morse sending is a real pleasure with this key. The contact points are 3/16 inch silver, right and left arm tension springs, contact spacings and vibrating arm are all fully adjustable. Size 3¾x6¼x3¼.

MODEL 300 DELUXE HAND KEY

The ultimate in fine telegraph keys. Finished in polished chrome and nickel. Its sturdy, balanced construction gives a feeling of smooth effortless keying. Contacts are 3/16" in diameter, adjustable for tension, spacing and bearing position. Equipped with a circuit closing switch.

MS700-P CODE PRACTICE SET

An ideal practice set that is being used extensively by all branches of the armed forces for learning code and maintaining speed at inactive intervals. External connections are provided for additional keys and headphones. All of the features in the MS700 are incorporated in this unit.

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WE'RE HELPING HALLICRAFTERS

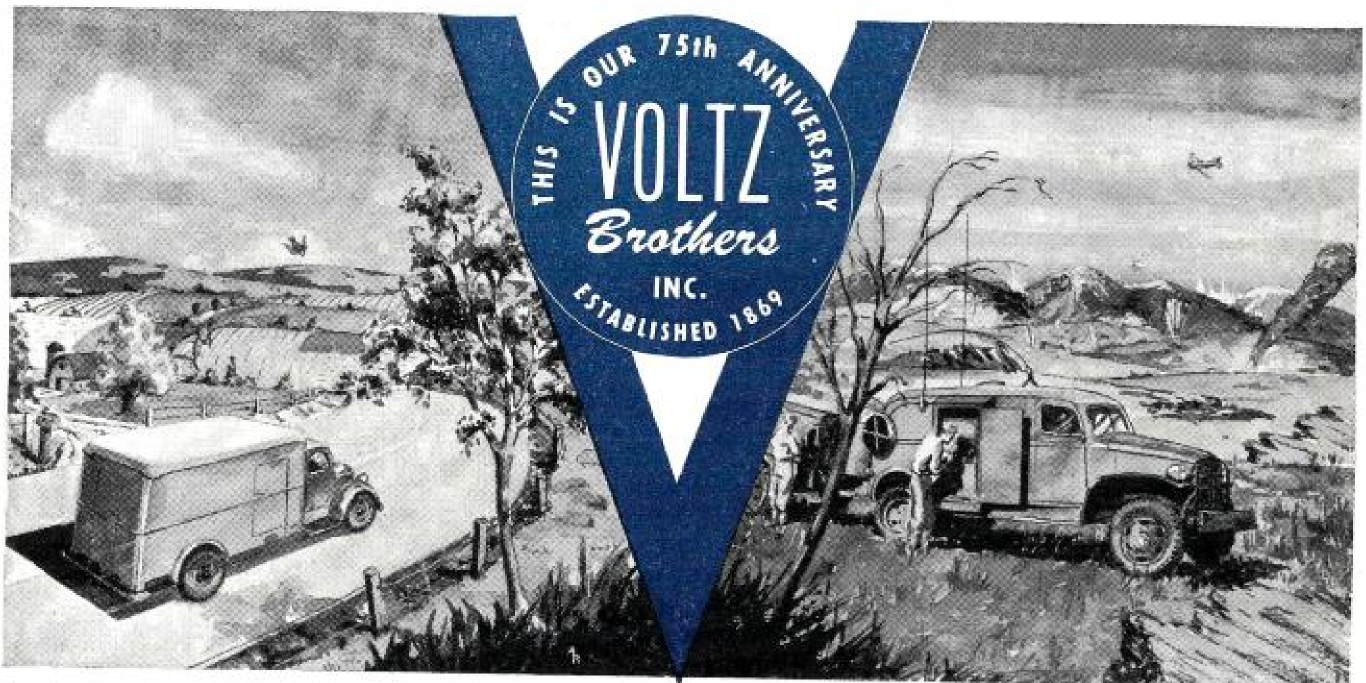
and proud of the privilege

Ours is a modest role in the supporting cast of a tremendous drama . . . *we're helping Hallicrafters to make communications history.*

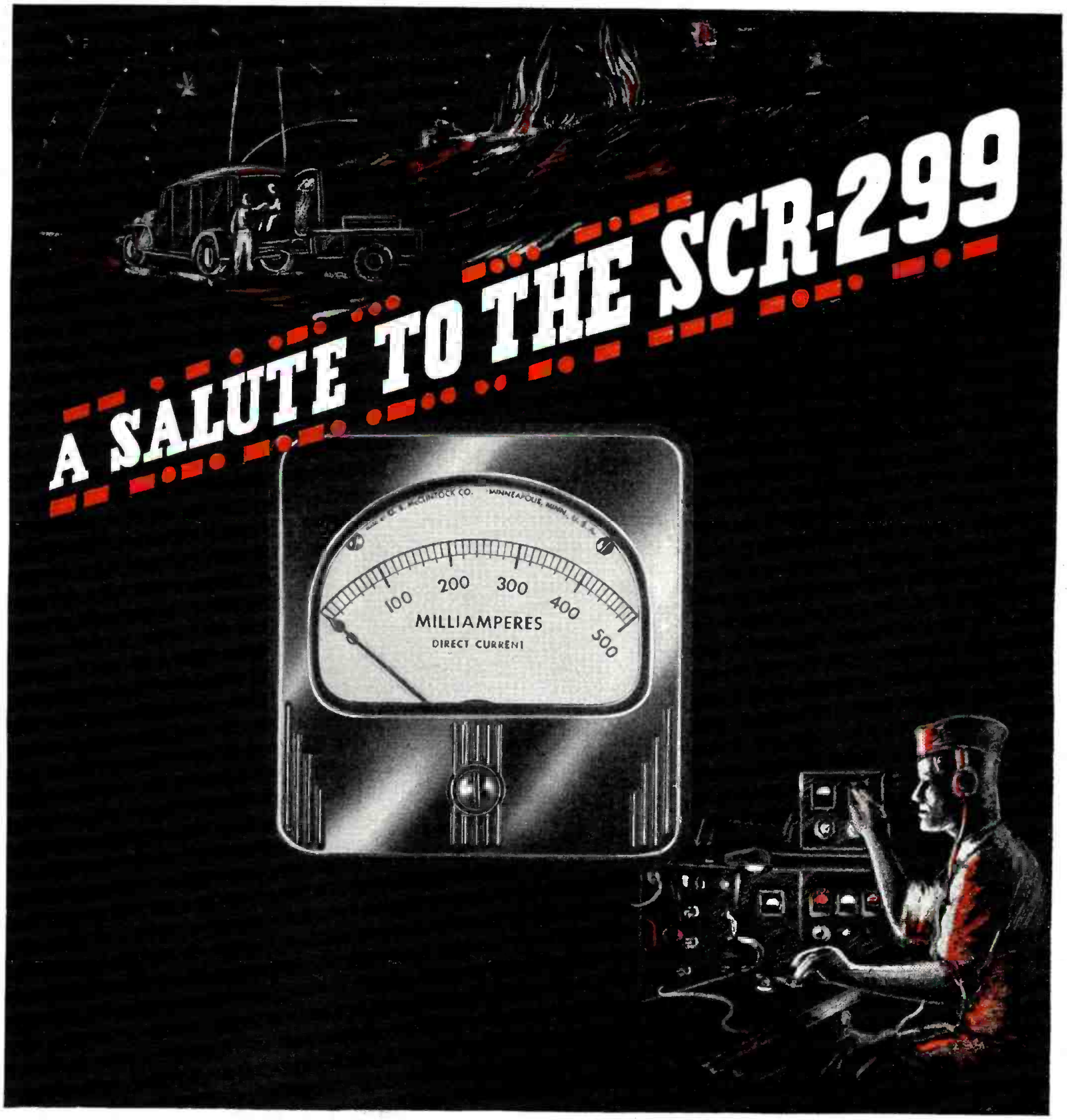
Our job in the creation of the SCR-299 includes the modification and preparation of the truck for the installation of the radio unit, the conditioning of the trailer for the installation of the power plant, and the fabrication of such accessories as chests, battery boxes, backboards, reel assemblies and carriers.

It may be a minor part, but in the production of so vital an instrument of war, *every* assignment is of critical importance. We are putting into ours everything we have in experience, energy, facilities and integrity.

This year we are observing our 75th anniversary. Before its close we hope also to celebrate the end of the war. Look to us then, with broadened experience and expanded facilities, not only to resume our service to pre-war customers, but to assist in the manufacture of post-war products. If any part of *your* post-war product calls for wood or steel fabrication, we would welcome the opportunity of discussing our facilities with you . . . *Voltz Bros., Inc., 215 E. 29th Street, Chicago 16, Ill.*



From fine custom-built truck bodies to cooperation in the creation of wartime mobile radio units was a logical step, quickly taken by Voltz Bros., Inc., after *Pearl Harbor*. When Pearl Harbor is avenged we plan, just as quickly, to resume and expand our service to civilian clients.


A SALUTE TO THE SCR-299
O. B. McCLINTOCK CO. MINNEAPOLIS, MINN., U.S.A.
100
200
300
400
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MILLIAMPERES
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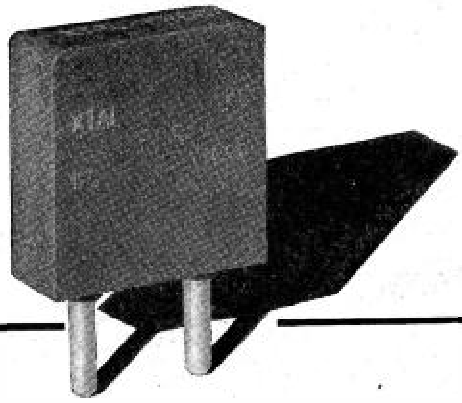
Ingenuity . . .



The Hallicrafters Company has repeatedly demonstrated its proficiency in the development of communications equipment for use in all fields. Past experience has paved the way to perfection in its every endeavor.

We, too, are drawing upon a vast reservoir of experience in meeting the exacting specifications and high standards of quality necessary for component parts of Hallicrafters equipment. We are ever watchful for possible improvement in design or method. Here is an example:

A major wartime crystal problem arose in the "plastic holder" which contains the oscillating blank. Soldered or bolted connections were insecure; solder flux melted at high temperature; impaired crystal operation; drill particles vibrated loose into the holder cavity; pin entries permitted leakage.

Our engineers saw these defects, refused to believe that new plastic molding techniques were impossible.

The result:
Henry developed a revolutionary new type holder. Pins, contact plates are now welded permanently together—molded as an integral part of the complete holder. This new holder is now available to the industry in a number of different types.

Thus, cleaner, sturdier, tighter crystal holders than any previously made are now being manufactured and satisfactorily used by our Armed Forces. Another apparently impossible task has been accomplished. Through war . . . into peace . . . look to Henry for the manufacture of Radio Equipment which will help you accomplish the seemingly impossible.

MEMBER OF WEST COAST ELECTRONICS MANUFACTURERS

HENRY *Manufacturing Company*

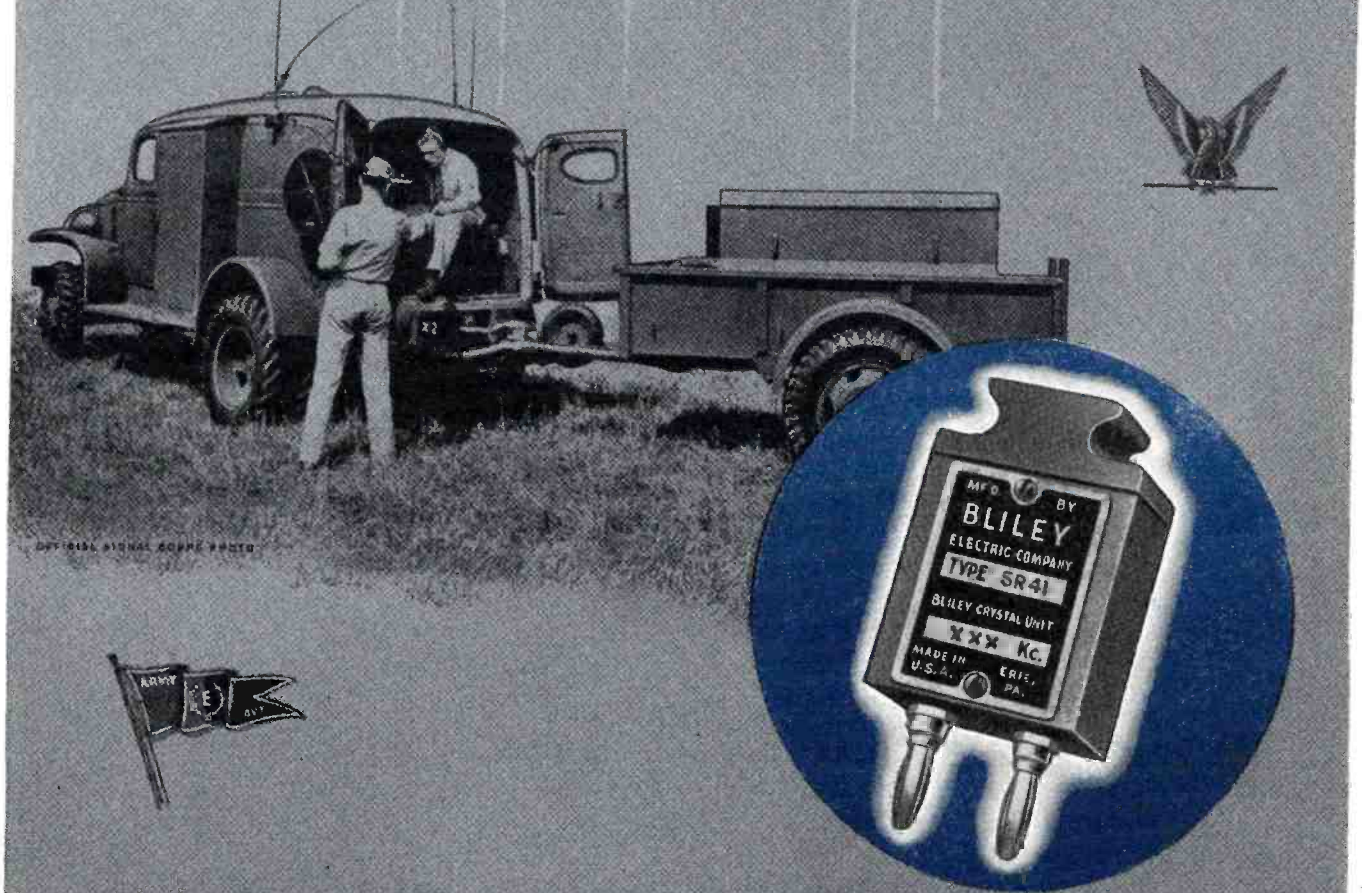
2213 WESTWOOD BOULEVARD • LOS ANGELES 25 • CALIFORNIA

MANUFACTURERS • ENGINEERS • PIEZO ELECTRIC QUARTZ CRYSTALS

BLILEY CRYSTALS
RIDE WITH THE SCR-299
Built by hallicrafters

ONE of the outstanding achievements in wartime radio transmitter design is the SCR-299. Serving equally well as a mobile or stationary radio station, this now famous equipment is doing a real job on our battle fronts.

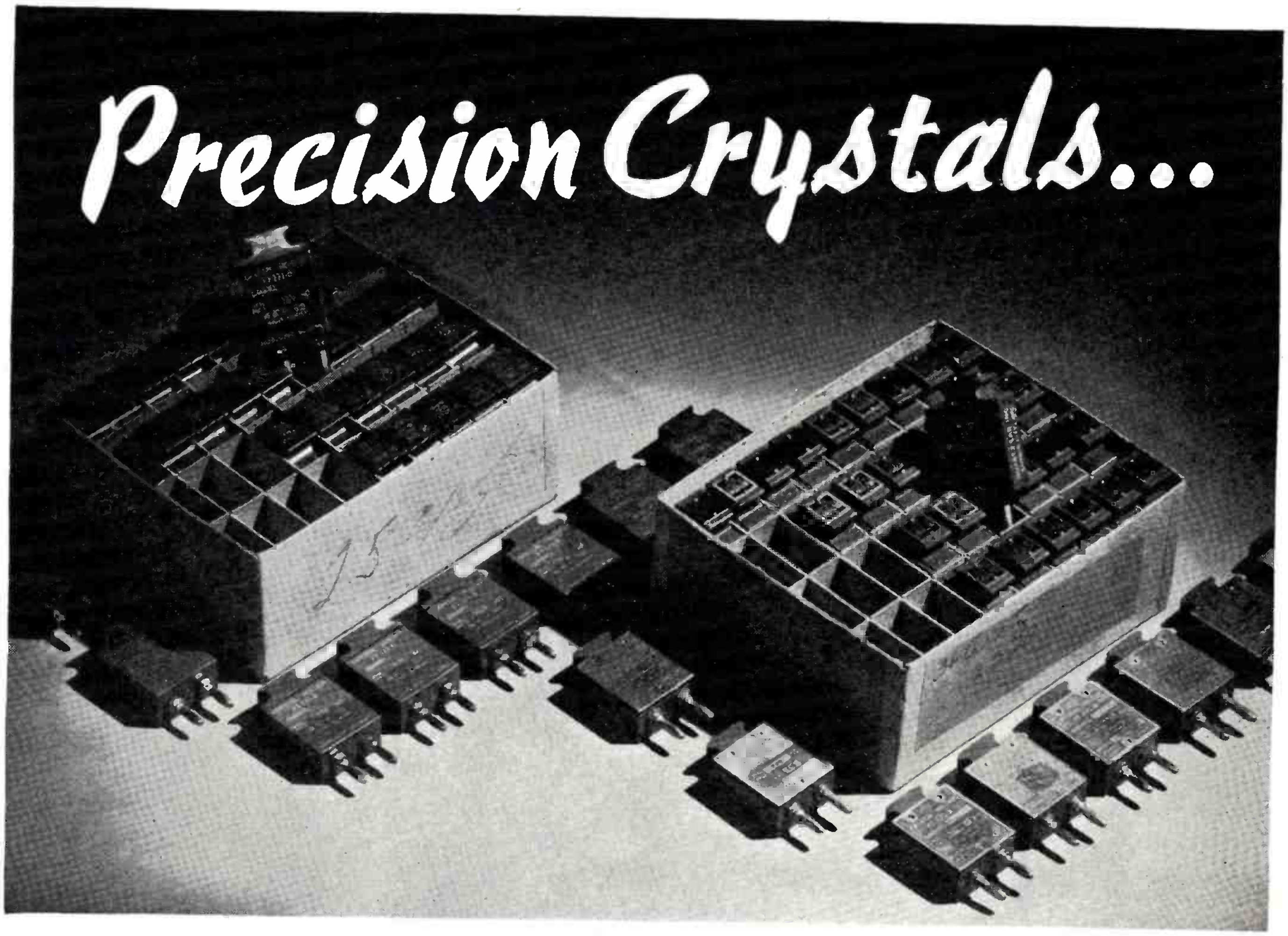
This war is run by radio. The vital importance of maintaining reliable communications necessitates the selection of quartz crystal units that are accurate and dependable. Bliley Crystals are engineered for service . . . they are used in all branches of military communications and are, of course, supplied for the SCR-299.



BLILEY ELECTRIC CO., ERIE, PA.

This high-powered Hallicrafters mobile transmitter, using RCA Tubes, was developed as a result of U.S. Signal Corps demand for a set that could stand "blitz" warfare.

Photo Courtesy U. S. Army Signal Corps



FOR AN EXACTING JOB!

Precision crystals for wartime uses must be *free* from electrical and optical flaws and must also be *free* from dust. Quartz Laboratories engineering methods and manufacturing procedure insures the most dependable products.

Continuous and indefinite operation, required of communications equipment, demands the highest quality component parts. Quartz Laboratories crystals are meeting the most rigid specifications of the Signal Corps as integral parts of the Hallicrafters-built SCR-299, 399, and 499. The crystals for the SCR-543 proposed especially difficult problems and Quartz Laboratories was able to solve them.

Quartz Laboratories is proud to have its products serving with the famous mobile communications units built by Hallicrafters.

QUARTZ LABORATORIES
1513 OAK STREET
KANSAS CITY 8, MISSOURI

DeKalb's Proudest Assignment
in 38 Years of Body Building

For 38 years, De Kalb has kept a step ahead of developments in automotive design and modern delivery needs. Our latest body designs, for your delivery needs, are again ahead of the times and will put you ahead of your competition.

De Kalb's earliest custom-built bodies were drawn by horses. Today, Mobile Radio Shelters built by De Kalb are fighting the "Four Horsemen" of War. Thirty-eight years of "know how" are behind every turn of a bolt on these Mobile Radio Shelters. If quick, economical delivery is part of your post-war distribution plan, that plan should include De Kalb-built Bodies. Our engineering department, now working on advanced body designs, can provide the perfect solution for your delivery problem. Let us know your future delivery needs and we will make expert recommendations without cost or obligation.

MILK DELIVERY BODIES MILK DELIVERY WAGONS
FREIGHT LINE VANS FURNITURE VANS
GRAIN BODIES BAKERY UNITS RERIGERATOR UNITS
STAKE TRUCK BODIES

BUILDERS OF BODIES FOR
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DEKALB
COMMERCIAL Body CORPORATION
OF DEKALB, ILLINOIS

FIGHTING COMPONENTS *for* FIGHTING EQUIPMENT

B & W COILS *and* ANTENNA TUNERS *for the Hallicrafters-built* SCR-299

In the vanguard of invasion, you'll find the SCR-299 Mobile Radio Unit built by Hallicrafters—and, in this famous unit, you'll find B & W's specialized facilities well represented.

Standard B & W Air Inductors with rugged, armor-type construction take competent care of all amplifier plate coil requirements. Not only is the complete Antenna Tuning Unit a product of the specialized B & W facilities for electronic equipment production, but B & W engineers collaborated closely with Hallicrafters on its design and construction details.

Proud of their part in the SCR-299, B & W engineers welcome similar assignments where the utmost in performance, ruggedness, and dependability are prime considerations.

B&W

AIR INDUCTORS • VARIABLE AIR CONDENSERS
ELECTRONIC EQUIPMENT ASSEMBLY

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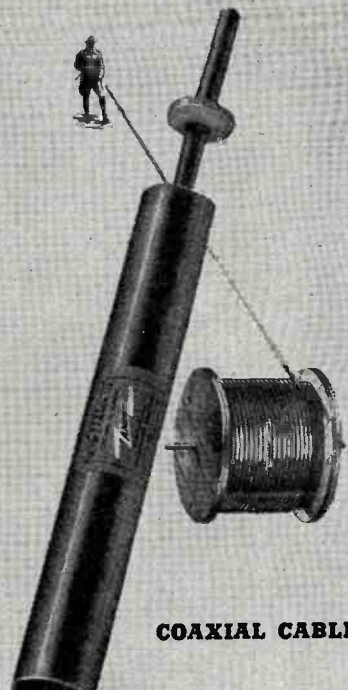


COAXIAL CABLES

ANDREW Coaxial Cables for the famous HALLICRAFTERS SCR-299

ANDREW Coaxial Cables are standard equipment on the Hallicrafters-built SCR-299: the mobile communications unit that is doing such an outstanding job on the fighting fronts. It is highly significant that ANDREW Coaxial Cables were chosen as a component of this superb communications unit.

The Andrew Company is a pioneer manufacturer of coaxial cables and accessories. The facilities of the Engineering Department are available to users of radio transmission equipment.

ANDREW
ANDREW CO.

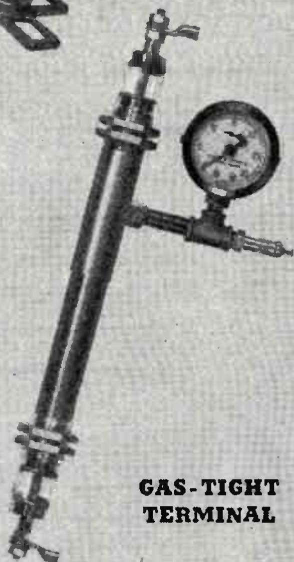
DRY AIR PUMP

COAXIAL CABLES. The Andrew Company is now able to supply standard 70 ohm 7/8" soft temper coaxial cable in lengths up to 4,000 feet! The cable is electrically identical to rigid cables of equal size, but has these extra advantages: the cable may be uncoiled and bent by hand, thus greatly simplifying installation; no connectors, junction boxes or expansion fittings need be installed in the field; thus a big saving is made in installation time and labor.

DRY AIR PUMP. This hand-operated pump quickly, efficiently and economically dehydrates the air inside coaxial cables, in addition to having a multitude of other applications. It dries about 170 cubic ft. of free air, reducing humidity from 60% to 10%.

GAS-TIGHT TERMINAL. The new Andrew glass insulated terminal is an outstanding development that provides a 100% air-tight, gas-tight system for gas filled coaxial cables. A special design that minimizes shunt capacity makes this terminal ideally suited to high frequency operation.

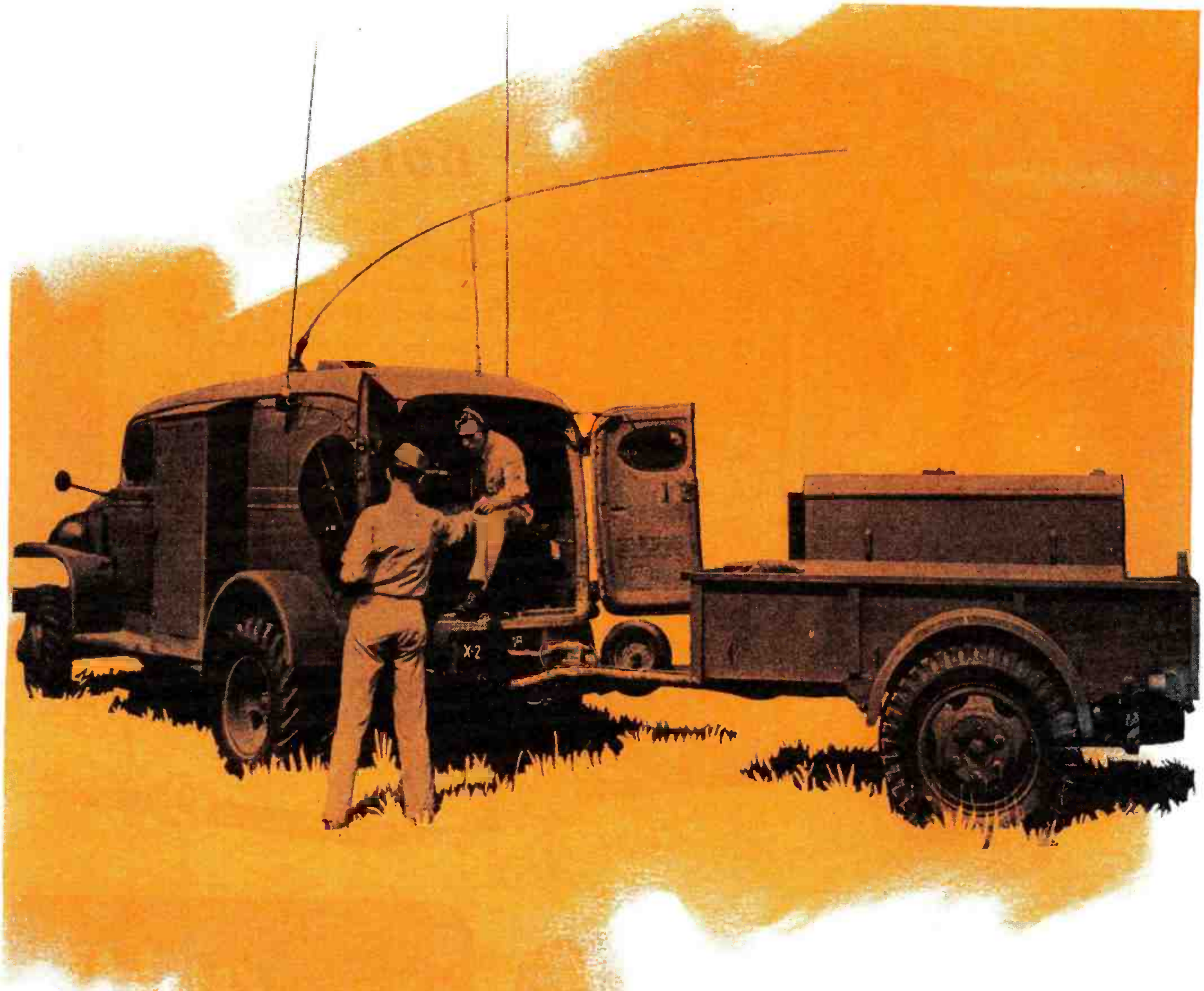
COAXIAL ANTENNA. Suitable for fixed station use and pretuned at the factory to the desired operating frequency, the Andrew type 899 vertical coaxial antenna provides an efficient, easy-to-install, and inexpensive half-wave radiator in the frequency range from 30 to 200 MC. Careful engineering has utilized to the utmost the well known advantages of the coaxial antenna over other types of vertical half-wave antennas.

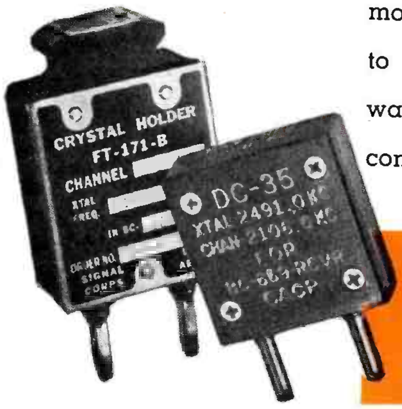


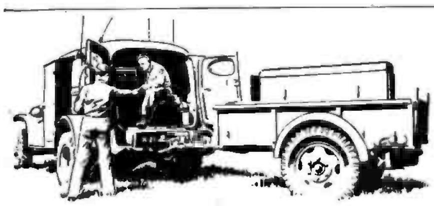
GAS-TIGHT TERMINAL

CATALOG DESCRIBING COAXIAL CABLES AND ACCESSORIES FREE ON REQUEST.
WRITE FOR INFORMATION ON ANTENNAS AND TUNING AND PHASING EQUIPMENT.

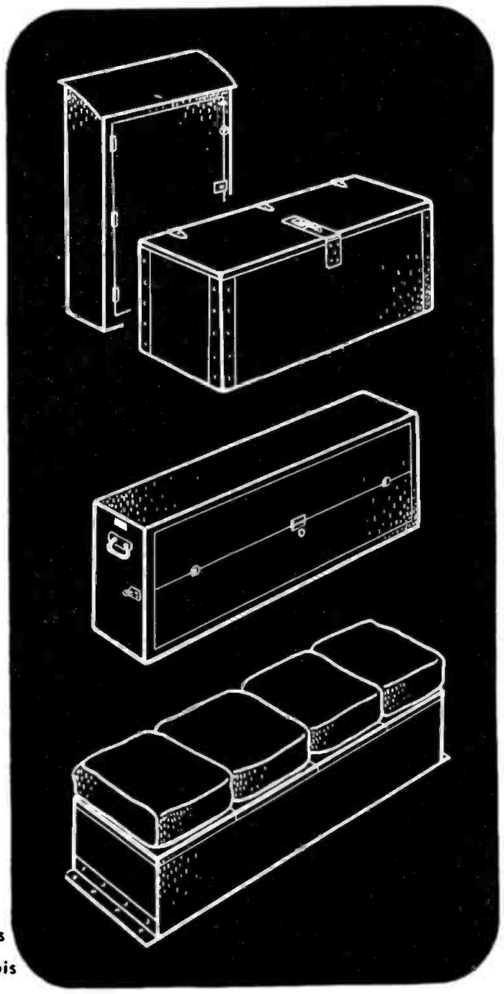
THE ANDREW COMPANY • 363 EAST 75TH STREET • CHICAGO 19, ILLINOIS




CRYSTAL HOLDER
FT-171-B
CHANNEL
DC-35



H. C. EVANS
Contributes too!



EVANS is happy to salute the Hallicrafters-built SCR-299 high-powered mobile communications truck . . . and proud to manufacture for this unit several necessary accessories, among which are: Wall cabinets, tool chests, seat benches, and cabinets for the exterior of the truck. . . . Communication lines must be open under any circumstances if VICTORY is to be won in any battle . . . **the SCR-299 Is Doing the Job!**

EVAN'S SHOCKPROOF RELAY

Has been subjected to complete tests, including vibration tests by Aircraft Radio Laboratory.

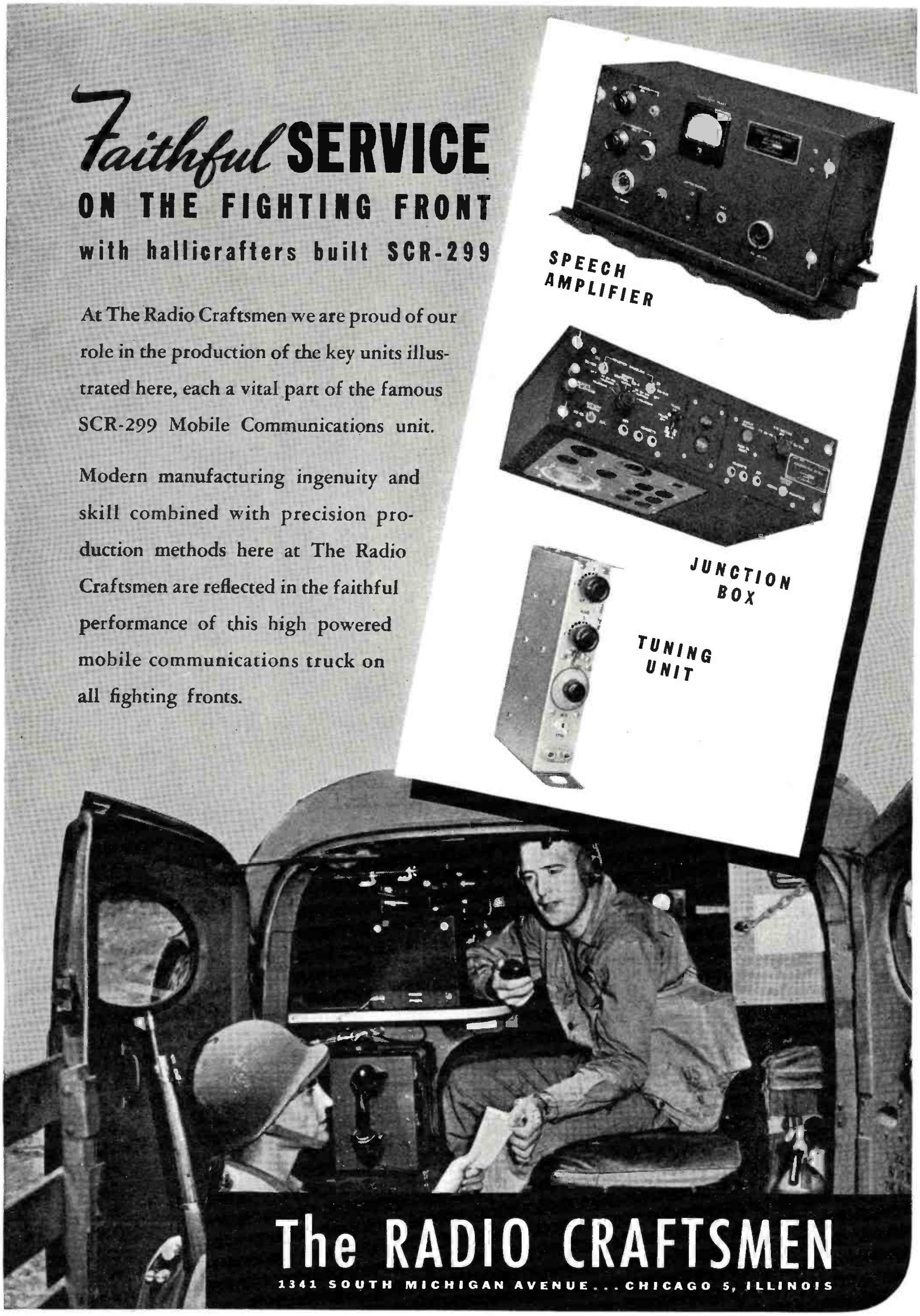
★

1⅝ INCHES WIDE
2¾ INCHES LONG
1½ INCHES HIGH
WEIGHT — 7 OUNCES
SINGLE OR DOUBLE POLE
WOUND TO SPECIFICATIONS

INQUIRIES INVITED

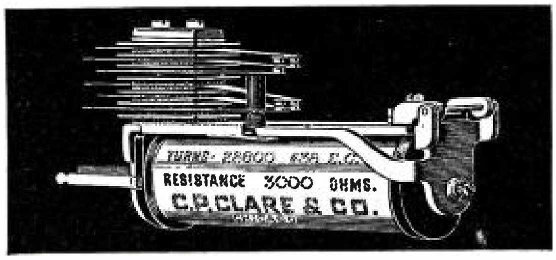
H. C. EVANS & CO.

1520-30 W. Adams
Chicago 7, Illinois


Faithful SERVICE
ON THE FIGHTING FRONT
with hallicrafters built SCR-299
At The Radio Craftsmen we are proud of our role in the production of the key units illustrated here, each a vital part of the famous SCR-299 Mobile Communications unit.
Modern manufacturing ingenuity and skill combined with precision production methods here at The Radio Craftsmen are reflected in the faithful performance of this high powered mobile communications truck on all fighting fronts.
SPEECH AMPLIFIER
JUNCTION BOX
TUNING UNIT
The RADIO CRAFTSMEN
1341 SOUTH MICHIGAN AVENUE . . . CHICAGO 5, ILLINOIS

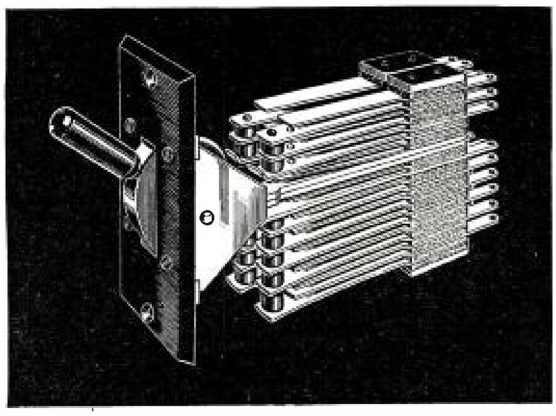

GTC
IMPORTANT
TO SCR-299 . . .
• • AND OTHER WAR COMMUNICATIONS AND ELECTRONIC EQUIPMENT • •
G.T.C. TRANSFORMERS
G.T.C. ASSEMBLIES
Including
POWER PACKS
SPEECH AMPLIFIERS
RECTIFIERS
BUILT TO THE RIGID SPECIFICATIONS OF THE SIGNAL CORPS; AIR CORPS; THE NAVY
GENERAL
TRANSFORMER CORPORATION
1250 W. VAN BUREN ST., CHICAGO, ILL.


When the going gets tough
PRODUCTS OF "MERIT"
are up in front with the SCR 299—"taking plenty"
. . . . where victory often depends on maintained communications and, as component parts of this famous mobile unit built by Hallicrafters, demonstrating conclusively the value of long-experienced precision workmanship in fulfilling every requirement of the most exacting military specifications.
Manufacturers of Special Transformers—Coils—Reactors—Electrical Windings of All Types for the Radio Trade and other Electronic Applications.
Since 1924
MERIT COIL & TRANSFORMER CORP.
311 NORTH DESPLAINES ST.
CHICAGO 6, U. S. A.

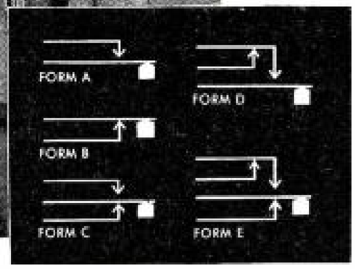


(*Above*) Clare Type "C" Relay.

(*Below*) Clare Type "G" Lever Switch with Bakelite escutcheon and lever key handle of catalin.



Operator of transmitter in SCR-299 mobile unit shown with hand on Clare Type G Lever Switch key.



Spring assemblies may include any combination of the five basic forms illustrated.

CLARE Relays and Lever Switches Are Vital Parts of Army's Front Line Radios

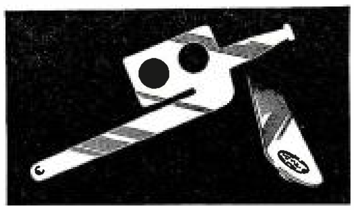
RUGGED design of Clare Type "C" Relays and Clare Type "G" Lever Switches made them natural components of the Hallicrafter's 450 Watt Transmitter with which the Signal Corps maintains communications in battle areas. Their small, compact size and innumerable contact arrangements allow them to fit snugly into the space-saving designs called for in the SCR-299 mobile intercommunication unit.

The Clare Type "C" Relay is a multiple contact relay particularly adapted for use in radio communication—as well as in electronic control devices, sequence control or interlocking operations.

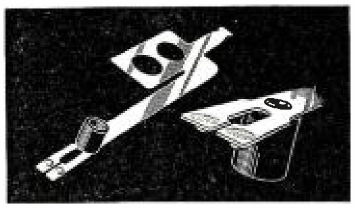
The Clare Type "G" Lever Switch offers the same versatility of contact arrangements. The cam assembly is unique in that stops may be provided, added or removed to change the switch from locking to non-locking, or vice versa . . . from one-way to two-way or the reverse.

These features, plus the fact that all Clare Relays and Lever Switches are carefully designed, well manufactured from the best available materials, and precisely adjusted, assure you that Clare products will reduce your overall relay cost, simplify your designing problem and assure better and more dependable performance.

Clare engineers are ready at all times to assist in developing a relay specifically "custom-built" to meet your requirements. Send us a "blueprint" of your problem for our suggestions. Also, send for the Clare catalog and data book. C. P. Clare & Company, 4719 West Sunnyside Ave., Chicago (30), Illinois.



Contacts can be provided in twelve different standard—or special—types and sizes. These are welded to the nickel silver springs by a special process. Contacts are made from precious metals or alloys, such as silver, palladium, palladium-iridium, tungsten and elkonium. Sizes may be from .062" silver, rated at 1 ampere, 50 watts, to .1875" tungsten, rated at 4 amperes, 500 watts. Various types can be incorporated in one assembly.



Spring bushing insulators are made of Bakelite rod under a patented process. These strong, hard, long wearing bushings are essential where heavy contact pressures are employed, where vibration exists or heavy duty service is desired.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

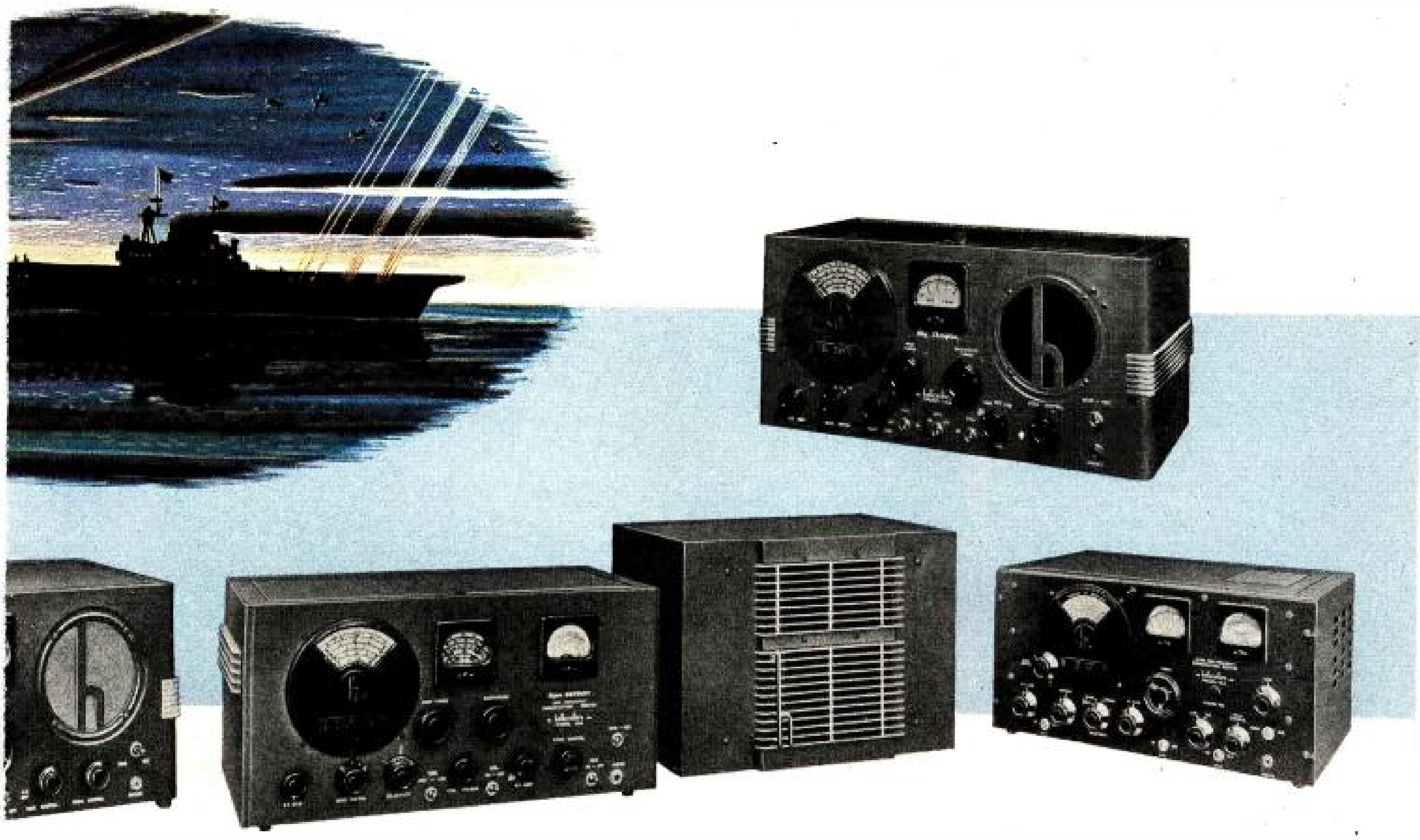

HALLICRAFTERS WAS READY!
Under the abnormal climatic and operating conditions of war, the Signal Corps SCR-299 communications truck, built by Hallicrafters, is providing peak performance for the Allied armed forces, fighting throughout the world.
Hallicrafters peacetime communications equipment is meeting the wartime qualifications and demands of the Military!
Just as Hallicrafters Communications receivers are meeting the demands of war Today—they shall again deliver outstanding reception for the Peace—Tomorrow!
hallicrafters
BUY MORE BONDS
World's largest exclusive manufacturer of short wave radio communications equipment...First exclusive radio manufacturer to win the Army-Navy Production Award for the third time.

These

hallicrafters

Receivers Went to War!

THE amateur fraternity is proud that Hallicrafters equipment—*built to amateur requirements*—meets the exacting wartime qualifications and demands of military service in each United Nation. The Hallicrafters label has become an old friend to fighting men on land and sea, on all the world battle fronts.



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A. N. WILLIAMS PRESIDENT — NEWCOMB CARLTON CHAIRMAN OF THE BOARD — J. C. WILLEVER FIRST VICE-PRESIDENT

1223

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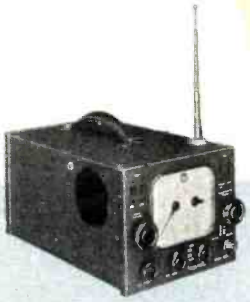
TO THE MEN AND WOMEN OF HALLICRAFTER CO INC=

YOUR SX28 RECEIVER ON THE "USSS ENTERPRISE" RECEIVED CONSTANT USE DURING THIS FAMOUS CARRIERS EXTENSIVE ACTIONS AGAINST THE JAPS IN THE SOUTH PACIFIC. TUNED TO RECEIVE MESSAGES FROM HER PLANES ON MISSION AND FROM FIGHTER PLANES PATROLLING THE FLEET YOUR RECEIVER EFFICIENTLY KEPT THE "ENTERPRISE" INFORMED OF THEIR ACTIVITIES. THIS INFORMATION WAS USUALLY TRANSLATED INTO ACTION AGAINST THE JAPS - TO THEIR SUBSEQUENT SORROW AS THE "ENTERPRISES" RECORD OF 185 PLANES DESTROYED 27 SHIPS SUNK AND 16 DAMAGED WILL ATTEST=

=E L COCHRANE
REAR ADMIRAL USN
CHIEF OF THE BUREAU OF SHIPS.

...CIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE



William B. Ziff

Foreword

MODERN war is a tremendous and complex business. In a phenomenon of such power and pyrotechnic display we are apt to lose sight of the vast, smooth-working machine by which it is efficiently waged.

It is axiomatic that the struggling soldier loses sight of the battle in the excitement of individual combat; the craftsman is apt to see only the condensers he is assembling rather than the huge installations for which they are intended. So do all of us have difficulty in grasping the immense shape of the total war-making machine of which we are a part. It is the old story of the three blind men and the elephant. The one who felt the trunk described it as an animal built like a tree; the one who patted its side thought of it as built like a door; and the one who grabbed the tail said it resembled a snake.

It could hardly be otherwise. With its unending complexity of detail the complete canvas of World War II is too enormous for the range of human vision. Even a single major segment of the picture such as the U. S. Army Signal Corps, appears in proportions so huge as to practically defy comprehension.

Today, entering the third year of the deadliest war in history, the Signal Corps has grown to an amazing institution, a living testimonial to the genius and know-how of the greatest industrial people on earth.

Behind this prosaic simple name, Signal Corps, is everything which goes to make industrial achievement, courage, determination, organization, and the will to win.

The Signal Corps is all of these things: It is a sweating soldier pounding a radio key in a truck jogging over bomb pits or careening crazily under the concussion of shells. It is a cripple grinding crystals, and a woman at a drafting board, or a kid winding motor armatures. It is all of these multiplied by a thousand times and augmented by many thousands more.

It is smoking, deadly combat, and throbbing industry; it is the thick of the fighting in every theater of action; it is farmers, miners and workers; it is the very essence of big business; all coordinated under the symbol of the torch and crossed signal flags.

Thus it is that to conceive the Army Signal Corps as it actually exists—the biggest communications industry of all time, purchaser of billions of dollars worth of equipment, and ruler of a complex radio, telephone and telegraph network spread like a giant web over the entire face of the globe—taxes the imagination.

It is doubtful whether the Chief Signal Officer himself, though his guiding fingers touch every activity of the Corps, can ever pause amidst its incessant demands to realize the extent of his charge.

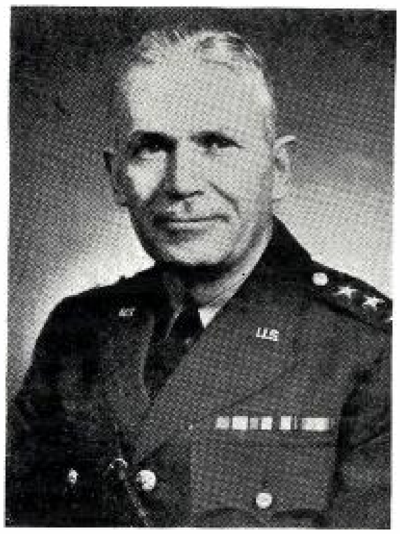
In the pages which follow is given the story of the Army Signal Corps at War, as it exists today. For those myriads of workers, executives and administrators who function in relation to this great institution, it fills an important need. It enables them to visualize the great changes which have taken place in its powerful, smoothly-moving organization. They see, in this graphic though matter-of-fact account, the vital relation of the Signal Corps to the total war machine, its heroic accomplishments in combat, as well as its scientific wizardry and industrial magnitude

In presenting the story of the Army Signal Corps at War, we do so with the warm pride and reverence of Americans who are privileged to see a preview of one of this country's greatest institutions.

To General H. C. Ingles, to Colonel C. J. McIntyre, and to the other officers and enlisted men of the Army Signal Corps whose generous cooperation has made this report to the nation possible, we make grateful acknowledgement.

William B. Ziff

Publisher, RADIO NEWS



Lt. Gen. Brehon Somervell

Introduction

FORCES of the United Nations in recent months have won encouraging victories, but not Victory.

Without the swift and accurate communications system provided by the Signal Corps of the Army, these successes could not have been achieved.

Lacking the endless stream of equipment pouring from our production lines, the Signal Corps could not have maintained these all-important lines of communication.

Victory lies ahead. So does the hardest fighting. So, too, does the most stupendous demand ever made upon the resources of this or any other nation.

Utilizing the product of the untiring effort of the communications industry, the Signal Corps will never fail to "get the message through."

Such teamwork between our fighting forces and the free enterprise and free labor of a free people will hasten the day when our victories will be consummated with Victory.

Commanding General, Army Service Forces

Presenting—

The Chief Signal Officer:

Maj. Gen. HARRY C. INGLES

TO MEET the primary responsibility of the Signal Corps of the Army Service Forces, as the major communications agency for the Army, for military Signal communications; to develop, procure, store, issue, and repair that equipment and supplies in such quantities and at such times as are required to meet the Army supply program and to install and operate much of this equipment—is the mission of Major General Harry C. Ingles, Chief Signal Officer.

Born on a Nebraska farm, March 12, 1888, and educated in country schools, Harry Ingles attended the University of Nebraska, Electrical Engineering, 1906-1909; entered United States Military Academy, West Point, 1910, graduating with B.S. degree in 1914; commissioned 2nd Lieutenant of Infantry, June, 1914; served at various stations with the 14th Infantry along the Mexican Border until May, 1917; detailed in the Signal Corps in July, 1917, serving for several months with the 2nd Telegraph Battalion; transferred to assignment as instructor in Signal Corps Officers' Training Camp, July, 1917. Later placed in charge of Signal Officers training and spent the remainder of World War I in charge of training of Signal Corps Officer Candidates. After World War I served on various Signal Corps assignments including command of Signal Corps ROTC unit, University of Minnesota; Signal Officer, Philippine Division; Director of the Signal Corps School; Instructor in Signal Communication, Command and General Staff School; Command of 51st Signal Battalion; Signal Officer, Third Army; and Signal Officer, Caribbean Defense Command. Served on the War Department General Staff, 1935-1939. Promoted from Lieutenant Colonel to Brigadier General, April, 1941. Chief of Staff, Caribbean Defense Command, March, 1942-January, 1943. Promoted to Major General, December, 1942. Commanded the Mobile Forces in Panama. Deputy Commander, European Theater of Operations, from the late winter to late spring of 1943. General Ingles was made Chief Signal Officer July 1, 1943. Military education: Graduate Signal Corps School, 1920. Distinguished Graduate, Command and General Staff School, 1927. Graduate Army War College, 1932. General Ingles is a member of the Beta Theta Pi fraternity. He married Grace Murray Salisbury of Lincoln, Nebraska, December, 1914. They have three children—Martha, now married to Major John R. Schrader; Mary, now working with the American Red Cross; and John, now in the Army.

It is a genuine privilege to present our Chief Signal Officer to the thousands of readers of this important issue. It has been my good fortune to have spent many hours with him, learning of the many problems encountered by his office and observing the efficient manner with which he and his command are solving those problems. He has the deepest admiration for those who are bending their efforts to hasten the day of Victory. Brilliant and modest—beloved by both his men and the business men with whom he works—General Ingles has won our deepest respect. He is "getting the job done"!

Oliver Read

Managing Editor, RADIO NEWS

Maj. Gen. Harry C. Ingles

A MESSAGE

From the Chief Signal Officer

ON BEHALF of all military members of the Signal Corps I take this opportunity to thank all civilians, whether employed in the Signal Corps or in the plants throughout the country where signal equipment is manufactured, for their splendid aid in helping to supply our Army with the world's finest in military communications equipment. Whatever successes have been achieved by our hard-fighting soldiers in every branch of the service, were due to their faith in the civilian workers on the home front, and the knowledge that through your efforts they would be furnished the necessary implements of war.

Your work here at home—whether it is supervisory, technical, on the production line, or clerical—plays an important part in the successful prosecution of a campaign. In battle, our combat forces are able to advance because of the coordinated action of all units involved. This coordination is made possible through the use of signal equipment—electronic, telephone, and telegraph—which civilians build. The Signal Corps supplies this equipment to the units of our Army now fighting in every quarter of the globe.

Our fighting men will win this war for us if we give them the equipment. Front line soldiers depend on you to discharge this trust. You have done a magnificent job thus far, but there must be no letdown in your efforts. Victory can be hastened by your continued support. I am confident that you will do your best for the finest fighting force in the world—the United States Army!

H. C. Ingles

Chief Signal Officer, U. S. Army

☆ ORGANIZATION ☆

Without a smoothly-working organization, the Signal Corps could not function at its present highly-effective pace.

Major Gen. JAMES A. CODE, Jr.

Born in California in 1893. Graduated from the U. S. Military Academy in 1917. First service was with the Artillery, as Major (temporary) in 1918, reverting to permanent rank of Captain in 1920. Promoted to Major in 1932; to Lieut. Col. in 1940; Colonel in 1941; Brig. General, 1942; and at present is Major General. Transferred to the Signal Corps in 1923, has held numerous posts, including duty at Manila, and in the Panama Canal Zone. Assigned to the Office of the Chief Signal Officer in 1941. In July, 1942 he became Assistant Chief Signal Officer.

NEVER in the history of man has there existed a communications responsibility of the size and magnitude which confronts the Signal Corps today. Just like the coursing of blood through our veins, the work of the Signal Corps in war is unending until final peace.

To accomplish its mission and to effectively provide the stewardship necessary to assure thrift, economy, and efficiency of performance with Public Funds, organization is necessary. A plan of organization is essential to harness individual energy to a team; to facilitate and expedite the direction, coordination and control of an enterprise, for it is the machine upon which management progresses. The organization plan of the Signal Corps has several simple objectives:

a. To provide that every function included in the mission is assigned to a unit of the organization.

b. That each unit's responsibility is specific and not duplicated.

c. That commensurate authority is coupled with responsibility.

d. That channels of command are definite and unbroken.

e. That staff and command responsibility are understood and not violated.

f. That the entire endeavor is logically subdivided into its inseparable components.

g. That the delegation of authority and decision is decentralized to the lowest practical operating level.

h. That provision is made for proper policy determinations, long-range planning, and over-all control.

i. That organizational structures, systems, and procedures do not become elaborate.

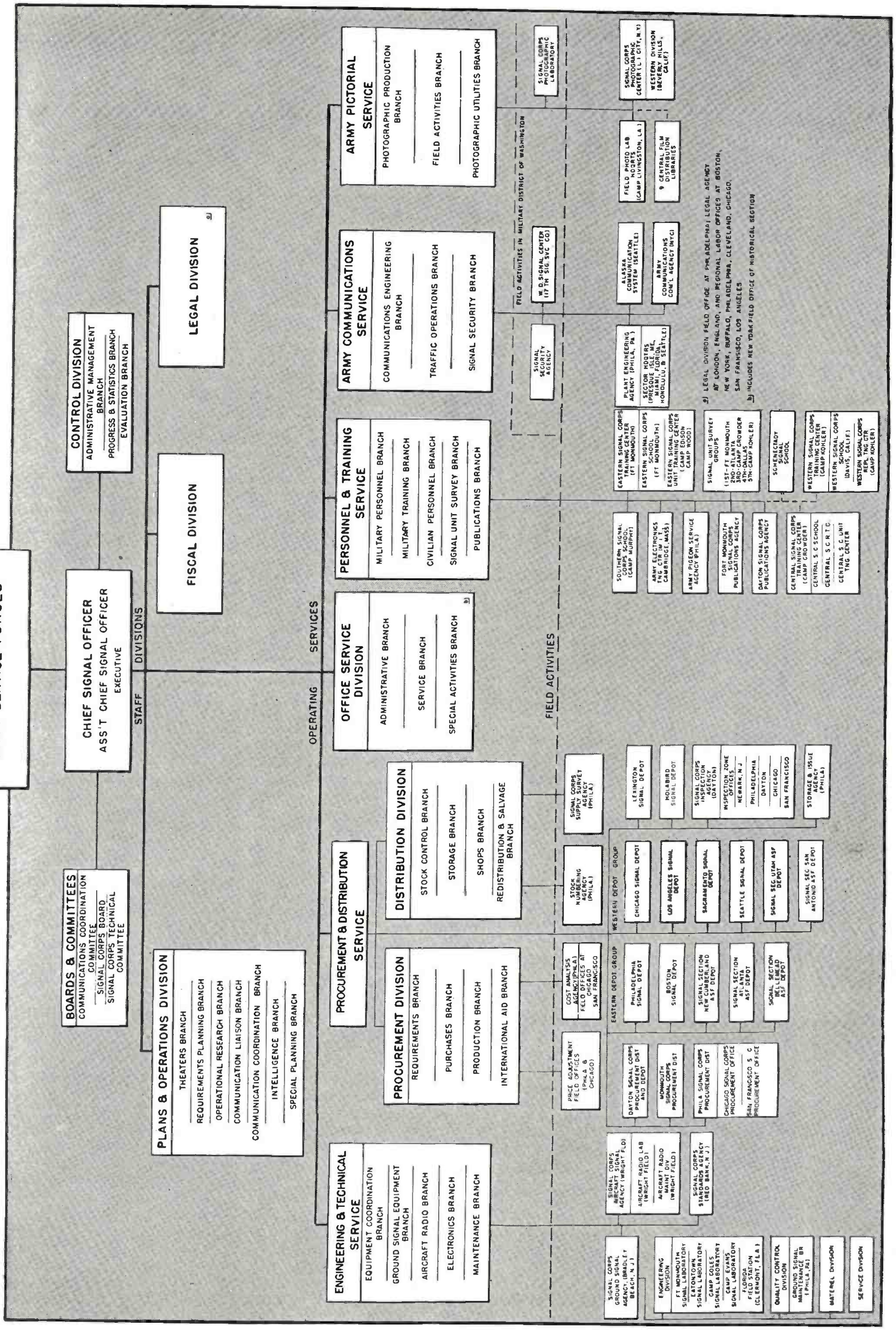
It was particularly fortunate that the Signal Corps organization did not "evolve" under changes and additions to meet expediency, but was permitted by the bomb bursting of war to be erected as a cohesive, organizational structure along one architectural basis devoid of a conglomeration of outworn assemblages.

Signal communications have not only kept pace with modern war, they have leaped ahead at a speed of light. That fact alone requires an organization receptive to the lessons of the past for use of the present and one ever alive to the requirements of the future.

To meet the problem demands aggressive leadership, planning and direction in an unbroken chain from the top down; initiative and pressure consistently and wisely applied to eliminate unnecessary functions, activities, personnel, or layering. It consists of devising a working mass where each is busy, knowing his job and to whom he reports. It requires the recognition of good work. the realization of interest, and confidence by superiors. While the chain of command must start at the top and the policies must so conform and run through the entire structure that delegation of authority will be alway unequivocal and complete, nothing must prevent the presentation of suggestions. There can be no substitute for individual initiative, resourcefulness, and energy to get the job done.

Civil Service employees working in a government secretarial office. Washington, D. C.

Organization Chart of the U. S. Army Signal Corps



Veteran of World War I and wife brush up on their code.

While management must be ahead of its organization and provide personal aggressive leadership, a chain is ineffective when it becomes isolated links. It is for that reason that the whole, while remaining flexible, must be welded into one smooth operational function looking upward for instruction and guidance to rivet together a machine for perfect precision and a unified marriage of efforts.

Organization is often a misinterpreted and misunderstood word and is not synonymous with chart or drawing. It means "that which is organized," which means men; men who can devise as well as procure; men who can train as well as use; men who maintain as well as repair; men who combine vision with drive.

Organization is the channel through which the activities of such men flow. It is the reins which direct this energy toward a concrete dynamic result. The mission of the Office of the Chief Signal Officer is to provide the channels by which command may command. Organization is the means to accomplish this mission. Yet an organization is really in existence only when all of those to be affected understand it. It must be as familiar to the outsider who has dealings with it as it is to its members. All must know whom to contact and the relationships between organizational members. The simplest way to do this is to document the plan of procedure; but think of organization not as a paper plan but as the written disclosure of a beehive of coordinated human energy, all acting toward the accomplishment of a common objective.

Signal Corps

The present Signal Corps organization consists of the Office of the Chief Signal Officer in Washington, D. C. from which staff supervision is exercised over all the activities and functions of the Corps; the office comprises an Assistant Chief Signal Officer; a Control Division; several boards and committees; three staff divisions; five operating services, and an Office Service Division.

Assistant Chief Signal Officer

The Assistant Chief Signal Officer represents the Chief Signal Officer during his absence. He acts for the Chief Signal Officer as his principal coordinator in a capacity comparable to that of a Chief of Staff. The Assistant Chief Signal Officer directs the continuous study of anticipated future developments, and contingencies, and the preparation of over-all operating plans.

He is assisted by executives who insure that all instructions published are in accord with the policies and plans of the Chief Signal Officer and directives from higher authority. It is within this office that assignments and reassigments of officers to duty in Services, Divisions and Branches of the Office of the Chief Signal Officer, and to committees, boards, and other duty are made.

Control Division

Directly responsible to the Chief Signal Officer is the Control Division. This agency studies and evaluates the functions, organization, administration, methods, procedures, and operations of all activities under control of the Chief Signal Officer, both within his office and in the field.

Although Control Divisions were subsequently established in all supply services in accordance with the example and wishes of the Commanding General, Army Service Forces, the first organization of this character known to exist was established by the Chief Signal Officer in the late summer of 1941, as the Executive Control Division.

The Control Division assists in planning and developing the organization structure to cope with the increasing responsibilities. It reviews and audits all reports of the organization to be submitted to the Chief Signal Officer and higher authority. It makes extensive examinations of basic reports and record systems, and assists in effecting improvements in statistical methods, better coordination of records, and improved accuracy and completeness of reports.

Boards and Committees

The Office of the Chief Signal Officer in Washington is assisted in its myriad problems by a number of boards and committees, which serve in the capacity of advisory agencies to the Chief Signal Officer.

As the occasion demands, new boards or committees are organized to investigate and report on some particular situation or problem affecting development, production, delivery, price, or performance of Signal Corp equipment. Other boards are organized in the interest of personnel, both military and civilian, or for matters of policy or security.

Frequently these agencies are abolished as soon as their aims are accomplished, or the duties and functions may be reassigned to existing agencies within the office for continuing action. Today three important agencies remain in force: The Communication Coordination Committee, Signal Corps Board, and Signal Corps Technical Committee.

The Communication Coordination Committee assists and makes recommendations to the Chief Signal Officer in the establishment of War Department policies on operational methods and equipment for communications for the Army. The committee consists of a representative and an assistant who devote full time to the work of the Committee from Operations Division, War Department General Staff; Army Air Forces; Army Ground Forces; and Army Service Forces.

All matters connected with communications arising in the Army Air Forces, Army Ground Forces, or the Army Service Forces, which affect two or more of these forces, are referred to this committee. Divisions of the War Department General Staff also use its services on matters requiring coordination in communication matters, either within the United States, or as may arise in overseas theaters of operation requiring coordination between theaters or between theaters and the United States.

The Signal Corps Board has been in existence since 1924. Its function is to initiate and submit recommendations for the improvement of Signal Corps operations and equipment. The Board, appointed by the Chief Signal Officer, is located at Fort Monmouth, New Jersey. It is here that tests are conducted on commercial equipment or during development or production to determine whether military characteristics are satisfied or whether improvements are required.

The Signal Corps Technical Committee effects coordination between the interested arms and services during the development and standardization of types of equipment and the preparation and coordination of specifications. It acts in an advisory capacity and considers and reports upon such other technical matters as may be referred to it.

The excellent work accomplished by these agencies contributed in no small measure to the success of our troops and those of our allies in all theaters of operation during the past year.

Staff Divisions

The Staff Divisions are Plans and Operations, Fiscal and Legal.

The Plans & Operations Division handles all matters pertaining to planning and coordination necessary for strategical and tactical matters. It performs staff functions relating to communications policies, procedures, tactical doctrines, and techniques. One of its accomplishments was concerned with the details of the complex communications required for the simultaneous landings at Casablanca, Oran and Algiers. This entailed the furnishing of hundreds of Signal Corps troops and thousands of tons of Signal Corps equipment.

The Fiscal Division is responsible for all the funds appropriated to the Signal Corps in its function of providing our Army with the world's finest military communications equipment. For the Fiscal Year 1943-1944, these appropriations amount to five billion dollars.

When it is recalled that in World War I, for the two-year period from April 1917 to April 1919, the Signal Corps spent the then unheard-of amount of $128,920,000 for war material, today's appropriations for the Corps can safely be said to be staggering.

The Legal Division is the agency which acts as general counsel to the Chief Signal Officer on all legal matters. It reviews all pending legislation affecting activities of the Chief Signal Officer and takes action in connection with patents, copyrights, inventions, and licenses. If there is doubt on any legal point the question is referred to the Judge Advocate General or to the legal units of the Army Service Forces or to the Under Secretary of War.

This Division reviews all formal contracts and all informal contracts in excess of $50,000 to determine if they are in accord with law, regulations, and directives. It represents the Chief Signal Officer in matters related to labor relations, labor morale, and supply of labor as they affect Signal Corps contracts, maintaining regional labor offices in seven major cities in the United States.

Operating Services

There are five operating services in the Signal Corps organization.

The Engineering & Technical Service directs research and development of Signal Corps equipment for all Branches of the Army—ground and air. It provides expert consultant service and loans technical personnel to other operating services.

To provide its research activities with the broadest possible base, it is the policy of the Signal Corps to utilize to the utmost the research facilities of private industry and academic institutions. The Signal Corps laboratories, however, maintain a development and design staff, which supervises development work done for the Signal Corps by industrial concerns.

Through the efforts of this Service, frequency modulation has been applied to signal radio equipment; reception interference by static and battle noise has been reduced, and mobile radio stations of medium ranges were successfully developed.

An efficient piece of equipment produced through this Service is the 5-pound "handie-talkie" radio set known as the SCR-536. This tiny transceiver, light enough to hold in one hand, is a favorite of Infantry patrols and other front-line troops. They are in use in all theaters of operation from Italy to the jungles of the Southwest Pacific.

The Procurement & Distribution Service consists of three divisions, one of which is temporary.

The Procurement Division arranges for the purchase of every type of Army communications equipment, including radio, telephone, telegraph, and teletypewriter. It takes appropriate action to achieve production and delivery of, inspects and accepts such equipment and supplies. During the past year this Division placed orders with industry for more than three billion dollars worth of communications equipment.

Operator copies 60 words per minute from Boehme teletype tape.

To meet the offensive now in progress by the United Nations, a Distribution Division was organized. This division exercises staff supervision over all Signal Corps Depots located strategically throughout the United States. These depots store and issue signal equipment to hundreds of posts, camps, and stations in this country and to our combat organizations wherever they are located in theaters of operation. The Division also salvages and repairs all such material, except photographic and fixed communications equipment.

The third Division in this service, the Requirements Division, is temporary at this writing. It compiles and prepares requirements for Signal Corps equipment and supplies for approval by Headquarters, Army Service Forces, which are published in the Army Supply Program. It reviews, edits and correlates requirements submitted by all using agencies and computes required production for Signal Corp equipment. The division maintains current data on costs of equipment and supplies and prepares budget estimates for Signal Corps procurement funds.

The Personnel & Training Service consists of four Branches: Military Personnel Branch, which handles all administrative matters for military personnel; Military Training Branch, in charge of training activities; Civilian Personnel Branch, which is responsible for the procurement, training, and assignments of all civilian employees in the Signal Corps; and the Signal Unit Survey Branch, the training inspection agency for the Signal Corps, which

(*Continued on page* 440)

Signal Corps warehouse at Casablanca, North Africa, where large stores of equipment are held in reserve.

PROCUREMENT

Huge warehouses are set up near every war theater to store vast quantities of Signal Corps equipment and accessories.

IF, AS General Nathan Bedford Forrest said, "victory is a matter of "gittin' there fustest with the mostest," then half the job of winning the war depends on procurement. Because procurement is the task of "gittin' the mostest."

Stated in those terms it appears quite simple. Superimposed on the pattern of modern warfare, however, procurement is a complex design of far-reaching activities.

Signal Corps procurement is a wide range of knowledge of techniques, of materiels, of manufacturing processes, of equipment, transportation, metallurgy, electronics, mechanics, chemistry, finance, economics, law, and logistics.

Obviously, Signal Corps procurement can be no one man. To be successful, it must be a huge and smooth-running organization of all those highly specialized services, and many more, operating to shape the communications materiels of war and draw them together for effective use.

The organization must be capable of more than filling the order; it must be able to anticipate the order. For example, an operation is planned. Naturally, there will be a great drain on communications equipment. But that knowledge in itself is not sufficient. Is it to eventuate into a campaign of swift and penetrating mobile movement, or of stabilized, siege-like strategy? On the answer to that question depends the planning of the whole signal procurement program.

Placing the orders is an all important part in the long process of preparation and the task of getting the equipment out on time.

Long before orders can be filled, the problems of basic materiel shortages must be met. One of the biggest jobs the Signal Corps Procurement Division has, is in this field. Shortages, which at one time appeared most critical, included mica for capacitators, sapphire jewels for meter bearings, tantalum for high-frequency electronic tubes, and acetylene black for batteries.

The mica capacitor constitutes one of the most important individual radio component parts applicable to the radio industry. Before the war it was designed into all important radio equipment. Then most of our mica came from India, but imports from India today are not the simple matter that they were then, so steps had to be taken to develop sources near home. Mines are being exploited in Brazil, Mexico, and Argentina as well as the United States. But in addition to that, substitutes were found effective in many cases and facilities were established for the manufacture of oil-filled paper and ceramic capacitors.

Glass-bead jewels have made satisfactory substitutes for sapphires, zirconium plated molybdenum, and graphite anodes have been substituted for tantalum in electronic tubes; the supply of acetylene black has been augmented by calcined carbon black; 83,000 pounds of copper were saved by substituting copper clad steel wire for copper wire; steel, zinc, and plastic replaced much aluminum.

In almost all cases, anticipating shortages has meant eliminating them.

Steatite is a good example. Steatite is manufactured from the steatite talc that forms a base for women's face powder. Its quality as a high-frequency insulation for radio communication equipment brought such a demand that steatite insulators soon represented a major bottleneck. The Army and Navy coordinated on a substitution program that utilized plastics and ceramics. But the Signal Corps had already instituted an industry-wide expansion of steatite manufacturers. As the demand for plastics increased because of their growing use in munitions, gas masks, airplane parts, and items of equipment for the individual soldier, factories were able to revert to steatite again with a good surplus from which to draw.

Shortages have turned up in strange places, such as, the lack of lithium hydride that threatened the Signal Corps development of Radio Set SCR-578, an emergency sea rescue transmitter for the Air Corps. The lithium hydride was needed to generate hydrogen gas with which to inflate a balloon to raise the transmitter antenna. In peacetime there was little need for the stuff. So to get those radios out, the Signal Corps first had to expand production of lithium metal, then provide facilities for converting it to hydride.

At the other end of the procurement problem, is the job of getting the equipment out of the factory and on its way to the combat zone. That's an everyday, all-year-round job, but sometimes it becomes Herculean.

Such as, the case one day in 1943 when a cable from one of the theaters of operation ordered a 1,350 mile telephone pole line, complete to every crossarm and nail. Four hundred fifty miles of this equipment had to be ordered, priced, loaded and transported to a port of embarkation within ten days.

Special arrangements were made, with various Signal Corps Inspection Zones, to assure proper accountability and have Government Bills of Lading issued; arrangements were made with the Chief of Transportation for shipment by truck of 1,900 miles of wire from one manufacturer and 1,300,000 pounds of wire from another manufacturer. Release for freight car shipment of lumber and cross-arms on Government Bills of Lading and at least two to three reports daily on the location of these cars, became necessary. Some of the material had to be shipped from one coast to the other. Factories and individuals worked 72 to 96 hours without rest. But the deadline was met.

To be able to meet these emergency orders, and at the same time to keep up the smooth flow of equipment requires constant coordination with the Army Air Forces, Navy, Coast Guard, Marine Corps, the United Nations Missions, and many government departments whose demands are similar.

The drama of converting America's great peacetime industry into a war arsenal has had the Signal Corps as one of its prime directors. Since radio and other electronic equipment comprise 90 per cent of Signal Corps procurement, and since America already had a huge radio industry at the outbreak of the war, this may not appear to have been much of an order.

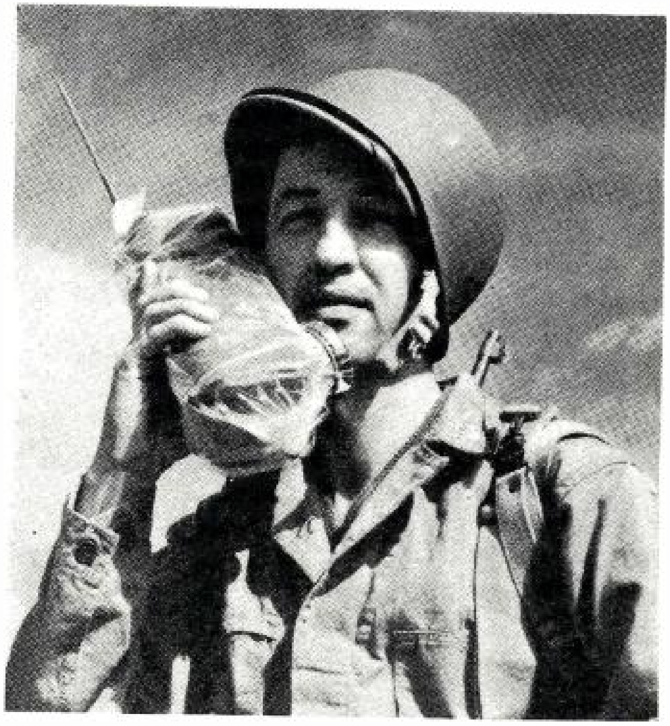
But there is a great difference between civilian and military requirements in radio equipment. In the first place, most civilian radio equipment is designed to sit in a safe and stable, protected place. Military radio is constantly on the move, banged and battered, subject to shock and stresses of explosives and manhandling, shaken and vibrated in tanks and trucks and airplanes, and exposed to extremes of heat and cold, dust and water. Military sets must be built to withstand all these things, which accounts for their greater cost, and what would ordinarily be slower production.

Then there is the subject of tubes. In peacetime, for each set of transmitter tubes sold, tens or hundreds of thousands of sets of receiving tubes were marketed. At the time of the invasion of Poland, 200 types of receiving tubes were being produced by American manufacturers. But today the Army alone uses more transmitter and special purpose tubes than former over-all production.

Things like that required conversion of the greatest part of the radio industry, while the multiplied demands called for expansion on an unheard-of scale. The expansion was accomplished by the industries themselves and through government financing.

In the first part of the War, Signal Corps sets, requiring high frequency antenna transmission lines, were using rigid lines, either air or nitrogen gas filled. But combat conditions found this type of transmission line frequently breaking down due to vibration, and too much time was required to set up or dismantle it. At that time, no one was manufacturing a truly flexible cable and only one firm produced a semi-flexible cable using polysterene beads inside a soft copper tube, or insulated braid. The Signal Corps helped the company to produce a flexible cable using a polyisobutelene dielectric. Because of the volume of Signal Corps orders, other companies soon followed the pioneer firm's lead, and the problem was met.

Two important devices in Army radio equipment are Selsyns and Amplidynes. Selsyns and Amplidynes are trade names, the first for a device for remote signalling, control, and indication; the second a power-control having a high amplification factor, rapid response, and extreme reliability. It is of more recent origin than the Selsyn, having been developed during the past three or four years. But at the start of the war, only one facility was producing these devices. An elevator factory was found with machine tool equipment and technical personnel adapted to Amplidyne manufacture, and production there was soon followed by others until now eight prime contractors and subcontractors are equipped to manufacture the devices.



Completely waterproofed handie-talkie—typical of the equipment that is shipped in large quantities throughout the world.

During the Civil War, the ability to transmit a message over metallic conductors was considered a miracle. Yet, in the last decade, the ingenious communication engineer developed means of employing metallic circuits in such a way as to get double or even triple duty from each system. In the last few years, even this has been improved. Engineers devised means of putting five or more phone conversations and telegraph signals on such circuits, thus giving a multiplicity of service with the very minimum of material. In the past, this efficient utilization was confined to the stablized permanent installations. Modern warfare, requiring the maximum communication facilities with the minimum of equipment, has put this modern miracle into the field. Special Spiral Four Cable, developed by the Signal Corps in conjunction with industry, has established new conceptions in long range field communications. The Spiral Four Cable has no real commercial counterpart; so in order to acquire both equipment and cable, it was necessary to develop a new technique, develop sources, and educate personnel in production procedures.

These expansion efforts involved many considerations. There was the small business man, for instance. He was being forced out of business at the very moment that the government needed every facility. To penetrate to his shops with Signal Corps orders, a program of subcontracting was instituted at the very beginning of the war.

As a result, watch manufacturers are now making electrical instruments; Christmas-tree light manufacturers are turning out capacitors; photographic suppliers are making variable air capacitors; tabulating machinery companies, *Selsyns;* elevator manufacturers, *Amphlidynes;* can companies, hydrogen generators; amplifier manufacturers, crystal assemblies and dynamotors.

The switchover brought a procurement problem once re-

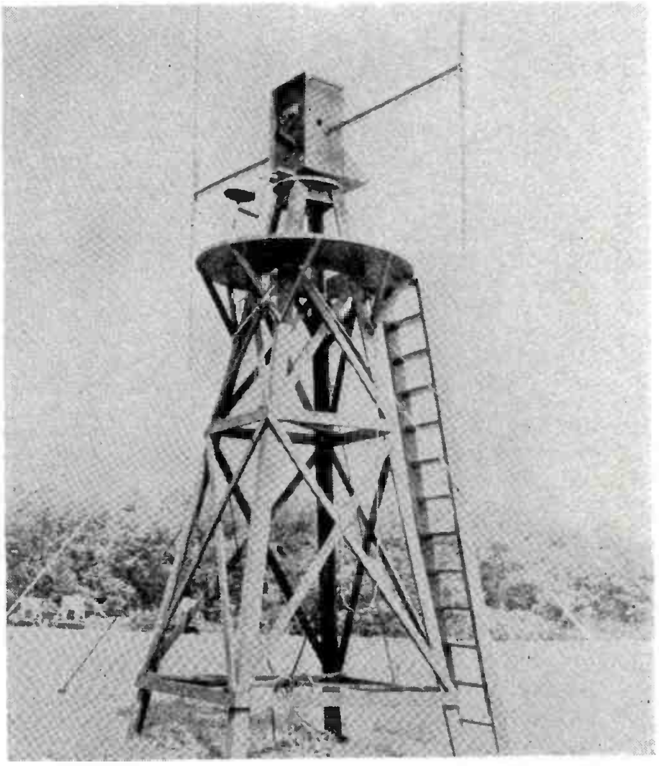
(*Continued on page* 443)

DISTRIBUTION

This war has often been referred to as "a war of supply." The Distribution Division "gets it there."

By Colonel GEORGE I. BACK

Born in Iowa, 1894. Graduated Morningside College, 1921; attended Yale; graduated Signal School, 1934, Command & Genl. Staff School, 1939. Was with Research & Development Division, Office of Chief Signal Officer, 1924-29 & Signal Corps Labs., 1930-33; Officer in Charge Plant Division, Office of Chief Signal Officer, 1934-41; Assistant Signal Officer, Genl. Headquarters, United States Army. He was Executive Officer and Assistant Chief, Signal Supply Services, Office of Chief Signal Officer until assigned to present post as Director, Distribution Division.



Original test model of radio-direction finder SCR-551-T1.

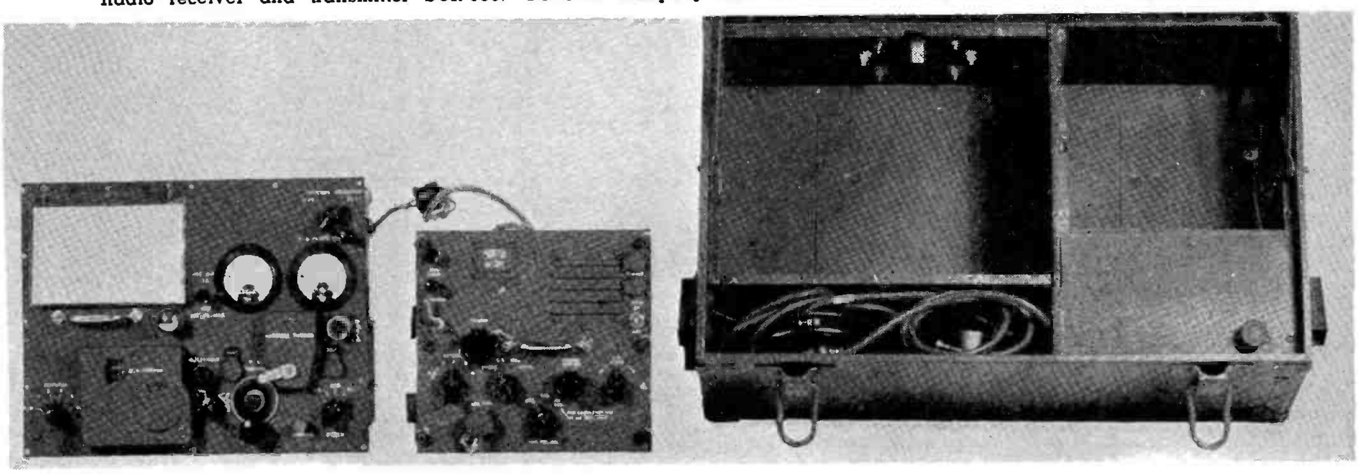
TO THE Distribution Division of the Signal Corps has been assigned the tremendous task of getting equipment into the hands of the men who must "get the message through." To accomplish this job one of the largest organizations within the Signal Corps has been built up; an organization employing 17,465 enlisted men and civilians in Signal Corps depots alone. This organization must receive, store, ship, and sometimes repair or process the communications equipment and photographic supplies for the entire Army. Thousands of problems have arisen in handling the equipment and in the assembling, packaging, and repairing the many different items for which the Signal Corps is responsible. Many changes in method, organization, and operations as the Army expanded have been required to solve these problems and to insure getting the proper materal to the right places at the right time.

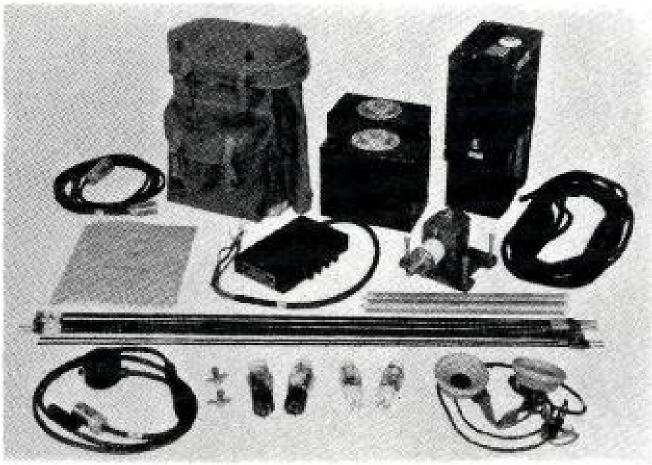
Probably the two greatest problems the distribution organization of the Signal Corps was called on to face, when the decision was made to expand the Army from four million to ten million men, were a shortage of manpower and a shortage of depot space. These were foreseen, however, and plans had been made to meet and overcome these problems. Manpower would be lacking, but there were women ready and willing to work. The warehouses were filled but there was still space to be had, space between the tops of present piles of stocks and the ceiling. But how could women do the back-breaking work of men and how could this vertical space be utilized? The Distribution Division found this answer in a device known as the fork truck. With the aid of this equipment, women could handle and transport heavy loads and could, in addition, easily pile these loads to heights of 18 to 20 feet.

The fork truck is squat and has wheels of about the size of a "Kiddie" car. At its forward end, it is equipped with a "Mast" consisting of two vertical steel tracks on which travels a protruding device having two fingers or forks. In a matter of seconds this truck can move up to a pile of stock, pick it up on its stout forks, run across the warehouse, raise it to a height of nine or twelve feet, and deposit it on the top of the pile. One girl with this device can do the work which, when formerly done manually, required a dozen men and can lift and stack even such heavy items as 6000 lb. power units without any help from other workers.

To assist in the utilization of this device, pallets are used. A pallet is a rectangular platform about 3 or 4 feet

Radio receiver and transmitter SCR-583. Portable carrying case contains necessary attachments and spare parts.





Attachments and spare parts that are used with radio set SCR-194.

Naval officer acting as beach master during amphibious operations.

square constructed in 2 layers of 1" boards separated by 3 two-by-fours on edge. Material is piled on the pallet. The fork truck inserts its forks between the two platform layers and thus easily moves the loaded platform.

Today over 150,000 of these pallets are used in Signal Corps warehouses and the number is growing rapidly. The use of this equipment has enabled Signal Corps depots to handle loads as great as 30,000 tons per month, a tremendous amount of material when one considers that much Signal Corps equipment is measured in ounces rather than pounds.

To get the equipment to the fighting fronts intact and in condition ready for use has required thought, planning, and action generally referred to under the head of packaging. This term is somewhat of an understatement when it is realized that the powerful radio transmitter-receiver SCR-299 is being shipped overseas completely installed in a truck, crated, sealed and waterproofed. The crate used for this purpose assumes some of the general characteristics of a summer cabin.

In the last war Signal Corps material was generally unloaded at established ports on regular docks. In this war much Signal Corps material is unloaded on beaches and not infrequently floated ashore through the surf. In many cases it remains exposed to the elements for some time before it can be forwarded to the using units. For instance, in the landing at Guadalcanal many batteries were ruined in the surf.

To protect the material from the results of such operations, it has been necessary to develop a new technique of packing. This generally calls for the treatment of the container so that it may be immersed in water with no damage to the contents. Batteries, for example, are now sealed in waterproof paper and can be brought ashore through rough seas if necessary.

Green lumber is often used for packing with the result that there is built up a moisture content inside of such packages. To protect the contents against this condition, Signal Corps includes in such packages a chemical compound known as silica gel which absorbs and retains any moisture built up inside the package.

The packaging task of the Signal Corps is a gigantic undertaking. Much has been done by the Distribution Division and much still remains to be done. One interesting example of packaging problems is that of feed for homing pigeons. This feed at times in the past reached the front infested with vermin. Without feed, pigeons cannot live; without pigeons as auxiliary means of communication, some hard pressed American soldiers might perish. Now, in each shipment of pigeon feed, a small cylinder of gas is included and this gas, slowly escaping during transit, kills any vermin without injuring the feed.

Marking is also a responsibility of this Division. Much of the material moves forward under code designations representing overseas destination. Even a slight error may lead to serious delay or to the failure of the material reaching the proper troops. The Distribution Division has worked tirelessly to see that depot personnel and the suppliers are instructed so that errors in marking will not occur.

No matter how sturdily Signal Corps equipment is constructed, it is essentially delicate mechanism and should be handled with care. Simply placing that familiar admonition on a container does not solve the problem since the crate or box may be handled by stevedores of every nationality as well as natives and others unable to read even their own language. One of the most amusing and effective devices used to warn illiterate longshoremen against turning the bottom side up was worked out by a British officer. On the sides of the crates he ordered stenciled a huge mug of foaming beer right side up. That was something that all cargo handlers can understand. They were careful "not to spill the beer." Every crate went right side up.

The Stock Control Branch is responsible for planning and directing the tremendous task of making proper distribution of Signal Corps equipment to the troops. This requires continual vigilance to insure proper stock at the proper point at the proper time. In order to accomplish this, there is established a staff in Washington and an operating force in the Storage and Issue Agency at Philadelphia. These groups must meet the problems of keeping the depots properly stocked at all times and of insuring the proper assembly of the many components required and then of speeding the material to the ports on time and in recognizable condition.

The problem of stock control is constantly becoming more complex in that unexpected demands are being received daily from the fighting forces in all sections of the world. For example, when General Eisenhower's troops were being equipped for the North African campaign, they were given the number of mine detectors deemed adequate. There was no way of knowing then that other Allied troops would look with such favor on the mine detectors issued by our Signal Corps and thus skyrocket the demand. By the time the African campaign was over, more than ten times the original number of mine detectors had been sent to Africa. Such unexpected demands are usually urgent and must be met promptly. A shipment of this kind usually involves the assembling of a multitude of component parts of equipment stocked at several Signal Corps depots. Each shipment must be clearly marked so that it will retain its identity and thus insure arrival of material as planned.

The movement of supplies has to be coordinated with the Transportation Corps and ports of embarkation to insure that all equipment arrives in accordance with a pre-established time table as set by convoy movements. There are occasions when a convoy is forced to split up and part of the equipment is landed in a port hundreds of miles from its original destination. Unless the missing equipment can be located and rushed to its original destination so that the parts of the original shipment are brought together, there

(*Continued on page* 448)

International Amphitheatre, Chicago—now used as a Signal Corps Depot. Radio set SCR-299 will be installed in each truck.

DEPOTS

The Signal Corps requires thousands of skilled personnel to handle more than 100,000 individual items ranging from tubes to trucks.

By Brig. Gen. EDGAR L. CLEWELL

Born in Minnesota in 1896, and has B.A. degree, Moravian College & Theological Seminary, 1916, and M.A., Columbia U., 1922. Graduated Tank School, 1923; Chem. Warfare School, 1929; Signal School, 1934; and Comm. & Genl. Staff School, 1940. Served as Executive to Signal Officer of Hawaiian Dept., 1927-28; Director of Dept. of Training Lit., Signal School, 1928-30; Signal Officer, 4th Army Corps, 1940; Executive Officer, Ft. Monmouth, N. J., 1940-42; and Comdr. of Signal Corps Replacement Training Center, 1942-43. Named Comm. Genl., Chicago Signal Depot, 1943.

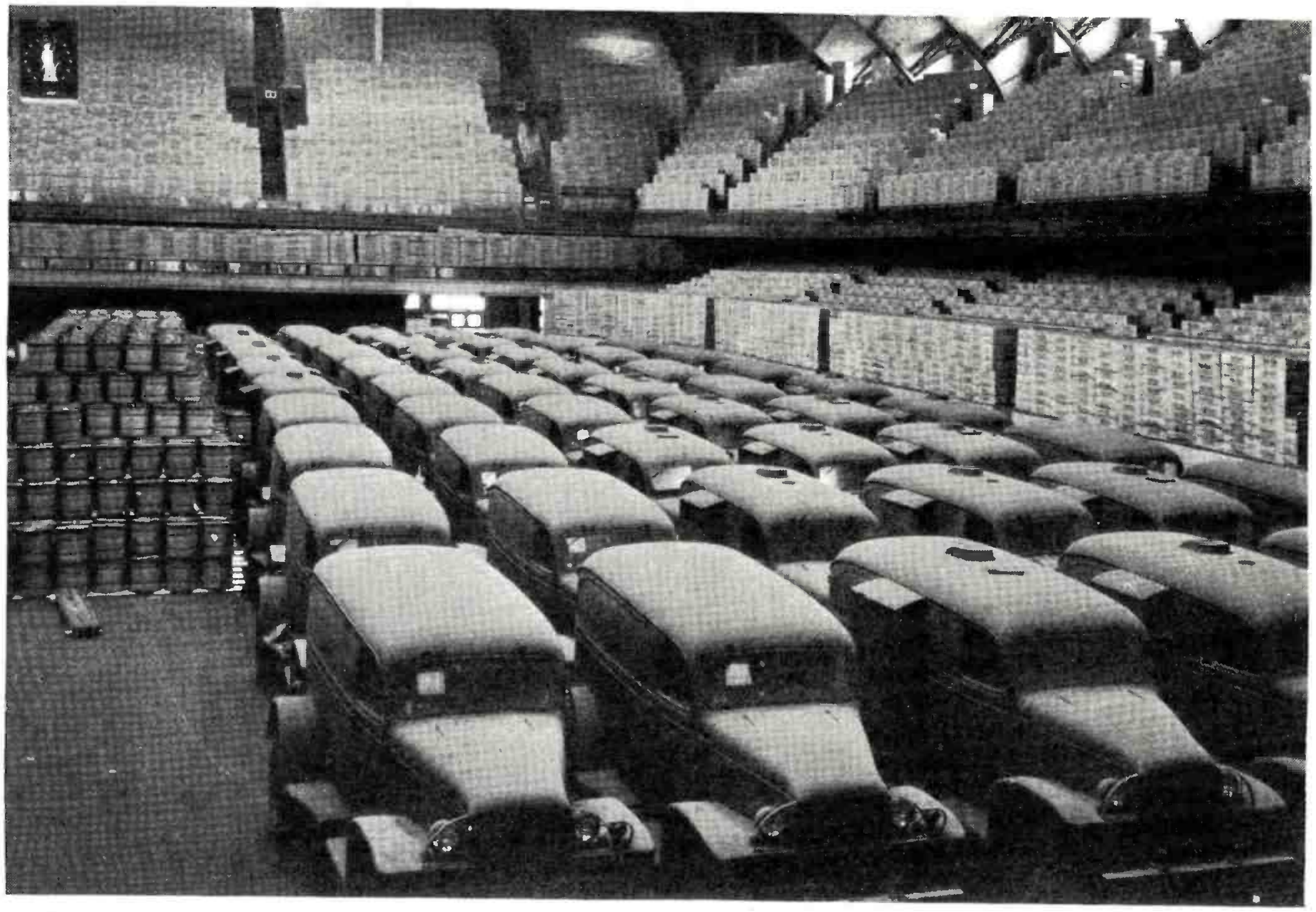
A GREAT chain of depots, reaching from coast to coast, is the backbone of the Signal Corps supply system.

Into eight depots, at Philadelphia, Boston, Chicago, Lexington, Ky., Los Angeles, Baltimore, Sacramento and Seattle, as well as at signal sections at Army Service Forces depots at New Cumberland, Pa., Bellemead, N. J., San Antonio, Atlanta, and Ogden, Utah, millions of dollars worth of communications equipment flows from war plants on its way to battle zones all over the world. The success or failure of the entire Army communications system, the nerve center of the armed forces, rests upon the speed and efficiency with which this equipment is handled.

With more than 100,000 individual items, ranging from midget tubes to huge mobile broadcasting stations, to be received, stored, classified, and shipped, the Signal Corps requires a highly-trained staff of civilians and officers who are thoroughly familiar with modern warehousing and shipping procedures as well as with the equipment itself. Efficiency is vital, for a damaged or defective unit or one delayed in delivery, which in peacetime would mean only inconvenience, today may well mean loss of life or defeat in battle.

In the huge Signal depots, all effective peacetime warehousing and shipping procedures have been utilized, adapted, and geared up to wartime demands. Systems which may have been adequate a year ago, or even six months ago have made way for improved methods as the tempo of warfare changed from preparation to attack.

Simplification of operation, eternal vigilance to minimize the elapsed time between requisition and shipment, efficiency of warehousing, reduction of wastage, the ability to anticipate and gauge army consumer demand; all these



require the 24 hour-a-day services of the vast Signal depot personnel.

Great strides have been made in perfecting a smooth functioning operation. These huge depots are more than depositories for the thousands of items needed to maintain army communications. They are in effect individual industrial cities geared up to wartime tempo. Inside their heavily guarded walls are endless acres of warehouses, shipping rooms and shops, as well as offices where multitudes of records are handled with speed and efficiency. The adjacent yards are packed with trucks, poles, cable reels and other heavy equipment. Railroad spurs facilitate storage and handling.

Signal depot organization falls into seven divisions: stock control, storage, maintenance, administrative, personnel, utilities, and transportation. These are correlated in their activities by an Executive Officer and an Executive Control Office. The Executive Officer, who acts directly on matters which do not require the personal attention of the Depot Commander, is the coordinator of all depot activities in accordance with established policies and procedure. The Executive Control Office is responsible for the planning and analysis of all depot procedure and activities, and initiates changes and improvements indicated by current developments.

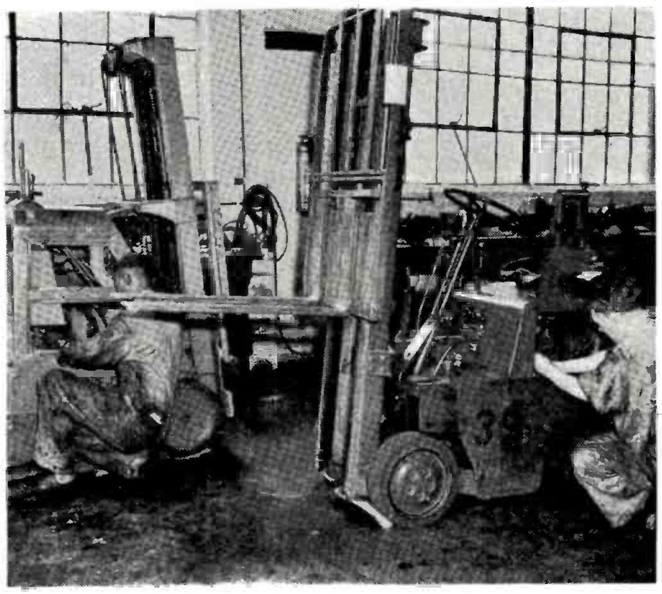
There are two main operating divisions, closely interrelated. The Stock Control Division is responsible for maintenance of all depot stock records pertaining to Signal Corps equipment and supplies. This division includes three branches: Inventory Control, Property, and Stock Accounting. This division issues orders enumerating articles to be shipped, shipping dates, and destination. These orders are transmitted directly to the Storage Division, which is responsible for storage of all materials from the time the supplies are received in the depot until final shipment is made. This is usually the largest of the operating divisions.

In order to function smoothly, this division is usually subdivided into five functional branches; a Labor and

Enlisted men receive their training in telephone equipment repair.

Broken Package Room—"Pickers" sorting items to complete orders.

Repair Shop—operator making adjustments on electrical meters.



Garage—mechanics repairing lift trucks used at depot stations.

Worker at the Philadelphia Signal Depot repairing radio head-set.

Equipment Branch, which furnishes all the labor and equipment used in the storage and shipment of materials; a Stock Numbering Branch, which checks and assigns identification numbers to all equipment received at the depot; a Storekeeping Branch, which maintains stock location records and is responsible for the selection of the proper stock to fill the requisitions, and also includes the packing of equipment upon proper requisitioning of these items; the Internal Transportation Branch, which operates all equipment used for internal transporting materials; the Cycle Inventory Branch, which makes regular and special inventories of all depots' stocks, correlating these checks with other depots' records.

Another main division of the depot related to the administrative and operating functions is the Maintenance Division, charged with the responsibility for repairing, manufacturing or fabricating parts for all types of Signal Corps communications equipment which are sent to the depot for fifth echelon (major) repairs. This division requires highly technical and skilled personnel.

In order to simplify operating divisions, administrative details are placed under separate responsibility. The Administrative Division is responsible for the maintenance of records of all funds allocated to the depot and all accounting for such funds. It is responsible for the security and protection of the depot from theft, sabotage and fire, and maintains identification systems for civilian personnel and visitors. The Office Service Branch is responsible for all service functions such as messengers, office supplies, office equipment and repairs. The Procurement Branch comes under the Administrative Division and is responsible for the procurement of all items for which purchase is authorized in the jurisdiction of the depot.

The Personnel Division is charged with all matters pertaining to the administration of both civilian and military personnel. It is responsible for the recruitment, interviewing, investigation, classification, promotion, transferring and terminating of civilian personnel, and also administrates employee relations, welfare, and morale programs. It is responsible for medical service, first aid and sanitation within the depot. This division also conducts employee-participating programs such as War Bond sales, Community Fund and Red Cross drives.

The Utilities Division maintains all depot buildings, ground maintenance, electrical, plumbing and heating installations, does minor construction and alteration work for all divisions of the depot, and provides janitor service. This division cooperates with the Post Engineer who is responsible for all repairs and installations of a major nature which are ordinarily handled through Engineer Corps facilities.

The Transportation Division acts as transportation agent for the depot and consolidates all rail and motor shipments to insure economical and expeditious transportation under Army and Interstate Commerce Commission regulations.

In order to circumvent manpower shortages, it has been found necessary to set up in-service training programs sponsored or correlated by the Personnel Division. These training programs usually consist of refresher courses for stenographers and typists to acquaint them with military and technical terminology used in Signal Corps procedure, courses to assist operators of accounting and office ma-

(*Continued on page* 378)

Major General HARRY C. INGLES

Chief Signal Officer, U. S. Army

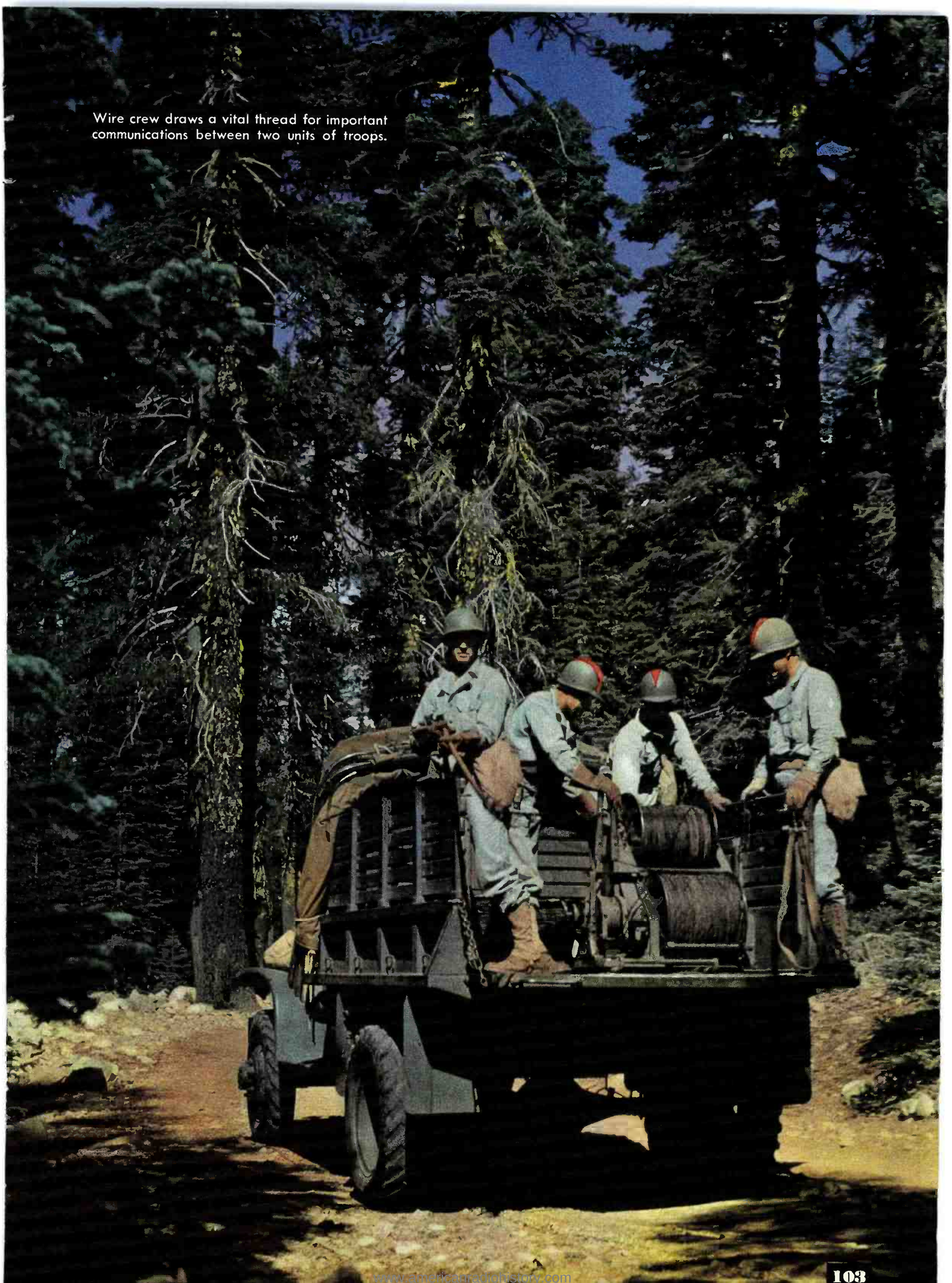
Field telephones provide communications over wires laid in combat areas.

Latest FM walkie-talkie provides reliable short-range communications between scouting parties and other units.

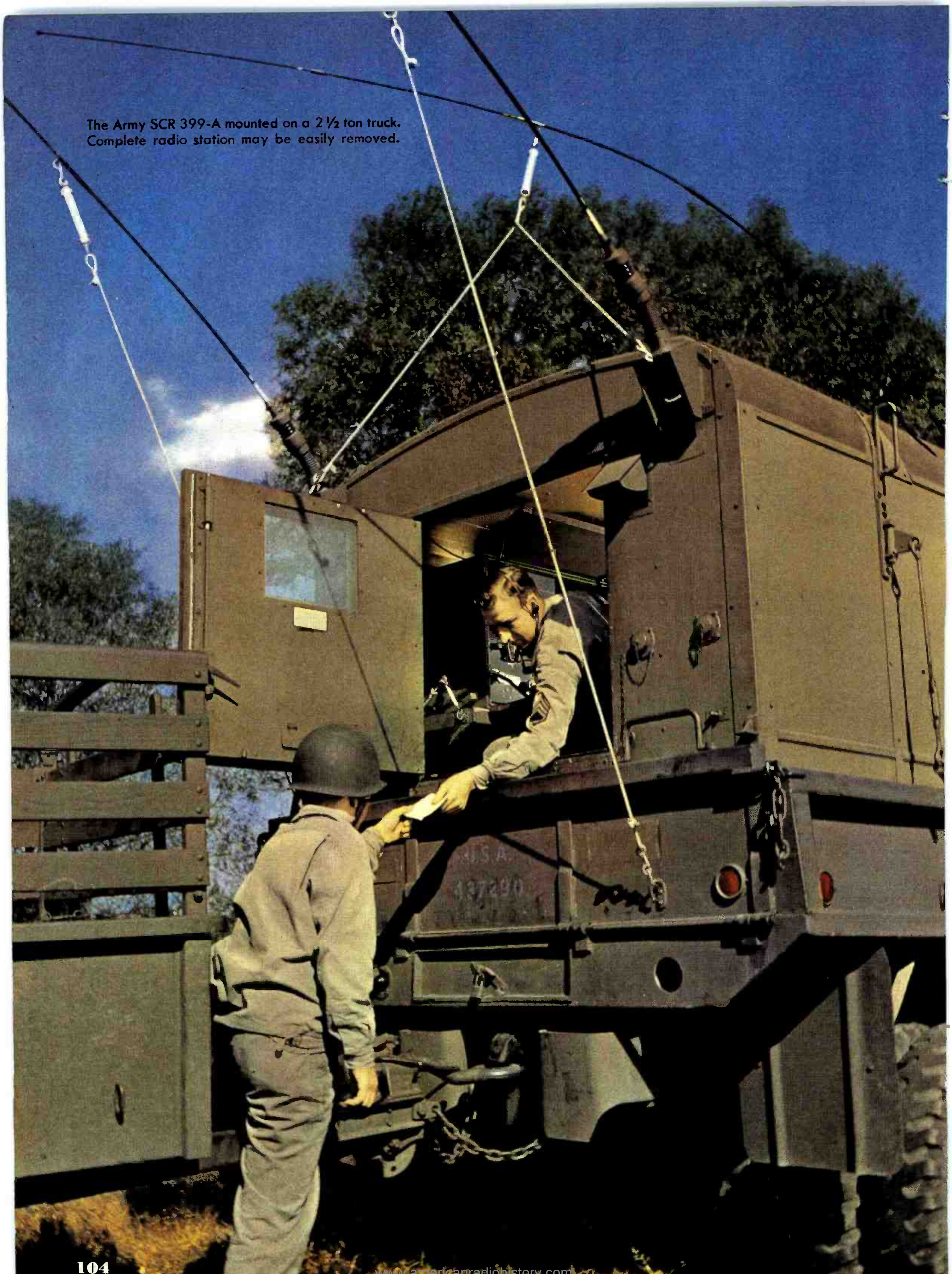
Field telephones permit privacy in territory where enemy troops might pick up signals from radio equipment.

SCR-299 mobile transmitter installed in half-trac. This unit travels easily over sand and rough ground.

SCR-608 FM set used by the Field Artillery. It is a multi-channel transmitter-receiver of late design.

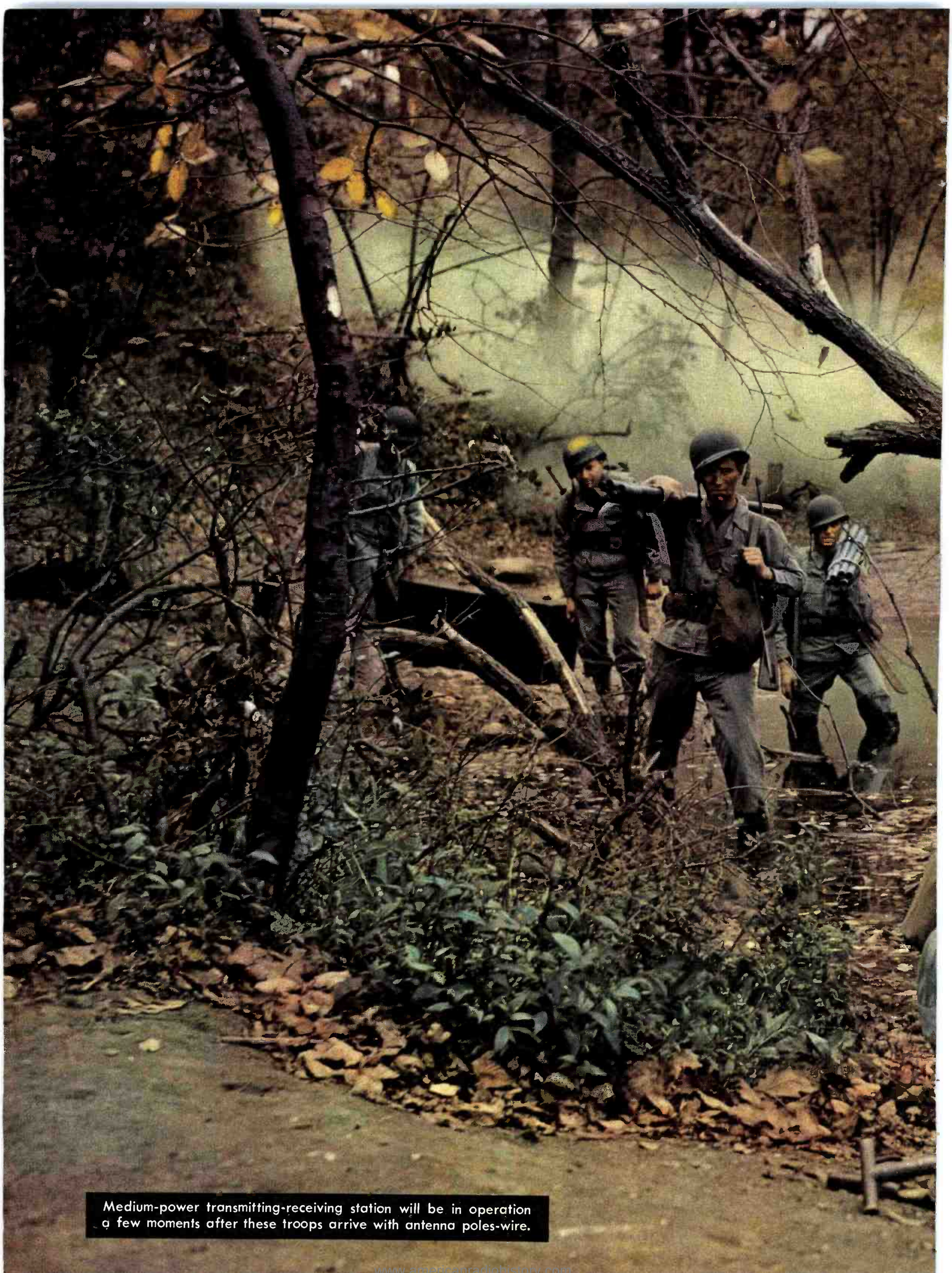


Wire crew draws a vital thread for important communications between two units of troops.

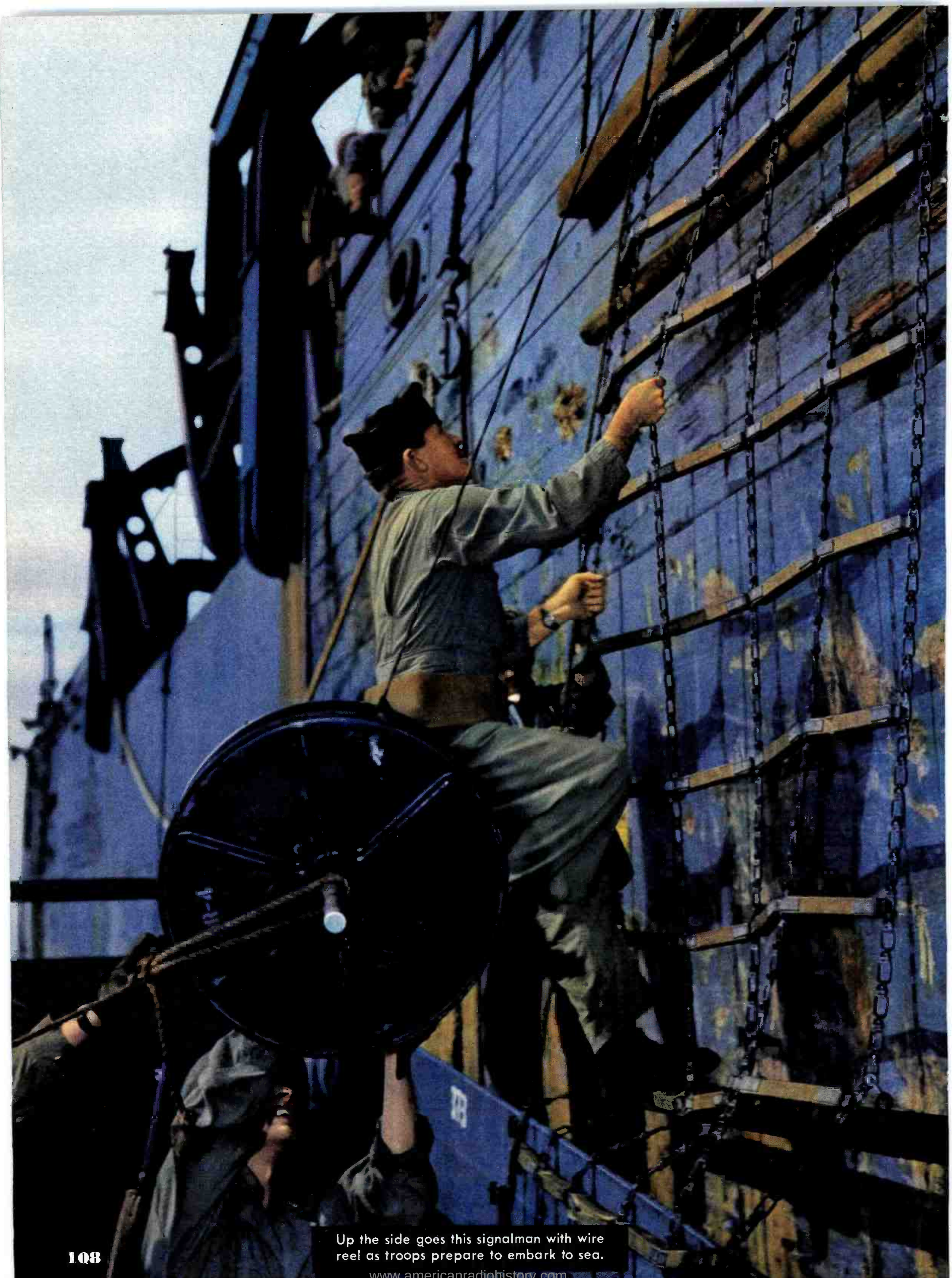


The Army SCR 399-A mounted on a 2 ½ ton truck. Complete radio station may be easily removed.

Servicing the famous "Gibson Girl" emergency automatic radio lifeboat transmitter.



Medium-power transmitting-receiving station will be in operation a few moments after these troops arrive with antenna poles-wire.

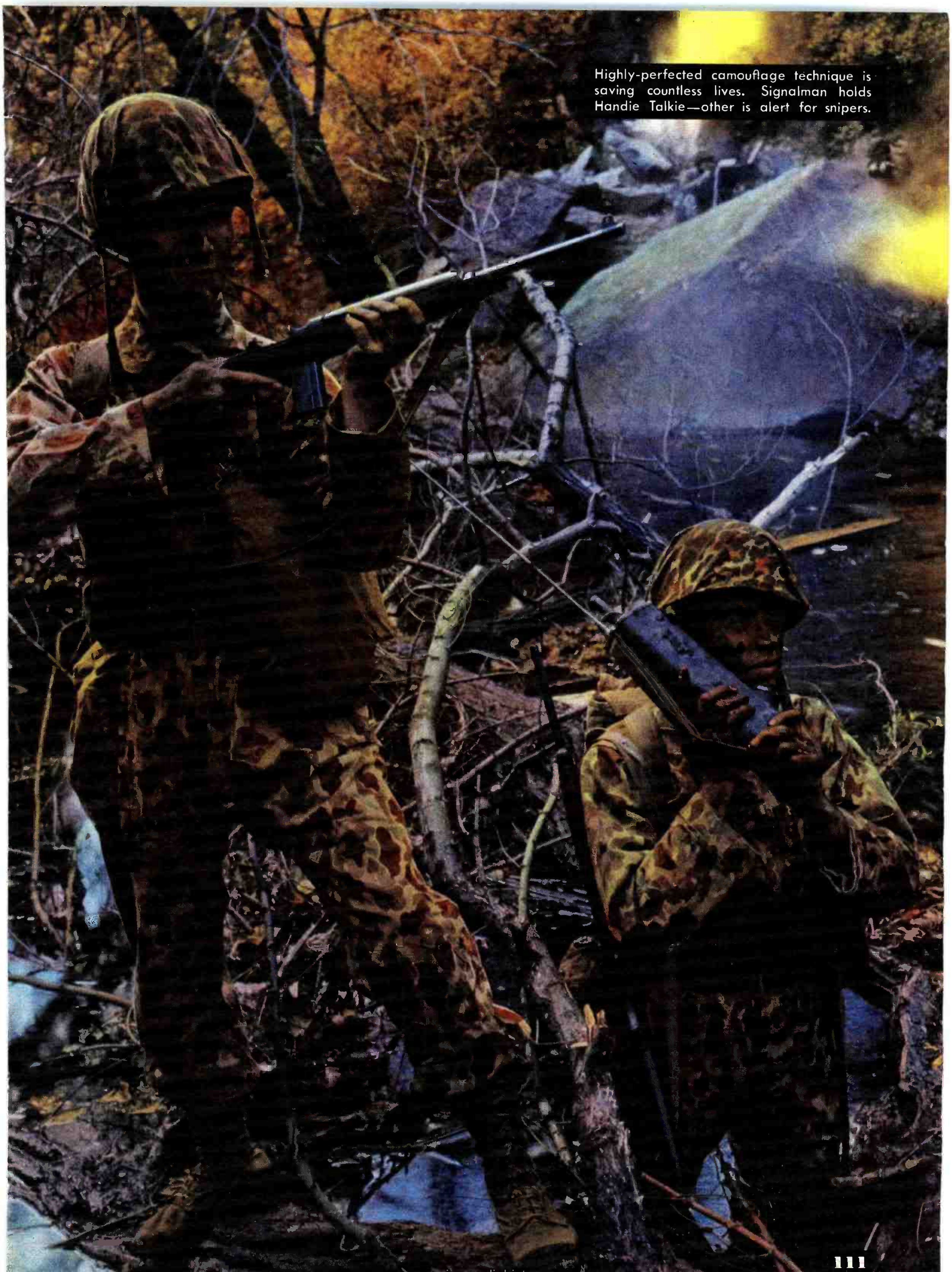


Up the side goes this signalman with wire reel as troops prepare to embark to sea.

Signal Corps troops disembarking with their portable radio equipment. Heavy units will follow in barges.

Signalling by semaphore to advance troops on shore as landing barge brings reinforcements.

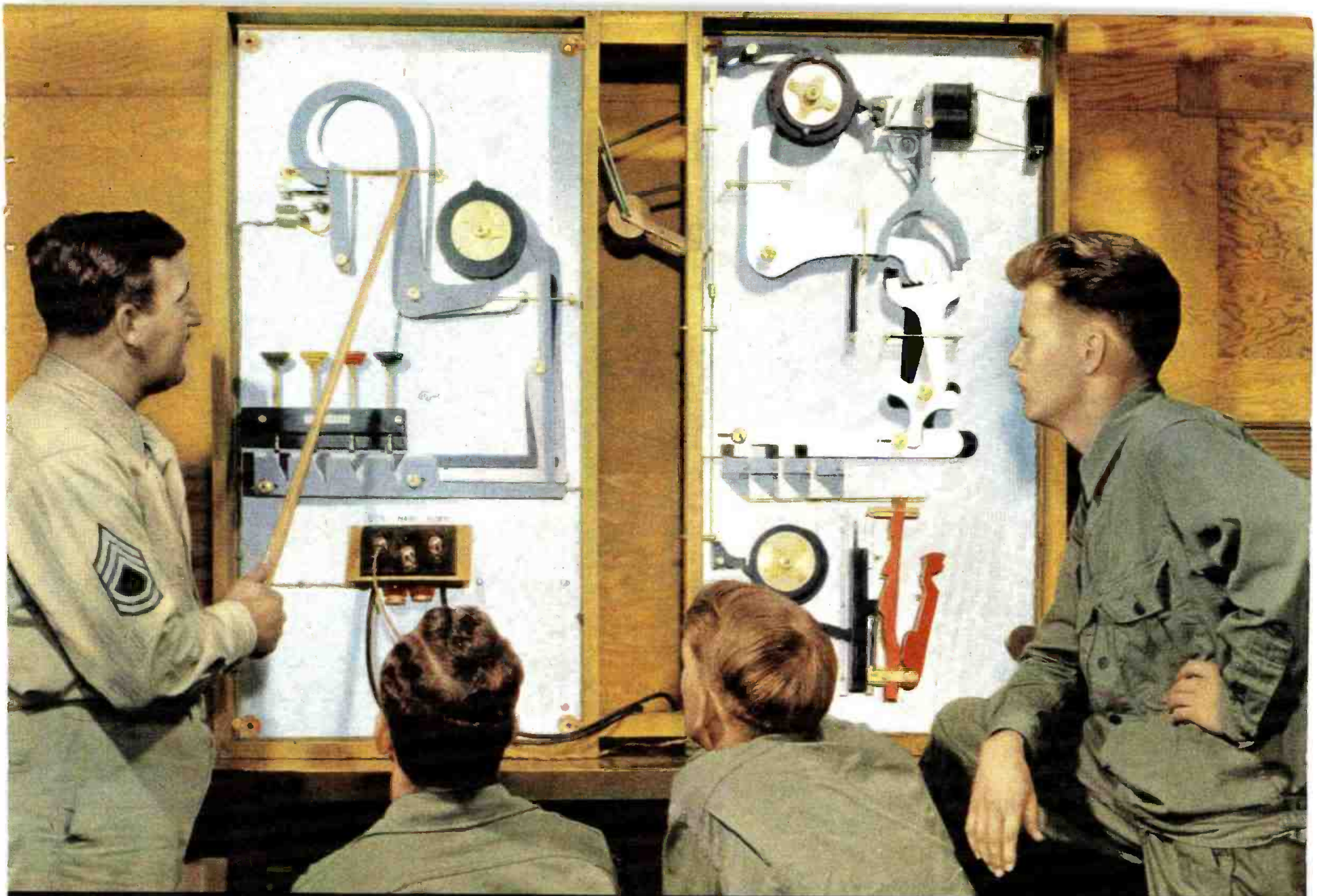
On shore. Signal Corps troops advancing with collapsible poles and light equipment.



Highly-perfected camouflage technique is saving countless lives. Signalman holds Handie Talkie—other is alert for snipers.

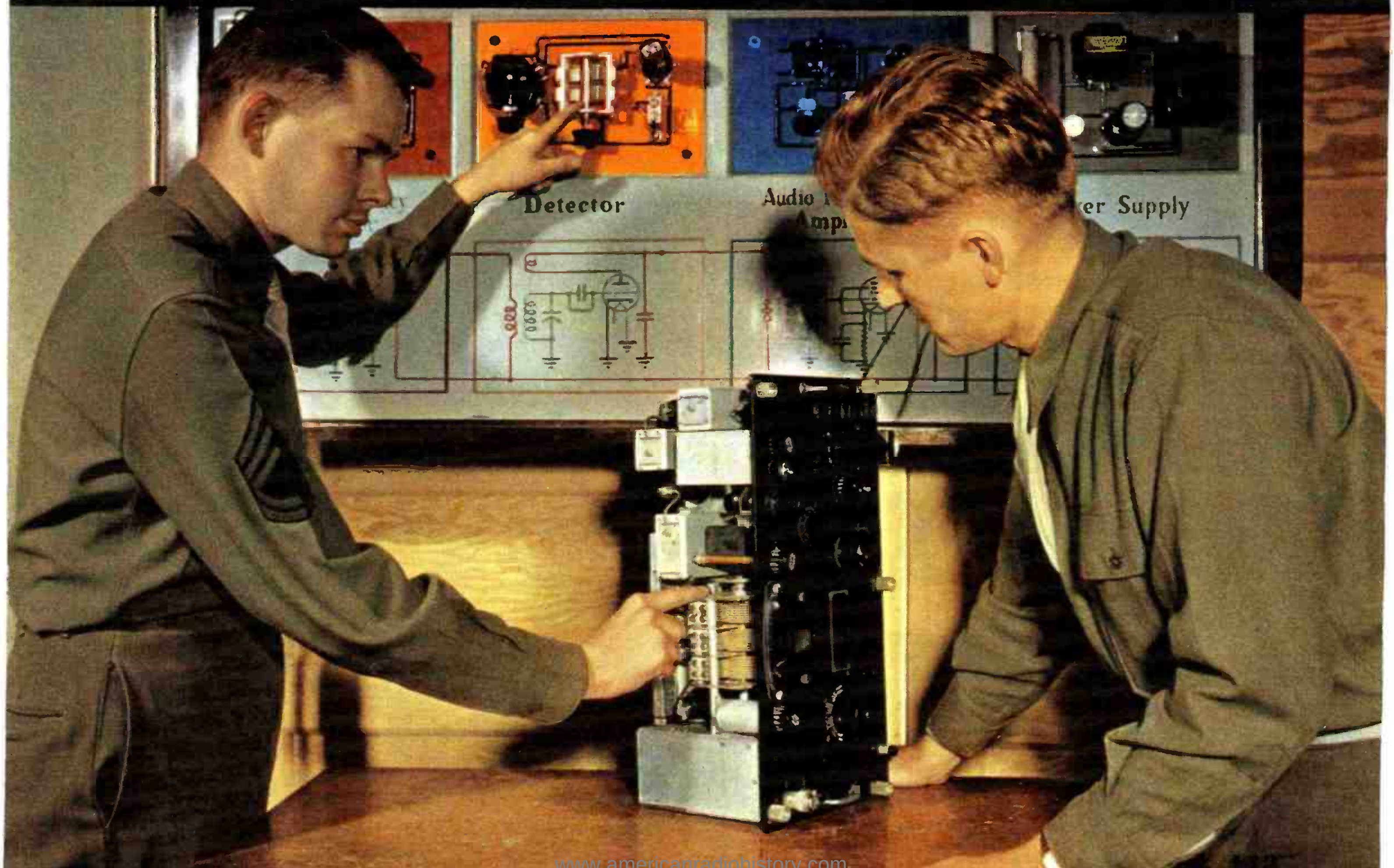
A radio operator of the WAC. Women are handling many jobs in various branches of the S. C.

Portable field telephone setup operated by feminine operators. They are all skillfully trained.



Instructor explains operating principles of a working-model teletypewriter.

Demonstrating the "hows" and "why" of a communications receiver to Signal student.



Thanks

MR. TROUBLE-SHOOTER

Thanks, Mr. G. I. You're close to our thoughts. All of us in radio know the world-wide job you're doing in the Signal Corps.

We know who you are. You're the radio ham across the street, the boy home from college who burned the midnight oil in the attic and rigged his aerial from the highest mast. You're the telephone man. You're the obliging young fellow from the lighting company. You're the serviceman who fixed our radio set the day before the World's Series. You're the radio engineer who added brains to that set.

We don't know where you're *seeing* action but we know that you are *helping* it. Crawling out ahead of artillery. Scrambling from one fox-hole to another. Rolling up telephone wire almost to the muzzles of enemy guns. Operating and servicing communication systems so that the attack may roll forward. Hunting booby traps. Saving lives.

Come back, Mr. G. I., just as soon as your trouble-shooting is done. Radio will need you—your skill—your sureness. Radio will not forget your part in victory. Solar Manufacturing Corporation, 285 Madison Ave., New York 17, N. Y. Plants at: Bayonne, N. J., West New York, N. J., Chicago, Ill.

CAPACITORS AND RADIO NOISE-SUPPRESSION FILTERS

SOLAR

Office of a typical Signal Depot—a quickly erected Nissen hut used widely in the European Theater of Operations.

SIGNAL SUPPLY IN THE E T O

Their job is to supply everything from porcelain eggs to multi-wheeled trucks.

By
Colonel ALFRED M. SHEARER

Born in 1894. Attended U. of Mich. Entered service 1917; in Philippines, 1923; promoted to Captain, 1920; with Signal Corps Procurement Dept. Graduated Signal School, 1928. Served Supply Div., 1932; promoted to Major, 1935. Instructor in the Signal School; Supply & Contracting Officer at Aircraft Radio Lab. Promoted to Lt. Col., 1940. Signal Property Officer at Brooklyn Genl. depot; Signal Officer, Panama Pacific General Depot. Promoted to Col., 1942. Served ETO as Director, Supply Div.; Director, Communications Div.; and present assignment, Deputy Chief Signal Officer.

WHEN armadas of ships, armies of men, and umbrellas of planes thunder against enemy shores, the success of the mission depends in part on the perfection of the means of communication available to the commander. Paralleling the months of training and hardening the men, goes the procuring, maintaining, storing, issuing, and handling of the required signal equipment. This ranges from porcelain eggs, that are used for fooling homing pigeons into laying real eggs, to powerful mobile radio sets that travel in multi-wheeled vehicles. There is neither glory nor fame in this half of the job but to the men in "Supply," jealous of their division's position and proud to be the hub of the signal service, the job needs neither glory nor fame to become the driving force in their lives.

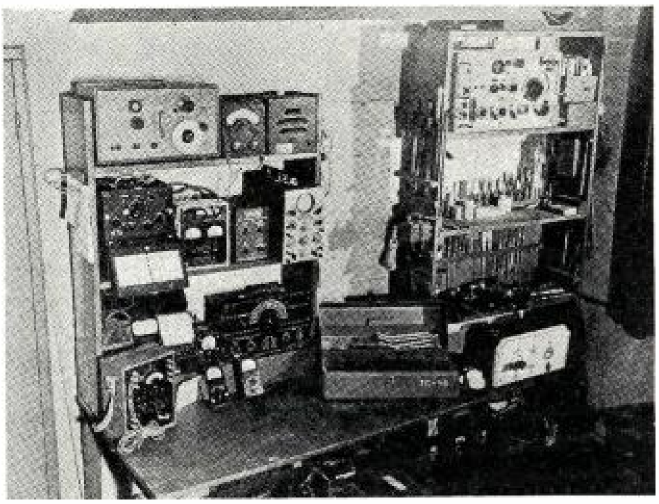
It is the responsibility of the Chief Signal Officer, Services of Supply, European Theater of Operations, to accumulate supplies for the American military forces in this theater in advance of anticipated needs and to issue these supplies to the troops as needed. A related activity is the repair of damaged equipment which cannot be handled by combat elements in the field because of lack of time or the necessary tools.

To discharge its duties efficiently, the Signal Supply Service is organized to comprise an executive office and several branches. The basis of the whole organization is flexibility; this applies to methods of thinking as well as to such physical matters as the location of depots, means of shipping, methods of handling the ever-growing paper work, etc. The various activities are completely integrated and under the control at all times of officers with wide experience in both military and civilian life.

The basic considerations in the operation of a supply system may be outlined as follows:

a. Requirements for maintenance.
b. Reserve to be maintained.

Corner of a modern repair shop in a large Signal Corps Depot.



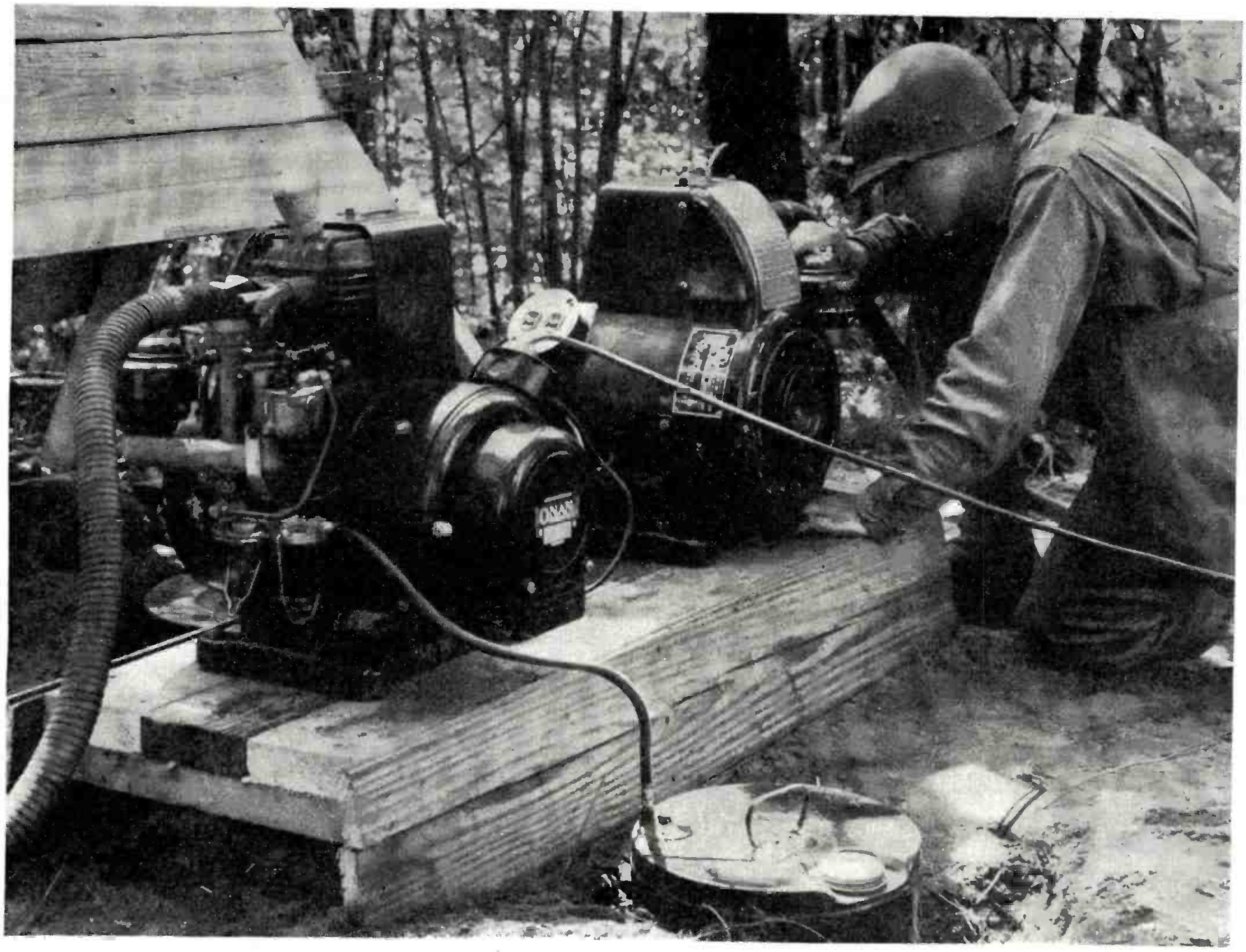
Well-stocked service bench used by the Signal Corps repairmen.

c. Sources of procurement.
d. Method of requisitioning and procurement.
e. Method of storage and distribution.
f. Flow of supplies.

For the ETO, these factors may be summarized briefly as follows:

The normal maintenance percentages for a theater of operations are established by the Office of the Chief Signal

(*Continued on page* 374)



Five-hundred watt power unit supplying 110-volts a.c. for electric lighting and communications equipment.

ENGINEERING

By Maj. Gen. ROGER B. COLTON

The Engineering and Technical Service is responsible for research, development and standardization of SC sets.

Born in North Carolina in 1887. Holds Ph.B. in Elec. Engineering, Yale University, 1908; and M.S. in Elec. Communication, M.I.T., 1920. Graduate of Coast Artillery School, advanced engineering, 1922; advanced course, 1927; Command and General Staff School, 1928; and Army War College, 1938. Was Signal Officer, Panama Canal Dept., 1930-32; Officer in Charge, Plant and Traffic Div., 1932-34, and Research and Development Div., 1934-36, Office of Chief Signal Officer; Chief, Signal Supply Services, 1941-43. Is now Chief, Engineering and Technical Service.

DURING the past year our new Army has entered into successful combat with our enemies in nearly every theater of this widespread war. During the year, reports have become available as to the battlefield performance of U. S. Army signal equipment and as to the capabilities of the equipment to meet the ultimate test: of combat in the hands of combat units.

It can be stated as a result of this experience that:

1. The performance of our signal equipment is second to none.

2. Despite extensive and arduous testing in development, and in training service, minor mechanical weaknesses in some equipments were discovered during early combat and immediate action was taken to correct them.

3. The many precautions taken to increase design safety factors, to improve the quality of component parts, and to obtain high quality controls in manufacture by careful inspection, have all proven more than justified by the final test of combat use. Further work has been done and must be continued to improve quality, increase the capabilities of equipment to withstand the elements, and to reduce maintenance.

The foregoing summary touches upon some of the principal responsibilities of the Engineering and Technical Service of the Signal Corps of Army Service Forces. As one of the five services commanded by the Chief Signal

Officer, the Engineering and Technical Service is responsible to him for the research, development and standardization of communication and other electronic equipment employed by combat elements of Army Service Forces, Army Air Forces, and Army Ground Forces. Included in these responsibilities are the essential elements of specification preparation and revision, improvement and refinement of equipment, establishment of quality control standards for use by the Signal Corps Inspection Agency, standardization of component parts, and establishment of maintenance policies.

Of course, the Army is only one of the Armed Services; its communication and electronic needs must be integrated and coordinated with the large requirements of the Navy, Marine Corps, Merchant Marine, and with the requirements of Lend-Lease. The United States Navy has extensive development facilities with which the Signal Corps maintains the closest possible liaison to the end that advances made by either development group are available to the other and that no unnecessary duplication of work takes place.

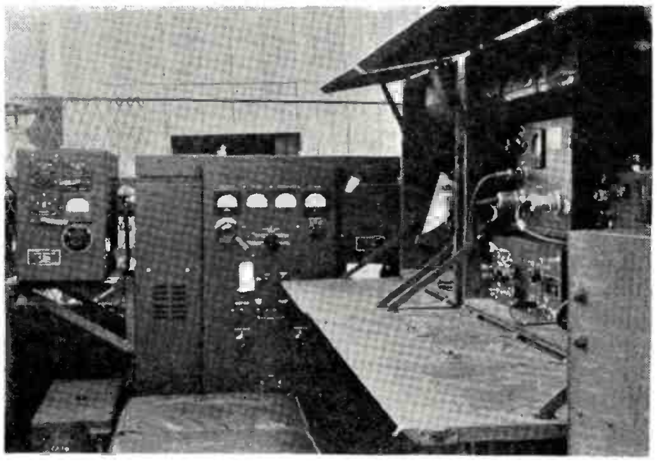
The development agencies of the Armed Services are greatly augmented by the effective and comprehensive research and development facilities of the National Defense Research Committee, which operates under the Office of Scientific Research and Development. This outstanding scientific body has mobilized an important part of the scientific resources of the nation for the accomplishment of important research and development work for the Armed Services.

When a need arises within the Army Air Forces, Army Ground Forces, or Army Service Forces, for a particular type of electronic equipment for which no design exists, the Service concerned establishes the nature of its need and makes application for the development of equipment to meet it.

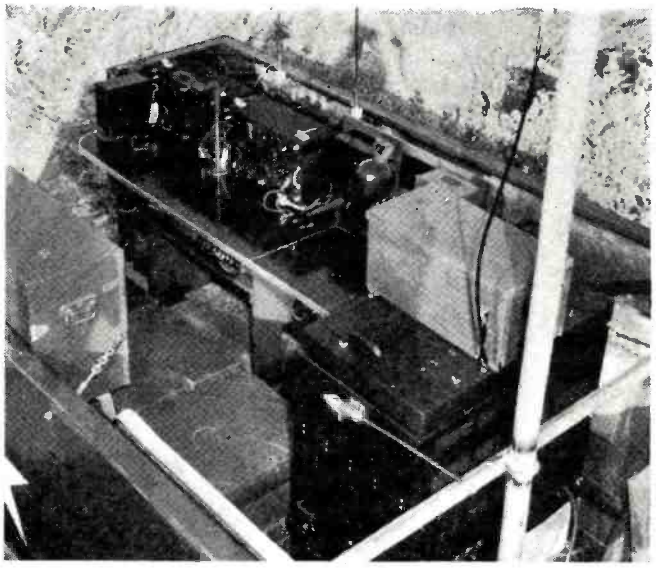
It then becomes the responsibility of the Army Service Forces, through the Chief Signal Officer and in turn the Engineering and Technical Service, to coordinate, plan, and effect the development of the equipment.

A study is then made to determine the elements of the problem, the nature of the research or development work involved, and the coordination which can be effected with any similar type of equipment under development for any of the Armed Services.

Assuming that a new development is required, the most suitable research and development facilities are examined; if possible, development by the National Defense Research Committee or a commercial laboratory or manufacturer is started. (*Continued on page* 340)

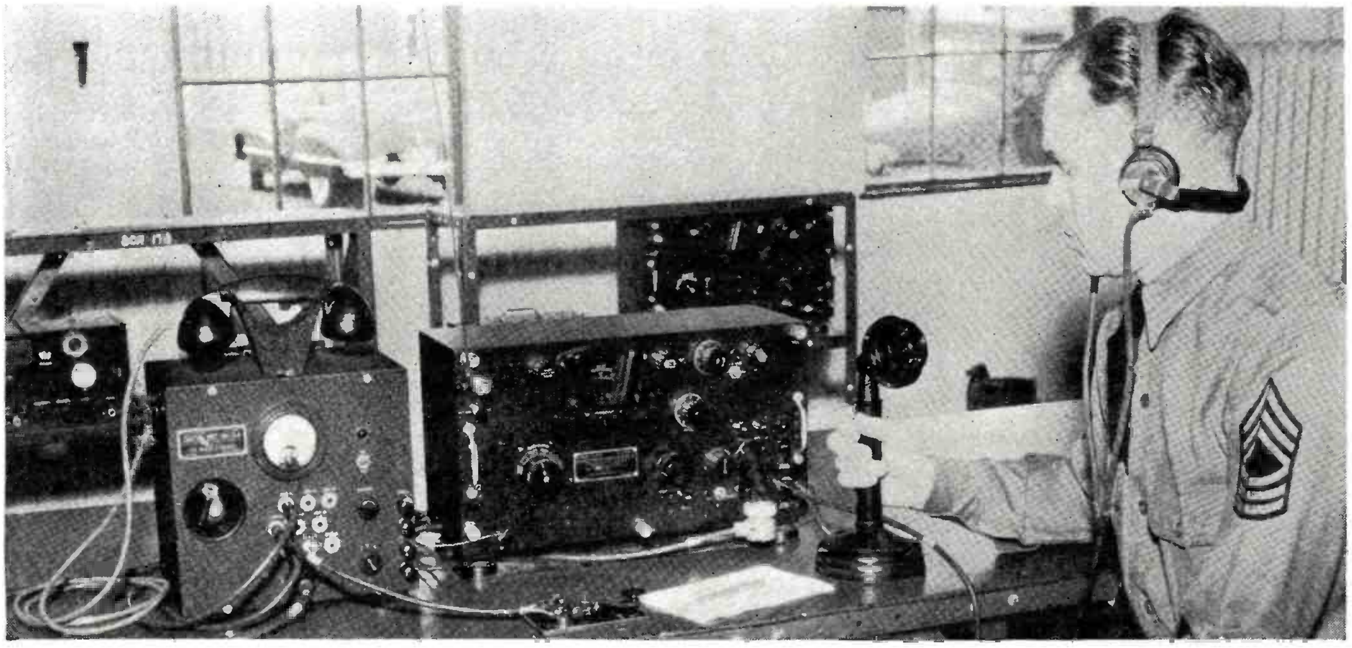


Components of radio set SCR-399-A and SCR-499-A installed in the rear section of a half-trac M3 personnel carrier.



Widely used SCR-299 mobile radio transmitter installed in an M3 half-trac. Unit is used in many other mobile forms.

SCR-18-A receiver and transmitter installation. All controls are within easy reach of the operator.



INSPECTION AGENCIES

The Agency is composed of five separate zones, a HQ organization and a liaison section. They maintain a staff of highly skilled men.

By Col. LESTER J. HARRIS

Born in Urbana, Missouri, 1886. Graduated from the Signal School in 1926. In Panama in 1927. Was in the Office of the Assistant Secretary of War in 1932. Received the degree of Master of Business Administration from Harvard University in 1932. Graduated from the Army Industrial College in 1936, and assigned to the Materiel Branch, Office of the Chief Signal Officer, in 1941. Was assigned to the San Francisco Signal Corps Procurement District in 1942. Returned to Materiel Branch. Appointed to present position as Director of Signal Corps Inspection Agency in 1943.

Inspecting leather case EE-8-A for field telephone unit.

IT IS obvious that defective communications equipment shipped to the fighting front is worse than no equipment at all. In the first place, faulty equipment means that much waste of precious shipping space. But even more important is the fact that fighting men have come to trust their lives to the sureness of their communications, and the slightest failure, at a critical moment of battle, could easily be transformed from minor tragedy to vast disaster.

Because of this vital importance of communications in every phase of modern combat, the Signal Corps employs a sharp-eyed, carefully trained staff of inspectors who maintain ceaseless vigilance in the plants of Signal Corps contractors throughout the nation. Around the clock they are on guard against every possible defect, whether it be caused by honest mistake, accident, negligence, sabotage, or fraud.

This corps of sentinels-of-the-assembly-line is supervised by the Signal Corps Inspection Agency, Dayton, Ohio, an organization which in some respects is unique among the Army units which make up the mighty chain of supply from factory to battle line. It is also one of the newest, having begun operation October 5, 1942.

For nearly 25 years, Signal Corps inspection had been accomplished by inspectors working under the direction of individual contracting officers from procurement districts and laboratories. During the latter part of 1941 and early 1942, however, it became increasingly evident that this system lacked coordinated direction, even though its many individual parts might be operated with high efficiency. Although the system had functioned satisfactorily on a small scale, the tremendous expansion of Signal Corps procurement that followed the entry of the United States into the war, had created a whole new set of problems. It was not uncommon for a manufacturer to find himself dealing with several sets of Signal Corps inspection units, each operating under different policies and procedures.

At the same time, a diminishing manpower supply made it imperative that the most efficient possible use be made of the limited number of skilled technical and engineering personnel needed to cope with inspection problems.

The Office of the Chief Signal Officer ordered a comprehensive survey of the situation, which resulted in a report which said in part:

"The present organization of inspection, consisting as it does of several separate and uncoordinated systems, causes a duplication of supervision at numerous plants throughout the country. It makes inefficient use of such first-class supervisory personnel as is available and has a tendency to place, in positions of general responsibility, individuals who are proficient from a technical standpoint but are lacking in administrative ability or experience, or who are good supervisors but not well rounded out technically. The present system also makes inefficient use of subordinate personnel. At plants where two or more inspection units are located, cases may be observed where one unit is overloaded with work while another unit is temporarily marking time, and where the temporary shifting of a limited number of subordinate inspectors, at the location, would equalize the load.

"The lack of uniformity, as to policy and practice in the present inspection system, fosters a lack of trust and confidence between inspection units which, in turn, tends to lower the morale of the force, as a whole, and to lower its prestige with contractors."

As a result of this report, all Signal Corps Inspection

Teletype repair shop—units are returned to depot where necessary repairs and adjustments are made.

was consolidated under a single agency, and the function of inspection, except for materiel in the pilot run or the development stage, was separated from the laboratories and procurement districts, the new agency serving, however, as agent for both.

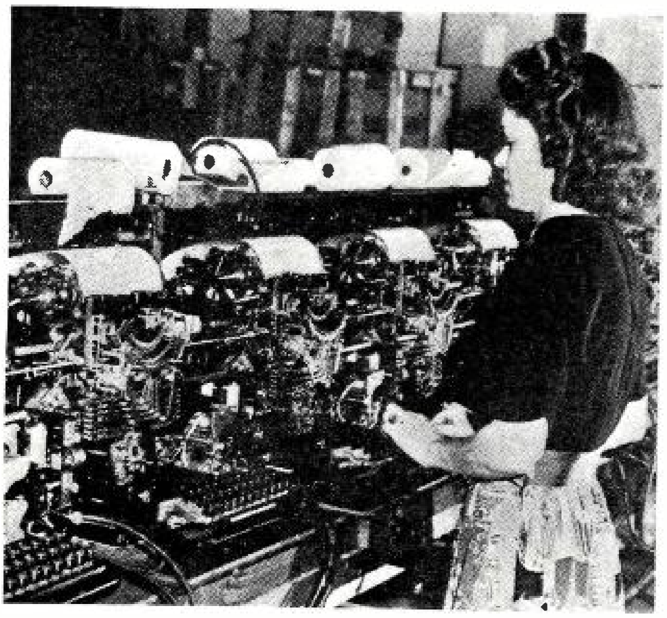
The Agency is composed of five separate zones, a small headquarters organization exercising coordinating and policy control functions, and a small liaison section in the Office of the Chief Signal Officer in Washington. The zone headquarters are located at Chicago, Dayton, Newark, Philadelphia, and San Francisco.

Each zone office is the center of control for all inspection matters within its designated area. The zone is the operating unit of the organization and has a semi-autonomous status, limited by (a) coordination and policy control from the director of the Agency in order to obtain uniformity of policy, (b) compliance with inspection instructions from the inspection engineering organization of the Signal Corps laboratories on products not completely out of the development stage, and (c) obligations to the contracting officer with regard to matters affecting terms of a contract.

Elimination of duplicate inspections was the most important and the first result of consolidating Signal Corps inspection under a single agency. Besides providing material savings in manpower, a Signal Corps contractor found himself dealing with a single inspection unit instead of several, automatically removing potential or actual confusion, loss of time, and unnecessary paper work with a constant speed-up of production and shipment. Likewise, the obtaining of testing equipment needed to insure proper operation of radio and electronic devices was facilitated.

It was quickly demonstrated also that reduction in the geographical distance between the field inspection units and the control centers to which they reported made for better administration. The system provided closer control necessary in a rapidly expanding program in which many of the products handled were relatively new to both the

Schooled in mechanics and minor repairs, women are driving 15-ton trucks, tractors, and other motorized equipment.



Inspecting Model 19 teletype printer at the point of manufacture.

manufacturer and the armed forces. The amount of business to be transacted at long distances was reduced to a minimum.

The organization is supervised by Signal Corps officers, but the bulk of the operations is carried on by more than 6,000 Civil Service employees scattered throughout the country, chiefly in small units but in some instances numbering several hundred in exceptionally large manufacturing plants.

One of the major jobs tackled by the Agency was to reduce paper work to a minimum and to speed the flow of essential paper so that this administrative phase would in no way slow up the shipment of equipment to the fighting forces.

The Inspection Agency is charged with determining whether Signal Corps materiel meets contract specifications, with accepting approved materiel on behalf of the government and with shipping the accepted materiel to the designated consignee from the manufacturer's plant. Handling many hundreds of millions of dollars of equipment, this involves considerable bookkeeping.

Formerly, however, three separate forms were required to accomplish this process. Now the Agency has devised and placed in operation a single form which serves as inspection return, receiving report, and shipping ticket, greatly reducing the size of the clerical force required to handle these records. This form, known as the Acceptance and Shipment form, has, in a large measure, also replaced a fourth form—the daily status report—by which the inspection organization supplied information to the Chief Signal Officer on the status of Signal Corps production throughout the country.

This speeding up of and reduction in paper work is worth emphasizing because it has meant two very important things—communications equipment gets where it is needed more rapidly than ever and the manufacturer gets his money. In most cases the necessary paper work, to enable the finance office to pay for accepted materiel, is completed within three to five days.

From the start the Agency recognized that it was confronted by an increasing load and a decreasing supply of trained personnel. Elimination of duplicate inspections helped greatly, but the problem was far from solved, so the Agency adopted a policy of employing and training women, many of them recent high school graduates, and men not physically qualified for induction into the armed forces. It is anticipated that inspection will provide ideal work for rehabilitation of soldiers disabled in the present war but still able to make a major contribution to the war effort.

Within less than a year the number of women inspectors rose from a scattered handful to more than 40 per cent of the total field personnel, and the ratio of women to men is expected to climb as the war goes on.

A number of all-female inspection units, including women inspectors-in-charge, have been established, and the results are gratifying.

While it was impossible to make electrical engineers out of several thousand young women overnight, an extensive training program was developed which has enabled them to become useful members of the organization in a very short time with little or no previous experience.

This training program is divided into two major parts, each complementing the other—pre-service training and in-service training. The pre-service training program was established with the cooperation of the United States Office of Education and the Service Commands, which provided facilities and instructors to do the job. Prospective inspectors were employed at regular government pay and given a six weeks' course of intensive training designed to give them a working knowledge of inspection duties and some technical instruction.

Graduates of these courses are given inspection assignments and their training is continued under the in-service program through frequent meetings, classes, and demonstrations.

The caliber of young women, who have been brought into the inspection service through these training courses, has been exceptionally high. Many of them have husbands, brothers, or sweethearts in the armed forces and have sought this type of employment for patriotic reasons.

Feminine Ordnance worker carefully inspecting linemen's belts.

Although large-scale employment of women, for inspection duties, was approached with some misgivings, this has been shown to be unjustified. In many types of mechanical and repetitive inspection, women have proved themselves superior to men, especially, where the checking of small, minute parts is concerned.

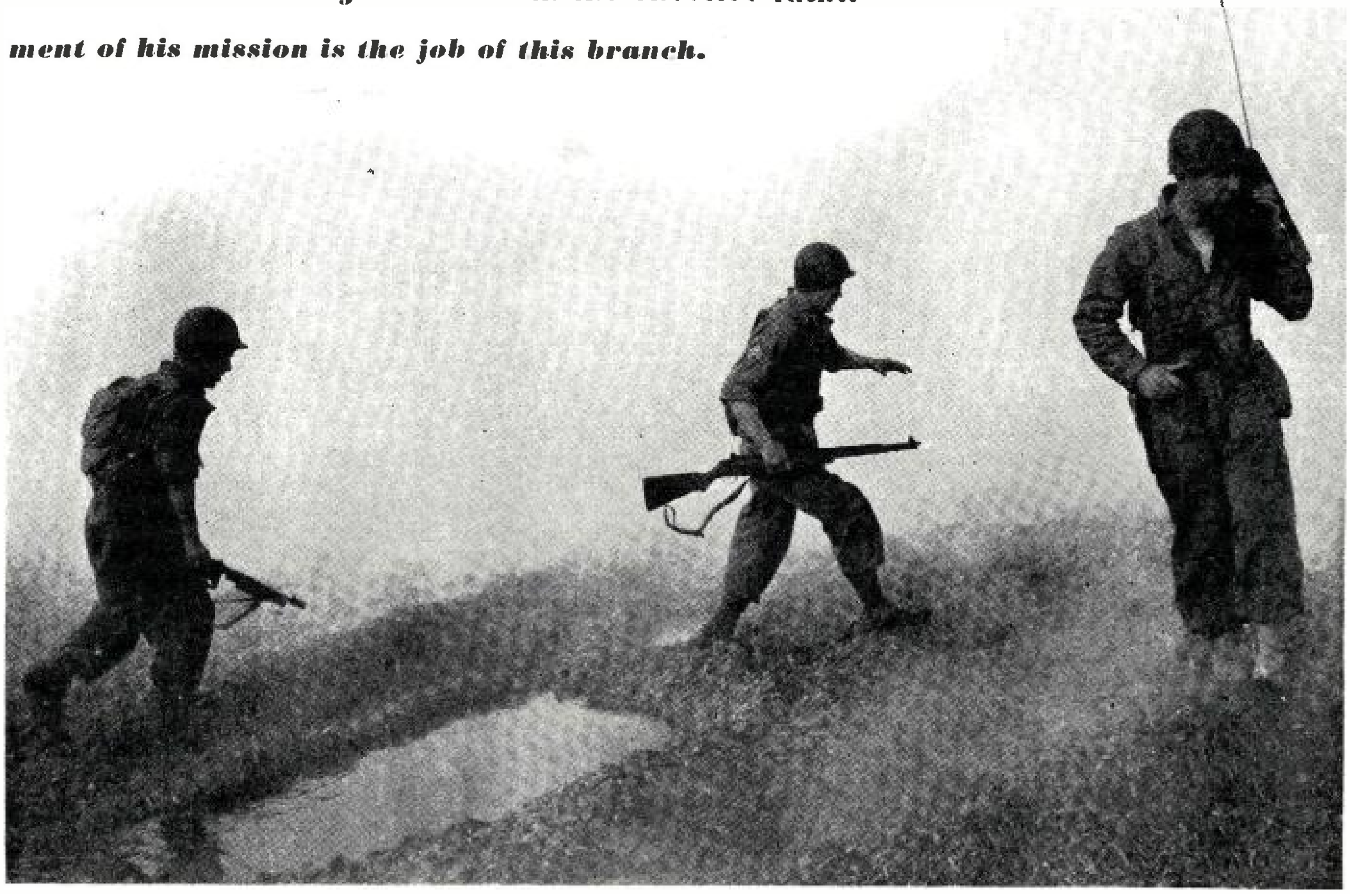
The Inspector's job is a thankless one—it is commonly said in manufacturing plants everywhere that "nobody loves an inspector." The work is unglamorous, little publicized and frequently monotonous. In emergencies, it frequently means working long hours, without rest, to enable a rush shipment to go out. High morale is required to assure constant attention to every detail, so that there will be no deviation from Signal Corps specifications.

A Signal Corps inspector's judgment, on as small a thing as a piece of solder, may mean the difference between victory and defeat in an attack many thousands of miles away. There is no time to repair a broken connection in a radio when a tank commander is using it to direct his armored units in the middle of the battle. An airplane group commander cannot wait for his radio man to heat

(*Continued on page* 254)

OPERATIONS

To assist the Chief Signal Officer in the effective fulfillment of his mission is the job of this branch.



Under cover of smoke. Rangers withdraw as beach officer coordinates movements by radio, during African offensive.

By Brig. General F. C. MEADE

Born in Philadelphia, December 16, 1896; was graduated from U. S. Military Academy in 1917. Holds an M. S. degree from Yale University, 1933; and is a graduate of Coast Artillery School, 1918; Signal School, 1928; Command and General Staff School, 1938. Served as instructor in Signal Corps School, 1933-37. Was with War Plans and Training Division, 1938-41, when appointed Officer in Charge, Air Communications Division. In 1942 served as C.O. of Replacement Training Center, Camp Crowder. Made Director, Plans and Operations Division, 1943.

WHERE the war really comes home to Signal Corps headquarters in Washington is in the Plans and Operations Division of the Office of the Chief Signal Officer. Over the desks of the officers who make up this division flow reports, requisitions, requests, recommendations, and decisions from the field and from the high command. And from these officers go directives and orders in the name of the Chief Signal Officer to all the myriad activities that make up the Signal Corps, U. S. Army.

The Plans and Operations Division is a staff agency. In military parlance this means its job is to "assist the Chief Signal Officer in the effective fulfillment of his mission." To do this it "secures and furnishes . . . such information as may be required; prepares plans and recommendations for . . . policies; translates his decisions, plans, and policies . . . into appropriate orders; brings to his attention matters requiring action by him or about which he should be informed; studies continuously the operations for which he is responsible; and assists, advises, and coordinates the operating services . . ."

In plainer language the Plans and Operations Division is the Chief Signal Officer's alter ego, taking action with respect to Signal men and materiel on the basis of strategic plans, filling requests from the combat zones, enunciating Signal communication's doctrines, and procedures, and handling a dozen and a half other responsibilities. What they all add up to is to see that the Signal Corps' part in this war is effective and efficient.

To carry out this function, the Plans and Operations Division is divided into several branches. They are: Theaters, Requirements Planning, Communication Liaison, Communication Coordination, Intelligence, and Operational Research. This last named branch is the subject of a separate article.

Theaters Branch

The Theaters Branch is fundamentally a liaison office between the Signal Officers of Theaters of Operations and the Chief Signal Officer. It consists of officers who represent the various fighting zones. Their mission is to see that when a theater commander requests certain supplies or personnel he gets them. With their knowledge of the general tactical situation in each theater, these liaison officers also anticipate needs.

At the same time, since these representatives are in one

Front-line scout relaying information back to command post.

office, the chief of the Branch and his executives are able to determine, when there is a conflict between two theater commanders for a limited amount of material, where the priority lies. This decision is also based on their knowledge of high strategy. They are kept up to date on these matters through their representation on the Joint Communications Board and the Combined Communications Board.

This coordination of Signal matters also applies to task forces, base commands, and defense commands. When the Signal Officer of the North African Western Task Force arrived in Washington in 1942, he had an immense amount of work to be done before that fateful D-Day in November when American soldiers stormed ashore to begin the Allied offensive that has continued to this day. He had to work out the final details of the complex communications requirements for the simultaneous landings at Casablanca, Oran, and Algiers, and to determine the specific Signal Corps troops and thousands of tons of communications equipment for shipment on the assault and supporting convoys.

The successful completion of this difficult task was aided considerably by the officers of the Theaters Branch. Under the conditions of absolute secrecy, which of necessity enveloped this operation, these Signal Corps officers provided for the activation of special troops, arranged for specialized training of Signal personnel, expedited procurement, modification, assembly, and shipping of vital equipment, and generally coordinated the activities of the Office of the Chief Signal Officer to enable it to meet the deadline.

One specific example of the details that went into this operation attracted much public attention and may be told. When the planning group of this Task Force decided it wanted a radio transmitter of the same wavelength as Radio Maroc, the then Vichy-French station in Algeria, it was up to Theaters Branch officers to see that this request was met. On five-day notice, the complete broadcasting station was procured, assembled, and installed by Signal Corps personnel on one of the battleships accompanying the invasion fleet. The seagoing station was then staffed by Signal Corps operators and maintenance men who even included a polylingual announcer.

The success of this method of reaching the military and civilian population of North Africa is well known. It was this transmitter that broadcast President Roosevelt's message to the French people, General Eisenhower's proclamation, and General Henri Honore Giraud's plea to the French military to cease resisting us.

Similar functions have been and, it is probably safe to say, are being performed for a number of other task forces and special convoys. Among those jobs performed in the recent past was a rush shipment of some 40,000 tons of signal equipment, effected entirely on the basis of an oral directive from Operations Divisions, War Department General Staff, on a single convoy for North Africa following the fall of Bizerte and Tunis. This job was followed through to the extent of having a representative of the Theaters Branch dockside to personally check the supplies onto the ships of the convoy.

Expediting urgent requests for communications supplies and insuring that Signal units are brought to full strength both in personnel and equipment prior to the departure of the task force that successfully attacked and captured the island of Attu in the Aleutians is another example of the closeness with which Theater Branch officers work with combat-bound fighting American soldiers.

Detailed estimates of Signal Corps units and equipment, which broad strategic plans of higher authority indicate will be required for operations in the principal combat areas, are prepared in Theaters Branch. Each estimate is broken down by successive zones through which the capture or recapture of enemy-occupied territory is expected to proceed and covers not only the specific types of personnel and equipment which will be needed but also the approximate dates by which units and materiel must be ready for action.

Requirements Planning Branch

The Requirements Planning Branch determines whether operational and training requirements will be met. Its job is to supervise the implementation of the decisions of Theaters Branch, both for immediate use and on a long range basis. That means that when an operation is decided upon, equipment, men, units, specialized troops and specialized materiel must be ready for D-Day. It is concerned, therefore, with training and procurement.

Runner receiving message for delivery during amphibious operations.

Walkie-talkie used to get message through after beach landing.

SCR-399 operating position. Operator uses push-to-talk microphone.

Signal Corps troops with portable hand-generator and receiver.

Stringing communication wires during landing operations.

It follows through on the activities for which it is responsible, and its officers are continually checking the progress of training and the progress in the procurement program so that men and materiel are ready when D-Day comes. Among its other jobs, it also assists the Theaters Branch in determining whether future operations can be supported. This responsibility is part of Requirements' job, since it has its fingers in the training and procurement program and thus is cognizant of the state of both programs.

This Branch is charged with preparation of Tables of Organization and Tables of Equipment for Army Service Forces Signal units. During the progress of the war it became apparent that the demands for varied communication services could no longer be met by the "type unit" organization.

Based on this knowledge Requirements Planning has set up operating teams which can handle anything from radio operating to crystal grinding. These teams can then be combined into a hand-tailored unit capable of operating any required communication system. The effectiveness of this new system has been demonstrated, time and time again, by the efficiency with which the Signal Corps has met demands for special men and material.

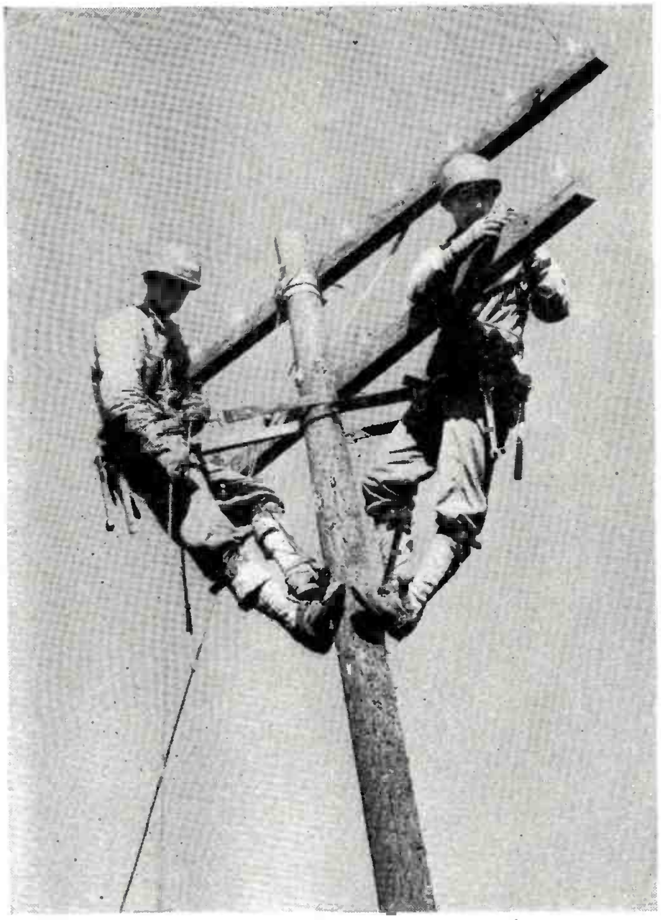
To carry out these duties, the Requirements Planning Branch maintains a file of the strengths, stations, and assignments of all Signal Corps units, and their Tables of Allowances. It also takes care of requests for Signal men and materiel from sources other than theaters of operations and defense commands. Among its other responsibilities it keeps an eye open on the assignment of Signal equipment to our Allies and others of the United Nations under Lend-Lease.

Communication Liaison Branch

The major function of the Communication Liaison Branch is to assign radio frequencies for all War Department installations and activities. To do this it must review and approve all requests and purchases for crystals and new type radios. In line with this major function, Communication Liaison also assigns tactical and international call signs for Army installations and activities operating within United States theaters. This also includes tactical call signs for all forces of the United Nations that are operating in U. S. theaters.

Another major function of C.L.B. is its position as technical advisor to War Department agencies on radio propagation matters. To do this it maintains liaison with the International Radio Propagation Laboratory. Other technical aspects of its work include maintaining liaison with the Army Air Forces concerning long distance radio communications and operating problems and with other federal agencies regarding frequency allocations, radio interference, and related matters.

Officers of C.L.B. represent the War Department on the



Signal Corps troops installing crossarms on a power-line pole. Many former Utility employees are keeping military communications open.

Inter-Department Radio Advisory Committee and other inter-departmental committees concerned with national and international radio frequency allocations. Its officers participate in the activities of the Combined Communications Board with respect to frequency and call sign allocations. Its officers also review non-government license applications for possible infringement on military needs.

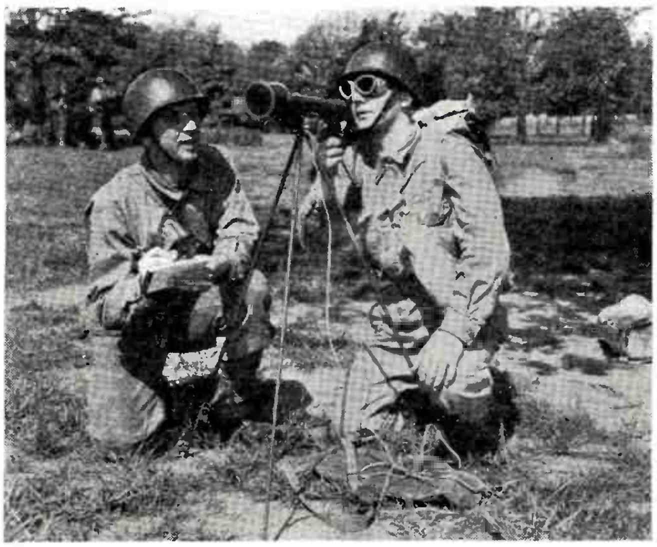
As readers of *Radio News* can well understand, the number of frequencies is definitely limited. There are just so many, and they can not be stretched, bent, or stuffed with more than one channel. This is the problem C.L.B. faces in allocating frequencies. It is one that includes such considerations as: existing operations, the needs of the United States, Great Britain, Russia, the French and our other Allies, the neutrals—Spain, Argentina, Sweden; and last but not least, the propagation characteristics for the job.

The necessity to keep new radio developments within the bounds of available frequencies is a highly important responsibility of C.L.B. There is more than meets the eye in increasing the effectiveness of radio equipment, and the field of frequency allocation and radio propagation is but one aspect of this problem.

Not so long ago C.L.B. officers received a call from a port of embarkation for a frequency to be used for plane-to-ship communications. Now, normally to answer that request would have taken considerable time for it is necessary to know the type of equipment being used, the crystals which are on hand, the modifications on equipment necessary, and innumerable other facts. However, this was a rush job, and so, working far into the night, officers of C.L.B. furnished it in 48 hours by slashing red tape and running things down personally.

At another time a C.A.P. plane was forced down some miles offshore and radio communications between searching planes and C.A.P. headquarters were interrupted by interference on the safety frequency. C.A.P. officials immediately called the Communication Liaison Branch to find out what station was operating on that frequency and to ask C.L.B. to "get them off the air." The next hour saw officers of C.L.B. calling the Navy, F.C.C., and the C.A.A. in addition to checking Signal Corps stations and having Signal Corps radio direction finders take bearings on the interfering station. Within 60 minutes the cause of this disturbance was located and the station was shut down.

Signal lamp and goggles equipped with red filters to increase visibility of the blinker light during daylight hours. This equipment is used for line-of-sight communications when radio silence is essential and wire lines have not yet been laid.



Communication Coordination Branch

Communication Coordination Branch has the job of setting up standard procedures for Signal communications. On a par with this it also has the responsibility of recommending how Signal communications men and materiel shall be used—tactical doctrine. Subsidiary to this latter is its responsibility to formulate tactical doctrine and techniques for Signal units assigned to Army Service Forces.

A second major function of the Communication Coordination Branch is to follow up cases of the Communication Coordination Committee and the Signal Corps Board. These two agencies are the advisory committees on Army communications.

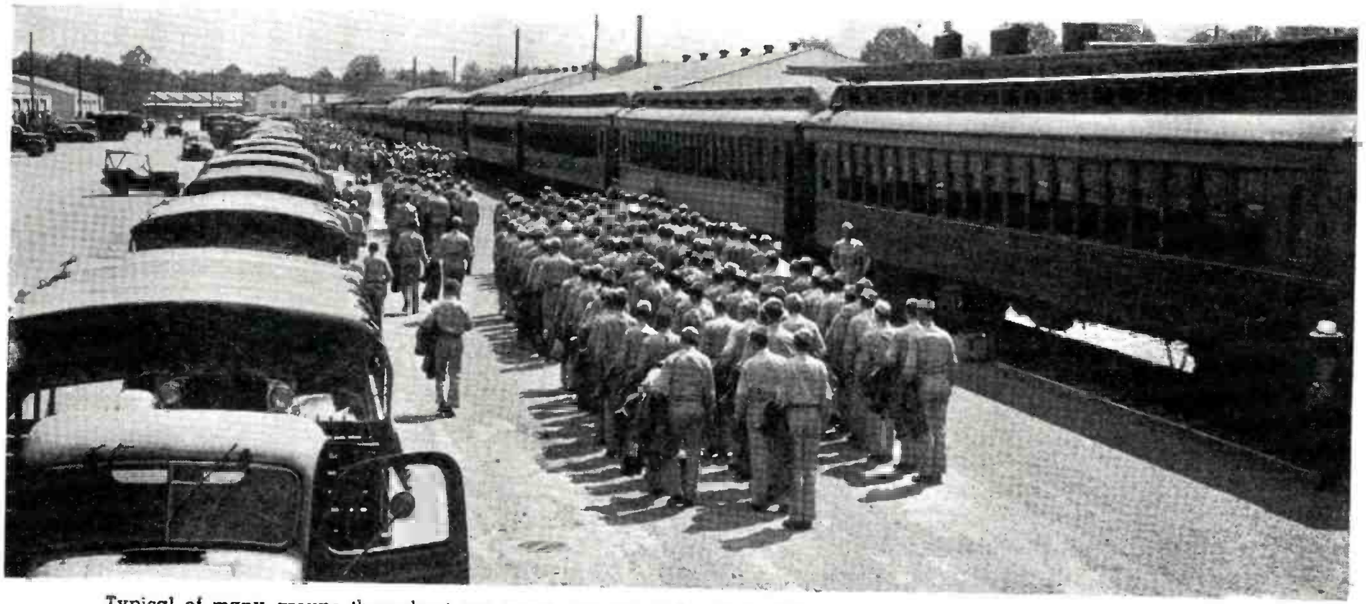
Highlight of Communication Coordination during the past year has been the establishment of combined operating procedures for Signal communications between the American and British forces. This is now in operation, and because of its promulgation, American Signal Corps men are able to work with the U. S. Army and Navy and the British Army, Navy, and Royal Air Force.

The importance of this amalgamation of the different practices can be seen by this simple example. At North African AFHQ it is necessary for General Eisenhower to be in contact with U. S. Army units, U. S. Navy units, British Army units, British Navy units, Royal Air Force units, and French Army components. Each of them had their own procedures in communications. Therefore it was necessary to have a British Army Signal unit take care of British Army communications, a British Air Force Signal unit take care of R.A.F. communications, a U. S. Army Signal Corps unit to take care of U. S. Army communications, a U. S. Navy unit to take care of U. S. Navy operations, a British Navy unit to take care of British Navy communications, and a French Signal group to take care of French communications.

Today only one Signal unit is necessary at AFHQ, and this unit may be entirely composed of men of one of the six services, or it may be composed of men from all six of the services, who are now all familiar with the standard operating procedures, the same in all services.

In its work on communications doctrine, officers of C.C.B.

(*Continued on page* 330)



Typical of many groups throughout our country is this cadre of the 80th Division arriving at Camp Forrest rail-head.

MILITARY PERSONNEL

The author of this article predicts an SC soldier will flash "Victory."

By Brig. General J. V. MATEJKA

Born in Texas, 1894, Graduated Univ. Texas, 1916; Army Ind. College, 1926; Signal School, 1930; Command and Genl. Staff School, 1930; Army War College, 1935. Was Assistant Signal Officer of the Panama Canal Dept., 1920; was Assistant Signal Officer, 8th Corps Area, in Office of Chief Signal Officer. Instructor in Signal School, 1930. In the Office of Assistant Secy. of War; Assigned to General Headquarters; went overseas; became Chief Signal Officer, E. T. O. and Allied Force Headquarters, North Africa, where awarded Legion of Merit. Now, Chief, Personnel and Training.

I THINK I should warn readers of this article that it is difficult to stop me when I start talking about the quality and character and performance of the military personnel of the Signal Corps.

It is natural, perhaps, that as Chief of the Personnel and Training Service, I should be inclined toward superlatives —in public, at least—when discussing the women and men under my immediate charge. And so, in order to be absolved of prejudice, I consider it important that I repeat here a general estimate of Signal Corps personnel based on experience overseas before I held my present assignment.

Reporting to the Chief Signal Officer, after a tour of duty as Chief Signal Officer of the Allied Force Headquarters in North Africa, I was proud to tell him that, from my observation and from the experience of others, it could justly be said that American signal troops in combat were maintaining the best traditions of the Corps and were supplying and operating unexcelled communications for our Army.

Whether moving with the front line elements or setting up and manning networks in less advanced echelons, the officers and men of the Signal Corps are proving their mettle and are—in the face of every destructive battle condition—getting the message through.

The Signal Corps is justly elated at the numerous awards and citations that are coming to its men from commanders in every theater of operations. We like to recall that a

(*Continued on page* 396)

Telephone exchange in Iceland handles 7000 calls a day.

Stringing wire for communications at our New Guinea front.

V-MAIL

The adoption of V-Mail service has reduced shipping tonnage to overseas ports.

V-Mail room at the Pentagon building. Paper reproductions are inspected and then cut into individual letters.

By Lt. Colonel E. D. SNYDER

Born in Springfield, New York, February 18, 1889. He attended Syracuse University before serving with the American Forces on the Mexican border in 1916. He served with the American Expeditionary Forces during the last war, and is the holder of the Purple Heart Decoration. He had been employed by the General Electric Company in the city of Rochester, New York, from 1920 until he was called into active service and assigned to his present position. He is now serving the U.S. Army in the capacity of the Officer in Charge of the V-Mail section, Army Pictorial Service.

THE scene is Paris, 1871.

Inside the besieged city, a fluttering pigeon, held tightly in the grasp of a man, is having something attached to its leg. The man's grasp is released with an upward fling. The pigeon wings its way over the heads of the encircling Prussians out to the French Army in the provinces.

The forerunner of V-Mail has gone out on the leg of that pigeon.

It was fitting that microfilming should make its bow to the world by air and in wartime. Crude as they were, the miniature photographs that left the French capital by pigeons, back in the dawn of photography, successfully carried to the outlying troops copies of army orders and newspapers.

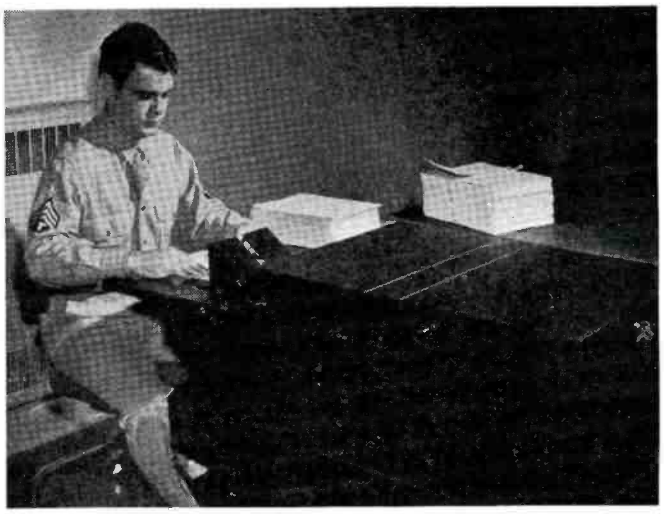
The next scene is another war, fought with weapons so much deadlier as to have staggered the most vivid imaginations of Prussians and Frenchmen alike back in Nineteenth Century Paris and on a scale so great that their war would have seemed almost a skirmish. In this war cities are besieged and obliterated from above. And men fight high over the earth's surface and below its waters and in many places across the whole wide circumference of the world at once.

Their swerving, straining lines of supply are no mere wagon trek across a continental nation but surpass the longitudes and latitudes of the earth itself.

The scattered soldiers of this war, like soldiers of all the wars before them, thirst for word from their people at home. Getting that word to them is a huge problem and an important one to their morale.

Now the scene focuses on Colonel William Rose (since Brigadier General), in charge of Army postal operations for the Adjutant General. Already, early in 1941—while the flames of war are sweeping closer and closer—he is giving thought to the task of getting mail to the Yanks garrisoning our island outposts quicker and with the least use of cargo space.

And then across Colonel Rose's desk comes a report on something the British call Airgraph, a microfilming technique developed in the United States by the Eastman Kodak Company. Begun in May, 1941, Airgraph is a process by which tons of mail of the English troops in Egypt are



Recording machine where V-Mail letters are photographed.

reduced to light and tiny parcels, flown between Cairo and London and, at their destination, transformed to readable size again for delivery.

Colonel Rose is impressed. Here may be an answer to that huge problem of moving the mail back and forth between America and America's far-flung outposts. More reports are ordered and studied. Then, in 1941, Colonel Rose recommends that a micro photographic mail service, patterned after the British system, be inaugurated.

The Signal Corps is asked to make a preliminary report on the project. Lt. Col. Kenneth B. Lambert (then Major) examines equipment and blueprints and every possible device that will handle what he is already certain will be a tremendous volume of filmed mail. Finally from a welter of figures he compiles the estimated cost of the project and on September 20, 1941, he submits his recommendations for the appropriations, personnel, and operation.

Postal Inspectors C. L. Williams and William A. Kenyon (both now colonels in the Army) and Inspector W. J. Means conduct experiments with a Recordak used for photographing records in the Washington Post Office Department and all rights to Airgraph are granted the Army by the Airgraph Corporation.

As difficulties are ironed out and the Army Micro Photographic Mail Service approaches reality, one detail still bothers Inspector Williams. He doesn't like that ponderous title waiting to be hung around the neck of the as yet unborn baby of the mails.

It should, he feels, have a name emblematic of the times, short and streamlined to typify the swift compactness of the service itself. He evolves the name "Victory Mail" and submits it to his colleagues.

"Why not just V-Mail?" Captain R. K. Awtrey, U.S.N. Retired, inquires. "After the words we could use the notes symbolic of the V sign from Beethoven's Fifth Symphony."

"Better than that," another suggests. "Instead of a hyphen between the V and the Mail we could have the Morse code for V!"

So the official name became V ···— Mail.

The Signal Corps was given the job of processing V-Mail for the Army and a large part of the Navy. That has turned out to be a big job and it's getting bigger every day. At this writing, the volume of V-Mail has increased 400 per cent since January 1, 1943. That means over 25,000,000 V-Mail letters a month.

It may seem a far-fetched statement to say that V-Mail is shortening the war and thereby saving the lives of countless American soldiers, but the connection can very easily be demonstrated— All military experts agree that only offensives will bring this war to a successful conclusion for us. Beginning and maintaining of these offensives are dependent on shipping, on the staggering task of transporting millions of tons of men and materiel all over the face of the globe.

Now all one has to do is consider the fact that each

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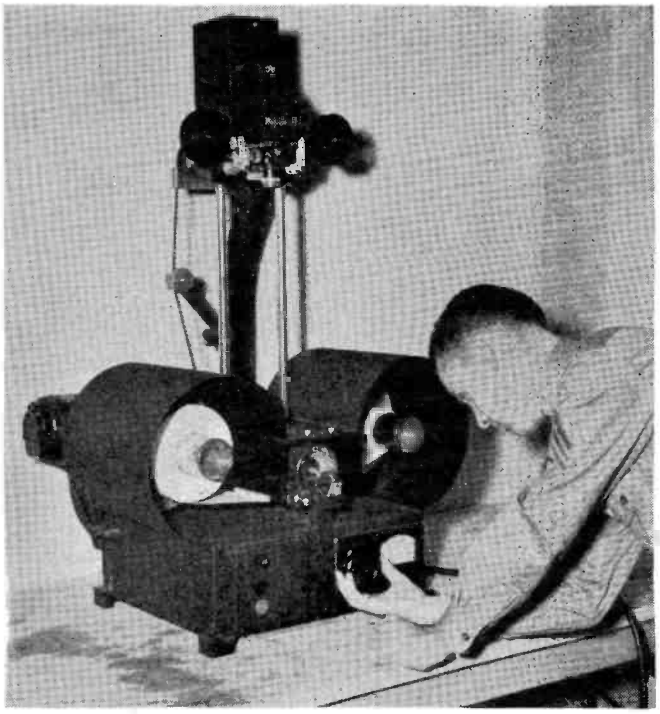
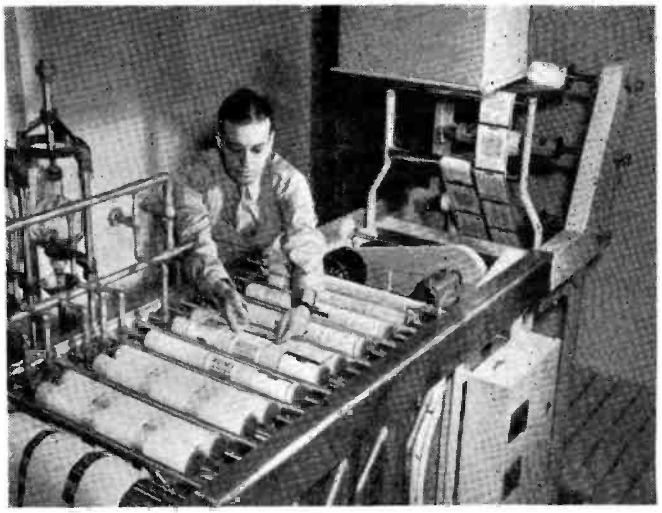
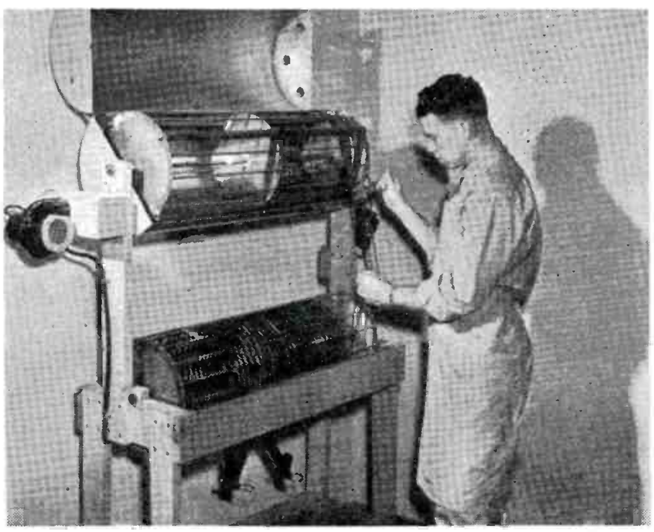


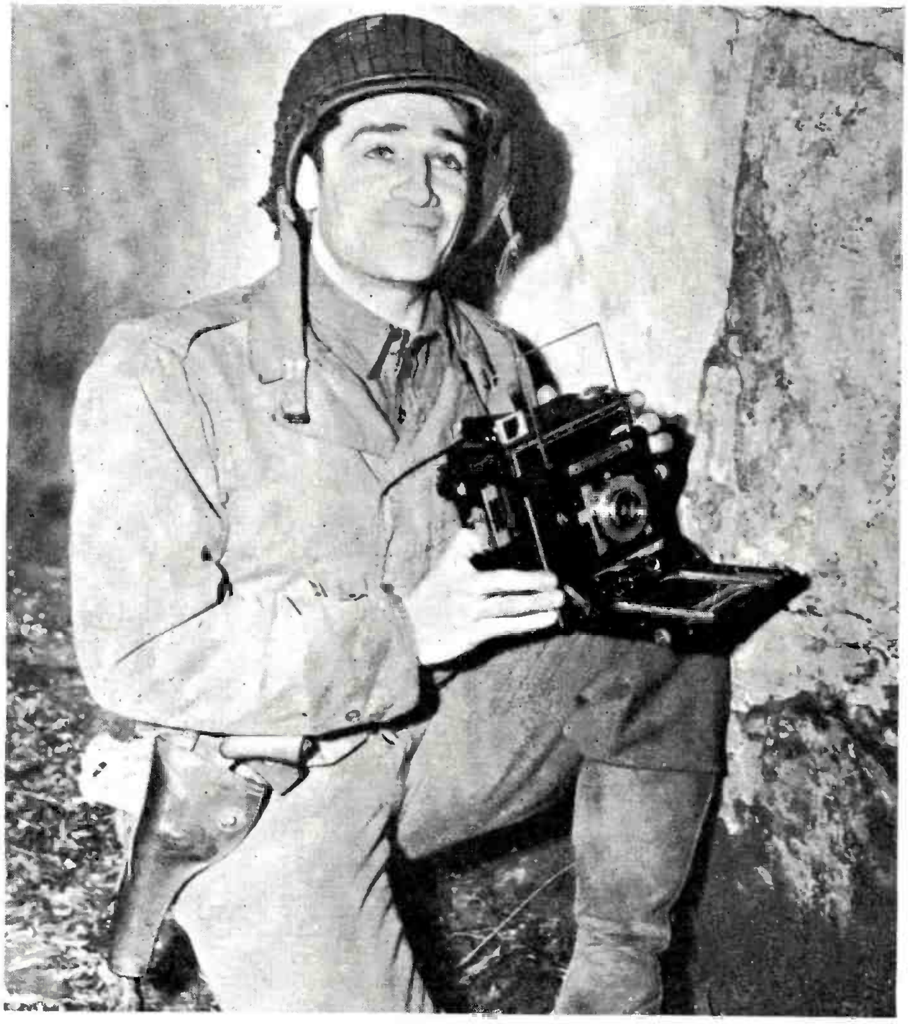
Continuous enlarger where films are reproduced to normal size.



Developing, fixing, and drying V-Mail letters on processing machine.

Films being developed. After drying they are sent in compact groups.





U. S. Signal Corps cameraman. The Army trains expert combat photographers so that the war can be recorded on film for intelligence and tactical study.

Signal Corps troops operating a beach signal station. Coded signals are used.

Photographic view showing elaborate pole line installations on New Caledonia.

Training Army PHOTOGRAPHERS

By Captain ARTHUR C. GASKILL

Experts teach men of the Corps the art of taking both still and sound pictures. Basic study course lasts twelve weeks.

IN ORDER to put the war on film for the record, newsreels, and newspapers and for intelligence and tactical study—the Army trains expert combat photographers and motion picture cameramen.

At the Signal Corps Photographic Center, at Long Island City, N. Y., there is a fully equipped and expertly staffed Training Division which teaches soldiers the art of combat photography.

The men in the school have some civilian photographic background of one type or other and many of them were affiliated with newspapers all over the United States. In the school they are taught what pictures the Army needs and wants, and how to get them under difficulties presented by battle conditions and by the elements. They are taught the mechanics and the general principles involved in the care and use of every type camera used by the Army. At the same time, the student photographers are taught to fight and to protect themselves from enemy action.

The course of study lasts for twelve weeks. All students, assigned to the Training Division, spend two weeks in a basic school, where, for two hours per week, they attend what is called an orientation course. In this class, they are indoctrinated with their mission on the battlefield in the prosecution of the war. The instructors, through interviews, quizzes, and questionnaires, learn the background of each man. The employment record of each student is studied, as is his educational and recreational background. The information gathered by the instructors in this way, helps them later to decide what, if any, is going to be the student's specialization.

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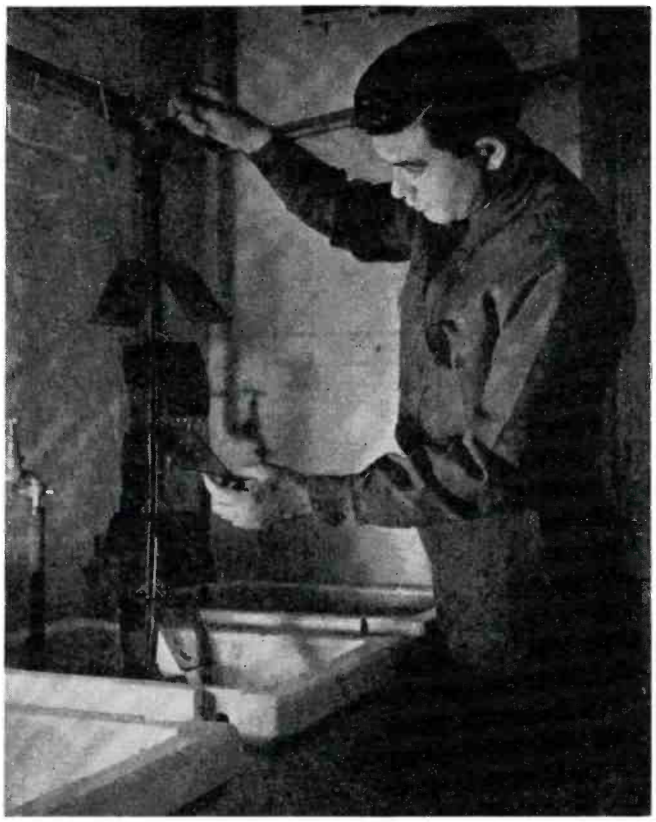


Processing film-pack negatives in the laboratory of an American Pictorial Service unit somewhere in England.

ARMY PICTORIAL IN ETO

By Col. WILLIAM W. JERVEY

Born December 22, 1897 in Chicago, and was graduated from the U. S. Military Academy in 1918; the Cavalry School, 1920, and the Signal School, 1929. Served in the Signal Corps Photo Laboratory, 1931-35, and was a student at Academy of Motion Picture Arts and Sciences, Hollywood, Calif., 1937-38. Was Officer in Charge, Signal Corps Photographic Laboratory, 1939-1940; Assistant Officer in Charge, Photographic Division, Office of Chief Signal Officer. Became Executive Officer during 1941-42. At this time, he is Photographic Officer, ETO.

Taking action shots under fire is but an "assignment" for Army photographers.

THIRTY days after the infamous attack on Pearl Harbor, a detachment of seven men, weighted down by field photographer's kits in addition to their regular GI equipment, boarded an oil freighter loaded with high explosives and set sail for North Ireland.

This group of one officer and six enlisted men was the initial contingent of photographers that eventually was to become the Army Pictorial Service in the European Theater of Operations.

Their first darkroom at Headquarters, ETO, was a basement kitchen with tar paper tacked over the windows. The only water supply issued from a battered old kitchen sink.

The mounting demands of the war effort soon made it necessary for the personnel to be greatly expanded, along with many additions of newer equipment and an ever increasing flow of supplies, until today the base laboratory and headquarters of the Army Pictorial Service in the ETO occupies nearly all the floor space of two office buildings in a United Kingdom city.

Instead of the seven men in the original detachment, the APS today consists of certain Photo Units and Mobile Photo Laboratory Units and headquarters staffs that comprise hundreds of trained technicians, photographers, and administrative personnel.

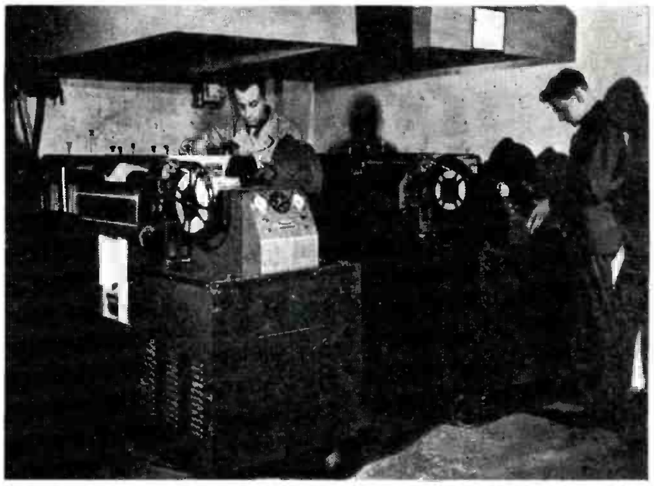
The present work is far different from what it was when the first detachment set to work. When returning from assignments it was not infrequent for them to be met at the station by 1st Lt. Eric Marquardt, the detachment commander, with a new supply of films and orders to another distant coverage. But today the well-trained staff and efficient organization make it possible for the APS to give complete coverage in the ETO.

Pictorial coverage of news is only one phase of the APS work. Film production and distribution occupy essential niches in its activities. Many intelligence reports are sup-

(*Continued on page* 258)

Drying and classifying finished prints in the laboratory.

Operating two 16 mm. movie-film processing machines.



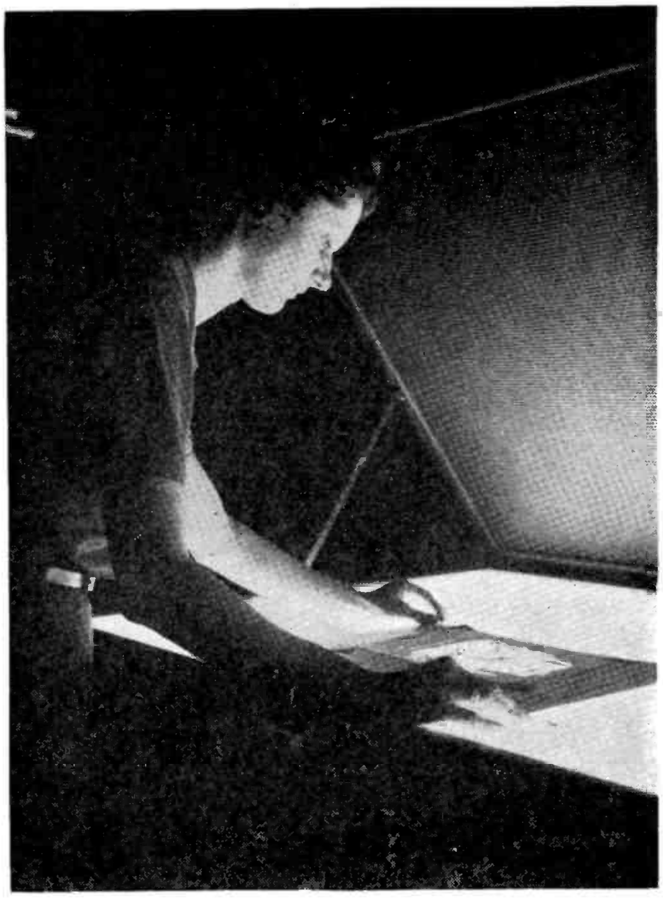
ARMY PICTORIAL

Army photographers are among the best in the world. They cover every battle.

By Col. KIRKE B. LAWTON

Born in Athol, Mass., November 3, 1894. Has a B. S. degree from Worcester Polytechnic Institute, 1917; graduated Signal School, 1925. Was assigned the post of Corozal, C. Z., as C. O. of the 10th Signal Co. and Acting Signal Officer, Panama C. Z. Became secretary of the Signal School, 1929-31; instructor of the Massachusetts National Guard at Boston, 1931-36; instructor at Reserve Officers Training Corps at M.I.T., 1936-40, and was with War Plans and Training Division, 1940-41. Was appointed Chief, Army Pictorial Service, 1942.

Signal Corps cameraman somewhere in French North Africa.



Giant contact printer used for reproducing blueprints.

AS YOU read this magazine, you may be sure that somewhere crouched in a foxhole, is a U. S. Army Signal Corps photographer, popping up between shell bursts to shoot a picture; that somewhere else another is probably unslinging a hot-barreled carbine as he temporarily discards his camera; that in another part of the world a helmeted soldier is cursing the quivering ground beneath his feet as he tries to steady his overworked Graphic for more action stuff.

In every theater of this global war, wherever the action is hottest and the fighting fiercest, will be found the camera crews of the Army Pictorial Service. They are the eyes of the War Department at Washington, sending back a visual realistic record of the fighting on every front.

To a great extent, they are the eyes of the American public, too, Try to conceive of how hazy and bewildered your own ideas of this war would be if you had never seen a picture of combat, of troops in action, of the devastation and destruction, of all the phases of warfare that the camera has clearly laid before you. Many, if not most, of those pictures, both still and motion, bear the familiar label, "By U. S. Army Signal Corps."

Every day and night men of the Army Pictorial Service are risking—and giving—their lives to bring you this graphic history and to send back the pictorial records on which our future tactics so often depend.

A glance at a few excerpts from the reports of Army photographic units in the combat zones will give you some idea of the difficulties that beset them:

"We have been in every major battle over here since . . . from mountain and green slopes to the sands of the desert and oasis. . . . One man who is missing in action . . ."

"Some of us ran into trouble . . . searchlights, machine gun fire. . . . Some of the boats turned over in the surf while others sank with just too many holes from .50 calibre machine gun fire. I was in such a boat and had to swim in with my camera equipment on my back."

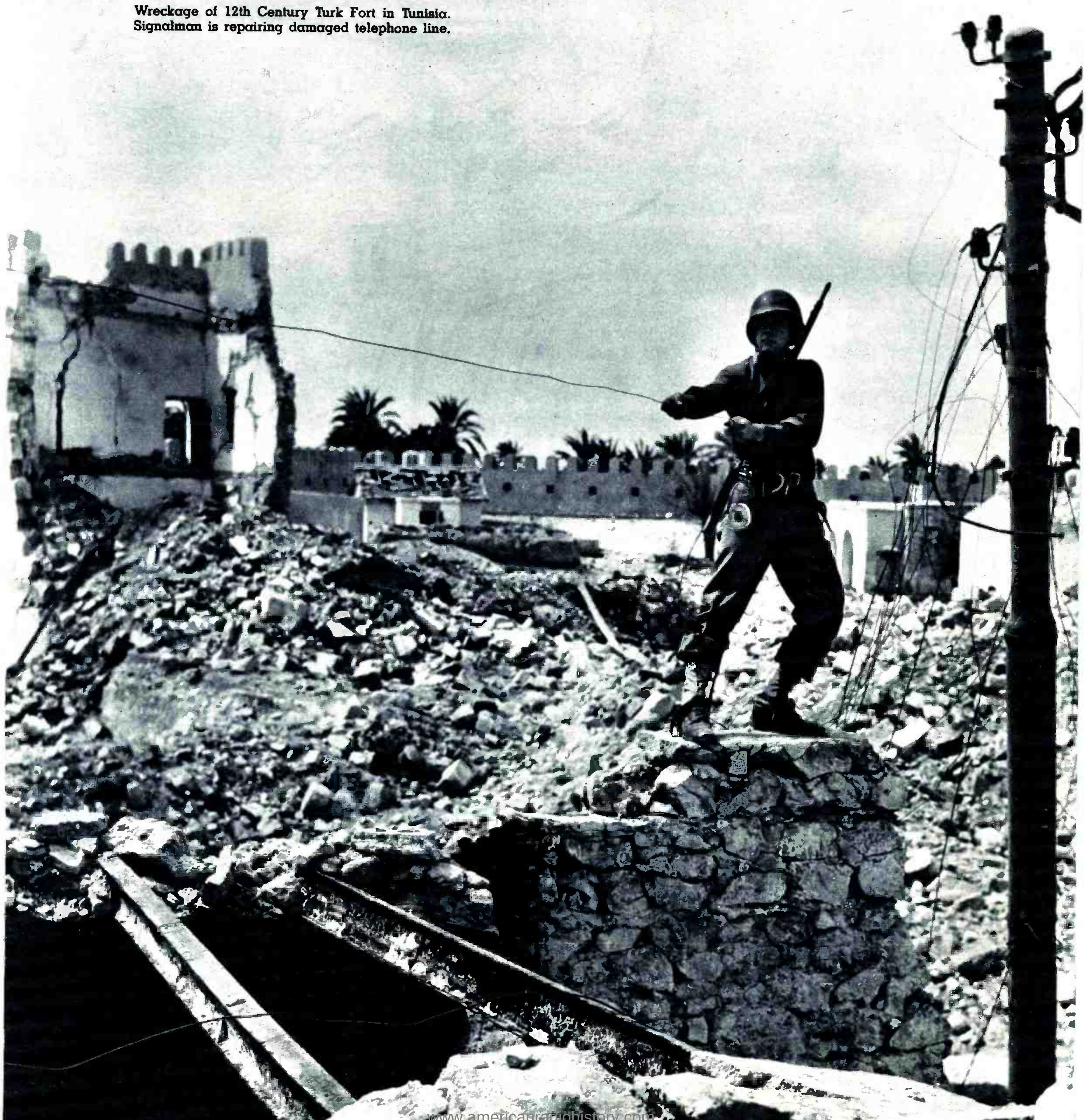
"We didn't have to go in on the first four assault waves but my men volunteered and insisted."

(Continued on page 147)

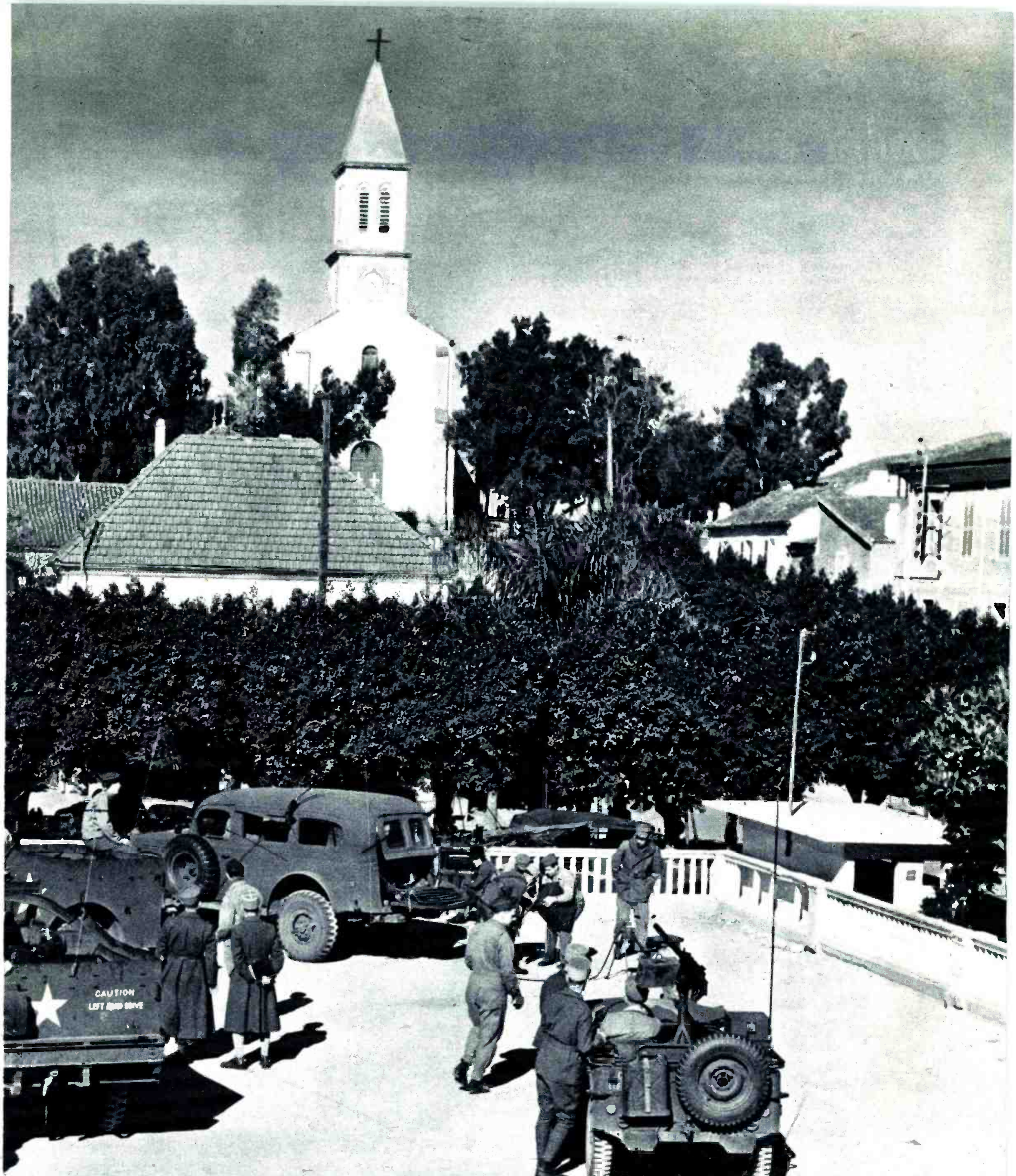
OVERSEAS PICTORIAL

Signal Corps Photographers are in every major battle, on every front—shooting a graphic record of our global war

Wreckage of 12th Century Turk Fort in Tunisia. Signalman is repairing damaged telephone line.



NORTH AFRICA



American personnel give instructions on American radio equipment to French communications officers at a class held near Algiers.

NORTH AFRICA

American main Signal Station. Regimental radio in ditched position located back from beach at Les Andalouses, Algeria.

Cpl. Milton Theodore, Signal Battalion man repairing damaged lines somewhere in the North African Theatre of Operations.

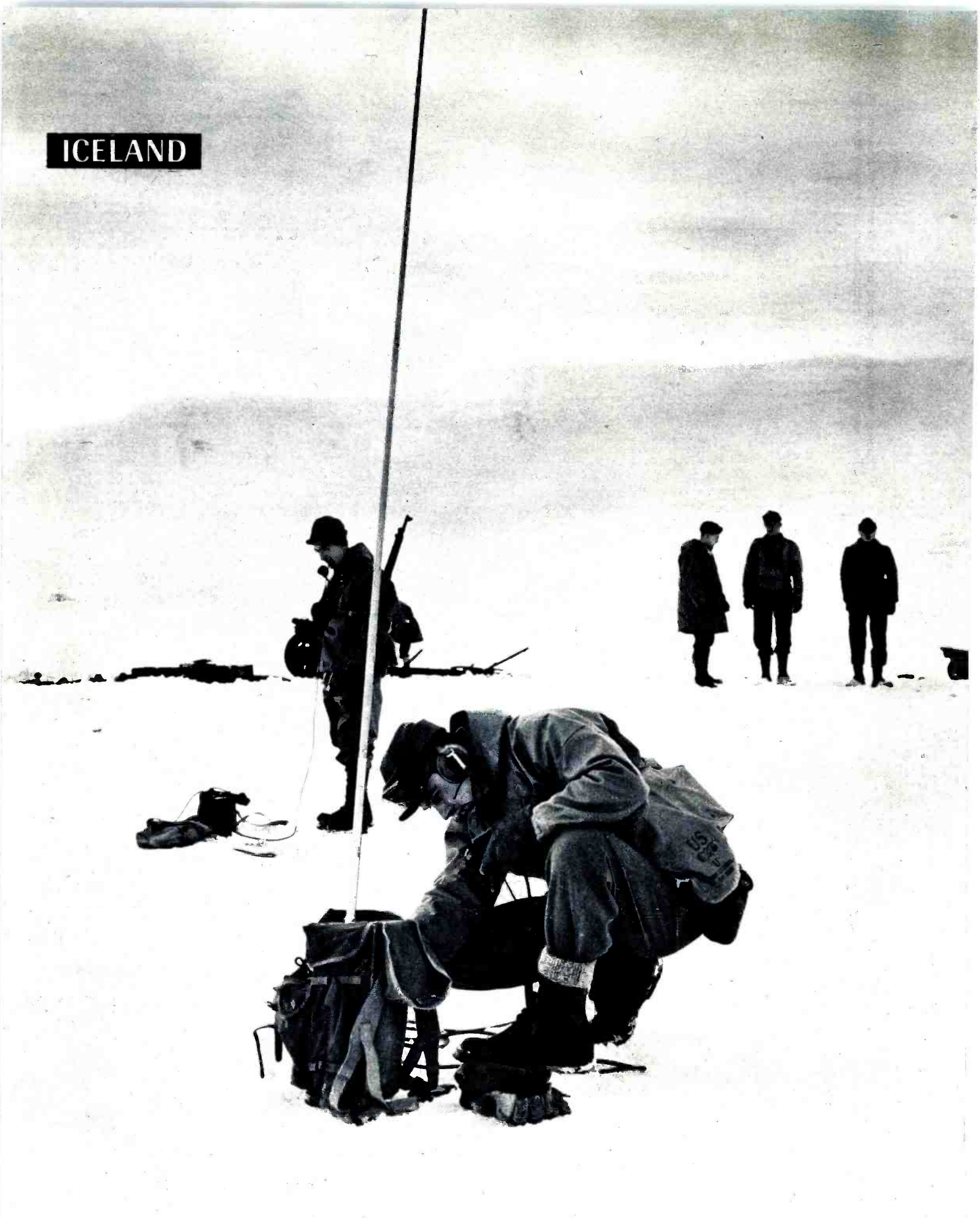

U.S. Signal Corps troops set up a telephone switchboard immediately following the Allied capture of Bizerte, North Africa.

SICILY

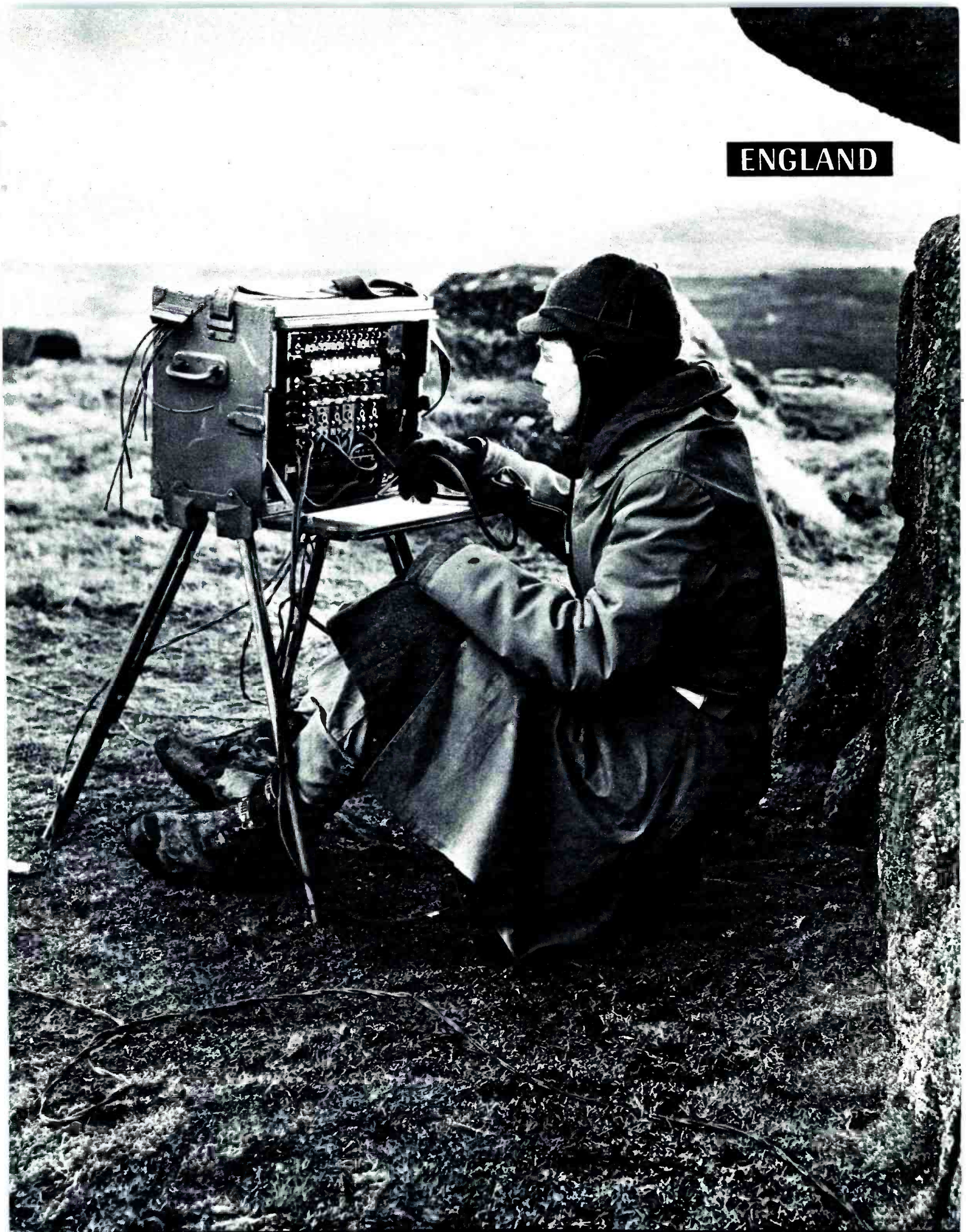
Center of Caltanissetta with Signal Corps men of the 45th Div. setting up wire installations. Note wire reel on American Jeep.

American Jeep, radio equipped, together with other equipment just landed at an Alaskan base after Japs were driven out.

Radios, telephone equipment and accessories complement this Jeep somewhere in the Alaskan Theatre. Note heavy tire chains.



The highly efficient "Walkie Talkie" two-way Radio in communications between our observation posts and the firing line.

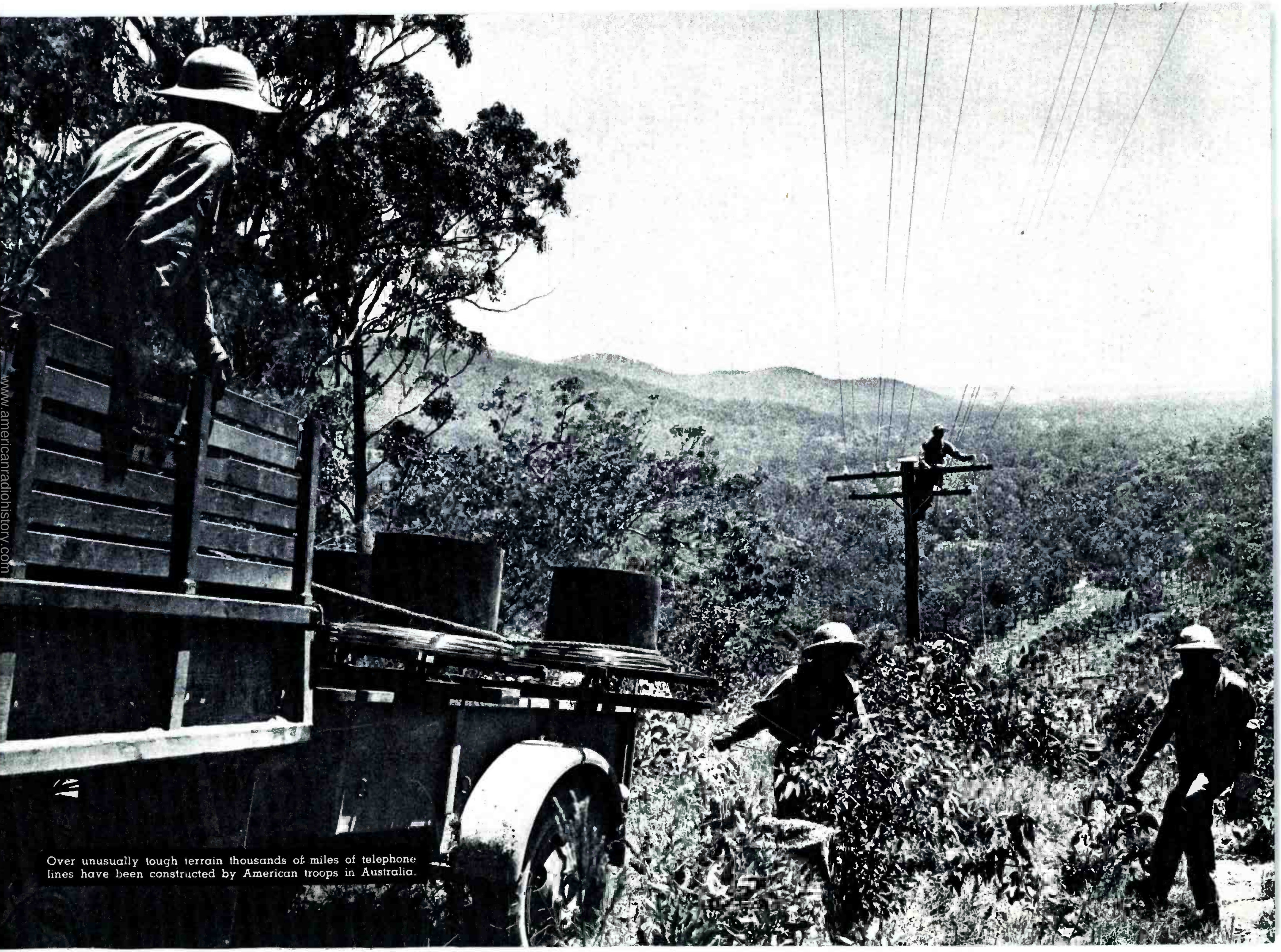


ENGLAND

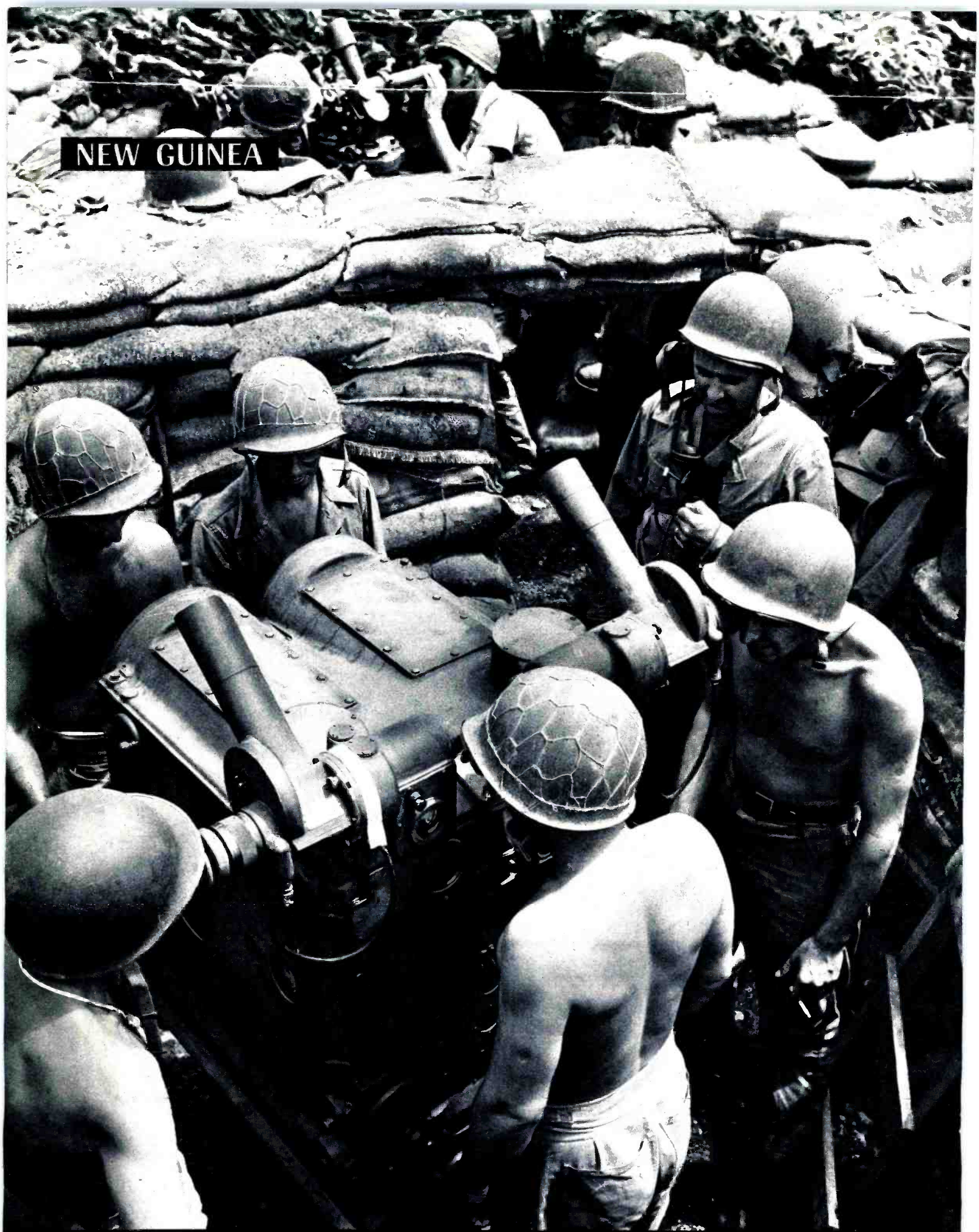
Cpl. William Halstead, Norfolk, Va., at field switchboard receiving orders from observation post of an Artillery range.

AUSTRALIA

American soldiers are here shown receiving firing orders from observation post somewhere in the Australian Theatre.

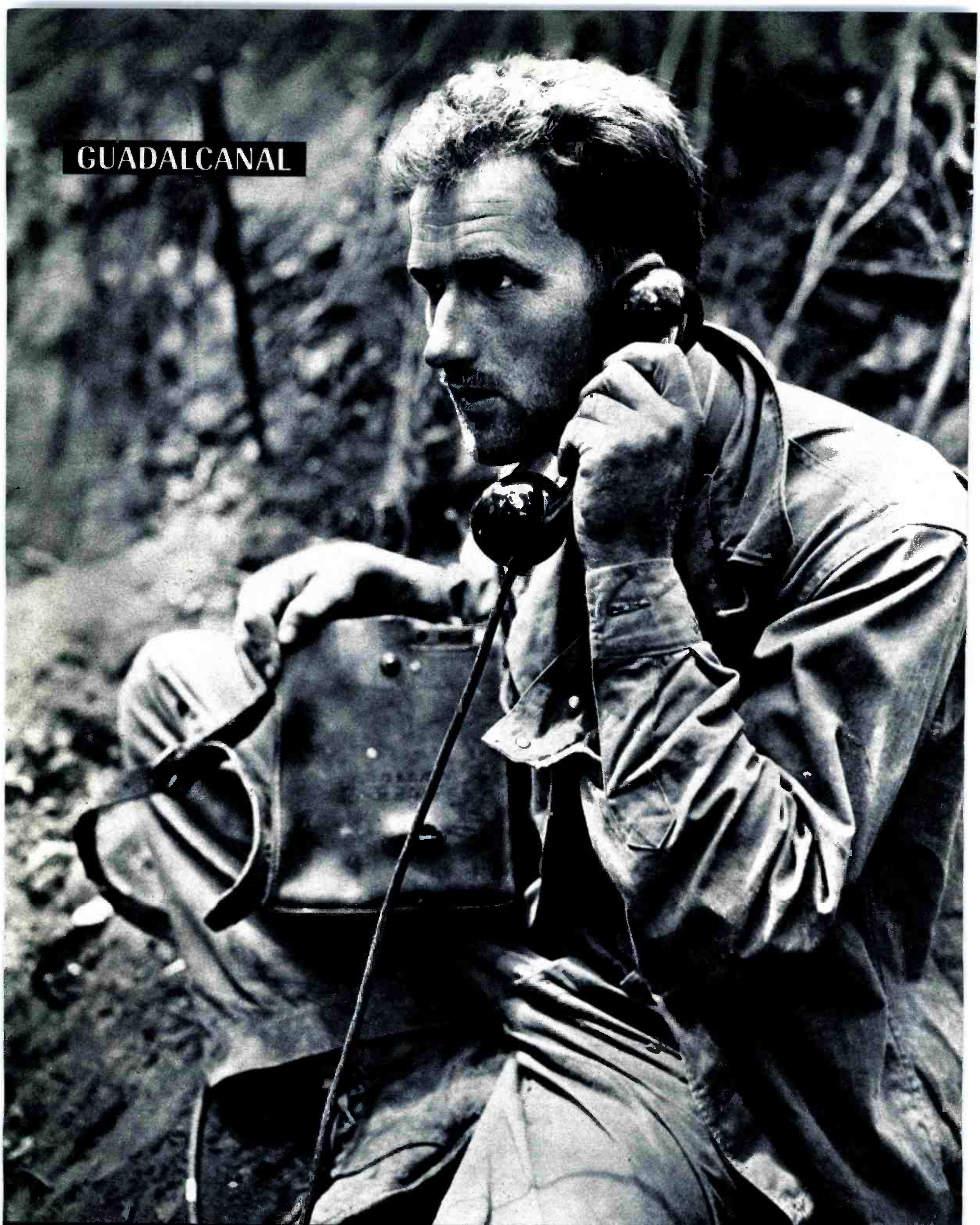


Over unusually tough terrain thousands of miles of telephone lines have been constructed by American troops in Australia.



Telephone communications play a vital part between artillery batteries and the directors. Such equipment is very delicate,

Pfc. Edward C. Griser operating the BD 72, 12 drop switchboard in a communications dugout somewhere in New Guinea.



Pvt. Edwin J. Yanushkis holding the phone which was hit by shrapnel when a Japanese knee-mortar landed six feet away.

(*Continued from page* 130)

"One corporal photographer led a group of infantry to the rear of a fort, where they knocked out a machine gun nest."

"One corporal photographer was the fourth American to land on African soil, going in with . . . to the very mouth of the French guns. He helped take prisoners and captured a small cannon."

"One sergeant was so anxious to get head-on shots of our advance that he was caught in our own barrage, but he got his pictures of the taking of the fort."

"We have had to scale cliffs and follow goat trails six to seven miles for pictures."

"The enemy hates photographers, we have found by quite a few close calls. Thus a musette bag with extra film, his cameras and rifle make up the photographer's combat equipment. There are times when you have to shoot your way out."

"We learned to keep our cameras out of the sun, particularly the desert sun; they get so hot we can hardly hold them and there is damage to the film."

"We have to walk, stalk, and crawl on our bellies to get a closeup."

"The boys have stuck their necks out plenty to keep up with the continuity . . . and in most cases have been fired upon by machine guns, rifles and the inevitable 88's . . . until everyone of them have what we call up here at the front 'eighty-eightitis'. . . . You don't see them, you don't hear them . . . then whoosh, there they are right in the middle of your area, and everybody has to duck."

". . . Three cameras shot out of my men's hands."

". . . One of my boys receiving the Silver Star for gallantry in action."

From dangers and difficulties such as these—and they are the merest sampling—have come such epic records as "Report from the Aleutians," "At the Front" in the Tunisian campaign, and thousands of still and motion picture scenes of American troops and America's war-time leaders in all phases of their activities the world over.

But these pictures you have seen are only a small portion of the job of the Army Pictorial Service. Every morning in a projection room in the War Department's Pentagon Building in Washington will be found one of the most select, and probably the most rapt, motion picture audiences in America.

They are the representative officers of every arm and service of the Army and of the Navy, Marines, and Coast Guard. The motion pictures they are watching are the daily receipts from the various theaters of operation.

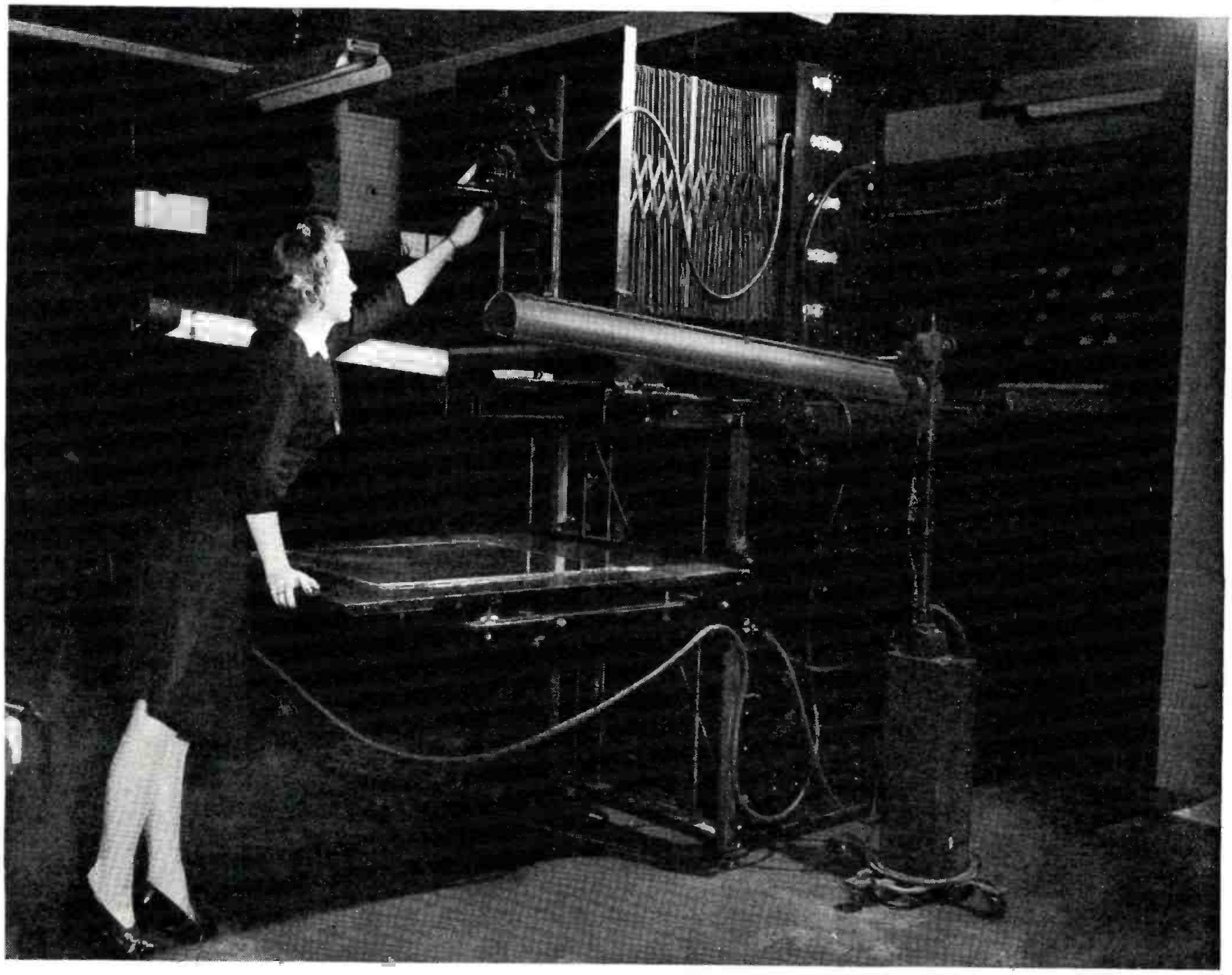
On the desk before each officer is a push button and a red light. The button controls a device developed by the Army Pictorial Service to meet the unique demands of this audience. As there flashes on the screen a sequence that will be of interest to any particular branch, its representative officer pushes the button. The red light goes on. As long as that light is on, a tape that is synchronized with the film is making a notation of the fact that the portion of film being shown at that time is of particular interest to that Branch.

When the showing is over, copies of the parts in which each officer has shown an interest are made for his branch, to be used for study in detail, for training, for correction of errors, for improvement in technique, and tactical lessons.

Likewise, the still pictures that pour into Army Pictorial

(*Continued on page* 312)

Giant photostat machine at Fort Monmouth Signal Laboratory. Operator shown adjusting camera prior to operation.



SIGNAL CORPS in the

The part that Signal troops play in winning this war.

EDITOR'S NOTE—The first elements of the Signal Corps arrived in the European Theater of Operations in the summer of 1942 with a lot of plans and a full appreciation of the magnitude and importance of their task. Officers and men quickly adapted themselves to British customs, materiels, and weather, and the results of their work were soon evident in the form of vast supply depots dispersed over the English country-side and busy networks of telephone, teletypewriter and radio stations handling astronomical numbers of code messages daily.

The intimate cooperation of the British people—military and civilian personnel alike—was from the start 100% perfect, and contributed in no small way to the accomplishment of the dual mission of providing complex communication facilities for numerous large and small headquarters and also signal supply service for a large army and a large air force. The first test of these facilities and services came during the planning and the subsequent execution of the landing operations in North Africa in the fall of 1942, hardly six months after the arrival of our main forces in the European Theater of Operations. That the Signal Corps, as well as all other arms and services, met the test is now a matter of history.

The restrictions of military censorship prevent the telling at this time of the full technical story. However, the specially-written articles that follow, with their accompanying illustrations, will give the readers of "Radio News" at least a general picture of what is transpiring in many of our foreign war theaters.

By Brig. Gen.
WILLIAM S. RUMBOUGH

Born in Virginia, 1892. Joined Nt. Guards, 1916, Reg. Army, 1917. Trained recruits in France, 1918. Prof. Military Science & Tactics, Univ. Illinois, 1920. Graduated Signal School, assigned Office of Chief Signal Officer, 1925. B.S. from George Washington Univ., 1927. Graduated Command & Genl. Staff School, 1931. Graduated Army War College, appointed Major, Director of Dept. of Communication Engineering, Signal School, 1934. Became Hawaiian Div. Signal Officer & Brig. Genl.; Com. Officer at Crowder. Chief Signal Officer, European Theater of Operations.

TODAY'S invasion army is tied together with threads of wire. Hundreds of miles of wire and innumerable radio nets form a vast communications network over beaches and mountains and streams, linking all units, coordinating the attack.

It is the mission of the United States Army Signal Corps to weave this vital web with one hand, while fighting off the enemy with the other.

When the U. S. Fifth Army struck Italy, General Mark Clark was able to direct first-hour operations from the deck of his command vessel in Salerno Gulf because Signal

Members of U. S. Aviation Engineers building shelters near air field in Youks Les Bains, North Africa. SCR-299 on right.

EUROPEAN THEATER

The saga of communications on our fighting fronts.

Corps soldiers landed first under fire and fought their way up the enemy's beaches toting "walkie-talkies"—portable sending and receiving radio sets. Amphibious two and a half ton trucks—called "Ducks"—carrying complete radio stations lumbered ashore immediately afterward to extend communications to point off the continent.

One of the first complete companies to go ashore, in the assault wave, was a Signal Corps unit. They clung precariously to the beachhead and wired in a lateral communications net between supply dumps. Through days and nights of almost continuous bombing, strafing, and artillery fire, these men kept their lines in operation, uniting advance elements, shore depots, and off-shore convoys. They are still there, ever extending. Their tireless efforts have helped make possible the tremendous stream of supplies and equipment that is pouring ashore to keep the Fifth Army dangerous and fed as it advances out over Italy.

The speed and movement of modern warfare calls for extreme coordination, especially during the early hours of an amphibious landing. Every unit must know just what the other members of the offensive team are doing minute by minute, if the attack is to succeed. The only answer to that problem is a reliable communications system, beginning from the time the entire assault force is waterborne, right through the landing and extending, to the most advanced outpost ashore. Deemed most critical is the 12-hour period immediately following the moment the first wave steps onto the beachhead.

A dramatic phase of the Italian invasion was the work of the Signal Corps in establishing and maintaining initial communications between the U. S. forces and the British elements attached to the Fifth, which had effected landings on separate beaches. The unit credited for this hazardous operation was commanded by Lieutenant Colonel Frederick C. Lough, of Fall River, Mass. His men piloted one of the huge radio "Ducks" over bombed and shell-torn roads right up to the enemy's lines, made perfect contact with the British headquarters, then dared the Germans to split the Allies' connecting link!

For fourteen consecutive hours Jerry shelled, bombed, and strafed the vital Signal installation. The men merely dug deeper foxholes and dared him to try again. Ultimately Fifth Army infantrymen pushed the Germans out of their dangerously close positions, the punishment eased and the Allies were permanently united by the circuit.

French equipment being evacuated during Kasserine Pass action, at which time the American troops were forced to retreat.

Signalmen instantly set out to open more secure channels of communications between the two forward prongs. At this stage of the landing, the Germans were never more than four miles from the shoreline, creating a narrow corridor in which the two forces were confined. A signal crew, under the direction of Lieutenant Edward L. Haynes, of Lubbock, Texas, and assisted by Technical Sergeants Robert Mozley, of Lithia Springs, Georgia, and Lawrence E. Savage, of Malone, Texas, was dispatched to lay lines through this "hot alley."

This gang laid their precious thread of wire for 15 miles over rocky hills and through strange country under the very noses of the Germans. They ducked in and out of slit trenches by day and worked in the light of bomb flares by night. But the line went in.

"That was just the beginning of our job, not the end," said a crew chief, Sergeant William E. Black, of Dadeville, Alabama. "They fought a stiff battle right over our line and cut it almost as fast as we could repair—almost but not quite."

Another crew head, Sergeant Odies R. Dorrell, of Morrilton, Arkansas, kept a record of the breaks during the battle to keep 'em talking. His report revealed the line was sliced eleven times by enemy shell-fire alone. With each break, expert crews moved out under fire, sometimes in complete darkness, to effect repair.

Private First Class Leonard E. Revier, of North Field, Minnesota, and Private Walter H. Gray, of Crane, Missouri, themselves worked as a complete two-day circuit. Special messengers between the two forces, they drove their motorcycles day and night over dangerous roads, around road blocks and demolitions, to carry important papers and information between the headquarters. So tortuous was their route along back roads and over detours that their round trip totaled 52 miles.

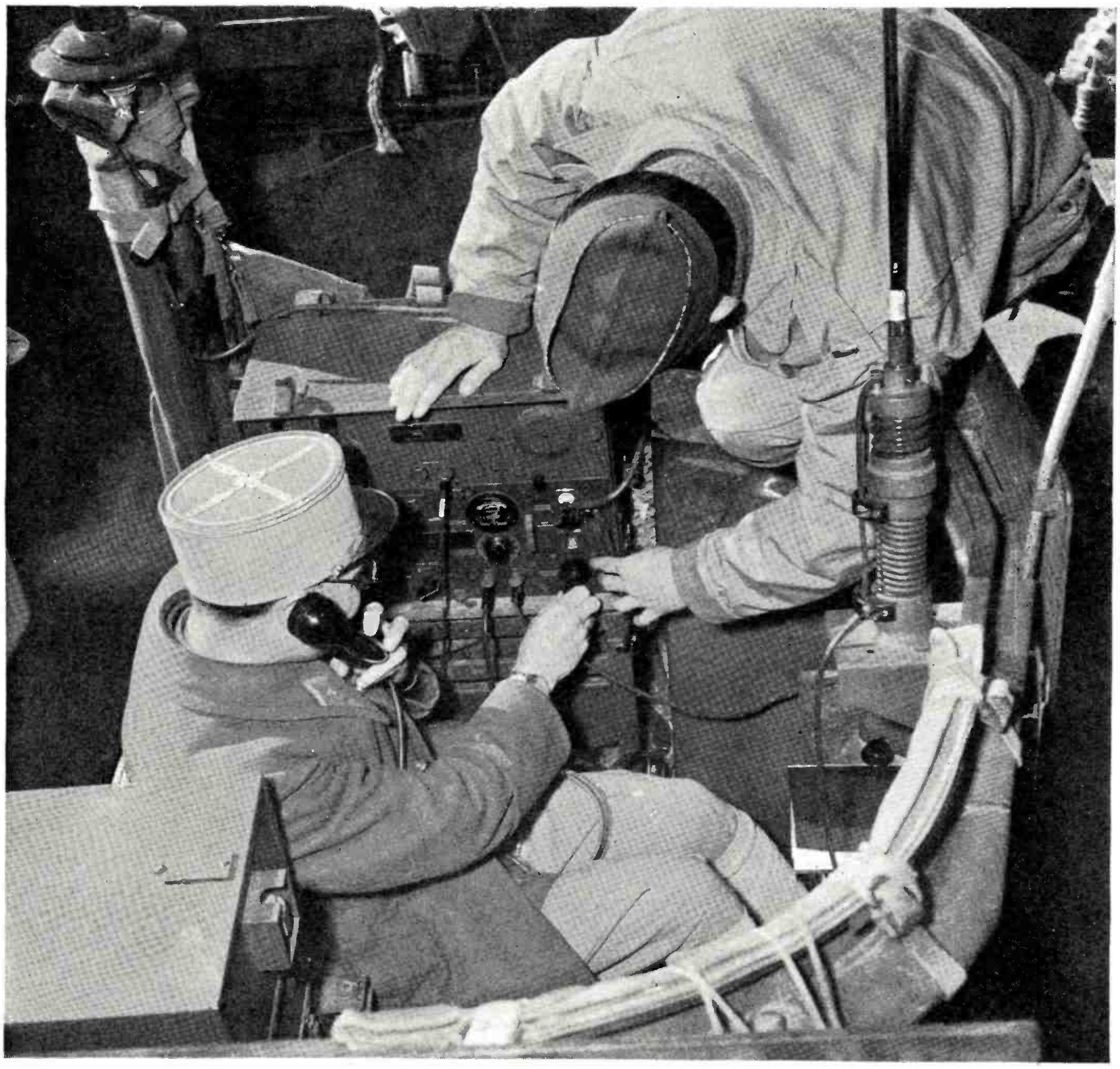
"We had to make time," Revier said between trips, "in order to get back in time to start out again. I got up to 60, once, when that whistling 88 struck barely 40 yards behind me."

Gray was soon sold on his Allies. "Those British Tommies not only gave me a cup of hot tea, at the end of my trip to them, but a slit trench, as well, to drink it in. That's what I call true hospitality."

As the British Eighth Army, under General Bernard Law Montgomery, moved north on the eastern half of the

(*Continued on page* 384)

American Officer showing French Soldier the operation of a communications receiver near Algiers, North Africa.



Members of American tank crew in field uniforms, prior to an Allied offensive in North Africa.

MEDITERRANEAN

Radio communications played a vital role in winning our recent victories.

By Colonel DAVID E. WASHBURN

Born in Nebraska, 1890. Was with Northwest Bell Telephone Co.; served with AEF; holder of Purple Heart. Graduated Signal School, 1928; instructed at Signal School, 1923-28. Signal Officer, Pacific Sector, Panama Canal Zone; instructor, New York Nt. Guard. Acting Director, Signal Corps Laboratories, 1930-40. Officer in Charge, Ground and Vehicular Equipment Section, Research & Development Division, Office of Chief Signal Officer. Signal Officer, U. S. North African Military Mission, 1941-42. Present duty is the Executive Officer, Office of the Chief Signal Officer.

Engineers clearing mines from Salerno beach to insure safe passage for the American Fifth Army when they stormed ashore.

"THE victory is of your making, too, and its fame and its glory belong to each of you."

The speaker is General Sir Harold R. L. G. Alexander, deputy commander to General Dwight D. Eisenhower and in charge of all land operations by the United Nations forces in North Africa. His audience is five hundred officers and men of the United States Signal Corps.

Thus was summarized the Signal Corps' thrill-packed role in the North African campaign which made possible the invasions of Sicily and Italy. Signalmen proved their versatility by fighting with the infantry to establish beachheads, by shooting down planes, and by clearing mine fields, and—above all—by establishing and maintaining the main arteries of signal communications throughout the battle areas, sometimes under strafing and heavy bombardment.

The story of the Signal Corps in the Mediterranean Area begins, however, long before the initial invasion, even before the plans for campaigns in this area had begun to crystallize. For months, while the British were engaged in a see-saw battle with the Germans and Italians across the Egyptian and Libyan deserts, the Signal Corps tested apparatus and equipment under a variety of atmospheric and climatic conditions to insure an adequate performance when the United States was ready to hurl its power into the fray.

As a result of these tests, special adaptations of the equipment were made before the start of ultra-secret preparations in England for the historic mass effort to

Acme Photo

Gun crew of a self-propelled 75-mm. cannon on half-trac, awaiting orders to advance in Troina, Sicily.

throw the Axis out of the African theater of operations.

High-ranking officers led by Brigadier General J. V. Matejka, Signal Corps Officer on General Eisenhower's staff, and Brigadier General W. S. Rumbough, in charge of signal supply activities in Europe, directed the advance planning of signal systems and the training of Signal Corps units for the delicate and well-timed invasion operation.

This was no small problem. The establishment of wire and radio communications to and within the landing forces was only the start of the project. Of vital importance was the maintenance of reliable signal communication channels and circuits to each task force and between adjacent task forces which were to land along the African shore lines of the Atlantic and Mediterranean. Constant communications had to be maintained with the supporting aircraft and with the bombardment aircraft squadrons. In addition, signal communication channels were necessary for the direction of the naval gunfire support and between the combat commands on shore and their superior commands afloat.

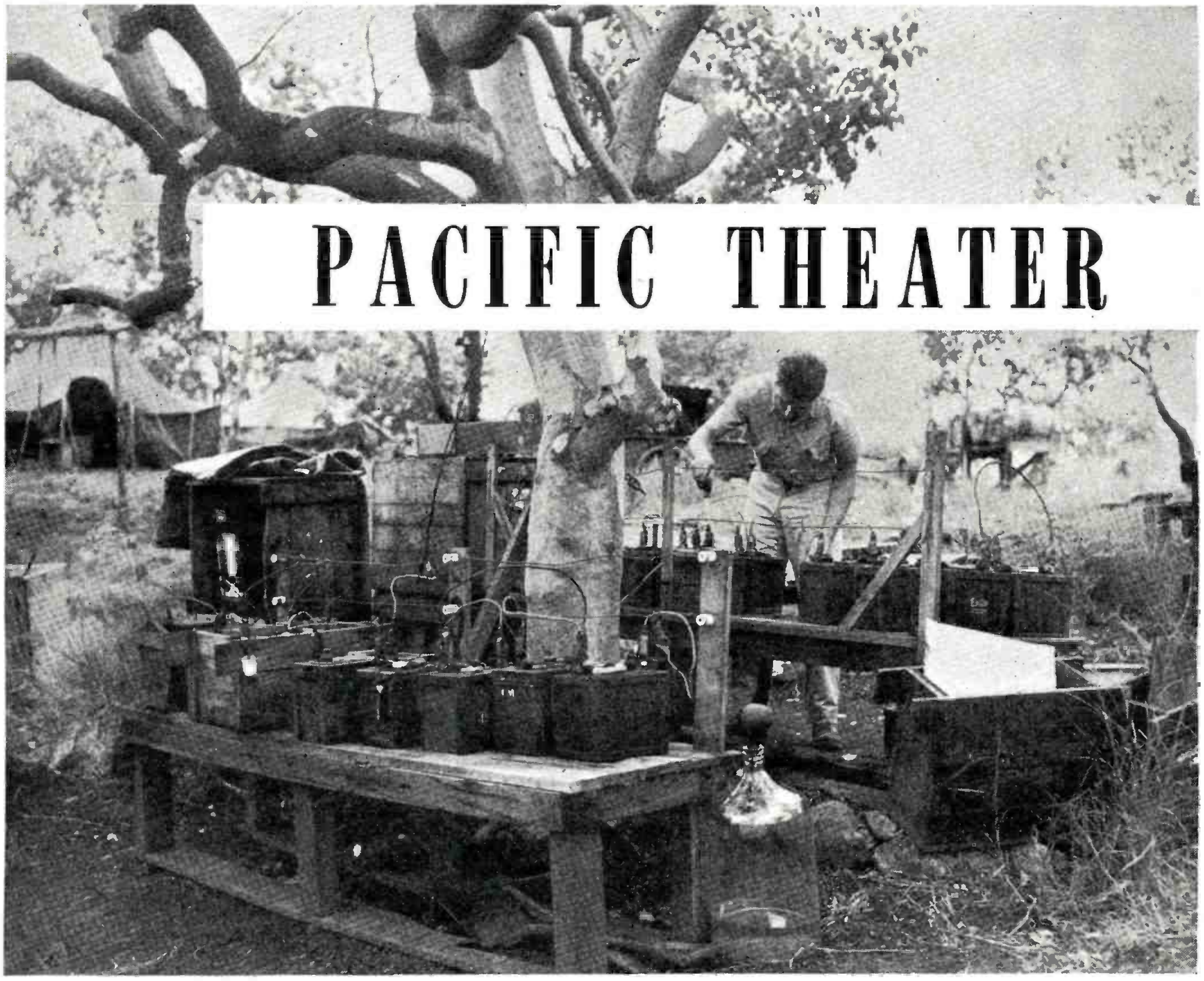
The Signal Corps established a system that would permit a flow of information between all major elements of

(*Continued on page* 420)

Soldiers laying wire for communications in African desert.

Emergency radio equipment aboard an Allied transport.

PACIFIC THEATER



Battery-charging section of a Signal Repair Company located in New Guinea.

By Lt. Colonel CHARLES J. McINTYRE

Born in Philadelphia, 1895; graduated with B.S. degree from U. of Pennsylvania, 1916; U. of Paris, 1919; and did graduate work at Temple U., 1936-7. Graduated School of The Line, 1917, and Infantry School, Company Commanders Course, 1921. Served with 3rd Div., AEF, and Army of Occupation; is holder of the Purple Heart. Was with Bell Telephone Co., 1922-28; taught modern languages at St. Joseph's College, 1928-34; and was Pres. and Director of Camp Lafayette, Inc., 1928-40, when called to active duty. Assigned Chief, Special Activities Branch, late in 1941.

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Reports from the Pacific Theater tell of the heroic accomplishments of Signal troops engaged in combat.

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AMERICAN landing barges crunch onto the sand of New Georgia Island. Out swarm the Infantry—and the Signal Corps—splashing through the surf and on to the shore.

As the Japanese open fire the Infantry crashes into the brush while the Signal Corps men don leg irons and climb trees.

There the Signal men string the wire connecting division and task force headquarters—opening vital communications for the mission.

With bullets whizzing through the palm fronds about them, the wiremen work as calmly as though doing a job along U. S. Highway No. 1. That is a sample—extracted from an Associated Press eyewitness account of actual operations last August—of the job the Signal Corps is doing wherever the going is toughest throughout the Pacific area.

The Signal Corps accepts such incidents as a part of the day's work, normally unspectacular but tremendously important, nevertheless, in the tortuous task—against terrific obstacles—of wresting territory from the Japanese Empire.

The first warning of the Pearl Harbor attack that plunged us into war came from the Signal Corps. Joseph L. Lockard, who later earned an officer's commission, spotted the first Japanese planes with the aircraft detector unit he was manning December 7, 1941, and subsequently was awarded the Distinguished Service Medal for his feat.

Immediately, the Signal Corps pitched in to meet Army

Message center "op" uses phone to transmit important information.

Operational Headquarters at the front during Munda campaign.

communication requirements that overnight had increased a thousandfold.

Over in the Philippines, Brig. Gen. Spencer B. Akin, as Signal Officer for General Douglas B. MacArthur, hastily organized emergency units from the limited number of qualified men available and set up a system that was able to maintain communications continuously to all echelons of command, despite heavy shell fire and bombardment.

"He contributed immeasurably to the success of operations during this period," read a War Department citation in which General Akin was awarded the Distinguished Service Medal. General Akin went with General MacArthur to Australia and again was decorated, this time with the Silver Star for gallantry in action near Buna, New Guinea, on December 23, 1942. The Signal Officer was on reconnaissance in an advanced zone where a strategic bridge leading to an airfield was being repaired for American troops to advance under fire from Japanese snipers.

"General Akin aided in reorganizing a platoon which had been under severe enemy fire," read the citation. "He then crossed the bridge IN ADVANCE OF THE INFANTRY and spurred them into attack which eventually led to the capture of the airfield."

Day in and day out, however, hard work and ingenuity are the keywords as Signals Corps men expand the vast facilities needed to coordinate war efforts in the far-flung Pacific Islands. Time and again they meet obstacles of weather, terrain, and jungle that at first seem insurmountable, only to be conquered by perseverance. The entire continent of Australia, as big as the United States, had to be organized as a base for operations through the Pacific islands on the road to Tokyo.

The remnants of one Signal battalion and very little equipment were available at the start. Australia had a communications system but it was not very extensive and was terribly overloaded.

Without hesitation, the Signal Corps went to work.

"One job we had to get done," said Major A. E. Wharton after a tour of the area, "the Australians gave us an estimate of six months to complete. Our boys did it in six weeks—strung the auxiliary wires on poles already in place."

Termites destroyed wooden poles; the Signal Corps promptly erected steel telephone standards. Everywhere the men took advantage of any existing facilities and devised substitutes on the spot when regulation equipment was lacking.

The problem of supply itself was immense. Huge depots were set up, then moved to more appropriate locations. Streams of materiel began moving forward as the system expanded and new equipment replaced the makeshift installations necessary at first in some places.

Progress on the neighboring islands was particularly difficult.

"The jungles," said Major Wharton, "are just plain hell for the men to work through. A lot of time they're lucky if they can get through the undergrowth with a trail of wire—no question of stringing it, and of course no underground cable. (*Continued on page* 382)

Telephone operator maintaining communications with front line.

SCR-299 radio unit in operation deep in the Munda jungle.

ALASKAN THEATER

Constructing communication lines—a rather difficult task, considering the rugged Alaskan terrain.

Maintaining communications at Attu was most difficult. The Japs preyed on our wire lines—slashing them with bayonets.

By 1st Lt. MACY M. CAROTHERS

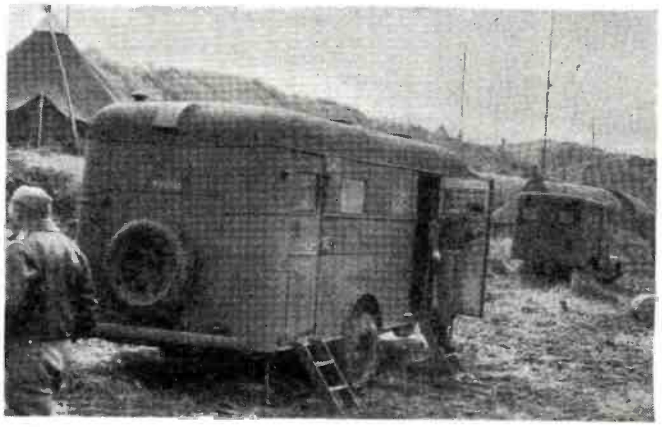
Born at Ekin, Indiana, January 25, 1900, and served with the AEF and Army of Occupation in World War I. In 1920 he joined the staff of the Columbus, Ohio, Dispatch, serving successively as news reporter, radio, promotion and state editor until 1938. The next four years he was in Government information work in Ohio and also served as Editor of the American Legion newspaper. He entered the service in 1942 and was graduated from the O.C.S., Fort Monmouth, New Jersey in 1943. He was assigned to the Special Activities Branch on April 9, 1943.

UP IN the vast frozen frontier of Alaska and out along the eerie fog-bound Aleutians, the Signal Corps has done its part in protecting the United States from invasion by the little men from Japan.

Even while achieving feats of Paul Bunyanish proportions to criss-cross Alaska itself with adequate lines of communication, Signal men were participating actively in chasing the Japs out of the Aleutian Islands where they had entrenched themselves shortly after Pearl Harbor.

First came weeks that stretched into months of grueling, unspectacular, behind-the-scenes work which made possible the bombings that softened the tenacious Jap defenders for land attacks. Then came Attu, and the bloody business of dislodging a stubborn, fanatic foe from that barren, mountainous island. With the American landing forces, of course, went the Signal Corps to install radio stations, lay telephones, telegraph lines, and otherwise attend to the usual duties of communications.

Naturally, there was trouble. The occupation was accomplished under extremely difficult conditions of heavy fog and rain which reduced the tundra to a quagmire and made the use of vehicles impossible. All equipment had to be transported by manpower and in freezing weather. The miserable dampness caused corrosion and short-circuits



Portable radio station with antenna mast shown in right background. Trailer and power truck make up the complete unit.

Telephone switchboard in dugout. Alaskan beaches are well guarded and connected by a vast communications network.

Communications are being maintained between landing parties and ship. Radio played an important roll in Aleutian Islands offensives.

in the equipment and tested the ingenuity of Signal men to keep the apparatus functioning. Intervening mountains hindered radio transmission. There were no trees or shrubbery to hide the radio antennas, which became a favorite target of enemy fire.

Once wires were laid, it became an almost super-human task to keep them humming with the messages vital to combat success. The Japs placed a strong emphasis on disruption of our communications. Small enemy groups filtered through the American lines and preyed on communications, slashing the wires with bayonets. In certain areas the wires were severed at an average interval of twenty feet. In other places bayonets scraped the insulation from wires, grounding the circuits.

One morning, linemen seeking the cause of a circuit failure, came across the body of a Jap soldier, his stiff fingers still clutching the wire. The wire also ran between the Jap's tightly gritted teeth and the insulation had been stripped off cleanly for six inches or more, shorting the circuit.

And always the snipers concentrated on wire repairmen. Almost every time they went out to patch a line, bullets began to whine around their heads. Still the Signal Corps did the job. The men improvised devices to combat the weather, made protective housings for the terminal strips, and they invented new methods of camouflage. They made radio sets perform near-miracles and they fought to keep the wire circuits operating.

Finally came that last futile attack by the desperate, frustrated, and near-crazed Japs, and all of Attu was ours.

Long before Attu, however, even the men of a Signal Service Company in Alaska—men who handle the more important fixed installations and are not normally expected to engage in hand-to-hand combat — had been trained for any eventuality. Men from that company were in the third boat ashore in the landing at Adak Island in the Andreanof group of the Aleutians. The landing was unopposed, as were subsequent landings at Atka and at Amchitka, in the Rat Islands just seventy miles from Jap-held Kiska, but the Signal Officers realized that if ranking Alaska Communications System men in the task force had been wiped out, it would have been virtually impossible to construct even temporary radio station facilities ashore.

So Capt. Honzie L. Rodgers put his men through a rigid course in marksmanship, camouflage, scouting and patrolling, map reading, use of demolitions, booby traps, and defense against chemical attack.

"Many of our stations are isolated from the main units," remarked Capt. Rodgers. "In case of an enemy parachute attack, one of the first things the enemy goes for is communications. This means that our men must know how

(*Continued on page* 308)

Telephone switchboard in trench connects this lonely Alaskan outpost with base headquarters.

ARMY COMMUNICATIONS

From the "nerve center" at the War Department are flashed communications by radio and wire to every Allied Theater.

By Brig. Gen. FRANK E. STONER

Born in Vancouver, Washington, on December 25, 1894 and attended the University of Washington. Served in the Philippines during World War I, and is a graduate of the Signal School, 1928; the Command and General Staff School, 1937; and the Army Industrial College, 1940. He served as Executive Officer of the Washington-Alaska Military Cable and Telegraph System, 1932-37; Signal Officer, 5th Corps Area and 5th Army Corps, 1940-41; and Signal Officer, 3rd Army, 1941-42. Was appointed to present post as Chief of the Army Communications Service in 1942.

SPREADING out from Washington like an immense spiderweb reaching to every corner of the globe is the most far-flung communcations system in the history of the world. Some ten million words a day, necessary to keep the nation's war machine in high gear, flash over the vast radio and wire channels of the Army Communications Service of the Signal Corps.

Known familiarly as "A. Com," the Army Communications Service itself extends throughout this country and overseas to the headquarters of the various Theaters of Operation—whether they be in London, Brisbane, Asmara, or Algiers. From these centers the system fans out through secondary networks of wire, radio, and submarine cable to American fighting men in tanks, planes, and the farthest outposts, as well as to the lonely Arctic, jungle, and desert stations along the widespread air-ferry supply routes.

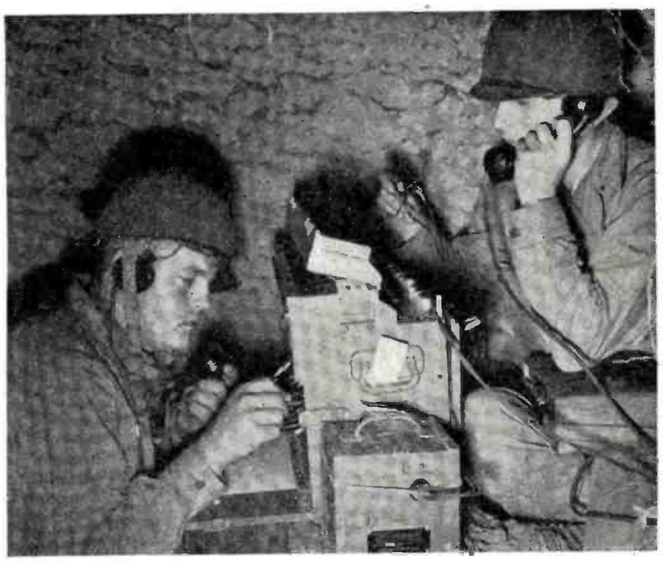
To A. Com falls the enormous task of transmitting information without which none of the Army branches could operate. The War Department General Staff couldn't conduct offensives, the Engineers couldn't build roads, Ordnance couldn't manufacture shells, the Quartermaster couldn't move beans—and so on down the line. The messages deal with combat orders and reports from the battlefronts, with changes in personnel, with purchase orders for clothing and equipment, with a thousand other essential operations.

It is one of the responsibilities of Major General H. C. Ingles, the Chief Signal Officer, to provide fixed communication to all Army units, wherever located, as well as the installation and maintenance of all airways communications equipment. He discharges that responsibility through A. Com and its organization, to which is also delegated the functions of field engineering and staff supervision over operation and procedure.

At the outbreak of war the system had begun to expand but was still a comparatively modest organization with only a half-dozen teleprinters and a radio network confined principally to stations in the United States and its possessions. As the Army grew, so did A. Com, working at top speed to keep ahead of skyrocketing requirements, particularly in new areas of action. Feats of engineering were accomplished to develop modern refinements for SECURITY, ACCURACY, and SPEED in the new world-wide system.

Nerve center of A. Com is the War Department Signal Center, the world's most modern and efficient communications headquarters. Here, streamlined message-handling methods are combined with the newest types of radio and wire equipment to speed vital information to its destination without a second's unnecessary delay. Teleprinter, telephone and telegraph circuits connect the Center with all the Service Commands in this country; powerful radio circuits, remotely controlled from the Signal Center, are beamed to all parts of the world, connecting directly and

Moving through dense underbrush with the Army's powerful one-man radio set—the FM walkie-talkie. Weighs 35 pounds complete.



Portable field-telephone switchboard in operation. Telephone communications are a vital link between all military units.

indirectly with hundreds of stations to which messages can be flashed in a matter of seconds.

The Signal Center itself resembles the largest and most modern telegraph central office, utilizing the most efficient apparatus in its operations with wire, radio, and cable. Each phase dovetails with the others to speed the transfer of messages; at every point are set up all possible safeguards to guarantee accuracy and security.

At one end of a long room are scores of teleprinter and cable machines, a huge switchboard, banks of automatic transmitters and receivers, recording and numbering devices. At the other end is the radio remote control equipment, each position topped by its station call sign, and a monitoring turret where distortion, fading, and interference may be detected and corrected.

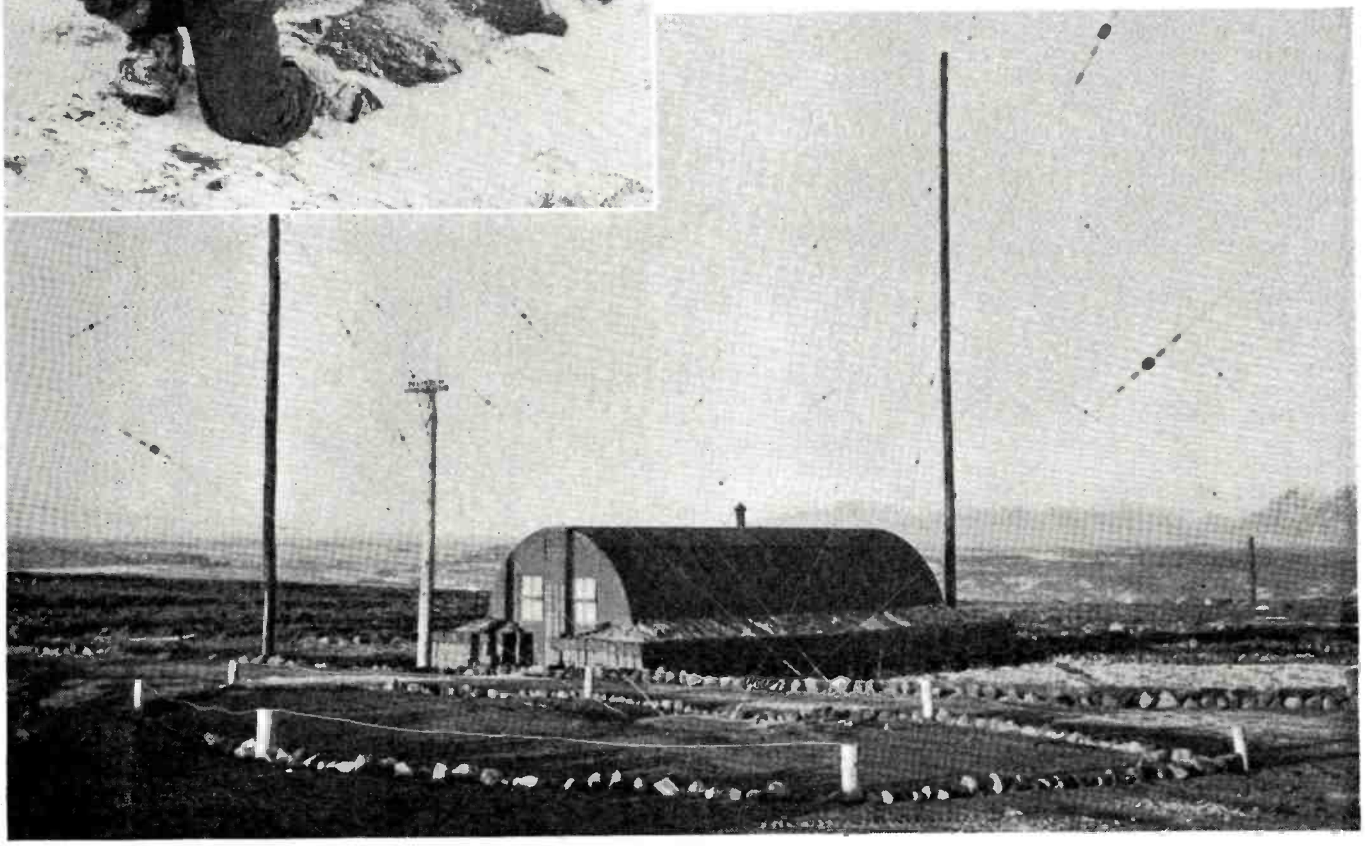
The progress of a message is so smooth it appears almost effortless. Let us follow an average message from the time it hits the desk until it is transmitted.

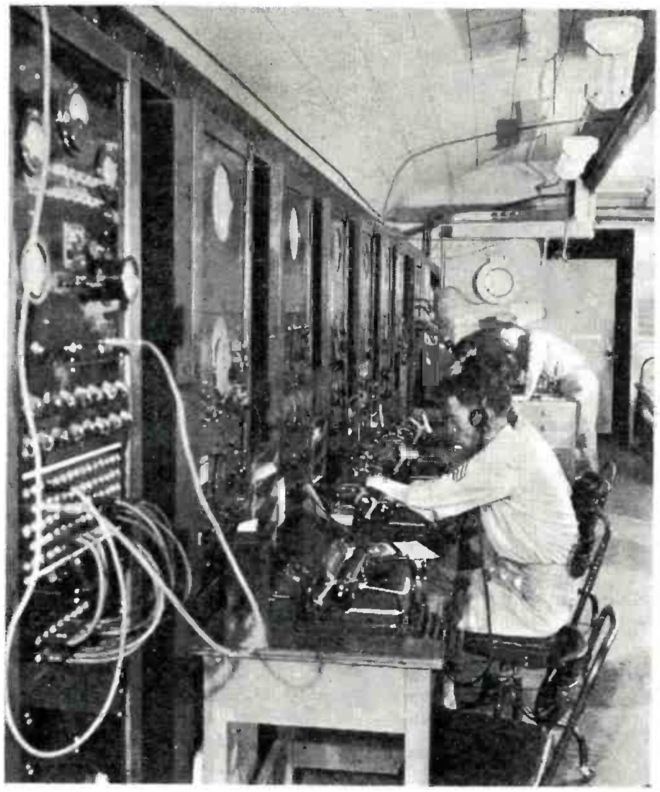
The message drops out of one of the pneumatic tubes leading from all agencies of the War Department in the Pentagon. At the tube-head it is processed for transmission, first being cleared by a censor who determines whether the message, if in clear-text form, may be transmitted without being encoded. A clerk scans the message for clarity and construction, checks and notes the number of words to guard against possible omission during transmission, and places it on one of the endless belt conveyors which connect all sections of the Signal Center.

At a routing and distribution desk another clerk determines the proper medium of communication, and enters routing and other data required by the operator, who must not be delayed in keeping traffic moving over heavily loaded circuits. The message glides on its way again by belt conveyor. From this desk the message will take one of several routes.

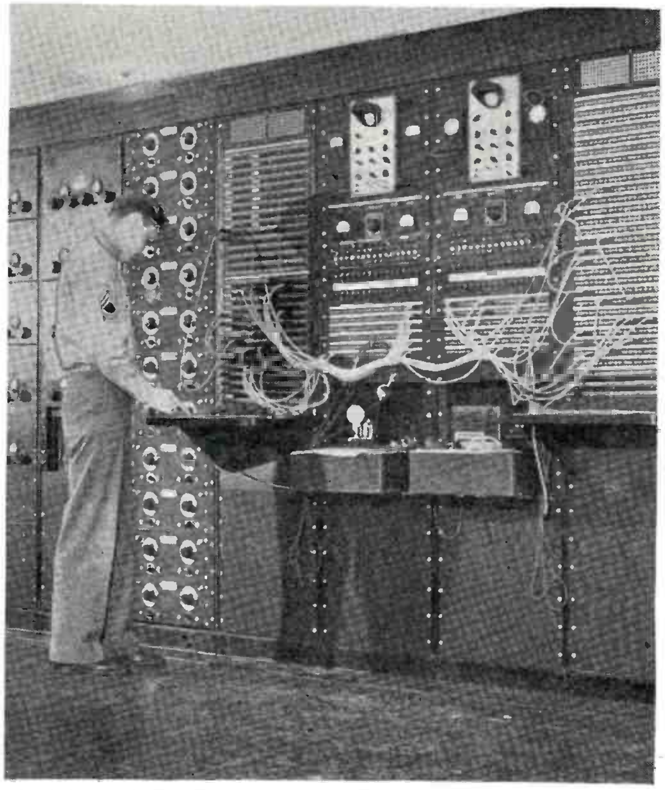
If it is intended for teleprinter handling, whether over wire, radio, or cable, the message goes to a bank of transmitting positions where expert operators man high-speed perforators. These keyboard operators translate the mes-

(Left) In the sub-zero temperatures of Iceland—communications covering a radius of one mile may be had with this tiny military transceiver. (Below) Antenna layout of radio station located in Iceland consists of 9 doublet antennas suspended from four 60-foot poles. This station handles all communications on the island.





Radio room of one of the larger military stations. All radio transmissions throughout the world are frequently monitored.



Radio switchboard connecting the Signal Center and the actual transmitters and receivers of Station WAR several miles away.

sage into perforated tape, in which each character is represented by a series of five or less holes across the tape. As the tape is perforated, it passes through a transmitter which sends the signals over a wire, radio, or cable circuit. A message may be relayed at several stations in a teleprinter-operated network without again being manually re-transmitted, because at each point it will be received on a printer reproducing the original message in typewritten form. If the message is intended for wire, cable, or radio circuits operated by manual or direct keyboard-printer method, it goes to an operator who transmits it directly.

The entire process requires as little as three minutes for a short message of fifteen to twenty words. An analysis of 40,000 messages showed that the average handling time was 8.4 minutes, even though some of them were hundreds or even thousands of words long. Every known mechanical device is used to eliminate lost motion and time, and new apparatus and methods are constantly sought to improve the service still further.

In teleprinter, especially, a minimum of manual handling is necessary. Automatic receivers and transmitters eliminate much of the "middle-man" work usually involved in communications. If a message is to be relayed in the Signal Center—say it is coming in from Atlanta and is to go to Chicago—the end of the perforated tape is placed in the transmitter on the Chicago circuit while the rest of the message is still being sent from Atlanta.

An ingenious device called a "line-finder concentrator" is used to conserve equipment and prevent congestion. By this means twenty-four relatively lightly loaded lines are terminated in eight receiving machines in such a way that when any one of the twenty-four stations wishes to send, the apparatus will automatically seek out an idle receiver and connect it to the line. If no receiver is idle, it will store the call and connect it to the first receiver that becomes idle, sending a signal to notify operators at both ends of the situation at all times.

All outgoing messages must be consecutively numbered to guard against loss of messages and also to permit quick reference in case of garbles or any other condition which would require the original copy to be consulted. In heavily loaded circuits, messages are numbered automatically by machines which also reproduce exactly everything which

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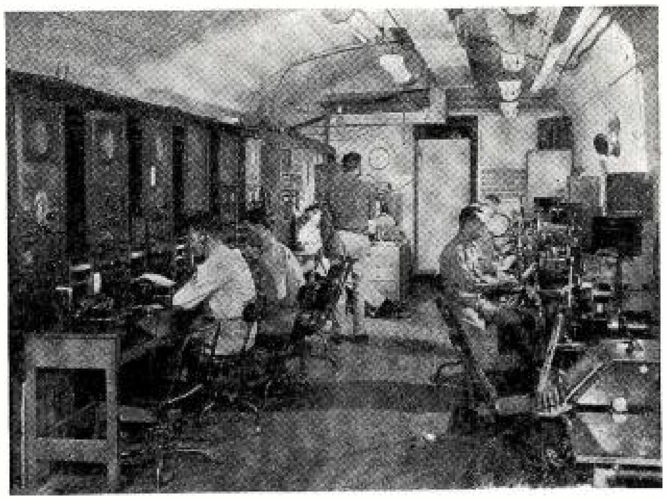
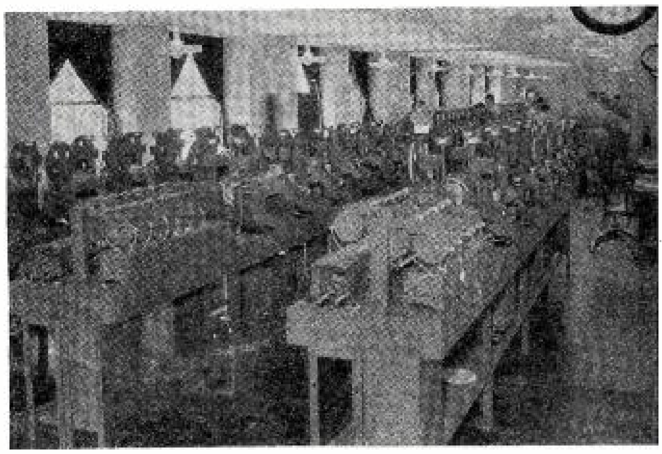
Member of Regimental Headquarters operating a late model guidon set. The r-f portion of the unit is mounted to the antenna mast.



Monitor room of a military radio station. A bank of teletype machines, shown at the right, is used to expedite messages.



Bank of automatic recording and numbering machines which reproduce on separate rolls of tape all teleprinter transmissions.

is sent over the circuit, greatly reducing the time required to find a copy of any outgoing message. Mechanical breakdowns are rare, since each machine is overhauled thoroughly after it has been in operation for a specified number of hours.

Several radio transmission methods are used—the ordinary international Morse code; voice; the Boehme siphon system in which the Morse code becomes visual as a stylus converts the dots and dashes into a staggered line; the IBM, or radiotype, system which handles one hundred words per minute, and radioteletype, operating at 60 words per minute.

Pictures are received and transmitted in the Signal Center by wire and radio telephoto, discussed in a separate article in this issue of Radio News.

Station WAR, remotely controlled and operated from the Signal Center, is the hub of the Army's huge radio net. WAR actually consists of a number of stations near Washington, with its transmitters ranging in power from one to forty kilowatts and its complete diversity and high frequency receivers incorporating the latest developments in radio engineering. An elaborate layout of rhombic type, uni-directional antennas is included in the installations for better utilization of power.

A recent development is the use of radio links between the Signal Center and the transmitting and receiving points, to eliminate dependence on wire lines for remote control operation. By use of ultra-high frequencies, six signals are carried on each of several radio channels.

The progressive substitution of wire for radio operation within the United States has released equipment, personnel and frequencies for the rapidly increasing volume of overseas radio traffic by Station WAR. In the first two years of war, new stations have been installed in London, Bermuda, Chungking, Iceland, Asmara, New Delhi, Brisbane, Oran, Cairo, Algiers, Trinidad, Recife in Brazil, and Accra on the gold coast of British West Africa. Add these to previously operated stations in Panama, Puerto Rico, Alaska, Hawaii, and other points, and you get some idea of the scope of the organization.

With the great station in Washington as a focal point, each station at the headquarters of a Theater Commander is the center of a net comprising the area of that command. Lesser stations are located within the Theaters, each in turn the key point in a still smaller system—until finally at the outer fringes of the web, the chain of communications actually reach individual soldiers carrying walkie-talkie sets. Yet the system is so beautifully integrated that the chain is continuous from the highest command in Washington to the most remote combat unit, aircraft, or tank crew in the field.

At the same time the world-wide net is so inter-connected that interference—man made or natural—seldom, if ever, completely halts a message. It can be sent out by another circuit that is connected with the receiver for which the message was originally destined.

A "gentlemen's agreement" with commercial agencies helped A. Com to acquire skilled technicians and operators without hampering essential private facilities. The Signal Corps agreed not to proselyte personnel from the companies which in turn co-operated by volunteering numerous thoroughly experienced men, who became officers in key positions after a period of processing to adapt them to military methods. These agencies also supplied the names of inductees who had been expert technicians in civil life, so that they could be requisitioned by the Signal Corps.

Many of these, after learning the Army techniques, quickly earned non-commissioned ratings and worked in closest harmony with old-time Signal Corps personnel in the common purpose of getting the Army's messages through by the fastest, most accurate means possible.

One of their tasks was to train the newcomers, many of whom were members of the Women's Army Corps, with no previous telegraphic experience. That the instructors did their job well is attested by the praise earned by the WACs—former college students, housekeepers, school teachers, secretaries, and welders—in their new positions as machine attendants, teleprinter operators, radio operators, clerks, and supervisors.

The Signal Center also acts as a "finishing school" for operators and technicians. After they have learned the theory in basic schools they attend a three-months practical course near the Signal Center itself, where they practice on messages that actually have been transmitted so that they can familiarize themselves with realistic working conditions. They then undergo a period of "internship" on regular circuits.

They do not become full-fledged WAR operators, however, until they can send and receive manually at thirty-five words per minute. They must be able to read recording tape at fifty words a minute, to operate a teleprinter, and to understand all of the delicate equipment with which they work. Teamwork is stressed, and each man is trained to handle any of several jobs. Thus is created an efficient, highly flexible force.

Such training is conducted continuously to compensate for a constant turnover as A. Com sends its trained specialists to fill key positions in installations throughout the system. Accuracy, even more than speed, is stressed during training and subsequent actual operations. If a flaw develops in an operator's technique, he is sent to a "refresher" class where an expert irons out the difficulty.

Even while A. Com kept pace with the Army's phenomenal expansion, it still found time to analyze and revamp the existing domestic systems for better efficiency. With the sudden outbreak of war it was necessary for almost every branch of the Army, particularly the supply and technical services, to establish its own independent communications system, taking advantage of any facilities at hand.

Gradually, working carefully to avoid even a momentary letdown in efficiency, the Signal Corps began to absorb

(*Continued on page* 258)

The "Gibson Girl" automatic SOS transmitter. Antenna wire is being released preparatory to operation.

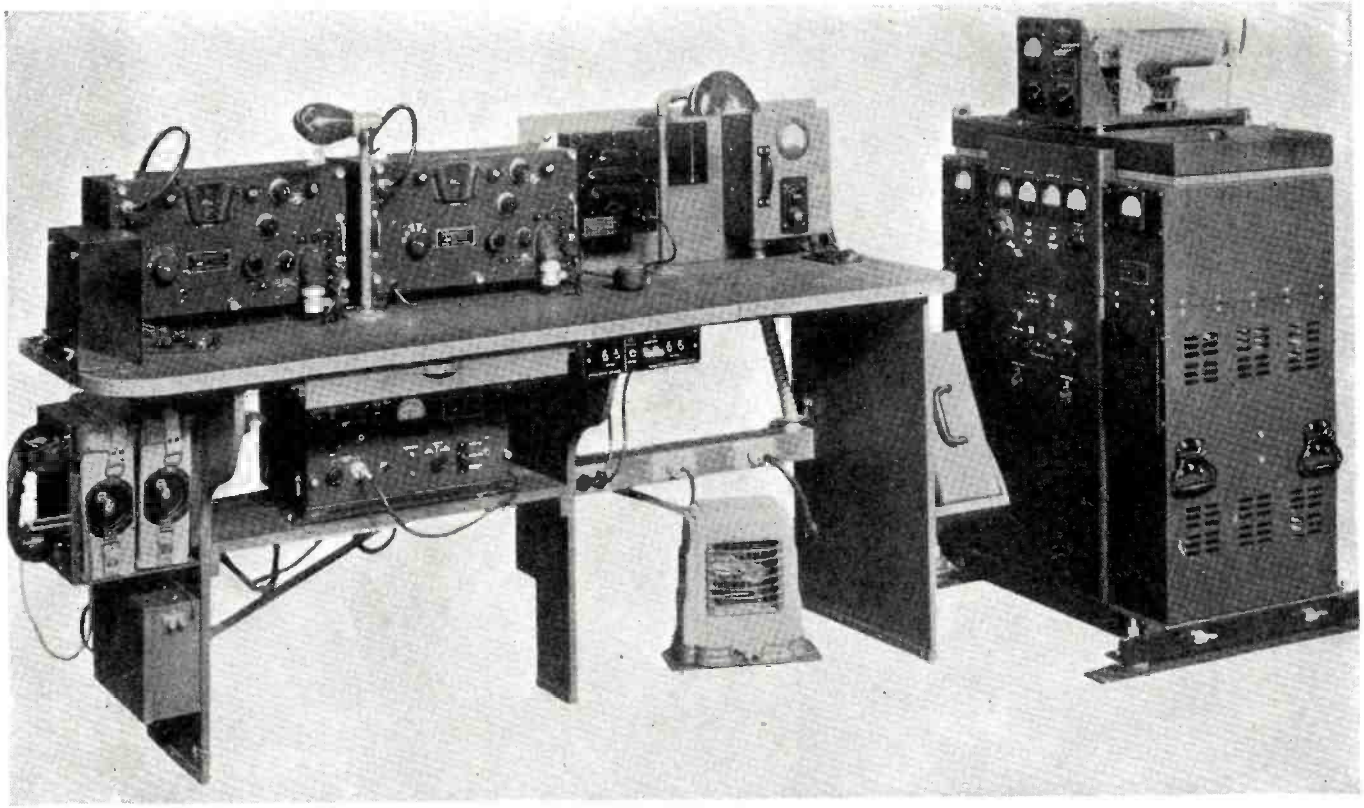
OPERATIONAL RESEARCH

By Dr. W. L. EVERITT

Born April 14, 1900 in Baltimore, Md. Served with U. S. Marine Corps in World War I, and later received a B.S. degree in E.E., Cornell University, 1922. In 1926, received an M.S. degree from the University of Michigan; gained Ph. D. in 1933 from Ohio State University, and has been a member of the faculty since 1926. Was appointed Chief of the Operational Research Branch in March, 1942; is now on leave from University post. Dr. Everitt is a Fellow and Director of Inst. of Radio Engineers, and a Fellow of American Inst. of Electrical Engineers.

THE scientists, engineers, and manufacturers of the country have rallied behind the tremendous research and production programs involved in the war program. One of the most important parts of this program is the provision of the world's best electronic and communications equipment for the armed forces. In this, the Signal Corps is a natural leader.

The enormous progress which has been made has given rise to many problems. Laboratory research has been speeded up to a point where years of peacetime progress have been compressed into a matter of months. Service, industrial, and university laboratories have been expanded and new ones set up, some of them devoted exclusively to specific problems. The flow of new ideas and devices is amazing. Production has kept pace with laboratory developments and our forces are receiving an ever increasing flow of fabulous electronic devices.



Principal components of radio set SCR-299-A. Apparatus shown, when in final assembly is installed in truck K-51.

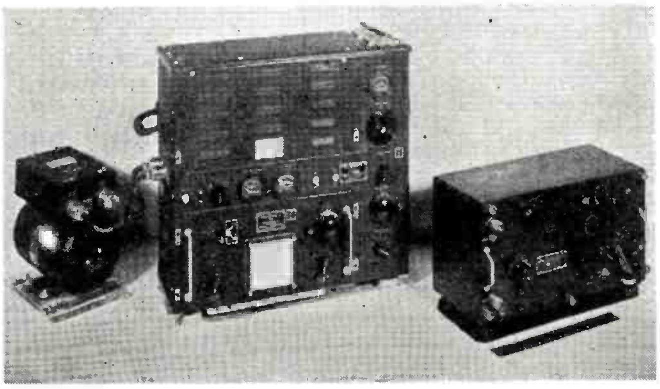
Under ordinary conditions, the design of new equipment is greatly influenced by the experience which the users of previous models obtain and return to the manufacturer in the form of suggestions, complaints, and commendations. We have all been told by the auto salesman that the faults of last year's model of his particular car are admitted but the new model has eliminated all those difficulties.

While we take this with a grain of salt, we have observed the improvement which the test of time and abuse by the customer has produced in cars, washing machines, and radios in the past ten or twenty years.

But in war, the speed-up is so great that new models are being planned before previous models have come off the production line. Yet failure to meet the customer's needs may exact a terrible price, for the customer in this case is an army in battle.

Military operations introduce new problems in every war, for battles are not won by depending solely on the experience of the last war or the intervening peaceful years. In particular, technical military equipment and personnel are being introduced to new conditions because of the high mobility of the war, the extreme variations in climatic conditions, the long lines of supply, the difficult maintenance problems, and the fact that a wholesale conversion of men to new technical skills in a short time has been necessary.

Radio set SCR-193 showing dynamotor, transmitter, and receiver.



Modern industry in peace times has found that, when acceleration in a program is necessary, it cannot depend on rule-of-thumb experience but scientific analysis or research in the broad sense can solve many problems satisfactorily in a surprisingly short time. In a similar way, the application of scientific methods to the analysis and solution of the problems involved in the use of new types of military equipment is indicated.

The scientific study of how best to use equipment and men and how to accelerate the application of field experience, in the guiding of development and procurement programs, has been termed operational research. The Operation Research Branch has been formed in the Plans and Operations Division of the Office of the Chief Signal Officer to make these studies. The personnel includes engineers with experience in the operation of radio equipment such as broadcasting station engineers, consulting engineers, engineers with manufacturing experience, statisticians, and psychologists. Each member of the group was selected because he had shown by past performance that he was expert at solving operational problems and getting the most out of equipment and men.

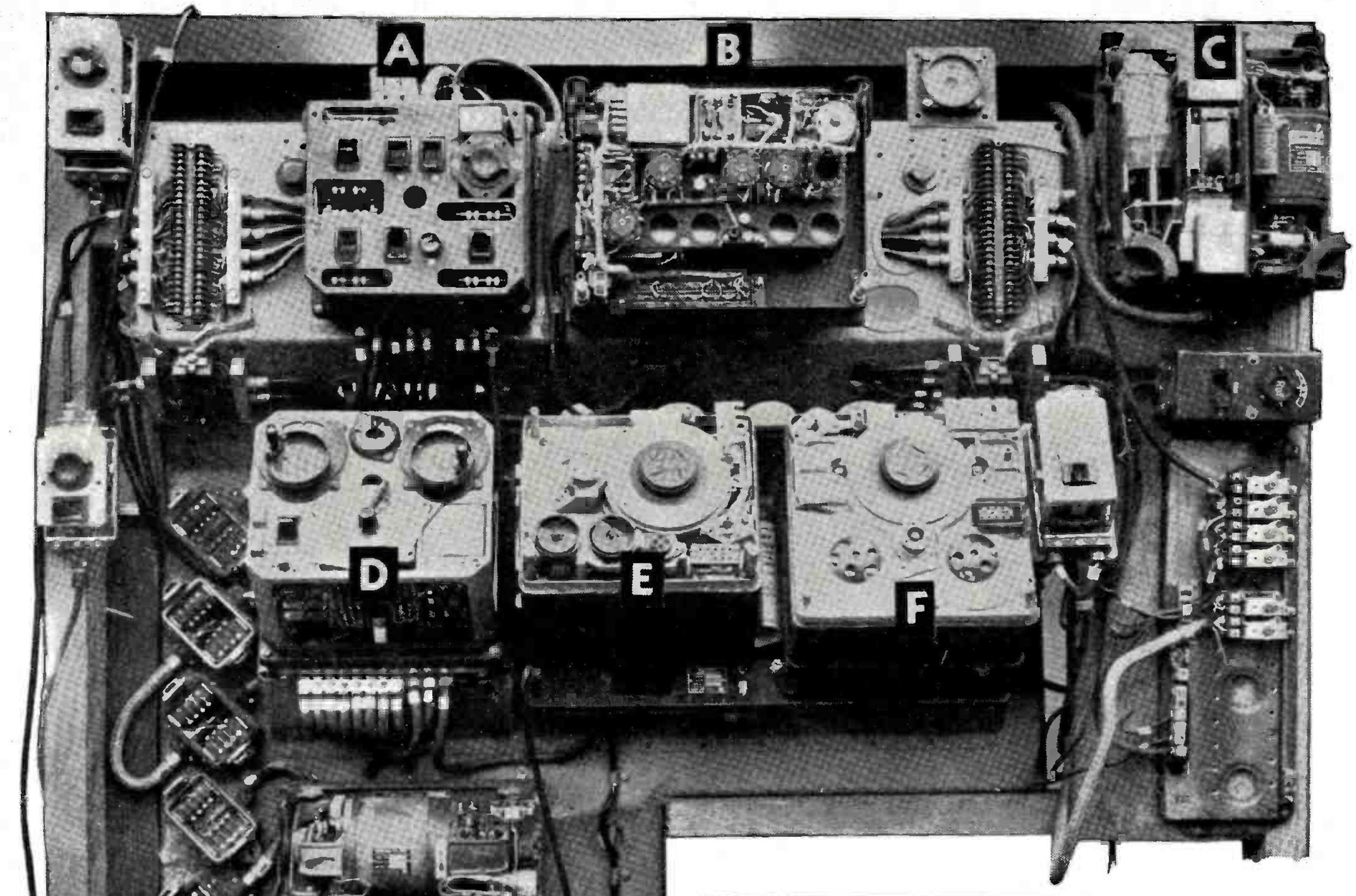
The final purpose of all signal equipment and personnel, is to provide a communications service; namely, the transmission of messages and, in the case of military operations, these messages must be transmitted without errors. This is the ultimate goal of all the research, development, production, and supply services which have gone before. Therefore the most important task of all is to determine the best methods of operation of the equipment supplied. The importance of this work becomes progressively greater as the war continues since the probability of translating current basic research into equipment which will be used in this war becomes lessened and the importance of properly using what we have becomes greater and greater.

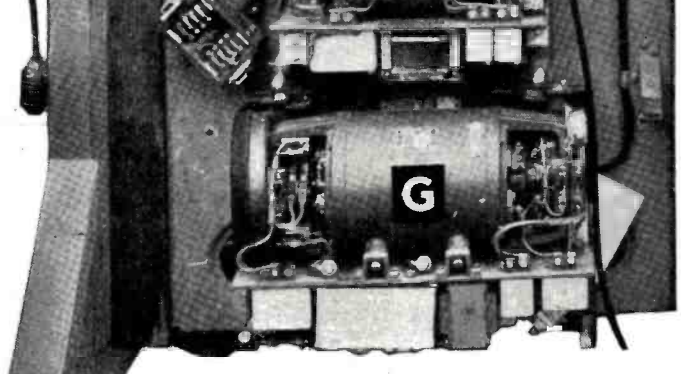
The provision of communication service always involves personnel plus equipment. Operational research naturally divides itself into studies of personnel and studies of equipment, while, at the same time, keeping the relation of one

(*Continued on page* 320)

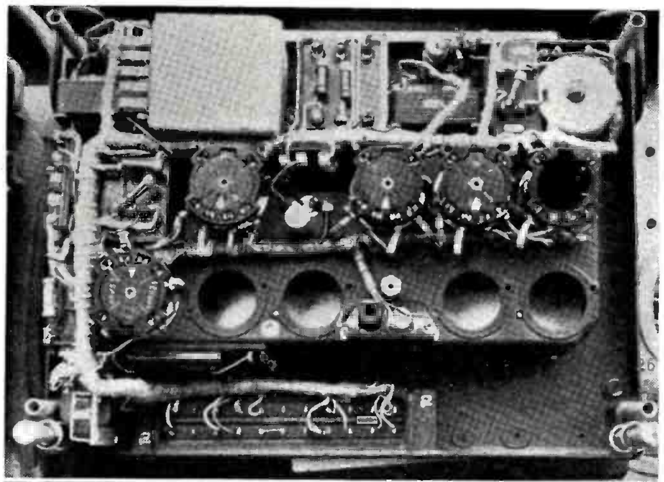
CAPTURED ENEMY EQUIPMENT

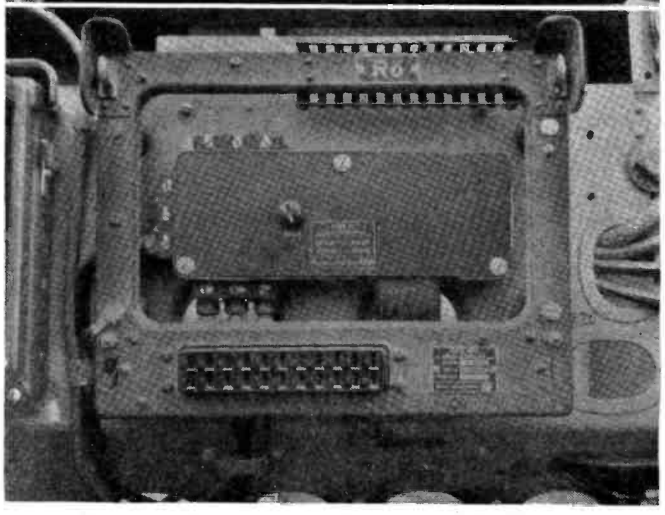
AMERICAN radio engineers are now able to study the characteristics of various types of communications equipment taken in combat and from enemy planes shot down over Allied territory. The personnel of the U. S. Army Signal Corps has made careful analysis of the construction, parts, materials, wiring techniques, tubes, circuits and tactical applications. Certain workable units are sent to combat training centers to be examined by students. They become familiar with those that might be found in the foreign theater in which they are to be sent. The tactical use of all captured equipment is restricted to the general public and is omitted from the units shown within the special section following—for security purposes.

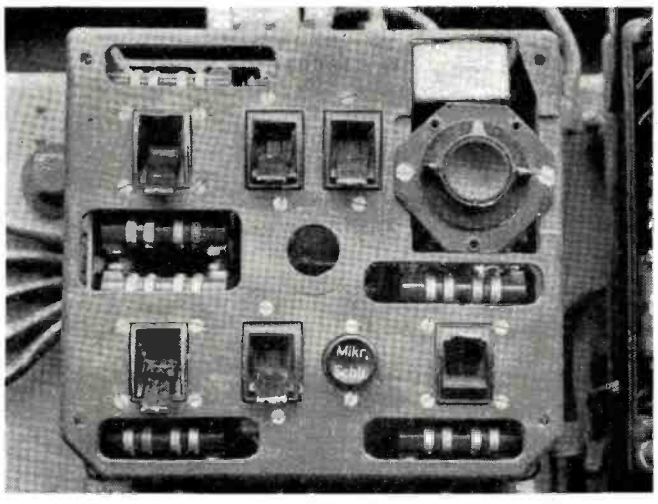




Airborne radio equipment installed in German Heinkel HE-111 fighter-bomber. Most of the covers have been removed to show more of the details.







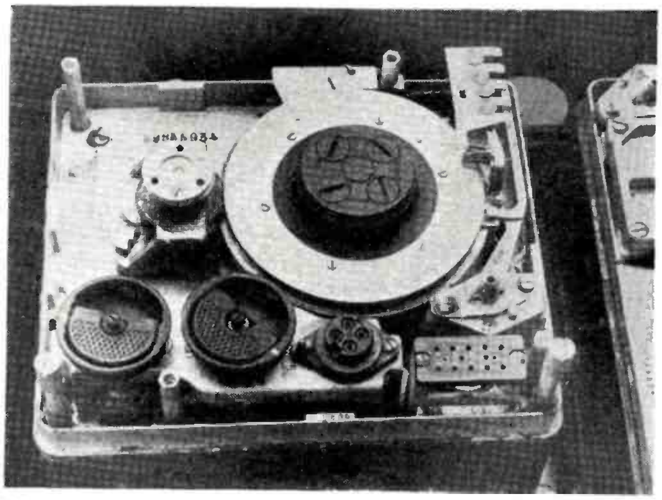
A The master control unit Fbg features a paddle-like type of toggle switch for easy operation while wearing gloves.

B Top: Interphone and amplifier unit RG, 10a chassis. Bottom: Quick-change mount permits tube replacement.

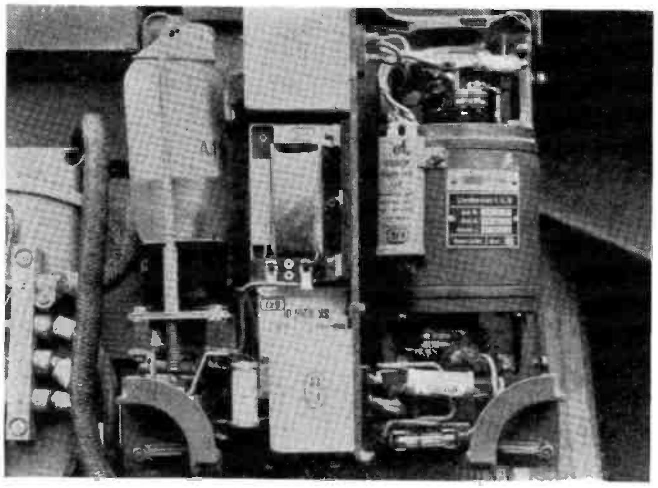
GERMAN EQUIPMENT

Developments in the period 1934-38 have set the standards for German equipment. Although ruggedly built—their sets are inferior to ours in construction, design, and weatherproofing.

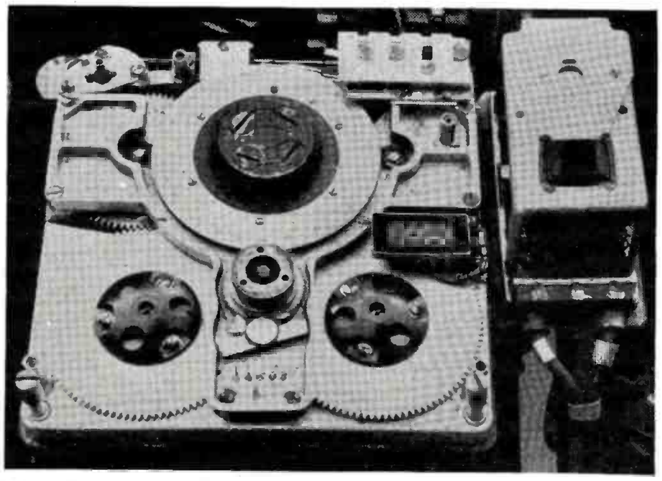
All of the units shown on this and the preceding page are a part of the German Airborne set FuG10. Technical characteristics: Frequency range: (mc) .3-.6 (S10L & E10L); 3-6 (S10K & E10K); 5.3-10 (S10K2 & E10K1). No crystals are used—either in the transmitter or receiver. Preset frequencies: 4 click stops. Antenna: Both trailing and fixed, connected by 50 ohm feeder tuning units at base of each antenna (remote control tuned). Tuning: (MO or Xtal) MO-Temperature compensated. Power output: 65 watts. Tubes: Total—31. Combined weight: 400 lbs.



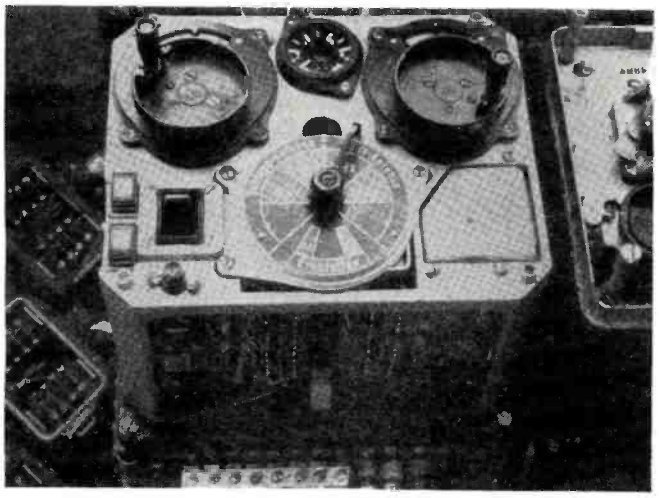
E Receivers may be interchanged to cover various ranges. This is the S10L, covering from .3-.6 megacycles.



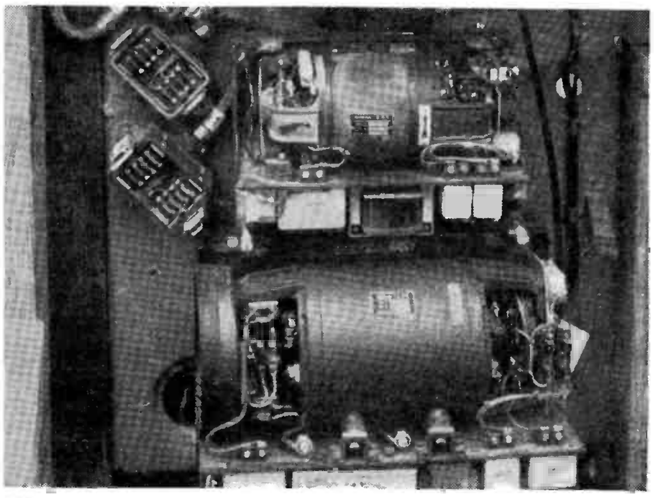
C Voltage-regulator unit and power supply uses the German "Stabilvolt." Supplies power for FuG10 radio compass.



F Intricate dial mechanisms predominate German sets. Note the "vernier type" of elaborate tuning assembly.



D Antenna control unit, with indicator, permits accurate loading adjustments to resonate antennas to frequencies.

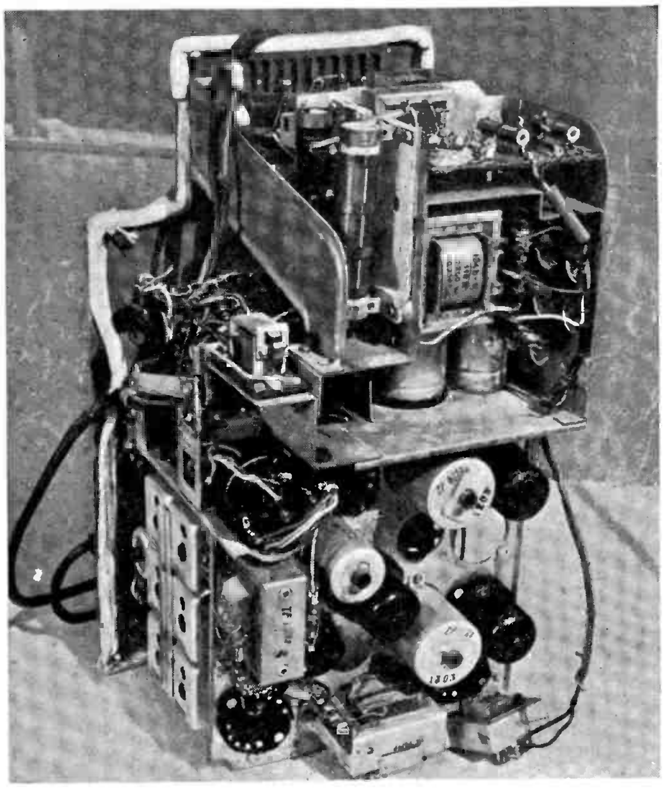


G The main dynamotor power supply equipment is shock-mounted. Designed specially for high altitudes.

TYPE WR 1 RECEIVER

Used for broadcast reception for entertainment and propaganda purposes at rear echelon. Frequency range: .15-15.8 mc. Tuning: MO or Xtal. Posted sticker reads "Use of this radio for foreign station reception is a crime against the National safety. By order of Der Führer such use will be punished with severest penalty. SOLDIERS, BEWARE!" This set is inferior to average.

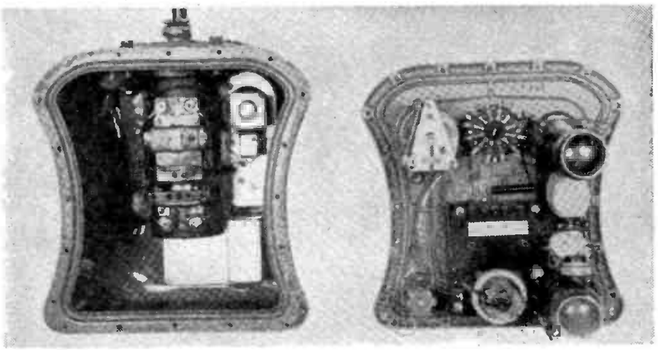
Knob near center controls a variac for choice of 110-220 v.



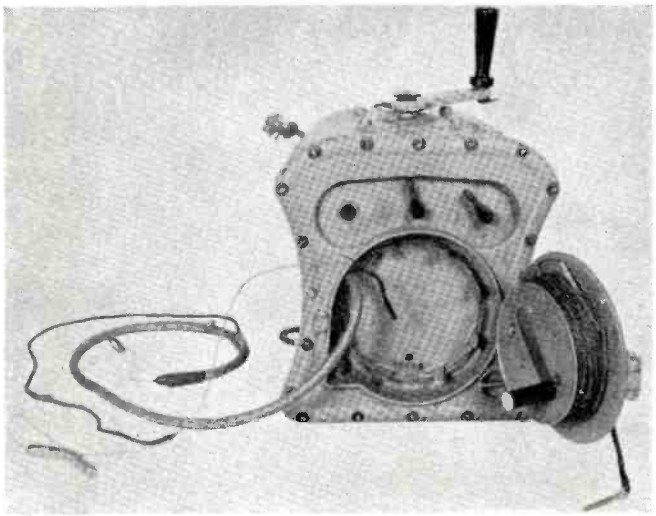
Poorly wired and haywire constructed chassis components.

NS2 "NOTSENDER"

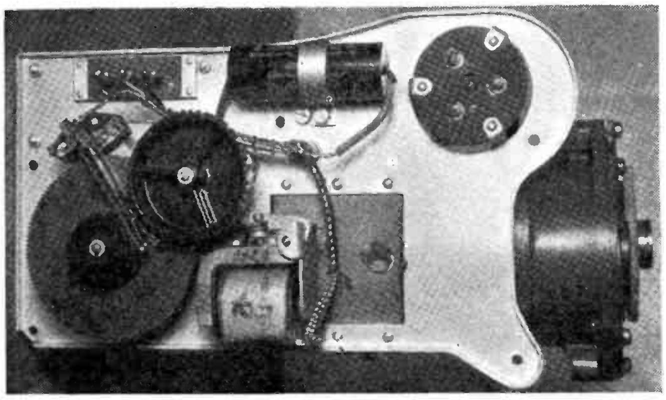
An emergency dinghy transmitter, carried loose in the aircraft, thrown in water and picked up after dinghy is floated. Frequency range: (mc) .5 only. Antenna: Kite-hoisted, or balloon-hoisted with ground wire and sinker. Hand generator. Power output: 6.2 w.



Insides of unit show R.F. assembly.



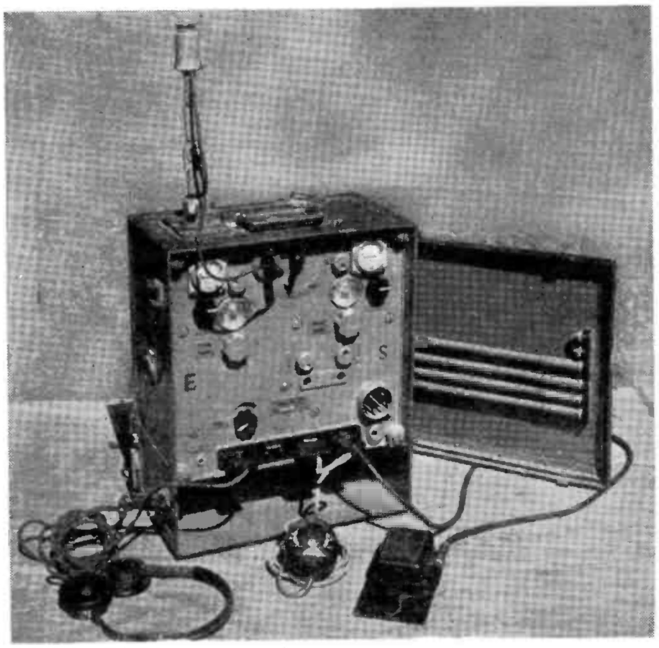
Wire reel and antenna cable are here exposed.



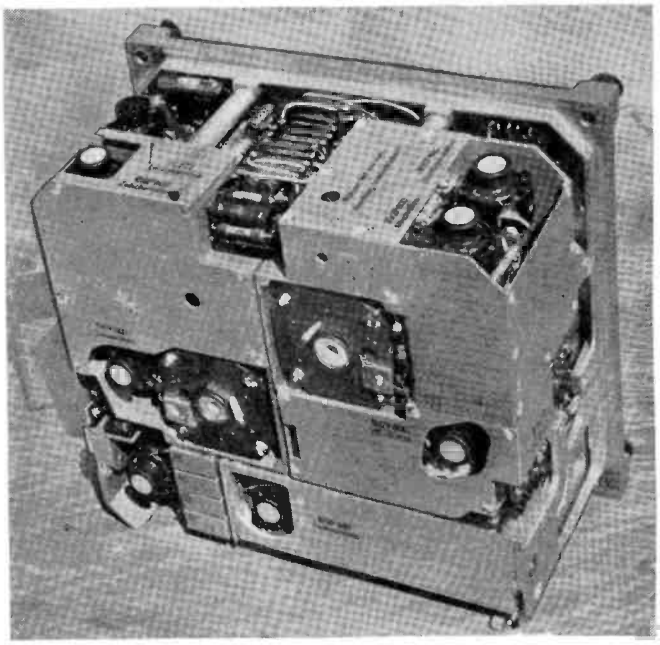
This mechanism controls keying automatically.

TORN Fud 2 TRANSCEIVER

Infantry pack set; used primarily for communications between Battalion and Companies. Frequency range: 33.8-38.0 (mc.). Antenna: 12 ft. aluminum rod. Power source: 2 v. A's, 130 v. B's. Power output: 1 watt. Tubes: 4 (receiver) and 3 (transmitter).



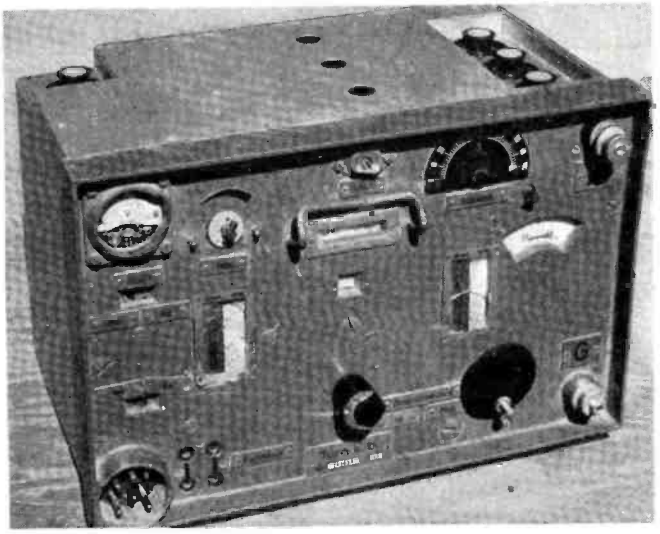
Magnifying lenses over dials permit quick tuning.



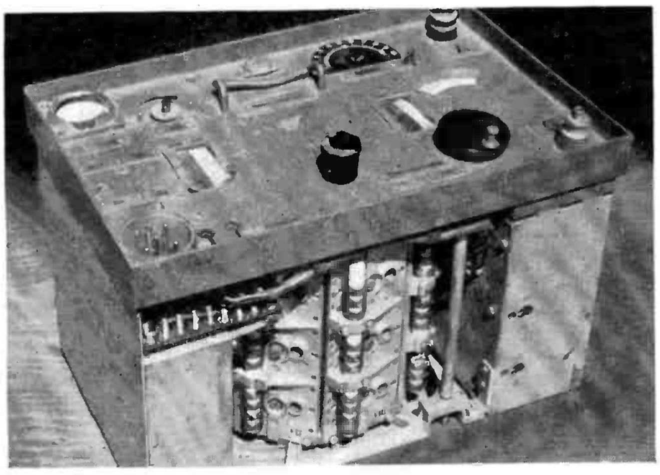
Sturdily-constructed, the unit weighs about 38 lbs.

TORN E.b. RECEIVER

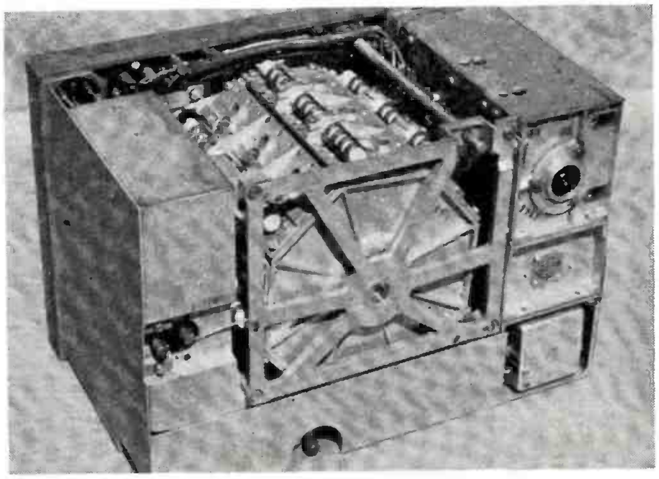
Used for portable and intercept and monitoring stations requiring a wide freq. range for reception. Frequency range: (mc.) 8 bands: .0966-.1772; .171-.3137; .304-.5585; .540-.990; .995-1.74; 1.674-3.075; 2.920-4.920; 4.360-7.995. Power source: Vibrator unit, input 1 amp., 12 volt output and 2 volt filament supply. Battery operated: 2 v/800ma.; 90 v/12ma. Tubes: Four RV 2P 800 "knob" type pentodes. The combined weight of components is approximately 51 lbs. including power supplies.



One of the most widely used sets in the German army.



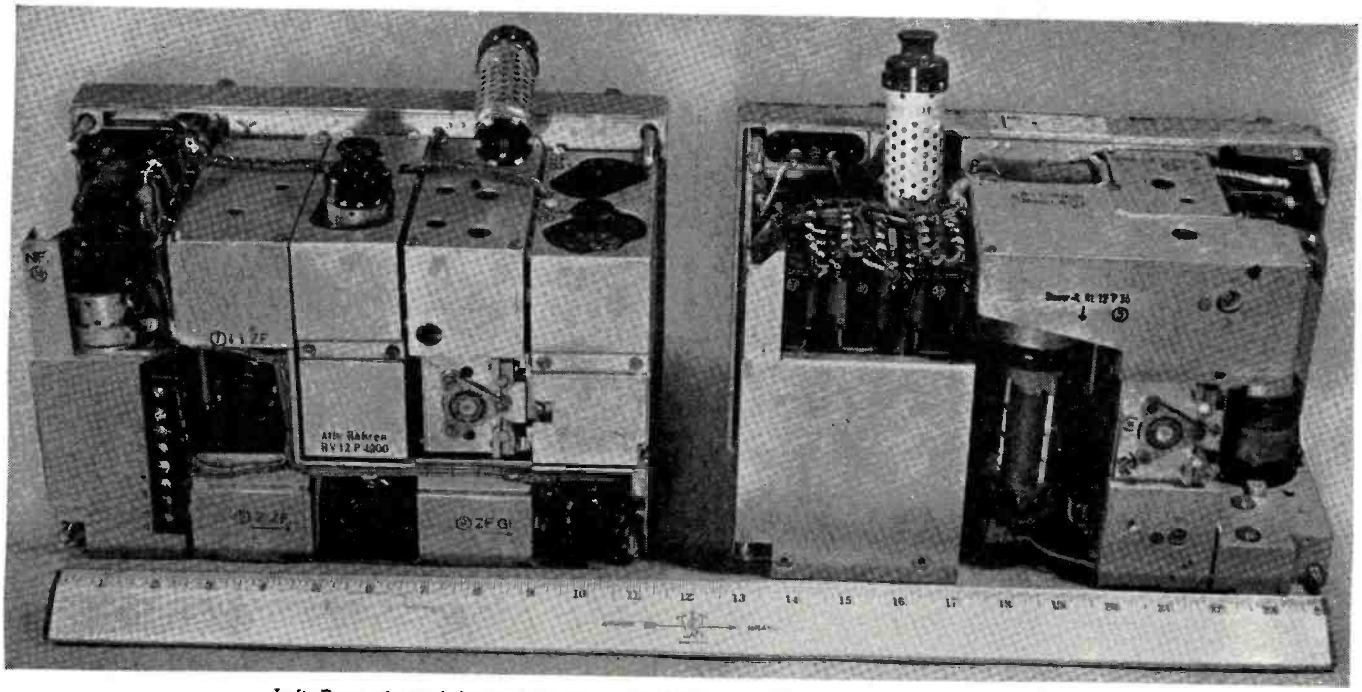
Lo-loss coils and magnesium shields are used freely.



Coil turret assembly is rotated by means of gears.

10 W.S.c (Trans.) U.K.w.E.e. (Recvr.)

Used in tanks and armored cars. Frequency range: (mc.) 10 W.S.c. 27.2-33.3, W.S.h. 23-24.95. Antenna: Two or three mast sections on vehicle (2 meters) or tuned antenna for ground use. Power source: Dynamotors operated from 12 volt portable batteries.

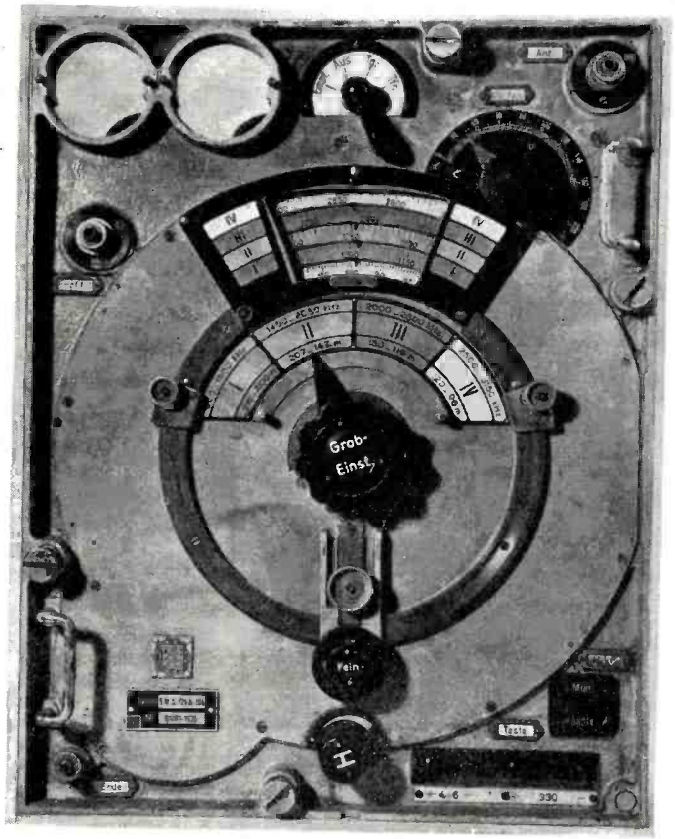


Left: Rear view of the tank receiver. Right: Transmitter unit showing tube locations.

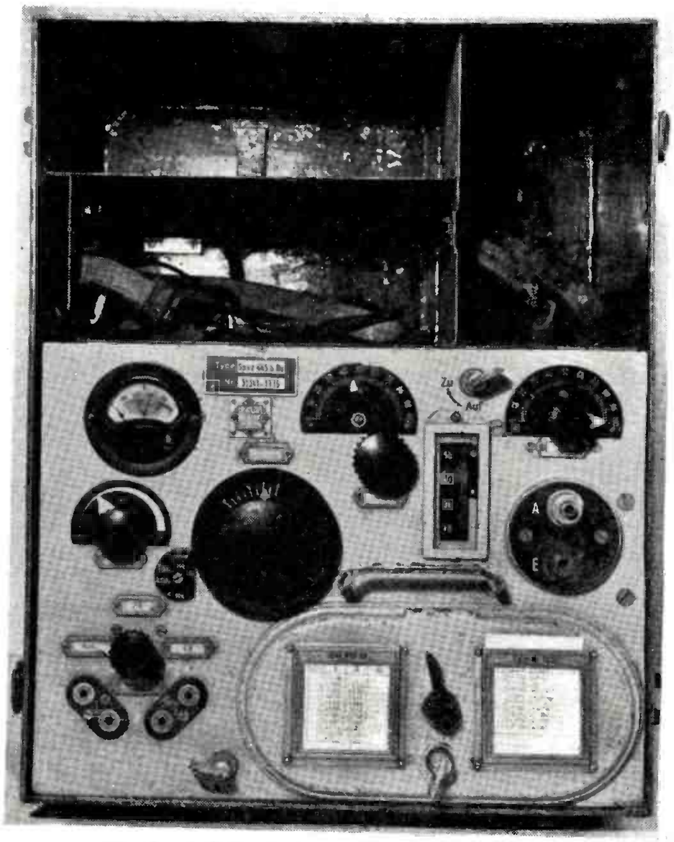
5W.S. PACK TRANSMITTER

The 5WS covers the following frequencies: .95-1.5; 1.45-2.05; 2.0-2.6; 2.5-3.15 (mc.). The 445b. is a universal portable receiver.

SPEZ 445b. RECEIVER



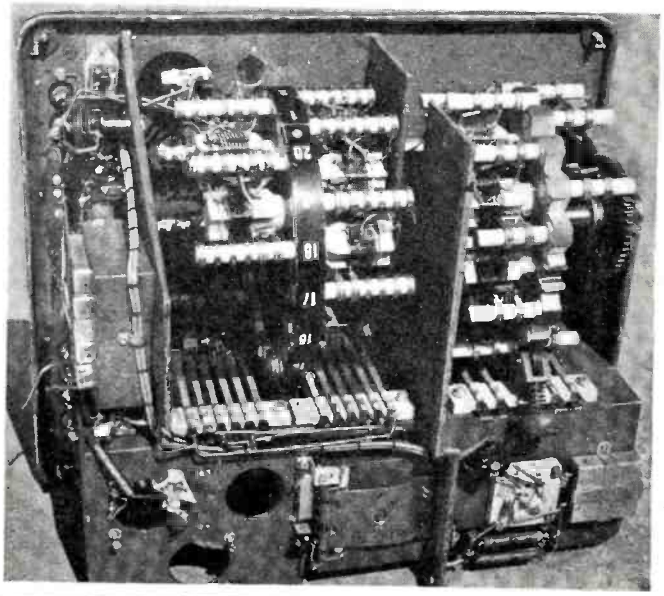
Of old design and engineered for "green" personnel.



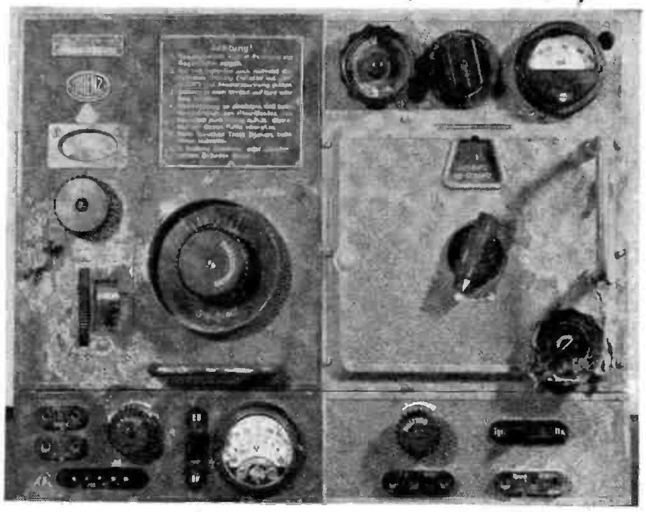
Obsolete T.R.F. receiver—replaced with Torn E.B.

FREMES a.

Frequency meter for measuring frequencies of transmitters and receivers. It covers from 28.5-31 mc. Twenty sets of coils are arranged on ceramic spools. Turret revolves. Uses four tubes.

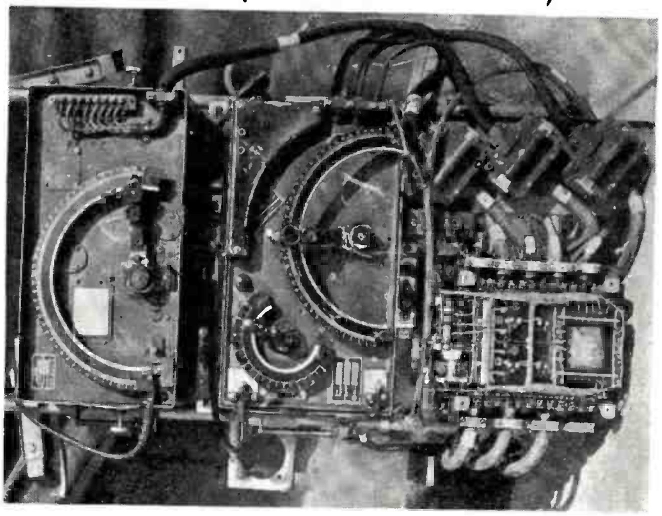


SE.a 2/24b-202 (Transcvr.)



Compact, well-built pack set. Used by German infantry.

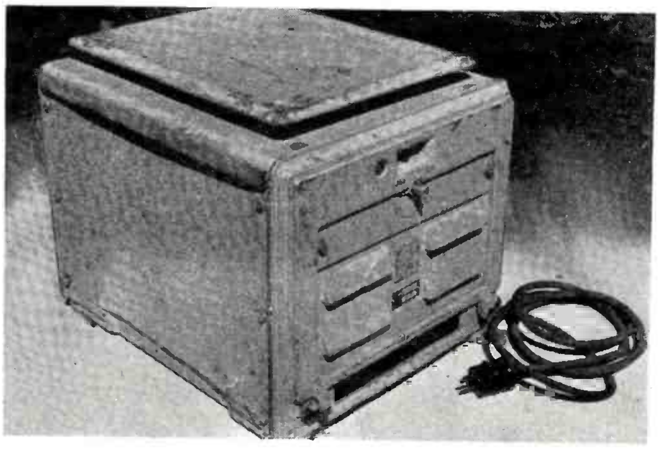
FuG 7 (Airborne Trans.)

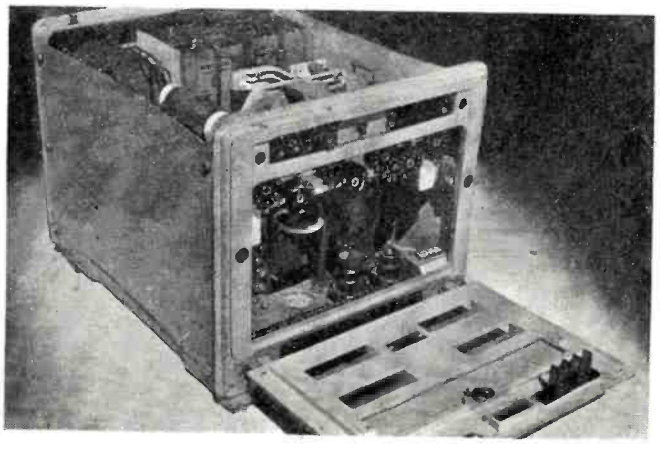


Used for single-seater planes. Trans. and Recvr. rubber mounted.

BATTERY CHARGER

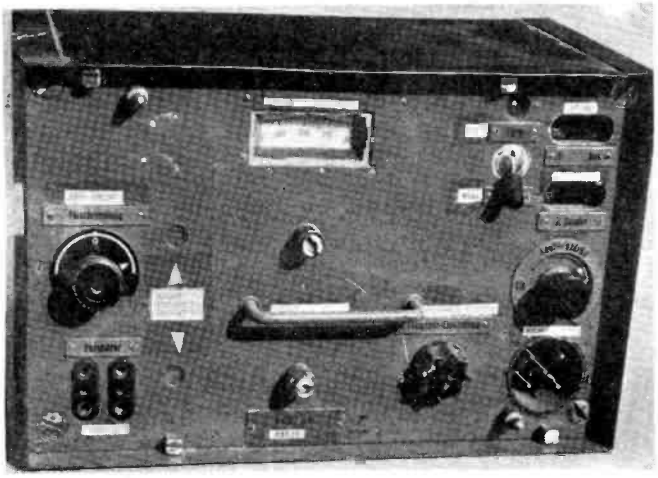
Rectifier-type 12 volt charger. Used for tank and armored car radio sets. Paper condensers are used freely.



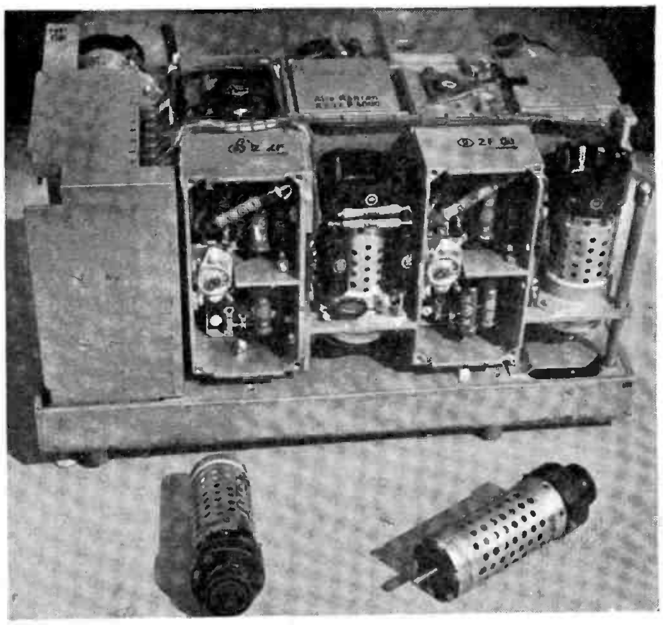


U.k.w.E.e. Recvr. (27.2-33.4mc)

Used in tanks and armored cars for signal communications in tank networks. CW-Phone.



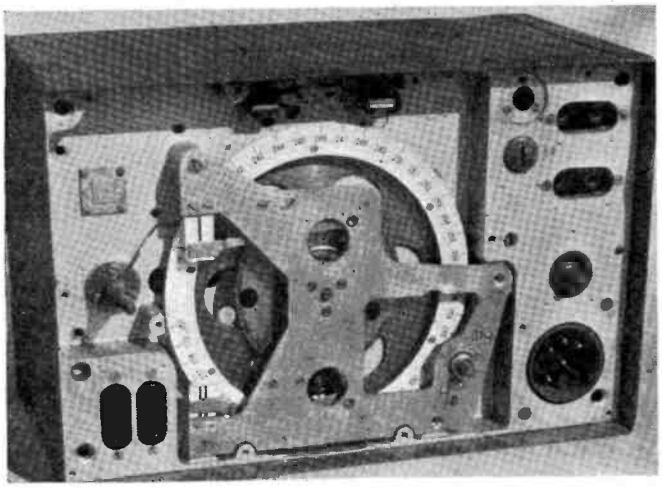
Well-constructed, light in weight, efficient design.



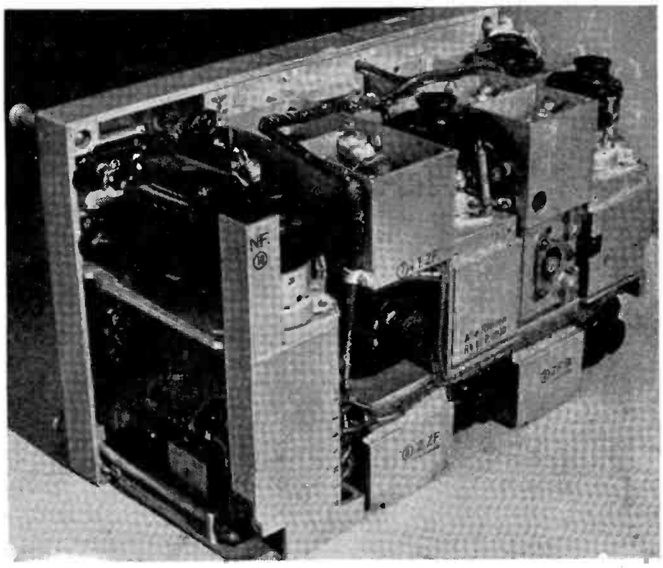
Cast metal boxes are used to shield various circuits.

U.k.w.E.h. RECEIVER

This set is similar to the U.k.w.E.e. shown above. No crystals are used in transmitters or receivers.



Another intricate and efficient tuning mechanism.

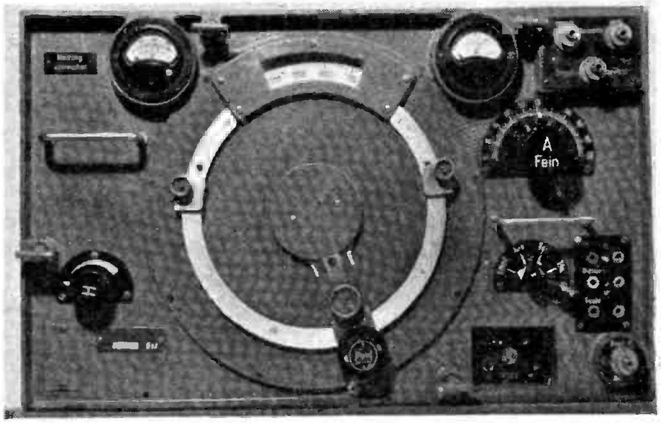


Rear view shows neat cabling and use of baffles.

FUSPRECH a TRANSCEIVER

The German unit (left) compared to our SCR-536 (right).

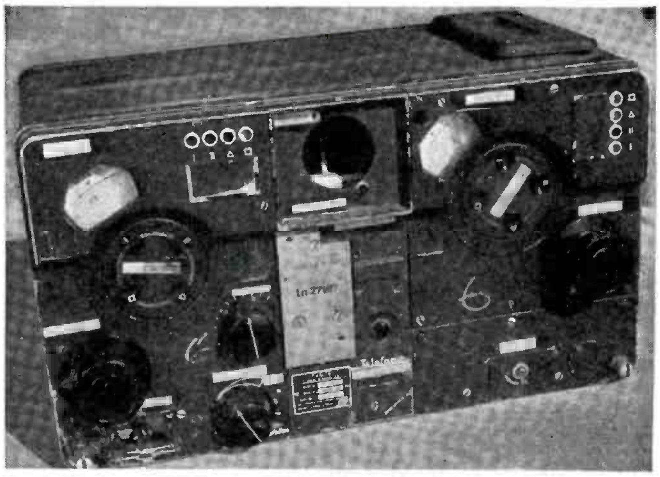
30 W.S./24b-120 MOBILE TRANSMITTER



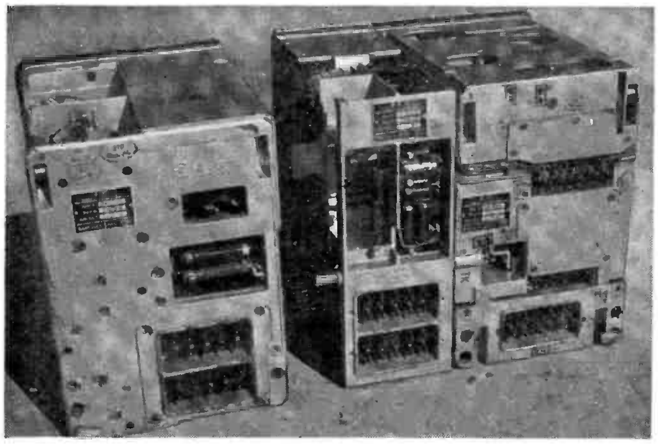
Used for mobile ground-to-air radio communications.

FuG.16 (Airborne Set)

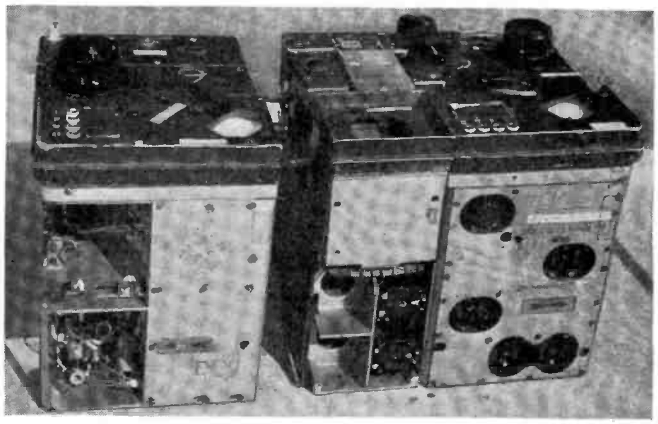
By standardizing on one tube (HF Pentode) it may be used throughout receiver and modulator by connecting them as a pentode, triode or diode in the various stages. Coils are made by electroplating silver on a spiral groove on the forms—followed by a thin copper electro-deposit form. Frequency range: (mc) 38.6-42.2. Preset frequencies: Four, both transmitter and receiver. Power source: Dynamotor (24 v.). Power output: 10 w.



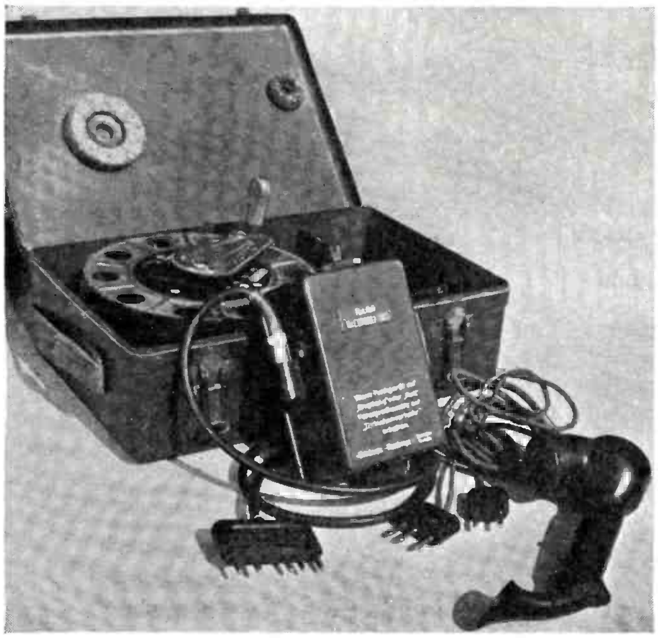
Left to right: Receiver, Modulator and Transmitter units.

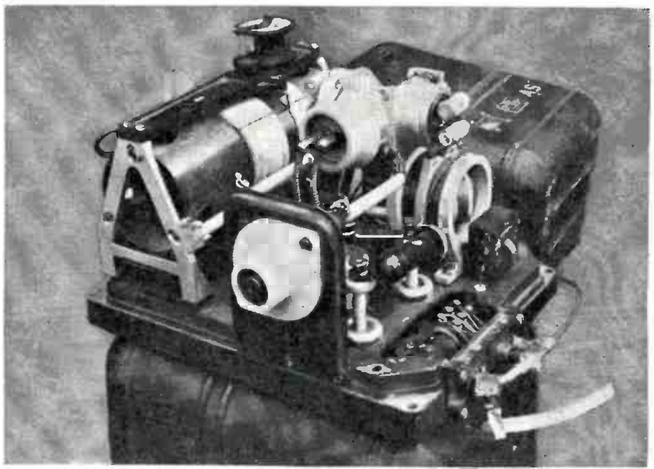


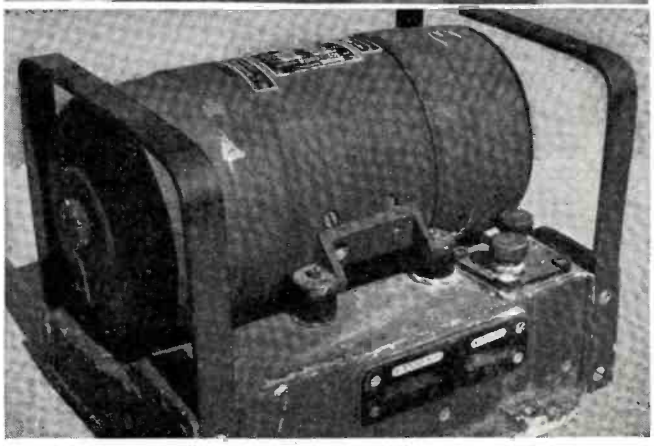
Rear view shows three-unit construction and connectors.



Top view of the FuG.16. Transmitter, modulator, and receiver.





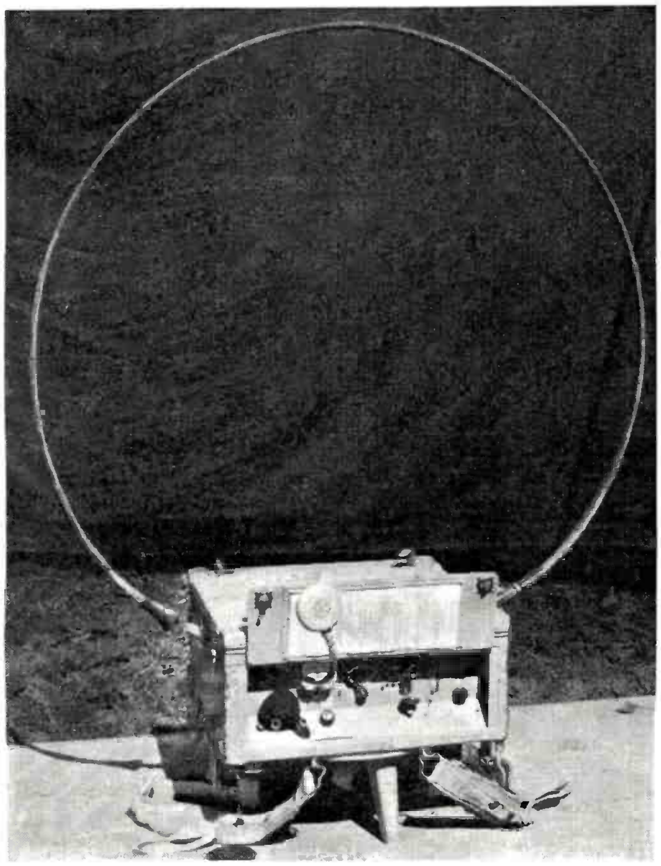


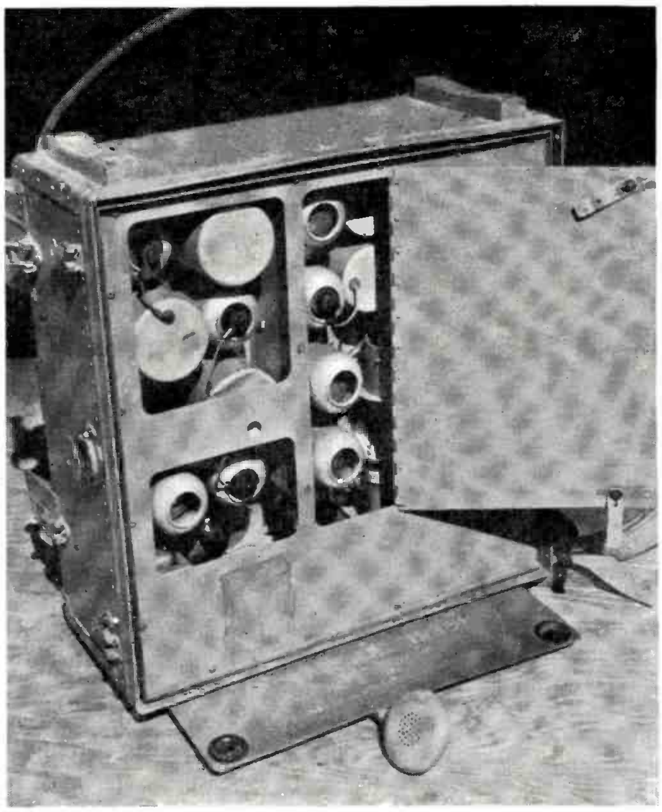
Above: Remote-control unit used in conjunction with Torn Fuf, Fuheu, Fud2 and Fub1 pack sets separated to 250 yds.

Above right: Antenna control with Selsyn indicators for operation with the German FuG10 airborne sets.

Captured German dynamotor. Supplies power to the 100 W.S. transmitter. Resembles American units.

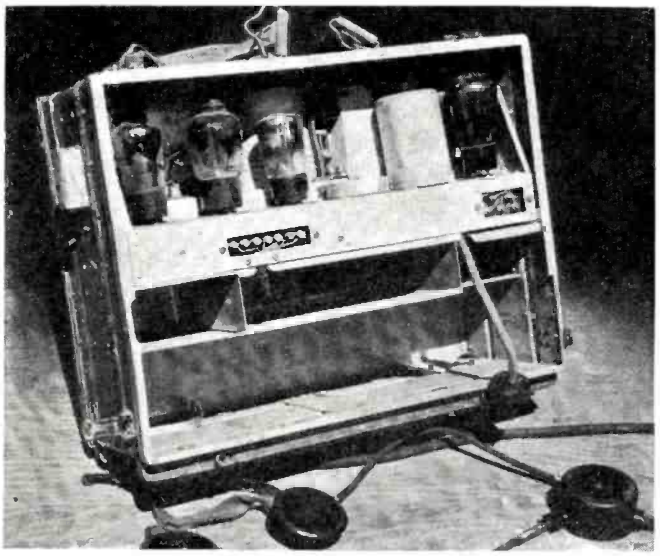
GERMAN-ITALIAN

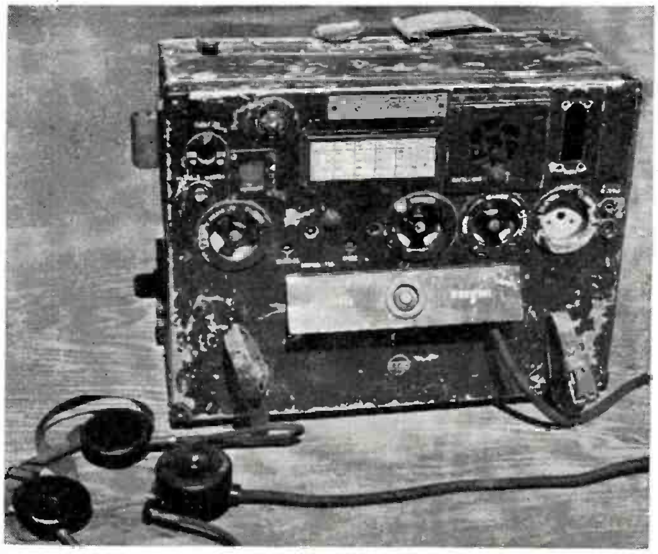




STAZ-R.F. 2 TRANSMITTER

Used within artillery units, transported by animal, cart, or by 2 men. Dry battery operated. Grid modulation varies plate voltage. Luminous quartz crystal used for calibration purposes. Uses loop antenna for better directivity.





STAZ-R.F. 1 PACK SET

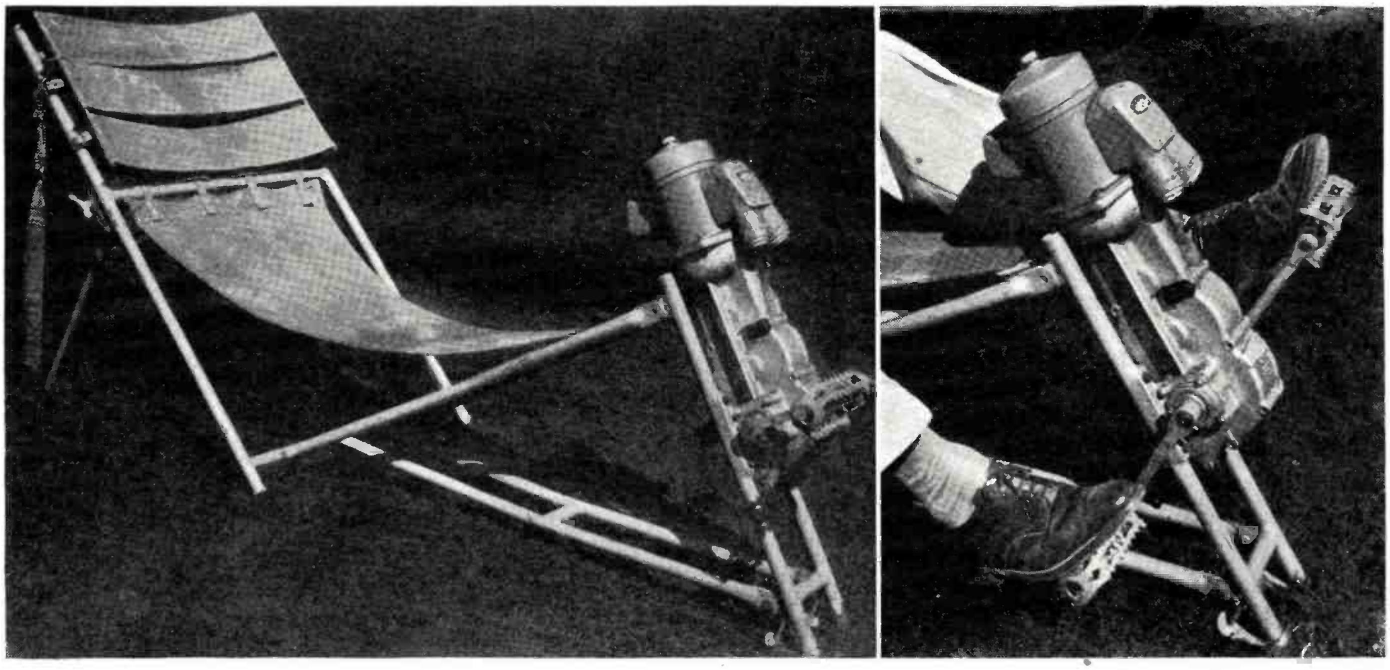
Frequency range: 2-3 (mc). Dry battery operated. Used within Infantry regiments and Infantry regimental tactical nets. Heising modulation. Crystals used in both transmitter and receiver.

WIRE CASE

Italian assault wire carrying case. Used by Infantry troops. It is made from natural animal hide and hair. Light in weight, strong and durable and carried in back of shoulders.

PORTABLE SWITCHBOARD

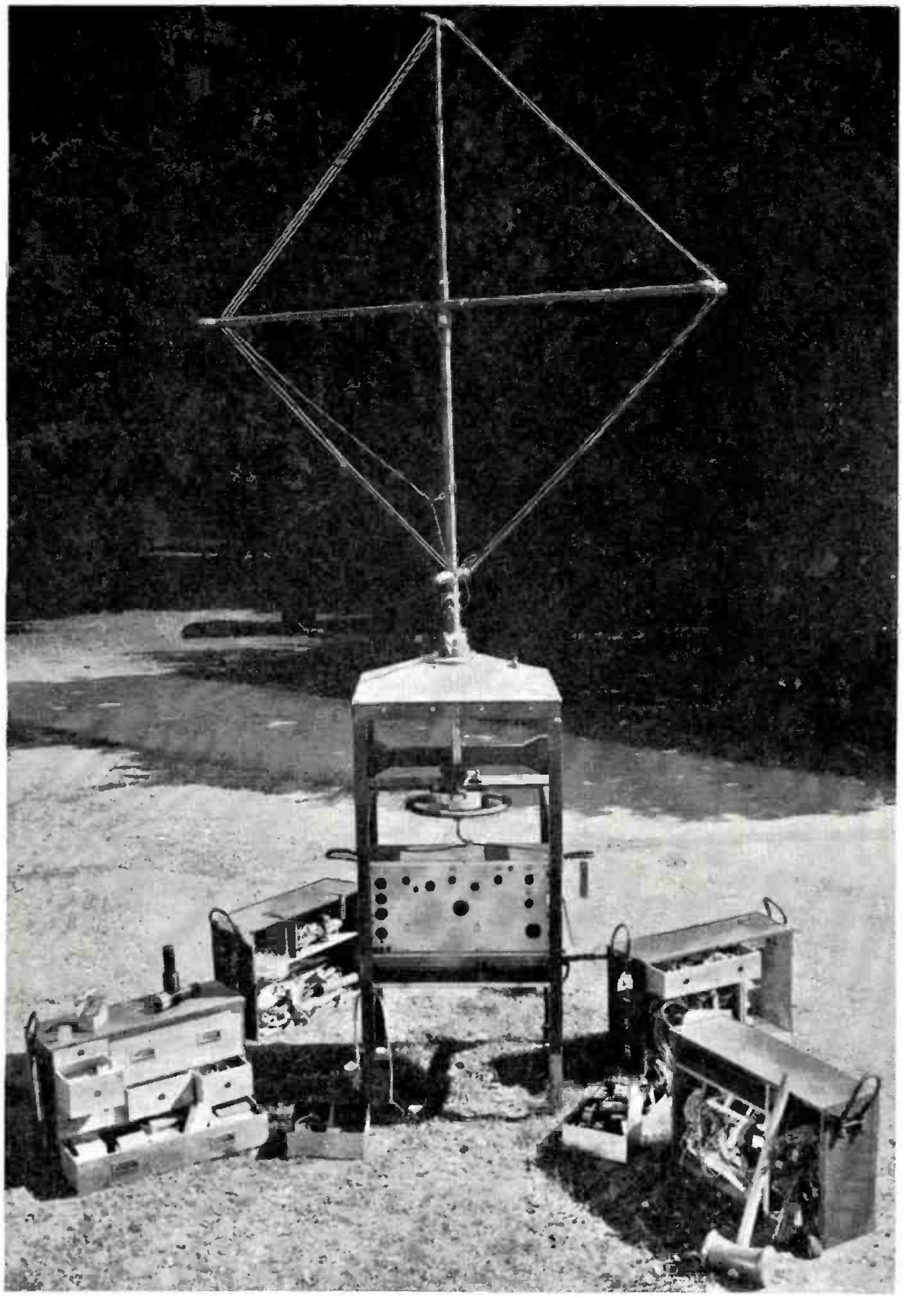
Italian 6-line cordless portable switchboard. Built into a hardwood box. Complete instructions and wiring diagram are included within the cover. Headset slides into compartment. Ringer is on side.



FOOT-OPERATED GENERATOR

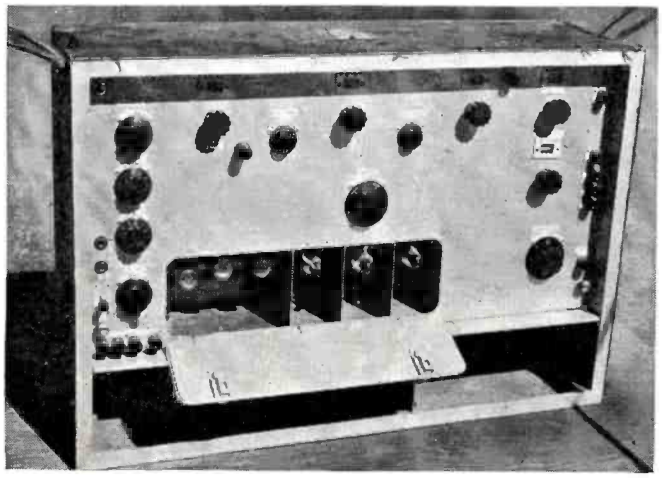
Foot-operated Italian generator supplies power to operate large pack sets. It furnishes outputs of 12 volts for filaments and 400-440 volts for plate supply. Operator is also an aircraft spotter.

JAPANESE EQUIPMENT

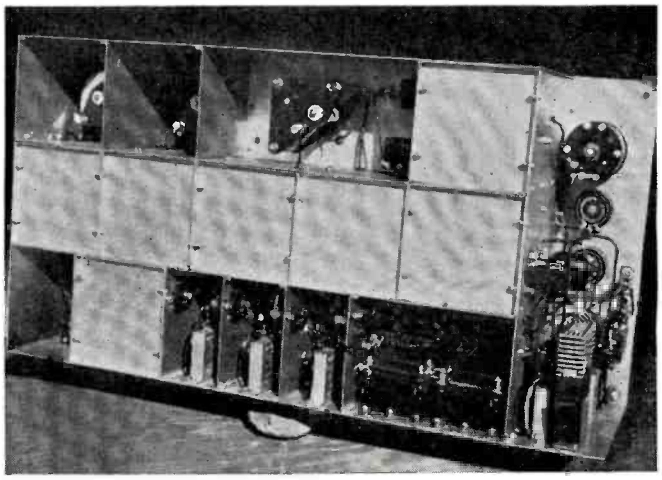


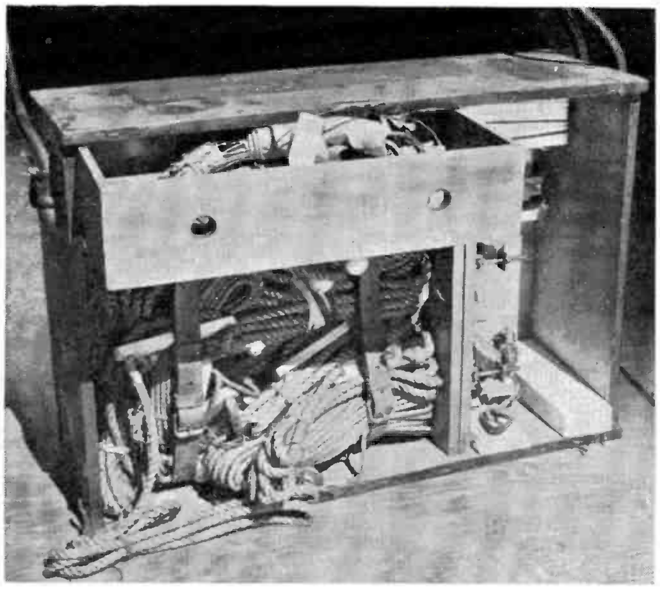
THE Jap Direction-finder shown on these pages is typical of their construction technique. Note the resemblance to American-made units. The Japs are great copyists. In fact—their B batteries are almost identical to the Burgess products as far as appearance is concerned. This assembly was captured in the South Pacific recently. It was never put in operation. The paper was still covering many of the accessories. A large amount of companion pieces are required for the operation of the unit. Ample quantities of spare parts are found in the various cases. Spare paper and mica condensers have both American and Japanese symbols for identification. Tubes appear to be direct copies of ours. The complete unit, set up for operation, requires several troops to handle and to erect antenna towers (when required). The general construction of Jap sets is inferior to those of the Germans. A light weight metal (aluminum, etc.) is employed to reduce the over-all weight. Castings are avoided—the choice being to use individual metal pieces, bolted together with screws.

Front view of the receiver. Six tubes are in compartment.

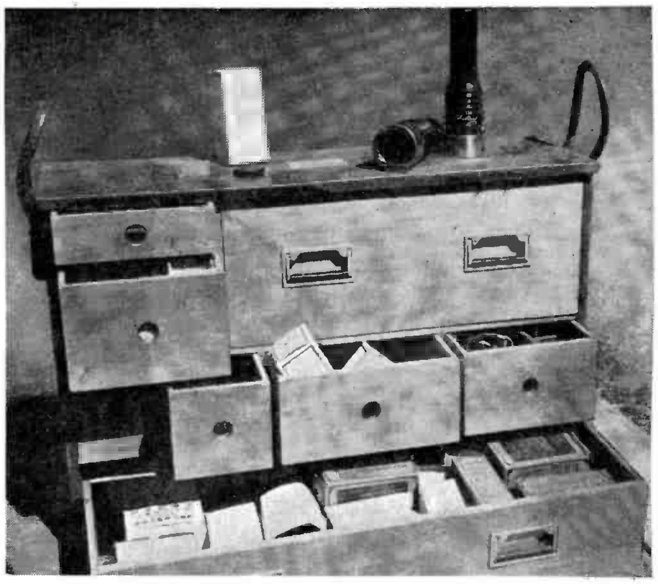


Rear of receiver. Note the small C battery—copy of Eurgess.

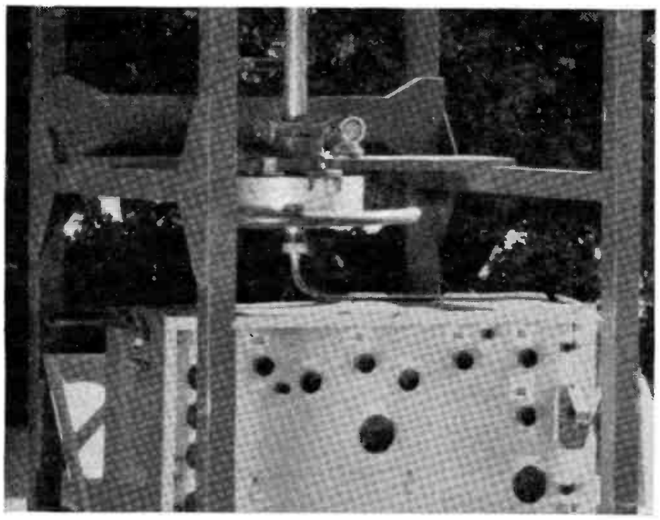




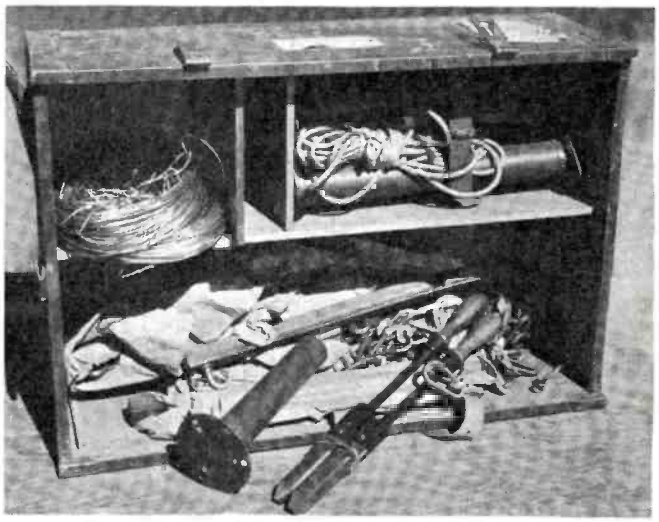
This accessory case includes rope to support antenna masts.



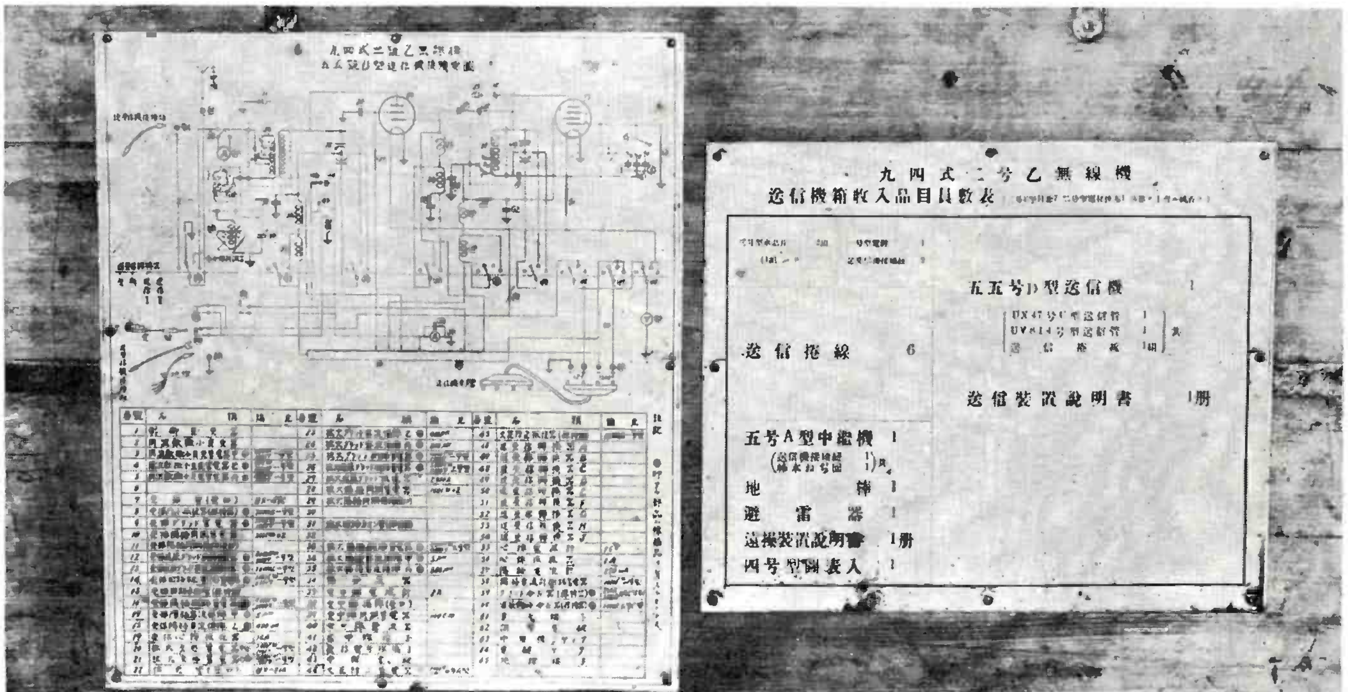
Tubes, insulators and small parts complement this case.



Azimuth circle is directly under frame below loop.

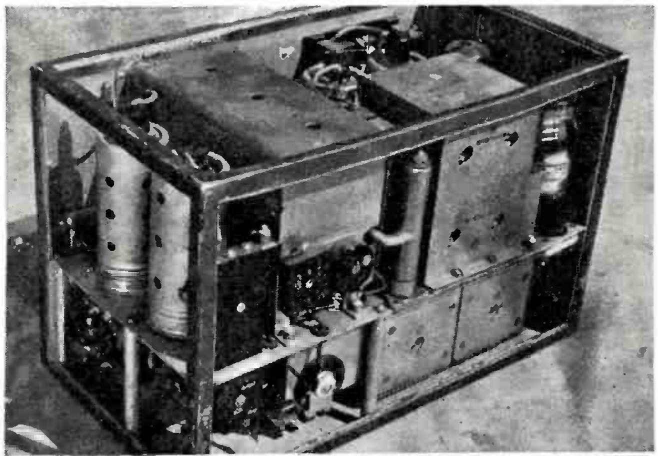


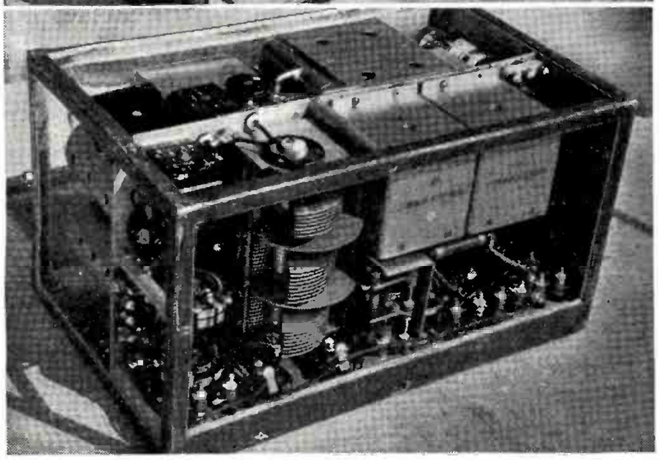
Heavy-duty soldering irons, ant. wire and supports.



Wiring diagram and parts list for the direction-finder. Chart on left shows position for the storage of spare parts.

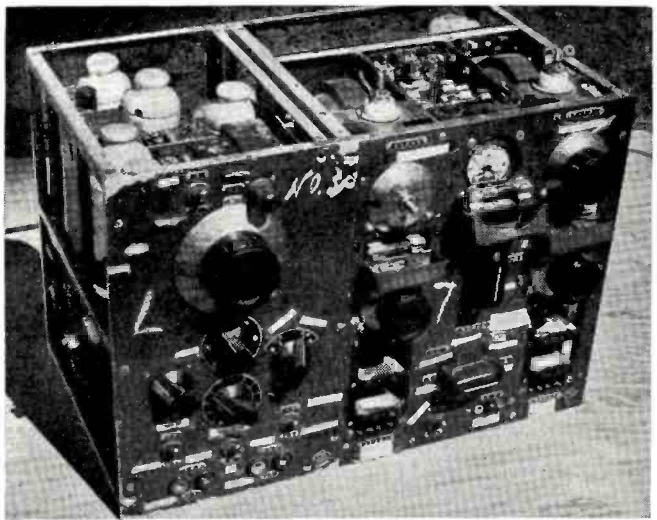
MISCELLANEOUS CAPTURED EQUIPMENT

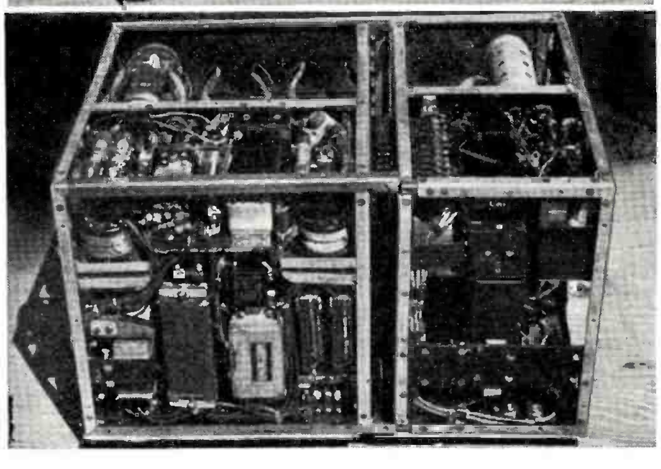


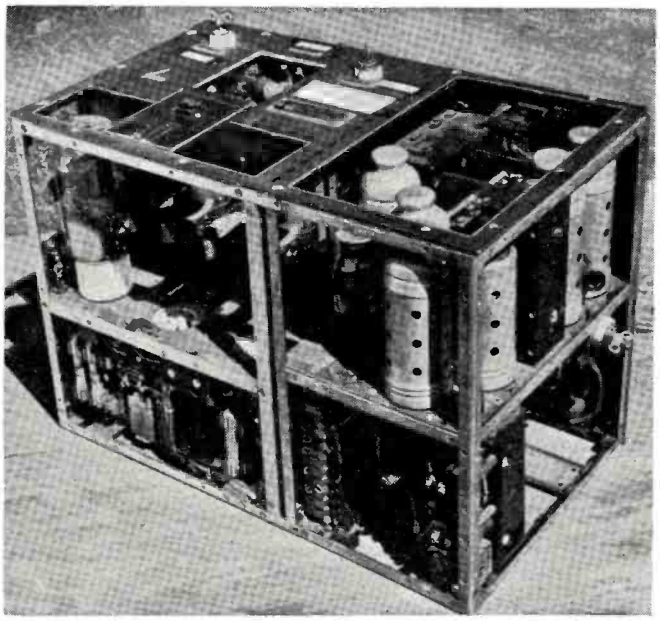


TYPE 13 TRANSCEIVER

One of many captured Japanese radio sets taken from Mitsubishi dive-bomber. This transceiver is designed for 140 and 275 kc. communications.

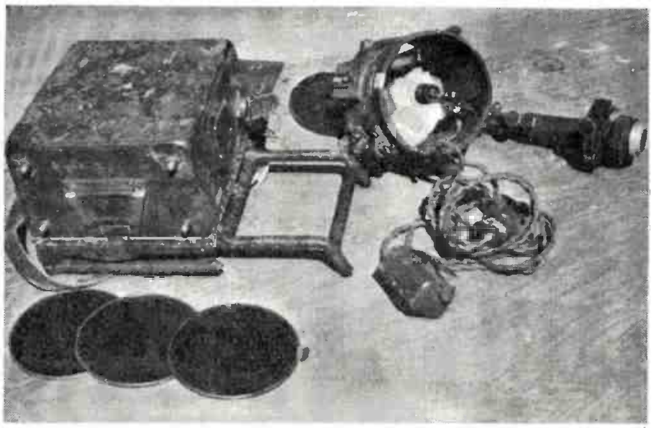


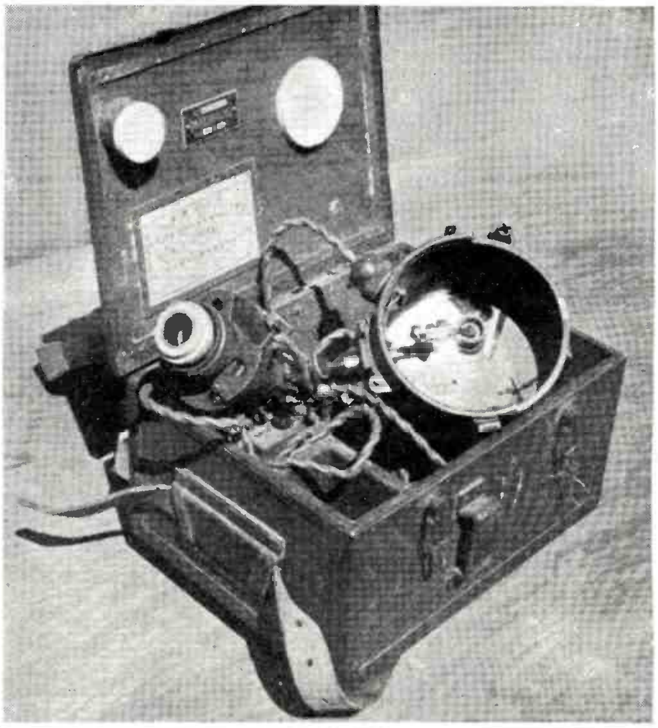




JAPANESE XMTR.-RECVR.

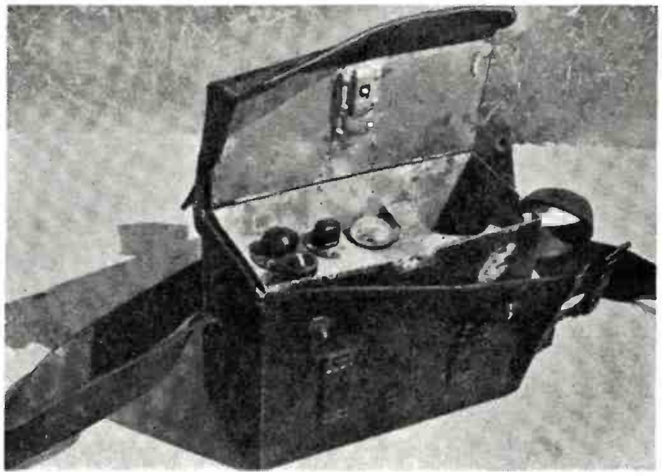
A separate vernier may be seen below the large silvered tuning dial on the receiver. Another control is marked "short-wave, long-wave." Note the small opened fuse compartments on the Xmtr. panel. Fabricated frame gives poor support to unit.

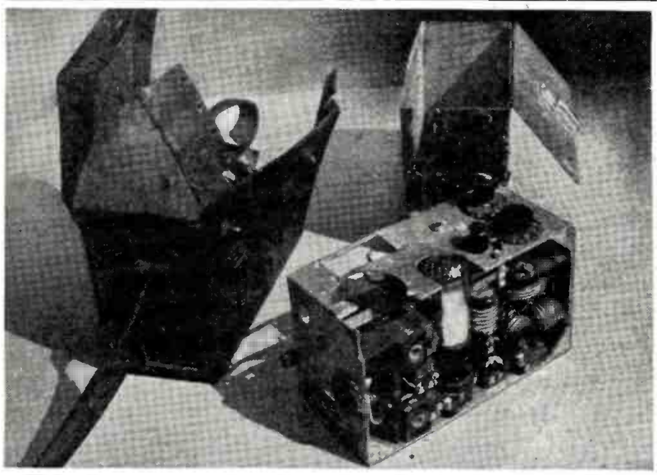




PORTABLE SIGNAL LAMP

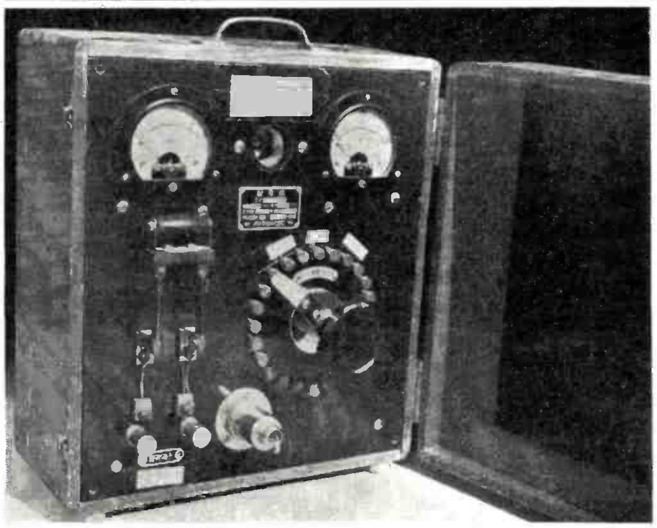
Well-constructed signal lamp for blinker code. Discs of different colors are carried in the wooden case. Small, auto-type lamp gives good brilliancy. Complete instructions are listed on the cover. Reflector is silvered glass.

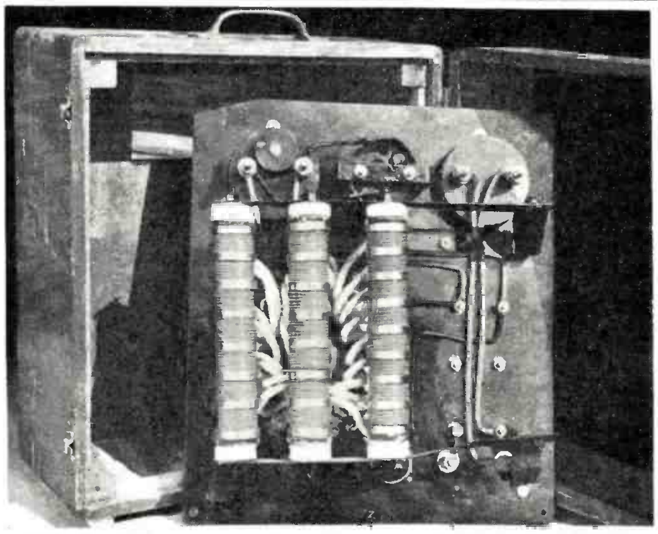




1-TUBE TRANSCEIVER

This tiny transceiver has very limited range. Soft aluminum box—easily damaged—has direct effect on calibration when distorted by twisting, etc.





CHARGING PANEL

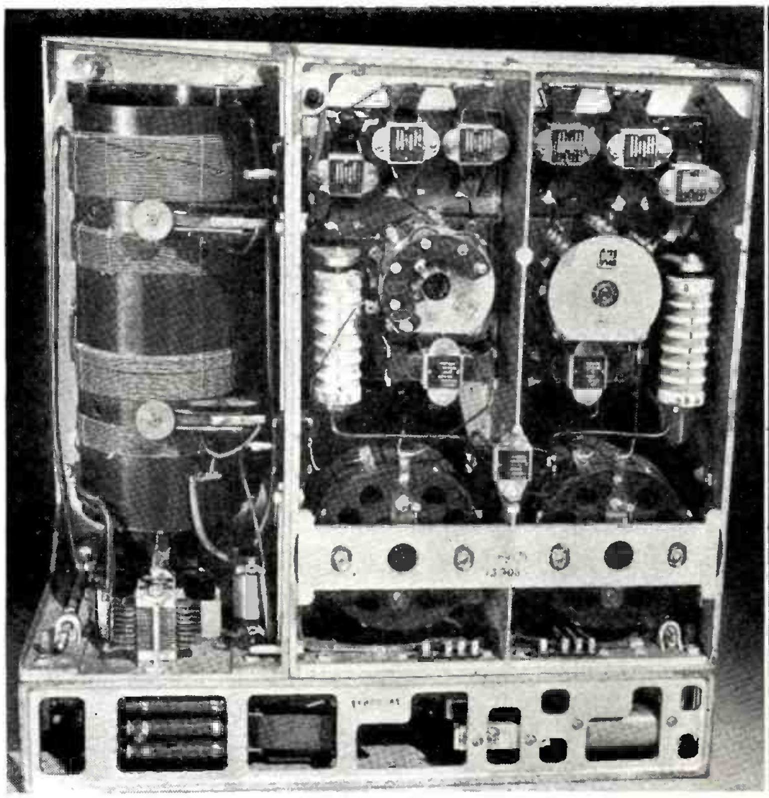
Kihako-3 Japanese charging panel. Rated at 100v. maximum @ 5 amperes. Tap-switch nameplate reads as follows "descent-voltage-ascension."

GERMAN 100 W.S. TRANSMITTER

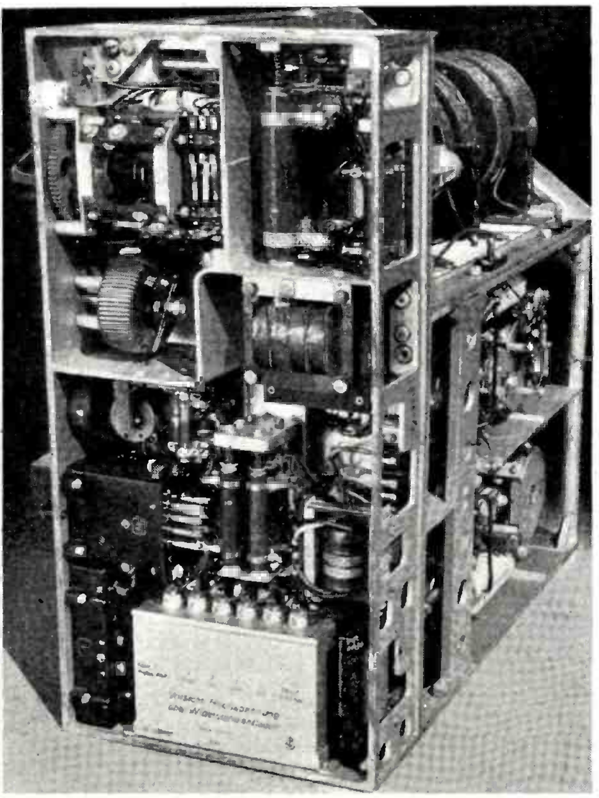
Military version of 100-watt commercial transmitter built by Lorenz. Using three tubes – it operates on both phone and CW

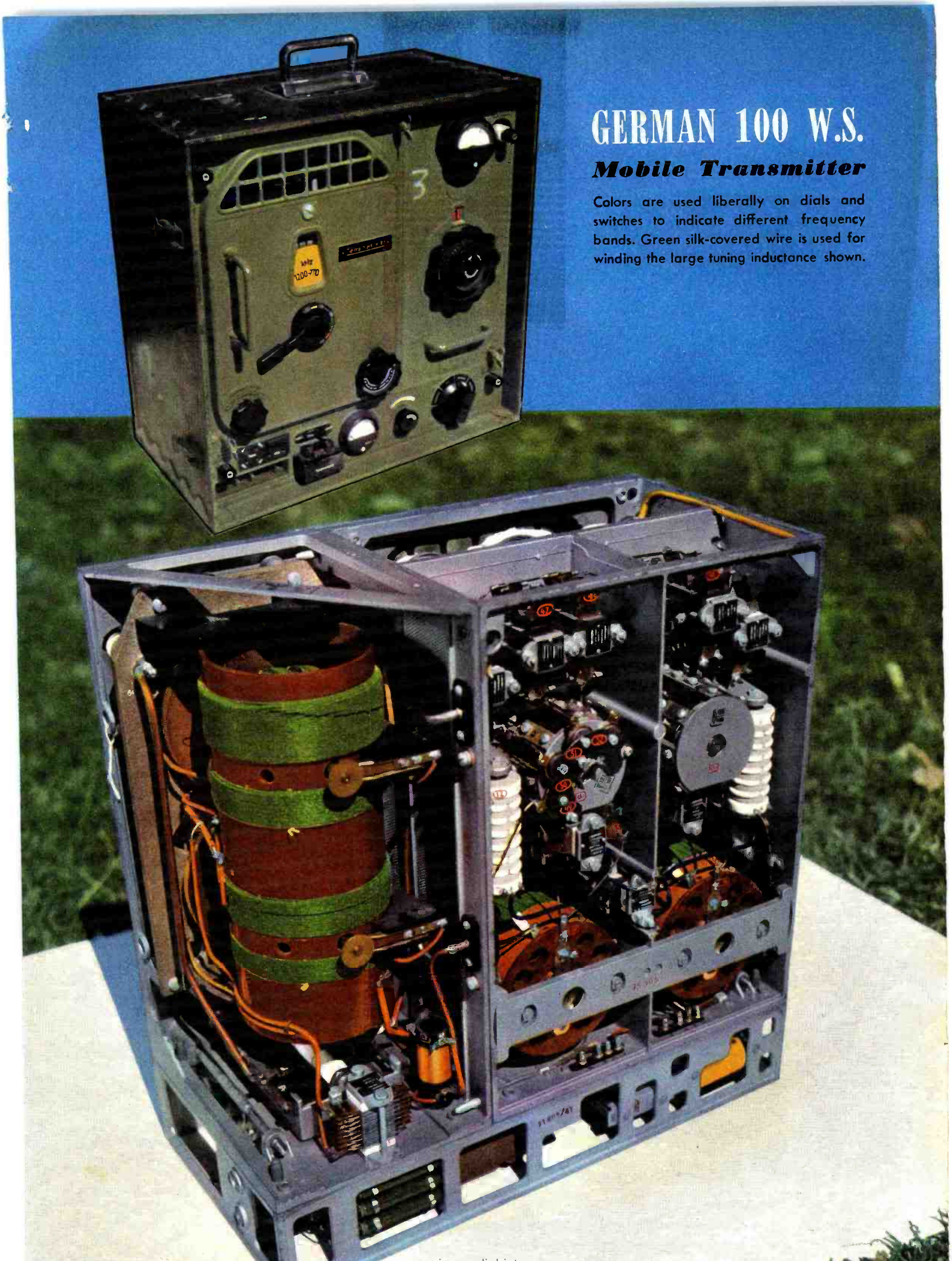
THIS transmitter is exceptionally well built. It is used in vehicles, as a fixed station transmitter and for the transmission of radiophotos. It covers a frequency range of from 200 to 1200 kilocycles on CW or phone. Provision is made for both local or remote keying. Like other German equipment—this set does not use crystal-control. It is designed to be used with a 30 ft. vertical antenna with umbrella top (to increase low angle radiation), an open wire, a roof antenna or an 18 ft. rod. A dynamotor, type U100A is used when operating in mobile units. For fixed station use—a machine type C furnishes power. A source of 12 volts @ 7.3 amperes, and a plate supply of 1000 volts @ 300 ma. is required. Provision is made to reduce the 100 watt output to 10 watts when limited range is desired. A total of three tubes is employed: two RS 237 transmitting triodes (M.O. and P.A.), and one type RS 241 (modulator). The weight of the transmitter is 57 lbs. and the type N-100 dynamotor is 48 lbs. Asbestos-covered shock absorbers may be seen over the three tubes. They hold the tubes firmly in the sockets. Mica condensers are used liberally throughout this set. Some of the assemblies are stacked two and three inches thick. They are made in higher capacities than those of American design. Metal castings are to be found in most German sets. Lightweight metals, such as aluminum, are well made and durable. Soldering and cabling is done neatly. Terminal blocks of bakelite or hard rubber are used. The variable condensers in the 100 W.S. are of good quality. Ball-bearings support the end of the rotor shafts. Heavy tie bars prevent de-tuning of circuits from mechanical distortion.

Rear view of the 100 W.S. transmitter. The large inductance is patterned after the variocoupler used in early receivers.



Bottom view showing neatly-arranged parts and general type of mechanical construction employed in German radio equipment.

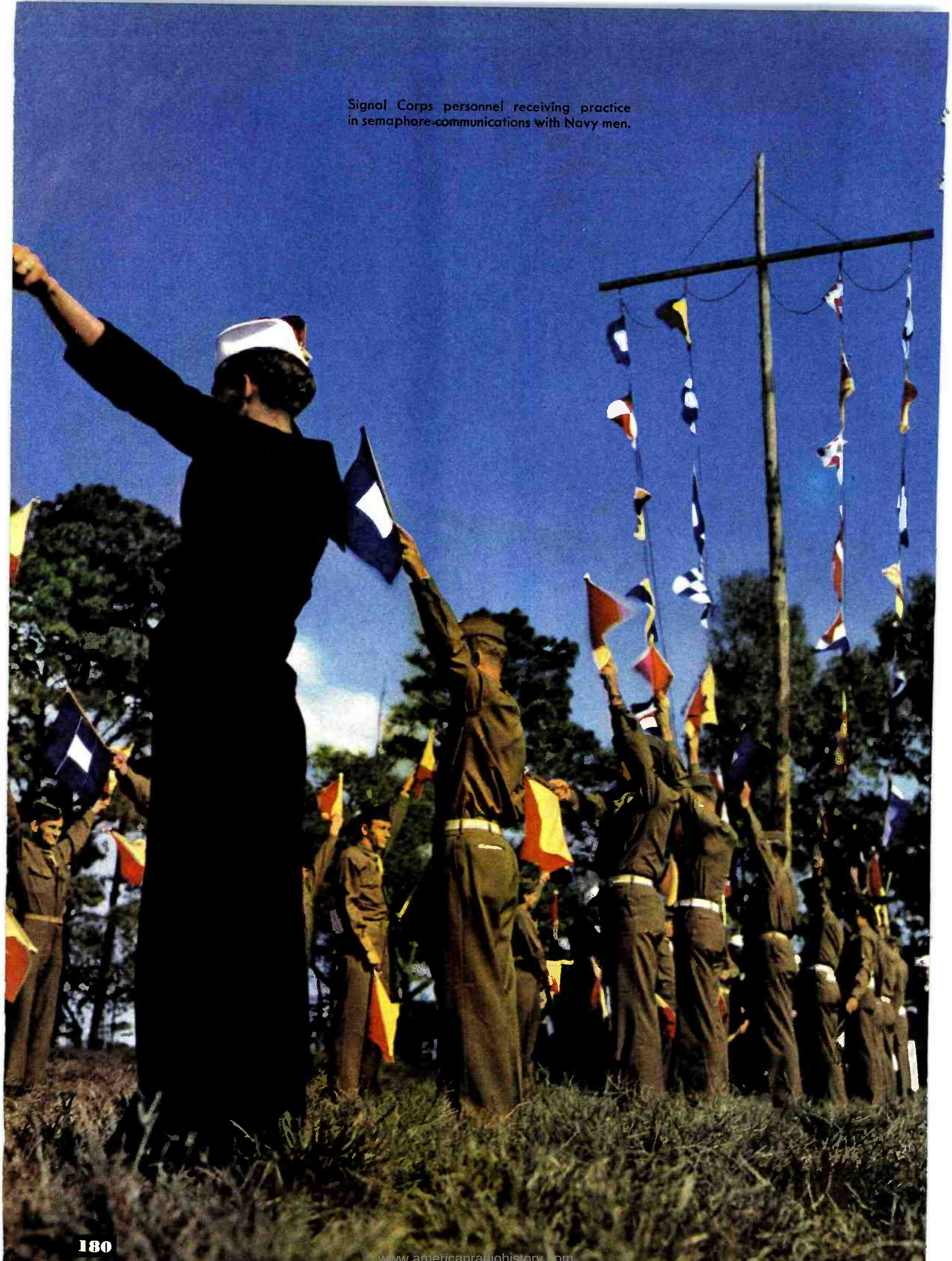




GERMAN 100 W.S.

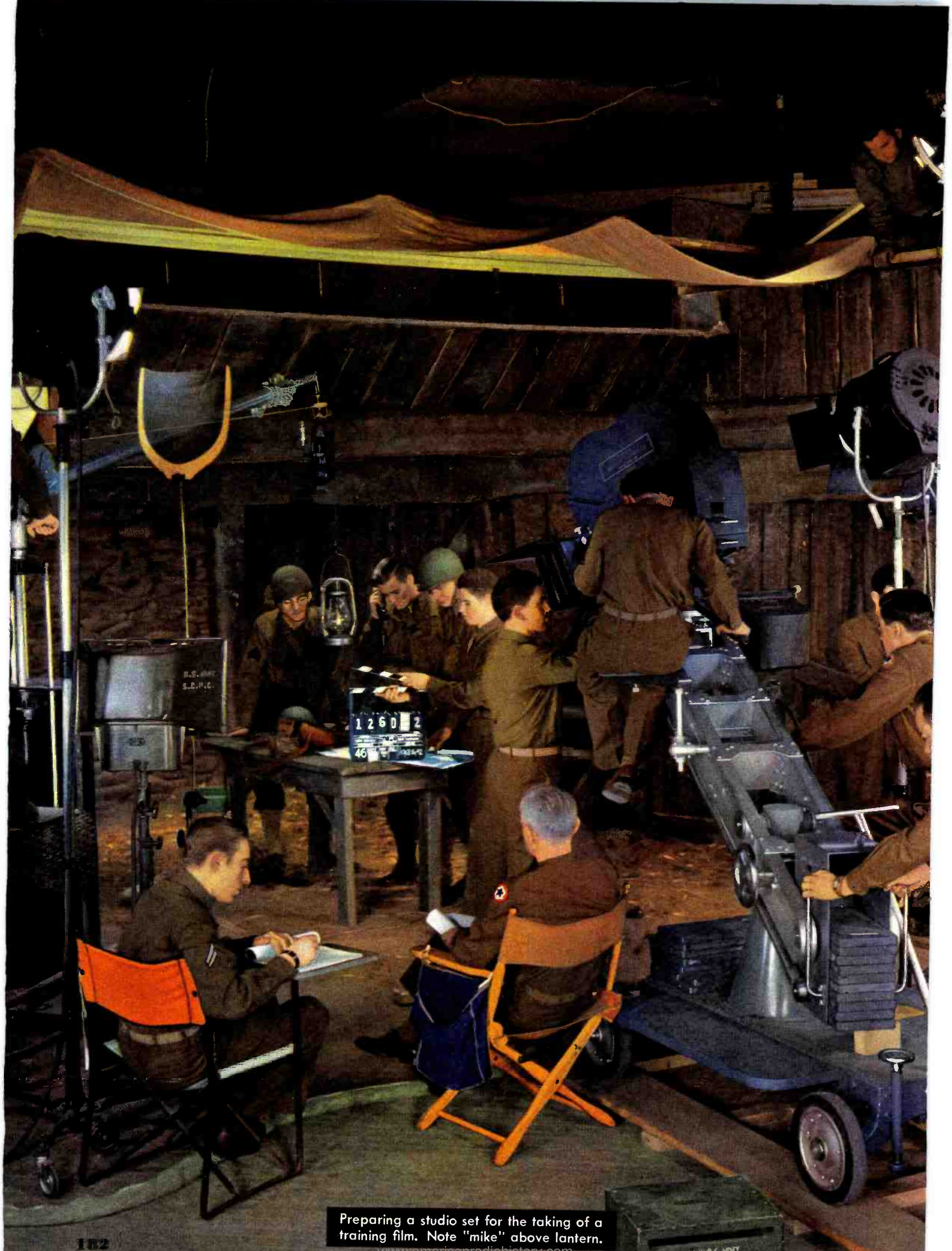
Mobile Transmitter

Colors are used liberally on dials and switches to indicate different frequency bands. Green silk-covered wire is used for winding the large tuning inductance shown.



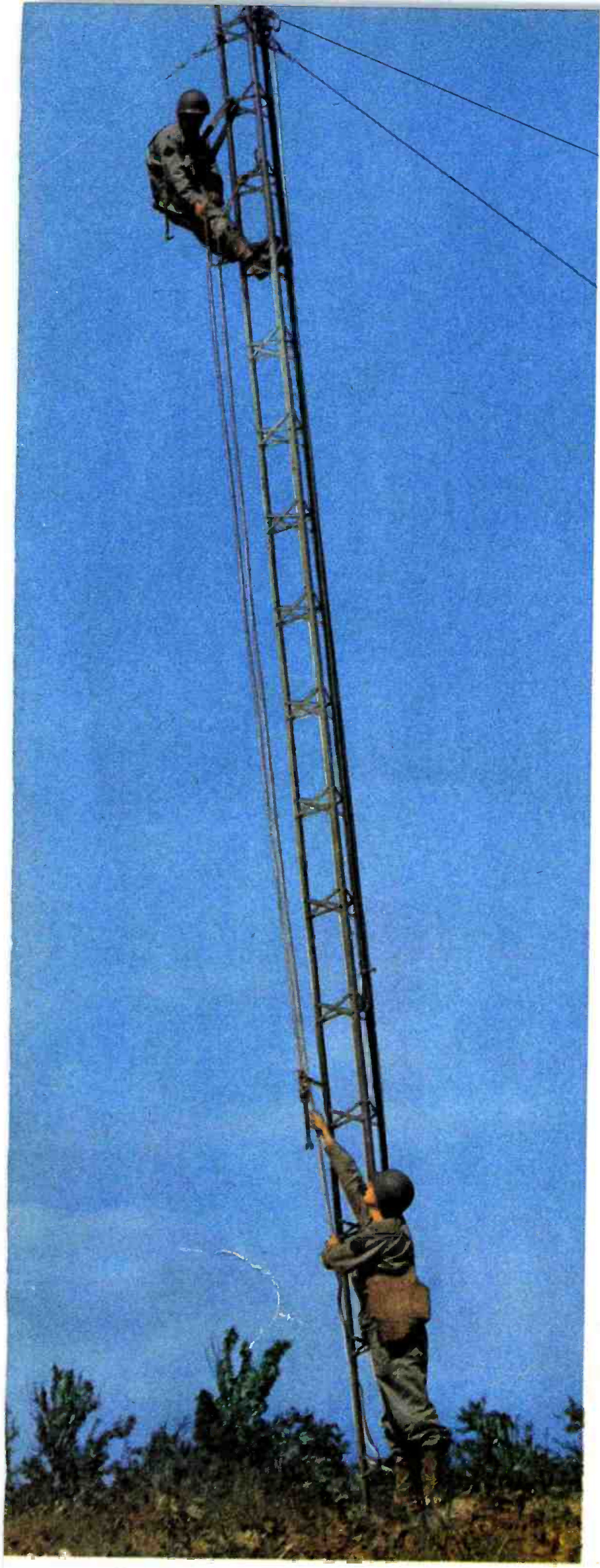
Signal Corps personnel receiving practice in semaphore communications with Navy men.

Wearing gas mask—this photographer of the Signal Corps prepares for an action shot.



Preparing a studio set for the taking of a training film. Note "mike" above lantern.

Experts of Army Pictorial preparing an indoor set for simulated jungle warfare sequence.



Signalmen erect light-weight steel antenna tower—used to support elaborate systems.

Crossarm being installed on pole by students of the long lines outside course, Ft. Monmouth.

Diversity receiving station. Each of 3 receivers is fed by a rhombic antenna — each pointing in a different direction.

McELROY CHART OF CODES AND SIGNALS

First Record 56 w.p.m. Boston 1922
Latest Official Record
75 w.p.m. Asheville 1939

RESPECTFULLY DEDICATED
TO THE
RADIOMEN OF OUR ARMED FORCES AND MARITIME SERVICE

18th Anniversary Dinner-Cruise, February 11, 1943
Veteran Wireless Operators Association.

INTERNATIONAL FLAG SIGNALS

INTERNATIONAL MORSE
(CONTINENTAL CODE)

LETTERS — OPTIONAL LETTERS — PUNCTUATIONS AND OTHER SIGNS

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Optional letters: ä or á, ch, é, ñ, ö, ü

Period, Comma, Colon, Question mark, Apostrophe, Hyphen, Fraction bar, Brackets, Double hyphen, Underline, Understood, Error, End of message, Invitation to transmit, Wait, End of work, Starting signal, Separation signal, *Semicolon, *Quotation mark

FIGURES: 1 2 3 4 5 6 7 8 9 0

FIGURES IN ROUTINE REPETITIONS: 1 2 3 4 5 6 7 8 9 0

Numerals and punctuation marks are the same in the codes for all languages.
*Not official but in general use.

COMMERCIAL "Z" SIGNALS

AERONAUTICAL "Q" SIGNALS
Used Especially in Airways Communications by Authority of the FCC.

(Complete code available on request)

AMERICAN MORSE

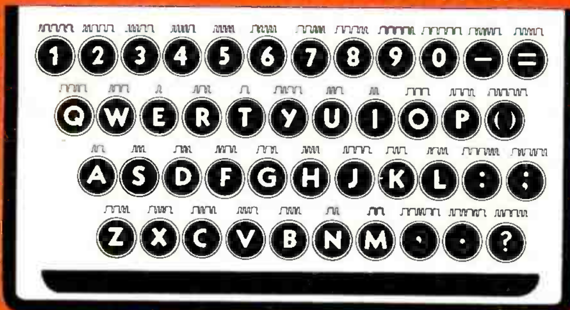
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z &

1 2 3 4 5 6 7 8 9 0

Period, Comma, Hyphen, Question mark, Exclamation mark, Colon, Parenthesis, Quotation, End of quotation, Colon dash, Capitalized letter, Small letter, Colon followed by quotation, Semicolon, Paragraph, Apostrophe, Dollar, Cents, Pound Sterling, Shilling, Percent

SEMAPHORE CODE

THE McELROY METHOD
FOR TRANSCRIPTION OF RADIO TELEGRAPH SIGNALS



Typists can learn to transcribe inked slip at high speed in 4 to 6 weeks
Use GISFL set of practice tapes and associated equipment with this chart

GREEK

A	Alpha
B	Beta
Γ	Gamma
Δ	Delta
E	Epsilon
Z	Zeta
H	Eta
Θ	Theta
I	Iota
K	Kappa
Λ	Lambda
M	Mu
N	Nu
Ξ	Xi
O	Omicron
Π	Pi
P	Rho
Σ	Sigma
T	Tau
Y	Ypsilon
Φ	Phi
X	Chi
Ψ	Psi
Ω	Omega
HY	Eta Ypsilon
YI	Ypsilon Iota
OY	Omicron Ypsilon
AI	Alpha Iota
AY	Alpha Ypsilon
EY	Epsilon Ypsilon
OI	Omicron Iota

RUSSIAN

А	A
Б	B
В	V
Г	G
Д	D
Е,Э	E
Ж	J
З	Z
И	I
Й	Y
К	K
Л	L
М	M
Н	N
О	O
П	P
Р	R
С	S
Т	T
У	U
Ф	F
Х	KH
Ц	TS
Ч	CH
Ш	SH
Щ	SHCH
Ъ,Ь	Mute
Ы	I
Ю	YU
Я	YA

ARABIC

Alif, Ba, Ta, Tha, Jeem, Ha, Kha, Dal, Dhal, Ra, Zay, Seen, Sheen, Sad, Dad, Ta, Za, Ain, Ghain, Fa, Qaf, Kaf, Lam, Meem, Noon, Ha, Waw, Ye, Lam-Alif

TURKISH

A B C Ç D E F G H I J K L M N O Ö P R S Ş T U Ü V Y Z

THESE CHARTS, SIZE 25x38 INCHES, PRINTED IN SIX COLORS, MOUNTED ON A PROTECTIVE LINEN BACK, ARE AVAILABLE TO ANY BRANCH OF THE ARMED SERVICES OF THIS COUNTRY AND OUR ALLIED NATIONS, TO SCHOOLS AND GOVERNMENT AGENCIES . . . AT NO CHARGE.

POSTAL TELEGRAPH — WESTERN UNION PHONETIC ALPHABET

Adams, Boston, Chicago, Denver, Edward, Frank, George, Henry, Ida, John, King, Lincoln, Mary, Newyork, Ocean, Peter, Queen, Robert, Sugar, Thomas, Union, Victor, William, X-ray, Young, Zero

U. S. ARMY AND U. S. NAVY PHONETIC ALPHABET

JAPANESE MORSE
(SOMETIMES REFERRED TO AS KATA KANA RADIO CODE)

A ア	KA カ	SA サ	TA タ	NA ナ	HA ハ	MA マ	YA ヤ	RA ラ	WA ワ
I イ	KI キ	SI シ	TI チ	NI ニ	HI ヒ	MI ミ	I イ	RI リ	(W)I ヰ
U ウ	KU ク	SU ス	TU ツ	NU ヌ	HU フ	MU ム	YU ユ	RU ル	U ウ
E エ	KE ケ	SE セ	TE テ	NE ネ	HE ヘ	ME メ	E エ	RE レ	(W)E ヱ
O オ	KO コ	SO ソ	TO ト	NO ノ	HO ホ	MO モ	YO ヨ	RO ロ	WO ヲ
N ン	NIGORI	HAN NIGORI	HYPHEN	PERIOD	BRACKETS	QUOTES	PARAGRAPH	QUESTION MARK ?	

GOVERNMENT PRESCRIBED PRINTING
(FOR COPYING MESSAGES AT HOLD STATIONS WITH PENCIL AND PAPER)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 1 2 3 4 5 6 7 8 9 Ø

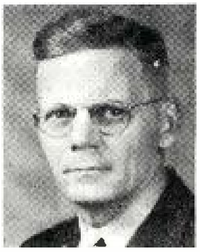
"Q" SIGNALS
(THE SIGNALS TAKE THE FORM OF ADVICES WHEN THE QUESTION MARK IS OMITTED)

QRA QRB QRC QRD QRG QRH QRI QRJ QRK QRL QRM QRN QRO QRP QRQ QRS QRT QRU QRV QRW QRX QRY QRZ QSA QSB QSD QSG QSJ QSK QSL QSM QSO QSP QSR QSU QSV QSW QSX QSY QSZ QTA QTB QTC QTE QTF QTG QTH QTI QTJ QTM QTO QTP QTQ QTR QTU QUA QUB QUC QUD QUF QUG QUH QUJ QUK QUL QUM

MILITARY TRAINING

The Signal Corps has adopted methods of training that are producing the finest of radio operators.

By Colonel FLOYD T. GILLESPIE



Born in Sturgeon Bay, Wisconsin, in 1892. Attended University of Southern California and is a graduate of the Infantry School, 1922; the Signal Corps School, 1926. During last war served with the AEF and Army of Occupation. Was Officer in Charge of the Wire Division, Signal Corps School, 1933, and Assistant Signal Officer, Hawaiian Department, 1939. In 1942 was assigned as Assistant Chief Signal Officer, Allied Force Headquarters, North Africa, from which duty he was assigned to his present position as Chief of the Military Training Branch.

WITH commanders on the world battlefronts stressing more and more the importance of communications to the successful completion of their mission, the job of training Signal Corps personnel becomes increasingly vital—and also more complex.

In our present-day accelerated warfare, personnel are continually facing changing demands and new techniques. Each theater of operation has its own peculiar, unprecedented problems, and the training of men to cope with these problems and to maintain efficient communication systems under any conditions—jungle, desert or mountain—obviously calls for a versatile and ever-changing program.

Many deficiencies were encountered in the first operations of the war, but the training program of the past year has been principally directed at correcting these shortcomings by benefiting from experience. To this end, efforts are being made to have officers and enlisted men return from theaters of operation to aid in the training of personnel.

The transformation of a civilian into a capable, highly-trained enlisted man or officer, ready to take to the field against an enemy, is a task of many phases. The goal is two-fold, for Signal Corps soldiers must be skilled at both combat and communication techniques. As an indication that the men stringing wire, operating radio sets, etc., are expected to do more than just that, the table of equipment of a division signal company allots the organization six Browning machine guns, .50 caliber; 32 submachine guns, .45 caliber; 148 carbines; 45 grenade launchers; five anti-tank rocket launchers; and 45 rifles, .30 caliber.

Obviously the Signal Corps soldier is trained not only in the maintenance and operation of his equipment, but is also a good all-around combatant. He is thoroughly acquainted with his weapons; knows camouflage, scouting, patrol, and map and aerial photograph reading; he is able to protect himself and his equipment from gas, air and mechanized attack.

After achieving a degree of proficiency in his specialty, the individual is then trained to become a member of a smooth, efficient team. And, at every opportunity, the training program must be made realistic. Men must be steeled against the shock of initial contact with the enemy. They must be prepared to take the step from handling practice signal traffic to handling real signal traffic upon which lives will depend.

All the various types of Signal Corps specialists are taught to operate under simulated battle conditions. For example, radio operators go through an intensive training period to increase their ability to copy through noise and interference; truck drivers undergo a series of tactical problems, during which nitro-starch charges are automatically detonated, showering dirt and debris on the vehicle.

Signal Corps military training can be grouped into three categories—Enlisted Men's School, Officer Candidate School, and Officers School.

Soldering transmission wires on a rhombic antenna prior to hoisting on large telephone pole.

Camouflaged message center during maneuvers near Fort Monmouth.

SCR-609, FM radio transmitter and receiver during field operations.

From civilian to qualified Signal Corps soldier is a series of integrated steps beginning at the Reception Center. At the Reception Center, information pertaining to a man's work, history, and educational background together with his scores on the General Army Classification, Mechanical Aptitude, and other tests are entered on his Qualification Card (Form No. 20). The classification officer uses this information in making assignments to the different arms and services. Arriving at a Signal Corps Replacement Training Center, a soldier is sent to Personnel Testing Headquarters where by interview, review of his Qualification Card, and his aptitudes, as determined by the two basic Signal Corps examinations (Radio Telegraph Operator Aptitude Test and General Electrical Information Test), he receives his assignment for specialized training or to a technical Signal Corps job.

Signal Corps training of enlisted men is now conducted primarily at the Eastern, Central, and Western Signal Corps Training Centers, the Southern Signal Corps School, and the Signal Corps Photographic Center.

The Eastern Signal Corps Training Center, Fort Monmouth, New Jersey, has a Unit Training Center and a School. The Central Signal Corps Training Center, Camp Crowder, Missouri, is composed of a Unit Training Center, a Replacement Training Center, and a School. The Western Signal Corps Training Center has a Replacement Training Center at Camp Kohler and a School at Davis, California. The Southern Signal Corps School, Camp Murphy, Florida, specializes in training officers and enlisted men in installation, maintenance and operation of more advanced electronics equipment. The Signal Corps Photographic Center is located at Astoria, Long Island, New York, and trains officers and enlisted men in various photographic activities.

The facilities of various schools—both vocational and those operated by manufacturing concerns—have been utilized extensively in the Signal Corps training program on a contractual basis. While this program has been sharply curtailed as service schools become ready to assume the load, some training of this type is still being conducted for special types of equipment.

Signal Corps Replacement Training Centers are composed of several training battalions, whose mission is to train the newly inducted man in the military essentials every soldier must know. Here he learns the drills and movements which give a unit cohesion, precision, and the individual poise and bearing. He also learns to take care of himself and his equipment. He is taught military courtesy and discipline and to realize that without them his organization would be just a mob and not the smooth-working, highly efficient team each military unit must be in order to accomplish its mission. It is here that instruction is first given in rifle marksmanship and basic signal communication.

The following specialists are trained in the Signal Corps Replacement Training Centers: Aircraft warning plotter, automobile mechanic, clerk-typist, and personnel clerk, cook, draftsman, field lineman, lineman telephone and telegraph, message center clerk, messenger, pigeoneer, radio operator (low speed), stock control clerk, and supply clerk, telephone switchboard operator, teletypewriter operator, and truck driver.

Signal Corps personnel required for tactical units include a wide range of specialists, who receive their individual technical training, primarily, in a Signal Corps School. Some of these specialties are cable splicer, central office repairman, communications chief, telephone installer-repairman, plotting board air warning installer-repairman, powerman, telephone repeaterman maintenance, telephone switchboard installer, teletypewriter installer-repairman, central office wire chief, field wire chief, intercept operator, radio intelligence control chief, fixed station radio operator, high speed radio operator, and radio repairman.

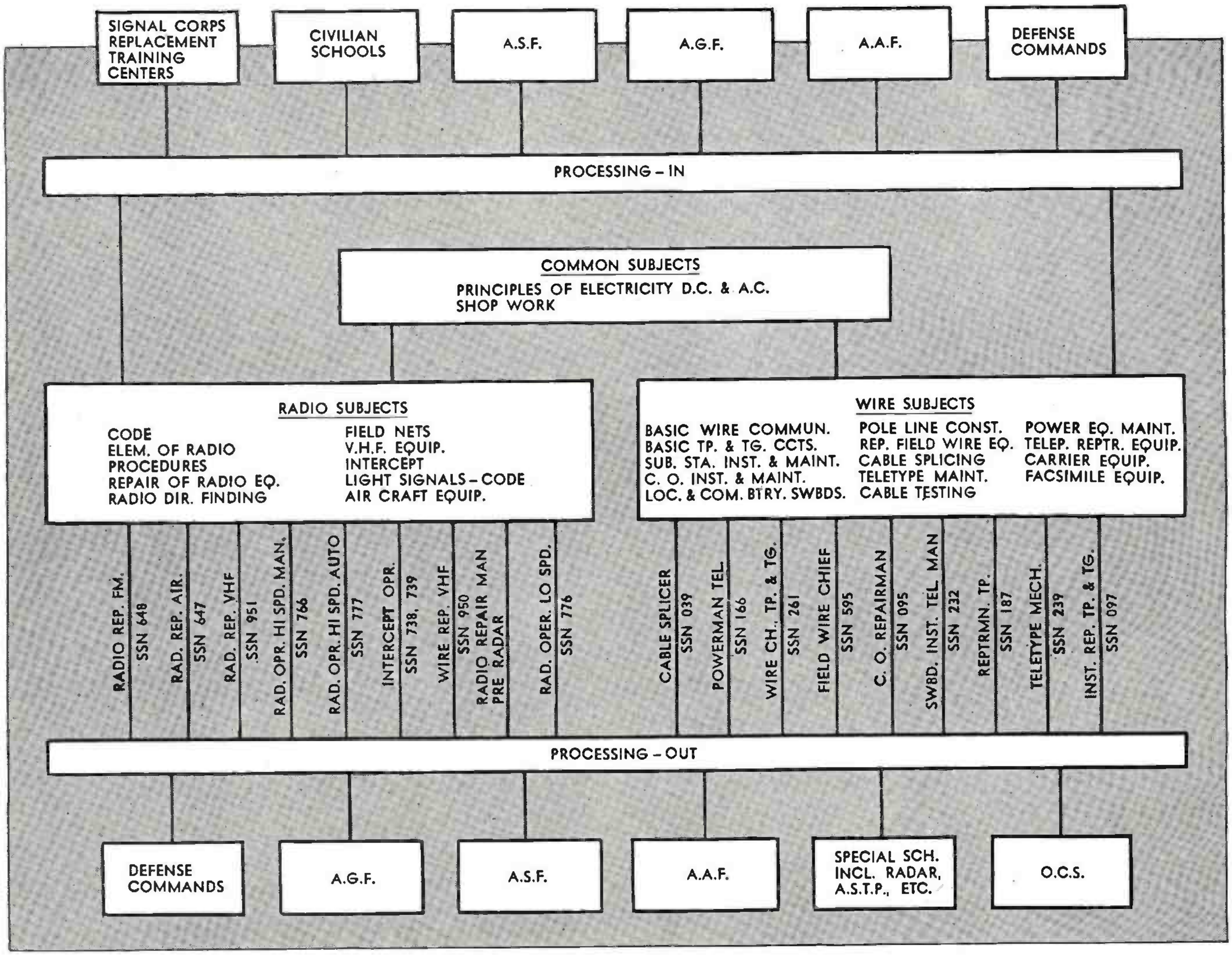
The vocational method of training is employed in the enlisted men's courses. The students are taught correct principles and methods and the associated practical application, with the greater part of the instructional time devoted to practical work covering the equipment on which the student is receiving training. When a student has successfully completed a given phase of instruction, he is permitted to progress to a more advanced phase. The rate of progress depends upon the ability of the individual student and not upon the class as a group.

In each subcourse the student is given frequent quizzes and progress tests and at the end of the course is required to take a final examination and performance test. A minimum grade of 70% is required to complete satisfactorily each subcourse.

A student who, by virtue of his education or previous experience, demonstrates knowledge of any subcourse may be exempt from all or part of the work required to complete that subcourse and quickly pass on to the next one. Thus a student may finish his work as quickly as possible and be available for the next phase of his training.

Each student is rated in each subcourse by his instructors on his aptitude, military bearing and neatness, attention to duty, tact, conduct, intiative, intelligence, and dependability. The standard ratings for each quality are the

STUDENT FLOW CHART—ENLISTED MEN
SIGNAL CORPS SCHOOLS

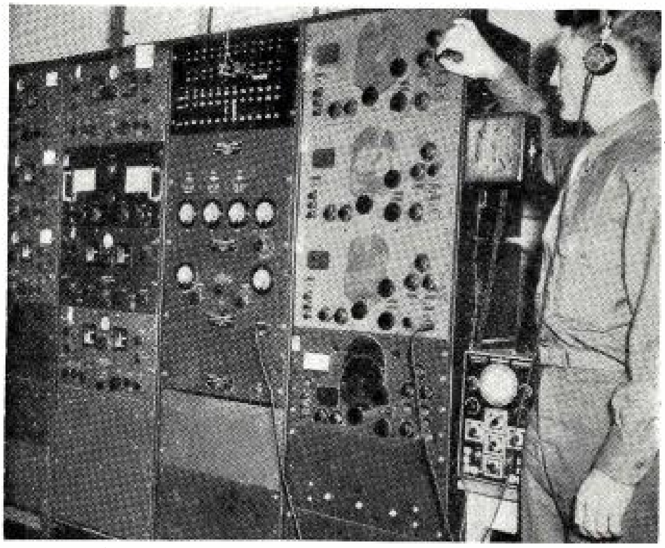


standard War Department Efficiency Report ratings of: Unsatisfactory, Satisfactory, Very Satisfactory, Excellent, and Superior. These individual ratings form the basis for the final rating given each man and entered on his Qualification Card when he leaves the school.

Upon satisfactory completion of the required course, the specialty and the degree of proficiency therein—skilled, semi-skilled, or potential—is recorded for each student on his Qualification Card. His general efficiency rating as a soldier for the school period is also shown. A record of

Artillery-fire direction center where students are taught firing techniques.

Handie-talkie communications.



Student is taught operation of a remote receiving station.

partial training is made in cases where a student has completed his major subjects and is unable, through no fault of his own, to remain at the school long enough to finish every subject.

The Signal Corps Unit Training Centers are organized for the activation and training of Signal Corps tactical organizations. The units are formed from men trained in Signal Corps schools and men from Reception Centers who have had no service training.

The first six weeks are devoted primarily to basic military training. From the seventh through the fourteenth week emphasis is placed on technical training in that specialty to which the individual soldier has been assigned. All specialists are familiarized with the component parts, description, correct nomenclature, capabilities and limitations of their equipment, and with any operating precautions which may be necessary.

At the end of this period the soldier should be qualified, at least as an apprentice, in the specialty to which he is assigned, and be able to operate with sufficient skill to undertake training as a part of a team without disrupting it by lack of proficiency in his particular work. The fifteenth through the seventeenth week is devoted to a Field Training Period.

The individual continues to gain skill in his specialty by his continual exercise of it but the emphasis on training is upon fitting the individual into a smoothly working team. When the newly organized unit completes its training, it is sent to the theater which requires the technical services of that particular type of Signal Corps unit.

The structure of a Signal Corps unit is determined by the mission it is to perform. The most common types and the mission of each is as follows:

Signal Company, Infantry Division—furnishes communications for Infantry Division headquarters, forward and rear echelons; provides communications down to regiment.

Signal Battalion—furnishes communications for Corps or larger headquarters; maintains signal supply dump.

Signal Wire Operation Company—installs operators and maintains wire communications within forward and rear echelons of larger headquarters.

Signal Battalion, Construction—generally used to construct the main wire and cable facilities between higher headquarters and their installations.

Signal Photographic Company—provides still and motion pictures for purposes of news, history and training.

Signal Pigeon Company—pigeon communications; Army down to regiment.

Signal Troop, Cavalry Division—furnishes communications for Cavalry Division headquarters, forward and rear echelons; provides communications down to regiment.

Signal Company, Armored—furnishes communications for Armored Division Headquarters, forward and rear echelons, provides communications down to regiment.

Signal Radio Intelligence Company—interception and location of enemy radio facilities; monitors friendly stations.

Signal Mobile Photographic Laboratory Unit—provides facilities for processing film (motion picture and still).

Signal Operation Battalion—provides communications for Army and higher headquarters.

Signal Depot Company—stores, issues and furnishes fourth echelon repair of Signal Corps equipment.

Signal Repair Company—provides third echelon repair and maintenance of Signal Corps equipment.

Signal Company, Mountain Division—furnishes communications for Mountain Division headquarters, forward and rear echelons; provides communications down to regiment.

Signal Port Service Company—provides communications for ports; carries on repair, storage and issue, receiving and shipping of Signal Corps equipment at port.

Signal Photomail Organization—operates V-Mail and official photomail service.

Signal Company, Airborne—furnishes communications for Airborne Division headquarters, forward and rear echelons; provides communications down to regiment.

Definite minimum prerequisites have been established for admission to the Officer Candidate School.

The following qualifications are considered essential in an application for pursuing the prescribed course of study: (1) at least a high school education, (2) some practical experience with radio, telephony and telegraphy, supply, motor transportation, photography, or pigeons, (3) interest in communications or some particular phase of Signal Corps work.

Preparation for entrance into the Signal Corps Officer Candidate School falls into several general phases. The development of a Signal Corps specialty will depend on the individual assignment of the enlisted man. A number of enlisted men in the Signal Corps who lack practical experience in radio or wire communication have found it advisable to request assignment to a course in the Enlisted Men's School before making application to the Officer Candidate School.

Objective of the Officer Candidate School is to teach the candidate the fundamental knowledge required to perform efficiently his duties as an officer. The officer candidate should have demonstrated his capacity to direct, control, and influence others in definite lines of action, either in civil life or in his army career, and is required to demonstrate proficiency which indicates that he can perform the basic duties of a second lieutenant.

The Officers' School at Fort Monmouth, N. J., offers the following courses: Officers' Basic Military Training; Company Officers' Common Subjects; Electrical Fundamentals; seven specialty courses, namely Administration and Supply, Motor Transport, Long Lines Outside Plant, Long Lines Inside Plant, Division Field Wire, Radio Communication and Message Center Officer; Officers' Combat Training; Advanced Officers' Signal Supply Survey, and Advanced Officers' Course.

All officers, upon completion of any of the seven specialty courses, are required to take the Officers' Combat Training Course prior to assignment to the Officers' Replacement Pool or to a tactical unit.

The Officers' Basic Military Training Course is a four weeks' program designed for commissioned officers who have not previously completed a course in basic military subjects or who have not had such training within a reasonable period of time. To the newly commissioned officer it presents the ground work upon which may be based future military schooling, or if he is assigned directly to a tactical unit, it aids him in accomplishing his mission efficiently and confidently. To the company and field grade officer, it presents the opportunity of reviewing those basic concepts of soldiering necessary to all officers. This course covers the rudiments of basic soldiering to which have been added the lessons of the present war.

Graduates of the Officer Candidate School and the Company Officers' Common Subjects Course may receive tactical assignment or be placed in an Officers' Signal Corps Replacement Pool. Some of these graduates will go di-

(*Continued on page* 441)

VISUAL AIDS

Class in Subscriber Station Maintenance. Students clear trouble on demonstration boards shown in background.

Study is the hardest kind of work for many men, especially older men entering through Selective Service. Visual aids simplify study.

By Lt. Col. E. A. REDDING, Jr.

Born in Ohio, 1900 and served with the AEF in World War I. He served in various Signal Corps enlisted ranks in the Regular Army; was called to active duty under his reserve commission in 1940. He was Officer in Charge of the Aircraft Warning Service, Panama Canal Department, until 1941, when he was assigned to the War Plans and Training Division, Office of the Chief Signal Officer. In 1924 he was with the Literature Branch, Military Training Division, Office of Chief Signal Officer, and in October, 1943 was appointed as Chief of the Publication Branch.

IN ITS preparation for World War II—a preparation job which is now over its hump, but still going strong—the Signal Corps has been faced with the problem of training thousands upon thousands of men to service and maintain the Army's communication equipment.

It has been necessary to train these men both well and fast. With the army growing in leaps and bounds and with equipment being turned out by the billions of dollars worth, it has been necessary to train technicians in proportionate numbers. In the beginning the ranks of maintenance men were expanded by enlistment of radio service men, hams, and radio experimenters from civilian life, many of whom required relatively little training to fit them for this work in the army. But this source of supply was soon exhausted. Then there was nothing for the Signal Corps to do but to select from among inductees those who were interested in radio, or who showed aptitude in this direction, and train them right from basic fundamentals through to a comprehensive understanding of principles and practice.

Too much credit cannot be given to the men who have gone through this Signal Corps training program nor to the men who have served as their instructors—many of the latter men who had themselves completed the training only recently and who, because of exceptional qualifications, educational background, and a firm grasp on the subject, were selected to help train others. It is no fun for anyone to spend in the vicinity of eight hours per day, six days each week, in concentrated study of a single subject. Particularly so when in addition there are hours of military training and duties before or after school hours.

For many, study is the hardest kind of work; especially the many older men who come in under Selective Service and perhaps had been out of school for a decade or more.

It was to help in all this that training aids have been very extensively adopted throughout the Signal Corps technical schools. It is recognized that to study abstract theory from the pages of a book is a difficult matter. Lectures and laboratory periods help tremendously but it has been found that training aids, by means of which students can *see* demonstrations of the principles studied, have not only speeded up the process of training but have resulted in students gaining a clearer understanding of many of the basic principles on which their study of radio is founded.

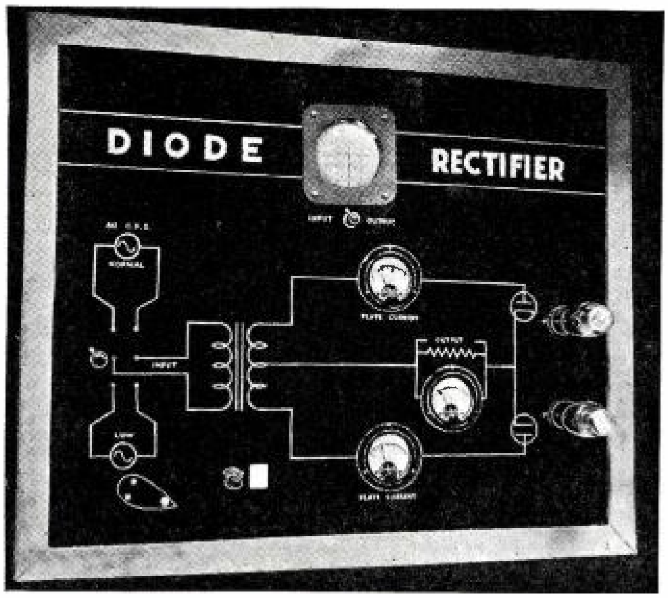


Fig. 1. Panel layout of the diode rectifier demonstrator.

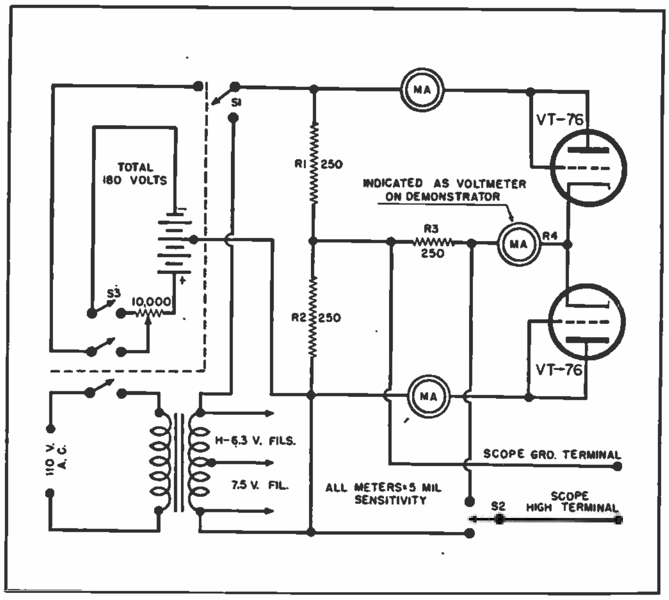


Fig. 2. Diode rectifier circuit as wired behind the panel.

The training aids are of two general types. Movies, charts and mock-ups constitute the first type. Every Signal Corps school boasts an extensive film library with films covering substantially every phase of every subject that lends itself to this type of showing. Charts, large circuit diagrams, posters, and other forms of wall-mounting aids are posted at all schools, many of them of local origin. Mock-ups are models of equipment or equipment installations which simulate actual installations. For example, a mock-up of an aircraft radio installation might consist of a wood structure which duplicates the inside of a plane, in full size, with the radio equipment mounted exactly as in a real plane. This gives the student a much more accurate idea as to the problems he will face when later it may be necessary for him to actually service real installations. Many things in his training will be made clearer to him when he has seen such a "mock-up" rather than having to depend on his imagination to picture the installation represented.

But the subject of this article is the second general type of training aids which really have no clean-cut designating name. They fall under the general head of "Visual Training Aids"—but so do the aids of the first type mentioned above. Among the students and instructors in the schools these aids to be discussed are more commonly known as "gadgets" to distinguish them from other forms of training aids. For the purposes of this article, however, we will consider them simply as Visual Training Aids.

These aids take a wide variety of forms and employ various means in performing their functions. They may show just what is happening in each part of a vacuum-tube oscillator or amplifier circuit, for example, or visually demonstrate the action of a rectifier tube in the conversion of alternating current into direct current; or they may be so designed as to give the student concentrated practice in some phase of his future work. Again, they may be purely mechanical devices which aid in the explanation of complicated principles. Each of the actual devices to be described here perform one or more of these various functions.

DIODE RECTIFIER DEMONSTRATOR

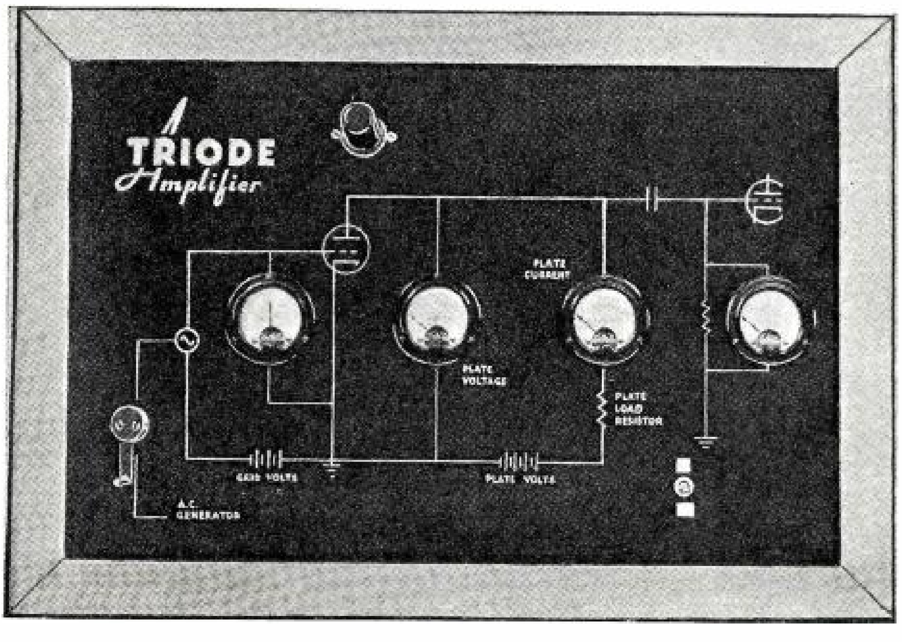
The diode rectifier demonstrator illustrated here is one that was developed at the Southern Signal Corps School, Camp Murphy, Florida, and is used in connection with basic radio and electronic training courses.

In effect, this demonstrator is one which shows on the oscilloscope screen the functioning of a conventional full-wave rectifier circuit utilizing two diodes, with 60 c.p.s. alternating current applied to the circuit; then by means of a small built-in hand "generator" it provides for the development of an a.c. input of such low frequency that the detailed functioning of each diode can be readily followed by the eye. What this amounts to is the conventional showing of the effect of rectification, then a repetition of this demonstration in slow motion so that every detail of the operation can be seen in the action of the meters.

Its purpose is to show students exactly how rectifier circuits function, and thus insure that they thoroughly understand this very basic principle of vacuum-tube operation.

The diode rectifier demonstrator consists of a panel on which is engraved the schematic circuit of a full-wave rectifier, with some of the actual components mounted in such manner as to provide close coordination in the mind of the student between the diagram and the actual components. This arrangement is illustrated in Fig. 1.

Fig. 3. Demonstrator used to show operation of a triode voltage amplifier.



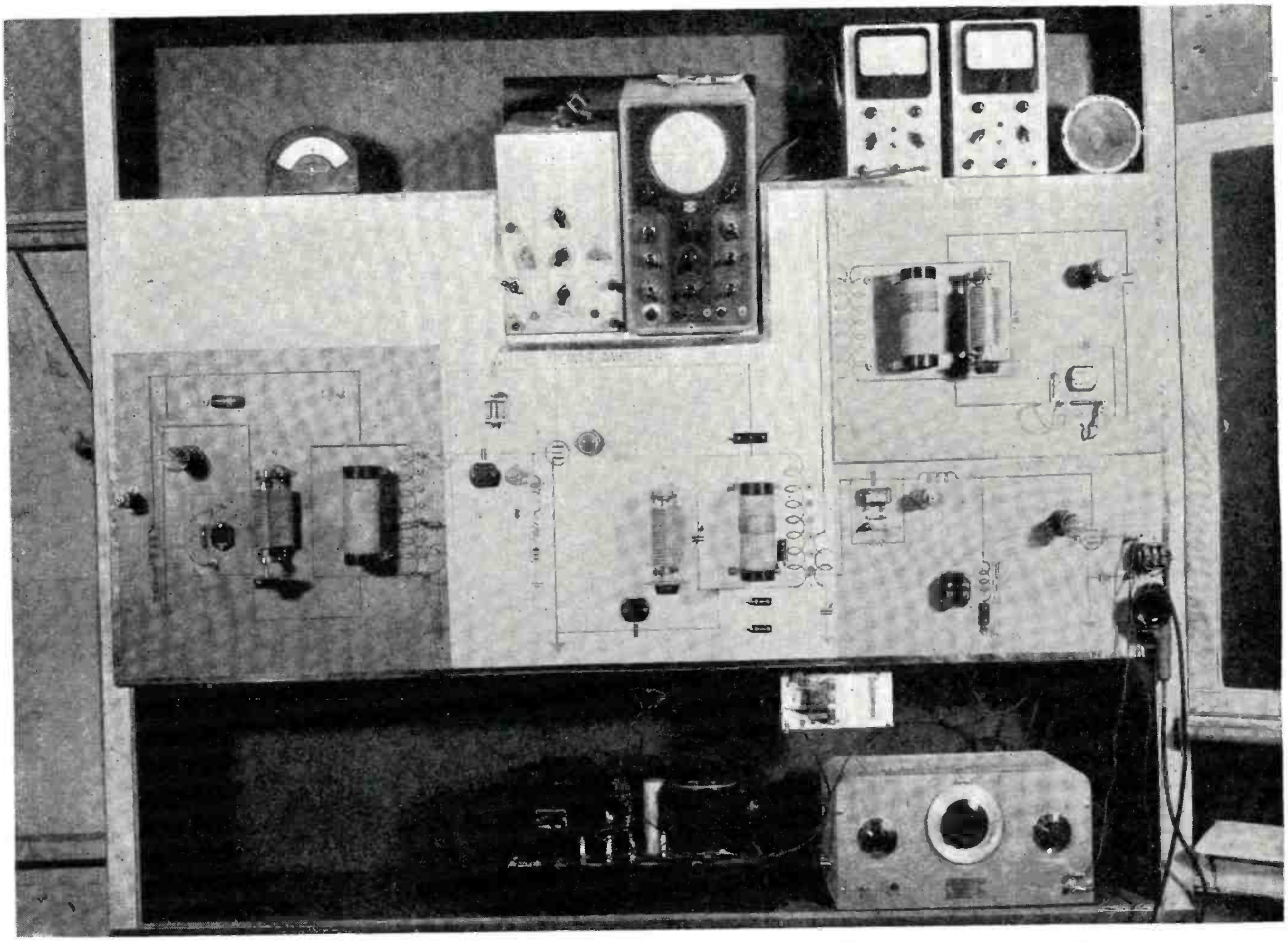


Fig. 5. Front view of low-frequency transmitter. Each section of the transmitter is clearly shown for demonstration purposes.

Fig. 2 shows the schematic diagram of the circuit actually employed. Forgetting for the moment the upper left hand portion of this circuit enclosed in the broken line, it will be seen that the balance constitutes a conventional full-wave rectifier circuit in which the a.c. output of a power transformer is applied to two diodes consisting of VT-76 triodes, with the plate and grid of each tied together. In each diode circuit is a milliammeter and in the load circuit a voltmeter (milliammeter operating as a voltmeter). In this load circuit the multiplier resistor of the meter itself constitutes a portion of the load resistance.

A switch arrangement is provided so that the associated oscilloscope can be connected either across the a.c. input to one diode or across the 250-ohm d.c. load resistor. Thus the 'scope will show the a.c. applied to the diode in one switch position and in the other will show the pulsating d.c. to which this wave has been converted by the two diodes. To study the half-wave rectification, obtained when only one diode is used, it is only necessary to withdraw one of the tubes from its socket.

Turning now to the portion of the circuit enclosed in the broken line, it is found to be a means for generating the equivalent of an alternating current of extremely low frequency which can be applied to the rectifier in place of the 60 c.p.s. supply by the action of the rotary switch S-1.

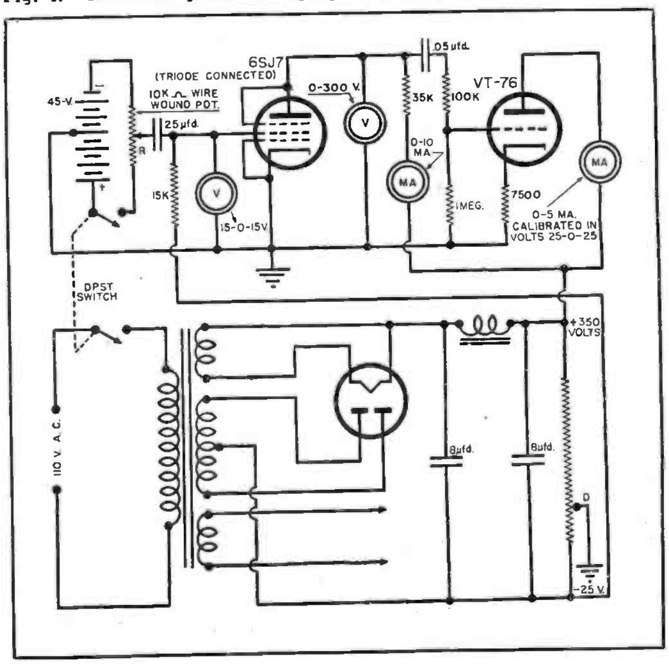
This simulated a.c. voltage is developed by action of the 10,000-ohm potentiometer as it is swung back and forth through its range by a hand-operated mechanical arrangement which will be described later. From a study of Fig. 2 it will be seen that this action makes the plates of the diodes alternately positive and negative in respect to each other, which is exactly the action obtained when supply line a.c. is applied to the circuit.

The switch S-3 is simply a triple-pole, single-throw power switch which breaks both the a.c. line and battery circuits.

In staging the demonstration, switch S-1 is set to connect in the 60 c.p.s. supply and the power switch S-3 is thrown to the lower position. The rectified d.c. voltage can then be read on the voltmeter. The two milliammeters will, due to their inertia, show continuous readings. For the moment these current readings are neglected, however.

The 'scope switch S-2 is now thrown to its lower position.

Fig. 4. Circuit diagram as employed in the amplifier demonstrator.



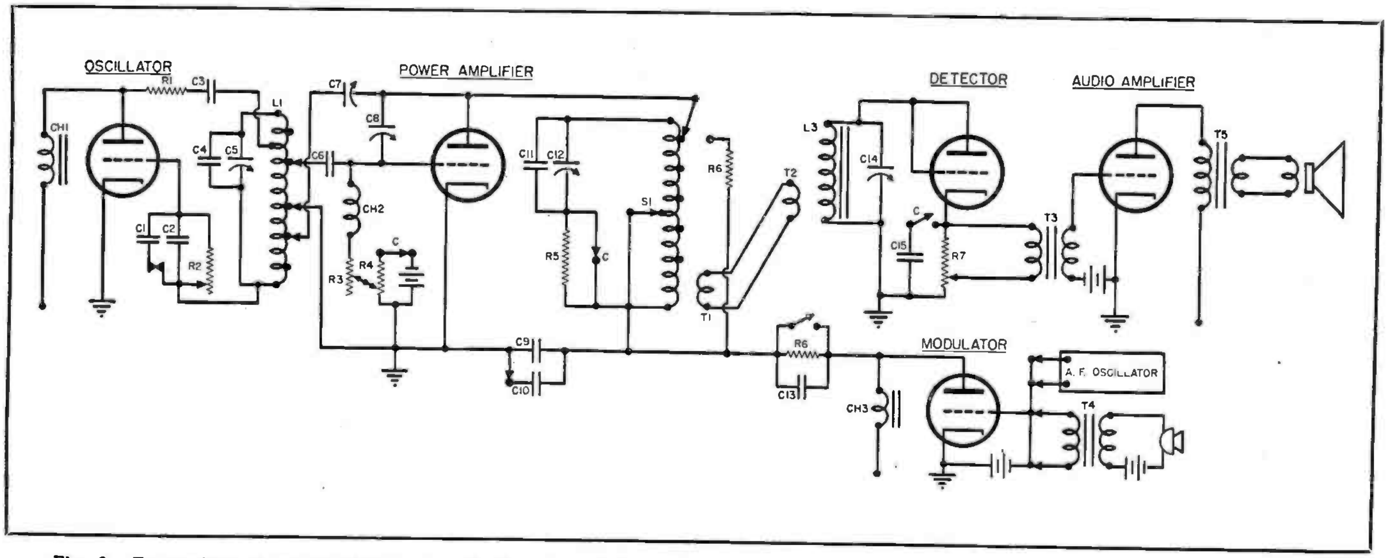


Fig. 6. Transmitter circuit consisting of a Hartley shunt-fed oscillator, power amplifier, detector, and Heising class "A" modulator.

The 60 c.p.s. sine-wave voltage developed across R2 will appear on the screen. Next, S2 is thrown to its upper position, placing the 'scope across R3, a portion of the load resistance and thus presenting on the screen a trace of the pulsating d.c. output of the circuit. This shows the student the effect of the rectifier action but there still remains the necessity for showing him just how this result is obtained.

To demonstrate the details of this function, the switch S-1 is thrown to the upper position of Fig. 2 and the hand crank which actuates the potentiometer is turned slowly. The frequency of the output is one cycle per revolution of this crank. The alternations of current at a rate of one per second or even slower permit the milliammeters to readily follow the current pulses through the diodes. A study of the alternate indications of the current meters and a comparison of these indications with those of the voltmeter clearly show the push-pull action of the two diodes.

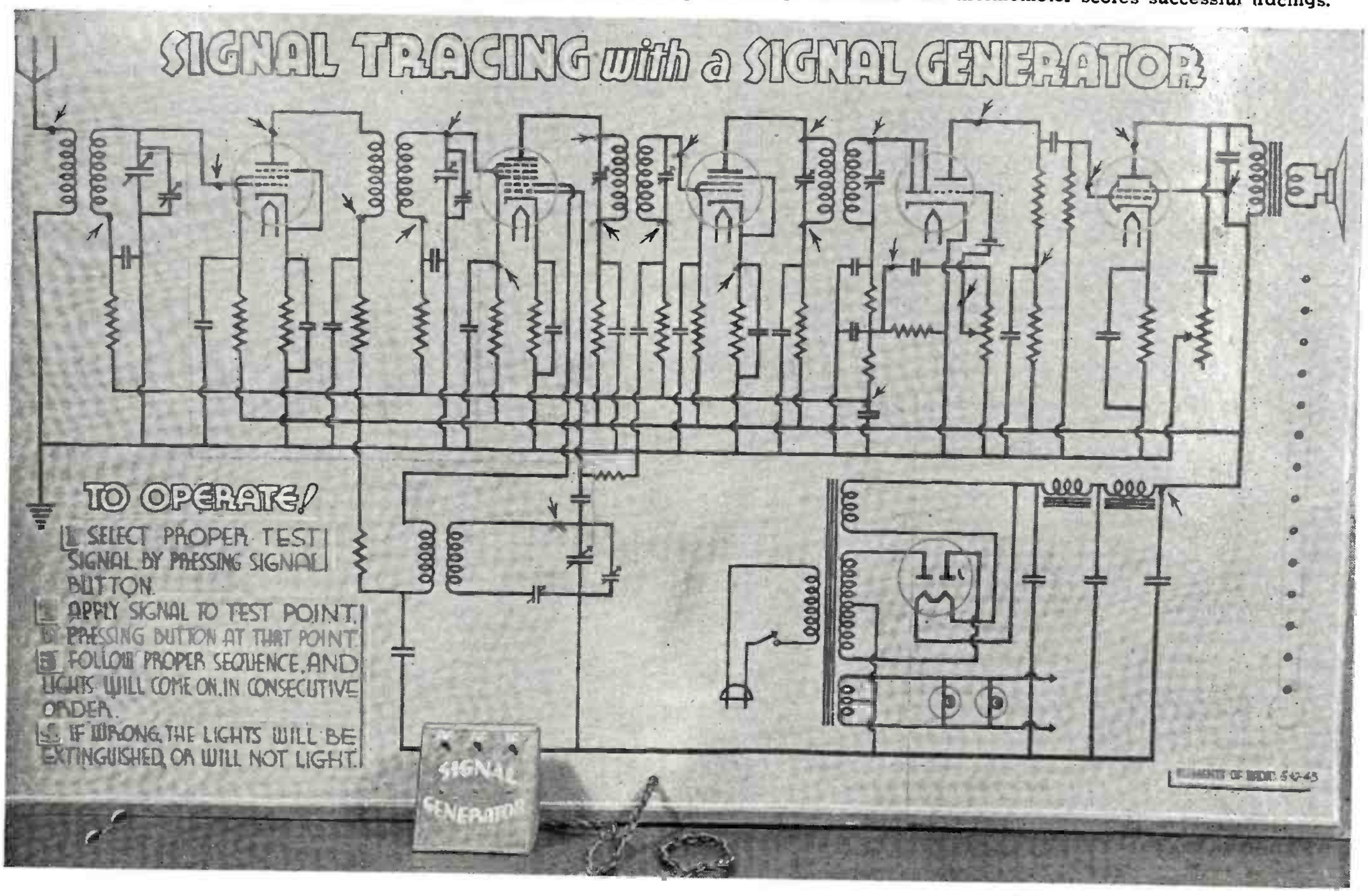
Constructional Details

As indicated in Fig. 2, the power transformer is simply a filament transformer in which the 6.3 volt portion of the secondary is utilized for the diode filament supply while the total voltage of all secondary windings (13.8 volts in the case of this particular transformer) is applied to the rectifier circuit. The center tap is obtained by means of the resistors R1 and R2.

The only other component calling for explanation is the coupling arrangement which enables the crank shown in the lower left-hand corner of Fig. 1 to manipulate the

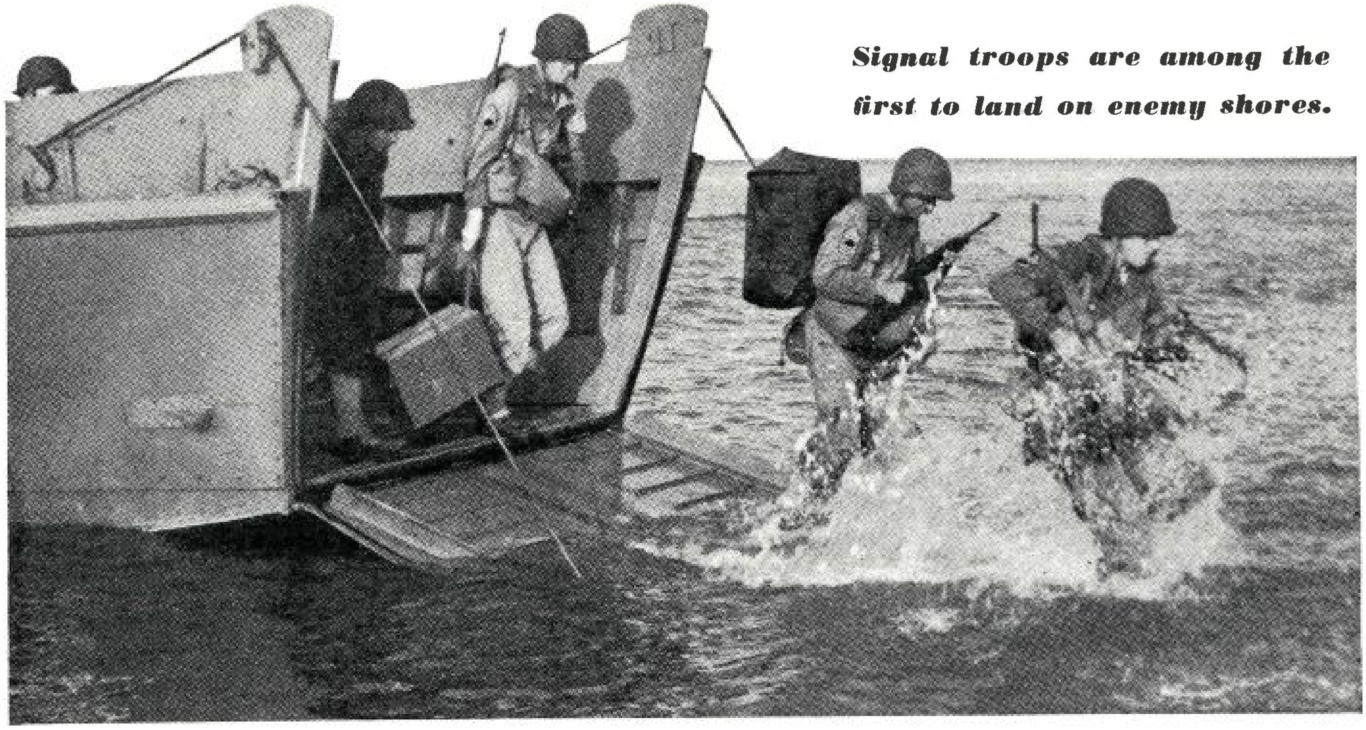
(*Continued on page* 412)

Fig. 7. Signal-tracing demonstrator. Arrows indicate strategically located push-buttons and thermometer scores successful tracings.



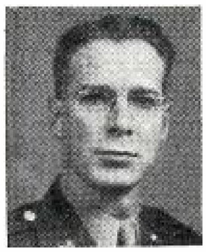
☆ ☆ AMPHIBIOUS ☆ ☆

Signal troops are among the first to land on enemy shores.



Going ashore with Signal Corps communication equipment during landing operations.

By 1st Lt. JOHN W. BRANDSTETTER



Born in Dexter, Iowa, 1914. Received degrees of B.S. & M.A. from Southwest Texas State College, 1934 and 1940. Did graduate work in speech and radio education, University of Texas, Columbia University, & University of Iowa. Taught radio and speech at Houston Texas High School and the University of Houston. Was Chairman of Houston Radio Education Committee. He entered Army, 1942. He graduated from Signal Corps Officer Candidate School in 1943 and was assigned to his present position as Asst. Chief, Office of Technical Information, Special Activity Branch.

CONDITIONS under which war is waged often change, and as our Army adapts itself to meet new situations, so does the Signal Corps quickly and flexibly move to provide necessary communication facilities.

The role of the Army and the Signal Corps in World War I was to exploit the art of trench warfare to the fullest, meeting the enemy inland on a long static front and advancing under cover of fierce artillery barrages only to dig in again when halted. Troops arriving from America were unloaded at ports far from the thunderous din of battle and then swiftly moved to the combat area with little danger from land mines, booby traps and bombing attacks.

But this is another war and the wide-spread positions attained by the blitzing Germans prior to America's entrance in the war, augmented by the advent of the Stuka, left no friendly docks at which American troops might be disembarked to press their attack against the Axis. Landings must be made by force and many casualties expected long before the first foot is planted on foreign soil. Axis coastal guns and dive bombers of the Luftwaffe speak hastily in deadly defense, and their effect is keenly felt far in advance of the time when the slowly moving and heavily laden Allied transports are ready to disgorge their cargoes of men and munitions into landing barges for the tense and bomb-attended ride to shore.

As the invasion crafts grind against the beach with Allied troops springing into the surf for the beach assault, the chattering fire of Axis machine guns blends noisily with exploding land mines, bursting bombs, and the sharp reports of enemy rifles.

This grim picture, vastly different from the wild flag waving attendant to our landings in France in World War I, has brought many revolutions in the training of Allied troops. Landings in Africa, Sicily, and Italy have found Signal Corps troops leading the way ashore to set up, well in advance, the communication facilities by which our leaders coordinated and directed the later movements of assault troops and their tons of supplies.

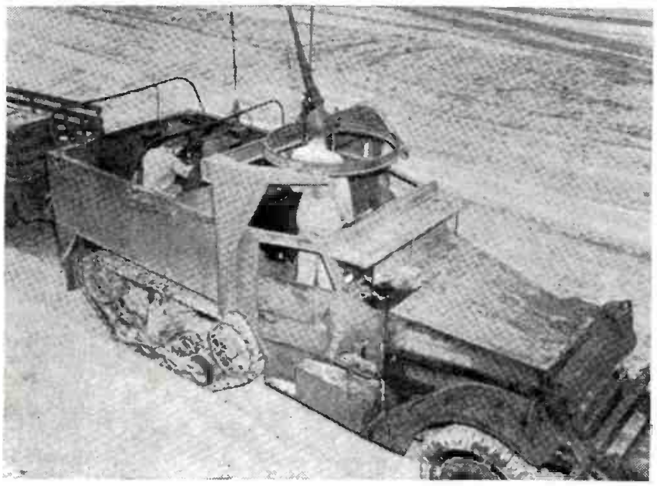
But these successful communication operations were not accidents. They represented long hours of study and planning of the countless difficulties to be encountered. They were the results of many more hours of painstaking and tedious rehearsals which were extended until every man knew his job and was prepared and determined to carry it out.

Amphibious operations are a complex enterprise and every detail must be exactly planned so as to afford the greatest chance of success. The problem of moving thousands of men onto a hostile shore and of supplying them with the necessary supplies and support calls for coordination of all movement. It is imperative that those in charge be able to make prompt and firm decisions in crucial moments that spell success or rout for the invading force.

It is at this point that Signal communications rise as a decisive factor in the successful accomplishment of any ship-to-shore movement. An ever-flowing stream of reports and observations must pour steadily into the commanders' pool of information so that all trends or all signs of enemy weakness can be quickly discerned and prompt advantage taken thereof.

But glamorous as it is, the amphibious operation is a deadly one. In those early morning hours when at "H"

Infantry advancing under simulated fire while Naval beach master and signalman direct traffic during amphibious operations.



SCR-299 transmitter mounted on half-trac, used in Air Liaison Communications. Machine gun used for anti-aircraft protection.

hour the first wave of assault troops hits the beach and fans quickly out to seek cover, every movement and every step holds the imminence of sudden death. In a typical operation the landing team reinforced by the shore party strikes hard at the assigned portion of the beach. The first waves are assault troops and their job is to move quickly across the sandy approach and into the cover of the woods beyond to prepare the way for those who follow. Close on their heels follow the first elements of the shore party, and these intrepid soldiers slog their way through the mine-bedded sand carrying waterproofed field wire, radios, and telephones to start their task of setting up a complex nervous system that will permit the shore party commander greatest access to the swift occurring events of the battle. Hastily, but confidently, Signal troops seek out the most strategically located positions for switchboards and radio sets and in an amazingly short time radio nets are humming the signals vitally important to the success of the Allied landing while steel helmeted Signal Corps troops are laying field wire, connecting field telephones, and setting their message centers in operation.

By the time the regimental commander comes ashore to consolidate the beach into a regimental unit, the shore party commander has already welded an efficient communication set-up, established local security for the beach party itself, and put in motion the machine that will establish the vitally important stores of supplies needed to keep the initial assault troops moving forward. Long lines of field wire will follow the infantry inland and lateral wire circuits are quickly laid to insure coordinated action and integrated movement.

With the advent of daylight, however, the job is far from finished. By this time reinforcements for the assault troops have landed and the forward drive is pushed with the utmost vigor. Countless Navy craft are busy unloading heavy guns, tanks, armored cars, and the ubiquitous jeeps as well as tons of ammunition, food, and good substantial American trucks by which supplies will be moved. Every man works fast and hard with a weather eye peeled for the always impending strafing planes and dive bombers.

With wire-laying jeeps dashing one way, heavy trucks moving supplies in another, reinforcements moving up, bulldozers grading down layers of sand, half-tracs moving into defense positions, and countless streams of vehicles pouring from ships, it is difficult to comprehend how control of every activity could be maintained, but again communications can provide the answer. Motor, boat, and foot messengers, chirping radio sets, and winding telephone field wire, all insure a constant medium of operation to the message center chief whose job is to get the message through.

These operations all bring problems that are not present in many land assaults. Close liaison with the Navy must

Anti-aircraft defenses under fire during simulated combat in amphibious training at Cove Point, Md.

Signal Corps radioman being trained, during a simulated attack, to "get the message through" regardless of the noise and fury of battle.

Beach radioman "hits dirt" under fire during simulated operations, while undergoing strenuous amphibious training at Cove Point.

Signal Corps equipment being moved ashore. Troops well trained in amphibious operations made victory possible on Gilbert Islands.

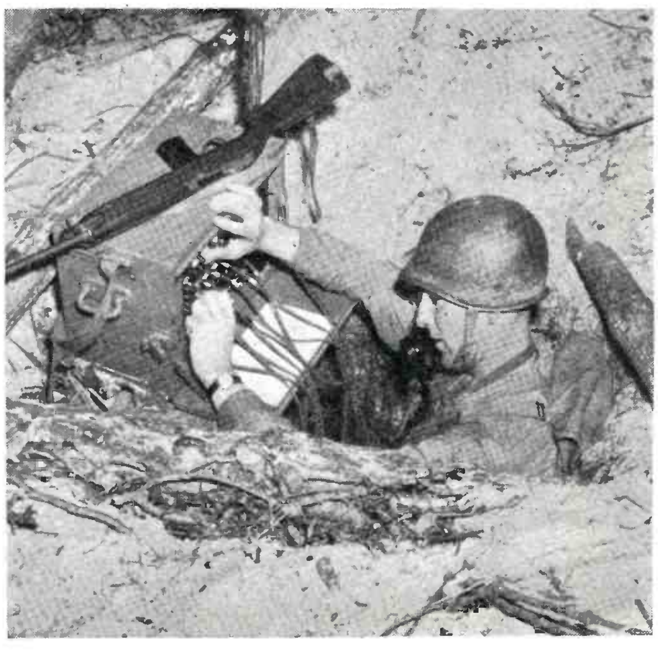
be maintained both in planning and executing the Signal project. There must be no overlapping of frequencies to interfere with the activities of ships offshore or of the installations on land. Call signs must be mutually understood and procedure unified. Air liaison is essential in order to maintain the closest possible contact with friendly air power and to bring the weight of friendly bombs down in wrath on stubborn enemy positions.

It is obvious that the close harmony necessary to establish a smooth functioning communication network could not be the result of any haphazard planning or organization

(*Continued on page* 374)

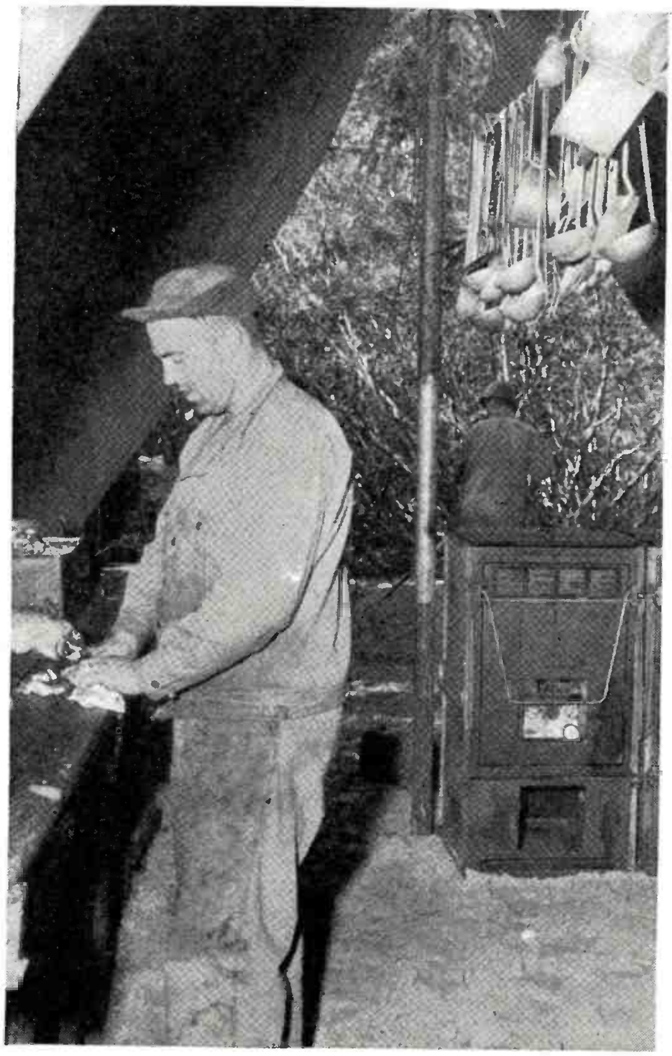
Shore party commander using waterproofed handie-talkie during recent amphibious training maneuvers at Camp Bradford, Virginia.

"Dig your switchboard in early" is the cardinal principle in all amphibious training. Communications are vital in any offensive.



Western Signal Corps Training Center troops on maneuvers, operating from a well-camouflaged message center.

Troops are on "K" rations during maneuvers and only occasionally receive hot meals prepared in well-equipped field kitchens.



On maneuvers in the Tahoe National Forest. Signal Corps radio-car maintains communications with other widely-spread military units.

Maneuvers

THE physical capacity and technical skill of our soldiers are proven during maneuvers which are scheduled after weeks of basic training. Under conditions simulating actual warfare —surrounded by the noise and vibrations of constant gunfire—men learn familiarity with recently acquired implements of war. The photos shown on these pages are typical of maneuvers held in a scenic forest location. Others are held under less ideal conditions—on deserts where difficult camouflages must be attained to protect the equipment, both from the blazing sun and the watchful eye of the enemy. And, in the arctic climate men must battle the freezing cold of snow-clad mountain terrain. Regardless of the misery of burning sand, waist-deep snow, or sweating jungles, our men must "get the message through" under every conceivable condition.

Camouflaged switchboard used as clearing point for wire messages to commands and units participating in maneuvers.

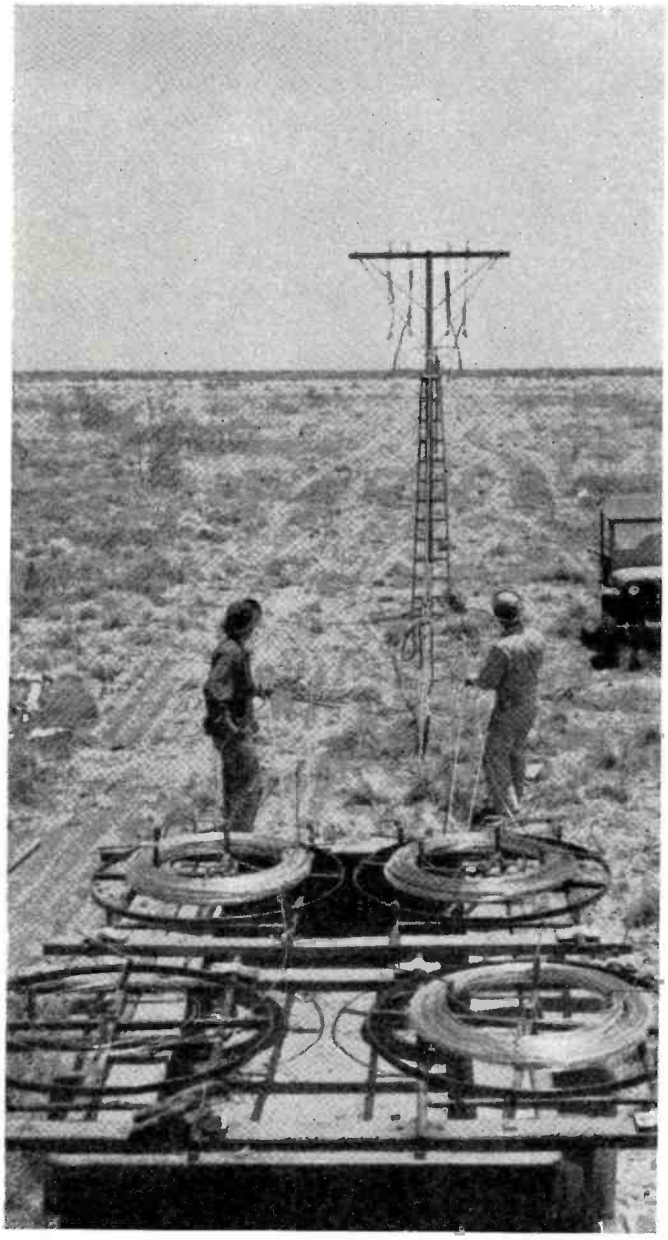
Radio-equipped military vehicles crossing rocky stream in Sierras. Men are tested for their durability and skill.

WIRE to TOKYO

The saga of the construction of the Alaskan Highway telephone circuit—a miracle of communications skill.

By Lt. Col. A. E. WHARTON

Born in Philadelphia, Pennsylvania, June 29, 1898. He attended Penn State College where he received the degree of Bachelor of Science in Mechanical Engineering, 1924. Was the division Plant Engineer with the New Jersey Bell Telephone Company until he was called to active service in the U. S. Army in 1942. He has been assigned to the Plant Engineering Agency, the Office of the Chief Signal Officer. He was assigned to his present position in January, 1943. He is now Officer in Charge, Communications Facilities Engineering Section of Communications Engineering Branch.



Men releasing cable from wire barrel during pole-line construction. Each reel is numbered for a particular position on pole.

THEY wallowed through snowdrifts in swirling blizzards to string wire with 72-degrees-below-zero winds biting into their faces . . .

They dynamited post-holes in ground frozen solid to depths of six and eight feet . . .

They sloshed through Arctic muskeg mud and they battled spring floods and washouts . . .

They worked through stifling summer dustclouds and fought off mosquitoes and horseflies . . .

They drove through 2,060 miles of the roughest wilderness in North America . . .

And they accomplished one of the modern miracles of communications engineering and construction—these men of the Signal Corps Army Communication Service.

Peacetime engineers had estimated — conservatively, they thought — that it would require a decade to link the United States and Alaska with telephone and telegraph service along the Alaska Military Highway route.

The Army Communications Service, working under the whiplash of war, did the job in slightly more than a year.

Behind this story of stringing wire along the road to Tokyo are the toil and sweat, the mechanical skill and ingenuity, the engineering and executive brilliance of thousands of men in many co-operating groups—some of them commercial firms—working together under the supervision of the Army Communications Service with a single purpose: To defeat time and nature in constructing the second longest carrier communications system in the world.

It became militarily imperative in 1942, if the Japanese were to be thrown out of the Aleutians and a concerted campaign expedited against Tokyo through Alaska, that the United States be connected directly with its huge territory near the Arctic circle. A highway and landline communications were needed, not only to carry out these operations effectively, but also to figure in postwar development of Alaska and the Yukon Territory with their tremendous potential oil fields, mineral deposits, virgin tim-

Wire-laying team stringing open lines. Men are snubbing wire to end a section. Sag and tie-in crew will follow to lay new section.

Maintaining contact with first wave as it lands on Attu.

Signal Corps soldiers stacking telephone pole crossarms.

ber, fertile farmlands, and many other natural resources.

To the Army Communications Service, went the task of building a 2,060-mile telephone line with two circuits expanded by "C" type carrier systems to provide seven talking channels and fourteen teletypewriter channels along the Alaska Military Highway to be constructed by the Corps of Engineers.

The new communications system was to open to the outside world a region that had just a single telegraph line running along the railroad right-of-way only as far as Dawson Creek.

Communications, however, had to be maintained even before the land line was completed. Engineers constructing the highway needed fast and dependable methods of contact if the work was to progress on schedule. The Alaska Communications System, a component of the Army Communications Service in operation since 1915, immediately stepped into the picture with radio equipment and personnel.

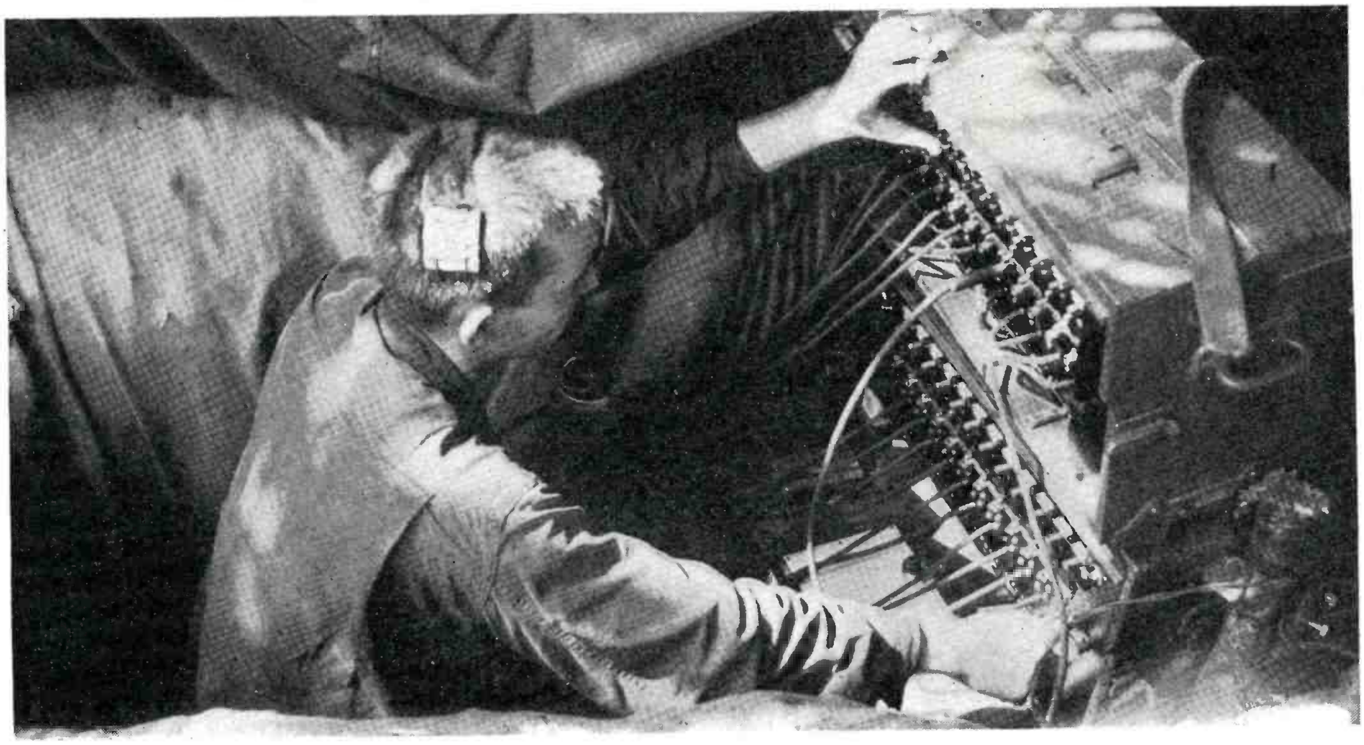
A Signal Corps lieutenant was assigned to the Corps of Engineers staff as Communications Officer, and a radio team was attached to each Engineer regimental headquarters and to each construction party.

Working principally with walkie-talkies and SCR-193 sets mounted in jeeps, these teams maintained contact between construction parties constantly on the move in the trackless wilderness.

It was, however, a stop-gap arrangement. The Alaska Communications System long before had discovered that radio transmission over long distances was unreliable over the highway route; first, because of interference by the

(*Continued on page* 264)

Operating a field-telephone switchboard, set up in a dugout near front lines in New Guinea.



Crystals For S. C. SETS

The heart of American radio equipment is the tiny wafer that holds transmitter and receiver "on frequency".

Signal Corps technician using diamond saw to cut raw quartz crystals. Wafer-like sheets are produced and used as oscillators in many types of radio equipment.

TINY wafers of quartz crystal, vibrating like super-speed tuning forks, are at the heart of much of the modern radio communications equipment of the Army. Entirely unrelated in nature and purpose to the "cat's whisker" crystal detectors of the early home-built radio receivers, these processed quartz crystals are used to put a transmitter or receiver on its proper frequency.

Not many years ago a laboratory curiosity and more recently a comparatively costly item of broadcast and amateur transmitters, such crystals have now become a commonplace component of battlefield communications equipment. Their mass production, in a quality suitable for rugged military service under all conditions of climate, is a story of research and development carried on through the close collaboration of the Army Signal Corps and the American electrical industry.

When the front-line scout tightens his fingers on the "press-to-talk" button of the Signal Corps handie-talkie, he can report the position of an enemy machine gun over a radio channel that has been accurately established by means of a quartz crystal.

When the Cavalry or Infantry communications man slips another tuning unit into the staff-mounted transmitter and receiver of his guidon radio set—a set which may be carried on a horse, a jeep or erected on the ground—he is introducing new transmitting and receiving tank circuits built around a pair of carefully calibrated crystals.

When the Armored Command radio operator, buttoned into his heavy tank and rolling blind on caterpillar treads over the remains of enemy foxholes, pushes a button on the Channel Selector of his frequency-modulated radio, he

(Continued on page 358)

Placing crystals in drill press type lapping machine for grinding. Crystal wafers are ground uniformly to proper frequency.

Hand-finishing crystals to frequency. Electronic gauge permits crystal measurement to 1-millionth of an inch by beat frequency method.

AXIS QUARTZ CRYSTALS

Acme Photo

Hastily erected field radio unit set up in Copenhagen during the Nazi "protective occupation" of the Danish capital.

The Germans use a crystal resonator to calibrate all pack sets. They are not used for frequency control.

By Capt. EDGAR A. WHITEHEAD

Born in Woodland, California, November 20, 1905. He attended the University of California and received a B.S. degree in Electrical Engineering in 1928. He is also a graduate of the Signal School in 1942. Since the time of his graduation from the University, he has been with the General Electric Company as an Electronics Specialist. He was called into active duty the middle of 1942 and was assigned to his present position early in 1943. He is now serving the U.S. Army in the capacity of the Officer in Charge, Enemy Equipment Identification Section, Intelligence Branch.

Acme Photo

German portable radio detail established in a destroyed Soviet position, maintains contact between Battalion and Regiment.

ALTHOUGH there is no confirmation of Hitler's use of crystals for divination purposes, Axis military forces do use this silicon dioxide compound for the same reason we do—to keep radio sets on channel.

The Germans apparently realized and anticipated that quartz crystals would become a scarce item, when they started their design of military radio sets in 1934. They do not have any ready source of good crystals but, just as the rest of the world does, they have to depend upon quartz crystals from Brazil. Of course, some supply does come from the Russian territories conquered by Germany but this supply seems due to be cut off as the Red Armies continue to recapture occupied territory.

The German is very thorough and painstaking in his design and he therefore evolved a theory that he would use the quartz to calibrate his pack sets, used in the various units of the German Army, and not to actually control the frequency. He had another motive in doing so; namely, that this calibration could be done by communications personnel less skilled than the regular signal personnel. In other words to calibrate a German pack set, it is not necessary to have a skilled technician and an expensive frequency meter to check the frequency of the set.

The so-called German crystal resonator unit is very similar to our ordinary receiving tube in size and arrangements are made to plug it into any of the pack transmitters of the German Army. Each crystal has a certain basic resonant frequency, corresponding to the tactical use of the set in question, thus when a German operator turns a set on, he peeks through a peep-hole and adjusts his tuning until the crystal resonator glows brightest. He then knows the set is "on frequency" and sets the click stop or mechanical brake accordingly and so calibrates the set. These small crystals are rectangular splinters about twice the diameter of a head of a pin, which shows the careful use made by the Germans of this critical material. Approximately half an atmosphere of neon is in the tube, which causes a pink glow.

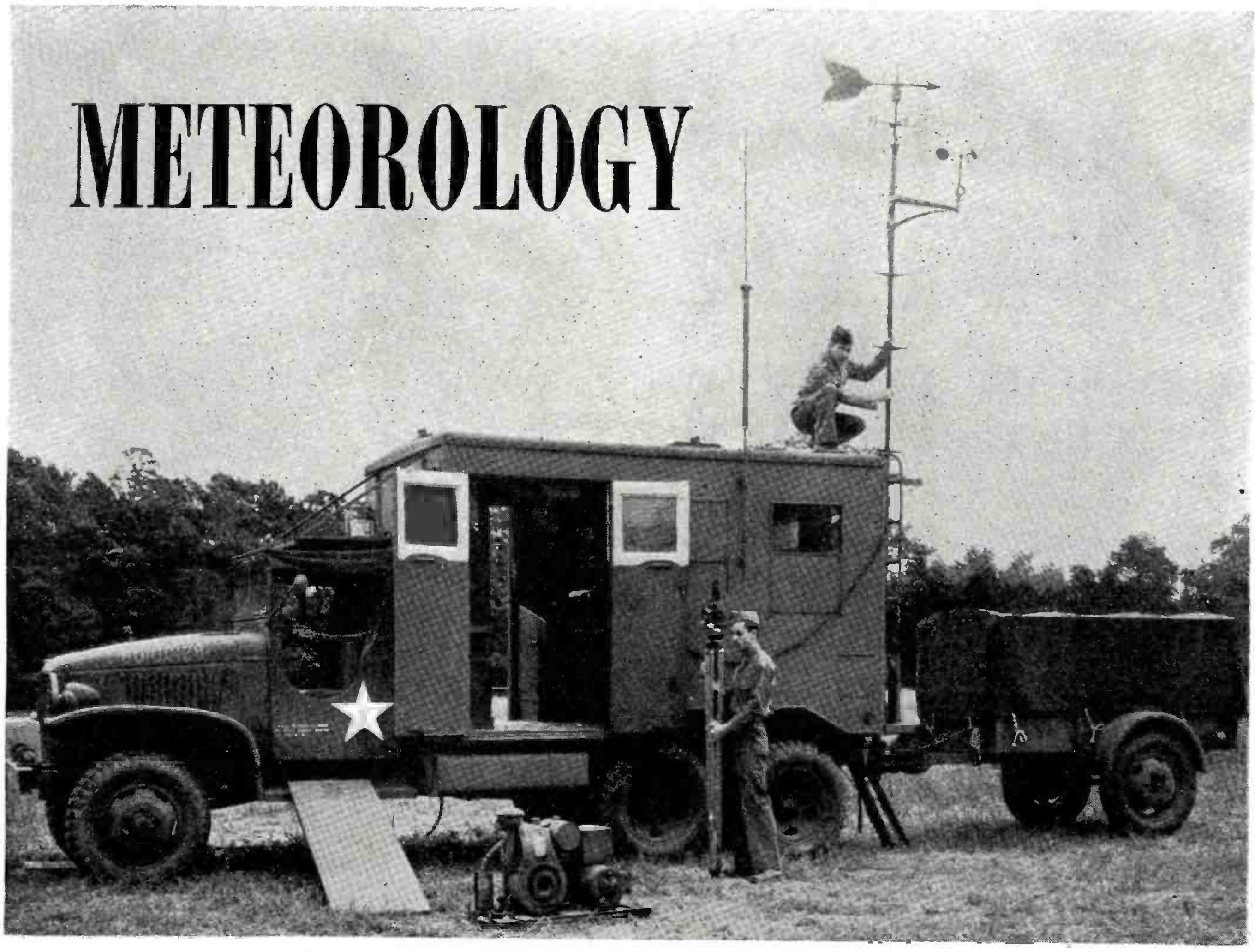
The Germans employ crystals in only a few sets which have special tactical problems or where an exact frequency is absolutely necessary. For example, in the German Notsender, or portable sea-rescue set, they employ crystal control so that the flyer forced down at sea will be able to be picked up quickly because the frequency is on the nose right at 500 Kilocycles per second.

The basic Luftwaffe ground-air liaison sets—both high power and for fighter and interceptor control from units located in the rear—use crystals also to control the frequency because of the great number of planes in the air, interference from our own sets, and ignition interference from the planes themselves. Other causes, such as static due to electrical storms, make it absolutely necessary that the Germans use crystals in this application.

The Japanese, on the other hand, use quartz crystals to control the frequency. These crystals are obtained from many of the same sources which we use and it was generally rumored—with some authenticity—that on the day

(*Continued on page* 443)

METEOROLOGY



Mobile weather station complete with all instruments necessary to obtain basic data for speedy and accurate weather forecasts.

By Major CARROLL W. ARFORD

Military strategists rely on accurate weather information to guide them in planning offensive operations. The meteorologists keep them informed.

Born in Marshall, Illinois, in 1905. Has the degrees of Bachelor of Science from the University of Illinois, 1931, and Master of Science from the Washington University, 1938. Headed the Science Department of the Madison, Illinois, High School from 1931 to 1937 when he joined United States Weather Bureau. Graduated from the Armored Force School in 1941. Served with the Armored Force at Fort Knox, Kentucky, and was called to active duty, 1941. Late that year he was assigned to his present position, which is: Officer in Charge, Weather Section, Aircraft Radio Branch.

THE Signal Corps has, or at least considers it has, a proprietary interest in the Weather Service of the United States Army. Regulations charge the Signal Corps with the "development, procurement, storage, issue, and major maintenance of the meteorological equipment used by the United States Army." But this is not a true indication of our interest in meteorology. A short review of the history of the meteorological service in the United States will indicate the reasons for this special interest.

It was long known by scientists that if weather observations could be made simultaneously at regular intervals at numerous widely-separated points and this data quickly transmitted to a central point, it would then be possible to estimate the future movement of storms thus forecasting coming weather. Shortly after the Civil War the Signal Corps, probably because it had ready access to telegraph facilities, became the agency in the United States which first made and transmitted regular weather observations for the purpose of forecasting. After about 20 years, Congress established the Weather Bureau in the Department of Agriculture and directed that equipment, records, and certain key personnel, be transferred from the Signal Corps to the Weather Bureau. After this transfer, the Army showed little interest in forecasting weather until the First World War, at which time the Signal Corps was again called upon to establish a weather service, keeping this service operating until quite recently when the operation of the weather service was transferred to the Army Air Forces.

Weather is not something new or occult—rather it is the result of physical processes in the envelope of gas surrounding the earth. Several of the simple basic facts of weather are as follows:

1. Warm gas (air) will tend to rise and cold gas (air) will tend to subside.
2. When a gas expands, it cools and as it is compressed, it becomes warmer.
3. As air becomes warmer it will hold more water vapor,

and when cooled sufficiently, the water vapor will be dropped out as precipitation.

4. As air moves over the surface of our globe it passes over water and absorbs moisture; is warmed or cooled by conduction from ground surfaces and solar radiation, and elevated by passage over mountains.

Consideration of solar heating and air movements would suggest that the air at the equator would be heated and rise. The air near the surface would then move toward the equator from polar regions. This movement of air actually occurs but is varied by the earth's rotation, local orographic conditions, and warm or cold areas. In general storms move from west to east with a velocity dependent upon their intensity, the latitude, time of year, and the characteristics of the terrain over which they pass. Storms, the direction of their paths, their intensity, and duration are of vast military importance since the attendant clouds will hide planes, ships, and installations from visual observation, thus affecting the conduct and outcome of battles.

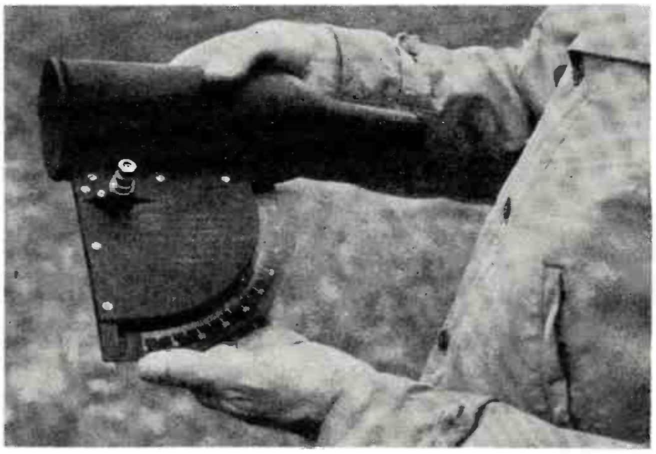
Numerous examples of the effects of weather on the course of battles are known to the students of wars. Among the more interesting ones that have occurred in this war are the following:

Flight of the German fleet through the English Channel. The Germans had part of their fleet in the French harbor of Brest and some units in German ports. While divided it had little chance to challenge the British fleet, and due to the rising power of the Royal Air Force the ships in Brest were liable to considerable damage from bombing attacks. In order that these ships might join the balance of the fleet, it was necessary for them to either steam northward around the British Isles or race through the English Channel (only 20 miles wide at the narrowest point). The latter plan was chosen. German meteorologists picked a day when there was a low cloud cover and very poor visibility over Brest and the channel. On February 12, 1942, the Gneisenau, Scharnhorst, and Prinz Eugen with escorting destroyers and mine sweepers slipped out of their harbor and were well on their way through the narrow waters before the British reconnaissance planes even discovered their absence from their harbor. An umbrella of German fighters protected the ships from successful aerial attack and the poor visibility prevented the British coastal guns from firing effectively. The German fleet was united with relatively little damage.

Battle of the Bismarck Sea. The Japanese considered it necessary to reinforce their garrisons in the southeastern part of New Guinea, they assembled a convoy totaling 22 ships with about 1,000 troops aboard, and sent it into the Bismarck Sea. Since the American and Australian flyers effectively had control of the air in this area the Japanese moved their convoy southward under cover of a tropical storm which normally would have provided protection all the way to Lae and Salamaua. Reconnaissance planes sighted the convoy and then lost it due to the thick weather, but on March 3, 1943, the storm deserted the Japanese and moved eastward leaving the fleet with no protective cloud cover. The Allied airmen had the chance they were looking for, losing only four planes in destroying the entire Japanese convoy.

Sicilian Invasion. General Eisenhower wanted several days of good weather on the African shore to prepare his invasion fleet, and then needed reasonably rough water for his initial landing in Sicily in order that the landing boats would not make good targets for shore fire. Off shore winds from the Sahara in Africa gave him the good weather needed for the preparation and a cold front moving southward across Sicily provided the rough sea desired for the initial landing during the early morning hours. Late in the day, after beachheads were established, the sea became calmer and reinforcements were easily landed. The invasion did not just "happen" to occur at the time when weather conditions were favorable: rather the meteorologists of the Army Air Forces picked the time when the desired combination of events would occur.

Prior to the outbreak of the present war, the Army and Navy had relatively few weather reporting stations. The United States Weather Bureau operated approximately 600 stations in the United States and Alaska all of which



Clinometer—to be used in conjunction with ceiling light projector. Instrument assists in determining elevation of clouds.

Trained operator tuning in on radiosonde equipment for latest data on pressure, temperature, and humidity of the upper air.

Generator, developed by the Signal Corps, is used to produce hydrogen gas for meteorological balloons, prior to their ascension.

made surface observations of the barometric pressure, relative humidity, wind direction and velocity, cloud cover and types, precipitation, maximum and minimum temperature and rainfall. Over 100 also made pilot balloon observations to determine the direction and velocity of the upper winds, and about 40 made radiosonde observations. As the Army of the United States started to expand, the Army Air Forces perceived the need for a world wide network of weather stations with trained forecasters. Forecasters and weather observers were quickly trained in universities and service schools. The Signal Corps procured the equipment required for this service—no easy task as manufacturers were required to rapidly expand their pre-war facilities by 10 to 20 times to produce the amounts of equipment necessary for this expansion. One of the most fruitful of the development projects carried out by the Eatontown Signal Laboratory was the installation of a complete meteorological station in a truck for mobile use. Considerable modification of delicate equipment was necessary in order that it would not be damaged in moving. These sets have been used in active war theaters and have proved to be quite valuable under such conditions.

Basically the instruments used for weather observation were designed and used prior to this war and only modifications have been made to obtain equipment suitable for modern warfare. These meteorological instruments are the maximum and minimum thermometer used to determine the daily temperature extremes, the psycrometer which indicates the moisture content of the air, the thermograph and barograph which provide continuous records of the air temperature and pressure, the barometer used for accurate determinations of the atmospheric pressure, the rain gage, the pilot balloon theodolite, is used to track a meteorological balloon rising freely into the upper atmosphere at a constant rate, and to determine the balloon's position in space from which data the direction and velocity of the upper winds can be determined. Those who saw the Signal Corps picture "Report from the Aleutians" probably remember that a weather observer made a pilot balloon observation just prior to the take off of the American planes on their bombing flight over Kiska.

The radiosonde is the most intriguing of all meteorological instruments. It consists of a tiny radio transmitter, battery, pressure, temperature, and humidity elements with a total weight of about three pounds. This instrument is sent aloft on a neoprene balloon filled with hydrogen gas, and as it rises through the atmosphere to altitudes up to 60,000 feet, broadcasts the meteorological conditions of the atmosphere to a receiving station where the signals are recorded graphically on a moving strip chart. Trained observers decipher the record and prepare it for distribution to the forecasters.

The forecaster has a wealth of information upon which to base his weather predictions. Weather records for the entire world have been collected in a weather atlas to show the forecaster the types of weather which are to be expected in any area. A weather map with surface data from many stations is prepared showing the current pressure systems and present weather over large areas. The pilot balloon and radiosonde charts present a picture of the air above the surface of the earth. These maps and charts are augmented by pilots' reports of atmospheric conditions encountered in flight.

Three years ago United States meteorologists were able to prepare adequate short term forecasts (up to 48 hours) and also prepared five day forecasts. The results of these five day forecasts were promising, but with the entry of the United States into the War, weather became a military secret and no more long range forecasts were given out to the public. Under the impetus of the war, however, long range forecasting has taken great strides and at present the long range predictions are more accurate than even the most optimistic meteorologist would have believed possible two or three years ago. New forecasting systems

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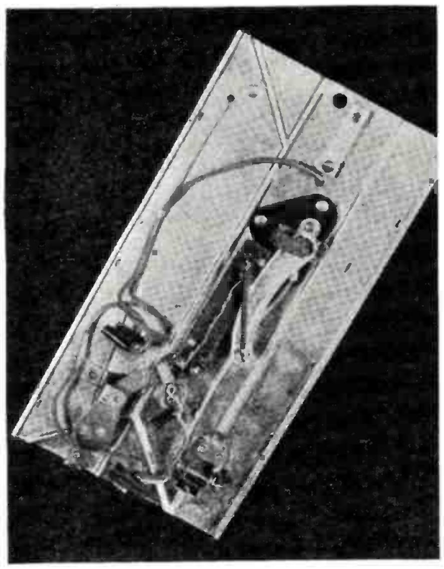
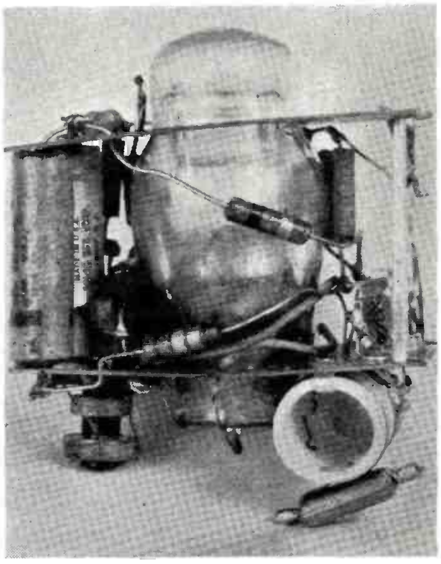
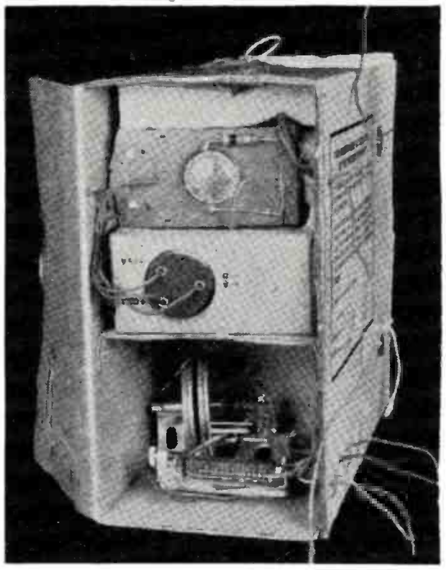
Theodolite instrument used to observe atmospheric conditions, velocity, density and wind currents of the upper stratosphere.



Humidity unit of the ML-141-B assembly showing the humidity resistor.



Radiosonde ML-141-B transmitter subassembly. Note compactness of parts.



Complete assembly with battery. Barograph is located in lower compartment.

RADIOSONDE

Packed in a plastic-covered case about the size of a shoe box—the radiosonde transmits weather information from the intensely cold stratosphere.

"HAMBURG Wiped Out."

"Flying Fortresses Raid Rabaul—All Return Safely."

"Allies Invade Italy."

Behind such headlines heralding United Nations' successes is the story of a little-sung hero—a tiny but ingenious device called "radiosonde."

Some of America's beautiful blondes played an indirect role in those successes, too, for hair from their heads is an integral part of this super-sensitive weather recording invention.

Radiosonde, consisting of remarkable meteorological instruments and a miniature radio transmitter, is sent aloft by balloon. As it travels upward, sometimes as high as ten miles, it broadcasts conditions of the atmosphere

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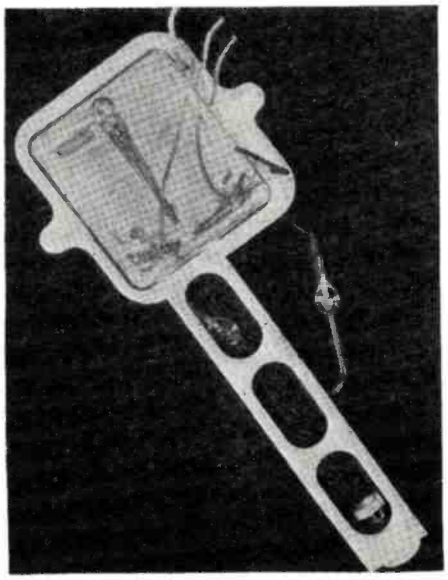
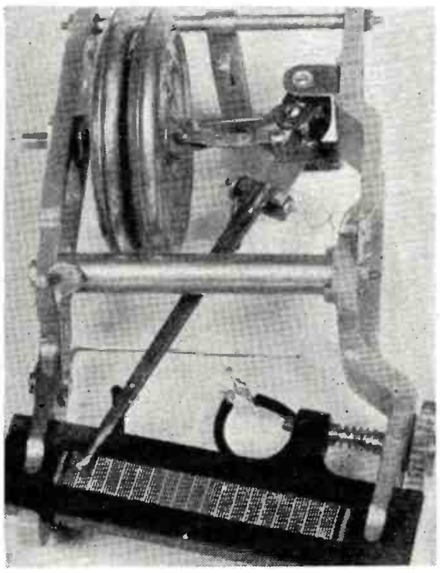
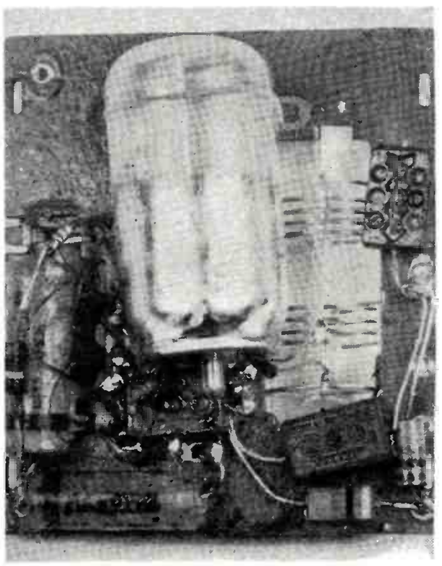


Humidity unit. Human hair is occasionally used to indicate variations in humidity.



Baroswitch, showing pressure element and commutator. Variations are sent via radio.



Transmitter assembly uses baseless tube. Wire leads are brought out for connections.

An officer of the Aircraft Laboratory testing the VHF radio equipment aboard a P-51 aircraft.

AVIATION RADIO

The SC Aircraft Signal Agency develops equipment for air communication and navigation purposes.

Assistant taking notes from mechanic on location of radio noise.

By Colonel HOBART R. YEAGER

Born in Ohio in 1895. Graduated from U. S. Military Academy in 1918 and Command & General Staff School, 1939; Coast Artillery School, 1920; Air Service Pilots School, 1921; A. S. Pursuit School, 1921; A. S. Technical School, 1925; and Air Corps Tactical School, 1938. Holds ratings of Command Pilot and Combat Observer in the Air Corps. Assigned to Aircraft Radio Laboratory in 1939, serving as Chief of Air Navigation Unit and later of Communications and Navigation Unit. At present is Director of the Laboratory and C. O. of S. C. Aircraft Signal Agency.

IN A previous article for *Radio News* (November, 1942) the organization of the Signal Corps Aircraft Signal Service was discussed. This service recently underwent an administrative reorganization and is now called the Signal Corps Aircraft Signal Agency.

This Agency is located at Wright Field, near Dayton, Ohio, and consists of the Aircraft Radio Laboratory and the Aircraft Radio Maintenance Division. The Agency is charged with research, development, preparation of procurement information, and maintenance planning required in the radio field incidental to design, supply, and installation of radio equipment on aircraft for communication and navigation purposes. In order to perform these functions properly, close cooperation is necessary with the Materiel Command at Wright Field, the Air Service Command at Patterson Field, the Dayton Signal Corps Procurement District and Depot, and the various research and manufacturing organizations in the radio field. Their job is to provide the best and most reliable radio equipment for Army Air Forces airplanes.

Today we do things with radio which were considered in the realm of fantasy a few years ago. It is a radio war. The commander, who knows how to get the maximum use out of the available radio devices, has a tremendous advantage.

As this article is being written the skyways in many latitudes over the globe are filled with American planes and the lifeline that binds them together and provides them with guidance from the ground below is radio. Without radio, each plane in the air is a lone entity on the horizon, effective within the human limitations of the man or little group of men that control it. With radio, the same airplane becomes a part of a flying combat team whose combined operation has the effect of many entities welded together, each contributing its own effectiveness to one purpose. Radio provides the bond that magnetizes a formation into one machine.

Valuable in group flying, radio, however, serves a primary purpose as a safeguard and aid to the individual. The vast stretches of the skyways can become a very lonesome place for the occupants of a lone plane on a long, weary mission. Nor can the value of radio be underestimated to the pilot who, after a life and death struggle in enemy skies, finds himself out of ammunition, low on gas, and miles from anywhere, with the uncomfortable but persistent thought that an enemy patrol might chance upon him and blast him from the heavens; or picture for a moment that same plane forced down through lack of fuel. At the last desperate moment a hidden field looms up. Friend or foe? A familiar challenge comes through the earphones—and all is well.

In order to get the maximum use from our aircraft radio, it is necessary that adequate supply and maintenance facilities be made available, and that operating personnel be familiar with the capabilities and limitations of the equipment and know how to employ it to the greatest advantage on military flights. Every day thousands of Army Air Forces airplanes fly all over the world in all kinds of weather. Many of these flights could not be carried out successfully except for radio and radio plays an important part on all flights.

The installation of airborne radio in Army Air Forces airplanes involves many problems. Every effort is made to get the best antenna installation and the best location to facilitate ease and efficiency of operation. However, the location of the component parts of the set must be coordinated with the other equipment which is carried, such as, armament, aerial cameras, oxygen tanks, and so forth. Frequently the installation is a compromise in order that all of the various types of equipment will have a location which permits of their satisfactory operation. Since Army Air Force bombers have power-driven gun turrets and bomb-bay doors, the number of possible locations for radio antennas is limited as compared to commercial transports.

During the past year a particular effort has been made to make available instruction books and test equipment at the time new equipments go into production. It is absolutely essential that maintenance personnel have available an instruction book at the time they receive new equipment. Also, the test equipment should be at hand. The instruction book and the test equipment cannot be finished until the basic design has been frozen. Therefore, there has been a tendency for the supply of these items to lag behind the basic equipment. However, we have found that the manufacturer can get these items out on time, provided proper planning and engineering have been carried out.

One of the most serious problems in the operation of airborne radio is radio noise. This noise may be of the so-called "man-made" type, coming from the high tension ignition system of the aircraft engine and the various interference generators on the airplane, such as, aircraft generators, electric automatic pilots, electric propellers, and so forth, or it may be atmospheric noise due to thunderstorm static or precipitation static. The latter type of interference can be greatly reduced by going to frequencies

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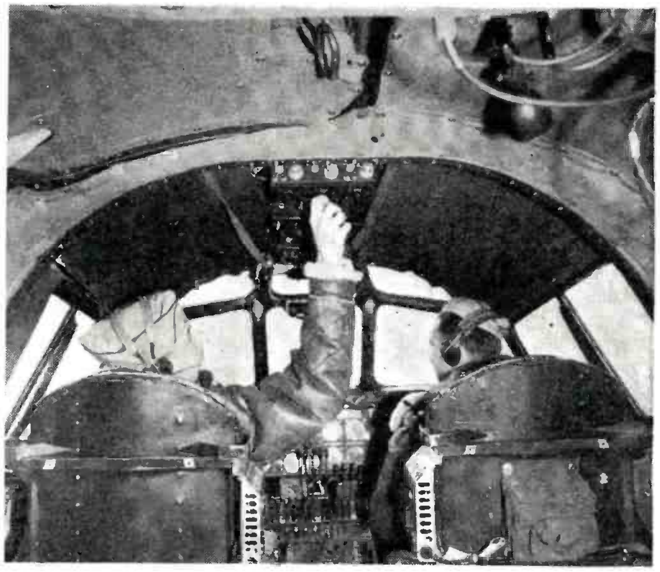
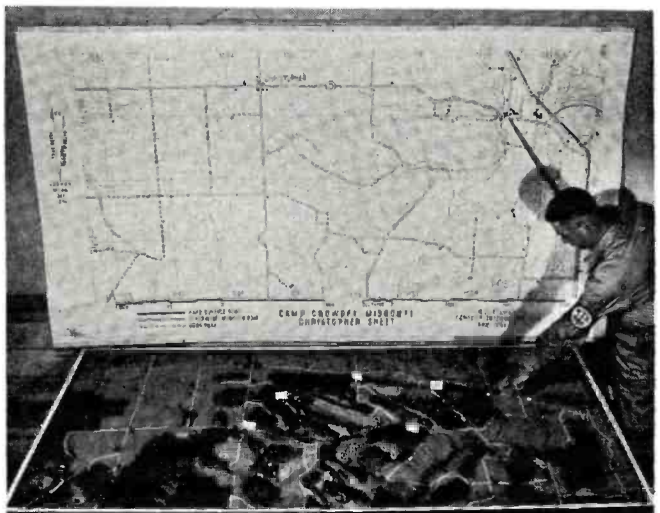
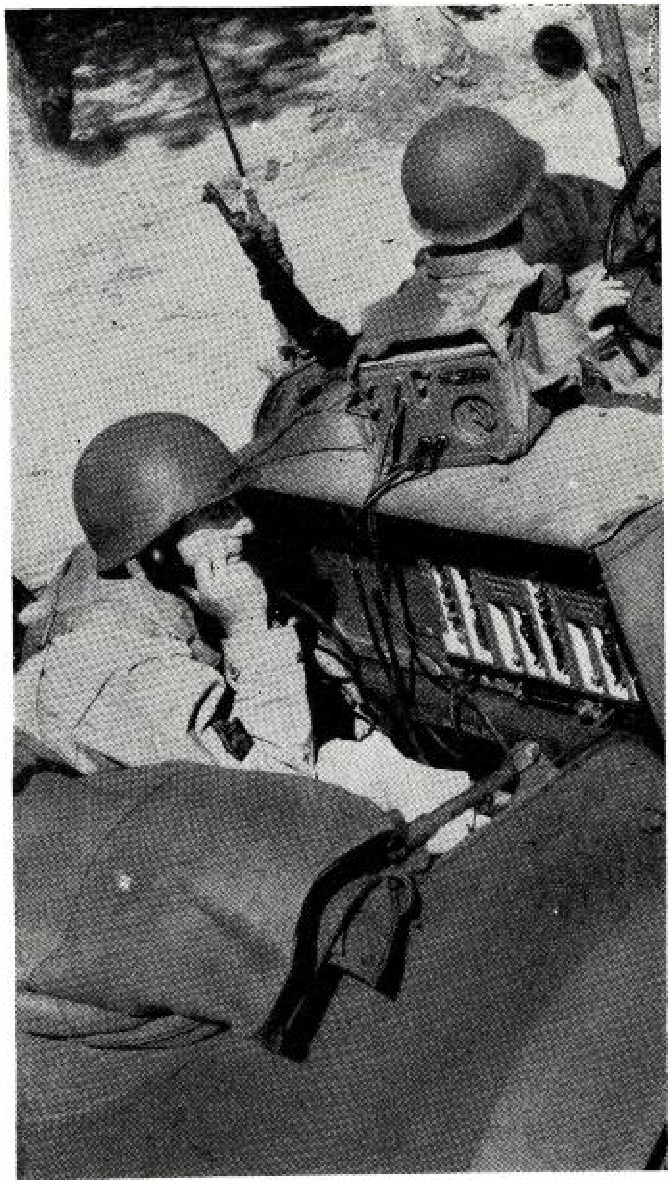


Pilot adjusting the frequency of his command radio equipment.

Enlisted man takes notes on message coming in on liaison set.



Map showing the symbolic plotting of terrain of model landscape.

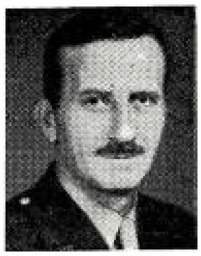


FM multi-channel transmitter and receiver used by Field Artillery.

Vehicular Radio

By

Col. HERBERT G. MESSER



Born in Texas, 1895; attended Alaska University, 1924-26 and completed graduate course in Comm. Engineering, Yale University, 1930. Graduated Signal School, 1922 and Air Corps Tactical School, 1938. War Radio Officer, Washington-Alaska Military Cable and Telegraph System, 1924-26; Officer in Charge, Radio Navigation Unit, Aircraft Radio Lab., 1930-36; Radio Repair Section, Panama Air Depot, 1938-40; and was communications advisor to the Brazilian Air Forces with U. S. Military Mission, 1941-42. At present is Chief, Signal Equipment Branch.

☆

Unified command—made possible by radio—has increased the firing power of American-made tanks.

☆

OUT where the bombs are gouging out the earth's surface and the big guns rumble their obligato to the rifles and machine guns, where the costume for men's exploits is chiefly grease, grime, and blood, the development of vehicular radio really begins.

Those charging tanks at the very forefront of modern battle are not only fire-belching forts as individual units but when maneuvering as a team are doubly formidable and unbeatable. The fire-power of American tanks has been multiplied many-fold by the unified command made possible by radio. Through radio the quarterback directs the play, assigns the decoy, sets up an ambush, and takes advantage as soon as possible of any hole that may appear in the enemy lines.

This communication was achieved by packing more power into a cubic inch of radio than had ever been dreamed possible, by assembly and disassembly far into the night . . . and, yes, even from men's curses on the battle field . . . "This damned thing never works right when it rains." . . . "That's a hell of a place to put that transmitter; I can never get at it!"

The complaints, the suggestions, and the requests come in, are sorted, studied, and out of them come the modifications of existing equipment and the design of new equipment to fit the needs of combat. Or it goes beyond the radio, to the vehicle itself; a hypothetical case will illustrate the process:

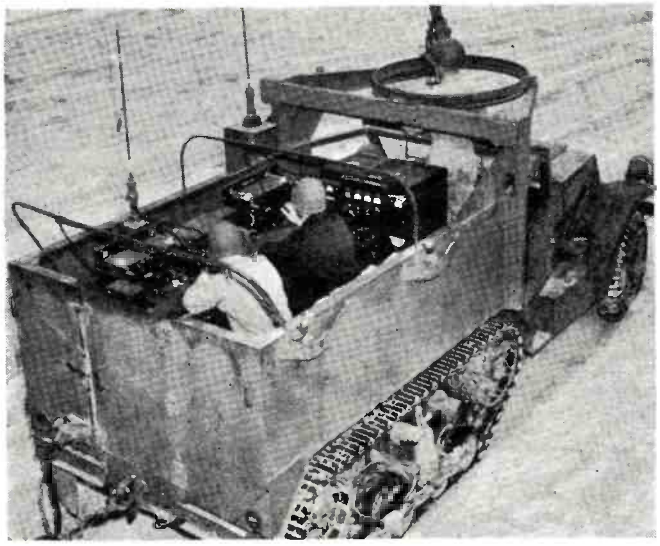
The tank crews return from the engagement, perhaps not all that started out.

"Jerry outranged us," they say. "We can't get close enough to that new baby he's got. Starts layin' shots around us before he's anywhere near the range of our guns."

Up from the battlefront goes the cry, "We need a longer range gun on that General ———— Tank. Those ricocheting shells sure knocked the hell out of our radio, and when Sarge in the command tank came on the air to tell us where Jerry was, we missed the message altogether."

Back in the United States, Ordnance engineers have been experimenting with a new tank construction, hundreds of pounds lighter, yet ballistically better than ever before. There's also an engine about ready for production that will increase speed by ten miles an hour. Take these features, combine them with a longer range gun, and a lot of other improvements that have been suggested by American ingenuity and by the experiences of combat, and design them into a new model.

Concurrently with the design of the new tank, communications requirements are considered. With its various innovations, this tank will operate further from its base, so it must have a radio of greater range. The tank commander will sit in a different place, so the radio set must be relocated. The noise of combat and the roar of more powerful engines dictate that an interphone system for



Interior view of SCR-299 on half-trac mount, used in Air Liaison Communications. This unit helped attain victory in Africa.

Ground portable radio set installed in jeep. Transmitter operated by telegraph key attached to the leg, or by voice telephone.

communications within the tank itself is an absolute necessity. "Military characteristics" for the tank's communications system are drawn up by the Armored Command. These are submitted to the Signal Corps, and come down through the Engineering and Technical Service to the Ground Signal Equipment Branch and then to the Signal Corps Ground Signal Agency.

One of the present model radios is found to come nearest to the specifications; there are certain requirements it doesn't meet, and there are several changes and modifications necessary. These problems are taken to the Laboratory. Many conferences follow among the Signal Corps engineers, the Ordnance engineers, and the tactical experts of the using arm to iron out inevitable discrepancies between what's wanted and what's possible. Presently, the engineers come forth with a model that meets all the specifications insofar as ingenuity will permit.

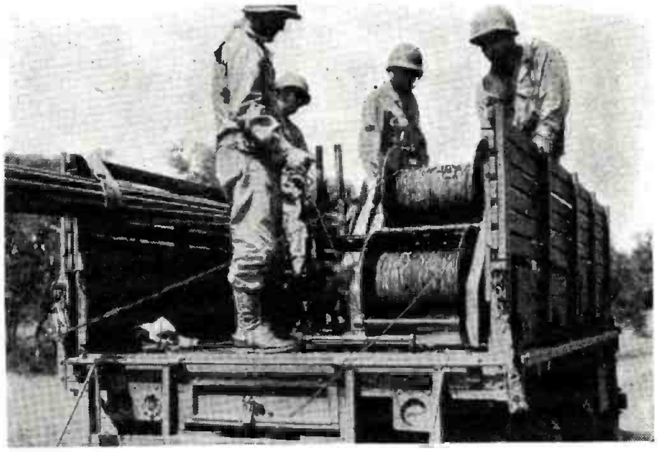
Meanwhile, the Ordnance people have built a wooden model of the new tank, constructed to scale, and they're busy learning what defects of the blueprint plans show up when they are projected to actual size. When they're through with it, the Signal Corps engineers install the model radio they've built to see how it's going to fit into a scale model of the tank. Next a soft steel model of the tank is constructed, at which time another phase vital to the success of communications is considered. Getting the basic communications equipment into a vehicle is only half, or less than half, of the job. The rest of the problem is making it operate. That is the problem of suppression.

The modern vehicle of war is a rolling powerhouse of electricity, every watt of which is bent on interfering with radio communication operation. The gun-firing mechanisms, the turrets, timing devices, special lights, sirens, all are electrically operated in addition to the commonplace electrically controlled functions of a vehicle. Filters, capacitors, suppressors, shielding, and bonds all play their part in suppression, but the greatest degree of suppression has been achieved in original design of the vehicle.

The engineers go to work on the problem. "Why couldn't all the interference be decentralized," they asked, "with each interfering circuit, filtered at the source and as far as possible from the radio." The wiring system is designed so that the greatest source of interference is eliminated, leaving isolated trouble spots that can be dealt with by special suppression techniques. They made a shield of the engine compartment itself to blanket down the engine's electrical mischief.

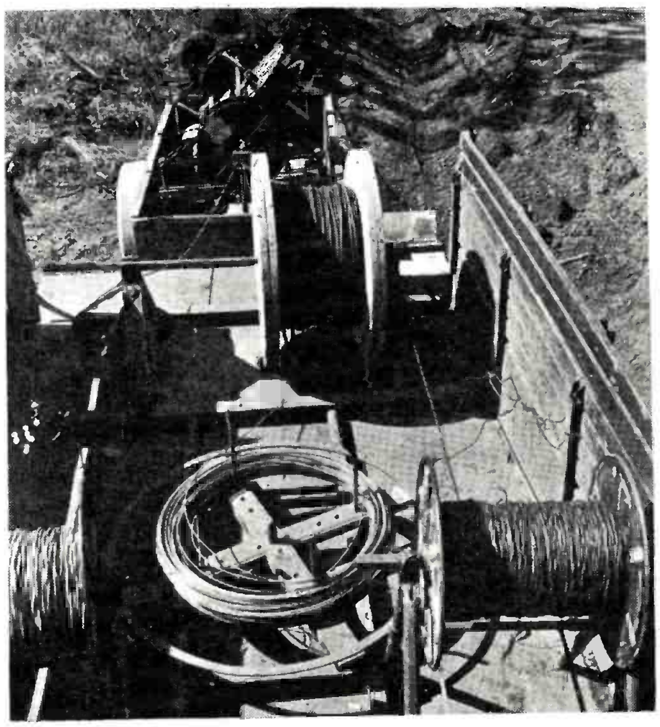
The steel model is then put through tests, with the new development radio set in it, and is subjected to all the test conditions that its construction will permit. Finally, complete with all the corrections born of the previous tests, one or more armor-plated tanks are built, piece by piece,

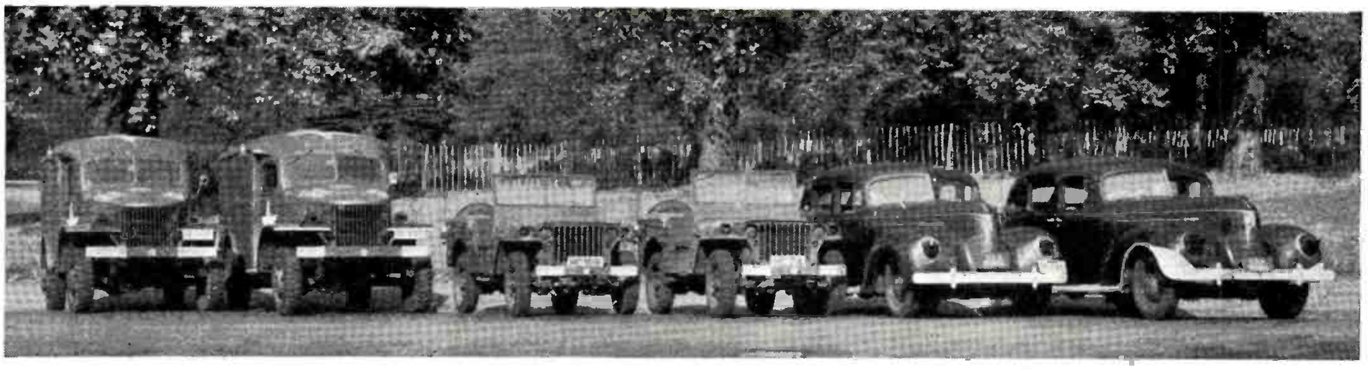
(*Continued on page* 348)



Wire laying crew and a R-L-26 on a two-and-a-half ton truck. Many miles of wire can be laid by these men in a single day.

Cable-spinning trailer and tender truck. Cables from separate reels are automatically twisted together, and laid in a trench.





Group of military cars used for MP communications. Note the mounted antennas on each vehicle.

MP Radio in the ETO

American military personnel in Britain are under the watchful eye of the MP. They have a very elaborate communications system.

By Major DAVID TALLEY

Born in New York, 1903. Received B.S. degree in Electrical Engineering, Brooklyn Polytechnic Institute. He was Plant Department Engineer with the New York Telephone Company and operator of amateur radio station W2PF before being called to active duty in 1940. With the Research & Development Division, Office of the Chief Signal Officer, Army Amateur Radio System; then assigned to the Signal Section of the 5th Corps in Northern Ireland. He has been in his present position since 1940, which is the Officer in Charge, Engineering Branch, Signal Supply Division, E.T.O.

"CAR fourteen, return to headquarters" and similar radio calls can often be heard on the short-wave police bands in the United States. But when a certain U. S. Army colonel, walking along Piccadilly Circus, recently heard these words in an unmistakable Brooklyn accent coming from a radio set in a parked jeep, he had to look twice to make sure he was in London and not in New York.

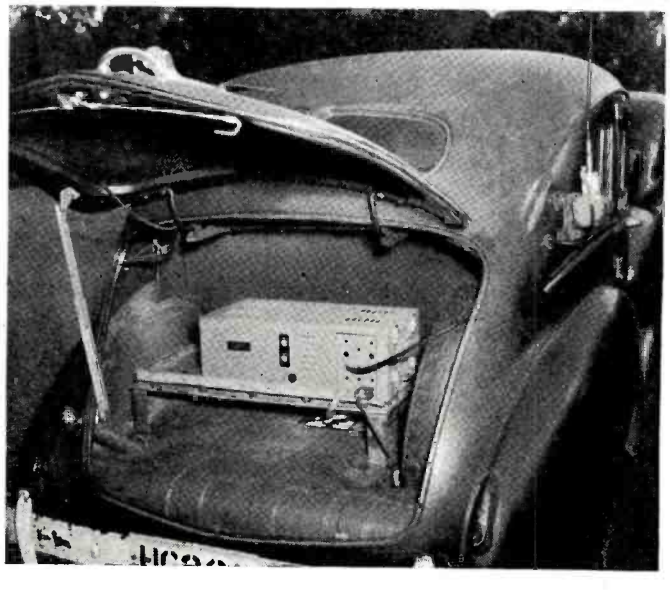
The average American, young or old, likes to go to town on Saturday nights. The fact that he is in the Army and in a different country does not change this habit very much. It is not surprising, therefore, that the number of U. S. soldiers on the "High Streets" of some English cities compares favorably with the crowds found on the main streets of typical American towns. The resultant traffic imposes heavy burdens both on the civil and the military police.

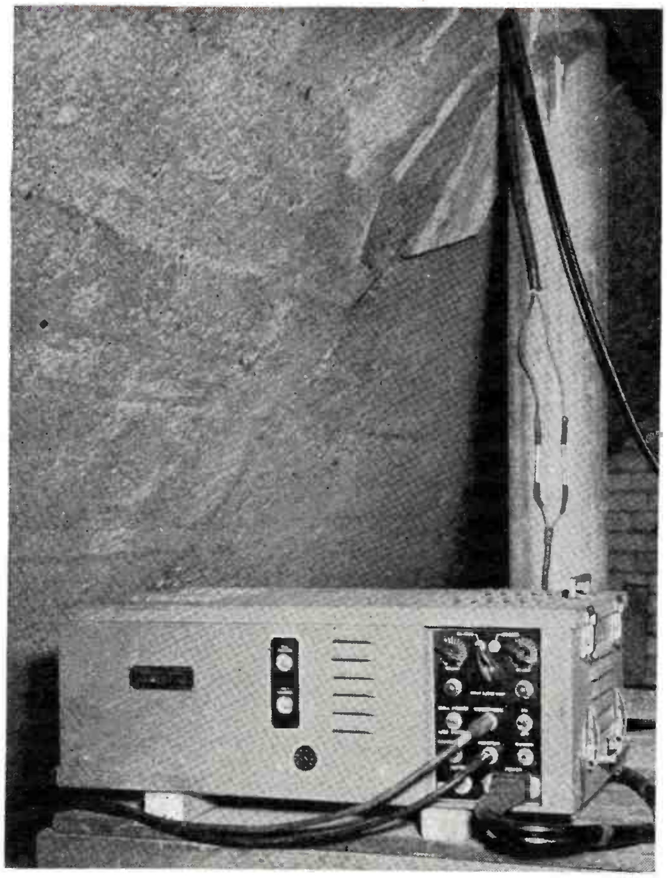
The need of a radio patrol system to assist the military police in their duties of protecting American troops had been foreseen early by the Provost Marshal General of the European Theater of Operations. The supply of the necessary equipment and its installation was undertaken by the Chief Signal Officer, SOS, ETO.

A number of radio sets of the frequency modulated type, very much like the commercial police radio equipment used in the U. S. was made available. These particular radio sets were ideal for the purpose except that the battry voltage required was greater than that normally available in the jeep and other vehicles which were to be converted into radio patrol cars. With the assistance of the Ordnance Service, this difficulty was soon surmounted. Higher voltage generators were fitted in the cars and, after a few minor changes in the vehicles' electrical sys-

Frequency modulation is used for all communications by the MP.

Transmitter mounted in rear compartment to reduce antenna losses.





Transmitter mounted at base of antenna is remotely operated.

tem, the required battery voltage was obtained. The high current taken by the radio set had to be considered in the modification of the electrical system in each car. It was necessary to make battery leads of short, heavy wires to minimize the voltage drop.

Vehicle Antennas

A correctly designed antenna, for the particular frequency to be employed, is very important for efficient operations on the very high frequencies. Preliminary experimental tests verified the fact that the rear bumper mounted type of antenna gave poor results. The metal body of the car absorbed considerable radio frequency energy. The antenna mast base, therefore, was mounted as high as possible on the car body.

In the case of the sedan type patrol cars, it was possible to support the rod aerial adjacent to the rear window. The "Black Maria" (formerly an ambulance) has its antenna mounted at the edge of the roof of the vehicle body. For the jeep, it was found satisfactory to install the mast base right next to the radio set. All of these arrangements were designed to afford short antenna leads in order to reduce to a minimum the losses in the lead-in cable.

The radio sets, in the sedan type of patrol cars, are mounted in the rear trunk compartment. The short antenna lead-in is a marked advantage of this location. It was necessary, however, to design a remote control panel to function with this set. Use was made, in this connection, of the glove compartment on the dashboard for these controls, which are all custom designed. In this way, the loudspeaker, microphone and switches are easily accessible both to the driver and the accompanying military policeman.

The installations in the other vehicles are made in the standard manner. The controls on these radio sets are handled by the MP in the vehicle.

The Control Station

The location of the central control station is most essential to the successful operation of any police radio

(*Continued on page* 254)

Control station showing receiver and transmitter control panel.

Control panel mounted on dashboard of a right-hand drive sedan.

Officers reviewing jeep-mounted Military Police communications unit.

LEND-LEASE

Panel layout of a development model radio set SCR-508 installed in a half-trac.

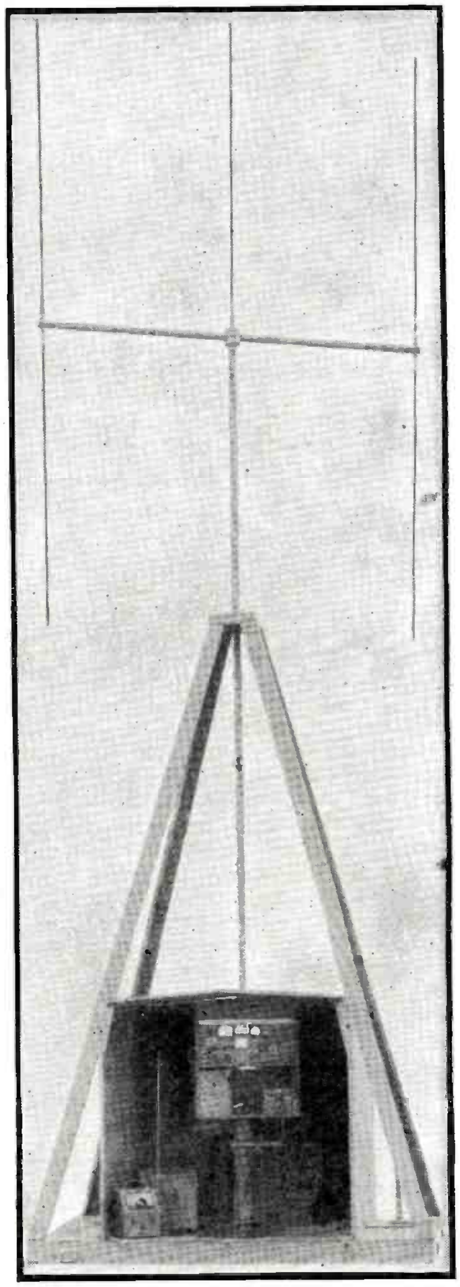
American-made supplies are rushed to Allied comrades in huge quantities the world over.

IN THIS global war—demanding communications that encircle the earth and requiring, at present, more than 56,000 miles of protected supply lines—the mastery of logistical problems may well mean the difference between victory and defeat.

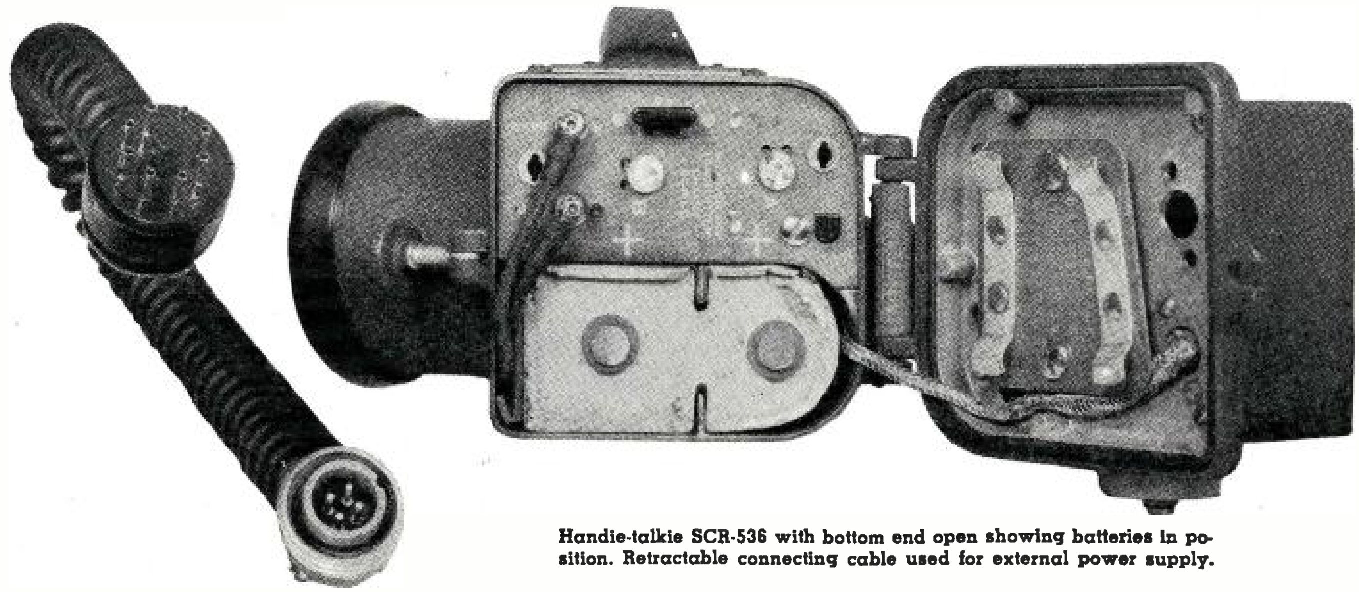
The Army has a simplified definition of logistics: "The right material in the right amount at the right place at the right time." That terse definition is admittedly correct as far as it goes but meeting its terms is one of the sternest and most formidable tasks ever imposed on military men.

These tasks, now being discharged primarily by the Army Service Forces, include the supply, equipment, and movement of troops at home and overseas; the coordination of production requirements for military munitions in the United States, the provision of a steady stream of supplies to various theaters of war, and myriads of other responsibilities requiring the utmost preparation and precision.

Along with the responsibility for supplying and trans-



Direction finder radio set SCR-555.


Handie-talkie SCR-536 with bottom end open showing batteries in position. Retractable connecting cable used for external power supply.

porting American troops goes the problem of providing munitions and supplies to the United Nations and, in most cases, transporting them overseas.

In his recent biennial report, General Marshall said: "We are equipping the Chinese troops and French troops, we have been providing equipment for the British, the Australians, the New Zealanders, and the Canadians, we have furnished supplies to Latin American republics—we have been truly an Arsenal of Democracy.

"All this demands an elaborate system for allocation, distribution, and transportation, to be coordinated with our daily normal problem of meeting the demands of our own forces."

The Lend-Lease activities of the Army are an integral and important part of the elaborate system noted by General Marshall. These activities are under the supervision of Army Service Forces and the International Aid Branches of the various services. Their chief responsibilities are to process requirements and initiate procurements. They further direct the transfer of equipment to Allied nations pursuant to the decisions of the Combined Munitions Assignments Board.

Lend-Lease had its inception nine months before Pearl Harbor. It was then that Congress passed the bill which authorized the President "to sell, lease, lend, or otherwise dispose of" to any country the defense of which he deemed essential to the defense of the United States, goods and materiel to the value of $1,300,000,000.

With the passage of this Act there came into existence within the Signal Corps a group whose responsibility it was to see that our potential Allies were provided, to the best of our ability, with various types of communications equipment, meteorological instruments, photographic material, and other articles essential to an army on the field of battle.

For eight months before Pearl Harbor this group had been receiving, processing, and completing requisitions placed by these nations. Hundreds of tons of equipment had gone abroad and thousands of items were coming off production lines in plants throughout the country.

Then came December 7, 1941, and it was necessary to temporarily freeze all this activity until our command could take stock of the situation and determine how best Lend-Lease requirements could be coordinated with the new and imperative needs of our own forces.

Actually the outbreak of the war had two effects upon the International Aid activities of the Signal Corps. First, it caused the contraction of the activity just referred to but, within a short time, it made possible a marked expansion. More and more industrial plants went over to 100 per cent war production, and, as a result, International Aid contracts were more rapidly completed and International Aid requirements more rapidly met.

Anticipating an increase in the volume of business, the Signal Corps unit streamlined its organization into the following three major sections with functional responsibilities: Requirements and Technical Section, Operations Section, and a Records and Reports Section. The first two units were designed as operational; their main functions were to process all foreign government requisitions and to direct the movement of materiel. Records and Reports Section was designed to prepare and maintain all records and reports for the branch and to furnish information to the operational units for expediting purposes. The effectiveness of this farsighted planning in revamping the organization has borne fruitful results.

By the introduction of the best business practices and the installation of more advanced record systems, the Branch was able to eliminate duplication of unnecessary work in the operating sections, channel all information through one central source, and produce accurate reports more promptly.

A comparison of the fiscal years 1942 and 1943 shows that monthly transfers were doubled or tripled in volume in 1943, as against the corresponding months of the previous fiscal year. Shipping tickets, received and processed during the first six months in 1943, exceeded all of those received in 1941 and 1942. During these periods, thousands of telephones, telephone poles, telegraph sets, radio sets, radio transmitters and millions of bits and pieces, such as resistors, relays, plugs, and jacks were sent abroad. In addition, other kinds of radio and electronic equipment, meteorological instruments, and photographic appliances were furnished to our Allies.

During the first six months of the year, 233,483 miles of wire were transferred to beneficiary governments. Cumulative shipments of wire, as of the close of the fiscal year, amounted to 1,303,886 miles—enough to extend from Washington to Tokyo approximately 167 times.

While only three countries received direct aid when the Branch began operations, the number of Allied nations, which benefited from Signal Corps Lend-Lease aid during the fiscal year 1943, was thirty-four.

Not only have direct shipments of all kinds of supplies been of substantial value to the United Nations but the countless amounts of communications devices that have been installed in planes, tanks, and other mobile equipment and which were not reflected in Signal Corps International Aid transfer statistics, also played a tremendously significant part in Allied successes.

All equipment does not go to the combat zones. The British have standardized their interior communications to a large degree on American equipment. They have depended on American manufacturers for their maintenance parts which are supplied through International Aid.

(*Continued on page* 338)

SIGNAL UNIT SURVEY BRANCH

The Signal Unit Survey Branch is responsible for the development, procurement, installation, etc., of SC sets.

By Col. ROLLAND E. STAFFORD

Born in Grand Rapids, Michigan, in 1888. He was graduated from the Army Signal School in 1928. He served with the A.E.F. in the last war. He was an Electrical Supervisor with the Southern Pacific Railroad. Served as an Assistant to the Signal Officer, 2nd Corps Area, 1930-34 and the same capacity, Philippine Department, 1934-36. Commanded a Signal Battalion in Iceland in 1942-43 and was appointed to his present post, upon his return from overseas duties, in 1943. He is Chief, Signal Unit Survey Branch, and is holder of the Silver Star, awarded in last war.

SO MUCH has been written about the important part that communications play in the prosecution of war, that this statement hardly bears repeating. However, the maintenance of communications in modern warfare, involving rapid movement and simultaneous land, sea, and air operation in theaters all over the world, has placed on the Signal Corps terrific responsibilities for the development, procurement, installation, maintenance, and operation of new and highly specialized communications equipment. It has required the development of new techniques and, most important, the training of many different specialists to high degrees of technical skill, to use these techniques and to operate and maintain the complicated modern communication equipment.

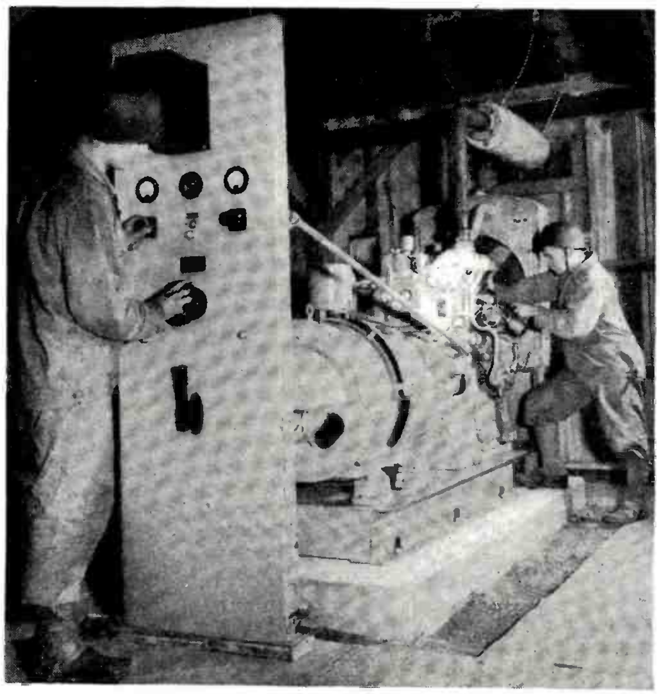
As a result, the efficiency and skill of the individual Signal Corps specialist and the ability of Signal Corps units to perform their many and varied missions have become matters of extreme importance.

It was in recognition of this fact that the Chief Signal Officer activated the Signal Unit Survey Branch on January 18, 1943. The purposes for establishing such a Branch were threefold: First, to make inspections of Signal Corps troops for whose training the Chief Signal Officer was responsible; second, to meet the requirements of the Inspector General, Task Force Commanders, and the Commanding Generals, Army Ground Forces, Army Air Forces, and Army Service Forces, for technical assistance in the inspection of Signal Corps units of those Ground, Air, and

Electrical cable for use in construction of military camp.

Maintaining communications during amphibious operations.

350 kw. power unit used to supply power to large transmitters.



Service Forces, alerted for overseas movement; and third, to accumulate data on deficiencies on the basis of which corrective action could be initiated to insure that units are properly manned, trained, and equipped to perform their missions efficiently.

"Inspections," so much a part of Army life, are looked upon by all Army personnel as having the primary objective of "finding fault," "being critical," and "hanging someone." Because it was desired that the activities of the Branch should be directed towards constructive suggestions for improving training, organization, and equipping of units, it was decided to substitute the word "survey" for "inspection." The words are synonymous, but the substitution has proved valuable from a psychological standpoint. Therefore, the name selected for the Branch was Signal Unit Survey Branch.

The Signal Unit Survey Branch was organized by Colonel Fred G. Miller, who conceived and developed the organizational plan and methods of operation; selected the personnel; and directed its activities as Chief of the Branch until September 13, 1943. Colonel Miller, by virtue of his broad Signal Corps experience, his technical knowledge of communications and his long and varied military experience, was well qualified for this important task. He was a National Guard officer from 1908-1918, serving as Division Signal Officer, 7th Pennsylvania Division on the Mexican border, 1916-1917; saw service overseas as a Division Signal Officer, 1917, with rank of Lt. Colonel; was Assistant Department Signal Officer, Philippine Department, 1923-1925 and 1930-1931; Signal Officer, U. S. Forces in Shanghai, China, 1932; Signal Corps Board, 1933-1939; Signal Officer, 2nd Armored Division, and VII Army Corps, 1941.

The organization of the Signal Unit Survey Branch was determined after careful analysis of the problems involved. Important considerations developed from this analysis were as follows:

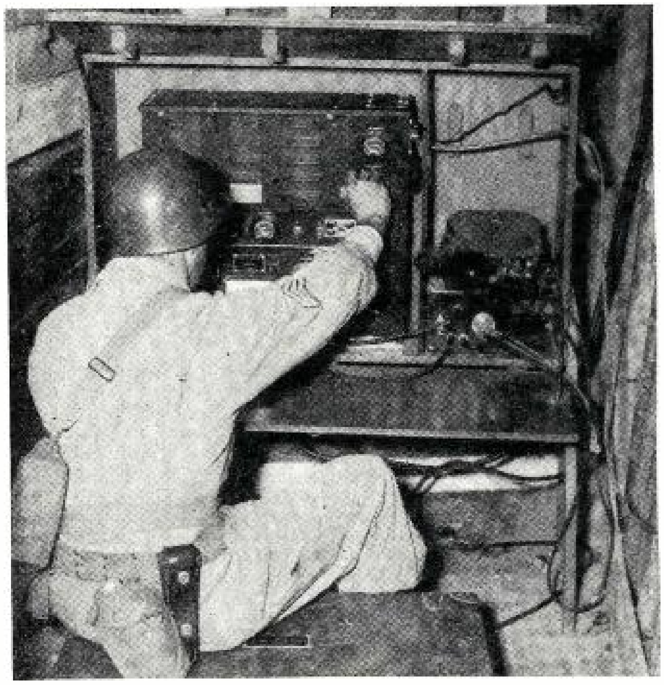
1. Signal Corps units should be inspected at the time of their activation; at least once during or upon completion of their Mobilization Training Program; and whenever alerted for movement to theaters of operation.
2. There were a large number of Signal Corps units stationed throughout the continental limits of the United States.
3. There were many different types of Signal Corps units (not counting an indefinite number of special teams) and many different Signal Corps specialists being trained by Signal Corps Schools.
4. Surveys of troop units required officers with field experience as well as officers with technical qualifications in the various specialized fields of wire, radio, aircraft warning, message center, pigeon, supply, and photography.
5. Scheduling and directing of surveys, initiation and follow-up on corrective actions, and necessary supervision and administration could best be accomplished from the Office of the Chief Signal Officer.

Therefore, the Branch was organized with Branch Headquarters in the Office of the Chief Signal Officer and five Signal Unit Survey Groups located in the field.

Locations for these groups were selected on the basis of concentration of Signal Corps activities; proximity to Signal Corps Schools and training activities and various posts, camps, and stations where Signal Corps units were located; and transportation facilities.

To each of these groups was assigned an officer in charge with broad Signal Corps and field experience. Officers qualified by technical training and experience in each of the fields of wire, radio, supply, and message center, were selected for each group, as these specialties are common to the majority of communications units. Specialists in aircraft warning, photography, and amphibious operations were assigned to those groups having a large number of these activities in their vicinity.

All surveys of Signal Corps units by the Survey Groups are scheduled and directed by the Branch Headquarters, Office of the Chief Signal Officer, Washington, D. C., the survey Groups operating as exempted field activities under the administration, supervision and control of the Chief Signal Officer. The Branch Headquarters secures information, from various sources, of activation, station, Tables of Organization, equipment, priority, training status and movement of Signal Corps units of the Army Ground Forces, Army Air Forces and Army Service Forces. From this information, survey schedules are prepared, and necessary directives issued to the Survey Groups giving them authority to make these surveys and furnishing them necessary information as to organization, equipment and mission of the units. Only surveys of Army Service Forces Signal Corps Units are initiated by the Branch. Surveys of Army Air Forces and Army Ground Forces Units are only made upon request of the Commanding Generals thereof or upon request of the Inspector General.



SCR-177-B radio transmitter located in underground dugout. Antenna is run up through trees outside and entire unit is operated by remote control from receiving position several hundred yards away, after adjustments have been made.

The Survey Groups make three types of surveys, "Initial" (Activation), "MTP" (during or upon completion of the Mobilization Training Program) and "Final" (when unit is alerted, or placed under movement orders, for overseas shipment).

At the "Initial" survey, the Survey Groups determine the following:

1. Capabilities of officers to command and discharge their respective duties.
2. Ability of the cadremen to instruct in their specialties.
3. Ability of the fillers to absorb the necessary knowledge.
4. That all training aids and instructional literature are available and that proper teaching methods are understood and will be employed. (This to include progress charts.)
5. That minimum training equipment is available.
6. That all necessary requisitions, reports, records, etc., are properly prepared, maintained, and rendered.
7. That personnel and equipment authorized is sufficient and of right type.
8. That all possible local action is taken to correct deficiencies noted.

At the "MTP" surveys, the Survey Groups determine the following:

1. Depending upon the state of completion of the Mobilization Training Program, that proper progress of individual efficiency has been attained (this by actual test of individuals).
2. That proper teams are formed and capable of accomplishing the team mission.
3. That the teams are capable of working with other sections in the combined mission.

(*Continued on page* 432)

Radiophoto

Pictures from foreign fronts are now seen in newspapers on the same day as "shot."

By Colonel CARL H. HATCH

Born in Massachusetts, 1904. He was a Plant Department Engineer with the Wisconsin Bell Telephone Company until 1940; entered the service as a 1st Lt. in Nt. Guard. Became Assistant to the Signal Officer, Fifth Army Corps, 1941; was placed in charge of all the telephone training and telephone facilities at Headquarters, Third Army. Appointed Assistant Executive, Signal Corps Replacement Center and assigned to Army Communications Division, Office of Chief Signal Officer, 1942; was assigned to present position as Executive Officer, Army Communications Service.

THE most complete pictorial coverage of any war in history is now being provided by the Signal Corps of the United States Army.

Scores of pictures are received daily direct from the battlefronts by the Radio-Telephoto Section of the Army Communications Service, sometimes with such rapidity that newspaper readers may see photographs of actual fighting the same day it occurs.

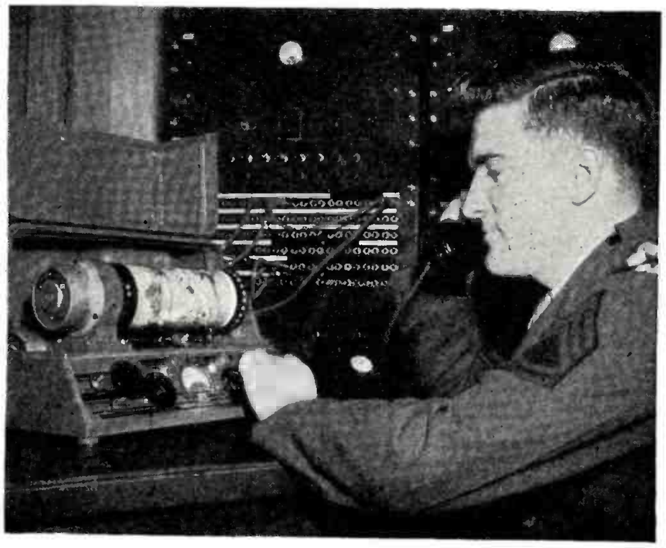
The Army, mindful of public news interest and the importance of public morale, has furnished an "as it happens" service through the medium of its Radio-Telephoto network, in which on-the-spot pictures are flashed to Washington with a minimum of delay.

A Signal Corps photographer at the scene of action shoots his picture and sends the negative by fast courier—sometimes airplane—to a transmitting station. There the negative is developed, a print made, and the picture is quickly on its way through radio channels. Seven minutes later a negative is stripped off a receiving machine in Washington and distribution of prints to news syndicates, magazines, and other publications is begun by the War Department Bureau of Public Relations.

In December of 1941 the possibility of providing telephoto service over Army telephone and fixed radio channels for the transmission of maps, charts, and pictures was

(*Continued on page* 316)

Small receiver through which pictures are transmitted to and from overseas points. Switchboard controls operating connections.



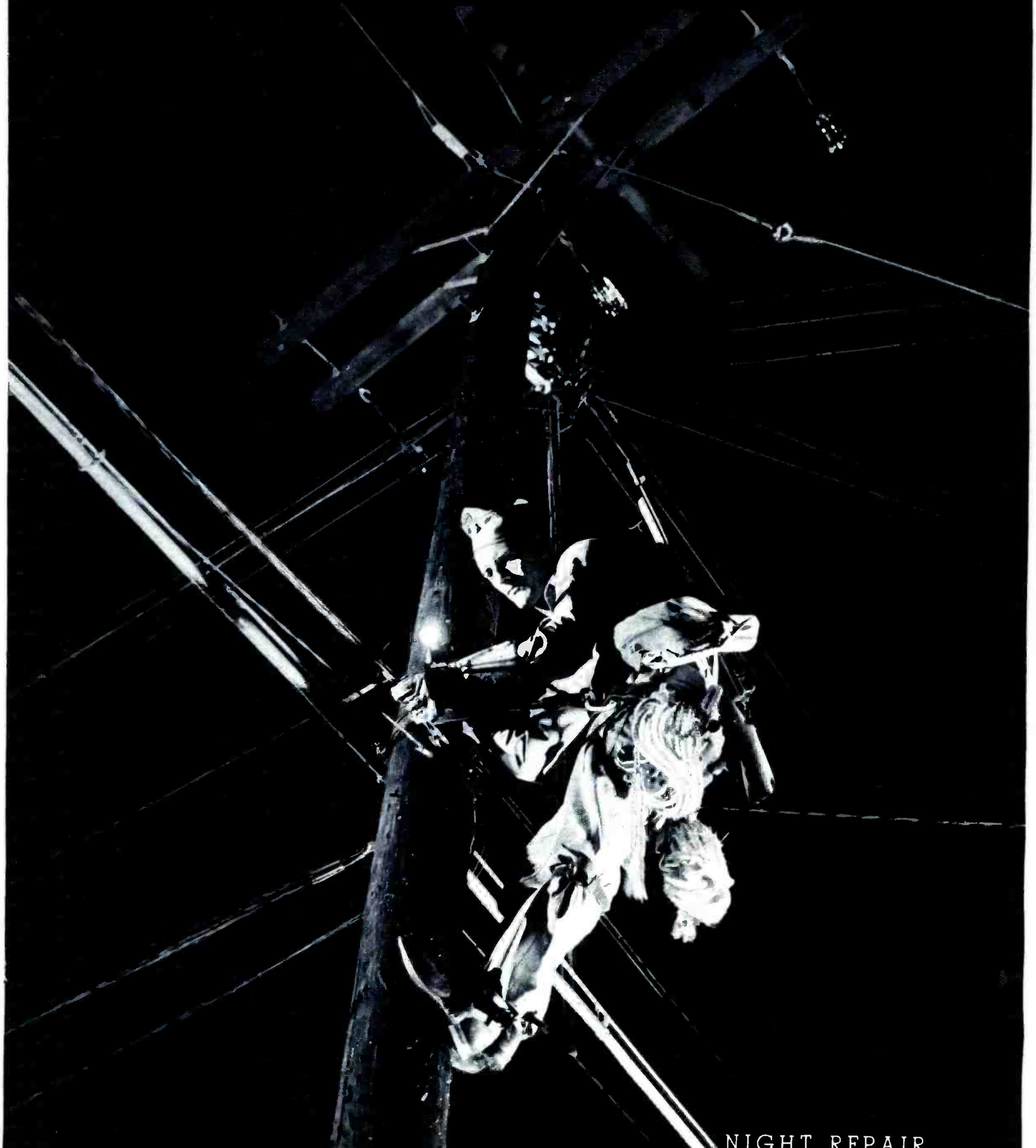
The first actual Signal Corps radio-telephoto news picture, March 18, 1943, showing gun crew on the alert in North Africa.

Radio-telephoto of American Infantry troops cautiously entering Acerno, Italy. Picture clearly shows many original details.

Famous Jinx Falkenburg test picture which was sent back and forth across the ocean over a hundred times during experiments.

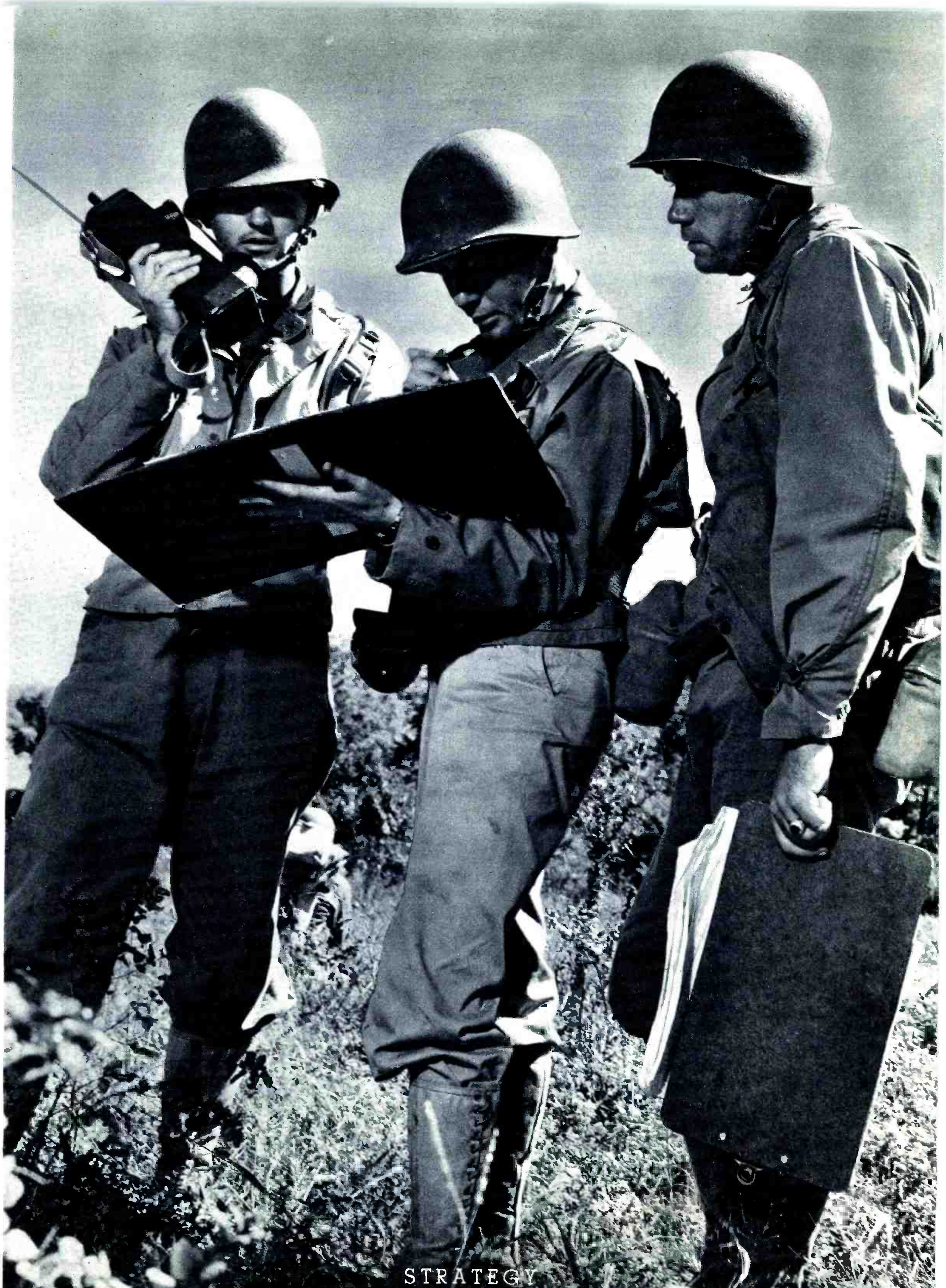
SIGNAL CORPS PORTFOLIO

The Signal Corps in action—dramatized in the photographs that follow



NIGHT REPAIR

DIRECTION FINDER

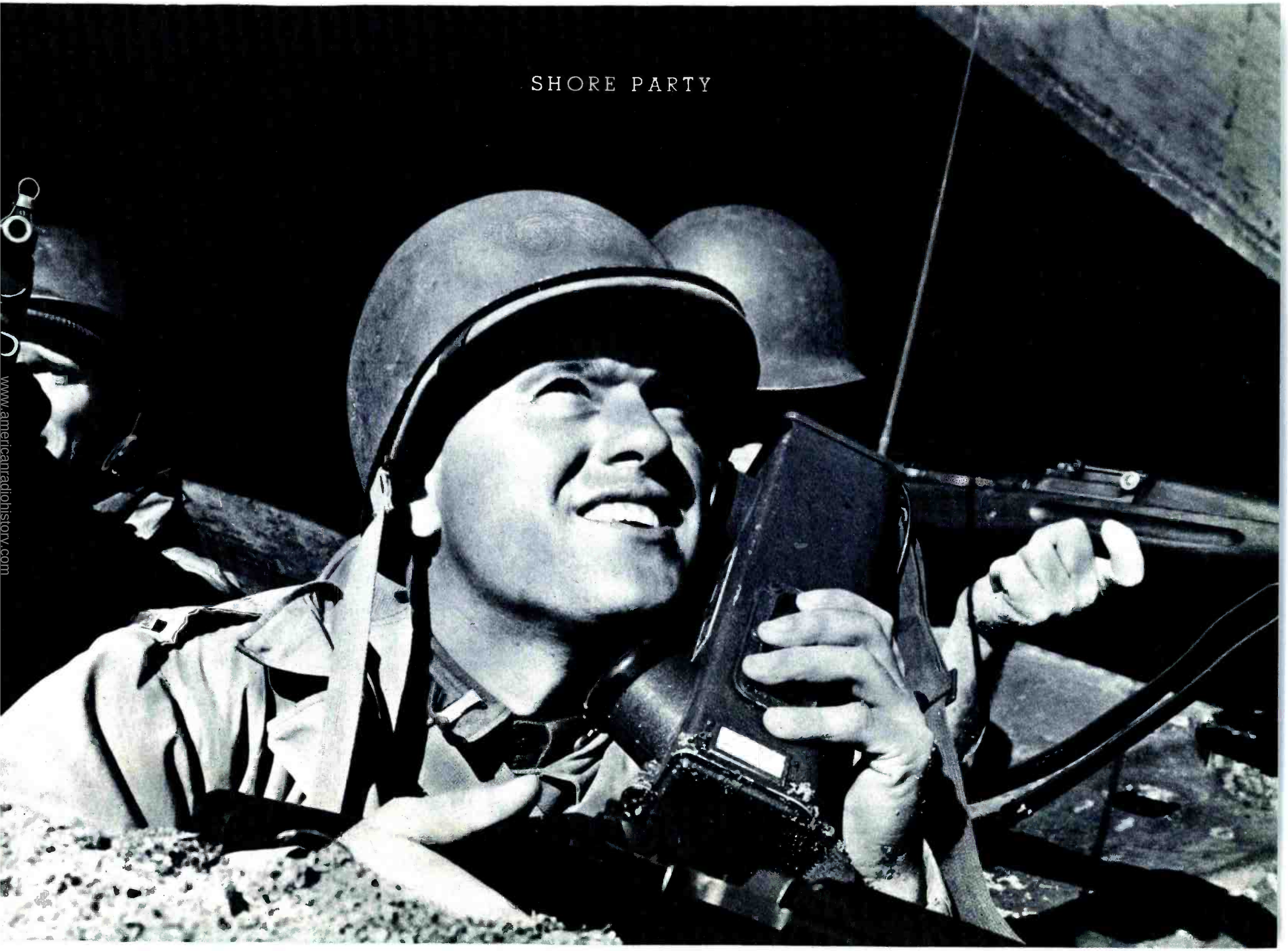


STRATEGY

MINE DETECTORS

LINE REPAIR

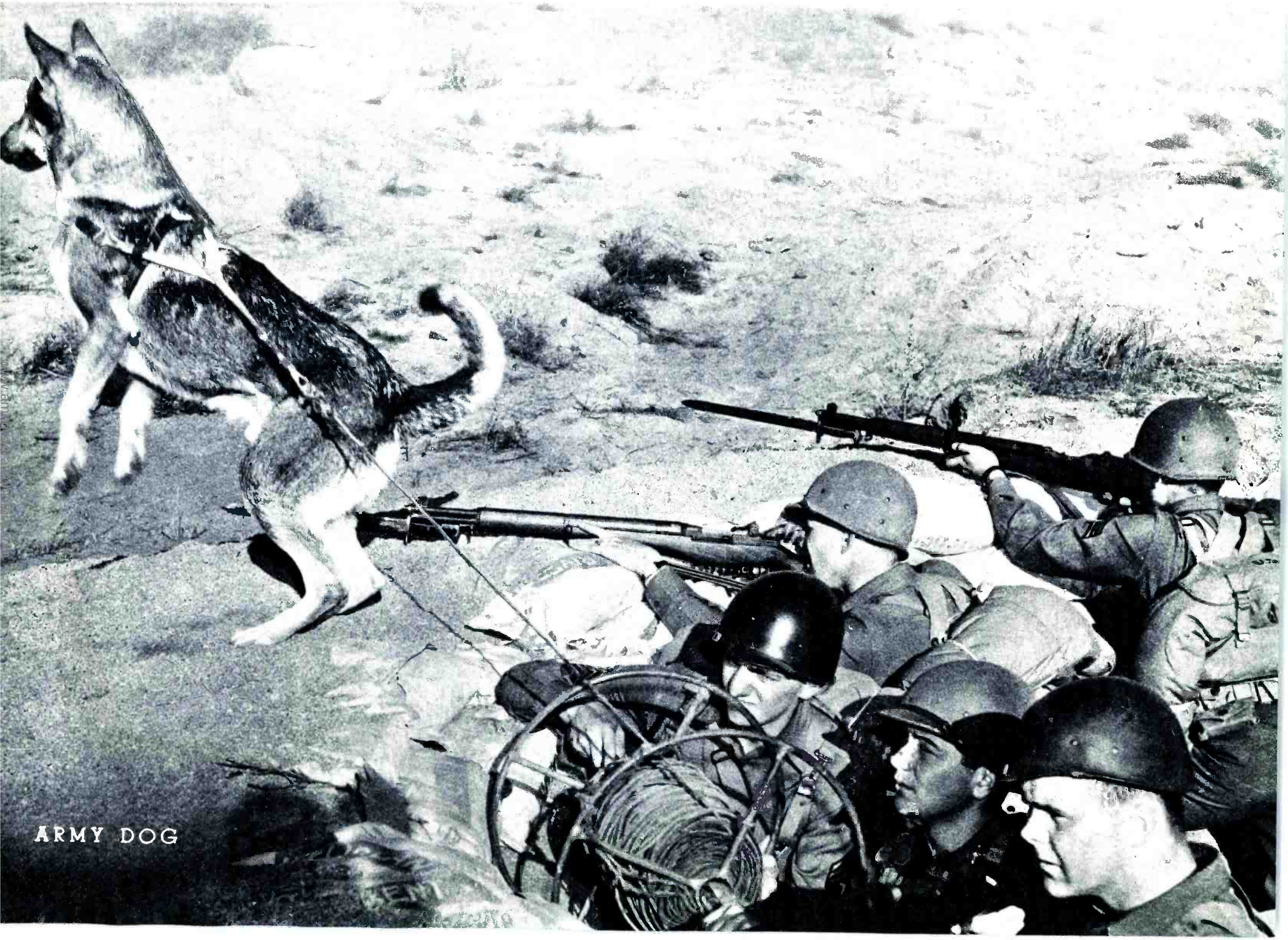
WINTER MANEUVER


SHORE PARTY

PIGEONAIRE

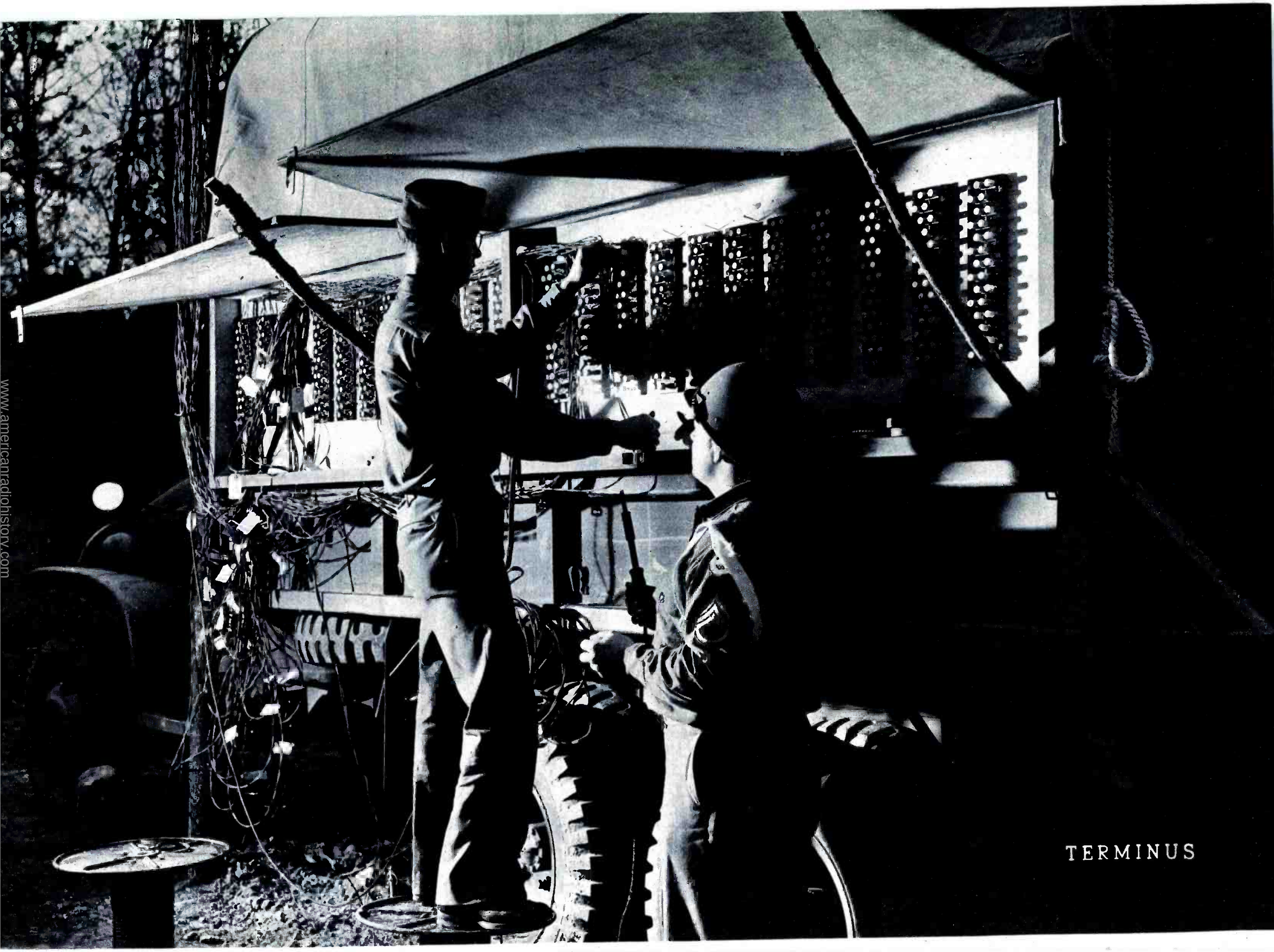
MESSAGE RECEIVED

WIRE CREW


ARMY DOG

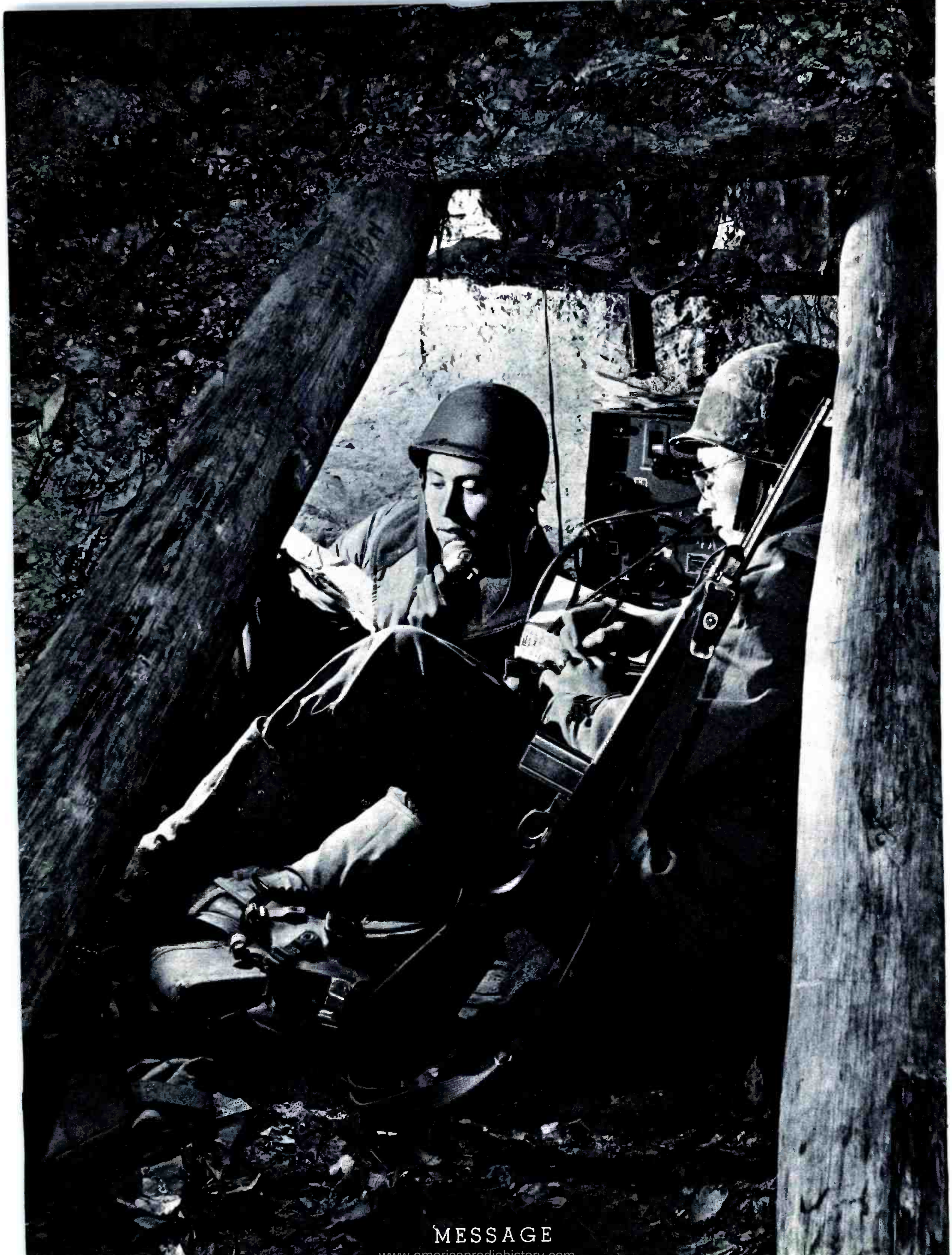
EARTH BORER

WIRE TRUCK

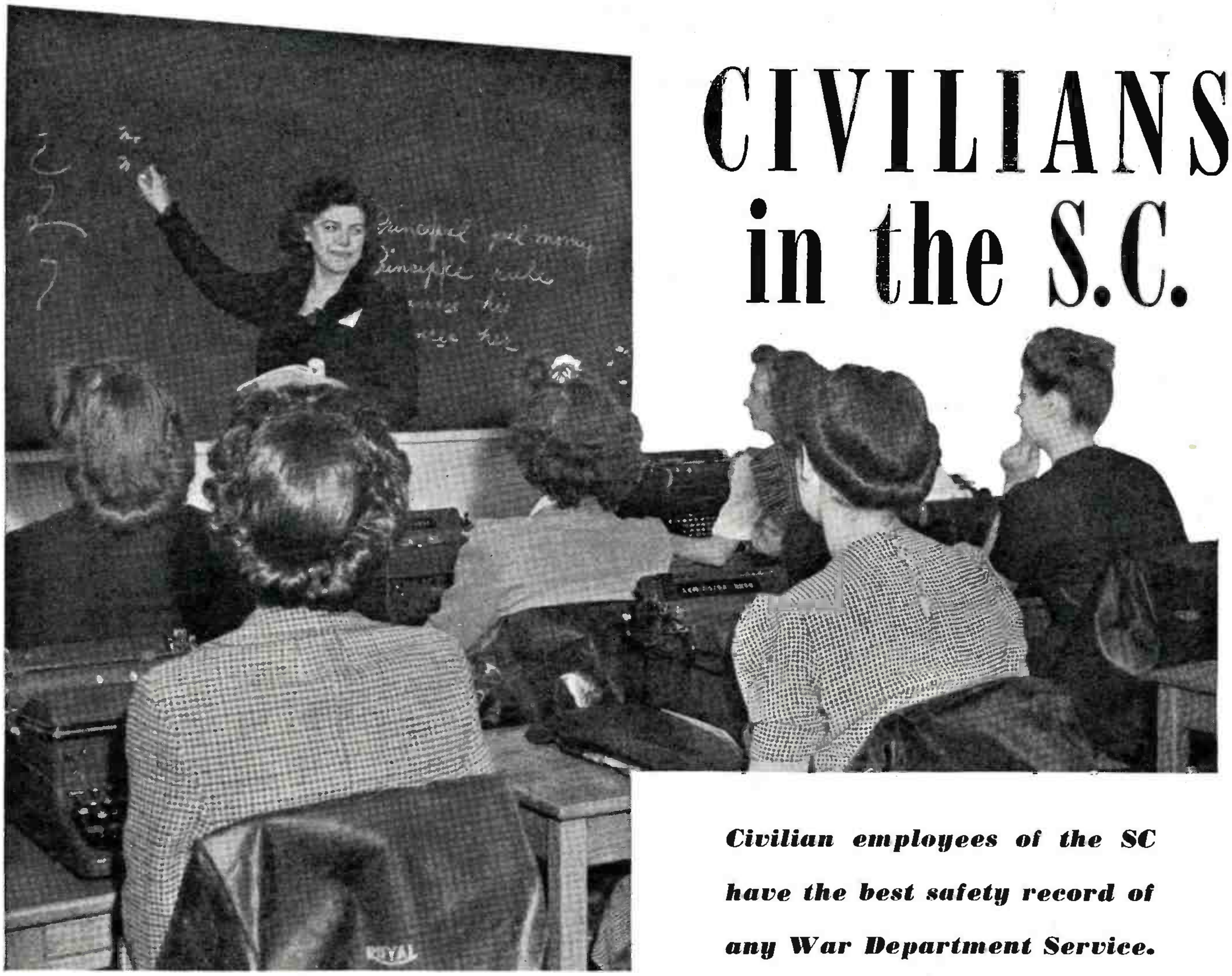


TERMINUS


UNDER FIRE



MESSAGE



Many civilians are being trained for important positions.

CIVILIANS in the S.C.

Civilian employees of the SC have the best safety record of any War Department Service.

By Colonel HARRY O. COMPTON

Born in 1903. Was graduated from the University of Washington, receiving a B.S. degree in Electrical Engineering in 1926, and commissioned 2nd Lieutenant in the Officer Reserve Corps following his graduation. Worked with Pacific Telephone & Telegraph Co. doing traffic methods, personnel, and management. Entered active duty August, 1941; first assignment was organization of the Postal Censorship Station, New York City, which he headed until April, 1943, when assigned to his present position as Chief of Civilian Personnel Branch of the Signal Corps.

OUT over the packing cases and machinery, the desks and work benches, from a multitude of loud speakers, soar the stirring strains of the Star Spangled Banner.

". . . . O'er the land of the free, and the home of the brave."

As the final notes end, 8,000 men and women take up their tasks for a new day, one day nearer to a victory they will have had a hand in shaping. They are all civilian employees of the United States Army Signal Corps.

The scene above described is the Philadelphia Signal Corps Depot. But from coast to coast, all up and down the land, and in foreign countries the world over, other thousands of men and women in mufti are doing jobs of all varieties with the same single purpose—that somewhere, in some far-off land perhaps, grim men in olive drab can "get the message through."

There are more than 40,000 of these Signal Corps civilian employees.

Who are they? They are Mr. and Mrs. and Miss America. They are all ages. They are fresh from high school and back from retirement. They are all races. They are from every walk of life. They are earning the first dollar of their lives, and they have given up $100,000 a year to help the war effort.

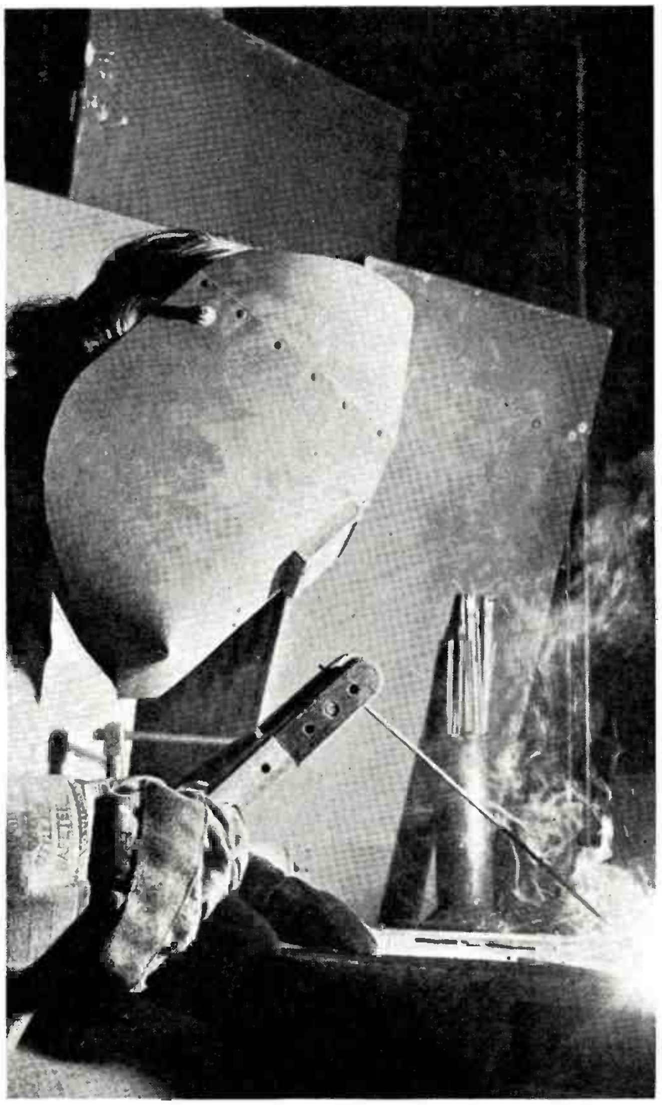
They are workers and experts of countless kinds—accountants, executives, filing clerks, photographers, stenographers, warehousemen, instructors, electricians, engineers, draftsmen, cabinet makers, radio operators, and repairmen, crystal cutters, pipe fitters, tool and die makers, typewriter repairmen, janitors, charwomen, and laborers.

What sort are they? Statistics show that they are among the healthiest workers in governmental service. They keep absenteeism to a minimum. They have the finest safety record of any War Department service. They've never presented the Signal Corps with a "labor problem." They know they're doing their jobs for more than money, that they're working for the same thing their husbands, brothers, sons and sweethearts in the service are working for—the destruction of totalitarianism. They'll "step up the pressure" when there's emergency work to be done. Their war bond purchases lead other groups. Their own ideas and suggestions have saved Uncle Sam thousands of dollars. Those are a few of their attributes.

Though it may seem paradoxical, their numbers have

Signal Corps laboratory assistant performing a shaft-turning operation on a lathe at Fort Monmouth.

Graduate of a civilian training school operating electric welder.



decreased as the war effort expands. Only a few months ago, there were approximately 60,000 civilians working for the Signal Corps as against the 40,000 today. An analysis makes the reasons for this apparent.

On December 7, 1941, the Signal Corps, like all the rest of the armed forces, was presented with a gargantuan task, and a single, undeviating objective: to produce, to get the work out in the quickest possible time. American lives, America's destiny, depended on it. Never mind the precedents or lack of them, the questions, the "hows"—do it! If workers are needed, get them. If trained workers aren't available, train them.

From schools and colleges, from offices and laboratories and factories, from their garret and basement short wave sets, the Signal Corps recruited them. Radio hams by the hundreds answered their country's call for their talents and went to work for the Signal Corps.

They did the job.

Gradually, the Corps began to settle down to this job. Methods were modernized, systems were streamlined, labor-saving ideas were introduced, efficiency increased as untrained hands became familiar with their work, and tedious paper work was eliminated.

The mushrooming personnel problem was decentralized. Where, at the beginning, every step in personnel management had to be reported to Washington, field supervisors now hire, fire and promote their own employees. That saved tons of reports, hours of time and hundreds of extra employees.

Thus, at a time when the country was feeling the severest pinch of diminishing manpower, the Signal Corps was able to make thousands of workers available for pressing jobs and to save millions of taxpayers' dollars.

Being boss over 40,000 jobs, is a large job in itself. It involves payrolls, records, training, housing, safety, health, production, efficiency, long range planning, and even the problems of Mrs. Jones' expected baby, and Ike Turner's feud with the foreman.

So let us examine U. S. Signal Corps, Employer.

"The boss" is alert to employment opportunities.

Fifty per cent of the employees are women. Except for the Medical Department, with its to-be-expected high proportion of trained women workers, that is the highest average in the War Department.

There is nothing traditional about the occupations of the

Feminine worker at the Signal Corps General Development Laboratory adjusting vehicular-radio equipment.

Signal Corps women. They are truck drivers, guards, mechanical repair experts, executives, and inspectors passing on intricate mechanisms.

In many of their new jobs, they have proved superior to men. They are particularly adept at work of a highly repetitive nature, requiring light, manual dexterity. Monotony jobs are their meat. Where men tire and grow bored, woman's efficiency remains unimpaired.

"The boss" is interested in his employees' welfare.

Housing, health, safety, education, recreation and private problems, financial and otherwise, are the concern of the Signal Corps Civilian Personnel Branch. These activities are based on the proven theory that happy workers are efficient workers.

Recreational functions are designed to build a spirit of team work and knit the employees into a co-operative family. Dances and other social affairs are arranged.

Off-duty classes are conducted in such subjects as French and Spanish. Self-supporting lending libraries have been formed. The importance of diet and rest are taught.

Counselling services have been set up where employees can take their personal troubles, anything from a domestic difficulty to an entanglement with loan sharks, and get sound advice and help.

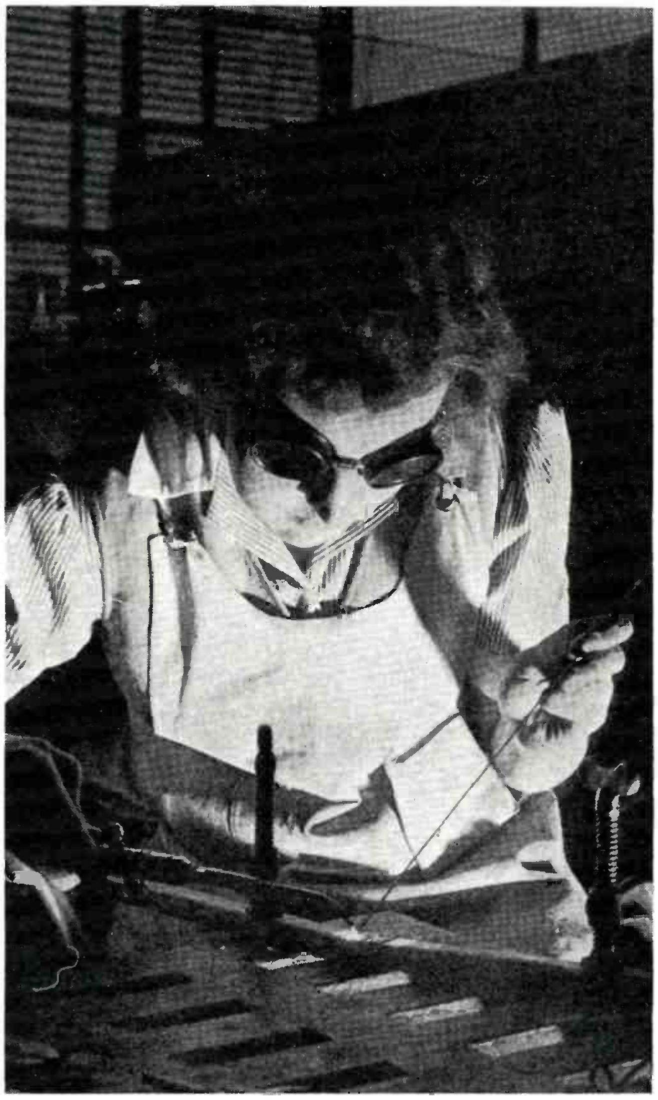
"The boss" makes a real effort to be fair.

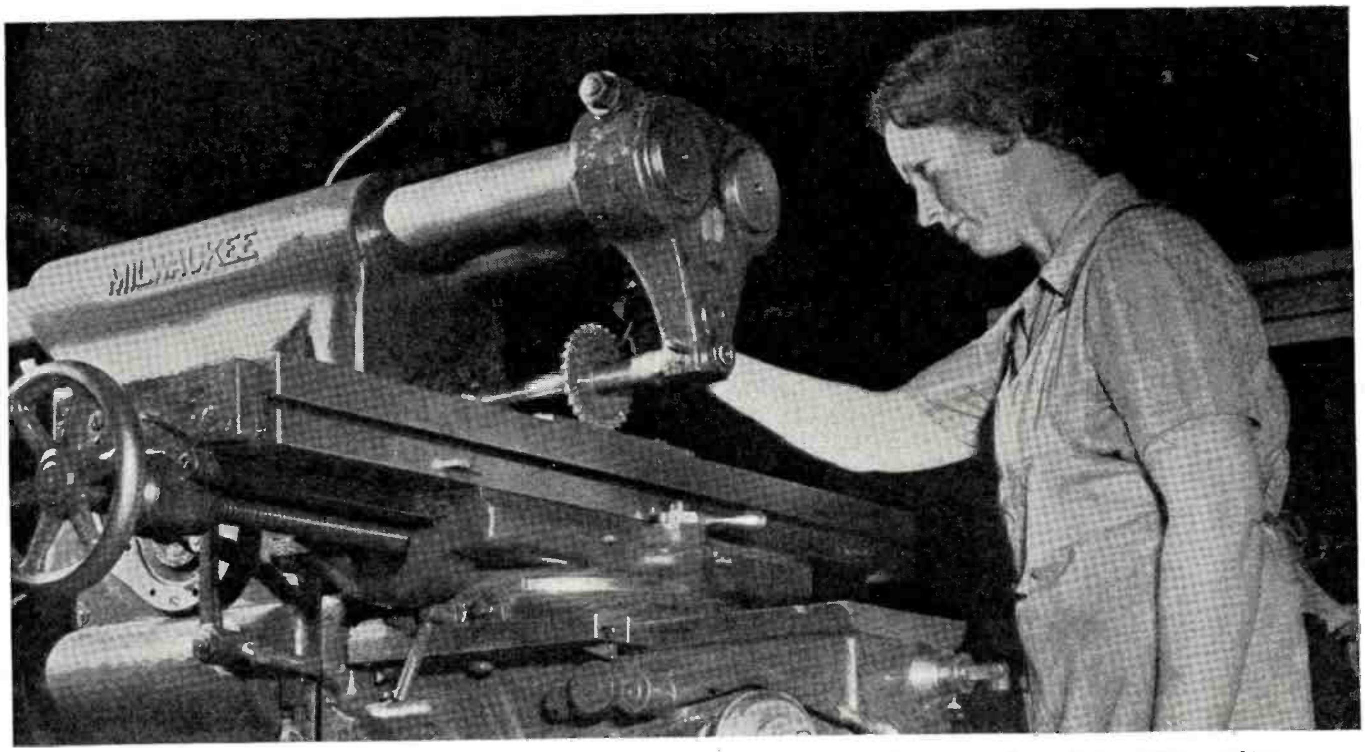
If an employee feels he is getting a raw deal, that he's in the wrong job, that his superior is mistreating him, or that he is being fired unjustly, he appeals to the Employee Relations Section in his installation.

If it is determined after investigation that the employee is being discriminated against or unjustly discharged or that his rights and privileges under Civil Service are being infringed upon, it is rectified. Often, the section has been able to make an efficient worker out of a poor one, by effecting a change of jobs. Sometimes it is a human obstacle, like a clash in temperaments. Sometimes it is a case of the right man or woman in the wrong job.

To every workingman and woman the most important factors in the administration of his job are the payroll and his vacation rights. Slipshod attention to these details can nullify all the other efforts. For that reason, the Civilian Personnel Branch has made it a rule that the payroll must be on time, if bookkeepers have to work all night for a week. Many of the Signal Corps personnel live on a small margin—thousands of them are in the civil service classi-

Welding radio-electronic equipment, using oxy-acetylene welder.





After completing her period of fundamental training, former sewing-machine operator now works on large milling machine.

Signal Corps inspector comparing raw quartz with finished crystal.

Civilian employee trained to operate high-speed tapping machine.

fications of $105 and $120 a month—and delays in the payroll can bring tragedy. Vacations of the Signal Corps employees are computed on a basis of accumulated time, and the same promptness is required in making available to them their record of time due.

"The boss" uses psychology.

Leaders may be born, but good leaders must be made. That is why the Signal Corps trains its supervisors in the best methods of getting the maximum efficiency from their subordinates.

They learn the value of words of praise and encouragement, and how to correct. They are taught that the object of criticism is improvement, not punishment.

It isn't school book theory stuff, either. The problems they study are their own, brought in by themselves from the shops, and discussed for the benefit of all.

Through Americanization meetings, often addressed by famous leaders in American life and returning war heroes, and through motion pictures such as the "Why We Fight" series and shorts showing the results of their work on the battlefield, every employee is made to realize the importance of his job. They supplement the continual activity carried on by printed matter and amplifiers, to inspire workers in Signal Corps installations.

"The boss" fosters enterprise.

One of the most productive schemes that has been initiated among Signal Corps personnel is the plan for employee suggestions. Cash awards for suggestions vary roughly in proportion to the amount of money saved by the idea. Suggestion boxes are conveniently placed for the personnel and the range of the suggestions that pour into them are limitless—inventions, improvements in machinery and methods, and valuable ideas for phases of the war effort far removed from the Signal Corps.

"The boss" trains his employees.

When the war came, the greatest of all the problems to confront the Corps was the lack of trained personnel.

So the Civilian Personnel Branch went into the training business.

Training ranged from simple courses for typists to meet the stenography shortage, to elaborate courses in engineering.

An engineer can't be trained in a flash, so those that were available had to be spread out thin. To do this, the Signal

(*Continued on page* 438)

SOLDIERS IN MUFTI

Women learning radio and telephone repair at the Philadelphia Signal Depot. 10,000 have been trained since 1941.

Civilian personnel of the Corps wear no hero's garb.

By 2nd Lt. M. SONTHEIMER

Author of "Newspaperman," he started his career as reporter and feature writer for various leading newspapers in the East. This experience led him to the San Francisco News where he held positions as Assistant City Editor, City Editor, and News Editor. He entered the Army as a volunteer in 1942 and was graduated from the Signal Corps School in June, 1943. He was on temporary duty in the office of the Chief Signal Officer from July until September of that year. At the present time, he is serving overseas in the Signal Corps Division of the United States Army.

Radio-operating room of a military station in Atlanta, Georgia. Civilians have relieved many military personnel for active duty.

AT FIRST animals fought with fang and claw and hoof and lashing tail. Paleoethnic man emulated them until one human swung a club and another heaved a rock. Then conflict became a war of weapons. The club was sharpened into a knife and the knife became a spear and the spear became an arrow and each made a different kind of war.

Soon man set fire to his enemies' villages, and fire became a weapon of war. But to set fire to your enemy's property you had to touch it and he could kill you before you got that close, so that was not altogether successful. Then some pelt-clad warrior hurled a torch! And some sage tactician fitted the torch to the arrow.

Later a slant-eyed scientist of old China, experimenting with combustibles, found a formula for one that would explode! Then conflict underwent a radical change and we had the war of munitions.

Alexander put his troops on elephants and Atilla mounted his on horses to scourge the civilizations of their days and to change the ways of war.

In our times the automobile and the airplane gave war a whole new suit of armor and from it evolved forts on flexible wheels that moved through forests and over shell craters; forts on wings that dumped death by the ton.

That was "mechanized war." It had its inception in World War I, and not by any means in this one.

In all of those conflicts, even that first mechanized one, armies met armies, each time on some given battlefield, and that was the war. Not so today. This is the war of the peoples. The War of the Nineteen Forties wears a

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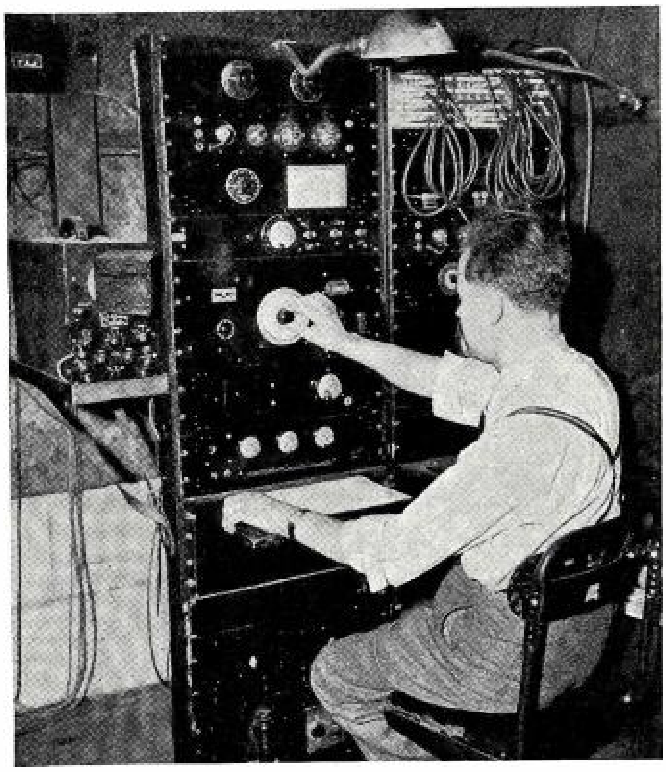


Radio engineer—obtaining data from curve-tracing equipment.

The RADIO INDUSTRY

To meet the demands for our Army supply program—the manufacturers have given their maximum efforts. The suppliers are "doing a job."

RADIO used as an instrument of war is incomprehensible to most of us for whom radio is associated with the finer things of life. Very few people can visualize it as an aid to the destruction of a ruthless enemy, yet today radio is serving on every battle front, on every ocean and in every sky. The very same elements that make up peacetime radios are contributing to the winning of the war and the same industry that produced these radios during peace today is geared fully for war. The complete mobilization of the industry, which has been in effect since early 1942, is the most all-embracing that has ever been seen in the history of our country. Men, materials, ideas, plants, and management are all harnessed in a stupendous effort to supply the finest communications equipment made in the world today to our Armed Forces. Production demands have continually been increased and yet these records have continued to be broken until we are producing at an all-over rate of better than 2000 per cent of our normal peacetime operation. The record here set forth can delineate only part of the outstanding achievements of an industry that is essentially American in character, ideas and performance.

Management

An examination of the problems which faced management at our entrance into the war, foreshadowed the tremendous strides which the industry was to make. Immediately following Pearl Harbor, the radio industry which had been, up to that time, supplying only a portion of its output to Lend-Lease and other Government services, was asked to convert 100 per cent to war production and to supply every communication need for our Armed Forces in whatever quarter of the globe they were to be stationed. The problem of major importance to management was the increased production necessary entailing decisions regarding space, manpower, finances, and materials. The space problem was generally solved in one of two ways; either the plant was expanded by renting additional adjoining space or entirely new plants were built with materials supplied under priority assistance from the Government, although many times a combination of the two methods was used.

Manpower was one of the foremost problems of management. While the status of the radio company employee has undergone many changes, it still remains in a very critical state as far as the radio industry is concerned. In its fight for ever increasing production, the addition of women, upgrading and training were tried but none of these proved to be the complete answer.

The local draft boards were, by law, no respecters of persons—so naturally many key men were withdrawn from plants, thus further complicating the manpower situation. Common sense on the part of management, the cooperation of local draft boards, and the aid of the W.M.C. were utilized in devising a plan of orderly withdrawal of men from industry. However, the problem remains unsolved, since there still remains such factors as training, absenteeism, rapid turnover, and inadequate supervisory personnel to be considered. As each of these problems arose, the Government, in cooperation with the manufacturer, tried to find the answer, but a failure to find the solution leaves the greatest problem in the industry.

Finances became one of the manufacturer's minor problems, since with the letting of large contracts by the Government, the manufacturer became a good credit risk, both to his bank and to the Government, which made it possible for him to borrow the neceessary money to carry on his business under wartime expansion.

However, the need for more money to prosecute the war laid additional burdens on management in the form of additional excise and income taxes. This, coupled with the tremendous amount of paper work necessary to keep track of withholding taxes of employees, might well have formed a stumbling block in an industry less well organized and less used to employing large numbers of people.

Materials were perhaps the greatest bottleneck in the whole setup, for with every manufacturer increasing production and each needing almost the same materials, chaos was inevitable. The advent of priorities on raw materials gave the manufacturer an entire new set of headaches, as whole departments had to be set up to handle the material problem. One of the major tasks of such departments was the filling out and answering of the flood of Government forms without incurring the penalties which were prominently displayed on each. From priorities, the industry progressed to the C.M.P. and the attendant complications which for a time seemed unsurmountable. The situation has now improved to the point where restrictions have been eased on many of the critical materials. This trend will no doubt increase in tempo from this point on.

In total conversion, such as the radio industry was undergoing, peacetime methods of operation had to be discarded. Among these changes were those of normal distributor and consumer operations, upon which the industry had been built. Efforts were made in almost all cases to distribute efficiently and fairly any remaining stock of civilian merchandise and to protect, as far as possible, the distributor who is so important in normal operation of the radio industry.

It is to the credit of the manufacturers in the radio industry that when they were faced with this demand on their resouces, all responded to the best of their individual abilities. These men gave unstintingly of their time and placed their entire businesses at the command of the Government. For the first time in the history of the industry unified cooperative action was available, individual and personal considerations were forgotten and the supplying of the communications needs of the armed forces became the only goal.

Engineering

The engineering problems posed by the war were of a very complex nature, and while not entirely foreign to the engineering procedures used in the peacetime industry, they, nevertheless, had to be solved before economical and efficient operation of a war plant was possible. One of the more serious problems which engineers had to face was the archaic specifications used by many Government agencies. Another problem was the lack of unanimity in engineering thought and action between the various departments of Government and industry. It became necessary almost immediately for engineers to clarify specifications, to decide upon a unanimous policy, and, greater than all the rest, to so present this problem to the various Government agencies that they, in turn, could begin to have a common course of action in engineering matters. The Procurement Division of the Signal Corps did much to bring about the fulfillment of this idea of straightline engineering thinking, both in specification and performance.

Prominent engineers of executive caliber were drafted into Government service; other engineers were taken directly into the armed forces where their talents could be most useful to the war effort. Through the coordination of the aforementioned agencies and these engineers, order began to emerge out of chaos; specifications which varied from company to company for the same type material were changed so that any company capable of supplying any need of the Signal Corps was able to use a standard set of working specifications.

In examining the structure of the engineering departments of the manufacturers in the radio industry, it was found they were of three general types. First, the large, well-organized, efficiently operating engineering department of the larger company; second, the medium, fairly well-run engineering department of the smaller manufacturer; third, the poor, or practically non-existent type which was prevalent among the very small manufacturers in the industry. It became evident immediately that in order to receive the maximum amount of help from the medium and very small engineering departments much work would have to done; since these departments were relatively poor in men and equipment and had little or no idea of correct engineering procedures.

In the letting of contracts by the Government, one of the major considerations was the type of engineering departments available. In the case of the large manufacturer

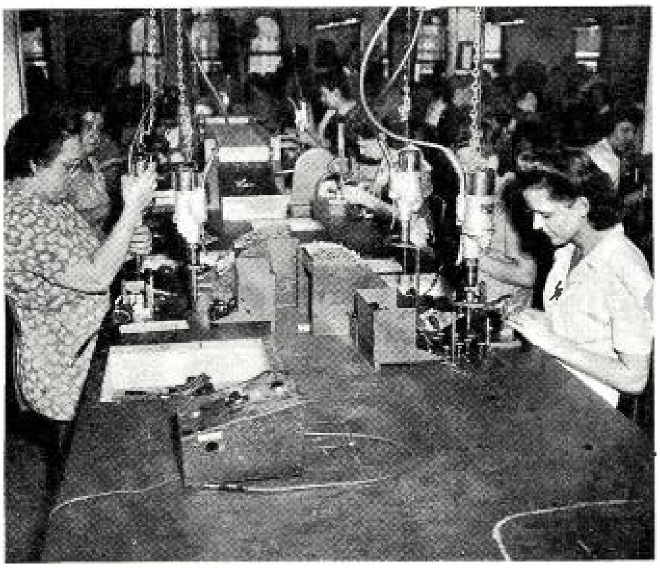
Typical radio-assembly plant laid out for high-speed production. T17 microphones are being assembled, inspected, and tested.

Testing raw materials. Many new substitutes for critical materials have been developed by the radio research engineer.

contracts could be let immediately since adequate engineering staffs were available to put them into production. In the case of the medium-sized manufacturer, greater care had to be exercised since some of the engineering departments were not equipped to do more than a small amount of production engineering. The smallest manufacturer, of course, was in no position, either from a design or production standpoint, to take advantage of Government contracts.

The Government wisely decided to take advantage of all types of manufacturers by its "bits and pieces" program. By that is meant that all communications equipment was broken down into its component parts and each manufacturer could, according to his ability, contribute his share to the completed product. This permitted a high degree of specialization which resulted in a much better type of equipment.

Soon after manufacturers began to supply materials to the Signal Corps under this program, engineering departments began to give a great deal of thought to the re-designing and to the re-writing of specifications for communications material. As a result of this cooperative program, many changes in design were effected which brought about a better product than was available before. Perhaps the greatest problem which these peacetime engineers faced was the realization that the manufacturer of communications equipment to Government specifications presented new and more rigid requirementts than those with which they were accustomed to working. This challenge became a stimulus to finer engineering performance.



Operators assembling bakelite cases. Automatic high-speed guns are used to increase production of electronic equipment.

It is evident that the need of manpower in the engineering field, as the result of this expanded Governmnt program, would become acute. This proved to be the case, and industry and Government were forced to take suitable action. The problem was attacked in a number of ways; first, junior engineers who showed some talent were up-graded and given more responsibility; second, the Government sponsored tuition-free courses in a large number of engineering subjects in most of the trade schools and universities of the country, where specialized knowledge of engineering subjects could be gained by attendance after working hours by interested engineers, third, students, both men and women, were given training in engineering and laboratory methods which enabled them to be taken directly into the engineering departments, in a junior capacity, to fill the need for laboratory technicians and other beginner-grade engineers.

At this time, the Government decided that the senior or executive engineers in many of the plants could be of further service by serving on technical boards and committees in an advisory capacity to Government. It is to the credit of these men that even under this additional burden they were able to discharge their obligations in so outstanding a manner that our engineering production has far outstripped that of our enemies. Another very serious bottleneck developed in the engineering laboratory due to the lack of adequate testing equipment. With the tremendous demands made upon them by the Armed Forces, the test equipment managers were not able to keep up with the requirements for the laboratory-type equipment neccessary. This was a serious handicap for a time until sufficiently high priorities were given to engineering laboratory orders to enable them to compete favorably with the armed forces and other agencies for a supply of this equipment. One good result of this program has been to make available laboratories more completely equipped than ever before, which fact, no doubt, will contribute heavily to the maintenance of an engineering output of high caliber in the postwar period.

On the whole, the engineering laboratories of the industry have completed 12 to 15 years of development under ordinary conditions in a short two years. This was made possible by several factors: one, the increased manpower which industry was able to bring to bear on its problems stimulated the output of the laboratories; second, many improvements which were in the laboratory state of development but which had not been developed commercially, were brought up-to-date and released; and third, many developments which, for one reason or another, had never gotten out of the laboratory stage, were now completed and put to useful service.

In discussing the achievements of the laboratories, we must not overlook the most important element, the engineers themselves These men worked long hours of the day and night, and drove themselves unmercifully in order that American "know-how" might overtake and surpass the head-start which our enemies enjoyed. They would be the last to asked any recogniition for this outstanding performance, but the industry and the nation would be very remiss if recognition were not given to their contribution to the war effort.

The engineers, by virtue of their war service, have elevated themselves from a mere department in industry to the management level where they have opportunities for greater service.

Production

Production, in the ordinary meaning of the term, concerns itself with men, methods and material. It is only by the skillful welding of these three elements that we are able to have a production weapon such as we have in the radio industry today. The greatest problem at the beginning of the war was that of factory manpower. Under the greatly expanded war production program, plant managers

(*Continued on page* 437)

FM in WORLD WAR II

Freedom from static and other noises is essential for vital communications. The SC FM sets are really "doing a job."

The new FM walkie-talkie. This unit has proven to be more reliable for local communications than its AM predecessor.

By
Major WILLIAM S. MARKS, Jr.

Born in Tennessee, 1900. He attended Naval Radio School at Harvard Univ. He was commercial radio operator for Marconi Wireless Co., and R. C. A. Received B.S. Degree in Electrical Engineering from Louisiana State Univ. He did post-graduate work at Union College & Rutgers Univ. Became a Radio Engineer in Signal Corps Laboratories in 1930. Was in charge, Radio Transmitter Section and Chief of the Vehicular Radio Section. Entered the service in July, 1943, and was appointed to his present position, Officer in Charge of Radio Communications Branch, Camp Coles.

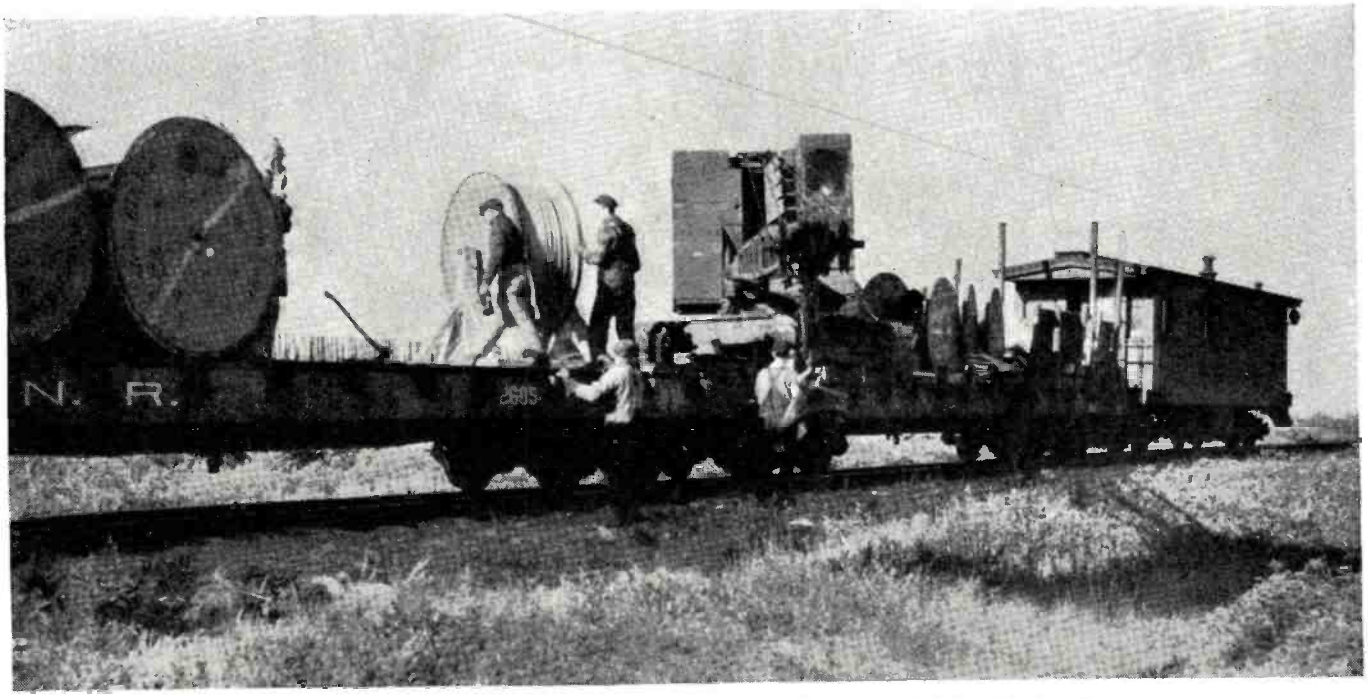
OUR Army's communication equipment is the finest in the world. Outstanding in performance are its FM radio sets, designed especially to meet the Army's requirements for "getting the message through." The American Army is the only army in the world equipped with tactical radio communication sets, utilizing the advantages of this latest revolutionary invention in the radio field.

The success of an army in modern warfare depends more than ever before upon the reliability of its communications. The burden of coordinating the fast moving action of tanks, artillery, and infantry in battle has placed new demands on radio. These demands call for equipment providing the utmost freedom from ignition and electrical noises, static, and interfering signals. The sets must be as simple to operate as a field telephone. Their communication range must remain unaffected by time of day or night, weather or geographical location. All these requirements are being met by the Army's FM radio sets.

These FM sets developed by the Signal Corps Laboratories in cooperation with the radio industry are the result

(*Continued on page* 426)

SCR-610 frequency-modulated transmitter and receiver powered from a Vibrapack. Radio frequency output is about 5 watts.



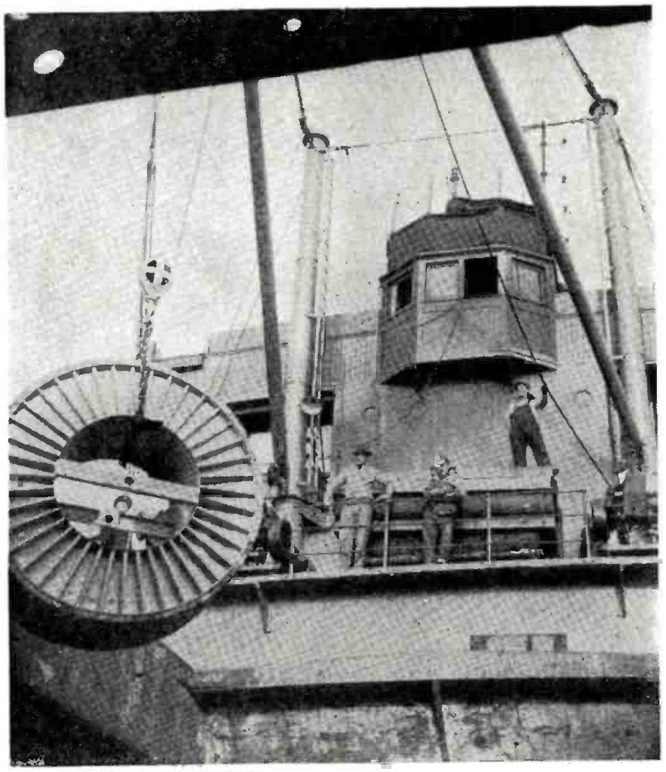
New cable in position on railroad car ready to be played out near Gandar, Newfoundland.

PLANT ENGINEERING AGENCY

The Plant Engineering Agency was established early in 1943 as a field agency of Army Communications Service.

By Col. WILL V. PARKER

Cable reel being unloaded from one of our many cargo vessels.



Born in Texas, 1884. Served in A.E.F. in World War I; awarded Purple Heart. Graduated from the Signal School, 1927. Served as Instructor, Signal School, 1920-23 & 1925-27. With Engineering and Research Division, Office of the Chief Signal Officer; Chief, Communication Division, 1927-31; 8th Corps Area, 1931-37; Assistant Signal Officer, Hawaiian Dept., 1938-39; Assistant Division Signal Officer, 36th Division, 1940-41; Signal Officer, 8th Army Corps, 1941; Plant Div., Office of Chief Signal Officer, 1942. Appointed to his present post, Director, Plant Engineering Agency.

THE Agency is responsible for the engineering, supply, construction, installation, and maintenance of fixed wire and radio communications of the Army—everywhere. What this means is that the Agency is doing a communications job equivalent to the amount of similar work done by all the telephone and radio companies in the United States in any typical year of peace. Its headquarters are in Philadelphia.

In the warfare of the past, the first requirements for troops were food and ammunition. Even a quarter of a century ago in World War I these were still the prime essentials. In this war without precedent, however, there are three requirements of first importance—food, ammunition, and communications. To win we must have better food, better ammunition, and better communications. We must have better communications due to the speedy movement of troops and equipment over large territories. A commander must always be in touch with his various units, wherever they are, through every echelon of organ-

Radio-equipped military cars of the 33rd Reconnaissance Troop.

Vehicular-mounted radio being used during amphibious operations.

ization. And those units are moving as they have never moved before. This makes communications service more vital than ever before.

The Plant Engineering Agency deals only with fixed Army communication installations. The mobile units of communications used in the actual battle zone are handled by other organizations in the Signal Corps. It is where territory is wrested from the enemy—as it has been in North Africa, Sicily and lower Italy, in the Mediterranean Area and Guadalcanal, New Guinea and other islands in the Southwest Pacific—and the American forces plan to hold this ground against counter-attack, that the Agency steps into the picture. It is there that its engineering and supply services culminate in the installation of permanent or fixed radio stations and in the establishment of complete, permanent telephone systems. It is then that the troops assigned to the Agency keep these installations in repair and operation.

Obviously military necessity prohibits being specific but a hypothetical example will give some idea of the work involved by this agency. Let us assume that offensive operations are to begin in a territory that stretches from the sea along a line 700 miles long, flanked on the right by another natural barrier—an impassable mountain range. Within this immense area, there are several important cities that must be captured and held before the operation culminates in a successful action.

The task forces to be used in this theoretical offensive are comprised of the usual combat units—infantry, tanks, and artillery assisted by tactical Signal Corps units and by combat engineers. The advance and every phase of the action against the enemy must be tied in with the Command by field communications. Naturally the communications used will be of the mobile type—radios in tanks and planes, field telephones connected with light field wire, pigeons, runners, and the one-man radio stations—the handie-talkie and walkie-talkie.

While this imaginative combat area might comprise as much as 150,000 square miles, it would be no exaggeration to state that the offensive might end in a victory within a period of two or three weeks. Modern warfare moves at this breathless pace. The enemy is driven out. The territory is mopped up. The civilians in the area are under control. The land is under the American flag and will be defended against counter attack from the foe. The mobile communication facilities must be replaced—and replaced fast—by permanent or fixed installations that are as good and as dependable as the telephone and radio services that we are accustomed to here in the United States—and the installation of these fixed communications systems, radio, and wire, is the job of the Agency.

The Agency just doesn't wait around and get into action when the triumph is reported in the press. Its work begins the moment the plans of operation are approved by the General Staff.

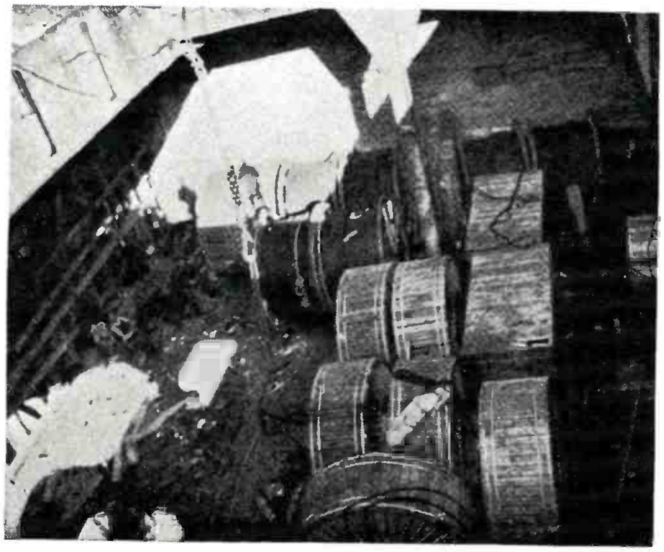
With the facts at its disposal, plus the experience of the members of its staff, the Agency can determine in Philadelphia—thousands of miles away from the action—just what will be needed to supply the territory with the right kind of permanent communications. Most of the officers and many of the communications experts attached to the Agency are thoroughly experienced executives from the telephone and radio companies, who have been generously released from their civilian occupations in order to lend their skills to the winning of an Allied victory within the least possible time.

Agency engineers take the factors at their disposal and draw up plans and specifications for the type of installations that will be required to serve the Army in the

(*Continued on page* 439)

Destroying military equipment is imperative when capture is imminent.

Cable reels in hold of ship, prior to shipment to foreign ports.



The Signal Corps Wac

Women are playing a very important part in the Signal Corps by handling "man-sized" duties.

By Col. OVETA CULP HOBBY

Born in 1905. Graduated from Mary Hardin Baylor College and University of Texas Law School. Became Executive Vice President of Houston Post, Director of the Southern Newspaper Publishers Association, and a member of American Association of Newspapers. Member of Board of Regents, Texas State Teachers College. Served as Parliamentarian of Texas House of Representatives and as Assistant City Attorney to Houston, Texas, being appointed to the post of Chief of Woman's Interests Section, War Department Bureau of Public Relations, 1941. At present is Director, WAC.

FROM the inauguration of the Women's Army Corps, the potential usefulness of members, in carrying out Signal Corps duties, was recognized. Women's agile fingers and ability to stick to routine jobs for long periods of time without tiring had been demonstrated time and again in civilian life. Women could do equally well in the Army.

As far back as the first World War, the Signal Corps had recognized the superiority of women as telephone switchboard operators, and the advantages to be gained by using women to replace men, who would then be transferred to combat duties. About 225 women who spoke both English and French were trained as local and long distance operators and sent abroad. They were assigned mostly to the large military toll centers and to central offices where local traffic was heavy.

The success of these women in the first war made the Signal Corps anxious to obtain the services of members of the Women's Army Corps. The Chief Signal Officer was one of the first Chiefs of Service to contact WAC headquarters regarding the possibility of securing Wacs for communications duty.

In a few months, a number of Wacs were on jobs formerly done by soldiers. The competent voices of women soldiers were heard on switchboards in Army installations both in this country and abroad. Their nimble fingers were tapping teletype and telegraphic messages. They were entering the photographic and radio field of Signal Corps.

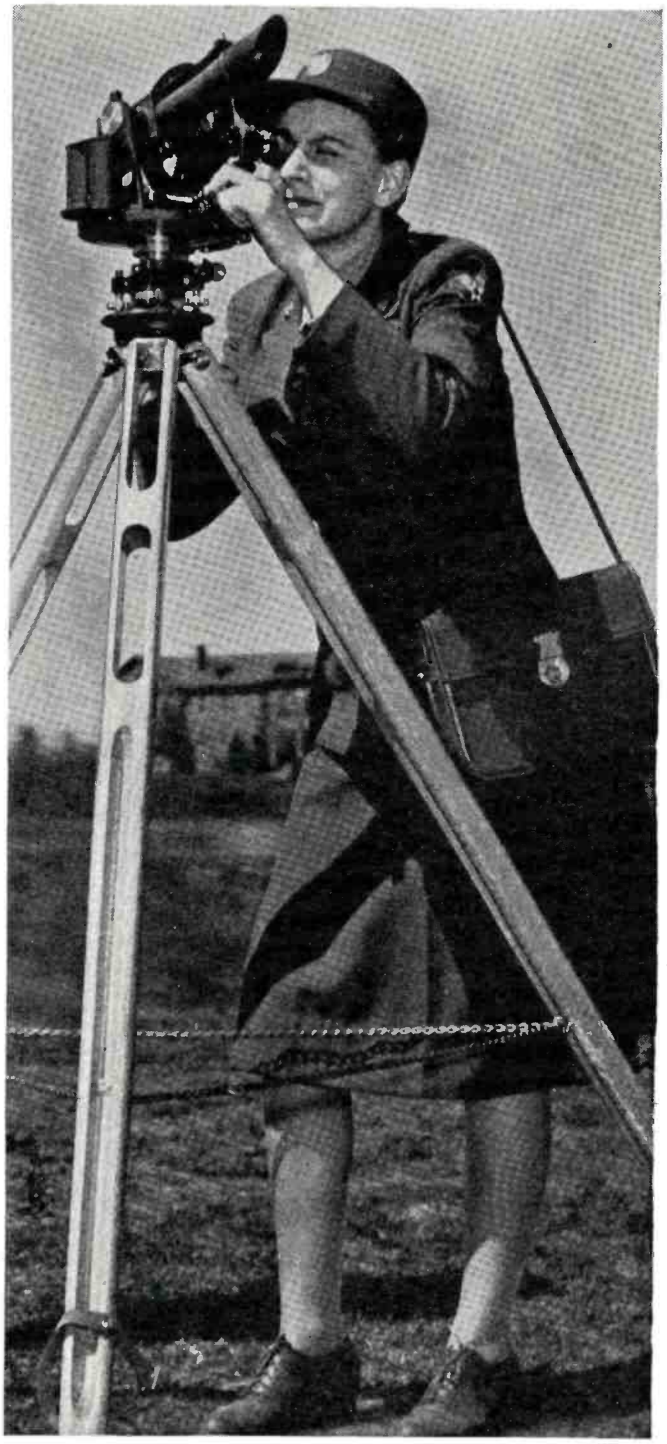
In preparation for the jobs which they would do, women in the radio field were given intensive training as operators and repairmen. Three schools were used: the first to open was the Midland Radio and Television School at Kansas City, Missouri. Later, opened were the United Radio and Television Institute, Newark, New Jersey; and the Keystone Schools, Inc., Hollidaysburg, Pennsylvania.

Women had been carefully selected for these schools on the basis of their Army General Classification Test—out of a possible score of 163 points, a score of 100 was ne-

Control tower operator giving instructions to a student ship for a take-off at Turner Field, Albany, Ga.

Wac with microphone, testing tower-to-plane radio communications.

Feminine radio operator sending and receiving coded messages.



Theodolite being used to record the wind velocity and direction.

cessary to qualify for the operator's course, and a score of 110 or better for the repairman's course. Women also were given the radio-telegraph operator aptitude test, in which they needed a score of 100 or better to qualify for the operator course. For repairman, a mechanical aptitude test score of Army grade 3 or better was required. To be an operator also meant that the woman was able to type at least 30 words per minute.

Women soldiers worked side by side with the men at the schools, tearing down radios, learning to wind coils, take voltage readings, splice wires, analyze circuits, etc. The instructors were amazed at the ease with which women became accustomed to the intricacies of building and repairing radio sets.

Other women, who had experience or knowledge of photography, were and are assigned to the AAF Photography School at Lowry Field, Denver. Wacs are being trained for Signal Corps duties there. They learned how to develop negatives and print pictures, how to mix their own solutions and repair cameras. By October, 1943, almost 400 had taken this highly technical course and had been assigned to positions in the field.

At Camp Crowder, Wacs are at work raising and training pigeons.

These, of course, are types of training in schools. Signal Corps instruction is also given on the job. A woman who is an excellent typist, for instance, will be able to learn how to operate a teletype machine in a couple of weeks at the post where she is stationed. Or she may learn to operate a telephone switchboard.

When the first feminine AEF in American history, landed in North Africa in January, 1943, a number of bilingual telephone operators were in the group. In a short time,

(*Continued on page* 406)

Carrying cage—used in the field to transport pigeons.

PIGEONS

New records have been made by Army homing pigeons. One recently flew 65 miles in but 82 minutes.

By Major OTTO MEYER

Born in Westerville, Ohio, 1905. Before he was called to active duty in 1941, he was a pigeon fancier; he was raising, breeding, and racing homing pigeons and carrier pigeons. After entering the service, he spent his time at Fort Monmouth, New Jersey and in 1942, he was assigned as Officer-in-Charge, Pigeon Section, Training Division, Office of the Chief Signal Officer. During the latter part of the year, he was the Officer-in-Charge of the Pigeon Branch of that division. He was appointed to his present post, Chief of Army Pigeon Service, in Spring, 1943.

THE homing pigeons of the Signal Corps have already made their mark in World War II, along with split-second radio and telephone communications. The first news of the recapture of Gafsa by our troops in North Africa was brought to Headquarters by "Yank," who made a ninety-mile flight through ugly flying weather in one hour and fifty-five minutes. "Yank," who was hatched in the Fort Benning lofts, was shipped overseas during the latter part of 1942. After landing in French Morocco with his many comrades, he was flown by plane to the Tunisian front lines for duty, along with other birds. If "Yank" is still living after this conflict, he will be returned to the United States to live as an honored veteran of World War II.

The most important flight accomplished so far in World War II was made by a pigeon named "Captain Fulton." The bird returned from the front lines in the vicinity of Bizerte, Tunisia, to its home loft, a distance of over sixty-five miles, in the short time of eighty-two minutes. The Blue Check Cock, "Captain Fulton," was named in honor of the late Captain Thomas J. Fulton of Pittsburgh, Pennsylvania, formerly the Commanding Officer of the Pigeon Breeding and Training Center, Fort Monmouth, New Jersey.

"Wisconsin Boy," a Blue Check Cock twelve weeks of age, was dispatched from the front lines at Tebourba, returning to its home loft making the distance of forty miles in forty minutes with a message from the U. S. 1st Infantry Division. This message was the very first news released to the outside world of an American advance.

In one day's time, after a mobile loft had been moved into Feriana, Tunisia, the birds were flown up to 135 miles with few losses. Between March 29th and April 4th, when the African campaign was pushing to a close, a total of forty-five "secret" and "urgent" messages were delivered

(*Continued on page* 410)

Army dogs bring the carrier pigeons to advanced positions.

Pigeon about to be released with message for headquarters.

Troops in training are taught, through pictures, the most approved methods of concealment to be used in combat.

PHOTOGRAPHIC CENTER

By Captain MILTON B. HERR

Born in Philadelphia, 1898. Attended Temple Univ. Served in Marine Corps, 1st World War. Graduated from Signal Corps School of Photography, Columbia Univ., 1918. Was editor of the Telephone News and member of faculty of Price School of Advertising and Journalism, Philadelphia. He served as an Officer in the Military Intelligence Division, Officers Reserve Corps, 1924-34. He was called to active duty in 1942 when he was assigned to his present position which is the Chief, Officer of Technical Information, Special Activities Branch.

Facilities for taking motion pictures are as elaborate as those in Hollywood.

WHEN the Training Film Production Laboratory early in 1942 moved from Fort Monmouth to the old Paramount Building in Astoria, another inspiring chapter was added to the history of the Signal Corps and to the history of visual education.

The studio was built in 1920 by the Famous Players-Lasky Company, and the original cost of construction, plus alterations made at the time of the introduction of talking pictures, was in the neighborhood of $10,000,000. For nearly ten years the studio was the center of production for Paramount films, and many great stars of that era made great motion pictures here.

The record reveals many "firsts" for the Paramount Studio in Astoria. The first really big picture made there was THE COPPERHEAD starring Lionel Barrymore. The first big musical was also made there. It was THE COCOANUTS with the Marx Brothers. Ginger Rogers scored her first big successes when she made SALLY, IRENE, AND MARY, and FOLLOW THE LEADER. A real milestone, however, was the making of the first full length feature sound picture, THE LETTER starring Jeanne Eagles. Autograph seekers haunted the doors of the studio in those days for the signatures of Rudolf Valentino, Gertrude Lawrence, Gary Cooper, Claudette Colbert, the Barrymores, and a galaxy of others.

Until the late 1920's Paramount made big pictures there with famous stars and then, although under the same aegis, the studio was used only for the production of short features until 1933. In that year Eastern Service Studio Division of the Western Electric Company took over. In subsequent years most of the pictures made here were of the industrial type.

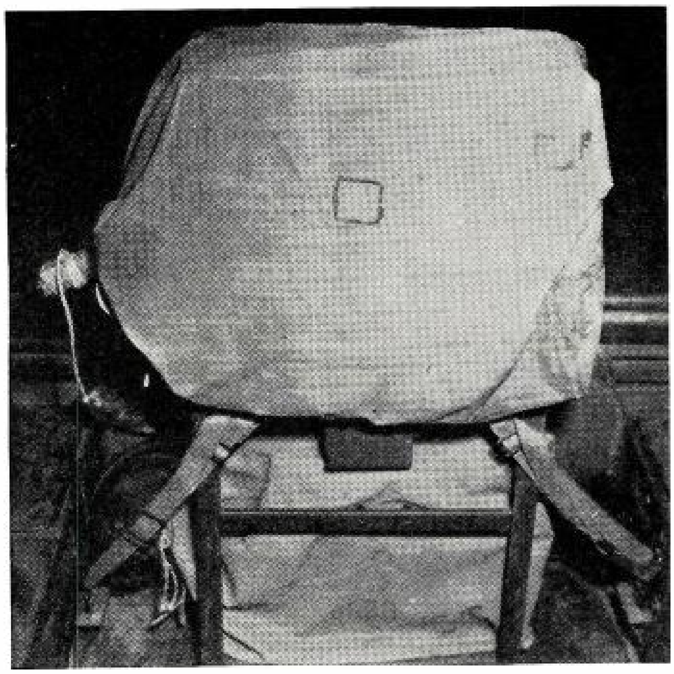
Eastern Service was succeeded by Audio Pictures in 1938 and the studio was occupied jointly by that firm and ERPI. Its facilities were used for short pictures on industrial and even juke box movies. Much of the huge studio, however, was unused and it gradually took on an abandoned appearance. But early in 1942 when the Training Film Production Laboratory moved from Fort Monmouth into the old Paramount building, the studio became once again the center of great activity and production for Army Pictorial.

Message center in operation with radio station and switchboard. Films are used to show approved communication methods.

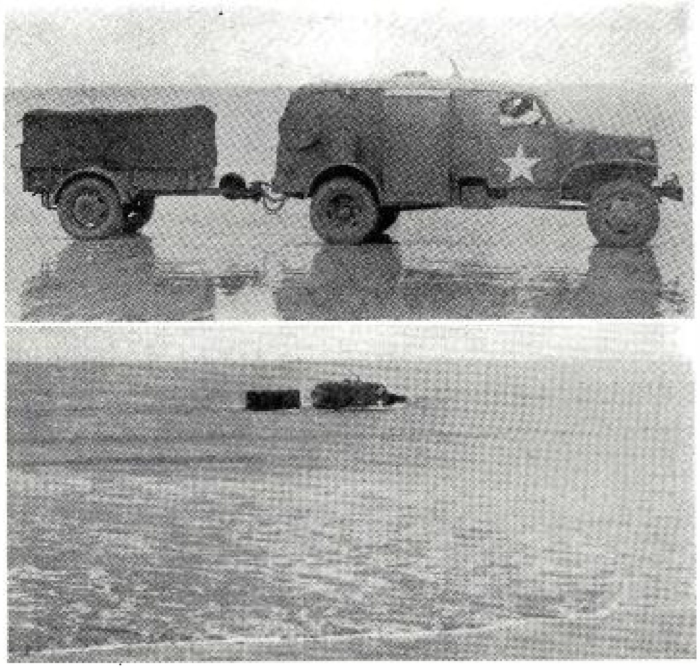
The history of training films dates back to shortly before the first World War with the making of social hygiene pictures by medical units. In 1917 the Signal Corps went to work and produced nearly 100 reels of training films before the Armistice was signed. For a while after that, although the value of these films was appreciated, the Government ceased production until 1928.

Along about 1928, however, the Government once again went into the motion picture field. The coming of sound tended to disrupt production at this point, but after 1932 a

(*Continued on page* 406)



Waterproofed radio equipment mounted in ¼-ton truck. All electrical apparatus must be protected against salt spray, etc.

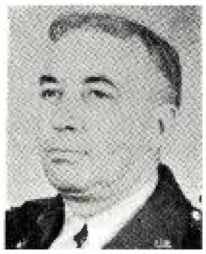


SCR-299 radio set completely waterproofed for beach warfare. Lower photo shows the military unit operating in 3½' of water.

WATERPROOFING

By Colonel R. C. HILDRETH

Born in Nebraska, 1887. Attended University of Nebraska; graduated Signal School, 1926. Worked for Nebraska Telephone Company as Supervisor, Foreman & Wire Chief. Served with A.E.F. & the Army of Occupation in World War I. Was Assistant Signal Officer, 8th Corps Area & 3rd Corps Area, Philippine Dept.; Supply Div. Officer in Charge, Storage & Issue Div.; Assistant Director Distribution and Field Service Div. Since latter part of 1943, he has been in present position, Director of the Signal Supply Division, Headquarters, S.O.S., European Theater of Operations.



Unlike German radio equipment—American units are carefully waterproofed and protected from the elements and insects.

THE Allied landings in North Africa, Sicily, and Italy, where thousands of soldiers with their equipment were disembarked from boats and other landing craft, required that the motor vehicles be waterproofed so that they would function during their journey through the surf to the beaches. Likewise, it was equally important that radio sets, especially the vehicular types installed in jeeps, command cars, half-tracs and other combat vehicles, also be waterproofed for operating in the water or immediately upon reaching the land.

The development of materials and methods for waterproofing vehicular and portable radio sets has been one of the important combat research activities of the Signal Corps in the European Theater of Operations. A special kind of waterproof compound, which has been developed by the Ordnance Service for waterproofing motor vehicles, was used together with canvas bags for the initial experiments. Amphibious operating conditions were simulated and a great deal soon was discovered about the damage to radio equipment that can be caused by salt water.

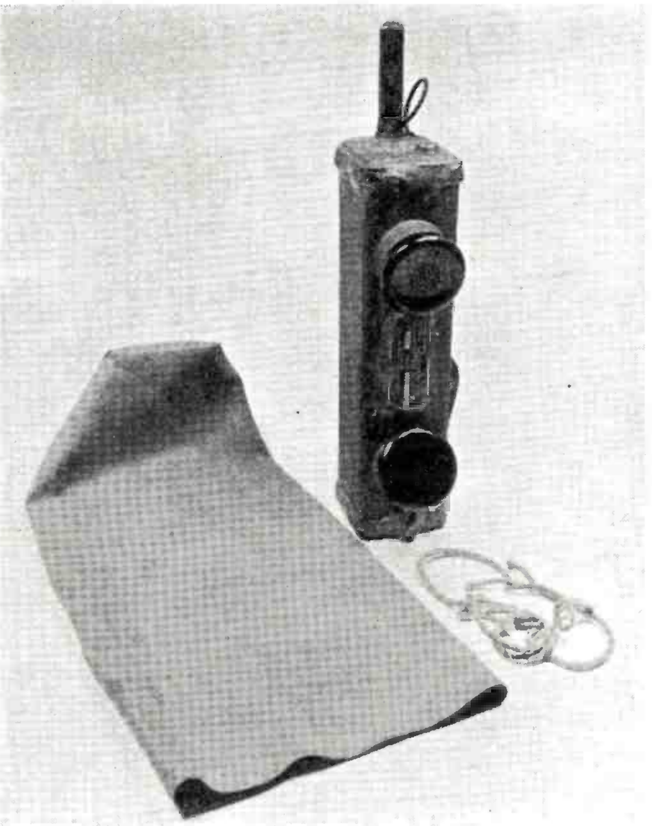
Salt water has a marked corrosive effect on aluminum and untreated brass and copper. Ordinary paint does not afford sufficient protection at all times. The rod antenna and the metal parts of antenna bases on vehicles, which are exposed to salt water spray, also require protection. It was discovered that the waterproofing compound was an excellent protecting medium in the absence of black asphalt or other waterproofing paints, which are not always on hand.

Low-power FM radio sets, which are used in large quantities in jeeps, require complete protection, because these vehicles are often almost completely submerged during landing operations. The use of a waterproof bag made from canvas, rubber or other suitable material was found to be the best protection for these and similar radio sets. Individual waterproof bags of various sizes were used to enclose the separate components of the larger vehicular radio sets. Each bag was designed for several types of radio sets or components in order to save material and to hold to a minimum the various sizes to be kept in depot stock.

A method of tying up the mouths of the bags to make a watertight seal was developed. Provisions also were made for the battery leads and other cables of the radio set to protrude through the sealed bag openings.

The protection of the vehicular radio set itself against water action does not complete the waterproofing job. It is just as important that the headphones and microphones as well as the handsets (used with some low power sets) be guarded because it may be necessary to operate the set in the water or a wave might splash over the equipment.

A simple protective device to accomplish this seemingly difficult task was discovered by chance. The cellophane



Handie-talkie with waterproof bag. This unit can be operated under extreme weather conditions when completely enclosed.

Waterproofed handie-talkie after receiving wade test. Each antenna connection is waterproofed with a special compound.

wrapper from a package of cigarettes, when placed over the receiver caps, was found to make an excellent seal. It excluded the water and did not impair the efficiency of the headphones. Improved cellophane material was procured and fitted inside the caps of receiver and transmitter units and the problem was solved.

The common handy-talkie set is treated in a similar manner. The waterproofing compound is employed to form watertight seals around the case of this portable radio set.

It is not always feasible to waterproof the higher power radio sets to permit operation during the trip through the water. In such cases, waterproof parts protect the various parts of the set. The bags are constructed so that they can be untied from the equipment and connecting plugs reinserted and the radio set placed "on the air" in a few minutes.

Waterproofed radio installations are made also in the all-purpose ¼-ton 4 x 4 truck, more commonly called the jeep. In these cases the waterproof bag is designed to permit the handling of the controls through the bag so that the radio set can be operated at all times. This is very essential in the fast-moving assault phase of beach landing operations.

The waterproofing job is made simpler when the radio set is inside a steel chest, as in certain motor vehicles. In these cases, the waterproofing compound is used to advantage for sealing the chest cover.

The higher power mobile radio sets, as the well-known SCR-299, require special treatment, especially for their trailer power units. Waterproof sheets and the special compound are the main basis for waterproofing these sets. A special waterproof sheet has been designed to protect the transmitter. Proof of the success of the methods developed for this set can be seen in the photographs.

The handy-talkie and carry-talkie radio sets are extensively employed by ground troops. The waterproofing technique for these portable radios was based on simple, practical procedures, easily mastered by the average soldier. The bags permit the radio set to be readily enclosed. In the case of the handy-talkie set, no difficulty is experienced in talking and hearing through the bag.

The waterproofed guidon staff radio set requires a few additional seals. There is no apparent reduction in the effective range of the waterproofed equipment.

In addition to radio sets, other items of signal equipment also have to be protected against damage from water action. Methods have been devised for protecting flashlights, telephone instruments, and even the mine detector, which is a most essential piece of appartus for clearing the way for our troops.

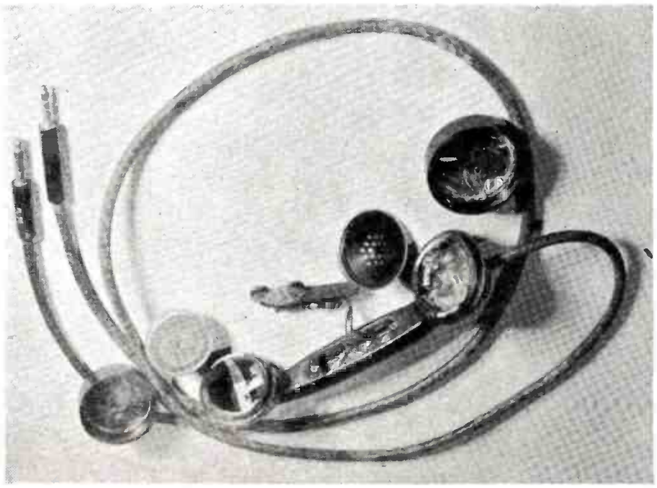
The procedures for waterproofing these items have been simplified so that the soldier can accomplish the necessary work with the minimum delay.

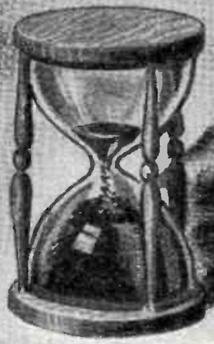
The importance of thoroughly waterproofing radio equipment for amphibious operations cannot be overestimated. A motion picture depicting the various methods developed recently was made in the ETO and it has been very useful for instructional purposes.

It should be borne in mind that the prime purpose of

(*Continued on page* 432)

Handset components. Cellophane and special grease are used throughout to prevent corrosion and electrical short circuits.





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Inspection Agencies

(*Continued from page* 120)

up a soldering iron before he gives his orders to the planes battling the Luftwaffe.

A soldered joint is a small thing, but it can make a $20,000 electrical unit worse than useless. A smart inspector checking a big radio transmitter, before sending it on its way overseas, may look first at the way wires have been soldered on, with sufficient heat to give a solid mechanical connection, no lumps, or dropped solder—a clean, efficient job that will not shake loose when a shell lands nearby.

The responsibility imposed on the individual inspector when he stamps a radio set "approved" or tags it as a "reject" is far from light. On the one hand, a faulty set sent to the front means waste, at least. On the other hand, an unnecessarily arbitrary rejection of equipment can interfere with vital production.

In his position as an impartial observer, the inspector frequently is able to make suggestions to manufacturers that enable them to cut down rejects and meet specifications or to improve efficiency of production. Inspectors also frequently conceive improvements in Signal Corps equipment which are passed on to the development laboratories. Often, these are incorporated in new designs.

Although there have been occasional instances of deliberate fraud in evading specifications, the vast majority of manufacturers are cooperative and are seeking only to turn out the maximum amount of equipment for the fighting forces. Sometimes, however, haste makes waste, and often manufacturers have difficulty in understanding that combat conditions require a rigid adherence to specifications that would be totally unnecessary in commercial equipment.

An inspector in a midwestern plant manufacturing aircraft radios overcame such a problem after conference with the management, when 70 per cent of the company's products was being sent back for changes after inspection.

"Why be so strict?" the inspector was asked. "Don't you know there's a war on?"

The Inspector pointed out that the equipment had to survive combat as contrasted with the treatment to which civilian radio is subjected. He related how a Signal Corps officer had demonstrated why a commercial police radio would not work in battle by taking such a set for a one-mile ride in a tank which shook it to pieces.

The company promptly effected certain changes, minor compromises were effected without weakening military specifications, and in three weeks, the percentage of rejections had dropped to 30 per cent. The number of completed aircraft radio sets climbed from 30 to 60, and finally, to 90 sets a day.

In another field, a Signal Corps inspector quadrupled the output of a western company manufacturing parachutes and bags for emergency sea-rescue equipment. Parachutes were being color-dipped and hung outdoors to dry. The result was a splotchy drying job and the time required for drying was dependent on weather conditions. The inspector first suggested an artificial drying process, which greatly speeded output but failed to solve the problem completely. He then hit upon the idea of using the facilities of a local laundry, and this simple expedient completely eliminated what had been a bothersome bottleneck.

Another plant encountered difficulty in turning out resistors that would meet specifications. The company was almost ready to give up, when a Signal Corps inspector devised a previously untried method of impregnating the resistors, and production went forward at once.

These are only a few of many instances in which cooperation and common sense have been able to solve production difficulties without relaxation of Signal Corps standards.

As has been indicated before, the manufacturer, who deliberately seeks to evade the terms of his government contract, is the unusual exception. Yet inspectors are prepared to deal with that type of situation, too, where a cooperative and helpful approach is of no avail. In one widely publicized case a Signal Corps inspector discovered that specially rigged test equipment was being used to give false electrical readings. The company and the individual responsible were punished by a federal court.

The Agency is proud of the record of economy it has maintained hand-in-hand with the simplification of procedure and greater efficiency that have been established. A survey, after the first six months of operations, showed that the cost of Signal Corps inspection was substantially less than one cent on the dollar of materiel inspected and shipped.

The Signal Corps Inspection Agency intends to continue patrolling the "quality sector" of the supply front for the duration, so that the labors of thousands of workers, technicians, and planners will bear fruition on the battlefields in equipment that does the job it is intended to do.

The Agency intends to see to it that when the hard-beset fighting man turns to his walkie-talkie in a tight spot, he will get through to his unit commander, that when the lives of men depend on a slender strand of field wire, that wire will not fail and that when the lone fighter-pilot is lost and desperately attempting to return to his home field on a dwindling fuel supply, his radio direction-finder will guide him surely.

The Agency knows that its responsibility is a heavy one but it accepts that responsibility and will do the job.

-30-

MP in the ETO

(*Continued from page* 213)

system. Very high frequency radio waves travel more or less in a line-of-sight direction; the higher the antenna, the greater the distance. Keeping the above in mind, selection was made of one of the highest buildings in each community, which also possessed a high and sturdy flagpole.

Preliminary tests indicated that the original location of the transmitter in the control room was unsatisfactory. This was due mainly to the long antenna lead-in with resultant losses in the coaxial cable. Therefore, the transmitter was mounted in a small hut directly below the flagpole supporting the antenna. This materially reduced the length of the coaxial lead-in. The receiver was installed in the control room together with a remote control panel similar to the one designed for the installation in the sedan patrol cars.

The remote control panel of the central station also incorporates a key and buzzer for tone calling purposes. C. W. tone signals can be sent, if necessary, for the attention of the various radio military policemen.

Provision is made at the base station for constant charging of the storage batteries supplying the transmitter.

Operations

Scotland Yard and the local constabulary of English towns maintain close liaison with the provost marshals and the military police. Telephone calls, received from Scotland Yard, are immediately relayed by radio to the MP radio cars for necessary investigation or action. A great deal of time is saved by this radio link. Petrol also is saved as well as wear and tear on tires by the expeditious dispatching of the radio cars.

An amusing incident occurred recently when a frantic request from a source, believed to be reliable, caused all cars to be ordered to converge on a main intersection in a large metropolis. When the MP's arrived, they found a soldier at a certain park being reprimanded by attending MP's for merely having his coat unbuttoned! He was not given a ticket but was taken on a ride to headquarters for a lecture on military bearing and discipline.

This network of military police radio stations is of great benefit to the civilian population as well as to military personnel. In the event of an air raid, soldiers and equipment, such as fire-fighting apparatus, ambulances, and even air raid wardens, can be quickly dispatched to affected areas. Traffic control and order are better maintained and the safety of the community is much improved by the military police radio system.

-30-

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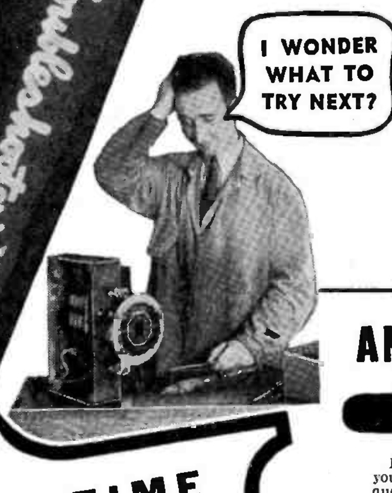

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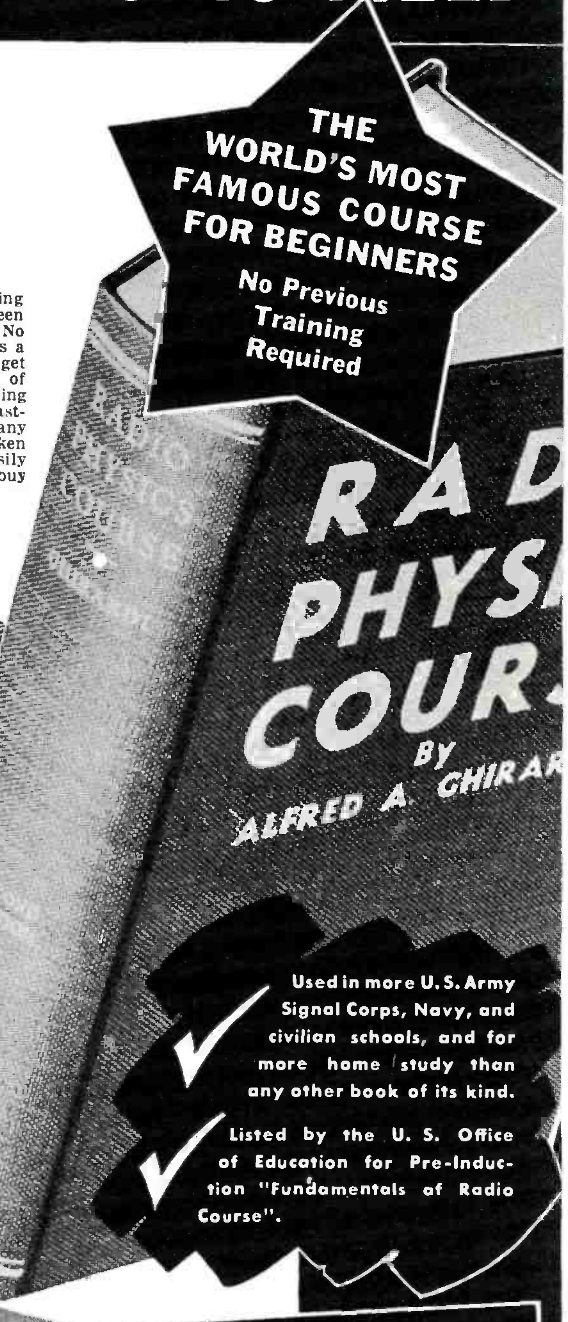

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TO YOU MONEY BACK GUARANTEE

Army Communications
(*Continued from page* 160)

these functions. In the interests of coordination and conservation of wire facilities, critical materials, and manpower, the domestic systems are being consolidated in the Army Command and Administrative Network, under the supervision of A. Com.

When the consolidation is complete, the wire network will include twenty-five principal centers which in turn will control many smaller sub-centers. The system will cover every part of the country, with direct connections between the principal points, with quick access to commercial means for sending messages into the smallest communities where Army messages may have to be delivered.

Among the few Army systems continuing to operate independently — those requiring specialized traffic handling—is that of the Air Forces. Out of a thorough A. Com study of Air Force requirements, however, has grown a closer liaison leading to a current plan to integrate two separate radio networks for the handling of all types of traffic in the Caribbean and South Atlantic regions. In addition to facilitating the primary objective of getting planes across to the fighting fronts, the consolidation will result in a saving of technically trained personnel, critical equipment, and radio frequencies.

Among the men responsible for the growth of the Army Communications Service, some have devoted years to their military careers; the names of others are familiar in civil technical fields.

Col. Carl H. Hatch, Executive Officer to the Chief of the Army Communications Service, came up through the enlisted ranks. Ideas gained during the 1941 maneuvers, a proving ground for the tactical use of teleprinter and telephoto, and for various other fixed equipment, such as commercial type switchboards, received a sound practical application when he began to participate in the supervision of A. Com activities. Formerly in the Field Artillery, Col. Hatch was later Executive Officer to the writer in capacities as Signal Officer of the Fifth Army Corps, Signal Officer of the Third Army, and as Commandant of the Signal Corps Replacement Training Center at Fort Monmouth, N. J.

Perhaps no one man has contributed more to the present efficiency of the Signal Center and WAR than Col. Edward F. French, Chief of the Traffic Operations Branch. Col. French, who has served with the Signal Corps continuously since the first World War, designed, planned and supervised the installation of equipment and facilities for the new Center in The Pentagon. He surrounded himself with experts and, despite the constantly increasing demands on the service, has always managed to have a margin to spare in capacity, equipment, and personnel.

Col. Ira H. Treest, Chief of the Communications Engineering Branch, also active in the Signal Corps since the last war, is a capable engineer who has been associated with all types of communications problems for thirty years. Before coming to Washington he was Signal Officer for the Western Defense Command and the Fourth Army.

The A. Com trouble-shooter is Col. William C. Henry, head of the special Cables and Long Lines Section. Col. Henry, for years a vice president of the U. S. Independent Telephone Association, brought a wealth of communications experience to the Signal Corps when he rejoined the service in 1941 after serving in the first World War.

Playing a prominent role in the development of the Alaska Communications System, one of A. Com's most interesting components, is Col. Fred P. Andrews. Col. Andrews is field supervisor of submarine cable, radio and wire installations that include the 2,000-mile line along the Alaska Military Highway, through the most rugged virgin wilderness in North America. It was under Col. Andrews' direction, too, that undreamed-of quantities of telephone, radio, and cable equipment were procured, shipped, installed, operated, and maintained as the Alaska system grew in importance.

Supervision of Plant engineering communications problems is the job of Col. Will V. Parker, director of the newly installed Plant Engineering Agency at Philadelphia. Col. Parker played a large part in plans for the agency, which procures and transports fixed plant equipment.

Much of A. Com's engineering success is attributable to Lt. Col. Vernon B. Bagnall, Officer in Charge of the Communications Facilities Engineering Section. A nationally recognized authority on long lines and radio communications in civil life, Col. Bagnall fostered many technical advances to keep abreast of requirements in this fast-moving war.

A former RCA traffic engineer, Lt. Col. Thompson F. Mitchell, is Officer in Charge of the Traffic Operational Engineering Section. Col. Mitchell is responsible for routing of radio and teleprinter traffic through continental United States and the world.

Development of important communication installations for defense projects in eight Pacific Coast states was under the direction of Col. Stewart W. Stanley, Chief of the Signal Branch, Ninth Service Command.

The Army Communications Service's job is to get things done, through the high-speed transmission of information and it is working overtime to see that the job is done as fast, as accurately, and as safely as it is humanly and mechanically possible. The motto that the officers in this service follow religiously is:

"Even a turtle must stick his neck out to get anywhere."

—30—

Army Pictorial in ETO
(*Continued from page* 129)

plemented by APS photographs, which form an important phase of the APS activities.

The Army supply branches are constantly developing new items of equipment and searching for new ways to improve its utility—all of which must be photographed to enable reviewing boards to better grasp the effectiveness of the materiel.

A great number of photographs covering important military events and ceremonies are supplied for records which are invaluable for future reference. Among other items the daily routine of the APS includes servicing the official government Photo Mail and processing all film taken by Army amateur photographers in the ETO.

The Army's Public Relations Offices depend heavily on the Signal Corps photographers to supply photographs for press releases. This includes a recently organized photo news section, whose job it is to see that that news events get the proper pictorial coverage.

The news coverage arrangement is perhaps the most unique section of the APS. News assignments are covered by a team of three men consisting of a still man, a movie man, and a caption writer. This caption writer can readily handle either of the other two jobs. Practically all of the men working on these teams have had experience on American newspapers and the majority of the still photographers come from Hollywood studios and other professional posts. Many of them were trained for their present work at the Army Pictorial Laboratories in Astoria, Long Island.

The still man on the team carries a kit equivalent to that used in civilian life. His basic camera is the 4 x 5 speed graphic, which is as important to him as the rifle is to the infantryman. Included is an f 4.5 Ektar 5" lens in a supermatic shutter, with speeds up to 1/1000 part of a second with a focal plane shutter. A Hugo Meyer synchronized range finder, a Mendelsohn or Graflex flash gun complete the camera proper. A film pack adapter is also part of the kit, but it is reserved primarily for emergency use. A Crown tripod, Weston or GE exposure meter, lens hood, and set of four filters complete the outfit.

In view of the constant wear on equipment, a complete repair shop has been installed. It now services work for the Navy and Air Force as well as for the Royal Navy and the British Army.

The movie man has a more complicated array of equipment. A 35 mm Eyemo or Mitchell, with as many of the 1- 2- 4- 6- 10- 12-inch lens as are accessible, form his basic equipment. In addition a heavy tripod, 400-foot magazines, and a 12-volt motor, operated by a twenty-five pound aircraft

SPRAGUE TRADING POST

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FOR SALE OR SWAP—Precision No. 199 modernized analyzer, complete with octal plug and socket, $45. Weston 0-7 volts No. 506 voltmeter, $3. Weston Thermo-ammeter .3 to 1.5 amps. No. 425, $8. Weston No. 528 AC voltmeter 4-8-150 volts, $11. Readrite No. 410 tube tester, $10. Radio City Products No. 205 supermultidapter, $3. Gernsback vol. 6 service manual, new—unbound, $5. Want late model tube checker, condenser analyzer, No. 8 Rider manual, or vac. tube voltmeter. Joseph Marcavage, 8515 253rd St., Bellerose, N. Y.

FOR SALE OR TRADE—One No. 189 Supreme signal generator. Built-in Modulator and audio sig. output. Also Jackson No. 680 dynamic output-tube tester and multi-tester combination. What have you? R. W. Stepanek, 2807 South Ave., Council Bluffs, Iowa.

WANTED—Professional or semi-pro recorder. Must have 2-mike input. Will swap any of following: RCA No. 156 tube tester; Philco 088 batt. signal generator; Superior channel-analyzer; Philco recording arm and train. Cherrill Radio & Television Service, 4235 Barnett St., Philadelphia 35, Pa.

WANT TO TRADE—A battery ranger model 557 signal generator (all bands) for an electric model, or will sell bat. model for cash and buy for cash. A. V. Larsen, Madison, Minn.

WANTED—Second I-F transformer for Majestic model 25 radio. I.F. is 175 kc. and has tapped secondary All replies answered. Frest Radio Service, 811 21st St., East Moline, Ill

FOR SALE—Hallicrafter frequency standard, Type HT-7, 10-100-1000 kc. Good tubes, and in fine condition, $25. Triplett type 321 0-1 ma. 3" meter, scale 100M-0, 0-500, 0-10-50-250-500. 100 ohms internal resistance, $4. One 6AB7 (1853) tube, $1.25. One 6N7 tube, $1. Both metal, and used very little. Wallace M. Kennard, R.D. 2, Wilmington, Dela.

FOR SALE OR TRADE—PR-16 good condition, speaker, Xtal, complete. Make offer. Also Philco all-purpose set tester No. 048, signal generator not hooked up at present, oscillator unit O.K. tester changed from AC to DC operation. Joseph F. Szabat, 120 Clarion St., Oil City, Pa.

FOR SALE—Weston thermo-galvanometer No. 425, 5.2 ohms, 1-115 ma., also 01 meter, Weston. Want a signal generator and Rider's manuals 10-12 and 13. Cash. J. B. Mosley, 1426 North 24th St., Birmingham, Ala.

FOR SALE OR TRADE—Bell No. 570 amplifier, $45. Has some distortion, needs some work. Also have two Shure No. 55 dynamic mikes; one just factory-reconditioned, $27.50; one "as is," $22.50. Want late model oscillator, or tube tester. Ohio Valley Sound Service, 2024 Pennsylvania St., Evansville 12, Ind.

TUBES FOR SALE—5—6AB6; 1—6AD7; 4—6AE5; 2—6B6; 2—6C7S; 1—6E6; 1—6E7; 1—6F7S; 4—6L5; 4—6N5; 1—6S7; 6—6V7; 1—6W5; 5—6Y6; 1—6Y7; 4—6ZY5; 3—6Z7; 3—201A; 2—1A6; 1—F4; 2—1F5; 1—1F6; 2—1G4; 2—1G6; 1—1G5; 2—1J5; 12—2A6; 5—2A7; 2—2B7; 3—3A8; 3—6A3; 2—6A4; 3—6A5; 1—12A; 1—12A5; 2—12A7; 1—12B8; 2—12E5; 1—12F5; 1—12SC7; 4—12SF5; 3—12J7; 1—12Z5; 2—19; 3—22; 4—25AC5; 8—25AC7; 1—25B5; 1—25D8; 3—25N6; 2—25X6; 1—25Y5; 10—31; 16—32; 3—32L7; 7—34; 8—33; 2—40; 3—48; 2—49; 8—55; 1—112A. Genesee Radio Service, G3432 So. Saginaw St., Flint, Mich.

WANTED—Portable typewriter, also 500 mill. 1250 DC after filter power transformer—or, entire power supply if available. Cash. Sgt. Harold H. Christianson, 219 AA Gn. Bn., Hq. Btry., c/o General Delivery, Paterson, N. J.

WANTED—Superior meg-O-meter (50,000 ohms to 100 meg.) and Philco or other battery signal generator for cash. Also want 100 ohm and 750 ohm W. W. potentiometers, used or new. F. R. Schroder, R.R. No. 1, Oakdale, Conn.

FOR SALE—Scott Sixteen receiver. Condition fair. New tubes have been installed. 1939 model. Console type. 4 bands. $90 or will swap for a signal generator. Set worth $200. Arthur J. Cherpoff, 86-96 Bay 26th St., Brooklyn, New York.

WANTED—Will pay 25c for one copy of 1942 catalog issued by Midwest Radio Corp. of Cincinnati. Write first. Wilmer H. Jacobson, Stanhope, Iowa.

TUBES FOR SALE—Four 35's; 5—58's; 1—6B7; 1—33; 1—36; 1—42; also 1 old BH tube. Want No. 585 Supreme set and tube tester, also oscillator. C. M. Rebelien, Kiester, Minn.

WANTED FOR CASH—Superior 1230 signal generator and 1280 set-tube tester. H. J. Ackermann, 5077 Genevieve St., St. Louis, Mo.

WANTED—Test eqpt. of all kinds. Have for sale or trade Webster PR60 sound amplifier, or what have you? Walter Keith Radio Service, 137 East 12th St. So., Newton, Iowa.

FOR SALE OR TRADE—Sprague No. 16 Telomike; Weston 772 with 666 socket selector; "Radio Service" neon sign (4' letters). Want good signal generator, cash, or what have you? Samuel Hornick, 8707 Twelfth St., Detroit. Mich.

WANTED—Precision signal generator series E-200 and a good V-O-M, Walter Stridick. 625 Ferry Ave., Camden, N. J.

FOR SALE—RCP tube tester and set tester; Precision tube tester No. 910 MCP; Astatic hi-fidelity Xtal pickup; RCP free point tester; also various service supplies. Will sell or trade for Stancor auto radio pack No. 133, or Hickok multimeter No. 210S, or will pay cash for same. Jeeve Radio Co. Baltic, Ohio.

WANTED—An AC-DC V-O-M of 1000 ohms per volt sensitivity. Must be recent, and of std. make. Give full details and price. E. B. Haffner, Patterson Park High School, Baltimore 24, Md.

TUBES WANTED—Types 1A7; 1H5; 1N5; 1A5; 12SQ7; 12SK7; 6SQ7—especially the 1A7's. G or GT types. Ellison's Radio Service, Centertown, Ky.

WANTED—New or used home recorder or recording mechanism, also photo electric cell. Have stamp collection, or will pay cash. Michael F. Benson, Fort Qu'Appelle, Sask., Canada.

WILL TRADE—Rider's manuals 1 to 4, never used, for 8mm., 16mm. or 35mm. silent projector. Leslie E. Kulberg, Route No. 1, Box 115-K, Washington 19, D. C.

WANTED FOR CASH—One complete Tok Fone recorder unit (recorder—phonograph—P. A. system). Le Swan Radio Service, 204 Green St., Cambridge 39, Mass.

WILL SWAP—Will trade Supreme No. 546 'scope used about 6 hrs., in A-1 condition. Want a No. 562 audolyzer, No. 155 traceometer, or chanalyst in good condition. H. E. Doverspike, Box 136, Summerville, Pa.

FOR SALE—Hallicrafter receiver SX-28, complete with crystal, 10" PM speaker, and an extra set of 15 tubes. A-1 condition. W. O. Brewster, 3101 Main St., Parsons, Kans.

CLOSING OUT—On account of death: tubes, mikes, ear 'phones, recorders, fans, battery charger, and wire, etc. Also table radios. What can you use? Write W. A. Hoberdier, 915 Sixth St. N.W., Canton, Ohio.

FOR SALE—Weston No. 354, 30-0-30 DC amps.; Weston 506 0-7 DC volts; Weston 280 0-15 to 150 v. and 0-1.5 amps.; Jewel 54 0-1 milliamps. DC; Jewell 77 0-300 and 0-6 AC volts; Jewel 74 0-30 AC volts; also AC ampere meters 0-5 and 0-2.5; Triplett No. 1502 tube tester portable or counter oak case, val. $60; and Triplett 1181-E portable lab. in oak case, val. $62.75. Ted Solarz, 3033 S. Pulaski Rd., Chicago 23, Ill.

WILL TRADE—Jackson counter tube tester No. 427. In good condition. Also superior sig. generator No. 1230, little used. Will trade for well-known communication receiver or what have you? Robt. Newman, 1701 Quentin Rd., Brooklyn, N. Y.

WANTED—Good used signal generator and tube tester or comb. sig. generator and set tester, or comb. tube and set tester. Cash. William Brisco, R.F.D. No. 2, Box 34-A, Hollondale, Miss.

FOR SALE—Radio tubes, parts, etc., slightly used. Send for list. J. C. Thimijan, 715 N. 7th St., Lake City, Minn.

WILL SWAP—ICS radio principles $200 course (1941) and cash for any good servicing eqpt. such as chanalyst, audolyzer, or set tester. Ty Lindgren, 274 Dolores St., San Francisco 3, Calif.

SELL OR TRADE—Westinghouse 115 v. DC to 110 v. AC 2-phase current converter unit in metal case, perfect condition. Also 110 v. DC to 110 v. AC phono motor converter. uses a vibrator. Need tubes, test eqpt.. Rider's, etc. G. Thoden, R.D. No. 1, Asbury Park, N. J.

FOR SALE—Need a chart for your tube tester? We have them for all makes and models. B. Paine, 1186 Lexington Ave., New York 28, N. Y.

FOR SALE—Weston No. 547 3-meter set analyzer, also Tobe condenser leakage tester. Good condition. Dave's Radio, 1316 42nd St., Brooklyn 19, N. Y.

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type battery, complete his working equipment.

A Wac sergeant recently has been added to the Press Room personnel. With the arrival of more and more Wacs in the ETO, it was found convenient to have a Wac photographer to cover their assignments.

Photographers find light conditions in England quite different from those in America. Actinic values usually deceive the cameramen when they first begin work over here. The light is generally much softer. While light meter readings are reliable, the light values may change between the reading and the actual exposure time. Actual experience in the ever-changing light condition, however, has offset the problem. As the photographers gain more experience, their photographs shows continuous improvement.

More than 30,000 pictures are filed at the APS headquarters laboratory. The Training Film Branch maintains a complete library service designed to supply the entire Theater. Approximately 500 titles are on hand for distribution to units throughout the United Kingdom. Where the number of troops warrant, sub-libraries have been established at strategic locations.

In addition to the training films sent over from the States, factual training reports on localized subjects are also prepared by the APS. A typical example is the recently filmed report, "How to Waterproof a Jeep." At the order of the War Department, a film dealing with activities of the Army Nurse Corps in the ETO is now being filmed. A staff of writers prepares the scripts.

The official photo-mail section handles all documents requiring immediate transmittal from the ETO to the United States. This function utilizes both 35 mm and 16 mm Recordak machines, operated by a unit of men especially trained in Washington for the job. The two model D Micro file units, when working at top speed, can process 1600 micro copies of a chart or of documents up to 30 by 50 inches, per hour.

The American Embassy also uses the official photo-mail facilities for classified papers. This operation cuts the time it takes diplomatic pouches to reach Washington. For the official letter-size paper, a Recordak 16 mm unit, duplicating the V-mail process, is used. Capacity is 1500 per hour. The laboratory service completely processes the rolls, and packs them for shipment after the first of the thousand letters have been photographed. Franked correspondence may also be transmitted by this method.

The supply problem is indicated by the fact that more than a quarter of a million prints are processed monthly in the APS laboratory. More than 30,000 feet of movie film are exposed monthly and distributed to British film laboratories for processing. The expendable supplies are to a large extent obtained from the British under Reciprocal Aid. This source is appreciated when adverse shipping conditions otherwise might have greatly curtailed the required quantity coming from the United States.

When the first American Forces landed in the ETO, they arrived without personal cameras, in accordance with Army regulations. Many amateur photographers bought and borrowed cameras from the British, however, and this, together with the subsequent abolition of the restriction against cameras, presented a real problem to Army Intelligence Officers. With only commercial processing available there was considerable opportunity for the right picture to be seen by the wrong person. Consequently, an amateur film section for Army personnel was organized. At present, it is developing more than 9000 prints daily, all of which are censored by the Army Press Censor. Prints that fail to pass censorship are not destroyed but are carefully identified. They will be returned to the owner after the war. Of nearly one million prints already reviewed, less than one percent were not returnable, primarily due to faulty addresses, not to censorship.

The APS in this theater has moved steadily forward from the "kitchen sink and tar-papered windows," to a smooth functioning organization which covers all the diversified activities found in this Theater of war.

-30-

Aviation Radio

(*Continued from page* 209)

in excess of 100 megacycles. The first type of interference can only be corrected by the proper shielding and bonding of certain circuits; such as, the high tension ignition circuits of the engine, electric propellor wiring, and generator circuits wiring. It has been found that a large amount of the shielded conduit on the balance of the wiring of the airplane can be eliminated, provided engineering personnel maintain the over-all shielding and bonding of the airplane in a satisfactory condition.

The elimination of this conduit has resulted in a saving of aluminum at the airplane manufacturer's plant, a saving in man hours, and increased ease of maintenance in the electrical wiring of the airplane.

At this point it might be interesting to have a look into some of our airplanes and see what they use in the way of radio equipment. According to popular misconception each plane is fitted out with one all-purpose radio augmented by an interphone system. Such is not the case. The modern long-range bomber or transport airplane will have a command set, which is operated by the pilot and used for command and navigation purposes; a radio operator's set, which is higher powered and employs both fixed and trailing antenna; the modern automatic radio compass, which is used by the pilot for homing or taking bearings

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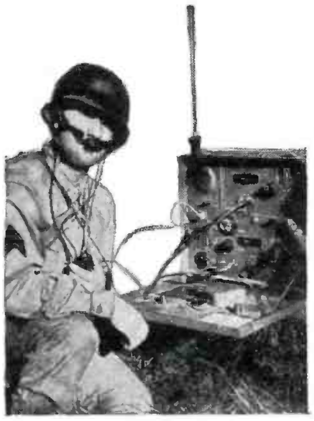

FEDERAL pioneered in developing and perfecting enlargers with "expensive" features but without the penalty of high cost. Consequently, more people were enabled to get more fun out of their hobby. America's entrance into the war was the signal that made us abandon the production, but certainly not the contemplation, of even better enlargers.

In the enormous war program ***Federal*** has become an important link in the chain of supply. Twice our efforts have been awarded recognition by the Army and Navy. ***Federal's*** wartime developments in electronics will be reflected in ***Federal's*** peacetime developments in photography ... and will prove, once again, ***Federal's*** leadership in the field.

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on radio stations on the ground; and equipment used for identification and instrument landing.

One of the most important devices on the airplane is the interphone system. This is essentially a telephone system connecting up the various positions on the airplane so that the pilot, co-pilot, bombardier, navigator, radio operators, and gunners can talk to each other during the flight. The airplane cannot efficiently engage in combat unless information and orders are quickly transmitted between the various combat positions on the plane. The interphone system has recently been modernized by oxygen mask type microphones and new flat response receivers. The interphone system is also used at high altitudes to check on the various members of the crew to determine whether or not each member is getting an adequate supply of oxygen and everything is going well at his position.

Both the pilot and the navigator are able to operate the automatic radio compass. The loop of this compass operates on the null position and causes the pointer of the pilot's indicator to automatically point to the radio station to which the compass is tuned. If the pilot desires to "home" on the position of a known radio station, he merely keeps the needle on zero. The needle swings around to 180 degrees when the station has been passed over. This type of compass is free of the difficulty experienced in 180-degree ambiguity on compasses of the right-left type of indication. Bearings can quickly be taken on radio stations which are to the right or left of the airplane course, the reciprocal of such bearings being employed for plotting purposes on the map. This compass is standard equipment on all of the larger airplanes, such as medium and heavy bombers and transports. A smaller version of the radio compass is also installed on light bombers and fighters.

While it is true that radio devices are used for many purposes in communication and navigation, yet the most important use of airborne radio is still in the field of airplane communications; that is, the transmission of messages between airplanes and between airplanes and ground stations. For this purpose our larger airplanes carry what is known as the command set, which is pilot-operated and the liaison set, which is operated by the radio operator. In addition, all airplanes are now equipped with the so-called VHF set, which is crystal-controlled with push-button operation. There is a strong trend toward simplification and greater use of operation of airborne equipment. Radio operators cannot be expected to carry out complicated tuning procedures under combat conditions and it is highly desirable that all sets either be crystal-controlled or have pre-set frequencies on the ground with air operation by push-button or a similar easy-to-operate type.

All of the larger types of airplanes are also equipped with a marker beacon receiver, which is used on instrument landing and also used to give the pilot a visual indication of position over fan and cone of silence markers when flying along the commercial airlines or along the ATC routes.

There is also a sea rescue set to be used by the crew in the event of "ditching," or as the Navy calls it, "dunking," in the water. Strangely enough, the idea for the development of a sea rescue set was suggested by the discovery of a fundamentally similar set among captured German aircraft radio equipment. The American product, however, developed and perfected, is far superior to the crude equipment which came out of the German plane which had been "clawed" to earth somewhere in England. Technically, the sea rescue set is a hand-powered, emergency transmitter, transmitting a MCW signal on a frequency of 500 kilocycles and designed for operation in a rubber life raft. It provides for automatic or manual transmission of a pre-determined signal upon which the radio compass of searching parties can "home." A signal lamp for night operation can be used by plugging the lamp into a socket on the transmitter case. Under these conditions no radio transmission takes place. The lamp burns steadily unless it is desired to key it manually. A box kite, or balloon inflated with hydrogen gas generated on the spot by means of a chemical generator, whichever is more practical according to the wind velocity, is used to suspend the antenna for this equipment. The set and all its facilities are dropped on the water with a parachute.

Army airplanes fly all over the world in all kinds of weather and under all kinds of climatic conditions and altitudes. Therefore, it is necessary that our airborne radio equipment be thoroughly tested under extremes of humidity, altitude, temperature, and vibration in order to make certain that satisfactory operation will be obtained under all conditions of flight. The radio equipment can and does cause the tactical mission to be successfully completed. It is capable of bringing, and does bring the airplanes and crew back to the airport for a safe landing when other means of navigation have failed. Therefore, it is of the utmost importance that our radio equipment be of the highest quality and reliability and be capable of operation under the most adverse circumstances.

Many radio engineers are looking into the future and making plans for the application of radio aids to commercial flying which have been developed during this war. Certainly all of the flying services will be benefited by the tremendous amount of research which is being carried out on radio aids to air navigation and a great forward step has been taken in the improvement of the over-all safety and efficiency of flying.

-30-

VIBRATION TESTED

Long before the war, TUNG-SOL established the practice of "Vibration-Testing" all radio tubes of new design and tubes picked out at regular intervals from the production line. Making tubes that meet government standards was nothing new.

Today the TUNG-SOL Radio Tubes in communication equipment of jeeps and planes and tanks and in portable sending and receiving sets are subjected to far more severe conditions than will ever be encountered in civilian uses. TUNG-SOL Tubes are giving praiseworthy performances . . . a direct result of "Vibration-Testing."

Manufacturers of electronic devices and of electronically controlled equipment will find TUNG-SOL a most satisfactory source of dependable tubes for every application. TUNG-SOL research engineers will be glad to assist you now in making your post-war products more efficient through Electronics.

Current is introduced through the various circuits of the tube while it is being rapidly vibrated. Uniformity of the current flow is indicated by sensitive meters and is positive proof of proper design and construction. Tubes that pass this most exacting test are truly classed as "VIBRATION-TESTED."

TUNG-SOL
vibration-tested
RADIO TUBES

TUNG-SOL LAMP WORKS INC., NEWARK, N. J., *Sales Offices:* ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK
ALSO MANUFACTURERS OF MINIATURE INCANDESCENT LAMPS, ALL-GLASS SEALED BEAM HEADLIGHT LAMPS AND CURRENT INTERMITTORS

Wire to Tokyo

(*Continued from page* 201)

Aurora Borealis; second, because of a high ground potential. The number of channels desired exceeded the number of frequencies available and, in any case, radio offered less security.

Construction of the first link of the wire system, 442 miles from Edmonton, Alberta, to Dawson Creek, British Columbia, was begun by a private contractor who soon ran into difficulty. The Signal Corps had promised that the link, to tie in with regular facilities at Helena, Montana, would be completed by December 1, 1942, the date of the highway's formal opening.

The contractor notified the Army Communications Service that it would be impossible to meet the deadline; that December 16 was the earliest he could guarantee to establish the circuits. One obstacle, a critical copper shortage, had been surmounted by engineers who made it possible to use copperweld wire, composed of only 30 per cent copper, but the reduction of conductivity made it necessary to use repeater stations every 95 miles instead of the usual 200-mile interval.

It was the third week of November. Only five miles of circuit had been placed and 93 miles of poles remained to be set.

Regardless of the handicaps, Brigadier General Frank E. Stoner, Chief of the Army Communications Service, decided the job would be finished on time.

So the Army Communications Service swung into action. How it accomplished that "impossible" feat is one of the most dramatic highlights of the entire project. An "Army Com" representative sped to the scene and began devising time savers. Rush orders were placed with the Western Electric Company which, with the co-operation of Bell Laboratories, produced in 26 days the telephone carrier and repeater apparatus that normally would have required 26 weeks to manufacture, assemble, and ship. Tons of the equipment were flown across the continent by Army Transport planes.

Things began to hum in the field, too. One hundred forty Signal Construction men were sent in as reinforcements to five wire line groups obtained from the Bell Telephone Company of Canada and other line gangs from the American Telephone and Telegraph Company.

Not even the region's worst blizzard in forty years prevented the Army Communications Service from making the deadline.

Working from dawn to midnight in the bitter sub-Arctic cold, the men laid wire and cross-arms on the ground at night, erected poles the next morning after blasting holes in the frozen soil. Fighting against time, they improvised expedients as they went along. They placed cross-arms on every second pole instead of every pole. They hung 150 miles of wire on nails driven in telegraph poles where regular pole setting couldn't be completed. They installed repeaters in prefabricated wooden Yakatat huts.

Storm-blocked roads hampered transportation, but still the line went through.

It was not until November 22, after completion of the arrangements, that actual work began. Just eight days later the line was finished over a distance comparable to that between Washington and Boston.

At 7:50 p.m., December 1, General Stoner picked up his telephone in Washington and talked with Col. Heath Twitchell of the Corps of Engineers in Dawson Creek.

The job that couldn't be done had been done.

That, however, was only the start. For months thereafter the Army Communications Service continued its work of extending the permanent line from Dawson Creek to Whitehorse—900 miles — and finally from Whitehorse to Fairbanks, 633 miles farther.

While the pole line is the core of the system, the communications are not confined to telephone, telegraph, and teletype. At each repeater installation along the way is a radio station for use as a backstop in the event of wire failures. There, also, unusual problems such as interference from the northern lights and freezing of radio parts have been met.

An enormous amount of electronic research and engineering lies behind the success of the wire line. Two physical pairs of conductors are utilized directly and indirectly for the provision of more than a dozen channels. The heart of the complex organism is the C-5 carrier system, without which the same number of channels would have required a far bulkier and more expensive cable.

Bell System engineers played a major role in solving problems of attenuation and of different losses at different frequencies within any given band.

The speed of the project is a direct tribute to the staff of the Army Communications Service: Colonel Fred P. Andrews of the Alaska Communications Service; Colonel Will V. Parker, Director of the Plant Engineering Agency; Colonel Carl H. Hatch, Executive Officer, Army Communications Service; Lt. Colonel Ora F. Roberts, outside construction foreman and Captain Hugh C. Harris of the Plant Engineering Agency. The problems of supply and transportation were in themselves tremendous. Involved in these operations were the Plant Engineering Agency — another component of the Army Communications Service — the Transportation Corps, the American and Canadian railroads and ship lines, Army and civilian trucking organizations, Army Air Forces and commercial airlines, the Philadelphia Signal Depot and Procurement District, Inspection Zones of Newark, Philadelphia, Dayton, and Chicago, and numerous contractors.

The Army Communications Service's work is far from finished—for operation, maintenance, and improvement of the line will continue indefinitely—but it was with pardonable pride that "Army Com" greeted on November 20, 1943, this terse memorandum:

"Headquarters of the Northwest Service Command, Whitehorse, Yukon Territory, has announced today to the Canadian and U. S. Press at Edmonton, Alberta, the completion of the final link—from Whitehorse to Fairbanks and Anchorage in Alaska—in the first overland telephone line connecting the United States with Alaska."

-30-

Radiosonde

(*Continued from page* 207)

to a receiving station on the ground, where the signals are recorded graphically on a moving strip chart.

Trained observers decipher the record for the forecaster who, armed with up-to-the-second information on pressure, temperature, and humidity, is able to time a mission to take advantage of the exact type of weather.

The intriguing little radiosonde, packed in a plastic-covered case, is about the size of a shoe box and weighs less than two and one-half pounds. The hydrogen-filled balloon ultimately bursts in the intensely cold thin air of the stratosphere and a parachute brings the instrument back to earth, where many are recovered.

The carefully selected blonde hairs in the hygrometer element of the radiosonde expand or contract in proportion to the relative humidity of the air. Blonde hair is preferred over other varieties because it is thinner and absorbs moisture faster and only the hairs which have not been subjected to permanent waving are used, since heating tends to kill the life of the hair.

A V-shaped glass tube, filled with a mixture of hydrochloric acid and alcohol whose resistance varies with the temperature, is radiosonde's thermometer. The pressure element is an evacuated bellows which expands or contracts in accordance with the pressure of the air.

The elements are connected across a commutator and tied in with a transmitter which broadcasts a continuous signal at a frequency of 72.2 megacycles. Tone pitches vary with the changing humidity, temperature, and pressure, so a complete running record of each may be charted on the ground.

Sometimes called the Diamond-Hinman radiosonde in honor of the two scientists largely responsible for the device, it was principally developed by the Bureau of Standards.

Signal Corps laboratories have done considerable work toward improvement, however, and two or three other types are under development.

-30-


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. . . plus a few items for which specifications have not been written
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NORTH ADAMS, MASS.
SPRAGUE CAPACITORS
QUALITY COMPONENTS • EXPERTLY ENGINEERED • COMPETENTLY PRODUCED

Army Photographers
(*Continued from page* 128)

During this period, the men are given brush-up courses in basic military training, such as first aid, the care and use of military equipment, gas mask, and close order drills.

It must be remembered that the men in basic will ultimately be combat photographers. They are soldiers and will be among the first to land on enemy shores. For 22 hours, the students are taught map reading. Since photographers usually go out on assignments alone or in small groups, it is imperative for them to be able to read maps, follow trails, and read a compass. To this end, the students are given field problems. They actually go out to training areas with maps and compasses and they are required to orientate themselves, find a trail, and follow it to a given destination.

Into this brief space of two weeks, time is found to teach the men Army organization and military courtesy. An Army photographer must be an all around soldier. He must know the fundamental principles and have a knowledge of every branch of Service for he travels, works, and fights with every arm of the Service.

Last, but not least, comes training in basic photography. Students are taught the mechanics, the care, and use of every type of camera used by the Army. In every emergency, an Army photographer comes through because he has at least a working knowledge of all the photographic equipment which can possibly come his way. Besides the speed camera, these men are given general lectures on all types of 35 mm cameras. This phase includes also motion picture cameras: the 35 mm and the 16 mm. There are lectures on lenses, filters, and basic optics.

During these two weeks, the emphasis is on general photography. There is little emphasis on detail or theory. At the conclusion of this course, and on the basis of the soldier's civilian record and talents, together with the results of an interview by two or more officers of the Training Division, each man is assigned for the remaining ten weeks to a specialized group.

There are three fields of specialized study, to which students may be assigned for further training. They are (1) the still school, (2) the darkroom or laboratory, (3) the motion picture school. After the basic class has been segregated into these three groups, students spend four weeks more in basic training in their particular field and then they are given six weeks advanced instruction.

During the next four weeks of basic instruction, the stress is on the practical side. The students are given problems with all types of cameras, including the miniatures. These problems are supervised and are designed to give

the students practice in the use of the various cameras and techniques. The assignments during this phase are intended to teach students correct exposure without the use of an exposure meter; to teach them to judge distance for focus and to teach speed in handling camera equipment—these obviously being important considerations for photographers in combat areas. Other assignments are planned to demonstrate the speed necessary to stop moving objects and the use of a camera over obstacle courses; also, the use of various types of lenses, including telephoto and wide angle.

During the latter part of this period the pictures are criticized for news and story value and for pictorial continuity. This brings the class up to a final assignment which includes a rough scenario, written by the cameraman. A story is built around a key picture and a series of supporting pictures which include variety in the picture angle, over-all shots to show story setting, detail shots, activity, portraits.

Along with training in photography, the students during these four weeks continue their military training. Their photography assignments are planned so that they will be required to build hasty fortifications after long marches and to make overnight bivouac. The Signal Corps photographers carry weapons at all times. Most commonly used by the men in photographic companies, are the carbine, the 45 calibre automatic, and the Thompson sub-machine gun.

During this course, the men are given preliminary training in the building and use of the field laboratory and in the care and operation of equipment under extreme or inclement weather conditions. Tropical temperature and high temperature processing and printing, although they sound alike, present two distinct problems. In tropical weather conditions, the temperature range is usually from 80° to 95° F. but the humidity is always over 70 per cent and at times from 95 per cent to 100 per cent; the latter during storms and hurricane weather. High temperatures, usually encountered in the desert, range from 75° to 135° F., but the air is relatively dry. This distinction is made early in the course and detailed instructions are given with regard to processing and printing under each condition.

At the other end, there are the problems presented in temperatures encountered during the winter and in Arctic and Antarctic regions. A pamphlet has been prepared outlining the information available on the subject, including chemistry, procedure, and general recommendations for low temperature processing.

Fortified with all these instructions, the students in the still school are then ready for the final six weeks of advanced training. In general, it might be considered just a continuation of the previous four weeks with an intensified program. The officer instructors of this phase are former newspa-

(*Continued on page* 301)

The "UNOBTAINABLE" MATERIALS

. . . that got there in time to support next day's production

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It was one of those cases where a high priority didn't mean much. The needed Electronic materials simply couldn't be made available through the usual sources for a period of weeks. It looked as though production in a big war equipment plant was going to bog down.

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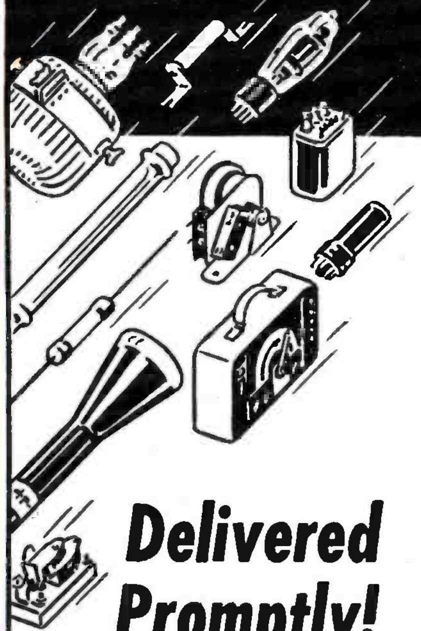

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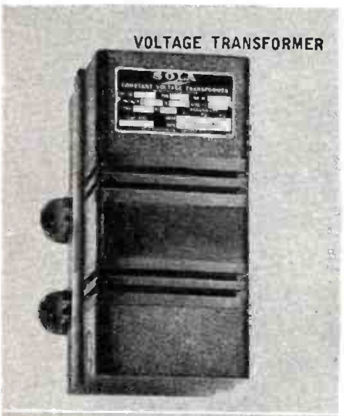
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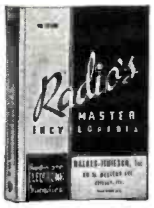

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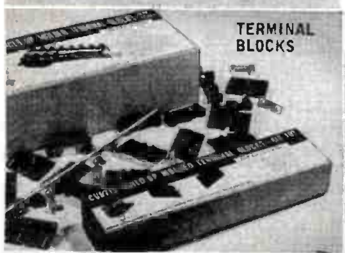
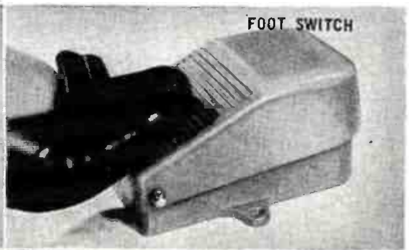
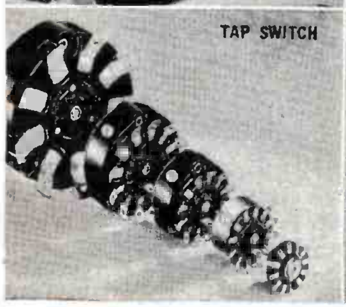
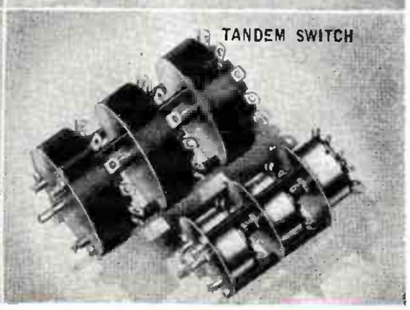

TERMINAL BLOCKS


FOOT SWITCH


TAP SWITCH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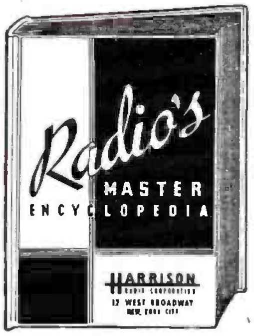

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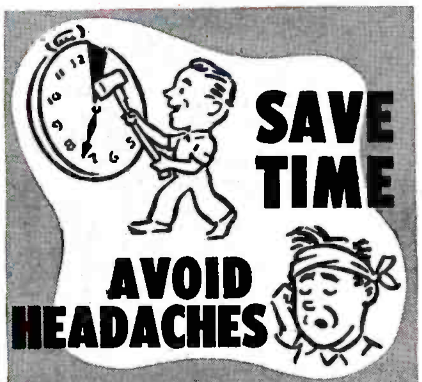

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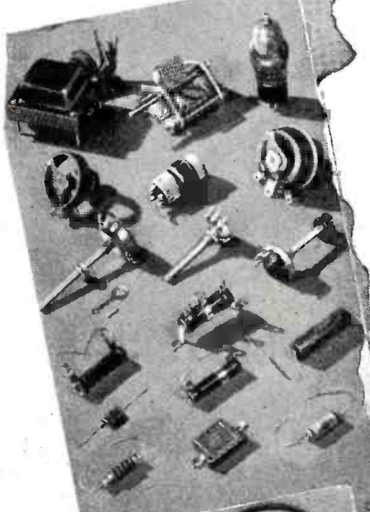

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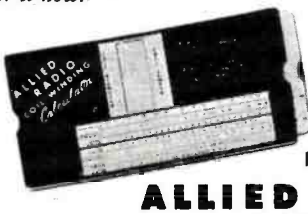

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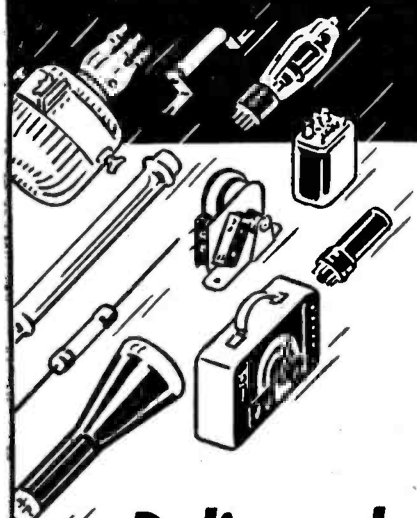

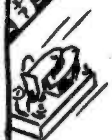

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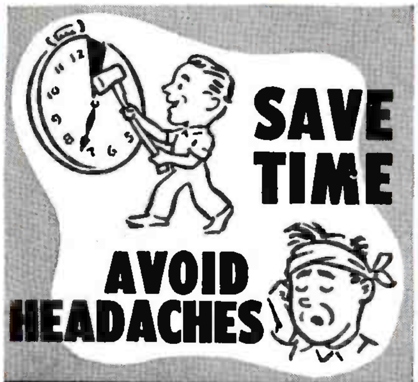

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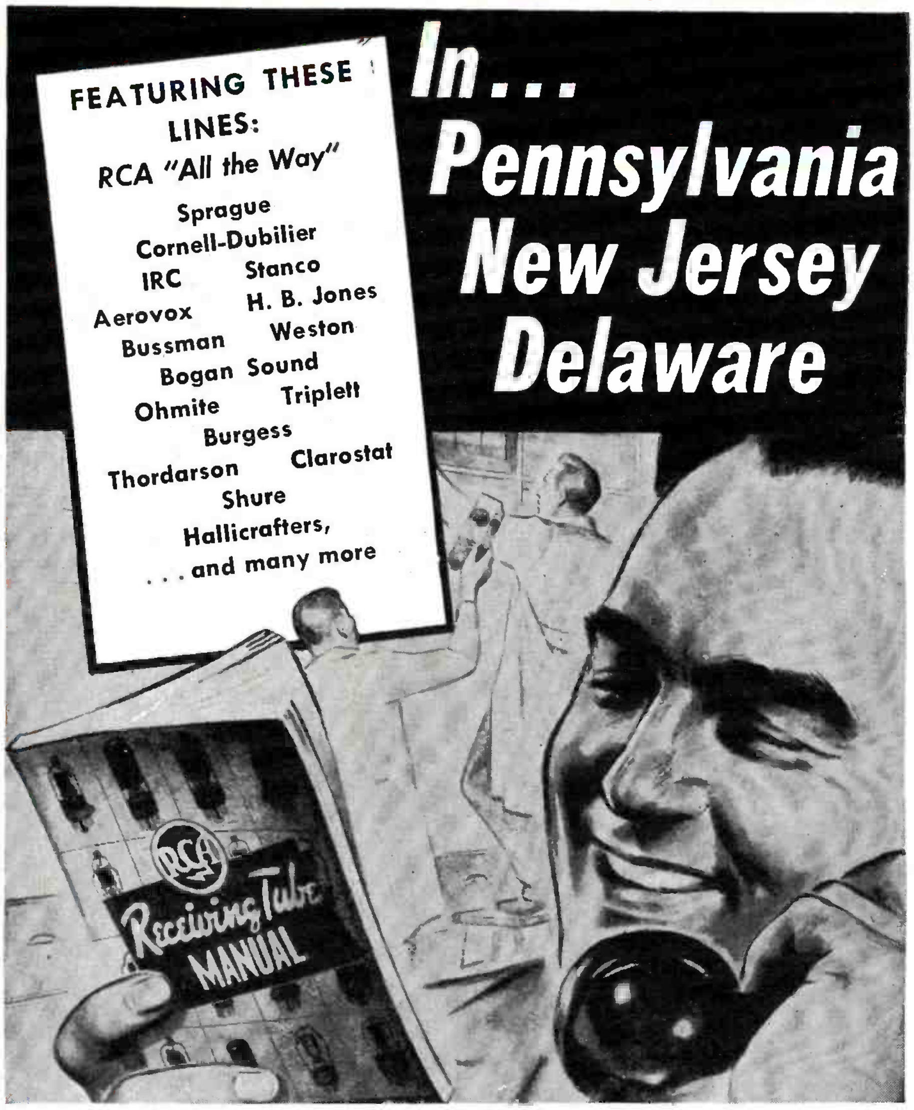

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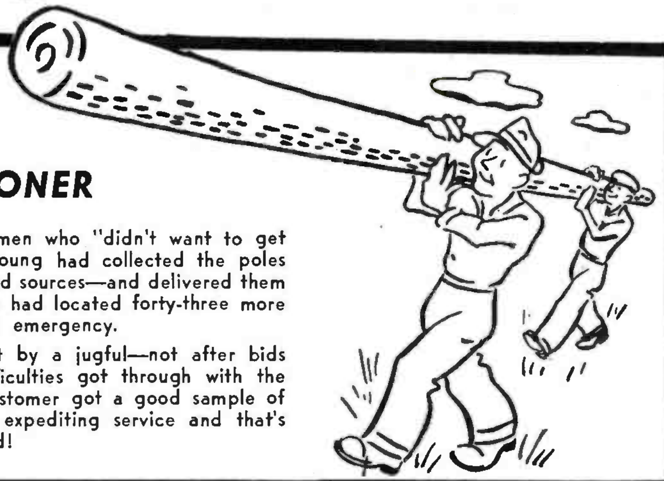

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IT WAS Boston calling—for twenty-two 60' telephone poles. Yes, telephone poles—to be U.S.A. grades 1, 2, or 3. What the heck are grades 1, 2, or 3? We clear that up. What are they worth? Never having sold telephone poles before, we don't know. Moreover, according to the rules of bidding, this sort of selling isn't cricket. Somehow, however, it all gets settled. *Within five days,* in spite of ice, a sleet storm, and truck men who "didn't want to get killed" Hatry & Young had collected the poles from three scattered sources—and delivered them on time. Also, we had located forty-three more poles for the next emergency.

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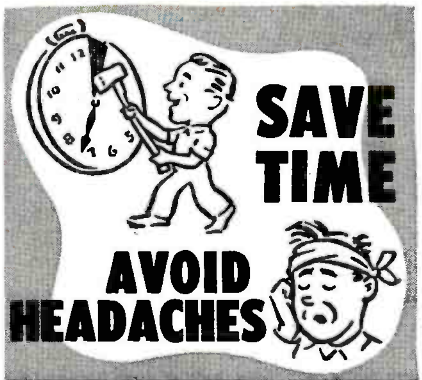

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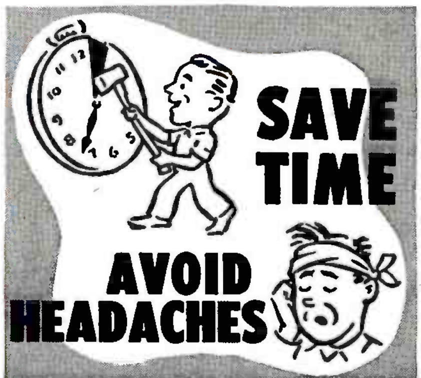

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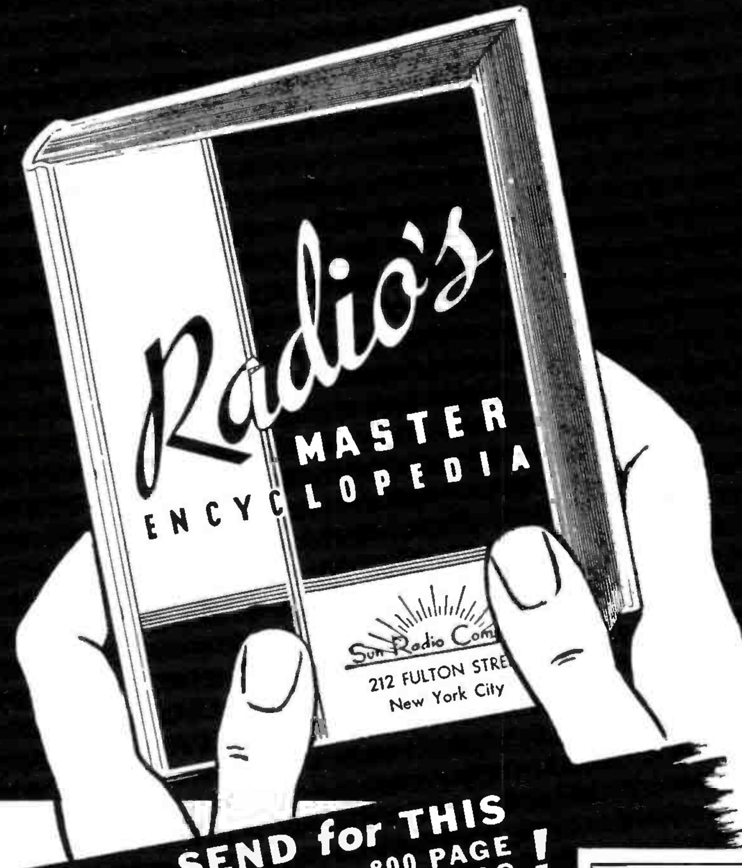

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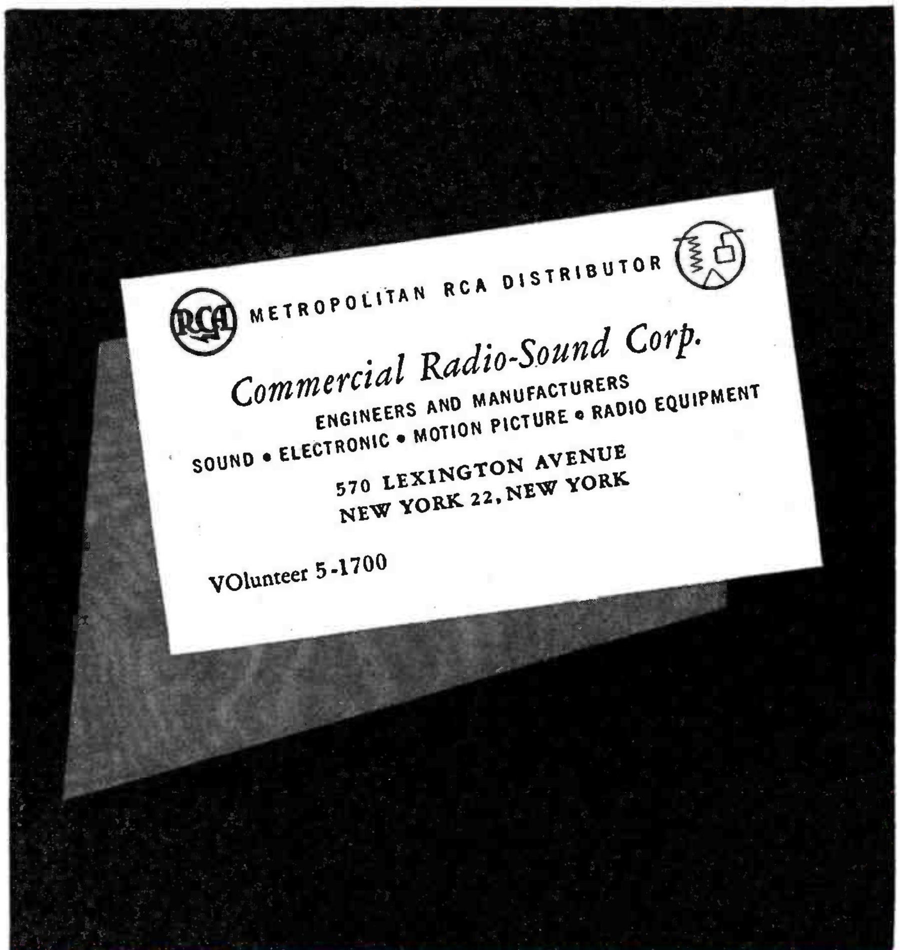

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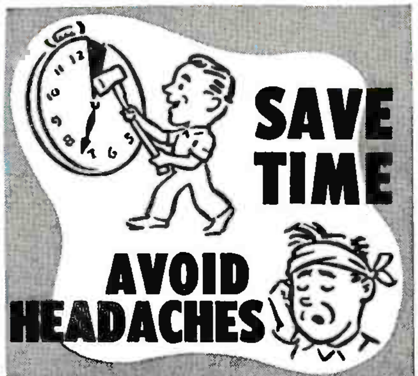

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- **TECHNICAL "KNOW HOW"**
- **TRADE KNOWLEDGE of what is available, and where**
- **LARGE STOCKS**
- **AN EFFICIENT ORGANIZATION**

Founded in 1919, Cameradio has been dealing with things Electronic since the "knee pants" days of Radio itself.

Our stocks are large—our lines cover practically any industrial Electronic requirement — and we're geared for the prompt, accurate, technically-informed service that busy war equipment manufacturers, laboratories, and governmental agencies demand.

Next time you need any of the equipment or components produced by manufacturers on the accompanying list—TRY CAMERADIO FIRST.

We deliver the goods!

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AND EQUIPMENT FROM SPECIALISTS

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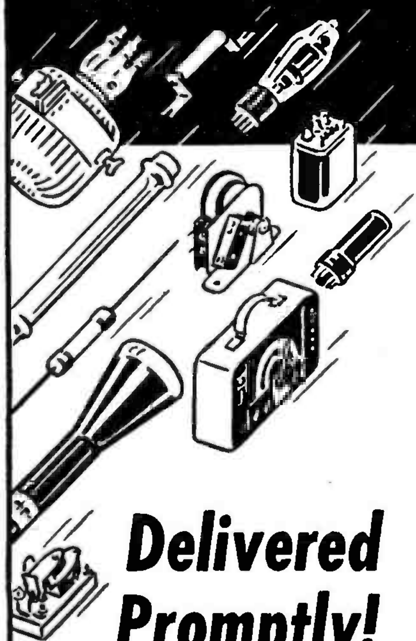
RADIO AND ELECTRONIC COMPONENTS



Delivered Promptly!

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Let us stack our "Know How" of the Radio and Electronic industries against your next order for materials. Let us show you what we mean by our slogan "WE DELIVER THE GOODS"—faster, more efficiently than you may have thought possible under present-day emergency conditions!

There's no dark secret about it. It's simply that we've been dealing with Things Electronic for a long time. We know who makes it and where. We know where it can be obtained, and how fast. This PLUS service costs you nothing extra—and it has already proved its value to countless plants which, like your own, are literally "snowed under" with war work.

SPECIALTY DISTRIBUTING CO., INC.

Atlanta, Macon,

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We are distributors for RCA Tubes and Test Equipment for any Radio or Electronic need, as well as for condensers, resistors, rheostats, controls, potentiometers, coils, relays, transformers, solenoids, wire, and numerous other components produced by many manufacturers.

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Making war equipment that necessitates frequent calls for Radio-Electronic tubes and other Electronic components? Then get acquainted with our service—today!

Chances are, we've got what you need in stock—for immediate delivery upon receipt of suitable priorities. If not, we're well equipped to get it for you faster than you can obtain it from any other source—and to render intelligent, personalized expediting service all along the line. Try us on your next order and be convinced!

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The "Know-How" of what is available, and where—how to match exacting specifications "on the nose"—how to make acceptable substitutions where necessary—how to utilize Electronic materials properly . . .

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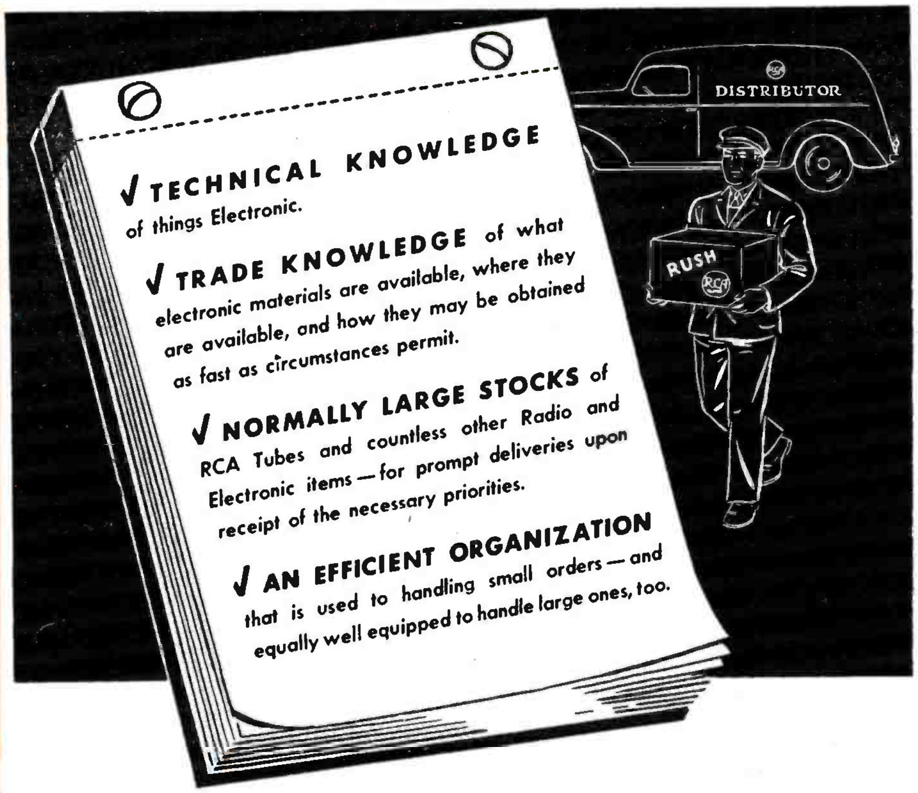

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TUBES AND RCA EQUIPMENT

SERVICE ON RADIO-ELECTRONIC MATERIALS

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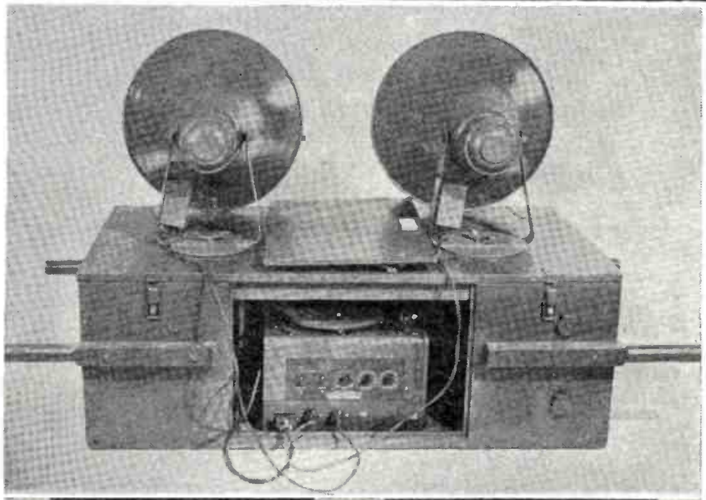
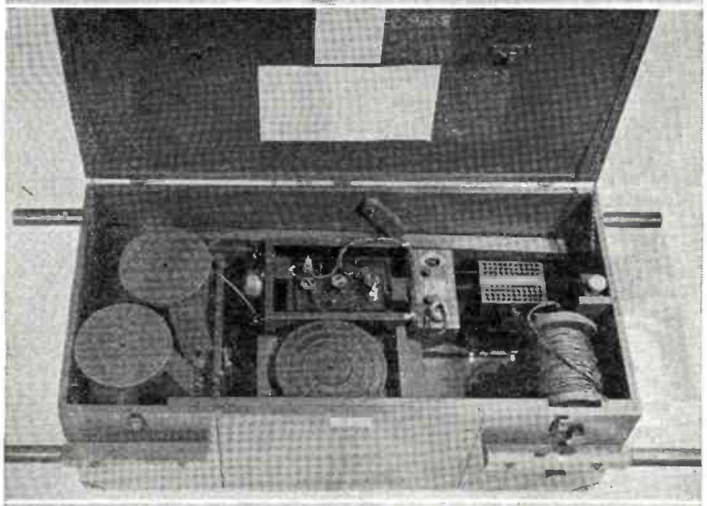
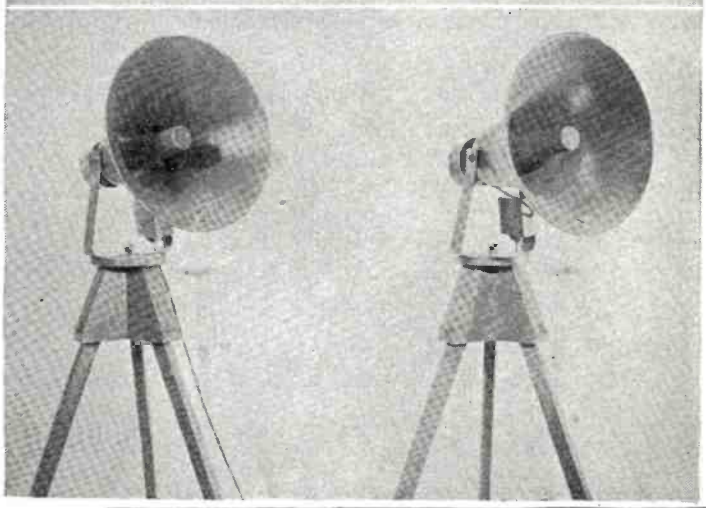
THIS RCA VICTOR DISTRIB







On December 7, 1941, The Eastern Company was engaged in the wholesale distribution of RCA Victor phonographs, radios, tubes, RCA commercial sound equipment, Victor and Bluebird records, RCA and numerous other makes of electronic parts and equipment. A large volume of business was also done in refrigerators, ranges, washers, vacuum cleaners and other major appliances. Since then The Eastern Company has gone to war as illustrated on these pages. Today 80% of this company's business is directly supporting the war effort.

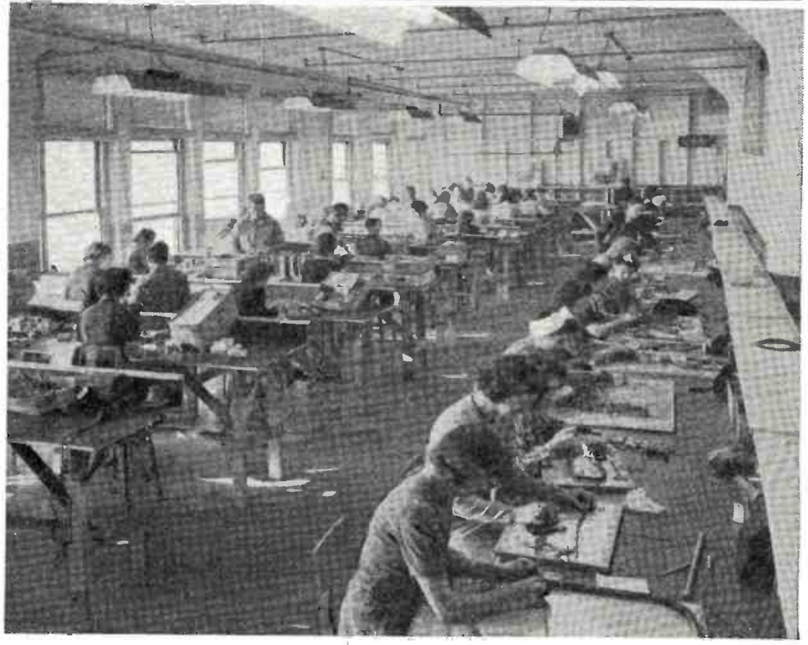
Pictured on this page is Public Address Set PA-5 being currently manufactured for the Signal Corps. This unique equipment is a multi-purpose, portable public address system designed for operation on storage battery or a.c. current with two loudspeakers mounted on one of the carrying chests or on stands which may be set up 200 feet from the amplifier. Microphone or phonograph record sound may be broadcast singly or in combination. A built in battery charger provides for keeping the equipment at top efficiency. All of this equipment plus a complete set of spare parts and spare battery is compactly stored in three chests equipped with carrying handles. It is easy to foresee wide peace time usage for apparatus of this design.

RCA *The* **EASTERN** *Company*

RCA 'ROUND-THE-CORNER SERVICE FOR BUSY WAR

PROVIDENCE, WORCESTER

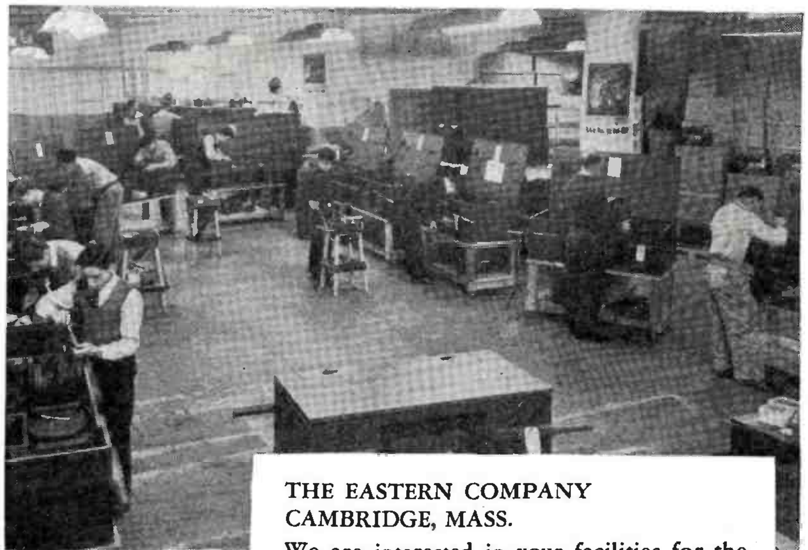
UTOR HAS GONE TO WAR!



● At the right is pictured a section of one of the floors of the former warehouse of The Eastern Company now converted into a fine daylight factory overlooking the historic Charles river. Phonograph record music is provided for the workers in this and other sections of the plant by an RCA Victor sound distribution system. Work in process here is cable assembly for vitally important electronic apparatus and other sub contract work for one of the largest electronic manufacturers. These facilities are constantly being expanded in size.

● Above is shown that section of the plant engaged in the assembly and test of Public Address System PA-5 described on the opposite page. Completion of this important contract will occupy these facilities for several months. In all of the activities as shown, the company is acquiring rich and varied engineering and manufacturing skill with which to attack further war needs and peace time electronic business.

● Below is illustrated a section of the plant devoted to the manufacture of Talk-Back Public Address Systems for the U. S. Navy. Many hundreds of these systems have been built for use in the many theatres of war throughout the world. Equipment of this type will also find wide adaptation to industrial uses in the post war world.



THE EASTERN COMPANY
CAMBRIDGE, MASS.

We are interested in your facilities for the production of electronic equipment as a prime or sub contractor. Please have a representative call on us.

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CHICAGO

GET YOUR RADIO AND ELECTRONIC SUPPLIES *ON TIME!*

Here is your "Open Sesame!" to rapid, intelligent expediting on your orders for almost any type of Radio or Radio-Electronic material. Chances are good that we can ship your order from stock upon receipt of proper priorities. If not, we know *where* the materials can be obtained, *how* they can be obtained, and how they can be shipped to you far more promptly than you may have thought possible under existing war-time emergency conditions. "Electronics" is nothing new to us. Try our service on your next order—small or large!

RCA

Remember: The "Magic Brain" of any Electronic Device is a vacuum tube and the fountainhead of modern tube development is RCA. We are headquarters for RCA Tubes for all applications; also RCA Test Equipment, as well as resistors, rheostats, relays, capacitors, transformers, wire, coils, and the products of many different manufacturers.

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HOUSTON

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SAVE TIME—AVOID TROUBLE

It pays to buy specialized Electronic items from long-time specialists in this field!

Our experience is broad—our stocks normally large—our service prompt—and our technically-informed staff geared for just the type of service busy Electronic equipment users require.

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Headquarters for Accurate, Informed Service on

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- Capacitors
- Resistors
- Controls (Potentiometers)
- Relays (Solenoids)
- and countless other components, produced by many manufacturers

Making war equipment that necessitates frequent calls for Radio-Electronic tubes and other Electronic components? Then get acquainted with our service—today!

Chances are, we've got what you need in stock—for immediate delivery upon receipt of suitable priorities. If not, we're well equipped to get it for you faster than you can obtain it from any other source—and to render intelligent, personalized expediting service all along the line. Try us on your next order and be convinced!

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FIVE FORKS BATTERY STATION

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Danville Virginia

Phone 797

RCA *THESE EMERGENCY ELECTRONIC EXPEDITERS*

Today, two years after Pearl Harbor

. . . Many of our boys are gone.

. . . Midnight oil is being burned by the barrel.

. . . Yankee ingenuity is being worked overtime.

. . . Our stocks are not as large as they used to be.

. . . Often, we've got to search all over the map for some small but necessary part that, yesterday, was only an arm's length away.

. . . And it's not unusual to be asked to furnish something entirely out of our line—or maybe something we've never heard of before. . . .

BUT . . . ***THE ORDERS ARE FILLED . . . AND FILLED ON TIME!***

Meanwhile, we're not kidding ourselves or indulging in self-pity because we have to work twice as hard as we've ever worked before. It's our job—the very least we can do—and we mean this sincerely when we say it. To deliver the goods on time; to be courteous, helpful, and genuinely efficient will, we hope, in some small way, repay our debt to our nation and those who fight its battles.

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A Constant, Dependable Source of Supply for
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Tubes! Resistors! Capacitors! Relays! Transformers! Coils! Test Equipment!
and 1001 OTHERS Delivered Immediately!
For large and small quantities from stock . . . or for hard-to-find components and equipment, HARVEY is a constant, dependable source of supply. This is our 18th year of service—buying, selling, representing and warehousing stock from America's leading manufacturers. Orders are filled quickly and efficiently. Components that we may not have at the moment are promptly traced by a staff trained to find them. If you need technical advice or have priority problems, our experts are at your instant command. In short, we are here to see to it that you get the best . . . and the best qualified . . . for your money.
Our Customers Are Our Best Advertisement
. . . Among Them You'll Find:
WAR PLANTS • AIRCRAFT PLANTS • PUBLIC UTILITIES • SCHOOLS • RADIO STATIONS
RESEARCH LABORATORIES • SHIPYARDS
U. S. ARMY AND NAVY
The proof of the pudding is in the service that we can render. If you need radio and electronic components, make it a point to contact HARVEY first.
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RCA THESE DISTRIBUTORS KNOW WHAT'S

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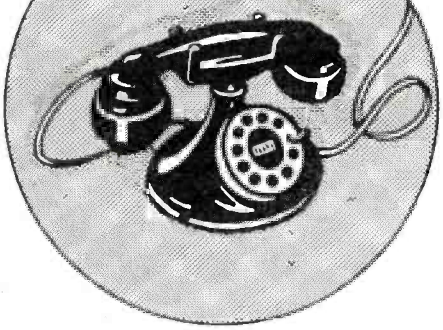
LAFAYETTE RADIO CORP.

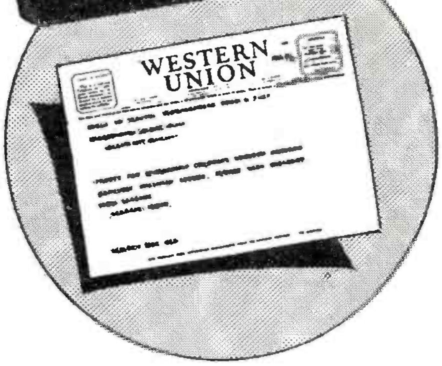
IS AS CLOSE TO YOU AS

a Letter

a Phone Call



a Wire



More than 20 years of "know-how" and "know-where" places Lafayette in a favorable position to rush needed radio and electronic parts and equipment . . . in almost any quantity . . . to war plants, government agencies, schools, laboratories, dealers, servicemen.

Working hand-in-hand with

RCA

and other fine manufacturers, and aided by a seasoned technical and expediting staff, we maintain two complete organizations, strategically located in Chicago and Atlanta. Here, we cut through red tape . . . assist you with priority problems . . . give you the help of our consultant radio technicians and engineers. And, every piece of equipment comes to you with our ironclad guarantee of satisfaction.

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"Same Day Deliveries" Difficult as it is, we make every effort to provide "Same Day Deliveries" wherever possible. Telephone HAymarket 0422 for Chicago and WAlnut 5140 for Atlanta. Teletype CG 320 for Chicago and AT 398 for Atlanta.

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Special Training Kits... This is a special division devoted to requirements of wartime industry and the Armed Services. Bids and advance quotations are invited.

Free! The Newest and Only Up-to-Date Radio and Electronic Catalog Available Today Newest listings of radio and electronic parts and equipment; latest developments in inter-communications apparatus; greatly expanded listing of tools, especially for factory use; an invaluable volume for all engaged in vital war and civilian work.

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ATLANTA 3, GEORGIA

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for prompt delivery of

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PUBLIC ADDRESS SYSTEMS
MICROPHONES RCA TUBES
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RELAYS RESISTORS CONTROLS

Replacement Parts for All Makes of Radio

● We carry normally large stocks for immediate delivery upon receipt of suitable priority. On items not in stock we usually know of a source of supply and therefore can be of considerable assistance to you in procuring vitally needed equipment. Our engineers have had many years of experience and are equipped to render invaluable advice, if you wish.

PROMPT, EFFICIENT SERVICE
ON ALL ELECTRONIC LINES

INTERSTATE SUPPLY COMPANY

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FOR QUICK EFFICIENT **SERVICE**

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These are days when it pays doubly to send your orders for Radio-Electronic materials to a long-time specialist. We know the field. We know what is available. We know where it can be obtained—faster than you may

have thought possible under existing war-time emergency conditions.

RCA Tubes, RCA Test Equipment—or resistors, rheostats, controls, potentiometers, capacitors, relays, transformers, wire—or numerous other products produced by many manufacturers. They're our business. We know how to deliver the goods. Try us on your next order!

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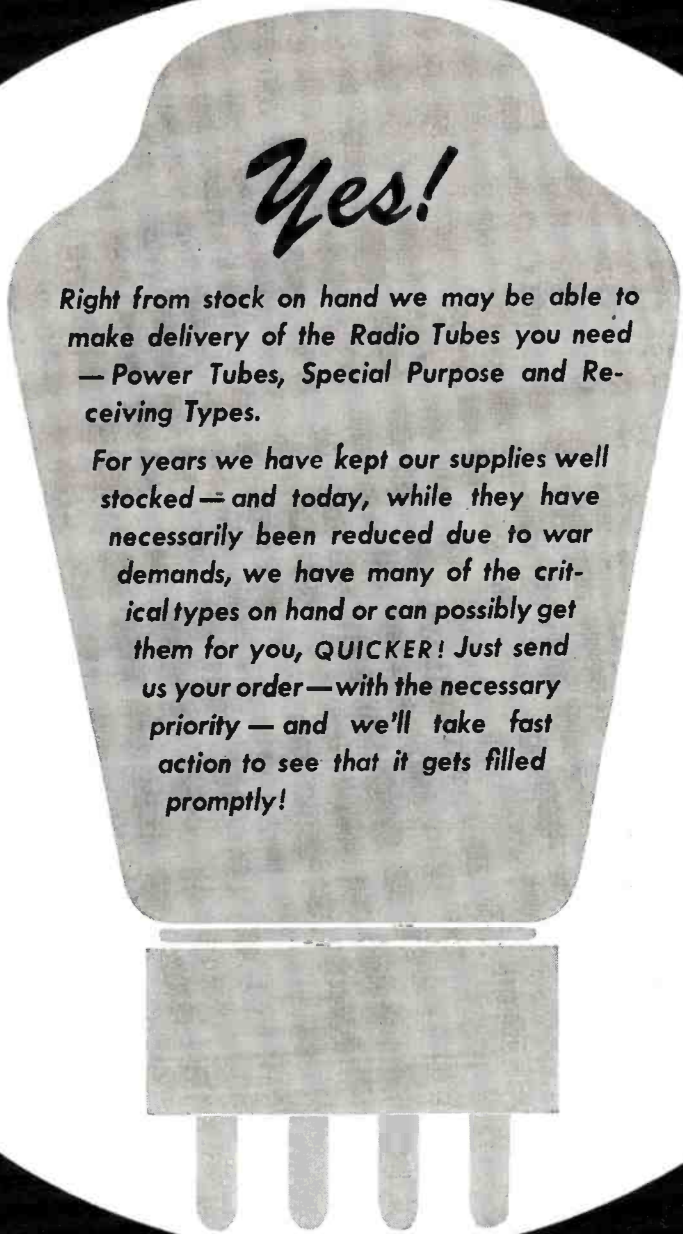
Grace at 14th St.
RICHMOND, VIRGINIA
Phone 3-1946

TUBES AND RCA EQUIPMENT

RCA CHECK WITH YOUR RCA DISTRIBUTOR FIRST

IF IT'S TUBES YOU NEED
Chances are We Have Them!



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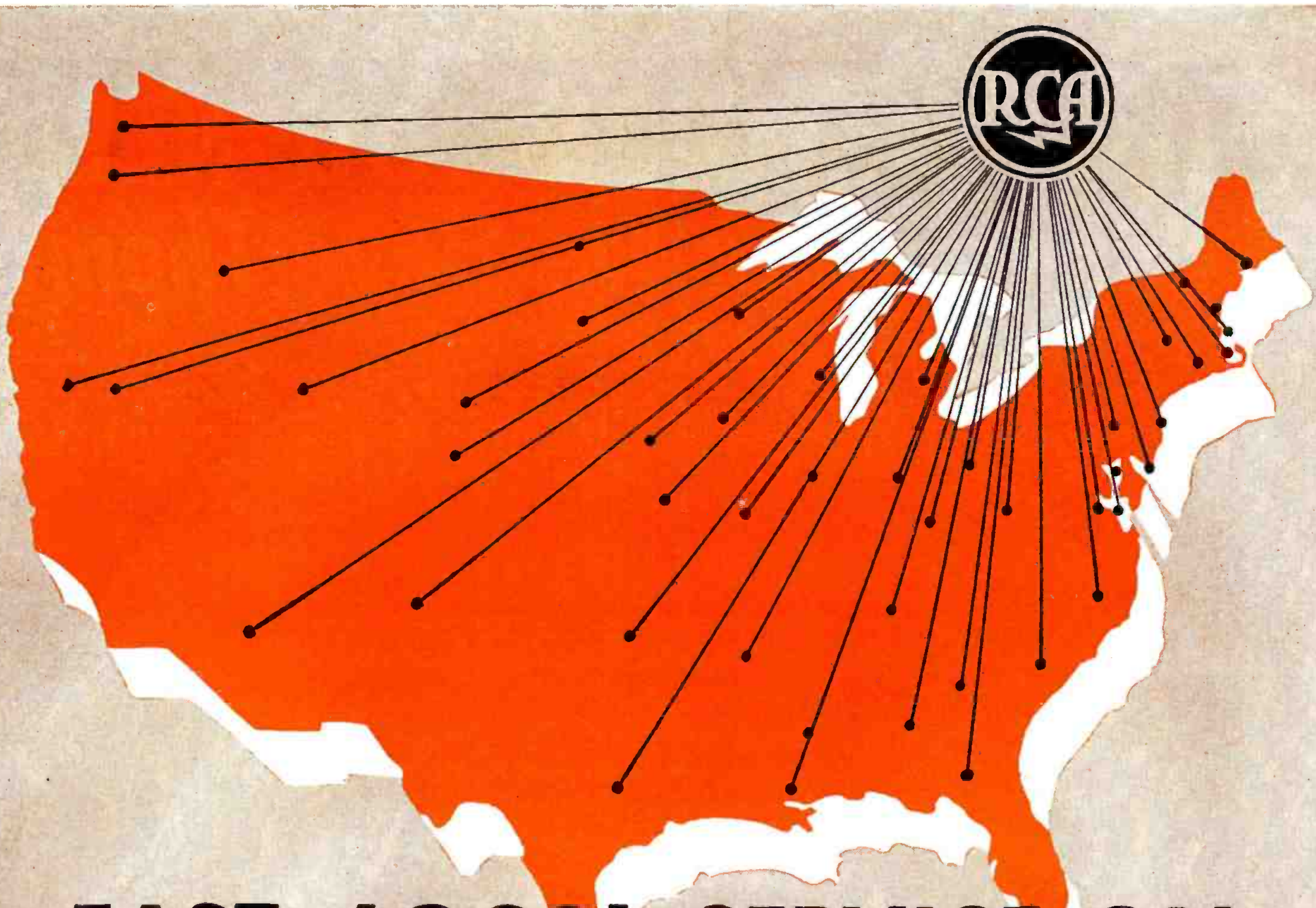

FAST, LOCAL SERVICE ON A NATION-WIDE BASIS

No matter where your plant may be, it is in a territory that is served on a close-range, personalized basis by an RCA Tube and Equipment Distributor.

Whether your need be for one Electronic item or a dozen, this Distributor is geared to help you select it correctly—then get it faster than you may have thought possible under wartime conditions. He knows Electronic equipment technically. He knows the Electronic markets. Above all, he knows how to deliver the kind of service that busy war equipment manufacturers require.

Let him serve as your specialized expediter in this fast-growing field!

RCA VICTOR DIVISION, CAMDEN, N. J.

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. . . Then turn back to the preceding pages for important messages by many RCA Tube and Equipment Distributors. These firms are geared to serve you. They may have just what you need in stock. If not, they know where to get it as fast as possible—and how to render an intelligent, personalized expediting service. Equally important is their technical knowledge. They know what to use, and how to use it. You'll find their technical advice and recommendations a big help!

RADIO CORPORATION OF AMERICA

(*Continued from page* 272)
permen with from 10 to 20 years' experience on the metropolitan papers.

Each student starts out on this final lap with a complete speed camera outfit which has been assigned to him for the duration of the course and a personal locker for his equipment. The students, who by this time are considered trained combat photographers, work from an assignment desk organized along the same lines as the assignment desk of any newspaper.

The field assignments given to these students are chiefly but not exclusively of a military nature. They go within a 30-50 mile radius from the Center in Long Island City and include the "shooting" of Officers at various public functions, military parades, all types of maneuvers, and pyrotechnic exhibits at nearby towns, the latter giving the students practice in night photography. On request of the Training Division the students are sent to cover pictorial stories in such restricted areas as ports of embarkation, Halloran General Hospital, and scenes of air accidents. And twice a week, these men are sent to the Tank School at Eastview, N. Y., where they learn to work with and from tanks through hazards and obstacles. It is during these assignments that the students begin to apply their classroom knowledge of continuity and the value of story-telling pictures.

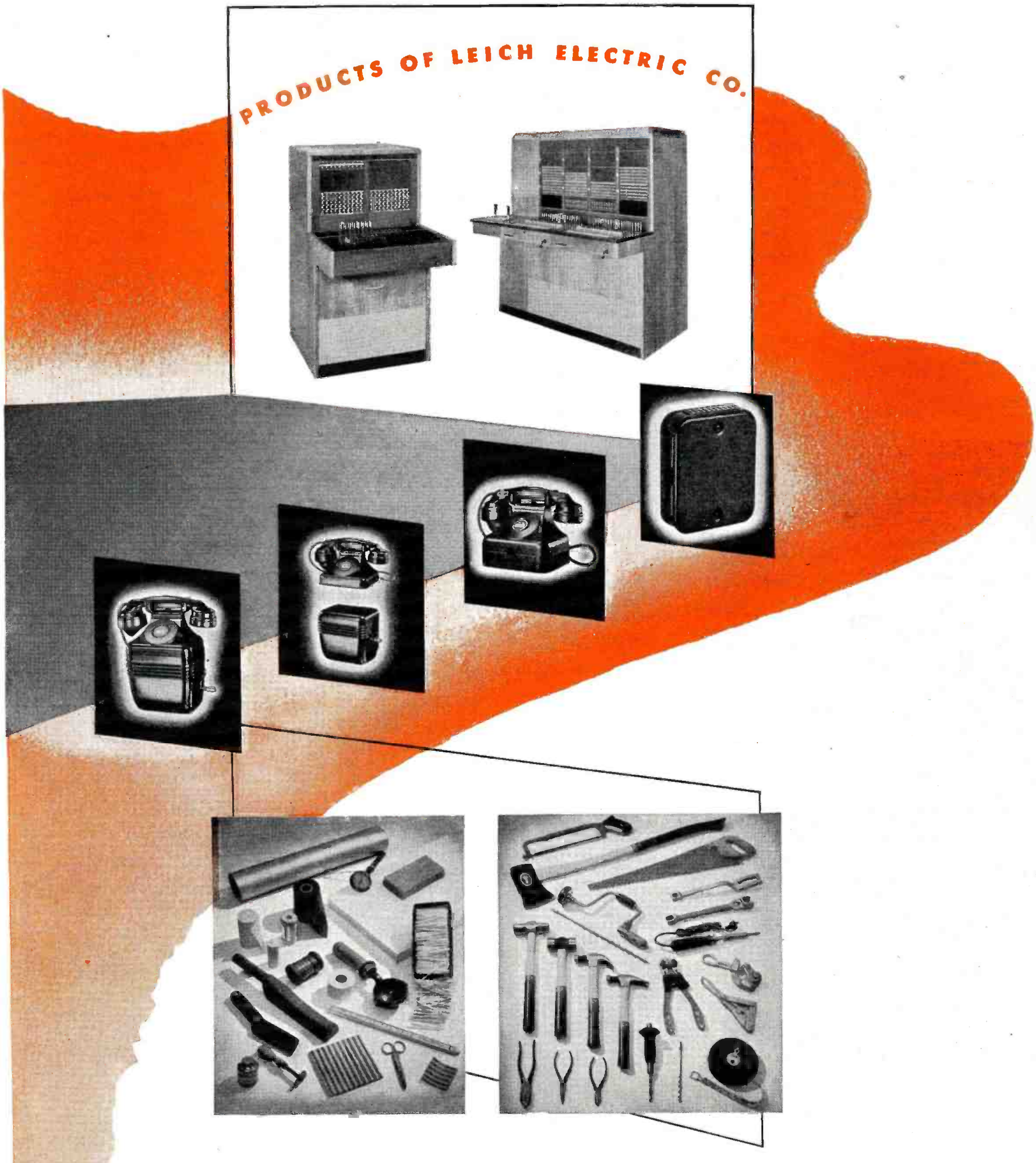
The aim of this part of the training program is not only to give the students practice in photography but to simulate battle problems and conditions. Thus, after arriving at a given destination, usually a wooded or suburban section, the men are taken on a nine-mile hike through streams and swamps, learning to protect the camera from water, shrubbery and entangling foliage, learning camouflage. On these hikes and under these conditions, they take pictures, remembering all they have previously learned regarding range, speed, exposure, and composition.

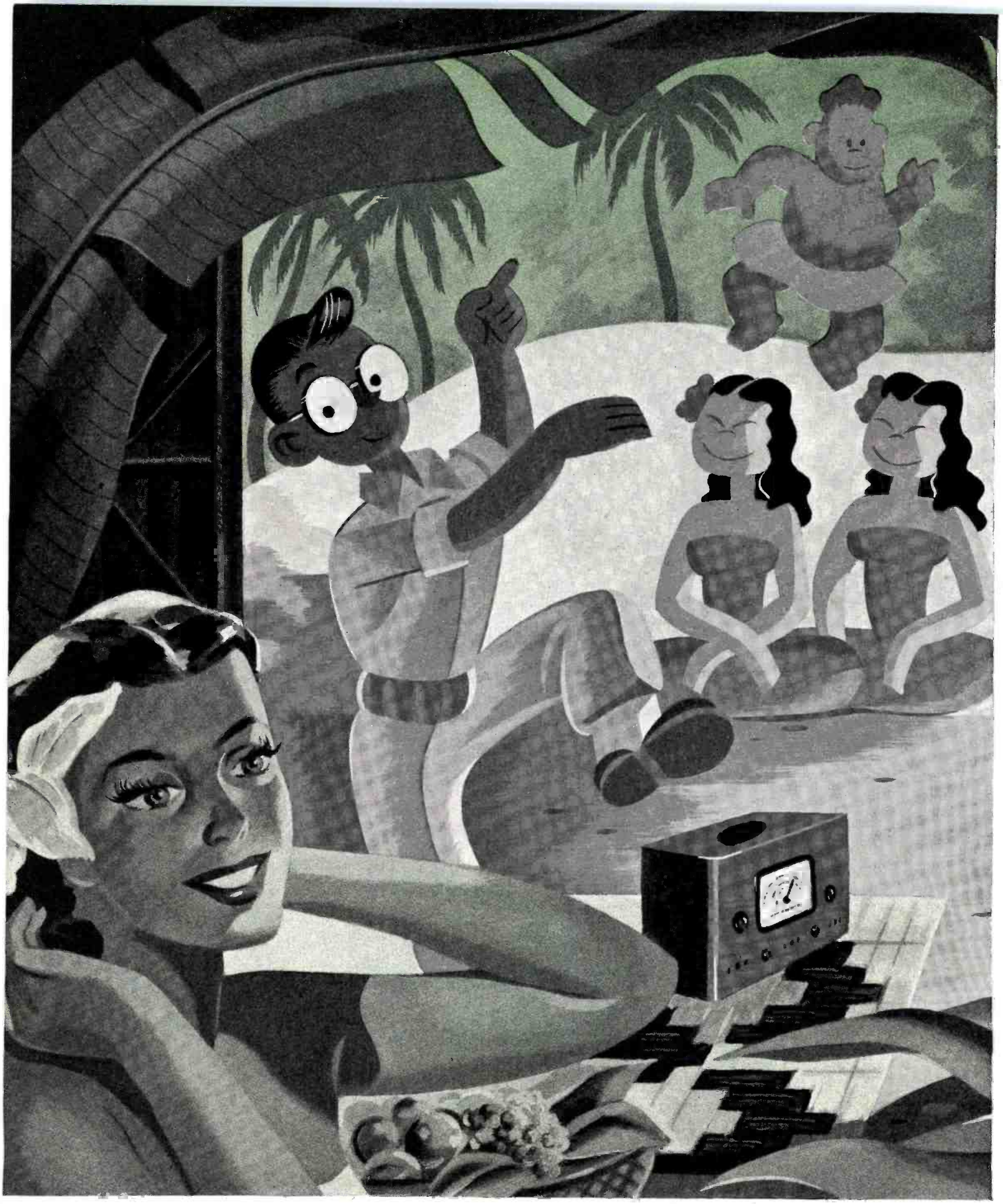
On these trips, the men are taught how to set up a portable laboratory unit. They erect a canvas tent and make it light-proof, in order to use it as a darkroom. Water is secured from nearby streams. The main object of a portable laboratory is speed and the men are required to make a photographic print from a wet negative and to deliver the wet print in 15 minutes.

Another very important phase of this study is the negative critique class held twice a week for the entire section. Each negative is projected on a screen and criticized by the instructor. The strong and weak points of each negative are brought to the attention of the class.

Each student in the still school is also required to know laboratory technique, so although these students are mainly photographers rather than technicians, they receive darkroom training along with everything else.

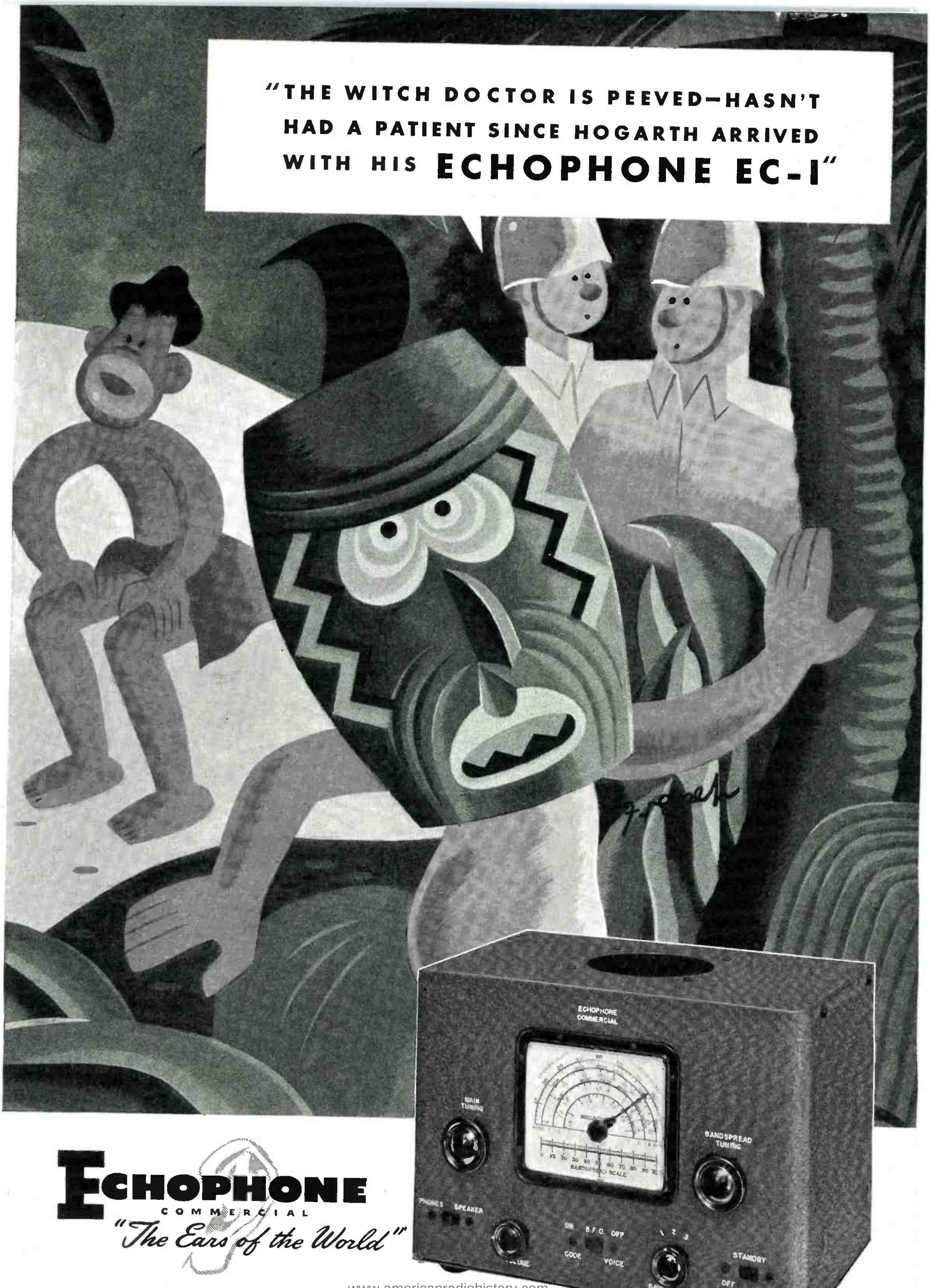
Weekly, all the instructors mark the


PRODUCTS OF LEICH ELECTRIC CO.



ECHOPHONE MODEL EC-1

(Illustrated) a compact communications receiver with every necessary feature for good reception. Covers from 550 kc. to 30 mc. on three bands. Electrical band-spread on all bands. Beat frequency oscillator. Six tubes. Self-contained speaker. Operates on AC or DC.


"THE WITCH DOCTOR IS PEEVED—HASN'T HAD A PATIENT SINCE HOGARTH ARRIVED WITH HIS ECHOPHONE EC-1"
ECHOPHONE COMMERCIAL
MAIN TUNING
BANDSPREAD TUNING
PHONES SPEAKER
B.F.O. OFF
CODE VOICE
STANDBY
ECHOPHONE
COMMERCIAL
"The Ears of the World"

negatives taken during the week by the students on field assignments. This enables the school to keep a complete record of the photographer's work during his training period. All the negatives are then filed under the student's name with the name of the project, instructor and grade.

At the end of each week, a "Picture of the Week" is chosen from the week's crop and conspicuously posted on the bulletin board together with the name of the photographer and the exposure used. This coveted honor carries not only intangible prestige but a half day off for the happy soldier.

When the students have completed their 12-week training period in the still school, they are available for assignment as photographers (1) with mobile Army units in the field; (2) to training film production units; (3) special photographic units.

Although all the men in the photographic school receive basic training in developing and printing, some are selected after the first two weeks to specialize in the laboratory end of photography and are, therefore, given a ten week course in laboratory work. The emphasis here is, of course, developing, contact printing, and enlarging. The students are taught to make photographic and photostatic copies of maps, text matter, charts, and photographs. They are taught to run identification cameras and to develop the 100-foot rolls of motion picture film used in these cameras. They are taught to retouch negatives. They study photographic chemistry and the various uses and preparations used in photography. These students, too, are given field training. They are sent into the field to set up portable laboratory units where they are required to work under difficult weather conditions. Another phase of their training is developing and processing under extreme weather conditions. They are required to print in temperatures as high as 130° and as low as 35°.

Into the third field of specialization, the motion picture school, is sent a group of carefully selected students for the remaining ten weeks.

As has been said previously, all the students in the school receive the same basic training for the first two weeks. The students who are selected for the motion picture specialization spend the third week in orientation and lectures on the fundamentals of pictorial continuity and on the mechanics, operations, and maintenance of the cameras used by the Army.

This takes them into the fourth week and the beginning of actual shooting. For the first three days the students are given cameras but no film. Under the supervision of an instructor, they do what is called in Army parlance, dry shooting. The students concentrate on planning and the sequence of long shots, medium shots, and close-ups. They practice handling the camera and equipment quickly under pressure and unusual conditions. The following three days, although the instructor remains with the class and the scenes are the same simple set-ups, the cameras are loaded.

During the fifth week the students are given simple, controlled stories to photograph under supervision, a controlled story being one in which the action may be repeated if necessary. All the films shot during these assignments are screened and criticized by the instructor who points out to the class the strong and weak points in the picture and then grades it.

The following week, the assignments remain on the same simple, controlled level but the students work without supervision from the assignment desk. The assignment desk of the school is organized and runs like the desk of any commercial newsreel company or the assignment desk of a metropolitan newspaper.

For the first three days of the seventh week the students are again given a series of lectures. This time on 16-mm photography and the use of kodachrome. The latter part of the week is spent in putting into practice the material presented previously in lectures. The assignments are more difficult, either harder controlled stories, or easy uncontrolled stories.

At this point the students are grouped into crews consisting of four enlisted men with an officer in charge. The officer facilitates the handling of assignments and arrangements. He does not shoot or direct. After he tells the cameramen what is expected of them, they go ahead with the assignment which is later screened, criticized, and graded. During this time each student is required to execute entirely on his own an individual assignment, the first of a series of three. Each man handles the entire assignment, making the contact, determining the time and shooting schedule, the amount of film required and the size of the crew.

The ninth week begins with the turning in of the second individual assignment. The men remain in the same crews and continue to work from the assignment desk. The crews are sent to cover real news stories, the same that are covered by the commercial newsreels and many others. During this week the students begin to cut and to edit their own films. This phase of the training is designed to give the cameramen a working knowledge of the mechanics involved in the operation of cutting and splicing machines. This experience gives them a greater appreciation of the problems that confront the cutters and editors and brings to the attention of the cameramen the importance of covering a story completely and thoroughly.

At the beginning of the tenth week new crews are formed. The object of changing the personnel of the crews is to prevent a group from becoming so accustomed to each other that it would be difficult for the individual members to work with other crews. The crews continue to report to the assignment desk for the day's schedule. The desk


Fastest Thing in Fastenings!
REDUCE
NET WEIGHT
RESIST
VIBRATION LOOSENING
Speed Nuts
CONSERVE WAR MANPOWER

endeavors to send the advanced crews out on military assignments, such as stories in Mitchell Field and the various camps and forts in and about the New York area. When the military objectives have been exhausted then the assignment desk sends crews to cover civilian activities. The students are given complete instructions as to deportment when dealing with civilian groups and individuals and as to forbidden subjects and subject matter. The students during this period continue to edit and cut their own film which is screened, criticized and graded. They also turn in the third and final individual assignment for screening and grading. For the last two weeks of the course, the students continue with the same routine but the crews are constantly changed.

During the entire course of study the students are required, twice a week, to attend showings of the newsreels made by the 5 major commercial companies. Once a week the entire school, both still and motion picture, is addressed by a war correspondent just returned from overseas duty. At this lecture the students are permitted to ask questions and have a round-table discussion.

At the end of the course, the students are given a five-day furlough and when they return they are ready for assignment to photographic units or companies going on overseas duty.

From time to time, officers and enlisted men of Army Photographic Companies, who have not been through the mill at the Photographic Center, are assigned to Astoria for special technical training. The course is much the same as described above. Upon completion of this training, the men are returned to their companies, where their field training continues.

—30—

Alaskan Theater

(*Continued from page* 156)

to take care of themselves." So it was that a Rodgers-trained team accompanying the task force to Attu knew how to take care of itself.

Back in Alaska proper the Signal Corps, through its Alaska Communications System, was meeting new and primitive problems in extending communication lines through storms, subzero weather, and over almost impassable terrain.

In one place a telephone line had to be strung from Portage to Whittier, a mere eight miles. Between the two points, however, was a mountain glacier over which it seemed virtually impossible to transport heavy reels of wire.

Again Signal Corps ingenuity met the challenge. Ten reels of twisted-pair telephone wire was loaded in an Army bomber. With its bomb bay doors open, the plane flew low over the glacier, aiming each reel at one of the stakes lining the route in deep snow. A line crew then struggled out

Signal Corps

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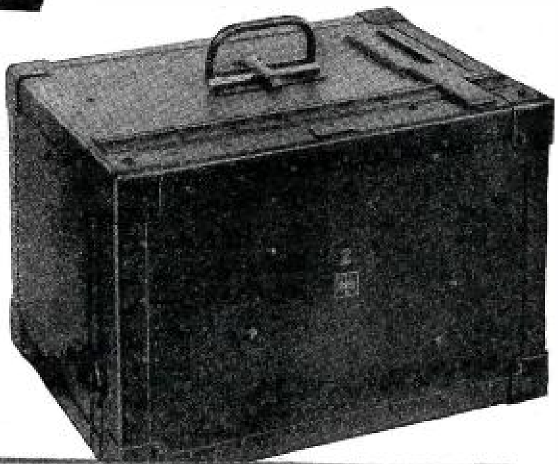

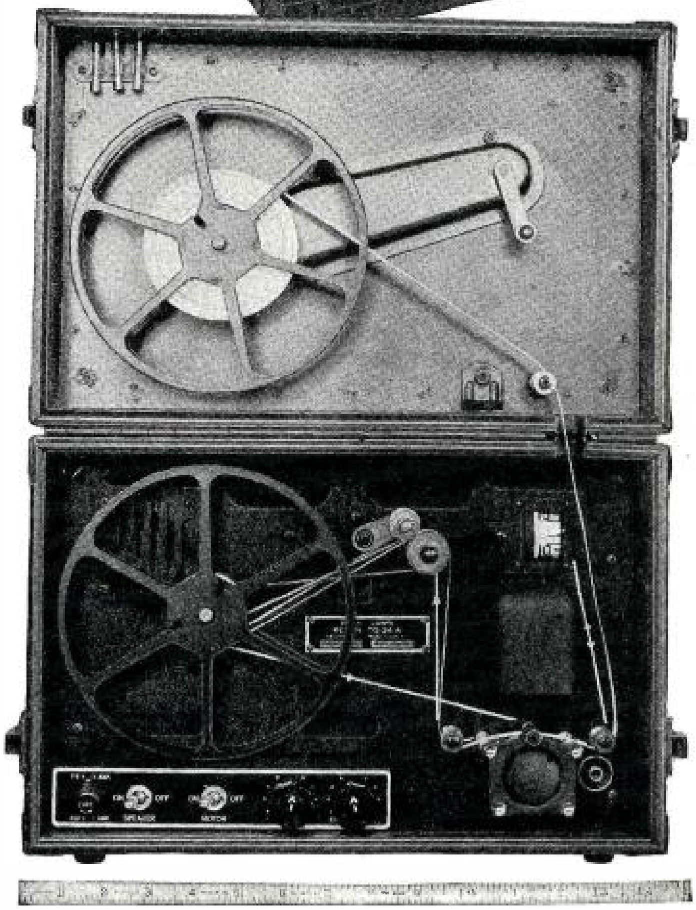

Thousands of our fighting men in various parts of the world are getting their first training on large TG-10 Keyers built by us. Now, with this new small field model, they can maintain and improve their code speed by practicing while in locations where portable equipment is essential.

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Using an inked paper tape recording, it produces an audible signal loud enough for a group of at least 25, and when provided with head phones, will serve several hundred listeners. Has only one plug-in attachment and can be put into operation in a few minutes. Has a variable speed ratio of 1 to 5 and a top speed of 25 feet per minute.

Gray has brought to the science of electronics the technical skill and inventive ability acquired in more than a half-century's experience in building electro-mechanical devices. When Victory is won, this knowledge and ability can be counted on to make outstanding contributions to peace-time progress.

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onto the glacier and strung the wire. Even so, it was no easy task; shortly after the line was completed, a workman froze to death trying to cross that same glacier.

Every area presented a new situation. Telephone and telegraph construction gangs battled drenching rains and hordes of fierce mosquitoes during the summer of 1942 to rehabilitate a line from Anchorage to Fairbanks and to string new lines from Anchorage to Portage and Whittier. The job still wasn't complete when winter came, so the men pushed on through blizzards and temperatures that ranged from forty to sixty degrees below zero.

Digging holes for antenna or telephone poles in the frozen ground was often like scratching at concrete. Picks and shovels hardly dented the surface, so Alaska Communications System engineers hit upon the idea of using compressed-air jackhammers. After drilling below the surface, the workmen drove a perforated iron pipe into the ground, forced steam into the pipe to thaw the ground, and then enlarged the hole with picks and shovels.

In many sections telephone poles wouldn't stay in the ground. The annual thaw and freeze would push up a pole six inches to a foot every year, until it eventually sagged and fell, wrecking the line. To lick this problem, three holes were set as a tripod, tripling the construction work but avoiding the difficult task of maintenance in poorly accessible tundra and muskeg.

Windfalls, landslides, and devil-club —a vicious bush with hard stickers— hampered the climbing of mountains to install radio stations. Often engineers had to dismantle the equipment and reassemble it at the top.

The land of Aurora Borealis, famous for freak weather disturbances, played tricks, too, with radio transmission and equipment. The intense cold slowed the chemical activity of batteries and affected the intricate mechanism of radio sets. With adjustments and improvements, however, the equipment won high praise for its performance—a direct tribute to the advance research and planning for sub-Arctic operations.

Behind all of this is the story of a tremendous expansion by the Alaska Communications System, whose personnel mushroomed from 320 to more than 3,000 in two years. It involved a huge job of procurement and of training radio and teletype operators, technicians, and construction teams.

"There are never enough men or equipment on the frontier," said Col. Harry L. Vitzthum after an Alaskan tour. "One headquarters station had to expand four times, handling nearly 200,000 messages a month." Down in Alaska Communications System headquarters at Seattle, the problem was even more acute. There the personnel turned over completely—except for two men—thirty times in ten months.

The greatest over-all difficulties were created by the sheer distances involved; not many persons realize that from Alaska's southernmost island to its Arctic tip, is as far as from the Rio Grande to Canada.

Already, however, Alaska Communications System-engineered equipment guides planes and gives them voice, warns coastal batteries of the approach of hostile forces, links commands of tactical units—and has shrunk the vastness of Alaska and Northwest Canada to the distance between your home and the corner drugstore.

-30-

Army Pictorial
(Continued from page 147)

Service Headquarters at the rate of approximately 5,000 a month, are distributed throughout the armed services to bring home, as no amount of words ever could, the lessons of fighting that may be used to shorten the war.

During the first week of the Sicilian campaign, The Still Picture Library Section received 3,400 pictures. In this section the pictures are sorted for the various interested departments; those for release to the public are selected; all of them are studied for improvements and suggestions on photographic technique, and finally, an extensive filing system is maintained.

Filed pictures are cross-indexed by subject matter, location, personalities, campaigns, and serial numbers, so that at any time in the future they are ready for instant reference.

For the Tunisian campaign, Army Pictorial Service sent over a specially trained "commando outfit" of eight photographers who penetrated to the heart of virtually every battle.

Perhaps the most remarkable part of the photographing of the Sicilian campaign was the fact that pictures of the initial landings of the American troops were being studied in Washington the afternoon of the day they were made. They reached the Capital seven minutes after they left Africa!

This is the accomplishment of Signal Corps Radiophoto. Radiophoto installations are being set up by the Signal Corps all over the world to speed the transmission of vital pictures. They virtually enable the high command at Washington to "see" a battle while it is in progress. The public, too, shares in the advantage of this achievement. Some of those pictures of the Sicilian landings appeared in American newspapers within hours of the actual happening. From the radiophoto machines at headquarters, pictures are distributed to the newspicture services to be telephotoed to every part of the country.

Not only black and white, but color photography is employed by APS photographers wherever pictures in natural colors would be of advantage, such as in the study of camouflage.

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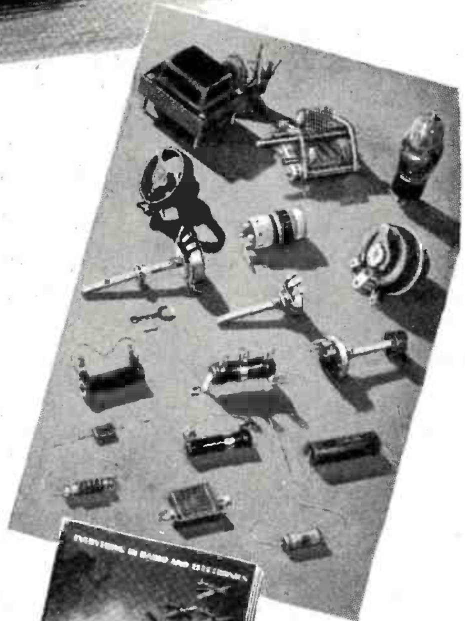

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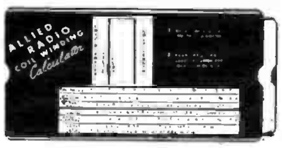

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ters of operation, Army Pictorial Service maintains laboratories all over the United States and photographic teams are dispatched to any point at which there may be call. As an example, two units of motion and still picture photographers "covered" the Quebec conference of President Roosevelt and Prime Minister Churchill in August, 1943.

Many more men are also in training under a continuous program of expansion and replacement that has its headquarters at the Signal Corps Photographic Center, Long Island City, L.I. While soldiers in the Army Pictorial Service are specially selected for previous training, the work of the service requires much training of an ultra-specialized nature. Besides, it is obvious from the work of the photographers at the front that they also need combat training of a high order.

Thus far, however, we have described only a minor portion of the work of Army Pictorial Service today, colorful as that portion may be. Still a major function of the Service is the Photographic Production Branch, with its Production Control Section.

The biggest job of the Production Branch has been the making of training films, a program that was begun in the last war and has reached such a point of development in this one that it has become almost indispensable to the Army's training system. The Production Branch makes two-thirds of all the Army's training films, which includes all confidential pictures and all those requiring extreme supervision. Where civilian actors or expensive sets, scenes, and equipment are required, contracts are made with commercial producers through the Hollywood Branch of the service. On such jobs, the APS assigns one of its own officers as unit manager and one or more technical advisors from whatever arm or service is concerned in the making of the picture.

Film strips and slides are also used extensively in the training programs for projection on screens to illustrate lectures, and at this writing the Production Branch is in the midst of making 3,000,000 slides to teach airplane, tank, and ship identification to our troops. Without these, the job of teaching our soldiers to recognize our own and enemy planes, ships, and tanks would be practically impossible.

In using these slides, the Air Force has a device for gradually speeding up their projection until finally the students are able to recognize a plane after a projection of one-fiftieth of a second, barely long enough for the image to register on the eye. Often in combat, as planes flash past each other, this is as much of a glimpse as these men will get for making a life and death decision.

Film libraries for training purposes are maintained in every service command in the United States and every theater of operations abroad, with sub-libraries in every post and station.

As much training film is now being produced monthly as in the entire pre-war era. But as the Army reaches its full, war-time strength, the training film program begins to taper off. At the same time, U. S. Army activities become more highly co-ordinated with those of the other United Nations and the Production Branch has undertaken the fast-growing job of rescoring our training films in other languages for their use. This branch also adopts the films of other nations, and of the Navy and Marine Corps, to the uses of U. S. Army troops.

What has proved an extremely useful function of the Production Branch is the making and issuance of film bulletins which are in reality short training films on new equipment and methods to keep the entire Army abreast of new developments. This branch also produces a "screen magazine" which is shown for morale and educational purposes on the same bill with Hollywood features for off-duty soldiers in posts and stations. Much of the screen magazine material is in the lighter vein, such as the adventures of Private Snafu, who illustrates for the soldiers the wrong way of doing things.

The films produced for the Industrial Services Branch of the Army Bureau of Public Relations, to speed up production by showing workers how their products are being used in the Army, have met with immense success.

The Signal Corps, Army Special Services Division, and Hollywood studios, are collaborating in the making of the famous "Why We Fight" series

of orientation pictures which have been called the most potent portrayal yet of America's position in the war. The eventual showing of all these dramatic films to the public seems almost a certainty. Recruiting pictures for the WAC, films illustrating specific problems for commanding officers, and records of tests of new equipment and procedures, made by specially assigned units, are also included in the vast scope of the Production Branch program.

All of this volume of production gives some idea of the problem of supply and distribution of photographic materials, which is the responsibility of the Signal Corps, not just for itself, but for most of the Army, along with the procurement and allotment of the film for the Navy, Marine Corps, Coast Guard and Army, including the Army Air Forces.

From a few thousand letters a month, the V-Mail service has expanded until it is now handling 25,000-000 a month, and still its growth is continuing.

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Radiophoto

(*Continued from page* 218)

conceived by Brig. Gen. Frank E. Stoner, then Signal Officer of the Third Army, and the writer. The assistance of Mr. L. A. Thompson, chief telephoto engineer of Acme Newspictures, was obtained and successful tests were conducted over field wire, commercial telephone, and radio facilities.

The results of these experiments were presented to General Walter Krueger, then Commanding General, Third Army and the Chief Signal Officer at Washington.

Experiments continued and in June of 1942 the first installation of a telephoto network was made by the Army Communications Service for the wire transmission of maps, charts, and pictures to the various Defense Commands. Equipment was installed in Washington, New York, New Orleans, and San Francisco.

Since traffic was light in those pioneering days, the first equipment at Washington was installed in a renovated broom closet. With the first machine arrived Sgt. Joseph E. Dunn, who handled the operation in the department's infancy—even doing the photographic processing without running water. As the personnel increased, he became chief operator, a position he still holds.

The service was an instant success. By November of that year new stations had been installed in San Antonio, Texas, and Seattle, Washington. These provided the War Department with a contact at each of the four Defense Commands and with the headquarters of the Alaska Communications System.

In January of 1943 the Army Air Forces, faced with the problem of

rapid delivery of its meteorological weather charts, conferred with General Stoner, now Chief of the Army Communications Service. As a result of this conference a station was installed at the California Institute of Technology, where the Meteorological Research Division of the Air Forces was then located. From this station weather maps were transmitted to Washington for delivery to the Directorate of Weather.

By this time the section had moved into new quarters in The Pentagon. Equipment necessary to adapt the wire telephoto to radio operation had been designed and manufactured and the first overseas installation was made in Algiers in February.

Capt. Lawrence D. Prehn flew to Africa to install test equipment. Technicians adjusted equipment and experimented with the types of photograph developing and printing best adapted to transmission by radio.

A single test picture—showing Jinx Falkenburg playing tennis—was sent across the ocean more than a hundred times before the technicians were satisfied with the quality of the transmitted photograph.

To make the best use of this new facility the Army Pictorial Service, another Signal Corps component, collaborated with the Bureau of Public Relations in sending a picked group of men to the North African Theater of Operations for the express purpose of shooting good battle pictures for radio transmission.

Capt. John J. Smith, photographer and former picture editor with a national reputation, was chosen to direct the mission. Among the photographers were Ray Scott of motion picture fame; Bob Wallace, one of America's foremost news and illustrative photographers; and several of the nation's better known press cameramen.

Photographs of the capture of Gafsa, radioed to this country and eagerly published, sent the service off to a flying start.

Next came the Sicilian invasion and the Italian campaign in which the photographic team demonstrated its ability in probably the greatest coverage of any series of battles in the history of pictorial journalism. Contributing were the many press photographers to whom the Signal Corps radiotelephoto facilities were made available.

Progress was made, meanwhile, in transmission technique and the improvement is best demonstrated by reproductions of radiotelephoto pictures shown with this article.

Two more stations have since been established in the Southwest Pacific area and plans are under way for other installations in London, Honolulu, and the Orient.

Operation of the equipment is simple, technically speaking. The photograph is clamped to a drum, shaped like a dictaphone record, which revolves at one hundred revolutions per minute. A tiny beam of light—one one-hundredth of an inch square—scans the drum, moving laterally at a speed of one inch per minute.

This beam, reflected to a photoelectric cell by lenses and an oscillating mirror, generates electrical impulses which vary in amplitude with the intensity of the light. This picture-carrying signal, with its 1,800-cycle, is applied to a telephone line.

Another process is necessary, however, before transmission by radio. To limit the effects of fading and interference, which would be disastrous to the picture, the signal is converted from a fixed frequency amplitude modulation to a constant amplitude with a varying frequency.

The signal is fed into a rectifier to get pulsating direct current and through a tube which controls the output of a variable frequency oscillator. The resulting output is mixed with that of a fixed frequency oscillator, then demodulated and filtered.

To receive a picture from this signal it must first be "inverted" back to amplitude modulation. The signal is first amplified and then sent through a pair of push-pull limiter tubes, which restrict the effect of selective fading to minus 65 decibels.

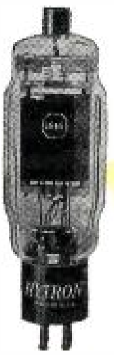
After filtering, the signal is again amplified and passed through a full-wave rectifier whose output, now a pulsating d.c. is fed to the plates of a control tube. The 1,800-cycle output of a fixed-frequency oscillator is applied to the grid of this control tube to provide the picture carrier. The

"Nothing Like Being Rugged, Eh Kid?"

Our mechanized Army must have brains, but brawn still counts. The big fellow wrestling interminably with 155 millimeter shells serves his greedy howitzer with the broad back developed by endless months of bone-tiring drill.

If it cannot take the jolts, vibrations, concussions, and extreme atmospheric variations of mechanized global war, the best electronic fighting equipment in the world is useless. Hearts of this combat equipment — electronic tubes — have two strikes against them from the start. Inherently delicate and fragile by nature, still they must be as rugged as the men who depend upon them.

Bump, vibration, immersion, life, and other punishing tests prove the mettle of Hytron tubes before they leave the factory. More important still, results of these tests form the basis for continual improvements in construction and processing. Throughout manufacture — in stem, mount, sealing-in, exhaust, aging, basing, and test departments — engineers, foremen, and skilled operators are ceaselessly striving to achieve in Hytron tubes not only the tops in electronic performance, but also the peak of dependable stamina which combat demands.



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resultant output may be applied directly to the standard telephoto equipment.

In receiving, the exposure, on the sensitized material wrapped around the drum, is affected by the same light beam used for transmission. The incoming signal, however, is applied to the modulator controlling the swing of the mirror, varying the intensity of the light striking the film.

The original picture is thus reproduced in negative form as the light beam draws thin lines—100 to the inch—across the film on the revolving drum.

Those almost overlapping lines reproduce the picture so faithfully, after it has been developed and printed in the usual mannner, that it is often impossible for any except an expert to detect the difference between the transmitted photograph and the original version.

—30—

Operational Research

(*Continued from page* 162)

to the other always in mind.

Personnel enter into a communication service in the performance of three major functions; as follows:

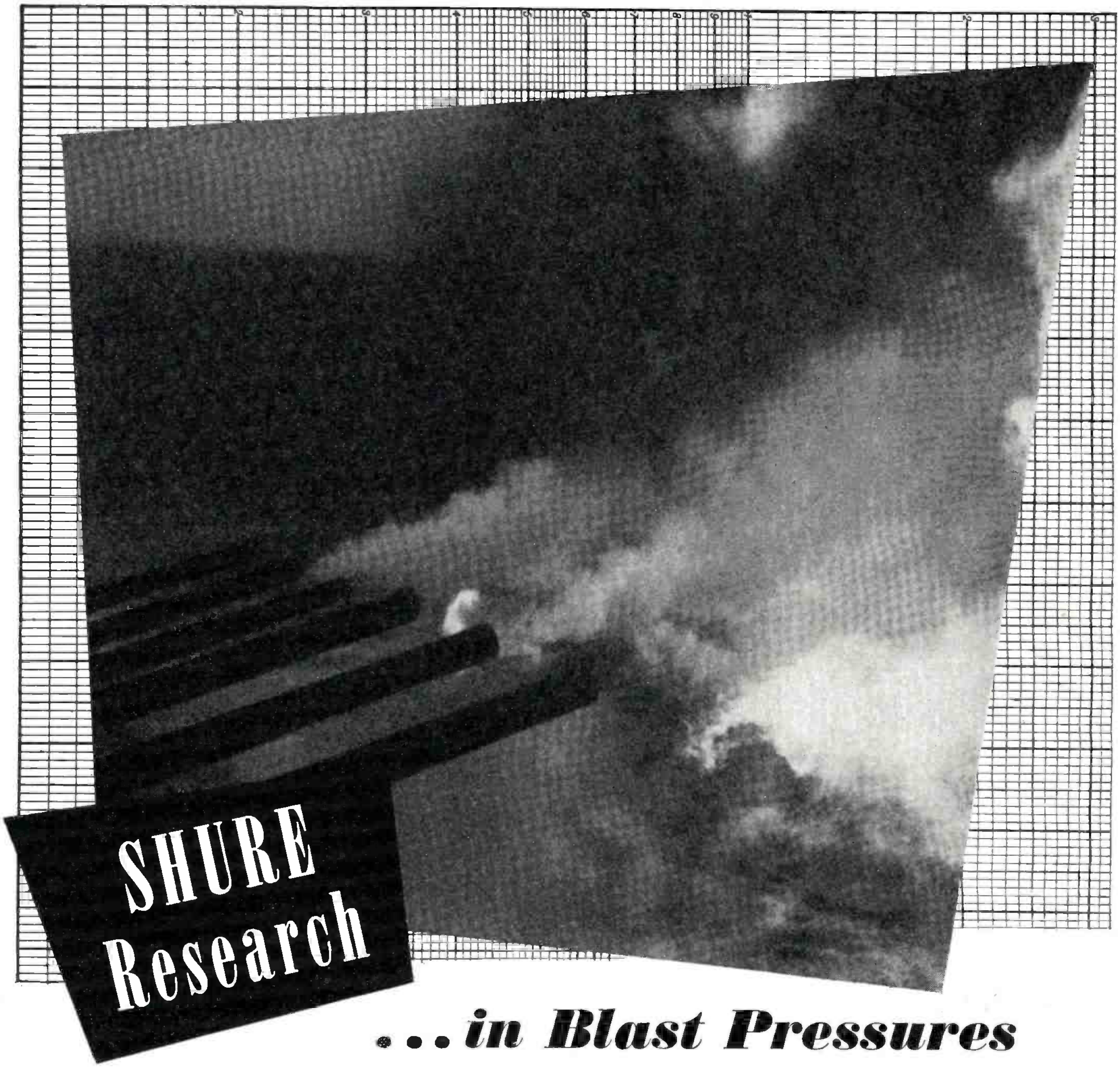
1. Personnel originate and receive the messages which use electrical means as a link.

2. Personnel plan the disposition of the equipment for its tactical employment.

3. Personnel operate and maintain the equipment.

In the origination and reception of messages by radio-telephone, the people at the terminals are part of the whole physical system and the performance of the system depends upon how they perform their functions just as much as upon how any coil or vacuum tube works. In military radio equipment, where weight is an important factor, the sets are commonly operated at just about the maximum range at which they can perform. Under these circumstances, the systems are naturally noisy in comparison with ordinary commercial circuits. Therefore, studies have been initiated looking toward improvement by proper speaking and listening procedures. Training methods are being continually developed to improve the operation of the people as a physical part of the system. Other Signal Corps equipment also depends upon the physiological reactions of the operators, their vision, or their hearing; studies are being made of the best methods of training and operating under these conditions.

The officers who plan the use of radio equipment may also perform other staff duties and so not be highly trained in the possibilities and limitations of radio systems or they may be very busy or find it necessary to make quick decisions. Under these circum-



...in Blast Pressures

In war, a microphone cannot expect to be pampered. It cannot be treated as a delicate instrument operating under carefully controlled conditions. It was a problem of Shure Research Engineers to design a microphone that would efficiently respond to infinitesimal speech pressure, and yet withstand the tremendous pressure of a sixteen-inch salvo—a pressure millions of times as great.

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stances, the information available may be too highly technical for ready use. The planning of operations may be greatly improved by simplified charts or other methods of presenting information, and studies for the improvement of such presentations have been made by the Operational Research Branch.

Everyone understands that a given gun can shoot only so far. However, no such general fact can be stated about a particular piece of radio equipment because its range under one set of conditions may vary widely from its range under another set of conditions. Equipment is often blamed for failure when it should not have been expected to perform under the circumstances to which it was subjected. The Signal Corps as a supplier has a duty to the using arms who are its customers, to supply the latter with simple and understandable technical information of the capabilities of the equipment it provides so that their plans for its use will be successful.

The operation and maintenance of newly developed military equipment is a particularly difficult problem. The training of personnel for this work cannot follow too closely the practice of civilian schools. When a democracy finds itself attacked and unprepared, it is essential that the soldier be taught enough to do his job immediately but he must not be taught unessential material, or time urgently needed will be wasted. It must also be recognized that when an individual has been taught a complicated job in a school, he does not really know it completely. He cannot be expected to carry it out in all details until he has had repeated practice. Yet he may be needed to perform these tasks at or near the front lines before that field practice has been obtained. This indicates three needs:

1. A careful analysis of the job to be performed.
2. A detailed step-by-step listing of work to be performed when jobs are complicated.
3. Adequate reference literature which can be used to teach the job in the schools and be used again to remind the soldier of his duties in the field. On complicated tasks, in the maintenance of large equipment, this literature must be of the handbook or reference type.

The job analysis of the operation and maintenance of radio equipment has been broken down into three groups:

a. Operating.

Turning the set on and off, proper tuning and adjustment, sending and receiving of messages.

b. Preventive Maintenance.

Preventive maintenance is the process of so operating and taking care of equipment that it will perform at its maximum efficiency and breakdowns will be reduced to a minimum.

c. Equipment Repair.

In spite of the best of care, equipment will inevitably have some failures. Men must be taught how to locate the troubles rapidly and make the proper repairs.

The Operational Research Branch has made extensive studies of the literature and procedure required for certain of the newer types of Signal Corps equipment. It has paid particular attention to the problems of preventive maintenance. It has developed a log system based on extensive broadcast engineering experience by which large and complicated equipments can be checked by inexperienced men and corrective measures taken before trouble has developed to a point where operation of the set would be interrupted. In this way, not only is improved performance obtained but the need for spare parts to correct failures can be reduced. The log system also serves a double purpose by supplying information, regularly and in sufficient quantity, which may be used as a basis for improvement of equipment.

The morale of personnel has been recognized as an important contribution to success in battle. If the personnel believe that they have good equipment, that they are well trained in its use, that they will be able to keep it operating, and that they have technical information and well trained officers to fall back on when they get into difficulty, they will turn in a much better job. These, of course, are technical factors over and above the general factors of proper housing, food, clothing, and recreational facilities. These factors are of equal or greater importance when

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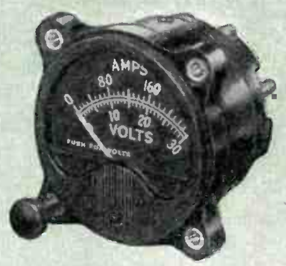
A New Design That Puts More Instrument into *Less* Space

These new, internal-pivot instruments were developed to fill a vital need—particularly in the radio and aircraft fields—the need for compactness. They are *thin*—in most ratings, less than 1 inch deep.

More important is the way their thinness was achieved. In the sketch below, see how the pivots are solidly anchored to the *inside* of the armature shell so they cannot work loose. The moving parts are permanently aligned with stationary parts by bolting the core assembly to a one-piece cast-comol magnet.

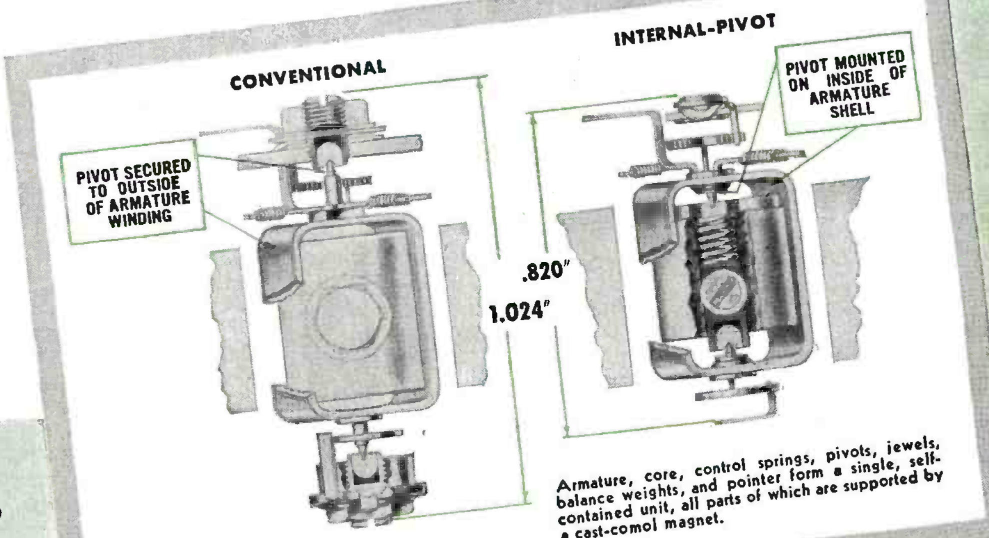
Other features are: large-radius pivots, high torque and good damping, lightweight moving element, and ample clearances. Added up, they give you an instrument well able to withstand vibration and hold its rated accuracy, one that is fast on response and easy to read accurately—a design that packs all-round fine performance in a small space.

For ratings, price, and dimensions, ask our nearest office for Bulletin GEA-4064, which covers instruments for radio and other communications equipment; or Bulletin GEA-4117, which describes those suitable for naval aircraft. *General Electric Company, Schenectady, N. Y.*



Type DW-53 d-c voltmeters, ammeters, and volt-ammeters that are specially designed to measure voltage and current in battery and battery-charging circuits on naval aircraft. They meet applicable Navy specifications.

Invest in your future
BUY WAR BONDS



Armature, core, control springs, pivots, jewels, balance weights, and pointer form a single, self-contained unit, all parts of which are supported by a cast-comol magnet.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

602-56-6200

the chips are down and performance in the field is the only thing that matters. Men can and will be proud of properly operating equipment and systems and will do their utmost to attain it if they believe it possible but will be equally indifferent if they are unable to produce results. These are all problems considered by operational research.

The performance of a radio link involves the use of equipment provided by man and a medium provided by God. However, the place where we must use the medium may be determined by the devil (the enemy). For many years, radiomen devoted themselves exclusively to a study of how equipment could be made bigger and better but were baffled by the vagaries of the medium in between. More recently, studies of the mechanism of the propagation of radio waves and how they are launched from antennas has provided knowledge of how to obtain improved results from radio systems.

The first studies of broadcast station performance were made by asking listeners to send in postal cards reporting reception. On this basis, very little planning of the anticipated performance of new stations could be done. When the technique of field strength and antenna efficiency measurements was developed, real engineering and planning became possible and is now the accepted method.

Point-to-point communications systems have more commonly been judged by service tests in which a particular set is tested under particular conditions. But such tests do not provide the information on which new systems can be planned for new situations. The performance obtained in a service test is a combination of many factors. Individual factors must be isolated in order to do engineering planning. In fact, that is the essence of the engineering method. As a contrast, the inability to isolate individual factors has always been the despair of those who have tried to reduce economics and other social studies to a scientific basis. As a first step factors involving equipment should be isolated from factors involving the terrain in the performance of a radio link. Then it will be possible to study terrain alone and predict how available equipment will perform under a new set of conditions, without testing every single set under these conditions. The importance of this is obvious when sets originally developed and tested in the United States must be used in the jungles of New Guinea, the snows of the Arctic, or the sands of Africa. There is not time to test all these sets individually all over the world before we send them out in large quantities to perform crucial tasks. The Operational Research Branch studies methods by which set and theater factors can be isolated, and works in cooperation with the Signal Corps laboratories in obtaining the analysis needed.

The improvement of equipment also requires an analysis of individual fac-

PERMANENT MAGNETS MAY DO IT BETTER

70 Permanent Magnets Are Used in a Flying Fortress*

IN the great Boeing B-17, permanent magnets are extremely vital parts of instruments, magnetos, compasses, audio speakers, radio equipment, the automatic pilot, and other highly complicated electrical and electronic devices. Additional permanent magnets in ground equipment help get the plane over its objective and safely home. These applications typify the constantly growing number of uses for which permanent magnets are being employed today.

Because of our 34 years of specialization in the development and manufacture of permanent magnets for peacetime products, our organization has played an important role in supplying units for numerous military machines and weapons. In many instances, uses have been increased and functions improved.

This unusual experience should prove invaluable to you in solving your engineering problems...and our specialists will be pleased to consult with you. Write us, on your letterhead, for the address of our office nearest you—and a copy of our "Permanent Magnet Manual."

*Approximate. Number fluctuates with model and combat requirements.

Back the Attack with War Bonds!

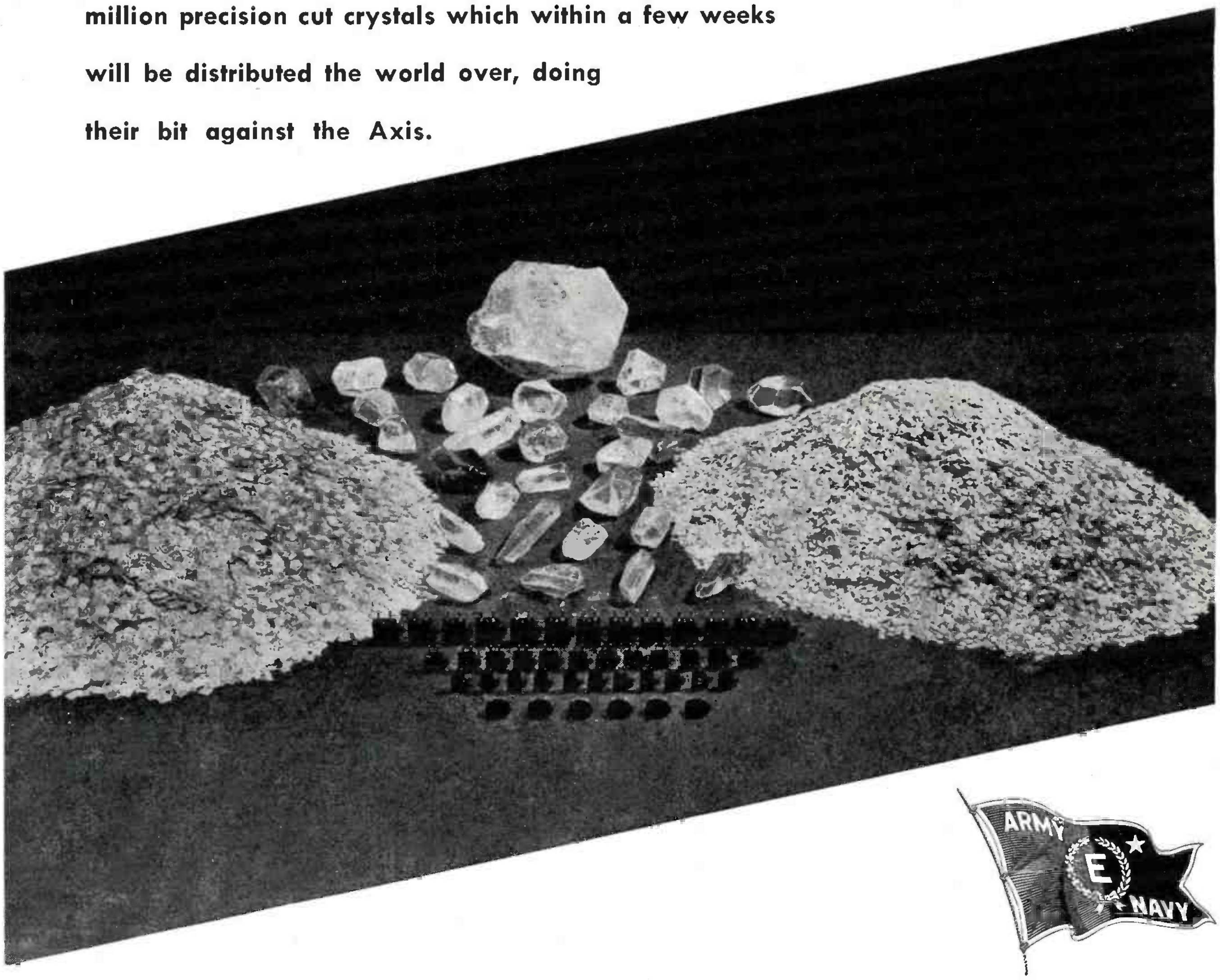
The
INDIANA STEEL PRODUCTS
Company

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO 2, ILLINOIS

Neither Too Little Nor Too Late

The two miniature mountains shown below, represent more than a half million precision cut crystals which within a few weeks will be distributed the world over, doing their bit against the Axis.



Because of years of extensive research and experience in the manufacturing of Quartz Frequency Controls, "MONITOR" was able to take the lead in quantity and quality production immediately following Pearl Harbor.

MONITOR PIEZO PRODUCTS COMPANY

THE LEADING MANUFACTURER OF QUARTZ FREQUENCY CONTROLS SINCE 1931

SOUTH PASADENA, CALIFORNIA

tors. If these individual factors are compared with carefully prepared charts showing the best modern practice, the weak and strong points are discovered. Then the point where emphasis should be placed in a development program, to accomplish the best results in the shortest time, can be quickly determined.

The Operational Research worker bears the same relation to the field operation of equipment as the industrial engineer does to the production of equipment. As industrial engineers constantly study better methods of production, the Operational Research Branch of the Signal Corps studies improvements in the use of equipment. It is not itself an operating group as it does not operate equipment nor does it direct the tactical operational procedures. Others are busy doing this and follow prescribed Army practices. The Operational Research Branch studies the operations and operational procedures from a detached engineering viewpoint and suggests to the operating groups new and improved methods aimed at a better over-all Signal service.

-30-

Operations

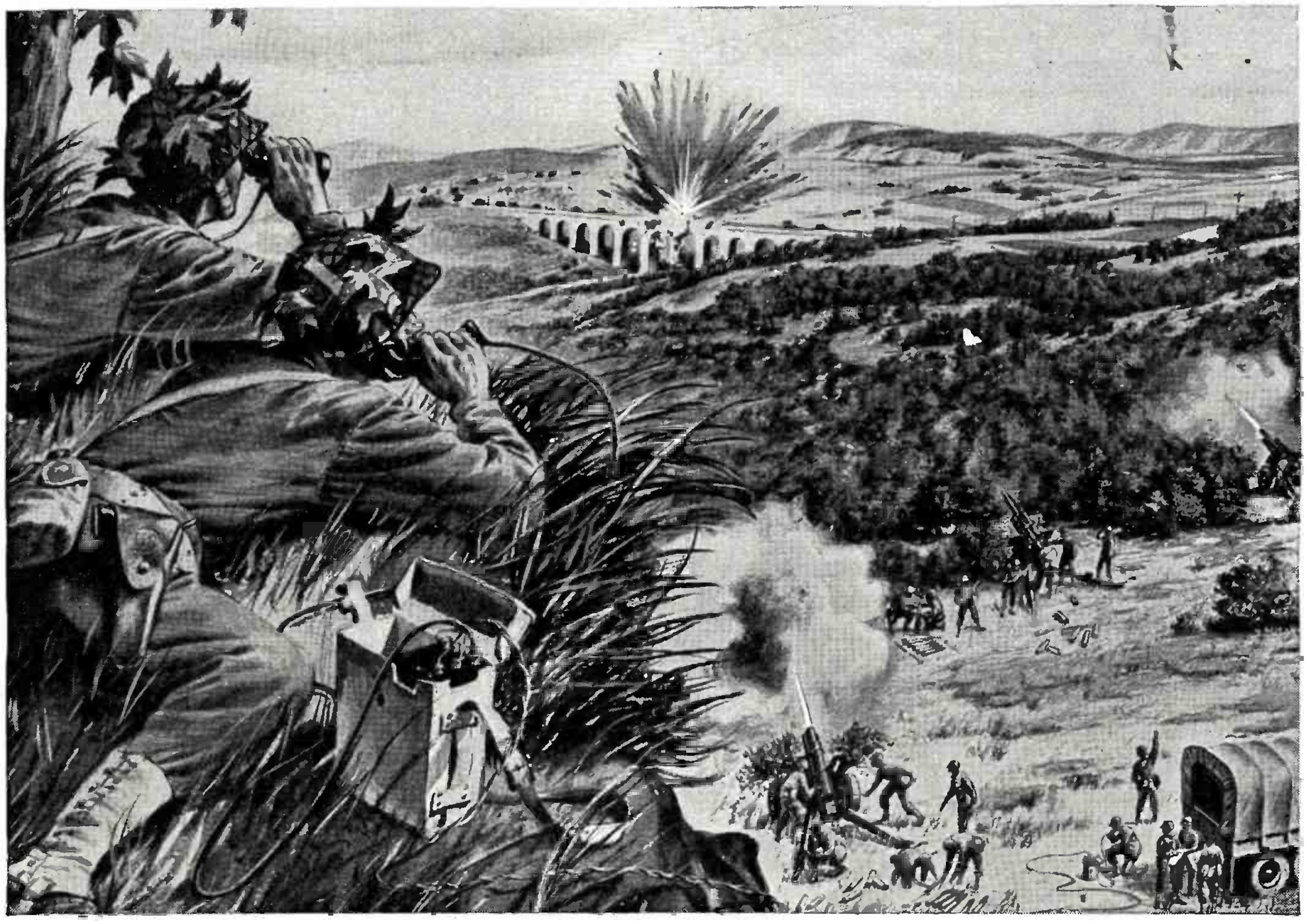
(*Continued from page* 124)

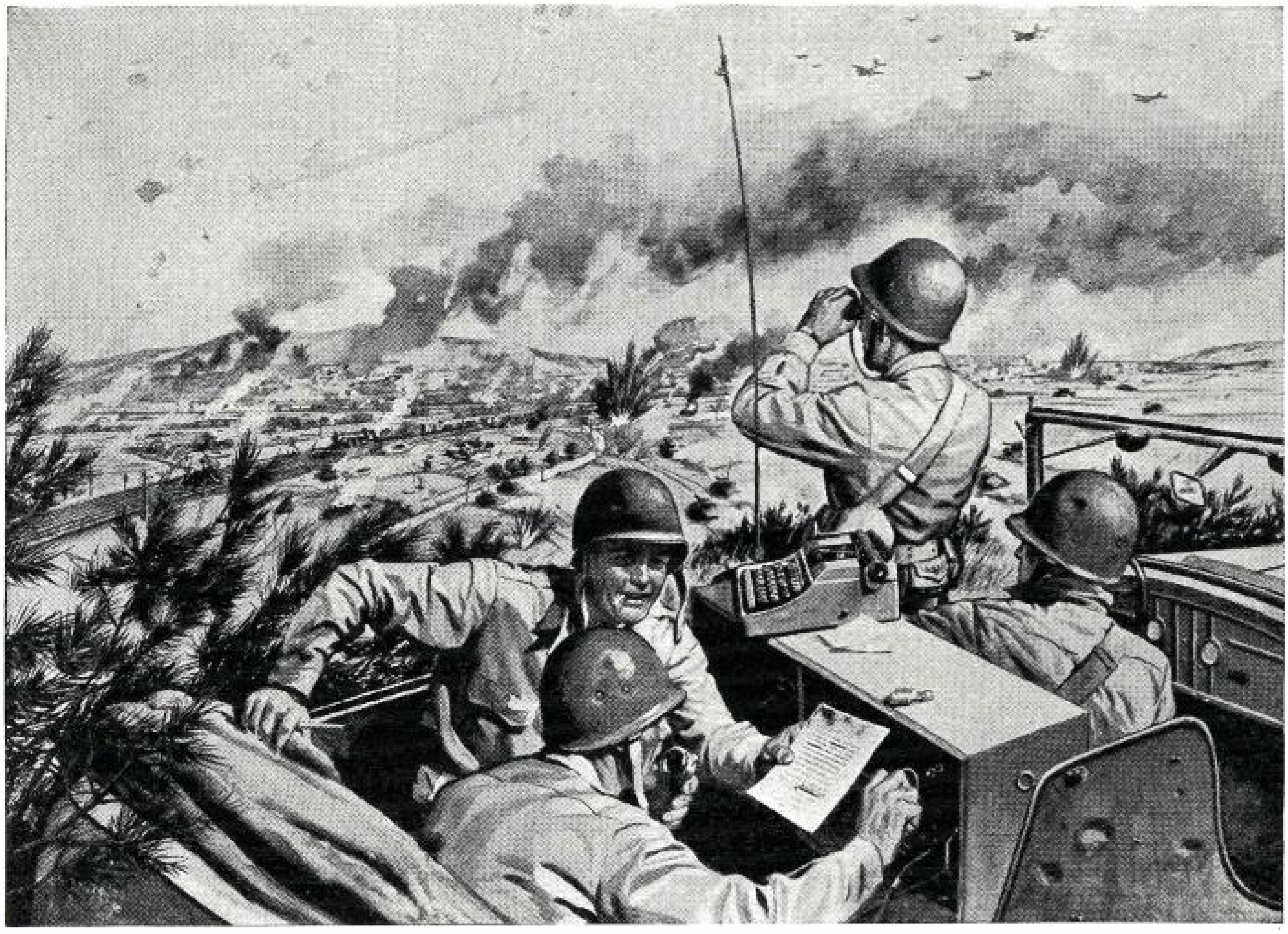
keep their fingers on the pulse of all communications organizations in the field. In this way the manner in which communications are used in the various combat areas is made public to commanders in other areas so that they may benefit by the experience in other theaters of operation. For example, in the North African campaign it was found that an armored signal battalion needed more wire. Its radio communications did not suffice due to heavy traffic and crowded frequencies. As soon as C.C.B. officers learned this from reports which they received, they immediately turned this information over to other theater commanders and also redirected Signal Corps training to incorporate this new doctrine.

Its work with the Communication Coordination Committee and the Signal Corps Board is that of coordinator, for when cases are submitted to the Chief Signal Officer, it is frequently C.C.B. which gathers the material and submits the problem to those two agencies and it is C.C.B. that receives reports from those two committees and forwards them with all recommendations and background material to the Chief Signal Officer for his final approval or disapproval. If a case is approved, it is C.C.B. that issues the directive for the Chief Signal Officer's signature and which follows through to see that the provisions of that directive are carried out.

Intelligence Branch

Military Intelligence is a glamorous term that covers just plain hard work.





They work together better
because they can talk together . . .

In this lightning war
Of mechanized equipment
Our forces are striking *fast*
And *first* . . .

No small credit for this
Goes to the Signal Corps . . .

Wherever new fronts
Are smashing forward
Wherever the fighting is thickest
There you'll find
The soldiers of the tube and wire . . .

And with them on a hundred battle lines
Serving in a hundred ways . . .

You'll also find
Electronic communications equipment
Designed and developed by
I.T.&T.'s manufacturing associate
Federal Telephone and Radio Corporation

From crystals, tubes and rectifiers
To field telephones
And complete two-way radio units
This apparatus is helping the armed services
Work together better
Because they can *talk* together . . .

After Victory it will help men
Live together better
For the same reason

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

NEWARK, NEW JERSEY

Although "cloak and dagger" activities are part of Intelligence, they are only a minor aspect of a far reaching service. As far as the Signal Corps Intelligence Branch is concerned, it has two main functions: To learn everything it can about the enemy's signal equipment, doctrines, and uses; and to keep the enemy from learning our own.

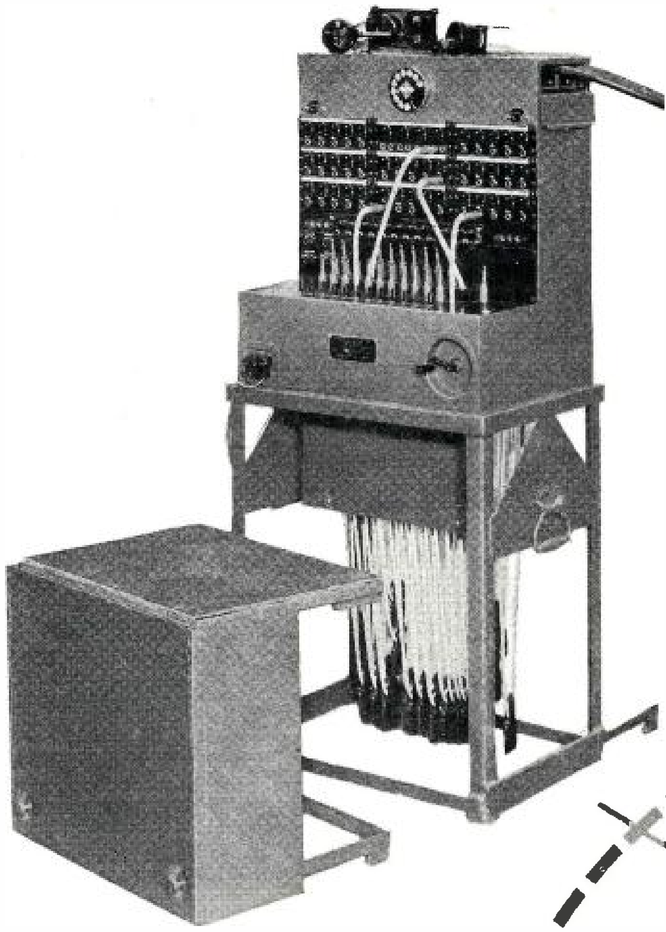
The first part of this job is known as "intelligence"—to get down to definitions; the second part is known as "counter-intelligence."

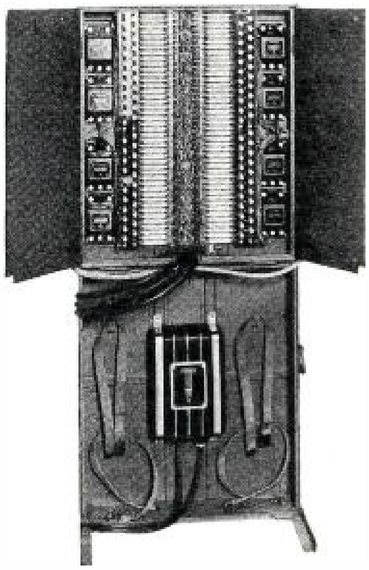
Knowledge of enemy activities comes to the Signal Corps Intelligence Branch in many ways, but mainly through the Military Intelligence Service, commonly known as G-2. Every morning a representative of the Signal Corps Intelligence Branch sits with representatives of all other branches and services of the U. S. Army at G-2 headquarters and receives all reports, statements, documents, etc., that G-2 received the previous day. These reports are analyzed by the representatives, and where one of them pertains to communications, it is turned over to the signal representative. These reports are then brought back to a review committee in Intelligence Branch that evaluates the documents and breaks them down into component parts. They are then disseminated to the specific branch or service within the Office of the Chief Signal Officer which may be concerned. This latter is done in two ways—through a daily summary of communications reports, and also through direct dealing when, in the opinion of Intelligence officers, such a procedure is necessary.

This war, if anything, is an electronics war and the advances, being made in this art, see-saw back and forth so that it is vital that American signalmen be kept right up to the minute on what the enemy is doing.

In the main this gathering and dissemination of Intelligence Information is the major function of the Intelligence Branch of the Office of the Chief Signal Officer. As important, but not as large, is the counter-intelligence function of this Branch. Not much may be related of the details, but in general the Branch is responsible for the investigation of military and civilian personnel that work for the Office of the Chief Signal Officer, keeping records of personnel who have been cleared for working with classified information and takes measures to prevent or combat disloyal activity.

Another important part of Intelligence's work is an evaluation of reports from Signal Corps officers and observers in the field and on maneuvers concerning equipment, doctrine, usages, and so on. These reports are broken down and sent to the various branches of the Office of the Chief Signal Officer concerned as well as to the Army Ground Forces, Army Service Forces, and Army Air Forces. In addition, recommendations are drawn up and action initiated to carry out these recommendations.





It was in the landing in North Africa early in November of 1942 that information came to the attention of Intelligence Officers of the need for waterproofing of Signal equipment. By the time of the invasion of Sicily, much had been done along these lines and when the American Fifth Army established its beachhead at Salerno, the Signal equipment they carried with them had been protected against the corrosive effects.

As American troops have moved forward and have rolled back enemy soldiers, much German, Italian, and Japanese signal equipment has fallen into their hands. Since one of Intelligence's main functions is to know all it can about enemy equipment, the establishment of an enemy equipment identification service in the Intelligence Branch has been of outstanding benefit to the Army during the past year. When American soldiers capture enemy equipment, it is sent directly to this service, which forwards it to the Signal Corps Laboratories for analysis, evaluation of strategic materials, and operating knowledge. This service keeps records of all signal equipment, including photographs, and coordinates the information thus obtained on enemy equipment with our Allies and other Federal agencies.

That this training has paid dividends has been authenticated innumerable times. One instance should suffice. During the last stages of the fighting in Tunisia an advanced American Infantry patrol, whose radio equipment had been put out of commission during an air bombing attack, found two abandoned German reconnaissance cars. Taking them over for their own use, they found that the radio sets with which the vehicles were equipped were but slightly damaged. A few minutes for repair, and the Americans were back on the air, in communication again with their own headquarters.

Two rather small groups within Intelligence Branch round out the work of this organization. One group prepares communications surveys on foreign countries which might be the scene of military operations. The other unit prepares and distributes the Signal Communications Equipment Directory, a list of all Signal equipment of the United States, the United Nations, and of the enemy.

As you read this article, it may be that new operations somewhere on the face of this earth have begun. Or if none has occurred recently, you can be assured that it won't be long before not one but several will be in progress. In any event, you will know that the signal men and equipment helping make those attacks possible were the result of painstaking, ceaseless work that went on in the Plans and Operations Division of the Office of the Chief Signal Officer. That the men, who wear the crossed flag and torch of the Signal Corps, who staff this office, jammed the orders through that gave the commander of the operations enough Signal men and material—on time!

-30-


COMMUNICATIONS FOR
VICTORY!
BOUGAINVILLE
GUADALCANAL
NEW GUINEA
AUSTRALIA
New Supreme "Hairline Accuracy" Meter
Allied lives . . . Allied victories . . . depend upon the Communication waves and wires. These channels of contact must be kept open. Our fighting men rely on the accuracy, dependability and ease of operation of Supreme Instruments and Meters, assured by Supreme's 15 years of experience.
Supreme Radio Testing Equipment Keeps Communications Open.
Combination Tube and Set Testers
Multimeters, Electronic Voltmeters
SUPREME
SUPREME INSTRUMENTS CORP.
GREENWOOD, MISSISSIPPI, U. S. A.
Cathode Ray Oscillographs
Signal Generators

Lend-Lease

(Continued from page 215)

International Aid has contributed to a greater standardization than ever before existed. The lessons learned from our Allies have made it possible for us to improve equipment furnished to our own forces. Likewise, through the use of our equipment our Allies have found it possible to incorporate certain features of American design.

One of the most common items in the Signal Corps catalog, perhaps, is the field telephone. This is a battery operated telephone of which many thousands were shipped to Russia. But in the almost incredible below-zero temperatures of the Russian front in midwinter, the batteries normally supplied with this telephone were not satisfactory. The Russians had a "non-freezing" battery larger and heavier than its American counterpart. To accommodate this battery, a special modification of the field telephone was developed which operates successfully under varied climatic conditions.

Equipment used in the Libyan Desert is subject to wear and strains unheard of heretofore. Dust and sand penetrate every moving part and grind surfaces as if with an emery wheel. This has demonstrated the necessity of shielding and enclosing moving parts more completely to ensure at least a reasonable period of useful life.

Designed as a means of aiding others, Lend-Lease has shown itself to be of real value to ourselves. Tried and tested in actual combat, under all kinds of climatic and geographical difficulties, equipment used by both ourselves and our Allies paid worthy dividends by way of reliable experimentation. From these struggles came recommendations, by Signal Corps engineers and foreign government representatives, for improvements and refinements. Lessons have been learned and the Signal Corps will continue to utilize the laboratory of battle as its testing ground for continued research, development, and production of the best communications equipment.

The Signal Corps, by careful and studied analysis, made technical recommendations of significance, eliminated procurement obstacles, and concentrated upon standarization of maintenance and replacement parts groups. Through diligent planning, it contributed toward keeping the production lines running smoothly, constantly, and with least possible time-wasting changeovers.

Emphasizing the flexibility of Lend-Lease shipments, whenever the occasion has arisen, the Signal Corps, pursuant to authority of the Combined Munitions Assignments Board, has halted the export of materials, already delivered to representatives of Lease-Lend countries, at portside in order to fill the unexpected needs of the United States or of another of the United Nations.

Thousands of Signal Corps component items were made available through Lend-Lease to foreign manufacturers to be installed in complete units. Walkie-talkies, mobile radio stations, and even portable radio sets used by ski troops were just a few of the purposes that Lend-Lease Signal Corps materiel served.

Discussing reciprocal aid between the United States and other nations, General Marshall said in his recent report:

"A feature of Lend-Lease is the so-called Reverse Lend-Lease, the term applied to the furnishing by other nations of supplies, equipment, services, facilities, and patent rights to the armed forces of the United States without cost. The most important single contribution of Reverse Lend-Lease in the war effort has been its saving in shipping requirements. Reverse Lend-Lease also reduced demands on United States raw materials, production facilities, and manpower. It further contributed to the more efficient utilization of all the productive resources of the United Nations.

"Overseas commanders of American forces have been directed to utilize all available sources of local supply on a Reverse Lend-Lease basis. Procurement organizations have been established in the principal theaters of operations to obtain supplies locally for American forces and to assist in the development of local resources. Within the United Kingdom, in the fiscal

year 1943, 1,500,000 ship tons of materiel were provided the United States forces stationed there, in addition to a large quantity of construction materials. Had all these supplies been shipped overseas in American vessels, it would have required more than 500 fully loaded ships. In Australia and New Zealand, American forces have obtained almost all their food requirements locally. In the Middle Eastern Theater the British have provided, for United States forces, all maintenance requirements, including food supply, clothing, and equipment."

To the Signal Corps in particular, reciprocal aid has been especially valuable. Secret scientific instruments, as well as other types of apparatus and information not available in this country were exchanged and placed at the disposal of our engineers and laboratories for research and developmental purposes.

During the year a foreign film section was set up by the Army Pictorial Service of the Signal Corps to exchange training films with other nations and to re-score War Department training films for Latin American countries and China. By the end of the fiscal year, 100 titles had been completed in Spanish and 84 in Chinese. Preparations were made to re-score films in Russian and French. All British training films were reviewed and prints obtained for those needed by the War Department.

In addition to Lend-Lease activities, a number of civilian experts have been furnished by private industrial organizations as observers to accompany field forces overseas. These experts, most of them engineers of high standing, went to such places as Cairo, Australia, Hawaii, England, the Southwest Pacific, North Africa, and elsewhere. They accompanied the troops in actual combat to assist in operation of equipment and to observe its performance. Reports received from them have been of great value to troops in the field and to the Army Service Forces.

To no field of military endeavor has American inventive genius made more distinct and vital contributions in World War II than to the communications and reconnaissance systems, dominated by radio. These developments have made it possible for a single man to direct combat troops from the skies. An air battle may be directed from the ground. Man may be brought to a central sector by the use of radio communications in a matter of hours.

The importance of these communications and the wartime responsibilities of the Signal Corps are described in the following statement by Robert P. Patterson, Under Secretary of War:

"As warfare has come to call for the rigorously calculated deployment of vast masses of mechanized might—mobile guns, tanks, troop carriers, surface vessels, submarines, and airplanes—one particular phase of the problem of supply has become of crucial central importance. This is the supplying of information—the right information, swiftly and accurately transmitted to the right place, at the right time. Without this, all else fails, for without it the close-working cooperation of varied forces moving at great speeds becomes impossible, control is lost, command is balked.

"The Signal Corps of the Army of the United States is expected to 'get the message through'—to establish and maintain swift and accurate communication wherever the lines of battle may be drawn. It is, therefore, in this war charged with the heaviest responsibilities in its history. We may look with confidence for the devoted performance of those responsibilities and to the victory to which that performance will so greatly contribute."

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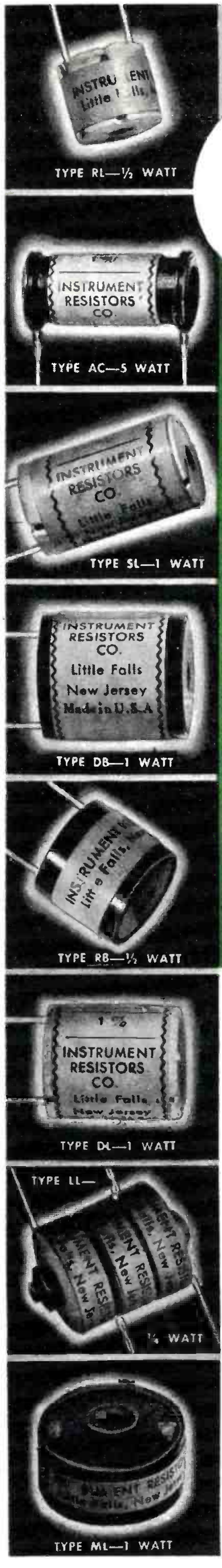
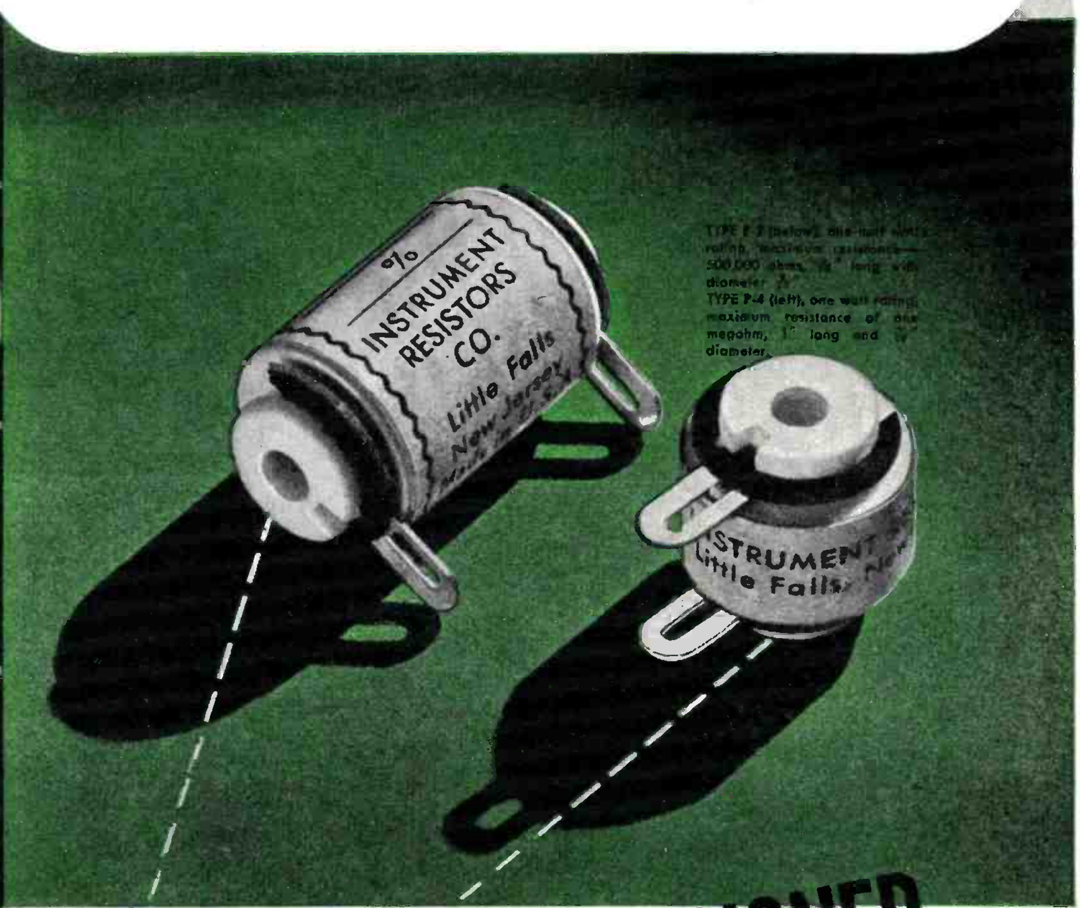
Engineering

(*Continued from page* 117)

If development is to be done by a commercial laboratory or manufacturer, in most cases one of the Signal Corps laboratories prepares a development specification, places the contract, and guides the development from the standpoint of performance and quality requirements to meet service needs. If development is to be by N.D.R.C., the



For Today's Vital Requirements and Tomorrow's Vast Complexities



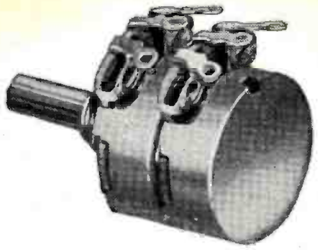
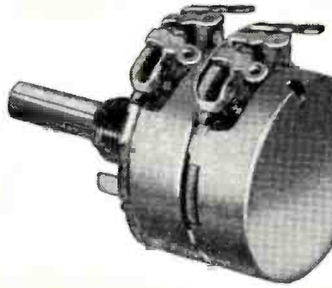
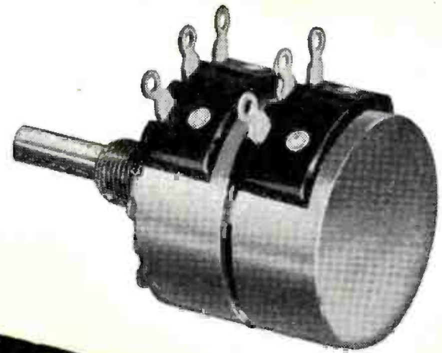
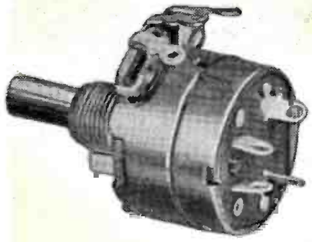
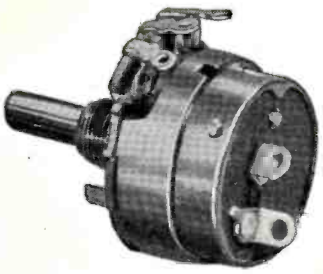
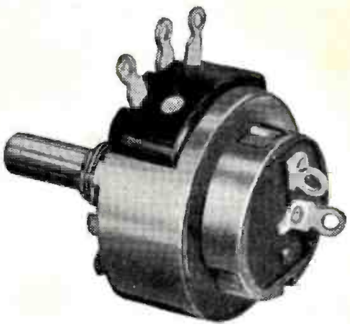
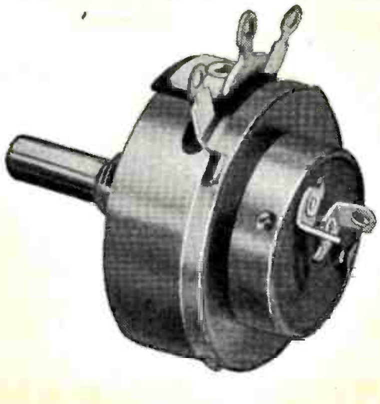
IN-RES-CO APPLICATION-DESIGNED RESISTORS

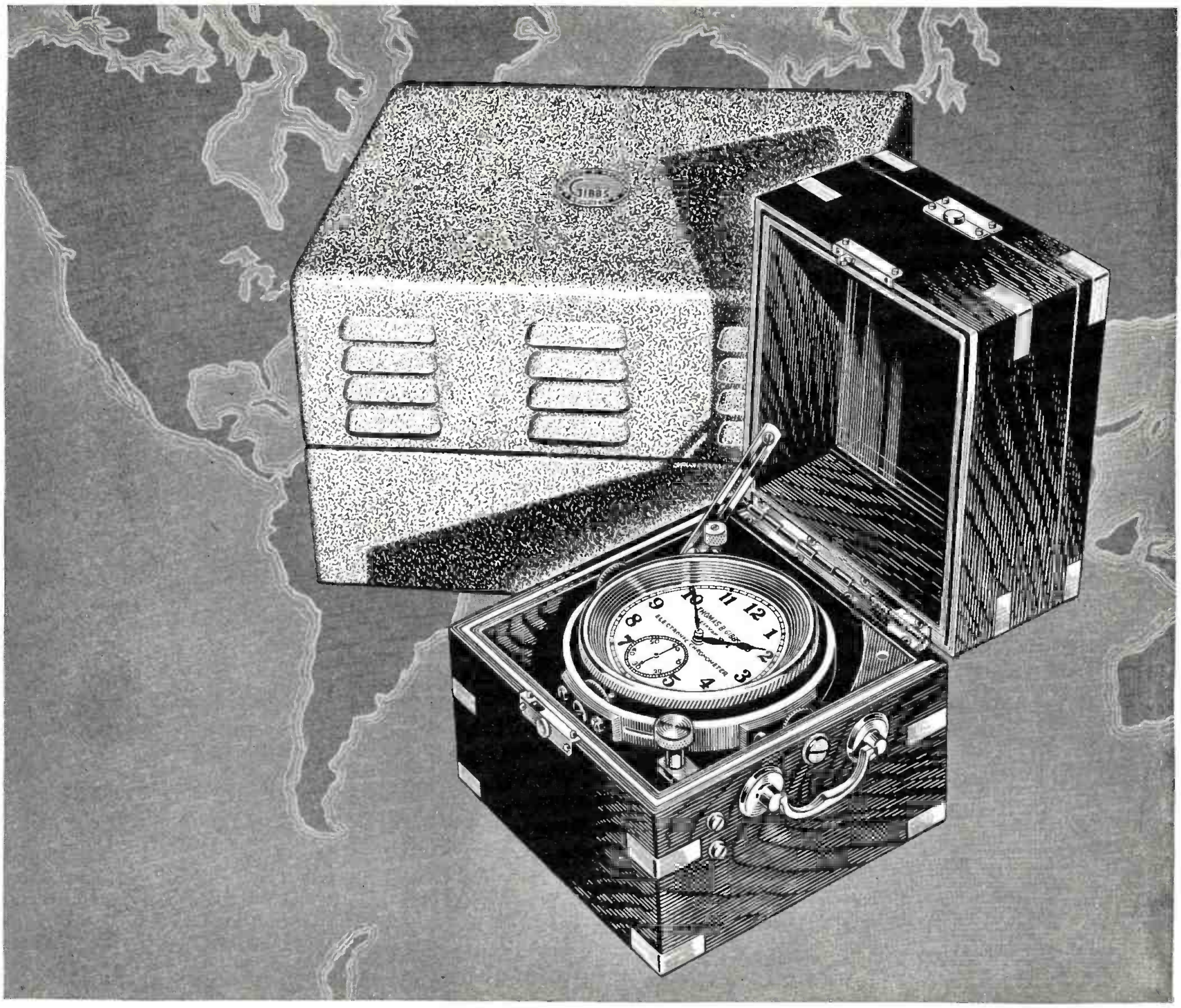
Proof of the outstanding quality of these highly-accurate, precision-made electronic components is their wide specification in communication and control applications for every branch of the Armed Forces. The multiple electrical and dimensional advantages of IN-RES-CO fixed and adjustable resistors, meter shunts, choke coils, meter multipliers, solenoids and special coils—plus their mechanical ruggedness and ingenuity of design—assures the extra degree of dependability required for military successes.

IN-RES-CO precision units are ideally suited for post-war plannings because each is application-designed for specific functioning. By specialization, IN-RES-CO resistors are offered without price premium for their extra quality . . . custom windings at stock prices. Inquiries—for present essential, or future industrial needs — are invited. Literature on request.

INSTRUMENT RESISTORS COMPANY

25 AMITY STREET — IN-RES-CO — LITTLE FALLS, N. J.



laboratories assist when needed for the interpretation of service needs.

By far the greater part of Signal Corps research and development is effected in this way. In some cases, however, the facilities of the Signal Corps' laboratories are employed to carry out the detailed design work. There are two groups of these laboratories which are operated as part of the Engineering and Technical Service of the Signal Corps, namely:

Signal Corps Aircraft Signal Agency, which includes those laboratories working on aircraft equipment.

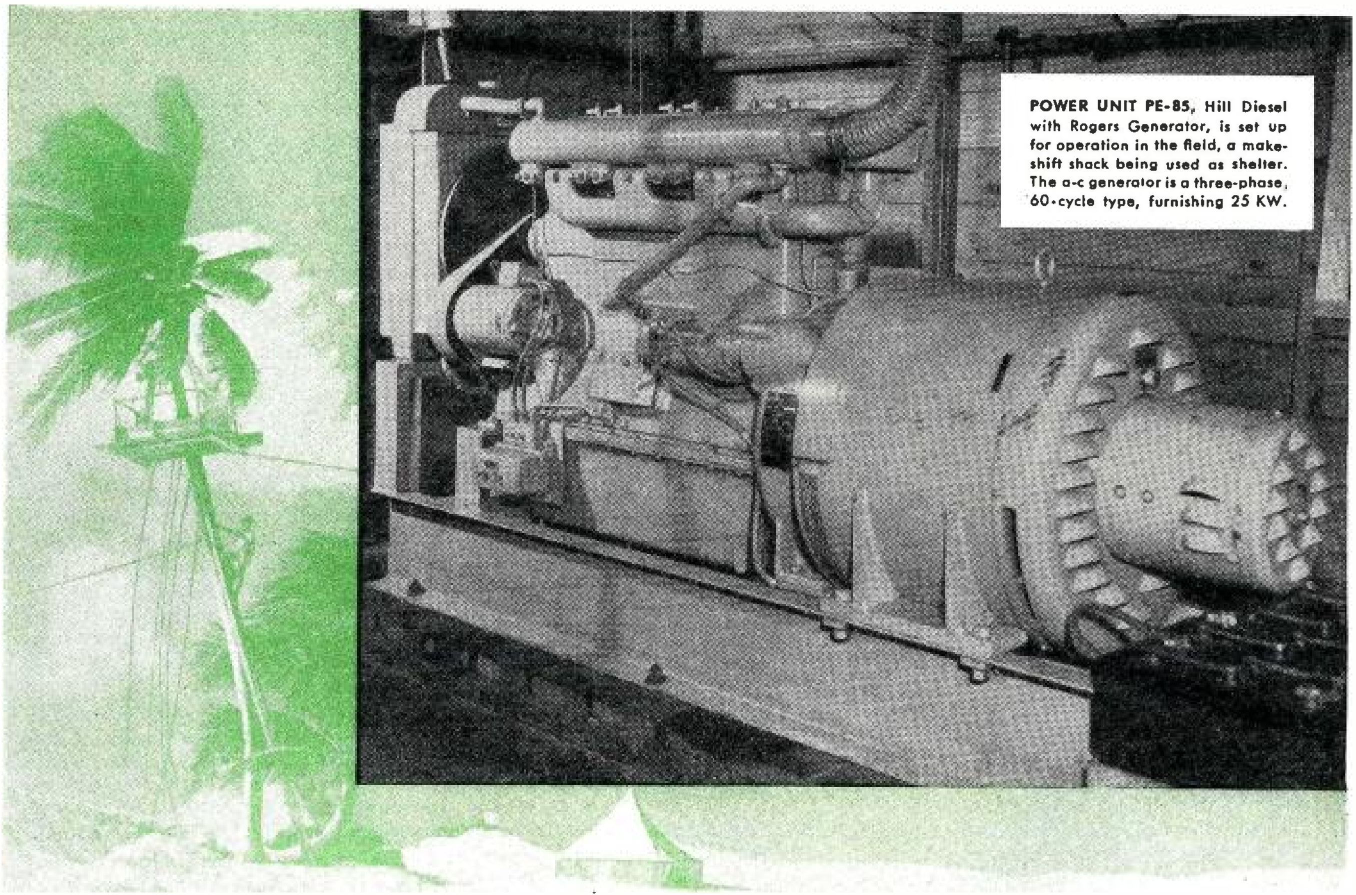
Signal Corps Ground Signal Agency, which includes those laboratories working on ground equipment. Although these two agencies do only a small part of the research and development work on Army electronic equipment, they are responsible for most development specifications; for the testing of development models; and for the preparation of specifications for most of the equipment prior to its being placed in production.

This war has so rapidly proved the practical military value of electronic devices of many types and such rapid strides have been made in the advancement of the electronic art that it has been necessary to put great emphasis on the exercise of economy in types of equipment, the selection of essential projects, the rejection of the non-essential, the standardization of equipment, and of component parts. Much supervision of this phase of development activities is required throughout the using forces and the Engineering and Technical Service. The Signal Corps Standards Agency is charged with the mission of accomplishing standardization of components; progress can be reported in the standardization of such components as vacuum tubes, meters, fixed capacitors, resistors, quartz crystals, and similar items.

One of the major difficulties experienced in the manufacture of electronic equipment has been the shortage of certain critical raw materials.

The Production Division of Army Service Forces, the Procurement and Distribution Service of the Signal Corps, the War Production Board and the Army-Navy Electronic Production Agency, having primary responsibility for this activity, have collaborated and accomplished great achievements in the expansion of needed facilities, and the supply of some items such as steatite insulators and quartz crystals is now entirely adequate to meet our needs. The mission of the Engineering and Technical Service is to assist these agencies through the development of suitable substitutes and the re-design of electronic equipment to utilize non-critical raw materials and substitute components. This substitution and re-design program has been one of the largest activities of the development agencies.

The problem of obtaining widespread substitution without sacrifice of performance or quality control is inevitably difficult. The accomplish-



Top: U. S. Signal Corps Official Photo — *Bottom:* Acme Newspictures, Inc.

"MORE POWER TO THE SIGNAL CORPS!"

Safe, dependable, Diesel Power The power unit shown above is typical of those being used by the Signal Corps and other branches of our Armed Forces to provide the necessary energy for this "electrical war". From units like this, telephone and other signal systems, radio communication, detection and control apparatus get their vital impulses...

When the big job is done, and the highly trained men of the Signal Corps turn again to peacetime pursuits, they will find Diesel Power units beside them again, operating with the kind of efficiency for which they are already famous.

Rogers Diesel and Aircraft Corporation, 1120 Leggett Avenue, New York 59, N.Y. *Divisions:* Hill Diesel Engine Company; Edwards Company; Edwards Aircraft Products, Inc.; Ideal Power Lawn Mower Company.

R D A
TRADE MARK REG

ROGERS DIESEL AND AIRCRAFT CORPORATION

Diesel Engines, 5 to 2000 h.p. » Gasoline Engines » Generator Sets » Generators » Power Units » Switchboards » Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms » Power Mowers » Power Brushes » Snow Removal Equipment » Streamlined DeLuxe Railway Motor Trains » Diesel Locomotives ments in this field have been many and noteworthy. Much still remains to be done.

The Engineering and Technical Service collaborates with and furnishes engineering assistance to other Technical Services, such as, the Ordnance and the Materiel Command of the Army Air Forces; such services as coordinating the installation of radio and interphone equipment in trucks, tanks, and planes. One of the important engineering problems in both vehicles and aircraft is the design and testing of systems for shielding the ignition system or otherwise providing suppression of ignition interference which would render radio reception in vehicles relatively ineffective. Some research and considerable development has been devoted to this activity; a field agency is operated at Detroit for maintaining close coordination of this activity with the Ordnance Tank and Automotive center. The Signal Corps Aircraft Signal Agency provides the necessary coordination with the Army Air Forces.

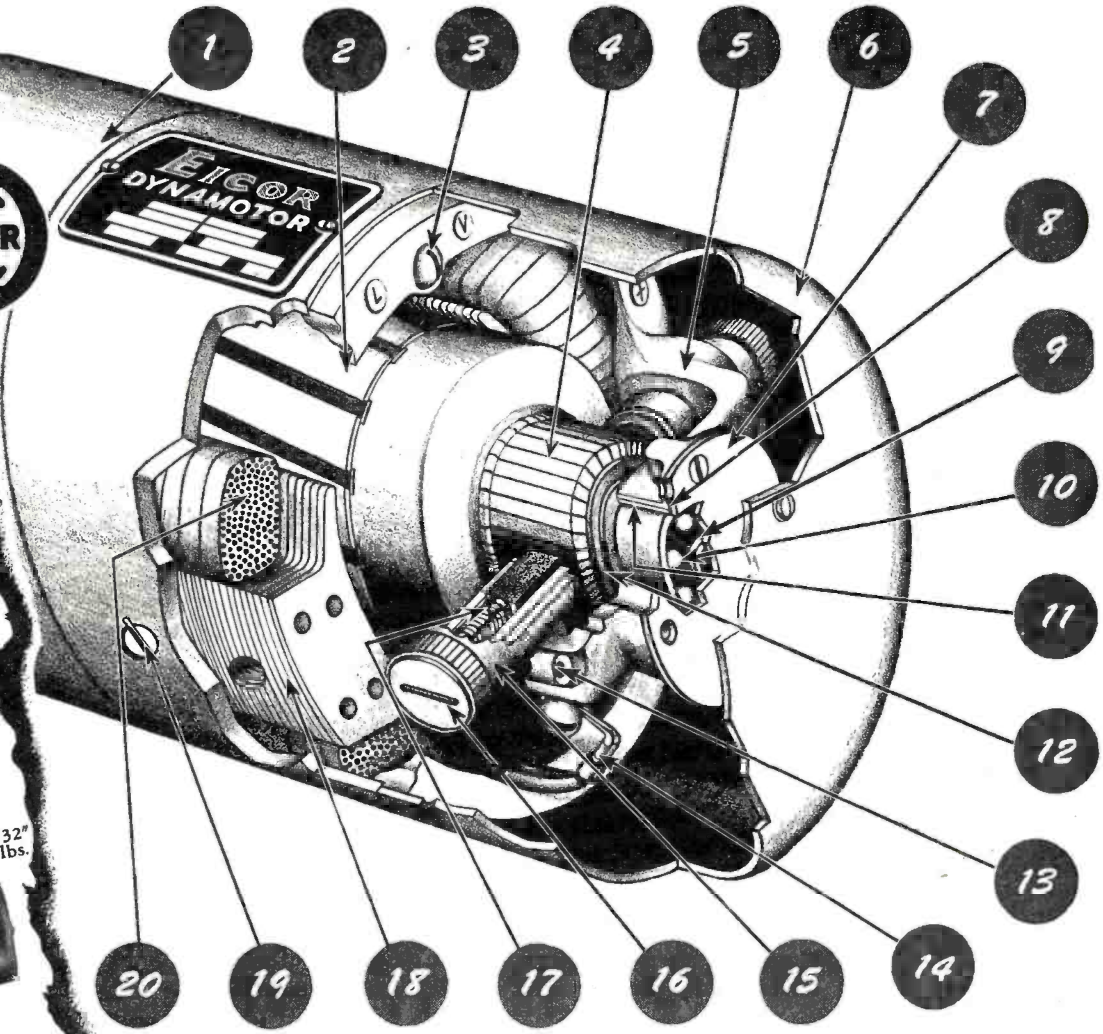
The responsibility of the Signal Corps and of the Engineering and Technical Service does not end when the equipment has been developed, manufactured, and issued to troops. Of vital interest to engineers and designers are those crucial periods when new equipment is first used in quantity by the using Service; when it is first used in combat operations; each time it is employed in a new type of operation; and each time it is employed in a new theater of operation where different conditions of temperature range, humidity, rainfall, static, dust, and vegetation prevail. Reports received are sometimes contradictory. Some units report difficulty with their equipment, other units with the same equipment report results exceeding the most optimistic expectations. Under these circumstances a multitude of doubts assail the development organization. Was the equipment correctly installed and aligned? Was it operational trouble? Was the equipment employed in situations beyond its capabilities? Did performance deteriorate under the service conditions? If so, why did this not show up during service tests?

Thus, it is easy to understand the need which engineering and technical personnel feel, for closely following equipment during its early service life; for analyzing by personal observation the conditions of use and the hidden or unknown design factors which are responsible for unforeseen weaknesses.

Military and civilian technicians of the Signal Corps Engineering and Technical Service have been in several theaters of operation for the purpose of evaluating the performance and serviceability of signal equipment; also, to assist theater personnel in the introduction of new equipment and to study maintenance problems. The results of such experience gained by close association with troop units are of the utmost value and are reflected rapidly in equipment design which is more completely suitable to the needs of combat units.

Another factor of the utmost importance to the successful use of any kind of equipment is *maintenance*. From the first conception by the using Service of the need for a type of equipment, through every step of the research, development, service test, production, inspection, and service use—life cycle of equipment—maintenance planning, maintenance organization, and maintenance training, must be considered and provided for at every step. There are no commercial service stations or radio repair services that can be called upon by an Army in a foreign theater of operation—the Army must carry with it, in its every unit, the responsibility, the means and the know-how of maintenance. Large scale modern battle is a struggle to wear down and wear out the enemy. The efficiency of equipment maintenance is a factor which can measure the difference between victory and defeat.

The Maintenance Division of Army Service Forces exercises staff and policy direction over maintenance. The Chief Signal Officer and, under his command, the Engineering and Technical Service are responsible for supervision of maintenance of signal equipment and the formulation of signal maintenance policies in accord with the over-all principles and policies established by Army Service Forces



Isometric Cut-Away View of an

EICOR DYNAMOTOR

1	**Frame**	11	**Steel Insert**
2	**Armature**	12	**Oil Thrower Washer**
3	**Thru Bolt**	13	**Brush Holder Screw**
4	**Commutator**	14	**Dynamotor Leads**
5	**End Bracket**	15	**Brush Holder**
6	**End Cover**	16	**Brush Holder Cap**
7	**End Plate**	17	**Brush and Spring**
8	**Gasket**	18	**Field Poles**
9	**End Play Washer**	19	**Field Pole Screw**
10	**Ball Bearings**	20	**Field Coils**

WALL CHART AVAILABLE—*18" x 24" reproduction of this isometric cut-away, complete with dynamotor data on outputs, sizes and weights—available without charge to engineers and instructors. Suitable for wall hanging. Write for it on company or official letterhead.*

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DYNAMOTORS • D. C. MOTORS • POWER PLANTS • CONVERTERS

Export: Ad Auriema, 89 Broad St., New York, U. S. A. Cable: Auriema, New York headquarters. This is accomplished by the Signal Corps Maintenance Agency at Philadelphia and the Maintenance Branch in Washington. These agencies are closely tied in with the development and specification activities of all Signal Corps laboratories to the end that efficient test and maintenance equipment shall be developed concurrently with the equipment to be maintained and that spare and maintenance parts kits and Depot maintenance parts shall be procured with the equipment issued concurrently to troops, and thereafter replenished at a rate consistent with the rate of consumption.

Unfortunately, from the standpoint of interesting reading, the most spectacular and important developments cannot be discussed. This necessarily deprives the public of information of many of the new techniques of warfare which increase the efficiency of our Armed Forces, disturb and confuse the plans and calculations of our enemies, and reduce our battle casualties.

Within our Armed Forces the experience gained in combat has caused an increased consciousness of the importance of signal communication and other technical aids in obtaining timing, coordination of effort within and between sea, air, and ground power, and the concentration of overwhelming fire power at the decisive place.

Faith in science and invention is an important element of the American philosophy. It is doubtful that this faith has ever been more adequately justified than by the record of achievement attained during this war in all its many branches by American, British, and Canadian scientists; physicists; engineers; the technical forces of draftsmen and highly skilled craftsmen who have implemented and contributed to their creations; and above all, by the fighting forces whose strategical and tactical applications of new techniques have demonstrated true genius.

At this time it does not appear possible to predict with reason the further duration of this war. But, regardless of its length, the results of the past two years form a reasonable basis for confidence that the technical and intellectual capabilities of The United Nations can find an effective answer to new weapons to which our enemies may resort.

—30—

Vehicular Radio

(*Continued from page* 211)

without the facilities of production line. The radio is installed.

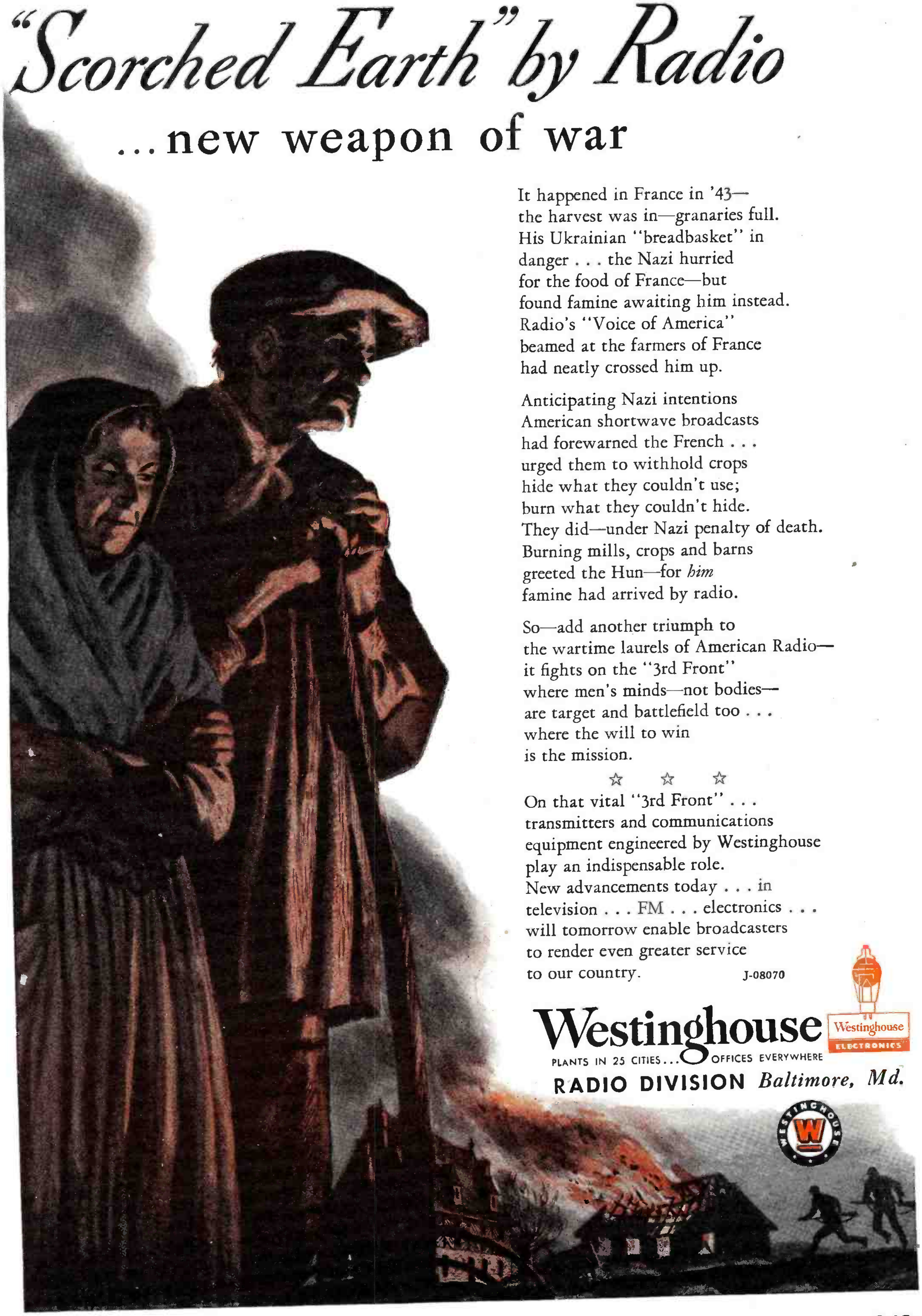
This model gets the works. First at the Ordnance Proving Grounds it goes through all the automotive and ballistics tests. It's tried for stresses and strains, pickup and speed, fitted on railroad cars, such as will transport it, tried on bridges, such as it will be expected to cross, including pontoon bridges, subjected to the concussions of near-miss bombs and shells, and finally it is fired at point blank, strafed and bombed and blasted by artillery to determine just how much it will stand, where its weak points are, how strong is its armor, how long will it keep going.

All through the preliminary tests, the radio and interphone equipments are operated to see how they react. And when the grand destructive finale comes, the radio is turned on while Signal Corps engineers listen on remote receiving sets to learn how it behaves when a bomb is shaking the tank, when bullets are rattling on its steel skin, and when an armor-piercing shell is ricocheting crazily around its interior.

Does a connection jar loose? A tube go out? Frequency vary? After each test, the radio and the suppression system are carefully examined. For the price of a tank and a radio, with the tank's other special equipment, the engineers have learned lessons that may save many tanks and radios and many men's lives.

Next, one of the unfinished models, incorporating the improvements determined by Ordnance Department tests, is sent to the Armored Command Board and regular tank crews put it through its paces under all the conditions it is likely to meet in the hands of their comrades.

When all the bugs that have developed in all these tests have been ironed


"Scorched Earth" by Radio
...new weapon of war
It happened in France in '43—
the harvest was in—granaries full.
His Ukrainian "breadbasket" in
danger . . . the Nazi hurried
for the food of France—but
found famine awaiting him instead.
Radio's "Voice of America"
beamed at the farmers of France
had neatly crossed him up.
Anticipating Nazi intentions
American shortwave broadcasts
had forewarned the French . . .
urged them to withhold crops
hide what they couldn't use;
burn what they couldn't hide.
They did—under Nazi penalty of death.
Burning mills, crops and barns
greeted the Hun—for *him*
famine had arrived by radio.
So—add another triumph to
the wartime laurels of American Radio—
it fights on the "3rd Front"
where men's minds—not bodies—
are target and battlefield too . . .
where the will to win
is the mission.
☆ ☆ ☆
On that vital "3rd Front" . . .
transmitters and communications
equipment engineered by Westinghouse
play an indispensable role.
New advancements today . . . in
television . . . FM . . . electronics . . .
will tomorrow enable broadcasters
to render even greater service
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out, tank and radio separately go into mass production. Inspectors closely follow not only the manufacture of the radio equipment but of the vehicles themselves. It often happens that during production someone will get an idea for a change that may put a fire extinguisher or an ammunition box in the place designed for the radio. Unless this were caught in time, a costly knot might be tied in synchronized lines of radio and vehicular production.

Production models of the radios and tanks are then sent to an Ordnance Tank Depot where the sets are installed in the tanks, together with all the other equipment required, ready for shipment to the Using Arms. When an order comes through for a vehicle to be "combat loaded" the depot readies it to the last turn of a bolt, even the ammunition cases are filled and the radios are tuned to perfection, so that the tank is ready to roll right off the ship into fighting action.

The Ordnance Tank Depot is a comparatively new departure in assembly practices that has been of untold benefit to troops in action. Under the old system, armored vehicles and radios were shipped separately to the field, where the troops themselves made the radio installations. That worked well under peacetime conditions when there was time for soldiers to experiment with the installations and benefit by the training that it gave them, and when standardization of combat vehicle installations was not of critical importance.

Commercial assembly experts frequently ask, "Why can't the sets be installed at the factory, as the automobile manufacturers used to install them with a couple of deft movements on the assembly lines?" In the first place, installation of military transmitters and receivers that will continue to function in a bucking, rolling, blast-wracked vehicle of war is a considerably more elaborate and technical procedure than buckling a little receiver into a passenger car. It would complicate the vehicle assembly lines for when an armored vehicle leaves the manufacturing plant, no one can say for sure where it is going. A few top Army officials may have a good idea, though those who handle the actual shipment do not because they are only told, at most, its next destination along the way. Even the Army officials who think they know the ultimate destination cannot be sure because late changes in the strategical situation may alter it. A tank originally intended for action in Italy might be rerouted to the Southwest Pacific if the successful conduct of the war demands it. Its final destination, when it is put aboard ship, is secret. Consequently, when that tank is at the factory, no one can say with certainty what type of radio equipment must go into it.

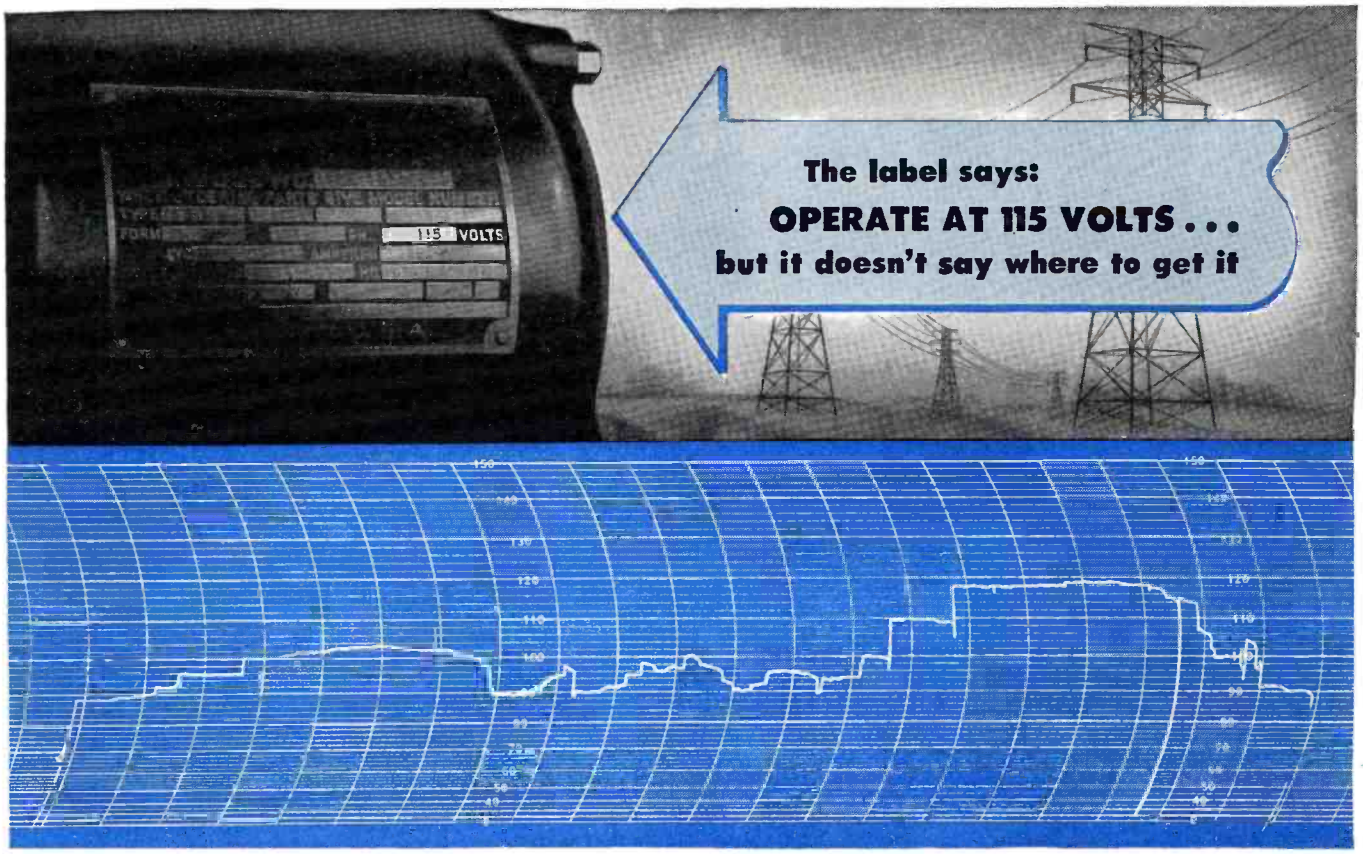
With a varied supply of both armored vehicles and radio equipment on hand, the tank depot is able to make the precise installation required at a moment's notice and has facilities for making special brackets or whatever changes are required to meet the needs of the particular combat theater. In the desert, sand shields are required; for amphibious warfare, waterproofing; for Arctic areas, protection from the cold.

Tank depots are also used as vehicular modification centers. When combat experience discloses the need for a change in equipment, that change can be made at the depot as each set is installed, or before, while the factory turning out the equipment requires much more time to change over its production process. Thus, from the moment a modification is decided upon, it can be put into effect on materiel leaving the United States while the factories are changing over to accomplish it in mass production.

This system requires great stores of equipment at the depots, in order that there be a sufficiency on hand to meet any sudden demand from the theaters of operation. That is the answer to the questions that come to civilian minds when they see vast concentrations of vehicles and other equipment apparently idle around these depots while industry is being pushed to the utmost to produce more.

Communications equipment is installed at the Ordnance Tank Depots in armored vehicles only, that which include armored cars, tanks, gun motor carriages, scout cars, and halftracs.

An equally effective system has been worked out for installing communica-



RATED VOLTAGE is always available to equipment protected with built-in CONSTANT VOLTAGE

"Operate at 115 volts" on the label of electrically operated precision equipment is not simply informative —*it's a warning!*

A *warning* that the device is too sensitive to tolerate the voltage fluctuations that may be met on America's power lines, and still perform with efficiency. A *warning* that sensitive tubes and other delicate mechanisms may be irreparably damaged by line surges and that costly replacements, with consequent loss of time and efficiency, lie ahead.

The design engineer who assumes that the precisely controlled voltages of the research laboratory will be duplicated in the field is heading his product toward trouble. Nominal line voltage ratings can no longer be used as single, stable reference points for design considerations. Commercial power lines are too heavily loaded and unpredictable.

"Operate at 115 volts" is no longer sufficient on a label. A guarantee that the "115 volts" will always be available, in spite of the unpredictable fluctuations of commercial power, is a prime requisite if the device is to perform with unfailing efficiency and precision.

The place to provide voltage control is within the equipment. With a Constant Voltage Transformer as a component part, the device is provided with a dependable source of voltage and unfailing protection against performance interference and construction damage.

SOLA Constant Voltage Transformers are available in sizes and capacities to meet design requirements of any electrically operated equipment or electronic device. Items so protected will deliver as efficiently in the field as under the most ideal laboratory conditions.

SOLA Constant Voltage Transformers have no moving parts to get out of order. There are no manual adjustments to be made. They perform instantly and automatically, maintaining output constant to within $\pm$ 1% of the rated voltage, regardless of line fluctuations as great as 30%.

SOLA Constant Voltage Transformers

To Manufacturers:

Built-in voltage control guarantees the voltage called for on your label. Consult our engineers on details of design specifications.

Ask for Bulletin 2CV-74

Transformers for: Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Series Lighting • Fluorescent Lighting • X-Ray Equipment • Luminous Tube Signs Oil Burner Ignition • Radio • Power • Controls • Signal Systems • Door Bells and Chimes • etc. **SOLA ELECTRIC CO., 2525 Clybourn Ave., Chicago 14, Ill.**

tions in the unarmored vehicles. These installations are made in the field because the installation is much less complicated and since it is impossible to know until the vehicles reach their final destination which vehicles are to be radio equipped.

In every theater of operations and throughout the United States the using personnel, who have been trained in correct installation procedures, do the work; for it is they who must transfer the radio set from a vehicle that has become a battle casualty to its ready replacement.

Some idea of the jig-saw puzzle that vehicular radio represents in the intricate fighting machine that is the American Army can be gained from the fact that we are producing many models of vehicles and many types of standard radio sets that may be used individually or in combination in the various vehicles. The combination possibilities suggest a little problem in multiplication that gives the number of possible installations an astronomical tinge.

Yet radio transmitters and receivers alone are not the only types of communications equipment installed in vehicles. Plans have been perfected for a radio fascsimile set to supplement the regular radio in half-tracs. These, it has been found, can send and receive faster than the CW operator.

Development of Signal Corps radio equipment in the past year or so has been chiefly in the direction of greater universality: to simplify the maintenance problems and to permit use of each set under more varied conditions.

In the war's early, frantic production period, the manufacturers were permitted to virtually set their own specifications because the prime object was to get radio equipment into the field. Now, as the Signal Corps has been able to benefit from the experience gained from the use of its equipment under actual battle conditions and perfect designs, it is able to effect greater standardization. and as a result, more interchangeability.

Recently put in service is a half-wave doublet antenna, to replace the vehicular whip antenna, when a set is being operated as a fixed station, causing it to radiate more power and consequently, have greater range.

The power supply for vehicular radio sets has been simplified by more extensive use of vibrators. They are easier to manufacture and maintain and reduce requirements for such critical items as ball bearings, and release manufacturing facilities for armatures and similar products.

The throat microphone, which proved lacking in articulation response when used in high ambient noise levels, is being replaced by the lip microphone, which is supported from the ears like a pair of spectacles and sits on the upper lip like a moustache, leaving the hands free. Incidentally, a moustache does not interfere with its operation. Nor does a gas mask.

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The Messages Are Getting Through!

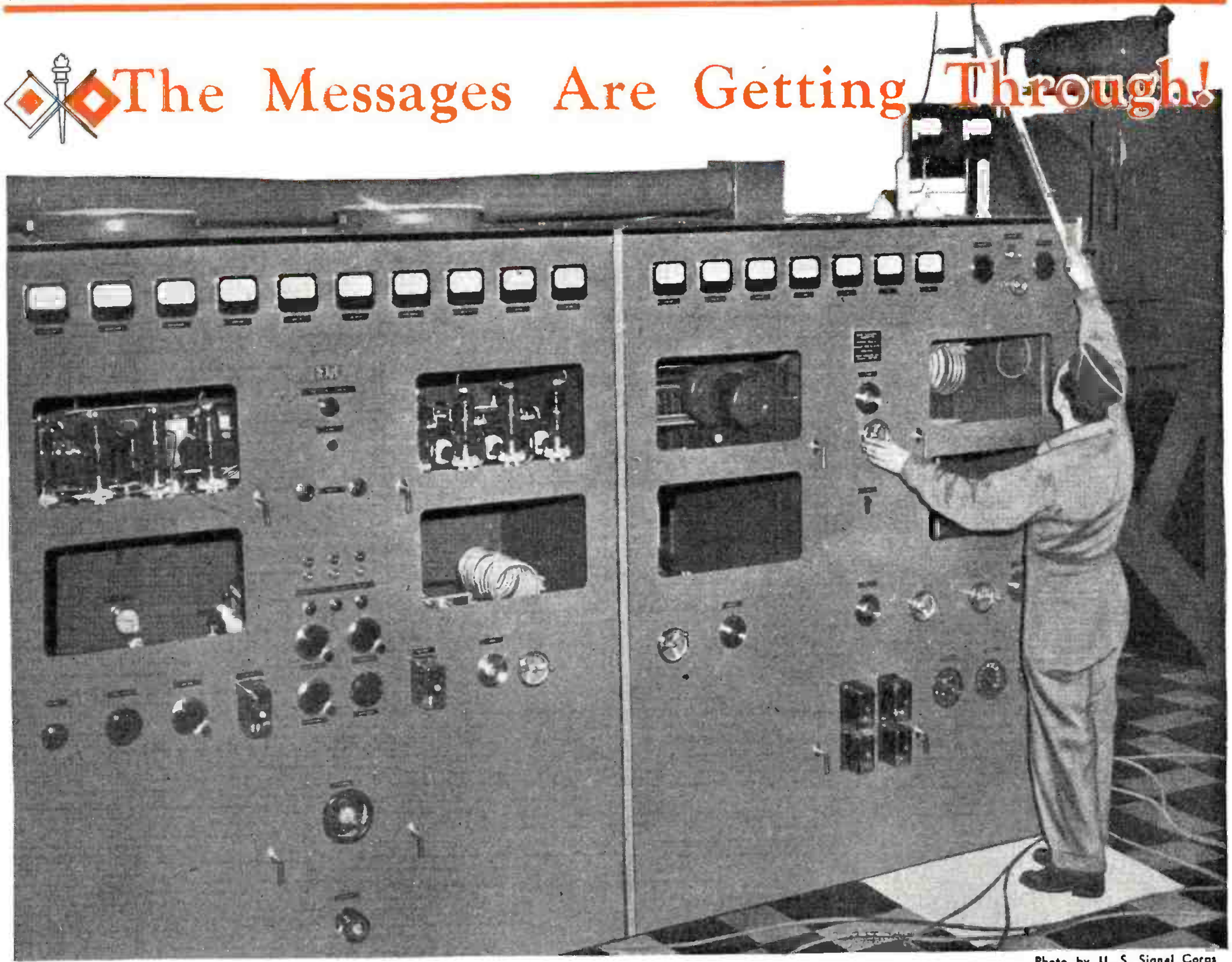

Photo by U. S. Signal Corps

A Signal Corps Sergeant checks over a Press Wireless 40 KW transmitter at a Signal Corps radio station in North Africa. Transmitters like this are the "backbone" of the Army Communications Service in the field.

Messages of United States Signal Corps over its far-flung Communications System totals more words per month than those of all other communications companies combined. A large share of this radio traffic is handled with equipment designed and manufactured by Press Wireless, Inc.

This equipment is a part of the primary installation at most of the headquarters of major theaters of operation, the backbone of the Army Communications Service network in handling communications to our troops in the field all over the world.

Press Wireless, Inc. is proud to be serving the Signal Corps as a principal supplier of apparatus which is proving so vital to victory. We salute the gallant men of the Corps who will continue to get the messages through until this war is won!

ARMY NAVY

Awarded to Our Hicksville Long Island Plant for Outstanding Achievement in War Production

PRESS WIRELESS, INC., IS DEVELOPING AND MANUFACTURING

- HIGH POWER TRANSMITTERS
- DIVERSITY RECEIVERS
- AIRCRAFT AND AIRFIELD RADIO EQUIPMENT
- RADIO PRINTER SYSTEMS
- MODUPLEX UNITS "TRADEMARK"
- CHANNELING DEVICES
- RADIO PHOTO TERMINALS
- FACSIMILE MACHINES

AND OTHER TYPES OF RADIO AND COMMUNICATIONS EQUIPMENT

PRESS WIRELESS, INC.

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RIO DE JANEIRO • MONTEVIDEO • BERNE • SANTIAGO DE CHILE

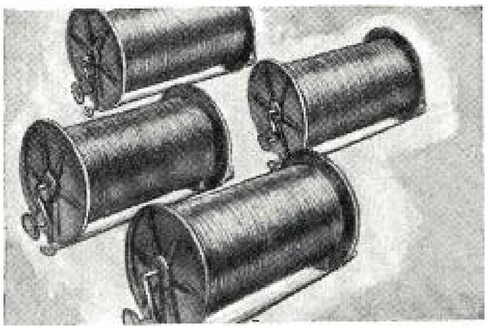
Miles from nowhere —but the message gets through

He'd crawled, run, crawled again. Now he was far ahead of his company... into enemy territory... surrounded... cut off completely from American forces except for a strand of lightweight wire... Laytex Assault Wire.

But his messages got through surely and clearly... made possible a successful advance.

Laytex Assault Wire is made expressly for jobs like this. It's extremely lightweight... yet tough enough to be used by advance scouts.

The use of such lightweight small diameter wire is possible only because the insulation is of such high quality—has high resistance to moisture, withstands a wide range of temperature changes and does not become embrittled when subjected to vibration and shock. Laytex Assault Wire has a talking distance of over five miles.



LIGHTWEIGHT Laytex Assault Wire weighs only thirty pounds per mile. This means that an advance scout can carry ample wire while pushing ahead.

SPECIALLY DEVELOPED for front line service, Laytex Assault Wire is hard at work in Europe, Asia, the South Pacific.

LAYTEX ASSAULT WIRE is unaffected by moisture or temperature changes because of the high quality of the insulation. This means it can be laid and used successfully regardless of climate or terrain.

FIVE MILES LONG—but messages get through clearly. Laytex Assault Wire, tested and retested for quality, has a proven talking distance of more than five miles.

RUBBER COMPANY

Military radio development today is a far-cry from the tedious progress of peacetime. Then, when orders were so small that manufacturers were loathe to take an Army job with its meticulous specifications, a new idea in radio required six years to design, perfect, produce, and distribute, where today, with the entire radio industry working for the Armed Forces, the most far-reaching experiments are carried to successful conclusion, into production, and into the hands of troops in a very much shorter time.

It is to be noted that over a two-year period the uninterrupted and rapid manufacture of billions of dollars worth of electronic equipment is being done by an industry whose total annual peacetime capacity was approximately three hundred million dollars.

Unfortunately, the problem involves other elements which are more difficult and more serious than is indicated by the comparison of dollar value. Of the annual 300 million dollar peacetime capacity of this industry, only about 5 per cent (or 15 million dollars) involved the type of precision manufacture of sturdy, high-quality equipment of advanced design, and of such high performance as to demand the maximum capabilities of the electronic arts and sciences. The major part of the electronic war program involves equipment of this type.

The rapid pace of technological research and development in this war continues to place a premium on the speed with which new devices, with hitherto unattainable performance, can be put into mass production. In no field has this need been greater than in electronics; and a very large share of our production difficulties are due to the realization of the need for producing new devices and the consequent initiation of such production, long before it would be attempted under normal circumstances. This condition can be expected to last throughout the war.

-30-

Meteorology

(*Continued from page* 206)

and techniques are being developed which will aid in the conduct of this war and will prove to be of inestimable value to humanity when peace returns. The network of weather stations established throughout the world will make flying easier and safer and will furnish more accurate information for special storms, floods, frosts, fires, and other weather forecasts of value to civilians.

A glance at the map will indicate that the Allied Nations are in an excellent position to use the weather, or rather the knowledge of forthcoming weather, to good advantage in their conduct of the war. Remember that the forecaster needs exact information concerning weather conditions over large areas to make correct long range forecasts, and also remember that, in general, weather moves from west to east. Germany and Japan control relatively small areas of land and sea so their meteorologists are badly handicapped in their attempts to forecast. Germany is in a particularly unfortunate position in this respect since almost no weather information is available to her from the Atlantic Ocean and storms reach the continent without much advance warning. While it is believed that the Germans were able to forecast the dry period in September, 1939, at which time their mechanized forces invaded Poland, it is probable that such excellent forecasts can no longer be made due to the dearth of meteorological information available. The Japanese are somewhat more favorably situated with respect to areas from which weather information is available, but their inability to obtain data from Siberia, Central China, India, and the Indian Ocean, and the loss of their weather stations in the Aleutians must be a serious handicap to their forecasters.

In the past, weather forecasting has been largely an art learned by the painful method of trial and error but, with the improvement in weather equipment and the development of new and improved methods of forecasting, it is rapidly becoming a true science based upon the known laws of physics and mathematics.

-30-

Crystals for S.C. Sets

(Continued from page 202)

not only rotates the set's variable gang condenser to a new and pre-set position, but also connects the tank circuit to another crystal on that preset frequency.

And when a fighter pilot, hightailing toward an enemy target, finishes talking to the control office at his base, he merely pushes a button in order to change his channel so he can talk to his squadron commander up ahead of him. This, like the tank radio described above, changes the circuit to another crystal.

Thus has the quartz crystal gone to war.

On a dozen battlefronts, where swift communications may so easily spell the difference between smooth success and a costly setback, messages take to their allotted portion of the air on wave-lengths accurately monitored by these little crystals of quartz.

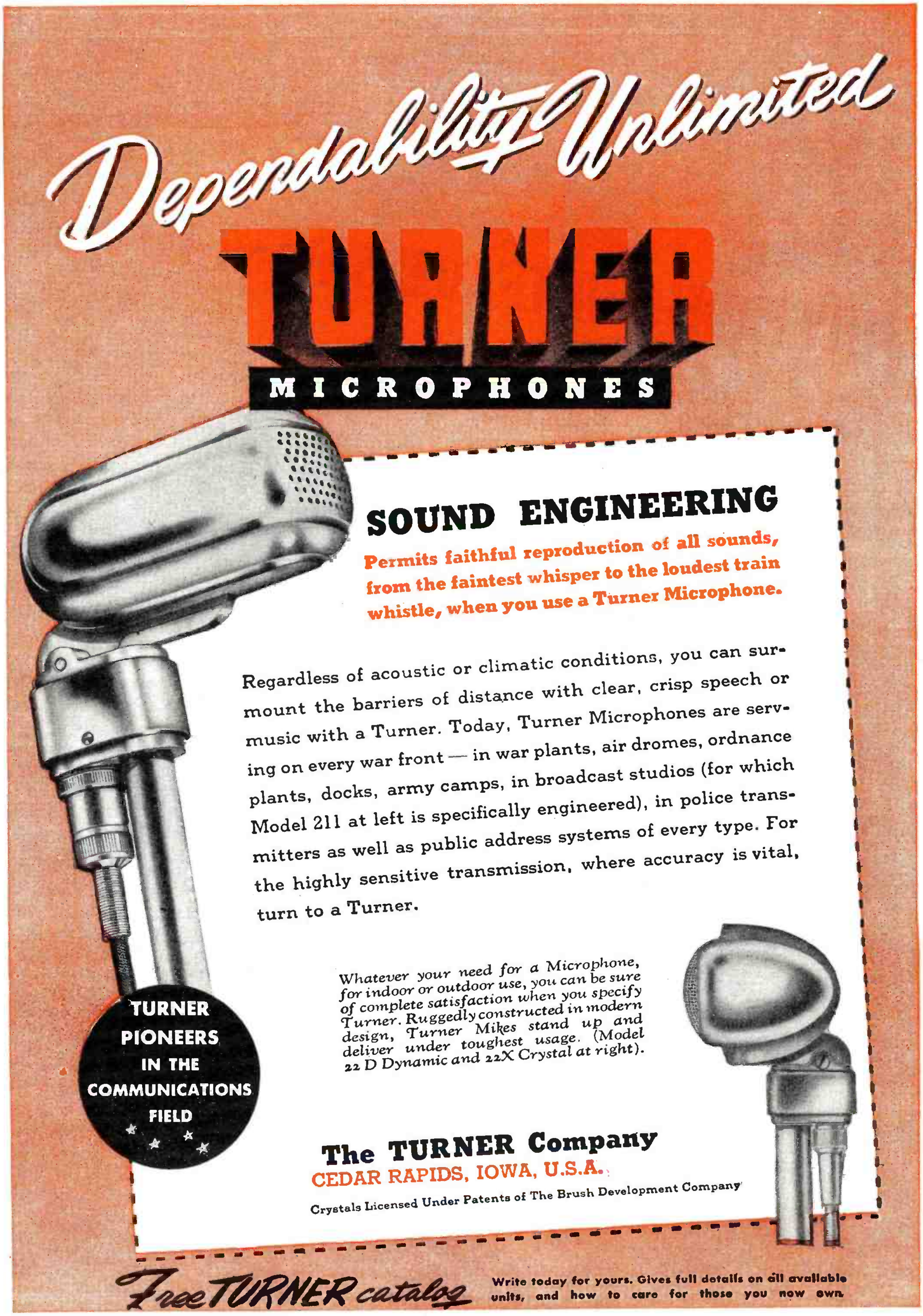
And in theaters of operation ranging from icy Adak in the Aleutians to the steaming jungles of Burma, Signal Corps radio sets retain their frequency stability under temperatures from 40 degrees below zero to 130 above and humidities from zero to 100, thanks again to the remarkable physical properties of a correctly cut crystal.

These Signal Corps handie-talkies, guidon sets, and tank push-button sets —and they are not the only ones that use crystals—are issued to our troops by the many thousands. They are mass production jobs. So, too, must be the crystal units that keep them in tune.

Yet most radio amateurs will remember, that only a few years ago, a processed tuning crystal was a fairly expensive item. The market for crystals was a limited one and production was conducted on a small scale by a few processors. The annual production was numbered by a few thousand units. Today it is numbered far into the *millions*—almost entirely the result of military requirements.

More than two years ago, it became apparent to Signal Corps radio engineers that the production of quartz crystals must be tremendously expanded if the advantages of instant push-button tuning, without laborious adjustments, were to be provided to our troops in situations where the loss of a split second may mean the difference between life and death for the operator.

Accordingly, a special group of quartz crystal authorities was established in the Office of the Chief Signal Officer, at the headquarters of Army Service Forces in Washington, to study and correlate all data on the subject. An experimental quartz crystal testing and processing plant was established in one of the Signal Corps laboratories under the jurisdiction of the Signal Corps Ground Signal Agency. Development as well as pro-


Dependability Unlimited
TURNER
MICROPHONES
SOUND ENGINEERING
Permits faithful reproduction of all sounds, from the faintest whisper to the loudest train whistle, when you use a Turner Microphone.
Regardless of acoustic or climatic conditions, you can surmount the barriers of distance with clear, crisp speech or music with a Turner. Today, Turner Microphones are serving on every war front — in war plants, air dromes, ordnance plants, docks, army camps, in broadcast studios (for which Model 211 at left is specifically engineered), in police transmitters as well as public address systems of every type. For the highly sensitive transmission, where accuracy is vital, turn to a Turner.
Whatever your need for a Microphone, for indoor or outdoor use, you can be sure of complete satisfaction when you specify Turner. Ruggedly constructed in modern design, Turner Mikes stand up and deliver under toughest usage. (Model 22 D Dynamic and 22X Crystal at right).
TURNER PIONEERS IN THE COMMUNICATIONS FIELD
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CEDAR RAPIDS, IOWA, U.S.A.
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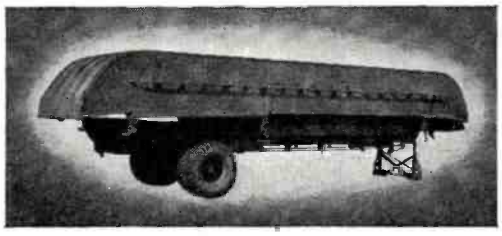
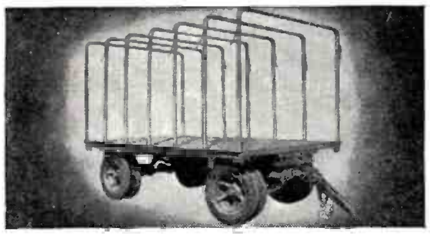
Free TURNER catalog
Write today for yours. Gives full details on all available units, and how to care for those you now own.

TRACTOR CARRIER



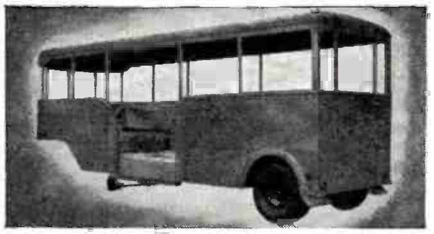
PONTON CARRIER

SEARCHLIGHT TRAILER

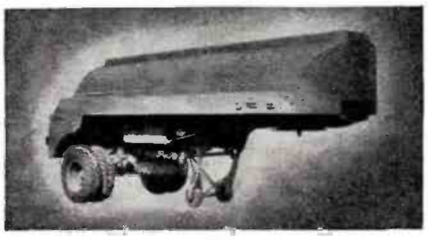


EQUIPMENT CARRIER

MERCHANDISE TRAILER

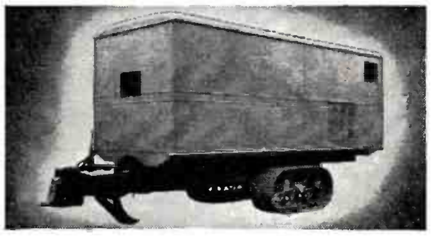


PERSONNEL CARRIER

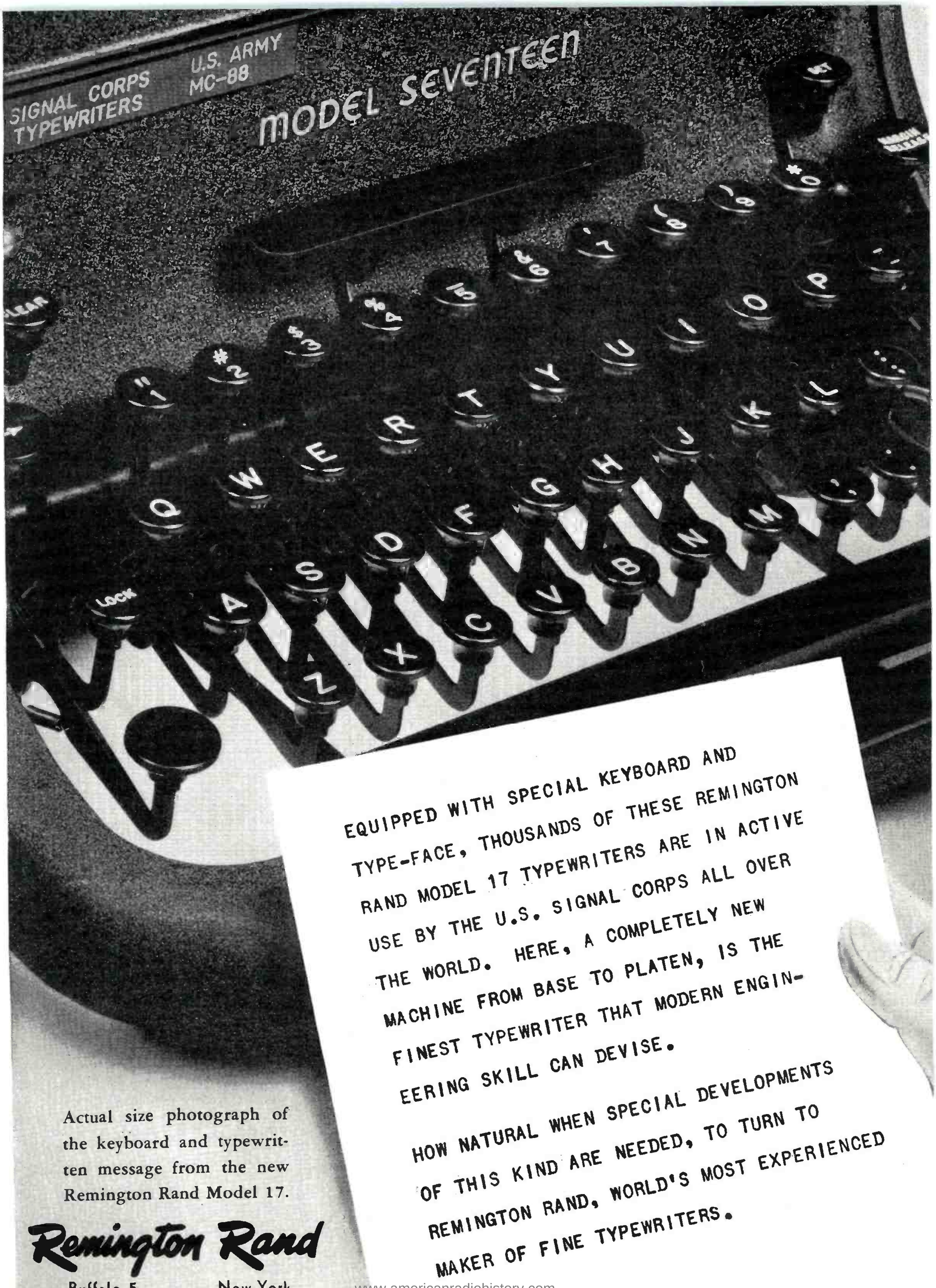


GASOLINE TANK-TRAILER

MACHINE SHOP TRAILER



CABOOSE TRAILER



Actual size photograph of the keyboard and typewritten message from the new Remington Rand Model 17.

Remington Rand

Buffalo 5 New York

duction contracts were issued to industrial firms having some experience in the field. At the same time a Signal Corps officer, attached as communications adviser on the U. S. Military Mission to Brazil, was put on the trail of raw material sources.

Chemically, quartz is silicon dioxide —a combination of silicon and oxygen, which are the two chemical elements most abundant in the crust of the earth. Quartz may be found in almost every part of the globe, but only a small proportion of the crystals are good enough for processing into tuning units and to date the most abundant source of raw material, from a commercial standpoint, has been Brazil.

The piezo-electric effect, which is the essence of the quartz crystal's value to radio, was discovered a little over sixty years ago by the French physicist, Pierre Curie, and his brother. Pierre Curie, it will be recalled, was, with his Polish wife, Marie, the co-discoverer of radium. The prefix "piezo" means pressure. The Curies discovered that, if a quartz crystal were subjected to pressure by putting a weight on it, the surfaces of the crystal would develop an electric charge. The more pressure, the more voltage.

In the science of electricity, we expect that if a certain phenomenon occurs, the opposite effect should occur as well. For instance, electricity in motion creates a magnetic field and, in turn, a magnetic field in motion generates electric current. Or again, if an antenna transmits radio waves, it will also receive them. So scientists realized almost immediately, after Curie's original discovery, that the reverse effect could be expected; namely, that if an electric voltage were applied to a quartz crystal, it would show a mechanical strain. Pierre Curie confirmed that by experiment.

One more scientific fact is needed—the fact that a section of quartz crystal, like any other elastic object, will tend to vibrate mechanically at a certain natural frequency depending on its size, shape, and internal structure. Thus, any section of quartz will have its mechanical resonant frequency. Couple it into an electrical circuit by means of the piezo-electric effect, and this natural mechanical frequency may be made to control the electrical tank circuit of a radio oscillator.

Piezo-electric crystals were applied in the First World War to generate mechanical vibrations at supersonic frequency. A submarine detector of this type, employing quartz plates, was developed by the French Professor Langevin of Paris at the request of the French Government. It was not perfected in time to apply it against the German U-boats during that war, but in the postwar years, this type of vibration generator served in the fathometers protecting ships from going aground by the reception of echoes from supersonic vibrations sent from a ship to the sea-bottom.

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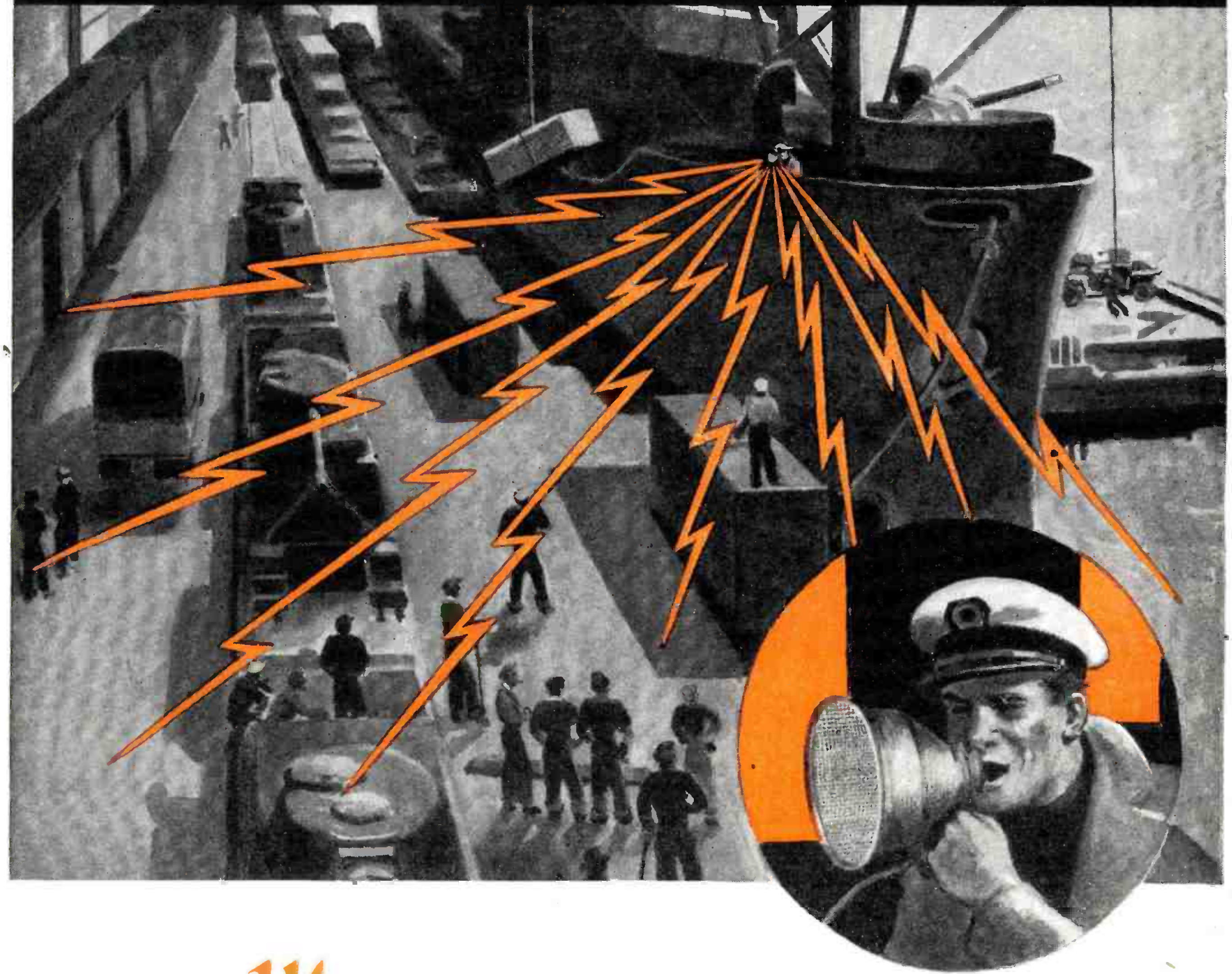

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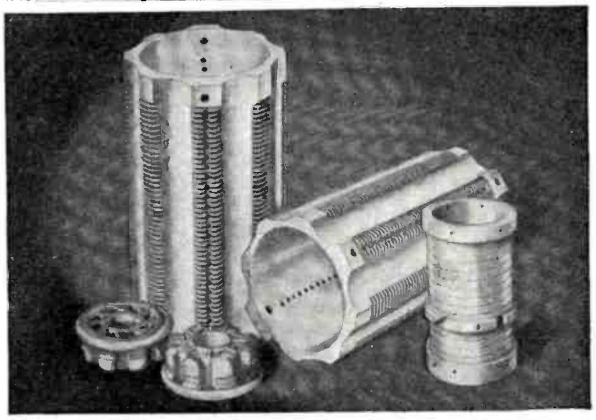

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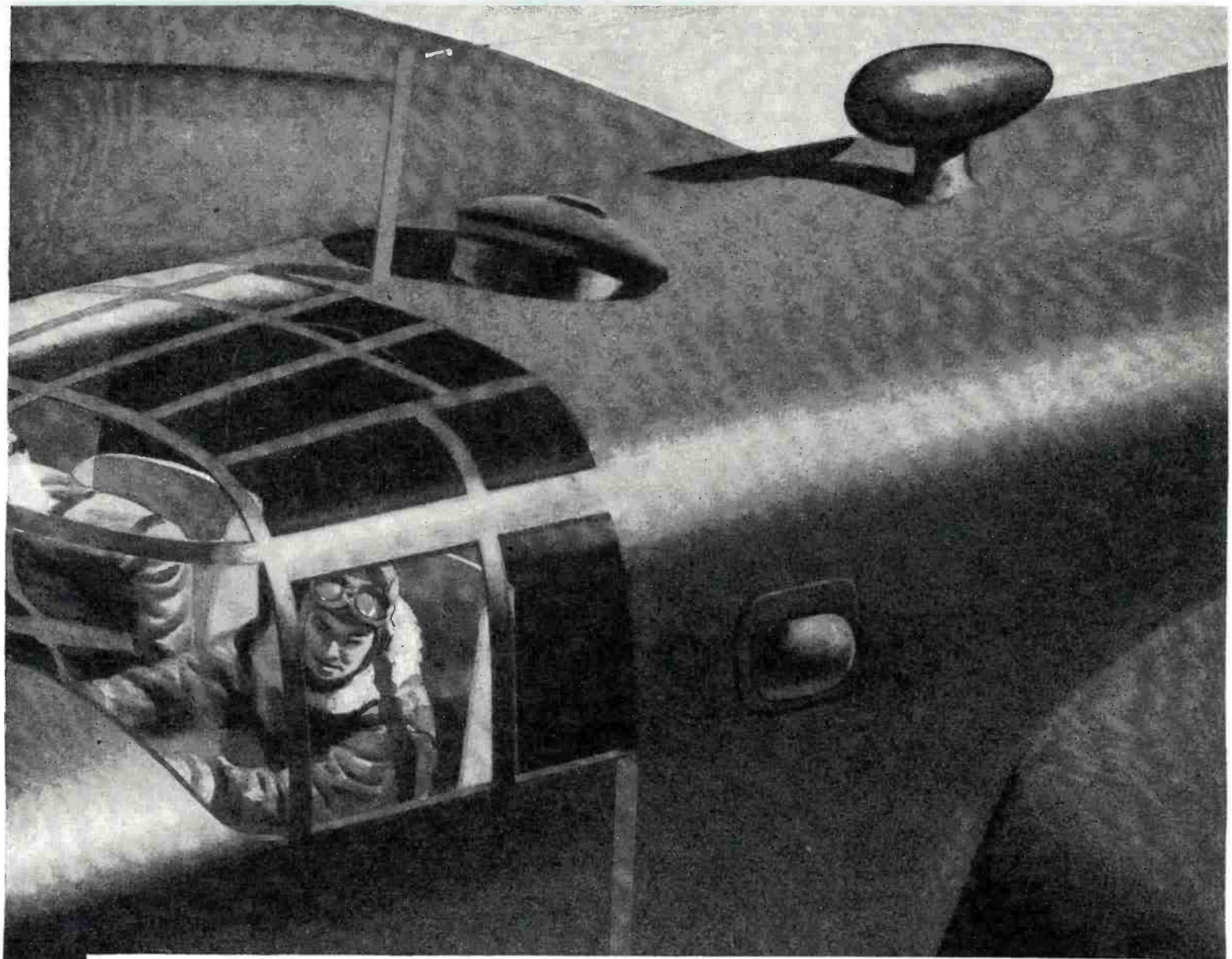

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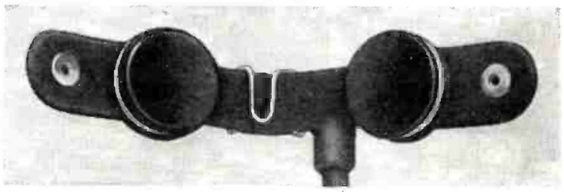

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In 1921, Professor W. G. Cady of Wesleyan University showed that quartz crystals could be used to create highly stable radio oscillators and that they could be arranged in such a way as to obtain exceedingly sharp frequency discrimination. Further improvements were made by Professor George Washington Pierce of Harvard and, in recent years, numerous investigators at many laboratories, particularly under the pressure of wartime need, have contributed a vast fund of knowledge to the nature of piezo-electric vibrations and their harnessing for the purpose of stabilizing the frequency of a radio set. So accurate can these crystal-controlled circuits be made that they are used for the timing of master clocks. Special applications in the field of supersonics and in carrier telephone filters have contributed to the development of the art.

The greatest concentration of research and development on crystal processing, however, has resulted directly from the current requirements of military radio communication. The development of manufacturing facilities and methods as a consequence of this need will no doubt be reflected in numerous postwar electronic devices aside from communication.

The property of piezo-electricity, like the beautifully symmetrical forms that crystals take, results from the internal molecular structure of the mineral. Numerous crystals of minerals other than quartz share this property. Among them, Rochelle salt crystals exhibit a very strong piezo-electric effect. However, from the commercial standpoint and, with due regard to such highly pertinent factors as manufacturing processes, availability of raw material and ruggedness in service, quartz has met the test and emerged as the most widely used material for the purpose at the present stage of our technological development.

The application of piezo-electricity to military communication, therefore, has centered around quartz—the discovery of sources for raw crystals, arrangements for their mining, purchase, and shipment to American processing plants, methods of inspection to select suitable crystals for processing and to determine their internal molecular structure, and a series of processes for cutting, grinding, lapping, finishing, testing, and mounting the oscillator plates to form units which could be incorporated in a radio set meeting rigid military specifications.

While, as has been said earlier, quartz in one form or another may be found in most parts of the world, only a small percentage of it is sufficiently pure and free from structural defects to provide suitable radio oscillator plates. There are well-known quartz crystal deposits in the United States, for example, in the region of Hot Springs, Arkansas, but the most intensive exploitation of crystal resources has occurred in another of the United Nations—Brazil. Prior to the entrance of the United States in the war, there was a considerable trade in raw quartz crystals picked up or mined in the less accessible parts of Brazil by a fraternity of pick-and-shovel prospectors known as "garimpeiros." The translucent stones which they put on the market constituted the most available source for the oscillator-plate industry. This source, for raw quartz crystals, will no doubt be extended in the postwar period.

In the first expansion of our quartz processing industry, quartz crystals available on the Brazilian market were shipped by high priority transportation to the United States where those suitable for processing were selected.

This met an urgent immediate need but much valuable shipping space was subsequently saved by the establishment of Signal Corps inspection laboratories in Rio de Janeiro and other Brazilian centers. This and other improvements at the source were brought about largely through the efforts of *Colonel Herbert G. Messer,* who had been assigned to Brazil as a member of the U. S. Military Mission and as adviser on communications matters to the Brazilian Air Ministry. Colonel Messer stayed on to make a survey of the Brazilian quartz industry and to recommend operating procedures which have increased production and eliminated waste. On his return to Washington, Colonel Messer became Chief of the Quartz Crystal Section in the Office of the Chief Signal Officer, Army Service Forces. He is now serving as Chief of the Ground Signal Equipment Branch of the Engineering and Technical Service, of which the Quartz Crystal Section is a part.

Meanwhile the Quartz Crystal Section, through a technical staff numbering some of the world's outstanding authorities on piezo-electric phenomena and applications, had initiated a far-reaching program designed to convert this nation's small and laboratory-scale crystal processing industry to one capable of handling mass production and producing a superior finished oscillator plate.

This technical staff consisted of a nucleus of Signal Corps officers and civilian scientists, a number of them with Ph.D. degrees in physics and allied fields. They worked closely with their colleagues in the Signal Corps laboratories, the Naval Research Laboratory and in a number of private industrial firms, which either had been engaged in crystal processing on a small scale before the war or had entered the field to help meet the need for crystal plates in military communication equipment.

The Quartz Crystal Section, Engineering and Technical Service of the Office of the Chief Signal Officer, is headed by Major Allyn Swinnerton, former professor of geology at Antioch College. The production and distribution of these millions of crystals

has been a terrific task excellently handled by Capt. E. W. Johnson, who has been a member of this Section since its start.

Much credit is also due Dr. Karl S. Van Dyke, one of America's leading experts on crystallography, for the present technical excellence of U. S. quartz crystal units.

One of the early problems was to obtain crystal processing machinery; for some of the processes involved, such as lapping, the only machinery available was that designed for optical equipment. Arrangements were made for Federal financing of facilities to manufacture the machinery needed for the manufacture of oscillator plates. This was the case, for example, in connection with X-ray machines used for inspection of the transparent crystals to determine their invisible internal structure.

Another major contribution of the Signal Corps Technical Staff was to consolidate the scattered items of technical "know how" that were available to various laboratories and manufacturers in different parts of the country. The technical men representing the Chief Signal Officer visited the plants and obtained the permission of virtually every important manufacturer to report his special technical processes into a common pool of information which was in turn put at the disposal of the entire industry to meet the national need. Handbooks and blueprints were prepared and technical specialists provided consultation and assistance to Signal Corps suppliers who asked for guidance.

Methods of examining and cutting quartz crystals are based on a knowledge of their fundamental structure. The typical shape of a quartz crystal, as produced by nature, is that of a hexagonal prism, longer than it is wide, and coming to a point at one or both ends in six-sided pyramids. Such a prism would, therefore, have six flat faces. This external structure results, of course, from the invisible internal arrangement of the atoms of oxygen and silicon that constitute the mineral. However, a good fraction of the "mother quartz," which is the industry's raw material, is of the "unfaced" variety. That is, although the invisible atomic structure is the same, the external structure has disappeared, perhaps—as in the case of a lump of quartz picked up in a riverbed—as the result of erosion. "Faced" quartz has the advantage that it betrays its internal structure and, therefore, expedites processing, since the wafers must be cut at certain angles to the natural axes of the crystal. However, "unfaced" quartz is also an important raw material and by special devices, using polarized light or X-rays, its internal axes can be discovered.

The X-ray goniometer is a very important tool in the determination of crystal orientation. It consists of an X-ray machine to generate the X-rays, and an ionization chamber to indicate when reflected rays are received, together with a method of mounting the crystal so that the angle of diffraction can be measured. To this "X-ray-eye," even an unfaced crystal exhibits the invisible structural arrangement of its atoms and indicates directly how the crystal should be mounted in the saw to cut it in one of the specified directions. Both the X-ray tube and the ionization chamber, with its amplifier, are electronic equipment.

Raw quartz crystals imported from Brazil by the Metals Reserve Corporation are inspected by the National Bureau of Standards and by certain Signal Corps laboratories prior to their sale to the American industry. Inspection by means of polarized light reveals flaws which frequently make an apparently perfect crystal unsuitable for the manufacture of oscillator plates. The most common flaw is known as twinning and results from unlike internal arrangement of the atoms in different parts of the crystal. Other defects, such as cracks and bubbles, may be seen in ordinary light. Some apparent flaws which appear under optical examination have been found, as the result of research, not to impair the electrical qualities and specifications have been rewritten by the Signal Corps to permit their use, thus, in effect, expanding our available supply of raw materials.

Even if only a small part of a quartz crystal is free from flaws, it may be worth while cutting it, discarding the bad sections in the process. Some quartz which was formerly regarded as scrap is now being run through the inspectroscope and in many cases useful blanks can be salvaged.

For purposes of inspection, the crystal is immersed in a tank in a liquid such as mineral oil which has an index of refraction approximately that of the quartz, thus minimizing reflection of light from the surface. A powerful source of light is focussed on the crystal through the oil bath with or without polarizing screens. The location of the normally invisible axes of the crystal can be determined by means of polarized light. Exact measurement is made with the precision polariscope or with X-rays.

The first manufacturing step is sawing of the mother crystal into wafers, known colloquially to the operators as "baloney slices." Many types of saws are in use, since they frequently had to be improvised from existing machine tools, such as milling machines and surface grinders. In any case, the quartz crystal is embedded in or cemented to a rigid base, and the cutting is accomplished by diamond dust adhering to the saw blades, which are either steel or copper.

The next stage is lapping. A number of blanks are mounted in a workholder which is placed in the machine. Various types of silicon carbide abrasives are used. The blanks are taken from the machine to have their thickness measured with a micrometer and their degree of flatness in a comparitol gauge. Blanks are finished by hand

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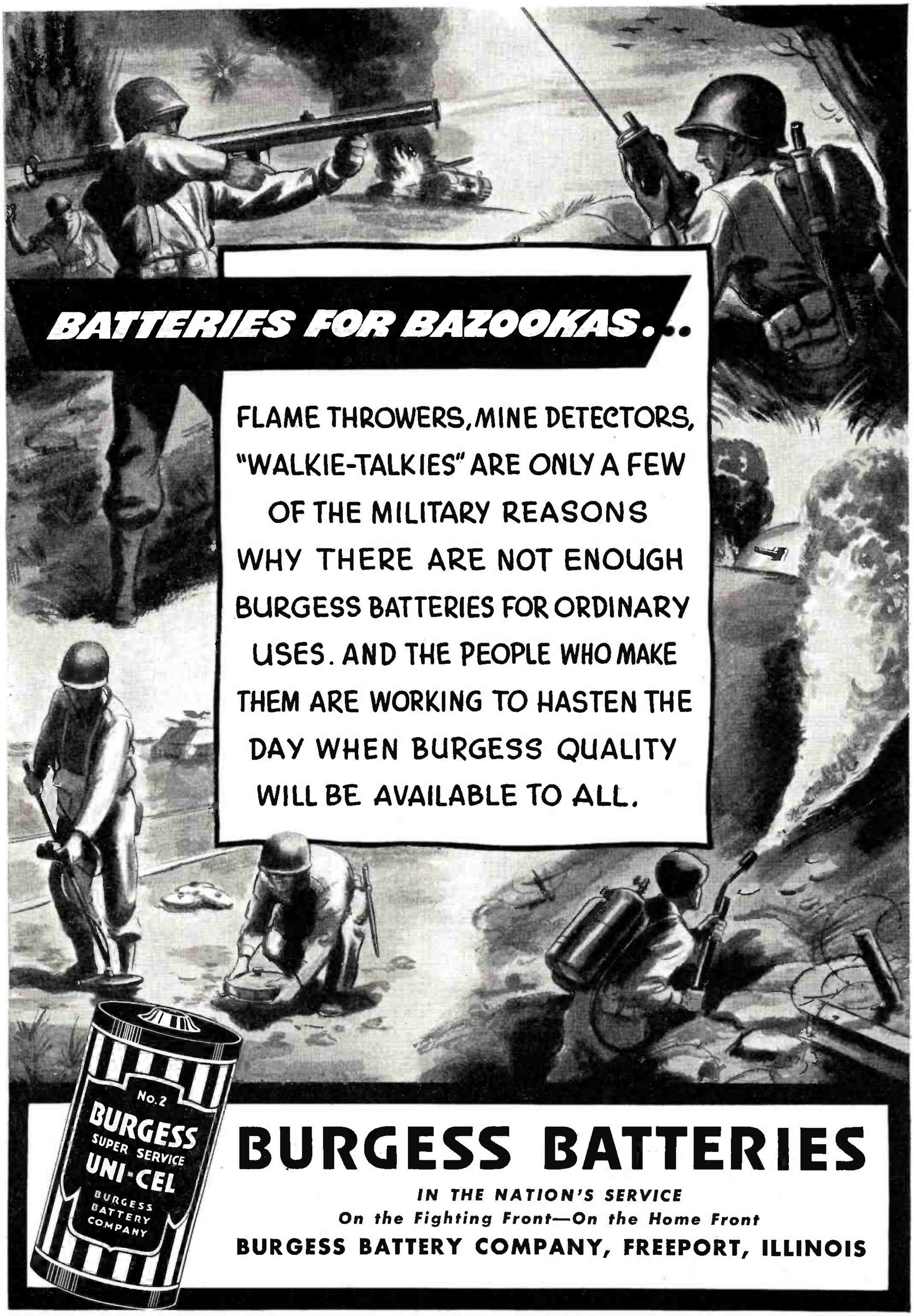
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lapping. This operation, like most of the work in crystal processing, is usually done by the hands of a girl. She holds the crystal between thumb and middle finger and rubs it over a fine abrasive, such as optical rouge, on a flat glass plate. The approach to final finishing is measured directly in terms of resonant frequency. The crystal wafer is placed in an oscillator along side a standard oscillator controlled by a standard crystal. The difference is an audio frequency beat note heard by the finisher in her earphones. The standard oscillator used in these tests is very often an actual Signal Corps radio transmitter of the type in which the crystal being finished is intended to be installed.

After the crystal has been mounted in its holder, it is further tested for stability under varying temperatures and for resistance of the unit to moisture. Thus, in the factory, the crystal unit must prove its ability to carry out the function that has been delegated to it on the battlefield.

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Amphibious

(*Continued from page* 197)

and the armed forces have been keenly cognizant of the necessity of schooling Signal Corps, Navy, Marine, and Air Forces' personnel in the varied intricacies of signal communication in amphibious warfare. Joint amphibious communication schools have been established to teach not only radio code, procedure, and tactics, but also the science of loading communication equipment and personnel on the transports and cargo ships. The moving of troops and supplies ashore and the establishment of a successful beachhead have been also stressed. This vital information is imparted to chosen officers and men alike; the importance of this type of operation itself is highlighted by the significant factor that only outstanding officers are assigned to this work.

In the Signal Corps, an officer who has successfully hurdled his OCS course and has mastered the officers' advanced training course is now only at the threshold of a career in the amphibious forces. He must still learn to speak the amphibious language. He must learn that the wall is a bulkhead and that the stairway is a ladder, and after he has learned to master the talk of the sea-going soldier and has learned to clamber up and down the side of a ship he is then ready to proceed with the science of loading, unloading, and landing. While all of this training is going on he is still being drilled in all of the arts of signal communications.

It is impossible as yet to say when this war will be over. But it is possible to say that when the last shot is fired the United Nations will have fought their way to victory in almost every theater as a result of successful amphibious operations. And in days to come when Allied soldiers reminisce and relive those courageous and death-haunted assaults, it will inevitably arise that the success or failure of every phase of those grim battles turned on the successful accomplishment of the Signal Corps motto: "Get the Message Through."

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Signal Supply in ETO

(*Continued from page* 115)

Officer. However, combat experience has indicated that certain types of equipment can be maintained on what is known as "zone of interior" percentages, which are somewhat lower.

Many items of signal equipment are very expensive or because of their technical nature, are manufactured of highly critical materials. These are known as "controlled items" and are given special handling to assure strict conservation. Their distribution is centrally regulated by the Signal Supply Service.

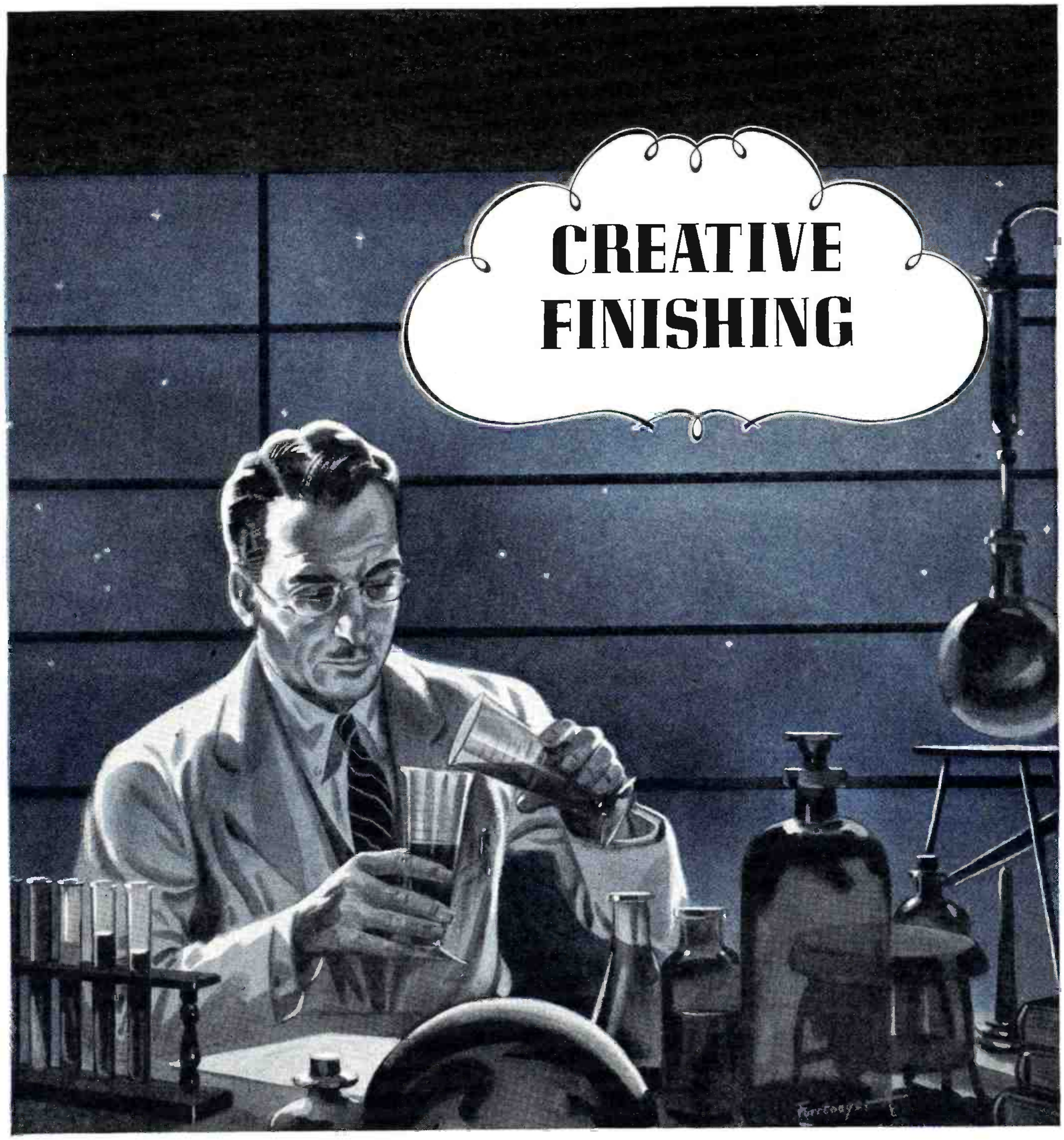
Stocks of non-controlled items are maintained at a level in accordance with figures set up by the War Department.

To save critical shipping space, the Army has found it expedient to obtain much equipment and supplies locally, through the whole-hearted cooperation of the British Ministry of Supply. The savings in this connection have been considerable and the substitutes have served their purpose with satisfaction. These locally procured items range from thumb tacks to a telephone exchange, large enough for a city the size of Syracuse, N. Y. The required procurement technique, involving complicated bookkeeping on both the American and British sides, had to be worked out literally from scratch, as there was no precedent to serve as a guide.

A physical problem of considerable magnitude is the location, manning, and administration of supply depots and repair shops. The locations of ports and sub-ports, the expected distribution of troop units in various staging areas, the road network, the railroad connections, and the availability of both active and passive defense measures all enter into the picture.

As supplies arrive at various ports, they are segregated into various classifications and shipped to the respective depots designated for them. Decentralization greatly speeds up the actual delivery of equipment to the people who want it. The word "service" in Signal Supply Service really means something over here.

Every organization has what is called a "table of basic allowance" or a "table of equipment"; this specifies the articles to which it is entitled for the accomplishment of its job in the military scheme. Troops arriving in this theater of operations are not accompanied by their organizational



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equipment but instead receive it here from the various services such as the Signal Corps, the Engineers, the Quartermaster, the Ordnance, and other service branches. The issue of the initial equipment is made through a system of requisitions originating, in the case of signal supplies, in the Office of the Chief Signal Officer in Washington. These requisitions travel through the necessary military channels to the proper base section signal officer, who notifies the proper depots when and where to ship the equipment for the organization concerned. This procedure has been systematized almost to a point of monotony. Often a newly arrived outfit hardly has time to open its barrack bags before it is already breaking out cases of telephones, batteries, radio sets, and other signal equipment.

The question is often asked, "Why don't the combat units bring their equipment with them from the United States?"

There are several good reasons. Firstly, the troops can be transported more readily if they are not impeded by heavy equipment. More important, however, are the requirements of the particular mission planned for each outfit. Will it fight in the desert, in the snow, in mountains, in a wet spot? Usually not even the organization commanders are informed on this point when they embark at a port in the United States. Before the North African operations, in the fall of 1942, one newspaper correspondent turned up for the trip carrying fur clothing and snowshoes!

The preliminary planning of the supply picture even encompasses the ordering of special materials. For example, invasion troops moving into enemy-held territory might need miles of a particular kind of cable to rehabilitate a partially destroyed telephone system or transformers to work on some odd voltage or frequency not standard anywhere else. These problems must be anticipated so that, if necessary, manufacturers can make these items well in advance and have them ready when needed.

One of the growing activities of the Signal Supply Service, in this theater of operations, is its repair facilities. Repair shops are located at all depots and the ingenuity and resourcefulness for which American mechanics are noted are given free play. Hardly anything is ever actually thrown away; no matter how badly damaged, a piece of equipment is stripped down to the bare chassis and every nut and bolt, every condenser and resistor, is removed and saved, if possible, for re-use. "Cannibalizing" has become a fine art. One working telephone is often produced from three defective units.

The best tools and test equipment are available, and the methods used in the extensive electrical and radio repair businesses in the United States are applied here with improvements born of the necessities of war.

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Depots

(*Continued from page* 98)

chines, training for operating warehousing equipment such as fork lift or mobile lift, the warehouse "mule" or tractor, and in the technical field there is training to cover all phases of radio, telephone, motor generators and electric meters to enable employees to become more efficient in the repair and maintenance of items sent to the depot from the Armed Forces in the field.

The Maintenance Division repairs Signal Corps equipment to be returned to the unit from which it was sent, as well as to be placed in depot stock. This division consists of property section and repair shop. The property section receives, itemizes and classifies material to determine repairs required or the advisability of salvage. A feature of this department is the stock room consisting of the many thousands of parts needed for the repair of this equipment. The repair shop is divided into eight sections: radio, meter and photographic equipment, telephone and telegraph, teletype, motor generators, machine shop refinishing department and battery department. In some instances, enlisted men are assigned to work with civilians in this branch to receive practical instruction in the repair of communications equipment. A quick appraisal of incoming equipment determines within 48 hours if the equipment can be repaired. If not, a new unit is shipped from the Storage Division and the defective unit is repaired and returned to stock. Much of the equipment sent back for repairs comes directly from battle zones and often shows results of combat use; bullet holes, shrapnel imbedded in the units, corrosion by water and, in some cases, blood stains.

Stock nomenclature provides speedy item identification, enables military units to requisition items in convenient, rapid and positive manner, assures proper warehousing, promotes rapid selection and shipment of material on requisitions, facilitates procurement, and provides official reference for use by laboratory personnel. When an item is handled in large volume and a large variety of articles are handled simultaneously, it becomes necessary to classify items for warehouse purposes. In addition to being classified, items are given numbers. A standard description and stock number enables purchasing officers to readily identify the item and source for purchase. This description facilitates the preparation of the order on contract inspection reports and the final receiving report. The identification description of Signal Corps equipment usually consists of three parts: the physical description which describes briefly the physical appearance of the items in technical language; the electrical or performance description sufficient to identify an item to the using personnel, and the purchase description to identify the item to contracting officers.

Signal Corps stock numbers are assigned to items and parts of items appearing on tables of basic allowances, tables of equipment, tables of organization; items shown on procurement and issue parts lists; expendable supplies required in replenishment; items appearing on equipment projects requiring routine maintenance and designated by engineering project numbers as requiring storage and issue, and standard assemblage approved by the Chief Signal Officer, each item of which is separately stock numbered.

The assignment of stock numbers is made only by qualified engineering personnel specifically designated for the purpose. This assignment is based upon descriptive information obtained by or for such personnel which describes the parts completely so far as this identification and issue is concerned.

When material has to reach a port of embarkation by a certain date, a deadline is determined and the shipping requisition is so marked. When the requisition is received by the warehouse with a deadline date, it is immediately given highest priority. If a number of deadline shipments reach the warehouse at the same time, the port is called upon to determine which shipment is to be held in abeyance and critical orders are given priority, requisitions being

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Every overseas shipment is packed in wood with a waterproof liner, the closure of which is sealed with a mastik. ¾" lumber is used on all packing material. All wooden containers for overseas shipment are banded and a staple is placed every six inches on the band. Extreme care is exercised in the stencilling of pertinent information on the outside of the container, especially code. Every precaution is taken by the packing section to see that the ultimate destination of the shipment which appears in code is correct and so spaced upon the container that all persons handling the shipment from point of origin to final destination can identify the shipment. Waterproof ink is used and whenever the material requires a dessicant, a silicate jell is placed within the container. Since many of these shipments are handled at their overseas destination by natives who cannot read, color markings are used to distinguish material for each technical service.

Information on the outside of the box is held to a minimum to avoid confusion and misinterpretation at the receiving point where the shipment is handled and rehandled.

In an effort to conserve lumber, the fiber industries have developed a product called V-board, impervious to water immersion, as well as salt air, to be used in packaging some Signal Corps items.

In packing overseas shipments, wherever possible, the weight of each container is kept under 100 pounds, due to the fact that at various points of debarkation manpower is used almost exclusively in the movement of the shipments.

In order to prevent material such as batteries from reaching its overseas destination with its shelf life expended due to the excessive heat and moisture in the holds of the ships, the batteries are waterproofed at the source in special sheaths which have a foil lining to prevent moisture and heat from penetrating to the batteries themselves. Plywood containers are used to some extent, depending upon the type, durability, and weight of material.

Since many items arrive from contractors in component form, it is necessary to make up or assemble the components into complete units, and rebox material which is returned from the field, so depots maintain box-making sections.

In order to expedite shipments which must reach ports by a deadline date every labor saving device available is used through the warehouses and packing rooms. Material is processed in the packing line on roller conveyors. In warehousing, material is placed on wooden skids, known as pallets, which permits material to be picked up by Fork Lift Trucks, operated by one man, and placed in the proper location. Dry batteries, for example, are received in containers weighing from 150 lbs. to 225 lbs. each. When this material is taken from the box car it is placed on a pallet (one pallet will hold approximately six battery containers). From this point on it does not have to be handled or lifted by a man but is picked up by a Fork Lift Truck, placed in the elevator and taken to the floor where it is ultimately warehoused.

The use of the pallet in warehousing has meant a tremendous conservation in manpower and has speeded up the movement of goods, from the time of arrival to the time it is placed on the transportation medium.

Very frequently requisitions arrive that must meet an immediate deadline. In these cases, it is not unusual to get out a shipment weighing many tens-of-thousands of pounds within a period of hours. Within the running time it takes a government vehicle to drive it to the airport, the material is on its way.

The Stock Control Division is responsible for the maintenance of all depot stock records pertaining to Signal Corps supplies and equipment, physical inventories and appropriate adjustments to stock records. It maintains liaison with Service Commands and stations regarding stock levels, inventories, and disposal of excessive and obsolete stocks of Signal Corp equipment.

Requisitions received by telephone and mail, from the Office of the Chief Signal Officer as well as ports of embarkation and camps, are properly edited and checked for accuracy of stock nomenclature and stock number. Requisitions are then placed in folders which are routed to the Elliott-Fisher Bookkeeping Machine Section which maintains stock cards showing balances of all material stored in the warehouses and a shipping ticket vellum is made and placed in the folder from which additional copies are run on Ditto machines and routed to the warehouses for packing and shipping. From there these shipping copies are routed back to the office Shipping Records Section which processes all papers showing the number of boxes, cubic dimensions, weight, etc. From this point they are then routed in turn to the Transportation Center which handles the actual shipment of the merchandise.

In case of inability to make ship-

ment of some particular item on a requisition, the folder is routed to the case workers who determine if a substitute can be furnished. If so, the folder is then re-routed. If it is impossible to substitute, the folder is processed through the Final Review Section, where attempt is made in some manner to supply the demand. In case this is impossible the items are extracted to point of origin for reordering from some other depot.

In connection with this work there is maintained a Stock Replenishment Section whose primary function is to replenish merchandise and maintain records of purchase orders of anticipated shipments. A Back Order Section keeps a record of all material so handled, to make a survey of all tallies daily, in order to handle shipments on back order at the earliest possible moment. Inventory and Adjustment Section works closely with the others in handling discrepancies between stock record balances on the stock cards and actual warehouse inventories to adjust these balances. They also conduct special inventories handling discrepancy reports from the field. Tally-Voucher Section verifies tallies against purchase orders, prepares receiving reports, handles all correspondence and adjustments relative to material due in, and insures that final action is taken on material due in.

Status and Reports Section compiles and handles all reports. It also functions in reporting the status of any requisition to any point of inquiry. Stock Analysis Section analyzes stock status reports received from stations, recommends revisions in stock levels for stations, initiates action for recovery of excess and obsolete stocks at stations, issues shipping orders on excesses at stations, and effects transfer and distribution of station stocks. Production Coordinating Section expedites the delivery of material on order. This work is handled primarily through the contracting officer, to have material on hand to fill certain known anticipated requirements as well as work in connection with helping the back order department in the earliest possible release of back orders. Technical Board Section works with the persons editing requisitions as well as rendering technical assistance to other departments in the Division. It prepares, breaks down lists on spare parts groups, and handles set assembly reserve material.

Memorandum Receipts Section handles papers for all merchandise shipped with the expectation of its return, such as loans to manufacturers. It also maintains records on Depot Items and Supplies, maintains records on shipments from the field which are returned to the Shop for repair, and follows through on its re-shipment.

Special Sections are maintained for individual functions, such as, the complete operation of the distribution of individual radio sets or on handling International Aid shipments, as well as for routine clerical work necessary in handling correspondence and file of all papers.

This is the physical structure of the depot system. But a bare recital of its organization can give no true picture of the magnitude of the operation. For example, the system of keeping records must be such that the records can be constantly consulted and studied, and yet they must be on hand in the file room at all times. When data from the files is required, therefore, a photographic copy is made in miniature studios in the file room in some depots. In a matter of minutes the original copy is in the hands of the person requiring it. The personnel system is another example of "know-how" applied to the individual labor situation in each depot area.

In-service training increases the efficiency of the individual employee, and, where practical, cafeterias and dispensaries are available to cater to the workers' comfort and welfare.

Property protection, special services, all the complex elements that go to make up the Signal Corps depot system must be kept under the closest scrutiny and efficient management to insure success in procuring, maintaining and issuing the supplies that "Get the message through."

—30—

Pacific Theater

(*Continued from page* 154)

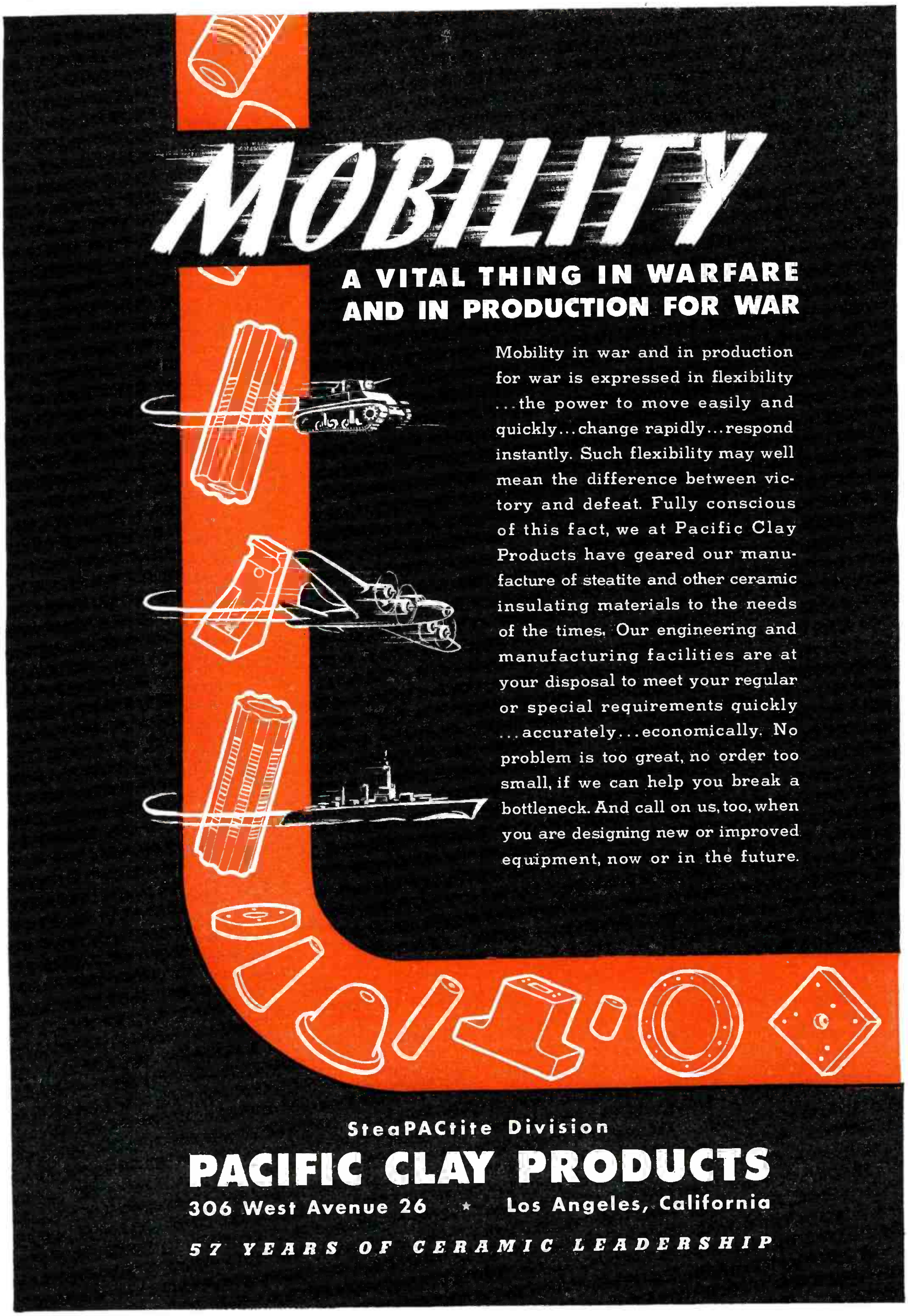
"Why, one of our Signal companies strung a pair of wires for 130 miles on one of those islands out there—and killed 32 horses doing it."

The jungles, the high humidity and heavy rainfall played havoc with equipment and operations, especially in New Guinea.

Recovering from the effects of Japan's surprise blow, the United Nations began driving the Japs from the wicked Owen Stanley Range, the backbone of New Guinea. There, in addition to the mud and the mountains, our forces encountered a unique obstacle. Instead of erecting wire entanglements, the Japs used the lush and tenacious vines native to the region. Shells poured into the obstacle merely seemed to interweave the vines more tightly and make the barrier even more impassable.

Still, the Signal men got through.

Petulant radio "hams" in the United States, who often call for vengeance against local atmospheric conditions and threaten to smash their sets when heavy static is encountered, would find that the source of their annoyance at home is but fleeting compared to some of the reception obstacles on the Pacific fronts. At first, during early stages of the assault from Port Moresby, radio was the principal means of communication. Atmospheric interference, jungle screening, and deterioration of sets through condensation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hampered transmission to the extent, however, that wire construction was begun immediately.

Pending completion of circuits, a laborious process in which wire had to be carried in packs and on muleback, the Signal Corps fell back on the age-old method of foot messengers. Bicycles were particularly useful, since they were lighter than motorcycles and more easily transported over barriers.

Along the northern and eastern coasts of New Guinea, the Signal Corps found heavy "tele-radio" sets which had been used by civilians to send weather information to fishing vessels. Technicians trained soldiers to operate the sets and soon were using them in an improvised aircraft warning system.

On Guadalcanal, signal companies found it extremely difficult to maintain wire communications due to lack of transportation and almost impassable terrain. Lines laid along jungle trails were continually knocked out by Japanese bombs or by road construction units. To maintain the lines at night, without lights for vehicles or flashlights for the Signal Corps men, became virtually impossible so that often radio was the sole means of communication.

"Two battalions of Infantry on Guadalcanal, which had entrenched themselves in the rear of the enemy, were so completely isolated that we had the utmost difficulty in supplying them, furnishing them communications, and evacuating their wounded," said one Signal Corps officer.

"We first supplied them by air but later were able to operate a boat line upstream to the base of a hill on which they had dug in. We used ropes and pulleys to get supplies to them and wounded were evacuated in the same manner.

"Air to ground radio sets were the only communications medium at first but later we were able to use our guidon radio sets which weigh only 16 pounds and have a normal range of several miles. The smaller sets, the five-pound handie-talkie and the thirty-pound walkie-talkie, were used for shorter distances by Infantry patrols and front-line troops. The distance range of all radio sets was diminished by the jungles, intervening hills, and other difficult terrain. Some difficulty was also experienced with signal equipment due to corrosion of metal parts exposed to salt spray along the beaches."

"The Japanese," said one officer who went through the Guadalcanal campaign, "are extremely clever in camouflaging their radio stations. One large transmitter with a large electric generator and Diesel engine was so well concealed that many passing troops failed to discover it. At last the sharp eyes of a chaplain located it. As a whole the Japanese radio equipment seemed to be designed with the idea of high portability. It did not appear to be well-designed from the viewpoint of moisture proofing."

The Signal Corps participated, also, in the expansion of air activities. Wherever the Air Forces set up its bases, the Signal Corps went along to install, and in some cases to operate the equipment. There, too, the Signal Corps accepts all the dangers of men in combat.

Col. John H. Brewer was posthumously awarded the Legion of Merit and the Purple Heart after being killed in action during May, 1943, while on duty as Signal Officer for a fighter command.

"Colonel Brewer made an important contribution to the defense of Northern Australia and to the success of the Papuan campaign," read the citation. There have been other decorations—for example, Capt. Claudius G. Farrow, Jr., was cited for overcoming "major handicaps and unusual problems" with radio equipment for a Pacific task force.

For the most part, however, the rank and file of Signal Corps men feel amply rewarded by that terse comment in a battle report:

"Communications were maintained continuously throughout the operation."

—30—

European Theater

(*Continued from page* 150)

boot, a Fifth Army Signal team worked south, through enemy-held territory, to meet them. In one week's time this unit itself cleared more than 100 miles of civilian wire line and rehabilitated it to military use.

The story of the Signal Corps' part, in the early stages of an invasion, is essentially the story of its part in war, day in and day out. Allied territory is ever expanding, bringing with it demands for more complex and extended lines of communication. Initial installations, set up under fire, soon yield to intricate telephone lay-outs, teletype networks, and extended buzzer telegraph circuits. Light airplanes are utilized in courier runs as the facilities rapidly expand and in a few weeks, underground cable systems put military communications on a par with the best on the home front.

It was stifling, that particular forenoon outside Gela, Sicily, and advancing Infantry patrols had paused for a breather on the dust-dry road to Vittoria. A battered quarter-ton bantam, carrying four helmeted figures, rocked past and sped on to disappear 'round an elbow job half a mile down the slope. The small "PRIORITY WIRE" sign on the vehicle's stubby nose was barely readable through the clouds of red powdery silt kicked up. The occupants of the stripped-down peep included two Signal Corps officers, a technical sergeant, and the driver, a private. They were seeking a suitable wire route—reconnaissance—for the day's attack when they inadvertently encountered, around that elbow-bend in the road, what later proved to provide the stiffest local opposition faced by American troops in the first hours of the island's invasion.

By all military standards, it couldn't happen to the Signal Corps, for the manuals dryly state that Signal personnel are vested only with the combat mission of providing communication for such large units as Divisions, Corps, and Field Armies. But here was this perky bantam, now slowing to a stop, while less than 200 yards away came the first of five Mark IV German "specials" followed by waves of Italian infantry.

As the lead tank's 50-caliber machine guns stuttered to life, all four men in the peep hit the ground, crawling for dubious cover offered by a cactus hedge bordering a vineyard, half a dozen yards off the road and slightly to the right. A hasty conference ensued as heavy slugs cut through the vines overhead. Technical Sergeant Don W. Carter, of Creston, Ohio, would try to make it back to warn our own Infantry of the now discovered counter-attack, while the others, Lt. Colonel William B. Latta, of Los Angeles, California; Second Lieutenant George Hands, of Detroit, Michigan, and the Private, Thomas Zeller, of Chicago, Illinois, spread out, hoping to survive by dispersing.

Treads of the first tank crushed rock and earth barely 18 inches from Lieutenant Hands' prostrate body as he lay screened from the driver's slit. All three dug in as best they could, using clips from their .45's, slivers of rock, and bare fingers. Less than a dozen yards from where Colonel Latta and Lieutenant Hands sprawled, they saw Italian infantry flush and capture Zeller (later, released unharmed in a successful Allied counter-attack).

"Then, all hell broke loose," Lt. Hands said. "We knew then that Carter must have gotten back, for it was our own artillery—afterwards we learned we were on the receiving end of U. S. Naval gunfire as well—that stopped those enemy tanks. Four were knocked out, the fifth scuttled backward, and the 'Eyties' pulled out in a hurry.

"I know now what the Germans meant in Tunisia when they claimed we had 'automatic' artillery, for we were buffeted about like nothing on earth. Our escape still seems miraculous."

When the barrage lifted nearly two hours later, the officers identified themselves to friendly patrols, picked up Carter in another vehicle, and continued on their mission.

Repeatedly, throughout the Italian, Sicilian, and Tunisian operations, Signal personnel found themselves confronted with similar and even more ticklish situations. Experience in combat has proven that in many cases, it is vitally necessary that Signal units go well forward, of battalion and Infantry company installations, in the performance of their duty. Commanding generals, down through the rough tough foot-slogger, will admit that

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At the conclusion of the Sicilian campaign, Lieutenant General George Smith Patton, who commanded the American Seventh Army in the 38-day struggle for the strategic island, and who is noted for his brusqueness, singled out the Signal Corps for special commendation with his phrase:

"Without food, favor, or affection, the Signal men carried on.

The General's reference to lack of food applied in the main to the wire and heavy construction teams which at the height of the battle not infrequently worked steadily for 18- and 20-hour stints without rest and usually on but two meals daily, for they were constantly on the move.

Somewhat significantly, General Patton's remarks concerning Signal performance followed by, but a few days, an impromptu conversation between himself and Technical Sergeant Richard Redding, 27, of North Kingsville, Ohio. Spurred well in, high atop a 30-foot pole, a mile out of San Stefano, on the north coast road, Redding was tying-in a telephone line. He was utterly oblivious to waves of Messerschmitts, coming in over a low hill to his back, for bombing and strafing runs on shipping and railway transports being loaded for the first of the two highly successful, amphibious landings behind enemy lines.

Redding presented a perfect target, outlined as he was against the sky but he worked on, so engrossed, that he failed to identify the general who had driven up to hail him from the foot of the pole:

"Hey soldier, what are you doing up that pole?" Without looking down, Redding shouted bluntly, "Working!"

"How long have you been up there?" the general wanted to know. Redding said about 20 minutes.

"Don't the planes bother you?" General Patton yelled.

"Hell no, but you do!" Redding bellowed in exasperation. The balance of Redding's crew at the foot of the pole gulped and expected fireworks but the general turned away, smiling. Redding swears, to this day, that he didn't know he was talking to a general.

In any large-scale operation, particularly amphibious in nature, Signal planning must of necessity be long and thorough for innumerable reasons, chief among them being the exceedingly delicate nature of equipment and its susceptibility to damage from salt air and water; the care necessary in the landing of such equipment from the invasion barges; establishment and maintenance of early communications from ship-to-shore; and the setting up of initial facilities once on the beachhead. From this point until weeks after the cessation of fighting, Signal headaches multiply a thousandfold.

British and American Signal units, participating in the Sicilian show, readied themselves for fully five months prior to D-day. To deliver both tactical and administrative messages, maps, wire overlays, and regulations over an area (the extremes of which were 1,100 miles distant) within a maximum of 24 hours, to all units concerned with communications, presented a problem that required the combined ingenuity of members of both Allied signal sections.

This was accomplished by the maximum use of radio, telephone and teletypewriter, motor messenger, and air courier. The latter alone travelled a total of 2,260 miles daily. Motor messengers averaged a daily total of better than 700 miles, while radio and teleprinter accommodated hundreds of messages.

Training presented a distinct problem. Only a smattering of the units to go into Sicily had previous combat experience. Many units had received new or replacement personnel to the extent of approximately 25 per cent of their total strength. Schools were established at convenient locations, however, and key personnel from both sections attended. Special emphasis was laid on radio procedure to give unified operation.

Approximately 100 supply requisitions were prepared, to be filled in the U. S. proper, and in the North African theater of operations. These represented almost 20,000 tons of Signal equipment, which it was necessary to receive, record, and issue or prepare for over-water transport to Sicily. Many items required special packing to prevent damage when being landed. Other special-phased requisitions were prepared for Ranger and Airborne outfits. Of particular interest and a constant source of trouble was procurement of waterproof bags, which were ultimately supplied to units for wrapping of Signal items where probability of damage from salt water might be encountered. These later proved their worth when several individual radio units were floated ashore in the buoyant, water-repellent sacks.

It was at this time that General Patton conceived the idea of a certain type and number of amphibious radio units, previously mentioned. He deemed them absolutely essential to the success of the thrust. Without previous warning, First Lieutenant George Shaffer, 32, of St. Joseph, Missouri, received rush orders to design, test, and construct a pilot model. Improvising with what little was available, requisitioning from nearby supply depots, and redeeming other necessary parts from wrecked half-tracs littering North African soil, Lieutenant Shaffer and his men set to work. Within two weeks from receipt of the job order, the first model was ready for testing in the waters of the Mediterranean.

Fortunately, as it later proved, the sea was rough for the first time in three months and with breakers from six to ten feet high, the model withstood every test and surpassed even the wildest expectations of its designer. Gratified at the performance of the pilot craft, more were ordered promptly by the General. Lieutenant Shaffer set up a miniature assembly line with seven distinct stages of construction. Supplies were flown in from as far as Casablanca. Within four days of the tests, completed amphibious radio units rolled off the line at the amazing rate of one a day. When our forces hit the beachheads July 10, these units proved invaluable.

For his ingenuity and designing ability, Lt. Shaffer today wears the Legion of Merit ribbon. Two other enlisted men of Shaffer's resourceful unit—

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Technical Sergeant Howard Benz, 27, of Cleveland, Ohio, and Sergeant Wilbur Etter, of Chicago, Illinois—also were awarded Legion of Merit ribbons for outstanding performance in North Africa. Etter for his work in improving communications for the Roosevelt-Churchill conference at Casablanca last January when he built repeater and carrier systems to bring order out of chaos wrought by the use of long, faulty French lines between Casablanca and Oran, and Benz for his diligence and devotion to duty in installing, aligning, and maintaining radio sets in tanks and tank destroyer battalions. Benz' commanding officer termed the former General Electric employee a "positive genius with radio."

Aboard the floating headquarters' ship, special improvisations were necessary to accommodate communications' installations and personnel. Because of this problem, personnel worked under the most trying of conditions during the landing operation. Ventilation was a constant source of trouble, as the temperature during the first few days soared under the blazing sun. Radio operators, and code and cipher personnel functioned flawlessly despite the cramped conditions, long hours, bad air, and bombing and shell-fire from shore batteries.

Some 15 Signal detachments went in with the assault waves in three simultaneous pre-dawn landings. Despite early anticipated confusion, these outfits were soon set up and in operation on the beaches, enabling unit commanders to control their forces and coordinate the drive inland. As rapidly as areas were absorbed in our advance and even while pockets of resistance were in the process of being mopped up, work was underway on the rehabilitation of existing circuits and the laying of new lines was started. Considerable damage was caused to all overhead circuits but by soldering defective splices, under withering sniper activity; transposing of wires to clear cross-talk; replacing insulators, shattered by small arms fire; placing new poles, splintered by bombing and artillery blasts; and by re-tying and re-sagging taut wires; reliable communication was speedily effected. Considerable trouble was encountered from enemy sabotage.

Field wire lines were slashed and spliced into one another by the retreating enemy. Fine armature wire was wound round open wire and then grounded. Valuable hours were lost in searching for such cases. Hand grenades were detonated beneath low-lying strands and long metal bars were inserted between the strands and twisted into a hopeless tangle. More than 100 cases of enemy sabotage were encountered within a seven-day period between Gela and Licata.

Before the close of the campaign, a large number of suspected enemy saboteurs were taken into custody. One Signal company's personnel apprehended 16. Those found in active interference with our communication were summarily dealt with. Wire was hacked with axes, pierced with needle-like pieces of metal, and burned. Saboteurs hacked out five sections of a cable circuit between Palma and Agrigento, and burned it in two or three different places.

As wire communications were extended up island, efforts were redoubled to keep pace with the rapid advance of the infantry. This was accomplished by various crews working from dawn until well into the night. The speed of the drive did not permit thorough rehabilitation of open wire so new lines had to go down. The use of carrier equipment was impractical due to the unbalance existing on all circuits, many being composed of varying gauges of wire as well as having copper and iron sections interlinked. As much as 50 to 60 per cent iron wire was found in use along with the copper sections.

It soon became apparent that the operation, insofar as it pertained to Signals, would continue along two axes—one due north toward Caltanisetta, and the other generally northeast to Agrigento and Castelvetrano. During this phase, radio contact was extremely difficult to establish because of poor ground conductivity in the area and because the distances between command posts were, on occasions, beyond the normal range of lower-powered sets. On the whole radio served excellently for shorter distances.

All long-distance telephone and telegraph lines in Sicily are owned and operated by the government. Local telephone systems are owned and operated by the Societa Esercizi Telefonica (S.E.T.), and long-line wire routes follow the railroads overland. Inland, wire teams encountered a new and deadly menace in the form of thousands of mines planted along the railroad right-of-way, at the foot of poles, between the ties, and just off the cleared stretches where new wire ordinarily would be laid. Here's where earlier training proved its worth. Using detectors borrowed from hard-pressed engineers who couldn't spare men for this work, Signal personnel attacked the mines and during the weeks that followed located and removed several thousand of the destructive instruments with a surprisingly low casualty rate.

Handicapped by the mines, on the one hand, and held to a crawling space by rugged terrain that even the versatile peep couldn't traverse, one unit succeeded in converting several bicycle-type railway hand cars into motor driven units. This was accomplished by removing engines from captured German motorcycles and installing them in the hand cars. These machines greatly facilitated the work of construction and maintenance teams.

Crews forged ahead in virtually impassable regions. When the going stopped wire-laying from peeps, equipment was transferred to mule-back. Signalmen continued to be hard put to keep up with forward elements, which at times advanced 15 to 18 miles in a

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Illustrated on the following pages are but a few of General Electric's electronic products . . . achievements that in the post-war era will result in new and improved electronic devices in the expanded markets of broadcasting, television, emergency communication, marine and aviation communications, and industrial applications.

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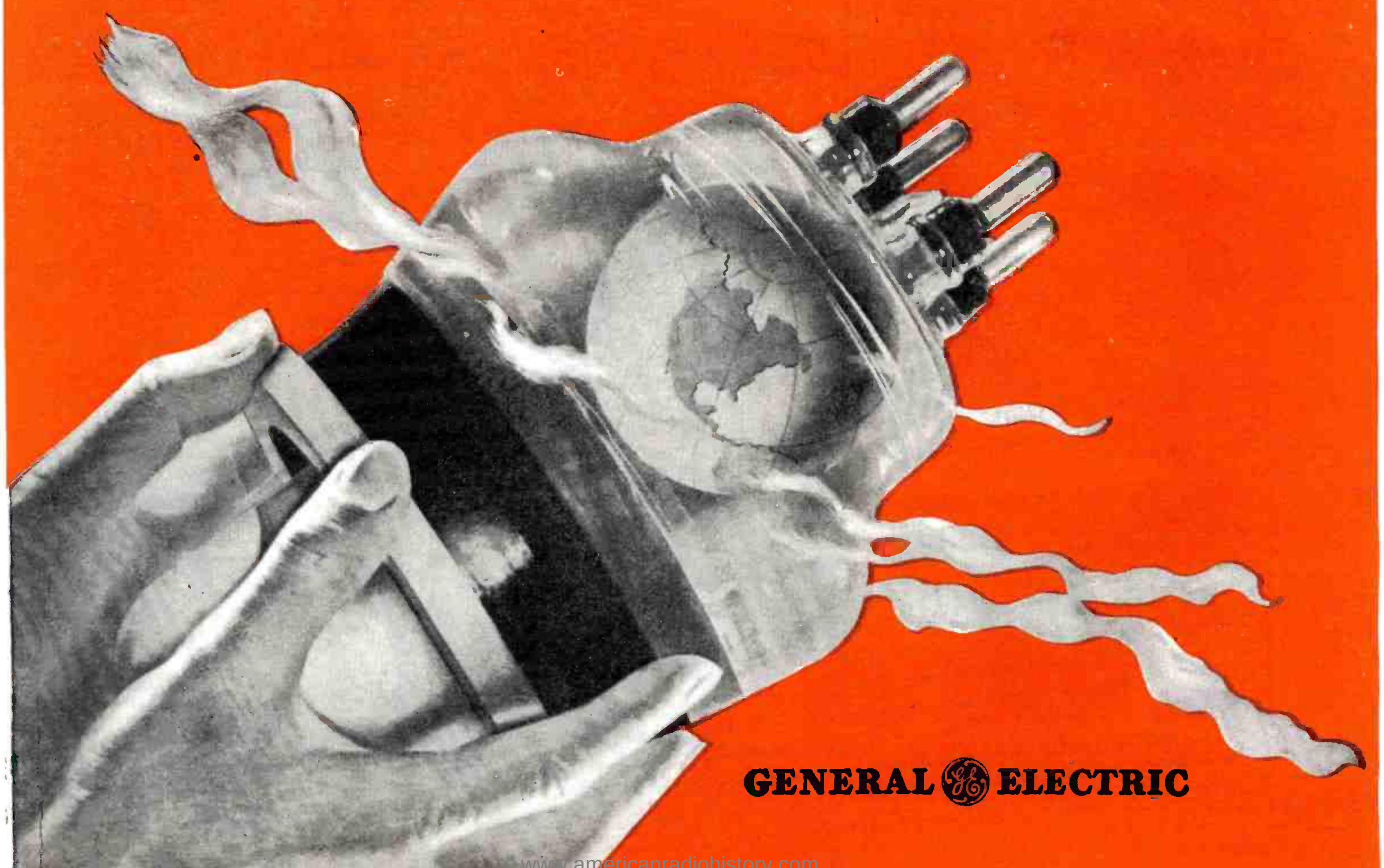
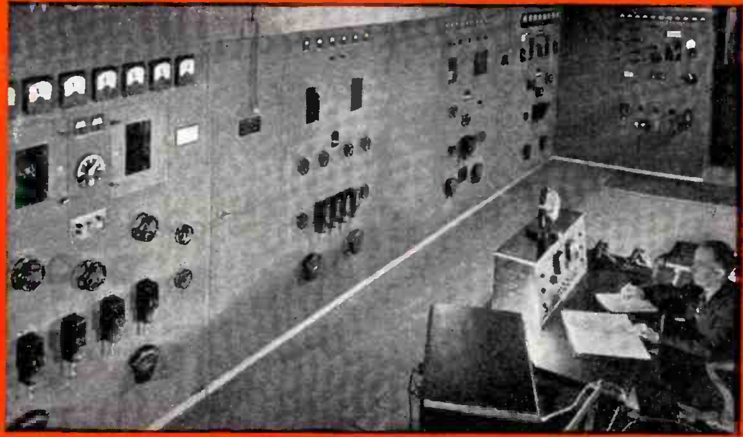
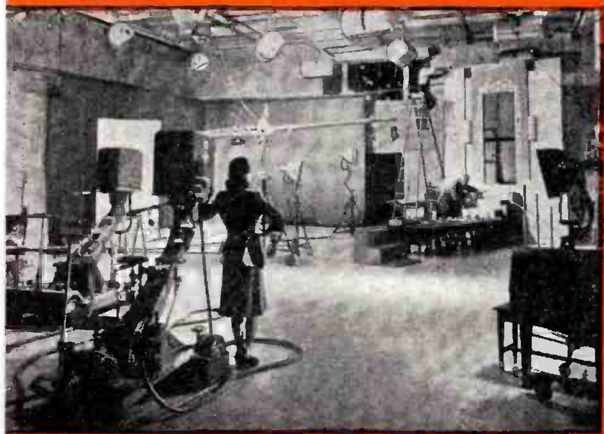
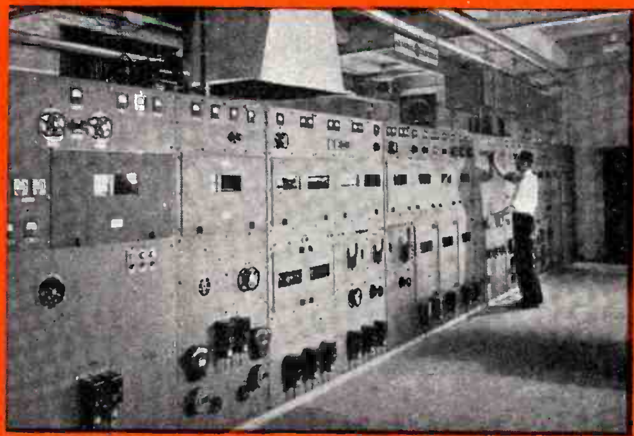
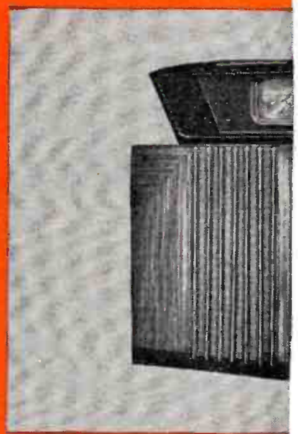


GENERAL ELECTRIC

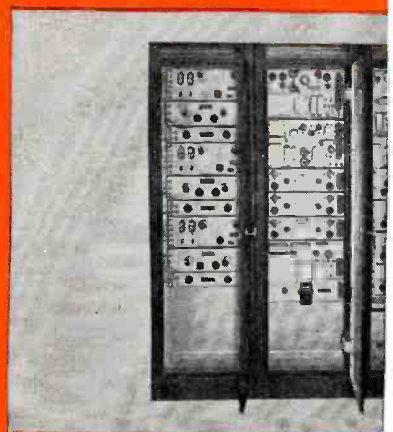









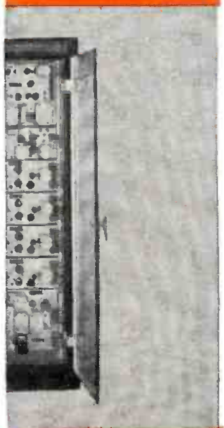
IMPORTANT GENERAL ELECTRIC ELECTRONIC PRODUCTS

FM AND AM TRANSMITTERS, RECEIVERS AND ANTENNAS. General Electric's experience in short-wave broadcasting is unequaled . . . General Electric has built all of America's 100-kw international-broadcast transmitters. General Electric built more than a third of existing FM broadcast transmitters, and supplied a large portion of the 600,000 FM receivers now in use. General Electric designed and built the unique FM circular antenna which incorporates an exceptionally high power gain. General Electric, in fact, is the only manufacturer with experience in building the complete FM system—including transmitter, antenna, and home receiver. Shown (left to right) are G-E FM circular antenna, AM transmitter and G-E radio phonograph combination incorporating AM and FM.

INDUSTRIAL ELECTRONIC TUBES. General Electric manufactures many types of electronic tubes. G. E. developed the Thyratron which has made possible today's high production welding of aluminum and stainless steel. The G-E steel-jacketed ignitron is being widely used instead of rotating equipment as a heavy duty D-C power supply. G-E pliotron supplies the high-frequency oscillations used in industrial heating. G-E Kenotron supplies the extremely high D-C voltages required for smoke precipitation and air purification. Shown (left to right) are the ignitron, thyratron, and kenotron.

TELEVISION TRANSMITTERS AND RECEIVERS. Evidence of G.E.'s leadership in studio planning and station equipping is Television Station WRGB, in Schenectady, New York. This television "workshop" is one of the finest and most complete studios of its kind in the world. From WRGB will come much of the programming knowledge and technical development for the post-war expansion of television. Shown (left to right) are WRGB's studio, transmitter, and a G-E radio and television receiver.

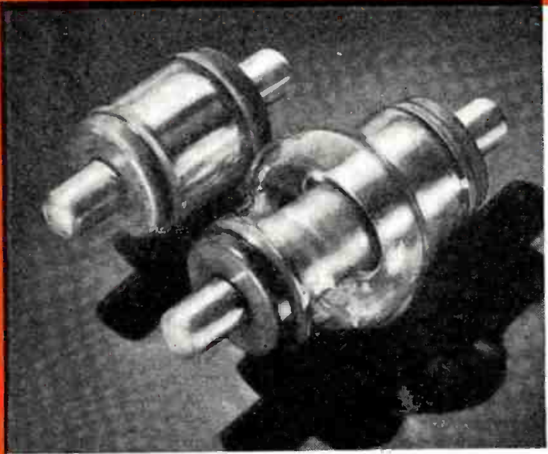
TRANSMITTING TUBES. General Electric has probably made more important contributions to the development of transmitting tubes than any other manufacturer. For example: G. E. developed the first high vacuum tube without which radio as we know it today would not exist. G. E. developed the first water-cooled transmitting tube which made high-power broadcasting possible; also the hot-cathode mercury-vapor tubes which cut broadcasting power losses greatly. (Left) Typical G-E transmitting tubes.



MAGNETIC WIRE RECORDER. "Sound on wire" for recording sound and speech in planes, tanks, mobile equipment, ships, and submarines. This compact, portable unit magnetically records and reproduces sound and may be "played back" thousands of times with unfailing fidelity! . . . Recorded sound may be erased at will and the wire used over and over again.

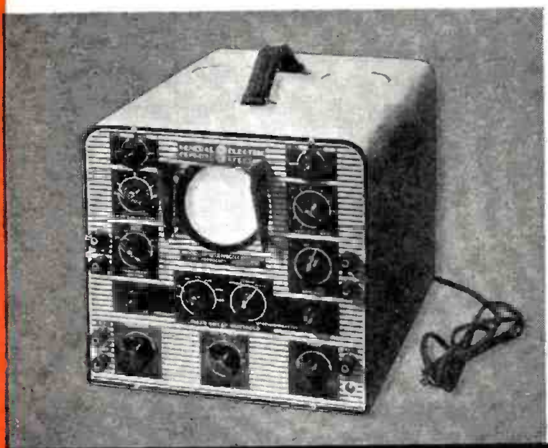
ELECTRON MICROSCOPE. The electron microscope opened up a brand-new research world to science and industry. Secrets long locked in metallurgy, chemistry, medicine and like sciences, today, are being revealed by the 10000X magnification of this new instrument that is operated by power from an ordinary 110-115 volt circuit.

CARRIER CURRENT. Compact, efficient, and standardized, 77 different G-E carrier current "panel units" use the powerline itself as a signal circuit to perform any carrier function such as pilot relaying, transferred tripping, telephony, telemetering, and automatic load control.



CAPACITORS. General Electric has pioneered and developed a new, unique line of vacuum capacitors, rated from 7500 to 16,000 volts peak and from 25 to 100 mmfd. These circuits are common to military, aircraft, and amateur radio equipment.

The small size of the G-E vacuum capacitor is of especial importance in the design of high-frequency circuits. Only a tenth the size of similarly rated air capacitors, these capacitors also provide an internal voltage breakdown characteristic which is unaffected by altitude.



TESTING INSTRUMENTS. The new General Electric line of laboratory and testing equipment provides an extensive choice of portable, compact apparatus for accurate, rapid maintenance and testing of radio electronic circuits and parts. It includes G-E unimeters, tube checkers, bridges, signal generators, oscilloscopes and other instruments — all planned for easy, error-free reading and long, dependable service. Shown at left is G-E oscillograph and frequency modulator for AM, FM, and television-receiver and transmitter trouble-shooting.

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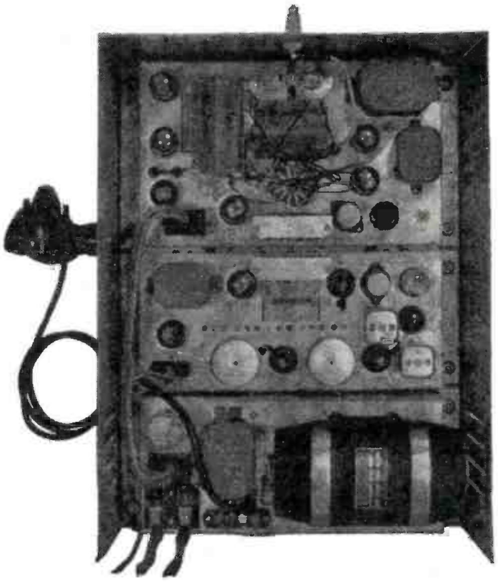

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day over jagged mountainous areas.

From Palermo on through to Messina, roads and lines were damaged almost beyond conception. The Seventh Army's rapid advance was assisted by two surprise landings behind the enemy along the coast in the vicinity of Torrenuova and Brole. During these landings, Signal personnel and equipment played an important role. Under the constant pounding of Messina from the Italian mainland in the closing days of the action, an American Signal battalion laid lines right through the city and around the tip of the island extending to the south to effect junction with the British.

Instances of personal bravery and performance beyond the line of duty on the part of Signal Corps' troops were numerous. For outstanding ability as a wire scout and for clearing mines from a stretch of railroad with nothing but a few minutes' verbal instruction, Master Sergeant Ivan G. Heimlich, of Cardington, Ohio, was awarded the Silver Star. He volunteered to search for a cable link known to exist in a specific area. In pursuit of his mission, Heimlich was obliged to by-pass German artillery and machine-gun emplacements and, despite being blown out of a water-trough in which he had taken shelter, he located the important cable point. Upon returning to his unit, he not only completely succeeded in his duty but gave information as to the location of the hostile guns which resulted in their being knocked out.

Outside Nicosia, a Signal power unit burst into flames one night near a Corps' command post. Under bombing and strafing from Focke-Wulf 190's, First Lieutenant Glenn L. Webb, of Los Angeles, California, Corporal Angelo Jeffries, of Birmingham, Alabama, and Private Donald H. Norris, of Chicago, Illinois, exposed themselves to bring the flames under control and save the installation from further punishment from the air. All three now wear the Silver Star.

Captain Max F. Meyers of San Antonio, Texas, recalls the night he was in contact with one of his telephone switchboards located near a bridge being subjected to constant aerial attack. The youth on the other end of the line was exceedingly polite and knew all the conciliatory phrases as well as the answers. The hotter things got, the more polite he became. Finally, he said, "You'll have to excuse me for a moment, sir. That last bomb was mighty close, and they're coming in again. May I ring you back?" He did, and Captain Meyers heard a chunk of debris hit the board after the soldier had kept his promise.

Within the towns and cities, destruction of communications centers was almost complete. What the enemy had not demolished before evacuating, bombing and shellfire had. Italian switchboards were found to be inferior for military use and local lines were poorly maintained. Trouble-shooting crews walked up to 25 miles a day to locate faults and at times would be away from their outfits for many days.

Electric power presented an acute problem as the hydro-electric sources in Sicily, like those of other Italian islands, have not hitherto been developed to anything like the extent of those on the mainland itself, although prior to the invasion there existed plans to provide considerable increases in capacity during the next few years. An additional obstacle, to a highly-developed hydro-electric system, lies in that many of the island's rivers are neither powerful nor accessible enough for building work to be done other than by a long and costly undertaking. Both in 1937 and 1938 the six important hydro-electric plants produced 70-75 million KWH, or about 35 per cent of the island's total power output. Before Italy's entrance into the war in 1940, the coal for Sicily's thermal plants was imported from Great Britain, Germany, or Poland. Before Sardinia and Corsica were reoccupied by the Fighting French, the coal came from those islands. Military power units supplied the current for electrically-operated equipment.

Excellent precision Allied bombing in Palermo saved days—even weeks—of additional work for the Signal Corps when in "knocking out" the S.E.T. office, one huge bomb shaved the building in half, the force of its blast destroying everything up to within one foot of a complete new automatic telephone exchange. Military locals were tied in promptly, and the board accommodated hundreds of lines. Civilian telephone service is discontinued immediately as soon as a city is occupied and only those lines, approved by the Allied Military Government of Occupied Territory, are allowed to be opened again.

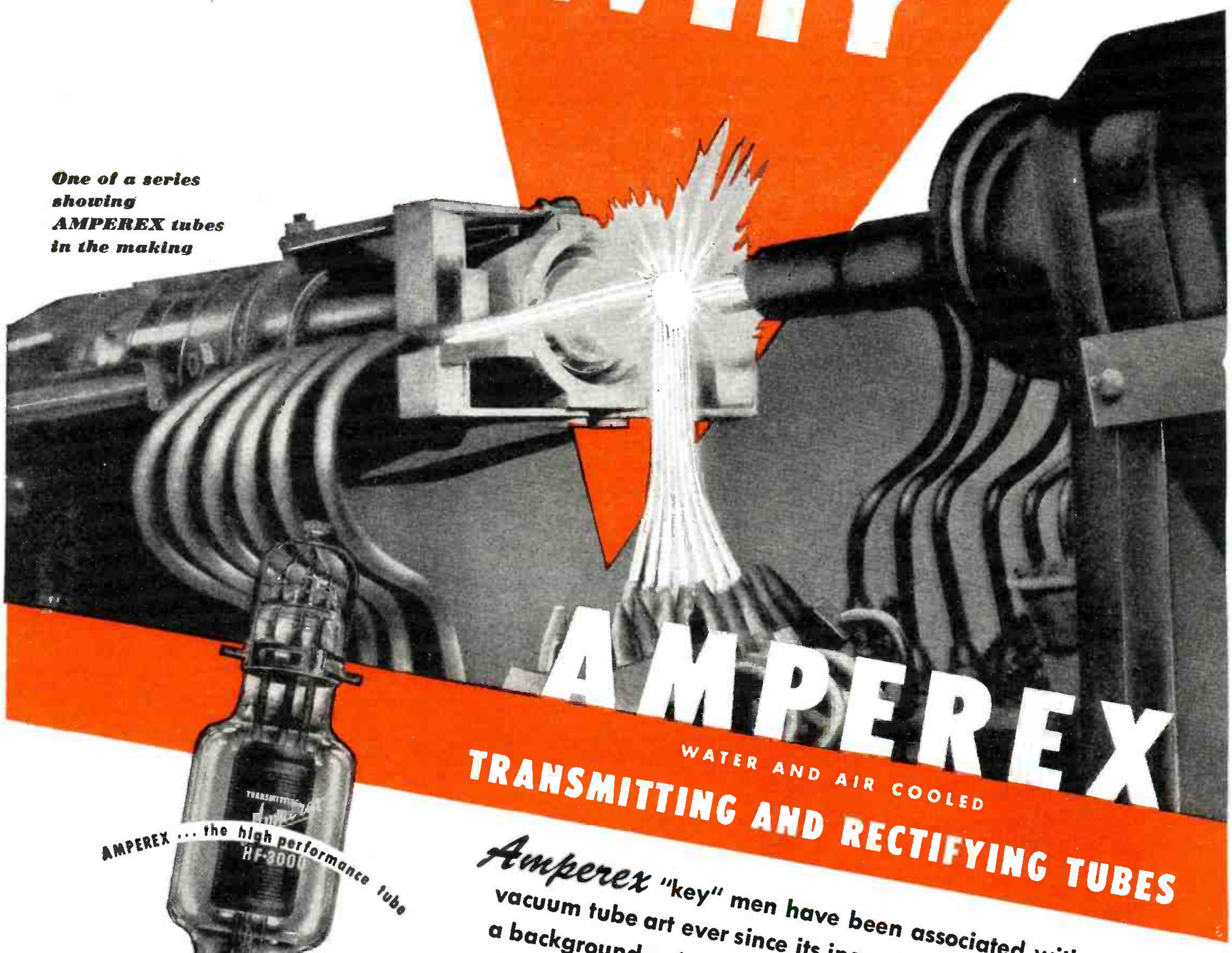
Considerable destruction of underground cable and open wire circuits, due to bombing and naval shelling, was also encountered in Palermo. The rehabilitation of open wire, which inside the city itself were thrown over the tops of partially-destroyed four and five-story buildings, stalemated progress until Staff Sergeant Bolish Piasecki, of Moosup, Connecticut, thought of using the local fire department's lone extension ladder. From that point on out, work was simplified materially, and the danger from crumbling walls was lessened.

The San Stefano-to-Messina phase presented a series of trials entirely peculiar to those previously encountered. One unit was required to operate against determined enemy resistance on a narrow coastal ledge where the length of the front was restricted, by mountains, to a mere ten miles. Communication was along a single, narrow coastal road interrupted by frequent enemy mine fields, interdicting artillery fire and demolitions.

This road provided a natural wire axis from which no unit could deviate, however. Open wire lines were non-existent. The operation as it developed involved a series of enveloping movements, by one regiment at a time, over rough country. During the ensu-

WHY

One of a series showing AMPEREX tubes in the making



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ing battle for San Fratello, it was necessary to lay a five mile stretch of wire over a trackless mountainside on which a man could move only by the use of his hands and a 15 mile stretch, where wire could be transported only by pack animals and laid by hand. This wire was put in at a rate determined by the advance of the pack train. One six mile link, from the coast road to San Marco, required 24 hours to put into continuous operation because the canyon-like road, on which it was placed, was under constant shellfire and was used by several battalions of artillery.

Army ground forces during the campaign laid and maintained a total of 49,176 miles of wire. This fantastic figure included rehabilitation of 950 miles of pole line construction, and the actual laying of 24,588 circuit miles of wire. Additionally, 1,800 miles of cable were placed during the operation.

Radio alone handled almost one million words. This figure does not include total cipher groups actually sent, as many of the messages were to several addressees, requiring transmission over several nets.

Due to lack of transportation, pigeons were not used at any time. Had they been available, it was felt that this agency of Signal communication could have been used to good advantage as the terrain and the rapid rate of advance of troops in some sections made the use of the birds highly desirable. In many cases, units were dispatched into the mountains to clear enemy pockets and to flank positions already held. Baskets of pigeons could have been carried by these troops and used advantageously.

Visual communications were not employed to any appreciable extent, except in one or two isolated instances wherein smoke was used to indicate positions of front line troops to friendly aircraft.

Intelligence, both friendly and enemy intercept, worked excellently. Scattered minor instances of security breaches were reported but these were held to a minimum and friendly service methods rapidly corrected infractions.

Most outstanding incident portraying the determination of personnel of the Signal Corps to live up to the letter of the arm's motto "Get the Message Through" is presented in the record of Second Lieutenant Harry Bender, of Pittsburgh, Pennsylvania. Bender was only recently commissioned from the enlisted ranks. During the campaign, this junior officer was assigned the task of delivering a message to a certain general—address unknown—and return to his own headquarters before dawn with the answer.

In the pursuit of his mission, Lieutenant Bender crashed in a liaison-type cub airplane, and was badly shaken, but carried on, in the face of other discouraging odds, to fulfill his assignment and return shortly before daylight with a wire overlay for that day's operations. This Signal Officer, similar to hundreds who are coming up from the ranks, out of the schools at Fort Monmouth, New Jersey, Camp Kohler, California, and Camp Crowder, Missouri, has been recommended for the Legion of Merit.

Thus the fight goes on—the fight to open communications and keep them open under any circumstances. The Signal Corps is doing it.

—30—

Military Personnel

(*Continued from page* 125)

Signal Corps private—now Lieutenant Joseph Lockhard—gave the first warning of the approach of Japanese aircraft at Pearl Harbor and that a Signal Corps private—Irving Strobing—sent out by radio key a stirring account of the final moments on Corregidor before our troops were overwhelmed. We are glad to do honor to the memory of Colonel William Herbert Murphy, killed in action in the Far Eastern theater, after devoting the major portion of his life to Army service. It is highly fitting that, because he pioneered in and developed much signal communication equipment now being used in this war, a camp should be named for him. These and many others are adding glorious pages to the annals of the Signal Corps. Some of their deeds of gallantry are told in another article in this issue.

In any attempt to describe the character of men that are bringing honor to the flaming torch and crossed flags of the Signal Corps, full recognition must be given to those pre-war officers and men who form the nucleus of our present, far-flung organization. Without further comment on the quality of those officers, except to say that they are meeting the most exacting standards, I want to express my conviction that no Army—anywhere—possessed a finer body of non-commissioned officers and enlisted men than those who served their country in the Signal Corps before Pearl Harbor. And I feel sure that their intense loyalty, their splendid spirit, and their intelligent discipline has made itself felt in all ranks of our wartime organization.

The present war has placed unprecedented responsibilities upon those entrusted with signal communications.

It is a war of world distances and of lightning movements. Orders and messages must overcome space and outspeed the fastest plane. Actions—thousands of miles apart—must be coordinated to the second.

The instrument of this coordination is signal communication and the heart and center of that communication is the Signal Corps.

Disaster threatens the Army which lacks accurate and dependable signal channels, and an Army commander, unable to transmit orders to front and flank and to obtain information from

his units, is—by military standards—blind and deaf and defeated.

In our Army every soldier who delivers a message or receives a command is, in fact, concerned with signal communication but because of our modern methods—especially the telephone, the radio, and the teletypewriter—we have not only been able to improve and speed up combat communication but we have the equipment to send messages almost instantaneously to any part of the globe.

Much of this equipment is so complicated that a special organization of technically trained men is needed to install, to repair, and to operate signal communications networks throughout the world. The military personnel of the Signal Corps furnishes that organization which serves the headquarters of divisions, corps, and armies of the Ground Forces; the Service Commands at home; the Task Forces abroad; and the Signal Center of the War Department and the General Staff.

On the Personnel and Training Service lies the chief responsibility of procuring—under general Army policies—the officers and men to carry out the war mission of the Signal Corps.

It is fortunate that the Signal Corps has a particular appeal to men of a technical turn of mind—radio men, telephone men, electricians. Professionals and amateurs in these and related fields recognized that the Signal Corps offered them unusual opportunities to learn the theory and practice of electrical communication and to become expert in the maintenance and repair of the most modern equipment.

The radio industry, the telephone systems, the power companies and, indeed, American industry and business as a whole have contributed thousands of men to the Signal Corps. Top-flight executives, outstanding scientists, qualified engineers and research men, a great body of operating and maintenance personnel, salesmen familiar with the products, mechanics, shipping clerks and packing men—all have been drawn to the Signal Corps where they have found assignments suited to their experiences.

In its laboratories and in the Office of the Chief Signal Officer the Corps has gathered many of the Nation's best-known figures in the fields of radio, electronics, physics, mathematics, and meteorology. An outstanding telephone executive, Major General William H. Harrison, heads our Procurement and Distribution Service and other experienced administrative leaders in commercial life are found in similar capacities. Other men from industrial ranks are aiding in the construction of major communication lines in base areas, in the operation of extensive systems reaching out from the headquarters of a combat theater, or are exercising their talents in supply depots, embarkation ports, or in the thick of the fighting on combat fronts.

From the jungles of Guadalcanal

come stories of former telephone linemen who have kept communications open through almost impassable terrain and have risen to the higher non-commissioned grades through their ingenuity in utilizing materials at hand and in improvising equipment when supplies were inadequate. We hear, too, of radio repairmen from countless small establishments throughout the country who are busy on combat fronts keeping signal equipment in working order or in manning the sets and, in many cases, getting more out of them than even the manufacturer thought possible. From our procurement districts, our depots, and our maintenance shops we get reports of former mechanics, shipping clerks, and warehouse men who are putting their skills to full military use. Former watchmakers and optical specialists are found in our laboratories grinding quartz crystals for radio sets; men familiar with precision tools are finding numerous opportunities; photographers are engaged in the production of training film and in recording the war in all theaters; and linguists are being used in various capacities.

Indeed, the Signal Corps owes a great debt to American industry which carried forward the advance of science and engineering. In the future, men now serving in the Signal Corps will, I am sure, repay that debt with interest when they bring back the knowledge and skills they have acquired in such diverse fields as communications, television, aerial navigation, electronics, and related branches of science. Not only private industry but the private citizen as well must benefit from this accumulation of experience.

From the beginning of the present war, the usual personnel policy of the Army has been to induct men, whether volunteers or from Selective Service, into the Army unassigned and then to determine, on the basis of classification tests and questionnaires, what their special branch assignment should be. However, a number of exceptions have been made from time to time to permit direct enlistment in particular branches by specially qualified men. The Signal Corps has received consideration in this respect because of its great need for men carrying out highly technical work in electricity or radio.

In building up sufficient numerical strength to fulfill its obligations to the Army, the Signal Corps determined to procure—wherever possible—"the cream of the crop." And in spite of this insistence on quality in its personnel, it has met the demands at home and overseas in full measure and to the complete satisfaction of the high command.

At the outbreak of World War II, the Signal Corps had only 16 more officers than it had at the end of the first war, bringing the number of officers then on duty to 2,728. The number of enlisted men was 13,627 less than at the end of World War I, numbering 39,650.

The Signal Corps saw a rapid expansion in its military personnel during the first year of the war. Since then enlisted strength and the number of officers have reached even greater proportions.

Securing this number of technically qualified officers and enlisted men presented many problems, in view of the fact that after Pearl Harbor, almost all Reserve Officers had been called to active duty and the demands of the war effort upon the supply of civilians, qualified for Signal Corps duty, had depleted the source of potential officer and enlisted material. Between June and September, 1942, Training Centers and Pools had been set up from which officers could be withdrawn when the need arose, and the Enlisted Reservists, both Signal Section and Electronics Training Group, were being trained for future duty.

Toward the end of 1942 the immediate needs of the Army for additional officers began to be met through Officer Candidate Schools. In October, 1943 the Army Specialist Corps was discontinued as a separate organization thus eliminating one source of officers for limited service activities. Establishment of the Army Specialized Training Program in December, 1942, automatically discontinued all enlistments in the Enlisted Reservists, Electronics Training Program, and Voluntary Officer Candidate Schools.

By June 30, 1943 there were sufficient officers already commissioned in the Signal Corps, so far as total numbers were concerned, to meet requirements. The obvious need was that pertaining to the procurement of officers in special categories, which were technical in their nature and demanded much in the way of experience and training, which would require an undue amount of service training.

Continuing stress is laid upon the special training, which could be given officers already commissioned, to qualify them for special assignments as well as improvement in classification and assignment procedures, which make it possible to locate officers with rare skills and reassign them according to the best interests of the service.

A rapid growth in the capacity of the Officer Candidate School occurred during 1942, the peak being reached that year when classes of more than 1,500 candidates were graduated in a month and assigned to active duty.

Since then the immediate needs of the Army for commissioned officers from these schools were beginning to be filled and it has become possible to place even more emphasis on further training and on the development of a greater number of specialized officers to meet current and future requirements.

Among the more notable accomplishments of the Signal Corps—to which the Personnel and Training Service contributed in large measure—was the initiation and successful termination of the Enlisted Reserve Program which enrolled and trained more than 50,000 men who have gone to replacement centers, to the Army Air Forces, and to the Signal units in the Army Ground Forces.

No article on military personnel would be complete without a description of the Affiliated Plan which produced more than 1,200 officers and 4,000 enlisted men of proved technical ability.

In the late 1930's as tension in Europe increased, the Chief Signal Officer asked communications companies of the country to consider development of procedures through which the experience and knowledge of technically trained men from industry could be utilized by the Signal Corps, with adequate safeguards, so that the commercial communications systems of the country would not be too severely handicapped. The men were to be assigned to units which were to be activated as a nucleus of trained personnel around which the unit could be built.

In carrying out this plan, the Signal Corps selected the units which were to contain affiliated cadres and notified the sponsoring companies of the quantity and quality of the men to be selected. The companies surveyed their organizations and determined the number of men who could be spared. Employees were notified of the program and qualified volunteers were recommended.

The original sources of supply for affiliated personnel, were the American Telephone and Telegraph Company and the independent telephone companies but the following organizations were subsequently approved as sponsoring agencies: National Research Council, Academy of Motion Picture Arts and Sciences, American Racing Pigeon Union, International Federation of American Racing Pigeon Fanciers, and the Eastman Kodak Company.

As the needs of the Army began to be met, the Chief Signal Officer, in July, 1943, directed that no more personnel be considered for direct appointment with assignment to the Signal Corps. However, the procurement of affiliated officers and men was extended until August, 1943, in order to fulfill commitments made under the Affiliated Plan.

To put the right man in the right place is one of the most important and exacting duties imposed on Personnel and Training Service which is guided, of course, by the general policies determined by the Chief Signal Officer.

At the outbreak of the war, the vast enterprise of maintaining communications for an army which was expanding at an unbelievable speed, made it necessary that exacting standards be set to maintain high quality of personnel demanded by the Signal Corps.

The problem was not only to secure data upon which to base the selection of men, but also to familiarize the various elements of the command to the full significance of the words,

"communications specialist." In most cases there was little or no information available on the classification of Signal Corps men. The Adjutant General's files were combed for all information on Signal Corps officers. This, together with information collected from qualification questionnaires, served as the source of information for classifying all officers.

Job specifications listed in Army Regulations were revised and in July, 1943, the first complete, up-to-date manual of Officers Military Occupational Specifications and Codes, to be compiled for a technical branch of the Army, was issued. This manual was distributed to all organizations and installations under the Chief Signal Officer. Copies were furnished the Army Air Forces who distributed them to all organizations under their jurisdiction down through Wings (the smallest unit of the AAF using Signal organizations). The Army Ground Forces were also given copies which were sent to all their organizations down through the Divisions and copies were sent to all the Theaters, Service Commands, Defense Commands, Technical Services, and other organizations.

All Signal Corps officers now have been classified in terms of the job descriptions covered by this Manual. Officers' principal duties are being reported in terms of these specifications and officers are being requisitioned and assigned through the use of the codes indicated. The classification of officers is now performed efficiently through use of a key-punched card which permits a rapid selection of varied categories.

In another article in RADIO NEWS, the story of the Women's Army Corps in relation to the Signal Corps is adequately described, yet I wish to pay a tribute from the Signal Corps to this splendid body of women and to testify to the important contribution they are making to our effective prosecution of the War.

WAC personnel are now serving in many camps and installations under the jursidiction of the Chief Signal Officer and they are also serving throughout the country as telephone operators, code clerks, message center clerks, teletype operators, radio operators, and in many other specialist capacities. Congress established the Women's Army Corps for service with the United States Army on July 1, 1943. The new Corps was to absorb WAAC personnel on discontinuance of that organization on September 30, 1943. On July 17, 1943, Women's Army Auxiliary Corps Headquarters directed all Service Commands to discontinue immediately the enrollment of women under the WAAC Signal Corps Trainee Program. All WAAC civilian training classes were closed prior to September 30, 1943 and women, who had enlisted in the WAAC Signal Corps Trainee Program, were not to be enlisted in the new Women's Army Corps while they were in school.

Women who had been enrolled in the WAAC Signal Corps Trainee Program were allowed to choose whether or not they would enlist in the new Women's Army Corps, on September 29, 1943. Only eight losses were reported; approximately two hundred and seventy women preferred to enlist in the WAC and continue their studies as communications specialists or be available for assignment to Signal Corps units. Upon classification by WAC Headquarters, it was found that this group of enrolled women represented extremely high caliber personnel, all having Army General Classification Scores of over one hundred ten, and many having achieved scores of over one hundred forty.

Any discussion of the men of the Signal Corps would be incomplete without reference to the thousands of civilians, both men and women, who man the supply depots, the procurement districts, the laboratories, and the inspection activities of the Signal Corps that are scattered throughout the United States. These people are soldiers, even though they are not in uniform and are carrying a tremendous load in the complex activities involved in the designing, procuring, testing, inspecting, and shipping of communications equipment to our Signal Corps troops in all parts of the World.

In concluding, let me make this prediction: whenever, in this war, crucial orders or historic dispatches are recorded, a Signal Corps man will be found at the communication controls and some day—the sooner, the better—a Signal Corps soldier will flash the first message of final victory.

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Soldiers in Mufti

(*Continued from page* 239)

brand new costume but history will not distinguish it for being the mechanized war or the aerial war or the war of offensives but rather as the total war, where the peoples of parts of the earth pitted themselves against the peoples of other parts and the clashing armies all over the world were purely focal points of a great mass struggle.

The day is gone when armies alone carried the conflict, with some cheers from the homeland and some increased activities back at base in their arsenals and depots. Then the blood and sweat were for the soldiers, only the tears for the people.

Today civilians, too, bleed and sweat as well as weep.

In America alone, of the great warring nations, are they still secure from the bleeding.

In the Signal Corps alone, 40,000 men and women in the glamorless garb of civilians are needed to move the materials that carry messages through the smoke and stench and crescendo of battle.

But they are only a fraction of the immense army of civilians in private industry toiling to plan and produce the equipment the Signal Corps soldiers need to function.

They are scattered around the world, laboring at drafting boards, in laboratories, in fields and mines, on production lines, at railheads, in scores of varied occupations.

They don't see the foe fall, they wear no hero's uniform but they are as indispensable to victory as the guns and the phones and the planes and the radios they make—these soldiers in mufti.

-30-

Over the whining bullets and the bursting shells . . . and in the dark silence of the night . . . he wants to hear the beat of your heart.

High up in his jungle roost, or down in the mud on his belly . . . waiting, watching, listening . . . he wants to know whether you're doing the things that will make his job easier, and the war shorter.

And if he were right here beside you, he might want to ask a few personal questions . . . like these:

Did you put some of this week's pay in war bonds?

Are you saving the scrap and fats and paper and other things we need to fight this war?

Have you given blood to the Red Cross to save the boys who are fighting to save you?

And . . . did you do your job today as if the outcome of the war depended on you alone?

These are the ways to show you're backing him up. These are the ways to let him hear the beat of your heart.

★ ★ ★

Here, at Kenyon, we're mighty proud to be playing a small part in winning a big war. That is why every Kenyon transformer used by the U.S. Signal Corps and other military branches reflects the same high craftsmanship and precision that went into our peacetime production. To bring victory closer, Kenyon workers are determined to do their share by turning out good transformers as fast as they know how.

THE MARK OF EXCELLENCE

KENYON TRANSFORMER CO., inc. 840 BARRY STREET NEW YORK, U. S. A.

Signal Corps Wac

(*Continued from page* 247)

they were handling calls in French and Spanish as well as English, coming in from all parts of the world. Their dexterity and skill accounted for the accurate and swift relaying of messages upon which the progress of the Tunisian campaign depended.

These Wacs, as well as those manning the teletype machines did a "bang-up job," according to Colonel Floyd T. Gillespie, for many months Assistant Chief Signal Officer, Allied Headquarters in North Africa.

"After the girls had a few weeks of experience in their jobs," he said, "they were handling their assignments like veterans. The manner in which they picked up the work was outstanding. They were fast and they were accurate. . . . We could have used hundreds more. In fact, had we had enough of them, we could have used them to operate all our fixed communication installations—telephone and telegraph—throughout the rear areas. Every one of these girls released some man for Signal Corps duty up in the combat zones."

The former Chief Signal Officer of AFHQ added this compliment for Wacs on duty: "Don't tell me a woman can't keep a secret. Why, their own company commander doesn't know where the board is located, and we've tested the girls again and again. What they hear stops right with them."

In September, when President Roosevelt and other American statesmen met with Prime Minister Churchill in Quebec, 29 Wacs were selected to act as telephone operators and security mail clerks. Once on the job, the Wacs showed their usual versatility. A need developed for skilled secretarial assistance. Some of the Wacs with experience in that field were assigned to those duties, and proved themselves to be as competent and efficient in such capacities as they had been as telephone operators.

The first three or four days, the telephone operators averaged 18 hours a day on duty. They started work the first day in the afternoon and the next day were still on the job, without letup, despite the fact that they took less than an hour to rest, after reaching the hotel.

As a result of the excellent way in which they handled the jobs to which they were assigned, commendations were received for each member of the group on duty there.

However, the number of these unusual assignments is small. The greater percentage of the Wacs are stationed at camps all over the United States. All AAF installations have requested radio operators and repairers as well as teletype and telephone operators. They have also asked for photographic technicians. Service force installations usually request telephone operators to take over Signal Corps duties.

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Photographic Center

(*Continued from page* 249)

steady schedule of training films was produced. Up to 1937 all training film production was centered at the Signal Corps Photographic Laboratory at the Army War College in Washington. In that year part of this unit was moved to Fort Monmouth and in August of 1940 a wide program for the production of training films was organized at Fort Monmouth into what was then known as the Training Film Production Laboratory. In the Fall of 1940, when Selective Service began to draft millions of civilians into military life, the training film program was greatly enlarged overnight.

Far-sighted officers working and studying the production and use of training films over a period of years had prepared for just such an emergency, which found the set-up capable of immediate extension.

The Training Film Production Laboratories, together with the motion picture section of the photographic schools, was moved on May 8th, 1942, from Fort Monmouth to the Paramount Studio and the unit became known as the Signal Corps Photographic Center. The still picture section of the school was transferred from Fort Monmouth to Astoria on May 26th. Colonel M. E. Gillette became the first Commanding Officer of the newly established Signal Corps Photographic Center.

On September 22nd, 1942, at ceremonies to which were invited Mayor Fiorello H. LaGuardia and representatives of the press and radio, Major General Dawson Olmstead, at that time Chief Signal Officer, dedicated the Signal Corps Photographic Center. In May, 1943, Lieut. Colonel Roland C. Barrett assumed command of the Center.

At the Signal Corps Photographic Center is one of the largest and most modernly equipped producing units of Army training films. On the main stage and on the smaller lower stages, where once Maurice Chevalier sang THE SMILING LIEUTENANT, pictures are now being made to teach our troops the highly mechanized techniques of modern warfare.

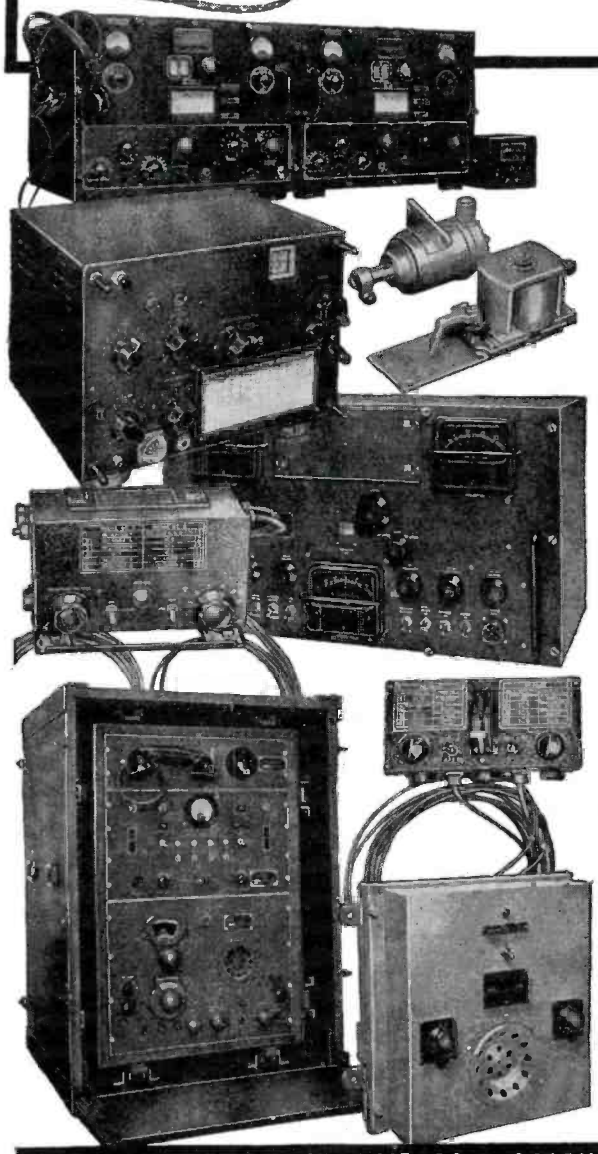
When millions of men were suddenly pulled out of civilian life from every corner of the country, from every strata of society, and from every level of economic and educational background, the Army was faced with the problem of making good soldiers out of these men immediately. During a period of war, time is a priceless element. From experience it was known that training films, although they cannot replace drills and manuals, when used jointly with lectures and practical demonstrations in the field, can cut time required for training up to 30 per cent in most cases.

The military mission of the Signal Corps Photographic Center is to produce films that will help to train fighting men as quickly and as efficiently as possible. It is hardly necessary to point out that, in the present situation, training time is a vital element. It is a military asset that must be rationed as carefully as steel or copper or rubber. Time, unlike other military commodities, cannot be stretched out. There is no substitute for it.

The work of preparing a training film begins outside the Signal Corps when a branch of the Service, such as Infantry, Coast Artillery, and so forth, selects a topic for a training film and submits a picture plan to the Army

MAGNAVOX WILL MEAN EVEN MORE TO THE POSTWAR RADIO INDUSTRY

These highly technical instruments—some of the many Magnovox makes for the armed forces—will find their counterparts in peacetime developments.

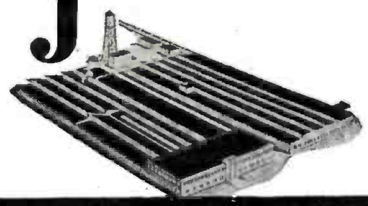


THIRTY-THREE years of pioneering work in radio prepared Magnavox to produce these highly complex precision instruments, ranging from gun firing solenoids to the most intricate radio communication systems.

V-Day will find Magnavox skills and facilities at a new high, because of the miracles of invention and production demanded by the emergency—ready to play a more prominent part than ever in the coming peacetime developments in all phases of electronics. The most advanced engineering and manufacturing facilities are housed in the new, modern six-acre plant. The Magnavox Company, Fort Wayne 4, Indiana.

Magnavox craftsmanship won the first "E" award in this field (1941), now with 3 White Star Renewal Citations.

Magnavox



LOUD SPEAKERS • CAPACITORS • SOLENOIDS • COMMUNICATION & ELECTRONIC EQUIPMENT

Ground Forces or Army Service Forces director of training. If the idea is accepted, an officer of the particular branch of the service concerned is assigned to prepare a detailed outline of the film and to act as consultant. This done, writers go to work to prepare a photographic scenario based on the film plan and to compose the dialogue or commentary that will later be syncronized with the film.

There is only one valid test for any training method. Does it train men better and quicker than methods previously used? The Army is convinced that audio-visual education is a practical idea.

Modern war is fast-moving and thoroughly mechanized, which means that each man must be a specialist and thoroughly indoctrinated. These millions of men from farms, factories, shops, offices, hospitals, schools, and so forth, bring no background or proficiency in the firing of a 105 Howitzer, or the clearing of enemy mine fields.

The best way to teach a man the care and use of a complicated and entirely new piece of mechanism is to show it to him, let him handle it and work it, explain its functions and operations. In time of war when time is of such vital importance and when equipment must be in the hands of troops on the battlefield, the use of motion pictures serves many purposes. Many men at one time can watch a screen and learn how a weapon is put together and how it is used.

Another advantage of training films is that as each group of soldiers is brought into camp for training, the instruction is exactly the same not only in subject matter but in presentation and emphasis. After field drilling and practice, if the officers feel that the troops have not absorbed enough to make them competent, the film can be run off again. Troops in combat must be well-trained and completely trained, for a minor error or oversight can result in sudden death and disaster. The motion picture provides a graphic means of teaching and indoctrinating the soldiers in modern warfare and, through repeated showings of the same films, certain procedures become second nature. In combat some times "quick" thinking is not enough.

Besides, the demands of modern war are not all mechanical. The mental stresses are just as important. The mobility, the tremendous power of the highly mechanized units make the battlefields a scene of incredible noise and terror. The sounds, the clamor and din of battle play a large part in modern warfare and are a major consideration in the training of troops.

At the Signal Corps Photographic Center there has been established a sound school to which qualified candidates are sent for training in the use and care of sound equipment. These men are taught to use their sound equipment in the field and under battle conditions.

Here, too, is a modernly equipped and expertly staffed Sound Department that handles all the sound effects for the training films. It records and re-records dialogue, narration, music, and all the sound effects heard with the films.

In a training film entitled "Battlefield Sounds," troops are shown various weapons on the screen accompanied by the actual sounds made by each weapon from varying positions. The narrator says, "This is the sound of rifles at the point of discharge." The screen shows rifles at the point of discharge and the sound track gives forth the actual sound made by these weapons when fired. Then he says, "The Browning automatic rifle sounds like this at the receiving end"; or, "This is the way the thirty-sevens sound to the soldier under fire."

In a film called "Baptism of Fire" an attempt was made to dramatize common battlefield psychoses. Through the medium of the screen, the soldier is taken through his first assignment, from a bivouac area behind the lines to the final assault with the bayonet. Troops watching and hearing the action on the screen are in some measure prepared for the action when they are faced with it.

The Sound Department also maintains a library of sound effects and music.

During the past year there have been many notable achievements resulting from Signal Corps photographic activities. Outstanding among these is the expansion of the Latin-American division for the translation of training films and film bulletins into Spanish and Portuguese and Russian. These films are released to our Latin-American and European Allies as part of the Good Neighbor policy and the Lend-Lease program. The films serve to teach the officers and men in the Armed Forces of our Allies the use, care, and repair of American weapons and equipment which they receive on the Lend-Lease basis.

A selected group of men is being trained in still and motion picture photography at the Signal Corps Photo Center in Astoria, L. I.

Upon completion of their courses they are assigned as photographers (1) with mobile army units in the field; (2) to training film production units; or (3) for other uses as the War Department may direct.

Only those men who were professional photographers (preferably newspaper photographers or motion picture cameramen) or those who have the necessary background to enable them to learn how to become assistant cameramen quickly, are eligible for the photographic schools.

The photographic schools offer no basic training. Students are expected to be qualified photographers or cameramen before enrollment. What the schools provide are short adaptation courses with emphasis on military methods, procedure, and equipment, rather than on the science of photography.

Photography is used in the field for the following purposes:

(1) Provide news films and pictures for release to the public.

(2) Convey military information to the War Department and the Theater Commander of combat and Allied operations in the field. Combat photography is the primary mission of all units when opportunities occur.

(3) Provide Theater Commanders with military information of immediate tactical, technical, or strategic value.

(4) At the Theater Commander's request, convey information on personnel, materiel, conditions, and techniques for use by responsible staff agencies of the Theater and the War Department for development and proper use of all weapons and means of warfare.

(5) Provide historical pictorial records of the war.

(6) Cover projects which may, from time to time, be assigned by the War Department for the production of specific films for training, orientation, historical, or public relations purposes.

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Pigeons

(*Continued from page* 248)

by Army pigeons—in a single major engagement. And in the closing phase of the battle, twenty-five additional messages of major importance were flown in by birds.

On the Italian mainland, General Mark Clark quoted a series of pigeon messages received at Headquarters from a Captain of a patrol out in front of the 5th Army. The first one said: "Surrounded on three sides." The second one said: "I am attacking." The last: "I've broken through."

In the raging battles of today pigeons are an integral part of the United States Army communication system.

As the younger men must fight the war, the younger pigeons must fly the messages. Military training begins for a pigeon at twenty-eight days of age. The older pigeons are retired from active service and must do their part on the production line; be mated and produce offspring capable of carrying on the heritage of their parents.

While it is the Army that flies its birds, and the Army that trains its birds, and the Army which must breed most of the birds seeing duty today upon the field of battle, it is the civilian pigeon fanciers to whom the nation must be grateful for much of the success of the Pigeon Service. When the Japs struck at Pearl Harbor and plunged the United States into total war, there was one active Pigeon Company and certain specialized detachments in service in the United States and insular possessions.

The nature of the war, the lessons learned from England and from Germany made it apparent that, in this conflict, as in no other war in the history of the world, pigeons would be needed—young, healthy, blooded birds to do a thousand specialized jobs. A call went out from the War Department to the civilian fanciers all over the United States: Pigeons were needed by the Army just as were needed the civilian's gasoline; the civilian's tires. A drive was started. It was sponsored by two great civilian organizations: The American Racing Pigeon Union and the International Federation of American Homing Pigeon Fanciers. Pigeon clubs took up the hunt and into the service birds began to arrive, their services volunteered by their civilian owners. These were more than ordinary homing pigeons; they were the offspring of champions possessing long pedigrees; some were champions in their own right, bearing certificates of their own records of six hundred miles in a single day. One shipment alone exceeded five thousand birds.

The pigeon in the Army, like his human civilian counterpart, undergoes an immense change as he begins to soldier. His home is changed, his habits are modified, his duties are new and strange. He must be especially trained and made to fit the specialized job he has to do. His duty varies with the branch of the service to which he is assigned. He may be in a jeep, or aboard a ship. He may fly with an airplane or in a blimp. He may be carried on a man's back or on a war dog's shoulders. Wherever the Army, Navy, the Coast Guard, or the Marines go, a pigeon may go with them.

What powers do pigeons have that they fly, so unerringly, to their base? Signal Corps Pigeoneers take the homing instinct for granted. It is probably about half "instinct" and half intelligence, for the pigeon is among the most intelligent of birds. Homers will endure over fifteen hours sustained flight to reach their home loft; they will cover the distance from Washington, D. C. to Chicago in thirteen hours (faster than train time). They will fly at a mile-a-minute clip, doing seventy-five miles an hour at their best. They will not stop for gale, storm, or lightning but will fly above or around atmospheric disturbances. They can go over seven hundred miles in a single day without rest.

Why do they fly home? Pigeons are almost human in their habits and desires. They know that food awaits them at home; also shelter and rest and the attention of their master. But most important, their mates are there, setting on eggs or squabs. The pigeon will remain loyal to one mate throughout life unless forcibly separated. Also he will live in one loft all his life, unless changed.

The homing instinct is not equally developed in all pigeons, not even in all homing pigeons. This urge is a matter of selective breeding and development by training.

Although the Pigeoneers of the

Army Pigeon Service number only one-third of one percent of the total Signal Corps personnel in the Army, they perform a vital and outstanding service. Their ranks are filled with some of the foremost fanciers and trainers in the United States.

The Army Pigeon Service Agency is a field office of the Office of the Chief Signal Officer. It is directly under the Chief of the Personnel and Training Service of that office.

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Visual Aids

(*Continued from page* 194)

potentiometer. It consists of a series of three links, one of which is permanently attached to the end of the potentiometer shaft, one to the end of the crank shaft, and the third is connected to these two by means of pins which permit free movement at the joints. As the hand crank is turned through a complete revolution the potentiometer shaft will be caused to travel through a portion of its normal swing then reverse itself and retrace its motion so that continuous rotary motion of the hand crank results in a to-and-fro movement of the potentiometer arm.

DEMONSTRATING VOLTAGE AMPLIFICATION

The triode amplifier demonstrator shown in Fig. 3 is also a development of the staff of the Southern Signal Corps School. In its physical make-up it will be recognized as incorporating some of the same ideas as the diode rectifier unit just described. Among these is the use of a hand-driven mechanical "generator" to supply a "signal" of extremely low frequency so that the variations of current or voltage in the various circuits may be readily followed by the meters, thus enabling the student to study visually the action in each portion of the tube circuit.

During tests of the first model some wit dubbed this training aid a "Mho Grinder" and the name stuck, because of the fact that, like a sausage grinder, nothing happens until the crank is turned.

The actual circuit diagram is shown in Fig. 4 and differs from the one shown on the panel in the substitution of a built-in power supply for the plate and bias batteries and in the arrangement of the input and output circuits.

The simulated "signal" is developed by means of the hand "generator" consisting of the potentiometer and battery in the tube grid circuit and the drive mechanism which includes the crank. This signal is then applied to the grid of the amplifier tube through the 25 μfd. capacitor, the prime function of which is to isolate the battery to avoid drain when the equipment is not in use.

The output circuit is effectively as shown in the circuit etched on the panel but actually is as shown in Fig. 4. By placing a milliammeter in the plate circuit of the 76 tube instead of using a voltmeter in its grid circuit, the tube provides normal operating load for the 6SJ7 amplifier tube but at the same time the static plate current of the 76 maintains the meter at mid-scale when no signal is applied. Thus its zero position is at center scale and when the signal is applied the pointer moves back and forth from this position, effectively conveying to the student the visual impression of alternating voltage.

Duplicates of this unit are prominently wall-mounted in each of the several laboratories where elementary vacuum-tube studies are carried on. Thus, they are always accessible to students. Further, it is a requirement that the students take advantage of them. This is accomplished by making a special fill-in quiz, dealing with the principles demonstrated by the board, a part of the vacuum-tube training material. Mounted beside each unit is an explanation of the demonstrated principles.

Important in electronic training is the phase reversal which takes place in a resistance-coupled amplifier stage. This is not always easy for students to comprehend but with the aid of these demonstration boards, becomes much more simple to many.

LOW-FREQUENCY TRANSMITTER

A low-frequency radio transmitter is being used at the Eastern Signal Corps Schools, Fort Monmouth, N. J., to overcome certain difficulties which have appeared in classroom instruction in this field.

While the teaching of radio presents problems as each new phase is entered, transmitters involve a special difficulty in that they lie entirely outside the experience of the average student. It is necessary not only to explain the functioning of the transmitter but also to convince him of the reality of the explanation—that the principles involved are fact and not theory. Every such attempt inevitably leads to a discussion of waveform. The plate current pulses in a Class "C" amplifier, harmonic distortion and frequency multiplication, and particularly modulation, all involve operations on the r-f wave itself. Although these phenomena may be expressed in a number of ways—in terms of instantaneous voltage or current or power—the summation of all such expressions is the shape of the wave.

The usual answer to this problem is the blackboard drawing, accompanied by a good many words. While this teaching method is probably indispensable, it is none-the-less inadequate, for two major reasons. First, a picture or verbal description of a sound wave, by its very nature, cannot carry one-tenth as much conviction as a single audible note emitted by a loudspeaker. Similarly, no black-

board drawing can equal an actual tracing drawn by the varying voltage itself on the screen of an oscilloscope. Second, blackboard pictures don't move. But the very essence of the developing waveform is motion. Since modulation involves motion, it is necessary to picture the variations of current and voltage in motion.

The obvious answer to these problems is the cathode-ray oscilloscope. But the application of the oscilloscope at the outset presents two problems of its own. First, since it is desirable to show the r-f wave itself, it is necessary to use a frequency low enough to be within the range of the sweep-frequency oscillator of the 'scope. With equipment available to this school, this means not more than 30,000 cycles. Second, it is desirable, in demonstrating the modulation, to show not only the r-f wave but also at least one complete audio envelope. This requires a ratio of r-f to a-f of not more than 15 or 20 to 1. For these reasons, it was decided to build a transmitter using conventional circuits but operating on a frequency of about 18,000 cycles. It was considered desirable to include a receiver capable of receiving this signal, so that the transmitter might be studied from the listener's point of view.

Fig. 5 shows the front of the board. The oscilloscope is centrally mounted so that it may be easily seen and accessible from all sections of the board. The transmitter section consists of a Hartley shunt-fed oscillator, a series-fed power amplifier, and a Heising class "A" modulator. In addition, there is a simple diode detector. Each section is distinctively colored. Most of the parts mounted on the front are actually used in the circuit. Some of the parts, notably the tank coils in all sections and the r-f chokes, are mere "window dressing."

The tank coils consist of a series of pies mounted on a common form. The actual chokes used are the secondaries of ordinary audio transformers. These, too, are mounted on the back.

While the circuit shown on the face is basically the circuit used, several changes were made in the actual circuit, in accordance with educational needs. All elements whose values are critical were made variable. In other instances, provision was made for shorting out a particular part to demonstrate its effectiveness in the circuit.

The actual circuit is shown in Fig. 6. This may be summarized under four headings—oscillator, power amplifier, modulator, and detector.

Oscillator

Grid bypass capacitor C_2 may be increased by switching in C_1 in parallel. Grid resistor R_2 is variable. The resistor R_1 is used to develop the pulsating voltage characteristic of class "C" operation. It should be noted that the cathode (ground) tap on the tank coil is variable. Note, also, that the plate lead is brought not to the top of the tank coil but a

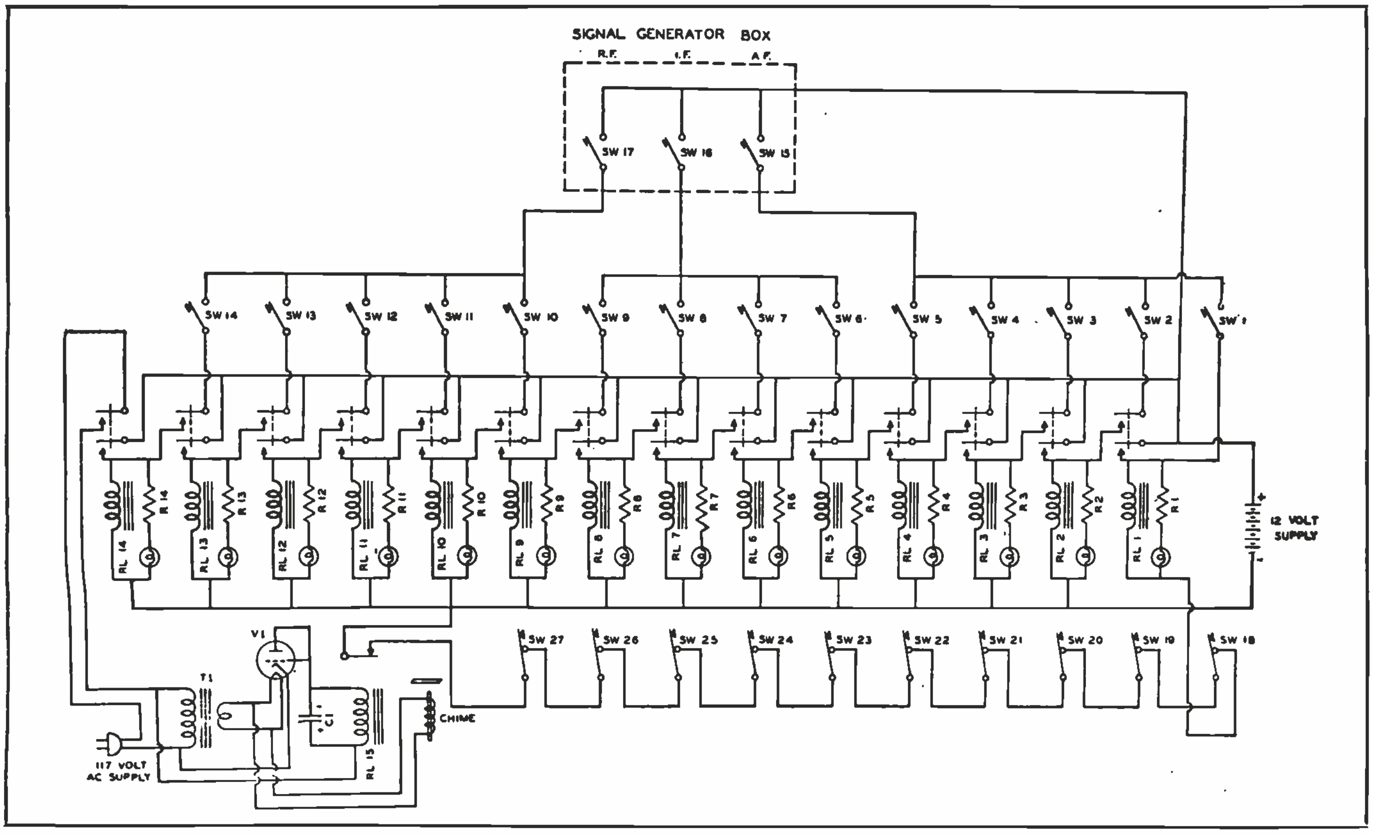


Fig. 8. Wiring diagram of the signal-tracing demonstration board.

little further down. The reason for this will be shown later.

In operation the scope leads may be placed across the tank. A sine wave appears on the scope. By varying the position of the cathode tap, the excitation is varied, as is the amplitude of the output wave.

If the scope is placed across R_1, the familiar picture of class "C" plate current pulses is seen. If the grid resistor R_2 is then decreased, the relative duration of the current flow increases, and these pulses broaden. If R_2 is given a high value and the grid capacitor increased by switching in C_1 the oscillator quenches and the quench pattern may be seen.

By means of an electronic switch, the patterns given by R_1 and the tank coil may be thrown on the 'scope at the same time to show the plate current flow at the peak of the tank voltage (grid excitation). In order to give the conventional picture, it was necessary to invert the relative phase of the tank voltages.

This was done by tapping the plate down on the tank coil and taking the voltage from there to the top.

Power Amplifier

Excitation feeds through blocking capacitor C_6. The power amplifier grid tap can be varied, thus varying the excitation and the load on the oscillator. Resistor R_3 is the variable grid resistor, while R_4 controls the fixed bias. Thus, the advantages and disadvantages of fixed and resistance bias may be shown. C_7 is the neutralizing capacitor. C_8 is the same size as C_7 and represents the grid-plate capacitance of the tube.

In the tank circuit, R_5 is a loading resistor which lowers the Q of the circuit. Even harmonic distortion resulting from rapid decay of the oscillation current, as well as the change in selectivity, can be shown.

R_6 is a load resistor which may be substituted for the tank circuit to show the plate current pulses. S_1 is a switch which shorts out half the tank inductance, and by thus tuning to the second harmonic shows frequency doubling. Capacitor C_{10} merely increases the size of bypass C_9, when it is desired to bypass lower frequency signals from the modulator.

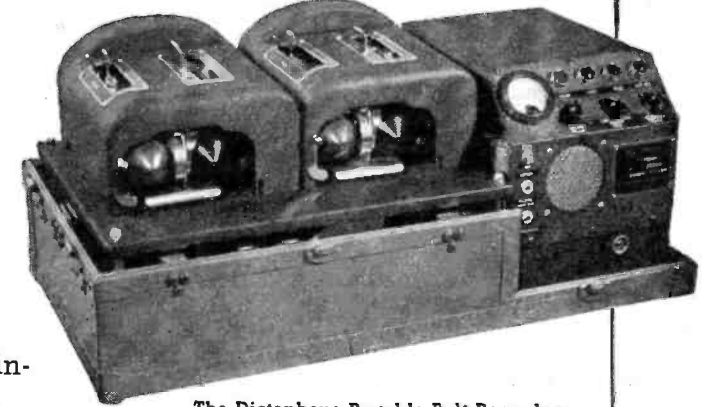
Modulator

R_6 and C_{12} are the voltage dropping resistor and audio bypass, respectively. These may be shorted out to show the distortion which results from their ab-

FOR A RECORD OF ACTION

When and where it is desirable to make a permanent record of information or instructions spoken through microphone, telephone or radio, the Dictaphone Electricord Belt Machine will do it, quickly and efficiently.

For instance, in air traffic control centers installations of this Dictaphone equipment record all flight instructions on flexible, plastic belts, three and a half inches wide by twelve inches in circumference, which are inexpensive, tough and practically unbreakable. They can be folded and filed away without damaging the recording, and a great many of them can be stored in a small space.

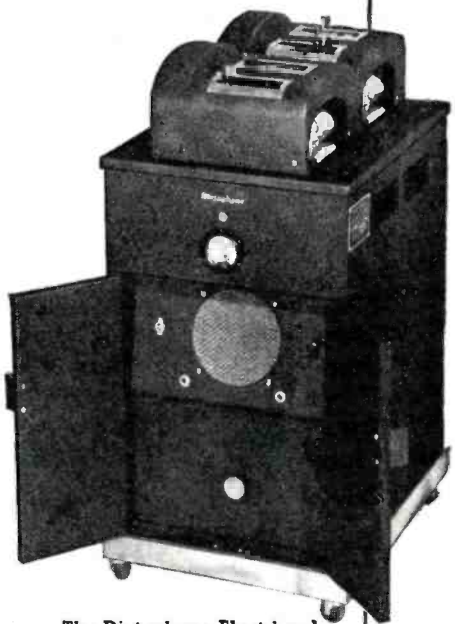


The Dictaphone Portable Belt Recorder-Reproducer with variable speed control.

Dual recording-reproducing units provide continuous operation. Constant sound track speed on the entire recording surface permits listening back at any point, while the machine continues to record.

Dictaphone Electricord Belt Machines are sturdily constructed for hard use. Conveniently located controls include a power level, indicator and a jack for headphones. The assembly includes a built-in loudspeaker, and a high-gain amplifier incorporates automatic volume control.

A portable reproducer is also available. This is equipped with variable speed control, for reproducing high-speed recordings at slower rates.



The Dictaphone Electricord Belt Recorder-Reproducer.

All Dictaphone Electricord equipment is designed and reserved for the armed services and their direct suppliers. For information, phone or write Dictaphone Corporation, 420 Lexington Avenue, New York 17. Washington Branch Office: 733-15th Street, N.W., Washington, D. C.

DICTAPHONE

DICTATING AND RECORDING EQUIPMENT

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sence. On the input side, the mike input transformer T_4 may be disconnected to allow feeding the output of the audio oscillator directly to the grid.

Detector

The tuned inductance L_3 is the secondary of an audio transformer. Varying the tuning of L_3-C_{14} changes the amplitude of the wave and is indicated by the 'scope when placed directly across the tank. The picture given by load resistor R_7 alone is that of the rectified signal pulses. Throwing in C_{15} filters out the r-f component, leaving the original audio signal.

The output of the detector feeds through transformer T_3 to the power amplifier. From there the signal passes through output transformer T_5 to the speaker.

SIGNAL TRACING UNIT

The training aid shown in Fig. 7 is one developed at the Central Signal Corps School, Camp Crowder, Missouri, to teach students in the Radio Division the proper method of rapid localization of trouble in a radio receiver that is not functioning. Students in this course have found this training aid interesting enough that the problem of teaching the student to trace such circuits has been greatly simplified.

The board consists of 24 push buttons (indicated by the small arrows that have been drawn in on the front-view photo, Fig. 7) placed at the various points on the diagram of a conventional superheterodyne receiver. Attached to the board by means of a three-foot connecting cable is a box labeled "Signal Generator."

Operation

The signal generator box has three push buttons which are marked "RF," "IF," and "AF." At the end of the board is a series of lamps in a vertical row with a thermometer painted around them. This is used as the student's "scoreboard." Assuming that the diagram is an actual receiver, the student is asked to locate an imaginary trouble in it by means of a signal generator. To properly localize the trouble, the student should use an audio-frequency generator to check the a-f section of the receiver first. By pressing the "AF" button on the Signal Generator box and the button at the plate of the last audio amplifier tube simultaneously, the bottom lamp is lighted in the thermometer. This lamp stays on when the buttons are released. This operation simulates checking the output transformer and speaker of the receiver. Pressing any other combination of buttons will not light the lamp in the thermometer. The next step is to apply a signal to the grid of the last audio amplifier tube. The student does this by again pressing the "AF" button on the signal generator box and the button on the grid of the last audio stage. With this operation the next lamp in the thermometer will light.

Should the wrong button be pressed, one of two things will happen. If a button is pressed where no signal is present at any time, such as the high voltage connection of the power supply, the lamps that have been previously "scored" will go out, requiring the student to start at the beginning again. Should he push a button where a signal is normally present but skip over an important stage, no lamp will light. Thus, for a good score, he must perform the trouble-shooting operations in the logical sequence. By pressing the "AF" button and the proper buttons on the diagram, he can simulate checking the entire a-f section of the receiver.

After he has progressed to the second detector, it will be necessary for him to use the button marked "IF" on the Signal Generator box. Using this button the student may check the entire i-f section of the receiver. Again if a button is pressed on the receiver where no signal is ever present, all of the lamps will be extinguished, requiring tracing all the previous work again. In this manner the entire simulated receiver is checked. When, after having tested all points in proper sequence the final button is pressed, all the lamps will be glowing and a chime will ring. After a delay of a few seconds, all the power will be removed from the board automatically. This feature was incorporated to prevent drain on the battery.

Function of Circuit Elements

Direct current obtained from a 12-volt storage battery and 117 volts alternating current from the commercial source are the sources of power used on the demonstrator. In order to light the first lamp, it is necessary to close switch 1 and switch 15 (see Fig. 8). This allows current to flow from the battery through the normally closed contacts of relay 15, through the normally closed switches 18 to 27 inclusive, through relay 1, switch 1 and switch 15, back to the battery. The bottom set of contacts as shown in Figure 8 will effectively short circuit switch 1 and switch 15 causing the relay to hold. The first lamp, being in parallel with relay, 1 will stay lighted. Resistor 1 is used to drop the voltage to the proper value for the pilot light. Should any one of the switches 18 through 27 be pushed next, relay 1 will not hold and the lamp will be extinguished.

As switches 1 through 5 are placed in the a-f section of the receiver, 5 lamps may be scored by pressing switch 15, then 1 through 5 in consecutive order. At this point it will be necessary to press switch 16 and switches 6 through 9 in consecutive order, so the next 4 lamps may be turned on. In like manner the remainder of lamps are caused to glow. At the moment the last lamp is turned on, the top set of points on relay 14 close the 117-volt circuit to the transformer 1. The 6.3-volt secondary of this transformer will cause the chime

to ring indicating that the student has completed the signal tracing successfully. The cathode of the vacuum tube will then begin to heat and when it has reached operating temperature, it will rectify the line voltage, causing current to flow through the normally closed relay 15 which releases all relays and opens the 117-volt and the battery circuits. -30-

Mediterranean

(*Continued from page* 152)

the task forces and General Eisenhower's headquarters, thence to the higher command in the United States and England.

It was a complex setup, because elements of the United States Army and Navy, the British Army and Navy, the Fighting French, and the Air Forces of each of the elements were involved. Combined codes and ciphers had to be arranged, with systems of identification and authentication, so that fake messages from the enemy could be recognized. Radio frequencies and call signs were completely reorganized.

No minor factor, either, was the logistical planning, which provided methods of supply to keep pace with a rapid expansion of the signal communications system.

Finally came "D Day," November 8, 1942—and the combined Allied Forces struck simultaneously at various points along the shore of Northwest Africa.

It is a matter of history that the operation was successful. Coordination among the British and American naval and covering air forces was characterized by military sources as "magnificent"—a tribute to signal communications.

Signal units landed with the assault units and established communications with the aircraft and the centers of command. They were trained teams which had carefully studied the existing communication systems in Morocco and Algeria, with a two-fold function—instant severing of enemy wire lines, and the seizure of telephone exchanges, telegraph offices and radio stations for use by the Allied Forces.

Signal communication rehearsals had continued during the trip across the ocean for the invasion. Emphasis was placed on the training of men handling the main Signal Center, located for the first few days aboard one of the accompanying warships.

During the landing operations a naval gunnery officer and army radio operators with a portable radio set accompanied each assault battalion. Thus the supporting naval gunfire was directed and observed, until the arrival ashore of field artillery units. Air support was provided by naval planes from aircraft carriers, communicating with the assault units ashore, which used a radio in a quarter-ton vehicle.

Acts of heroism by Signal Corps personnel were commonplace during the landings.

At one hotly disputed point near Casablanca, Pvt. John M. Smolkovich yanked a .30 caliber machine gun off a landing boat, set it up on the beach and downed an attacking enemy plane. His Signal Corps detachment landed with the first wave and fought Infantry style throughout the day until their communications equipment was landed. Their carbines and the commandeered machine gun furnished the fire power for the protection of their sector of the beachhead.

Sgt. Lorenzo Alcock, a Signal Corps movie cameraman, was later decorated with the Silver Star for his work that day. Sgt. Alcock was perched on a destroyer's bridge entering a French Moroccan port when a dock searchlight suddenly focused on the ship and shells began exploding around it in all directions. The sergeant remained exposed, photographing the entire action. Upon landing he marched into town with the first Infantry wave and kept grinding his camera until he discovered he was running short of film. Starting back to the boat for more of the precious celluloid, he encountered heavy crossfire. Instead of fleeing, he jumped behind a large rock and from this shelter proceeded to take more pictures with his remaining film.

The carefully selected signal equipment (more than 10,000 different Signal Corps items were shipped to North Africa) came in for a good share of the glory. At one place a rubber scout boat was guiding two destroyers by means of a signal light through a safe channel into the harbor of Safi. The first destroyer got through quickly, but the second apparently failed to see the guiding signal light and headed for the breakwater rocks. It happened that the comparatively new "guidon" set, a portable two-piece transmitter and receiver, was in the scout boat, another on the destroyer. The men in the boat hurriedly radioed a warning to the destroyer, which corrected its bearings, came safely through, and the harbor was soon in our hands.

Radio also figured in the use of another powerful weapon—propaganda—which lessened French resistance and contributed to the success of our landing operations.

The use of this weapon had been planned ahead of time. As soon as the operation plan was completed and approved, the Signal Corps War Plans Division, Office of the Chief Signal Officer, figured the equipment and personnel needed for its execution. The Army Communications Service, within five days, purchased, modified, and installed a five-kilowatt broadcasting transmitter on a battleship. Military Personnel Division assembled the technicians—assigned a well-known radio announcer of the Signal Corps.

On the morning of the landings the battleship hovered off the coast, within effective distance for clear transmission, and began broadcasting to the populace of Northwestern Africa. The Army station broadcast President Roosevelt's message to the French peo-


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ple, General Eisenhower's instructions to French troops willing to cooperate with the landing forces, and General Honore Giraud's appeal to French soldiers. Between announcements, interspersed with the latest news from various African battlefronts, the station played music with "La Marseillaise" predominating.

The station continually called upon the French to lay down their arms. At one period, when our naval forces off Port Lyautey decided to open up with big guns against shore objectives, a special communique was broadcast so that civilians could take cover.

United States signal equipment was, without a doubt a large factor in the North African victory. A recent report by Captain James P. Lipp said that German radio equipment was "five years behind our own." The Germans, he declared, standardized their radio apparatus during the 1934-1938 period and attempted no further improvements.

"The captured German sets we tested," he said, "were certainly not made for Africa. They lacked waterproofing and were not dust-proofed. An obvious fault was the lack of impregnation of coils and transformers to keep out moisture."

Our own planning and engineering, meanwhile, paid rich dividends. A new series of radio sets procured by the Signal Corps since Pearl Harbor proved highly successful. The tiny handie-talkie, a five-tube transceiver, was especially popular with combat patrols and other front-line troops who praised its simplicity and dependability. The versatile "guidon," a portable transmitter and receiver for use on horseback, in a vehicle, or on the ground, is another radio set which withstood the test of combat.

Radio sets for armored organizations, designed by Signal Corps engineers to overcome interference due to static and other disturbing background noise, also came through with flying colors. The frequency-modulated sets, improved tremendously since the United States entered the war, were built sturdy enough to withstand the shock of large caliber gunfire. One type of tank sets featured push-button tuning, which not only enables the operator to select his channel instantly, but also guards against detuning as a result of dial shift caused by vibration.

The more powerful SCR-299 radio set, a mobile headquarters radio station, proved to be one answer to the problem of long-distance communication involved in the African campaign.

As soon as our forces were firmly established in Africa, work was begun by the Army Communications Service, Office of the Chief Signal Officer, on the most important single Signal Corps installation in the African Section. More than a thousand boxes of equipment, ranging in weight from seven pounds to twenty tons, were shipped to Algiers, where there was set up a transmitter powerful enough to maintain direct communications with the United States.

Signal communications equipment played an important part in the brilliant work done by the Artillery. During the Tunisian campaign one corps Artillery officer commented:

"We have such good communications we can lay down concentrations of artillery fire at any point at any time, and there isn't much that can come through alive."

The mass artillery firing technique required good signal communications. Field wire was strung as far forward as possible, over routes where it was not likely to be torn by tank tracks or shell bursts. At the same time, the area was covered by parallel radio communications as an alternate means of communications, should the wire lines go out, while beyond the area covered by wire, radio was used almost entirely.

Attesting to the efficiency of the Signal Corps system was an incident of an Artilleryman's ingenuity. Our forces drove north of Lake Achkel, west of Bizerte, until the advance was stalled by German batteries. Our own battery was in a position to fire, but was unable to find a suitable point for forward observation. South of the lake from the crest of Djebel Achkel, which we had just taken, other American combat units without artillery support could see the German gun positions. Direct communications had failed between the Americans west of Bizerte and the crest of Djebel Achkel. An enterprising observer on Djebel Achkel routed a telephone call over signal lines back 100 miles to a switchboard and thence forward along another circuit to the Yank guns north of the lake. In a few minutes the American batteries adjusted their fire and began dropping shells on the enemy gun positions. The Germans withdrew hastily, and our advance continued.

A classic example of Signal Corps performance in the thick of battle is the story of Lt. David C. Buscall, Jr., of Silver Springs, Maryland, who won the Silver Star for his "calm and courageous conduct" during the battle of Kasserine Pass.

Lt. Buscall not only managed to maintain communications under severe fire, but he stuck to his post even after the counter-attacking enemy had surged past the town of Sbeitla in which Lt. Buscall and his crew were operating a signal center. Then, refusing to give up, he succeeded in evacuating all personnel and equipment—even to a French switchboard which he loaded on the hood of his jeep.

The lieutenant told later of establishing the center in a blackout, and of a group of wire crewmen who constructed a thirty-mile circuit under heavy shellfire directly behind the the front lines from Sbeitla to Sidi-Bou-Zid.

"Trouble on lines was frequent," he related, "due to bombing and strafing. On several occasions our main link was cut by bombing, but immediately our

radio set was put on the air and stayed there until the wire trouble was cleared. At no time did the radio fail to reach the main signal center."

Soon it became apparent that the American situation in Sbeitla was critical.

"On 16 February at 1900 hours," an officer wrote, "an artillery duel could be plainly heard from our message center. At about 2100 hours French soldiers who operated the telephone exchange at Sbeitla came over and wanted to borrow some incendiary grenades to destroy the civilian switchboard.

"After contacting the corps signal officer, they were instructed to remove the switchboard and set it on the sidewalk for us to pick up. Toward midnight the artillery fire increased in intensity and machine gun fire became louder. After this, many American tanks were seen retiring west of Sbeitla. At that time trouble was being cleared on some of the local circuits that had gone out." At 1:30 a.m. Lt. Buscall sent most of his messengers and wire crewmen back, keeping a skeleton force to operate the center.

"At that time we started to cut our circuits over, but hardly had we started when the ammunition dump, about 100 yards away, blew up. We continued to connect lines and sort out circuits after we found out what the explosion was. These explosions continued. Finally about 0300 hours we completed our cutover and were loaded.

"Left Sbeitla about 0310 and passed the P.T.T. (French Telephone Company) building. The switchboard was on the sidewalk but our truck had not come back, so the switchboard was loaded on the hood of my jeep, and we continued on. At the time we left, many machine guns were firing approximately 600 yards east of Sbeitla. The ammunition dump was still exploding. The whole sky was red. Several buildings were on fire. We finally arrived at 0445 hours."

As a sidelight to the affair, one of Lt. Buscall's messengers, watching the battle from a rooftop, noticed a battery of Artillerymen trying to evacuate their guns. The messenger volunteered his assistance, helped get the guns out, and returned to his duties.

Elsewhere, too, Signalmen were having an exciting time. In the battle of El Biar, Algeria, American forces were fanning out and mopping up resistance. Lt. Albert Klein, a combat photographer, chanced upon an enemy machine gun nest, heaved in a hand grenade to wipe out the position, and nonchalantly took pictures of the rubble.

Edward W. Beattie, United Press writer, told of meeting Lieutenants Sam Center and Wendall Boston "between the American jumping off place and Gafsa."

"They were searching the countryside with a crew of veteran telephone men," he wrote, "picking up mines and getting poles for their lines."

At another place Cpl. Samuel Balish of the Signal Corps found 75 native soldiers and a French officer asleep in their barracks. Balish awakened them, gave them some American cigarettes, talked them into surrendering and imprisoned them in a nearby railway station.

Lt. Robert Philips and three enlisted men were working on communication lines when two Junker 88's attacked. A bomb exploded a few feet away, shattered Philips' right arm and wounded the others. He drove a truck six miles to an aid station and dispatched an ambulance to the scene.

Pvt. Milton Peterson and six others were on their way to the front to repair tank radio sets in Tunisia when they were ambushed by German paratroops with a machine gun.

"I was hit as I jumped out of the truck to take cover," Peterson said, "A bullet entered my left side, went through the stomach and right arm."

As the Signalman sprawled in a ditch covered with blood from a scalp wound, he saw his comrades taken prisoner but the Germans left him for dead.

Everywhere the Signal Corps, with typical ingenuity, met and conquered spur-of-the-moment problems that developed as the campaign progressed. At Tripoli dust clogging of wheels, keys, joints, and springs of teletype machines created a real trouble for the maintenance men.

"It's quite a problem," reported Major Louis J. Simonich, "but by good hard work and sweat Signal Corps men are overcoming that obstacle."

A common sight on the North African landscape was a symbol of Allied unity—a single telephone pole carrying the distinctive cross-arms and insulators of the French, British, and United States manufacture. When circumstances interfered with other means of communication, the Signal Corps fell back on the centuries-old method of pigeons. In one battle pigeons delivered some forty-five urgent tactical messages. A pigeon named "Yank" bore the first news from the front of the recapture of Gafsa, flying twenty miles in bad weather. Time and again the Signal Corps began installing signal communications before the staff had completed its tactical plans.

Col. T. J. Tully, a corps signal officer, wrote in a report:

". . . Success is due mostly to a thorough anticipation of a damn good guess as to what somebody else will decide later. . . . If the Signal Officer waits . . . it might be too late."

Writing under fire during a crucial Tunisian battle, Col. Tully gave a graphic account of field operations:

"As I dictate this letter in our field set-up here in the woods tonight at 2200 o'clock, we are in the midst of a very mobile, very fast moving operation with a very fluid front. This operation might be compared to a football game where the Corps Command Post is in the position of quarterback, well back of the line of scrimmage, di-

recting a play with its full force on end of the line; and then, without waiting to call a new set of signals, the play is suddenly shifted to the extreme opposite end of the line—some dozens of miles across from end to end.

"At the moment, the corps wire officer is making his shifts of circuits by a series of telephone calls to various key points where, with the aid of an interpreter, he hopes to switch over the connections necessary to insure telephone and telegraph service at the other end of the lines for the major units within the next three hours.

"The corps radio officer is also at the phone arranging details to cover emergency radio communication on one end of the line where the enemy has suddenly withdrawn and where communication at the moment is rather uncertain, since wire installations had not been entirely completed.

"Corps radio, wire, teletypewriter, and message center teams are moving at this moment to the other end of the line, to an advance Corps Signal Center being established there from which we will give more detailed instructions to the teams later tonight as the tactical plan unfolds. Our message center people are planning the revision of their scheduled messenger runs to take care of the new developments. By midnight we hope to have both ends of the line well in hand."

Fast and thorough planning, then, was a keynote of Signal Corps success; North Africa, however, was only the first chapter in the Signal Corps' performance in the Mediterranean Area.

Signalmen were in there pitching as the Allies swept over Sicily.

The Signal Corps was there, too, when the Allies landed at Salerno and opened the main Italian campaign.

And—the Signal Corps will be there when United Nations forces smash into Germany itself.

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FM in World War II

(*Continued from page* 243)

of a major investigation undertaken by the Signal Corps three years before Pearl Harbor. When the treacherous Japs struck, the Signal Corps was ready with new and modern radio sets which could be placed into mass production with the least possible delay.

In the fall of 1937, when the triple-crossed steel tower of Major E. H. Armstrong appeared on top of the Palisades near Alpine, New Jersey, to begin what later turned out to be a new era in radio, it was evident to Signal Corps engineers that this "thunder-defying" type of communication, as FM was popularly called, was able to offer far more than crystal clear, staticless reception to homes within a 50-mile radius. These same technical characteristics, it was believed, might well transmit a clear message to a tank in battle through the severe ignition interference and track static, produced by a dozen or so machines in column. If so, FM would be a military weapon fully as effective as any produced for modern coordinated warfare. With this in mind, the Signal Corps began a series of tests and experiments to find if FM was perhaps the answer.

Active coordination of information was begun with the General Electric Company, which, working closely with Major Armstrong, conducted a series of FM demonstrations in April, 1939, for the benefit of engineering representatives of all interested Government departments. Under the direction of Major General Roger B. Colton, the Signal Corps Laboratories sent engineering representatives to witness these tests and make recommendations as to the military value of FM. As a result of the recommendations submitted, the author was assigned the task of designing the first mobile FM radio set.

This FM set was included on extensive demonstrations of new communications equipment for the Mechanized Cavalry at Fort Knox, Kentucky.

Those were critical times. The world was just waking up to the fact that modern warfare was different. The Mechanized Cavalry, then only a Regiment, had just recently returned from the Plattsburg maneuvers while

Hitler's panzer divisions were completing the conquest of Poland. Our Army was busy streamlining its organization and changing its tactics to meet the lessons of Blitzkrieg.

The Mechanized Cavalry promptly became the Armored Force and expanded to many divisions. It was fully conscious of its need for the very best in radio communication equipment in order to carry out most effectively its fast, hard-hitting missions. It very shortly submitted to the Chief Signal Officer its military requirements for a series of radio sets to provide mobile radio communication to all Armored Force units. This series of sets varied from a long-range, 400-watt "truck" set to a short-range, 1-watt pack set.

The Signal Corps Laboratories began immediately to translate these military requirements into technical characteristics and to rush through to completion development models to be thoroughly service-tested before large scale production could begin. In the advantages of FM seemed to lie the answer to the Armored Force's requirements for short-range voice radio communication. However, before the Signal Corps could embark upon such a radical program, these advantages had to be proven beyond a shadow of a doubt. Many avenues of investigation were begun. It was highly desirable that the decision should not rest upon technical considerations alone; therefore, it was determined that identical sets, one AM, the other FM, should be developed and tested by the Armored Force under the same field conditions. Toward this end development of two types of radio sets were undertaken, one a rugged push-button tank set, the other a small, lightweight pack set. For both types both AM and FM models were completed.

In the meantime, commercial concerns were now manufacturing FM mobile police radio sets and the Connecticut State Police was installing the first FM police system. The Signal Corps Laboratories sent officers and engineers to make a thorough study of the operation of this equipment. As commercial FM police equipment became available, identical models in both AM and FM were procured and subjected to thorough analysis and comparative tests. The average results of these tests showed that FM had a range advantage over AM of 3 to 2 under identical operating conditions. At extreme range FM was 4 to 3 above AM in intelligibility, while at medium range FM was 3 to 2 over AM in intelligibility.

The Signal Corps was satisfied. The development models, both FM and AM, were now available for tests. They were taken to Fort Knox, Kentucky, and installed in tanks and other combat vehicles and subjected to gruelling tests under all conceivable conditions. *The verdict was FM.*

These two models were immediately put into large scale production and are now found on all American fighting fronts where they arrived on time and in sufficient quantities.

After adoption by the Armored Force of FM sets, other requests came pouring in to the Signal Corps from all other branches of the Army. These were speedily met by the Signal Corps Laboratories working in close cooperation with an indefatigable industry until now FM constitutes a great proportion of the Army's radio communication system.

The time has not yet arrived when it will be possible to divulge the complete details of FM developments, but it can be said that many vital strides on the road to victory were made possible by the developments FM contributed by both the Signal Corps and radio industry. The development and investigation of new ideas in radio is still in progress by the Signal Corps Laboratories and will, no doubt, have a most profound and beneficial effect on postwar activities of the radio industries.

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V-Mail

(*Continued from page* 127)

soldier overseas receives around forty letters per month and that V-Mail saves ninety-nine per cent of the weight and space occupied by regular mail, then the contribution of this function to a quicker victory becomes apparent.

V-Mail effects a seventeen-to-one reduction in the size of letters in transit. The letter is written on paper eight and one-half inches by eleven, sent overseas on film one-half inch by five-eighths of an inch, and then transferred to a readable print four and a quarter inches by five and a half.

On 100 feet of 16 millimeter film, 1800 letters can be photographed and carried across the sea in a small box weighing less than seven ounces and displacing only sixteen cubic inches. Send 150,000 one-sheet letters by ordinary mail and they will weigh 2,575 pounds and require the space and use of thirty-seven mail sacks. Send the same 150,000 letters by V-Mail and the weight is only forty-five pounds, occupying the space of only one sack of mail.

The V-Mail Section of Army Pictorial Service, which is responsible for the processing, has now achieved, and is maintaining, its goal of processing all mail leaving or reaching the United States within twenty-four hours. This means that despite the gigantic volume of letters flowing through V-Mail centers, an outgoing missive will be photographed and on its way and an incoming letter will be transformed from film to readable form and dispatched, within a full day of their receipt.

The boast of the V-Mail Service is that it has never lost a letter.

V-Mail is impervious to the hazards

of war. Sunken ships, fallen planes, and all forms of destruction can mean at most, delay to V-Mail. Original letters are always kept until their reproductions reach their destination. Thus it was that when the Lisbon Clipper crashed with 110 rolls of V-Mail film, every letter in those rolls was on its way again on another plane within a short time.

The Army itself has learned to rely on this system that was originally designed for the personal use of its soldiers. The War Department has adopted a modified form of V-Mail for carrying official documents and communications. Called Official Photo Mail, it differs from V-Mail only in that final reproductions are enlarged to full size instead of the four and a quarter by five and a half inch reproduction used by V-Mail.

A complete photo mail station and laboratory is maintained in The Pentagon in Washington for the processing of this Official Photo Mail. It is equipped with outsize cameras for micro-filming large blueprints, maps, sketches, plans, and diagrams. In conjunction with it, the Signal Corps runs a training school for V-Mail technicians.

The Adjutant General's Department, which conducts the Army Postal Service and, except for the processing, operates the V-Mail system, has also put micro-filming to work reducing the multitudinous, space-consuming files of the War Department. The contents of 5,000 four-drawer file cabinets have been microfilmed to clear War Department space. The documents that they contained are still available on the film, which can be read on a "reader" that projects an enlarged picture of the document on a glass screen. More than eighty high-speed cameras capable of taking 500,000 pictures a day are used.

Ordinary V-Mail is processed largely through commercial contract. Processing stations are maintained in the United States, the Southwest Pacific, New Zealand, Hawaii, the European Theater, and the Middle East. In other places, V-Mail processing centers are operated by the Signal Corps.

Processing V-Mail in a theater of operations in some out-of-the-way corner of the earth, under extreme conditions of blazing heat or biting cold, with water scarce, fluctuating power sources, and sometimes without essential equipment, taxes the ingenuity and perseverance of Signal Corps personnel but every station started, is functioning today despite handicaps.

In one place supplies had to be kept dry despite a humidity that remained constantly around ninety per cent. In another, the thermometer registered regularly around 167 degrees and the emulsion ran off the film. That obstacle seemed insurmountable until refrigerators were sent to the unit and a system was devised of shipping an adequate supply of film in the winter to be stored the year around in the refrigerators.

In one of the Southwest Pacific stations, the Signal Corps men installing a V-Mail station found that they would need a big water tank that hadn't been anticipated. To obtain one from outside their isolated post, would mean a long delay. It may look rather odd up there on dry land but today there is a sawed-off marine buoy serving as a water tank for the V-Mail station.

The North African V-Mail station was set up in a wheat field, sheltered for the most part in discarded packing cases and temporary wooden structures, that had been used in converting a freight ship to a troop transport.

Outgoing letters reaching a V-Mail station are opened by machine and fed into a recorder at an average rate of 1200 per hour. The average allows for time for such things as adjustments and replacing of burned-out lights. Maximum capacity of the machine is over 2,000 per hour.

As the letter feeds into the recorder it makes a contact that turns on the photographing lights and starts a new frame of the film reel moving synchronously with the letter to make the photograph. The letter is swept beneath a comparatively narrow strip of light, photographing a small portion of it at a time, although the movement is so rapid as to appear instantaneous.

After each 100 letters a "target" letter is fed into the recorder, bearing a number. Then, if the microfilming of any of the letters is found to be faulty during inspection, the originals of the faulty letters can be easily located by the numbers on the "targets" and put through again.

The long strips of exposed film are next put into a machine that develops, fixes, and washes them in a continuous process. This is accomplished at the rate of approximately 100 feet of film every half hour.

Inspectors then view the film greatly enlarged on projectors but at such a rapid rate, that they are able only to determine the quality of the photography and cannot read the contents of the letters.

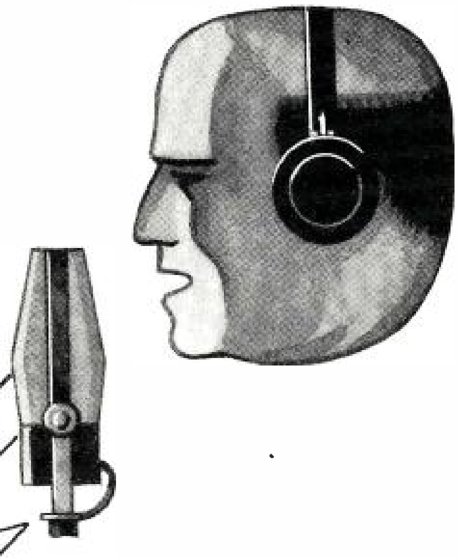
The film is then packed for shipping.

Letters that have been shot are placed on file to be destroyed when word has been received of the safe arrival of their recording film.

Incoming film is inspected and measured on a densitometer, which determines its exact density. From this can be computed the precise amount of light and stop opening for the enlarger.

Enlarging, too, is a continuous process. Film feeds through the enlarger at a fixed rate while below it, on the enlarging board, a roll of sensitized paper feeds through in an opposite direction and at a rate of speed geared proportionately to the film. They move in opposite directions because of the lens' inversion of the image. A hundred feet of film prints on 825 feet of paper.

The paper is then run through a



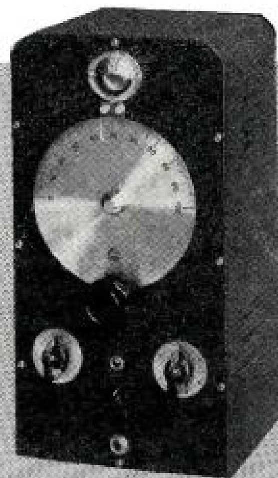
"Calling Car 29 . . . Car 29" **"OK - ON THE WAY!"**

Police radio installations have for some years depended on the Browning Frequency Meter for help in determining the accuracy of fixed-frequency operations. Police departments have found this unit economical to buy, easy to operate, and ruggedly built. Other emergency services have also found this product of Browning Laboratory research to be an asset. Full details are available in literature sent upon request.

Another product of Browning Laboratory research is the balanced-capacitance Browning Signal System for plant protection without armed guard patrols. Descriptive literature is available on request.

BROWNING

LABORATORIES, INCORPORATED
WINCHESTER, MASSACHUSETTS



continuous processing machine that develops and washes it, while more machinery dries it at an accelerated rate.

Next, paper is chopped into individual letters. This step is the only one that has not been successfully mechanized to the fullest extent. The black rectangle at the bottom of V-Mail letters was originally designed to enable a photo-electric cell to chop the paper at the proper point but the photo-electric cell proved unsatisfactory. Automatic determination of the chopping point had to be abandoned. The chopping itself is still mechanical, although controlled manually. But machines take up again in folding the letters and inserting them in the envelopes, ready to be delivered to the addressees.

Th United States Armed Forces Institute at Madison, Wisconsin, conducts most of its overseas correspondence courses by Official Photo Mail. The blanks on which the student prepares his lessons are designed for transmittal to Institute Headquarters and return to the student by Official Photo Mail.

All V-Mail travels by plane, which brings it into the United States within eight days from Karachi, India, and within seven days, from North Africa.

It affords the same privacy as all other mail after it has passed through censorship, the volume of it and the mechanical handling making it prohibitive for operating personnel to read it. Users of it, however, should be sure to make their writing large enough, as some V-Mail with tiny script reduced in reproduction has proved difficult for the recipients to read.

However, V-Mail has one inflexible limitation. It cannot accommodate enclosures. A photographed dollar bill would be hardly expendable, a photographed stamp hardly usable, or a photographed stick of gum hardly chewable, even if it were possible or legal to take V-Mail pictures of such objects.

As the V-Mail letters are opened mechanically and at such a high speed, extra contents are usually scattered and can't be traced back to the letters. Even pasted pictures in V-Mail letters cannot be transmitted because the recording machines are made to accommodate only a certain thickness of paper. When the enclosures can be traced back to their original letters, the letters are resealed and sent by regular mail.

In spite of difficulties, the acceptance of V-Mail is growing constantly both with our overseas forces and with the people at home. Volumes are growing larger each month. Plans are being made for new stations and for means of improving the service. A new station has been opened in Chicago to serve Midwestern States. By having the films flown directly to Chicago, a saving of 24 hours is being made in the delivery of V-Mail letters to people in that area.

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Waterproofing

(*Continued from page* 251)

waterproofing radio sets in vehicles is to prevent the equipment from being damaged by water action while the motor vehicle is being driven ashore from the landing craft. The waterproofing is either 100% effective or it is unsatisfactory; it must be done thoroughly to assure successful operation of the radio set while in the water or after reaching land.

The knowledge and experience gained in these waterproofing experiments should be most beneficial in the postwar period, as the same principles can be applied to the protection of many kinds of industrial apparatus.

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Survey Branch

(*Continued from page* 217)

4. That equipment has been issued according to the unit priority.

5. That the Training Status Report rendered by the Unit Commander (Army Service Forces units only) is correct and complete.

6. That personnel and equipment authorized is sufficient and of right type.

7. That all possible local action has been taken to correct deficiencies.

On "Final" surveys, the Survey Groups determine the following:

1. Status of personnel (officer and enlisted) complement in accordance with the Table of Organization.

2. Qualifications of the unit in procedures for securing replacements of personnel, equipment, and repair of equipment.

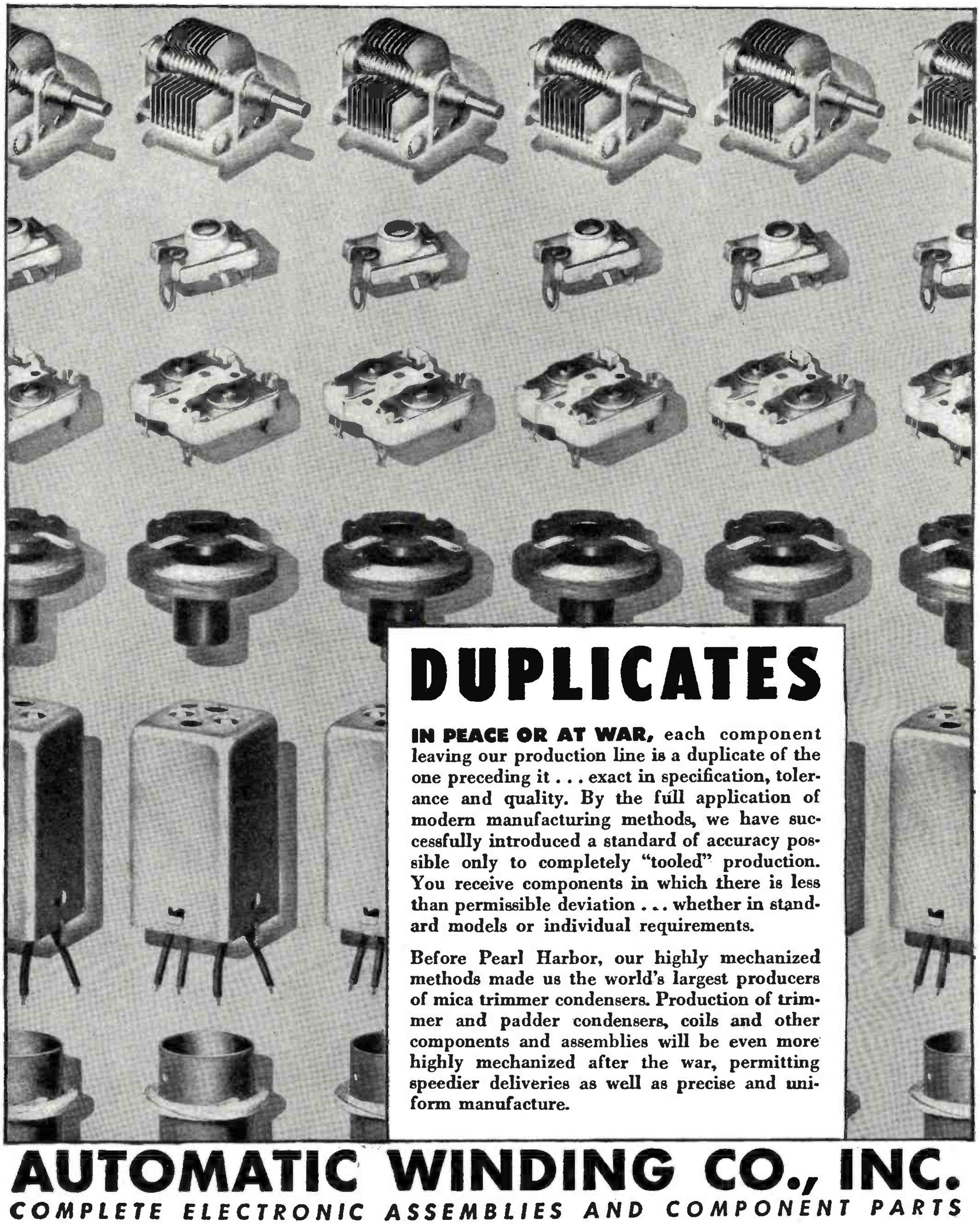
3. Qualifications of the individual specialists to perform their individual tasks. (This is *not* taken from records but is determined by actual check or performance tests either by individuals or groups).

4. Whether each team (radio, wire, message center, supply, photographic, etc.) can perform its combat mission and function as part of the integrated system. This is determined by actual tests of teams.

5. Whether the unit as a whole is capable of performing its tactical mission in combined operations. (This is determined, if practicable, by actual performance test in a field exercise, to include operation with air units, if appropriate.)

6. Whether the unit understands its function in the general plan and has in its possession appropriate Standard Operating Procedures, Standard Operating Instructions, etc.

7. Whether all personnel are qualified in weapons training; defense against gas (both personnel and equipment); first aid; and methods of self protection, including foxholes, concealment, active and passive defense against air and mechanized attack; etc.



8. That minimum Army Service Forces training requirements (for Army Service Forces units only), and War Department policies have been complied with.

9. That administration of personnel is complete as to records, blood typing, immunization, dental and medical requirements, individual clothing and equipment, etc.

10. That unit has on hand (or that arrangements have been completed for the unit to receive at some definite point) all equipment, including spare parts, in accordance with existing authorization.

11. Whether the unit, if part of a Task Force, has or will have received its specific task prior to embarkation and is or will be proficient therein.

12. That personnel and equipment authorized are sufficient and of the right type.

13. That all possible local action is taken to correct deficiencies.

14. That deficiencies, beyond the control of local authorities to correct, are immediately reported by the most expeditious means to the responsible authorities.

Signal Corps Units are rated by Survey Groups as "Satisfactory" or "Unsatisfactory." A rating of "Unsatisfactory" is accompanied by a statement of the reasons for such a rating and a statement, in the case of a "Final" type survey, of the date by which it is expected that the unit can be made ready to perform its mission.

In rating a unit "Unsatisfactory" from the standpoint of unqualified specialists, the Signal Unit Survey Branch is guided by the realization that no unit can be expected to have 100 per cent of any class of specialists "skilled." It is therefore considered satisfactory when a minimum of 50 per cent of each class of specialist in the unit is found to be "skilled" and the rest are "semi-skilled" or "potentials" and trainable within the unit in the time available. This arbitrary yardstick was selected on the theory that if a minimum of 50 per cent of the specialists are skilled, the unit can function and the others, if semi-skilled or potential, can be further trained within the unit.

Other deficiencies, of course, affect the determination of whether or not a unit is satisfactory to perform its mission. The Signal Unit Survey Groups therefore check to insure that:

1. There is no misassignment of personnel.
2. There are no personnel with physical disqualifications.
3. There are no shortages of personnel.
4. Personnel is properly processed as to immunization, blood typing, dental requirements, service records, etc.
5. There are no shortages of equipment.
6. Weapons training is completed.
7. Minimum Army Service Forces training requirements are met (Army Service Forces units only).

8. Table of Organization or Table of Equipment do not require revision.

In determining the qualifications of individual specialists, the survey officers interview and test each man, using check lists. They are guided not by whether the man has learned what he has been taught but solely by whether he can do the work outlined in the job description for the Specification Serial Number of the position to which he is assigned in the Table of Organization. He is then rated as "skilled," "semi-skilled," "potential," or "unqualified." Determination is also made as to whether he has qualifications for some other Specification Serial Number. If his service could be better utilized in another job, appropriate recommendations are made.

The Survey Groups take all possible local action on the spot to correct deficiencies which they find. They also make recommendations to local authorities for correction of deficiencies which are the responsibility of local authorities to correct. Deficiencies which require corrective action beyond the control of the Survey Group or Local authorities are reported to the Branch Headquarters, Office of the Chief Signal Officer, Washington, D. C.

Immediately upon completion of its survey, the Survey Group prepares and forwards to the Branch Headquarters a Survey Report. This report is prepared in the following form:

Section I. General

1. Authority for making survey.
2. Type of survey (Initial, MTP, Final).
3. Superior Organization (assigned, attached, or originally a part of).
4. Authority responsible for training the unit.
5. Station and date of activation and reference to activation authority.
6. A concise statement as to whether unit is satisfactory or unsatisfactory:
   a. To initiate training in accordance with MTP-1 or a special training program designed for special units. (Initial type surveys.)
   b. In progress of team training. (MTP Type Surveys.)
   c. To accomplish its prescribed mission. (Final Type Surveys.)
   d. If unit is unsatisfactory, a concise statement will be made giving reason therefor.

Section II. Personnel

1. Authorized Table of Organization and date.
   Authorized strength, *(Officers), (Warrant Officers), (Enlisted Men).* Actual strength, *(Officers), (Warrant Officers), (Enlisted Men).*
2. Number of personnel by Specification Serial Number required to bring unit to authorized and allotted strength in accordance with authorized Table of Organization and activation order.

3. Names, grades, Army Serial Numbers, and Specification Serial Numbers of personnel over authorized strength, i.e.,
   Personnel qualified in a specialty not authorized by Table of Organization.
   Personnel overgrade.
   Personnel overstrength in each Specification Serial Number.
4. Names, grades, Army Serial Numbers and Specification Serial Numbers of personnel misassigned, i.e.,
   Personnel assigned to a specialty for which they are not qualified but are qualified in another specialty authorized by Table or Organization, (such cases may require reclassification).
5. Names, grades, Army Serial Numbers and Specification Serial Numbers of personnel not qualified according to Specification Serial Number and cannot be trained in unit in time allowable.
   Indicate reason for disqualification.
   Itemize subjects in which deficient.
   Indicate where the unqualified specialists were trained.
   Indicate number of personnel actually assigned the Specification Serial Number in each case.
6. Names, grades, Army Serial Numbers and Specification Serial Numbers of personnel not qualified according to Specification Serial Number and who can be trained in unit in time allowable.
   Indicate reason for disqualification.
   Itemize subjects in which deficient.
   Indicate where specialist was trained.
   Indicate degree of qualification either potential or semi-skilled.
   Indicate number of personnel in the unit actually assigned the Specification Serial Number in each case.
7. List of deficiencies or discrepancies noted in personnel records.
8. Names, grades, Army Serial Numbers, and Specification Serial Numbers of personnel physically unqualified.
9. Other appropriate information, not covered above, relative to personnel deficiences.

Section III. Training

1. Give training program the unit it's training under.
   Indicate progress of training in accordance therewith and adequacy thereof.
2. Status of training equipment, training aids, training manuals, training facilities, etc.
3. Status of individual training, i.e., Basic training.
   Number that have fired rifle Course "C" and qualified.
   Number that have not fired rifle Course "C."
   Technical training and compliance With Army Service Forces requirements.
   Requirements of "Preparation for Overseas. Movement," etc.

4. Status of team training, organization of teams, etc.
5. Status of organizational training.
6. Date of most recent Training Status Report submitted by the unit commander indicating all deficiencies found in this Report. (Army Service Forces Units.)
7. Other appropriate information, not covered above, relative to training deficiencies.

Section IV. Equipment

1. Number and date of Table of Equipment, Table of Basic Allowances, and special authorization under which equipment is supplied to the unit.
2. Priority for issue of controlled items of equipment. A statement as to whether this priority is sufficiently high for this unit to secure adequate training equipment or equipment for overseas shipment.
3. List of shortages of controlled items of Signal equipment.
   Show quantity authorized and on hand where full allowances have not been received.
   Include a statement as to the extent to which these shortages are retarding training of unit.
4. List of shortages of non-controlled items of Signal equipment.
   Indicate quantity authorized, on hand, and short where full allowance has not been received.
   Indicate the extent to which these shortages are retarding training of unit.
   Give the number and date of requisition and to which depot forwarded, and commitment date for its arrival.
5. List of shortages of equipment other than Signal.
   List separately controlled items and non-controlled items.
   Indicate the extent to which these shortages are retarding training progress.
   Give number and date of requisition and who placed same.
6. Number and date of most recent status of equipment report rendered by unit commander.
   Indicate deficiencies in shortages reported and those found by the Signal Unit Survey Group.
7. List deficiencies noted in supply records.
8. Availability of instruction literature furnished with equipment and adequacy of same.
9. Other appropriate information relative to equipment shortages and deficiencies.
10. General condition of equipment on hand, i.e.,
    Maintenance of equipment—Satisfactory or Unsatisfactory. If Unsatisfactory, state deficiencies.
    Methods of preventive maintenance.
    Any other information relative to condition of equipment.

Section V. Miscellaneous

1. Recommendations, clear and concise, presented so that there will be no question in the mind of reviewing and other interested agencies, as to what action should be accomplished and the reasons therefor of the following:
   a. Changes of Table of Organization, Table of Equipment, Table of Basic Allowances, etc.
   b. Modifications of equipment to more adequately fit it for the service intended.

When the Survey Report is received at the Branch Headquarters, it is analyzed and matters requiring corrective action are extracted and forwarded to the Branch, Service, or Division of the Office of the Chief Signal Officer or to such other Agencies, outside the Office of the Chief Signal Officer, as are responsible for taking the necessary corrective action. The Branch Headquarters follows up on these extracts to insure that proper corrective action is taken and secures reports of actions taken on all deficiencies before closing out each case. The function of the Signal Unit Survey Branch is to locate deficiencies and to see that deficiencies are reported to the agencies responsible, and to insure that *those* agencies take the necessary corrective action.

The Branch Headquarters prepares periodic reports for the Chief Signal Officer indicating surveys made for the period covered by the report, conditions of units surveyed, deficiencies found, and corrective action taken. By this means the Chief Signal Officer is informed of the general condition of all Signal Corps Units and also of serious deficiencies requiring corrective action.

Experience gained in surveying a large number of units over a period of seven months has clearly demonstrated the value of these surveys in preparing Signal Corps Units for performance of their mission. The advantages and accomplishments of the system may be summarized, briefly:

1. "Initial" type surveys enable units to start training quicker, and to complete the training in less time and with better final over-all efficiency.
2. "MTP" type surveys permit a check of the training programs, establish the date on which the unit will be ready to perform its mission, and allow more time for correction of deficiencies prior to movement of unit.
3. "Final" type surveys insure that no unit will be sent overseas in an unsatisfactory condition.
4. The cumulative effect of corrective actions has brought about improvement in many courses, programs, and methods in selection, classification, assignment of personnel, and in administration of units. This is evident by a lessening in the recurrence of deficiencies and by improvement in the qualification of specialists and the condition of units surveyed.

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The Radio Industry
(Continued from page 242)

recognized that it would be necessary to augment the production force by recruiting and training. The recruitment of new labor for radio industry plants presented no very great problem at the start. Many workers were available from less essential industries who saw an opportunity to help in the war effort by becoming workers in radio plants.

With so many manufacturers drawing from this source of manpower it very soon became depleted, and it was necessary for industry to recruit workers from new sources. One of the most plentiful sources of new workers was the woman power of the nation. For a long time the radio industry has been an employer of women in its plants and was, therefore, in a good position to recruit and absorb women workers. Prior to the war young girls and unmarried women were employed, now because of the tremendous needs of mass manpower it was found necessary to widen the field to include married women and others who ordinarily would not be found in the labor market.

There were two problems immediately apparent in the assimilation of these workers: the lack of any training at all on the part of the new workers, and the lack of adequate supervisory personnel available among the old workers. Since radio is, in itself, a rather highly technical field which requires semi-skilled and skilled workers for most of its operations, some sort of a program had to be provided to train this type of help. About this time, the Government started what was known as the "Training-in-Industry Program"; instructors were sent into the plants to provide training for employees who desired to become supervisors. Instructions in handling people, and in training methods for new workers, were given in a streamlined course to people on the job. As soon as these courses were completed, a large number of trainees were available for further instruction in order that they might be raised to the supervisory levels in the plant setup as hired production personnel. Careful training was given on the job to these employees which enabled them to perform the semi-skilled tasks necessary to maintain production.

This "Training-in-Industry Program" has been very successful and no doubt some modification of it will be continued into the peacetime period. The problem of supervisory manpower still remains one of the biggest bottlenecks in the production program. Manpower problems are in no sense of the word solved, for as soon as one set of troubles had been overcome another arises to take its place. Manpower has always been the No. 1 problem of production and there does not seem to be any single answer to its many ramifications. A further supply of labor will no doubt be available as the war program is curtailed and these workers can be absorbed into the radio and communications industries without trouble or delay.

Materials have been one of the crucial problems which the production managers have had to contend as most of the materials used in radio have been onthe critical list almost from the inception of the war. Such things as copper, aluminum, mica, and steel, to name only a few, have been at the top of the critical list. This has forced the industry to operate on a hand-to-mouth basis as far as critical materials are concerned for many months. Through the priorities system, established by the War Production Board, most of these materials were available to essential manufacturers on something approaching an orderly basis. However, the priority system introduced a complete new series of troubles of its own. First, about three times the supervisory and clerical personnel were necessary in order that the system could be efficiently established and administered. Second, due to the numerous changes in the system itself, manufacturers were continually at a loss to know how to proceed under these ever-changing rules and regulations. Third, production departments had to learn entirely new techniques on the purchasing, storing and inventoring of materials necessary for their war efforts. More recently under the C.M.P. the situation has become somewhat clarified and it is to be hoped that we are finally approaching a solution to one of the most troublesome problems of production.

One of the great stumbling blocks to the efficient operation of the production department was the dearth of machine tools. To further complicate this picture, considerable hoarding and overbuying of machine tools by manufacturers was evident. Here again the priority system operated to alleviate the condition which, to say the least, was no credit to the industry. Securing tool makers and better grade machinists remains a bottleneck for which there is no solution, since it requires considerable time and experience to properly train men in these trades.

With the exception of a very few of the larger plants, time and methods study as an aid to production, was practically unknown. Since the radio industry, like Topsy, had "just growed" and since most individual operations were of highly specialized character, each manufacturer had his own way of adjusting his labor and material to his own particular need. However, with the standardization of specifications and with the tremendous demand for material, time and methods studies were found to be necessary. Most of the plants in the industry have by this time instituted time and methods procedures which have greatly speeded up production with a consequent saving in cost and manpower. One of the greatest benefits to be gained will be the increased savings in the cost of operation in the all-important postwar period.

Productions engineering, which up to this time was something only vaguely understood in the industry, has emerged as a definite asset to the manufacturer. Efficient factory layouts together with labor saving machinery have contributed greatly to the efficiency of production.

Distribution

One of the largest parts of the operation of any radio manufacturer before the war consisted of his sales and distribution setup. Under the impact of the war there was no longer a necessity for a sales department, as such. Since most manufacturers converted 100 per cent to war, they had nothing to offer their ordinary channels of distributors. However, in the sales personnel of the various companies, the manufacturers had an invaluable asset, namely, specialized knowledge and experience. These men were immediately used as contact men between Government and industry. Here their knowledge and experience was of great service, both to the industry and to the war effort.

At about this time, the sales outlets of the manufacturers were beginning to wonder what their part would be in the war effort, since they knew when their present stocks of merchandise were exhausted in all probability no more would be forthcoming. They were most apprehensive concerning the future of their businesses. As it turned out, most of them had the ingenuity to become suppliers to the many war plants through the nation which they were peculiarly able to serve. Because of their strategic position, they were able to get orders from these plants carrying high priorities which in turn, enabled them to obtain merchandise from manufacturers. This has served to keep the better jobbers and distributors in business throughout the war period, and, in most cases, has enhanced his position in the industry. This position of the distributor will, no doubt, bear good fruit in the coming postwar period. Another service which distributors have rendered to the war effort was the continued provision of the necessary parts and supplies to maintain in operating condition the 60 million civilian radio sets in use in the country.

Associations

No story of the radio industry would be complete without mentioning the part that has been played by the various industry associations. They have continued to function as a liaison and clearing house between Government and industry and have drawn heavily from the resources of their membership, both in personnel and experience, to aid the Government in its efficient prosecution of the war.

Space is too limited to tell in complete detail the story of the part played by the radio industry in this war. Much of it can only be written after the din of battle has died away and men have had time to evaluate its service. This has rightly been called a radio war and the radio industry has responded nobly to every demand made upon it. There is one unescapable conclusion. By virtue of its background and service, the radio industry has assumed an obligation to itself and the future of America which it does not accept lightly and which, if the past is any guide, it will discharge honorably and fully.

In short, all associations in the industry, reflecting the thinking of their membership, have been of unestimable value to the war effort.

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Civilians in the S. C.

(Continued from page 238)

Corps decided to use under-engineers, or engineer aides, who could relieve the engineers of much of their technical detail work and enable them to devote themselves to wider fields. Engineer aides could be trained within a reasonable length of time. Courses were set up in several universities. The training consisted of six months' background and engineering education at one of the universities, and two months' supplemental laboratory training to prepare each student for specific duties.

At the height of the training program, the changing draft requirements began to catch up with many students. The Corps acted quickly to protect its investment in trainees. All who had become eligible for the draft, or were likely to become eligible soon, were dropped from training. The draft boards were notified of their availability and asked to assign them, upon induction to the Signal Corps so that the training they had already received could be utilized. That and the quick weeding out of unpromising material saved more than a million dollars in training costs for the government.

Since safety and health have been found to be chiefly matters of learning to be careful and taking care of one's self, those features are a part of the training program. United States Compensation Commission figures for 1943 reveal an accident frequency of 8.3 per million hours of work for Signal Corps civilian personnel as contrasted with a frequency of 13.2 for the War Department as a whole.

In all this recital of Signal Corps personnel accomplishments, it must be borne in mind that the Corps is simply carrying out the policies of its parent, the Army Service Forces, and its grandparent, the War Department. Most of the methods by which it accomplishes its mission are laid down by the higher authorities and many have been borrowed from the business, education and scientific worlds, but in the last analysis, whatever the Personnel Office has achieved, has been done by the thousands of men and women to whom the word "boss" means a pair of crossed semaphore flags superimposed on a torch.

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Plant Engineering

(*Continued from page* 245)

hypothetical objective territory. This will be done, of course, well in advance of the beginning of operations. In the interest of speed and economy, standard equipment is used. There isn't time to design and produce special gadgets for each job. Nevertheless, there are thousands of different components that go into establishing a telephone central office of the size found in many small communities in the United States. There are innumerable parts that make up a workable radio station. There are all kinds of parts and accessories required for teletypewriter service. And they must all be secured here in the States. The specifications lists for these fixed installations are long and accurate.

Now we come to the second step. Again this is taken as far in advance as possible but at best the procurement must be done with extreme dispatch. Usually it has to be done in a hurry. The Agency uses standard parts. These are the things that come off the assembly lines of the communications equipment factories and laboratories throughout the nation. These are the things that are stocked in the various Signal Corps Depots and warehouses in the States. But parts are moving out of Depots as fast as they come in. Will there be enough of everything specified by the engineers for each job? Have demands depleted stocks to such an extent that some equipment will be temporarily unprocurable? That is always the hazard to step No. 2—the procurement step.

Orders are sent out to the various depots where it is felt that specific equipment can be procured. Certain elements are drawn from Dayton; others come from Philadelphia. Some are requisitioned from Lexington, and so the procurement process goes.

The requisitions are accompanied by shipping instructions. They must be selected, crated, and shipped to make a transport or a cargo ship at a certain place before a certain time. That is what experts call "concentration." The important thing is that there can be no delays. There can be no missing parts. If there are—there will be a breakdown in the plans of operation.

To secure this concentration *on time* requires field trips to depots and to manufacturing plants. It sometimes involves assistance in securing priorities for manufacturers. It needs checks on transportation facilities—tracing motor caravans and freight cars. It involves switches to air express and the employment of special couriers. Everything, in fact, is done to make the ship on time.

Checks and rechecks are made in the Philadelphia headquarters and the progress of each installation is logged from hour to hour. When records show that every procurement step has been taken—when checks show that everything is on the way—the Agency does not leave the shipment of the component parts to chance. An officer from the Agency is on the docks to check arrivals, to supervise temporary storage, and to report shipments that are behind schedule. And, when the ship is being loaded, this officer stands by to see that everything is stored aboard.

As soon as the transport reaches the docks abroad, in this territory we are using as an illustration, the Signal Corps equipment is unloaded and transported to the pre-determined location where it is to be installed. If it consists of telephone, teletypewriter, and radio equipment, it will be awaited by the requisite number of specialized troops to do the complete job in a hurry. These military organizations in the theaters of operation are composed of officer and enlisted personnel. They are known as Special Installation Signal Service Companies. In their ranks must be experts in every phase of electrical communications.

The formation of the Special Installation Signal Service Companies has presented a major problem to the Agency in that all of the officers and men require specialized training due to the highly technical features of military communication facilities. Many of these are secret. Many are new developments born of war necessity. The training has been and is being conducted in the training departments of some of the larger communication companies and manufacturers of communication equipment, as well as in the training establishments of the Signal Corps. The training is intensive. Fortunately there is a large percentage of electrical engineers and others with practical, peacetime training in the communication's field in the Signal Corps—men who take to the military aspects of communication like ducks take to water. This has helped the training program immensely. It has helped the Agency get into action much earlier than if it had to start with absolutely green men.

In this imaginative instance, involving a theoretical fixed installation the Agency has:

1. Engineered fixed telephone and radio installations for conquered territory.
2. Procured great amounts of equipment and seen to it that it made the ship and was delivered at destination.
3. Installed the equipment with its trained personnel in the theater.
4. Provided communications equipment, the maintenance of which will be the responsibility of Signal Corps troops for the duration and as long thereafter as is necessary.

While the above is a theoretical case, the Plant Engineering Agency is today doing numerous jobs like the one outlined. This, despite the fact that the Agency was only established on the 23rd of January, 1943. From that time on things moved with tremendous speed.

At its birth the Agency found a multitude of overseas and coastal jobs in its lap. Work had to proceed on these while plans for moving the Agency to Philadelphia progressed. Quarters, suitable to house a sizeable organization, had to be found by February 1. There was nothing available. Thanks to the generous offer of General Farmer, Commanding General of the Philadelphia Signal Corps Depot and Procurement District, the Agency was allotted temporary quarters in one of the Depot's branch warehouses.

The equipment started off from Washington consisted of hundreds of safes, files, desks, typewriters, chairs, and a miscellaneous assortment of drawing boards, tables, lockers, coat racks, and other office equipment. On Saturday morning, January 30, it started moving. All through Sunday, January 31, the moving continued. By Monday, February 1, the temporary office of the Agency in Philadelphia was shaping up. By Tuesday, February 2, it was functioning on the same basis as it was in Washington, three days before.

The move involved more than furniture and fixtures. The officers and most of the civilian personnel assigned to the Agency, when it was activated in Washington, had to be moved also.

This was a problem the visualization of which needs no elaboration to suggest its magnitude.

Rush jobs in progress—

Moving equipment and personnel 140 miles,

Practically overnight—

These in themselves were enough to keep nerves fraught to the raw edge.

But, simultaneously, there was the necessity of expanding the organization—not only at headquarters but also in many parts of the world. The job was an expansion program that had to be done on the doublequick—with no rests between marches.

While office furniture was being moved into temporary headquarters, people were being interviewed for jobs in the Agency.

Now it is no military secret that Army routine is a system unto itself. To an efficient civilian secretary, for instance, the "red tape" and paper work of the Army is an unknown quantity. New employees, regardless of their clerical and stenographic aptitude, must learn the way of the service.

So, while the Agency was working and moving and hiring, it also got into the business of starting a training school for new employees, a school which was maintained at full capacity for more than six months and is still operating, although on a decreased basis.

As remarked earlier, production plants and Signal Corps Depots in all parts of the country furnish Agency units with equipment. In Philadelphia, it is geographically far removed from the West Coast. Hundreds of miles separate it from the Southern Coast and from the northern reaches of New England. In order to embrace the whole world within its organization and so that it might have representation at all points of the compass, without undue expenditure of time and money in traveling, the globe was divided into four sectors with headquarters at strategic points. The Northeast Sector headquarters are located at Presque Isle, Maine, the Southeast at Miami, Florida, the Northwest at Seattle, Washington, and the Southwest at Honolulu, T. H. These sector offices are manned by capable officers and a staff of civilian personnel.

These instances are cited to illustrate the size of problems that have been faced and to demonstrate the speed with which the Agency has been operating. Time has been against it. Hard work has been the lot of its personnel but the results are beginning to show and the Agency officer and civilian personnel can well be proud of their efforts.

The Plant Engineering Agency is now housed in the Architects Building, Philadelphia, Pennsylvania.

–30–

Organization
(*Continued from page* 91)

checks continuously training of Signal Corps units and individuals to assure that signal troops are ready for overseas duty.

Training

Communications in modern warfare, involving rapid movement and simultaneous land, sea, and air operation in all theaters of operation, necessitates the training of many different specialists to a high degree of technical skill to perform their many and varied missions.

Signal Corps troops are given thorough courses to qualify them as radio operators, radio repairmen, cable splicers, installers, line foremen, powermen, switchboard installers, wire chiefs, telegraph printer operators and repairmen, truck drivers, clerks, as well as many other specialties.

The training is carried on at four posts in the United States. Fort Monmouth, New Jersey, regarded as the parent station, contains an Enlisted Men's School, and Officer Training School, and the only Officer Candidate School for the Signal Corps in the country. The post is known as the Eastern Signal Corps Training Center.

Camp Crowder, Missouri, named the Central Signal Corps Training Center, is the largest of the Signal Corps training stations. This center also contains a school. On the West Coast at Camp Kohler, near Sacramento, is located the Western Signal Corps Training Center and school.

For advanced electrical students the Signal Corps operates a school in Florida where large numbers of skilled young men are receiving training in the maintenance and operation of more complicated equipment.

There are other Signal Corps Schools at the Philadelphia Signal Depot and at various Signal Corps installations throughout the country, which provide specialized training for additional thousands of men. Telephone companies are teaching small groups of men and many of the large suppliers of communications equipment conduct classes in their plants where Signal Corps troops can learn how to operate, install, and maintain the equipment which they manufacture.

The Army Communications Service controls and directs the development, engineering, installation, operation, and maintenance of all fixed radio and wire communication and signal security facilities for the Army. Its operations are world-wide in scope.

This service controls and directs the operation of the War Department Signal Center, the War Department Code Center, and associated Transmitting and Receiving Stations in or near Washington. These functions combine to fabricate the War Department Administrative Communications Network, comprising Radio, Telephone, Telegraph, Wire and Radio Photo transmission, together with respectively related communications media.

This service supervises the Army Amateur Radio System; controls and directs the operation of the War Department radio net and associated facilities, and prepares engineering plans for military fixed communication requirements throughout the world.

One of its outstanding contributions during the past year was the over-all engineering on the Alaska Military Highway telephone line, running from Edmonton in Canada to Fairbanks in Alaska. The construction of this telephone line was characterized by Under Secretary of War Robert P. Patterson as "one of the great stories of Army accomplishment . . . a story of almost superhuman effort by the Signal Corps."

The Army Pictorial Service performs all photographic work for the Army Ground Forces and Army Service Forces. Its duties encompass supervision of the V-Mail and official Photo-Mail Services.

Heart and center of the Army Pictorial Service is the Signal Corps Photographic Center at Astoria, Long Island, New York. There are produced hundreds of training films which are distributed not only to the various branches of our own Army, but also to those of our allies. There also are trained motion picture and still camera photographers, who march into the very vortex of battle to get some of the excellent shots of actual combat scenes viewed almost daily on screens throughout the country.

One of the outstanding accomplishments of the Army Pictorial Service during the year was the opening of fourteen V-Mail stations for the expediting of soldier mail to and from points all over the globe. This service contributes to the morale of troops overseas and their friends and relatives at home, by eliminating the long delay of letters sent by less rapid means.

Office Service

The Office Service Division performs administrative and service functions for the Office of the Chief Signal Officer. The Division has three branches:

The Administrative Branch which receives and distributes mail; administers personnel relations, and provides counselling service.

The Service Branch, performing office service functions, including distribution of office supplies and furniture, and operating the Signal Corps Reference Library.

The Special Activities Branch gathers and distributes signal communication information to newspapers, magazines, radio, picture services, and other media through the War Department Bureau of Public Relations. It arranges ceremonies for Army-Navy "E" Awards to plants manufacturing Signal Corps equipment. It prepares the Annual Report for the Chief Signal Officer and the History of the Signal Corps.

Wars are not won by signal communications alone, but wars can and have been lost for lack of them. Signal communications of today represent the expenditures of billions of dollars, thousands of miles of wire, tons of equipment, skilled engineers and technicians in the thousands and specialists in the hundreds of thousands, world wide radio networks, telephones, teletypewriters, telegraph, automatic and intricate machines performing seemingly miracles.

This then is the job of the Signal Corps and the organization set up to accomplish this end. No organization can expect to exist in a fixed or static state, for without flexibility it will break. The pressure of modern war demands a capacity for adjustment and readjustment and concerted effort will continue to be exerted to attain organizational perfection.

Total victory is our goal and it is the determination of the Signal Corps to furnish our Army with communication service and equipment worthy of American brains and ingenuity.

—30—

Military Training

(*Continued from page* 190)

rectly to a specialist course while a few will first take the Electrical Fundamentals Course. Assignments to specialty courses are based upon educational background, previous experiences, demonstrated ability and personal interest by the officer in that field of signal communication.

The Electrical Fundamentals Course is a seven-weeks' program to qualify those who have no previous background in electricity for courses in telephone, radio, or wire. Graduation from Company Officers' Common Subjects Course or Officer Candidate School is the prerequisite for entrance. This course continues basic military training and physical conditioning and covers the basic fundamentals of electrical theory and practice through direct and alternating current theory and circuits, vacuum tube operation and circuits, the fundamentals of electrical machinery, and internal combustion engines. Particular consideration is given to standard Signal Corps field equipment. All phases of the course are dealt with from the viewpoint of basic wire and radio communication, with emphasis on practical exercises in the laboratory and work with electrical wiring diagrams.

The Administration and Supply Course is of five weeks' duration. Experience in a merchandising field, warehousing and storage, purchasing or manufacturing of merchandise is preferred. This course covers administration and supply functions of Signal Corps field units, post camp, and station Signal Officer; Signal Property Offices and Signal Depots. There is also a continuation of basic military training and physical conditioning. Graduates of this specialty course may report to tactical units, to Camp Lee, Va., for a four weeks' course at the Quartermaster Depot, or to one of the three Signal Corps Supply Depots for a specialized four-week Depot Supply Course. Graduates of Camp Lee may also report to one of the three Signal Corps Supply Depots, at Philadelphia, Pa., Lexington, Ky., or Dayton, Ohio.

The mission of the Message Center Officers Course is to prepare selected Signal Corps officers to supervise the operation of Army message centers. These students are also given basic instruction in maintenance and operation of motor transport vehicles, and are given a thorough knowledge of the capabilities and limitations of the various means of signal communications.

The Advanced Officers Signal Supply Survey Course offers ten weeks of instruction for selected Supply Service Officer personnel in the grades of Lieutenant Colonel, Major and Captain. This training program is divided into three parts. The first part is military training, physical conditioning, individual protection, sanitation and weapons. The second and third parts of this course consist of classroom lectures on general Signal Supply Survey subjects and allied subjects, and conducted tours of Signal Supply installations and other Signal Corps activities.

The Advanced Officers Course, sixteen weeks in duration, is to instruct specially selected officers in subjects necessary to qualify them to: (1) command tactical Signal Corps battalions, (2) serve as Signal Officer of tactical units, (3) train Signal Officers for the Army Ground Forces and Army Air Forces, (4) plan and participate in Signal Corps responsibilities of Air-Amphibious operations. Students must have demonstrated fitness for higher command responsibilities with a field unit or have sufficient technical ability together with adequate field experience to qualify for higher command responsibilities. Students should be of the grade of captain or higher, or senior first lieutenants fitted for staff assignments with higher command. The course places emphasis on development of signal orders, wire and radio communications, amphibious operations and planning, tactics and tactical applications of signal communications for all armed forces.

The Officers Electronics Training Center located at Cambridge, Massachusetts, offers training at Pierce Hall and Cruft Laboratory, Harvard University, and at the Massachusetts Institute of Technology. Prerequisites for this training are a B.S. degree in Electrical Engineering, Electronics, or Physics, and completion of three months of basic military training.

The program of instruction at Pierce Hall is a review of mathematics, electricity and magnetism to officers who fail to pass qualifying examination for direct admittance to Harvard Cruft Laboratory Basic Electronics Course or the qualifying examination for the MIT School. This course is one month in duration and the graduates continue training for thirteen weeks at Cruft Laboratory. Graduates of Cruft Laboratory may go direct to Camp Murphy, Florida, or they may be assigned to the thirteen-week Course at MIT before reporting to Camp Murphy for a continuance of their training.

Students completing the four months' General Electric Radio Operation and Maintenance Course at Schenectady, N. Y., go direct to tactical assignments, replacement pools or certain selected students may report to Camp Murphy.

At Camp Murphy, Florida, courses are given that provide detailed knowledge of specific airborne or ground electronics equipment for Air Force Signal Corps and for Coast Artillery specialists. Prerequisites for entrance to this training are satisfactory completion of the MIT School or the General Electric Operation and Maintenance Radio School or completion of approximately one year of field experience in an Electronic Training Group outside continental United States.

The Signal Corps Photographic Center at Astoria, Long Island, N. Y., trains officer and enlisted personnel in the following specialties: motion picture cameramen, still picture photographers (news and commercial), photographic dark-room men, film editors and cutters, motion picture sound recorder, camera repairmen (still and motion picture), sound recording equipment maintenance men, motion picture projector repairmen and motion picture equipment maintenance men.

These courses vary in length from six to seventeen weeks. The still photographer and motion picture cameraman must have had experience in the photographic field in order to be eligible for this training. Commercial experience is preferable to amateur work and experience as a news photographer or news cameraman is the most desirable. The still photographer studies and uses various types of cameras. Motion picture cameramen study and use 16mm and 35mm cameras.

Upon completion of the cameraman course, those students with a background in electricity are sent to the sound recording course, and then assigned to production units as sound cameramen recorders or maintenance men.

The course for film editors and cutters is designed for students who have had experience in this field in civil life or who show special aptitude for this type of work. The training consists of instruction in the principles of construction of motion picture productions and news reels, and extensive practical application of these principles.

Camera repairmen and motion picture equipment maintenance men must have a high mechanical aptitude and preferably have had experience as a watch-maker, instrument repairman, or other allied craftsman. These men are taught the construction and repair procedures on all of the types of cameras used by the Signal Corps.

Photographic darkroom men receive training in all phases of laboratory procedure. In this training emphasis is placed on high and low temperature and tropical processing and field expedients.

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Axis Quartz Crystals

(Continued from page 203)

they struck at Pearl Harbor, Jap bombers were returning from Brazil loaded with this precious material to be used in the sets to work against our boys on Guadalcanal and in the Solomons.

The Japanese have showed little ingenuity in the preparation of holders for the crystals and although their idea of using crystals is excellent, the results were impaired because many of these crystals, which we captured in their early airborne and infantry sets, would not even oscillate or had been ruptured by too much pressure on the crystal itself, poor electrical contact, or unstable mounting. As a matter of fact, the Bliley so-called "book type" crystal holder was extensively copied by the Japanese sets built in 1939.

The Italians used crystals sparingly as did the Germans in resonator units employed in their ordinary army pack set. They did make improvement in that, to get a multi-channel operation, they employed two and three calibrating quartz resonators in each set but contained in the same tube.

They (the Italians) copied us in their commercial designs which were converted for military use of necessity. In other words, they converted some of their broadcast equipment into military use to handle the heavy traffic at the rear units. These employed wafer-type crystals which our own sets use. The Italians were also very helpful on their captured sets in that they always put in a calibration chart and glued it in the lid of the pack set or somewhere near the transmitter.

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Procurement

(Continued from page 93)

moved to the Signal Corps—machine tools. A Machine Tools Subsection was set up, and it unraveled that knot.

When a problem like that seems all nicely ironed out, along comes a question like batteries. The rules that are made for steady production of other equipment won't apply to batteries because batteries deteriorate in storage and in transit. Since the Signal Corps is charged with supplying batteries for the entire Army, that's a good-sized problem in itself.

As each situation is met, new ones crop up, sometimes from surprising sources. A helmet, for example, wouldn't seem to have anything to do with communications procurement. But the old type radio headset can't be worn under the new, bucket-type helmet, so a whole production system had to be stopped and changed over when the new helmet was adopted.

One of the greatest factors in facilitating the change-over and expansion of industry were the educational orders placed with manufacturers by the Signal Corps in 1939 and 1940, to acquaint them with the procurement procedures and the types of equipment the Army would employ if war came to America. It proved to be a foresighted action without which the procurement accomplishments of the past couple of years could never have been possible.

Some idea of the over-all magnitude of the Signal Corps job of obtaining communications and other types of electrical equipment and photographic equipment, as well, for almost the entire Army, can be gained from comparisons with World War I.

In this war, the number of prime contractors with contracts over $100,000 for communications equipment is more than 100 times as many as in World War I; total expenditures have been more than 16 times as great; the number of contracts outstanding is almost twice as great; the types of electronics sets in production are five times as many; and where radio equipment represented ten per cent of the Signal Corps procurements in World War I, in this war it represents ninety per cent. In the first World War, maximum production of the commonest type of field wire reached 80,000 miles of single conductor a month. Maximum production now is 150,000 miles a month.

The Signal Corps of World War I boasted of 2,010 portable radio sets, mounted in heavy wooden chests, which were lugged to advance positions. In World War II there are thousands of types of radio equipment for advance operational use, so far surpassing the performance of the old heavy, socalled portable sets, that comparison is comic.

For the first World War, 7,029 airborne radio telegraph sets were procured. Requirements for one month of aircraft radio, of one model, in this war far exceed that figure.

Only 527 ground radio sets of all kinds were used in the first World War, while in this war, one month's production, for one particular type of ground radio telephone equipment, passed the 6,000 mark.

Much of this procurement has been for Lend-Lease purposes. But the benefits of Lend-Lease have not been all in one direction. The trial of our equipment in actual combat before being used by our troops was of invaluable aid experimentally, and Lend-Lease went far toward readying American industry for its war-time job, even as it now helps to keep production lines running smoothly and constantly.

Our Allies have been of great technical assistance to us in the manufacture of secret scientific instruments, airborne radio equipment, interference units, dynamotors, and teletypewriters, and their training films have been useful to our troops.

A hurry call from the Air Force for dynamotors that were not immediately available resulted in a cabled request to the United Kingdom, and within 72 hours, one hundred of them had arrived by air and were speeding to their

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Continued

destination across the entire country.

Most of the procurement personnel is civilian and the employee spirit of the Signal Corps has figured largely in the job already done.

Foundation of all the technical progress the Procurement Division has made, are the engineers, whose vision and ingenuity have worked miracles in conceiving and producing the communications equipment our fighting forces use today.

A decade, more or less, from now, when you telephone your office from your automobile, when you look at any portion of your plant or its branches instantly reflected in action on a screen before your desk, when you participate in a nation-wide conference without leaving your office, you may look back to the struggles of the Signal Corps with wartime production to trace the development of conveniences you will take for granted.

—30—

Distribution

(*Continued from page* 95)

will be duplication of effort, waste, and inevitably delay. The Stock Control Branch is responsible for the necessary action to straighten out situations of this kind.

In the anxiety of getting equipment to the fighting forces and the combat zones, care must be exercised not to overlook the requirements of troops in training who will themselves be the fighting forces of tomorrow. Equipment would be of little use if delivered only to the fighting front to be used by men who had had no chance to learn how to operate it.

The issue of Signal Corps stocks is carefully controlled to insure that every one gets his fair share. Stock levels in all Signal Corps depots are continually being reviewed for the purpose of stocking each depot in accordance with the demands that may be placed upon it. Expensive, wasteful "cross-hauls" of freight are eliminated by having adequate stocks in the immediate vicinity of the spot where demands arise.

Besides the immediate problem of distributing assembled stocks, it is also the responsibility of Stock Control to work with other agencies in forecasting future requirements. Unless plans are made for procuring sufficent stocks of Signal Corps equipment now, the requirements of tomorrow cannot be supplied and the stock levels of the future cannot be maintained.

Just as important as the securing of new material for future demands, is the problem of disposing of excess and obsolete material. In any operation as vast as our war effort, there is bound to be some waste. Unless it is continually sought out and eliminated, this waste can assume large proportions and clog the channels of normal distribution. While this is the duty of every individual in the entire distribution organization, there is one group in Distribution charged with the responsibility of disposing of excesses and eliminating waste where possible. This is the Redistribution and Salvage Branch. This Branch must see that, as equipment is succeeded by newer or more modern equipment the old equipment is properly disposed of. A determination must be made as to how many of the old models should be retained for parts or replacement and what agencies can use the old model or its parts for training or for conversion into some other type of needed equipment. The Redistribution and Salvage Branch is in continual contact with all agencies of the Signal Corps and with other agencies of the War Department and of the Federal Government to insure that as far as possible what is excess in the Signal Corps may be utilized to good purpose in some other organization and that the Signal Corps has made maximum use of excesses of other departments.

An important phase of distribution is the repair or remodeling of equipment to insure that the maximum life is secured for it. The Shops Branch is charged with the responsibility of seeing that proper methods are used in the several Signal Corps shops throughout the Distribution Division. Many new methods of repair and fabrication of equipment have been developed by this Branch and vast quantities of repaired materials have been made available to troops and thus lessened the demand on production.

The Stock Numbering Agency, another field activity of the Distribution Division, is located in Philadelphia. The responsibility of this group is to assign identification or stock numbers to the thousands of items of Signal Corps equipment. It is their responsibility to coordinate and correlate all information pertaining to this identification and to issue the Signal Corps General Catalogue.

In addition to the Branches in Washington and the Storage and Issue and Stock Numbering Agencies in Philadelphia, the Distribution organization consists of nine Signal Corps branch depots at Boston, Massachusetts; Chicago, Illinois; Dayton, Ohio; Lexington, Kentucky; Los Angeles, California; Philadelphia, Pennsylvania; Sacramento, California; Seattle, Washington; and Baltimore, Maryland. In addition to the branch depots, there are Signal Sections in the Army Service Forces depots at Atlanta, Georgia; San Antonio, Texas; New Cumberland, Pennsylvania; Belle Mead, New Jersey; and Ogden, Utah.

This war has often been referred to as "a war of supply." Basically, every war is a war of supply but the requirements of our mechanized Army greatly exceed any previous demands. The men and women, civilian and military alike, of the Distribution organization of the Signal Corps are proving every day that these requirements can and will be filled.

—30—

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"Handie Talkie"

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RADIO NEWS

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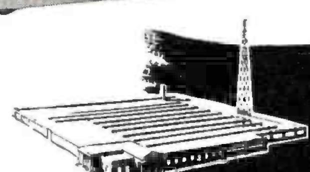

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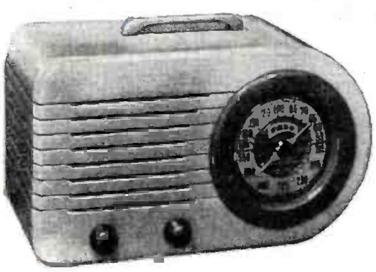

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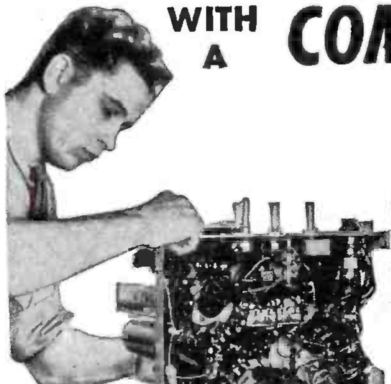

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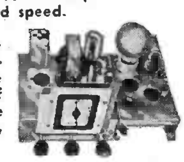

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I train your *mind* by putting you to work with your *hands* on a big 6-Tube Superheterodyne Receiver. And, believe me, when you get busy with real Radio Parts — 8 big Kits of them — you really LEARN Radio and learn it RIGHT! You get the practical stuff you need to be *useful* in Radio, and that's what it takes to make money. You don't have to worry about what to do with these 8 Kits of Parts. Step by step, I show you how to build circuits, test, experiment, trouble-shoot. And you don't need any previous experience. The Sprayberry Course starts right at the beginning of Radio! You can't get lost! Simplified lessons, coupled with real "Shop" practice, makes every subject plain and easy to understand and remember.

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Soon after you begin Sprayberry Training, I'll send you my sensational BUSINESS BUILDERS. You'll find out how to get and do neighborhood Radio repair jobs for nice profits and rich experience while learning. This sort of work can easily pave the way for a Radio Service business of your own. But with Sprayberry Training, you're not limited. You can swing into any one of the swiftly expanding branches of Radio-Electronics INCLUDING Radio, Television, FM, Radar, Industrial Electronics. Be wise! Decide now to become a fully qualified RADIO-ELECTRONICIAN. Get full details about my Training at once! Mail coupon below for my 2 big FREE Books.

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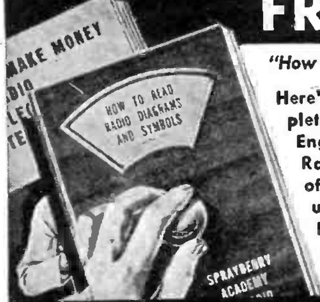

"How to Read Radio Diagrams and Symbols"

Here's a valuable and wonderfully complete new book which explains in simple English how to read and understand any Radio Set Diagram. Includes translation of all Radio symbols. Send for this volume at once! It's free! Along with it, I will send you another Big Free book describing in detail my Radio-Electronic Training.

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For the RECORD

BY THE EDITOR

THE recent survey among our readers has now been completed. From the results we have been able to determine individual preferences for editorial material. The response was most gratifying. In fact, there were several thousand returns on these questionnaires, filled out very completely and containing many concrete and worthwhile ideas for articles, new developments, servicing instructions and amateur gear. So enthusiastic was the response that we have undertaken a compilation of the suggestions and were able to select many outstanding requests for early publication.

While it is impossible to completely satisfy each and every reader every month, we do strive for an editorial balance which will fulfill the needs of the majority. The tremendous growth of RADIO NEWS confirms our belief in maintaining a well-balanced format.

Many of you made the suggestion that every article published should be completed on one or two pages without having to dig into the back of the book for what we call "runback." Unfortunately, this is not mechanically workable in most cases. If each ad were a full page, this could be done. At any rate, we are attempting to streamline our constructional articles so that whenever possible they will be completed without any runback. This, of course, will make it far easier for the reader to follow the text and to immediately refer to the accompanying diagrams.

Hundreds of our salesmen-dealers are becoming more and more concerned with the future sales of radios, television sets, parts and accessories. Accordingly, we are now preparing a new series of articles which will present, in simplified form, the basic formulas that have been successfully worked out in selling that type of merchandise.

We have also found that thousands of readers are vitally interested in simplified "how to make it" articles. A new department therefore will be set up to cover this interest and the staff will build and describe such units for those who are intrigued with simple gadgets and electronic equipment.

An ever-growing interest is being shown by the amateur for u.h.f. transmitter design and technique. For the most part, these "hams" have had previous experience on the 160 meter band. They are interested primarily in local rag chews and are not too much concerned with a DX contact.

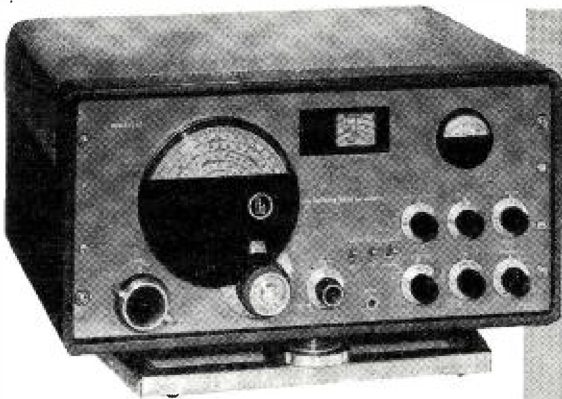
New and unique applications for the miniature tubes have been requested by our readers. At this writing, many types are not available but when they are we'll print plenty of articles on ultra-compact receiving and transmitting equipment making use of these "tiny bottles."

Other helpful suggestions were made —too numerous to mention. I should like to express my thanks to all of you for your fine cooperation in helping to design your radio magazine along the lines that will be of the greatest interest and assistance to you. We are planning to send such questionnaires periodically in order to keep pace with your interests. With twice the circulation of any other radio publication, the task of satisfying everyone becomes a real problem. This is particularly true when we consider that radio to us is no longer a mere entertainment media. Our profession and hobby has branched out into a very large electronic group. Accordingly, there are those who have found their niche in some highly specialized branch of radio-electronics who require an entirely different type of material than those of us who have remained in one particular branch of radio for some time.

The Citizens' Radiocommunication band is a good example of what to expect in the way of new services and developments. Since keen interest has already been shown in this service, many radio men have already begun to lay the ground work for future sales and service of two-way units. Let's not overlook the ever-growing interest in television. You can sell, in advance, by telling your customers about TV. Make it known that you will be able to supply them with sets and to install and maintain them when television programs are available in your town.

Yes, we are indeed in a new era of radio. The annual Radio Parts and Electronic Equipment Shows, Inc. is fully cognizant of the desirability of showing the myriad of new products to the radio serviceman, the amateur and even the public at large. A special Open House Day has been inaugurated in connection with the Show to be held in Chicago next May which will enable many radio-minded men and women to get a preview of things to come. We think it is a splendid idea and will do much to gain prestige for the serviceman and amateur. We'll see many of you there in person and we want you to make yourselves known.

We will again publish the RADIO NEWS DAILY at the Show this year as a service to the radio industry. Be sure to get your complimentary copy.
. . . . O.R.



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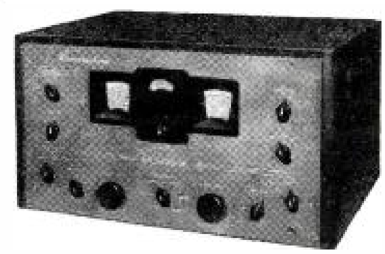
NEW!

HALLICRAFTERS SX-42

Here's the NEW SX-42—the receiver that sets a new standard in radio performance. Covers everything: Frequency range of 540 KC. to 110 MC. brings you high-fidelity broadcast reception—world-wide Short-wave coverage—PLUS true high-fidelity FM broadcast reception (all FM frequencies), and hi-fi phono reproduction. The new SX-42 is brilliantly designed to bring you more features, more operating thrills than you've ever thought possible. Wide-vision no-glare dials, AM-FM signal level meter, six-position selectivity control, dual IF system, separate sensitivity and volume control, NEW SIMPLIFIED controls for family use. Designed for top-flight reception—in the home, or for Amateur and Commercial communication work.
Net, less Speaker.................... **$275.00**

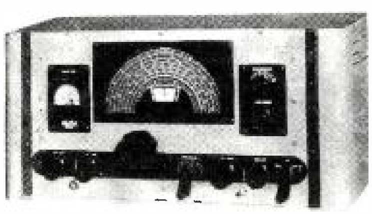
NATIONAL NC-2-40D

One of National's top receivers. Covers 490 KC. to 30 MC. range in 6 tuning bands. Has definite, accurate calibration for all bands. Features efficient single-dial control. Famous for its stable high frequency circuits. Frequency drift is reduced to a negligible value by temperature compensation. Has automatic band-in-use indicator. Wide-range adjustable series-valve-noise limiter. Flexible crystal filter. Special r.f. coupling circuits maintain full sensitivity.
Net, less Speaker.............. **$225.00**
Speaker in matching cabinet, *Net*.. **$16.44**



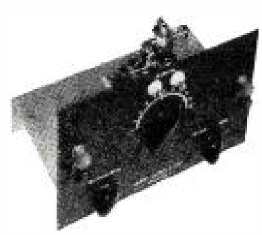
HAMMARLUND HQ-129-X

Designed to meet the most critical demand of professional operators. Full range, .54 to 31 MC. accurately calibrated. Has 4 calibrated Ham bands and one arbitrary scale. Variable selectivity crystal filter. Low-drift beat oscillator for code and locating stations. Antenna compensator. Voltage regulation. Automatic noise limiter. Compensated oscillator to reduce drift during warm-up. Earphone jack. Three i.f. amplifier stages. Two audio stages. Speaker supplied in matching metal cabinet.
Net, with Speaker.............. **$173.25**



THE RME 45

The famous RME 45 Receiver delivers peak reception on all frequencies—550 to 34,000 KC. Features full-vision calibrated dial using a single control for two-speed tuning. Includes five Amateur bands with ample band-spread. Has DB-calibrated signal level meter; 5-step variable crystal filter; Automatic Noise Suppression; stable, variable-pitch beat oscillator, and a host of other features. Housed in handsome streamlined metal cabinet with matching speaker.
Net, with Speaker............... **$198.70**



SPECIAL! NEW 2-METER TRANSCEIVER KIT

For the new 2-meter band! Uses 6N4 as mod.-osc. in transmit position and as super-regen. det. in receive position; 7C5 as mod. in transmitting, and as power audio amp. in receiving. Supplies current for single button carbon mike; has output transformer for coupling to speaker or headphones. Requires 250 v. at 75 ma., 6.3 v. at .65 amp. for power. Kit when completed measures 6" x 5" x 9". Includes all necessary parts and tubes (less mike, speaker and power supply). No. 83-220. **NET**.................................... **$18.95**
Power Supply Kit. Includes all parts necessary to build power supply for transceiver. No 83-371. **NET** **$10.25**

Other Communications Receivers

Hallicrafters S-38	$47.50	RME-84	$98.70
Hallicrafters S-40A	89.50	RME VHF-152 Converter	86.60
Hallicrafters S-41G	36.75	RME DB-20 Preselector	68.20
National NC-46	97.50	National HRO	274.35
NC-46 Speaker	9.90	Hammarlund SPC-400X	342.00

Net F. O. B. Chicago. Prices subject to possible change.

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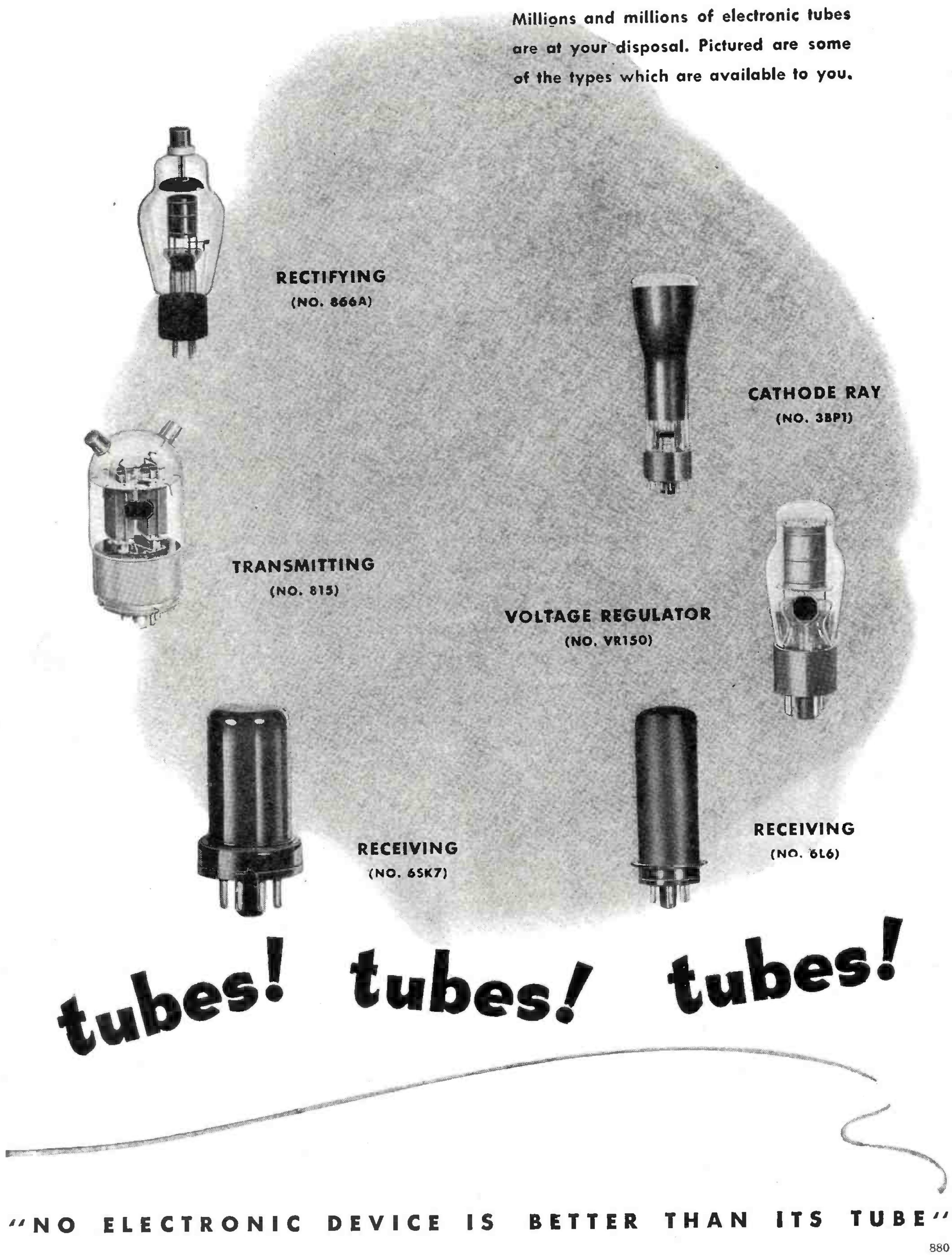
Millions and millions of electronic tubes are at your disposal. Pictured are some of the types which are available to you.
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(NO. 866A)
CATHODE RAY
(NO. 3BP1)
TRANSMITTING
(NO. 815)
VOLTAGE REGULATOR
(NO. VR150)
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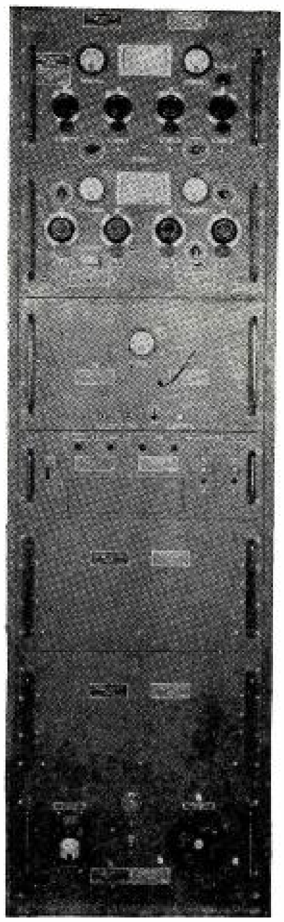
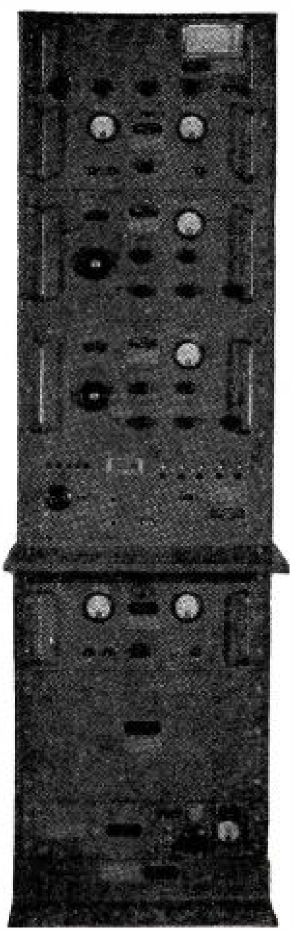
880



Transmitter

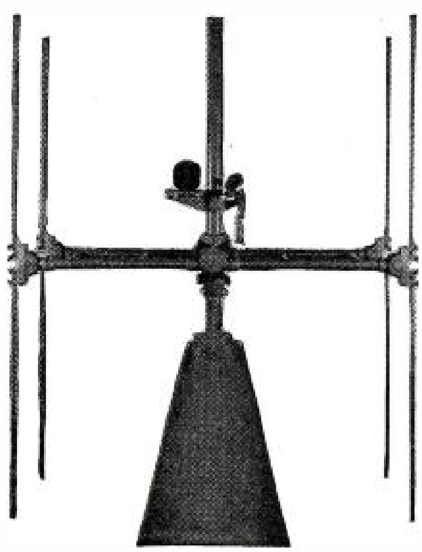


Receiver

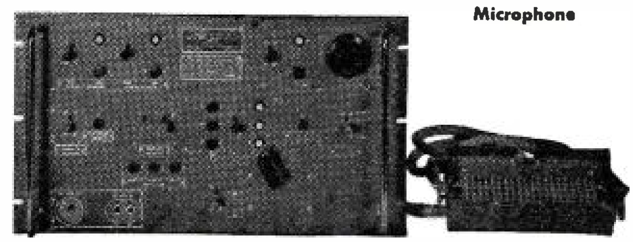
MODERN COMMUNICATION and PRODUCTION depend on Electronics

Today—virtually all methods of high-speed communication use electronic tubes. In the industrial field, heating, welding and various methods of control are being done better and faster because of electronics. From big broadcasting stations to tiny hearing aids—from induction heating to voltage regulation—the science of electronics is playing a major role in industry.

Microphone



Matching Stub and Antennae



Control Unit

Headset

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with a COMPLETE LINE of TEST INSTRUMENTS

IMMEDIATE SHIPMENT Please place your order with your regular radio parts jobber. If your jobber does not handle our line kindly write for a list of jobbers in your state who do distribute our instruments or send your order directly to us.

SUPERIOR SICO INSTRUMENTS CO.

Now you can SEE and HEAR

The signal with the new CA-12 SIGNAL TRACER

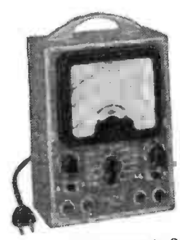
Always ready for instant use it takes less than five seconds to begin using this versatile unit. No maze of special cables—the Model CA-12 uses only one connecting cable. No line cord—the CA-12 operates on self-contained batteries. No tuning controls of any kind are used in this model.

FEATURES:

- Comparative intensity of the signal is read directly on the meter—*Quality* of the signal is heard in the speaker.
- Simple to operate—only one connecting cable—no tuning controls.
- Highly sensitive—uses an improved vacuum-tube voltmeter circuit.
- Tube and resistor capacity network are built into the detector probe.
- Built-in high gain amplifier—Alnico V. speaker.
- Completely portable—weight 8 pounds—measures 5½"x6½"x9".

The Model CA-12 comes complete with Detector Probe, test leads, self-contained batteries and instructions. Comes housed in heavy gauge crystalline cabinet with beautiful two tone etched front panel. **NET PRICE**.................... **$34.85**

The New Model 670 SUPER METER



A Combination VOLT-OHM MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes.
RESISTANCE: 0 to 500/100,000 ohms 0 to 10 Megohms.
CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (quality test for electrolytics)
REACTANCE: 700 to 27,000 Ohms 13,000 Ohms to 3 Megohms.
INDUCTANCE: 1.75 to 70 Henries, 35 to 8,000 Henries.
DECIBELS: —10 to +18, +10 to +38, +30 to +58.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½"x7½"x3"........................ NET **$28.40**

The New Model 650 SIGNAL GENERATOR

Ranges: 100 Kilocycles to 35 Megacycles on Fundamentals; 25 Megacycles to 105 Megacycles on Harmonics.

- RF obtainable separately or modulated by the Audio Frequency.
- Audio Modulating Frequency—400 cycles pure sine wave—less than 2% distortion.
- Attenuation—3-step ladder type of attenuator (T pad).
- Uses a Hartley Excited Oscillator with a Buffer Amplifier.
- Tubes: 6J5 as R.F. Oscillator; 6SA7 as modulated Buffer and Mixer; 6SL7 as audio oscillator and rectifier.

Complete with coaxial cable, leads and instructions............ **$48.75**

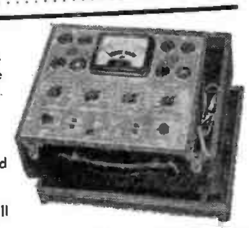
The New Model 450 TUBE TESTER

Speedy operation—assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

- Tests all tubes up to 117 volts.
- Tests shorts and leakages up to 3 Megohms in all tubes.
- Tests both plates in rectifiers.
- New type line voltage adjuster.
- Tests individual sections such as diodes, triodes, pentodes, etc. in multi-purpose tubes.
- Noise-Test—detects microphonic tubes or noise due to faulty elements and loose internal connections.
- Uses a 4½" square rugged meter.
- Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.............................. **$39.50**

The New Model 600 SET TESTER



A NEW COMBINATION TUBE TESTER AND MULTI-METER. A complete testing laboratory all in one unit. Test tubes. Reads A.C. Volts, D.C. Volts, D.C. Currents, Resistances and Decibels.

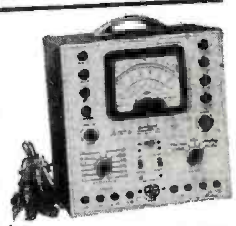
TUBE TESTER SPECIFICATIONS:

- Speedy operation—assured by newly designed rotary selector switch.
- Tests all tubes up to 117 Volts.
- Tests shorts and leakages up to 3 Megohms in all tubes.
- Tests leakages and shorts of any one element against all elements in all tubes.
- Tests both plates in rectifiers.
- Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- New type line voltage adjuster.

MULTI-METER SPECIFICATIONS:

D.C. VOLTS: (At 1,000 Ohms Per Volt) 0 to 7.5/15/75/150/750/1,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma., 0 to 1.5 Amperes.
RESISTANCE: 0 to 2,000/20,000/200,000 Ohms, 0 to 20 Megohms.
DECIBELS: (Based on zero decibels equals .006 Watts into a 500-Ohm line.) —10 to +18 D.B., +10 to +38 D.B., +30 to +58 D.B. **$62.50**

The New Model 400 ELECTRONIC MULTI-METER



A combination vacuum-tube voltmeter and volt-ohm milliammeter plus capacity, inductance, reactance, and decibel measurements.

SPECIFICATIONS:

D.C. V.T.V.M. VOLTS: (At 11 Megohms Input Resistance.) 0 to 3/15/30/75/150/300/750/1500/3000 Volts.
D.C. VOLTS: (At 1,000 Ohms Per Volt.) 0 to 3/15/30/75/150/300/750/1500/3000 Volts.
A.C. VOLTS: (At 1,000 Ohms Per Volt.) 0 to 3/15/30/75/150/300/750/1500/3000 Volts.
D.C. CURRENT: 0 to 3/15/30/75/150/300/750 Ma., 0 to 3/15 Amperes.
RESISTANCE: 0 to 1,000/10,000/100,000 Ohms; 0 to 1/10/1,000 Megohms.
CAPACITY: (In MFD.) .0005—.2, .05—20, .5—200.
REACTANCE: 10 to 5M (Ohms), 100—50M (Ohms), .01—5 (Megohms).
INDUCTANCE: (In Henries.) .035-14, .35-140, 35-14,000.
DECIBELS: —10 to +18, +10 to +38, +30 to +58. **NET.** **$52.50**

SUPERIOR INSTRUMENTS CO.

Dept. RN 227 FULTON ST., NEW YORK 7, N. Y.

MODEL 4706

The Regent

Post war is a term that can be applied, honestly and proudly, to this 1947 Air King model. Beauty and good taste mark the design and finish of the cabinet. Appealing lines, artistic proportions, and the contrasting dial all contribute to the Regent's visual appeal. When you first see the Regent, you like it instinctively. When you hear it you know your first impression was right.

You—and your customers—
will appreciate these keen-value features

Precision, die-cut antenna for maximum signal . . . Modern illuminated, white-on-black airplane tuning dial gives maximum readability, and forms artistic design element of the set . . . Loudspeaker of Alnico No. 5 alloy gives exceptional volume without tone distortion . . . Beam Power Pentode Audio System brings new tone and definition to familiar programs. The Regent is a 6 tube Superheterodyne (including rectifier). Operates on AC or DC, and is available in Ivory (illustrated above) and Walnut Plastic Cabinets.

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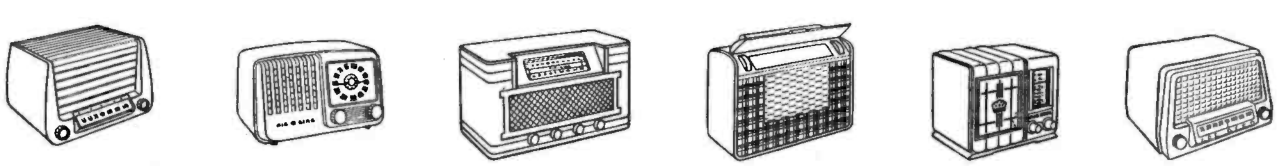
RADIO

Division of HYTRON RADIO & ELECTRONICS CORPORATION, Brooklyn, N. Y.



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For years and years on end—for as long as 1946 receivers are in use—Volume XV will continue to pay you annual cash benefits by providing authorized time-saving servicing data complete and bound in a systematic form, always ready for easy reference. For 16 years Rider Manuals have proved their value. For 16 years they have constantly been improved; the owners of Volume I, purchased 16 years ago are still deriving benefits from it. A library of Rider Manuals is a lifetime-profit-paying-investment.

Volume XV incorporates the latest Rider "first"—"clarified schematics," a plus service on which we have spent tens of thousands of dollars in order to save you hundreds upon hundreds of hours each year. Also, with each copy of Volume XV there is included the separate book "How it Works," a practical guide to the theories of operation of the new technical features of the latest receivers. It explains the functions of those "gimmicks" and "gadgets" which can cause time-wasting headaches if not recognized and understood. These and other exclusive analyses by our engineers will be found in "How it Works" another Rider "first."

Many post-war sets are equipped with record players and changers; these are covered in Volume XV.

All the popular brands of "Ham" communication receivers are included in Volume XV.

You are brought up to date on all Scott receivers by Volume XV.

Yes, on the 1984 pages of Volume XV, covering the sets of 121 American Manufacturers and the 150 pages of "How it Works" you will find the data and services that will make it pay its profitable way for years to come.

Be sure of your copy. Avoid disappointment, place your order with your jobber today.

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On "Alternating Currents in Radio Receivers"
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On "D-C Voltage Distribution" $1.25 each

This new Rider Book, soon to be announced, will be of lasting usefulness to everyone interested in any phase of radio.

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By FRED HAMLIN

Washington Editor, RADIO NEWS

TO OUR READERS

A sufficient supply of the glue ordinarily used in binding the January, 1947, issue of Radio News was not available at the time the magazine was being printed and therefore a substitute material was used on some of the copies. In some cases this substitute adhesive used for binding failed to do a good job of holding the magazine together.

Any reader having such a copy may return it to us for replacement. We regret the inconvenience resulting and assure you that it was in no way due to carelessness.

FM, LIKE WE SAID last time, is getting organized on a national basis from headquarters in Washington and with the enthusiastic blessing of no less than the Federal Communications Commission. First steps toward activating a group of FM station executives was taken at the National Association of Broadcasters convention in Chicago in the early winter, and a complete organization, with program, was drawn up at the first all-FM convention, held in Washington early in January.

PUBLICIZING AND PROMOTING FM nationally is the first order of business in the new outfit, which bears the name "Frequency Modulation Association," with headquarters at 810 International Building, Washington 4, D. C. Scores of FM station heads have already joined under the leadership of the Washington-led group which spark-plugged the FMA. These included Roy Hofheinz, Leonard Asch, Wayne Coy, W. R. David, Everett L. Dillard, Gordon Gray, F. A. Gunther, Ira A. Hirschmann, E. J. Hodel, C. M. Jansky, Jr., R. F. Kohn, and Stanley Ray.

FCC ENTHUSIASM FOR FM and an FM station organization was summed up by chairman Charles R. Denny. Denny recently told FMA: "An organization such as yours, concentrating on the building of FM, can perform one of the most valuable services in the history of broadcasting. Those of us close to radio are excited over this revolutionary improvement, but to the vast majority of listeners, FM is still just another alphabetical combination. It is highly gratifying to know that your group has embarked on a crusade to carry the story of FM to every radio listener in the land." That the crusade will have financing was indicated early in the FMA's career. "Our dollars will be spent for FM promotion," said its steering committee. An all-out national publicity campaign may be expected during the spring, summer, and fall as a result.

IF YOU HAVE ANY FURTHER DOUBT about FCC's attitude toward FM, listen to Commissioner Ewell K. Jett: "FM," he declared recently, "is now established on a sound, permanent postwar basis. In all, we at the FCC expect some two thousand of these FM stations in the next few years—nearly twice as many as the present number of standard stations." He sounds a note of warning to the general public, however: "FM receiver production is troubled by the same shortages that afflict so many other industries. But FM sets are coming on the market in increasing numbers. The latest estimate is that at least five million will be produced next year." Mr. Jett's advice to the prospective buyer of a new radio: "If I were buying one today, I would certainly not buy one that did not include FM."

SPEAKING OF PRODUCTION, every indication at year-end was that it will continue generally good, despite supply and labor difficulties. Latest complete figures—for October—showed shipments that month at a new all-time peak. Domestic radio sets, including phonograph and record players, increased 20 per-cent to 1,800,000 units over September, according to the Civilian Production Administration.

COLOR TELEVISION—whether it will come into its own tomorrow or years hence—may develop into the jackpot radio question of the year. It was brought up with fanfare before the FCC in December largely at the urging of the Columbia Broadcasting System. While RCA and NBC, both working in the color field, favor taking more time to perfect their methods. Frank Stanton, president of CBS, went so far as to declare that Columbia could start colortelecasting within a few weeks, if FCC permits are forthcoming. "Substantial, regular" programs were predicted "within a year." . . . Reason for the FCC hearings was the Columbia request for FCC to set standards for

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☐ **Check here if veteran of World War II** color television commercial broadcasts "immediately" on 480 to 920 megacycles, bands now classed as experimental. Opening these bands would give color opportunity to develop into national networks, another prediction that Stanton felt Columbia could make good in the near future. He added that CBS had spent approximately two million dollars in experimenting during the last two years. . . . What the ultimate decision would be, nobody was willing to predict as this went to press. A good bet; some kind of television with color in the commercial field by 1948.

FOREIGN RADIO ACTIVITIES will come into the electronics news again in April, with a number of interesting developments promised. Occasion will be the International meeting of the Marine Radio Aids to Navigation groups from interested nations. The meeting will last two weeks, convening first in New York City, followed by a gathering at New London, Conn., where marine radio aids will be demonstrated to the 250 U. S. and foreign delegates expected to attend. Three ships will be used in the demonstrations, one from the Coast Guard, one from the U. S. Maritime Commission, one from the Coast and Geodetic Survey. What will be demonstrated has not been crystallized, but you can count on seeing radar, sonar, loran, and advanced types of ship-to-shore radio in action. . . . Also on the international docket for the immediate future are the international radio conference, scheduled for May, place yet undecided, but probably San Francisco; the international plenipotentiary conference in July, and, following, a meeting of high frequency experts, scheduled tentatively for August or September. No locations have been chosen for the last two. . . . The May meeting will be to revise the regulations of the 1939 Cairo conference, while the plenipotentiary gathering will amend and change the 1932 rulings of the Madrid convention. Participating nations at all three meetings will approximate the membership of the United Nations.

SHORAN WILL BE ONE OF THE THINGS to watch with interest at the New London, Conn., meeting, although it is just the opposite of an aerial device. Kept under blankets by the Navy and Army during the war and still obscured by military redtape, it is the pet of the Coast and Geodetic Survey, which uses it for mapping the ocean bottom. Geodetic has four sets, costing $50,000, and wish they could get more. It operates on a one-way echo principle, a hydrophone (waterproof microphone) sending a sound to a land-based receiver. Underwater sound has been found to travel best at 4200 feet, and hydrophones are set at that level if possible, with cables carrying the sounds to shore from the hydrophone base. . . .

Navy is using it in its Pacific-air-sea rescue project, by triangulating messages picked up by the phones. A plane in trouble or lost may drop a bomb that explodes at the 4200-foot level, and the phone pickups, when graphed on a map, give the plane's exact location in a few seconds. Hydrophones are being strategically located so that rescue ships may reach distressed planes in three or four hours after a bomb call for help has been dropped. Shoran is accurate within twenty-five feet, Coast and Geodetic scientists report.

RETURNING HOME, the recent coal strike pointed the way toward a radio revolution which might have resulted in all the school kids of the nation staging a strike of their own. With schools closing, Justin Miller, president of the National Association of Broadcasters, urged members from coast to coast to offer broadcasting facilities for classroom work. A lot of stations took him up on the suggestion, including Denver, where school-free kids were suddenly brought up short by the announcement that lectures and lessons would be broadcast. We can only imagine their reaction, but it did not reach any high boil, owing to the end of the strike. Seriously, radio stood ready to do a magnificent emergency job, as Mr. Miller's statement to the broadcasters indicated. "This (strike) situation," he said, "presents a valuable opportunity for the individual broadcasters to demonstrate again their desire and ability to operate in the public interest. Dr. John W. Studebaker, U.S. Commissioner of Education, endorses our recommendation that stations in affected areas contact the superintendent of schools and offer the services of broadcasting in meeting the emergency."

FOREIGN ACTIVITIES in all fields of radio would seem to be booming, according to reports received by an interested Washington bureau. Surprising—to us, at least—is word from England that there are now from 25,000 to 30,000 television sets in the hands of the public over there, with the broadcasters giving full programs daily, including plays and coverage of news and sports events. (FCC estimates only 10,000 sets in the U.S. as of year-end, 1946.) Reason for the British lead in the field is that they started television ahead of us before the war, and had a comparable jump on the market when the shooting stopped. From Africa comes word via the Department of Commerce that the Union of South Africa may furnish a profitable, substantial market for U.S. electronic products in the future. Total estimated number of radio sets in operation are half a million. Radio is popular—communities are isolated in many instances, and use the air to keep posted and entertained. The Union suffered less than almost any other place from the war—prospered, indeed, on gold mining, wool, hides, and other native products. U.S. products are popular and war restrictions did not permit purchase of new equipment. Imports are under no special restrictions if they are in the radio field.

NO RESTRICTIONS on importing radios into Argentina is a rule favorable to U.S. marketers, although State Department and other experts warn that anyone desiring to go into the Argentine should make a close study of all rules and regulations before attempting it. Estimates of consumption, while varying, are all good. A reasonable guess would be about a million receivers, more than half radio-phonograph combinations. War-born radio manufacturing plants in the country offer potential competition to outsiders, and high tariffs have been raised to protect the home industries. "Imported goods continue to retain a reputation for higher quality," says a Department of Commerce authority, "and United States firms can therefore still compete successfully, although high tariffs tend to restrict the market."

HAMS CONTINUE TO DEVELOP all kinds of gadgets, notably the recent job of reconversion by 33-year-old Edward McIntyre, a Naval research laboratory employe by day, a ham by night, at his home in Silver Springs, Md. He's converting a surplus tail-warning radar set from a B-29 into a domestic home-to-auto radio hook-up. McIntyre estimates that his set will have a range of from ten to twenty miles, and has an FCC experimental permit to operate it. How he's making it work is still a mystery, but if you want to hook up with him his ham station is W3KHJ.

THE CITIZENS RADIOCOMMUNICATION service—under which McIntyre got his experimental license—is shaping up under FCC supervision. Latest Commission move, begun in the early winter, is to get together with manufacturers to prepare technical requirements for equipment to be used in the field. FCC got the ball rolling by suggesting a list of requirements, but emphasized that the suggestions were not "to be regarded as proposed rules but as a preliminary proposal designed to organize discussion and comment." Suggestions from the industry were aired at subsequent meetings in Washington, and final rules should be forthcoming before spring. . . . Chief nut for the manufacturers to crack, according to FCC, was the ability of citizens' equipment to operate, "under all practical service conditions, on a frequency or frequencies within the allocated bands 460-470 mc." Whatever the final rules, FCC is agreed with everybody else that "the possible uses of this service

(*Continued on page* 163)

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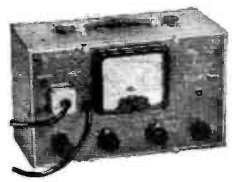

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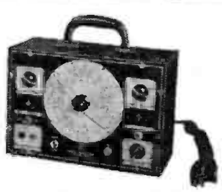

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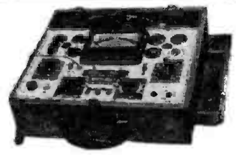

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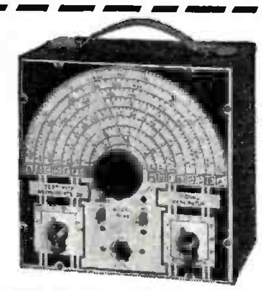

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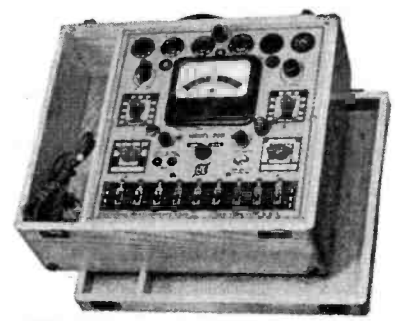

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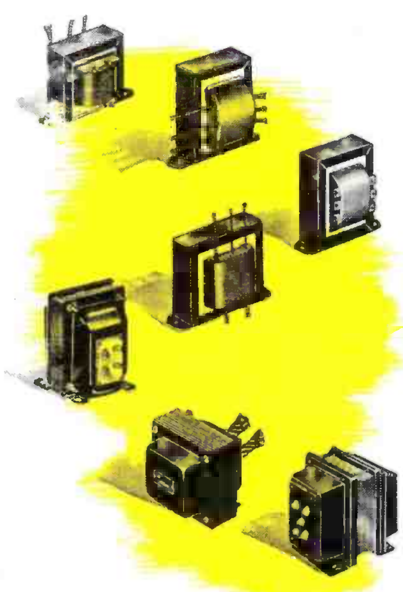

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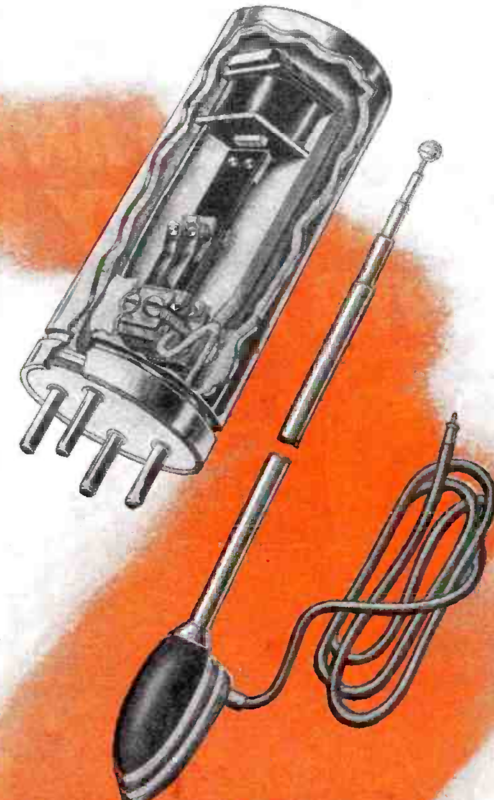

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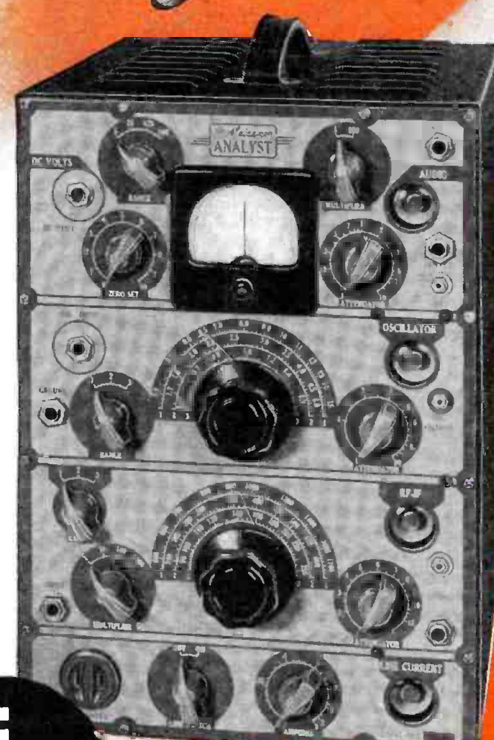

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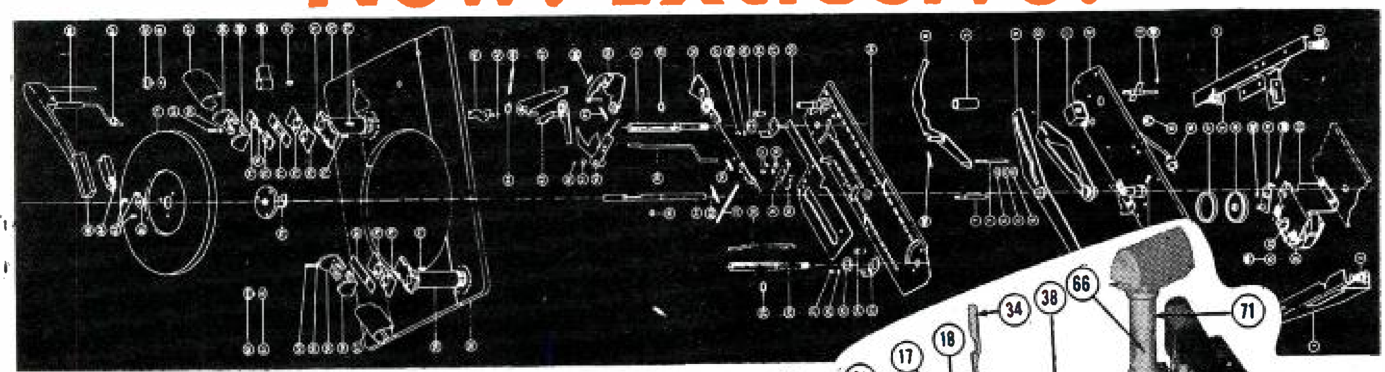

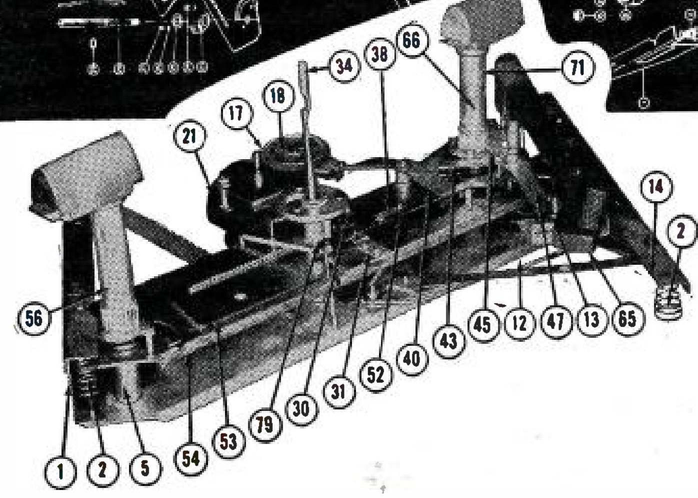

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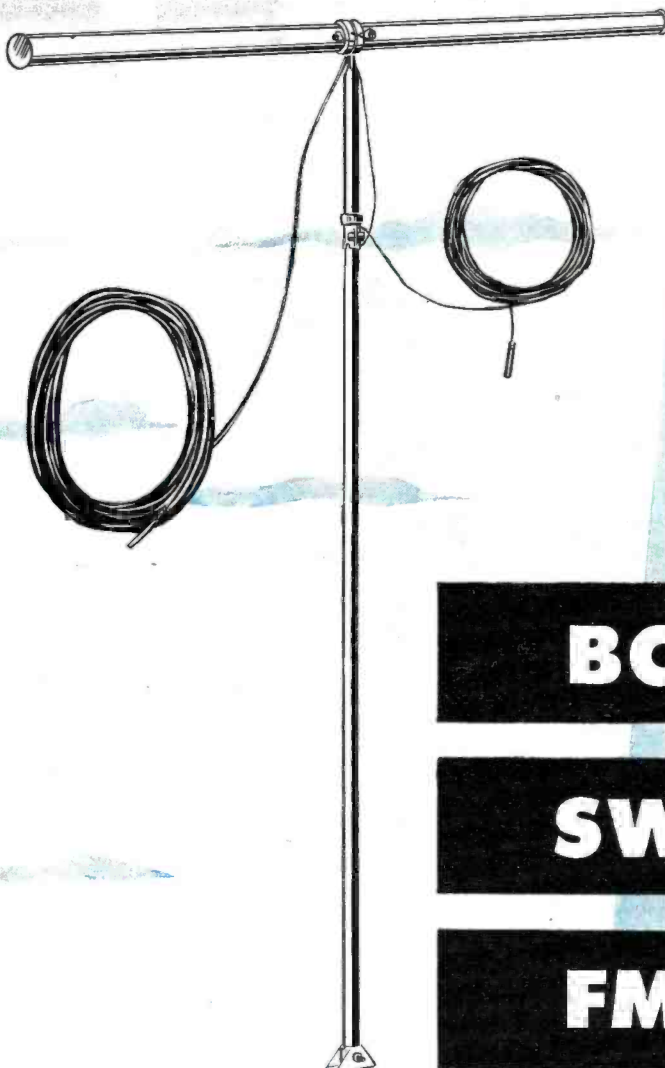

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The FM section of this new 3-way antenna is a horizontally polarized dipole. It operates most efficiently between 88 and 108 mc.

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A specially designed series M derived low-pass filter automatically switches the energy from the proper antenna to receiver input.

Installation is simple. The mounting is a 1-inch steel mast 5-feet in length. All hardware is included. A guy clamp bolted to the mast provides for tripod guying.

Vinyl-jacketed Amphenol 52 ohm coaxial transmission line serves as a low-loss lead in and eliminates interference from transmission line pickup. Noisy areas are not a problem with this antenna.

In a comparative test with the best available standard double doublet (with matching transformer) the Amphenol All-Wave Antenna proved far superior in gain—as well as being interference free.

Write for complete technical data, or see your jobber for full information.

AMPHENOL ALL-WAVE ANTENNA UNIT INCLUDES:

- ★ FM dipole with molded phenolic weatherproof filter housing
- ★ Steel mast 5-feet long with guy clamp and adjustable insulator
- ★ 50-feet Amphenol RG-5/U 52 ohm coaxial cable
- ★ Antenna wire polyethylene covered
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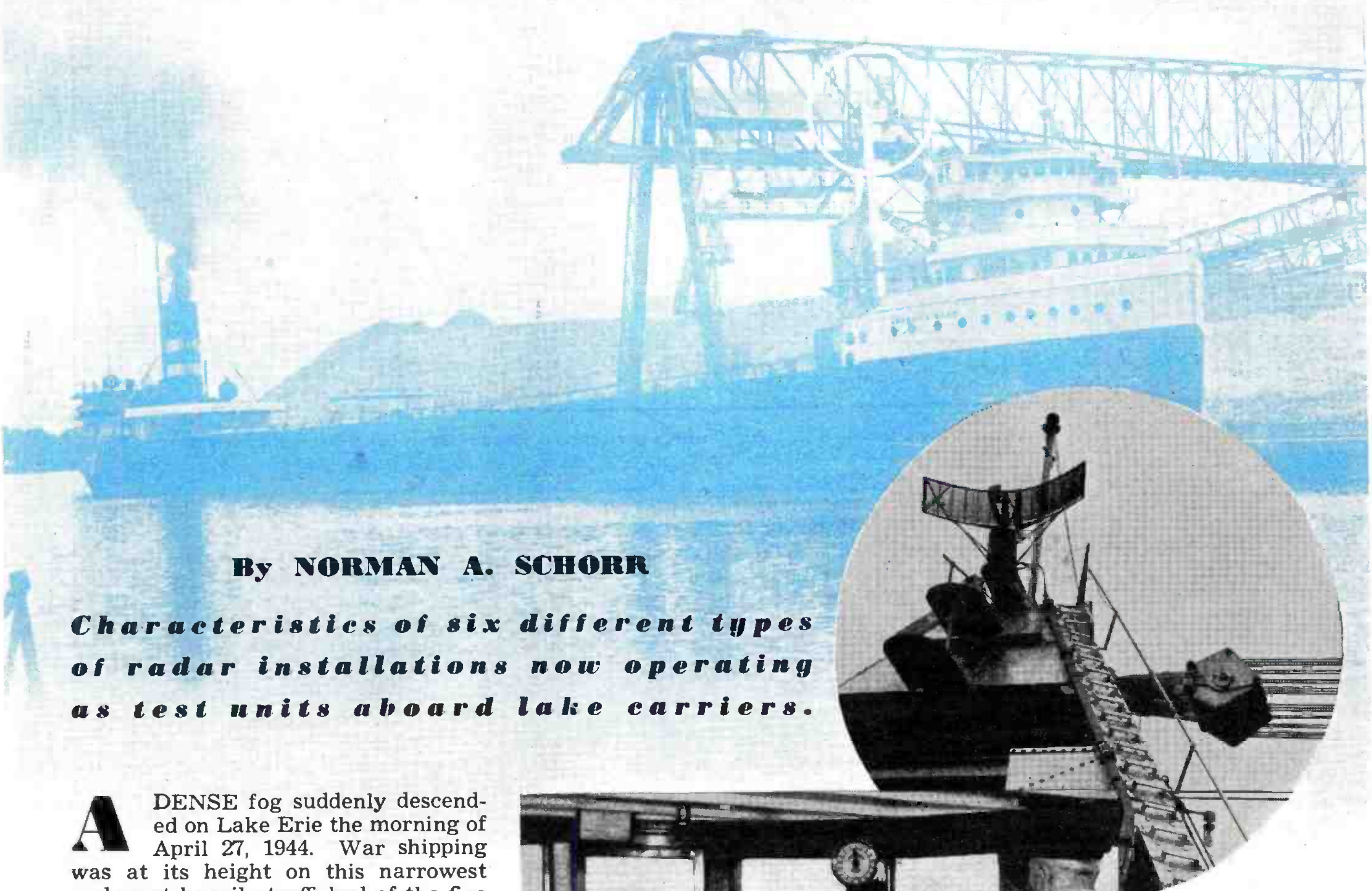
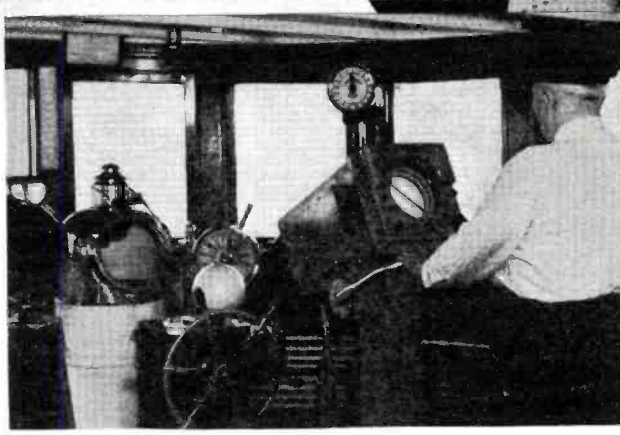
Radar on the Great Lakes



By NORMAN A. SCHORR

Characteristics of six different types of radar installations now operating as test units aboard lake carriers.

The ship "George F. Rand" was assigned to Raytheon for their radar installation. The wave guide run from the antenna to transmitter is 70 feet. The indicator, housing a 7" PPI, can be tilted 45 degrees vertically and rotated through 45 degrees horizontally.



A DENSE fog suddenly descended on Lake Erie the morning of April 27, 1944. War shipping was at its height on this narrowest and most heavily-trafficked of the five Great Lakes. Within a few hours, two collisions occurred that cost the lives of 12 crew members and the loss of two cargo-laden ships. Without warning, the ore-carrier *James H. Reed,* collided head-on with the steamer *Ashcroft,* and sank quickly off Conneaut, O. Seventy-five miles west, the 4000-ton *Frank E. Vigor,* carrying a load of sulphur from Chicago to Buffalo, foundered and sank after colliding with the *Philip Minch.*

Accidents like these are rare in Great Lakes shipping history. In fact, they have occurred on Lake Erie an average of once in 20 years since the advent of steel vessels in 1886. Stringent traffic rules, a special system of whistle signals, carefully routed up and down courses, and more recently radio telephone, radio beams and direction finders have combined to hold down the number of accidents.

But still they have occurred—and when they do, the need for all-weather navigation instruments is emphasized.

Though collisions caused by fogs have been infrequent, it is not unusual for skippers to be forced to drop the hook and wait until adverse weather conditions lift. Fog is encountered frequently in the spring and fall, and occasionally at other times. In the late fall, storms of sleet and snow can be expected. In a recent year more than 4,000,000 gross tons of cargo space were lost as a result of delays, collisions and groundings due to fog. Bad weather has held up ships for as long as 30 hours. As many as 100 boats have been fog-bound at the locks of the Sault Sainte Marie canal at one time.

Great Lakes shippers took an immediate interest in radar as soon as the first successful marine application became known. Experience of the Coast Guard with radar during the war was watched as closely as security regulations permitted. A few sets were installed for brief trial runs, but extensive equipment for thorough experimentation was not available. It was not until after V-J Day that the shippers through their Lake Carriers Association initiated an active program, called the Radar Operational Research Project, to develop radar equipment best suited for Lake operations.

They needed a navigation aid that would make possible close-range sailing in thick weather. Such a radar design would of necessity have high accuracy and definition at close quarters and would be capable of clearly showing shore lines, other ships, and the comparatively small buoys and channel markers.

It was decided that the radar re-

Manufacturer	Band	Diameter of PPI (in inches)	Range Scales (in miles)	Transmitter Peak Power Output (in kw.)	Modulator	Pulse Length (in microseconds)	Pulse Repetition Rate (in cycles per second)	Antenna Construction	Beam Pattern at Half Power Points	Polarization	Rate of Antenna Rotation (in r.p.m.)	R.F. Transmission Line
GENERAL ELECTRIC	10 cm.	7	2, 6, 30	7	Pliotron	0.5	1500	Truncated Parabola	Vertical: 17° Horizontal: 5°	Vertical	11	Coaxial
RADIO-MARINE	3 cm.	12	1.5, 5, 15, 50	30 or more	"Hard" tube 5D21	Short Range: 0.25 Long Range: 1.0	3000 750	Parabolic Cylinder	Vertical: 18° Horizontal: 1.7°	Horizontal	10	Wave Guide
RAYTHEON	10 cm.	7	1.5, 5, 15, 50	15 or more	Hydrogen Thyratron	0.4	1000	Truncated Parabola	Vertical: 12° Horizontal: 3.5°	Horizontal	7	Wave Guide
SPERRY	3 cm.	12	2, 10, 40	35	4C35	0.25	1000	Parabolic Cylinder	Vertical: more than 15° Horizontal: 2° or less	Horizontal	15	Wave Guide
WESTERN ELECTRIC	3 cm.	7	1-40 (variable)	40	Hydrogen Thyratron	0.5	1000	Truncated Parabola	Vertical: 15° Horizontal: 2°	Horizontal	12	Wave Guide
WESTINGHOUSE	3 cm.	7	2, 8, 32	15 or more	Hydrogen Thyratron	0.4 (maximum)	2000	Truncated Parabola	Vertical: 15° Horizontal: 2°	Horizontal	12	Wave Guide

Table 1. Characteristics of radar sets installed in Lake Carriers Association's Radar Operational Research Project.

search men and engineers should be brought in direct contact with Great Lakes navigation personnel, so that each group might become familiar with the problems of the other. To this end, radar manufacturers were invited to install sets aboard a Lake cargo vessel during the 1946 season. Six manufacturers accepted the invitation and each was assigned a different ship on which to make an experimental installation that would operate on the Lakes. Upon conclusion of test runs and evaluation of results, minimum operating specifications will be set forth.

Since the Lake Carriers Association represents 90 per-cent of the bulk cargo carried on the Lakes, this project is being followed with great interest in marine shipping circles, particularly with regard to inland waterway navigation.

The busy Great Lakes are connected chiefly by rivers and dredged channels, some of which are no more than 600 or 700 feet in width. On an average trip a freighter will spend 25 to 30 per-cent of the time traveling in these confined waters.

Among the most tortuous of these are in the entrance to the locks of the Sault Sainte Marie Canal between Lakes Superior and Huron; the Straits of Mackinac between Huron and Michigan; the St. Clair flats and Detroit River between Huron and Erie; and the Welland Canal between Erie and Ontario.

One of the narrowest and most inadequate of the dredged channels is the 700-foot wide Southeast Bend around Harsens Island, in the delta of the St. Clair River. It is in an area subject to sudden fog. Up and down traffic must squeeze through a 2½ mile stretch of reverse bends that afford slight clearance. Each season the Bend sees about 20,000 vessel passages, carrying 90 to 100 million tons of ore, coal, grain and stone.

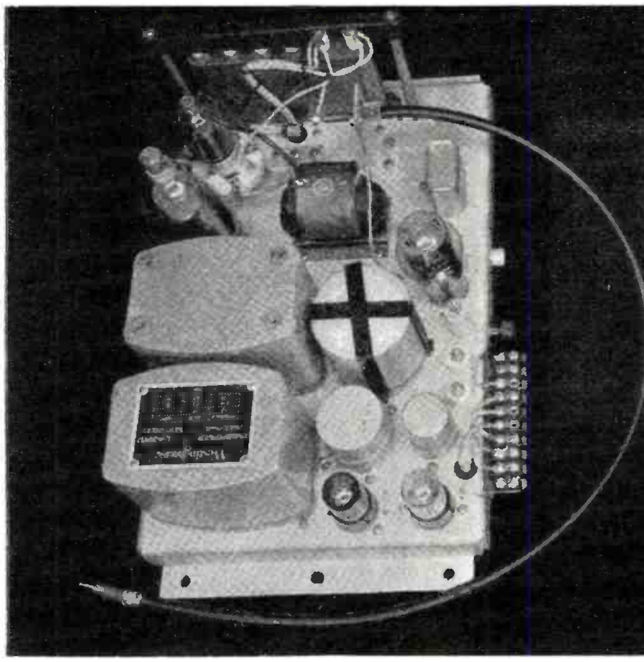
Another tight spot is the 4½ mile long West Neebish Channel, down bound from the Sault Canal. There, shores are as low or lower than a vessel's deck. Three miles of the channel are only 600 feet wide. Then it narrows for 5000 feet to a width of only 300 feet, and a depth of 24 feet, 8 inches—blasted through rock.

Typical ones of the larger bulk cargo vessels are 600 feet or more long, 60 feet wide and travel at a speed of 11 to 13 land miles per hour. All in all there are about 800 commercial vessels of both American and Canadian registry plying the Lakes, almost half of them major type vessels.

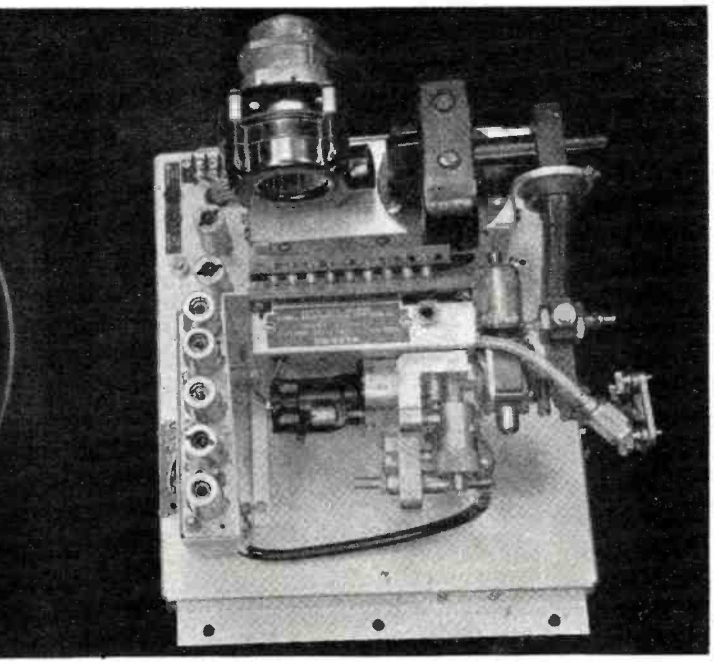
During busy times there is a two-way procession of ships going through the man-made locks and channels sometimes only 15 minutes apart. It is not difficult to visualize how impairment of visibility as a result of fog, sleet or other thick weather can seriously hamper traffic and even paralyze all navigation.

Indicator binnacle of the Sperry Gyroscope set houses 12" PPI and associated controls. Visible are range selector switch, variable range marker, bearing cursor, anti-clutter selector switch, and azimuth scale illumination control.

The parabolic reflector in the scanner component of the Sperry Gyroscope marine radar is 48 inches by 18 inches and rotates 360 degrees in azimuth at about 15 revolutions per minute. Contained in the splash-proof box are a driving motor (split-phase 1/8 horsepower squirrel cage induction motor) and a type 5G synchro generator.



Modulator section of the Westinghouse set is located in the weatherproof base of the antenna pedestal. Action of the sine-wave oscillator, blocking oscillator, and thyratron tube, all shown in the picture, triggers the magnetron 2000 times per sec.



Radio frequency head of the Westinghouse set is also installed in the lower section of the antenna pedestal. It contains the magnetron oscillator, the crystal detector, local oscillator, and the high-frequency circuits associated with them.

During fogs, a phenomenon known as "aberration of sound" often occurs and contributes to make navigation more hazardous. On such occasions, "dead spots" appear on the Lakes. In these areas whistle signals from approaching vessels either cannot be heard or are distorted so that they seem to come from a source other than their true one.

Other aspects of Great Lakes shipping that affect the job that radar is being called on to perform:

Extreme length of travel in the Lakes from Duluth to Montreal is more than 1300 miles, but the main movement of ships is over the 1000-mile run between the upper Lakes and Lake Erie. Sailing season averages eight months, from about April to December, when the Lakes are free of ice. During this period a bulk cargo vessel may travel a distance equal to 2½ times the earth's circumference at the equator, making port at least twice a week, for about 4 to 5 hours at a time.

Compared to similar salt water vessels, these Lake carriers are somewhat larger and travel a few miles faster. During the war they delivered 4½ times the total tonnage carried by all of America's merchant marine fleet on salt water.

The master of one of these vessels cannot sail down the winding course of a river or channel by setting a compass course as is done in ocean sailing. He must follow a course marked by buoys of various sorts. At night his course is indicated by red and green lights on top of these markers, in addition to a heading taken on the range lights. When the skipper reaches an open lake area the widely separated up and down courses are followed by compass bearings in reference to special shore lights.

Unlike the salt water master he cannot call on a harbor pilot, and a tug or two, to guide him into each of the 80-odd major ports on the United States and Canadian shores. He himself controls all the ship's movements from the time she raises anchor in the spring until she is laid up at the end of the season. An additional navigation problem is presented by the fact that many of the Lakes harbors are located at mouths of rivers.

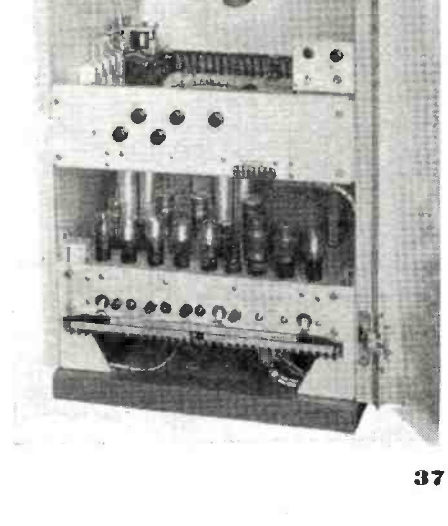
This was the picture when the radar manufacturers entered the program last year.

The surface search sets they installed are principally simplified versions of the military and naval designs in widespread use during the war. They are designed for reliable operation without the attention of technical personnel. A navigator can operate a radar set after an hour of practice. Installed to give a maximum over-all view of the horizon, they furnish a continuous radar picture of the waters surrounding a ship, detecting the presence and location of shore-lines, buoys, lighthouses and other vessels, with respect to the radar-equipped ship.

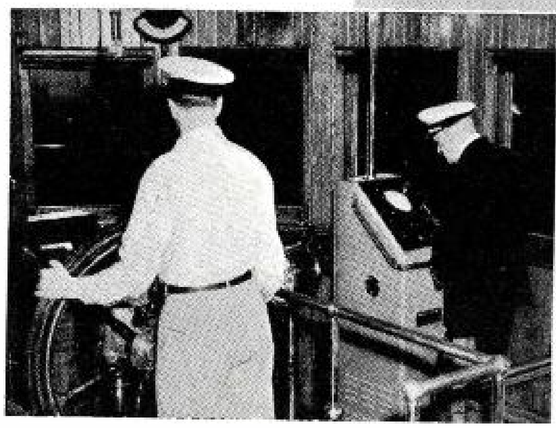
Unlike military radar sets which included the so-called A-type indicator, the simplified marine radar sets depend solely on the PPI (Plan Position Indicator) to give the ship's navigator range and bearing information. This is accomplished by transmitting short pulses of ultra-high frequency radio energy at a rapid rate. These powerful radio waves are concentrated in a beam that is narrow in the horizontal plane and comparatively wide in the vertical plane. They strike objects in their path and are scattered. A small fraction of the original waves is reflected back to the rotating antenna, which in the interval between pulses serves as the receiving antenna. The reflected waves are amplified and fed to the fluorescent screen of a cathode ray tube where they are translated into spots of light.

Factors governing the determination of a range reading include an object's size, shape, reflectivity, height, radar sensitivity and the wavelength of the radar set. But in general, radar horizon is the basic limiting factor for maximum range readings. In other words, a large object will loom higher

Indicator console in the Westinghouse installation. Below the seven-inch PPI and its controls and circuits are the low voltage power supply and the intermediate and video frequency amplifiers.



A GE parabolic reflector installed atop the pilot house of the "Ernest T. Weir." First Mate Gallagher and Captain Hartman are inspecting the installation.



Captain Hartman, a veteran of more than 40 years' service on the Great Lakes studies the PPI of the General Electric "electronic navigator" aboard ship.

on the horizon and will offer a larger reflecting surface; hence it will be able to be detected at greater distances.

Since radio waves travel at a constant speed of 186,000 miles per second—like light—measurement of the time it takes for a signal to travel out and bounce back gives a reliable reading of range, or the distance between the ship and the object. On the sets in this project, readings are accurate to within approximately one or two percent.

The face of the scope is calibrated in miles. Maximum range can be varied, in steps, depending on how large an area the operator wishes to scan. Concentric marker rings, equally spaced, can be superimposed on the screen of the cathode ray tube to aid in estimating range. The minimum range at which an object can be detected is 100 yards and the maximum with any of the sets is 50 miles.

Transmitting a pulsed high-frequency signal is accomplished in this way: A high voltage pulse of microsecond duration causes a magnetron to oscillate. The resultant signal is sent to the antenna through a wave guide or coaxial system and directed into space by a reflector.

Reflected energy is returned to the transmitter and detected in an r.f. section, where an i.f. signal is produced according to the superheterodyne principle. The i.f. signal is then amplified and detected. This time a video signal is the result and it is sent to the PPI indicator circuits, modulating a narrow electron beam. This beam shows up as a line of light on the scope face, and as it rotates, leaves a trail of objects visible to the observer as bright spots.

In order that range information be accurate, indicator circuits are timed to start the electron beam's radial sweep each time the magnetron emits a pulse. As a burst of energy leaves the antenna the beam in the tube starts its movement toward the rim, and completes its journey in the interval between pulses. It is in this interval that the reflected signal is picked up by the antenna and fed to the PPI.

Rotation of the antenna is linked to the magnetic deflection coils around the CRT, thus synchronizing the rotation of the electron beam. Since the high frequency energy travels in straight lines and at such great speeds, the reflections show up in proper bearing.

As the antenna's beam sweeps across the bow of a ship, a radio line called a "heading flasher" is intensified on the PPI. When the picture is stabilized with North at the top of the scope, this flasher indicates ship's direction or heading.

Equipment for azimuth stabilization is provided with some sets to furnish a bearing with respect to true North. This is possible when a ship is equipped with a gyro-compass.

The radar picture is a continually changing one, and therefore the direction of any moving object may be noted. The path of another ship can be "observed" through a fog; and together with the use of navigational charts and standard techniques of seamanship, safe travel is made possible under adverse conditions.

In addition, an indication of an object's physical composition also can be learned from the blobs of light on the scope face. Shore lines are clearly outlined; rain appears as feathery masses. Buoys show up as small, but distinct dots. Ships may be accurately outlined, but more frequently resemble oval-shaped objects. A tug towing a barge often can be distinguished from two separate ships.

To help the receiver provide an accurate scope picture under varying conditions, it is equipped with STC (sensitivity time control), FTC (fast time constant) and AFC (automatic frequency control circuits.

STC suppresses "sea return," which is the reflection of signals from waves or particles of water. These signals impair observation of close target objects in rough weather. The STC circuit increases the receiver gain automatically with range, and is usually available to the operator in steps.

FTC breaks up large signals caused by interference or by closely-grouped targets. It is particularly useful in detecting objects like channel buoys in heavy "sea return" or heavy rain.

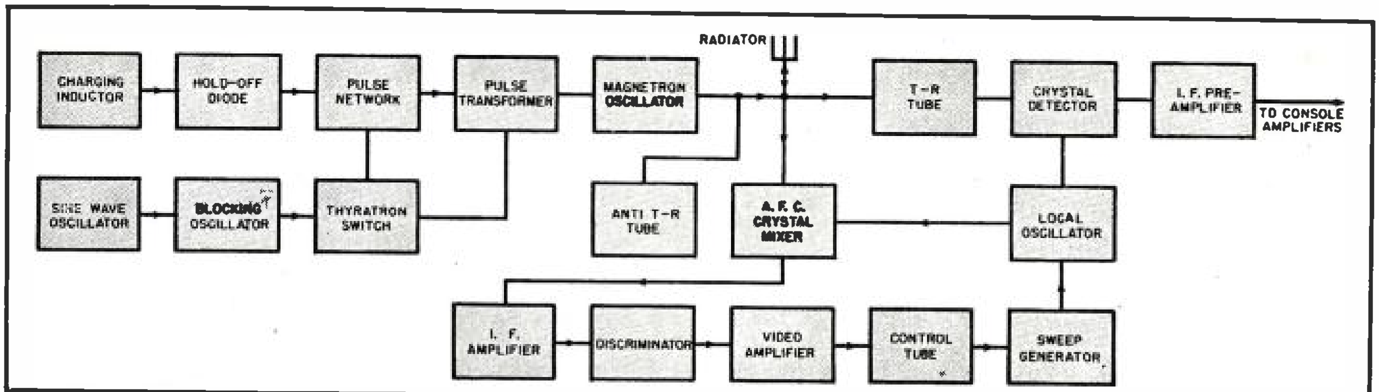
Automatic frequency control stabilizes receiver tuning with respect to the magnetron frequency.

Since one antenna is used for transmission and reception, the sensitive receiver must be protected during transmission periods. This is accomplished by a transmit-receive tube which fires and effectively short-circuits the receiver every time an outgoing pulse travels toward the antenna. To prevent any reflected power from being wasted by going to the quiescent magnetron between pulses, an anti-transmit-receive tube that presents a large impedance to the signal is employed.

The sets are designed to operate on

(*Continued on page* 144)

Modulator and r.f. head of Westinghouse radar set, including microwave section, a.f.c. control, and preamplifier.



Superregenerative Frequency Converter

Fig. 1. Panel view of home-built frequency converter.

This inexpensive, easy-to-build converter will extend your present communications receiver into the v.h.f. and u.h.f. region.

PRINCIPLE OF OPERATION

In the superregenerative frequency converter circuit, self-quenched, or one using a separate quench oscillator, the frequency of the incoming signal is changed to a new radio frequency (harmonics, see Table 1) that can be amplified and detected. The frequency is changed by means of the quenching process, the introduction into the circuit of an alternating voltage of a frequency above the audible range (20 to 200 kc.) in such a way as to vary the detector's operating point. As a consequence of the introduction of this quench or interruption frequency, the detector produces harmonics (Table 1) of the quench frequency which contain the modulation of the incoming signal. This quench frequency and/or its harmonics can be amplified thru a low frequency receiving system or radio frequency amplifier and the original modulation recovered.

This converter results in improved selectivity, sensitivity, and signal to noise (hiss) ratio. It detects and converts AM and FM signals, and acts as a limiter and a.v.c.

This conversion is not a heterodyne process, thus is able to convert direct to frequencies low enough that a stable, high gain amplifier may be used. It does not contain spurious r.f. signals known as "images," since conversion is a one step conversion and the high frequency does not have to be tuned so that other signals of another frequency will produce an output.

By

P. V. TRICE, W3QHS

and

M. BARAT Jr., W3KIL

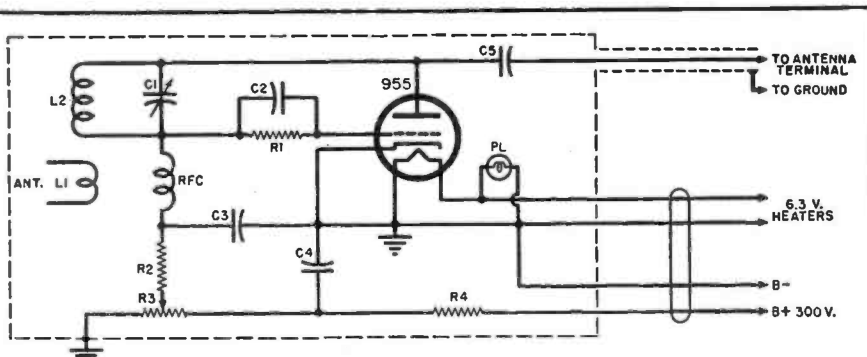
THE unit to be herein described provides a novel and inexpensive means of securing good reception of signals on the ultra-high and very-high frequency bands. The ultimate range which can be reached, must, of necessity, be determined by the type of tube used. The apparatus shown and described here was constructed primarily for use in the 144 mc. band but, if desired, the v.h. frequencies could be reached by the substitution of a Lighthouse tube. The principle involved, which consists of selecting a suitable quench frequency harmonic from the converter and feeding it through a low-frequency r.f.-audio outfit (receiver), is not basically new. Many ultra-high experimenters have, no doubt, at some time or other, noticed that the u.h.f. signals they were listening to on their superregenerative receiver, were, at the same time, receivable at a certain point on the near-by broadcast receiver. However, the signal from the latter was always distorted beyond the point of intelligible reception. This distortion was the result of the superregenerative receiver (local oscillator) overloading the input stages of the low frequency b.c. set.

In this converter, the distortion is eliminated by keeping the actual plate voltage applied to the tube to the minimum necessary to keep the self-quench action in effect; and by means of extremely loose coupling between the output of the converter and the input of the low-frequency receiver, controlling the amount of drive to the input of the low-frequency stages, and thus obtaining normal, distortionless reception.

Although the quench frequency may occur somewhere between 10 and 100 kc., depending on the particular set, let us assume, for the sake of simplicity, that the fundamental quench frequency is 50 kc. Then as shown in the chart (Table 1) the harmonics

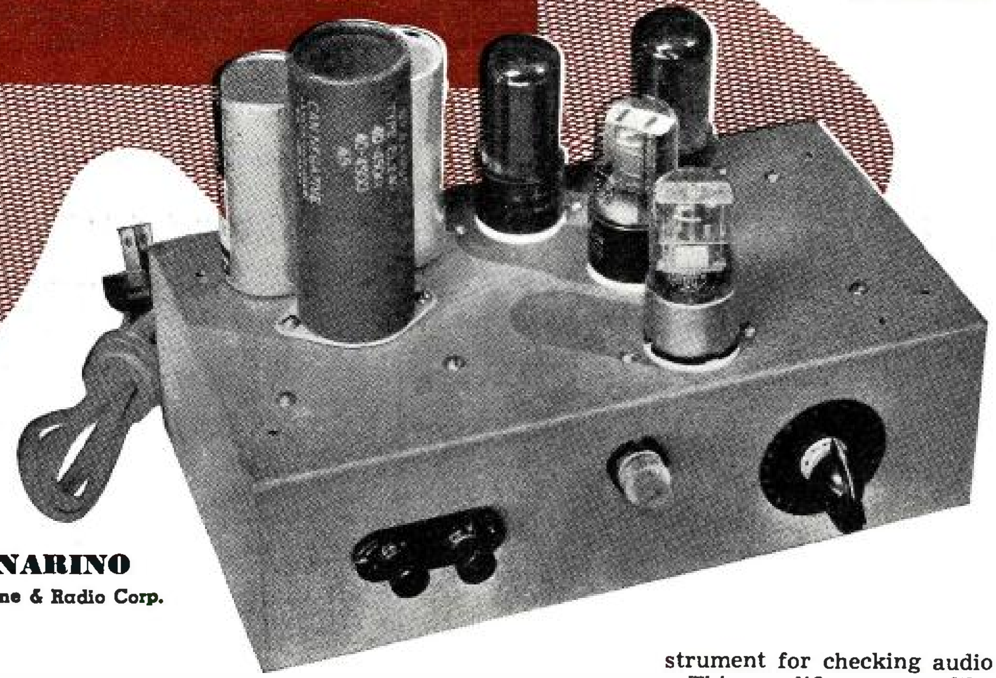
(*Continued on page* 133)

Fig. 2. Diagram of 144 mc. converter. Frequency range may be extended by substituting a "Lighthouse" tube. "A" and "B" voltages may be obtained direct from receiver.



R_1—500,000 ohm, 1/2 w. res.
R_2—15,000 ohm, 1 w. res.
R_3—50,000 ohm, w.w. 2 w. pot.
R_4—50,000 ohm, 2 w. res.
C_1—5 μμfd., variable cond.
C_2—100 μμfd., mica cond.
C_3—.01 μfd., 200 v. cond.
C_4—.05 μfd., 400 v. cond.
C_5—Coupling to be kept to a minimum to prevent blocking of receiver (see text)
RFC—U.h.f. choke
PL—6.3 v. pilot light
L_1—1 t., #14 wire, 1/2" dia.
L_2—4 t., #14 wire, 1/2" dia., 1/2" winding length

A.C.-D.C. AUDIO AMPLIFIER



Front-top view of completed amplifier. Note in particular that all transformers have been eliminated.

By
GEORGE EANNARINO
Field Eng., Federal Telephone & Radio Corp.

This 10 watt, 4-tube audio amplifier using the new selenium rectifiers is easy and economical to build.

THIS transformerless power supply, four-tube audio amplifier having a maximum power output of 10 watts has the added feature of incorporating a miniature selenium rectifier in place of a conventional vacuum tube. Use of the selenium rectifier not only enables this amplifier to weigh less, cost less, and occupy less space, but also due to the long life and high current carrying capacity of this rectifier, improves its performance and reduces power supply failures to a minimum.

Sensitive enough for crystal microphone or phonograph pickup and with only a 10% distortion between the frequencies of 40 to 15,000 cycles at 8 watts output, this amplifier should find extensive application in home receivers, telephone equipment, loudspeaker systems, and low power voice transmitters. Here is a compact, inexpensive amplifier, which can also be used as a self-sustained component in all types of combination sets, a pre-speech amplifier or modulator in amateur voice transmitters, or a test instrument for checking audio systems.

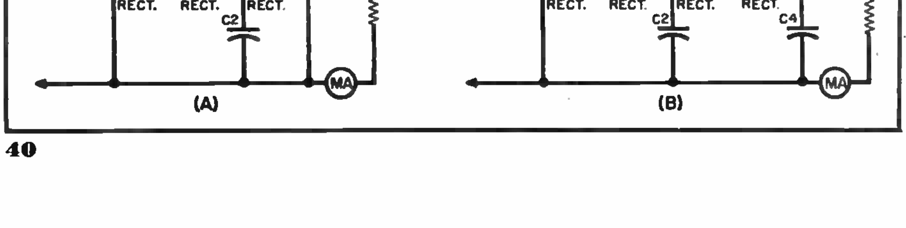
This amplifier can readily be incorporated into the original design of such equipment and offers the manufacturer an opportunity to cut his costs, speed production, and stimulate sales. Use of the selenium rectifier not only reduces the weight and size of the product, but also simplifies assembly and therefore saves production time.

As indicated on the schematic diagram, Fig. 2, this amplifier consists of three stages using four tubes—a 12SQ7 as the first audio, a 12J5 as the inverter, and two 50L6's in push-pull as the output. These circuits are conventional and it is only in the power supply, where no transformer is required, that this amplifier does not follow conventional design.

Elimination of the power transformer is accomplished by the use of two selenium rectifiers in a voltage doubler circuit which supplies 200 v.d.c. at 125 ma. to the two 50L6 output tubes. No filament is required either, since all the filaments are connected in series and are placed across the a.c. line. Thus a large saving in weight, space and expense is obtained without any loss in efficiency or performance of the amplifier.

The use of a rectifier in voltage multiplier circuits is in itself not novel and has been used before. However, when applied to vacuum tube rectifiers, this design is highly impractical. There are two reasons for this. In the first place, with the tube heaters connected in series in this type of chain circuit, there exists dangerously high potential differences between

Fig. 1. (A) Voltage tripler circuit using three 200 ma. selenium rectifiers. With 40 μfd. for C_1, C_2, and C_3, a d.c. output of 325 volts can be obtained with a load of 200 ma. (B) Voltage quadrupler circuit using four 200 ma. selenium rectifiers. With 40 μfd. for C_1, C_2, C_3, and C_4, a d.c. output of 425 volts can be obtained at 200 ma.



heaters and cathodes of the rectifier tubes at the high voltage end of the system. This difficulty might, of course, be obviated by the use of heater supply transformers but this destroys the simplicity of the system.[1] However, since selenium rectifiers do not use filaments, this problem does not exist when they are used. Low current rating, resulting in poor voltage regulation, is the second reason for the inadaptability of vacuum tubes to this type of a circuit.

From the theory of power supplies[2] it is known that the degree of regulation will depend to a great extent on the size of the condenser immediately following the rectifier (shunt condenser input-filter circuit). The size of this condenser, in turn, is limited by the current carrying capacity of the rectifier. Since a selenium rectifier will safely pass more current—both transient and steady state—a larger condenser can be used and improved voltage regulation obtained.

The voltage doubler circuit used in this amplifier is shown in the schematic diagram (Fig. 2). The maximum voltage output that could be obtained at 150 ma. is approximately 255 volts when a 40 μfd. condenser is used. Since only 205 volts are needed for the plates of the 50L6's a 22 ohm safety factor resistor and a 200 ohm dropping resistor are inserted in the circuit. The function of the 22 ohm resistor is both to drop the voltage and to limit the peak condenser charging current, thereby increasing the life of the selenium rectifiers.

Of course this circuit may be modified to meet any individual requirements. For instance a simple method whereby the 10 watts maximum output can be increased to 15 watts is to replace the 50L6 tubes with 6L6 and the 150 ma. selenium rectifiers with the 200 ma. type. Likewise lower powered amplifiers can be constructed using the a.c.-d.c. power supply circuit shown in Fig. 3.

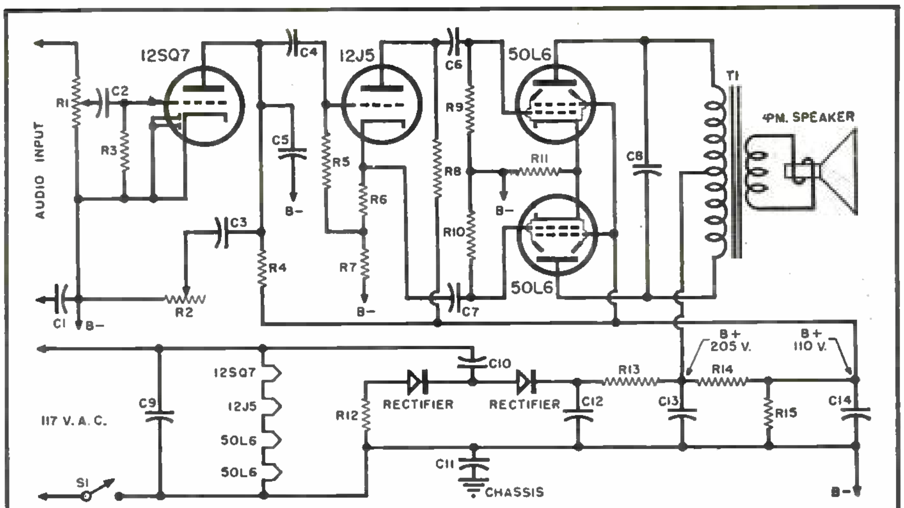
If even higher powered outputs are desired a voltage tripler or even quadrupler circuit, shown on Figs. 1A and 1B, can be utilized. The voltage tripler circuit can be used to power a 20 watt maximum output amplifier. In this case the same amplifier circuit is used except that a 6SQ7, 6J5 and two 6L6's replace the 12SQ7, 12J5 and two 50L6's, and a filament transformer is added to the power supply.

It should be noted that when these transformerless circuits are used, as indicated in Fig. 2, an isolated ground (chassis not d.c. ground) must be used. The reason for this is that the standard practice in most communities in the United States requires that one side of the house wiring be connected to ground at the electric meter. It is readily seen that if the power plug is so inserted in the outlet that the chassis is connected to the ungrounded side, the full line voltage can occur between chassis (if isolated ground is not used) and any other grounded conductor such as a waterpipe, radiator system or outlet face plate.

In order to use this unit in conjunction with other equipment a .05 μfd. condenser should be connected between the isolated ground and the chassis. This will provide adequate radio frequency grounding or by-pass of the power line[1] and at the same time, if the .05 μfd. value is adhered to, it will prevent the chassis from being at a high d.c. or 60 cycle potential.

—30—

[1] "Mallory Technical Manual"—page 59.
[2] Terman, F. E., "Radio Engineering"—pages 491-498.



R_1—500,000 ohm pot.
R_2—500,000 ohm rheostat (tone control)
R_3—10 megohm, ½ w. res.
R_4, R_7, R_8—250,000 ohm, ½ w. res.
R_5—1 megohm, ½ w. res.
R_6—2000 ohm, ½ w. res.
R_9, R_{10}—330,000 ohm, ½ w. res.
R_{11}—70 ohm, ½ w. res.
R_{12}—22 ohm, 1 w. res.
R_{13}—200 ohm, 5 w. res.
R_{14}—10,000 ohm, 2 w. res.
R_{15}—50,000 ohm, 1 w. res.
C_1, C_{11}—.05 μfd., 400 v. cond.
C_2—.01 μfd., 200 v. cond.
C_3—.006 μfd., 400 v. cond.
C_4, C_6, C_7—.02 μfd., 400 v. cond.
C_5—.0005 μfd., 400 v. cond.
C_8—.005 μfd., 400 v. cond.
C_9—.01 μfd., 400 v. cond.
C_{10}—40 μfd., 150 v. elec. cond.
C_{12}, C_{13}, C_{14}—40 μfd., 250 v. elec. cond.
S_1—S.p.s.t. toggle sw.
T_1—Output trans. Push-pull pri. to v.c.
Speaker—Permanent magnet type (Any size)
2—Selenium rectifiers (Federal #403D2787)
1—12SQ7 tube
1—12J5 tube
2—50L6 tubes

Fig. 2. Schematic diagram of 4-tube, 117 volt a.c.-d.c. audio amplifier.

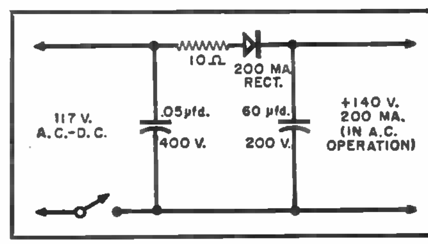
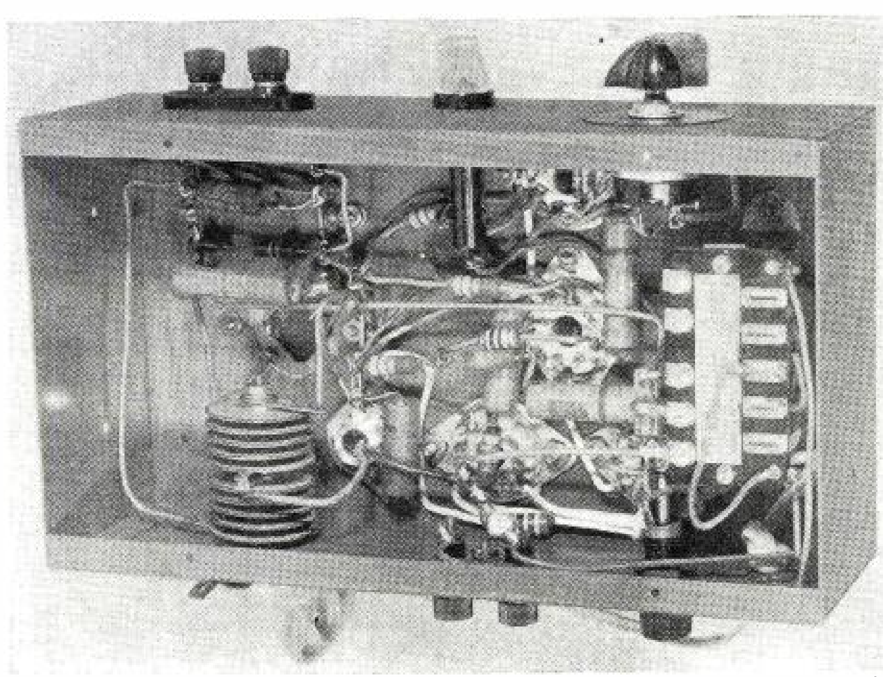


Fig. 3. Schematic diagram of an a.c.-d.c. selenium rectifier power supply which can be used to operate a 6 watt audio amplifier, using same circuit shown in Fig. 2.

Under-chassis view of amplifier shows position of the two selenium rectifiers.



Retailing Basics That Pay Off

What merchandise shall I carry?

How shall I dress my store?

By DR. LOUIS BADER

Assoc. Professor of Marketing
New York University

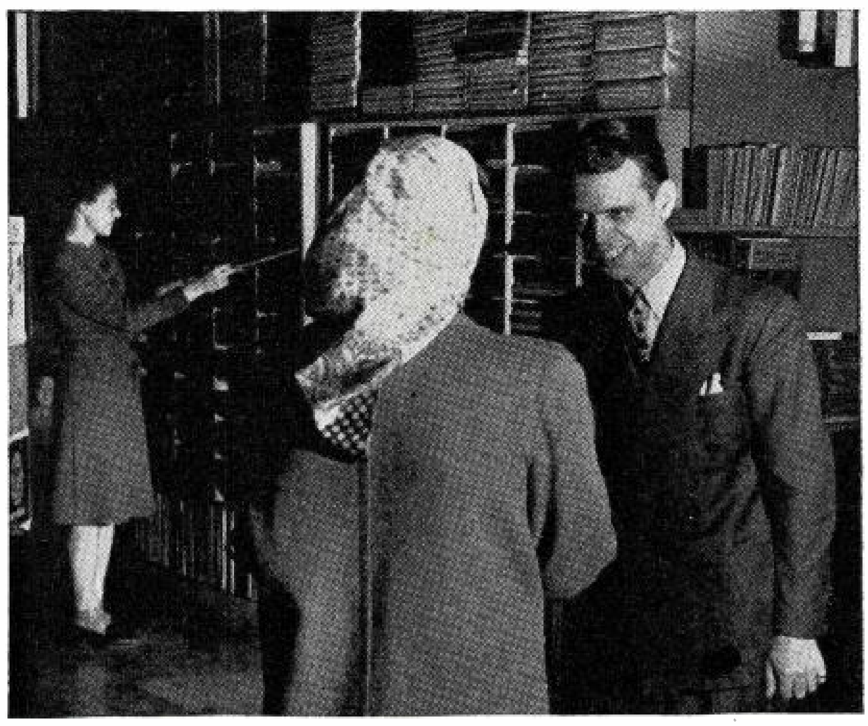
Although the points stressed by the author are not new, they are of sufficient importance to be reemphasized for both old and new dealers.

ONE of the most important problems a dealer has to face is how to get customers into his store to buy radios and appliances. This is the crux of successful retailing—sales promotion. Related to it is another problem which should be dealt with first, i.e., Dealer Sales Quotas and Allocation.

Manufacturers and national distributors estimate a total sales potential based on studies of recognized trading areas. A quota is set for each area. Dealers are then selected, usually with the understanding that they are to secure, from the areas they cover, a certain amount of business. When all of the dealers' quotas are added together the total should equal the manufacturers' sales potential. That much planning the manufacturers and national distributors must do.

The assigned quota for each item that the dealer handles should be made the *central point or core* of his sales promotion plan. Without such a point his sales promotion work may become chaotic, seem difficult to understand, and may be ineffective.

The foresighted dealer, unless in the country, will allocate a sales quota for each residential block in his area. The dealer's own marketing survey will furnish data for each block and provide complete information on the number of families, their incomes, and the condition of their homes. The dealer who carries a full line of appliances ought to sell \$1200 to \$1500 worth of merchandise to each family during the next five or six years, assuming that the period is one of full prosperity. It is also assumed that the trading area will average 1500 to 1600 occupied wired homes. Under these conditions and in a normal market, the aggressive and well-equipped dealer with sufficient capital, should do between \$200,000 and \$400,000 worth of business annually. A dealer with an especially full line of the smaller, and in some cases, "impulse buying" items might increase his sales volume and profits materially regardless of the size of the trading area. Conversely, stiff competition might reduce his share considerably.



The manner in which you and your employees greet your customers goes a long way toward establishing your company's reputation.

In connection with the sales quota, the dealer should work out some simple system of control which would enable him to keep tabs on his block sales as against expectations so that special attention could be given to those areas where sales do not meet the quota.

The over-all business that the manufacturer expects to secure is going to be divided among many types of dealers. Most department, furniture and variety stores are looking forward to establishing or re-establishing radio and appliance departments. They are usually very aggressive merchandisers. It is not too early, therefore, for other dealers to take stock of themselves as merchandisers, to check over what successful merchants have done, and to emulate them.

Observations and talks with many successful business men have provided several interesting conclusions:

1. *Personality of the dealer and his salesmen.* We are convinced that this is the most important single factor in the success of retailers and many other business men. We all have personality, some people have the right kind and others the wrong kind for this work. The right kind of personality suggests to the customer that the dealer is a pleasant sort of person who is sincerely interested in him and his desires. The atmosphere of the store should indicate immediately to the customer that the dealer and his employees are at his service. The dealer and his clerk should show by their attitudes and actions that they really want to serve the customer and that the size of the order is a secondary consideration. Customers should be greeted with a genuinely pleasant inquiry as to what can be done for them; an interest should be shown in their conversation, and their opinions should be respected.

People cease to patronize certain stores when their wishes and feelings are ignored by the owner and/or his sales personnel. No one likes to be ridiculed, thus, real or implied slights which border on ridicule constitute a sure way to lose customers.

Not everyone who enters your store will be blessed with your good taste. If some of the requests for merchandise seem ludicrous to you or your staff, they must still be treated seriously and the customer should be assisted as courteously as your most cherished sales prospect. Never forget for a moment that the most important subject in the world to any person is himself. You can never make a customer unhappy by letting him talk about himself, his problems, his ideas or his dreams.

While the very thought of being subjected to the whims of your customers leaves you with chills running up and down your spine and a defensive attitude that would do credit to the Marines, these are personality traits which can be developed—in fact, must be developed if you are to become a successful retailer.

2. *The merchandise to carry.* Equally important to the success of a retail venture is the choice of suitable merchandise. The dealer must know his trading area intimately, what merchandise his clientele can buy, and will want to buy. He should carry the most complete line of goods that his trading area can sustain. In addition to complete lines, he must also select merchandise in the price ranges which *his* customers can afford. This may entail carrying several price ranges within each product line, but each line should be the very best value for the money the customer has to spend.

A great many people know the nationally advertised lines. Dealers will, therefore, find it profitable to carry such lines. Since nearly all dealers seek brand lines, a particular dealer may not always secure the agency for the particular brand he would like to carry. In such cases he will take what he can get and be prepared to explain to prospective customers why *he has selected* the X washing machine rather than the Z machine. Each brand has its outstanding selling points and these then become the reason for the selection of that product by the particular dealer.

3. *The dealer's store.* It has been assumed that the progressive dealer will have selected the most advantageous location within his means, but his responsibility toward his store and his customers does not cease with this consideration.

The appearance of the store, both inside and out, is vital to securing and maintaining a good business reputation. First of all, the alert dealer will have a show window that does a real selling job. This is the customer's first contact with the organization—it must be effective. It goes without saying that the merchandise on display should be arranged in a neat and attractive array, and the over-all effect should be one of military cleanliness. This is important particularly in displays of appliances. The glossy white finishes of refrigerators, ranges, etc., will reflect every bit of dirt and soil on them.

The second point of contact with the dealer's store is the sales floor. Merchandise should be so arranged that demonstrations can be conducted easily without the necessity for removing merchandise from one part of the floor to another. Adequate provision should be made for convenience outlets in order that appliances can be operated for the customer's benefit.

In arranging the sales floor as a traffic builder, thought should be given to the placing of merchandise and service centers to the rear of the store in order to draw traffic through the entire merchandise display. The public utility companies put the cashier's window at the rear of the show room; the supermarkets put meat and dairy products at the back of the store, etc. This arrangement pays off in the increase in the purchase of impulse items. The wide-awake dealer will investigate the possibility of rearranging his show rooms to conform with these time-tested selling techniques.

4. *The presence of the dealer on the floor of his store.* Most people like to feel important and a pleasant greeting from the owner of the radio and appliance store will go a long way toward creating the feeling of goodwill engendered by such attentions. The presence of the dealer on the sales floor has two important aspects; he conveys the impression that he is interested in his customers and he keeps his sales personnel on its collective toes.

5. *Advertising the store and the product.* Since every dealer will advertise in some form or another, the important thing for the dealer to decide is how much he is willing to set aside for this purpose each year. After this sum has been determined, a breakdown should be made according to the media to be used; newspapers, handbills, direct mail, radio, etc.

Many manufacturers and national distributors have already given the

(Continued on page 164)

A well-wrapped package in distinctive paper is a good advertisement for you.

TRANSMISSION LINE SYSTEMS for FM & Television Home Receivers

By C. SPEAR

Conventional antenna systems with which most servicemen are acquainted in standard broadcast work will not suffice in FM and television installations. Each antenna system for these higher frequency bands must be individually "engineered."

THE trend toward the use of higher frequency bands for FM and television has accentuated the importance of an efficient transmission line system between antenna and receiver. For as the frequency goes up it becomes increasingly difficult to feed an adequate signal from the antenna to the receiver and every effort must be made to conserve the comparatively little energy that is available. For this reason high gain directive antennas become necessary in many localities, and by the same logic highly efficient transmission line systems must be installed.

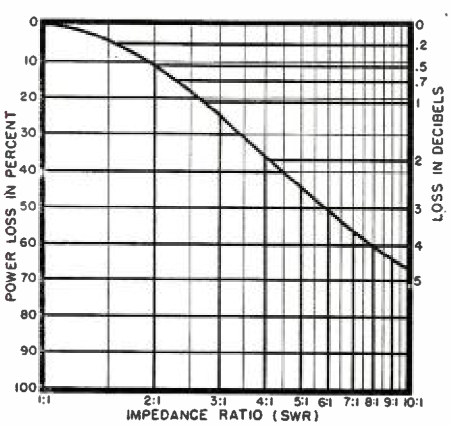


Fig. 1. Power loss that occurs when a mismatch of antenna to receiver exists.

Fortunately, due to the advances made during the war in the high frequency cable field, low-loss transmission lines are available at low cost and if used properly will transmit the energy picked up by the antenna to the receiver without undue loss. However, the word "properly" has a great deal of significance, for another adverse effect of the increase in frequency is to make mismatching more critical and unless transmission lines are installed with a complete understanding of this phenomenon they may be useless.

This latter statement is intended only to emphasize the importance of the problem, and not in any way to indicate a difficult or hopeless condition, for the remedy is both simple to perform and understand.

It is the objective of the author to unveil the mystery of matching and indicate the necessary calculations—requiring only a knowledge of fundamental multiplication and division, a straight edge, and some rule of the thumb procedures—with which the serviceman can solve virtually any of his transmission line problems.

Included in these h.f. cable line problems that can easily be solved are; how to match any antenna to any receiver whether it be FM, television, radar, instrument landing, Army, Navy or any other electronic device; the effect of mismatches in terms of power or signal lost and how they can be corrected; how to intelligently select the appropriate transmission line; the "net" gain of directive antennas. In addition to a discussion of these questions some of the terms frequently used in the field will be clearly defined and converted into simpler expressions.

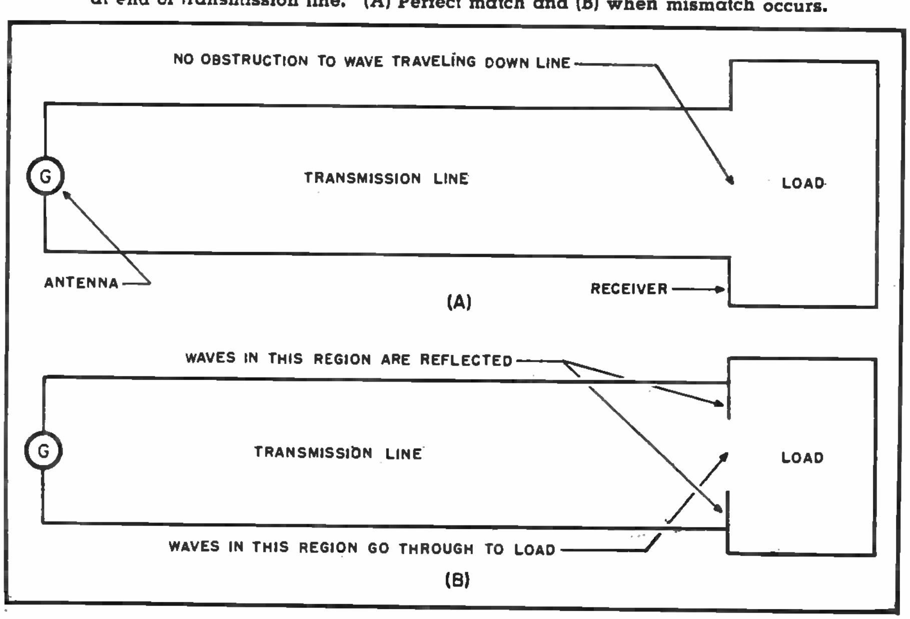
"Decibels," one of the terms that will be used very frequently throughout this article, should be carefully defined. The decibel, abbreviated db., is a numerical means of expressing the ratio of two compared powers or voltages. The following formula shows the relation between db. and power: db. $= 10 \log P_1/P_2$, where P_1 and P_2 are the two powers compared; or in terms of voltages where E_1 and E_2 are the two voltages compared, db. $= 20 \log E_1/E_2$, assuming that the two voltages are measured across equal impedances.

For example, if a dipole antenna normally picks up 1 microvolt of signal, and, after adding directive arrays, it picks up 10 microvolts, then the gain of the antenna in db. due to the array is: $20 \log 10 = 20$ db.

Likewise, if a transmission line receives 10 milliwatts from an antenna, but delivers only 5 milliwatts to the receiver then the power lost in the cable is: $10 \log 2 = 3$ db.

In order to simplify the calculation

Fig. 2. Semi pictorial representation of what an electrical wave experiences at end of transmission line. (A) Perfect match and (B) when mismatch occurs.



of the decibels gained or lost see the conversion table (Table 1). From this table the reader can convert db. into power or voltage ratios or vice versa without the need of logarithm tables or a slide rule.

There are three sources of power loss between antenna and receiver; mismatch between antenna and transmission line, attenuation or power loss in the transmission line, mismatch between transmission line and receiver.

Antenna Mismatch

One of the fundamental concepts of power transmission is that to obtain maximum power transfer, the output impedance of the generator (in this case the antenna) must be equal to the input impedance of the load (in this case receiver). Thus if the antenna resistance is 70 ohms, the receiver input should be 70 ohms, otherwise some of the power is lost. This is shown in Fig. 1, which is a graphic presentation of the signal voltage lost due to mismatch.

At the present time consideration of the antenna impedance is very important for two reasons. In the first place receiver input and antenna impedances may vary to a great extent due to the lack of standardization amongst the various manufacturers, and due to the fact that many surplus Army and Navy receivers, designed for use with special antennas, may be circulated for general use. Secondly the addition of directive arrays changes the antenna impedance, and therefore it is necessary to calculate the power loss due to mismatch in order to determine the net or effective gain of the antenna. For example a typical problem of this type might be:

Given: An antenna array which gives a 5 db. gain but changes the impedance from 300 ohms to 100 ohms. The original antenna was matched to the receiver—calculate the net gain.

Solution: From Fig. 1 we note that a 3:1 impedance mismatch ratio results in signal which is 25 per-cent or 1.2 db. less. The net gain is therefore only 3.8 db. It then becomes a matter of mathematics whether the extra expense is worth the resultant gain. Of course as the mismatch becomes greater, the effective gain decreases, and the array bcomes useless unless a matching network is utilized. However the matching can be performed rather simply, and the details will be discussed later in the article.

Attenuation of the Cable

The limiting factor on the minimum amount of power loss possible in any transmission line system is the attenuation or power loss of the cable; for any power lost due to mismatch can be corrected by means of matching circuits, but there is no remedy for the power lost due to the attenuation of the cable. Though there is no fixed standard, cable attenuation is usually rated in db. per 100 feet by most manufacturers. However, the power loss is proportional to the length of the cable. That is, 100 times more power is dissipated in a 100 foot cable than in a one foot cable. Therefore cable is sometimes rated in db. per foot instead of per 100 feet so that it will sound more efficient. For example, a h.f. cable whose attenuation is 20 db. per 100 foot (a very high value) could be rated at 0.2 db. per foot or 0.016 db. per inch.

Another factor that affects the attenuation is the frequency at which it is used; for the power loss of any h.f. line increases approximately as the square of the frequency. This is an essential fact particularly at the present time, since many of the cables are rated at the old FM frequency range of about 45 mc., and many manufacturers have not had a chance to reevaluate their cables so as to rate them at the new FM frequency band centering around 100 mc. Thus a 4-db.-per-100-foot cable rated at 30 mc., would be rated at approximately 6.8 db. per 100 feet at 100 mc.

Matching the Transmission Line To Load

All the sources of power loss discussed heretofore are not limited to high frequency receiver equipment, but apply equally as well to all types

LOSS		DB.	GAIN	
POWER RATIO	VOLTAGE RATIO		POWER RATIO	VOLTAGE RATIO
1.000	1.000	0	1.000	1.000
.977	.988	0.1	1.023	1.011
.955	.977	0.2	1.047	1.023
.891	.944	0.5	1.122	1.059
.794	.891	1.0	1.259	1.122
.631	.794	2.0	1.585	1.259
.501	.708	3.0	1.995	1.413
.398	.631	4.0	2.512	1.585
.316	.562	5.0	3.162	1.778
.251	.501	6.0	3.981	1.995
.199	.447	7.0	5.012	2.239
.158	.398	8.0	6.310	2.512
.126	.355	9.0	7.943	2.818
.100	.316	10.0	10.000	3.162
.010	.100	20.0	100.0	10.00
.001	.0316	30.0	1000.0	31.62

Table 1. Decibel conversion table. Power or voltage ratios can be converted to db. (or vice versa) without the need of logarithm tables or slide rule.

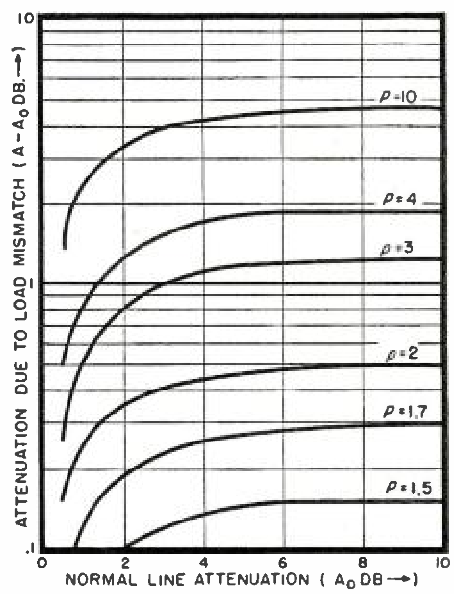


Fig. 3. Graph shows increment of attenuation as a function of the standing wave ratio (SWR) and normal line attenuation. Note in particular that the power loss due to transmission line mismatch does not become serious until the standing wave ratio is about 3:1.

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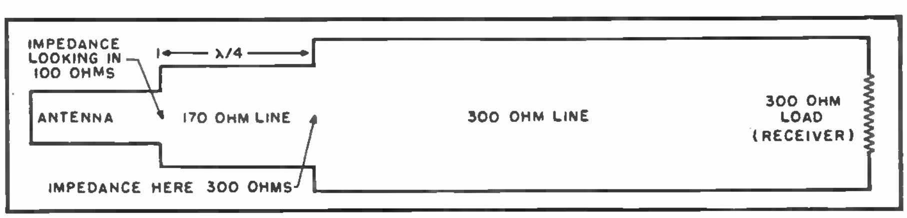
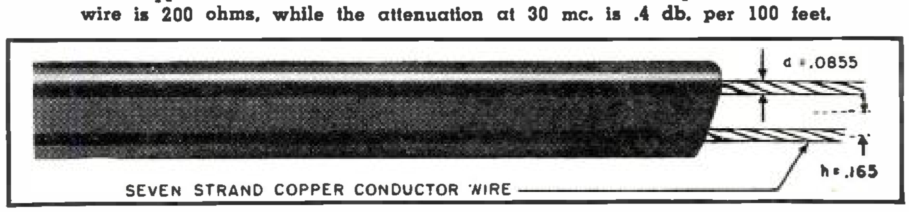


Fig. 4. Method of matching antenna to receiver via a quarter-wave transformer.

Intelin type K-200 antenna lead-in wire. The characteristic impedance of this wire is 200 ohms, while the attenuation at 30 mc. is .4 db. per 100 feet.



of apparatus regardless of their frequency. However, very little attention has been given to them in the past because in the AM broadcasting range power was plentiful and there was no need for a highly efficient transmission system. Matching the transmission line to the load is a problem met only in high frequency receivers. For, in the megacycle range, the transmission line must be terminated in a load whose impedance is equal to the characteristic impedance of the line, otherwise reflection occurs causing standing waves, and a subsequent increase of power loss. (An exception to this statement is the special case of tuned lines—but this phenomenon has no significance in the problems considered in this article.) Therefore a 70 ohm line must be terminated in a 70 ohm load or, from a more practical viewpoint, if the receiver input impedance is 70 ohms—then a 70 ohm transmission line should be used.

The idea of reflection and standing waves, and its relationship to power loss requires additional elaboration. Fig. 2 gives a pictorial representation of what an electrical wave experiences when it reaches the end of a transmission line for different load terminations. Fig. 2A indicates perfect matching, that is, all the power goes into the load—no obstacle in its way. Fig. 2B on the other hand shows a load which reflects about 50 per-cent of the wave. That is, the portion of the wave that travelled down the center, still goes unmolested into the load. The rest of the wave, however, hits the barrier and is reflected back down the transmission line. Then it hits the generator and the process is repeated. Again 50 per-cent of the wave goes through and the rest is reflected once again. Of course the generator is continuously sending out waves so that there is always a wave travelling in both directions which causes the phenomenon of standing waves. The magnitude of these waves is dependent on the amount of reflection that occurs, and is called the standing wave ratio.

Obviously if no power is lost as the reflected wave travels up and down the transmission line, eventually all the power will be transferred into the load. However, if attenuation does occur, then a certain percentage of power is lost due to each reflection, and it is this power loss that is considered to be the attenuation due to standing waves or mismatch. The magnitude of this increased attenuation is therefore proportional to two parameters. In the first place it is dependent on the percentage of the wave that is reflected back (the standing wave ratio) and secondly, it depends on the attenuation of the cable.

The standing wave ratio can be calculated as a function of mismatch. For example, if a 70 ohm line is terminated in either a 140 or a 35 ohm load the standing wave ratio will be 2:1. Fig. 3 is a graphic representation of the increment of attenuation as a function of the standing wave ratio (SWR) and normal line attenuation. As indicated in Fig. 3 the power lost due to transmission line mismatch does not become serious until the standing wave ratio is about 3:1.

The following is a typical illustration of how these calculations may be helpful.

Given: A 70 ohm input receiver requiring a transmission line 100 feet long. Available are a 6 db. per 100 foot, 70 ohm line, a 4 db. per 100 foot, 100 ohm line and a 3 db. per 100 foot, 300 ohm line. Which line should be used?

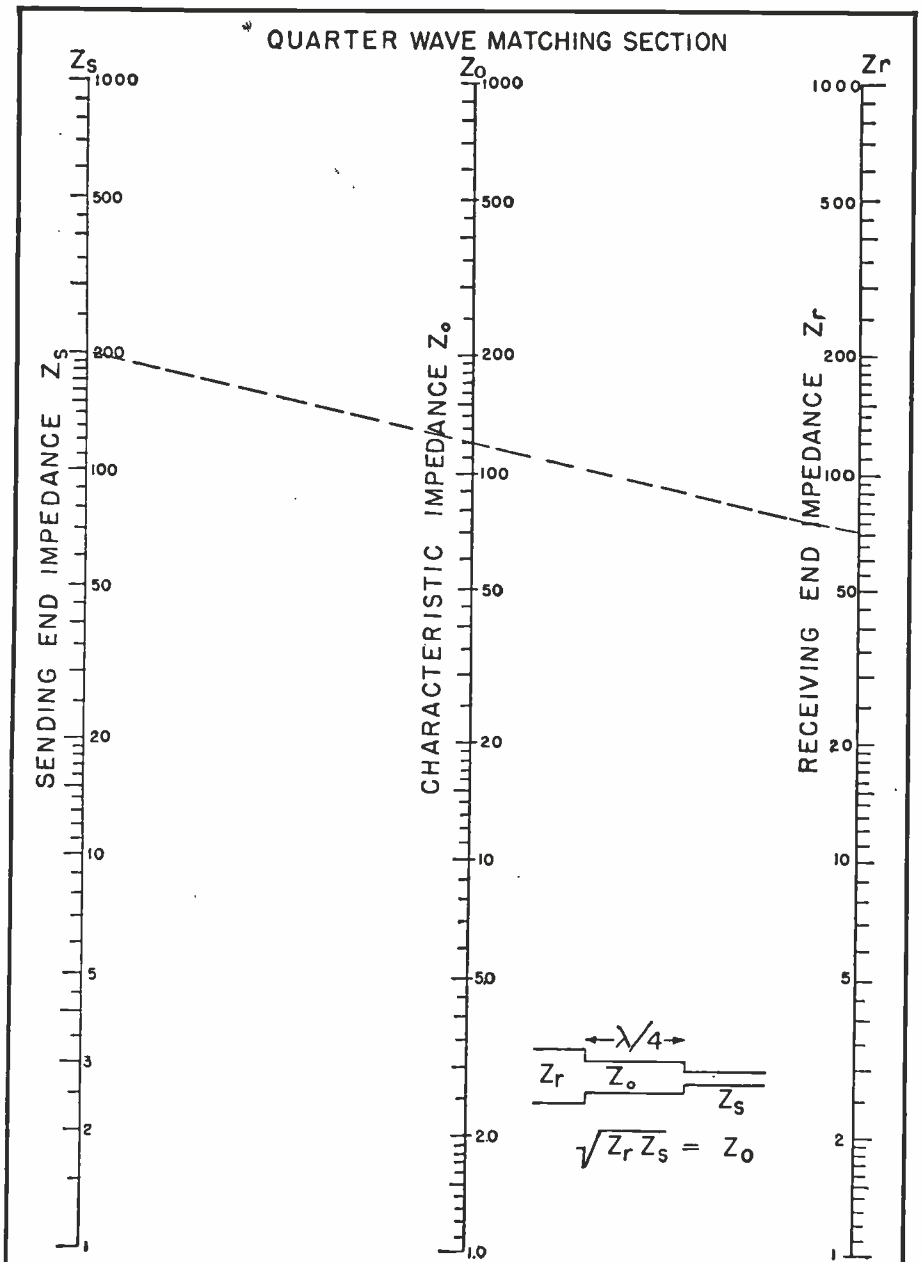
Solution: The power lost by the 6 db. line is 6 db. because it is perfectly matched. The power loss of the 4 db. line is 4 db. plus .15 db. due to a standing wave ratio of 1.4 as indicated in Fig. 3 or 4.15 db. The attenuation of the 3 db. line is 3 plus 1.5 db. due to a standing wave ratio of over 4:1 or about 4.5 db. Obviously the 4 db. per 100 foot, 100 ohm line would be the best cable to use.

Quarter-Wave Matching Line

As previously indicated, an antenna mismatch can very possibly materially reduce the signal voltage picked up by the receiver to a point where it completely nullifies the other advantages that the antenna may have, such as, economy, availability, simplicity or power gain. Obviously, if a simple medium existed whereby the mismatch could be corrected, it would provide a far better solution to the problem than to use a different antenna.

(*Continued on page* 137)

Fig. 5. This chart may be used to obtain the surge impedance of a quarter-wave matching section used as an impedance transformer from one real impedance to another. In the example shown: $Z_r = 72$ ohms; $Z_s = 200$ ohms, indicating a quarter-wave matching section of 120 ohms is needed.



Courtesy of Federal Telephone & Radio Corp.

An Inexpensive 4-ELEMENT ARRAY

By VINCENT C. HALE

Construction details covering a high gain beam which may be built of readily available materials.

SINCE the original papers published by Yagi and Brown on the superior advantages of the multi-element array for transmitting and receiving, amateurs have probably evinced more interest in this type of antenna than any other, for the higher frequency bands. Particularly is this true of ten meter operation, since a well designed rig with modest power capabilities, used in conjunction with a beam of proper design and adjustment, can equal on most counts a relatively high power rig with a simple antenna system. The same holds true, with certain modifications, for the receiving situation.

Culling from the many articles available, and from a somewhat varied personal experience in the matter of beams, the author has evolved the array to be described, incorporating in its manufacture those features that would give a maximum of performance and a minimum of trouble and expense. It has been found desirable to eliminate all wood in the structure, since invariably warpage and aging will adversely affect the operation of a beam so constructed. Metal tubing, light but strong, has been used throughout, and the antenna proper, for ease of feed and adjustment, has alone been insulated from the supporting stucture.

While a close-spaced, three-element array is satisfactory, the addition of another director, properly adjusted, results in superior performance and adds but little to the cost. Accordingly this antenna system uses two directors, the antenna proper, and one reflector, all spaced 1/10 wave, for compactness primarily, but also because the impedance so obtained makes a good match very easily attainable by several methods. There is little advantage to be gained in using any particular one of the matching methods . . . personal preference and ease of obtaining material will be the primary criteria of choice, rather than any especial benefits to be obtained. These optional feed methods have all been tried, and found to be practically equal in performance. A description of each system is found in the *Handbook*, and the builder will find that any can be adapted to the particular needs and desires of the individual.

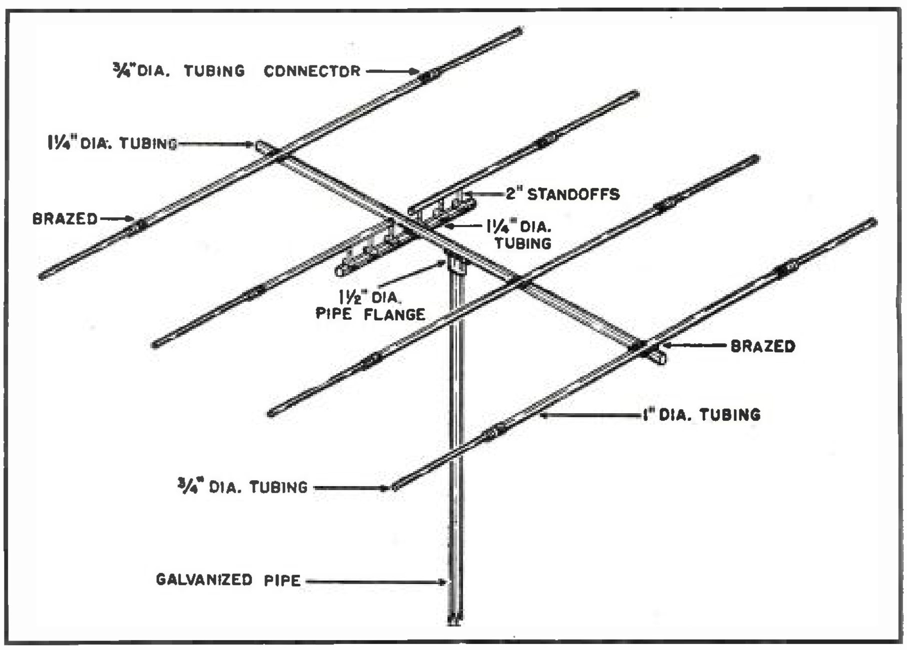
The particular beam shown in Fig. 1 was made from sections of 1¼", 1" and ¾" thin wall tubing, known as steeltube. These sizes were used because of the relative ease with which this diameter tubing was available in this particular locality. Smaller sizes can, of course, be used, and will work equally as well. Aluminum, brass, dural, copper, etc., can be used as well as the steeltube, and performance will be practically the same.

The complete listing of material for the beam proper is as follows:

4 sections 10' long, 1" dia. tubing.
4 sections 10' long, ¾" dia. tubing.
1 section 10' long, 1¼" dia. tubing.
1 1½" pipe flange, threaded internally.

(*Continued on page* 78)

Fig. 1. Mechanical details for the construction of 4-element array.



Servicemen's associations get excellent cooperation from manufacturers and jobbers in keeping posted on radio developments. Bill Behr, president of the New Jersey Assn., Henry Johnson, ad manager for Sylvania and Rene Jacobs, V.P. of Dale Distributors, look over one of the door prizes.

Service Associations Can Be Successful

By DAVE KRANTZ

Pres., Philadelphia Radio Service Men's Assoc.

Servicemen's associations fill the urgent need of today's technician by supplying him with a clearing house for problems of his business.

TO MOST citizens, Philadelphia is known principally as the cradle of American liberty, repository of our beloved Liberty Bell and scene of many of the early struggles to secure the future of our country. To those of us who live in this sprawling metropolis, it is the scene of a continuing battle to maintain our business existences and to wrench a livelihood from them.

This is especially true of those of us who elected to try to make a living out of the business of selling and servicing radio receivers. Within Philadelphia's borders, you will find areas which reflect every level of living condition to be found in any densely populated city. Rich man, poor man—they all have radio receivers and we make available the service equipment, the knowledge and the ability to keep those receivers in working order. Our ambition is to be able to do this work efficiently and profitably.

Radio service as a business came into being spontaneously. In most cases, radio manufacturers distributed their products indiscriminately without any regard for the availability of service in the areas where these receivers would be used. Further, many intricate and sometimes questionable circuits are employed without any supporting schematic or operating data to assist the radio serviceman to locate the reason for the failure when he is called on to repair the equipment. At no time, to the best of the writer's knowledge, has any manufacturer made a serious attempt to train independent field servicemen to handle the necessary service for his home receivers.

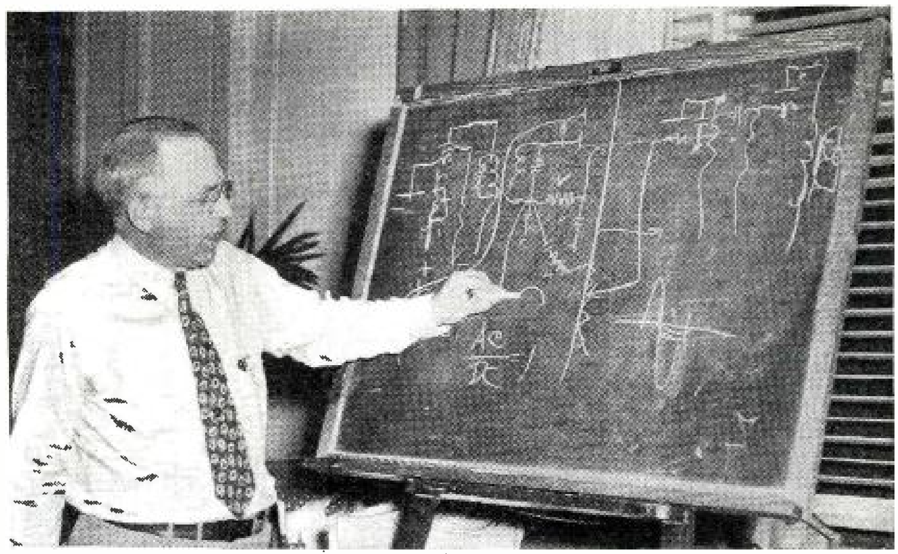
Since its growth stems from local needs for service, radio servicing as a business attracts a heterogeneous group of individuals, most of whom are interested in radio service primarily through an intense personal interest in the mysteries of this new science. For the most part these men are good technicians in that they comprehend the functional operation of a radio circuit. However, few of them are even well-grounded in radio theory. In other words, they know *why* a radio receiver works, but not *how*.

Running a business, to the average person, means merely opening a store

Members of the New Jersey servicemen's association listen attentively as Sylvania's Walter R. Jones discusses circuit analysis. Up-to-the-minute information, as supplied by service organizations to their members, is the pressing need of radio men.

at some convenient location and making your services or goods available to the public. This, too, is the attitude of the average radio service business novice, who ingeniously assumes that his skill in repairing radios—usually perfected in his kitchen repairing neighbors' sets—will be wafted on the wings of happy customers' conversations to bring a stream of repair jobs beating a path to his door.

As the service dealer flounders about trying to induce people to bring their radio repair jobs to his shop, he usually tries every unprofitable scheme in the book in the hope of increasing his volume of business. Seldom does the individual, as a product of his own thinking, reach the conclusion that he is first of all a retailer and second a technician. He usually fails to realize that if he doesn't know how to merchandise his services in a profitable volume, all of the money-making artifices avail him nothing.



Walter R. Jones, Chief Engineer, Radio Tube Division of Sylvania, highlights his discussion of circuit analysis with a chalk talk.

With the thought in mind that we could lift the level of radio servicing as a business and at the same time, the stature of the men engaged in it in the eyes of the public and of fellow businessmen, a group of us formed the Philadelphia Radio Service Men's Association a number of years ago. In the course of its fifteen years of existence, PRSMA has successfully weathered all of the storms of organizational and operational difficulty which usually beset voluntary associations. Through trial and error a type of organizational structure was evolved which insures against the common dangers which beset such associations and which in so many cases, result in eventual disintegration.

There has been so much interest expressed in the organization of PRSMA that I would like in this article to briefly outline the operation of the association and its various committees.

The organization is headed up by a Governing Board of eighteen members, each of whom is elected for a three-year term. One-third of this Board comes up for reelection or replacement each year. The Association's program is directed by its five officers who are elected by secret ballot each year.

The Association's programs are carried out by a group of eight committees, each of which is headed by a chairman, who, in turn, is a member of the Association's Advisory Board.

The following breakdown of the committee structure will give a general idea of the functioning of these various units.

Entertainment Committee—This group arranges all technical meetings. The primary purpose of these meetings is to permit local distributors to present engineers familiar with the lines the distributor carries. This provides the opportunity for members to acquire a better understanding of the technical details of various types of equipment and products, and promotes a better understanding between distributor and servicemen.

Membership Committee—The function of this committee is to pass on all applications for membership in the Association. Through examination and investigation, they determine the qualifications of each new applicant and recommend his acceptance or rejection for membership.

Employment and Veterans Committee—This group has the responsibility of ferreting out employment opportunities for members and veterans.

Education Committee—This committee was set up to carry out a program for courses in electronics, both basic and advanced, at local institutions and at closed meetings of the Association. It is charged with the responsibility of securing and distributing technical literature to members of the organization.

Magazine Committee—"PRSMA News" has been a financially successful monthly house organ for a dozen years. The preparation and distribution of this publication is the responsibility of the Magazine Committee.

Grievance Committee—Any and all complaints are diligently checked by

(*Continued on page* 122)

Many Eastern service organizations are already equipped to handle television and FM installations and repairs. Here Frank Krantz and Reginald Cherrill of Witte Radio and Television Company, Philadelphia, check a couple of television receivers.

Author at work in his shop in Philadelphia. A clean, uncluttered service bench, up-to-date test equipment, and complete reference data, in addition to ample electrical outlets, all combine to make for an efficient radio servicing operation.

Capacity Operated RELAYS

By
R. G. ROWE, W2FMF
Consulting Engineer

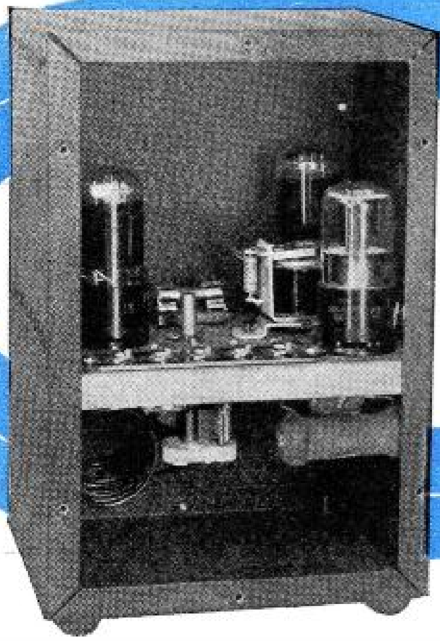


Fig. 1. Rear view of home built oscillator and negative impedance unit. Schematic is shown in Fig. 5.

Although adapted primarily to various industrial applications, this novel device will be of interest to the experimenter. Many intriguing setups can be operated simply by body-capacity effects.

A CAPACITY-OPERATED relay may be described as an instrument which responds to a change in capacitance, or in the character of the capacitance, in a capacity-sensing element by activating or deactivating a current responsive load. The load may be a relay for the operation of an indicating or alarm circuit, a motor for the actuation of a valve or a multiplicity of other electrical devices. In general, the term "capacity-operated relay" implies an "on" or an "off" snap-action function as a result of a capacitance change, rather than a smooth, gradual function.

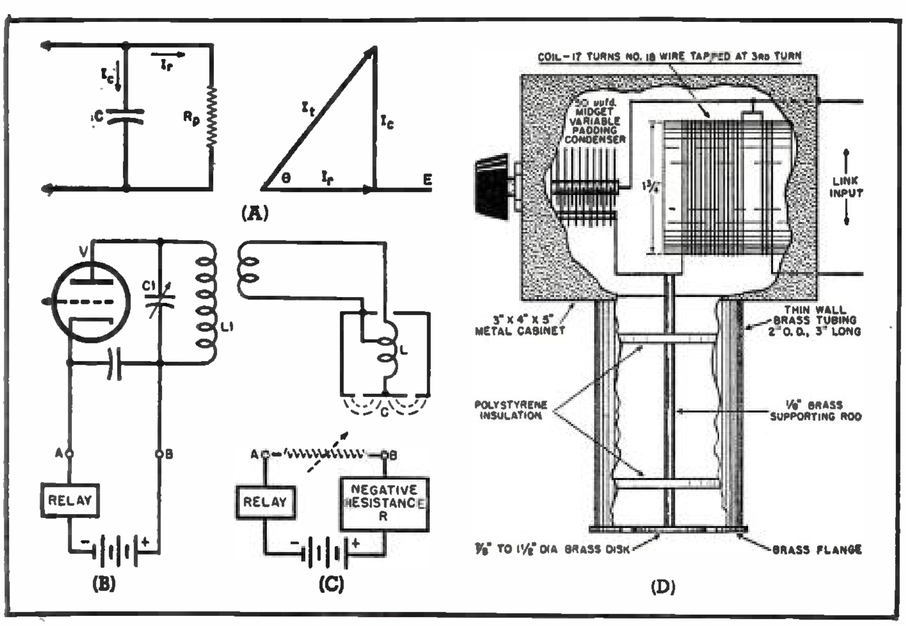
One general type of capacity-operated relay employs the beat principle, wherein a capacity sensing element becomes part of the frequency determining network of a variable frequency oscillator, the output of which may be "zero beat" with a fixed oscillator in a mixer circuit. A change in the capacitance of the sensing element, in producing a frequency shift of the variable frequency oscillator, is reflected as a beat note in the mixer output which may be rectified or further altered to activate a relay or other load circuit.

A second general type of capacity-operated relay consists of two identical radio frequency oscillators, the tank inductances of which are link-coupled. A sensing capacitor is connected in shunt with the frequency determining network of one of the oscillators. When the two oscillators are in phase with one another, no current flows in the link circuit. When a capacitance change is delivered by the sensing element, the frequency of the corresponding oscillator attempts to change and currents flow in the intercoupling link in an effort to keep the two oscillators synchronized. These currents may be rectified or otherwise altered to operate the relay or load.[1]

A third general type of capacity-operated relay consists in a crystal controlled radio frequency oscillator, in which the sensing capacitor shunts the tank circuit. The oscillator tank may be so designed as to operate on the tank capacitance-plate current curve at a point where reasonably small capacitance changes will produce sufficient plate current excursion to operate a relay in the anode supply circuit.[2]

A fourth general type of capacity-operated relay, and one enjoying wide popularity, consists of a radio frequency oscillator in which the sensing capacitor is so connected as to control the amplitude of oscillation by effectively modifying the phase or amplitude of the regenerative feedback voltage. The radio frequency output voltage, or some portion thereof, may

Fig. 2. (A). Vector analysis of sensing circuit. (B). A capacity-operated relay using a sensing capacitor and inductance, link coupled to an r.f. source. A greater change in control resistance across AB can be obtained by adding a negative resistance as shown in C. In our completed unit this negative resistance is in the form of vacuum tubes, V_1 and V_2 (Fig. 5). (D). Construction details of sensing element shown in schematic diagram, Fig. 5.



be rectified, amplified and employed to operate the relay or load device.[3, 4, 5, 6, 7, 8, 9]

In all capacity-operated relay setups, the sensing capacitor, which is usually designed according to the dictates of the particular application, obviously must be located at the site of the function being sensed. In all of the aforementioned relay types, the remainder of the electronic apparatus should be located near the sensing capacitor to insure short coupling leads, if the maximum potential sensitivity is to be realized. It will be appreciated how the connecting leads shunt the sensing capacitor so that a small capacitance change of the sensing element itself represents only a small percentage change of the total "lumped" capacitance. By eliminating the lumped capacitance it is in general possible to employ smaller capacitance changes to trigger the relay and, hence, more compact sensing capacitors may be used. Further, in many applications it is undesirable or impossible to locate the relatively bulky, delicate capacity-operated circuit at the site of the function being sensed. One such possible approach to this problem is indicated wherein a secondary *LC* circuit shunts the primary *LC* circuit by virtue of a link coupling.[10]

A new method will be described wherein a conveniently small *LC* circuit, comprising a sensing capacitor and an inductance, may be located at the site of the function being sensed and link-coupled through a low impedance, low-loss line to a specially designed radio frequency source.[11]

With reference to Fig. 2B, there is shown a sensing capacitor and inductance, *LC,* link-coupled to a radio frequency source comprising tank circuit L_1C_1 and tube V, in which the grid circuit is deleted for convenience. It is known that when resonance is obtained between *LC* and L_1C_1, *LC* will exhibit unity power factor and reflect a purely resistive load to L_1C_1. The magnitude of this reflected resistance will be determined largely by the resistance of the inductance *L* and the resistance of the dielectric material in the capacitor field, provided that the link line losses are kept to a minimum. The exact nature of the effect of this load on the source, where the source may be a self-excited oscillator or a radio frequency amplifier, is rather complex and beyond the scope of the present article.

However, in the case in point, the introduction of reflected resistance in L_1C_1 effectively lowers this tank circuit impedance, resulting in a relatively high plate current flow through tube, *V*. As *C* is detuned, the effective impedance of L_1C_1 increases, thus reducing plate current through tube *V*. While not meant to represent theoretical limits, plate current

(*Continued on page* 135)

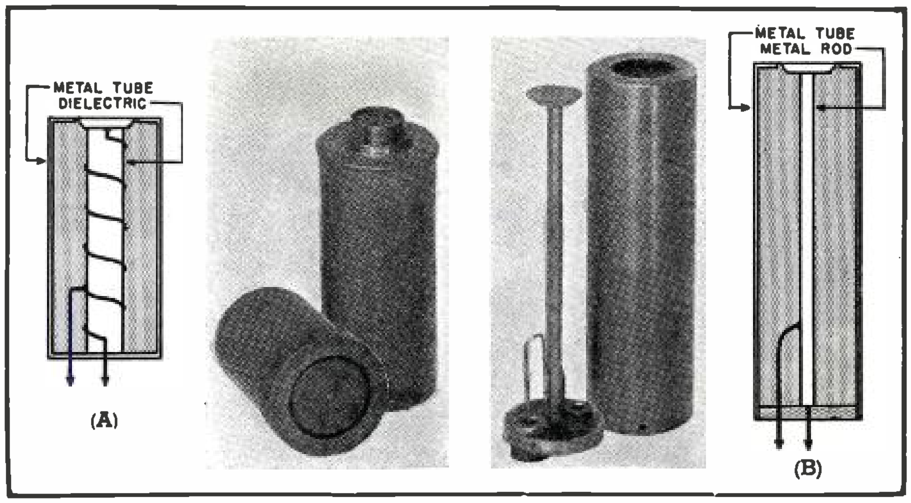


Fig. 3. Two different types of sensing elements that have been used successfully. (A) For the lower frequencies where appreciable inductance is required for resonance, and (B) For higher operating frequencies, this coaxial type is applicable.

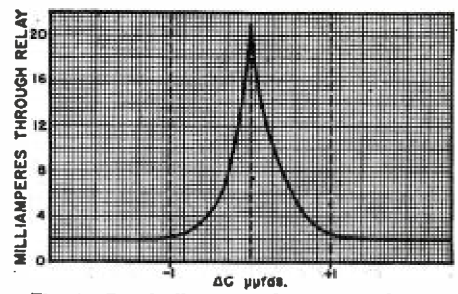
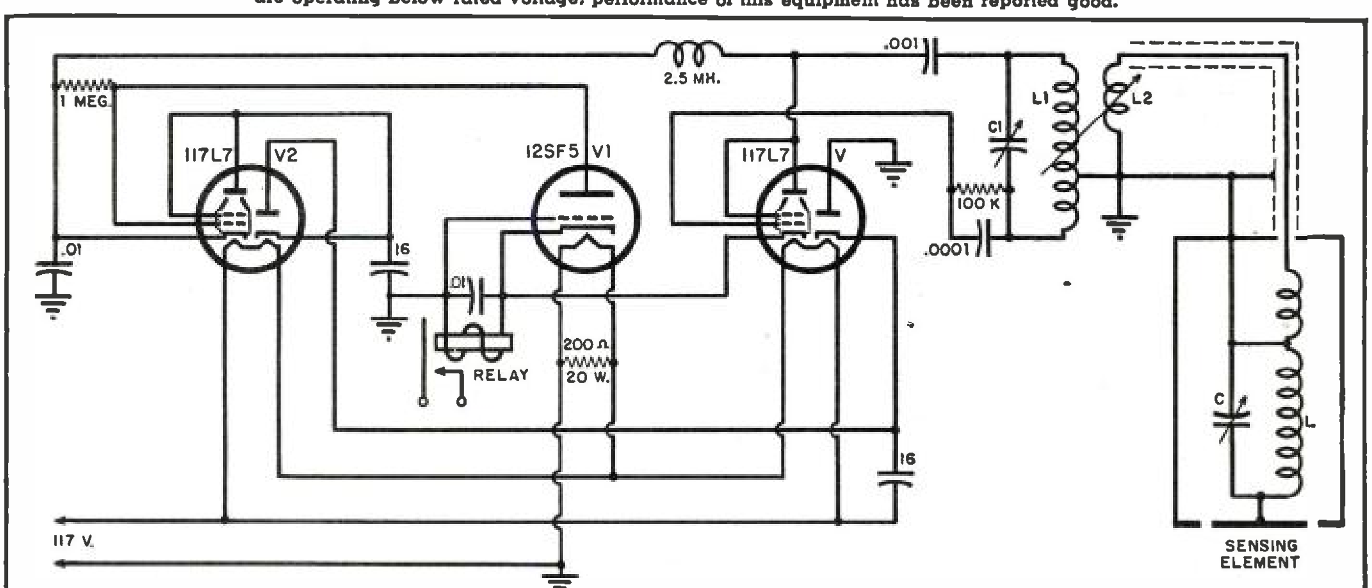


Fig. 4. Graph illustrates the current change that can be obtained through the relay shown in the schematic diagram, Fig. 5.

Fig. 5. Schematic diagram of home built capacity-operated relay. Although tube filaments are operating below rated voltage, performance of this equipment has been reported good.



The self-supporting oscillator coil L_1 has eight turns of #14 copper wire, 1½ inches in diameter, spread to a length of 2 inches and tapped at the fifth turn from the plate end. The self-supporting coupling link L_2 has three turns, 1½ inches in diameter, close-wound and is arranged to be moved with relation to the oscillator coil for adjusting coupling.

The oscillator tank coil L_1 is shunted by a 100 to 140 μμfd. air dielectric midget variable tuning condenser C_1 for adjusting the frequency of the oscillator.

The d.c. resistance of the field coil of the relay should be 200 ohms. This may be an Allied Type AS, coil number 36, relay having a coil resistance of 205 ohms. Another relay with a 450 ohm coil, shunted by a 400 ohm, 1 watt carbon resistor has been successfully used.

The 1N34 crystal diode when mounted in housing shown makes a convenient test probe.

CRYSTAL DIODE Reduces Probe Size

By ALBERT BEIN
Radio Eng., National Radio Service.

This simple and compact crystal diode probe makes the signal tracing of small receivers practical.

APPLICATION of the crystal diode has made signal tracing practical for the radio serviceman by reducing the size of the probe for application to compact receivers and eliminating tuned bands and channels and volt or ohm ranges requiring adjustment when a volt-ohm meter is used. In addition, signal tracing technique analyzes the audio component of the broadcast signal for the source of hum, noise, oscillation, microphonics and other operational faults instead of simply measuring the electrical characteristics of various components which may or may not be the cause of faulty operation.

Unlike the conventional type of signal tracer, which indicates the difference of carrier frequency, the crystal diode probe indicates difference in modulation or changes in the audio component of the signal. All frequencies between 90 kc. and 33 mc. are demodulated by the crystal diode and fed directly into an a.c. audio amplifier.

The crystal probe may be easily constructed by fitting a *Sylvania* Type 1N34 germanium crystal diode and a ¼ watt ceramic type carbon series resistor into a standard voltmeter probe or an *Amphenol* r.f. coaxial probe with capacitance removed. The coaxial probe is recommended. Space allowed for the capacitance is ample for the *Sylvania* crystal and ¼ watt resistor. Shielded cable should be used with either type of probe and should be pushed in as far as possible to reduce capacity effects. Connecting the plus side of crystal to probe will result in greater output at broadcast frequencies.

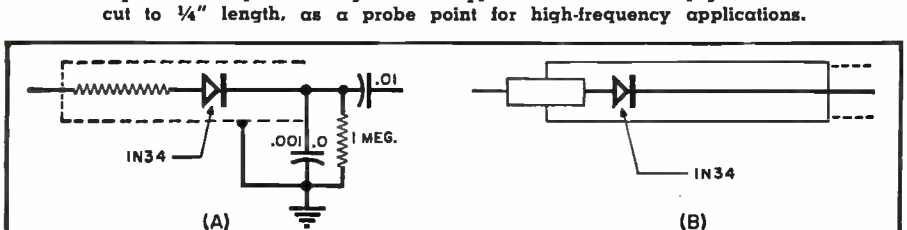
Value of the ¼ watt series resistor depends on amplifier gain and signal generator output. With an average signal generator and hi-mu triode and pentode output amplifier the value will be about 100,000 ohms with a possible range from 50,000 ohms to ½ megohm. A .001 μfd. mica r.f. bypass condenser will prevent pickup of r.f. currents at frequencies below 1000 kc. To prevent crystal damage a .01 μfd. blocking condenser is recommended. These capacitances may be mounted in the input section of the amplifier as shown in Fig. 1A.

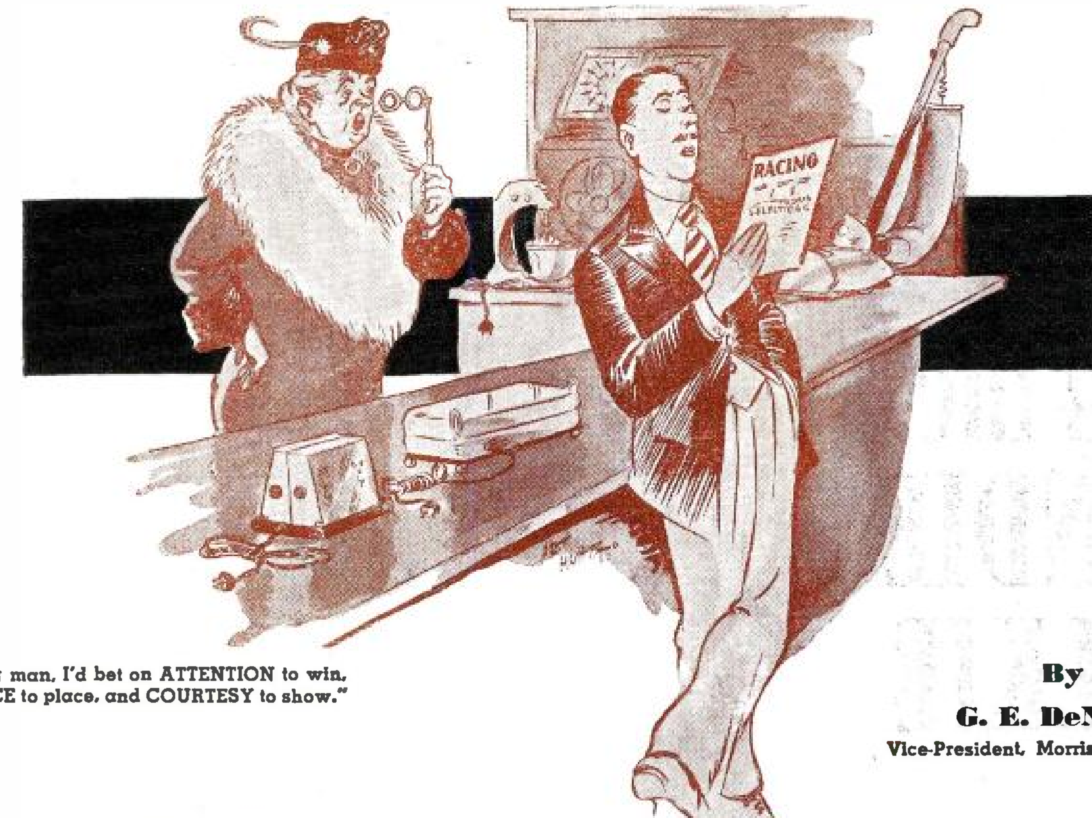
To reduce loading effects of the probe, which should contain a minimum of metal, the ¼ watt ceramic resistor may be used as the probe point by cutting off the external lead wire to within ¼" of the resistor body and using it as a probe point as shown in Fig. 1B. This arrangement will have negligible loading effect even at high frequencies.

If the probe is made to plug into the wide band amplifier of a signal tracer containing a vacuum tube voltmeter and scope, waveform and sensitivity may be checked at service test frequencies. The crystal diode probe is connected to the signal generator which is operated through its entire range. The result will usually be a good waveform and good signal strength throughout a range of 90 kc. to 33 mc. Frequently signal strength is adequate to drive both the scope and the v.t.v.m. off scale.

Straight a.c. amplifiers should be used with the crystal diode probe.
(*Continued on page* 147)

Fig. 1 (A). Arrangement of resistor, blocking and bypass condensers in probe utilizing 1N34 crystal diode. Output of the probe is increased at broadcast frequencies when the positive terminal is connected to probe tip. At high frequencies increased output is obtained by connecting the negative terminal of the crystal to the probe tip. (B) Physical arrangement of crystal diode probe using ceramic type carbon resistor's pigtail lead, cut to ¼" length, as a probe point for high-frequency applications.





"Young man, I'd bet on ATTENTION to win, SERVICE to place, and COURTESY to show."

By
G. E. DeNIKE
Vice-President, Morris F. Taylor Co.

CONSUMERS ARE SORE

The first wave of buyers which hits your store will be people sorely in need of merchandise. You can make or break your reputation by the way you handle them now.

WHEN we heard the tale of the returned veteran who decided he and his buddies had better start rehabilitating civilians, we listened with a wry smile. The lad was undertaking a project which might well utilize his full time and talent. "War nerves" of the civilians is a disease induced in large measure by the treatment accorded them by the very persons who might be expected to exert a soothing influence, the merchants of America.

From having been the silver tongued persuaders of the prewar years, merchants and those in their employ did a turnabout which left the consumers with a mixed train of emotions. First shocked and incredulous, then mildly resentful but resigned and finally irate we find today's consumer in a vengeful mood.

How often have you heard "There'll come a day," or how often have you said it yourself when you've been ignored, insulted or intimidated by a storekeeper. That day the consumer has yearned for is dawning. Sooner than we think possible our gigantic production machinery will be spewing forth mountains of consumer goods. Certainly there will be a time lag before they reach every retail outlet, before shelves are filled and showrooms replete, but don't delude yourself that eager millions of consumers are going to storm retail outlets, cash in hand. Don't imagine that they are going to brook wartime insults characteristic of over-confident, under-supplied merchants of the painful sales demotion era. As rapidly as supply loosens, sales resistance will stiffen. That day when the millions have dreamed of giving the merchant a piece of their mind and stalking proudly out to purchase elsewhere is at hand.

Be assured that the waiting queue which characterized the cigarette shortage will not form and patiently wait to buy radios and appliances. Consumers are sore and they're going to take some salving before they lay down the cash for what you have to sell them.

The widespread advertising and publicity on new products is going to keep the prospective buyer in a wary mood. There are even signs of an incipient buyers' strike. Dolores Bigelow of Burton Bigelow Organization warns of this danger in an article in "Retailing" wherein she points out that in 1921, a nationwide consumers' strike expressed a revolt against the retailers' failure to reduce inflated war prices and brought on one of the severest depressions in American history. We well remember how, eventually, prices tumbled all along the line, thousands of stores went bankrupt, factories closed, millions of men were out of work. All because merchandisers had been blind to the fomenting mood of the masses.

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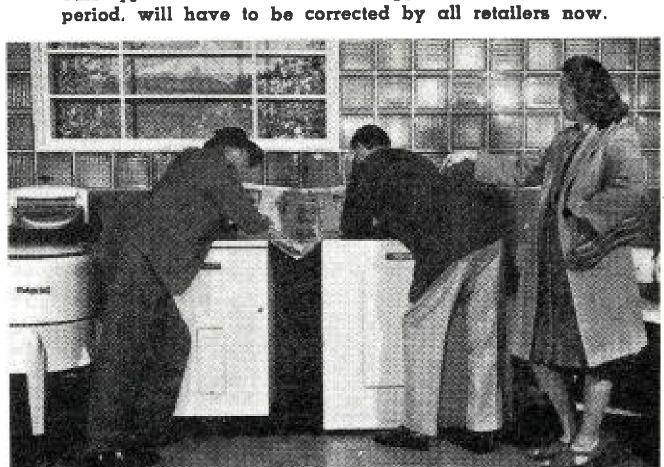
This type of sales demotion, so typical of the wartime period, will have to be corrected by all retailers now.



144 mc. HANDIE TALKIE

By
C. T. HAIST, Jr., W6TWL
General Electric Co.

Fig. 1. Over-all view of completed unit.

Complete construction details of a home-built handie talkie featuring separate transmitter and receiver.

LOTS of interest and enthusiasm has been shown in the handie-talkie sets I designed, built and described in the June issue of *QST* for 1944 and the April issue in 1946. I have now combined my ideas for a third set. This is a handie-talkie to end all handie-talkies.

The first two sets being of the transceiver type had one disadvantage that had to be eliminated. Since the same tube was used for the oscillator for transmitting as well as a detector for receiving, the transmit and receive frequency was not quite the same. This is not objectionable when working a fixed station having a separate transmitter and receiver but does present a problem when two hand sets are used. The result is that on every transmission the receiving station has to retune to receive the other transmitter. This, in turn, changed the transmitting frequency so the other station had to retune when receiving. The different operating frequency of the oscillator and detector is brought about by the different potential applied to the plate and the introduction of the quench voltage in the grid circuit.

The new set consists of a separate transmitter and receiver using three tubes. The circuit is so arranged that only two tubes are used in either "transmit" or "receive." Simple switching for "transmit" or "receive" is accomplished by switching the filaments of the tubes. Two tubes are connected in series for 3 volt operation and the selection of the oscillator or detector is had by switching either tube in series with the third tube which is the modulator or audio amplifier. Switching of grid and plate circuits are not necessary in this arrangement. This increases the efficiency of the circuit by keeping the leads short.

Antenna switching is accomplished with another section of the same switch. No loss occurs in this circuit even with a common fibre insulated switch, since the switch is at a point of low r.f. voltage of the ¼ wavelength antenna. A third section of the switch closes the microphone circuit when transmitting.

With the 3 volt filament supply and the tubes connected as shown, the modulator amplifier tube is automatically provided with a 3 volt grid bias. If 67½ or 90 volts of "B" supply is used, it will be necessary to insert additional bias (two pen-lite cells between secondary of T_1 and ground) to keep the plate current drain down. A 1S4 connected as a triode is used for the oscillator tube. A 957 tube is used for the detector. A 30 ohm resistor R_1 is connected across the filament connections since the filament drain is .05 amp. in the 957, and .1 in the other two tubes. A 958 could be used and the resistor eliminated, but the 957 makes the better detector and the radiation on receiving is less. The modulator or amplifier is another 1S4 tube. The rest of the circuit is conventional except that the earphone for receiving is used as a Heising modulation choke when transmitting. Since transceiver transformers are at a premium now, a midget 3 to 1 audio transformer with an additional winding for the mike was used. The midget transformer core is disassembled and the winding cover paper is removed. A single layer of #30 cotton covered wire is wound over the secondary winding of the transformer and the winding shellacked for holding it in place and for protection. The 3 volt filament circuit is also used to supply the mike current.

Switch S_2, as shown in the circuit diagram, is used for turning the set "on" and "off." This switch was later modified so that the set turned on when the antenna was pulled out of the case. Two leaf springs taken from an old headphone jack were mounted along the side of the polystyrene antenna holder. By fastening a polystyrene block on the end of one spring (providing a cam action) the contact was made to close when the antenna was pulled out. The block riding on the antenna when the antenna is in the case keeps the filament circuit open.

The chassis is a ⅛"x2⅝"x4½" piece of polystyrene. The chassis is drilled as shown in Fig. 8. All parts are mounted and wiring is completed before the chassis is inserted in the case. This provides ease of wiring and service. Double tie points mounted on each end of the transformer provide soldering terminals for the microphone, earphone, and "B" battery leads. The A lead from the "on" and "off" switch is the only wire coming from the chassis to be connected. On the under side of the chassis small angles are mounted under the transformer mounting screws to provide a means of holding the chassis to the case. The front end of the chassis is held by the polystyrene antenna support going through the top of the case. Tube socket VS_1 is supported by soldering pins 2 and 6 to the stator plate supports of tuning condenser C_4. Socket VS_3 is supported by a small brass angle. Tank coils L_1 and L_3 are self-supporting and their leads are soldered directly to the condenser stator and rotor connections. L_2 and L_4 antenna coupling coils are single turn loops supported by 4-40 screws. Assembly details are shown in Fig. 6. The knobs for the tuning condensers are made from a polystyrene rod as shown in Fig. 7C. The knobs extend through slots on both sides of the case. The condensers are turned by thumbing the edge of the knob. This method leaves the case free from large protruding knobs that would be bumped and turned in handling. A piece of hard finish white paper is glued to the back of the knobs and the condensers are then calibrated for the two meter band. Two small windows ¼"x5/16" are filed in the back of the case for viewing the figures. In filing the windows a small point should be left in the center of the slot for the index pointer.

Below the chassis is the battery compartment. A 67½ volt battery is supported off the rear of the case by a small channel made from a piece of aluminum. This provides clearance for the antenna when it is raised or lowered. Bias cells for the 1S4 modulator are placed on each side of the antenna under the "B" battery. Below the "B" battery is located the flash light cells for the filament circuit. The two batteries are connected in series and the connections may be soldered to the batteries or a bracket made so that the batteries may be plugged in.

The earphones and microphones are fastened to the cover of the case with machine screws. Flexible leads are connected to the two units and brought down to their respective tie point terminals on the transformer.

The telescoping antenna is a modified auto radio antenna. With the auto antenna extended, the bottom section is cut off so that it is ap-

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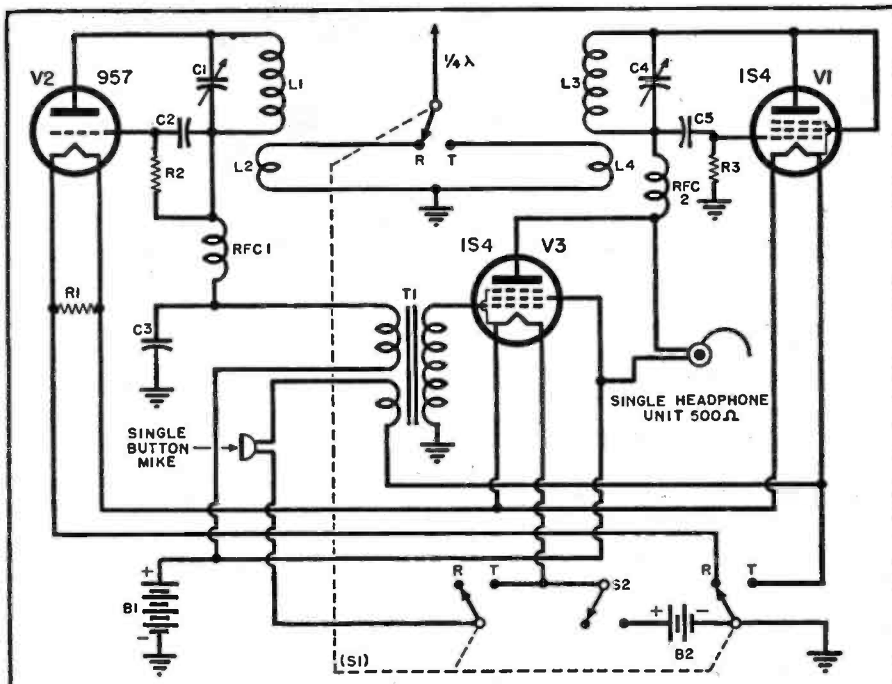


R_1—30 ohm, ½ w. res.
R_2—25,000 ohm, ¼ w. res.
R_3—10 megohm, ¼ w. res.
C_1 C_4—3-10 μμfd., 2-plate var. cond.
C_2, C_5—50 μμfd. ceramic cond.
C_3—.002 μfd., 200 v. cond.
RFC_1, RFC_2—50 t. #36 d.s.c. (Use a 1-10 megohm, ½ w. res. as winding form)
T_1—Midget audio trans. (3 to 1) with 1 layer of #30 d.c.c. wound on secondary
L_1—5 t. #16 e., ⅜" o.d.
L_2, L_4—1 t. #16 e., ⅜" o d.
L_3—4 t. #16 e., ⅜" o d.
S_1—3-pole, 2 pos. slide sw.
S_2—S.p.s.t. slide sw. (see text)
B_1—45, 67½, 90 v. "B" battery
B_2—Two #2, 1½ v. flashlight cells
1—500 ohm single headphone
1—Single button mike
2—1S4 tubes
1—957 tube

Fig. 2. Schematic diagram of three-tube, 144 mc. home-built handie-talkie.

Fig. 3. Front view of unit with cover removed; internal assembly arrangement.

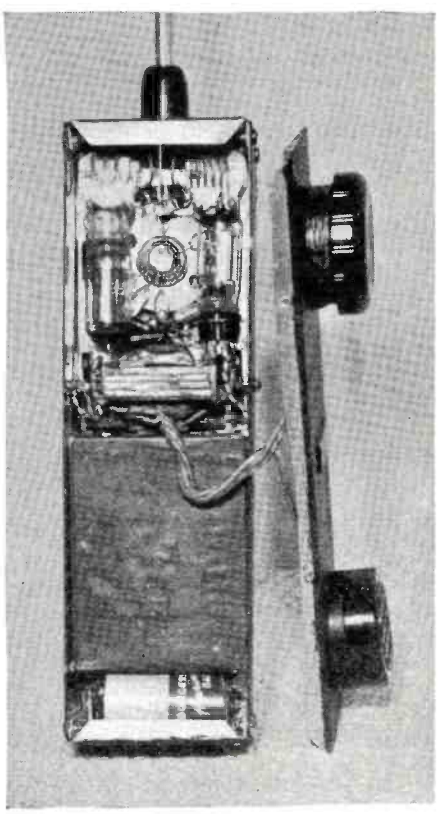


Fig. 4. Rear view of transmitter-receiver portion of 144 megacycle handie-talkie.

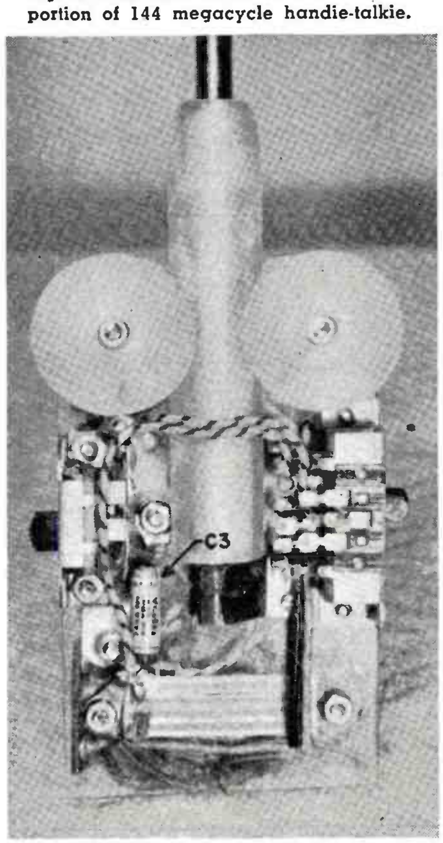
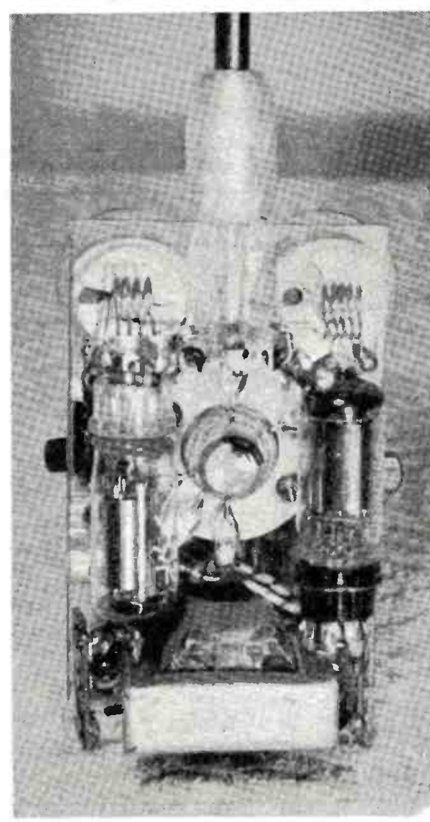
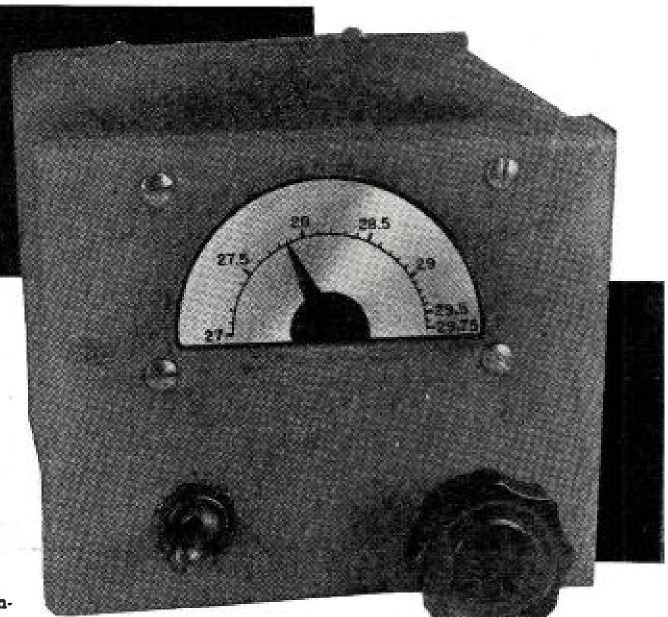


Fig. 5. Front view of transmitter-receiver shows placement of component parts.



SIMPLE 10-METER CONVERTER



Front view of home-built converter. The unit covers a frequency range from 27 to 29.7 mc.

By C. W. ROESCHKE, W9PFB/5

Construction details for a frequency converter that will extend the range of many war surplus communications receivers to the 10-meter band.

IN THE months since VJ-Day many thousands of surplus receivers of various types have been disposed of by the military at very attractive prices. These low prices, combined with the dearth of commercially manufactured units at the present time have resulted in the acquisition of these receivers by countless amateurs.

Unfortunately, the government services had little need for the frequencies above 18 megacycles in their regular communications, with the end result that the upper frequency limit of most of these receivers was 18 megacycles. The omission of the broadcast band, while annoying in some cases, is not at all serious.

In order to have the maximum amateur usefulness, it is essential that any receiver also cover the ten meter band. Then there is always the possibility of mobile operation on ten or the new QRM eleven meter band, if some simple converter can be devised to use the inherent good sensitivity of the receiver.

In the past there have been many excellent converters of different types in various publications. Examination of the circuits, however, revealed that many of the parts required were not available at the present time. Experience with some of the designs in the past had shown inherent faults, such as bad frequency stability, poor mechanical construction, and too great a physical size for use in a car.

The first attempts to simplify a converter were along conventional lines, using standard tubes. Although good results were obtained in some cases, the large size of the tubes made the over-all size too great. Another design was then worked out using miniature tubes, with performance above expectations. With such excellent performance, steps were taken to further simplify the design, and still maintain satisfactory results.

Experiments proved that the r.f. stage could be eliminated without noticeable loss. This stage, while it did contribute some gain, had its main function in the lessening of image response. With an i.f. frequency of from 1500 to 1600 kc. this was not a problem.

Of the various tubes listed which appeared to have possibilities as a one tube converter, the 6J6 seemed to be the logical choice. Its stability as an oscillator was excellent, while its high transconductance made it an excellent mixer.

In the construction of the converter described, every effort was made to hold down the physical size so that it could be used in a car as well as at home. If use only at a fixed station is desired, the dimensions may be increased to any reasonable size.

The entire converter is constructed on a chassis formed of scrap 1/16" aluminum and measures 3½" wide, 4" long and 1" deep. The tuning condenser, a *Cardwell* ER-15 AD with one rotor and one stator plate removed from the rear section, is mounted in the center of the chassis. The tube is mounted to the right of the condenser, with the oscillator coil just in front of it and the mixer coil located to the right.

The output transformer T_1, a home-made unit, is mounted in an i.f. can from a defunct "personal" portable. The primary of this transformer consists of a single pi from a 2½ mh. r.f. choke, with 100 of the turns removed. The secondary of this transformer is simply a jumble winding of 50 turns, with a tap at the 25th turn, of the wire removed from the primary. The tuning condenser across the primary is a 75 μμfd. mica with a 3-30 μμfd. trimmer across it.

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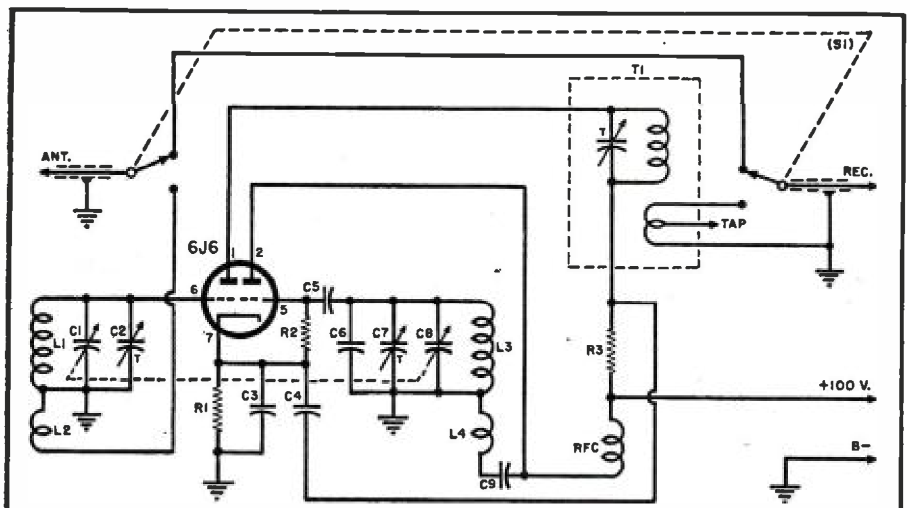
Schematic diagram of frequency converter. All coils are home constructed.



R_1—1200 ohm, ½ w. res.
R_2—22,000 ohm, ½ w. res.
R_3—1000 ohm, ½ w. res.
C_1, C_8—15 μμfd. (per sec.) dual var. cond. (See text)
C_2, C_7—3-30 μμfd. ceramic trimmer cond.
C_3, C_4, C_9—.003 μfd. mica cond.
C_5—25 μμfd. ceramic cond.
C_6—50 μμfd. silver mica cond.
L_1, L_2, L_3, L_4—(See text)
T_1—1600 kc. i.f. trans. (See text)
RFC—2.5 mh. r.f. choke
S_1—D.p.d.t. toggle sw.
1—6J6 tube

Television Takes to the Air

Fig. 1. Complete camera unit of the "Block" airborne television set.

By JORDAN McQUAY

Technical review of the warborn "Block" and "Ring" television systems which will be used for airborne on-the-spot video news coverage

THE rapid advance of television during the past half-decade has brought about the development of an important specialized phase; highly mobile, *completely airborne* television equipment.

Television pickup and transmitting equipment that once might have weighed tons and filled a large room now has been redesigned, modified, and built to "suitcase" compactness, while retaining a high degree of picture fidelity. Although useful in many other applications, the extreme portability of the equipment makes it particularly adaptable for use in aircraft.

And thus: Television takes to the air.

Using cameras equipped with supersensitive Image Orthicons, the newest of airborne televisors incorporates all of the latest and most efficient video techniques, including use of improved automatic gain control, synchronizing, picture shading, and automatic frequency control circuits for scanning.

Ranking in technical importance with radar and the proximity fuse, airborne television was largely a wartime development.

Two principal types of gear provided electronic "eyes" for remote controlled aircraft, flying bombs, and other types of guided missiles. Airborne televisors were also used to observe naval and military actions, as well as general reconnaissance work and the transmission of maps, charts, and other tactical information.

But use of this type of equipment is not limited to warfare. Its greatest future lies ahead.

Many of the video and electronic circuit developments are even now being incorporated in new commercial television apparatus.

Laboratory work is now under way to convert and adapt this warborn equipment for practical peacetime employment.

What will airborne television do?

It will provide revolutionary newsreel-type coverage of important events for rebroadcasting into the homes of television set owners. "On-the-spot" coverage of fires, floods, accidents, disasters, parades, and other events of public interest can be obtained over long or short distances, from moving vehicles, boats, airplanes, and helicopters. Such instantaneous transmission of eye-witness views of important events will bring a new meaning of realism to broadcast-television.

Other important uses of this portable television equipment include exploration of unknown terrain, and the transmission of such data to ships or planes, whose pilots may be unfamiliar with the region.

Small, fixed installations can be used as electronic "watchdogs," where peril from heat, chemical, or radioactive processes would render human observation impossible.

Because it is relatively small and light in weight, the equipment lends itself to either fixed or mobile installations and for *any* kind of visual supervision or investigation.

Besides being lightweight and diminutive, the equipment operates satisfactorily with the small transmitting antennas practicable for airplanes, on airplane power supply, and under unusual physical handicaps of noise and extreme vibration.

Two distinct types of airborne tele-

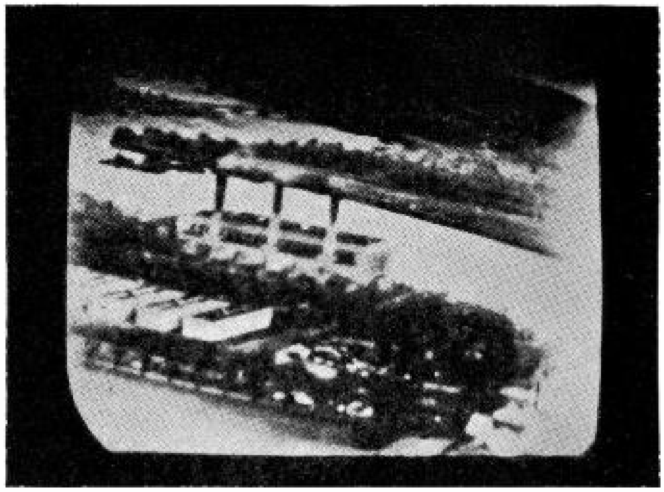


Fig. 2. Typical image televised by the "Block" airborne set. Picture shows a river-side power plant picked up at 3000 ft.

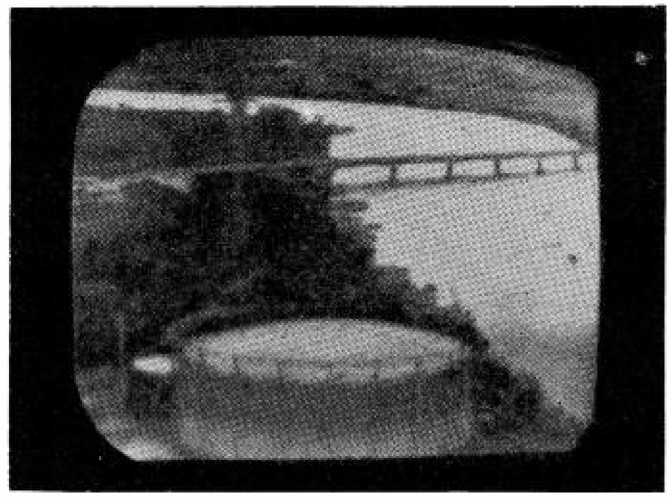


Fig. 5. Typical image televised by "Ring" airborne equipment. Scene is Sousa bridge and storage tank on the Potomac River.

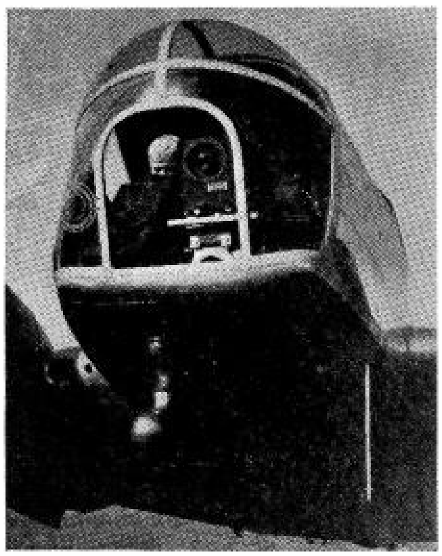


Fig. 3. "Block" television camera mounted in nose of plane and ready for action.

vision equipment were developed during the war by engineers and scientists of the *Radio Corporation of America*, the *National Broadcasting Company*, and the United States Navy. For security reasons, the two television systems were identified by special code names: "Block" and "Ring." But since the war these names have become permanent nomenclature.

The *Block* system is a small, compact televisor suitable for short-range pickup and transmission of pictures, operating up to about 50 miles. The complete apparatus, including power supplies and a single camera, weighs only 100 pounds. It operates unattended, and provides good picture fidelity under most operating conditions.

The *Ring* system is much larger in size, using two or more cameras and a crew of four operating engineers. This equipment has a range of over 200 miles when transmitting at an altitude of 15,000 feet. And the complete apparatus weighs about 500 pounds.

The *Ring* system provides considerably greater picture fidelity than is possible with the smaller *Block* system, chiefly because components of the *Ring* system can be operated *at all times* under optimum operating conditions, while components of the *Block* system cannot be adjusted during flight and thus can be operated only under average operating conditions.

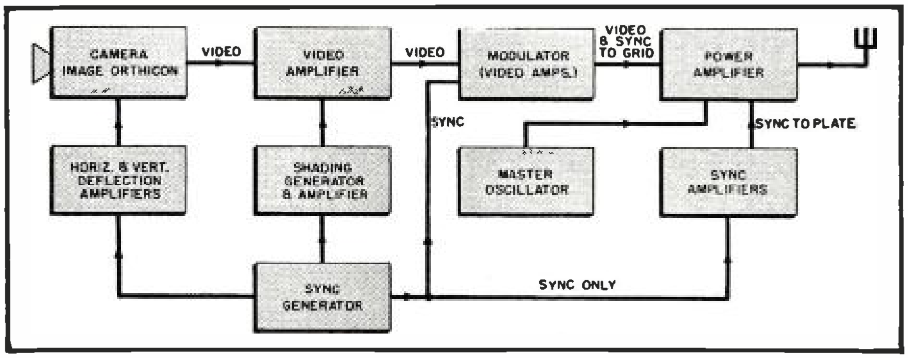
However, such a comparison of the two systems is not strictly fair, since each type of airborne equipment was designed for a particular tactical purpose. And the two systems were not intended to compete with each other.

Block Equipment

The *Block* airborne television system (Fig. 4) is a small but complete television broadcasting system, normally installed in high-speed reconnaissance aircraft.

The entire *Block* equipment is housed in a single demountable unit (Fig. 1) containing all components necessary for televising and transmitting images. The power supply for the unit is self-contained and operates directly from the plane's generator.

Fig. 4. Simplified functional diagram of "Block" television system.



Block equipment functions automatically and is unattended. The camera-unit is fixed, usually in the nose of the aircraft (Fig. 3). Any panning effect is accomplished by the plane's pilot, who moves the controls of the plane in such a manner that the television camera screens the desired object or target.

The camera uses an Image Orthicon, and the output of this tube is fed to a video amplifier whose gain is preset (Fig. 4). The video signal is then combined with appropriate sync and shading signals in the conventional manner, and this combined signal—sync plus video—is applied to the modulator stage. This amplified signal is then used to grid-modulate the power output stage of the transmitter. The output stage is also plate-modulated by a separate sync signal from the sync generator.

Thus the transmitter is decidedly unique in that it combines both grid and plate sync modulation.

The purpose of this modulation arrangement is to maintain the percentage of sync modulation constant, increasing the range, reliability, and electronic stability of the televised picture.

Operating frequency of the *Block* transmitter is between 264 and 372 megacycles, controlled by a master oscillator stage. The output of the transmitter delivers approximately 60 watts of power to special transmitting antennas used for each of ten workable channels.

Scanning standards for *Block* equipment require sequential scanning at 350 lines, 40 frames per second.

Sequential scanning is used for purposes of circuit simplicity. This method of scanning, however, provides considerably less resolution, primarily because of adjacent-line halation.

Since the *Block* equipment operates unattended, it must be properly adjusted by the technical ground crew

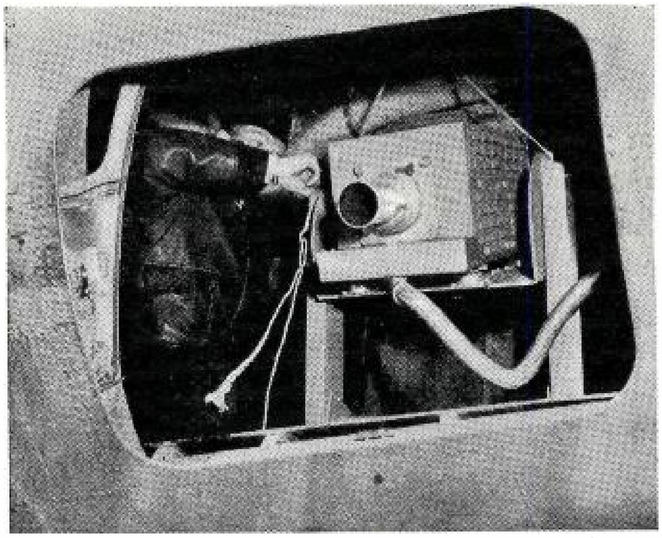


Fig. 6. "Ring" type camera mounted in the waist of aircraft. This camera was used principally for close-up observations.

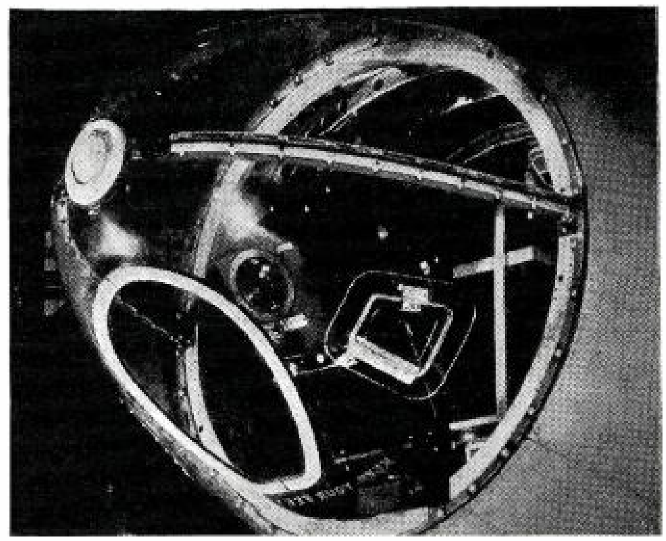


Fig. 7. "Ring" camera mounted in the nose of aircraft. This camera is usually used for shooting general over-all scenes.

before it becomes airborne. In operation the gear must have fixed focus, fixed lens aperture, fixed shading, and fixed camera positioning in the nose of the plane. For these reasons the equipment can never function with an efficiency comparable to the larger *Ring* system since the *Block* equipment must be adjusted for average (*not* optimum) operating conditions. Any variance from the average operating conditions will be detrimental to its operation thus impairing the picture quality.

In its early stage of development *Block* equipment was used by the Navy's Special Task Air Group One during attacks on Bougainville and Rabaul. The targets there were successfully relayed back over a distance of 15 miles.

In a slightly modified form *Block* equipment was also used extensively during the war for control of guided missiles, including glide bombs, "crash" boats, and other death-dealing devices in need of visual control or observation of final results.

A typical image televised by the *Block* equipment is shown in Fig. 2.

Ring Equipment

The *Ring* airborne television system (Fig. 8) is also a complete television broadcasting system, but it's normally installed in medium or large airplanes.

While the previous *Block* system was designed to be compact and expendable if necessary, the *Ring* equipment was built for television production along standards comparable to those expected from portable ground equipment now in use to cover boxing, football games, and other special events.

Two pickup cameras are generally used with *Ring* equipment, but three or more could be used if desired. Each is operated by a television cameraman. A transmitter engineer is required to supervise operation of the 1 kilowatt video transmitter. All technical operations within the plane are controlled and monitored by the video control engineer.

Thus in the more general installation, four television engineers are required to operate the *Ring* equipment, these in addition to the usual plane crew.

This television system is specifically designed for synchronized control of all technical operations under the direct supervision of the video control engineer.

The cameras are not fixed, but are free to move. They are each equipped with lenses of different angles to permit observation of an over-all area or, when desired, the observation of pinpoint targets within a given area. And when required, specific targets can be greatly enlarged.

Picture monitoring is an important part of the *Ring* equipment. One monitoring scope is for the exclusive use of the plane's pilot, providing the pilot with a view of either output of the two cameras. Then, by means of closely integrated communication between the pilot, video control engineer, the cameramen, and ground base headquarters it's a simple matter to locate pinpoint targets.

This integrated control is only one of the many duties of the video control engineer. He's also responsible for shading of each camera, controlling the video output and blanking level for each camera, directing each cameraman (via the plane's intercom system) on matters of excessive brightness, lens apertures, panning, and focussing. This engineer is the focal point for all communications with the ground base headquarters and with any other planes involved in an operation.

Because all components of the *Ring* equipment are under the constant control, scrutiny, and supervision of a complete engineering staff, all of the many technical adjustments can be maintained continually at their optimum during the entire flight or

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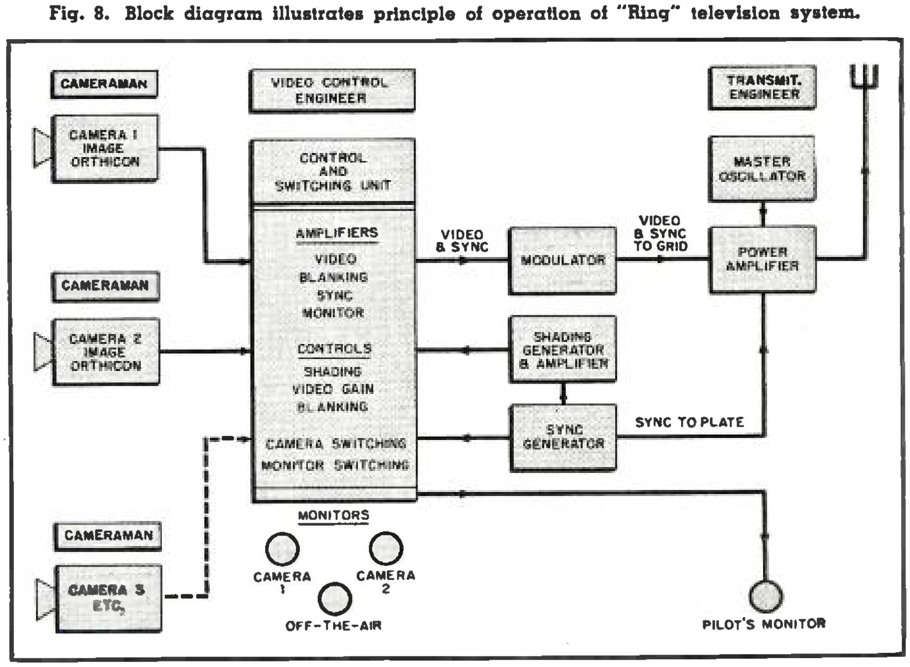
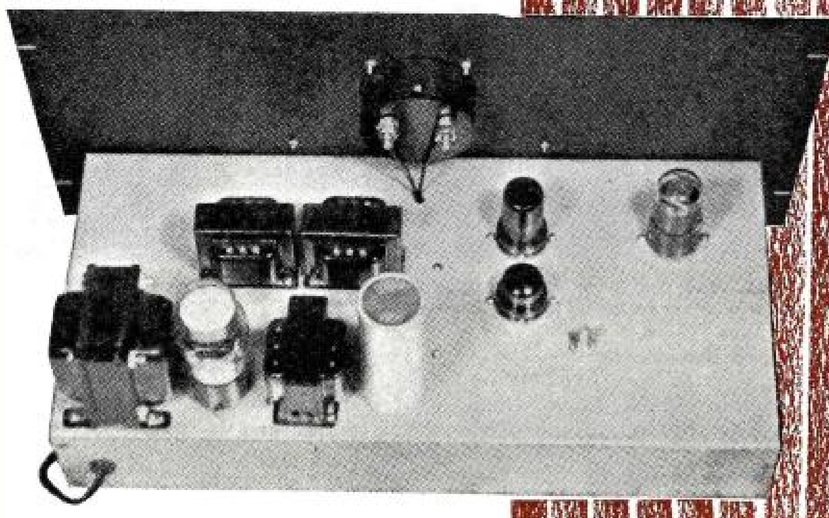
Fig. 8. Block diagram illustrates principle of operation of "Ring" television system.



Distortion Analyzer

Simplicity of construction and operation puts this test instrument within the reach of the average serviceman.

By J. T. GOODE
Asst. Chief Eng.
Packard-Bell Co.



Top rear view of distortion analyzer. Cost is reduced by using minimum number of components.

THE equipment to be discussed in this article when used in conjunction with the *RC* audio oscillator discussed in last month's issue gives the operator an opportunity to delve into some of the mysteries of audio amplifiers. An engineer who has constructed several audio amplifiers soon finds out that one amplifier operates differently from another. The difference may be in tone quality, power output, or both.

If distortion measuring equipment is not available, the engineer is not in a position to analyze properly what is causing the difference other than by checking voltages and observing patterns on an oscilloscope.

Under some conditions the voltages will be identical and continuity tests will indicate no change. By substitution of parts the difficulty is usually determined and corrected. A distortion analyzer makes it possible to check stage by stage and adjust each value of resistor, condenser, or transformer for optimum operating conditions. The use of common resistor and condenser values for resistance-coupled amplifiers is normal practice, but actually some definite value of resistor, condenser, or transformer will give optimum operating conditions if proper equipment is used to indicate slight changes when these values are varied.

A well designed amplifier will naturally have a minimum amount of distortion. It is extremely difficult for an engineer to simply listen to a loudspeaker and determine by substitution of parts when the amplifier is giving minimum distortion. The use of an oscilloscope aids the situation materially but still does not completely suit the purpose.

When determining the correct value of resistance for a particular circuit and selecting an optimum value, it is necessary to use something that will indicate small changes, such as a fraction of 1%, in that some changes of this value of resistance may cause only a slight improvement. For instance, the plate resistor in a resistance-coupled amplifier may be changed from 100,000 ohms to 150,000 ohms, decreasing the distortion by 1%. The screen resistor on this same stage is adjusted from 500,000 ohms to 750,000 ohms, reducing the distortion another 1%. By selecting these optimum values, we have reduced the distortion in this amplifier 2%, but with an oscilloscope this change would not be noticed and most certainly not by a listening test, yet 2% of distortion was removed from the circuit.

The same adjustment made on the following amplifier stage could result in another decrease of distortion in the order of 1% or 2%. The net result of the over-all amplifier distortion would be in the order of 4% or 5%, which is a worthwhile improvement. In transformer design, distortion becomes a very important factor. Selection of a transformer that gives maximum gain may result in an increase in distortion over another transformer that gives slightly less gain.

The difference in percentage of distortion can be less than that observed on an oscilloscope. In amplifier design, the addition of a tone control or negative feedback circuit is normal. Tone controls sometime result in an increase in distortion as well as high frequency attenuation. The percentage of distortion created under such conditions can be compensated for if the amount of distortion can be indicated. Negative feedback is normally used to reduce distortion. The use of a distortion analyzer makes it possible to determine what effect this feedback is causing and how much feedback is optimum.

The distortion analyzer becomes an important piece of equipment for servicing radios. Placing new tubes in a receiver may result in no particular improvement in the quality of the set. New tubes have a habit of being defective, and when such a condition exists, the technician may spend considerable time determining the difficulty. A simple distortion test immediately indicates the difficulty.

The use of this distortion analyzer is extremely simple. By connecting the distortion analyzer to any part of the audio circuit, the distortion can be read in direct percentage. Going from stage to stage in a matter of seconds, the source of distortion can be located.

Understanding the operation of a distortion analyzer aids the operator in determining where a distortion measurement can be made to aid design or the repair of existing equipment. The distortion analyzer consists of four tubes: (1) 6SN7, amplifier stage; (2) 6SR7, vacuum tube voltmeter amplifier; (3) 6H6, vacuum tube voltmeter rectifier; (4) a type 80 tube used in the power supply. The 6SN7 amplifier stage amplifies low voltages, creating a sufficient voltage for the distortion filter. This amplifier is distortionless (.1% or less). The output of this amplifier is sent into the bridged-T filters.

Two filters may be selected by a switch on the front panel, one frequency at 400 cycles and the other at 1000 cycles. These filters cancel the fundamental frequency, leaving all harmonics. The vacuum tube voltmeter is simply switched from input to output of the bridged-T filters, and the difference in voltage determines the percentage of distortion. The 6SR7 amplifier amplifies the input or output of the filter, creating sufficient voltage for the 6H6 rectifier tube. The power supply voltage is adjusted so that 200 volts is applied to the plate circuit of the 6SN7 and 6SR7 tubes.

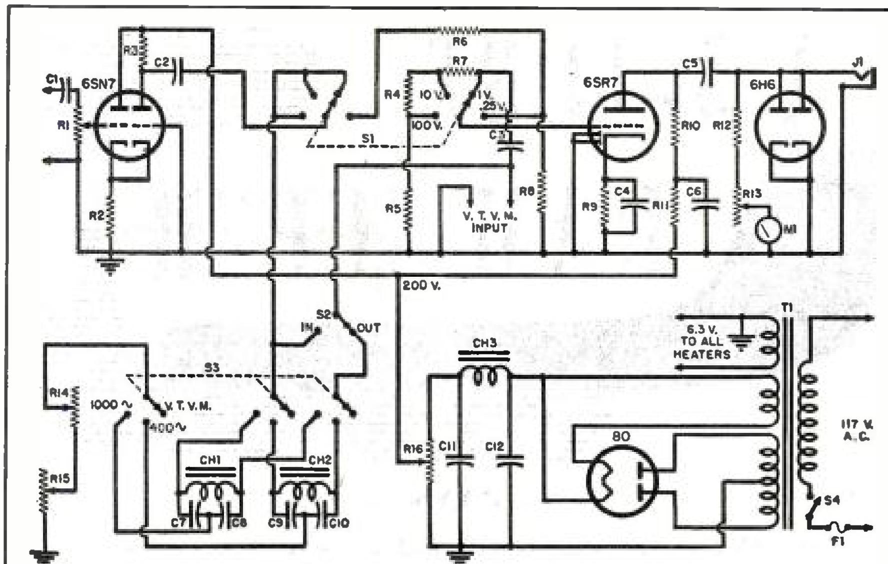
The 6SN7 amplifier is an extremely simple audio circuit. The first section of the amplifier operates as cathode follower, and the voltage created by the common cathode resistor is then impressed on the grid of the second stage of the amplifier, which creates an extremely low impedance grid circuit as well as negative feedback. The gain of this amplifier is approximately 5. The operation of the bridged-T filter circuit is to cancel the fundamental without materially affecting the harmonics. This filter does just that, effectively.

The filter consists of an iron core coil with two condensers in series shunting it. The center tap of these condensers is connected to two variable resistors. One variable resistor is 150,000 ohms and the other is 10,000 ohms. The 150,000 ohm resistor becomes the coarse adjustment, and the 10,000 ohm resistor becomes the fine adjustment. By means of a three-pole, three-position switch, the two filters may be selected, and the third position of the switch will allow the use of the vacuum tube voltmeter circuit for other purposes.

A single-pole, double-throw switch connects the vacuum tube voltmeter to the input or output circuit of the filters. At this point the voltage is fed into the vacuum tube voltmeter decade switch. This decade switch will select various voltage ranges. The output of the amplifier is then fed into the plate circuit of the 6H6 and the rectified current is indicated by a 100-microampere meter. A 10,000 ohm variable resistor is connected in series with the meter, which creates a calibration adjustment for the meter.

The operation of the vacuum tube voltmeter is as follows: 1 volt is fed into the vacuum tube voltmeter with the switch in the 1 volt position. The 10,000 ohm calibration resistor is then varied for full scale deflection of 100 microamperes. After this adjustment is made, the vacuum tube voltmeter will be in calibration on all voltage ranges with the exception of the .25 volt range, providing the decade resistors are of the correct value. By measuring several resistors of the same value, it is possible to select a set of three resistors that will give 1% or 2% accuracy. For instance, if the nearest value to 900,000 ohms turns out to be 950,000 ohms, then select a 95,000 ohm resistor in place of the 90,000 ohm resistor. Next, select a slightly higher value for the 10,000 ohm resistor. In other words, the total resistance of the three resistors is not critical, since the grid circuit offers no load, and it is simply a voltage divider. The resistance values selected added together will total 1 megohm. The total resistance could be two megohms, one and one-half megohms, or any other value in that region as long as the steps in the decade follow in steps of ten to one.

The author was able to bridge a quantity of 10% resistors and create a decade that was accurate within 1%



R_1—500,000 ohm pot.
R_2—390 ohm, 1 w. res.
R_3—50,000 ohm, ½ w. res.
R_4—90,000 ohm, ½ w. res.
R_5—10,000 ohm, ½ w. res.
R_6—220,000 ohm, ½ w. res.
R_7—900,000 ohm, ½ w. res.
R_8—500,000 ohm, ½ w. res.
R_9—1000 ohm, ½ w. res.
R_{10}, R_{12}—82,000 ohm, ½ w. res.
R_{11}—25,000 ohm, ½ w. res.
R_{13}, R_{15}—10,000 ohm rheostat
R_{14}—150,000 ohm rheostat
R_{16}—20,000 ohm, 25 w. adjustable res.
C_1, C_2—.1 μfd., 400 v. cond.
C_3—.1 μfd., 200 v. cond.
C_4—20 μfd., 25 v. cond.
C_5—2 μfd., 200 v. cond.
C_6, C_{11}, C_{12}—20 μfd., 450 v. elec. cond.
C_7, C_8—.005 μfd., 200 v. cond.
C_9, C_{10}—.03 μfd., 200 v. cond.
CH_1, CH_2, CH_3—10 hy., 50 ma. filter chokes
T_1—Power trans. 250-0-250 @ 50 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2 amps.
S_1—2-pole, 4-pos. rotary sw.
S_2—S.p.d.t. toggle sw.
S_3—3-pole, 3-pos. rotary sw.
S_4—S.p.s.t. toggle sw.
M_1—100 μa. d.c. meter
J_1—Open circuit jack
F_1—2 amp. fuse
1—6SN7 tube
1—6SR7 tube
1—6H6 tube
1—80 tube

Schematic diagram of the completely a.c. operated, 4-tube distortion analyzer.

in a matter of minutes. The purchase of 1% resistors would, of course, eliminate the problem but would increase the cost of construction. When the voltage selector switch is moved to the .25 volt position, the gain of the 6SN7 amplifier stage is utilized. To calibrate this set of resistors, rotate the input control to maximum and apply .25 volt to the input terminal. Connect a 500,000 ohm variable resistor in place of the 220,000 ohm resistor which connects between the contacts of the selector switch. Adjust this resistor until full scale deflection is indicated by the 100 microampere meter. Remove the variable resistor from the circuit and measure its resistance, substituting a fixed resistor for that particular value.

The 500,000 ohm resistor from the switch contact to ground is not critical if placed in the circuit prior to the adjustment just mentioned. By placing the filter selector switch in the vacuum tube voltmeter position and the "in or out" switch in the "out" position, it is then possible to use the vacuum tube voltmeter for purposes other than distortion measurements.

For voltages of 1 volt, 10 volts, or 100 volts, use the vacuum tube voltmeter binding posts. For voltages less

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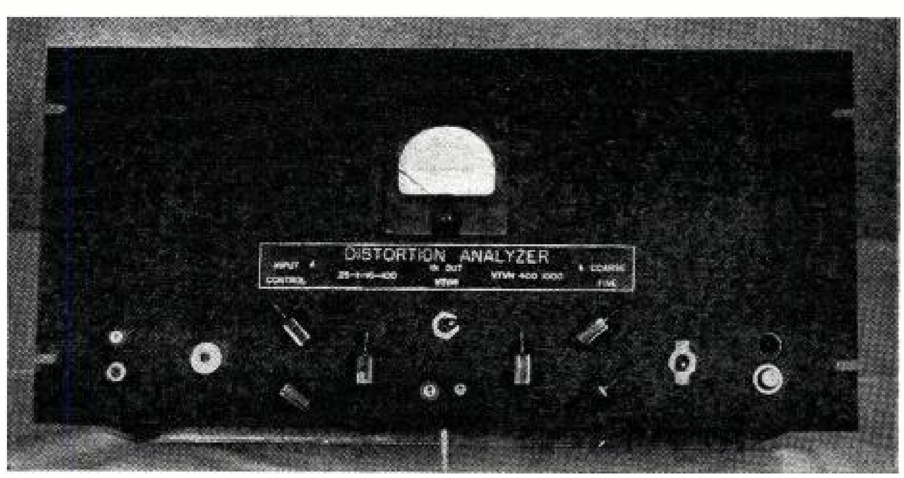
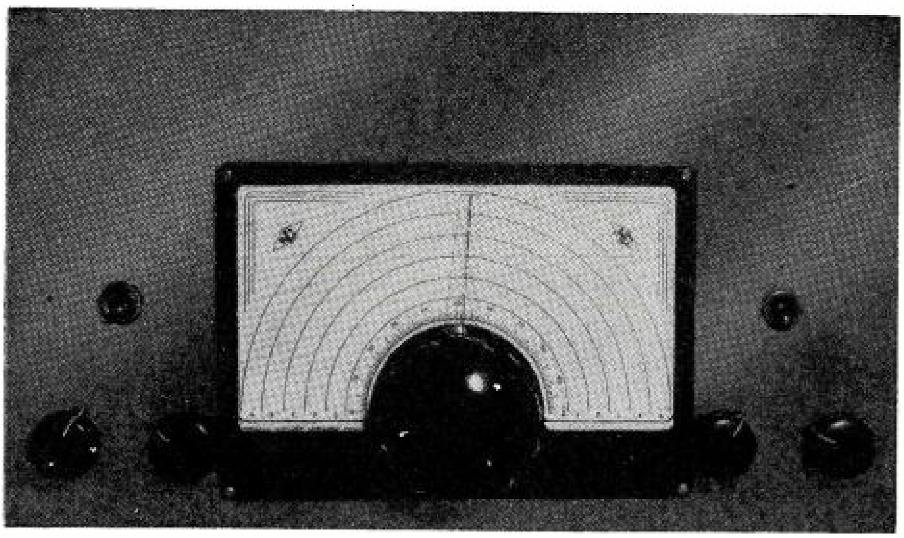
Front panel view shows proper location of various operating controls. In order to achieve a symmetrical panel layout, the control toward the left of the panel, below the "Input Control" is a dummy and not used. It may be omitted entirely.



A 5-TUBE HAM SUPER

By C. V. HAYS, W6RTP

Complete construction details for a short-wave receiver that can be built at reasonable cost.



Panel view of completed receiver. Controls from left to right are; volume control, R_{11}; a.v.c. control, R_{16}; tuning condenser C_{1a}, C_{1b}; regeneration control, R_5; and standby switch, S_3. Toggle switch S_2, is to the left and S_1 is to the right.

IN THE design of a suitable amateur communications-type receiver there are several approaches open to the builder. If the only consideration, or the primary one at least, is the matter of performance, then the problem simply becomes one of choosing the best circuits and components available. However, many hams do not have the requisite pocketbook to indulge in the deluxe type receivers commonly to be found, and the usually-to-be-seen simpler type of receiver is almost always frankly one which the designer admits will not hope to equal in performance the more elaborate jobs; i.e., it lacks sensitivity, has no selectivity, usually has no speaker output stage, no b.f.o., etc., etc. This article will give data on the construction of an inexpensive communications job which makes no apologies insofar as performance is concerned—the cheapness has been obtained by deleting heavy panels and chassis, cabinet, meter, pilot light, etc., and by using a simple type of dial whose excellence of action is well known among hams, yet is not expensive. A simple type of power supply adds further to the economy, so that the builder's \$20-\$25 purchases pure performance without doo-dads.

The front end of the receiver employs a high gain 7V7 or 7G7 tube, fed conversion voltage from a simple 7A4 Hartley oscillator in a method which ensures quiet, high conversion gain detection in this critical spot. A single stage of 1600 kc. i.f., using a type 6SF7 tube may be used if the builder desires a.v.c.; if not, a conventional 6SJ7 tube in this spot is recommended, merely leaving out the a.v.c. circuit shown in the schematic. The i.f. stage has regeneration of a simple sort applied to it by inserting a variable series resistance between the chassis and the screen grid bypass condenser, giving a degree of selectivity, easily controllable, that can be adjusted to the familiar "ping" sound common to crystal filters for c.w. work, or used in broader positions as desired. Careful layout and shielding, as well as good bypassing, etc., are necessary in the i.f. stage—we want the regeneration to be introduced *when* we want it, and as *much* as we want it, only! Build the stage exactly as shown, not forgetting a 1" x 1¼" shield (of tin or brass) which connects to pins 3 & 8 (ground), if a 6SF7 is used. If a tube of the 6SJ7 type is used, just make sure the shield solders to a good ground connection, and isolates plate and grid circuits.

Following the i.f. stage, we use a 6SN7, which tube has two complete triode units in one envelope, for a combined plate second detector and b.f.o., in which use it has proved an excellent performer. Lay out the socket so that pins 1, 2, and 3 point at the b.f.o. transformer, and the pins 4, 5, 6 come as close as possible to the last i.f. transformer; this will ensure neat, easy wiring, with all leads spaced sufficiently. No other precautions are necessary in the second detector circuit—follow the parts placement exactly for the b.f.o. section, and no trouble will be experienced with "birdies" when using b.f.o. for c.w. work, with the shielding as shown. A different layout might require that all component parts of the b.f.o. circuit be shielded separately, so that chassis layout given had best be followed in the interest of painless construction.

The audio stage is a conventional 6V6, which more than sufficiently excites a 5" PM speaker for those who wish speaker performance—if phones only are used or desired, the 6V6 stage can be deleted, the 6SN7 detector giving more than enough gain for such operation. In the interest of laziness, the output transformer was fastened directly to the chassis, instead of on the speaker itself, as is common practice. It has worked out better thus than on the speaker, since in carrying the little job from place to place, it is a simple matter to find a permanent magnet speaker of some sort lying around, and since the receiver has its own output transformer, it is a simple matter to fire up the 5-tuber for demonstration, etc., without the necessity of finding a suitable matching transformer.

Alignment of the receiver is a simple matter. With a set of coils installed (80 meters is good) turn on S_3, and, with audio gain open, r.f. gain open, and the tuning gang set half-mesh, turn the osc. trimmer (in coil form) slowly for signal indication (3750 kc.) from the signal generator—the lower signal is the one used in the model shown, but the oscillator can just as well work on the high side—then peak the detector trimmer for maximum signal, and the little super is ready to go. The matter of i.f. alignment is equally simple, and needs no word except one of caution perhaps—if your i.f.'s are new, it is a good idea *not* to change any trimmer screw adjustments until you are ready to adjust the i.f. stage—the transformers are usually set for frequency, and will need merely a bit of touching-up. I.f.

adjustments are made with regeneration full off.

The manner of obtaining bias is simple and positive, and affords a large degree of smooth control, as well as allowing the cathode of the i.f. stage to be grounded directly, an important point in quiet, high-gain stages. It is not recommended that this bias method be changed, but copied exactly as is, for best performance of the receiver.

In wiring the job, it is recommended that the constructor, particularly if not too experienced in receiver building, follow the parts placement exactly. It will be found convenient to wire all filaments first, keeping the filament lead spaced well away from grid and plate leads, and running it in chassis edges when possible, grounding one filament pin of each stage directly at the sockets. The author advocates, if at all possible, building the little job backwards, that is, wiring and testing the audio stage, then the second detector, i.f., converter and oscillator, then when all circuits "perk," wiring the b.f.o. stage. This avoids the common trouble of having possibly two or three wiring errors, etc., in a row to contend with. In following this method, wire cathode and grounds first, then plate, then grid circuits. (NB—This type of converter/oscillator must be tested with *both* converter and local oscillator wired and operating with proper coils installed, to insure bias for the first detector. *Always* turn off switch S_3 when changing coils.)

It is wise to build your i.f. stage first with the regeneration control (R_5) out of the circuit—simply ground the i.f. screen by-pass condenser (C_9) directly, until the i.f. stage is properly aligned and operating perfectly, which means that no hissing nor noise of any kind is audible in the output without signal being applied to the i.f. grid. This is important if you wish a dead-quiet receiver, a highly desirable condition for weak signal reception; once the stage is operating properly, unsolder the ground end of C_9 and connect it to R_5 as shown in the schematic diagram—increasing the value of R_5 will then be found to give smooth selectivity.

The author highly recommends the inclusion of the type 6SF7 tube in the i.f. position, since it allows simple, good a.v.c. to be obtained. A careful study of the schematic will show the foolproof action of the a.v.c. circuit, and its inclusion is very desirable if phone operation is contemplated. The operation of the circuit

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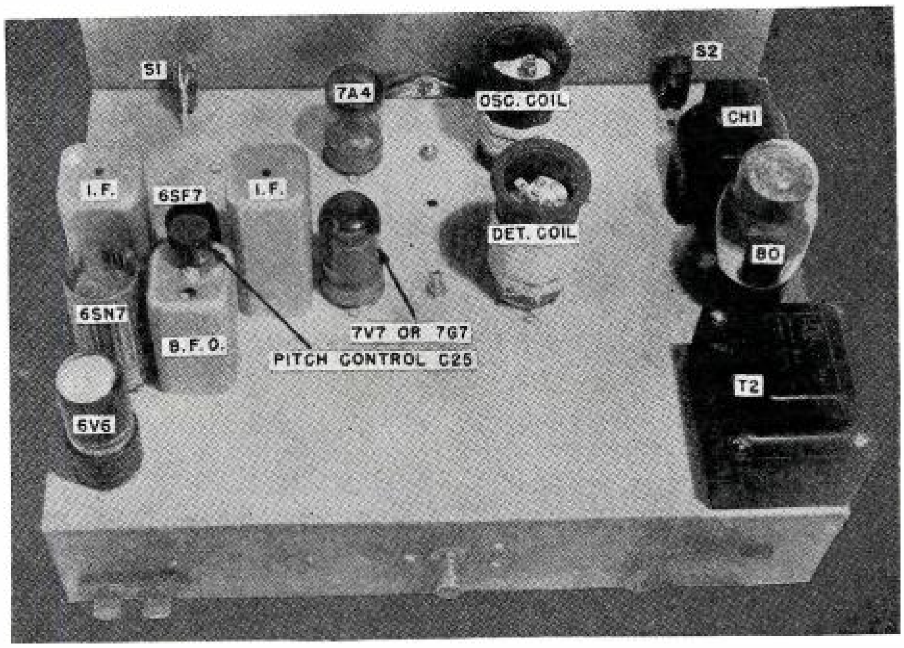
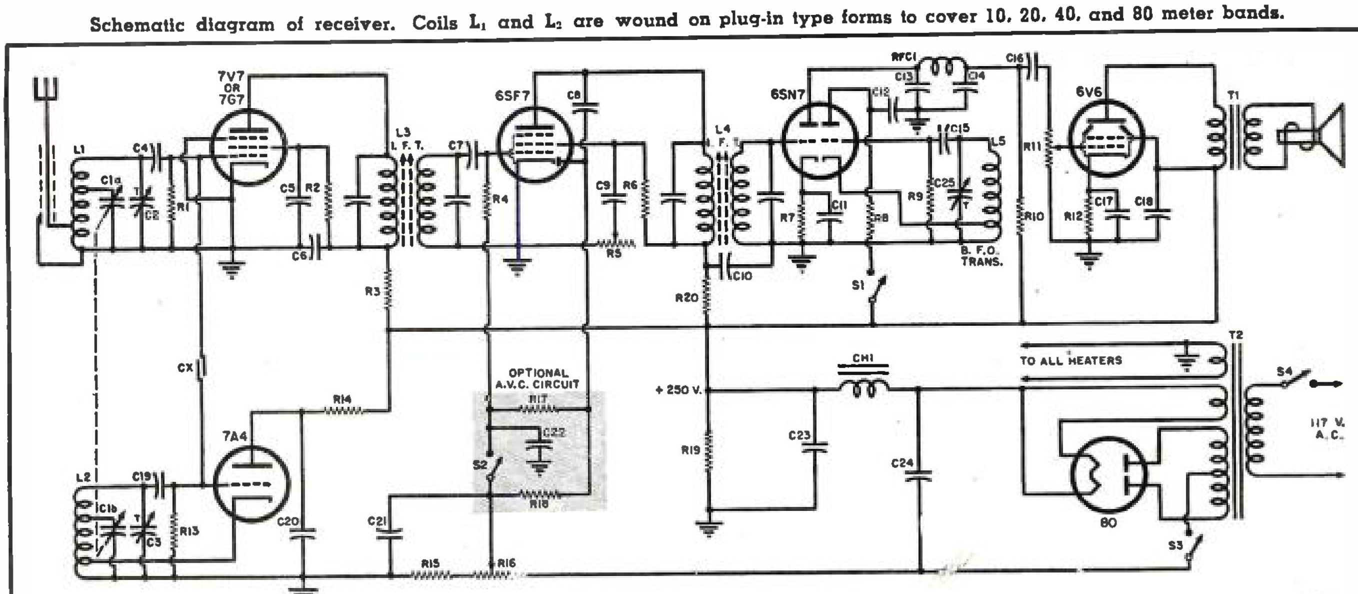


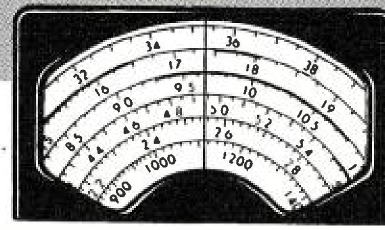
Top view of short-wave receiver shows placement of major component parts.

Schematic diagram of receiver. Coils L_1 and L_2 are wound on plug-in type forms to cover 10, 20, 40, and 80 meter bands.



R_1—5 megohm, ½ w. res.
R_2, R_6—75,000 ohm, 2 w. res.
R_3, R_{20}—1000 ohm, 1 w. res.
R_4, R_{17}, R_{18}—1 megohm, ½ w. res.
R_5—2000 ohm, rheostat
R_7—15,000 ohm, 2 w. res.
R_8, R_{14}—25,000 ohm, 2 w. res.
R_9—50,000 ohm, ½ w. res.
R_{10}—50,000 ohm, 2 w. res.
R_{11}—.5 megohm, pot.
R_{12}—300 ohm, 2 w. res.
R_{13}—25,000 ohm, ½ w. res.
R_{15}—25 ohm, 2 w. res.
R_{16}—500 ohm, pot.
R_{19}—100,000 ohm, 5 w. res.
C_{1a}, C_{1b}—2 gang, 35 μμfd. per sec. variable cond.
C_2, C_3—See coil table
C_4, C_{13}, C_{14}—.001 μfd., mica cond.
C_5, C_6, C_9, C_{10}, C_{12}, C_{16}, C_{20}, C_{22}—.01 μfd., 400 v. cond.
C_7, C_{15}, C_{19}—.0001 μfd., mica cond.
C_8—.0005 μfd., mica cond.
C_{11}, C_{17}—5 μfd., 50 v. elec. cond.
C_{18}—.05 μfd., 400 v. cond.
C_{21}—.5 μfd., 400 v. cond.
C_{23}, C_{24}—20 μfd., 350 v. elec. cond.
C_{25}—B.F.O. trans. trimmer (pitch control)
C_x—Twisted pushback wire, ¼"
T_1—Output trans., 5000 ohm plate to v.c.
T_2—Power trans., 525 v. c.t. @ 70 ma., 6.3 v. @ 3 amp., 5 v. @ 2 amp.
Ch_1—12 henry, filter choke @ 75 ma.
S_1, S_2—S.p.s.t. toggle sw.
S_3—S.p.s.t. rotary sw.
S_4—S.p.s.t. sw. on R_{11}
RFC_1—30 mh. r.f. choke
L_1, L_2—See coil table
L_3, L_4—Iron core i.f. trans., 1600 kc.
L_5—B.F.O. trans., 1600 kc.
1—7V7 or 7G7 tube
1—6SF7 tube
1—6SN7 tube
1—6V6 tube
1—7A4 tube
1—80 tube

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

IT IS with great pleasure that this month's ISW Department is dedicated to two widely-separated short-wave outlets—*Radio Saigon*, French Indo-China, and *Radio Central America*, Republic of Panama.

For the benefit of ISW readers, I am quoting portions of a letter just received from Mrs. R. G. (Margaret Morgan) Coughlin, formerly of Pennsylvania, who is now *"Speakerine Anglaise"* at *Radio Saigon*, French Indo-China:

"Radio Saigon received your grand letter about ten days ago and was delighted to hear that the signal comes through so clearly. We of the English Department were particularly pleased with your comments on the English programs and your pleasure at hearing English over a foreign station. I am the woman announcer you referred to as speaking 'fluent' English. That comes naturally to me, as I am an American. My husband is in the foreign service here and I, to keep myself occupied, have taken a job with *Radio Saigon* as 'afternoon' English announcer. The work is extremely interesting and we've received letters from radio listeners all over the world, reporting reception of our English programs.

"By the time you receive this, I will have stopped broadcasting regularly, as I've found it too heavy a schedule to swing along with my other duties. I will continue to help with the programs, however, and will probably continue to give the Tuesday 'afternoon' broadcast and the French lesson.

"Radio Saigon had one of the strongest signals in the Far East before the war and, I am told, had the finest record collection. Practically everything was destroyed in the arsenal explosion which occurred last April, however, and the station has been forced to begin building 'from scratch' with very primitive equipment. We are gradually building up again; but it will be a difficult task with equipment from overseas so hard to procure.

"We give two *English* broadcasts a day—the first at 4:45-5:30 EST;* the second, 8:30-9:30 a.m. The 'afternoon' broadcast consists usually of 15 minutes of dance music, followed by 10 to 15 minutes of news. At 5:15 a.m. there is usually a 10-minute special feature; and the program is concluded with music. Features include an English lesson for French listeners on Mondays and Fridays; a French lesson for English listeners on Tuesdays (taught by myself); a short talk on subjects of general interest on Wednesdays; our Listener's Letter Box (replying to letters received from short-wave listeners) on Thursdays; and over the week-end, occasional special talks or sports lectures. The 'night' broadcasts follow the same pattern, except that there is always a half-hour of music (popular, classical, or semi-classical), preceding the news (usually heard around 9 a.m.); the English lessons are also omitted in the 'evening' period and music is substituted.

"The shortage of personnel necessitates our programs being rather simple; however, we hope soon to be able to include occasional skits, plays, and other special features.

"Let me assure you that your reception of our station on August 7 on the 11.78 frequency was most accurate . . . I surely hope you will be tuning in this frequency Thursday afternoon when I answer your letter over the air." *(Your ISW Editor missed it!)*

Mrs. Coughlin concluded, "Thanks so much for your letter and also for the RADIO NEWS which is much appreciated; it is the first record I've seen of other Far East stations and their wavelengths. Please continue to write us; and if you have any suggestions or material that we could use on our English broadcasts, they would be much appreciated, as there is little of that sort of thing left in postwar Saigon."

(Your ISW Editor is trying to arrange a special DX broadcast from Radio Saigon for some Sunday in March or April, dedicated to readers of RADIO NEWS, *for around 5:15 a.m. (1015 GMT). Watch for it!)*

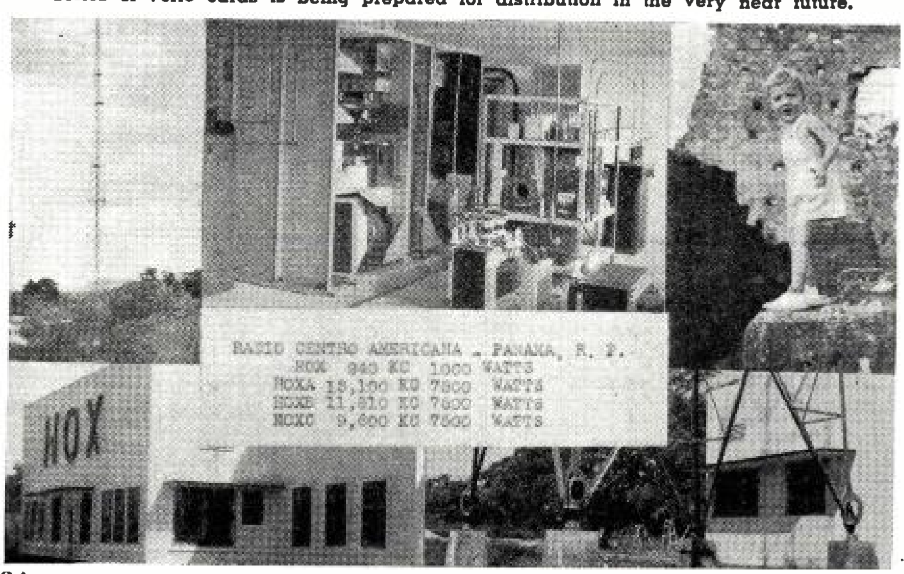
Technical data on *Radio Saigon*, furnished by Mrs. Coughlin, follows:

The station radiates on 11.780, 4.810, and 1050 kilocycles in the 25-, 62-, and 285-meter bands, respectively. Studio is located at 198 Rue Chasseloup Laubat, Saigon, French Indo-China. Transmitters are located at Phu T-no, 3 miles from Saigon. The station is owned and operated by the *Haut Commissariat de France pour le Pacifique.* Studio equipment is emergency equipment; former studios were destroyed in an ammunition depot explosion in April, 1946.

The s.w. transmitter on 11.780 operates on a non-directive, half-wave antenna; the 4.810 one with a non-directive, delta-matched. Output power is 12 kw., input power, 50 kw. Final stage tubes are (two) water-cooled 10 kws. anode voltage 8800 volts; modulation is Class A.

Full schedules of *Radio Saigon* are: Daily, 6-7:30 p.m.; 9:45-12 midnight;

This photograph "verie" has been sent to all parts of the world by HOXA, Box 1335, Panama City, Republic of Panama, and features scenes around the station. A new series of verie cards is being prepared for distribution in the very near future.



* Unless otherwise indicated, all times herein are expressed in American Eastern Standard Time, 5 hours *BEHIND* GMT.

and 3:30-9:45 a.m.; *English* periods begin at 5:45 and 8:30 a.m.

* * *

Radio Central America

We are indebted to the staff of *Radio Central America,* Box 1335, Panama City, Republic of Panama, for this interesting article prepared expressly for readers of RADIO NEWS:

"New equipment now being installed at Station HOX, Panama, will make *Radio Central America* the first radio outlet to give complete long-wave coverage of the Republic of Panama and other parts of Central America as well, although Panama now has nine stations in operation and seven others in various stages of construction.

"The new equipment consists of a one-kilowatt transmitter, beam antenna for short-wave transmissions which will increase the power of the station approximately six times; new recording facilities; and FM transmitters.

"*Radio Central America* first went on regular schedule on October 12, 1946, after three years of planning and painful accumulation of equipment and building materials.

"Although the Republic of Panama has long had several commercial radio stations (due to local restrictions, there is but one amateur station on the Isthmus, although the amateur field is expected to be opened shortly), the promoters of *Radio Central America* were not satisfied with the local radio stations, and were determined to add a new station to the list.

"This group of Panama businessmen, therefore, placed orders for equipment through the Panama Radio Corporation and applied to the Government of Panama for a construction license. At that time—1943—it was a difficult question to answer—which was the harder to get, building materials or radio equipment. For some time, *Radio Central America* remained a 'paper company.'

"The end of the war brought not only equipment to *Radio Central America,* but also the services of two young Americans, James T. Cooper, Raleigh, North Carolina, and Wilbur T. Morrison, Lancaster, Pennsylvania. Cooper, now English Program Director of Station HOX, was formerly with WIP, Philadelphia, and both he and Morrison were in radio work with the Army Air Forces on the Isthmus during the war. Cooper was for a time director of USO stage and radio activities in Cristobal, Canal Zone.

"After two years of waiting, equipment and building materials for HOX began to arrive. In December, 1945, work began on the building which now houses the station's transmitting equipment and temporary studios. Workmen began setting up the transmitting equipment in February of 1946, and in April the all-steel *Blaw-Knox* tower which is HOX's BCB antenna, began to rise toward its present height of 261 feet, seven inches.

"Late in July, 1946, HOX began to make test broadcasts. Letters poured

in from all over the world reporting that the station was coming in fine—better than some local stations, the letters invariably said. With the exceptions of Bolivia, Uruguay, and Paraguay, HOX received confirmation of the strength of its signal from all countries of the Western Hemisphere and from every state in the United States. *Why Bolivia, Uruguay, and Paraguay have remained silent is still a mystery!* Responses have come in from Hawaii, Portugal, India, Liberia, Norway, Nigeria, Egypt, Germany, Newfoundland, The Netherlands East Indies, England, the Christmas Islands, Denmark, Australia, New Zealand, and a number of places in the Pacific, identified only by APO numbers. One letter from Germany—in a tight, careful script—covered several pages with a painstaking description of HOX reception; the writer, a radio technician, said that he had once had a transmitter of his own but that 'it burned down about three years ago.'

Reports from Sweden were especially notable. As reported in the November (1946) issue of RADIO NEWS, the Swedes are great radio listeners. Chief Engineer Morrison, of HOX, says that, judging solely by the mail received by *Radio Central America,* from Sweden, "one would think that all Swedes speak English, listen to the radio avidly, and are great stamp collectors!" Morrison lists the Swedes as *Radio Central America's* greatest foreign fans, and after them, Canadians and Cubans.

"Like most Panama radio enterprises, *Radio Central America* now transmits on more than one frequency. At present on the air are Stations HOX, 940 kcs., and HOXA, 15.100. Eventually, it is planned to radiate over Stations HOXB, 11.810; HOXC, 9.660; HOXD, 1310 kcs.; and HOXFM, 43.300. HOXFM will be Panama's first and only FM station; it will serve chiefly as a link between *Radio Central America's* downtown studios—now under construction—and the transmitter, which is located in Panama City's suburbs.

"At present, transmissions over HOX and HOXA are identical. From 11 a.m. until 9 p.m. each day, Spanish programs are transmitted over both frequencies, and from 9 p.m. until midnight, *English* language broadcasts are radiated.

"It is planned, however, when all the new equipment is ready for use, to expand the *English* language broadcasts to a full day and to broadcast them on a frequency different from the Spanish language outlet.

"When *Radio Central America* goes on the air with a full-time program in English, it will be broadcasting more English than any other station in Panama, and probably more than any other in Central America. Before HOX appeared on the scene, Panama radio stations broadcast almost entirely in Spanish with only a few programs—such as short newscasts—in English. Heretofore, the only all-English broadcast from the Isthmus was done by the *Armed Forces Radio Station* in the Canal Zone, which still broadcasts all day in *English.*

"Other Panama stations have protested the existence of the AFRS and its continuance after the end of the war. They charge that it offers unfair competition to Panama stations because the great majority of English-speaking residents on the Isthmus prefer to listen to programs in English rather than in Spanish. During the recent Inter-American Radio Congress in Mexico City, the Panama delegate—an employee of one of the local stations—put in an official protest against the AFRS which protest was adopted by the Congress. Even so, authorities of the Canal Zone have shown little disposition to remove the AFRS which they regard as a considerable morale factor among the men of the U.S. Army and Navy stationed on the Isthmus. The recent announcement concerning the Caribbean Area indicates that there will be more soldiers and sailors on the Isthmus in the future than there are now, and that probably, unless budget considerations force its removal, the AFRS will continue business at the same old stand.

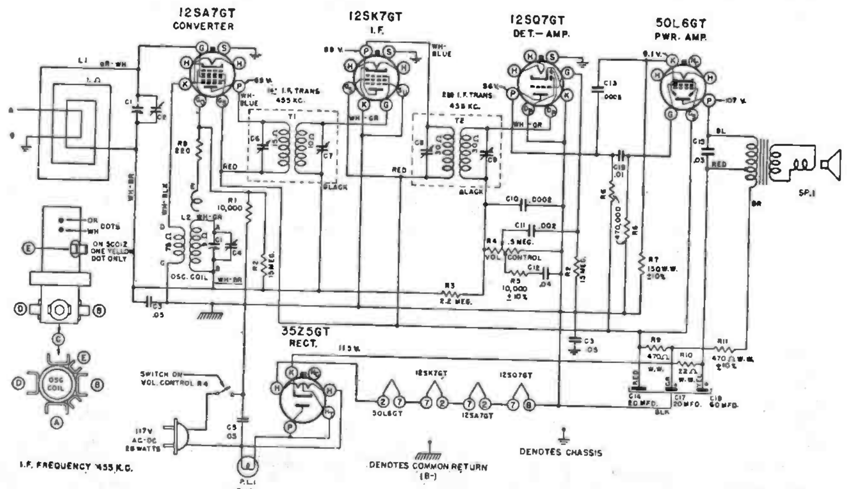
"Despite the many protests by various Panama radio enterprises against the AFRS, *Radio Central America* was the first Panama station to offer ac-

(*Continued on page* 104)

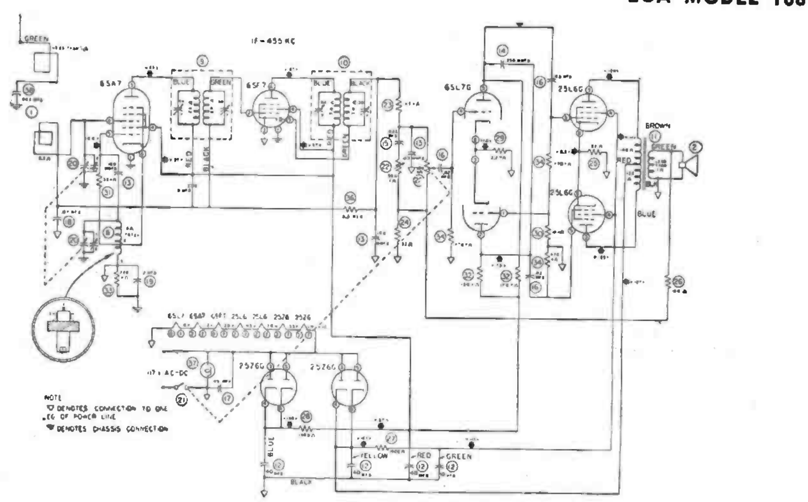
CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 76)

RADIO NEWS, FEBRUARY, 1947 — **ZENITH MODELS 5D011-5D027**

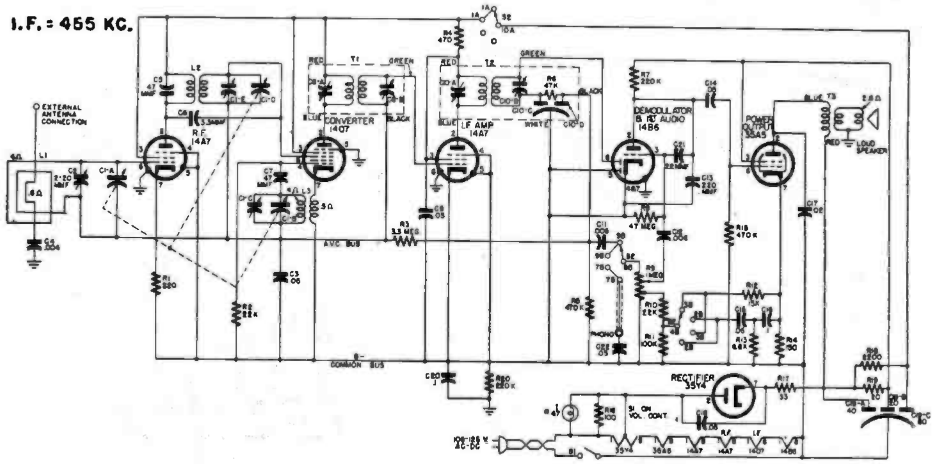


RADIO NEWS, FEBRUARY, 1947 — **ECA MODEL 108**



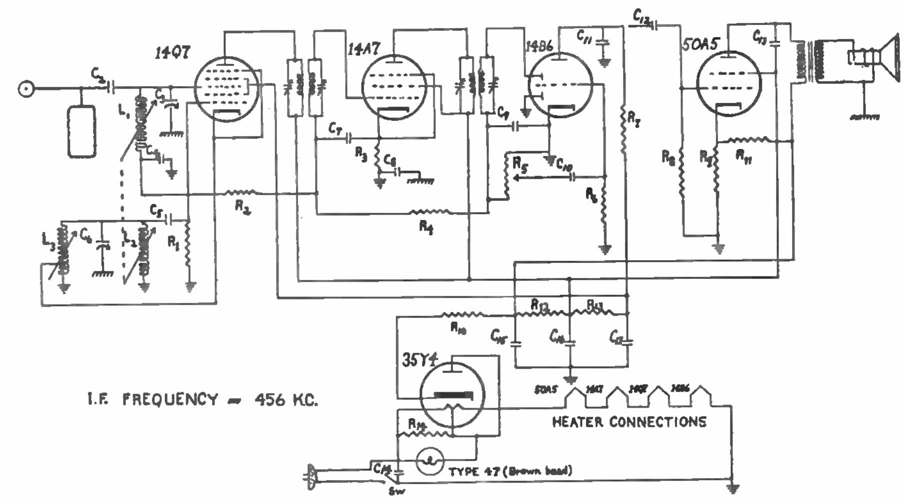
RADIO NEWS, FEBRUARY, 1947 — **BENDIX MODELS 636A, C, D**

I.F. = 455 KC.

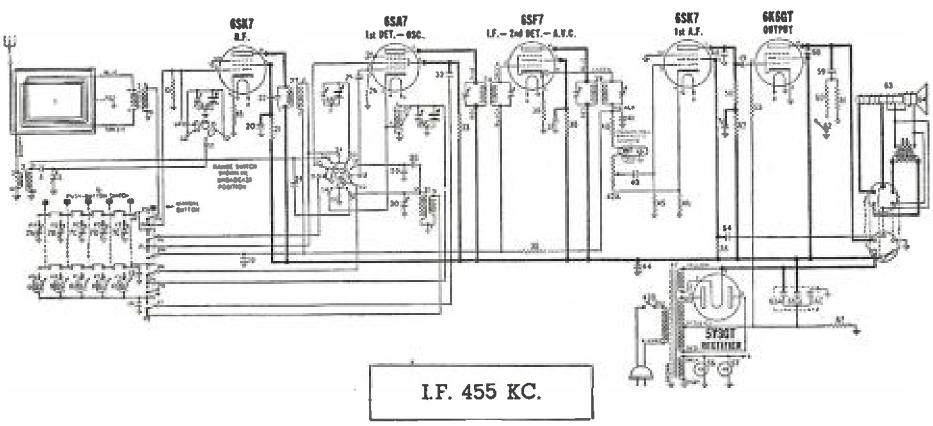


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

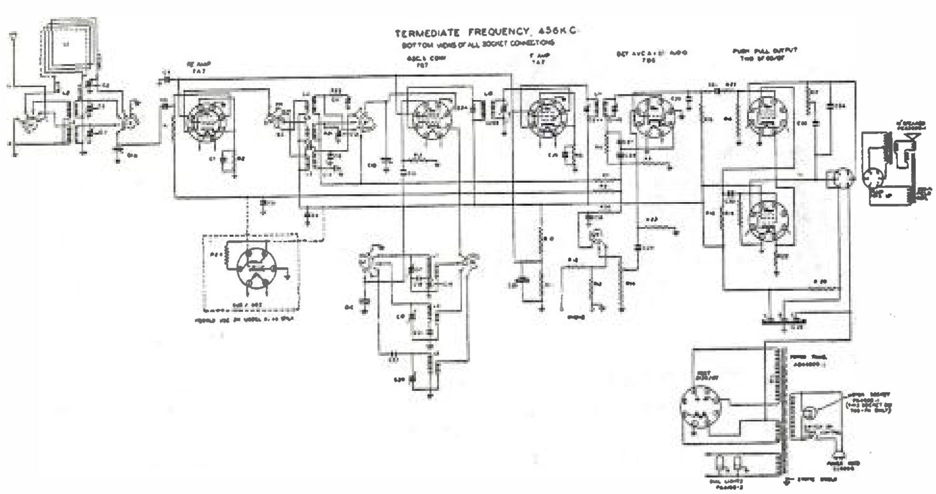
RADIO NEWS, FEBRUARY, 1947 — **CORONET MODEL C-2**



RADIO NEWS, FEBRUARY, 1947 — **STEWART-WARNER MODELS 9001-C, D, E, F**



RADIO NEWS, FEBRUARY, 1947 — **SPARTON MODELS, 7-46, 7-46PA, 8-46, 8-46-PA**

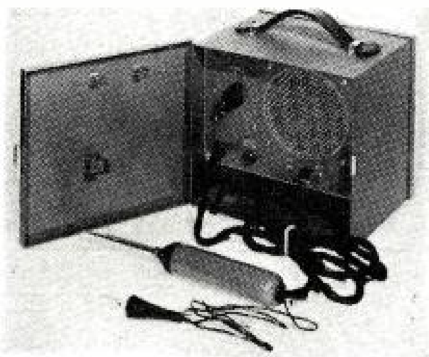


What's New in Radio

PORTABLE SIGNAL TRACER

A new portable, battery-operated signal tracer for the radio serviceman is now being distributed by radio parts jobbers for *Special Products Company* of Silver Spring, Maryland.

The new SPECO instrument is housed in a gray crackle finish steel



case which is equipped with a carrying handle. The unit weighs 4 pounds, 10 ounces, and the over-all size is 5¼"x6¼"x6⅛".

Low drain tubes have been used in the construction of this unit in order to assure longer battery life. A safety feature has been incorporated which prevents the closing of the cover when the power switch is on. An extra long probe and long test leads make this unit suitable for all types of radio servicing including auto radios.

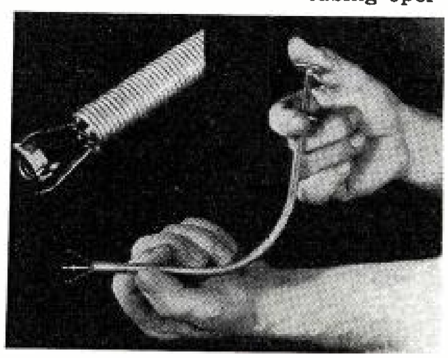
Special Products Company, Silver Spring, Maryland is the manufacturer.

SERVICING TOOL

Angelus Tool Manufacturing Co. of Los Angeles, California has announced a servicing tool which should be of interest to the radio man.

Known as the "Flex-o-claw," this tool which is made of all steel wire, is particularly adapted for installing or removing small parts, nuts, screws, etc. from otherwise inaccessible places on the radio chassis.

This unit is ¼" in diameter and is available in lengths of 12, 15, 18 and 22 inches. A simple plunger arrangement at the end of the flexible tubing oper-



ates the jaws of the unit to permit firm gripping of parts.

Angelus Tool Manufacturing Co., 3060 W. Pico Blvd., Los Angeles 6, California will supply prices and delivery dates on this item to those requesting this information.

WIRE RECORDER

Peirce Wire Recorder Corporation of Evanston, Illinois has recently announced production on two postwar model wire recorders, one for heavy duty office work and the other a portable model for field work.

The heavy duty business unit features remote controls which permit dictation to the recorder from 50 to 100 feet distant in addition to a button control for the use of the typist in transcribing. The light weight reel which carries the thin stainless steel "thread" weighs only a few ounces and is capable of recording from 66 minutes to over two hours. Messages may be played back as many as 100,000 times without loss of volume or tone quality.

Recordings may be erased automatically in the process of dictating a correction or using the wire for new recording.

Full details on either the heavy

duty or portable model wire recorder will be furnished by *Peirce Wire Recorder Corporation,* 1328 Sherman Avenue, Evanston, Illinois.

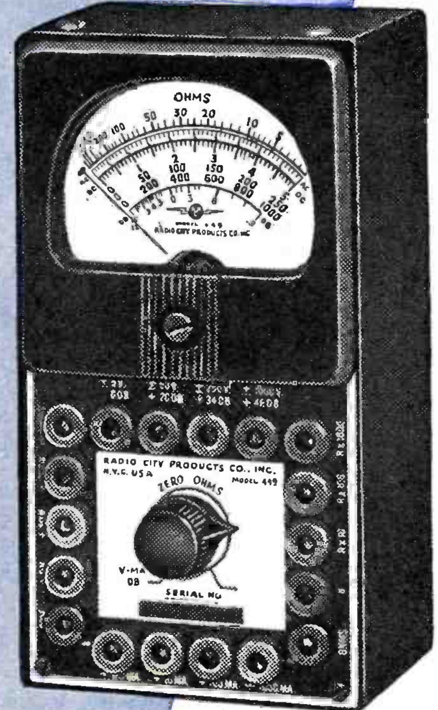
SYNCHROSCOPE

The *Electronics Division* of *Sylvania Electric Products Inc.* has recently announced the availability of a new synchroscope specially designed for the visual examination of the fine structure of periodic waveforms in television, pulse time modulation, sonic depthfinders, geophysical exploration and loran equipment.

The instrument includes a five inch cathode ray oscilloscope; trigger generator for synchronization; space for the addition of a video amplifier and r.f. envelope viewer; adjustable time delay phasing circuits; and seven input connectors and a selector switch for rapid viewing of separate external circuits.

Television applications include study of the shape, amplitude and duration of video pulses ranging from a fraction to several hundred microseconds. Used with the video amplifier and an r.f. envelope viewer it provides a

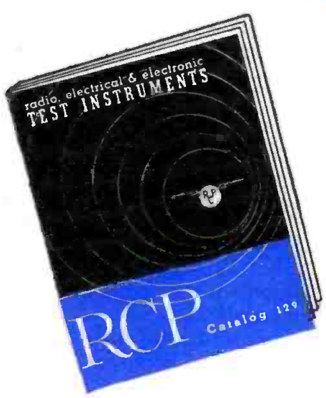
NO OTHER INSTRUMENT OFFERS SO MUCH FOR SO LITTLE



Ruggedness of a pocket portable . . . high sensitivity of a bench model . . .
RCP's Model 449 gives you both . . . at a price way down among the lowest.
When you take this fine instrument along on your service calls you're taking a *complete* testing unit in your coat pocket.
With its 5000-ohms-per-volt DC sensitivity you can check voltage of high-resistance circuits . . . and its wide resistance range will measure up to two megohms with *self-contained batteries.*
There's hardly a service problem that can't be solved with the Model 449 Multitester. Call your jobber now . . . tell him to send one out TODAY.
Complete with self-contained battery—**PRICE $24.50.**

IMMEDIATE DELIVERY

RCP's 5000-ohms-per-volt
POCKET MULTITESTER
MODEL 449



Write today for your copy of RCP's new Catalog No. 129. In addition to all the RCP instruments it contains the famous Reiner line. Complete descriptions and handsome illustrations of America's leading high-quality testing instruments.

FEATURES:

- Germanium-crystal-diode rectifier eliminates temperature and frequency errors.
- The 3" square, high-visibility meter is accurate to 2% and has a sensitivity of 200 microamperes.
- Six instruments in one pocket-size unit.
- A-C voltmeter frequency response is flat from 30 cps to 50 kc.
- Spring-clip-mounted batteries are readily accessible.
- Metalized, matched voltage multipliers have a tolerance of *one per cent.* This is far closer match than in most instruments of this type.
- All-metal case offers complete shielding of instrument.
- All ratings are based on standard A.I.E.E. and R.M.A. specifications at full-scale deflection.
- Size only 3"W x 2¼"D x 6"H. Weight: 2 lbs.

RANGES:

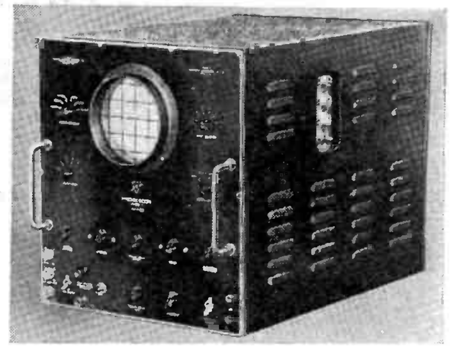
D-C VOLTMETER:	0/5/50/250/1000 volts. First scale division—0.1 volt. (5,000 *ohms per volt*)
A-C VOLTMETER:	0/5/50/250/1,000 volts. First scale division—0.1 volt. (1.000 *ohms per volt*)
D-C MILLIAMMETER:	0/.5/10/100/1,000 ma. First scale division—.01 ma.
OHMMETER:	0/2,000/20,000 ohms; 0/0.2/2 megohms.
DECIBEL METER:	—6 to +10, +14 to +26, +28 to +40, +40 to +52. The db-scale calibration is based on a line impedance of 500 ohms, 6 milliwatts reference level. For other impedances correction charts are supplied.
OUTPUT VOLTMETER:	0/5/50/250/1,000 volts. First scale division—0.1 volt.

RCP INSTRUMENTS—BEST FOR EVERY TEST

RADIO CITY PRODUCTS COMPANY, INC.
127 West 26th Street, New York 1, N. Y.

means of visual examination of r.f. pulse envelopes or waveforms up to and including the microwave region.

Additional data on the Synchroscope



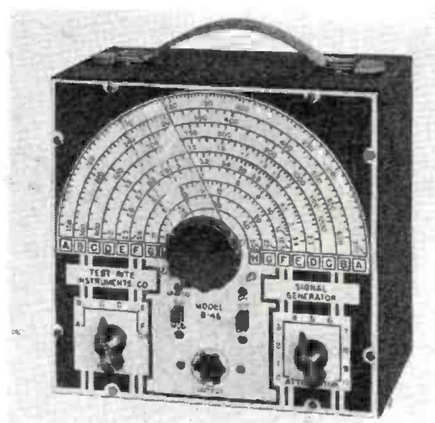
will be supplied by the *Electronics Division, Sylvania Electric Products Inc.*, 500 Fifth Avenue, New York, 18, N. Y.

SIGNAL GENERATOR

Metropolitan Electronic & Instrument Co. of New York are currently offering their Model B-45 Signal Generator for all types of radio servicing.

This model is a one-tube, self modulated unit which covers the range from 150 kc. to 50 mc. The range from 150 kc. to 12.5 mc. is coverd on fundamentals and from 11 mc. to 50 mc. on harmonics. Pure r.f. is obtainable or can be modulated by a.f.

The Model B-45 may be used in servicing television and FM receivers as



well as all types of AM equipment. Modulation is accomplished by grid blocking action.

This signal generator is completely portable and self contained, requiring no external power supply.

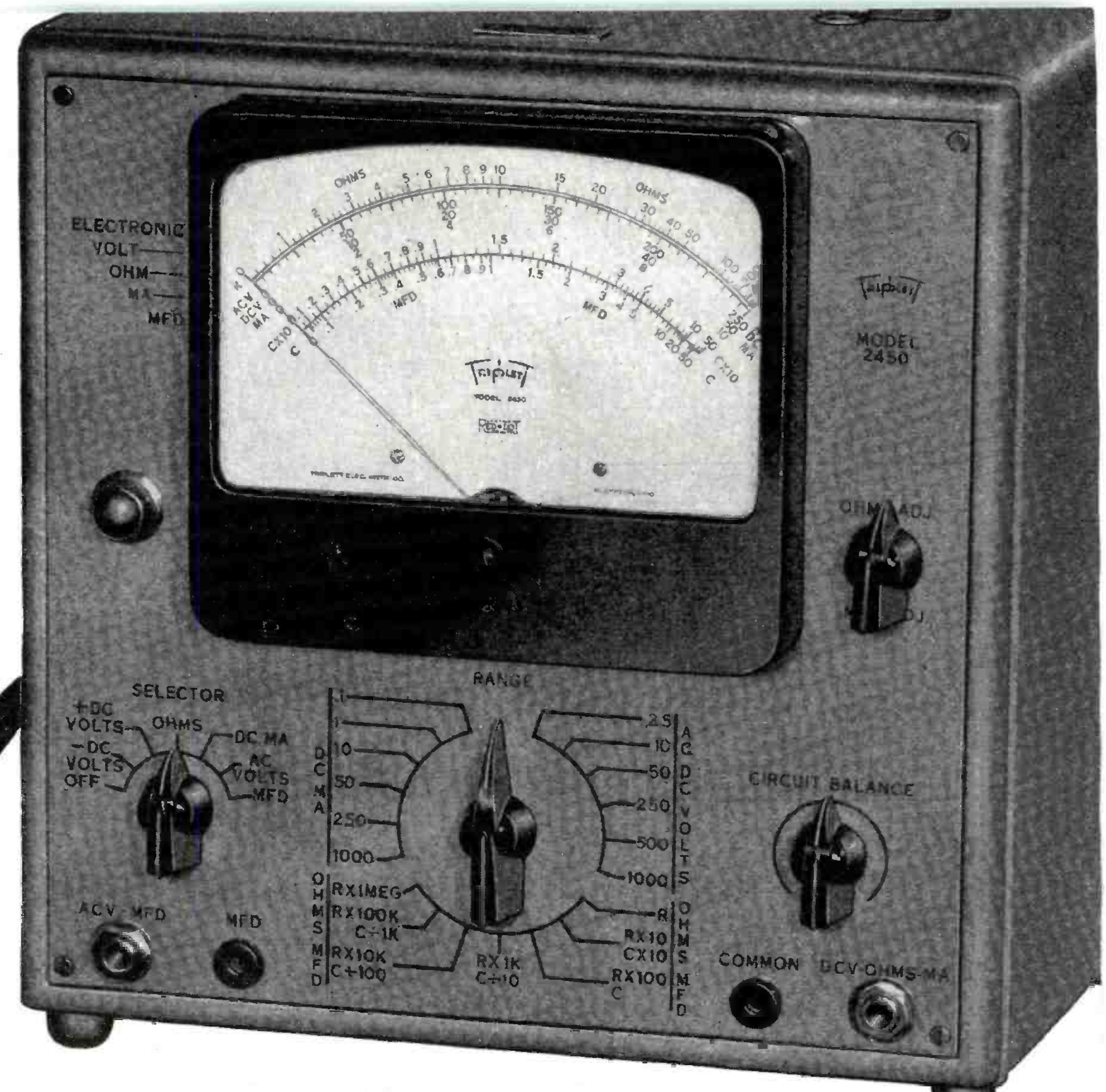
Full details, including price, will be furnished by *Metropolitan Electronic & Instrument Co.*, 6 Murray Street, New York 7, New York.

TUBE TESTER

The Triplett Electrical Instrument Co. of Bluffton, Ohio have recently placed on the market their new Model 2425 Transconductance Reading Tube Tester which features several innovations in the field.

Micromho readings and simplified testing are featured in this new unit. Transconductance readings are made possible through a simple measure-

(*Continued on page* 92)



Model 2450

ELECTRONIC TESTER

There's <u>never</u> been a tester like this!

Here's a tester with dual voltage regulation of the power supply DC output (positive and negative), with line variation from 90 to 130 volts. That means calibration that stays "on the nose"! That means *broader service* from a tester that looks as good as the vastly improved service it provides. And, together with its many other new features—including our Hi-Precision Resistor which outmodes older types—it means higher performance levels wherever a tester is needed. Detailed catalog sheets on request.

Highlights:

- 42 RANGES: DC and AC. Volts: 0-2.5-10-50-250-500-1000. DC MILLIAMPS: 0-0.1-1.0-10-50-250-1000. OHMS: 0-1000-10,000-100,000. MEGOHMS: 0-1-10-100-1000. CAPACITY IN MFD: 0-.005-.05-.5-5-50.
- LOAD IMPEDANCE: 51 megohms on DC Volts.
- CIRCUIT LOADING: Low frequencies. Circuit loading equal to 8 megohms shunted by 35 mmfd. High frequency circuit loading equal to 8 megohms shunted by 5 mmfd.

Precision first ...to last

STANDARDS ARE SET BY TRIPLETT

Triplett

ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 70 AND 71)

STEWART-WARNER MODELS 9001-C, D, E, F

Part No.	Code and Description
502468	15—4.7 megohm, ¼ w. res.
502127	18—560 ohm, ¼ w. res.
502132	21—100,000 ohm, ¼ w. res.
502130	26—22,000 ohm, ¼ w. res.
502466	33—33,000 ohm, 1 w. res.
502135	35—2.2 megohm, ¼ w. res.
502264	36—47 ohm, ¼ w. res.
502467	38—68,000 ohm, ½ w. res.
502131	40—47,000 ohm, ¼ w. res.
502148	42A, 42B—500,000 ohm vol. control & sw.
502468	45—4.7 megohm, ¼ w. res.
502128	46—2200 ohm, ¼ w. res.
502133	50—220,000 ohm, ¼ w. res.
502132	52—100,000 ohm, ¼ w. res.
502134	53—470,000 ohm, ¼ w. res.
502135	55—2.2 megohm, ¼ w. res.
502291	60—4700 ohm, ¼ w. res.
502127	61—560 ohm, ¼ w. res.
502137	67—330 ohm, 2 w. w.w. res.
502202	4 —150 μμfd., 500 v. cond.
502172	5 —25-100 μμfd. trimmer
502910	7A to E—Trimmer assembly for P-B tuner
502161	13—270 μμfd., 500 v. cond.
502165	14—1000 μμfd., 500 v. cond.
502122	16A, 16B, 16C—Variable gang
502155	19—.1 μfd., 200 v. cond.
502157	20—.05 μfd., 400 v. cond.
502295	22—10 μμfd., 500 v. cond.
502411	24—2 μμfd., 500 v. cond.
502159	25—50 μμfd., 500 v. cond.
502201	28—130 μμfd., 500 v. cond.
502182	29—39 μμfd., 500 v. cond.
502171	30—5-35 μμfd., trimmer
502151	32—.01 μfd., 400 v. cond.
502157	37, 44—.05 μfd., 400 v. cond.
502271	41—260 μμfd., 500 v. cond.
502150	43—.004 μfd., 600 v. cond.
502160	48—110 μμfd., 500 v. cond.
502152	49—.02 μfd., 400 v. cond.
502410	51—.1 μfd., 400 v. cond.
502405	54—.25 μfd., 400 v. cond.
502150	58—.004 μfd., 600 v. cond.
502154	59—.05 μfd., 600 v. cond.
502207	66A, 66B, 66C—20/10/20 μfd., 400/400/25 v. elec. cond.

ZENITH MODELS 5D011, 5D027

Part No.	Code and Description
63-589	R_1—10,000 ohm, ¼ w. res.
63-976	R_2—15 megohm, ¼ w. res.
63-600	R_3—2.2 megohm, ¼ w. res.
63-1337	R_4—.5 megohm vol. control
63-641	R_5—10,000 ohm, ¼ w. res.
63-597	R_6—470,000 ohm, ¼ w. res.
63-686	R_7—150 ohm, ½ w. wire wound res.
63-579	R_8—220 ohm, ¼ w. res.
63-1449	R_9—470 ohm, 1 w. wire wound res.
63-1450	R_{10}—22 ohm, 1 w. wire wound res.
63-1222	R_{11}—470 ohm, 1 w. wire wound res.
22-1356	C_1—2-gang var. cond.
	C_2—Broadcast ant. trimmer (part of C_1)
22-829	C_3—.05 μfd., 200 v. cond.
	C_4—Broadcast osc. trimmer (part of C_1)
22-1017	C_5—.05 μfd., 200 v. cond.
	C_6—First i.f. trans. pri. trimmer (on T_1)
	C_7—First i.f. trans. sec. trimmer (on T_1)
	C_8—Second i.f. trans. pri. trimmer (on T_2)
	C_9—Second i.f. trans. sec. trimmer (on T_2)
22-953	C_{10}—.0002 μfd., 600 v. cond.
22-492	C_{11}—.002 μfd., 600 v. cond.
22-1202	C_{12}—.04 μfd., 200 v. cond.
22-854	C_{13}—.0005 μfd., 600 v. cond.
22-243	C_{14}—.01 μfd., 400 v. cond.
22-1049	C_{15}—.03 μfd., 400 v. cond.
22-1519 or 22-1551	C_{16}, C_{17}, C_{18}—20/20/40 μfd., 150/150/150 v. elec. cond.
22-196	C_{19}—.01 μfd., 600 v. cond.
S-11099	L_1—Wavemagnet assembly
S-11136	L_2—Osc. coil
95-905	T_1—First i.f. trans.
95-906	T_2—Second. i.f. trans.

BENDIX MODELS 636A, 636C, 636D

Part No.	Code and Description
RC1H16	R_1—220 ohm, ¼ w. res.
RC1H40	R_2, R_{10}—22,000 ohm, ¼ w. res.
RC1H68	R_3—3.3 megohm, ¼ w. res.
RC1H20	R_4—470 ohm, ¼ w. res.
RC1H58	R_5, R_{15}—470,000 ohm, ¼ w. res.
	R_6—47,000 ohm, ¼ w. res.
RC1H54	R_7, R_{20}—220,000 ohm, ¼ w. res.
RC1H70	R_8—4.7 megohm, ¼ w. res.
RV4S00	R_9, S_1—1 megohm pot.
RC1H51	R_{11}—100,000 ohm, ¼ w. res.
RC1H38	R_{12}—15,000 ohm, ¼ w. res.
RC1H34	R_{13}—6800 ohm, ¼ w. res.
RW1B14	R_{14}—150 ohm, 1 w. wire wound res.
RW1A06	R_{16}—100 ohm, 1 w. wire wound res.
	R_{17}—33 ohm, ¼ w. res.
RC4G28	R_{18}—2200 ohm, 2 w. res.
RC1H32	R_{19}—4700 ohm, ¼ w. res.
CV0C00	C_{1A}, C_{1B}, C_{1C}, C_{1D}, C_{1E}—Var. cond.
	C_2—2-20 μμfd. trimmer
	C_3, C_9, C_{14}, C_{15}, C_{18}, C_{22}—.05 μfd., 400 v. cond..
CP6T16	C_4—.004 μfd., 600 v. cond.
CM5A14	C_5, C_7—47 μμfd. mica cond.
CC9A16	C_6—3.3 μμfd. cond.
	C_{8A}, C_{8B}—Part of T_1 assembly
	C_{10A}, C_{10B}—Part of T_2 assembly
CP4T20	C_{11}, C_{12}—.006 μfd., 400 v. cond.
CM5A05	C_{13}—220 μμfd. mica cond.
CP2T51	C_{16}—.1 μfd., 200 v. cond.
CP4T34	C_{17}—.02 μfd., 400 v. cond.
CE3A00	C_{19A}, C_{19B}, C_{19C}—20/40/50 μfd., 150/150/150 v. elec. cond.
CP4T51	C_{20}—.1 μfd., 440 v. cond.
	C_{21}—22 μμfd. cond.
TI0C01	T_1—First i.f. trans.
TI0D01	T_2—Second i.f. trans.
TA0O01	T_3—Audio output trans.
TR6L00	L_2—R.f. interstage trans.
LO6B00	L_3—Osc. coil

CORONET MODEL C-2

Part No.	Code and Description
	R_1—20,000 ohm, ¼ w. res.
	R_2, R_7, R_8—470,000 ohm, ¼ w. res.
	R_3—33 ohm, ¼ w. res.
	R_4, R_6—3.3 megohm, ¼ w. res.
	R_5—500,000 ohm, ¼ w. res.
	R_9, R_{14}—170 ohm, ½ w. res.
	R_{10}—22 ohm, ½ w. res.
	R_{11}—18,000 ohm, 1 w. res.
	R_{12}—670 ohm, ½ w. res.
	R_{13}—1000 ohm, ½ w. res.
	C_2, C_3, C_5—50 μμfd. cond.
	C_4, C_7, C_{14}—.05 μfd. cond.
	C_6—550 μμfd. cond.
	C_8—.25 μfd. cond.
	C_9, C_{11}—250 μμfd. cond.
	C_{10}—.004 μfd. cond.
	C_{12}, C_{13}—.02 μfd. cond.
	C_{15}, C_{16}—20 μfd. cond.
	C_{17}—30 μfd. cond.
	L_1—Tuning coil
	L_2—Osc. coil.
	L_3—Padder coil

SPARTON MODELS 7-46, 7-46PA, 8-46, 8-46PA

Part No.	Code and Description
BR12S-105	R_1—1 megohm, ½ w. res.
BR12S-921	R_2—820 ohm, ½ w. res.
BR12S-203	R_3—20,000 ohm, ½ w. res.
BR12S-561	R_5—560 ohm, ½ w. res.
BR12S-335	R_6—18,000 ohm, ½ w. res.
BR12S-335	R_7, R_9—3.3 megohm, ½ w. res.
BR12S-184	R_8—180,000 ohm, ½ w. res.
DR12G-163	R_{10}—16,000 ohm, 2 w. res.
CR12G-223	R_{11}—22,000 ohm, 1 w. res.
BR12S-274	R_{12}, R_{13}, R_{15}—270,000 ohm, ½ w. res.
PA4401-2	R_{14}—2 megohm vol. control
BR12S-474	R_{16}, R_{19}—470,000 ohm, ½ w. res.
PA4404-1	R_{17}—.25 megohm tone control & sw.
BR12G-202	R_{18}—2000 ohm, ½ w. res.
DR12S-102	R_{20}—1000 ohm, ½ w. res.
BR12S-151	R_{21}—150 ohm, ½ w. res.
DR12G-241	R_{22}—240 ohm, 2 w. res.
BR12S-106	R_{23}—10 megohm, ½ w. res.
BR12S-105	R_{24}—1 megohm, ½ w. res. (For Model 8-46 only)
BR12S-331	R_{25}—330 ohm, ½ w. res.
	R_{26}—18,000 ohm, ½ w. res.
BR12S-102	R_{27}—1000 ohm, ½ w. res.
PB40400-1	C_{1A}, C_{1B}, C_{1C}—Variable cond.
PA4356-1	C_2—Broadcast antenna trimmer
PA4356-1	C_3—Police antenna trimmer
PA4356-1	C_4—Short-wave antenna trimmer
MC60G-241	C_5, C_{16}—240 μμfd. mica cond.
PC40HL-503	C_6, C_9—.05 μfd., 400 v. cond.
PC40HK-503	C_7, C_8, C_{14}, C_{20}—.05 μfd., 200 v. cond.
MC60G-050	C_{10}—5 μμfd. mica cond.
PA4356-2	C_{11}—Broadcast det. trimmer

MODEL VH-91
*Hypex** PROJECTOR

This latest addition to the famous JENSEN Hypex line meets a real need for paging and intercommunication applications. Particularly efficient in the voice frequency range, it delivers clear, intelligible speech with maximum "punch" to override high noise levels.

By reason of an extremely clever mounting bracket, this projector can be pointed in any direction and securely locked into position with a single wing nut. Two holes in the bracket are provided for mounting on table, wall, ceiling or a post.

The diaphragm is cloth base, phenolic impregnated. Nominal voice coil impedance, 8 ohms; power handling capacity, 15 watts maximum speech signal input. Two-wire RC cable is provided for connections. Mounting facilities are also provided on the bracket for a 5/8" x 3/4" core or smaller transformer. Because of the Hypex flare formula, useful output is attained for a 100° total angle.

This new Hypex projector is now in production; deliveries are expected early in 1947 and literature will be available shortly.

JENSEN MANUFACTURING COMPANY
6617 S. LARAMIE AVE., CHICAGO 38, U.S.A.
In Canada: Copper Wire Products Ltd., 11 King St. W., Toronto, Ont.

*Trade Mark Registered

PA4356-2	*C_{12}—Police det. trimmer*
PA4356-2	*C_{13}—Short-wave det. trimmer*
MC60F-510	*C_{15}—51 μμfd. mica cond.*
AB3503-36	*C_{17}—Broadcast osc. trimmer*
AB3503-36	*C_{18}—Broadcast osc. padder*
PA4357-1	*C_{19}—Police osc. trimmer*
PA4357-1	*C_{20}—Short-wave osc. trimmer*
PA4354-2	*C_{21}—1680 μμfd. mica cond.*
PA4354-1	*C_{22}—3320 μμfd. mica cond.*
AB43500-44	*C_{23A}, C_{23B}—First i.f. trimmer*
AB43500-55	*C_{24A}, C_{24B}—Second i.f. trimmer*
PA4303-1	*C_{25}—4 μfd., 400 v. elec. cond.*
MC60F-101	*C_{27}, C_{28}, C_{30}, C_{36}—100 μμfd. mica cond.*
PC40GK-203	*C_{29}—.02 μfd., 200 v. cond.*
PC40GL-503	*C_{31}, C_{32}—.05 μfd., 400 v. cond.*
PC40GM-203	*C_{33}—.02 μfd., 600 v. cond.*
PC50GM-202	*C_{34}—.002 μfd., 600 v. cond.*
PA4300-1	*C_{35A}, C_{35B}, C_{35C}—15/10/15 μfd., 450/450/450 v. elec. cond.*

ECA MODEL 108

Part No.	Code and Description
C-ZQ-522	*1 —Loop antenna*
S-QL-105E	*2 —Speaker*
S-LR-120	*8 —Osc. coil*
S-LR-127	*9 —Input i.f. trans.*
S-LR-128	*10—Output i.f. trans.*
S-TA-116	*11—Output trans.*
S-CE-126M	*12—Elec. cond.*
CM-103E	*13—100 μμfd. mica cond.*
CM-112E	*14—250 μμfd. mica cond.*
CP-122E	*15—.002 μfd., 400 v. cond.*
CP-104E	*16—.02 μfd., paper cond.*
CP-105E	*17—.05 μfd., paper cond.*
CP-105D	*18—.05 μfd., 200 v. cond.*
CP-133D	*19—.2 μfd., 200 v. cond.*
S-ZQ-500	*20—Variable capacitor and drum*
S-SR-137	*21—Sw.*
S-RV-174-1	*22—500,000 ohm vol. control*
RS-186B	*23—47,000 ohm, 1/4 w. res.*
RS-220B	*24—33 ohm, 1/4 w. res.*
RS-221D	*25—82 ohm, 1 w. res.*
RS-114B	*26—100 ohm, 1/4 w. res.*
RS-195C	*27—1500 ohm, 1/2 w. res.*
RS-195E	*28—1500 ohm, 2 w. res.*
RS-185B	*29—2200 ohm, 1/4 w. res.*
RS-222B	*30—18,000 ohm, 1/4 w. res.*
RS-197B	*31—22,000 ohm, 1/4 w. res.*
RS-120B	*32—100,000 ohm, 1/4 w. res.*
RS-190B	*33—220,000 ohm, 1/4 w. res.*
RS-189B	*34—470,000 ohm, 1/4 w. res.*
RS-223B	*36—2.2 megohm, res.*
IP-115	*37—Pilot light*
CP-116D	*38—.005 μfd., 200 v. cond.*

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4-Element Array

(*Continued from page 47*)

6 2" beehive metal-base standoff insulators.

8 ¾" thinwall conduit connectors.

1 section 5' long, 1¼" dia. thinwall conduit.

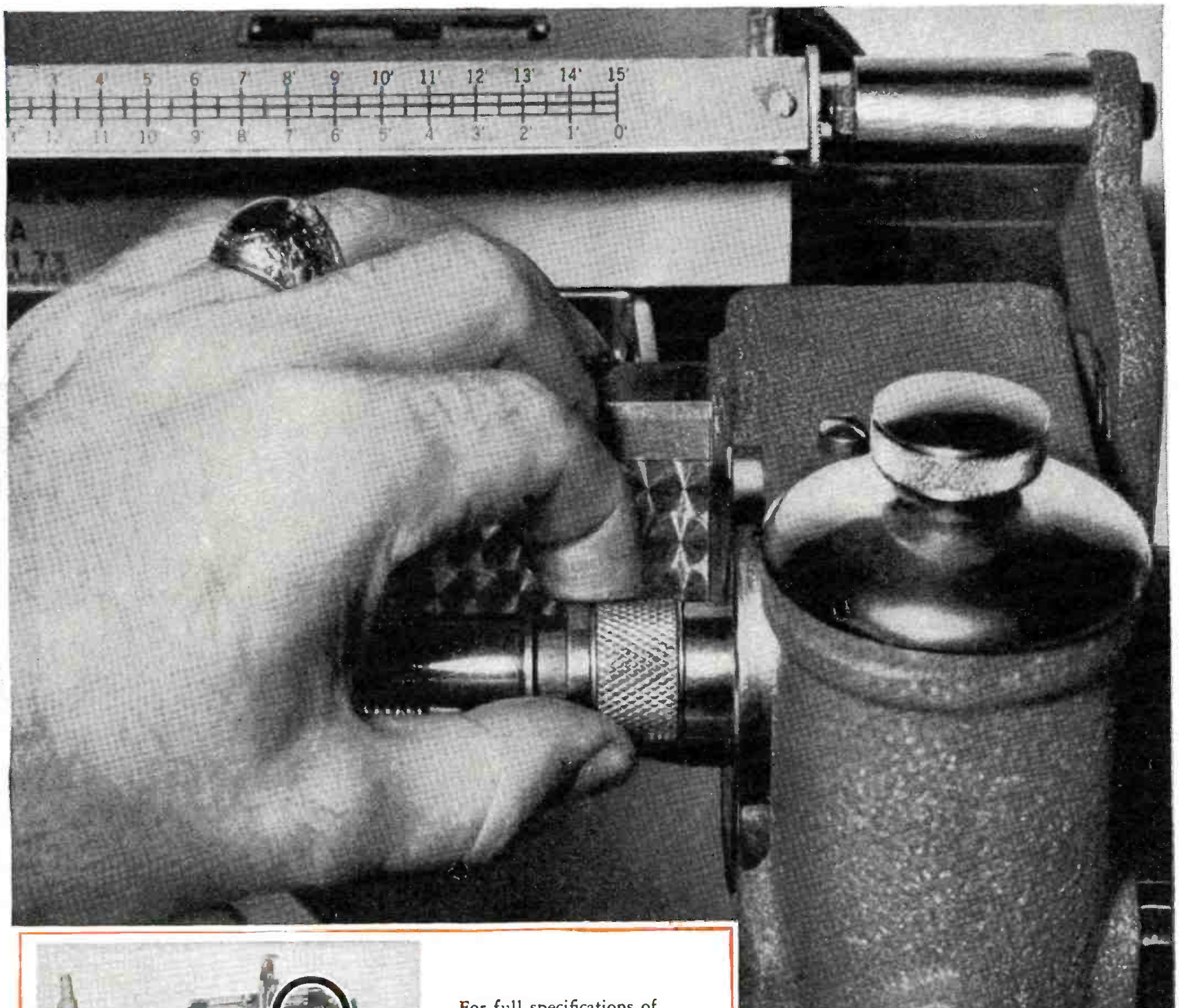
The 10 foot section of 1¼" tubing is laid out on a flat surface, and marked at intervals of 3' 4". Two of the 1" dia. ten foot sections are placed, respectively, at the first and second marks from one end of the boom and carefully brazed, making sure they are at exact center and at 90 degree angles with the boom itself. Next, the five foot section of 1¼" tubing is similarly affixed to the boom at the next mark, but on the opposite side from the previous sections. A study of the diagram will show the method of assembly at this point. After this joint has cooled sufficiently, braze another of the ten foot sections of 1" tubing, on the same side of the boom as the other ten foot lengths and in exactly the same manner, at the final mark, making sure that all angles are 90 degrees, and that the tubing element lengths are brazed at the exact center. Failure to observe this will entail trouble in tuning the beam later, and will give power loss and a distorted pattern.

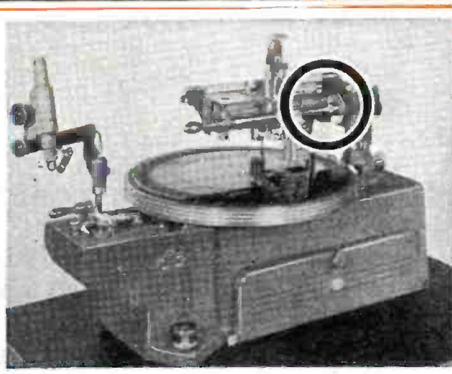
The remaining length of 1" tubing is then cut at its exact center; this is the dipole proper (when the tuning stubs in each end are added). These two 5' sections are then mounted with a two-

change pitch and direction almost instantaneously with the improved Presto 8-D Recorder

The Improved Presto 8-D Recorder is equipped with a reversing device for the feed screw. Result: Six feed pitches, inside-out *and* outside-in, using only one feed screw. This feed screw need never be removed from the recorder. Thus, changes in pitch and direction are accomplished within a matter of seconds.

The Presto 8-D Recorder is the easiest and most convenient machine to operate because of the arrangement of its controls and the cantilever overhead which saves lost motion in operation. Its unusually heavy construction assures high fidelity masters and instantaneous recordings.





For full specifications of the Presto 8-D please write Presto Recording Corporation, 242 West 55th Street, New York 19, N.Y. To insure future delivery within a reasonable time, we suggest you place your order now for immediate listing.

PRESTO

RECORDING CORPORATION
242 West 55th Street, New York 19, N. Y.
Walter P. Downs, Ltd., in Canada

World's Largest Manufacturer of Instantaneous Sound Recording Equipment

inch spacing between the split ends, by means of the standoffs, to the respective ends of the five foot section of 1¼" tubing, giving an insulated but rigid and light antenna, and thus making possible either split feed methods, or, by joining the dipole sections with a jumper, delta-match, T-match, etc.

Next, the 1½" pipe flange is brazed at the exact center of the boom, and on the same side as the single five-foot length of 1¼" tubing which supports the antenna. This flange is to enable the whole assembly to be mounted on top of a jointed length of galvanized pipe at the desired height which been determined to be optimum for your particular locality.

The eight ¾" conduit couplers are then filed out so that ¾" tubing will slide freely through them, and with one nut and lock ring removed from each coupler, it will be found they will fit snugly inside the 1" pipe, where they are brazed securely as shown in the diagram. This makes a highly satisfactory, efficient and simple means of adjusting and locking the tunable end-lengths of the elements. These tunable sections are obtained by cutting, exactly in the center, each of the four ten-foot sections of ¾" thinwall tubing. The remaining nut and lock ring of the brazed couplers allow the elements to be quickly and securely locked at any length for the ten-meter band.

The method of mounting used by the author involves the use of the familiar eave-bearing and thrust-bearing base and suitable lengths of galvanized iron pipe to attain the desired height, but individual preference and facilities vary so widely, no particular information will be given, other than to recommend the abovementioned method of mount for simplicity and low cost.

The preferred feed method tried at W6RTP consisted of a feed line of 70 ohm coax, in conjunction with a stub made of four lengths of 70 ohm coax paralleled, and cut to the length given by the formula for coaxial stubs. With this arrangement, and a reversible motor drive, rotation is a simple and foolproof matter. However, any feed method involving open lines and conventional stub match, delta, T, or other similar systems, with slip-ring feed, is applicable to the particular way in which the antenna is designed, and allows plenty of room for individual preference and experimentation.

The highly important matter of tuning and adjusting is covered thoroughly in the *Handbook*, and rigid and careful adherence to this method is recommended. Remember, a beam is not a beam until tuning has made it such, and no general rules will hold true for all locations, so careful and detailed attention to this matter is highly advisable, following the rules laid down in the chapter on rotatable arrays in the *Handbook*.

With the tuning, as such, accomplished to the erector's satisfaction, next comes the matter of determining one of the most important, if not *the* most important, details of getting a beam to work satisfactorily other than by sheer luck. As is well known, the gain achieved by a beam is primarily due to the lowered angle of radiation in a vertical plane. At ten meters, it is apparently optimum to secure an angle of approximately 10 degrees from the horizon, and height is highly important in achieving this. Accordingly, it is highly recommended that the system, completely tuned and adjusted, be fed power and raised in two-foot steps, through the range from thirty to forty feet above ground level. The ingenuity of the individual comes in here, depending on the mounting structure involved, but if the pipe support system is used, as shown in the photos, two or three huskies can do it quite nicely, by raising and lowering the supporting pipe up from a hole (dug directly under the structure by garden-hose hydraulic pressure.) This convenient three or four inch diameter vertical shaft in the ground also is a great aid in the erection of the affair itself, and is easily done. With a small amount of power fed to the system, and a receiver 'S' meter some distance away used as a reference, it will be found that the emitted signal will take a decided hop upward at some point in the aforementioned thirty to forty foot range, and at this point the array should be secured and left.

If this performance is not desired, and the builder is satisfied with a less efficient arrangement, heights of sixteen or twenty-two feet will be found to be quite satisfactory. The array was used for a time at W6RTP (a flat, coastal location) at sixteen feet elevation, and marked directivity characteristics were evident. The signal got to the Philippines, Guam, Australia, Hawaiian Islands, Tinian, Saipan, Peru, Guatemala, the Galapagos Islands, etc., as well as the usual continental contacts, with "S" reading that compared equally favorably with other W6's at the time, using an 829B with 60 watts input, and during the definite early summer slump of the band. It can be seen accordingly that results are quite gratifying, even if one cannot achieve the optimum height for the system. However, it is highly recommended, if at all possible, that the proper height be determined and used with the beam, since the results to be obtained, used thus, will leave nothing to be desired.

In receiving, the array has shown very good characteristics, depending, as usual, on power, direction, distance, and the all important conditions. Generally speaking, there is about four to six "S" points front-to-back gain, with almost infinite attenuation off the sides, both receiving and transmitting. If a conscientious and thorough job is done by the builder, and the array is tuned and adjusted properly with the optimum height determined and used, results will more than gratify the ham who wants to "get out, and get heard," as well as hear the choice stuff that the returning ten meter season is sure to bring.

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A New Synchronous Motor

By **H. H. EVERETT**

Eng., Fairchild Camera & Instrument Corp.

This smooth starting, low cost synchronous type phono motor reduces "flutter" and "wow."

WHEN the average customer considers a radio-phonograph combination, he usually looks for one that has a "good tone" and a handsome cabinet matching his living room furniture. Seldom does he ask what kind of a drive it has, whether it uses a crystal or a dynamic pickup, what features its inner mechanism, in general, offers. Usually he cares less about such purely technical factors.

But his ear is almost always keen enough to know one machine's "good tone" as against another's, even though he may not know the reason. Distracting hum, wobbling tone, turntable rumble, surface noise do not escape his attention. He tries to buy a machine that does not have, nor is likely to develop, such distractions.

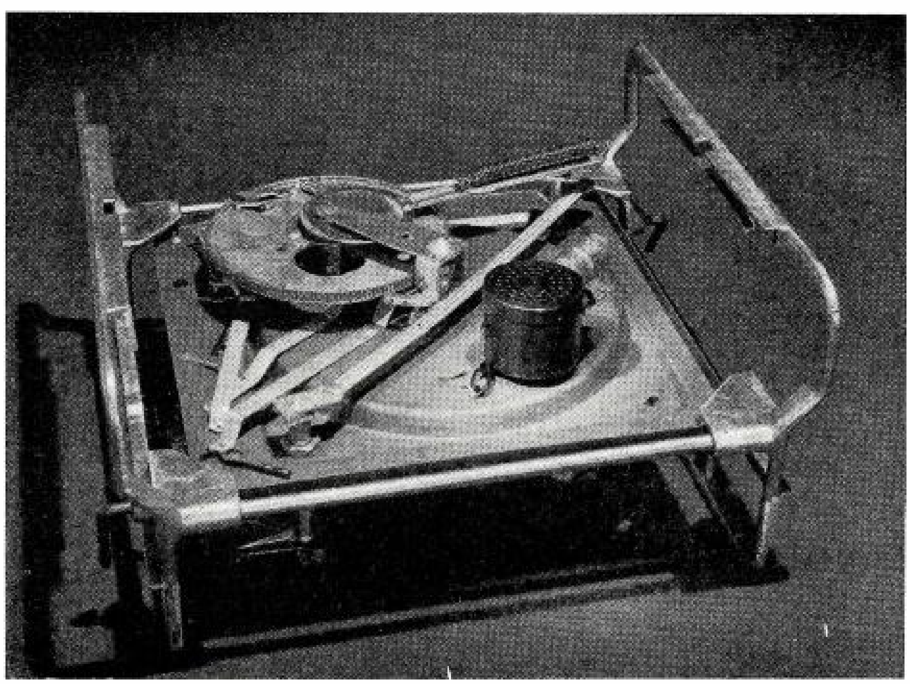
Aside from this average consumer, there is a still small, but ever widening, section of the consumer public, able to afford the purchase of good equipment and fine record albums. These people love their music, and demand good playback equipment for it, even requiring standards of machine performance approaching professional quality. They are making it their business to learn more about the "insides" of their machines. They want to know the causes for the extraneous noises—"background hum," "wows," and the rest—that mar their listening enjoyment.

It may be argued that the layman should not be expected to be familiar with the mechanical workings of his playback machine. That is really the province of the manufacturer who builds it and of the dealer who markets it. They are the ones who should point out to customers its fine points, the reasons, why this may be good and that may be bad, and guide the customer's purchase accordingly.

Manufacturers and dealers have begun to do this. An education on some specific features has been increased through merchandising effort, the whole subject of quality basis is being more consciously impressed on all consumers. Thus, both manufacturers and consumers in turn are naturally becoming thoughtful about other quality features and so new components are beginning to come under wide general scrutiny.

With this growing spirit of criticism and inquiry, and the constant search for something better, manufacturers of high quality radio-phonograph equipment for the home are striving to satisfy the demand for better playback components. They know that consistent improvements in records

This new motor is designed for use in conventional record changers.



SPRAGUE TRADING POST

SWAP — BUY — SELL

SITUATION WANTED by married radio serviceman, 15 yrs. experience, 40, graduate B.S. physics, math and radio. Now taking course through F-M and Television. Desire position where training and knowledge count. J. C Wunderlich, YMCA, Galesburg, Illinois.

SALE OR TRADE—Port. single-play phonograph with 3-tube amplifier, brown fabrikoid case; vol. and tone controls and 6" speaker; lightweight pickup. $30 or equal value in multitester. Barry Windsor, 212 W. Jamieson St., Flint 5. Mich.

WANTED—Hytron HY30Z plate transformer, Thordarson T19P56 or equivalent. Will swap new 1" hand reamer for a 1" taper reamer. I. D. Smith, 39 Prosepct St., Milford. Mass.

FOR SALE—No. 288x Hickok sig. generator crystal controlled, new, in original carton, $140. 4" a-c voltmeter, $15. 200 new tubes—what do you need? Testing machine to test tensile strength of wire. S. L. Malone. 2531 Sharon Ave., Dallas 11, Texas.

WANTED—Any schematic diagrams o phono-amplifiers or just plain amplifier circuits. Will trade. Stanley Schneider, 1041 Findlay Ave., Bronx 56, New York, N. Y.

WILL TRADE 2-meter RCUR and built-in code osc. plus speaker; surplus 814's, RK20, 837, 807's, 808, 5R4GY's. Want HK257B's. 866A's, 811's, 2A3's or 200-watt mod. xformer or beam indicator. Cash or what have you? Louis Gerbert, 815 Richmond St.. Grand Rapids, Mich.

WANTED—RCA 8500 receiver in A-1 condition with coils for 5500-8900 kc. State price. Will trade or sell SX16 speaker. R. G. Summers. 104 Herman St.. Buffalo 12. N. Y.

WANTED—Good sig. generator and tube checker. Cash or what do you need? F. A. Thompson, 1316 West Division, Grand Island Nebr.

FOR SALE OR TRADE—100-watt phone-cw transmitter complete ready to use on 10 meters. In 5 ft. rack. One Electro-Voice hi-impedance velocity mike and one hi-impedance dynamic mike. Both like new. Can use good camera. Bill L. Godden, 504 Norton St., Kansas City 1, Mo.

FOR SALE—Transmitter, receiver 3.5-7 bands. VFO. Phone/cw. 25 watts. 235 mc. Transceiver in same unit. 12 v. dynamotor. 15 tubes, phones, mikes, key, antenna. tuner spare parts. Mordecai Katz. 1399 Carroll St.. Brooklyn, N. Y.

FOR SALE—Model C-E Solar Exam-eter. like new, Has AC-DC vac. tube voltmeter tests resistance to 10,000 meg., capacity to 2000 mf. $45. John J. Marsh. 4624 No. 19th St., Milwaukee 9, Wisc.

WANTED—U.S. Signal Corps "Sound Powered" telephone headset and microphone assembly consisting of 2 earphones on head-strap microphone with switch, wire harness. Rider Chanalyst. Cash. Chas. S. Brotzman. 173 Main St., Mexico, Maine.

FOR SALE—New 10-tube National 100 ASD receiver, perfect condition with real S-meter and 8" speaker. 200-400 and 1300 to 30,000 kcs. in 5 bands. Includes kit and instructions for converting to broadcast band. $100. Howard E. Moore, 13 So Dubuque St., Iowa City Iowa

FOR SALE—Masco 35-watt amplifier like new, $65. Astatic T-3 mike with floor stand. $28.50. Two new phono motors. $5 ea., also many new and used tubes. What do you need? We want 25B8 tubes. Ben's Radio, North Tonawanda. N. Y.

WANTED—Bass reflex cabinet, D.B. 20, preselector, also good communication receiver. C. Horn, 325 E. 163 St., New York 56, N. Y.

FOR SALE OR TRADE—Westinghouse 6 mfd. 1000 v. oil-filled condensers, $1.50 plus postage. Will trade for speech amplifier parts or Class B stage. Don Morris, 303 Home St.. Fairmont, W Va.

FOR SALE—117N7, 35Z5. 25Z5. 9002, 807 and many other tubes. What do you need? C. Gutman, 4415 Explanade Ave., Montreal, Que., Canada.

FOR SALE—30-watt phone and cw transmitter complete. 80-10 meters. Plug-in coils furnished for 10 meters. Also 1 crystal. New, std. size cabinet. $85. M. J. Hill, 105 E. 46th St.. Austin, Texas.

WANTED—All kinds of war surplus radio eqpt. Will pay cash or swap hard-to-get tubes. both receiving and transmitting types. W3QEM, 2036 Chalfant St., Wilkinsburg, Pa.

FOR SALE—Hallicrafter SX-28A receiver complete with matching speaker. Excellent condition. $185. Clair A. Rupert, R.D. No. 1. Sandy Lake, Pa.

FOR SALE OR TRADE—Triplett model 3212 tube tester, counter type. Will trade for any portable model and $20 cash. Will sell for $50 cash. This is new. Edward C. Punt, 397 Melrose St., Brooklyn 6, N. Y.

FOR SALE—New 6AC7 tubes, $1 ea. in lots of 10 or more. Also Hallicrafters S-20-R absolutely new, $50. Emanuel Wincor, 708 So. Homan Ave., Chicago 24, Ill.

FOR SALE—HRO receiver with power, $150. Extra coils, $9.95. BC 375E transmitter, $40. Dynamic mikes and earphones, $5 ea. B19 Mark II transmitter, $59. Want transmitter and E.C.O. A. Livingstone, 1201 Ellis Ave., Fair Lawn, N. J.

FOR SALE—Transceiver, 2½ meters, 10 tubes including HY75, microphone, antenna; power pack 450 volts, 100 ma. Operates mobile on 6 v DC or fixed on 110 v AC. Parts cost $125. Herb. Baumgartner, 8637 Litzsinger, Brentwood 17, Mo.

FOR SALE—No. 802 R.C.P. tube and set tester with chart, $35. No. 304 R.C.P. tube tester (no chart) $15. Portable P.A. system complete with 1 horn, $35. Harry Hollander, 2136 77th St., Jackson Heights, New York.

FOR SALE—Hallicrafters Sky Ranger S-39 receiver, $67.50. Almost new. Rupert Radio Service, 708 F Street, Rupert, Idaho.

SELL OR TRADE—New 15-watt amplifier for sig. generator or tube tester. J. Bazewick, 3000 No. Christiana, Chicago 18, Ill.

URGENTLY NEEDED—One ribbon for replacement in RCA Jr. Velocity microphone Type 74-B. All inquiries answered. Western Auto Associate Store, Madison, N. C.

WANTED—A Meissner signal shifter. Will pay cash or trade. What do you need? Alex A. Polityka, 248 Western Ave., Allegan, Mich.

FOR SALE—RCA No. 158 5" oscilloscope; Hickok 19XD crystal controlled sig. generator. Both like new. Also have Triplett 1210-A tube tester. T. Wojciechowski, 2837 Fulton St., Brooklyn 7, N. Y.

FOR SALE—Stancor 20P xmitter, $50 with 75-meter coils. 40-meter 25-watt CW rig, $40. 10-meter xtal, Bliley 29, 436 kc., $5. Three HY69 tubes, new. $3 ea. Two TU10B tuning units, $4 ea., $7.50 pair. Frank H. Carlson, New London, Iowa.

SWAP—Complete 1946 N.R.I. radio course incl. television and experimental ohmmeter. Would like a late model tube tester. W. T. Graham, 6624 Forest Ave.. Brooklyn 27, N. Y.

FOR SALE—Astatic HP-16 phono pickup, $14 postpaid. Want G.I. model D dual-speed phonomotor with turntable. Charles A. Idol, Madison, N. C.

FOR SALE—70 random copies of Electronics, QST, Radio, FM, Radio News, Electrical Communications from 1936 to 1944. All perfect, all different. $6 plus shipping. Philip Ross, 280 Wadsworth Ave., New York 33. N. Y.

FOR SALE—Kato rotary converter, 110 v DC to 110 v AC, 60 cycle. Used only one month. $50. W. J. Donlay, 17 Hawthorne Ave.. Buffalo, N. Y.

SELL OR TRADE—Triplett vac. tube voltmeter No. 1251, good condition. Want transmitter components, plate transformers, chokes, tubes, etc. or $25 cash. R. E. Green, 703 N. County St., Waukegan, Ill.

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SWAP—BUY—SELL

Sprague will gladly run your own TRADING POST ad free of charge in the first available issue of one of the six radio magazines in which this feature appears. WRITE CAREFULLY or print. Hold it to 40 words or less and confine it to radio subjects. Sprague reserves the right to rewrite ads as necessary, or to reject any that do not in our estimation fit in with the spirit of this service.

Harry Kalker Sales Manager

will be largely lost through failure to reproduce them faithfully, and that the radio manufacturers will be blamed. They are giving their attention to the components on which the ultimate quality of sound-reproducing equipment depends; the drive mechanism for the record turntables, the pickup, the amplifier, and the speaker.

Of these several factors required in superior equipment, our concern here is with the drive motor, one of the most important contributions to smooth, "wow"-free turntable performance.

Unfortunately, up until now, too little serious attention has been given the special requirements of motors for sound equipment, even though two cardinal principles in the best quality sound reproducing apparatus driven by a motor are, (1) that the motor shall operate at *constant speed* without pulsations, regardless of changes in voltage supply to the motor, and changes in the load on the motor; and (2) that the motor's vibration noise level shall be below the level of audible reproduction, and not interfere with it in the slightest degree.

Every critical listener knows, whether or not he is conscious of the cause behind it, that any change in speed of the motor driving the apparatus while the record is being played, and any audible vibration noises ("background hum"), result in painful distortion and noise components that spoil listening pleasure. These annoyances can be exemplified by three specific effects contributing to inferior sound reproduction due to changes in driving turntable speed:

1. Changes in pitch—where speed changes are gradual, occurring from record to record, as the record changer turntable load increases from one to ten records;
2. "Flutter"—where speed changes are rapid, with resulting wobbling pitch variations, within a single revolution of the turntable;
3. "Wow"—where speed changes and resulting pitch changes occur at slower intervals (once or twice) within a single revolution of the turntable.

The cause of these annoyances can be found in the type of motors used in

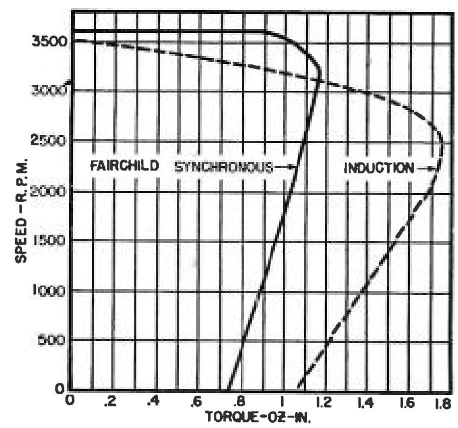


Fig. 1. Graphs show comparison of speed vs. torque characteristics at 117 volts, 60 c.p.s. Maximum efficiency of the synchronous motor is 24 per-cent as compared with 17 per-cent for an induction type.

non-professional record-playing equipment.

In the past, induction motors have been the most commonly used. Yet it is generally admitted that these shaded pole induction motors have poor speed stability, because speed variations with load and line voltage changes are inherent in them. The vibration noise level of these motors is by nature high due to greater torque pulsations, especially when price considerations have prohibited dynamic and magnetic balancing of the squirrel cage rotor for low-priced playback equipment.

Up to now manufacturers have chosen induction motors largely because there has been no economical low-cost synchronous motor (such as used in the best professional, expensive sound recording and transcription equipment). With the advent of a new low-priced synchronous motor, this situation changes for the better immediately.

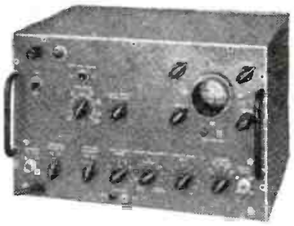
A new synchronous motor has just been developed. *Fairchild Camera and Instrument Corporation,* well-known in the past fifteen years as manufacturers of professional sound recording and transcription turntable equipment, has introduced a new low-cost unit operating at synchronous speed of 3600 r.p.m. throughout its load range, on 117 volts/60 c.p.s. It is

(*Continued on page* 120)

Synchronous motor compared with conventional shaded-pole induction motor.

RHS TELEVISION—SCOPE—POWER EQUIP'T

NAVY MODEL Q SYNCRO-OSCILLOSCOPE



105 - 120v. - 60 cyc. operation.
Sweeps: 4, 15, 250, 1000 microsecond triggered sweeps, 25 to 3000 cps. saw - o - tooth sweeps.
Trigger output: +150 or —75 volts, 100 to 3200 cps.
Trigger input: ±10 to 150 volts.
Sawtooth-output: 250v. at 25 to 3000 cps.
Amplifier response: 30 cps. to 2.5 megacycles.
Grey wrinkle enamel cabinet, 9 tubes including 2AP1 scope tube.
Used as a regular scope plus the advantage of observing high speed wave shapes as in pulse and television work.
COMPLETE with tubes, cables and carrying case **$89.50**

OIL CONDENSERS

1 mfd. 600v	$0.35	1 mfd. 2000v	$0.95
2 mfd. 600v	.60	2 mfd. 2000v	2.10
4 mfd. 600v	.75	3 mfd. 2000v	2.95
8 mfd. 600v	1.10	4 mfd. 2000v	3.95
10 mfd. 600v	1.40	10 mfd. 2000v	6.95
1 mfd. 1000v	.90	.05 mfd. 3000v	1.95
2 mfd. 1000v	1.05	.25 mfd. 3000v	2.95
4 mfd. 1000v	1.10	1 mfd. 3000v	3.50
8 mfd. 1000v	2.00	2 mfd. 3000v	3.75
10 mfd. 1000v	2.40	1 mfd. 5000v	6.85
15 mfd. 1000v	2.60	2 mfd. 4000v	7.60
25 mfd. 1000v	5.95	.1 mfd. 7000v	3.95
24 mfd. 1500v	6.95	1 mfd. 9000v	14.95

MICA CONDENSERS, SANGAMO

.001-20,000v	$9.95	.004-8000v	$2.25
.0005-20,000v	9.95	.002-8000v	2.25
.0005-8000v	2.25	.006-6000v	1.95
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G.E. Vacuum Capacitor
50 MMF. 7500v **$3.95**

HIGH CAPACITY CONDENSERS

2400 mfd.—50WVDC	$1.95
4000 mfd.—18WVDC	1.95
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6v or 12v dc Input. Delivers: 1.5vdc at 700ma; 1.5vdc at 700 ma; 7.5vdc at 300 ma; 90vdc at 45ma; 90vdc at 25 ma; 150vdc at 45ma.
COMPLETE with VR90/30; CK1005; & Vibrator **$14.95**

METERS—G.E., WESTON, 3½"

0-1.5 Ma.	0-8 Amps. R.F.
0-5 Ma.	0-15 Amps. R.F.
0-50 Ma.	0-3.5 K.V.w/shunt
0-100 Ma.	0-15Vac
0-350 Ma.	0-350Vdc
0-500 Ma.	0-150 Ma. R.F.

Frahm Freq. Meter 58-62 cycles
Your choice any 3½" METER... **$3.95**

0-150Vac.	—10+20db.
0-20Vdc.	0 1ma.
0-10Vdc.	0-8Amp.

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110V—A.C. Reset—Model 705
0-500 Microamps.
0-50 Microamps.
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TUBES (Brand New) ARMY-NAVY INSPECTED

6C4	$0.75	954	$0.99
6J6	.99	955	.99
6F6	.99	956	.99
6L6	1.59	957	.99
6V6	1.19	958	1.10
6C5	.90	959	1.15
6J5	.90	9002	.99
6AL5	.99	9003	.99
6AC7	.95	9004	.99
6AB7	1.25	9005	1.10
6AG5	1.10	9006	1.15
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6AK5	1.60	1625	.89
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2V3G	1.75	211	6.95

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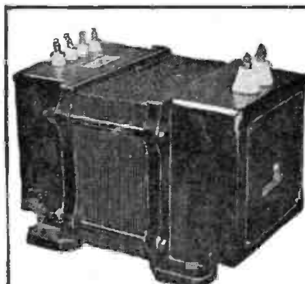
36v ac	28v dc	5-Amp	7.95
36v ac	28v dc	10-Amp	13.95
36v ac	28v dc	15-Amp	19.95

Federal's New Midget Selenium 1.60
Immediate Delivery



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Our Price **$39.95**

POWER SUPPLY FOR MARK 1-11-111 BC-19 OR OTHER EQUIPMENT

12 Amp-12v D.C. from 110v A.C. Unnecessary to tear set apart. Leave set portable.
COMPLETE READY TO PLUG IN **$32.50**

NATIONAL DRIVE UNIT

PW-O or NPW-O ....Only **$2.95**

TRANSMITTER SHELF T66CRN-10

Complete RF section uses 1—807 Crystal oscillator tripler, 1—807-RF doubler, 1-257B-RF tripler driving 2—257Bs, RF amplifier in push pull, 1—6H6-RF output indicator. All volts and current read on 2 Weston meters through panel switch. Now on 110mc. Slight change to 144mc. Capable 500 watts output. Less tubes and crystal.
Reduced to **$39.95**

OSCILLOSCOPE KIT

5CPI Cathode ray tube	ea. $6.95
Socket for 5CPI	" 1.98
Anode button for 5CPI	" .35
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Xformer, 1700v, 6.3v, 2.5v, 110v 60 cycle	" 7.50
Condenser, oil .5-2000v	" 2.10

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TRANSFORMERS—115v ac 60 cyc

Hi-Voltage Insulation

6500v at 4 ma.	$9.95
6000v at 2 ma.	7.95
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3710v at 10 ma.; 2.5v at 3A; 2.5v at 3A	9.95
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2.5v at 3 amp.	3.95
5v at 115 amp.	14.95
5v at 190 amp.	17.50

FILTER CHOKES—HI-VOLTAGE INSULATION

10 Hy.—200 ma.	$2.25	12 Hy.—300 ma.	$3.95
4 Hy.—250 ma.	3.95	15 Hy.— 30 ma.	1.95
10 Hy.—250 ma.	3.25	20 Hy.— 30 ma.	2.25
12 Hy.—150 ma.	2.95	75 Hy.— 8 ma.	1.95
4 Hy.—600 ma.	5.95	15 Hy.—100 ma.	2.35

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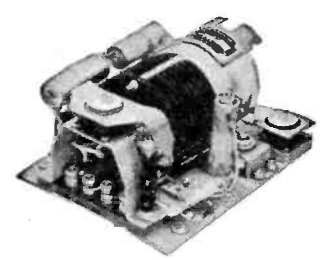

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Simple Code Practice OSCILLATOR

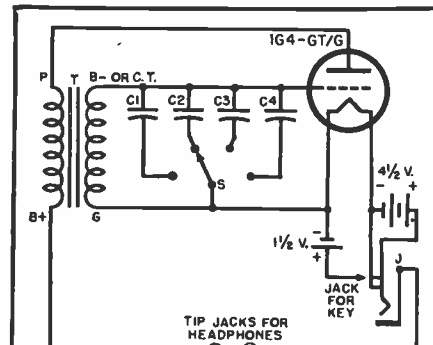
By RUFUS P. TURNER, W1AY
Consulting Eng., RADIO NEWS

This battery-operated, code practice oscillator can be constructed at a cost of only five dollars.

THERE is no reason why a one-student code practice oscillator should be complicated and expensive. The unit shown in the accompanying photographs and schematic gives a strong signal in a pair of earphones and is easy on its self-contained batteries. It is of neat appearance and can be used equally well with a key or code machine. It costs an even 5 dollars to build, but can be made even more cheaply by using less expensive parts and by using breadboard mounting.

The oscillator shown is built into a 6" x 6" x 6" wrinkle-finished steel "instrument box." A dime-store type of drawer pull is used as a handle. The two batteries are mounted on the back of one of the panels; all of the other circuit components on the back of the other panel. This complete construction may be seen in the second photograph, Fig. 3, in which the panels are shown removed from the case. Fig. 2 shows the external view of the assembled instrument.

Fig. 1 is the circuit schematic of the oscillator. The arrangement will be recognized as a simple tuned-grid, triode oscillator with inductive feedback. The feedback transformer, *T*, is an ordinary interstage audio unit with a turns ratio of 3 to 1. Primary and secondary polarities shown in Fig. 1 are correct for oscillation. The filament of the 1G4-GT/G tube is powered by a 1½-volt pen-size flashlight cell; the plate by a miniature, flat 4½-volt battery. A jack, *J*, is provided for the key or code machine. This is an open circuit jack with a pair of separate make-contact springs to close the filament circuit when the plug is inserted into jack *J*. Cord tip jacks are provided for the earphones. Oscillation frequency is controlled by the rotary switch, *S*, which cuts any one of the four grid capacitors into the circuit. The capacitances indicated in Fig. 1 for C_1 to C_4 give a good selection of tones. However, other values may be substituted to obtain other tones more pleasing to individual ears.



C_1—.01 μfd., 200 v. cond.
C_2—.005 μfd. mica cond.
C_3—.002 μfd. mica cond.
C_4—.001 μfd. mica cond.
S—Single pole, 4-pos. rotary sw.
T—Plate-to-grid interstage audio trans. 3:1 ratio (Stancor A-63C)
J—Open circuit jack with one pair of separate make contact springs

Fig. 1. Wiring diagram.

-30-

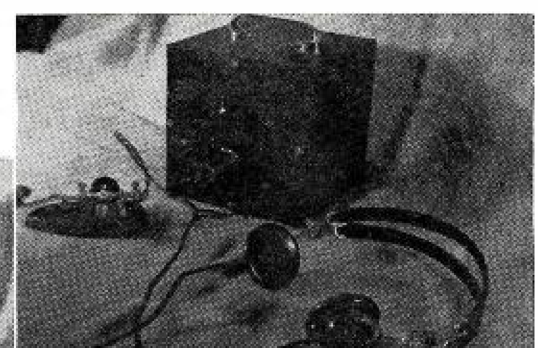


Fig. 2. Over-all view of completed code practice oscillator. Headphone and key shown connected in proper position.

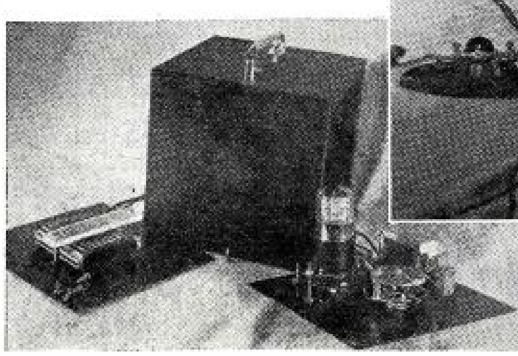
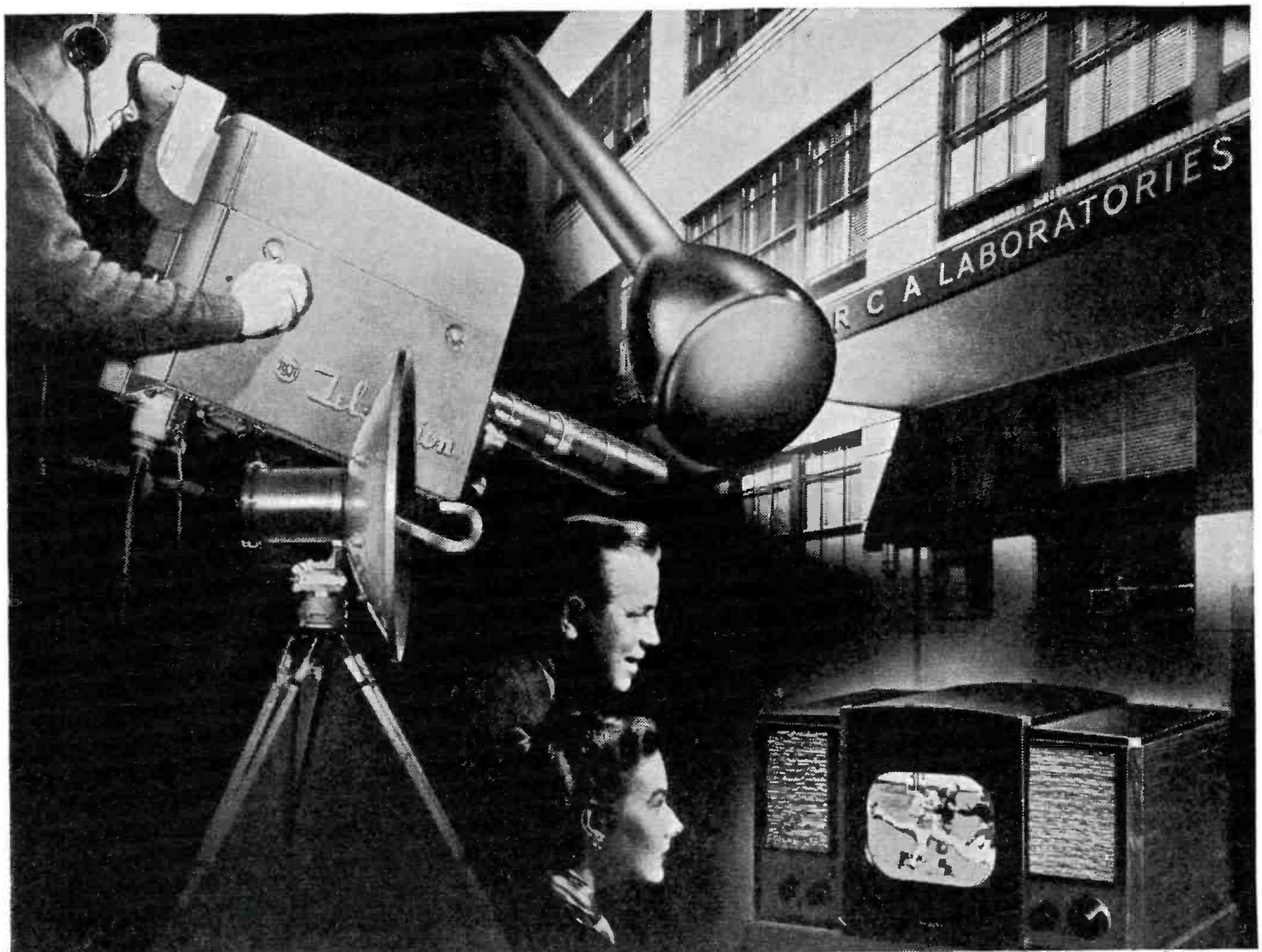


Fig. 3. Note that all circuit components are mounted on the front panel of metal case; both batteries are on the opposite panel.



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From the scene of action—to your own living room—these RCA developments based upon research at RCA Laboratories mean *television at its finest:*

RCA Image Orthicon Camera sees whatever the human eye sees, even in the light of a match! Sports events on cloudy days or in twilight do not fade because this super-sensitive camera eliminates the need for strong lighting.

RCA Mirror-backed Kinescope—searchlight brilliance for home television. All the lifelike realism and detail caught by the RCA Image Orthicon Camera is reproduced by this new receiving tube that loses none of the original brilliance.

RCA Victor Television Receiver—with the new RCA exclusive "Eye Witness" feature that "locks" the picture, keeps it bright, clear—as steady as a picture on the wall.

RCA Radio Relay equipment enables television stations to broadcast events taking place far from the studio, and eventually may link television networks. In television, as in radio, Victrola* radio-phonographs, records, or tubes, if it bears the name RCA or RCA Victor, it is one of the finest instruments of its kind science has achieved.

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RCA VICTOR table model television receiver with the exclusive "Eye Witness Picture Synchronizer" that assures you *brighter, clearer, steadier* pictures. It is now available in some areas—see your local RCA Victor dealer.

RADIO CORPORATION of AMERICA

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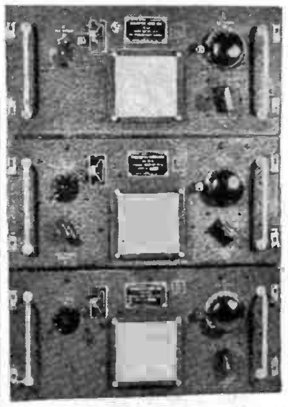
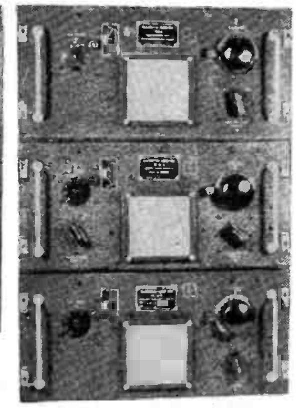




SCR-522 100-156 Mc. RECEIVER AND TRANSMITTER

One of the most interesting and useful pieces of surplus equipment. Designed for plane and ground station use, this unit offers remote control of any four pre-selected crystal controlled frequencies in the spectrum of 100-156 Mc. This spectrum covers facsimile, air navigation aids, airport control, railroad, police, urban telephone, as well as the amateur band 144-148 Mc. October Radio News gives details for converting the SCR-522 receiver section, BC-624.

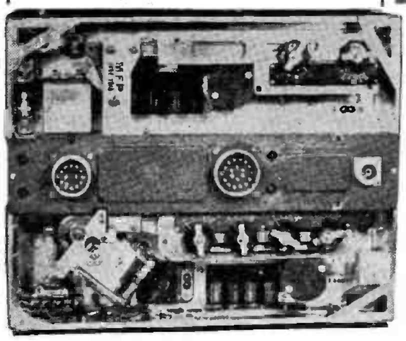
Transmitter section, BC-625, is voice amplitude modulated and has an output of 8-9 watts.

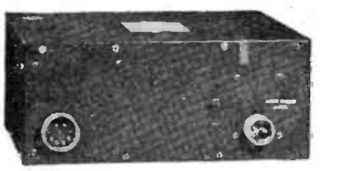
Tubes used and included: 2-832, 3-12A6, 1-6G6, 2-6SJ7, 1-12J5GT, 3-12SG7, 1-12C8, 1-9002, 3-9003, 1-12AH7GT.

These units were removed from planes but are guaranteed and are shipped in operating condition, including tubes, control head, and cable plugs ready to connect to dynamotor or other power supply.

Weight, 49 lbs. Shipping weight approx. 65 lbs.

Price .... **$39.95** each





Dynamotor for 24 V. DC operation of SCR-522 .... $8.50. Wt., 39 lbs.

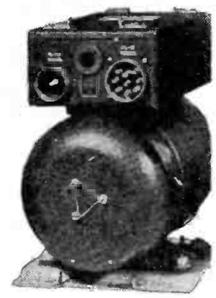
TELRAD MODEL 18-A FREQUENCY STANDARD

Measures signals 100 Kc.-45,000 Kc., with check points at 10, 100, and 1,000 Kc. with a high degree of accuracy. Power supply is self-contained for operation from 110, 130, 150, 220, and 250 V. 25-60 cycles AC.

Complete with tubes, dual crystal, and instruction book.

Brand new, in original carton.... **$24.95**

BC-375-E GENERAL ELECTRIC MOPA TRANSMITTER



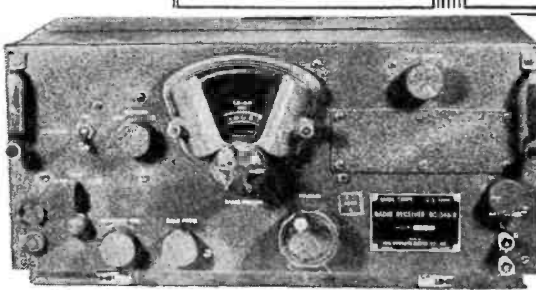
Used as liaison transmitter in bombers and ground stations. Frequency range of 200-500 Kc. and 1,500-12,500 Kc. is covered by means of 7 plug-in tuning units furnished. By slight modification operation on 10 and 20 meters is possible. Oscillator is self-excited temperature compensated type. Power amp. is neutralized class "C" using 211 tube and is equipped with antenna coupling circuit to match practically any antenna. Modulator is class "B" using two 211 tubes. Power supply is 24 V. DC dynamotor which furnishes 1,000 V. at 350 M. A. However, transformer shown on this page is ideal for construction of 110 V. AC power supply. Transmitter output conservatively rated at 42.5 watts, phone 75 watts CW, but may be pushed to 150 watts.
Complete as shown with tubes, dynamotor, seven tuning units, and cable connector plugs. Removed from bombers but checked and guaranteed.

Price complete **$36.95**
Weight, approximately 150 lbs.

LS-3 LOUDSPEAKER

6" PM type, housed in heavy metal case. For use on BC-348 Receiver. Self-contained output transformer to match 4,000 ohm impedance. Used but guaranteed satisfactory.

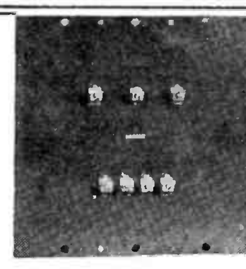
Price .... **$7.50** each



BC-348 COMMUNICATIONS RECEIVER

Excellent selectivity, sensitivity and stability make this the most outstanding of any receiver yet available from government surplus. This receiver will give outstanding performance wherever used. Built to withstand vibration and features gear driven 100-1 ratio vernier tuning control. Six bands—200-500 Kc. and 1.5-18 Mc. Two stages RF, 3 stages IF, BFO, crystal filter, manual or AVC. Complete with tubes and 24 V. DC dynamotor. Easily converted to 110 V. AC operation. These receivers used, but can hardly be told from new. Guaranteed operation. Models N, M, P, and Q available—please specify.

Price .... **$44.75** each



H. V. PLATE POWER TRANSFORMER

1425-0-1425 sec. at 750 ma. Pri. 110-115 V. 60-cycle, tapped for low and high power. These transformers were made for RCA equipment. Size, 10¼" x 10" x 8". Weight, 81 lbs.

Brand new...... **$17.50** each

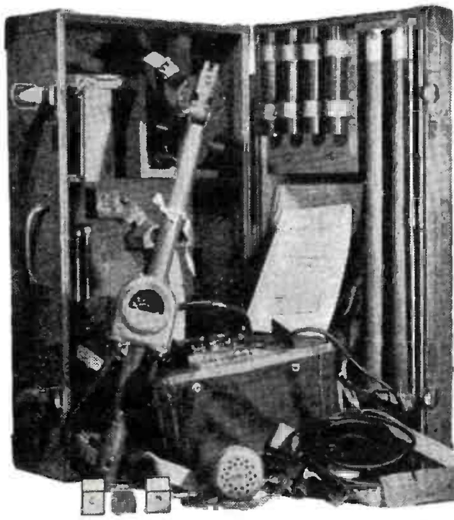
3-10 Hy. 750 ma. Swinging Choke for filtering of power. 5,000 V. insulation. Size 6½"x7¼" x 8". Weight, 38 lbs.

Brand new, **$7.50** each

TERMS: CASH with ORDER or 25% BALANCE C.O.D.
All Items Shipped Collect

ESSE Radio Company
130 W. New York St. · Indianapolis 4, Ind.

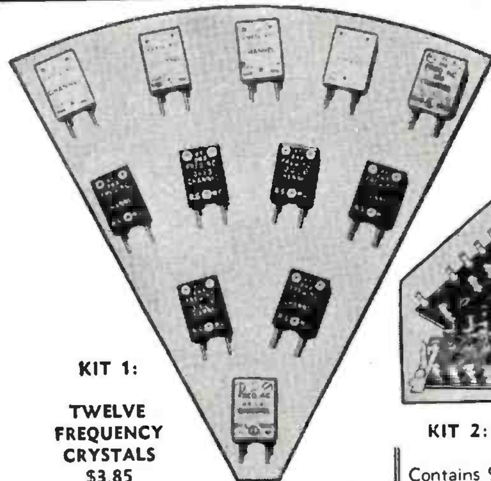
ESSE Specials!



AN/PRS-1 MINE DETECTOR

For detecting metallic and non-metallic substances by oral or visual indication. Used for locating pipes, treasure, etc. Complete as shown with spare tubes, carrying case and ready to operate by connection of batteries not included. Shipped in original overseas moisture-proof container.

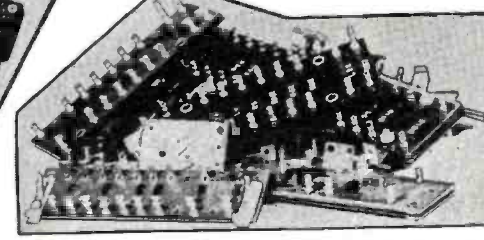
Price, brand new..$14.95
Weight, packed for shipment, 101 lbs.



KIT 1: TWELVE FREQUENCY CRYSTALS $3.85

Contains assorted frequencies between 3,000 Kc. and 8,000 Kc. in FT 243 crystal holders. We pick at random from mixed supply and cannot select frequencies.

Complete Kit of 12 Crystals........................$3.85



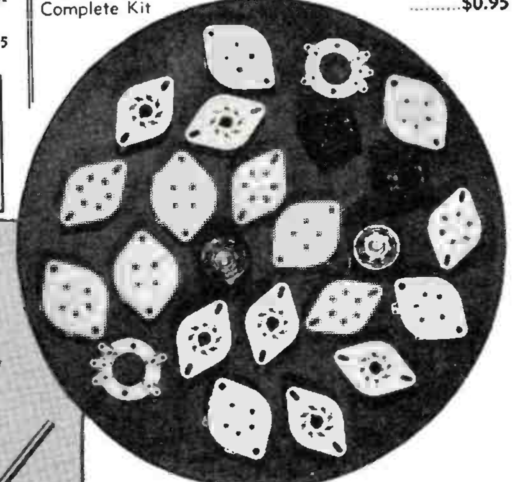
KIT 2: 25 RESISTOR MOUNTING STRIPS AND TERMINAL LUGS

Contains 9 bakelite resistor strips for mounting 2, 4, 9, 23, and 28 resistors which may be cut apart for any requirement. Also contains sixteen 1, 2, 3, and 5 lug terminal strips.

Complete Kit $0.95

ITEMS FOR THE RADIO AMATEUR, EXPERIMENTER OR SERVICE MAN

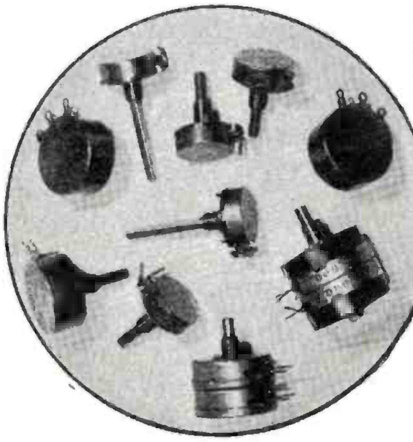
Available in kit form at a small fraction of their original cost—all brand new.



KIT 3: 24 TUBE SOCKETS

Containing the following new Ceramic lo-loss sockets: 2-Acorn, 6 octal Amphenol, 4-6 prong Millen, 4-5 prong wafer, 4-4 prong wafer, 2 molded bakelite, 2 octal female plugs and 2-7 prong tube tester sockets with center socket for checking pilot lamps.

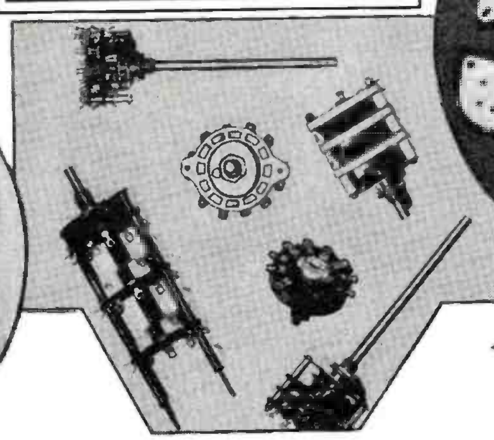
Complete Kit $2.35



KIT 5: 10 POTENTIOMETERS

Contains 3-.5 meg. carbon with ⅝" length shaft, 2-3500 ohm carbon 1⅜" shaft, 1-1000 ohm wire wound ⅝" shaft, 1-dual 25,000 ohm wire wound with ⅜" shaft, 1-dual 30,000 ohm wire wound with ⅜" shaft, 2-100 ohm wire wound with screw driver adjustment.

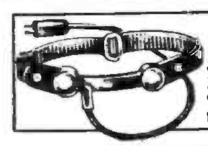
Complete Kit of 10 Potentiometers $2.85



KIT 4: 6 ROTARY TAP SWITCHES

Contains: 1-3 pole 11 position non-shorting; 1-2 pole 5 position non-shorting; 1-6 pole 4 position non-shorting; 1-1 pole 9 position non-shorting power tap; 1 ceramic insulated special; 1-6 pole 4 position with double contact wipers on 4 poles and 2 positions on 5th pole.

Complete Kit of 6 Switches..$1.85

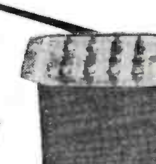


CARBON THROAT MICROPHONE

Ideal for plane, portable, or mobile operation, also for construction of lie detectors, toys, etc. You can't afford to be without a few at the price. Adjustable elastic strap fits any neck. Works into 200 ohm impedance input circuit. Used, but in good condition.

Price...$0.25 each

Plate and Filament Transformer:



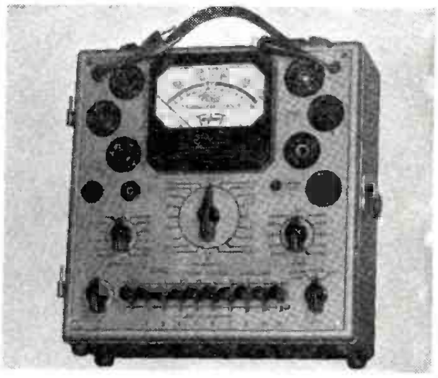
650 V. Ct. 150 Ma., 6.3 V. 7.5 Amp., 5 V. 3 Amp. Secondaries. 110 V. 60 cycle AC Primary. An excellent buy for the set builder. Brand New $1.95

ESSE Radio Company

130 W. New York St. • Indianapolis 4, Ind.

What's New in Radio
(Continued from page 74)

ment directly proportional to G_m and a properly measuring instrument. Short and open tests of every tube element are also possible. Gas tests may run on all tubes with this instrument.



The entire unit is housed in a 10" x 10" x 5¾" metal case of hammered enamel finish, tan with brown trim. An attached handle provides easy portability.

The Triplett Electrical Instrument Co. of Bluffton, Ohio will provide additional information on this unit upon request.

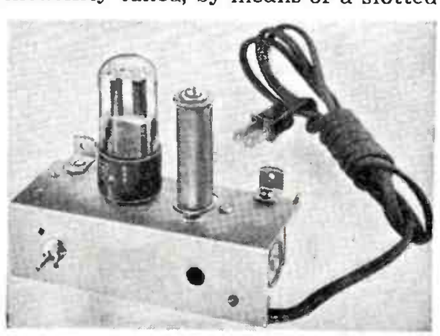
PHONO OSCILLATOR

D & M Manufacturing Company of Midland Park, New Jersey are introducing a new phono oscillator which may be used to link any record player or automatic record changer with any standard broadcast receiver.

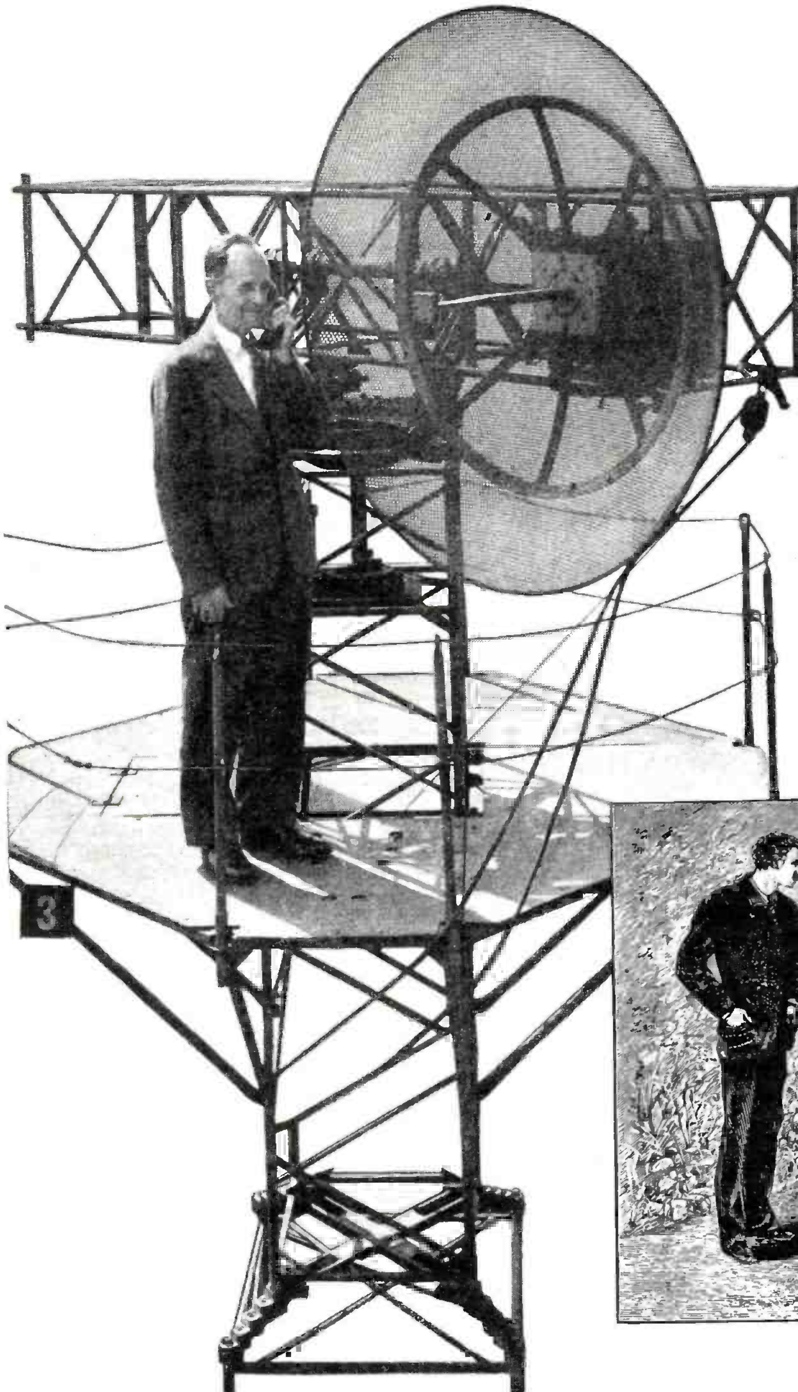
With this unit no wire connections between the record player and the radio are required. An unusually strong signal completely blankets ordinary static or extraneous noise when the unit is located within 50 feet of the receiver.

This oscillator, because of its small size, may be mounted in almost any record player. The unit weighs only 12 ounces including the tube. A dual purpose 12SL7 is used, the rectifier portion carries a load of less than 2 ma. which assures long tube life.

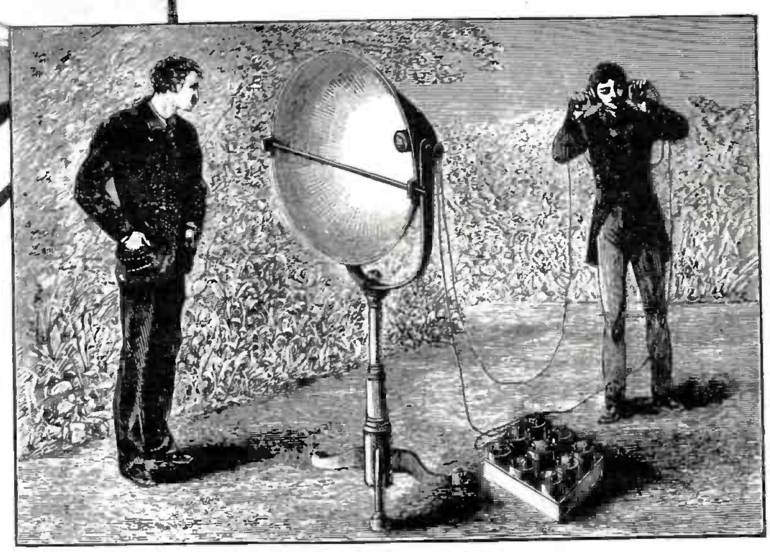
Transmitting frequency may be permeability tuned, by means of a slotted



screw, through a range from 550 to 1550 kc. Units are shipped tuned to 600 kc. Second harmonic transmission is equal in strength to transmission on the fundamental frequency so that in many cases the radio receiver can pick up the recorded music on



Words that rode on a beam of light



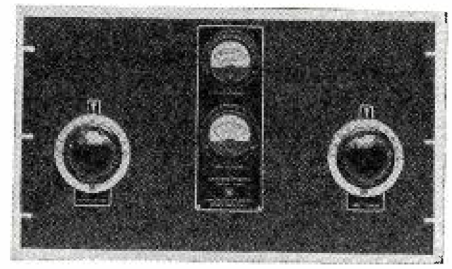
either of two settings without retuning the phono oscillator. The unit operates on 115 volts, a.c. or d.c., and includes a built-in scratch filter.

This oscillator is a product of the *D & M Manufacturing Company,* 51 Lincoln Avenue, Midland Park, New Jersey.

R.F. POWER AMPLIFIER

Of interest to the amateur is the new 500 watt r.f. power amplifier unit which has just been announced by the *James Millen Manufacturing Company* of Malden, Massachusetts.

This amplifier may be used as the basis of a high power amateur trans-



mitter or as a means for increasing the power output of an existing transmitter.

As shipped from the factory, the No. 90881 r.f. power amplifier is wired for use with *RCA or G.E.* 812 type tubes, but adequate instructions are furnished for readjusting for operation with other types of amateur transmitting tubes such as the *Taylor* TZ40, *Eimac* 35T, etc.

The amplifier is mounted on a 10½" relay rack panel. The panel contains the grid and plate tank tuning capacitor dials, as well as the grid and plate current milliameters. Plug-in inductors are furnished for operation on 10, 20, 40 or 80 meter amateur bands.

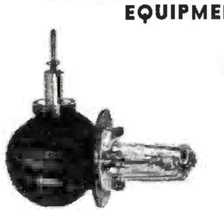
Additional details will be furnished by *James Millen Manufacturing Company,* Malden, Massachusetts.

PORTABLE PHONOGRAPH

Sonata Electronics Corporation of Chicago is currently offering their battery-operated, electrically amplified portable phonograph to the trade.

Known as the TRELA HW-301, this model plays records equally well indoors or out. The tilt-panel front and special battery amplification provide sufficient volume and clarity to permit it to be used on the beach or in a large

MICROWAVE PARTS AND EQUIPMENT



Magnetrons!! Type 2J32 (JAN.) just released. The 2J32 is designed for 10 cm. operation. Rated at 300 kw peak pulse power. Complete information supplied. Brand new, packed in individual protective cartons. The 2J32 is listed at $200.

OUR PRICE $25.50

3J31's just received. One cm. magnetron listed at $95.00.

OUR PRICE 18.95

KLYSTRON oscillator tubes 2K25/723ab, designed for 3 cm. operation. New. Packed individually. Listed at $38.00 .... 7.75

1B24 T-R Tube (with complete information) 2.98

Duplexer using 1B24 .... 10.00

30 mc oscillator-amplifier with 2 6AC7's. Uses 723ab, Waveguide input, xtal detector. With 6AC7's 10.00

With 6AC7's and 723ab 16.50

Thermistor Beads (D-170396), for use with UHF and Micro-Wave Equipment (List $3.00). In separate sealed containers .... .95

3 CM WAVE GUIDE SECTIONS

Silver Plated Narrow Band Directional Couplers with a 20 DB drop with:

A. Straight wave guide section 6"..$ 3.95
B. 15° bend in wave guide 15"...... 5.90
C. 30° bend in wave guide 10" long. 4.75
D. 90° bend in wave guide 15" long also 90° bend in coupler......... 6.50

SECTIONS

E. T Section with choke terminations 6.00
F. 2½ foot silver plated with 90° bend (2" radius)................ 5.50
G. 150° bend with 90° twist 3½" radius with pressurizing nipple and coax coupler................ 3.95
H. 2½ foot 3 cm wave guides choke to cover fitting 4.95
J. 5 foot 3 cm wave guide section per foot 1.95
K. Feed Horn 3 cm................ 3.50

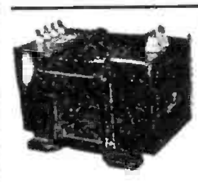
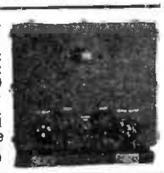


PLATE TRANSFORMER! MADE BY AMERTRAN. 115 v. 60 cycle primary. 6200 volt-ct-700 mil secondary. Size 11"x14"x10" $39.95

½ WAVE RECTIFICATION TRANSFORMER. 115v-60c/3200v @ 150 mils. MADE BY KENYON $7.25

CHOKES

12hy-12 hy @ 150 ma., 15 amp. rating, each price $4.25
15 hy @ 165 ma 200 ohms DCR. Price... 2.00
59 hy @ 100 ma 850 ohms DCR. Price... 2.00
2.6 hy @ 800 ma stud and terminals at bottom 5.95



NEW POWER SUPPLY for LM-18 freq. meter. Output: 290 v. at 20 ma; 13 v. at 600 ma. Input: 105-125v. at 60 cps; 260 ma; 27.6 W. type 84 rectifier tube; shock mounted. Complete with input and output cables; tube included $14.75

OHMITE WIRE WOUND RHEOSTATS

Model H	250 Ohms	25 Watt	$0.98
Model H	125 Ohms	25 Watt	.98
Model J	6 Ohms	50 Watt	1.25
Model J	1800 Ohms	50 Watt	1.25
Model K	3000 Ohms	100 Watt	1.98
Model L	250 Ohms	150 Watt	2.25
Model N	22 Ohms	300 Watt	3.00
Model P	1200 Ohms	225 Watt	2.75

NEW USN NAVY MODEL RAK-7 SHIP RECEIVER

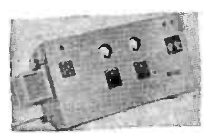
15 kc. to 600 kc. 6-tube receiver with: AVC-Band pass filter-Audio filter — Noise limiter — Precision tuning with a Vernier dial — Voltage regulated power supply, with three tubes, for 60 cycle, 115 volts. Can be battery operated. Complete with spare parts box weighing 73 lbs., spare tubes and inst. book...... $69.50

KILOWATT KOMPONENTS!

SONAR SOUND DETECTION UNIT!!!

Ideal for detecting underwater sounds, such as fish swimming in schools, within a 15 mile area. Using a Rochelle salt crystal, which is about 1000 times more sensitive than quartz, as the active unit the sound is transmitted up a 60 ft. length of cable. It is completely enclosed in a solid rubber sheath. This sound detector was originally used in harbor defense. Coupled to an audio amplifier, this can be found to have many valuable applications. Ask for SD-1.. $9.95

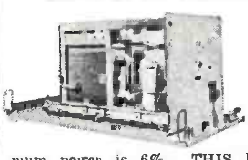
PULSE AMPLIFIER



Signal Corps type BC409. Designed for 115 volts. AC 60 cycles. Component parts worth several times the price of this unit. Slightly used. Following are a few of the items that make up the unit.

1—304TL (Eimac)
3—2 mfd. 4,000 W.V. GE Pyranol condensers.
1—3200 volt. 150 MA power transformer.
1—Variac 5 amps. General Radio type CU-200.
1—5 volt. 26 Amp. fil. transformer (for 304 TL).
1—2.5 volt. 10 Amp. fil. transformer (5000 volt insulation).
1—1 mfd. 1,000 volt. GE Pyranol.
1—2 mfd. 1,000 volt. GE Pyranol. $59.50

RA-58-A HI-VOLTAGE POWER SUPPLY



Ideal for breakdown insulation testing, or as a source of power for a pulse transmitter. This unit supplies continuously variable voltages between 500 and 15,000 volts DC at 35 ma. A voltage Doubler circuit using two 705A rectifiers and two 1 mf condensers is employed. RMS ripple voltage at maximum power is 6%. THIS UNIT OPERATES FROM 115 v/60c. Variable voltage is obtained by means of a Variac in the primary circuit of the high voltage transformer. Size is 21"x17½"x29" deep. Net weight 314 lbs. This unit sells for the low price of.................... $116

SPECIAL ITEMS

Filament transformer 115v/60 cps Input; 6.3v @ 1.6 amps/6.3v @ 1.6 amps Output. 25,000v Air insulation. KS-8767 ....$3.95
Tube shields for 2AP1.......................... .98
Transmitting key; 200 watt...................... .79
Hook-up wire, stranded, 100 ft.................. .95
Mycalex strips, ¼"x¾"x14½", ea................. .10
12 for $1.00. Minimum order..................... .60
Hand generator type GN-45B. Output: 6v-3a/500v-.14a, rated speed 60 cps.................. 5.95
Antenna loading coil, Heavy duty, with six (6) variable taps, 6¾" longx4¾" dia............ 2.95
Visor for 5" 'scopes............................ .75
Broadcast band push-button tuning units. Inductive and capacity types.................... 1.98
Matched pair precision resistors, 6.33 megs...... 1.50
Completely punched chassis for 2 inch scope, with some sockets 1.50

B-29 Computer Amplifier, containing 8 JAN6SN7 amplifier tubes, 1—6X5 GT 8—relays, 5—neon glow lamps, completely wired amplifier circuit with many components. This fine amplifier was designed for use with remote controlled guns. This buy sells for...................... $9.95

Low Voltage Power Supply for AN/APS-10, using 3—6x5 GT's, and 1—9006, complete with 6 chokes, 1 power transformer, and filter condensers..................... $4.50

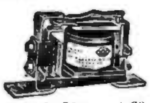
All merchandise guaranteed. Mail orders promptly filled. All prices F.O.B. New York City. Send Money Order or Check. Shipping charges sent C.O.D.

COMMUNICATIONS EQUIPMENT CO.

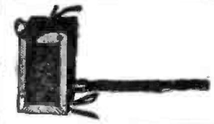
131-A Liberty St. New York City 7, N. Y.

Telephone WH 4-7658

A. C. RELAYS



DPDT 10a contacts. 115v/60 cps. coil Allied $1.79
SPST 5a, ac: 115v cont. 115v/60 cps... 1.49
SPDT contacts; 5a coil rated 115v/60c 1.39
DPDT 115v/60c. cont. rating 5a @ 50v... 1.69
DPST Telephone type; 2p. 1 cl; 1 open; cont. rating. .5a @ 50v, coil rating 3.5 ma (@ 12K ohms) 1000 vac............ 1.05
DPDT Steatite Insulated 10A Silvered Contacts. Made by Leach................. 1.95



1-F Crystal filter for BC-312. BC-342. Resonant at 470 kc. Crystal included. $6.95

OIL-FILLED CONDENSERS

500 mf 200 vdc..........................$1.95
2000 mf 50 vdc.......................... 2.00
4000 mf 30 vdc.......................... 2.25
1 mf 300 vdc............................ .25
2 mf 300 vdc............................ .30
4 mf 300 vdc............................ .35
4 mf 400 vdc............................ .55
1 mf 600 vdc............................ .35
2 mf 600 vdc............................ .40
3 mfd 600 vdc pyr....................... .65
4 mf 600 vdc pyr........................ .70
6 mf 600 vdc pyr........................ .95
10 mf 600 vdc pyr....................... 1.49
15 mf 300 vdc........................... 1.95
1 mf 1000 vdc........................... .90
2 mf 1000 vdc........................... 1.10
1 mf 1500 vdc........................... 1.20
.4 mf 1500 vdc.......................... .30
2 mf 600 ac/1000 vdc.................... .95
2 mf 4000 vdc........................... 5.95
.1-.1 mf 7000 vdc....................... 4.95

G.E. Pyranol 23F47 2mf 4000v List $30..$5.95
G.E. Pyranol 23F49 1mf 5000v List $27.. 4.75
C-D TC-50010 1mf 5000v List $30.. 4.50
G.E. 14F191 .1mf 10000v List $37.. 6.75
G.E. Pyranol .06 mf 15,000 vdc..List $25.. 5.95
G.E. 14F136 Pyranol .75 mf 20 KV DC....22.00

SANGAMO MICA CONDENSERS

F3L .0003 mfd 8000v list $29..............$3.75
F3L .0015 mfd 8000v list $31.............. 4.00
Solar type SX .0015 mf 3000v—list $9.95.. .75
Sangamo G-4 .004 mf 20kv (list $110) $25.50
Sangamo G-3 .006 mf 10kv (list $87.50) 19.50

A. VHF Variable Condenser. 15-60 mmf. ⅜" air gap. 11 rotor plates. 6 stator, with feedback provision. Designed to operate in a tuned grid, tuned filament circuit. Listed at $148. Our price..... $10.95

B. Split Stator. Cardwell PK-200-QD: 30-200 mmf per section. Special Hi-Volt. Listed at $60...................... $9.95

C. Johnson Type 500D35. Maximum cap. 500 mmf., min 35 mmf. .08" spacing. 3500v. Listed at $11.75. Lowered to... $4.75

SILVER BUTTON MICA CONDENSERS

stud. mtg. (Erie/Centralab.) 175-180-185-245-335 mmfd 400 vdc, each......$0.05
lots of 100............................ 4.50

AUDIO TRANSFORMERS

Line to Voice coil transformer. Pri. 600 ohms, Sec. 6 ohms. 1200 Test volt.....$1.75
Audio output transformer Split pri. 1500 ohms each side. Secondary impedance 85 ohms center tapped—6:1 ratio. 100 Watts output 7.50
Modulation xfmr: typical for 211's CL.A/50W 1.35
Modulation xfmr: 807 to pr 807's in parallel 1.00
Modulation xfmr: pr 811's to 813......... 5.00

TUBE BUYS!

Tube Type	Approx. List	Your Cost
3BP1	$15.00	$ 3.95
3FP7	27.00	2.98
5BP1	20.00	4.95
5CP1	45.00	4.95
5CP7	48.00	6.00
5FP4	.....	4.95
5FP7	32.00	4.25
5JP2	48.00	8.95
837	2.80	1.50
872A	7.50	3.50
705A	22.50	7.50
241B-WE	85.00	50.00
861	155.00	95.00
2C40	.....	5.95
2C43	.....	8.95

Sockets for 5CP1, 5BP1, 3BP1, 705a, 829, and 723 A/B tubes......................$.95 ea.

SELSYN MOTORS

Ideal for remote control, or for antenna rotation. Size 5G. 115 V/60 cps. Cost per pair...................... $7.75

hall. The model is hand-wound by means of a special disc and plays two records with one winding.

The cabinet is covered with leatherette and is equipped with a sturdy handle. The total weight of the unit is about 21 pounds.

Sonata Electronics Corporation, 624 South Michigan Avenue, Chicago, Illinois, will supply additional details on this item.

FEILER STETHOSCOPE

Feiler Engineering Co. of Chicago have introduced their new signal tracing "Stethoscope" which has been designed to facilitate servicing of radio receivers by cutting down time expended to located parts failures, intermittents, noise, mistracking, low sensitivity causes and distorted tone.

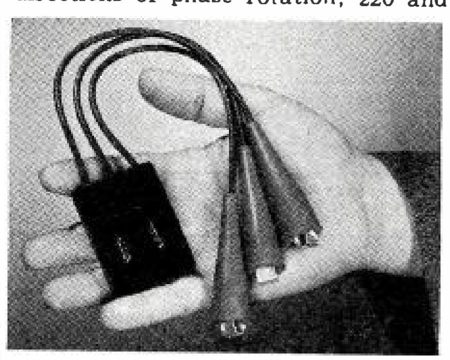
Available in two models, the TS-2 battery operated and the TS-3 a.c. operated, this unit is completely portable and utilizes low current drain miniature type vacuum tubes.

A new type probe, 1" in diameter and 4⅜" long, is made of aluminum and houses a miniature tube, isolating network and associated circuits for the special detector-amplifier.

A data sheet covering both of these models will be forwarded upon request to *Feiler Engineering Co.*, 803 Milwaukee Avenue, Chicago 22, Illinois.

POLYVOLTESTER

Fox Valley Instrument Company has announced a new pocket test instrument which distinguishes between directions of phase rotation; 220 and 110 volts, a.c. or d.c.; a.c. and d.c. and identifies positive and negative wires on d.c.



Known as the Polyvoltester, this unit is characterized by rugged construction and imperviousness to damage regardless of how the instrument is connected to any of the systems mentioned above.

In operation, the unit features no switches to turn, no metal to touch, no meters to read and no moving parts to wear out.

Further details of this unit will be furnished by *Fox Valley Instrument Company*, Box 603, Ingleside, Illinois.

—30—

10-Meter Converter

(*Continued from page* 56)

If a standard 1500 kc. i.f. is available, one of its sections may be used for the primary of T_1, with a jumble winding for the secondary.

The coils L_1, L_2, L_3, L_4 are wound on one and one-half inch lengths of one-half inch outer diameter polystyrene tubing. Bakelite tubing would have served just as well. L_1 consists of twelve turns of No. 18 enameled wire, wound to a length of ¾", with L_2 consisting of two turns of number 32 d.s.c. around the cold end. This primary is designed for use with a low impedance antenna, and if 300 ohm line or some similar feeder is to be used, L_2 should be increased to 4 turns.

L_3 is seven turns of number 18 enameled wire with a winding length of ½", with L_4 being three turns of number 32 d.s.c. It is important that L_4 be wound in the same direction as L_3 or the oscillator will not function.

In mounting the tube socket care should be taken to orient the socket so that pins number 3 and 4 are toward the front of the chassis. This will insure the shortest leads and greatest ease in wiring.

The trimmer condensers C_2 and C_7 are mounted under the chassis on either side of the tube socket. Placement of other parts may be seen from the photos.

For ease in tuning, a 2" diameter dial pulley from an old receiver was fastened to the shaft of the tuning condenser, and driven by a length of dial cable from a shaft and panel bearing assembly.

Switching from regular operation of the receiver to operation with the converter is accomplished by means of the d.p.d.t. switch, S_1. A short length of coaxial cable runs from this switch, out through the back of the chassis for input to the antenna and ground terminals of the receiver. Input to the converter is through a standard microphone connector.

A pointer from a small radio is fastened to the condenser shaft in front of a piece of opaque celluloid to indicate the frequency.

The case for the complete converter is constructed from the same material as the chassis, and measures 4" wide, 3¼" high, and 4¼" deep. The rear cover is fastened permanently in place by means of small sheet metal screws, while the front cover is held to the chassis by means of locknuts on the switch and tuning shaft. This front cover has a ½" lip all around. The

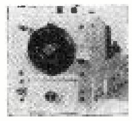
McGEE'S MILLION DOLLAR WAR SURPLUS SALE

8000 PIECES IN STOCK—AIRCRAFT TRANSMITTERS—RECEIVERS—MODULATORS I.F.F., ETC.

McGee's Big 3 month clearance sale (Feb., Mar., April). Over a million dollar stock of war surplus (Gov't. cost). No priority needed; order now. Send 25% deposit; balance sent C.O.D. Canadian and American Possession customers send full remittance and ample postage. All prices F.O.B. Kansas City, Mo. Phone Victor 9091.

BIG SCOOP! WESTERN ELECTRIC AIRCRAFT SURPLUS

Aircraft Receivers



These Army surplus aircraft receivers may be operated from a 24 volt AC filament supply and any lowpower 250 volt B supply; or the tubes changed to the 6 volt type. There is plenty of room for a power transformer and rectifier tube; in place of the dynamotor. This receiver is very selective and sensitive; has RF stage and BFO. Made by Western Electric and you never saw finer wiring. Offered complete with tubes; 12K8, 3-12SK7, 12SR7 and 12A6, but less 28 volt dynamotor. Specify the frequency you desire. We have about 1500 available.

BC-454-B Superhet Receiver 3 to 6 MC. Your Cost $9.95

BC-453-B Superhet Receiver 200 to 500 KC. Your Cost $9.95

BC-455-B Superhet Receiver 6 to 9 MC. Your Cost $9.95

Very special: All 3 of the above receivers; with shock mounting rack..........$27.95

28 volt dynamotor (snaps on receiver chassis) $1.95 3 for......................$5.50

This is the Ham's Delight—Army Aircraft Transmitters

BC-457-A 4 to 5.5 MC
BC-458-A 5.3 to 7.5 MC

This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 454-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 12J5 M. O. and 2-1625 (807) in parallel as final P. A.; or buffer to feed into a high power rig. Built in crystal dial calibration checker. Antenna loading inductance. Complete conversion data to VFO or FM oscillator is covered in CQ magazine; May '46 issue. Why not use this for your VFO? It's a real buy. 1000 to sell; at the ridiculous price of $14.95; with tubes.

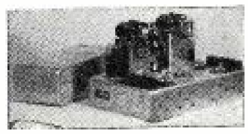
BC-457-A Transmitter 4 to 5.5 MC. Complete with 4600 KC crystal. ....Your Cost $14.95

BC-458-A Transmitter 5.3 to 7.5 MC. Complete with 6200 KC crystal. ....Your Cost $14.95

Special. Both of above on shock mounting rack $28.95

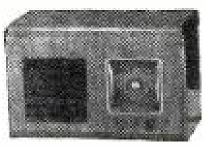
2" 0 to 10 antenna current meter in case; ideal for loading above transmitter. ....Each $2.95

BC-456-E Western Electric Modulator Unit



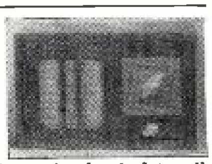
Companion unit of BC-457-A and BC-458-A. Complete with 12J5 and VR150 and 1625. Gives necessary output to modulate above transmitters. We have a few more modulators than transmitters and are offering them at a ridiculously low price. You can salvage many parts from this modulator unit. Offered complete with tubes. Very special $4.95. 3 for $13.95. Dynamotor 28 volts input; 250 volts 160 MA output continuous. Snaps on modulator $3.95 each; 3 for $10.95.

COMPLETE RADIO KITS

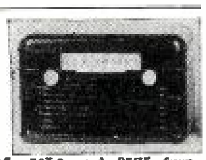


5-TUBE AC RADIO KIT superhet circuit using new permeability tuning unit. Covers broadcast 550 to 1700 KC. Beautiful walnut cabinet 12x7x6 5" A5 PM speaker. Everything complete, includes 6SA7, 6SK7, 6SQ7, 6K6 and 5Y3 and diagram Model K-5A. Net $16.95

KIT K-7A 7 tube AC superhet 550 to 1700 KC. Has push-pull audio stage with tone control and 6½ in. alnico 5 PM speaker. Conventional circuit with AVC. Similar in appearance to model K-5A except has slightly larger cabinet. Everything complete including diagram and tubes 6SA7, 6SK7, 6H6, 6SN7, 2—6G6, 5Y3. A real value....................Net $19.95



OUR LEADER KIT $9.95. 2 gang cond. AC-DC 4 tube TRF kit 550 to 1600 KC Kit K-4R, a TRF job with a walnut cabinet and 5" alnico 5 PM speaker. All parts furnished; including tubes and diagram. Has direct drive dial and a very simple standard circuit. An ideal kit for the student or experimenter. Just a few hundred to sell ....Very Special at only $9.95



NEW PLASTIC CABINET AC-DC SUPERHET KIT. Cabinet size 7x6½x10½". Attractive slide rule dial. Positive drive permeability tuner. Receives broadcast 550 to 1650 KC. Has latest Alnico 5 PM speaker Loop antenna; all parts simplified diagram and tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 furnished. ....Kit P-48 Net $12.95

4 TUBE 1½-90 VOLT FARM RADIO KIT. Offered in same cabinet as the above Kit Model P-48. The same high gain broadcast superhet circuit. Complete with 4 tubes; 1R5, 1T4, 1S5, 3S4 and diagram. Less battery pack. Kit model PB-48. Your Cost $10.95

JAN OR REGULAR BRAND TUBES CARTONED OR UNCARTONED

SPECIAL AT .49			SPECIAL AT .69		
39/44	42	6D6	1J6	7A7	6G6
76	41	6C6	1D5	7A4	6C5
37	27	1S5	1H4	7H7	12Z3
5Y4G	26	1T4	30	5U4	1V
5Y3GT	6H6	3S4	7A6	5T4	
6C8G	6AC7	1L4	7C5	6K6	
6F8G	6SH7	3A4	14B6	6F6	
1633	56	1R5	7Y4	6Y6	
1634	6B4G		7Z4	12SF7	
12SN7	80		5Z3	12SQ7	
6SN7	6K7		6SA7GT	46	
6SD7	12J5		6SK7GT	38	
			6SQ7GT	6SJ7	

VERY SPECIAL JAN 6L6M .99

LOCTAL 1½ Volt Tubes: 1LN5, 1LH4, 1LD5, 1LB4, 1LA6. Special $1.49

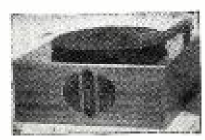
NAVY RBZ PORTABLE MINIATURE RECEIVER. Same as we advertised in November '46 Radio News; except it covers 2 to 5.5 megacycles. Weighs only 5 lbs. complete with battery. 200 to sell. Net $14.90 Navy RBZ 5 to 13 megacycles complete with battery. Net $14.95

LATEST IN PHONO-KITS

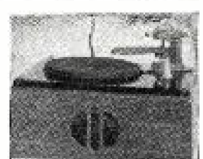
High Power Push-Pull Amps

You can save money by assembling your own record players. All the kits listed below are complete; nothing else to buy. In 15 or 20 minutes any of these kits will be ready to sell to your customers.

*The model JT-5 high power push-pull 3 tube AC-DC amplifier is furnished with all record player kits complete; wired and tested and furnished with tubes and speaker. The push-pull circuit assures good base response even at low volume. For servicing convenience and connecting to pick-up, a schematic diagram is furnished.



KIT J-15 SINGLE RECORD PLAYER. Attractive ready cut walnut finished cabinet with latest 78 RPM phono motor and light weight crystal pick-up and *JT-5 push-pull AC-DC amplifier and 4" alnico 5 PM speaker. This player will surprise you in appearance and performance. Kit J-15 Dealers............Net $15.95 complete



KIT J-16 AUTOMATIC RECORD PLAYER. Beautiful walnut finished, made to fit cabinet; latest single post automatic record changer and *JT-5 high power push-pull AC-DC amplifier (wired and tested) and heavy duty 5" alnico 5 PM speaker. This kit makes a deluxe home record player.

Kit J-16 Dealers..............Net $29.95 complete

KIT J-16A. Same as J-16 except with leatherette base instead of walnut. Dealers....Net $26.95 complete

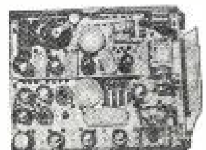
KIT J-18 PORTABLE AUTOMATIC RECORD PLAYER. Beautiful portable leatherette case and latest single post automatic record changer and *JT-5 3 tube AC-DC push-pull amplifier (wired and tested) and heavy duty 6" alnico 5 PM speaker. We have sold hundreds of these to our dealers and they keep coming back for more. A real value. Kit J-18 Dealers.......Net $33.95 complete

KIT J-19 SINGLE RECORD ATTACHMENT. Attractive walnut finished base with motor cut out, latest 78 RPM rim drive phono motor and light weight, high output crystal pick-up. Easily attached to any radio or amplifier. Kit J-19 Dealers.......

...Net $9.95 complete

Model B-4 phono oscillator (fits under base). Dealers ....Net $3.69

ARMY BC-645 I.F.F.



ARMY BC-645 I.F.F. UNIT. Net $16.95. Early in the war, when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-We316A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power Supply..............$16.95

SENSATIONAL SURPLUS BUY.

BC-654-A. Transmitter-Receiver 12 watts CW. 8 watts phone. 3800 to 5800 KC $19.95. Used but in apparently good order. Offered with 3-307A tubes but less receiver tubes. The 7 tube superhet receiver has 2 RF stages. Designed for 1½ volt octal tubes. Could be converted to heater tubes. Has built in 200 KC crystal calibrator. The 200 KC crystal and 0-3 RF thermocouple ammeter and 3-307A tubes are worth the price we are asking for the whole unit. First come first served. BC-654-A transmitter-receiver less power supply ....Net $19.95

BC-654-A Complete with all tubes and spare tubes. Net $24.95. 2 for $47.50.

RADIO-PHONO COMB. KIT

Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tunes broadcast 550 to 1650 KC, has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12..........................Your Cost $29.95

Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output Astatic crystal pick-up. High power JT-5, push-pull 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 5" Alnico 5 PM Speaker. Single record player kit Model WL-3....................Your Cost $19.95

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3 Section Side Cowl 66" C-3L..........Net $1.79

4 Section Side Cowl 100" C-4..........Net 2.49

3 Section Fender Cowl only 8" closed, 55" extended FC-4 ....Net $3.95

4 Section Deluxe swing angle............Net 2.69

Teeny Weeny I.F. Trans. 456 KC ¾x¾x2" double slug tuned. Both 1st and 2nd......$1.49 per set

Teeny Weeny 500,000 ohm volume control. D.P.D.T. Sw. ⅞" Dia. 1½" shaft..................Net 88c

Pillow speaker; very thin; easily attached to radio. Made by Carron. Very Special..........Net $2.95

Auto Antenna; full 66" 3 section side cowl. Shipped with 36" separate lead. Red Hot Special $1.09. Each 10 for $9.90

Two-Tube Phono Oscillator, $3.69

COMPLETE, WIRED AND TESTED. 800 to 1500 KC. Model B-4. Has audio gain stage for proper power output. Complete with tubes ready to operate. $3.69.

Mike Oscillator model C-4 is similar to model B-4 except has added gain stage for crystal mike. Complete with 3 tubes and fader control $4.95. Crystal mike $4.90 extra.

Write for latest bargain flyer of radios, parts kits, tubes and war surplus.

McGEE RADIO CO.

1225 McGee St., KANSAS CITY, MO.

chassis is held in the case by the two screws which may be seen protruding from the rear of the chassis.

Two leads are run through shielding for the hot "A" lead and "B" plus, with the shielding being used for the negative "B" and grounded "A" lead.

A semicircular hole is cut in the front cover, and covered with green celluloid to permit viewing the dial. Illumination is supplied by a 6 volt pilot light located behind the dial.

No provision has been made for the turning off of the unit when not in use, as most operation at this station is on the ten meter band, but a switch could be provided in the hot "A" lead for this purpose.

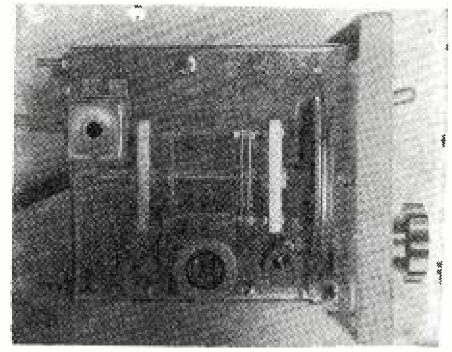
Several published articles on converters using 6J6s as mixers have shown a 50 ohm resistor for the cathode bias. In order to operate efficiently as a detector, it is necessary that the tube be operated on the straight portion of its curve, and high bias is necessary. Accordingly a 1200 ohm resistor is used for cathode biasing in this application. The oscillator grid leak is returned directly to the cathode so that only the grid bias developed across this resistor is applied to the oscillator grid.

It was decided that the frequency range of the converter should be from 27 to 29.7 mc. to cover both the new "QRM" band and the entire 28 to 29.7 band. The oscillator operates on the low side of the signal frequency, and as the i.f. frequency was chosen in the vicinity of 1600 kc. the fundamental range of the oscillator is 25.4 to 28.1 mc.

When construction has been completed, the proper voltages should be applied, with a 25 ma. meter connected in series with the "B" lead. Oscillation will be indicated by an increase in the plate current when the stator plates of the oscillator condenser are touched with the finger. If this indication is not observed, it is probable that the tickler winding, L_4, is reversed.

If all is well in the oscillator section, the frequency of the oscillator should be checked by means of an accurately calibrated receiver. The first step is to set the high frequency end with the tuning condenser at minimum capacity by adjusting the trimmer C_7. The tuning condenser should then be turned to maximum and the frequency again checked. If the frequency is too low, the turns of the coil L_3 should be spread slightly and the high frequency end again realigned. In the event that the oscillator does not reach a low enough frequency at maximum tuning capacity, the turns of L_3 should be pushed together and the procedure repeated.

When the oscillator range is within limits, the output of the converter should be connected to a receiver tuned to the vicinity of 1600 kc. This frequency need not be exact but should be in an interference free spot near this point. The trimmer condenser in the output transformer T_1 should then be peaked for maximum noise in the receiver.



Top view of completed converter shows placement of various parts.

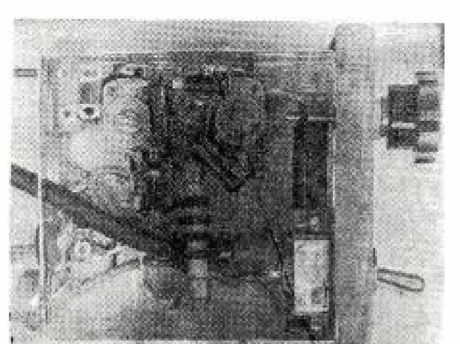
An antenna may now be connected to the converter, and the converter slowly tuned over the band in search of signals. If a signal generator is available, this problem is much simplified. The trimmer condenser C_2 should be adjusted for maximum response. At least two points in the band should be checked for tracking between the oscillator and mixer portions. When all adjustments are proper the point of maximum response of the trimmer condenser C_2 will be the same at either end of the band. The same procedure followed on the oscillator coil may be followed here for adjustment of the range.

The receiver usually used at this station is provided with an antenna input circuit of 75 ohms impedance. Accordingly, the tap on the secondary of the output transformer T_1 is used for an accurate match between the converter and receiver. Most of the standard communications receivers in use by amateurs, however, are designed for an antenna of approximately 300 ohms, and if this type of receiver is used the entire secondary should be used.

When the converter is used with an auto radio the tap is used as this type of receiver has a very low input impedance. The antenna which normally goes to the auto radio should be connected to the input of the converter and either unit is then ready for instant use simply by flipping the switch S_1.

The small current drain of the converter, only six milliamperes at 100 volts, may be easily obtained from almost any receiver using the normal plate supply of 200-250 volts, by means

Under chassis view indicates the simplicity of final wiring.



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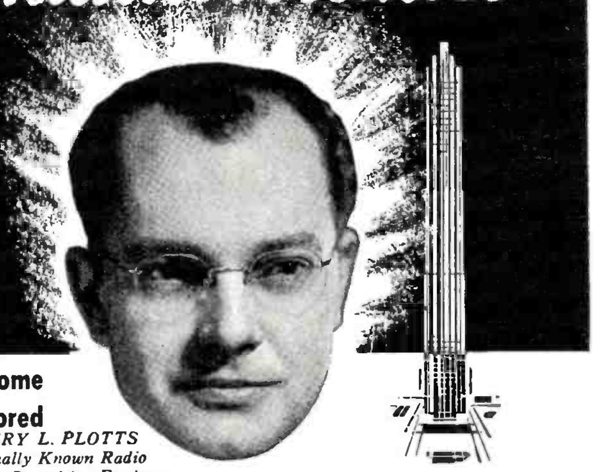

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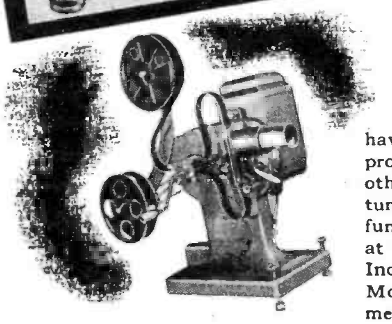

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City..............................Zone..........State..........

☐ If under 16, check here for special information.

☐ If a discharged veteran of World War II, check here.

of a dropping resistor of 12,000 to 17,000 ohms in series with the "B" lead of the converter. A resistor of the 2 watt size will be ample in any case. The voltage at the converter should be measured by means of a high resistance voltmeter to insure that the voltage does not exceed 125 volts under any conditions.

—30—

Airborne Television

(*Continued from page 59*)

operation. This overcomes a serious limitation of the smaller, unattended *Block* system.

Basic operation of the *Ring* equipment (Fig. 8) is somewhat similar to the *Block* equipment previously described, with the important addition of a large Control and Switching Unit and related monitoring facilities.

One camera is mounted in the nose of the plane (Fig. 7), and a second camera is generally mounted in the waist (Fig. 6). The output video signals of both cameras are fed to the Control Unit. There the video signals are amplified and combined with appropriate sync and shading signals. The output of one camera is selected by a switching arrangement.

The combined output, video plus sync and shading signals, then passes through a modulator stage, and the amplified signal is used to grid-modulate the power output stage of the transmitter. Also, much as in the *Block* system, a sync signal is used to plate-modulate the final stage of the transmitter. Thus the power output stage combines both grid and plate sync modulation, maintaining constant the percentage of sync modulation.

The scanning system of the *Ring* equipment uses 567 lines, 40 fields, interlaced to form 20 frames per second.

Interlaced scanning is preferable to sequential scanning (used in the *Block* system) in order to reduce the problem of adjacent-line halation. This also acts to cut down the bandwidth, because of the resulting half number of frames—as compared with sequential scanning.

The video pass band is from 20 cycles to about 8 megacycles, and about 6 db. down at 10 megacycles.

Peak power output of the transmitter is slightly more than 1 kilowatt. And the transmitter operates (temporarily) in the 90 to 102 megacycle band.

The *Ring* system of airborne television is, of course, superior to the *Block* system. But the *Ring* equipment was purposely designed for much greater range and much greater picture fidelity. Chief advantage of the *Ring* system over its cousin-televisor, is that the *Ring* equipment permits optimum utilization of every variable component of the complete television system; optimum lens aperture settings, in accordance with sky, light, and terrain conditions; optium focus conditions; optimum shading; maximum video gain; continuous control of percentage modulation of the video transmitter; and continuous operational or tactical control of cameras to permit viewing of the target at all times with maximum clarity.

A typical image televised by the *Ring* equipment is shown in Fig. 5.

Public Recognition

The relative effectiveness of the *Block* and *Ring* airborne television systems was demonstrated to the public for the first time recently by engineers of the *RCA, NBC,* and the U. S. Navy.

Naval authorities assigned to the demonstration a fast, high-flying JM-1 *Marauder* (B-26) carrying *Ring* equipment. The plane cruised over Baltimore and Annapolis, picking up scenes and action along the way and transmitting the images directly to a bank of television receivers at the Anacostia Naval Air Station.

Then proceeding to a rendezvous, miles away, the *Marauder* trained its *Ring* cameras on mock combat scenes that involved dive-bombing, smoke-screen laying, strafing, and dog-fights. The receivers at Anacostia faithfully portrayed the action, eye-witnesses of events far beyond the horizon.

Two smaller planes were equipped with lightweight short-range *Block* equipment. These planes cruised above the Potomac relaying their televised images back to the receivers at the Naval Air Station.

Thus typical wartime uses of airborne television became a grim, factual, visual reality.

But there were still other uses of the equipment during actual wartime.

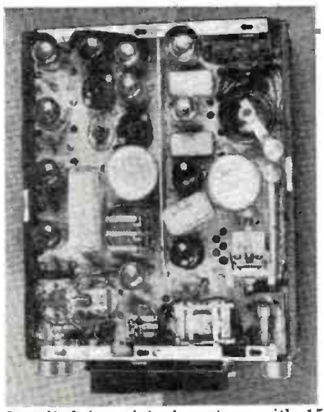
These same television systems were used to direct pilotless, over-age bombers or "crash" boats laden with explosives against enemy concentrations. These television systems were also used for the observation of gunfire, and reconnaissance in connection with amphibious landings. They were used in observation planes for artillery spotting, gun control, map-making, and other urgent reconnaissance functions. They were used to transmit maps and charts between ships and aircraft. They were used to observe dangerous operations from protected or remote positions. They were used to guide free-falling, radio-controlled aerial bombs, flying torpedoes, and assault drones.

Airborne television systems were used to direct explosive-laden gliders against land and sea targets. They were used for obtaining eye-witness information under conditions of space, speed, or peril which would preclude the gathering of required information by personal or any other means.

Many of these applications had specific and historic codes names. A *Block*-equipped Navy glider was know as a "Glomb"; a Navy crash boat with television eyes was "Campbell"; and use of *Block* gear in over-age bombers was termed "War

RADIOMEN'S HEADQUARTERS ⁂ WORLD WIDE MAIL ORDER SERVICE!!!

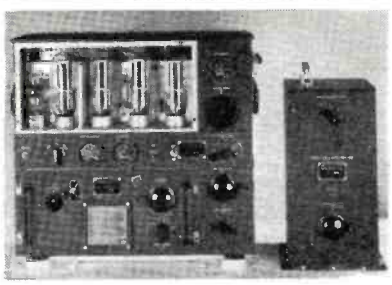
General Electric RT-1248 15-Tube Transmitter-Receiver

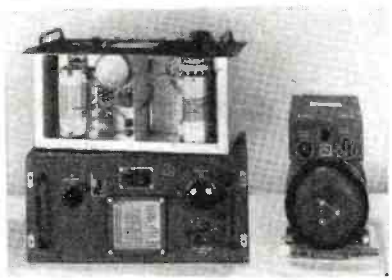


TERRIFIC POWER (20 watts) on any 2 instantly selected, easily pre-adjusted frequencies from 435 to 500 Megacycles. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's as first detector and oscillator, and 3—7H7's as IF's, with 4 slug-tuned 40 MC. IF transformers, plus a 7H7, 7E6's, and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12V operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for telephone use as in a taxicab, or for any kind of remote control applications as with drone airplanes. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice, and for using the receiver as either an AM or FM set. As an FM set, the receiver section of the 1248 is capable of better results than almost any of the commercial FM sets on the market, largely as a result of the superb engineering and meticulous workmanship employed in constructing the converter, oscillator and IF sections. Supplied in original cartons with 15 tubes. Your cost **$29.95.**

10% less if ordered in lots of 2 or more. If desired for marine or mobile use, the dynamotor, which will work on either 12 or 24 V.D.C. and supply all power for the set, is only $15.00 additional.

BENDIX SCR-522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This **job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't $2500.00.** Crystal Controlled and Amplitude Modulated—High Transmitter Output and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles at high altitudes. Receiver has 10 tubes and transmitter 7 tubes, including 2—832's. Furnished complete with 17 tubes, **AND POWER SUPPLY** for 12 or 24 volts, also remote control boxes and cable connectors. We include complete diagrams and instructions for the simple conversion of the 522 to full 110 Volt 60 Cycle operation. Your cost. Brand New—**$44.50.**





General Electric 150-Watt Transmitter: *Brand New!*

Cost the Government $1800.00. Now Only $44.50!!!
(Can be used by amateurs without any changes or modifications!)

This is the famous transmitter used in U. S. Army bombers and ground stations during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of seven plug-in tuning units which are included. Each unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: **FREQUENCY RANGE:** 200-500 Kc. and 1500-12,500 Kc. (Will operate on 10 and 20 meter band with slight modification.) **OSCILLATOR:** Self-excited, thermal compensated, and hand calibrated. **POWER AMPLIFIER:** Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. **MODULATOR:** Class "B"—uses two 211 tubes. **POWER SUPPLY:** Supplied complete with dynamotor which furnishes 1000 volts at 350 milliamperes. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½x23x9¼ inches. Total shipping weight, 250 lbs., complete with all tubes, dynamotor power supply, seven tuning units, antenna tuning unit, the essential connector plugs, and two profusely illustrated instruction books, all in the original factory packing case. These transmitters are priced to move fast; quantities are limited! Order today, and be the proud owner of one of the finest rigs obtainable.

Brand new 274 N COMMAND SETS, including 3 separate 6 tube superhet receivers, 2 separate transmitters, each with 40 watts output, and a 24 V. dynamotor unit. Bargain price for all 6 pieces complete with tubes—**$39.95.**

SIX BAND COMMUNICATIONS RECEIVER

Featuring continuous coverage from 1500 KC to 18000 KC on a direct reading dial with the finest vernier drive to be found on any radio at any price—extreme sensitivity with a high degree of stability—crystal filter and phasing control—BFO—antenna compensation—transmit-receive relay—standard 6 volt tubes. Contains a plate supply dynamotor in compartment within the handsome black crackle finish cabinet, the removal of which leaves plenty of room for installation of a 110V, 60 or 25 cycle supply. These new receivers, which make any civilian communications receiver priced under $200.00 look cheap and shabby by comparison, are only **$44.50.**

Power supply kit for conversion to 110V, 60 cycle, is only $8.50 additional.

THE INSTRUMENT BARGAIN OF A LIFETIME

NEW BC-221 FREQUENCY METERS with calibrating crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician, serviceman, amateur, and experimenter, at the give-away price of only **$39.95.**

SERVICEMEN

Check This Column for Lowest Prices on Quality Parts

TUBES: A warehouse full, including the new miniatures. Order all types you need. We'll try to supply you completely. **Special this month:** Sylvania 6V6gt—3 for $2.00; RK-75 or 307 Transmitting tubes only $2.50 each; 6L6G—99c; 6SD7 (replaces 6SK7)—59c.

POWER TRANSFORMERS—Half-shell type, 110V 60 cy. Centertapped HV winding. Specify either 2.5 or 6.3V filament when ordering.

For 4-5 tube sets—650V. 40MA. 5V & 2.5 or 6.3V....$1.49
For 5-6 tube sets—650V. 45MA. 5V & 2.5 or 6.3V.... 1.75
For 6-7 tube sets—675V. 50MA. 5V & 2.5 or 6.3V.... 1.90
For 7-8 tube sets—700V. 70MA. 5V & 6.3 or two 2.5.. 2.35
For 9-11 tube sets—700V, 100MA. 5V & 6.3 or two 2.5V 2.85
For 9-15 tube sets: 600V. 150MA; 5V & 6.3V.......... 2.95

TRANSFORMERS—All types in stock. **AUTO-TRANSFORMERS;** Steps up 110v to 220v, or steps down 220v to 110v—$1.95. **FIL. TRANS.;** 6.3v, 8 Amps.—$1.98; 5v, 10 Amps.—$1.98; Universal Output Trans. 8 Watt—89c; 18 Watt—$1.29; 30 Watt—$1.69. **AUDIO TRANSFORMERS:** S. Plate to S. Grid. 3:1—79c; S. Plate to P.P. Grids—79c; Heavy Duty Class AB or B, P.P. inputs—$1.49; Midget Output for AC-DC sets—69c; **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—$2.00.

MICROPHONES—All types, nationally known brands. Bullet crystal—$5.45; Bullet Dynamic—$7.45; Mike Jr.—60c; Handy Mike—90c; Lapel Mike—93c; other types at lowest prices.

CONDENSERS — PAPER TUBULAR 600 WV—.001—8c; .002—8c; .005—8c; .01—9c; .02—9c; .05—10c; .1—10c; .25—23c; .5—36c; **ELECTROLYTICS:** 8mfd. 200v—20c; 10mfd. 35v—20c; 30mfd. 150v—23c; 20/20mfd. 150v—35c; 30/20mfd. 150v—46c; 50mfd. 150v—43c; 8mfd. 475v—35c; 16mfd. 350v—65c; **OIL-CONDENSERS:** 4mfd. 600v—49c; **VARIABLE CONDENSERS:** 3 gang 350mmfd.—83c; 7.5-20mmfd. 1750v. Extra long shaft Hammarlund—only 69c; Miniature Variable condensers: 25mmfd.—39c; 50mmfd.—49c; 75mmfd.—49c; 100mmfd.—54c; 140mmfd.—69c.

PERMEABILITY TUNERS—Attractive slide-rule dial, compactly replaces dial, tuning condensers, oscillator and antenna coils in broadcast band receivers. Special $3.43.

WILLARD rechargeable 2 volt storage batteries for G.E. portable radios $2.95.

SPEAKERS-PM dynamic type-4"—$1.55; 5" $1.55; 6"—$1.95; 8"—$3.95; 10"—$5.95; 12"—$7.50.

CRYSTAL PICK-UPS—Two nationally known makes, one regularly $6.10, only $2.79, the other at $3.43.

PHONO-MOTORS—110V 60 Cycle with turntable and high quality crystal pick-up.—$7.95.

WIRELESS RECORD CHANGERS—These are beauties—two post, with featherweight plastic and chrome pick-up, plays 10" and 12" records intermixed through any radio without connections. Complete with your choice of blue leatherette or walnut stained cabinet, priced at only $28.95.

PHONO CABINETS — Beautiful, portable leatherette covered with or without speaker grille—$7.75.

PHONO AMPLIFIERS—A real AC. 110V, 60 Cycle, 6 Watt Amplifier suitable for PA systems and phonographs; with a husky power transformer. Complete with tubes—$12.95.

PUBLIC ADDRESS AMPLIFIERS—25 Watts peak output, 5 tubes, separate controls for Microphone and Phono Inputs. $65.00 value for only $32.00.

HIGH VOLTAGE (5000V) rotary ceramic D.P.D.T. switches 49c.

RELAYS—Guardian SPST 12-24v, has heavy duty 15 Amp. Contacts—$1.25; Guardian 12 to 24v D.C. triple make, single break relay, 5 for $3.75; Sigma supersensitive 2000 ohm D.C. SPDT Relay. (May be adjusted to operate on less than 1 Milliampere)—$2.50.

SELENIUM RECTIFIERS—Dry disc type 1½" by 1", 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers—90c.

METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment—$1.25. Half Wave—90c.

FILTER CHOKES—200, 300, 400, 500 ohm light duty—59c; 200 ohm hvy. dty.—99c; 250 MA, 35 ohms DC res. Made for U. S. Navy. Fully shielded—$1.95.

PLIERS KIT—Khaki case with 4 alloy steel pliers of different designs. Flatnosed, pointed-nose, adjustable parrot-nose, and adjustable slip-joint. Brand new. Complete—$2.08. Screwdriver type **SOCKET WRENCH KITS**—Handle with 6 attachable sockets—69c. **ALCOHOL BLOWTORCH**—99c.

REPLACEMENT CABINETS—Beautiful leatherette cabinet for portable radios—$3.95. Silvertone model 4619, 9x10x16⅓; model 4465, 5x10x8—$1.50 each.

WIRE—No. 18 POSJ 2 conductor parallel zipcord, brown. 250' spools—$5.25, 500' spools—$9.95, No. 18 PO brown rayon covered parallel lampcord. 500' spools—$12.25. No. 18 SV round rubber covered double wire for wash machines, vacuum cleaners, etc. 250' spools—$6.95. Rubber covered mike cable 250' Spools—$25.00. All kinds hook-up wire 1c per ft., transmission line, 50 ohm impedance RG8U, cut to any length, 8c per ft. Single stranded conductor shielded lead with brown rubber over shield, super special, $1.20 per 100 ft., $10.00 per 1000 ft.

PORTABLE AIR COMPRESSOR—Attaches to any ¼ H.P. motor. Just the thing for refinishing radios, painting cars, blowing out chassis, etc. 100 lb. gauge and syphon type gun with 12½ feet of rubber hose included. Pressure adjustable to stay constant at any value up to 100 lbs.—Net price—$22.25 prepaid.

Famous Collins Autotune Transmitter

This is the well known unit used in Army and Navy planes that features automatic motor tuning of any of 11 front-panel pre-selected frequencies up to 18,100 Kc., as well as the manual tuning possible any time. The transmitter operates on voice, CW, and MCW on all frequencies. This beautifully designed unit uses an 813 final, and push-pull 811's as modulator, measures 23½ x 13¼ x 11, and weighs 70 lbs. Estimated average power output is 150 Watts. Plans provided for easy 110v. conversion. Complete with 24v. dynamotor & all tubes & connectors, only $139.95.

Write for literature describing any units you wish more information on.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 2N, BUFFALO 3, N. Y.

Weary." Another smaller television camera, developed by *RCA* and known as *"Mimo,"* was used for guiding aerial bombs. This type bomb was tagged *"Roc."*

Last of the important war-developed electronic miracles to be revealed to the public, military airborne television was perfected through the joint efforts of the Bureau of Ships and the Bureau of Aeronautics of the Navy Department—and the Research and Development Laboratory of the *Radio Corporation of America,* in conjunction with the *National Broadcasting Company.*

Into the Future

A look into the future promises many exciting applications of airborne and highly mobile television equipment.

Already mentioned has been "on-the-spot" reporting of disasters and other events of public interest, which can then be rebroadcast to millions of television-equipped American homes.

Airborne television gear will likely replace test pilots in experimental planes of supersonic speeds, or in any planes in which there is an element of risk while in flight. Television equipment can not only give electronic "eyes" to the plane, but also transmit to ground control headquarters complete up-to-the-second readings of instruments and testing apparatus.

Plane navigation will be greatly assisted by airborne television, when televised reports and maps of terrain surrounding airports, as well as the general lay-out and activity of the airports themselves, can be flashed to incoming pilots in time to avert landing difficulties.

This form of visual transmission of terrain would also be invaluable to marine navigation.

Portable or airborne television sets will make possible hazardous explorations by scientific expeditions. Television pictures would provide vivid clues to the perils of such exploration groups.

Fixed installations of minute television sets will be widespread in industry, becoming the "eyes" in factories and large-scale production enterprises. This will be a new and precedent-shattering means of coordinating activities and the means of watching and controlling, from a distance, manufacturing processes and situations that might otherwise be inaccessible or too perilous to humans.

Many other applications of this type of extremely lightweight, compact, and portable television equipment can be expected in the future.

It's good to think of a world at peace again.

But should war ever strike our country once more, airborne television will be destined to play an extremely important role in both offensive and defensive action, because to date it is the most practical and feasible means of controlling guided missiles.

—30—

International Short-Wave

(*Continued from page* 68)

tive competition in the form of English language broadcasts. Spurred by this competition, several of the other Panama radio stations are considering an increase in their English language broadcasting. Some even propose—as HOX does—to broadcast a full daily schedule in English.

"Thus far, the English language broadcasting over HOX and HOXA has been limited largely to musical programs based on commercial discs, and newscasts. In addition, the English staff has presented several programs of a special nature on the occasion of U.S. and Panamanian holidays. With the recent arrival of a library of World Service transcriptions and programs, English Program Director Cooper now plans an expanded series of programs—including many live programs using local talent.

"The Spanish program staff of *Radio Central America,* headed by Salustiano Chacon, formerly of CBS, New York City, has naturally been more fortunate in the matter of being able to use live talent. Latin America is a land of music where nearly everyone likes to sing or strum a guitar, or both, and Panama is no exception. Panama is noted for several highly-individual musical forms, mostly connected with traditional national dances.

"All indications point to a considerable growth in radio activities on the Isthmus of Panama. As previously noted, seven more stations are in various stages of construction, of which at least two are scheduled to be on the air about the time you read this.

"Business circles predict an expansion of English broadcasting, especially in view of the expected increase in activity in the Canal Zone. Before the war, a great number of people were employed in the Canal Zone in connection with the construction of a third set of locks for the Panama Canal. The war halted the project, but it has been under consideration again recently along with proposals to convert the present lock canal into a sea-level canal or to construct another canal at a different location. No matter which project is selected, it appears likely that there will be a considerable increase in activity in the Canal Zone within the near future, with a subsequent upward trend in volume of business and prosperity.

It is expected that HOXA, 15.100, will broadcast a special DX program sometime soon for readers of RADIO NEWS. Definite arrangements have not been completed, but will be announced shortly.

* * *

Re The Byrd Expedition

First report to this Department of reception of NAVE, station aboard Adm. Byrd's "Mt. Olympus," of the Antarctic Expedition, came in early in December from Lynn McLaughlin, Charleston, West Virginia:

"I have been listening to some interesting point-to-point work from the 'Mt. Olympus,' Adm. Byrd's Antarctic Expedition; call-letters of 'Olympus'

A SIMPLE NOISE LIMITER

By R. J. HAGERTY, W6JMI

THE problem of installing a noise limiter in a receiver not so equipped usually involves procuring bias voltages, installing condensers, resistors, potentiometers, etc., and generally becomes a complicated business.

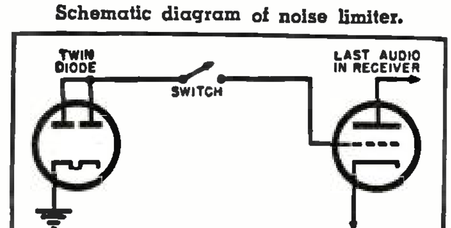
In searching around for a simple noise limiting device it occurred to us that the diodes of a tube, whose cathode was connected to ground, would be sufficient to cut off the noise peaks. Carrying the idea a bit further we figured that if the sharp peaks of noise, such as caused by automobile ignition, were cut off in the audio, reception would improve.

In practice the circuit shown in the accompanying diagram has proven very practical. It is of the utmost simplicity—using only one tube, one switch and no other parts. The only voltage necessary is the filament voltage. It has a further advantage in that it will not upset any existing circuits and no tuning is required. We used a 6SQ7 because it was immediately available in our junk box although a 6H6, 75, 85 or similar tube could have been used. The cathode is connected directly to ground. The diodes are connected in parallel and then to the switch for cutting limiter in or out of the circuit. The other side of the switch is connected directly to the grid of the last audio amplifier in the receiver.

In operation, signals of low to medium intensity are not affected but on sharp bothersome noise, the kind that plays havoc with ten meter reception, the limiter "clips" off the peak and shunts it to ground. On broadcast reception distortion will be present due to the clipping of the highs—but this is no problem in communication work. It is the simplest and cheapest noise limiter possible and one that has helped us immeasurably on ten meters. We have tried potentiometers in the diode and the grid circuits in an effort to improve same but the improvement was so slight that it wasn't worth the effort. We know that it isn't the best noise limiter in the world but for simplicity and low cost it can't be beat and it has made communication possible that would have been impossible without it.

—30—

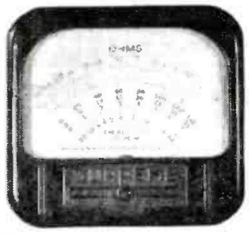
Schematic diagram of noise limiter.



BETTER VALUES from ARROW!

SUPREME FOUNDATION METER

40 Micro Amps. 25,000 ohms per volt. 4½" square. Mfd. by Supreme Instruments Corp. Each.................. $8.95



HICKOK 2½" 0-150 Volt AC Voltmeter

Each.......................... $2.49

HEADPHONES

Signal Corps, 8000 ohms and 200 ohms, each............ $2.49

2000 ohms, Trimm, each.... $1.79

SPEAKERS

	Each
PM Alnico 4"	$1.60
5"	1.65
6"	2.25
4"x6"	2.15
6" extra hvy	2.85

	Each
Dynamic 12" 1000 ohm field	$5.95
3" PM Hvy. Duty Speaker	1.59
8" PM Hvy. Duty Speaker	4.95

COAXIAL CABLE

50 ft. of coaxial cable RGU8, 52 ohm, with 2 Amphenol plugs, 1 on each end .... each $1.19

KITS

Kit of 10 assorted volume controls up to 2 meg. less switch.................$1.59

Kit of 20 5 to 20 watt resistors 1.89

100 assorted—⅓ & ½ watt resistors, all popular sizes... 2.19

100 assorted 1 & 2 watt resistors, all popular sizes....$2.95

100 assorted Bathtub condensers, up to 2 mfd. at 400V, per 100............$2.95

TRANSFORMERS

4-5-6 Tube Power Transformer, 110-120V, 6.3V and 5V winding.....................$1.89

7-8-9 Tube Power Transformer, 110-120V, 6.3V and 5V winding.....................$2.59

6L6 output transformer......$1.79

Single output for 50L6, 25L6, 6V6.....................$.55

Single pentode output for 42, 43.....................$.55

AC-DC Chokes. 250 ohms... .45

POWER TRANSFORMER—NAVY TYPE

159 ma; 6.3V at 6.5 amps; 5V at 3 amps..................Each $3.29

2 Post VM RECORD-CHANGER........................Each $16.95

SURPRISE PACKAGE

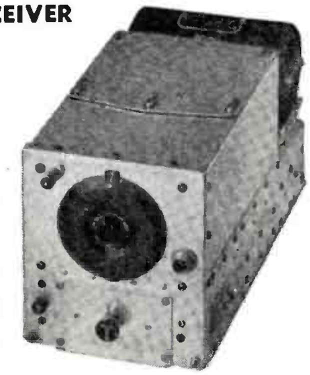
For the experimenter, radio serviceman, handy man, repairman, "ham," hundreds of valuable miscellaneous radio parts. 10 lbs.. $1.59

ANTENNA

10½ ft. sectional antenna, collapsible. AN-131A ....Each $1.89

ARMY AIRCRAFT RECEIVER

Model BC-946-B



Broadcast band from 520 to 1500 KC, tube complement, 3—12SK7, 1—12SR7, 1—12A6, 1—12K8; can be used with 24V dynamotor supplying A & B power; can be converted to AC or DC or 32 volt sets; 3 stages of IF used, uses 3 gang condenser, complete with tubes and schematic. Each.......... $12.95

Dynamotor DM32A. Each................$4.95

USED SIGNAL CORPS RECEIVERS

6 tubes; 3—12SK7, 1—12SR7, 1—12A6, 1—12K8; 190-550 Kc. (specify freq. desired) 3-6 mc; power 28 VDC. Complete with tubes, whole receiver at cost of tubes only, original cost $99.23, slightly used. Your cost, each $6.95

3½" AUTOMATIC TIME METER

60 cycle 110 volts. This time meter consists of a cyclometer driven by a Telechron synchronous motor. Connect to an electric circuit; it will measure and indicate the number of hours or minutes that the circuit is in use. Shpg. wt., 61 lbs.—list $17.00. Your cost $4.95

CONDENSERS

Oil Filled

Standard Brands	Ea.
2 mfd; 600V	.39c
4 mfd; 600V	.49c
3 mfd-3mfd; 600V	.69c
.5 mfd; 3000V	.89c
10 mfd; 1000V	$1.85

Tubular Electrolytic

40-30 mfd; 150V	.59c
50-30 mfd; 150V	.69c
2500 mfd; 3V	.49c

MICA CONDENSERS

All popular sizes, 100 assorted................................. $2.95

PICKUPS

Low pressure crystal.......................... $2.20

PLUGS

PL55 Plugs.........ea. 20c | PL68 Plugs.........ea. 20c

JACKS

JK26......................................ea. 20c

CARBON MIKE

T-17-B Carbon mike............................ea. $1.49

SOCKETS

Molded octal sockets, each.....7c

Lots of 100..................$5.00

Ceramic sockets with metal ring, each........................9c

Lots of 100.................$7.00

VIBRATOR

4-prong, used in 90% of auto radios, Each......................$1.49

CONDENSER KIT

600 Volt By-pass Condensers, 70 assorted .01; .02; .05; .1...$4.95

TRANSMITTING TUBE 5BP1.................ea. $3.95

VEEDER-ROOT METER AND CASE

Counts no. of ft. of trailing wire antennae; no. turns when winding on coil applicable for many uses; flexible shaft can be attached and connected to another device for counting without direct attachment; speed 300 ft. per minute for reeling out; beautiful bakelite case, jeweled dialite, pilot light enclosed, 3 position switch, counts up to 1000. Each...95c

Wholesalers, dealers, institutions, and other quantity purchasers . . . write, wire, phone for quantity prices.

Dept. C

ARROW SALES, INC.

59 WEST HUBBARD STREET • CHICAGO 10, ILLINOIS

Telephone: SUPERIOR 5575

are NAVE (pronounced *Navy*), operating on 12.250, 15.930, 15.960, 9.288; among frequencies in the United States worked by NAVE were (announced) 15.610, 10.010, 15.370, 15.830, 14.800, 17.900, 15.835, 11.460, 20.820, 20.800. When first picked up, NAVE was in the Canal Zone, and had a better signal here than did the American network stations contacting it." We join Mr. McLaughlin in his "hope we can follow them down to the Pole!"

(It will be appreciated if readers will send in details of reception of NAVE to your ISW Editor, 948 Stewartstown Road, Morgantown, West Virginia, U.S.A.)

* * *

UN Sessions

At your request, Roger Legge, New York City, has compiled this list of United Nations Broadcasts from the United States; this will be of especial interest to overseas readers. *(Time is GMT.)*

To Europe—WNBI, 17.780 (16.87 m.), 1500-1830; WNRI, 13.050 (22.99 m.), 1500-2315, and on 6.190 (48.47 m.), 2330-0030; WNRX, 21.610 (13.88 m.), 1500-1845, and on 9.750 (30.77 m.), 1900-0030; WOOC, 15.200 (19.74 m.), 1500-2130, and on 11.870 (25.27 m.), 2200-0030. (When there is no UN broadcast on the air, these stations carry "Voice of America" programs.

To Latin America—WCBX, 15.270 (19.65 m.), WLWL-1, 9.750 (30.77 m.), WLWO, 11.790 (25.45 m.), and WRCA, 9.670 (31.02 m.), 0215-0315, *except* Monday.

To Australasia—KNBA, 9.490 (31.61 m.), KNBI, 9.490 (31.61 m.), and KRHO, Honolulu, 9.650 (31.09 m.), 0745-0845, *except* Monday.

Mr. Legge reports that the relays to Europe during the day are mainly relays of UN Sessions; the Latin America and Australasia broadcasts are programs put on by UN. The UN sessions can be relayed by any station so desiring.

In addition to the above, the Canadian Broadcasting Corporation's International Service, with studios in Montreal, is using its powerful s.w. transmitters at Sackville, New Brunswick, for relaying UN broadcasts overseas.

* * *

Report On Swedish DX Program

Reception of the special DX broadcast from the Swedish Radio, Stockholm, November 24, 1946, dedicated to readers of RADIO NEWS, varied in many quarters, from "good" to "inaudible." High sunspot activity—and in many places, local QRN—prevented good reception in most points of the United States and Canada; some DXers reported bad QRM from a New York transmitter, interfering with reception of SBT, 15.155, while SDB-2, 10.780, was hampered by CWQRM.

QSL cards on the broadcast are being sent out direct from Stockholm to all those who sent in correct reception reports. *We wish to thank the Swedish Radio and Arne Skoog, Stockholm, for having made possible this fine broadcast which had as its theme "the part SW radio can play as a medium for a better understanding between the peoples of the world."*

SBT, 15.155, continues to send a good signal daily to the Eastern United States in its North American beam, 10-10:55 a.m., while SDB-2, 10.780, is usually a good signal afternoons in the Home Service relay. The Swedish Radio, Stockholm 7, Sweden (Sverige), would appreciate reception reports at any time from those who pick up the Swedish transmissions anywhere in the world.

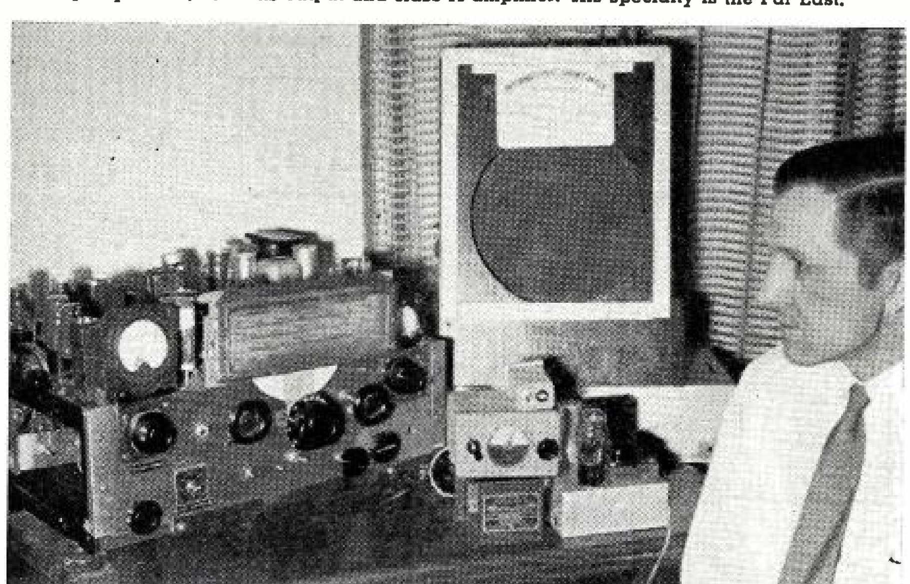
* * *

Radio Club Notes

England—New editor of the "Short Wave Review," official organ of the British Short-Wave League, is J. Wm. Charge 34, Winborne Drive, Pinner, Middlesex.

Italy—Direct from the Radio Club

Henry Ecklund of St. Paul, Minnesota is an avid short-wave listener. His record of bringing in the DX is especially noteworthy considering that all his work is done on this home-constructed receiver which employs four 6V6s in push-pull parallel, 25-watts output and class A amplifier. His specialty is the Far East.



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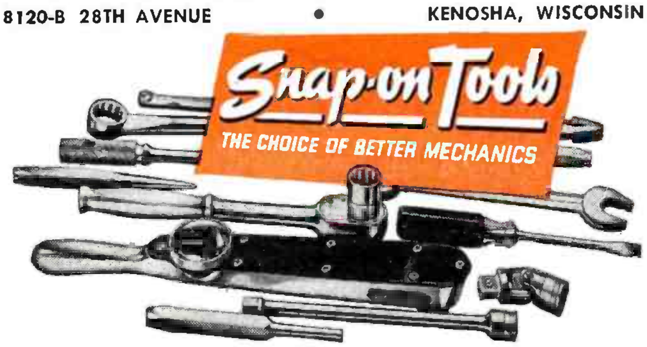


D'Italia, Rome, comes this data: "Immediately after the end of the war, the Radio Club D'Italia started its activity. It tries to gather the amateurs who are scattered all over the country, and we want to line them up and to give them such an organization that finally also the amateurs would have a personality, a real, genuine ego. At the present time, many new and old elements are united in the Radio Club D'Italia and we fight on all levels the perennial bureaucracy of this country. Indeed, at the end of May, 1946, the Allied Control Commission gave permission to the amateurs to start working but in five months the Italian authorities have failed in bringing out the necessary legal provisions, and for this reason, the amateurs are still in the same condition in which they were under the fascistic rule." (Letter was dated September, 1946, and since that time, I believe Italian "hams" have returned to the airwaves.)

"We had organized an exchange service QSL, which avails itself of the principal airlines of the world; we had established schools for radiotechnicians in which we wanted to train the great number of new and inexperienced amateurs; two great annual contests have been organized for the OM, open to all OM from all countries, with two cups being assigned as prizes. These contests will take place every year during January and February.

"Three categories of members are represented in the Radio Club D'Italia: Transmission amateurs; listeners; and students of theoretical radiotechnics.

"Presidency of the Radio Group is held by KTA (Pietro Spriano), with two advisers—the TQ (Luigi Ivaldi) and the WR (Oscar Buglia Gianfigli). Headquarters is in Alessandria, Via Alessandro Sappa No. 1. Address of the Office for WSL movement is R.C.I., P.O.B. 147, Alessandria, and there is a QSL exchange every other week." Official publication of the club is called "*Radioschemi*."

Spain—This information regarding officers of the R.C.E. (Radio Club Espanol) comes from Luis Diez Alonso:

President, Javier de la Fuente, Plaza de las Brisas, Sardinero, Santander; vice-president, Louis Diez Alonso, Daoiz y Velarde, 25, Santander; second vice-president, Luis Perez Alvear, EAJ32, Radio Santander, Santander; editor of club bulletin, Arturo Moreao, Stos. Martires, 5 Letr "B," Santander; secretary, Francisco Bercedo, Martillo, 13 segundo, Santander.

U.S.A.—Persons wishing sample bulletins of the URDXC are now requested to send along ten cents to cover cost of mailing out. Requests should be sent direct to Charles Norton, president, Universal Radio DX Club, 7507 Holly Street, Oakland 3, California, U.S.A.

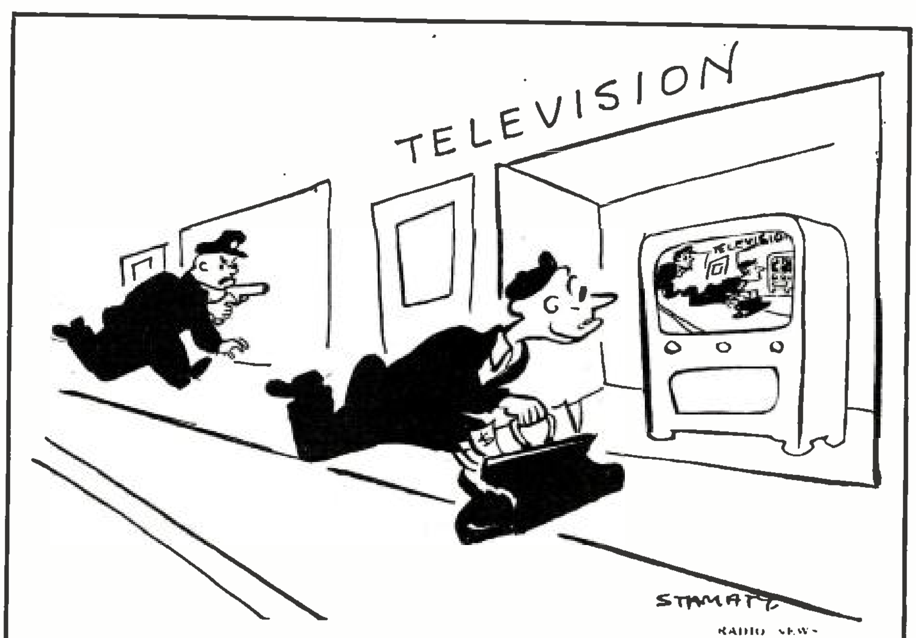
* * *

Verifications

Radio SEAC, G.P.O., Colombo, Ceylon, is verifying widely now with a black and white, odd-size QSL card which is sent via airmail. (Cooley)

Mervyn P. Laubscher, South Africa, writes: "My airmail report on XGOY, 9.635, Chungking, of May, 1946, was verified by an airmail card which I received six weeks after mailing my report; it is a plain white card with 'The Voice of China,' address, and frequencies in black; in the left-hand corner is a drawing of a panda; verie was signed by the director of the station, Fung Chien." Reports for XGOY may be addressed simply to XGOY, The Voice of China, Central Broadcast Administration, Chungking, China; while they *may not* be required, it is suggested that an IRC accompany reports.

Gote Olsson, Sweden, reports that The Turkish Press Department, Radio Branch, Ankara, Turkey, is now sending out a new verification card; it has an attractive outline map of Turkey



with an antenna mast rising from Ankara. Other recent veries received by Mr. Olsson include those from VLH3 and VLR2, Australia (cards are slightly different for these respective calls, signed by same person); CXA19, Uruguay, which sent along a colorful brochure on Difusoras del Uruguay; and WNRX.

W. J. Arthur, West Virginia, reports that HH2S, Port-au-Prince, Haiti, verifies promply; stated "actual" power is 300 watts, using an east-west bi-directional radiation; stated frequency as 5.943, but no schedules were furnished.

From the Directorate-General, All India Radio, New Delhi, we learn that they "send QSL cards in verification of reception reports from listeners; it is *not* necessary to send Internation Reply Coupons as we do not make use of them; all reception reports from foreign listeners are sent for verification and acknowledgment to Station Engineer, AIR, Delhi." (Reception of *all* AIR stations—including Madras, Bombay, Calcutta, and so on —should be reported to AIR, Delhi.)

Rex Gillett, Australia, reports a nice verie from HS8PD *(note official callsign)*, Bangkok, Siam; this very colorful card with yellow background, features a map of Siam and below the map the skyline of Bangkok, both being in white; "the card is a worthy addition to any collection," Gillett states; his verie was marked, "Yours is our second report since the war." Frequency was given as 6.040 but is nearer 5.990, according to Mr. Gillett; power was given as 900 watts. HS8PD's schedule was stated to be 5-6:30 a.m.; the BCB station, HS7PJ, on 825 kcs. and HS8PD, however, were stated to be in parallel between 7-9:15 a.m.

On December 1, 1946, William Cooley, Fairchance, Pennsylvania, received verification from CBLX, 15.090, 7500 watts, Montreal, Quebec, Canada; it was stated that studios are in Montreal, transmitter at Vercheres, and operating time was listed as 7 a.m.-8 p.m. daily; card was signed by J. Marcotte who added the footnote, "This frequency has been in use only since October 23, and *you are the first one reporting reception of CBLX.*" simply address, CBLX, Montreal, Quebec, Canada.

A Swedish correspondent, Gunnar Persson, has received a letter verification from Sudwestfunk, Baden-Baden, Moltkestrabe 5, Kaiserin Elisabeth, French Zone of Germany; gave frequency of 6.321, with schedule of 2 a.m.-12:45 p.m., Sundays from 2 a.m. to 6 p.m. The same monitor has received a QSL card from Norway with picture of Oslo; this verified the Fredrikstad experimental short-wave transmitter on about 6.185, scheduled 12 noon-1:30 p.m. and 3:45-5 p.m. with 8 kw. power; address, Administration of Telegraphs Radio Department, Broadcast Division, Oslo, Norway (Norge). Also reported is "the new QSL card with map of Italy" from

Radio Italiana, Via Arsenale 21, Torino, Italy (Italia). And from Spain came a letter verifying reception of Radio S.E.U., Station EDV10, Diego de Leon, 48, Madrid, Spain (Espana).

Buddy Giles, Texas, recently received verification from JLU-2 and JVU-2, Tokyo, Japan, signed by Major Carl E. Frisby; address, Technical Supervisor, Japanese Radio Systems, Headquarters, 8th U.S. Army Signal Office, Tokyo Communications Center, A.P.O. No. 181, c/o Postmaster, San Francisco, California, U.S.A.

* * *

This Month's Schedules

Alaska—A letter verie from WXFG gives power as 600 watts; said is beamed to Seattle. Uses a frequency of around 12.255 and can be heard usually around 10 p.m.-1 a.m., irregularly. (Rice)

Albania—ZAA, 7.852, *Radio Tirana,* has *English* news between 4-4:15 p.m. daily now. (Hughes)

Andorra—*Radio Andorra,* 5.985 (varying), has a *daily English* period between 3:30-4 p.m., produced by Freemantle Overseas Radio Network, London; is good level in England. (Rowden) This station is heard well in the eastern U.S., mostly in Spanish, to around 7 p.m. closedown.

Australia—VLC9, 17.84, to Eastern North America evenings, has been dropped; only VLA9, 21.600 is used, 7:15-8:30 p.m. The special DX program continues to be given at 8:10 p.m. Saturday, immediately following the 8 p.m. newscast. The West Coast beam, 11:45 p.m.-12:45 a.m., is heard over VLA4, 11.77; VLB9, 9.615; VLC4, 15.32; and VLG7, 15.16; the special DX program on Sunday is at 12:30 a.m. (Balbi)

For the 11 a.m.-12 noon beam to West Coast, currently in use are VLA8, 11.76; VLC6 (or VLB9), 9.615; and VLG4, 11.84. (Balbi)

VLR2, 6.150, Melbourne, signs off at 9 a.m. (Dilg) Usually has a good signal here in West Virginia mornings; relays the BBC news from London at 8 a.m., followed by Australian news.

Here in the East, VLQ2, 7.215, Brisbane, has had improved signals lately; news is heard well at 8 a.m. VLW7, 9.52, Perth, which signs off at 11 a.m., is one of the best Australians this winter.

VLC10, 21.680, is being used again to Britain, 2-3:15 a.m., replacing VLA2, 9.615, which was used only a few days on this transmission. (Balbi) Is heard on West Coast, 4:15-6:30 p.m., to Forces in Pacific; opens rather weak but signal improves to fairly good during last hour; in this beam, the 19- and 25-m. band frequencies are inaudible on West Coast. (Dilg) All three —21.680, 11.77, and 15.200—are sometimes heard in the East in this transmission.

Bermuda—SFD2, 10.335, was heard recently at 8:58 a.m. contacting WOG2. (Ferguson) Call is probably "ZFD2."

British Somaliland—*Radio Somali,* 7.126, Hargeisa, is being heard again mornings on the West Coast, best around 9:15 a.m. (Dilg)

The BSWL reports that *Radio Somali* opened in 1942 in Harar (Abyssinia) as a local force station, using a homemade transmitter of about 200 watts made from captured enemy material; it moved from Harar to Hargeisa in 1943 and was taken over by the Government there, which had purchased a 600 watt American transmitter (amateur type), used as the *Radio Somali* station until November, 1943. Hargeisa is the temporary capital of British Somaliland, and is situated 110 miles southwest of Berbera, the chief seaport; QRA of *Radio Somali* is Information and Broadcasting Department, Hargeisa, British Somaliland.

Bulgaria—LZB, 7.460, *Radio Sofia,* is heard in England daily with an *English* program between 3:30-3:40 p.m. sign-off. (Hughes)

Burma—Official schedules received direct from *Radio Rangoon* list *English* transmissions as 8:15-8:45 p.m., with headline news at 8:30 p.m., on 9.543; 1:15-2 a.m., with news at 1:30 a.m., on 6.035; and 8:40-10:15 a.m., with news at 8:45 a.m., and headline news and summary of next day's programs at 10:10 a.m., on 9.543; those are "weekday" schedules, and for Mondays, *only* the last period is listed. Programs are heard *daily* between 6:15-7 a.m. in Hindustani, presumably on 6.035.

Canada—CKRZ, 6.060, is a new station added by the CBC's International Service in the Caribbean and Latin American beam, 6:20-7:35 p.m. daily; in this beam, CKRA, 11.76, is heard at the same time daily, *except* Sunday when it runs to 9:05 p.m. closedown. The European beam is radiated on CKNC, 17.82, 9:30 a.m.-12:45 p.m. daily, and 7 a.m.-12:45 p.m. Sunday; CKCX, 15.19, 9:30 a.m.-12 noon daily, and 7 a.m.-12 noon Sunday; CKCS, 15.32, 12:05-3 p.m. daily; CHOL, 11.72, 1-6 p.m. daily; and CKLO, 9.63, 3:15-6 p.m. daily. Incidentally, the CBC is sending out a fine monthly booklet entitled *"Canada Calling,"* from the new address of the International Service, CBC, P.O. Box 7,000, Montreal, Quebec, Canada. (Flitcraft, Cooley)

CKRO, 6.150, Winnipeg, Manitoba, has "Night Final" news at 12 midnight; CKRX, 11.72, also Winnipeg, is heard as late as 12 midnight. CBRX, 6.160, Vancouver, British Columbia, has news at 2:45 a.m., usually is fair signal. (Reed) This latter one usually is heard well here in West Virginia with the news at 12 midnight.

Cape Verde Islands—CR4AA, 6.465, Praia, is correct call. (URDXC) *If this station is still on the air, your ISW Editor would welcome schedules.*

Celebes—*Radio Makassar's* 5.030 frequency recently has been a much better signal than its 9.260 (varying) outlet; peaks around 7 a.m. (Dilg)

Ceylon—*Radio SEAC,* 11.77, Colombo, is heard with very poor quality in its 7:30 a.m.-12 noon transmission, being QRM'd by GVU, London,

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same frequency, in the BBC's European Service. (Beck) The opening of this transmission at 7:30 a.m. is with *English* news. On 15.120, *Radio SEAC* is a good signal at 6 a.m. when relaying the BBC news from London, also has BBC news relay at 8, 9:30 p.m.; in some locations, suffers bad interference from HCJB, Quito, Ecuador, 15.115, from 7:30 p.m. daily sign-on of Colombo.

Chile—CE1180, 11.997, Santiago, usually has a good signal around 7:30-9 p.m. (Ferguson)

China—XTPA, 11.650, is now sending a better signal to the Eastern U.S.; peaks around 7 a.m. (Ferguson) This station uses mostly Oriental languages, but can be heard here in West Virginia most mornings as late as 9 a.m. when it relays *English* news from Chungking's XGOY, good level but usually is marred by CWQRM.

As usual, on November 18, XGOY left the "summer" frequency of 9.635 and is now heard mornings on approximately 6.143. For the first week after moving to the 49-m band, XGOY opened at 6:35 a.m. on about 6.154/5, closed that transmission at 7:45 a.m., and opened again at 7:50 a.m. on about 6.143. Later on, however, they have been using the 6.143 frequency during both transmissions; first one is heard, 6:35-7:45 a.m.; second one, 7:50-10:30 a.m.; moves to about 11.918 between 10:45-11:45 a.m.; *English* news is heard at the regular times, 7 a.m., 9 a.m., and 11 a.m. on the respective frequencies; *English* press dictation (for America) is at 9:30 a.m. (Dilg, Balbi) XGOY uses 7.152 in parallel with its other stations during the entire period from 6:35-11:45 a.m.

Here in the East, XGOY's 6.143 frequency usually is a good signal, in the clear, at 7 a.m. when a woman reads the *English* news; it generally fades out around 8 a.m. here in West Virginia. On the 11.918 frequency, most mornings has a good to excellent signal from around 5 to 6:28 a.m. sign-off, all this transmission now appears to be in Chinese.

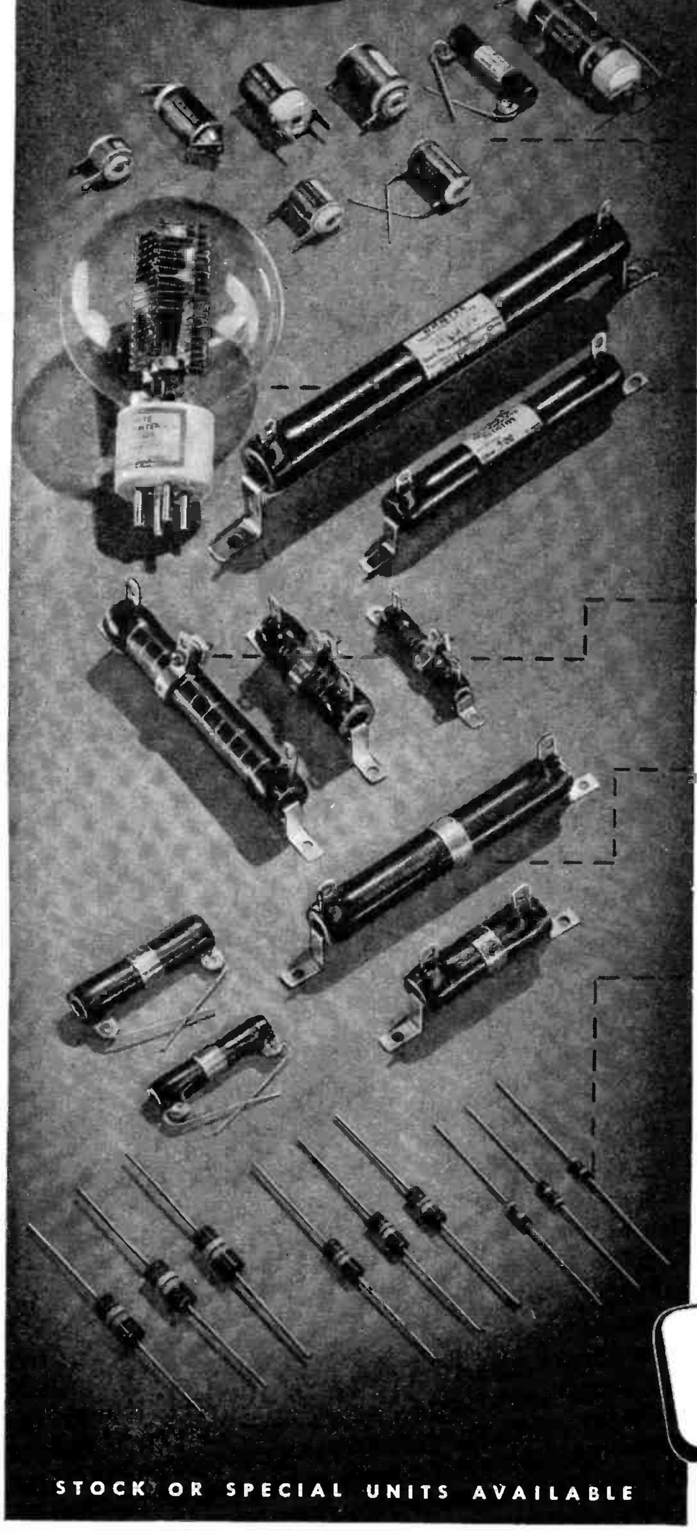
XMTA, 12.215, opens at 6 a.m. with the Chinese National Anthem; leaves the air normally at 8 a.m.; apparently uses only Oriental languages; location is believed to be Shanghai. *("Radio Call")*

XORA, 11.695/8, Shanghai, has *English* news daily at 5 a.m. *("Radio Call")* This station has not been reported as heard in the Eastern U.S. lately.

XLRA, 6.054, Hangchow, (*not* XRRA, Peiping!), is scheduled, 5:30-9:45 a.m., and relays the XGOY (Chungking) news at 9 a.m. (URDXC)

Rex Gillett, Australia, informs me that XGOE, 9.820, heard in Australia around 8 a.m., is located at Kweilien; has been heard announcing as "broadcasting for the Chinese Army and their Allies." This station has been heard also by Paul Dilg, Monrovia, California.

The projected Nanking station will likely take to the air soon, and can be



Now... a complete line of dependable OHMITE RESISTORS

"RITEOHM" PRECISION RESISTORS

Six types—including non-inductive pie-wound vacuum-impregnated units, pie-wound hermetically sealed glass units, and single-layer vitreous-enameled units. Tolerance ± 1%. Five types available from stock in ½-and 1-watt units ranging from 0.10 to 2,000,000 ohms.

NON-INDUCTIVE RESISTORS

For use in radio frequency circuits where resistors of practically constant resistance and impedance are required. Available in the vitreous-enamel tubular type with special winding and in hermetically sealed-in glass type with special winding and vacuum tube base.

"DIVIDOHM" ADJUSTABLE VITREOUS ENAMELED RESISTORS

Use them for multi-tap resistors or voltage dividers, and for obtaining odd values of resistance quickly. Consist of vitreous-enameled resistors of the lug type with wire exposed along one side for contact with adjustable lugs.

"BROWN DEVIL" AND LUG-TYPE VITREOUS ENAMELED RESISTORS

Ohmite's dependable, general-purpose resistors. Available in ratings of 10 to 200 watts. Smaller sizes have tinned copper wire terminals; larger sizes have lug terminals.

"LITTLE DEVIL" INSULATED COMPOSITION RESISTORS

An extremely small, sturdy resistor. Three sizes—½, 1, and 2 watt, in 10 ohms to 22 megohms. Tolerance ± 10%. Light, compact, easy to install. **Available only from Ohmite distributors.**

Write for Catalog 18. Contains helpful information on rheostats, resistors, tap switches, chokes, and attenuators.

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Be Right with .. **OHMITE**

RHEOSTATS • RESISTORS • TAP SWITCHES

expected to use several frequencies. *Watch for it!*

Czechoslovakia—Prague's *English* transmissions, aired from OLR4A, 11.840, 3:30 p.m. daily, consists of talks and news of topical interest, together

(*Continued on page* 153)

5-Tube Ham Super

(*Continued from page* 63)

is simple: the manual bias (r.f. gain) control R_{16} sets the initial bias desired, then with signal, the diode section of tube 6SF7 rectifies and passes, by means of the customary load resistance and filter circuits, a negative d.c. voltage in accordance with the strength of the received signal, which is applied to the grid of the i.f. tube. When S_2 is open, a.v.c. is applied and to use m.v.c. only, it is closed. The circuit has the desirable characteristic of allowing initial bias to be set at any convenient point by means of R_{16} and a.v.c. will have as a "take-off" point, this particular amount of initial bias, thus a.v.c. does not come in until signal input strength exceeds the initial bias, which all boiled down means your receiver does not, as is usual, lose sensitivity when on a.v.c.

The tuning gang shown in the photos is a re-vamped single section condenser, which has had the center plates of the stator deleted, leaving effectively a split stator condenser of about thirty-five $\mu\mu$fd. per section, with a solid shaft for the rotor drive. When the isolantite end-plates are bolted firmly to the chassis, this allows a solid, well-insulated tuning gang to be obtained very cheaply; it gives smooth no-backlash tuning and is recommended, but if desired two separate thirty-five $\mu\mu$fd. condensers can be ganged in its place, or a split-stator job can be purchased.

The power transformer used was a war surplus item, which accounts for the low H.V. secondary voltage. Most of the standard transformers available have either a 610 or 630 volt center tapped secondary. If it is necessary to use one of these, it would be advisable to place a resistor in series with the "B plus" lead to drop the output to 250 volts at the point indicated. A ten watt, 900 or 1000 watt resistor will be satisfactory in most cases.

Built as shown, it will be found the job is absolutely stone-quiet, with the r.f. and audio gain wide open, and antenna lead disconnected, a condition

(*Continued on page* 120)

80 METERS.
- L_2—20 t. closewound, C_{1b} tap 13 t. from gnd. Cathode tap 7 t. from gnd. C_3 is 75 $\mu\mu$fd. in coil form.
- L_1—40 t. closewound, C_{1a} tap 26 t. from gnd. Ant. tap 10 t. from gnd. C_2 is 25 $\mu\mu$fd. in coil form.

40 METERS.
- L_2—18 t; 1½" long, C_{1b} tap 6 t. from gnd. Cathode tap 5 t. from gnd. C_3 is 75 $\mu\mu$fd. in coil form.
- L_1—23 t; 1½" long, C_{1a} tap 8 t. from gnd. Ant. tap 6 t. from gnd. C_2 is 25 $\mu\mu$fd. in coil form.

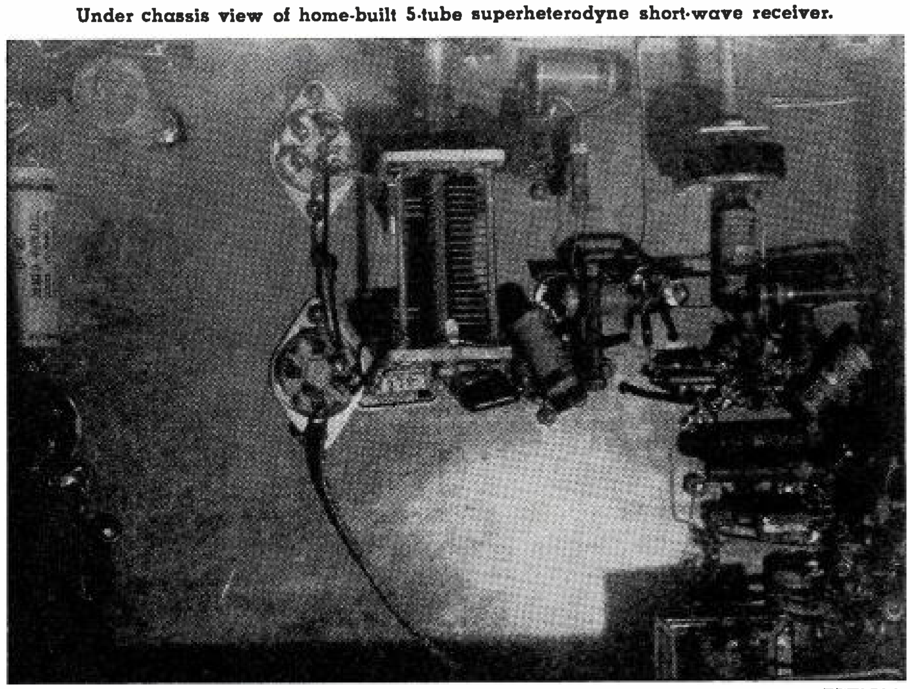
20 METERS.
- L_2—9 t; 1¼" long, C_{1b} tap 3 t. from gnd. Cathode tap 2½ t. from gnd. C_3 is 75 $\mu\mu$fd. in coil form.
- L_1—12 t; 1½" long, C_{1a} tap 3 t. from gnd. Ant. tap 2½ t. from gnd. C_2 is 15 $\mu\mu$fd. in coil form.

10 METERS
- L_2—3 t; 1¼" long, C_{1b} tap 1 t. from gnd. Cathode tap ¾ t. from gnd. C_3 is 50 $\mu\mu$fd. in coil form.
- L_1—6 t; 1½" long, C_{1a} tap 1¾ t. from gnd. Ant. tap 1 t. from gnd. C_2 is 15 $\mu\mu$fd. in coil form.

Note: Mica compression padders may be used for C_2, C_3 with results equal to the air padders shown.

Winding specifications for coils covering 10, 20, 40, and 80 meter bands.

Under chassis view of home-built 5-tube superheterodyne short-wave receiver.




HERSHEL'S
MONEY SAVING VALUES
on Radio and Electronic Equipment
1 KW. MODULATION TRANS.
We have a real value in a modulation transformer. This item, made by RCA to broadcast specifications, is conservatively rated at 550 W audio to modulate that new KW rig. Primary impedance for class B tubes up to 10,000 ohms plate to plate, secondary rated at 450 MA. 1:1 Ratio. Third winding modulates screens up to 80 MA current.
Really rugged construction, with flash-over gaps on a Mycalex terminal board. Due to the fine lamination, this transformer will not talk back at 1 KW. Weight 40 lbs.......... $19.95
1000 V PLATE SUPPLY
Thordarson plate transformer T47105. 1185 V each side of center at 300 MA. Tapped at 300 V each side of center, also 215 V at 55 MA bias. 6" x 5" x 7½" in square. gray, CHT type case. $9.95
Thordarson T48003 2H-7H 550 MA swing choke, size 4½" x 5½" x 5½", square black crackle case.
$5.95
Hi-voltage condenser, 3 MFD, 4000 V, hermetically sealed in aluminum can.
$4.95
IF transformer, mounted in aluminum shield can, 1500 KC, with air trimmer, impedance coupled type............ 95c
CFW 47602
Westinghouse meter, 0-1 MA movement, 2" round case, scale calibrated 0-140 and 0-500. Includes mounting hardware.
$2.95
Western Electric meter, 4" round, zero center, 0-½ MA each side.
$3.95
Westinghouse meter, 0-1 RF amps, 2" round case, internal thermocouple, in original box. Includes mounting hardware.
$2.95
Tuning unit BC 375. Approx. 65 MMFD cond., coils, RF chokes, dials, asstd. mica condensers 2500 WVDC, over $50.00 in parts.................... $3.75
SELSYN MOTORS
The ideal way of indicating the position of rotary beams, wind indicator, etc. Line cord and instructions for 110 VAC operation furnished.
2 for
$3.95
R. L. T.
TUBE TESTER
• Tests all tubes up to 117 V
• Tests shorts and leakages
• Tests individual sections
• Works on 90-125 V 60 cycle AC
• Comes in portable cabinet complete with all operating instructions.
PRICED AT ONLY
$49.95
PHOTO FLASH TUBE
High speed photo flash tube, 12,000,000 lumens light output. Stops all action. Ignition coil included on back of bulb. 10,000 flashes. Diagrams furnished on request. Your cost only.................... $8.95
SCR 522-100-156 MC receiver and transmitter with 18 tubes.
Price New $59.95
Price Used $39.95
Transmitter and Receiver. Has been widely used on the 144 MC band. Shipping wt. 100 lbs. U. S. Govt. surplus. Your price, less tubes and power transformer........ $14.95
Hot Spot Specials
• Thordarson fil. trans., 110 V 60 cycle pri., two 10 V 10 A sec., CHT type case.................. $4.95
• Thordarson fil. trans., 110 V 60 cycle pri., sec. No. 1 2.5 V 10A CT, 3000 V ins., sec. No. 2 10 V 3.25 A; two 5 V 3 A; 6.3 V 1 A.................. $4.95
• Thordarson fil. trans., pri. 110 V 60 cycle; sec. 6.3 V 6 A, CT.......... $1.49
• 8-8 MFD 350 WVDC, 20 MFD 150 WVDC, round can.......... 69c
• 75,000 ohm 200 W bleeder...... 49c
• 2500 ohm 100 W adj.......... 49c
• 955-9004 tubes.......... 65c
• Sockets for acorn tubes.......... 24c
• 6J4..........$1.50 6J6....... 95c
• Lip mike and head band.......... 95c
• No. 60 A—6F6-5 General Universal A & B battery, 7.5 V 9V 90 V B.... $1.49
Dynamotor power supply—inputs 6 or 12 V, output 500 VDC at 160 MA, mounted on box with circuit breakers, relays, interference filter and two 10 ft. cables. U. S. Govt. surplus.......... $9.95
R44/ARR-5, High frequency receiver. Patterned after S-36A by Hallicrafters. Receives FM and AM signals in the spectrum between 28 and 145 megacycles. Circuit has 14 tubes including voltage regulator for high frequency oscillator. Has two position selectivity control. Contains no internal power supply. Has acorn tubes RF., Osc., and Mixer. Complete with components for power supply including transformer, choke, filter condensers, and rectifier tube...................... $100.00
30 MC IF transformer in square aluminum can, silver slugged tuned.
29c
Mica capacitor .002 MFD 3000 WVDC
89c
368AS-tube. A real buy in a VHF door knob tube that will take 30 W input on all frequencies up to 1500 MC. No socket required. Priced at small fraction of original cost........ $4.95
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5249 GRAND RIVER
DETROIT 8, MICHIGAN
20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

Build a Television

Instructor demonstrating rare Schmitt Optical System, used in big picture, projection type, television receivers. This famous television school's location in the heart of the television industry, helps it to get such scarce scientific equipment. At N.Y.T.I. of N.J. all types of television receivers are available for student study.

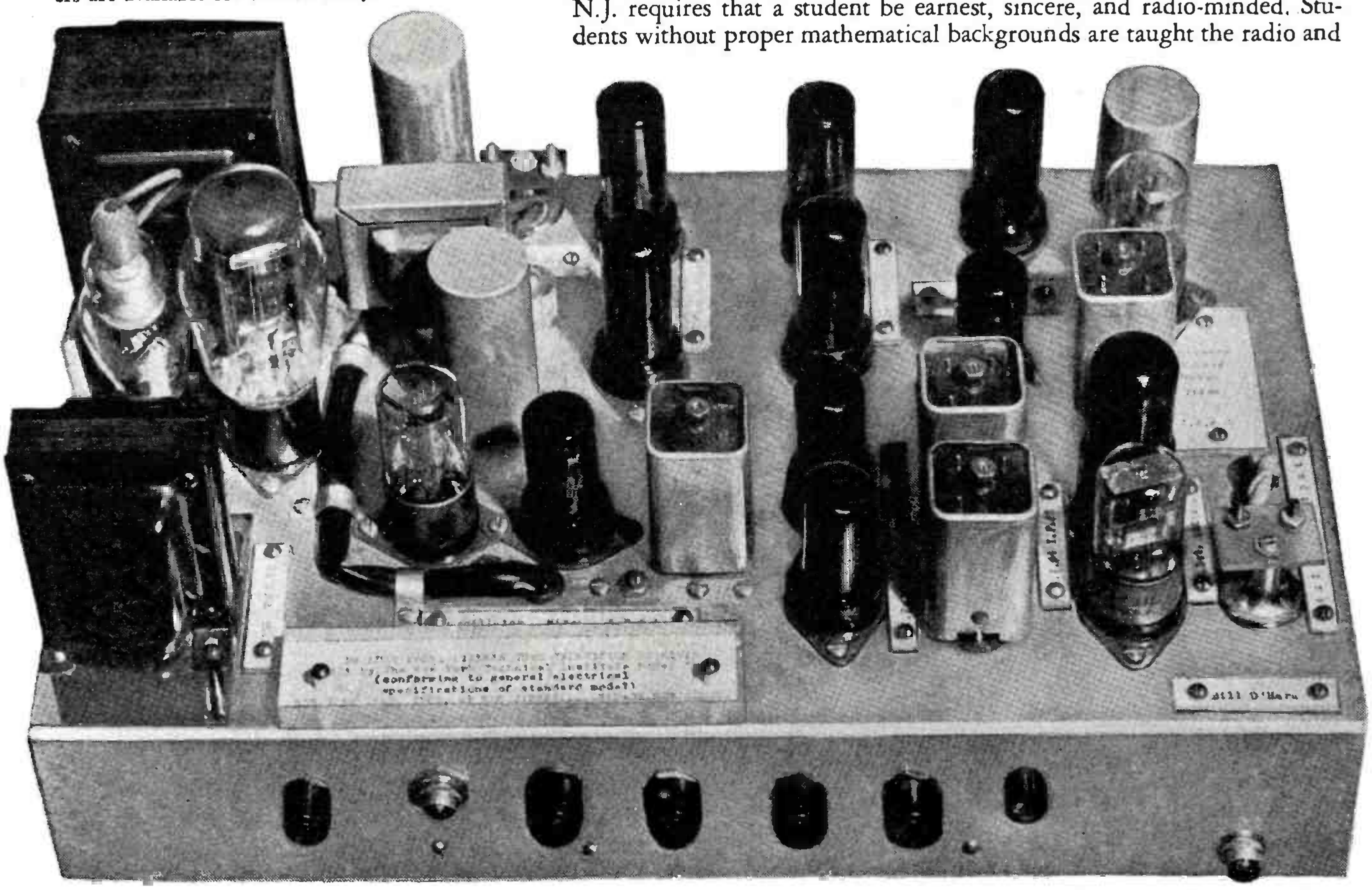
To stimulate its radio and television training programs, this famous resident radio and television school is offering men interested in television this unusual opportunity.

IF you are unable to leave home to go to a resident school, N.Y.T.I. of N.J. can supply you with parts to build a television chassis in your own home. You will be supplied with the same instructions and directions with which the school's resident students are equipped, when they reach the stage in their training that calls for television set construction. If you already have a sound radio background, with experience in building radio receivers, you will be surprised to find how much you can learn about television by building this set.

N.Y.T.I. of N.J. is one of America's leading resident schools for men seeking dependable, thorough, up-to-the-minute training in the various fields of radio and television.

The schooling offered by N.Y.T.I. of N.J. is particularly useful to those who recognize the high-earning possibilities of technical training in radio and television and are willing to tackle the class and laboratory work offered, regardless of their previous education.

No high-school diplomas are needed for entrance. But N.Y.T.I. of N.J. requires that a student be earnest, sincere, and radio-minded. Students without proper mathematical backgrounds are taught the radio and



You can build a direct viewing television chassis similar to the one pictured above, either in your own home or in the magnificently equipped shops and laboratories of this famous television school, located square in the HEART of America's television manufacturing and broadcasting industry. Mail the coupon at the right to get full details.

Set Right in Your Own Home!

television mathematics they need. Several students with only grammar school educations have successfully completed advanced technical television courses.

A considerable number of out-of-state students attend the school because of its excellent, practical type of radio and television courses, so difficult to get anywhere else in the world today. Living quarters are obtainable by single students.

You Put Into Practice Everything You Learn

Students at N.Y.T.I. of N.J. particularly like the way the school puts into practice what it teaches. You may actually build a 17-tube television chassis. You also help build as many as 7 radio receivers of different types, a total of 75 electronic educational devices. Class study, and laboratory study, in the proper combination, increase interest—and your hands get as smart as your head.

A 17-tube, experimental, television chassis may be built by all resident students of television, and may be kept as their own property, if they so choose.

Located in the Heart of the Electronic Industry

The New York Technical Institute of New Jersey is in Newark, N. J., just across the river from New York City (only 20 minutes from Broadway by subway or train). The school is located in the heart of America's great radio and electronics industry. Such leading television, radio and electronics manufacturers as R.C.A., Western Electric, Du Mont, Federal and Edison are nearby. This means that the school offers numerous advantages, as it is in touch with the most recent developments in radio and television.

Highly qualified television and radio instructors are here in abundance. Equipment is easier to get. Television students are offered exceptional advantages in this great electronic center.

MAIL THE COUPON TO GET FULL INFORMATION . . . FREE

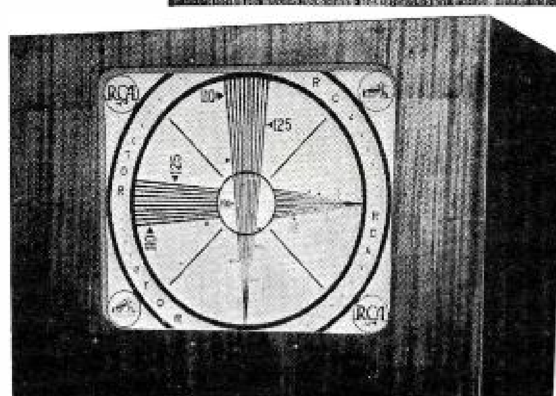
The school issues a special Bulletin which illustrates and describes its truly exceptional facilities and equipment. This Bulletin also describes classes that may be attended, housing conditions, costs, hours, etc. If you are interested in Television—you will want to read this Bulletin. You can have it *free*, merely by mailing the coupon at right.

The school will also be happy to send you complete information about the television kits and directions which are now available to you if you desire to build your own television chassis at home.

Just fill out the coupon at right and mail it NOW to: *New York Technical Institute of New Jersey, Dept. 12, 158 Market Street, Newark, N. J.*

Instructor demonstrating theory of light in connection with study of optical systems used in projection type television receivers. This is just another one of the pieces of equipment which the New York Technical Institute of N.J. has available for resident student instruction.

Big picture television (16" x 21¼") in the flesh at N.Y.T.I. of N.J. When it comes to television receivers, N.Y.-T.I. of N.J. has it! All types of television receivers are available for student use and instruction at the school.



Standard laboratory type test pattern used for determining picture perfection in all types of television transmitters and receivers. (You can see it at N.Y.T.I. of N.J.)

New York Technical Institute of New Jersey, Dept. 12
158 Market Street, Newark, New Jersey

☐ Check here if you wish to receive the Special FREE Bulletin describing the resident school of the New York Technical Institute of New Jersey located in Newark, N. J.—including its facilities, equipment, courses offered, costs, hours, etc.

☐ Check here if you wish complete information about building a television chassis in your own home.

☐ Check here if you are a War Veteran.

Name.. *Age*..............

Address..

City.............................. *Zone (if any)*.............. *State*..................

very much to be desired in any receiver, and seldom to be found, especially in the cheaper products. Sensitivity is very good, especially if a 7V7 tube is used as a mixer; selectivity comes close to crystal filter; a.v.c. is adequate and simple, and does not impair weak signals; bandspread is more than adequate, and is adjustable; enough controls are provided to give complete control of the receiver; appearance is neat; the receiver is completely self-contained, excepting speaker only—no inconsiderable list of advantages for the builder's $20-$25 worth.

Reception, both fone and c.w., has been very gratifying on 80 meters. The b.f.o. gives a good beat note and the i.f. selectivity was found surprisingly good for this type of work. On fone the 5-tuber brings in house volume sigs, and most of the states have been copied on c.w. Alaska and Canada produced, in one evening's listening, good Q5/S7-8 sigs. There is no sense of flimsiness nor any annoying instability apparent when tuning the receiver, and all in all, it represents about as good a return for the time and money invested as can be imagined.

The author wishes to acknowledge, with thanks, the suggestions and advice on the a.v.c. circuit shown, made by Mr. Harold Harding, a veteran old-timer in receiver experimentation and construction.

-30-

New Synchronous Motor

(*Continued from page* 86)

encased in a light perforated can and is fan-cooled.

Embodying a number of new design principles, this new synchronous motor is exclusively different from any other type commercially available. For example, it is the smallest non-hunting synchronous motor for its power output and reliability at equivalent cost. Its high efficiency results in low temperature rise under continuous operation conditions (45° C. at 60 c.p.s., 55° C at 50 c.p.s.). Design-elimination of stator tunnel windage noise insures quiet operation. Finally, since the hysteresis rotor eliminates pulsations and is essentially in dynamic balance, it is actually the smoothest running motor that could be selected for driving record-changer equipment; and the inverted stator structure removes all tooth ripple.

In dimensions, its over-all length, including the can, is two inches, and its diameter approximately two and one-half inches. Total weight is slightly over one pound. Attached to the motor by flexible lead wires is a .55 μfd. condenser for 60 cycle operation, which may be mounted in a convenient chassis location. A solid hysteresis rotor, ground from special alloy steel to extremely close tolerance on diameter, is mounted on a ground stainless steel shaft, which rotates in self-aligning oilite bearings.

The stator construction differs from conventional shaded pole record-changer motors in that four coils, each held within close resistance tolerance, are used.

Available in the near future to manufacturers and dealers in radio-phonograph combinations, the synchronous motor is now the only type that inherently operates at constant speed regardless of load and voltage changes, and with smoother torque of the hysteresis type rotor to insure low vibration noise level. A smooth-starting motor, it reaches synchronism immediately and, because it is synchronous, the speed of the turntable which it drives is not affected by changes in line voltages.

If we examine the way in which the introduction of this new motor allies itself with more discriminating consumer demand, we find several reasons. The average untrained human ear is critical to pitch changes caused by turntable speed variations of ½% or more. The demand for better quality equipment comes from a discerning public, who will no longer tolerate the more than 1% speed change found in induction motors now used to drive most automatic record changers and turntables.

Comparative tests show that this synchronous motor holds turntable speed constant at 78 r.p.m., whether one or ten records are loaded on the record-changer turntable. On the other hand, most induction motors show a 2 r.p.m. (more than 2%) drop in turntable speed as the corresponding record load increases. Fig. 1 shows actual curves obtained from these tests.

Other tests show that "flutter" and "wow" are held below the ½% tolerance in the *Fairchild* motor drive, a reduction of more than 50% below the induction drive. Further tests indicate that in this synchronous motor vibration noise level is more than 6 db. lower than the induction motor, measured on both the panel and turntable surface.

Engineers have found that when dynamic or magnetic pickups are desired in a record-changer, the type of motor drive used exerts a strong influence. With a synchronous motor, such improved pickups as the magnetic and dynamic types can be applied more readily than with the induction motor.

Up to now the crystal pickup has been widely used with induction motor drives, because it is inexpensive and offers generally satisfactory performance under ideal conditions. But recently the opinion has been expressed that the crystal type pickup is no longer as good as best quality records deserve, as it produces distortion and severe limitations of response. For use in climates where temperature and humidity are high, it has often been found unsatisfactory.

Through a combination of these factors, there has been a large demand recently for fine quality dynamic and magnetic types of pickups that can give more faithful and reliable results in playback operation.

How does this situation regarding pickups relate to the subject of motor drives? The answer lies in the motor design. The conventional induction motor's "open-type" construction permits a large magnetic leakage field to exist in space near the motor. This high leakage field, while not affecting a crystal pickup, does adversely affect a magnetic or dynamic pickup. A very audible 60-cycle hum is picked up and reproduced through amplifier and speaker when such a pickup is in proximity with the induction motor.

With the enclosed-type construction of the new synchronous motor, as compared to the open-type of the induction motor, there is a reduction of more than 10 db. in the magnetic leakage field hum reproduced by magnetic or dynamic pickups. It is for that reason that radio-phonograph manufacturers find it essential to use this new synchronous motor in equipment where other-than-crystal pickups are employed.

As for the replacement market, it is a simple matter for a radio serviceman to replace a damaged or unsatisfactory induction motor in a record-changer with a new synchronous motor. The discerning owner therefore is able to obtain improved performance from his present equipment until new consoles are on the market.

Thus, either as a replacement motor for existing radio-phonograph combinations with record-changer, or as a standard component in new equipment, the new synchronous motor is expected to eliminate several among the most annoying sources of dissatisfaction among critical listeners to fine quality records.

—30—

Service Associations
(Continued from page 49)

this committee. These include complaints filed with us by OPA, the Better Business Bureau, any dealer against any member in the service field, any customer who may complain about a dealer and complaints of servicemen and distributors.

Broadcast and Publicity Committee —The group looks after the Association's relations with the broadcasting stations and the press.

The broad programs for mutual help and training which have been charted as prime postwar projects of PRSMA are designed to assist radio servicemen to become better technicians and better businessmen. It's our firm belief that the public can be better served at less cost for essential radio service by an organization of qualified, independent service businessmen than by any other type of service set up. Specifically, we plan to raise the standards of radio service in our areas and to secure local recognition of the independent service dealer as a businessman on a par with any other merchant.

It is lamentable but true, that the average service dealer before the war had no recognized standing in his community. To the banker he was anathema. He was held on a cash basis with his suppliers, and, in most cases, looked upon by his fellow businessmen as some jerk who tinkered with radios. Yet this radio service dealer, if he was a good technician, had to have a technical background superior to that required of most of his fellow businessmen, including the banker, and an aptitude for constant study of a dynamic field of activity

Charles R. Denny who was recently named chairman of the Federal Communications Commission takes time out to look over a new Hallicrafters Model SX-42 FM-AM amateur radio receiver. Prior to his new appointment Mr. Denny served as acting chairman of the Commission after Paul A. Porter resigned.

which was erupting more new ideas per month than the average businessman had to cope with in a year.

In a tangible way, the PRSMA helps to channel a large volume of radio service business into the stores of members of the association. To accomplish this a radio service merchandising program has been developed. As a part of this program we are using 15 spot announcements, two fifteen minute programs and six FM spots on radio service per week over Station WFIL in Philadelphia. These spot announcements and programs encourage the listener to phone the PRSMA for radio service. Calls originating from these announcements are turned over to the member dealer whose place of business is nearest the point where service is required. This radio program will be broadened as time goes on and will be supported by suitable advertising in the leading local papers and other media.

Another project of PRSMA is a complete course in basic television installation and servicing, which is being given in cooperation with Radio Station WFIL in Philadelphia. Other courses in AM, FM and television are being mutually sponsored with various educational institutions in the Philadelphia area.

The service dealer has unjustly been the butt of many thoughtless charges. In our area, television and FM are now a reality. The service dealer has been wrongly criticized for not becoming an expert on television service and installation. Those who level this sort of charge against the independent service dealer are either wholly ignorant of the basic functions of radio servicing or are using it as a smoke screen to mask some selfish plan or ambition.

Radio service dealers are concerned only with adjusting and repairing equipment that has been designed, manufactured and delivered to a dealer or end user. While an understanding of radio theory and circuit application is important, the prime need of a dealer is for full and complete information about the particular piece of equipment he is called on to install or service. What manufacturer to date has revealed to anyone outside of his own organization circuit details or other pertinent information on either television or FM receivers which he plans to produce? It is obvious that until the manufacturers supply the technical data necessary for installing and repairing their equipment, there is little the independent service dealer can do to equip himself with the specific information absolutely necessary for intelligent installation and servicing of the manufacturer's equipment.

Perhaps one of the most important parts of the PRSMA program is the plan to help the individual dealer become a better merchandiser and businessman. It is the purpose of this program to encourage the dealer to operate his business as any successful business must be operated. Accurate records and accounting to enable him to pass up service jobs that lose money. Clean, efficient service shops and store layouts that have eye-appeal. Effective use of his window display space with the right kind of displays, changed frequently. These are all segments of a program for merchandising education which will bring material benefits to every active member of the Association.

Predicated on our own experiences in Philadelphia we believe good radio service organizations will receive enthusiastic support and tangible assistance from broadcasting stations and particularly wholesale radio suppliers which service the radio Association's area.

Broadcasting station operators know that the quality of their programs is no better than the efficiency of the receiver that reproduces it. Efficient, capable radio service, widely available, is a decided asset to the broadcaster as well as the set user. Since most broadcasting station managers recognize this need for improved radio service they are usually ready to cooperate wholeheartedly with a service dealer organization which will lift the quality of radio receiver performance. Engineering personnel from the broadcasting stations are usually available as instructors in association training programs in receiver servicing and installation.

The radio service association will usually find a staunch friend in the power and light company which serves its area. These organizations are constantly looking for new ways to give their customers more value for their electrical service expenditures and a cooperative service dealer program provides an excellent opportunity in this direction. Power and light companies usually have auditoriums or other meeting rooms which can be used for Association meetings and as classrooms for evening training programs.

PRSMA's staunchest friends have been the radio jobbers of Philadelphia who have consistently given us excellent support. The wholesalers have, in turn, benefited greatly from this cooperation. In a recent survey of buying preferences conducted among local radio servicemen the question was asked whether they bought their supplies locally through radio parts wholesalers, from outside suppliers or by mail. *Ninety-nine* per cent of the servicemen indicated they bought *all* of their supplies from local jobbers when the parts were available here.

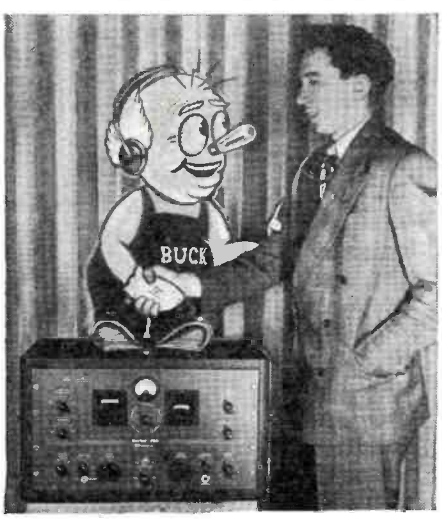
In the final analysis it is the customer—the radio set user—who gains most from the activities of an active and alert radio service organization. Dealers cooperating to raise the horizons of radio service as a business can eliminate the chiselers, the racketeers and the fly-by-nights quicker and more effectively than could the individual dealer acting alone. Further, the Association results in a pooling of practical knowledge and experience which is reflected in improved methods of operation in members' shops and more value to the customer for his radio service dollar.

In years past, attempts have been made to form national associations of servicemen. It is the opinion of those of us who have been associated with successful service organizations for a number of years that there is no particular need at the present time for a national association of service dealers. However, we do feel that strong state associations should be built up. These state associations should be cooperative groups of autonomous local radio service dealers' organizations who can combine their activities for solving their problems on a state-wide basis.

The intense interest which has been spreading among service dealers throughout the State of Pennsylvania on the subject of adequate and equitable radio service associations, crystallized recently in a meeting at Harrisburg for the purpose of forming a state association. The meeting brought together officers and representatives of dealers and associations in Pittsburgh, Harrisburg, Philadelphia, Lehigh Valley and Williamsport. Representatives of the radio parts wholesalers and the broadcasting stations also attended the meeting. From plans drafted at this and a subsequent meeting a *State Federation of Radio Servicemen's Associations* will soon become a reality. We believe that through the medium of this organization a state-wide program will be developed and carried out which will go far towards helping the individual service dealer and provide radio set users with an increasingly higher standard of radio service.

—30—

Dan Rober of New York acted as stand-in for Maurice Kraay, W9HEI, who was declared winner of the Hammarlund SP-400-X Super-Pro when "Buck" Stretcher (the character seated on the receiver) presented the award. The contest to "name-the-pixy" was sponsored by Sun Radio & Electronics Co., Inc. of New York for all hams.



Within the INDUSTRY

ROY BROWN UNGER has been appointed to the post of assistant sales manager of the jobber division of *The World Products Corporation* of Cleveland, manufacturers of home and automobile radio aerials.

Mr. Unger was graduated in 1943 from Cornell University. As a first lieutenant of the field artillery he served overseas with the 77th Division on Okinawa and the Philippines.

His new duties include developing and directing new advertising and merchandising plans, expediting shipments and supplying customers with a complete service of sales aids.

* * *

C. J. ANTHONY has been appointed merchandising manager of the *John Meck Industries*, radio manufacturers of Plymouth, Indiana.

Mr. Anthony has been associated with the company since 1943 and has held posts of assistant to the sales manager, personnel director and sales promotion manager.

Three years before his association with Meck he was employed in the wholesale marketing department of the *Pure Oil Company*.

* * *

AERO NEEDLE COMPANY of Chicago manufacturers of the *Aeropoint* phonograph needle, have recently announced the appointment of *The Sampson Company* of 3201 South Michigan Avenue, as exclusive distributor of the company's products in the Chicagoland area.

* * *

RICHARD MATTISON, who for many years has been associated with *Tung-Sol Lamp Works, Inc.*, as manager of their wholesale division, recently joined the *Minerva National Sales Corporation* as general manager.

In his new post Mr. Mattison will direct sales activities in connection with the merchandising of the *Minerva* line of radios, radio-phonograph combinations, FM and television receivers.

* * *

JEFFERSON-TRAVIS INCORPORATED has become a wholly-owned subsidiary of the *Emerson Radio and Phonograph Corporation* of New York.

Jefferson-Travis, manufacturers of marine radio and radiotelephone equipment, will operate as a separate company and will have at its disposal the engineering, purchasing, production, promotion and management counsel of *Emerson* personnel.

Robert C. Berner, an official of *Emerson,* has been elected president of *Jefferson-Travis Incorporated* and Harold Lloyd, formerly with the parent company has been named general manager. Ray Friedman will remain in his post of sales manager while Joseph Mas will continue to serve as chief engineer.

* * *

GENERAL CEMENT MANUFACTURING COMPANY of Rockford, Illinois was recently admitted as a new member of the Radio Manufacturers' Association by the RMA Board of Directors.

The company manufactures a line of products for the radio serviceman, including cement, dial belts and kits, wire strippers, etc.

* * *

BRUCE R. LAFFERTY has been promoted to the post of general service manager for *The Hallicrafters Company* of Chicago.

Mr. Lafferty, a veteran of eighteen years in the radio field, was formerly assistant to the general service manager of the company. He has been associated with the CAA as a radio engineer in charge of field installations and with the Chicago Ordnance District.

* * *

RADIO EQUIPMENT DISTRIBUTORS, West Coast outlet for a complete line of service and amateur parts and equipment, has recently moved to their new modern store at 312 West Pico Boulevard, Los Angeles.

The new location comprises 5000 square feet of floor space with 1500 feet set aside as a "ham shack" containing a complete line of amateur radio supplies

One of the features of the new store is a technician's lounge where the latest news and technical information on radio is available. The downtown store at 709 South Main Street will continue to operate under the guidance of Jack Robbins.

* * *

RADIO CRAFTSMEN, INC., has entered the loudspeaker business, according to the company's vice-president and general manager, Byron L. Friend.

The company will produce a complete line of 8", 10" and 12" speakers with deliveries being made currently on the "Standard," "Master" and "De Luxe" lines.

Designed to be used as replacement units in radio-phonograph combinations and public address systems, these speakers are being merchandised through local jobbers.

* * *

GORDON S. CARBONNEAU, president of the company bearing his name, has announced the entry of his organization into the loudspeaker field in both the jobber and equipment lines.

Mr. Carbonneau, who served as production engineer for *Utah Radio Products* of Chicago, has been active in the radio industry for the past 25 years.

Although processing and manufacturing operations of *Carbonneau Industries* will be centered in Grand Rapids, Michigan, advertising and jobber sales offices will be located in Chicago.

* * *

DAN D. HALPIN, a pioneer in the promotion of commercial television, has been named television receiver sales manager for *RCA Victor Division* of *Radio Corporation of America.*

Mr. Halpin who has been engaged in television activities since he joined the division in 1940, is a past president of the American Television Society, a member of the Sales Executives Club of New York and past president of the Notre Dame Club of New York. While at Notre Dame, Mr. Halpin managed the 1930 national championship football team.

* * *

MYRON J. MORRIS has recently been named manager of the service division for *Electronic Corporation of America.*

In his new position, Mr. Morris will be responsible for the company's Integrated Service Plan which coordinates technical information, parts and service facilities for dealers.

Prior to joining *ECA,* Mr. Morris was a radio and radar instructor for the Naval Signal Corps and a radar technician attached to the Naval Aviation Supply Office.

* * *

RADIO MANUFACTURERS ASSOCIATION and the National Association of Broadcasters have recently appointed a joint committee to provide closer cooperation on major radio problems, including the development of FM, television and other services in the public interest.

The liaison committee, made up of five members from each organization, includes, for RMA: W. R. G. Baker, *General Electric Company,* Walter Evans, *Westinghouse Electric Corporation,* Frank M. Folsom, *Radio Corporation of America,* Paul V. Galvin,

Galvin Manufacturing Corporation, and E. A. Nicholas, *Farnsworth Television & Radio Corporation.* NAB members include: T. A. M. Craven, Station WOL, Washington, D. C., William Fay, Station WHAM, Rochester, New York, Gordon Gray, Station WSJS, Winston-Salem, N. C., James Shouse, Station WLW, Cincinnati, Ohio, and Carleton D. Smith, Station WRC, Washington D. C.

* * *

HECTOR A. CASTELLUCCI was promoted recently to the post of assistant manager of the sales division of *Farnsworth Television & Radio Corporation.*

Mr. Castellucci, who has been associated with *Farnsworth* as a procurement specialist, is well-known in the radio and appliance industry, having been associated with *Grigsby-Grunow Company, Universal Cooler Corporation, World Utilities, Inc.,* and *Servel Incorporated*

His offices will be maintained at the Fort Wayne, Indiana, headquarters of the company.

* * *

LAND-C-AIR SALES, INC., is the corporate name of a new sales representatives' organization recently organized by Robert E. Sargent, Paul Nichols and Walter C. Hustis.

The three founders of the new company were all formerly employed by *Jefferson-Travis Corporation.* Mr. Sargent and Mr. Hustis served as Western and Eastern Sales managers respectively, while Mr. Nicholas was director of purchases for the company.

The new company is located at 14-16 Pearl Street, New York City.

* * *

B. V. K. FRENCH, well-known radio engineer, has recently joined the *Howard W. Sams & Co., Inc.,* staff as director of field relations for the company.

In his new post Mr. French will act as liaison between the radio manufacturer and the servicing profession. He will assist in the expansion of the company's "Photofact" service to radio technicians.

Mr. French has served in various engineering capacities with *Federal Telephone and Telegraph Co.* of Buffalo, *RCA* License Division Laboratory and *P. R. Mallory Company* of Indianapolis. During the war he served on the Joint Army-Navy Standardization Board. He is a senior member of the I.R.E. and has served as chairman of the Connecticut and Indianapolis sections.

* * *

ILLINOIS CONDENSER COMPANY, INC., have moved into their new plant located at 1616 North Throop Street, Chicago, and are now in full operation at the new address.

The manufacturing facilities of the company are now housed in a modern, air-conditioned, one-story structure which was specifically designed to meet the firm's production, laboratory and research requirements.

The dust-proof quarters are illuminated with fluorescent lighting and a plant broadcasting unit brings recordings and FM broadcasts to the works.

* * *

C. RUSSELL FELDMANN, formerly president of *National Union Radio Corporation*, was recently elevated to the post of chairman of the board of the company.

Succeeding Mr. Feldmann as president of the company is Kenneth C. Meinken, who has been associated with *National Union* since 1941 as assistant to the president.

Other corporation officers elected to fill new posts included: Winfield H. Carey, to the office of treasurer and Jerome V. Deevy who was named secretary of the company.

* * *

AMOS H. CAREY has been named the new director of manufacturing for the *John Meck Industries* of Plymouth, Indiana.

Mr. Carey, who was formerly in charge of manufacturing for the *Radio Corporation of America*, came to *John Meck Industries* from *Sprague Electric Company* of North Adams, Massachusetts where he was in charge of all operations including special tool design, machine shop and production.

The company manufactures a line of home receivers.

* * *

SCOTT RADIO LABORATORIES, INC., held a preview of their new *Scott* Video, for the benefit of their dealers and the press at the Knickerbocker Hotel in Chicago recently.

A telecast of the Chicago Blackhawks-New York Rangers hockey game was the "feature" attraction of the evening with a special message to *Scott* dealers preceding the regular program.

The new *Scott* Video has been engineered to provide a direct-view 8x10 inch black and white image from the 12 inch cathode-ray tube. The new television unit is housed in a separate cabinet which is designed to be connected to either the present *Scott* chassis or the "Phantom," "Philharmonic," "Laureate" or the instrument of *Scott* prewar manufacture.

All of the video controls are on the television unit while the audio controls are on the regular *Scott* receiver. Magnetic focusing is employed and operates automatically once the installation is made. A brightness control is provided in addition to a touch tuning meter with needle indication to facilitate precise station settings.

—30—

Technical BOOKS

"PRACTICAL ELECTRICAL MATHEMATICS" by W. E. Rasch. Published by *D. C. Heath and Company*, Boston. 355 pages. Price $2.00.

While this text is designed primarily for the electrician, much of the material contained in the book is basic and applicable both to the radioman and those working entirely in the electrical field.

The author, an instructor in the Electrical Department of Washburne Trade School in Chicago, has not assumed a knowledge of mathematics on the part of the student over and above the study of arithmetic. From this point the author has proceeded with his exposé of "electrical mathematics" in easy progression, introducing only necessary mathematical techniques when they are needed.

In order to assist the students who use this text, presumably apprentice electricians and journeymen, the problems which appear at the end of each chapter deal with some phase of electrical work which the student may encounter on the job.

* * *

"RADIO OPERATING QUESTIONS AND ANSWERS" by Arthur R. Nilson & J. L. Hornung. Published by *McGraw-Hill Book Company*, New York. 409 pages. Price $3.50.

The new and eighth edition of this practical handbook contains several innovations which should be of interest to those preparing to take FCC examinations for commercial or broadcast licenses.

This eighth edition has been revised to conform with new and altered FCC regulations and expanded to include newly added material. In addition, the new American Standards Association approved symbols for radio, telephone, telegraph and electronics circuits have been adopted and used.

Because of the particular makeup of the book, with the answers directly following the stated question, this text should prove to be invaluable to radio operators preparing for their license examinations. No attempt has been made to cover the over 1300 questions which might be asked on the licensing examination, but a sufficient cross-section is given to permit the student to determine just what sections might prove to be a stumbling block.

* * *

"PROFESSIONAL RADIO WRITING" by Albert R. Crews. Published by *Houghton Mifflin Company*, Boston. 463 pages. Price $4.00.

Although most of our readers are not interested in the professional side of radio programming, we would like to call to their attention, from time to time, noteworthy books dealing with this phase of the broadcast industry.

In this book the author has presented a workable guide for the benefit of students and writers who wish to enter the field of writing for the radio medium. Since this is a specialized work, requiring a new set of writing techniques, Mr. Crews' practical experience as Production Director, Central Division, NBC, qualifies him to speak with considerable authority on the subject.

This book should be of value to the writer who wishes to embrace radio as offering a vast audience for his talents.

-30-

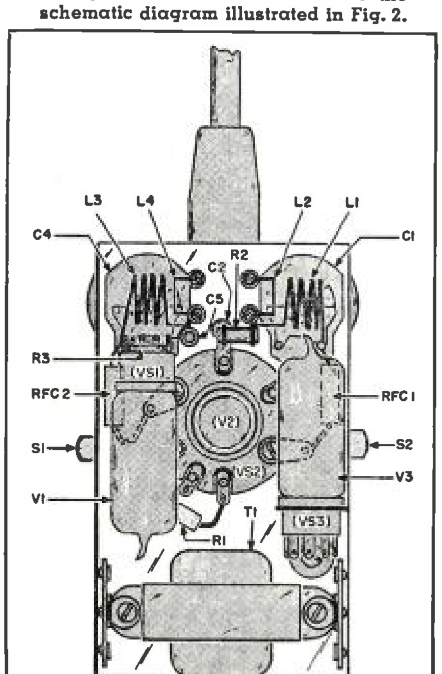
144 mc. Handie Talkie
(*Continued from page* 55)

proximately 8" long. The next section is telescoped down to its normal position and the remainder sticking out from the bottom section is cut off. The same is done with the third section. The modified antenna when fully extended should be approximately 21" long. A ¼ wavelength antenna for the 144 mc. band would be close to 18". The other 3" are used inside the case for support.

A brass plug is turned down on a lathe to fit into the bottom section of the antenna. A shoulder on the plug provides a stop when the antenna is extended. A small groove is also turned on the plug providing a detent for the antenna contact spring. This spring contact is made from a piece of spring bronze and a small V is bent in one end. The vertex of the V rides in the plug groove and holds the antenna extended as well as providing the antenna connection.

The current drain from the filament circuit is 100 ma. in either transmit or receive. The "B" battery drain is approximately 6 ma. on receive and 15 on transmit. At a distance of 8 to 10 miles, two-way com-

Fig. 6. Mechanical layout shows front of chassis assembly of various component parts. Code numbers refer to the schematic diagram illustrated in Fig. 2.



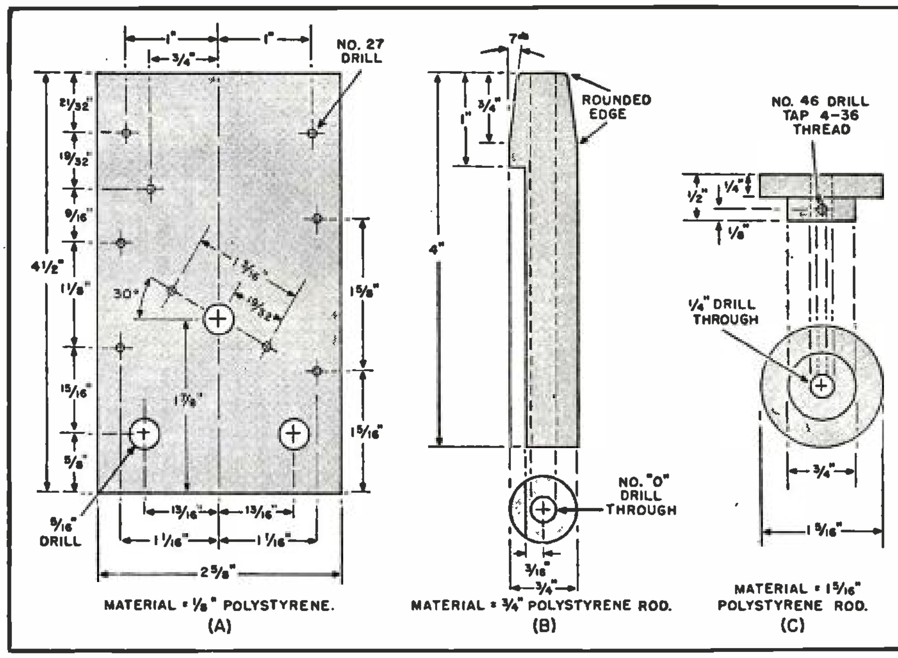


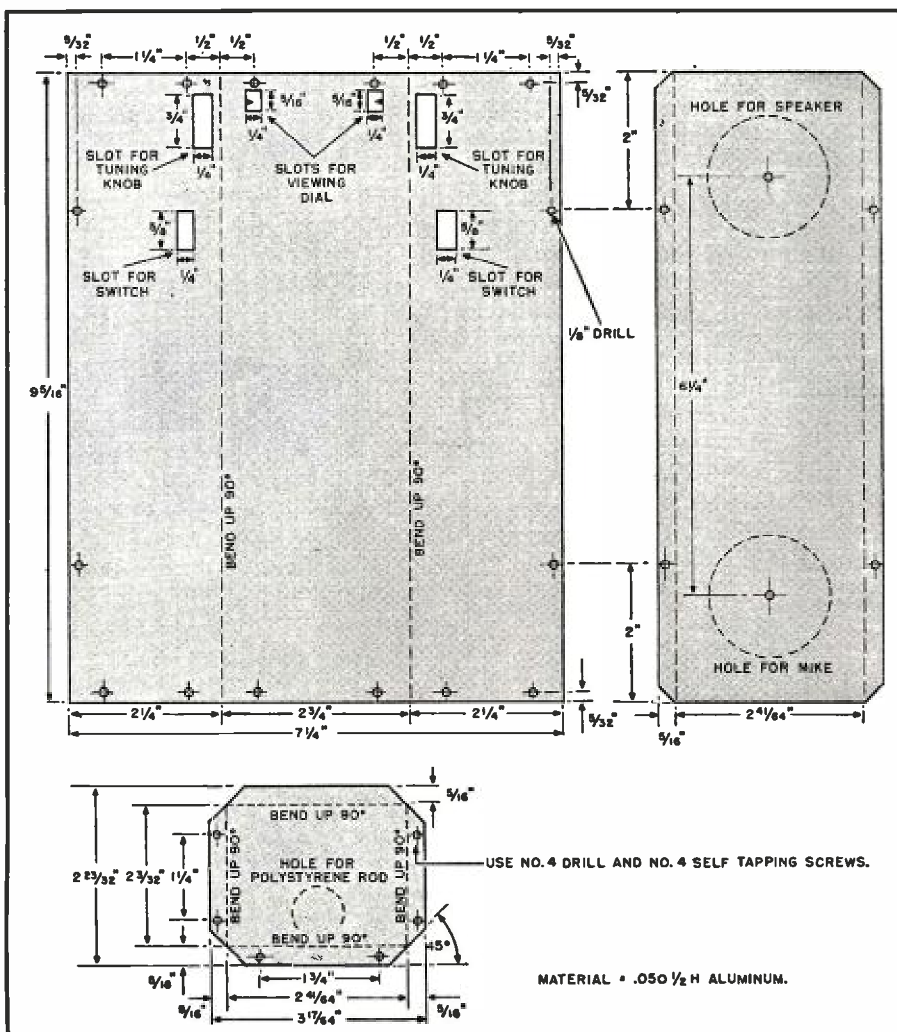
Fig. 7. Mechanical layout of chassis, antenna insulator, and knobs.

munication has been established with signal reports of R6 to 7. Intended use, of course, is for short range and best results are obtained when operated on the line of sight basis.

This set is approximately 2¼" deep and 2¾" wide by 9¼" high and weighs close to three pounds complete with batteries.

—30—

Fig. 8. Mechanical layout of case shows location of all punchings.



Frequency Converter
(*Continued from page* 39)

generated will appear every 50 kc. throughout the radio spectrum, several of which can suitably be used as *intermediate frequency*. This then would provide a harmonic in the vicinity of 550 kc. which would be the logical one to accept, inasmuch as it is the closest harmonic (within the b.c. band) to the fundamental frequency.

There are several advantages aside from economy to be gained by the use of a converter of this type. Selectivity, sensitivity, and signal to noise (hiss) ratio are improved; there are no "images" and both AM and FM signals can be received.

While the purpose of this article is to pass on to the hams, the idea in its simplest, basic form, where its intended use is for 144 mc. and higher frequencies, many worthwhile improvements are envisioned and being worked on (i.e. r.f. stage, separate quench osc., etc.) which will, it is expected, adapt the converter to use on *any* of the higher frequencies and provide good reception even in crowded communities, without the disadvantage of receiver radiation.

Construction

As can be seen in Fig. 2, the circuit is that of a conventional self-quench superregenerator, with several improvements to adapt it for use as a converter. The complete unit is housed in a metal box measuring 3" x 4" x 5". With the exception of the cable leads and shielded output lead which are mounted on the right hand side of the case, and the antenna pickup insulators which are mounted on the left hand side of the case, all parts are rigidly mounted on the panel itself. Due to the compact size of the unit, short leads are almost a necessity. The wiring itself is conventional and will not be elaborated on here, except for several details. The antenna coupling lead from the shielded cable inside the case should be a self-supporting solid wire (#14) which is not connected physically but is placed in close proximity to the coil near the plate end. This can be moved closer to or farther away from the coil to achieve the best possible coupling. One other thing which may be done to improve operation is to experiment with various values of C_2 and R_1. Those values shown in the diagram were found to work best in the original set.

The receiver which is to be used with the converter can be equipped with a cable adaptor at the antenna lead to use the cable connector on the converter's output. Also the plug on the power supply cable can be whatever the builder desires to use. In the model unit an octal base was used. One other thing that deserves mention is the pilot light, which can be seen just below the small vernier dial, and which is a valuable addition, since it readily indicates when the converter

REGENERATIVE FREQUENCY CONVERTER
(Numerical Example)
Strongest Harmonics 50 Kc. Fundamental Freq.
Spacing of Harmonics—50 Kc.

100 Kc.*
150 Kc.*
200 Kc.*
250 Kc.*
300 Kc.*
350 Kc.*
400 Kc.*
450 Kc.*
500 Kc.*
550 Kc.*
600 Kc.
650 Kc.
700 Kc.
750 Kc.
800 Kc., Etc.**

The fundamental frequency and the spacing between the harmonics is determined by the quench frequency.

* Can be used as Intermediate Frequency.
** Harmonics continue up thru the radio frequency spectrum.

Table 1. Numerical example of the various harmonics that are produced by superregenerative frequency converter.

is in use. This is connected in parallel with the tube's heater.

Operation

Operation of the unit is quite similar to a conventional superregen receiver with one exception: due to its exacting control over the plate voltage, the regeneration control will cause regeneration for only 4 or 5 points of the tuning dial at any one setting of the control; and as the tuning dial is adjusted, the regen control must also be adjusted simultaneously, for maximum results. When operating properly, the signals received will be of good clarity, free from the usual side band hisses, and of a quality not usually expected of the superregenerative receiver, whether the signals being received are AM or FM. Needless to say, the results that can be obtained far outweigh the nominal cost of the unit.

At the present time, a new unit, incorporating some of the improvements as suggested above, is in the construction stage, which it is hoped, will eliminate radiation, reduce the critical adjustment on the regen control, and otherwise improve the unit here described.

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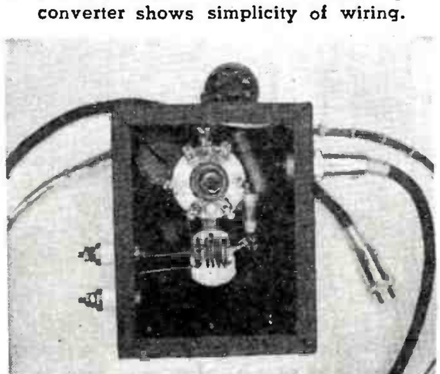
Fig. 3. Under chassis view of frequency converter shows simplicity of wiring.



Capacity Operated Relays

(*Continued from page* 51)

changes in the order of 1.5: 1 to 3: 1 are obtainable as C is tuned through resonance. In general the magnitude of current change is insufficient and the slope of the plate current-sensing capacitance curve is too low to provide optimum sensitivity and snappy action of the relay.

In Fig. 2B it is possible to visualize that portion of the circuit comprising the battery, relay and terminals A and B, as a series circuit in which the phantom resistance subtended across terminals A and B is a function of the

8
45
1.18
78
98
28
.35
2.40
1.65
36
95
2.65 63
08
13.36

PURCHASE ORDER

COMPANY

Long Distance
PHONE

pedance is relatively high and the series circuit current is minimum. The voltage drop across the field coil of the relay is low and, hence, the grid bias on V_1 is minimum, resulting in maximum plate current flow through the 1 megohm resistor and a high grid bias on tube V_2. Tube V_2 therefore exhibits a high plate resistance, such that the plate potential on oscillator tube V is approximately 50 volts. In the circuit shown, the oscillator plate current is approximately 2 milliamperes in this condition.

A suitable sensing element for link coupling to the capacity-operated relay may be constructed as shown in Fig. 2D. The coil and padding condenser are mounted inside a shield housing box, to which is attached the coaxial sensing condenser. The thin brass flange on the base of the condenser tube forms the "grounded" plate; and the thin brass disc on the supporting rod, which is electrically connected to the "hot" end of the coil and padding condenser stator, forms the "hot" plate of the sensing capacitor. The sensitivity of the sensing capacitor may be increased by increasing the diameter, and hence area, of the flange and disc.

When this apparatus is link coupled to the oscillator, adjustment of the padding condenser it will cause the relay to pull in. As an object approaches the sensing capacitor, detuning the sensing circuit, the relay will fall out. Link lines up to 50 feet in length have been successfully used.

As the sensing capacitor approaches resonance, the oscillator tank impedance begins to drop to a lower value, increasing the series circuit current. The voltage drop across the relay field coil and, hence, the bias on V_1 (Fig. 5) increases. This action, in reducing the plate current of V_1 and the bias on V_2, results in a lowered V_2 plate resistance. The oscillator plate voltage and the series circuit current increase in a cumulative, or somewhat regenerative, fashion to a sharp maximum, resulting in snappy relay action. The oscillator plate current is approximately 20 milliamperes in this condition.

With the above-described capacity-operated relay several other types of sensing elements have been employed. For the lower frequencies where appreciable inductance is required for resonance, the types shown in Fig. 3A are feasible. The inside diameter of the outer tube should be enough greater than the coil diameter to reduce distributed capacitance, minimize resistance losses and permit reasonable circuit "Q." The illustrated coaxial type sensing elements were designed for experimental use in detecting the approach of a liquid, without physical contact, as it rose in a storage tank.

If higher operating frequencies are used, the coaxial types illustrated in Fig. 3B are applicable. These may be regarded as sections of coaxial line, somewhat shorter than an odd multiple of ¼ wavelengths and terminated in the coaxial sensing capacitor. Both types may be end-sealed with a low loss dielectric material if necessary.

It is well to bring out that capacity sensing circuits of the type specifically described may be termed "capacity sensing" not alone by virtue of their sensibility to variations in the spacing of capacitor plates, but also because of their sensibility to variations in the properties of the dielectric material surrounding them. As stated previously, the magnitude of the resistance which an LC sensing element reflects to the tank circuit of its exciting source is determined largely by the resistance of the coil plus the effective resistance of the capacitor dielectric.

As illustrated in Fig. 2A, the sensing capacitor may be represented by a perfect condenser C paralleled by a resistance R_p, representing the "leaky" dielectric. The power factor of the dielectric material is related to R_p according to the following notation:

Power factor = cosine θ = sine $(90-\theta)$

But for small angles:

Sine $(90-\theta)$ = tangent $(90-\theta)$

Hence, p.f. (power factor) = tangent

$$(90-\theta)=\frac{I_r}{I_c}$$

But $I_r=\dfrac{E}{R_p}$ and $I_c=\dfrac{E}{X_c}$

$$\text{p.f.}=\frac{X_c}{R_p} \qquad R_p=\frac{X_c}{\text{p.f.}}$$

The resistance R_p combines with the resistance of the coil in the sensing unit to determine the magnitude of the resistance reflected to the tank circuit of the driving source at resonance. In the experimental work with the relay illustrated in Fig. 5 it was noted that, in certain cases, shunting the LC sensing circuit with a resistance increased the change in oscillator tank circuit impedance as indicated by the plate current of tube V.

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11. R. G Rowe, *"Electronic Amplifier & Modifier,"* U. S. Patent No. 2,406,565, issued August 27, 1946.

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H. C. Roberts, *"Electric Gaging Methods."* Instruments, April 1944, page 192.

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Transmission Lines

(*Continued from page* 46)

Such a solution does exist in the form of a quarter-wave matching transformer. For if a cable is exactly a quarter of a wavelength long, and if its characteristic impedance is:

$$Z_o=\sqrt{Z_rZ_s}$$

where:

Z_o is the characteristic impedance of the matching cable

Z_r is the impedance at output end of matching cable

Z_s is the impedance at input end of matching cable,

then the input is perfectly matched to the output. For instance, in the example cited under antenna mismatching, where the antenna impedance was 100 ohms and the receiver input 300 ohms, if a quarter-wave line whose characteristic impedance is:

$\sqrt{100 \times 300}$ = 170 ohms (approx.)

is connected in the circuit as shown in Fig. 4, then the antenna will be matched to the receiver. Fig. 5 is a

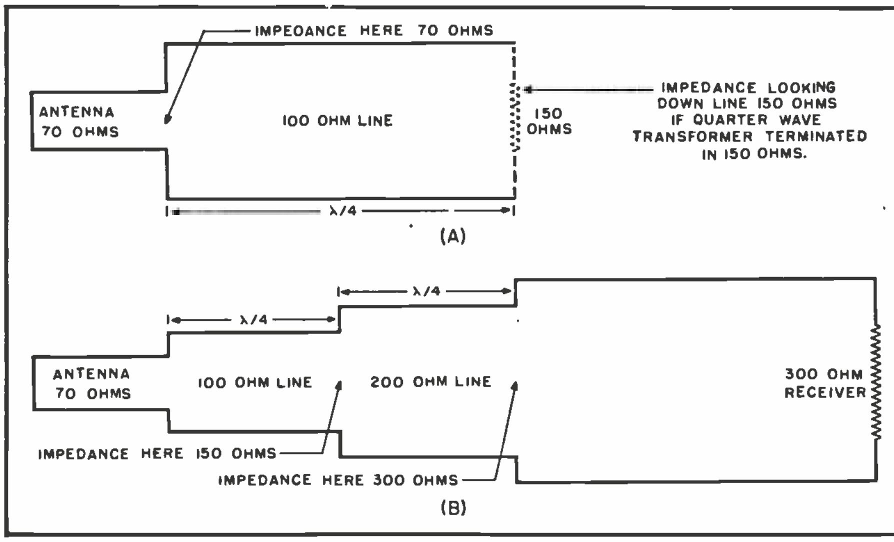


Fig. 6. (A). Stepping up antenna impedance to 150 ohms. (B). Matching a 70-ohm antenna to a 300-ohm receiver via two quarter-wave transformers.

nomograph whereby the characteristic impedance of the matching section can be calculated utilizing nothing more than a straight edge.

A quarter-wave transformer, however, has one serious disadvantage in that the line can be exactly a quarter of a wavelength long for only one frequency and not for any other. The receiver, on the other hand, must be capable of receiving all frequencies in the FM band (in the case of FM) —88 to 108 megacycles—whose quarter wavelengths then vary from 33 inches to 27 inches. The solution to this problem is usually in the form of a compromise. For instance if there are two stations of equal signal strength, one operating at 88 mc. and the other at 108 mc., a 30 inch quarter-wave line would be used. 30 inches is, of course, the mean value between 33 and 27 inches—the respective quarter wavelengths of the two frequencies involved.

If the matching ratio (ratio of output to input impedances) is not much over 2 then the fact that the line is 10 per-cent above or below a quarter of a wavelength is not too serious. Of course the line could be made more or less than 30 inches when it is desirable to favor certain stations or frequency bands.

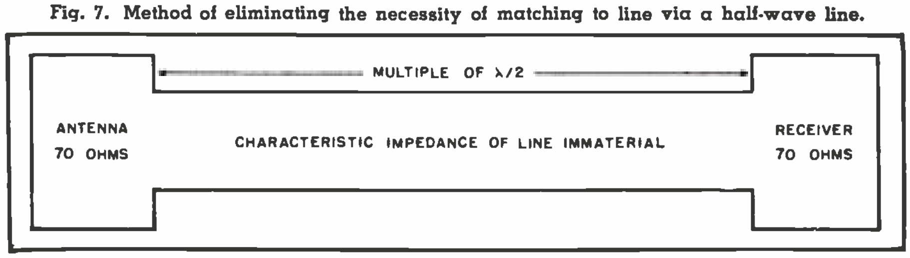
When the matching ratio is higher, and the matching section must pass a wide band (88-108 mc.), then it is necessary to use two matching cables. In effect, the impedance is raised or lowered in steps. For example assume a 70 ohm antenna must be matched to a 300 ohm receiver. First we calculate, by use of the nomograph (Fig. 5), the characteristic impedance of a quarter-wave transformer that will raise the antenna impedance to 150 ohms. Place a straight edge at Z_s equal to 150 and run it through Z_r equal to 70. Z_o is seen to be equal to 102 ohms. With a 100 ohm quarter-wave cable connected up as shown on Fig. 6A, the receiver now "sees" the antenna as a 150 ohm impedance. Now run a straight edge between Z_s equal to 300 and Z_r equal to 150, and the characteristic impedance of the second quarter-wave transformer comes out about 200 ohms. The two matching sections are then hooked up as shown on Fig. 6B and as a result a good, wider band match is accomplished between antenna and receiver.

There are some important precautions that must be observed in making quarter-wave transformers. In the first place, the connector length should be taken into consideration when calculating the necessary cable length. If a 30 inch line is desired, and the connector is 1 inch long, then the cable should be only 29 inches. Secondly, as just indicated, the connector is a part of the transmission line system and therefore should have the right characteristic impedance. For this reason not any connector can be used but only one which has been designed for high frequency cables. In addition, great care should be exercised when soldering the connector to make sure that a good connection exists and that no excess solder is present; otherwise the circuit may be mistuned.

Half-Wave Matching Lines

The other source of mismatch is between transmission line and receiver

Fig. 7. Method of eliminating the necessity of matching to line via a half-wave line.



and this too can be corrected by means of a simple circuit. If the length of the cable between antenna and receiver is exactly a half a wavelength long or a multiple of half wavelengths long, as shown on Fig. 7, then it does not matter what the characteristic impedance of the line is. Here again the problem of passing a wide band of frequencies occurs though it is not too critical in the FM band. The serviceman can learn the exact limitations of these matching networks only via the trial and error method.

Installing an Antenna

One of the features of FM receiving equipment is the fact that beyond a certain threshold value of signal input, additional signal has virtually no effect on the output. In other words, if the threshold signal input voltage is 3 microvolts, it will make virtually no difference at all as far as the operation of the receiver is concerned, whether a 3 or 33 microvolt signal is received. For this reason it is just a waste of energy to develop a highly efficient transmission line system which gives a signal that is far above the threshold value. Actually the antenna should deliver just enough signal so that it will be safely above the threshold value at all times.

The first step is, therefore, to determine the threshold value of the receiver. This can be done with the help of a signal generator. Then using any transmission line setup that is handy and whose constants are known, measure the input signal of a reference station. (Each serviceman should have a reference station, that is, one station about which he can say, "When I obtain 5 microvolts signal from WXYZ then I know that all the other stations are being received all right.") Compare this measured signal with that of the desired signal in terms of db. For example, if the signal that is measured is 1 microvolt and you need 5 microvolts to assure good reception, you must improve the transmission line system by 13.8 db.

A good method of summarizing the facts presented in this article might be to work out a typical antenna installation problem. Let's assume these facts.

A signal of 1 microvolt is measured when a dipole antenna is connected to a receiver through 2 feet of cable. (Because of the short length of cable there is no power loss due to the attenuation of the cable. The receiver is in the room where it will be permanently located. A signal of 5 microvolts is necessary before the receiver can be considered to be operating properly. As previously shown this means the transmission line system must be improved by 13.8 db. The other pertinent characteristics are:

Receiver input	150 ohms
Antenna impedance	73 ohms
Cable characteristic impedance	300 ohms
Cable attenuation	6 db. 100 ft.

The first step is to locate a position for the antenna where the most signal exists. This can be done by the use of either a field strength meter, or by carrying the entire setup to different locations. The best location would probably be on the roof. When determining the best location for the antenna be sure to consider the length of the transmission line necessary to carry the signal into the receiver. For instance, a 2 db. advantage is obtained by moving the antenna 100 feet. But an additional 100 feet of cable results in an additional 6 db. loss due to the cable attenuation. Therefore we gain nothing by using this location—in fact we lose 4 db. of signal.

By locating the antenna on the roof we obtain, in this example, a 17 db. improvement in signal voltage. However the signal must now be transmitted through 100 feet of cable. The total attenuation of the cable is 6.5 db. per 100 feet due to the fact that there is a 2:1 standing wave ratio. The net gain is therefore only 10.5 db. This is not sufficient, so the next step is to obtain a better transmission line. A 4 db. per 100 feet—150 ohm line will increase the gain of the system to 13.0 db. The additional .8 db. necessary to give the desired signal voltage can be obtained by use of a 100 ohm quarter-wave transformer to correct the antenna mismatch. If more signal was necessary the serviceman might have to find a higher gain antenna or a lower loss cable.

The author hopes that with this article as a background the serviceman will be able to intelligently select the cables he requires by examining their characteristics. In general since dipoles are used for most FM and television home installations, the only type of transmission line that is used is balanced lines. However, coaxial lines can be used as quarter-wave lines if desired.

There are two types of balanced lines—the less expensive unshielded, untwisted type and the more costly shielded or twisted line. Shielding or twisting the cable improves the signal-to-noise ratio only in areas where there is an abnormal amount of extraneous noises such as in automobiles, but otherwise it does not offer any other advantages.

-30-

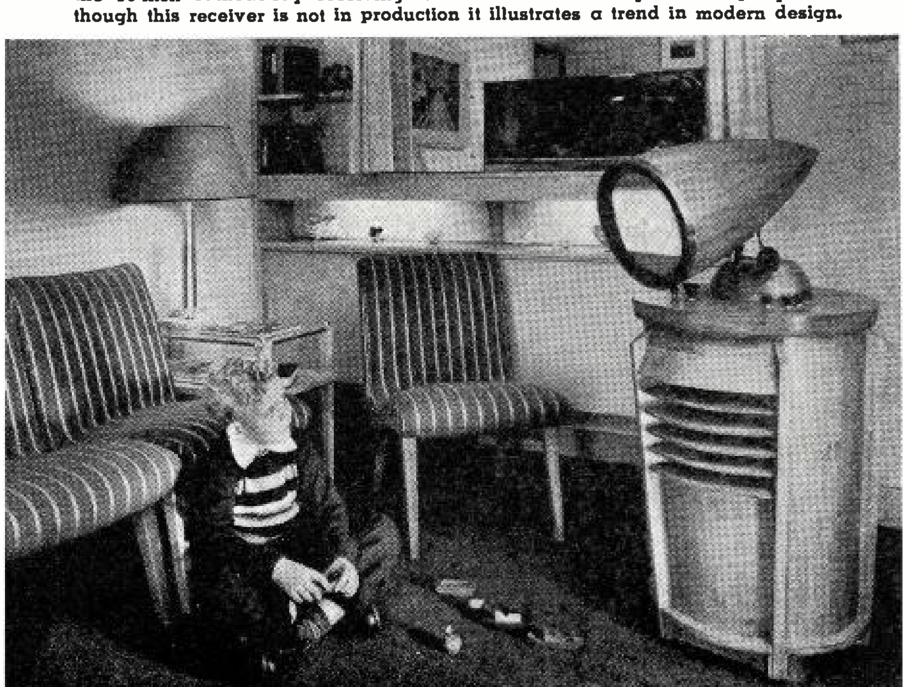
Distortion Analyzer

(*Continued from page* 61)

than .25 volts, connect to the input binding posts and rotate the gain control for maximum. If the 10,000 ohm calibrating resistor fails to cause 100 microamperes deflection when 1 volt is applied to the grid of the 6SR7, it may become necessary to increase or decrease the value of the 82,000 ohm diode load resistor. Sufficient diode load resistance must be maintained to offset the internal resistance of the diode rectifier. When this is accomplished, the voltmeter scale will be linear. When the selector switch is placed in the 100 volt position voltage is read direct. When the switch is in the 10 volt position simply divide all readings by 10. When the selector switch is in the 1 volt position, divide all readings by 100. When the switch is placed in the .25 volt position, divide all readings by 4 and 100.

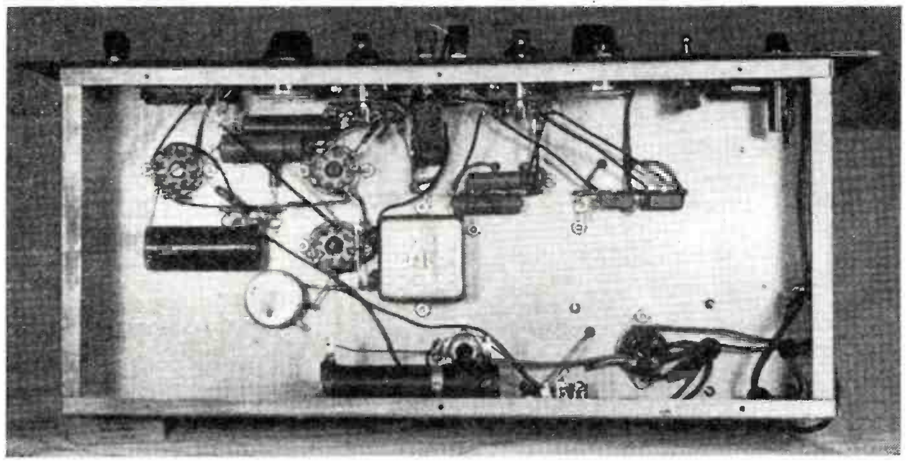
An error of 2% between scale readings will cause an error in distortion measurements of .2%, which is not serious. The values of inductance and

One of the features of the new Sylvania Lighting Center is the television receiver of unusual design which was engineered to provide video reception to any part of the living room. The special screen, which can be rotated from side to side, to a 180 degree angle or up and down to suit viewing conditions, was built around the 10-inch cathode-ray receiving tubes manufactured by the company. Although this receiver is not in production it illustrates a trend in modern design.



capacity for the filters can be determined quite easily with a reactance slide rule. The use of filter chokes is permissible for this application.

If it becomes desirable to use other than 400 or 1000 cycle filters or a different value of inductance, the following procedure is recommended. The value of inductance must be known. The design of the 1000 cycle filter is as follows. The reactance of 10 henries at 1000 cycles is approximately 65,000 ohms. A condenser reactance corresponding to this is .0025 μfd. Therefore, connect two .005 condensers in series giving a shunting capacity of .0025 and a center tap. If other frequencies or additional frequencies are desired, use the above procedure and simply use additional switch contacts and filter components. This filter network is capable of 60 db. of attenuation which, for all practical purposes, cancels the fundamental.



Under chassis view of completed instrument shows simplicity of wiring.

Distortion Analyzer Operation

Connect the input terminals to the voltage source to be analyzed. Place the frequency selector switch in the 400 cycle position. Place the "in-out" switch to "in" position. Place the vacuum tube voltmeter switch in the 10 volt position. Adjust the input gain control for full scale deflection on the 100 microampere meter. An audio oscillator having less than 1% distortion is connected to the input of the amplifier to be analyzed. The output of this oscillator should be adjusted for normal input voltages of the amplifier to be analyzed.

Next, throw the "in-out" switch to the "out" position. Adjust the audio frequency oscillator for a minimum reading indicated by the microampere meter, at the same time adjusting the 150,000 ohm variable filter resistor. Vary the frequency of the oscillator at the same time for minimum, making the final adjustment with the 10,000 ohm variable resistor in the filter network. If the distortion is less than one volt, which would be 10%, then rotate the vacuum tube voltmeter switch to the 1 volt position. This scale reading will indicate 10% full scale.

Final adjustment should be made on this scale, and the frequency adjustment of the oscillator and the filter resistor will become quite critical. Since the input was readjusted for 10 volts, any voltage reading in the output can be read as direct harmonic distortion. Next, rotate the frequency selector switch to 1000 cycles and repeat the above procedure, changing the frequency of the audio oscillator to approximately 1000 cycles. By checking the distortion of an amplifier at several levels, it is possible to indicate the overload point of the amplifier.

This equipment was checked against a commercial piece of equipment of the same type. The error between the two pieces of equipment was .2%. At one level the commercial equipment read .2% less and at another level of distortion it read .2% plus. We were unable to indicate which instrument was in error since the percentage was so small.

Before making any distortion measurements, it is advisable to check the distortion content of the audio oscillator to be used. If distortion is indicated, this percentage of distortion should be subtracted from any distortion measurements made using this oscillator. Oscillators having a distortion content in excess of 1% will produce quantitative measurements rather than qualitative. If the operator is simply reducing the distortion content of an amplifier, having a small amount of distortion in the audio oscillator it creates no particular problem. If actual distortion measurements are required, such an oscillator would not be satisfactory.

Those not familiar with distortion measuring equipment are apt to consider such equipment complicated devices that only the best of laboratories would attempt to construct. The author finds that many engineers using distortion measuring equipment seldom take the time to understand how it operates. Consequently, few engineers consider building a simple piece of equipment which can become practically worth its weight in gold in analyzing certain problems that are encountered almost daily.

Actually, the construction and operation of such a piece of equipment is relatively simple. The parts used in the construction of this distortion analyzer can be found in many so-called "junk boxes" with, of course, the exception of the 100 microampere meter. After an engineer has used distortion measuring equipment, restricting him from its use would be like removing his right arm. The equipment can become useful without construction in its entirety if a sensitive vacuum tube voltmeter with several ranges is available. Then it only becomes necessary to construct the filters, which consist merely of two potentiometers, a filter choke and two condensers.

Such a filter can be "hay-wired" together in a matter of minutes and prove to be a very desirable unit to have in any laboratory or repair shop. During the war many such filters were constructed and used on production lines, releasing the precision distortion equipment for laboratory use. A few fast measurements soon prove the filter is operating satisfactorily. If a low "Q" inductance is used, a certain amount of attenuation takes place at the harmonic frequencies. By using filter chokes with at least a 50 mil rating, the chances are one hundred to one that the "Q" of the inductance is sufficiently high to cause no difficulty. Of course, if an inductance bridge is available, measuring the "Q" is recommended.

Anyone using this filter circuit soon

finds that measuring different output levels will cause the frequency of the filter network to change slightly. This shift does not occur in the equipment described in that the same level of voltage appears at the filters for each measurement since the input gain control is always set for full scale reading of 10 volts before making each measurement. Since the vacuum tube voltmeter is required, the expense of two binding posts makes it available for other type measurements. Some of the uses for the voltmeter are gain per stage measurements, fidelity measurements and all sorts of trouble shooting. The vacuum tube voltmeter circuit lacks frequency discrimination between 15 and 20,000 cycles. No effort was made to indicate the top frequency limits of the circuit. Such a range is satisfactory for all audio measurements.

Mechanical Construction

The panel layout at first glance will lead the reader to believe that operation of this equipment is quite complicated. Actually, distortion measurements are easily made in a matter of seconds. Precise adjustment is required but in no way difficult to make. The input binding posts are to the left of the panel. The input gain control is next with the vacuum tube voltmeter selector switch near the center. The "in-out" switch is located in the center connected in such a way that the toggle points toward the input binding posts when it is in the "in" position.

The filter selector switch is next followed by the coarse and fine adjustment controls. The power switch panel light and fuse complete the layout. The tube layout is such that all tubes are near their particular panel controls. The filter inductors are located in the immediate vicinity of the filter selector switch. The power supply is at the rear of the chassis to eliminate the possibility of hum pickup.

Selection of the chokes was determined by the availability of material. The filter choke should be at least 10 henries and the bridged-T inductors should be approximately 10 henries. If it becomes necessary to use more or less inductance for these filters, the condensers must be changed correspondingly.

Point-to-point wiring is recommended rather than cabling, since such wiring reduces the possibility of stray pickup. The tube layout is such that individual shielding of parts is not necessary. A small receiver power transformer may be used, but the use of a voltage divider will undoubtedly be required, since the actual power consumption of this equipment is only a few mils. The voltage divider should be adjusted to approximately 200 volts. A 2 μfd. condenser is used as coupling between the plate of the 6SR7 and the plates of the 6H6, since this is actually a power detector.

A phone jack is connected between the 6H6 plates and ground, and as it becomes desirable to use this circuit as a voltage amplifier, simply plug high impedance headphones into this jack. The use of the headphones will cause the vacuum tube voltmeter to read in error. Headphones should not be connected when the equipment is used as a vacuum tube voltmeter or a distortion analyzer.

All resistors and condensers, with the exception of those indicated before, can be 20% tolerance. There is no particular reason why the filters should be on exact frequency; therefore 20% condensers can be used. If the application does require exact frequency, it is permissible to shunt additional smaller capacities across the filter condensers and thereby correct the frequency error.

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Great Lakes Radar

(*Continued from page* 38)

an alternating current power supply of 115 volts and 60 cycles, principally. For vessels where primary power is d.c., a suitable motor-generator set is used. A detachable viewing hood is provided to aid in observing the scope under unfavorable light conditions.

One fundamental difference among the various sets is found in the operating frequencies. Four (*Radiomarine, Sperry, Westinghouse,* and *Western Electric*) are built to operate on the "X" band or three cm. wavelength. The *Raytheon* and *GE* models operate on the "S" band, with a 10 cm. wavelength.

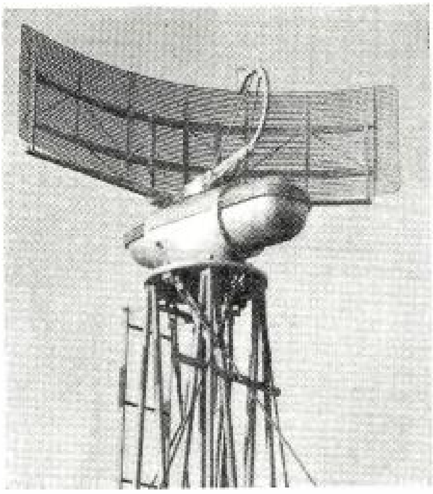
Supporters of the "X" band contend it provides better definition, better azimuth discrimination and hence is better for piloting a ship in close quarters. They also claim it furnishes greater range for a given radar sensitivity. "S" band advocates claim more reliability in bad, rainy weather, and less interference from "sea return."

Determination of which band is superior for operation on the Great Lakes is one of the hoped-for results of the project, although at the time of this writing it has not been decided whether all regularly-installed radar sets on Great Lakes ships will be limited to one band or the other.

Other differences and similarities can be discovered in an examination of some of the different sets (see Table 1).

One of the 10 cm. sets, *Raytheon's* "Mariners Pathfinder," was installed on the self-unloader bulk freighter *George F. Rand* in August. Operating frequency is 3070 megacycles ± 50 mc. Range scales are 1.5, 5, 15, and 50 miles. All exposed parts of the set are designed to withstand temperature from −40°C to 60°C. The indicator, housing a seven-inch CRT and mounted on a pedestal, is movable. It can be tilted 45 degrees in a vertical plane and rotated 45 degrees in a horizontal plane.

The transmitter, receiver, modulator and associated components are built in one unit. In the transmitter, pulse



Antenna unit of the Radiomarine radar installed on top of the pilot house of the "A. H. Ferbert." The 18 inch high parabolic cylinder is constructed of spaced stainless steel rods and rotates at 10 r.p.m. Lower part of antenna assembly includes a driving motor, synchro generator, gearing and the wave guide rotary joint.

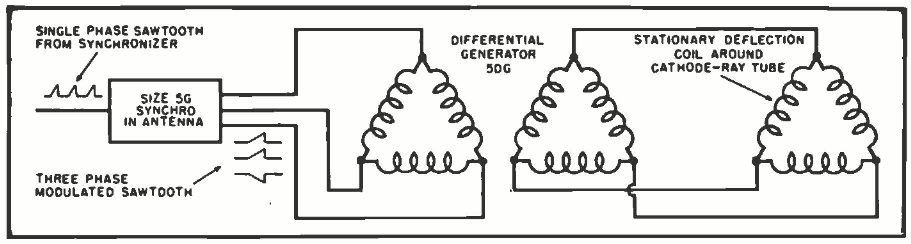
rate is 1000 cycles and pulse length is 0.4 microseconds. Peak power output is more than 15 kw. Source of radio frequency, of course, is the magnetron. In the receiver, a 30 megacycle i.f. is used; the r.f. band pass is 3 mc.

The truncated parabolic antenna, 7 feet wide and 18 inches high, is installed on top of the ship's "A" frame, necessitating a waveguide run of approximately 70 feet. Antenna rotation is 7 r.p.m., both clockwise and counter-clockwise. It gives a beam approximately 3.5 degrees at half power points in horizontal plane. In the vertical plane the beam width is about 15 degrees. While proceeding on Lake Erie, gas buoys were observed at ranges of four to five miles. Ships were observed from 20 to 25 miles. A rainstorm, about 10 by 30 miles in area, was picked up and plotted. When the *Rand* entered the storm area, vessels and other targets were accurately observed. In the Detroit River channel, buoys, piers, and even rowboats were detected at limited ranges.

The other 10 cm. set is the *General Electric* "Electronic Navigator" installed on the 8000 ton steamer *E. T. Weir*. It uses a 7-inch PPI, with fixed range scales of 2, 6 and 30 miles. A true or relative bearing can be obtained by direct reading from a movable bearing cursor with respect to a movable azimuth scale.

The 4½ foot high viewing console contains all the radio equipment. Peak power output is the 7 kw. minimum output from the magnetron. Pulse length is 0.5 microseconds maximum, and pulse repetition rate is 1500 cycles per second. This frequency is determined by a blocking oscillator which simultaneously keys the modulator (pliotron tube) and the gate for the sweep generator.

The reflector, a cast aluminum truncated parabola, makes about 11 r.p.m. and gives a beam width of five degrees to the half power points in the hori-



Cathode-ray tube deflection system of Radiomarine's radar set.

zontal and 17 degrees to the half power points in the vertical.

The *Radiomarine* 3 cm. installation made in September on the *A. H. Ferbert,* operates on a frequency of 9320-9430 megacycles. It consists of three major units: oscilloscope indicator, antenna assembly and transmitter-receiver. A four-foot high indicator cabinet houses a 12-inch cathode ray tube, associated circuits and power supply.

Rotating the CRT's electron beam in synchronism with the rotation of the antenna, for accurate bearing data, is achieved electronically without use of a moving coil. Single phase saw-tooth energy from synchronizer circuits is fed through coaxial cable to a size 5 G Synchro generator located in the antenna assembly, and three-phase modulated saw-tooth waves are produced. This energy then is sent through a 5 DG (differential generator) to a stationary deflection coil around the neck of the CRT, and this coil controls beam rotation. A 5 DG is not required on a ship without gyro compass. Since the differential generator is driven from the gyro compass, a stabilized picture always is obtained, so that *"UP"* position on the scope always points to North. A true or relative bearing can be obtained by merely flipping a switch, without recalibration.

A gyro repeater scale is mounted at the head of the PPI, to indicate ship's course at all times, whether radar is on or off. Range can be varied from 1½, to 5, 15 and 50 miles.

The transmitter and receiver are built into a rectangular cabinet about five feet high, installed in the wheelhouse. Capable of delivering a peak power output of approximately 30 kw., the transmitter has two sets of pulse rates. For short distance operation, the pulse length is 0.25 microseconds and pulse rate is 3000 cycles. For longer ranges, the pulse length becomes 1 microsecond and the pulse rate 750 cycles.

An 18-inch high parabolic cylinder antenna is constructed of curved, spaced stainless steel rods and rotates at 10 r.p.m. It uses a horn-type feed. Mounted on a standard 16½ inch Navy flange, the lower section of the antenna assembly includes a driving motor, synchro generator, gearing and the wave guide rotary joint.

The *Westinghouse* "X" band set was installed in July aboard the *William G. Mather* while the ship was underway. It gives readings for areas with radii of 2, 8 and 32 miles. On the wheelhouse roof a cut paraboloidal antenna is mounted, in a round plastic dome on a 5½ foot pedestal. This pedestal also houses the driving a.c. motor, related drive gears and a so-called synchro-tie system to coordinate the circular movement of antenna with rotation of electron beam.

In the weather proof base of the pedestal are the modulator, high voltage power supply, preamplifier and the r.f. head, which includes magnetron oscillator, the synthetic type crystal detector and local oscillator. The r.f. components are mounted in the antenna pedestal to cut possible power attenuation between transmitter and antenna.

The 7-inch PPI scope is mounted on a four-foot high cabinet, on the ship's bridge, called the indicator console. Within this cabinet are the low voltage power supply, the i.f. and video amplifiers and related PPI circuits.

The magnetron is triggered 2000 times a second by the action of a sine wave oscillator, blocking oscillator and thyratron tube, and emits a 0.4 microsecond pulse. Peak power output is more than 15 kw. Conducted by a horn-type wave guide to the radiator, the signal is sent out in a vertical fan pattern, two degrees wide horizontally and about 15° vertically. The radiator rotates at 12 r.p.m.

In the receiver, a constant i.f. signal of 60 megacycles is provided by action of a klystron local oscillator.

The *Sperry* 3 cm. set was installed on the *Frank Armstrong* in August, on a trip from Cleveland. It consists of an antenna assembly, viewing binnacle and transceiver unit which contains transmitter and receiver. Three internally-adjustable ranges can be set up on the 12-inch PPI; the first, from 100 yards to 2-5 miles, second, 500 yards to 6-12 miles, third, 1 mile to 20-40 miles.

Fixed electronic range markers, appearing at regular intervals, are provided for each scale; in addition there is a variable marker. Range at this marker can be read to the nearest 100 yards directly from a counter. To permit clearer definition of close targets, the ship's own position indicator at the center of the scope can be expanded.

This set can also be used in conjunction with the Coast Guard radar beacons, or racons, originally designed for aircraft navigation. By turning a control switch, the operator can bring in only signals from a beacon. These appear now as a series of short lines, coded to indicate the particular beacon. Provision is made so that the set will be able to operate with the new beacons designed for marine use.

Pulse width is 0.25 microseconds and 1000 cycles a second for radar; 2 microseconds and 400 cycles per second for beacon operation. Peak power output is 35 kw. The parabolic cylinder reflector, four feet wide and 18 inches high emits a beam 2 degrees or less in the horizontal plane, and more than 15 degrees in the vertical plane. It rotates at 15 r.p.m.

Last of the 3 cm. sets is the *Western Electric* radar which actually was the first of the six to be installed. Just before it went into operation aboard the *John T. Hutchinson* a "Miss Radar of the Great Lakes" christened the antenna with a bottle containing water from all of the Lakes.

The installation consists of three basic units: the antenna on the pilot house, the indicator cabinet inside the pilot house, and the transmitter-receiver and synchronizer cabinets in the chart room.

Pulse length of the transmitted signal is of 0.5 microsecond duration and a frequency of 1000 cycles per second. The truncated parabolic antenna, made of laminated aluminum, turns at 12 r.p.m. It emits a beam pattern 15 degrees in the vertical plane and two degrees in the horizontal. The range scale is variable and can be adjusted to cover an area with a radius from one to 40 miles.

Because of delays in installation of some of the sets the operational phase of the research project will extend into the early part of the 1947 shipping season, according to C. M. Jansky, the electronics engineer who heads the project committee. For this reason recommended standards for future sets will not be issued until later this year.

General reports have indicated that the sets have worked well. Ship personnel have caught on to radar quickly and are enthusiastic about its effectiveness. In one period when traffic approaching the St. Mary's River below the Sault locks was stalemated because of fog, two of the six radar-equipped ships were able to proceed straight to the locks and continue on their way. A performance like that is the best salesman radar can have.

To simplify the task of observing the PPI picture in coincidence with navigation charts, two methods have been developed and are under consideration for future addition to the equipment. One will be to project a microfilm of a radar-piloting chart on the PPI screen; the other is to superimpose the scope picture directly on a navigation chart by means of a reflectoscope or similar device.

In addition to its value for close range navigation, radar's ability to gather long-range information is expected to be helpful in expediting ship movements under the rapidly-changing weather conditions found on the Lakes.

Ship operators predict a brilliant career for radar in one of its first and biggest peacetime assignments.

In the words of Captain C. O. Rydholm, marine superintendent of the Cleveland-Cliffs Iron Company, which is a member of the Lake Carriers Association: "We believe radar will enable us to move cargoes with maximum speed, and, although our captains have set an enviable record of safe operations over the years, we believe radar will afford us an extra measure of safety for crews, cargo, and ships."

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Crystal Diode Probe

(*Continued from page* 52)

High hum level and "hot" chassis make a.c./d.c. amplifiers unsatisfactory. Amplifiers feeding the output of a 6SQ7 tube into a 6F6 are usually satisfactory except when there is low signal generator output or low percentage of modulation. With less than 10% modulation an extra amplifier stage may be necessary.

A means of checking gain at the plate of the amplifier output tube may be provided by connecting a variable range a.c. voltmeter in series with a .25 μfd. condenser. Waveforms in any part of the receiver may also be measured and observed if a scope is connected through a .25 μfd. condenser between the power tube plate and the input to the scope's vertical amplifier.

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Consumers Are Sore

(Continued from page 53)

"We don't expect a strike from similar causes after this war. But, if today's explosive undercurrent of customer resentment is similarly ignored, retailers have no assurance that they will not suffer another consumers' strike—this time expressing a revolt against the shortsightedness of management and the high-riding arrogance of their employees."

It is not that they don't want that new radio, refrigerator, washing machine or range, but don't forget they've been making the old one "do" for some time and they may figure it will last a bit longer until they have a chance to "look around" and make comparisons. You're going to find a mighty small minority who are *forced* to buy a new unit and beware of arrogance in dealing with these few. They resent the fact they simply can't wait any longer and if you're smart you'll use every selling guile to please them. The consumer who must have a new unit immediately can make or break a sale you'll be hoping for in the days to come. Treat them as though they could walk right next door and buy an equally good product, as though your very success depended on pleasing them at this time.

As Walter Morrow, president of the American Retail federation aptly puts it: "Soon there won't be any more sass from the lass behind the counter. The boss is fed up with her (or him), too. Just as you are." He says, along with electric irons and inner spring mattresses, courtesy will be back in the nation's stores.

There will be more than courtesy too. You can expect an early return to extensive advertising, special wrapping, frequent deliveries, easy credit and other consumer lures.

Of course if you care to, you can continue the "take it or leave it" attitude now, during the early days of reconversion. Don't forget that this sales brutality will react against you, however, in the not too distant future.

You have a great opportunity right now to practice all the arts of good selling without the pressures which will enforce them later on. If you can learn to humble yourself to the point of average decency in your sales relationships today, when the cards are stacked in your favor, you will reap rich rewards when merchandise starts pouring into the market and competition again becomes bitter.

It is probable that all who read this have had their skin rubbed raw in some wartime encounters with insolent merchants and sales people. Remember every person who enters your store has had similar experiences and they're on the touchy side until they find out how you are going to handle them. They know that for the moment some types of merchandise are scarce. They know you can lounge back and read a newspaper while they examine the merchandise, and for that reason these first forced customers are particularly sensitive to your treatment of them.

Your cue is to lean over backwards to please them, put them at their ease, make them feel they are important. The merchant who administers the sedative of good selling to "war nerved" consumers will find his reputation growing by leaps and bounds. This is a condition where the soft word not only turneth away wrath but buildeth a future business. Consumers properly handled today will be so astounded to find their ego built, they will not only spread the news far and wide to their friends, but will defend the justification of their purchase by praising the advantages of the unit they buy.

Don't be deceived by a rush of curious people who come to see the first of this, that, or the other piece of equipment which reaches your store. Turning curiosity into a signature on a purchase contract requires good old-fashioned salesmanship. Use these early postwar demonstrations to garner names of prospects—you're going to need them not too many months from now. A distributor tells us the story of a dealer who simply had to have nine deluxe floor lamps the minute the factory could ship. His customers were demanding them. He finally received the shipment and much to his dismay he found the demand had melted away. Now that he had the lamps, the customers who were ready to lay the cash on the line had other obligations at the moment, they thought they'd wait for some new kind of lamp they'd just heard about or some other excuse.

Of course, you're going into the greatest land of sales opportunity our country has ever known but you're not going to just drift into it on a downy cloud. You're going to have to sell your way into every foot of it. If you don't, your competitor will.

Woe unto the retailer who doesn't face the facts. Lure the customers in, start at once to put on your best company manners, your smoothest sales approach. Sell them on the fact that you *want* their business, you sympathize with the kicking around they've received during the war years. Be free to admit you've taken some pretty shabby treatment from the other merchants yourself. Consumers are sore. Salve them to sell them. —30—

"Pa tried washing his feet in the automatic dishwasher!"

LETTERS *from our readers*

READER FROM NIGERIA

"BEING a regular local subscriber to RADIO NEWS I thought I would write you a few lines to congratulate you on your new feature 'RN Circuit Page' which is very helpful to the serviceman, it is something I have been looking for—it is swell.

"Being a radio serviceman, I follow all the articles on servicing with interest and await each copy with expectation of new articles.

"Keep it up."

Rufus Allen
Lagos, Nigeria

Thanks, Mr. Allen. It is always nice to hear from our readers.

* * *

THE CATHODE FOLLOWER

"PLEASE allow me a word on the cathode follower situation. Mr. Gaines is very correct in stating that the 6A5G is an indirectly heated type. In fact, I use them in my personal amplifier, which consequently has absolutely inaudible hum, a thing difficult to achieve with 2A3's. However, the facts must also include this drawback. The cathode on the 6A5 is connected to the heater internally. The purpose in using 6L6s was, to interpret Stevens more correctly, to avoid the necessity of separate filament windings. Please slip this information in as soon as possible as I fear some incautious persons may purchase 6A5Gs in ignorance and they cost quite a bit. There would also be wasted time and money on other parts of the system.

"Now regarding cathode followers. I am rather interested in high quality reproduction, but am also skeptical of the claims made.

"To be specific, I set up a push-pull 6L6 cathode follower system which disappointed me. Perhaps you can spot my error. I used fixed bias (in the range from 22.5 to 45 volts) employing a good battery. The plate voltages ran up to 350 and 400 volts. Transformer coupling was used. The plate load was that recommended by Stevens yet my results differ.

"The maximum undistorted power output (checked on a large scope) was in no case much larger (10%-20%) than the normal connection. That is, about 3.5 watts undistorted. Stevens claims 8. However, I measured into a resistance load, with the first obvious deviation from sine being the m.u.p.o. point. The frequency was varied to assure that driver and output transformers were not at fault. Both were oversized.

"Worse, from my point of view, was the large amount of noise produced by oscillations of the heater cathode system. These mechanical vibrations, resulting from a.c. voltage from heater to cathode is distressing. These vibrations are audible at my own threshold of 19.5 kc. Could this be tolerated in a high quality system? I think not.

"More power to Stevens, anyway. I am getting at my objections in this fashion.

"I have acquired a low capacity filament transformer which will cause small loss of high frequencies using such tubes as 6B4s or 6A3s. (Unfortunately, I have not had time for measurements, but it is theoretical fact that a capacitive load is bad for linearity of cathode followers). Immediately I should have large powers available with better highs and no noise. Also the matter of bias on the output tubes is deserving of investigation. Doubling the bias on 6L6s did not alter the maximum undistorted power output more than 10%, while 'B' drain is obviously lessened. Intermodulation will be the limiting factor, no doubt, but savings in power seem possible.

"Also the business of widening the response of transformers can be gone about in a different way. Neutralization is rare in audio amplifiers, but it is possible and worthwhile where high response is poor, under certain common conditions.

"I am all in favor of damping and economy, but I like to see them achieved in the simplest, cheapest way (specially the economy)."

Charles McCleskey

Thanks to Reader McCleskey for his comments. Any more pro's or con's on the cathode follower?

* * *

BOUQUET FOR THE "LITTLE GUYS"

"THE story of the 'Spindle Eye' and her role in the Bikini Atomic Bomb experiment, appearing in the December issue of RADIO NEWS, was read with deep interest. My interest comes of having been closely associated with the project from the day the first incomplete sketch was made in Manila until the day the ship sailed for the Orient from Seattle. Lt. Col. 'Marty' Luichinger has written a fine description of the equipment that went into the 'Spindle Eye' and his story is the only firsthand account I have read of her use during 'Operation Crossroads.'

"To the generals go the laurels when the battle is won. But the little guys, the privates, the non-coms, the junior officers—they are the men who slug it out to make victory possible. So it was in the case of the 'Spindle Eye.' It is with the thought that a footnote might be of interest to your readers that I am writing to tell you of the work done by the 'little guys,' especially the dozen or more hams, who

combined their efforts to make the "Spindle Eye" the great ship that she is.

"A young public relations officer, Major Donald G. Weiss, New York City, formerly Radio Officer on General MacArthur's Public Relations staff, was the driving force behind the birth of the "Eye." It was he who continued to press the need of a ship to back up the "Apache" at a time when many high ranking GHQ officers felt that the latter vessel was adequate to meet the press and broadcast needs of all the Allied countries. He eventually convinced the brass that the "Apache" simply did not have the facilities necessary to carry the volume of press and radio traffic that would come out of a full scale invasion of the Japanese home islands. Major Weiss called upon his wealth of press/radio relations experience extending from the Solomons to Luzon to dream up the many innovations that went into the "Spindle Eye."

"The undersigned, then in the radio engineering section of General MacArthur's signal office, was detailed by the Chief Signal Officer to plan the Signal Corps equipment that would be needed to meet the recommendations of the Public Relations Office.

"To the civilian technicians of the Army Signal Corps' Alaska Communications Systems, Seattle, go the credit for the superb radio and telephone installation. These boys, most of them hams, burned the midnight oil for weeks in order that the ship might sail on schedule. Richard C. Young, W7BDQ, showing all the ingenuity inherent in a ham, solved many knotty technical problems. He could be seen daily in conference with Howard W. Johnson, W7NU, and Myron Scott, shop foreman, as they worked out the design of some special piece of gear needed for this unusual radio ship.

"Bert K. Field, W7CHG, Carl Minister, W9JDT, Garry Lewis, W6TSM, Matt Gormley, W7ETN, and Robert Jefferson, W7DSY, assembled the 7.5 kw. *RCA* transmitter with nothing to guide them but a small schematic diagram.

"Roy Stanton, heading a telephone crew consisting of Joe Busey and Frank Davis, wired the radio control switchboards, and installed the 100 subscriber common battery switchboard and the carrier terminal bays. William M. Bruner, ex-W7FPU, supervised the installation of audio and recording equipment in the two control rooms. Other hams who spent long hours on installation and testing were: S/Sgt. Darrell Taylor, W7EBH, Albert Mowery, W7BCS, Del Rutledge, W7DC/K6SYM and Norbert Bouchard, W7IMF.

"Surprisingly few bugs developed, attesting to the first class job done by those ACS hams.

Sanford T. Terry, Jr., W4AGH,
ex-W3AGH
Capt. Signal Corps (inactive)

—30—

International Short-Wave

(*Continued from page* 116)

with an interlude of music. *("Radio Call")* Is heard weak to fair here in the Eastern U.S.

Denmark—A Danish correspondent to *"Radio Call"* magazine (Australia) reports that the new 50-kw. Danish short-wave transmitter is scheduled to take the air early in 1947; it will cover Australia and New Zealand as well as South America; it is believed frequencies in the 19-, 25-, and 31-m. bands will be used. Address for reports on transmissions from this country is Statsradiofonien, Rosensorns Alli, Copenhagen, Denmark (Danmark). Should be heard well in North America.

Ecuador—HC4EB, 6.870, Radio Manta, is heard evenings to 11 p.m. sign-off; this is correct call, *not* HC4AB. (Legge) Complete schedule is 7:30-11 p.m. (Smith)

HC5HC, "O das del Chimborazo," located at Riobamba, is a new station heard between 9-11 p.m. on 4.960. (Legge)

HCJB's frequency in the 19-m. band has been changed from 15.095 to 15.115, probably to escape QRM from HOXA, 15.100; on at 7 a.m. (Sutton)

Ethiopia—Radio Addis Ababa, listed as 15.103, but actually operating on about 15.065/15.070, was heard afternoons the last week of November, 1-3 p.m.; played badly worn, old recordings, some of them ("The Last Round-Up" and "Harbor Lights," for example) two or three times during a transmission; pauses between recordings, probably changed discs by hand. Had frequent announcements in *English.* Was good level here in West Virginia; have airmailed the station for schedules. Grady Ferguson, North Carolina, reported hearing this station opening at 8:16 p.m. with a recording, and with English announcement; second English announcement was not until 30 or more minutes later; faded out around 9:10-9:30 p.m. *These may have been tests.*

Finland—OIX2, 9.505, Peri, is being heard on East Coast at 7:15-7:25 a.m. with *English* news. (Ferguson) OIX1, 6.120, Helsinki, is reported to be scheduled 12 midnight-2 a.m., 4-7 a.m., and 10:30 a.m.-3:30 p.m., according to a recent DX broadcast from *Radio Australia.* (Ferguson) OIX2, 9.505, is heard well in England with *English* news around 7:15 p.m. (Harrison) The 15.190 frequency parallels (Bromley)

OIX4, 15.190, Peri, is being heard irregularly around 7:15-7:35 p.m. with *English* news; chimes usually precede the news. (Grivakis)

France—August Balbi, Los Angeles, recently received word from *Radio Paris* that they expect to have two 100-kw. transmitters in operation by April.

French Morocco—CNR3, 9.082 (varying), Rabat, is good signal in the

Eastern U.S. afternoons; heard with French programs around 4-4:30 p.m. and later. (Sutton)

Germany—BFN, 7.290, Hamburg, is heard on West Coast at 2 a.m. with local *(English)* news and weather reports. (Balbi)

Greece—*Radio Athens,* 7.295, comes on the air at 2:58 p.m.; has brief *English* announcement, then is all in Greek to 3:45 p.m. sign-off with martial tune. (Bromley)

Guadeloupe—*Radio Guadeloupe,* 5.985, Pointe-a-Pitre, is now reported heard well in the East, in French and Spanish, 5:15-7 p.m., and irregularly to after 8:05 p.m. (URDXC)

Guatemala—TGWA, 15.170, is being heard with excellent signals, usually with fine marimba music, afternoons here in the East. TGRA, 6.255, "La Voz de la Guardia Civil," is heard evenings to 10 p.m. sign-off; replaces TGNA and relays TGR (1350 kcs.). (URDXC)

Haiti—HH2H, 5.948, Port-au-Prince, was heard recently between 9:45-10 p.m. relaying New York (in French); signs off at 10 p.m. (Norris)

Holland—PCJ, 15.220, Hilversum, was tuned recently at 7:10 a.m. with chime signal; at 7:15 a.m. opened program in Dutch to the Netherlands East Indies. (Ferguson) *A feature story on PCJ will appear shortly in this Department.*

Honduras—HRP1, 6.350, San Pedro Sula, "El Eco de Honduras," is heard from around 7:30 p.m. in North Carolina with good signal; at 9 p.m. relays the BBC news in Spanish from London. (Ferguson)

Hong Kong—"This is ZBW, Hong Kong. We are now taking you over to London for the news," is announced at 6 a.m. on 9.538; this announcement is made on completion of a recorded session; the BBC news is followed by a weather forecast; then there is more recorded music, compared in *English*; at 6:30 a.m., after station identification again, the program continues in Chinese. ("Radio Call") Hong Kong is just audible around 6-6:30 a.m. here in West Virginia; signal should be improving.

India—Madras, 4.920, and Delhi, 4.960, parallel Bombay, 7.24, and other AIR stations now in the 7:30 a.m. *English* news. (Dilg) The 41-m. AIR transmitters are coming through with fair to good signals at that time here in the East; Bombay, 7.24, usually identifies in *English* around 7:15 a.m.

VUD7, 15.160, Delhi, is heard at 9:30 a.m. with *English* news, off at 9:45 a.m. VUD10, 11.830, Delhi, was heard a recent evening opening at 10:15 p.m., gave schedules for the day, and said was operating to Africa on 21.51, 17.83, 15.29, 15.19, 15.16, and 11.83. (Ferguson)

The 15.19 transmitter continues to be heard widely in the Eastern U.S. with a good signal in the evening, with *English* newscasts at 9:30, 10:30 p.m.

VUD10, 17.830, Delhi, has been heard in Ohio between 7:30-8:50 a.m.; has BBC news relay at 7:45 a.m. (Sutton)

From Sweden it is reported that AIR is using 21.510 between 7-8 a.m. (Malmgren) In Australia, this station on announced frequency of 21.510 is heard closing down at 8:30 a.m.; reported as early as 1:30 a.m. with splendid signals "Down Under." (Gillett)

Iran—The new s.w. station at Tabriz, capital of Azerbaijan Province, is heard in Sweden between 9 a.m.-1:45 p.m. on a frequency of about 6.090. (Skoog) Is listed as 6.087. This station is heard by Paul Dilg, Monrovia, California, opening at 9 a.m. with 5 pips; Mr. Dilg first reported it as "unknown," but has since observed that Azerbaijan Province is 8 hours ahead of EST, whereas the remainder of Iran is 8½ hours ahead of EST; sometimes has a good signal on West Coast, Mr. Dilg reports.

EPB, 15.100, Teheran, signs off at 7:32 a.m. (Sutton) Still can be heard weekly in East some mornings at 6:15 a.m. when has *English* news, and later; identifies at 7 a.m. as "Ici Teheran."

Iraq—YI5KG, 7.085, Baghdad, is coming through again mornings to West Coast, but does *not* now have *English* news at 11 a.m. as has been reported from some quarters in the past. (Dilg)

Italy—Australians report a good signal at around 4 p.m. from *Radio Italiana*, 11.810.

Jamaica—ZQI, 4.700, Kingston, is heard well these early evenings in the Eastern U.S., 4:30-6:30 p.m. weekdays; world news is heard at 5:15 p.m. According to the URDXC, closedown on Sundays is at 5:30 p.m., and a frequency of 2.330 has been brought into use for Sunday *only*, between 6-8:30 p.m.

Japan—JZK, 15.160, Tokyo, was heard recently in contact with KQZ from tuning at 6:40 to their sign-off at 7:08 p.m.; they mentioned frequencies of 9.295 and 7.815 (probably used mornings); a few mornings later, Tokyo was picked up on 9.295 with transcriptions and a news relay at 8:30 a.m., signal was weak and "mushy." (Ferguson)

JLT3, 15.225 (varying), Tokyo, has a strong signal around 6 p.m. some evenings.

American authorities in Tokyo are expanding their short-wave facilities; in addition to JLR, 6.015, and JCV, 3.075, two further outlets have been added—JLP, 9.605, and another on about 4.880. ("Radio Call") Closedown is at 9 a.m.

I have recently been hearing JLR, 6.015, relaying AFRS programs around 6-7 a.m.; good signal here in West Virginia; at 7 a.m. EST, they give local time as "9 p.m."

WVTD, "The Voice of the British Commonwealth Occupation Forces in Japan," reported by Australians as heard one or two times some months ago on 15.831, closing at 8:15 a.m., is believed to have been a harmonic of a medium-wave outlet. ("Radio Call")

Java—The new Indonesian station on 10.365 is scheduled *daily* between

11-11:30 a.m.; and tests between 8-9 a.m. on Mondays, Wednesdays, Fridays, and Sundays; signs on with *"Allo Holland,"* off with a march, *not* Dutch National Anthem. (Dilg) Is heard in Sweden. (Skoog)

According to "Radio Call," the 11.010 transmitter opens at 4 a.m. with details of programs originating from "The Indonesian Broadcasting Centre." From 4 to 4:30 a.m., *English* is broadcast for Australian listeners; 4:30-5:30 a.m., Dutch for Netherlands Indies and Australia; 5:30-7:30 a.m., *English* for Australian listeners; 7:30-8:30 a.m., Indonesian for Netherlands Indies and Australia; 8:30-9 a.m., Siamese for Siam; 9-9:30 a.m., *English* for Indian listeners; 9:30-10 a.m., Indian languages for India; 10-10:30 a.m., Arabic; 10:30-11 a.m., Dutch for Holland; and 11-11:30 a.m., *English* for England and Europe. Continues to send a good signal to the Eastern U.S. early mornings; usually *English* news, read by a woman, can be heard around 7-7:30 a.m.

"The Allied Forces' Radio in Batavia" is stated to operate on 4.613 and 2.600; at 9 a.m. is scheduled to take a relay of "The Voice of Britain" period from the British Far Eastern Broadcasting Service, Singapore. ("Radio Call")

A Javanese station on about 6.380 was logged in Australia some weeks ago; announced as Djojakarta; was heard around 6:30 a.m. with a program of English-type recordings. ("Radio Call")

The Javan on 10.060 usually signs off around 11 a.m., but on Saturdays generally runs to 11:30 a.m. or later. (Dilg) It is believed this frequency is not used on Sundays and Mondays. A frequency of about 7.997 parallels this one.

Korea—JODK, 2.510, Seoul, is being heard again early mornings on West Coast. (Dilg) Runs to around 8:30 a.m. sign-off, which is in *English* and other languages. ("Radio and Hobbies," Australia) The singing of "Auld Lang Syne" as a goodnight signature was recently replaced by another vocal tune. ("Radio Call") Opens at 4:30 p.m. ("Radio World," Australia)

Lebanon—Beirut, 8.020, is now audible in the Eastern United States between 3-4 p.m. with fair strength; has Arabic programs between 3:15-4 p.m. sign-off, closes with "La Marseillaise." (Legge)

Madagascar—Australians report this country has provided exceptionally strong signals by putting into service a new transmitter on 6.065, with 6.140 in parallel; sign-off is at 1 p.m. ("Radio Call")

Malaya—Radio Malaya's Blue Network broadcasts on 7.22 from 11 p.m.-1 a.m.; on 4.78, 8:30-11 a.m.; Red Network, 4.82, 11 p.m.-1 a.m.; and on 4.78, 6:45-8:30 a.m. Address, Department of Broadcasting, Cathay Building, Singapore, Malaya. (ISWC, London)

Manchuria—According to the ISWC, London, MTCY, 11.78, Hsinking, is scheduled 4:24-4:50 p.m.; address, Manchuria Telephone & Telegraph Co., Ltd., Hsinking Central Broadcast Station, Hsinking, Manchuria. May now announce as Changchun.

An oriental station heard by West Coast DXers on this frequency early mornings may be Hsinking.

Mozambique—A short *English* news service can be heard from CR7AB, 3.493, at 2:55 p.m.; at 3 p.m., the announcer requests listeners to tune to 9.715 for further *English broadcasts.* ("Radio Call") The 9.715 frequency is scheduled to have *English* news at 2:55 p.m. However, the URDXC reports that the 9.715 frequency is now off the air, and that 9.650 is being used for the period between 2-3:30 p.m. weekdays, with sign-off at 2:30 p.m. on Sundays; may have call of CR7BJ which is listed on 9.645.

New Caledonia—*Radio Noumea,* 6.208, was heard in Australia recently as late as 5:30 a.m. some mornings; may have been tests, normal sign-off is around 4 a.m. ("Radio Call") Is good signal in New Zealand at 2 a.m. (Whitty) I believe 2 a.m. is sign-on time.

Norway—According to the URDXC, Oslo, 6.187, is scheduled weekdays between 3 a.m.-5 p.m., Saturdays to 6 p.m.

In Sweden, the Fredrikstad shortwave transmitter has been heard with special tests on 6.130, at 12 noon-1:30 p.m. and 3:45-5 p.m. (Lindhe)

Palestine—Direct from Tim Heffernan, assistant engineer, P.O. Box 636, Jaffa, Palestine, comes this information regarding Sharqal-Adna: "Present frequencies are 3.325, 2.5 kw.; 6.190, 7.5 kw.; 6.170, 7.5 kw.; 6.790, 2.5 day, 7.5 kw. night; 11.720, 7.5 kw. day. Between 12 midnight-1:15 a.m. all transmitters are used, except 11.720; and between 4:30 a.m.-1:15 p.m. all transmitters are used, but 11.720 goes off at 11:15 a.m., while the 6.790 (7.5 kw.) one closes down at 11:30 a.m.; on Fridays and Sundays all transmitters except 11.720 are heard 12 midnight-1:15 a.m.; and between 5 a.m.-1:15 p.m., all transmitters are in use, other than that 11.720 signs off at 11:15 a.m., and 6.790 (7.5 kw.) at 11:30 a.m. *We are also scheduled to do some tests in English every Saturday very soon; proposed times are 1:15-6:59 p.m. on all waves."* Sample, attractive QSL cards were sent along and Mr. Heffernan stated these are sent all reporters.

Incidentally, although the 6.135 frequency is reported "off the air," I have more recently heard it signing on at 12 midnight along with those listed by Mr. Heffernan.

Panama—Direct from *Radio Central America,* Wilbur T. Morrison, chief engineer, informs me that HOXA, 15.100, has Spanish news at 12:30-12:45 p.m. and 6-6:30 p.m., and that the *English* news is scheduled for 10:45-11 p.m. This station is heard with good signal in most parts of the world.

Philippines—A recent DX broadcast from *Radio Australia* listed a Manila s.w. station as operating on 8.000; schedule was not given. (Dilg) A late flash from Paul Dilg, Monrovia, California, reports he picked up a station on approximately 9.710, signing off at 11 a.m., with a call that sounded like KZ-I (maybe KZRI), believed to be Manila; said would be "back tomorrow at 5:30 a.m.," evidently meaning local (Manila) time; QRM made readability low.

Now that XGOY has left 9.635 (listed, but usually swung to 9.640), KZRH, 9.640, Manila, announcing as "The Voice of the Philippines," can be heard with fair level early mornings here in the Eastern U.S.; has *English* news at 5:30 a.m.

Pitcairn Island—From A. W. Owen, GW2FUD, Radio Officer of a British ship running between Montreal, New York, and Australia, and who does some commercial work with Radio ZKG, comes this additional information regarding radio on Pitcairn:

"The amateur call of Nelson Dyett, operator of ZKG, is ZL2FR and *not* ZL2FM. When working on radiotelephony, Dyett says, 'ZL2FR . . . Z-L-2-Fat-Rabbits.' Also, the frequency used by ZKG5 is *not* 7.270, but 17.270. It is quite true that both ZL2FR and Andrew Young, VR6AY (the Government Secretary of the Island) have so far had no replies to their applications for amateur relicensing. After 7 years' stay on the island, however, Dyett hopes to be home again in the first few months of 1947, and will again be active as ZL2FR; his home address is 8 Duthie Street, Karori, Wellington, New Zealand. The present population of Pitcairn is only 120 compared to the 1939 figure of 185—the balance are now living in New Zealand and Australia, and cannot return just yet. During the war period when ZKG was a naval station, staffed by personnel of the Royal New Zealand Navy, the population was, of course, increased, but such military personnel have now left the island. Mail arrives there nine times a year. although in the nine months up to September, 1946, thirty ships had called in."

Portugal—CSW7, 9.730, Lisbon, was heard recently signing off at 8:30 p.m. (Norris)

Portuguese Guinea—Radio Bissau is reported again, 5-5:30 p.m. on 7.100. (URDXC) Is listed on 7.094.

South Africa—Mervyn P. Laubscher, Johannesburg, has just forwarded via airmail this data obtained direct from the SABC: "The short-wave station at Durban (6.169) was dismantled when the new medium-wave transmitters were put on the air. *It is proposed to erect a new short-wave transmitter at Pietermaritzburg as soon as equipment can be obtained.* We can assure you that the Johannesburg station on 11.71 has *not* been in operation for a long time and it is unlikely that it will be used in the near future." The 11.71 SABC station reported some time ago by several monitors may have been a harmonic.

The SABC harmonic on 11 megacycles is still being heard with strong signal in Pretoria. (Ecksteen)

Sweden—The special DX broadcast on November 24, 1946, dedicated to readers of RADIO NEWS, transmitted over SBT, 15.155, and SDB-2, 10.780, was heard on the latter frequency in South Africa. (Laubscher)

SBU, 9.535, Stockholm, is now scheduled 1-5 p.m. (paralleling 10.780) and 8-9 p.m. (paralleling SBP, 11.705). (URDXC)

Tahiti—FO8AA, 6.980, Papeete, is heard on West Coast, Tuesdays and Fridays around 10-11:45 p.m.; peaks at 11:30 p.m.; has bad c.w. interference. (Balbi, Dilg) This one still eludes your ISW Editor here in the East; it also applies to several other Eastern DXers who are "out to get" Tahiti!

Turkey—TAP, 9.465, recently has been coming in with a good signal in the Eastern U.S. at 12:45 p.m. when has *English* news. In the 4:30 p.m. *English* transmissions on Monday, Thursday (to England) and Sunday (Postbag), this station usually has severe CWQRM, sometimes is completely blocked out.

U.S.S.R.—Moscow's announced frequency of 11.72 is best one now in use in the morning transmission in *English* to North America, 7:20-8:15 a.m., although the 11.63 and 15.18 frequencies are good level some mornings, also; 17.820 parallels. Recently I have observed an echo on about 11.718;

It may be that Kiev is used on this frequency to relay Moscow during this period.

Petropsvlovsk (Kamchatka), 6.07, has a strong signal on West Coast, 1:45-2:30 a.m. or later daily, and Saturdays between 12 midnight-1:30 a.m.; the 9.565 transmitter, located at Komsomolsk, Khabarovsk Territory in Siberia, is heard strong from 9 p.m. on; still has *English* news at 4 a.m. Heard in the Home Service at 2 a.m. irregularly are frequencies of 6.11, 6.125, 6.06. (Balbi)

RV15, 5.940, Khabarovsk, has been heard recently after 9:30 a.m. with news in Russian (at dictation speed), read by a woman; has been heard as late as after 10 a.m. (Dilg)

Uruguay—In a verification to Gote Olsson, Sweden, it was stated that CXA-19, 11.835, operates between 6 a.m.-10 p.m. daily. In an attractive brochure now being sent out by this station with its verification card, it is stated: "Under the Southern Cross vibrates in the Voice of 'El Espectador' the fervent wish for and the ratification of the Liberty of Man. From the mast of 'El Espectador,' Hope goes out to the roads of the world in sense of the purest Fraternity."

Vatican City—HVJ, 15.095, has French at 9:30, German at 9:45, and *English* news at 10 a.m.; good level. (Ferguson) The 9.660 frequency is heard on West Coast at 10:15 a.m., signing off to India, good signal. (Balbi) It is reported that HVJ's 6.190 frequency can be heard in Spanish between 2:50-3:15 p.m.

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Acknowledgments

AUSTRALIA—Radio Australia; Gillett, *Radio Call;* Addis; Keast, *Australasian Radio World;* Matthews, Short Wave League of W. Australia. BELGIUM—Salmon. BRITISH COLUMBIA—Verigin, Park. CALIFORNIA—Balbi, Dilg, WestDyke; Norton, *URDXC;* Anderson, Woodruff. COLORADO—Woolley. DENMARK—Friis. DISTRICT OF COLUMBIA—Eaton, Havlena, U.S.S.R. Embassy, Hay; Harris, WIRN; ENGLAND—*London Calling,* BBC; Atkins, Garrard; Bear, *ISWC;* Lloyd, Wicks, White, Mitchell, Daniels, Hall, Shankie; Charge, *BSWL, The Short Wave Review;* Norris, Tonks, Friend, McGee, Harris, Muxlow, Brown, Rowden, Harrison, Logan, Hughes, Pearson, P. Hayes. FRENCH INDO-CHINA—Mrs. Margaret Coughlin, Radio Saigon. ILLINOIS—Wajda, Daum. INDIA—*AIR,* Delhi; Lalljee. INDIANA—Flitcraft, Green, Cossell. IRELAND—Levi. ITALY—*Radio Club D'Italia.* KANSAS—Seckler. KENTUCKY—French. LOUISIANA—Crandall, Crites. MASSACHUSETTS—Sternfelt, Harris, Holzman, Simonian, French, Healey, Kernan. MICHIGAN—Reid, Sekach. MINNESOTA—Ecklund. MISSOURI—James; Kiernski, IRT. NEW JERSEY—Wooley; Williams, American QSL Bureau; Shaw, Stauhs, Crowell. NEW YORK—Legge, BBC, Beck, Taylor, Ignoll, Kentzel, Sink, Gernert. NEW ZEALAND—Gray, Whitty, *NZDXC.* NORTH CAROLINA—Ferguson. NORWAY—Otnes. OHIO—Berg, Sutton; Jacobs, *GNSWLC;* Campos. ONTARIO—Smith, Hart, Bromley. PALESTINE—Heffernan, Sharq-al-Adna. PANAMA—Radio Central America. PENNSYLVANIA—Cooley, Jones, Callahan, Conley, Hankins, Starry, Brown. POLAND—*Radio Warsaw.* QUEBEC—Gauvreau, Dunlop. SCOTLAND—Morris, Watson. SOUTH AFRICA—Laubscher, Eck-steen, SABC. SPAIN—Alonso, *Radio Club Espanol.* SWEDEN—Skoog, Skogsberg, Carl-Eric Petersson, Kalderen, Mattsson, Lindhe; Samsoie, *Radiotjanst;* Forsstrom, Swalen, Frick, Ohrwall, Persson, Gillbert Andersson, Gimby, Malmgren, Rundblad, Gustafsson, Bengt Andersson, Olsson. TENNESSEE—Seaton. TEXAS—Giles, Rice, Thompson, Lyerly. VIRGINIA—Norris. WALES—Owen. WEST VIRGINIA—Rupert, Reese, Gonder, McLaughlin, Arthur. WISCONSIN—Reed, Thomka, Walz.

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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

CONTROL CATALOGUE

Spencer Thermostat Company of Attleboro, Massachusetts have announced the availability of their new catalogue covering Klixon Thermo-Snap Built-In Temperature Controls. These controls are applicable to equipment ranging from electric and gas heaters to radio equipment.

The catalogue includes information on the various types of automatic and manual reset thermostats. It provides dimension data, specifications, ampere rating and other pertinent information which facilitates and simplifies the selection and application of the devices.

Copies of this catalogue will be sent upon request to *Spencer Thermostat Company,* Attleboro, Massachusetts.

TV ANTENNA DATA

The Workshop Associates Incorporated are currently offering a single page data sheet covering their 3-element high-gain television receiving antenna.

In addition to pertinent information regarding this equipment, the data sheet features an exploded diagram of the antenna and specifications for the various parts.

This particular receiving antenna comes in five different models covering the video channels 2, 3, 4, 5, and 6.

A copy of this data sheet will be furnished by *The Workshop Associates Incorporated,* 66 Needham Street, Newton Highlands, 61, Massachusetts.

EQUIPMENT CATALOGUE

Of particular interest to schools and laboratories is the new catalogue No. 6S issued by *Radiolab Publishing & Supply Co., Inc.*

In addition to listing television kits suitable for laboratory projects, the catalogue carries information on available multi-testers, signal generators, oscilloscopes, sound amplifier systems and student construction kits.

Free copies of this catalogue may be obtained by writing to *Radiolab Publishing & Supply Co., Inc.,* 652 Montgomery Street, Brooklyn, 25, New York.

TUBE DATA BOOK

The new "Easy Guide to Electronic Tube Data" recently announced by *Westinghouse Electric Corporation* has been designed to facilitate the selection of replacement tubes for electronic devices.

The data book lists tubes according to classes and gives all essential technical data on each tube. A separate index is arranged numerically by type number and lists the class to which each tube belongs, its warranty class and list price. An interchangeability chart shows the company's equivalent for competitive type numbers.

Copies of this guide, designated as booklet 86-020, may be secured from *Westinghouse Electric Corporation,* P.O. Box 868, Pittsburgh, Pennsylvania.

DEALER HELPS

Because of the increased need for accurate and up-to-date business records, the Systems Department of *Uarco Incorporated,* are making available to firms in the radio equipment and servicing industry a series of new sample portfolios which contain business forms and cost-reducing systems used by comparable business organizations.

To receive your portfolio without obligation, address your request on your business letterhead to Systems Department, *Uarco Incorporated,* 5000 South California Avenue, Chicago 32, Illinois.

NEW CATALOGUE

Radionic Equipment Company, New York distributors of various types of electronic parts, have just issued their new complete catalogue, designated No. 47.

Included in the listing are radio and electronic parts, radio receivers, record changers, p.a. systems, test instruments, meters, tubes, amateur equipment, recording apparatus, intercom systems, etc.

Distribution will be made free of charge to service dealers, engineers, schools and institutions, government agencies, laboratories and amateurs. Requests should be made direct to *Radionic Equipment Company,* 170 Nassau Street, New York 7, New York.

CERAMIC CATALOGUE

Centralab of Milwaukee, Wisconsin has just issued a new catalogue entitled "Fine Ceramics by Centralab" which includes 28 pages of information on standards, design criteria. body characteristics and a listing of certain established shapes and sizes in common use.

Special features of the catalogue include a comparative table of average characteristics, a listing of ceramic tolerances and ceramic design data. Groupings include male and female bushings, special bushings, single entry, double entry, cup type and conical feed thrus, round, square, conical, butterfly and strain insulators, coil forms, extruded stock,

metallized ceramics, printed circuits and miscellaneous steatite pieces.

Those interested in obtaining a copy of this catalogue should address their requests to *Centralab,* 900 E. Keefe Avenue, Milwaukee, 1, Wisconsin. Ask for form No. 720.

RELAY MANUAL

Wells Sales Inc. of Chicago has recently issued a comprehensive manual covering hundreds of relays which they have available for immediate shipment.

Representative of the products of many well-known manufacturers, the listing includes telephone relays, slow action d.c. relays, aircraft service relays, midget d.c. relays, hermetically sealed relays, keying relays, and many others.

A copy of this manual "Relays for Every Purpose" will be sent free of charge to those requesting it from *Wells Sales Inc.,* 4717 W. Madison Street, Chicago 44, Illinois.

SYLVANIA BULLETINS

The Radio Tube Division of *Sylvania Electric Products Inc.* has just announced the availability of three new bulletins describing electronic test instruments manufactured by the company's Electronics Division.

The bulletins cover the Types 139 and 140 Tube Testers, the Type 134 Polymeter and the Type X-7018 Modulation Meter.

In addition to describing these instruments, the bulletins list operating characteristics and special features of the test equipment.

Copies of any or all of these bulletins will be forwarded promptly to readers who make their requests direct to *Sylvania Electric Products Inc.,* Emporium, Pennsylvania.

REFERENCE CHART

Originally designed to facilitate engineering procedures, *E. F. Johnson Company* has now made available a handy reference chart which identifies the proper sockets and cap connectors for each of some 800 transmitting, control, regulator, rectifier, receiving and miscellaneous tubes.

This easy-to-use and practical chart will be distributed free of charge by the company to readers of Radio News who may obtain their copies either from the company's distributors or by writing direct to *E. F. Johnson Company,* Dept. Z, Waseca, Minnesota.

RESISTOR CATALOGUE

Resistors, Incorporated of Chicago have just released a new catalogue containing resistor data on their full line of resistors and windings.

Included in this catalogue is data on fixed and adjustable resistors, r.f. and choke plates, ferrule resistors, heating elements, special windings and accessories. This data consists of pictorial diagrams, complete specifications and application information on each product.

The resistors feature the "silver-soldered" connection construction, which consists of resistance wire silver-soldered to the solder lug to assure a more permanent electrical bond.

Free copies of Catalogue No. 87 are being distributed upon request to *Resistors, Incorporated*, 2241 South Indiana Avenue, Chicago 16, Illinois.

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Spot Radio News
(*Continued from page* 22)

are as broad as the imagination of the public and the ingenuity of equipment manufacturers." Latest ideas in the field include using units for communication between mountain climbers. FCC also predicts that the units—and their operators—will probably make headlines in times of national disaster, such as floods, hurricanes, or earthquakes, when all wires are down.

RADAR'S USE to study the stars is proving successful, we learn from scientists at the Bureau of Standards. Biggest experiment in this type of radar work so far took place in October, during the huge meteor shower. Overcast weather would have prevented accurate observations but radar made the meteor fragments "clearly visible," the investigators reported. Their work, which is to be continued, is aimed, among other things, to determine the effect of meteors on radio waves, particularly important in FM broadcasting and long-range radio communication and navigation. Radar is also expected to be helpful in astronomy as a method of observing both on overcast nights and during the day, when meteors are not visible. The scientists are tending after preliminary work toward the theory that "bursts" on local station programs from long-distance stations are caused by meteors. One way in which meteors may affect radio waves is to cause these "bursts" on FM channels, it is thought. Out of the research on the effect of such phenomena will come decisions as to which frequencies are the best for the various types of radio services. Whatever the result, radar would seem to be in this type of work to stay. "The tests," declare the Bureau of Standards experts, "indicate that radar, besides being a plane locator and navigation device, is a valuable tool for the study of radio-wave propagation and is finding a place as an observing instrument in the field of astronomy."

HAMS ARE ALSO DOING YEOMAN SERVICE in the meteor field. When skies are overcast, many have been enlisted to check up on meteor fragments, which register their presence clearly with a "bump" on shortwave sets. On the big meteor nights last October hams counted thousands. The shortwave "sound" of meteor fragments, one Princeton professor declared afterwards, may make it possible in time to set up automatic counters, but until that day hams are enlisted by scientists to help estimate the number of fragments when a big meteor show goes on. Big showers are rather frequent—next one is scheduled for April 21. But if you want to know how they sound—you probably do already—there are little showers almost every week. It's when an otherwise well-modulated voice you are listening to bawls one syllable extra loud. Only he doesn't, really. It's a meteor fragment passing by in the neighborhood.

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Retailing Basics

(*Continued from page* 43)

dealer a good start on his advertising program by making certain brands household words through extensive consumer advertising. Some of these organizations have cooperative advertising plans which will focus area attention on both the products and the dealer handling the line.

Small town dealers, or dealers in large cities who have access to neighborhood newspapers, can use such media to publicize their name and merchandise. Handbills can be used effectively to cover the dealer's immediate territory. Local movie houses and radio stations can be used to advantage in some locations.

Another form of advertising is the show window. The dealer can gain publicity by installing "live" or action windows, to demonstrate merchandise. A transparent washing machine can be used to show the action of the unit in washing the family clothes. A demonstrator could be used to show the ease with which the ironing can be done with an electric ironer. A live window demonstration will always draw a crowd. A roast or some other baked product could be prepared in an electric range set up in the show window. Demonstration cards, explaining the advantages of this form of cooking, should be set up and details of the experiment under way explained. Numbered tickets could be passed out and the holder of the lucky number would be entitled to the food which had been prepared during the demonstration.

Direct mail advertising is still a very effective means of telling your story to a select audience. Mailing pieces should be dignified, yet attractive. They should tell a simple story about one or two items and should include a sincere invitation to the prospective customer to visit the store and inspect the merchandise. Be sure the name *and* address are included. The letter should be addressed to the lady of the house, by name, and should be sent by first class mail in order to receive the attention usually reserved for her personal correspondence.

When conditions indicate, house-to-house canvassing can be used to advertise and sell the dealer's line. In case the dealer selects this form of merchandising, it is of utmost importance that the persons chosen for this work be trained carefully for their job. To many customers, the salesman who calls on them in their homes will be the only contact they have with the dealer's store. Because of this feature of house-to-house selling, salesmen must be neat, courteous, enthusiastic and fully informed on the line of radios and appliances carried by the store.

Some dealers have found that telephone selling is profitable, but if this program is adopted, a carefully thought out plan must be made before tackling the telephone list. Unless this procedure is set up carefully, it can be make more enemies than friends for the store. Care must be taken not to call at hours which are obviously inconvenient to the housewife, i.e. just before mealtime when she would be working in the kitchen, or very early in the day when she might be upstairs making the beds, etc.

Basic to all of these advertising promotion schemes is the fact that demonstrations, explanations and advertising copy must be simple and nontechnical. The average customer cannot understand a technical discussion of horsepower, three-line service entrance, etc. The customer *does* want to know how much the unit will cost to operate, what it can do for him in terms of comfort, convenience, safety, and family welfare. All of these points can be explained and demonstrated by the use of homely analogies and without resorting to highflown technical data from the service manual prepared by the manufacturer.

6. *The manufacturers' responsibility.* Make a thorough study of what manufacturers and national distributors have to offer in the way of sales helps. Manufacturers of "brand" merchandise who advertise extensively assume some responsibility for the relation between their dealer and his customers. Because of this close tie-in, the manufacturers will welcome suggestions from dealers on how they can be of assistance in making the selling job easier, and keeping the customer sold. This assistance can materially reduce the dealer's cost of doing business. It can take several different forms; cooperative advertising, the loan of demonstrators, mailing pieces with the dealer's name imprinted, window displays and point-of-sales material.

7. *Becoming community conscious.* It is important that a dealer become a real force in the community. Nothing is more detrimental to his success than for him to assume the attitude that what happens to his community is of no interest to him. If a dealer makes a living in a city or town, he owes it to himself and his business to become community conscious. If possible, the dealer should live in the community that gives him his bread and butter; he should go to the church there; he should join clubs and civic groups and contribute to accepted "worthy causes."

8. *Customer relations.* In conclusion,

there are a few important points which should be mentioned in connection with the dealer's relations with his customers. For one thing, a great many customers will probably want to buy on credit. Arrangements should be made well in advance so that when this type of request is made a complete and definite plan for handling such extensions of credit can be laid before the customer.

Another point which looms large in the customer's mind is that of promises made and *kept*. Don't tell your customer that a product will be delivered, serviced, etc. or that one of your employees will call at a certain time unless you are prepared to fulfill that promise 100%.

Be sure every item that you sell is properly installed and is in perfect working condition before you consider the transaction concluded. New merchandise which needs demonstration, such as ranges, refrigerators, certain radios, etc. should be explained and operated in the customer's home after installation in order to insure that the housewife or member of the family who will use the equipment is thoroughly familiar with the item. It is well to make a "follow-up" call or visit a week or ten days after the installation has been completed in order to intercept any complaints at the source and make the correction. Bad news travels fast and a customer who is dissatisfied with merchandise bought at your store is a carrier of ill tidings for your reputation.

When it becomes necessary to service merchandise which you have sold to the customer, be sure that the best possible job is done on the unit; that it is operating satisfactorily, and that it is re-installed carefully and promptly.

Finally, a very small but important item. Customers who come into the store and buy small items which they propose to carry with them will appreciate receiving well-wrapped parcels. If you are handing good-looking packages to your customers to carry, you can earn an extra measure of free advertising by using distinctive paper which will tell the world at large that the item was purchased at your store.

In the last analysis, the best advertising that a dealer can receive is "word of mouth advertising." You can't gain a worthwhile reputation without working for it. By following the suggestions included in this article you have started on the road to becoming a successful business man because the principles stated are as old as successful business.

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Photo Credits

Pages	Credit
35 (top)	Lake Carriers Assn.
35	Raytheon
36	Sperry Gyroscope
37, 145	Westinghouse
38	General Electric
40, 41	Federal Telephone & Radio Corp.
42, 43, 53	Arthur Haug, Staff Photographer
49 (bottom)	Walter Steinhard, Staff Photographer
52	National Radio Service
57, 58, 59 (left), 166	RCA
58 (top right), 59 (right)	U. S. Navy
60, 61	Packard-Bell
64	Radio Centro Americana
84, 86	Fairchild Camera & Inst. Corp.
104	Barker Brothers
122	Acme
125	Sun Radio & Electronics Co.
140	Sylvania Electric Products Inc.
Cover	Allied Advtg. Agency, Inc.

RCA's newly developed mobile television unit has been designed to facilitate news coverage and other remote pickup operations. This unit is mounted on a standard 1½ ton truck chassis, and can be used to transport all the equipment necessary for picking up, monitoring, and relaying remote television events to the studio. Mounted in the rear of the vehicle, facing two large shatterproof windows, is a specially constructed operating desk for the monitoring, control, and power supplies used with the Image Orthicon Camera. Immediately below the rear windows are six cable reels mounted on crane-like arms to permit easy winding and unwinding of camera cable. The roof of the unit is reinforced.

Classified

Rate 20c per word. Minimum. 10 words

RADIO ENGINEERING

RADIO Engineering Broadcasting, Aviation and Police Radio, Servicing, Marine Operating and Electronics taught thoroughly. Expenses low. Write for catalog. Valparaiso Technical Institute. Dept. N. Valparaiso, Ind.

FOR SALE

SUPREME Audolyzer, practically new, $75.00. A. Joltin, 285 Hawthorne St., Brooklyn, N. Y.

INTERVALOMETERS. Used by Air Corps in actual bombing. Convert to dark-room timer, train controller, expander, etc. This seven pound instrument contains silver plated relays, switches, resistors, high capacity condensers, knobs, pilot light, plug, heater, thermostat, etc. Postpaid anywhere in States, $5.50. (Two for ten dollars.) No C.O.D.'s. Send money order, postal note or check. Hunter Heath Co., 1634 18th, Lubbock, Texas.

PR 16 COMMUNICATIONS receiver with Jensen baffle and 12" speaker. Also portable play-back recording assembly. F. F. Knapp, 6508 Montgomery Rd., Cincinnati 13, Ohio.

AUTOMATIC wireless record changers, $32.95. Wireless phono oscillator complete with tube, $4.95. Quantity and dealer discount. K&G Sales, P. O. Box 53, Cincinnati 13, Ohio.

ST. CLAIR Electronic Volt Ohmmeter 6 DC ranges, 20 meg. imp., 0 to 3, 10, 30, 100, 300, 1000. 6 AC ranges, Imp. 5 meg. shunted by 5 Mmfd. Electronic Ohmmeter, 6 ranges 0.1 to 1000 megs. With instructions & circuit. Price $47. Auto Radio Service, 915 4th St., Three Rivers, Mich.

QSL CARDS that stand out! Individualized, original. Cartoon by W2EA (ex-SEA) incorporating your ideas, personality, etc. Reasonable, but not cheap. Send stamps for specimens. Harrison Radio Corp., 9 West Broadway, New York, N. Y.

ELECTRONIC bargains. Free lists. Gifts 'n' Gadgets, 518 Hilton, Catonsville 28, Maryland.

PRIVATE Parties, amateurs and dealers may now buy radio tubes, parts, equipment, transmitters and receivers direct from the U. S. Government Signal Corps at huge savings. Individual items, small or large quantities as you choose. Complete set of instructions, $5.00. Postpaid anywhere in U. S. A. Send money to Ramboll Distributing Co., 719 North 4th Street, Grants Pass, Ore.

FREE wholesale bulletin. Tubes. Parts. Bargain prices. Henshaw Radio Supply, 3313 Delavan, Kansas City, Kansas.

250 BACK issues Short Wave Craft, Radio Craft, etc., complete NRT course (1944); 2 SW Receivers. Mueller, 77 W. 181, Bronx 53, N. Y.

HAM Specials, SCR 522 Unit—$50.00. Replacement Part line for SCR 522, RF-Oscillator Sections, $8.00 per set, 12 MC. ironcore IF Transformers, $1.00 each. 50 feet RG8/U $2.00, RG59/U—6c per foot. Meter Insurance Kit, 20 assorted fuses, $1.00. Bayonet Base, 10¼ watt Neons, $2.25. Throat Microphones, $1.25. HQ129X complete, $173.25 delivered. Service Supplies. Just send us your order. Castle Radio Supply, W2JBM, 677 Euclid Ave., Brooklyn 8, N. Y.

RADIO Sales and Service business in fast growing western city, health and resort area. Well established doing both wholesale and retail Service. Owner has other interests. Box 442, % Radio News.

DESK type carbon microphones, new, $3.50. Radio City Roller Chart Tube checkers, new, $52.50. Advance Appliance Shop, 10505 W. 7 Mile Rd., Detroit 21, Mich.

NINE Hexagon Keys for Hollow Head Set Screws with Holder, 75c postpaid. Drill and Tap Sets with Holder, $4.08 up. Write for folder. Riverside Tool Co., P. O. Box 87, Riverside, Ill.

SELENIUM Rectifiers, full wave, ½ ampere, $1.85; 1 ampere, $2.50. Half wave 5 amperes, $4.50; 2.2 amperes, $2.25; 1.5 ampere, $1.85. Bulletin. Bursma Radio, Route 5, Grand Rapids, Mich.

LOWEST Prices. Radio Tubes, parts. Bargain lists 3c. Potter, 1314 McGee, Kansas City 6, Mo.

RADIO Tubes—Dealers, order your needs—be surprised at prices. Address Radio Tubes, Box 108, Elizabeth City, N. C.

ELECTRIC Windshield Defroster, 2 for $1.00, Postpaid. Size 6x18. Brooks, 777 W. Adams, Chicago 6, Ill.

WIRE Recorder, high fidelity, suitable school, broadcaster, musician, etc. Trial privilege. P.O. Box 18, Station G, Brooklyn 22, N. Y.

SURPLUS radio parts. Free circular. Alco Electronic Lab., Box 214, Lawrence, Mass.

APA-10 PANORAMASCOPE, with tubes, case and manual, but less panel and knobs, $65.00; BC645 VHF IFF, Conversion Instructions, $22.50; APR-5A VHF Receiver, 1000-6000 Mc., 60cy. 115v., $57.50; C-1 Servo, ideal rotary beam drive, used, $15.00; 5SDG Selsyns, $4.00 pair; Indicator Selsyns, $3.00 pair; SCR284, 211, BC348, free descriptive list. Engineering Associates, Far Hills Branch Box 26, Dayton, Ohio.

NEON Window signs you install. Complete with transformers and all wiring ready to plug in 110 AC. "Radio" $19.50; "Radio Service" $31.50. 5 inch letters, color choice. "Radio-Appliance-Repair" in modern design, $52.50; Radio and Repair, Pink; Appliances and trim Green. Safely boxed F.O.B. Inter-State Laboratories, 4049 Minnehaha Ave., Minneapolis 6, Minn.

MISCELLANEOUS

RADIO wholesale repairs. Just send us the radio prepaid, we repair and return C.O.D. You add markup and deliver. Complete stock. We fix them all. 48 hrs. service. Our low prices mean more markup profits for you. Ship to Elkins Radio, Elkins, W. Va.

THIS is it—your big opportunity. Become independent—operate as you please—spare or full time—right from your own home. Great Booklet "How to Build Your Own Mail Order Business." Only 25c. Satisfaction or money back. Merit Products, 216-32 132 Ave., Springfield Gardens 13, New York, N. Y.

ELECTRICAL instruments. Meters repaired and converted. Inquiries solicited. Haledon Electrical Instrument Co., 319 Belmont Ave., Haledon, N. J.

RAILWAY telegraphy. Be a railroad telegrapher. Operators are in great demand. Salaries from $3,200 up. For information write to Bell Telegraph Ry. Institute, 10 Parker Ave., Suite 9, San Francisco 18, Calif.

EXPORTERS! We are desirous to import anything and everything in the Radio and Electrical line. Complete sets, receivers, transmitters, kits, parts, also electrical household appliances. Send catalogues, price lists, and full particulars to Radio Service Station (Pty) Ltd., 18a Second Ave., Springs (Tvl) South Africa.

WRITE S&G Instrument Co. for sheet metal work, engraving, machining; for fine equipment to your specifications. Box 1461, Tulsa, Okla.

WANTED

WIRE Recorder. Player for sermons, music. Rev. Richard Sneed, Rockford, Illinois.

CORRESPONDENCE COURSES

CORRESPONDENCE Courses and self-instruction books, slightly used. Sold. Rented. Exchanged. All subjects. Satisfaction guaranteed. Cash paid for used courses. Complete information and 100-page illustrated bargain catalog FREE! Write Nelson Company, Dept. 59, Chicago 5, Ill.

USED Correspondence Courses and Educational Books sold or rented. Inexpensive. Money-back guarantee. Write for Free Catalog listing 4000 bargains.—(Courses Bought.)—Lee Mountain, Pisgah, Ala.

AMATEUR radio licenses. Complete code and theory preparation for passing amateur radio examinations. Home study and resident courses. American Radio Institute, 101 West 63rd Street, New York City.

USED Correspondence Courses and Educational Books Bought, Sold, Rented. Catalog free. Educational Exchange, Henagar, Ala.

PATENT ATTORNEYS

INVENTORS—Send today for "Detailed Patent Information" outlining preliminary steps to be taken toward Patent Protection, also convenient "Evidence of Invention" form. Victor J. Evans & Co., 282-B Merlin Building, Washington 6, D. C.

PATENT and Trade-Mark Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine & Rommel, Registered Patent Attorneys, Suite 414, 815-15th Street N.W., Washington 5, D. C.

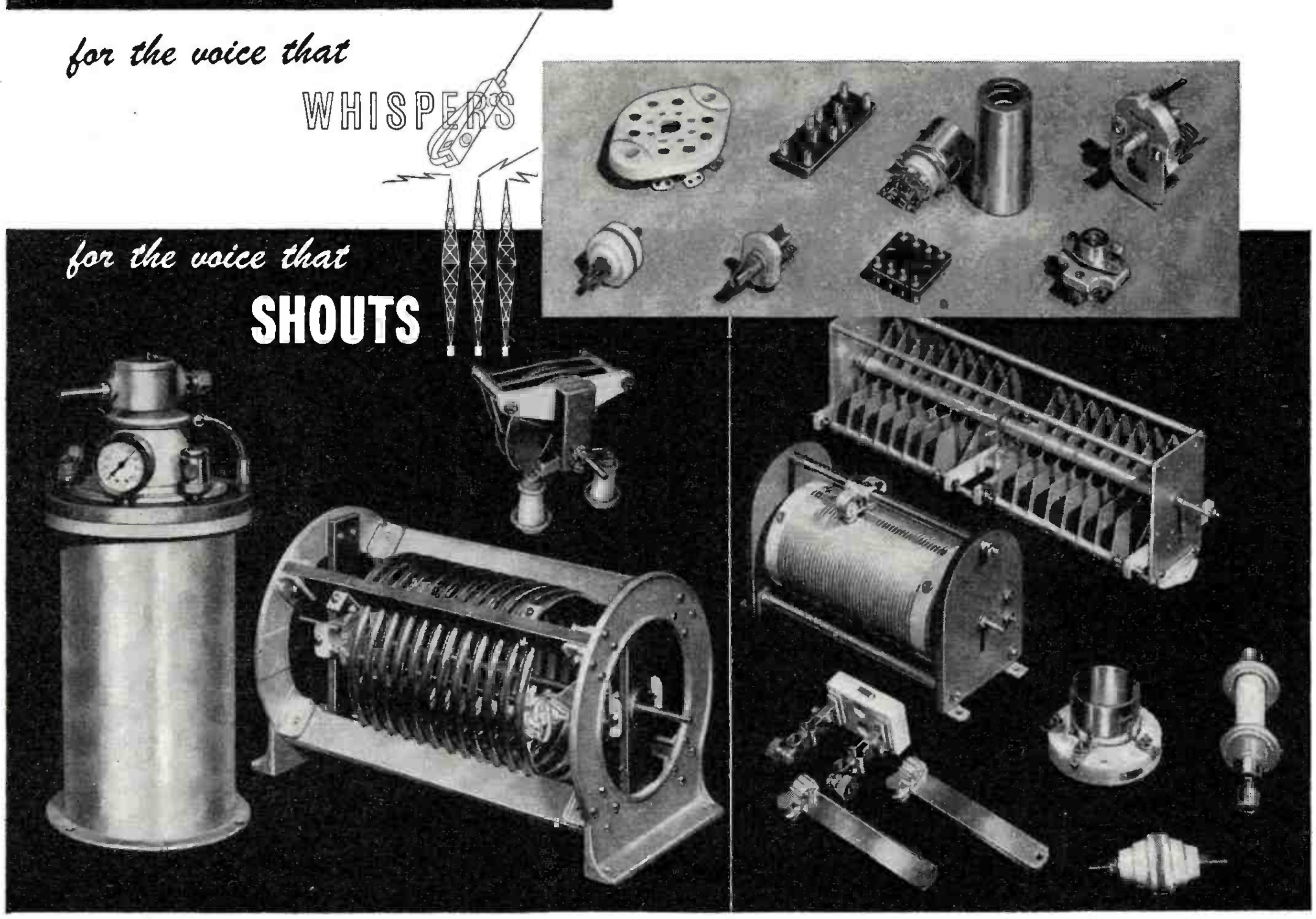
SITUATIONS WANTED

RADIO Radar technician. Graduate 60 weeks Navy-Marine, and Army technical schools. Position in radio or electronics. F. P. Fifield, Pittsfield, Vt.

INDEX OF ADVERTISERS

February
1947

JOHNSON COMPONENTS



If you design or build electronic equipment no smaller than a handy-talkie, no larger than a 50 KW transmitter there are JOHNSON components "your size." Many of the small parts above find application in circuits operating at battery voltages. The miniature socket for instance is a modification of a predecessor that floated down over Europe in a handy-talkie with the paratroopers. They're catalog items with the exception of the terminal boards which typify JOHNSON ability to manufacture special assemblies quickly, easily and economically. The miniature condenser is an inch and half overall, has .015" spacing, 12 mmf. maximum and 3 mmf. minimum capacity. On the large side of the condenser family are the pressurized nitrogen-dielectric condensers offering RMS voltage ratings to 30,000 V capacities to 10,000 mmf., and highest capacity to mounting space ratios. Similar comparisons might be made with the other JOHNSON components.

Between the large and small above there's a big JOHNSON line from which to choose. Check the list below for parts you need. You'll find them carefully designed, skillfully manufactured. For more information write department Z today.

Johnson Products Include

Condensers • R. F. Chokes • Connectors • Pilot and Dial Lights
Directional Antenna Equipment • Inductors • Q Antennas • Plugs & Jacks
Broadcast Components • Tube Sockets • Insulators • Hardware

JOHNSON
a famous name in Radio

E. F. JOHNSON CO., WASECA, MINNESOTA

THESE WORDS MEAN PREMIUM QUALITY

APPROVED PRECISION PRODUCTS

. . . at no extra cost!

You don't *pay* more for Mallory parts—but you *expect* more and *get* more from them. That fact has been proved for over fifteen years—by performance that has constantly justified the Mallory slogan, "Approved Precision Products."

Why, for instance, have most servicemen found Mallory FP capacitors "tops" in quality? Because, for one thing, chlorides and other impurities are kept to *less than one-half of one part per million*. This is accomplished by a system of rigid controls that insists upon capacitor gauze actually purer than hospital gauze . . . that compels plant operators to wear rubber gloves . . . that assures production under scientifically air-conditioned surroundings.

As a result, Mallory FPs are eminently dependable. They have a nationwide reputation for premium quality. Like other products sold by Mallory's carefully selected, conveniently located distributors, they really *are* approved . . . they really *are* precise.

You Expect More and Get More From Mallory

P. R. MALLORY & CO. Inc.
MALLORY

VIBRATORS . . . VIBRAPACKS* . . . CAPACITORS . . . VOLUME CONTROLS . . . SWITCHES . . . RESISTORS . . . FILTERS . . . RECTIFIERS . . . POWER SUPPLIES.

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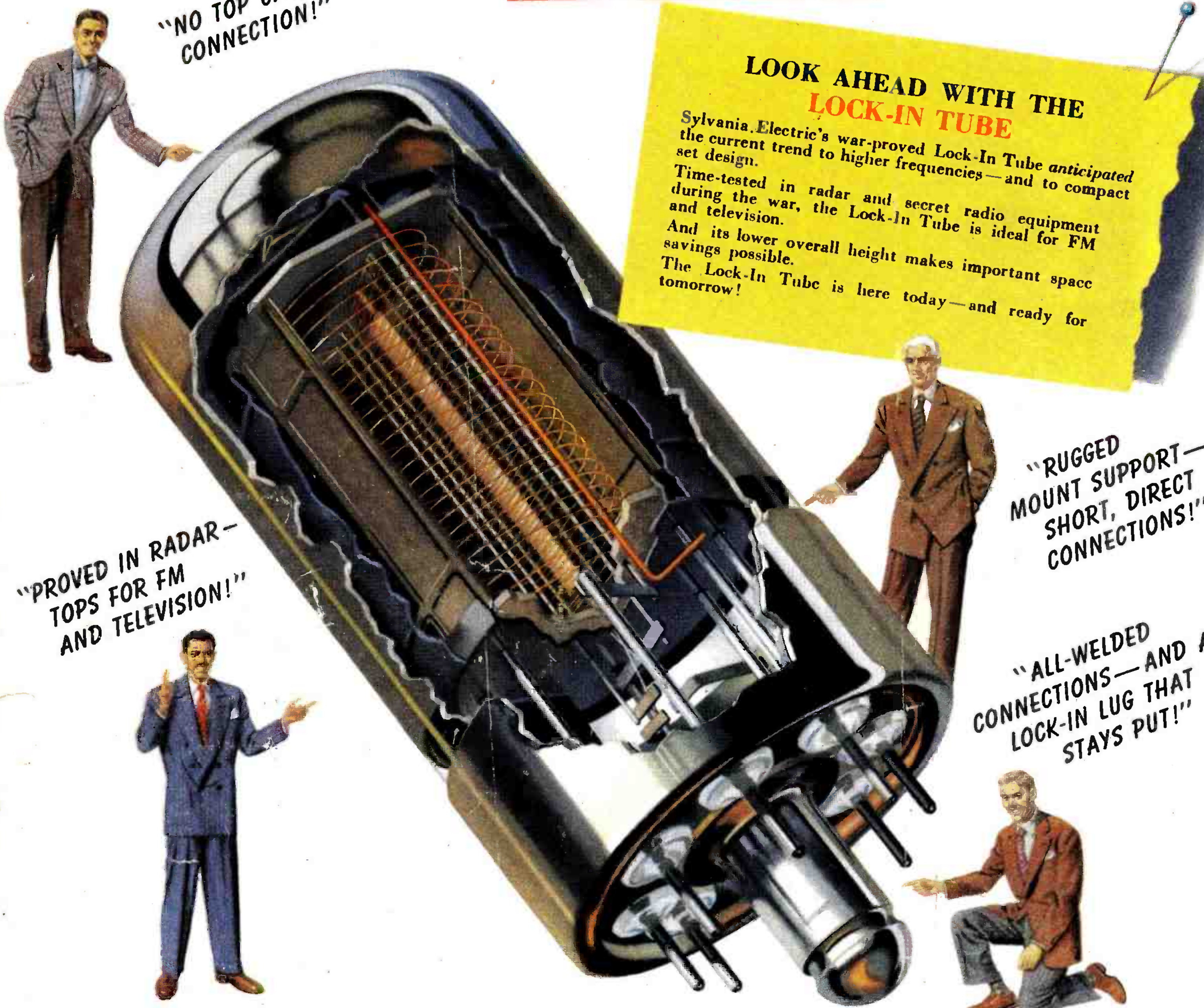
APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

TIMED FOR TOMORROW . . .
TIME-TESTED ALREADY!



LOOK AHEAD WITH THE LOCK-IN TUBE

Sylvania Electric's war-proved Lock-In Tube *anticipated* the current trend to higher frequencies—and to compact set design.

Time-tested in radar and secret radio equipment during the war, the Lock-In Tube is ideal for FM and television.

And its lower overall height makes important space savings possible.

The Lock-In Tube is here today—and ready for tomorrow!

SYLVANIA ELECTRIC

Emporium, Pennsylvania

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS