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SIGNAL CORPS
Technical Information Letter

JULY · 1944

ARMY SERVICE FORCES · OFFICE OF THE CHIEF SIGNAL OFFICER

SIGNAL CORPS

TECHNICAL INFORMATION LETTER

PURPOSE THE SIGNAL CORPS Technical Information Letter is a monthly publication designed to keep Signal Corps personnel and other military personnel using Signal Corps equipment informed on Signal Corps matters. It provides means for the dissemination and interchange of information of a widely-varied nature, both technical and tactical.

SOURCE THE LETTER is compiled mainly from information available in the divisions and branches of the Office of the Chief Signal Officer. Signal Corps and other communications personnel are invited to submit, through channels, material of general interest. Information on problems encountered and overcome by combat and service communications troops is desired. Such items should reach the Chief Signal Officer (SPSAY) not later than the 15th of each month for inclusion in the letter for the following month.

DISTRIBUTION DISTRIBUTION overseas is made by The Adjutant General on the following basis: Theaters of Operations (25); Armies, Corps, Departments, Island Commands, Air Forces and Base Commands (10); Divisions and AAF Commands (7); AAF Wings and Groups (4); AAF Squadrons (2); Signal Battalions (6); Signal Companies and separate Signal units (2).

Within the continental limits of the United States the Letter is distributed to Signal and other Ground and Service Forces units and installations by the Chief Signal Officer (SPSAY), Washington 25, D. C. Distribution to Army Air Forces units and installations in the continental United States is made by the Commanding General, Army Air Forces (AFMPB), Gravelly Point, Virginia.

Correspondence relative to distribution overseas and to all addresses, except AAF units, in the continental United States should be directed through channels to the Chief Signal Officer (SPSAY), Washington 25, D. C. Air Force units in the continental United States should write to the Commanding General, Army Air Forces (AFMPB), Gravelly Point, Virginia, on this subject.

WARNING THIS publication is issued solely to give proper and speedy dissemination to timely, useful information concerning pertinent trends and developments. Nothing herein is to be construed as necessarily coinciding with United States Army doctrine. Changes in official doctrine, as they become necessary, will be officially published as such by the War Department.

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BRITISH GPO ENGINEERS AND U. S. ARMY OFFICIALS AT THE OPENING OF A NEW SWITCHBOARD "SOMEWHERE IN ENGLAND."

COMMUNICATIONS IN UK

Five Months Before D-Day a Wire and Radio Network Linked U. S. Forces All Over the British Isles. This Is What It Consisted of Then

THE FOLLOWING, based on articles published in the January and February issues of the Current Information Letter which is issued by the Office of the Chief Signal Officer, Headquarters, Services of Supply, European Theater of Operations, United States Army, is intended to give a picture of communications in use by U. S. forces within the United Kingdom as of the early part of this year.

The Chief Signal Officer, ETO, in addition to furnishing communications for U. S. armed forces in UK also furnishes service to other U. S. Government agencies, chiefly OWI. A large percentage of the commercial equipment, including wire lines, in use by U. S. forces is furnished by the British General Post Office (GPO). Construction and service units under the Chief Signal Officer frequently work with GPO personnel in furnishing required service.

In addition to the overseas channels operated from Central Base Section Signal Center, which are covered in a later paragraph, radio nets are operated as follows: ETO Net, joining HQ. ETO, HQ. SOS, HQ. VIII AF, HQ. ATC and Army headquarters; ETO Emergency Net, using Radio Sets SCR–299 or SCR–399, joining HQ. ETO and each base section headquarters; and two SOS emergency nets, joining HQ. SOS with port and base section headquarters. The SOS nets are as of the beginning of the year consolidated and used for practice purposes only; however, in the event of wire failure the two nets will separate, in order to provide greater traffic capacity.

The Chief Signal Officer is charged with installation, maintenance and technical operation of radio transmitters and procurement and maintenance of program transmission lines for the Special Service Division. On 1 November 1943 eleven 50-watt radio broadcast transmitters were in use carrying U. S. Army special service programs to American forces in UK. Technical operation of these stations and the wire network joining them is coordinated with the British Broadcasting Company and GPO.

The GHQ Messenger Service provides messenger service throughout UK. Motor vehicle, boat, air and rail routes are operated. Scheduled messenger service over these routes permits messenger delivery to almost any point in UK.

THE WIRE PLANT

Fixed plant telephone and telegraph (teleprinter) facilities are provided by GPO. Extensive use is made of GPO civil exchanges and of the Defense Telecommunications Network (DTN).

As of 1 December 1943 there were in operation 234 telephone switchboards with a total of 405 positions, serving approximately 9,000 extensions. There were also 15 standby switchboards, 10 of which are located at buildings currently served by the ETO centralized switchboard. Approximately 1,900 interswitchboard circuits provide connection between U. S. switchboards and British military and civil exchanges.

As of 1 December 1943 there were 11 teletype (teleprinter) switchboards in use by the U. S. Army, exclusive of those at Air Force installations. The teletype network includes 64 interswitchboard circuits, and 174 circuits from switchboards to machines at U. S. installations. Most of the machines are British teleprinters supplied by GPO. Due to the acute shortage of this equipment some U. S. teletypewriters have been installed, equipped with adapters to permit operation with the British machines.

Communications for HQ. ETO, are furnished by CBS Signal Center. This Signal Center, one of the largest outside the U. S. provides communications for HQ. ETO, HQ. SOS and various Government agencies in London, including U. S. Navy. Channels used by the Navy are operated by Navy personnel.

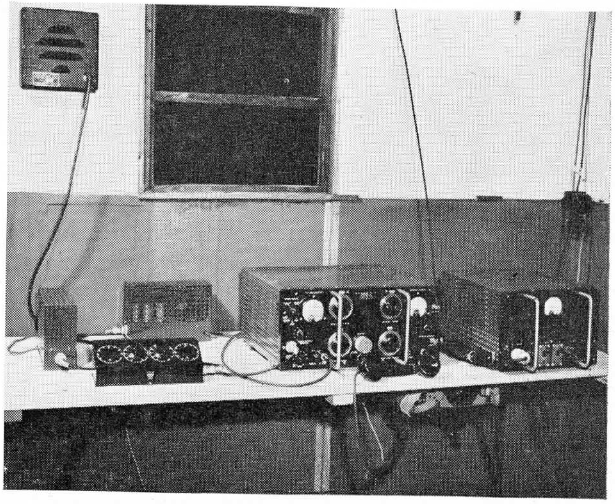
The message center is responsible for recording, routing, addressing, servicing, dispatching and filing of all traffic. It maintains a complete card file directory of headquarters and units within UK and overseas.

Messages to HQ. ETO are delivered by means of a pneumatic tube carrier which requires approximately 45 seconds to cover the $\frac{1}{4}$-mile distance. Messages to other headquarters in the London area are usually relayed by teletypewriter or delivered by couriers. Messages for messenger delivery outside the London area are dispatched via GHQ Messenger Service.

Certain headquarters, which receive a large volume of traffic, are connected to the Signal Center by direct lines terminating in No. 133 subsets. Classified traffic to and from these stations is enciphered at the point of origin and passed thru the Signal Center without being deciphered. Direct teleprinter circuits to Western Union and other commercial cable companies are used for messages to be transmitted by these companies. All wire lines and equipment in the overseas section terminate in a jack panel to provide maximum flexibility in the use of spare line facilities.

Remote control equipment for all channels to points outside UK is operated in the overseas section. This equipment is connected by land lines to distant radio stations.

Six 2-way radio teletype channels provide communication with WAR. The six channels are not always available as it is sometimes necessary, due to atmospheric conditions, to combine all



A RADIO NETWORK STATION AT A DEPOT IN ENGLAND.

AMERICAN SIGNALMEN MANNING A TELETYPE PRINTER INSTALLATION IN THE UNITED KINGDOM.

channels in order to obtain intelligible signals. An additional channel exists through Western Union cable facilities. An emergency high-speed channel is maintained principally for communication with WAR in the event of failure of the radio teletype equipment. The equipment for this channel was, until the end of November 1943, used to provide communication with Oran. One manual Morse channel is used to provide communication to Iceland.

In addition to the radio channels currently controlled from the overseas room, the Signal Center operates sets in the SOS Emergency Net, the ETO Net, and the ETO Emergency Net. Sets recently installed for use in connection with operations on the Continent will also be controlled from the Signal Center.

The radio telephoto service comprises an administrative office, operations room and photographic laboratory. Since 15 December 1943 this facility has been in use for facsimile transmission and reception of official photographs and other communications between ETO and the U. S. The radio telephoto equipment used is a portable type and may be used as a field facility as well as at a fixed station.

The U. S. Army and Navy share the facilities of the teleprinter room. All machines terminate in a jack field to provide flexibility. A four-position, multiple type teleprinter switchboard serving a total of 57 teleprinters and with access to 29 trunks is installed at a location away from the Signal Center proper. A small, but well-equipped, teletype maintenance shop has been set up for maintenance of British and American machines and overseas terminal equipment.

ETOUSA CENTRALIZED SWITCHBOARD

Early in 1942 all U. S. headquarters in London were concentrated in one building. The telephone system then consisted of a four-position common battery switchboard with 640 extensions plus a total of 240 private wires and exchange lines. As the Navy had the largest number of extensions, the switchboard was under Navy control. By the end of June 1942 the various Army headquarters had expanded to such a point as to require most of the space in the original building and several neighboring buildings as well. The original switchboard, still under Navy control, had grown to a 10-position board handling approximately 7,500 calls from 0900 and 1700 each day.

Between 1 July and 1 October 1942, five more buildings each requiring its own switchboard were occupied by the Army. The various switchboards were interconnected by an elaborate system of tie lines and each board had lines to one or more city exchanges, to DTN, and to the Admiralty and Air Ministry networks. On 1 November 1942 the original switchboard was transferred to Army control as approximately 75 percent of the traffic was originating at Army extensions.

At about the same time the proposal was advanced to consolidate the various switchboards into one central board. The chief objection, the probable extent and duration of service interruption in case of damage to the central switchboard was overcome by retaining the previous switchboards as standbys for use in emergency. As the majority of installations were within a one-half mile radius of the original building, the problem of interbuilding cabling, even taking into account the necessity for providing alternate cable routes to each building, was not too difficult. The 37-position centralized switchboard, serving 2,400 extensions, was cut into service on 3 April 1943. Since then 41 more positions have been added and another 15 are on order. Service features of this board include eight information positions, four toll positions, and two five-party conference jacks.

An alternate headquarters for general and special staff was constructed in the early part of 1943. This headquarters is located 120 feet below the ground. A telephone switchboard equipped with 240 extensions and 150 private wires was installed in this location. These extensions are not served by the centralized switchboard but can be connected to it by trunking. Every telephone served by the centralized switchboard is also connected to one of the ten standby boards, which can be cut into service with a minimum of delay in the event of damage to the main board. A limited system of tie lines is maintained between these standby switchboards. Stencils are cut and maintained up-to-date for the running off of telephone directories for the standby switchboards in the event it becomes necessary to put them in operation. At the same site an emergency Signal Center is set up. A Radio Set SCR–299 is provided for operation in the ETO Emergency Net. Since the antenna for this set is mounted on the roof of nearby buildings, an unusually long antenna lead-in was required. This radio set may be operated either from the Signal Center or from the emergency Signal Center position.

FURTHER SCTIL DISTRIBUTION EXPANSION

DURING the past two months, requests for the Signal Corps Technical Information Letter have been received from units of the Army Air Forces, Army Ground Forces, and Army Service Forces, both in this country and overseas. Receipt of these requests has enabled the Office of the Chief Signal Officer to make a better estimate of the needs of troops in the field for the Information Letter.

Accordingly, a revised overseas distribution list, superseding that announced in SCTIL No. 30, May 1944, has been compiled and has gone into effect with this issue. No change has been made in the number of copies being sent to Theaters of Operations, Armies, Corps, Departments, Island Commands, Air Forces and Base Commands. These organizations will continue to receive the number of copies as announced in the May issue.

However, Divisions will receive 7 copies of SCTIL beginning with this issue which, it has been estimated, will be sufficient to cover the Dvision Signal officer, the assistant Division Signal officer, and the communications officers of the regiments, artillery and attached units. Signal battalions have likewise been upped from 2 copies to 6 copies. Signal companies and separate Signal units will continue to receive 2 copies.

Added to the SCTIL distribution list have been AAF Commands, which will receive 7 copies; AAF Wings and Groups, 4 copies; and AAF Squadrons, 2 copies.

Distribution within the continental limits of the United States will continue to be made as announced in May.

AIRCRAFT INSTRUMENT APPROACH SYSTEM

Routine Landings Through Low Ceilings and Poor Visibility Now Possible With New Equipment

A COMPLETE instrument approach system for aircraft has been made available by the Signal Corps for quantity installation. Upon installation of this system, medium and heavy bombers and transport aircraft will be able to make everyday routine landings on runways even with very low ceiling and poor visibility. Reliability of the system is sufficiently established to permit large numbers of aircraft to operate in bad weather without any appreciably increased approach or landing hazards over fair weather operation.

The first Army instrument landing system embodied ground transmitters in line with the runway, homed to by means of the airborne radio compass. Markers indicated progress during the complex landing procedure. Serious errors due to cross-winds and the difficult and elaborate procedures precluded the routine use of this system.

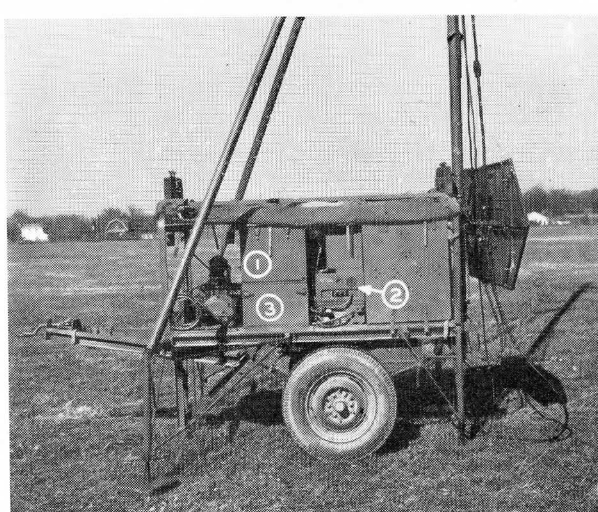
Localizer equipment, which defines a fixed vertical plane containing the runway centerline, became available 6 months ago and has been operated on a limited scale using a procedure let-down. The present availability of glide-path equipment, which defines a straight-line glide path, completes the first available practical instrument landing equipment, each system of which is composed of the following elements:

Ground	*Airborne*
Localizer Transmitter	Localizer Receiving Equipment
Glide-path Transmitter	Glide-path Receiving Equipment
Marker Beacon Transmitter	Marker Beacon Receiving Equipment
	Localizer-glide-path Indicator

For the ground installation, three marker beacon transmitters are employed. The equipment elements of the system are described in further detail below.

Principal element of the approach system is a localizer transmitter which establishes a path about 1° wide in a horizontal plane to guide aircraft directly over the center of a runway. Radio Set AN/MRN–1 is a mobile localizer transmitter completely contained in one Truck K–53. This set can be placed in operation about 30 minutes after arrival at an airport. Usable range is about 50 miles to an aircraft at 10,000 feet altitude. AN/MRN–1 includes a self-contained gasoline driven power supply but can be operated from 110-volt, 60-cycle ac mains. Radio Set AN/CRN–3 consists of the components of Radio Set AN/MRN–1 crated for air transport less truck. This set is functionally identical to AN/MRN–1.

Radio Set AN/CRN–2 is an air-transportable trailer-mounted glide path transmitter which provides vertical guidance to an aircraft while making approach and landing. The ground transmitter may be adjusted to provide glide angles between 2° and 5°. Usable range is about 25 miles to an aircraft on the glide path. Radio Set AN/CRN–2 includes a gasoline driven power supply but may be operated from 115–230-volt, 60-cycle mains. Fifty- to sixty-cycle converters are available to permit system operation from 50-cycle mains. The Signal Corps glide path is of the equi-signal type in contrast to the previously abandoned constant-intensity type. Ninety- and



RADIO SET AN/CRN–2 GLIDE-PATH TRANSMITTER IN OPERATION.

RADIO SET AN/MRN–1 LOCALIZER TRANSMITTER IN OPERATION.

150-cycle side frequencies are radiated in separate patterns so that the locus of points at which the 90- and 150-cycle side frequency field strengths are equal defines precisely a straight-line glide path independent of fluctuations in signal strength.

One Marker Beacon Set AN/MRN–3 is installed at the edge of the runway; a second, 2 miles from the point of contact, and the third, 4½ miles from the point of contact. This set radiates a fan-shaped pattern vertically, indicating to the pilot by means of a lighted lamp his progress along the glide path. Different keying rates are used for the respective marker positions, providing coded flashing of this lamp. This set includes a gasoline-driven power supply, but may be operated from 115-volt, 50–60 cycle mains. AN/MRN–3 includes a jeep for transportation to remote sites and a Radio Set SCR–610 for two-way communication with the localizer and glide path locations. The components of Marker Beacon Set AN/MRN–3 may be shipped by air transport and used without jeeps.

To use the instrument approach system, aircraft must be equipped with Radio Receiving Equipment RC–103, Radio Set AN/ARN–5, and Marker Beacon Receiving Equipment RC–39, 43, 193 or 193–Z. Glide path and localizer information is presented to pilot in the form of deflections of the vertical and horizontal pointers of the cross-pointed Indicator I–101. The pilot needs only to "follow the pointer" exactly as he does in using the right-left radiocompass. Indications are of appropriate sensitivity so that only a reasonable effort in maintaining on-course indications assures arrival of the aircraft at the desired point of contact at an appropriate rate of descent.

NORTH ATLANTIC AIRWAYS NETWORK

A Signal Corps Long-Wave Installation That "Gets Through" Winter and Summer

IN THE spring of last year, the Signal Corps was requested to establish six long-wave radio communications stations in the North Atlantic and Sub-Arctic area. That, in itself, was not out of the ordinary, but what was exceptional was that the stations had to be ready for operation 28 days after the request was received.

This haste was occasioned by the need for 24-hour radio service for the Army Air Transport Command and for Administrative and Command communications, and also by the lack of satisfactory service through the winter months on existing high frequency facilities. High frequency radio communications in the northern latitudes are, as is well known, subject to interference and "black-outs," particularly during the winter.

As the days went by after the start of the project, obstacles that had to be overcome mounted until it appeared that the job never would be completed on time. High winds and freezing temperatures, together with difficult transportation problems were the greatest handicaps. Technical experts on all phases of radio station construction had to be gathered from virtually the four corners of the globe and flown to remote sites. Equipment had to be procured, assembled, and shipped to the same out-of-the-way locations—likewise by plane.

In spite of these handicaps, the network was completed within the allotted time. It links Newfoundland, Labrador, Greenland, Iceland, and Great Britain and is serving as a vital communications system for aircraft traversing the Great Circle route between this country and England.

The first phase of the construction job was a survey of the route to determine requirements and the obstacles which might be expected to delay its completion. By using personnel who had had previous experience in this region, much time was saved in ascertaining requirements. With the cooperation of the Army Air Forces, it was possible to send an officer from Philadelphia to London and return, with inspection stops at each point along the route to check final details, in the short period of 14 days—several of which were required to complete the survey in Great Britain.

The selection of equipment for the project was somewhat simplified because the early completion date meant that only available equipment could be used. It was found that six 15-kilowatt short wave transmitters could be made available by modifying them for use on the low frequencies. These transmitters were used to span the longer and more difficult distances where topography required greater power than would be available with standard long wave transmitters. Standard Signal Corps long wave transmitters, having a power of from 2½ to 6 kilowatt, were used at those stations where the greater power was not essential.

The available stock of radio receivers was surveyed and two types were selected as best suited for operation of radio teletype channels. Dual crystal transmitter exciters and crystal oscillators for the receivers were fabricated in the Philadelphia Signal Depot Shop.

A radio teletype channel operates on a continuous carrier basis with the transmitting frequency shifted back and forth over a 170-cycle band when using low frequencies. On high frequencies, the carrier shift is increased to 340 or 850 cycles. Teletypewriter equipment is associated with the radio transmitter which sends separate frequencies for mark and space teletypewriter signals. A standard radio transmitter is used, to which is added a frequency shifter, to shift the frequency of the transmitter the required number of cycles above or below the carrier frequency. The receiving equipment picks up the radio signal and feeds this signal into a radio teletype receiving terminal which is designed to interpret the fluctuating frequency into mark and space signals. On long wave channels a signal transmitted on the carrier frequency plus 85 cycles operates the polar relay in the radio teletype receiving terminal to a mark position and a signal transmitted on the carrier frequency less 85 cycles operates the polar relay to a space position. This terminal equipment then operates the teletypewriter equipment to give the printed message.

This installation of the equipment for this network was both difficult and interesting. Necessary personnel were transported by air to each location to supplement the construction crews already on the job. A complement of from 10 to 50 men was chosen for the respective locations dependent upon the amount of work required and the construction difficulties which could be anticipated. In moving construction troops for a job of this type, it was important that personnel experienced in many technical phases of the work be included. Personnel familiar with outside construction including building of antennas, construction of buildings, radio receiving and transmitting equipment installation work, radio teletype terminal installations, installation of teletypewriter equipment, and code room installations were all required. Specialists in each of the above equipments were made available to insure a satisfactory installation. Riggers competent to erect high steel towers under adverse conditions were also transported to the various sites. This problem of qualified personnel was an extremely important one, particularly since the installation time was so short.

In transporting the equipment and material, it was important to include ample stocks of wire, insulators, anchor rods, ground rods and other outside plant material to care for "on the job" type of construction which could not be engineered in detail before construction actually began. Transportation had to be coordinated very closely with the Air Transport Command. The major part of the equipment was shipped by air and it was necessary that material for the various stages of the job be shipped in the order in which they would be required. This was necessary as shipment by air could not include total requirements in single shipments. Motorized equipment was already on hand, the bare essentials being light and heavy trucks, bulldozers, and cranes.

Actual construction began with the clearing of land for towers, buildings, and antenna lay-outs. In Maine, Labrador, and Newfoundland, the terrain is covered with muskeg which requires great ingenuity when using heavy equipment. In some places trees were removed by merely pushing them to one side. In swampy sections, it was necessary to cut the trees down as bulldozers were unable to operate. In Greenland and Iceland, the terrain is rocky without appreciable undergrowth. Clearing away the brush at these locations was not the task which was encountered elsewhere.

Three types of antennas were employed for the network. Rhombic and doublet antennas which are commonly used on high-frequency circuits were not suitable for this job because of the low frequencies involved. In their place long wave Beverage type and loop antennas were installed for reception, and flat-top antennas for transmission. Later, long wave Beverage type antennas were also used in selected locations for transmission.

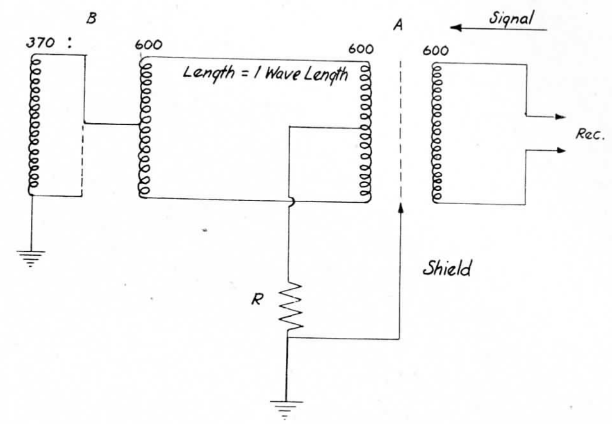


FIG. 1

The Beverage type antennas required the clearing of strips approximately 50 feet wide and ranging from 3,000 to 10,000 feet in length. Short poles were erected at 150-foot intervals.

The electrical design of these antennas is as shown in Figure 1. The Beverage antenna consists of a pair of horizontal wires in the order of a wave length long directed toward the desired transmitting station. The wave front of an approaching signal is tilted slightly forward in the direction of travel due to ground losses. This tilted wave front produces a small horizontal component inducing a voltage between the horizontal wires and the earth. This voltage builds up as the wave front travels along the antenna until at point B its magnitude is many times that at point A.

The longitudinal current resulting from this voltage flows through the center tap of the 600 ohm winding of the transformer at B, and through the 370 ohm winding to ground. The current in the 370 ohm winding induces a voltage across the 600 ohm winding, causing the antenna to act as a two-wire transmission line, carrying the signal back to the receiver at A.

Considerable guying was required because of the difficult terrain and impossibility of setting poles to proper depth. In many spots, poles were set just below the surface with guying in four directions. This same practice was applied to the transmission lines to receiving and transmitting buildings. Loop antennas were also shipped to each location to provide emergency reception in case the construction of the long antennas could not be completed within the required time.

The original installations made use of some existing towers for transmitting antennas. By erecting additional towers and improving ground systems by placing counterpoises, reasonably satisfactory results were obtained with flat-top transmitting antennas strung between towers ranging from 90 to 400 feet high. At each station which included transmitting terminals for two circuits, one central tower was erected with two shorter towers supporting the outer ends of two flat top antennas. These antennas were of the T type. That is, the down leads were taken from the center of the antenna with a tuning house placed directly beneath. From the tuning house, transmission lines were constructed to the transmitting station located nearby.

The erection of towers in these northern latitudes proved a problem of magnitude. Temperature and wind conditions greatly handicapped the riggers. At least two well experienced riggers were required at each location. Temperatures well below freezing prevented working on the towers without protection against contact with the steel. Wind velocities were registered well above 75 miles per hour in some of the locations. Construction could not proceed when the wind

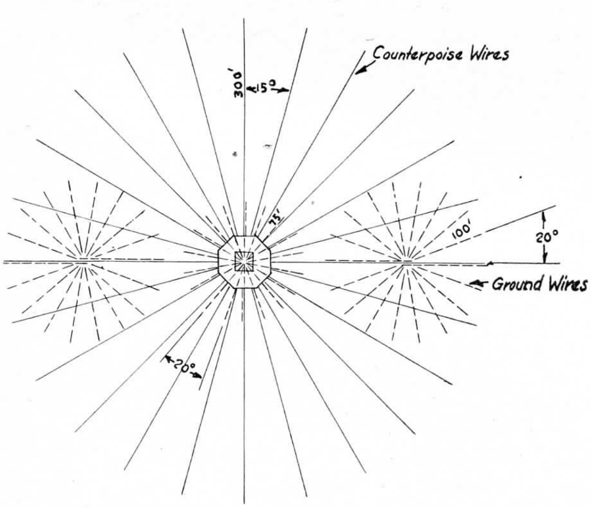
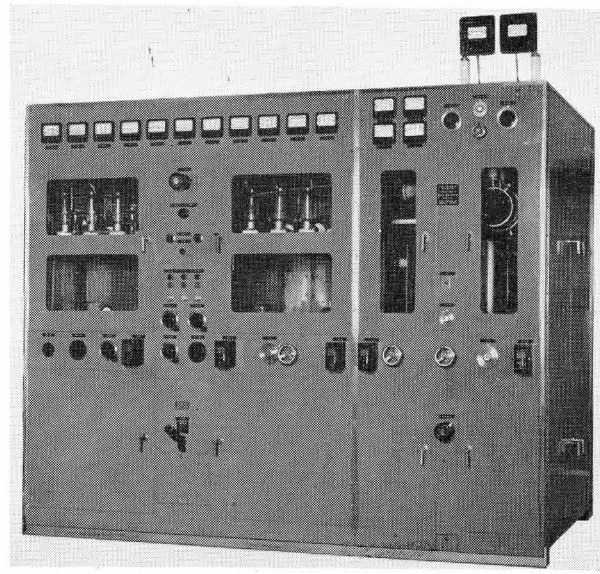


FIG. 2


A 15-KW TRANSMITTER OF THE TYPE USED IN THE AIRWAYS INSTALLATION.

velocity exceeded 20 or 30 miles per hour. Winds of this velocity distorted the towers to a degree where it became difficult to place bolts and fit new pieces together. Guying was, of course, necessary and towers designed with a single insulator at the base with top guying proved to be most satisfactory under these high wind conditions.

Ground conditions at the majority of the sites were found to be very poor. To overcome this, elaborate ground and counterpoise layouts were designed and erected. Short 15-foot poles were spaced equally under the flat tops to allow construction of radial wires from the tuning house and extending beyond each tower. The design of such a counterpoise is shown in Figure 2.

Buildings were required to house transmitters, receiving equipment and power installations. As all radio installations were necessarily remotely situated to avoid man-made noises, existing buildings were not suitable. Small buildings for transmitters were constructed with wood or concrete floors, the size depending upon the amount of equipment to be installed. These transmitting huts were located as close to the antennas as possible. Buildings with concrete floors to house power equipment were located nearby. Because of land requirements for long receiving antennas, the receiving equipment could not, generally, be located near the antenna. Buildings for receiving equipment were located between the several receiving antennas to shorten the transmission lines as

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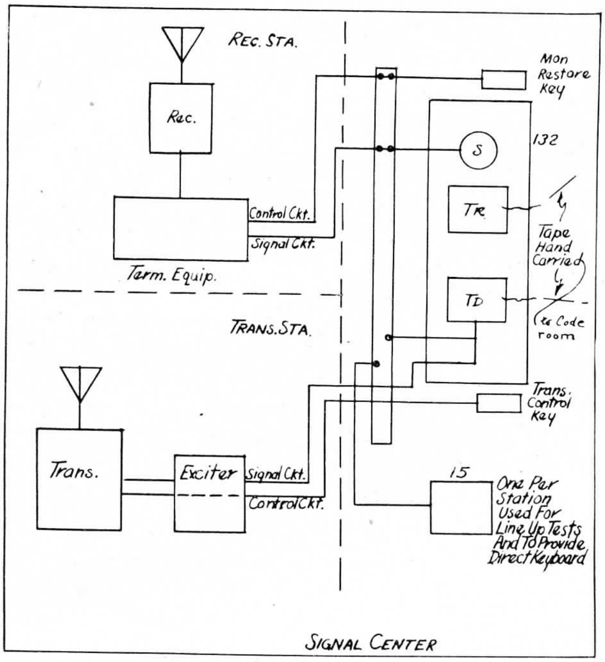


FIG. 3

much as possible. Telegraph lines were then used to connect the receiving terminals with the teletypewriter equipment located at the signal centers. Ground systems were provided for each radio building.

The installation of the equipment began in some cases by installing the transmitters before the buildings were actually completed. Precautions were, of course, taken to protect this equipment from weather and the dust caused by construction activities. Dummy antennas were used to pretune the transmitters. Preinspection of the equipment was made to determine breakages or additional requirements so that immediate action could be taken to ship replacement parts for final operations. As the radio receiving equipment was shipped complete, no great problems were encountered in setting up this apparatus for operation. Some experimenting was done on the job to determine which of the two types of receivers furnished gave the best results.

The teletypewriter equipment was arranged to suit the available space and at the same time present a satisfactory working arrangement. The normal alignment was as shown in Figure 3. As soon as this equipment was operating, one machine was used to work with a second one, to make routine tests. These routine tests were carried on extensively to insure that no difficulties would be encountered when the radio circuit was ready for operation.

Power equipment was installed as the work on the radio installations proceeded. As soon as the Diesel generators were installed, they were tested for several days with both motors and generators under load and no load conditions. Fuel tanks of ample capacity were located so as to be accessible to trucks transporting oil drums.

When installing the equipment, much thought was given to the proper location of the apparatus to permit uniform and proper operating procedures to be followed. As previously stated, the transmitters and receivers were located as closely as possible to the antennas. The teletypewriter receiving terminals were located with the radio receivers. Telegraph lines tied in the transmitters and receivers remotely situated to the teletypewriter equipment located in the signal centers.

Operating and maintenance personnel were trained to keep equipment in satisfactory operating condition. At each location, two men associated with the installation were retained for several months to familiarize operating and maintenance personnel with the new equipment. Special arrangements were made for the personnel to be stationed at the transmitter locations. These men were trained in maintenance of the transmitter and particularly in the proper method of tuning the transmitters to stay within the frequency limits imposed by the teletypewriter receiving equipment. Frequent retuning is required as temperature and icing conditions change repeatedly.

The radio receiving equipment is arranged to operate on the one frequency, and few adjustments, if any, are required. Normal maintenance routines keep the receiving equipment in satisfactory operating conditions; however, complete familiarity with the apparatus is essential so that unforeseen trouble conditions can be discovered and repairs made without extensive loss of operating time.

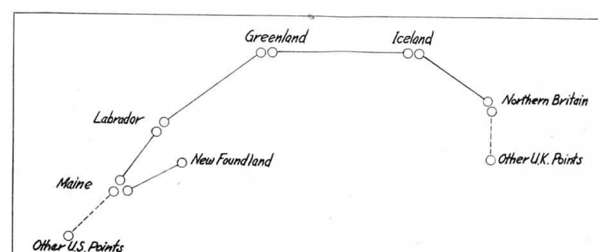
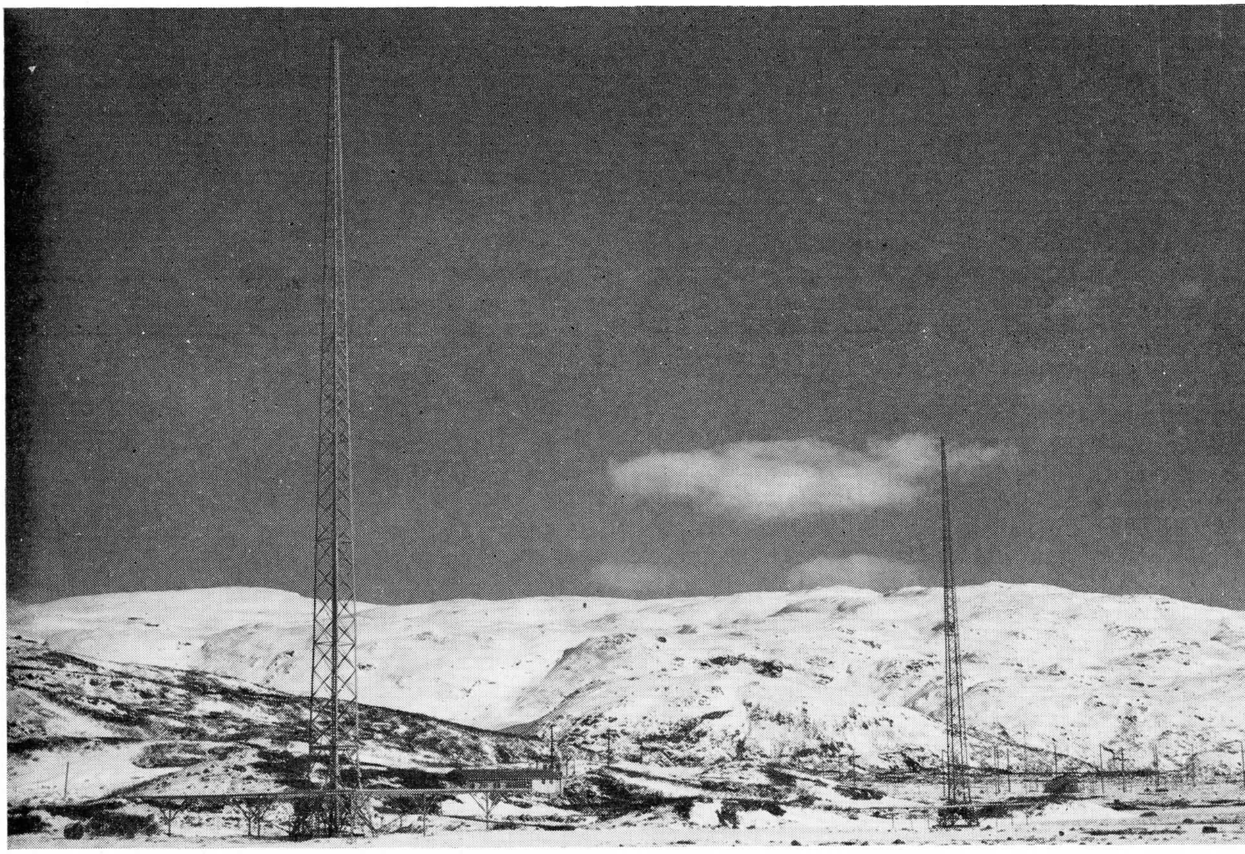


FIG. 4



ONE OF THE NORTH ATLANTIC AIRWAYS SYSTEM STATIONS. THIS IS A GOOD EXAMPLE OF THE TERRAIN AT THE SITES WHERE THESE STATIONS ARE LOCATED.

Specially trained teletypewriter maintenance personnel are stationed at each location to keep teletypewriter equipment operating. Daily routines are necesary to insure that all of the equipment is ready for operation when traffic begins to move. In these remote locations, replacements are not readily available and the practice of using spare equipment cannot be relied upon. It is therefore doubly important that each piece of apparatus be maintained in good working order. Maintenance is a continuous job and is the major consideration now that the construction has been completed.

Teletypewriter traffic over the network is on a tape relay basis; transmission to a distant station is by tape transmitter, using tape prepared locally on a keyboard reperforator or using tape received from other stations on reperforators. Thus traffic from any one of the several stations is readily retransmitted to other stations. The network with associated wire lines tying in related installations is shown in Figure 4.

Operating procedures for radio teletype traffic are covered in Traffic Circular Letters 1, 2, 3, 4, and 6, based on FM 24–8 and FM 24–10. Separate instructions are being prepared for AACS traffic. Personnel trained in this practice are now operating the network on a 24-hour basis.

The experience gained in making these installations has given much added information to the Signal Corps and the radio field in general. Long-wave radio installations are not frequently required and it is expected much will be gained from observing the results of the operation of this network. The designs of long-wave antennas suitable for these installations have been recorded and actual results using these various antennas will guide future installations.

Similarity of terminal teletypewriter equipment installations at the several stations is important. Experience has shown that it is desirable to transfer personnel between stations from time to time. If all equipment is similarly installed, the operation and training problem is minimized as personnel are assigned to new posts.

IMPROVING WIRE INSTALLATIONS

Vertical Crossarms in Italy and Bucket Anchor in CBI Overcome Construction Obstacles

AN OBSERVER who visited the Mediterranean area during March and April 1944 reports the following with respect to wire communications:

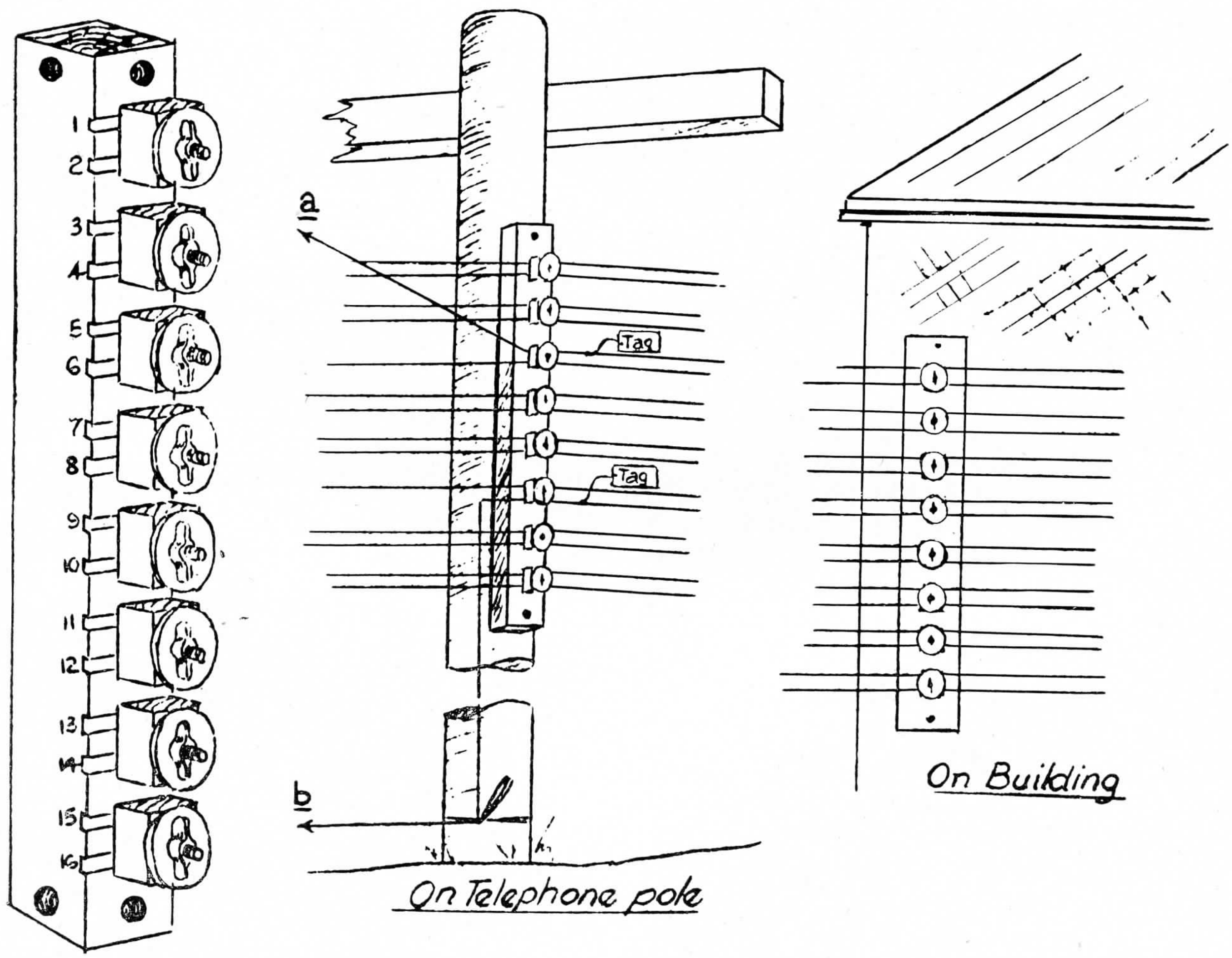
Spiral-4 Cable is meeting with more and more favor. However, open wire construction is generally preferred where conditions permit.

The consensus of officers, who have a good background for their judgment, is:

> Where conditions permit, plowing the cable underground one foot or more deep gives good service. At Anzio, outside of towns, the bulk of communications are thus supplied. These were plowed in with a cable plow.

It is incorrect to assume that slap-bang sloppy construction methods must be assumed as normal and proper in war theaters, even very close to the front. It is also incorrect to assume that good communication channels, telephone and telegraph, are not to be expected because soldiers cannot be trained to properly care for and adjust equipment. Many instances have been observed in this theater of lack of adequate operation and maintenance instructions and lack of spare parts, but few have been observed of poor jobs performed where such were available.

For example, in the Anzio beachhead area, I have seen the best looking installation of field Wire W-110-B of any so far observed in this theater. The communication officer in charge had devised a vertical crossarm with clamps for hold-



VERTICAL CROSSARM USED IN ITALY. LEAD OVERHEAD IS INDICATED BY "a"; LEAD ON GROUND, RUN FROM CROSSARM TO BASE OF POLE, IS INDICATED BY "b."

ing the wires in place in evenly spaced vertical rows. He claimed that shell fragments did less damage to this construction than it did to the usual construction, and that when such damage did occur the wires were more easily repaired.

Open wire lines constructed in this theater, at least, contained practically no intermediate lengths of cable or twisted pair, in contrast with construction in U. S. maneuver areas, where many such lengths have been encountered. The construction observed, both British and U. S., has been good, with wire spacing and wire sag irregularities not at all bad.

In another report information was made available that a Corps Signal officer in the Italian area used an experimental vertical crossarm for stringing field wire. This crossarm was designed by the Corps Signal battalion and provided a simple means for all linemen to install lines in a neat and orderly manner. Figure 1 shows the construction and use of these fixtures.

An experimental installation of this type was constructed along the Anzio-Nettuno road. Along one side of the road 16-position vertical fixtures were installed and along the other side, 8-position fixtures for any additional circuits. Units could use any vacant position on either side of the road.

INSTRUCTIONS FOR USE

The following instructions were issued by Corps Headquarters in the use of this installation:

The Corps Signal Battalion will install the vertical fixtures along the congested routes. Fixtures will be installed on convenient poles or buildings and numbered consecutively in the direction away from Corps headquarters.

All field wire installations along the route or to be installed will be placed on the fixtures by the unit using the wire.

The top notches on the fixtures will be used for through circuits.

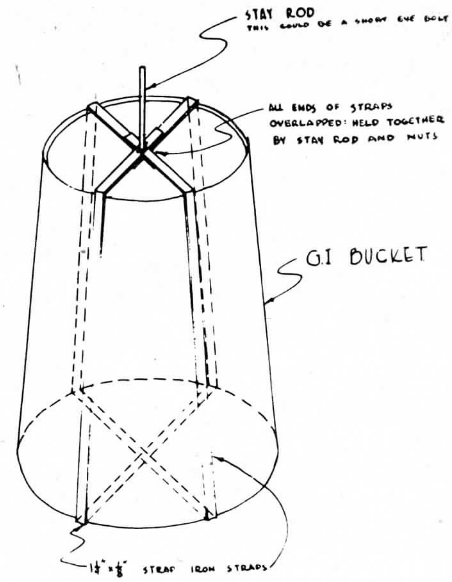
To simplify maintenance for the using personnel the relative groove on each fixture will be used for the same circuit throughout the length of the circuit.

Circuits will be tagged every 10 poles, all units tagging at the same pole.

Abandoned circuits will be removed as soon as possible.

It will not be necessary to obtain permission from Corps headquarters before using the fixtures. The Corps personnel will check the installed circuits periodically to insure compliance with the outlined procedure.

If the results from the experimental fixtures prove satisfactory, it will be adopted for future use. The success of the project depends on how well the using units respond.



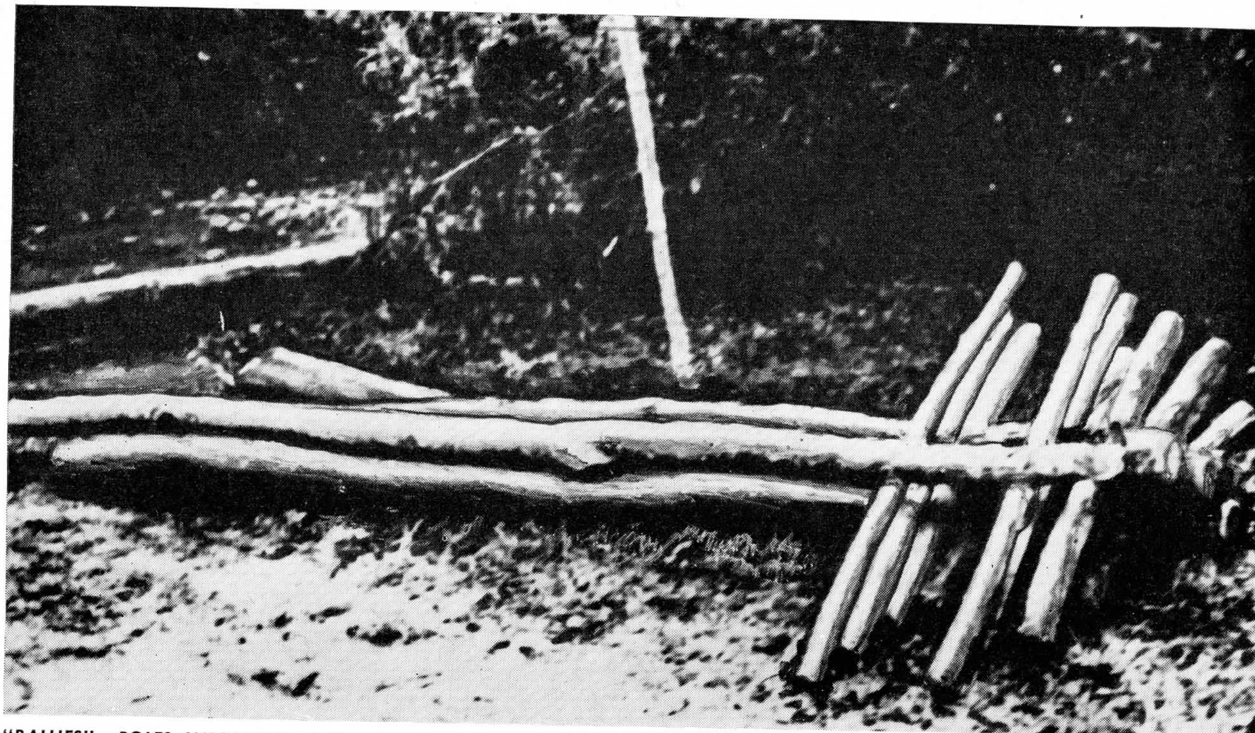
G.I BUCKET SUCTION ANCHOR

The tactical employment and problems encountered in wire installations in the China-Burma-India Theater of Operations is contained in the following extract from an overseas report:

The material for the original report on Communications, Wire Line Construction in Northern India, was gathered on an inspection tour during January 1944.

The Corps Signal units in this area have been faced with many unusual problems in constructing communication facilities and have devised several practical expedients which have been helpful in the construction and restoration of permanent and semipermanent pole lines. The terrain in this area varies from flat paddy land in the Manipur Plain to very rough mountainous country. The paddy land is of dense viscous clay which becomes soft and "oozy" during the monsoon season and extremely hard during the dry season.

The permanent line construction consists of steel poles with iron fittings all of which are standard with the Indian Post and Telegraph Department. The conductors are of 200–300-pound-per-mile copper or of 600-pound-per-mile galvanized iron. When a section of permanent pole line is in trouble it is connected by jumpers of field wire which are laid on the ground at a sufficient distance from the poles to insure their safety while in use during the repairs. The wires are examined on at least four poles on either side of the fault if the original



"BALLIES"—POLES IMPROVISED FROM LOCAL TREES CUT AND TRIMMED IN THE CBI THEATER. THE CROSSARMS, KNOWN AS "BUSH ARMS," ARE LOCAL SAPLINGS.

construction was done by the civil authorities. This is necessary since under civil standards the wire ties are made only on every fourth pole.

POLES DAMAGED BY TRUCKS

Poles which are constructed on the shoulders of mountain roads are being continually damaged by trucks and in some instances by landslides. These roads are winding and very narrow and new lines are now being run cross country whenever possible. The poles sunk in wet clay continually are losing their alignment and in many cases fall due to lack of support. This is especially true along sections where the poles have not had time to settle. The pre-war civil practice has been to install poles and allow them to stand for at least six months before stringing wires. Good footings are secured for the steel poles by means of cast-iron plates. Emergency anchors and guys are used as required to insure stability of the poles and are usually made from local materials.

One type of improvised anchor is called the bucket type suction anchor and has a great holding ability. It is made from a heavy iron bucket with two iron straps fastened so as to encircle the top, sides and bottom. These straps are in planes perpendicular to each other and are joined in the center at the bottom end of the bucket with a stay-rod as shown in Figure 2. The bucket is buried with the open end down to a depth of 18 inches usually in soft mud with a guy wire or rope fastened to the stay-rod. An indication of the tremendous holding power can be appreciated by the fact that 21 men pulled on the guy rope without causing the surface of the mud to quiver.

Semipermanent wood pole lines are generally aligned along the small dikes which separate the paddy fields and which offer a fair amount of support if the loading on the poles is not too great. The poles are made locally and called "Ballies". The wood "bally" applies to any suitable local tree and not to a particular species. The main requirements are those of proper length and proportionate diameter and reasonable straightness. The "ballies" are usually cut to four different lengths varying from 12 to 25 feet and support one or two cross arms called "bush arms." "Bush arms" are cut from saplings or tree limbs.

STEEL POLES FOR CORNERS

The 25-foot poles have been used to carry as many as 16 copper wires weighing as much as 300 pounds per mile with some installations using fourteen 300-pound-per-mile copper wires and two 600-pound-per-mile GI lines. When such heavy loads are carried the corner poles of the line are the standard Indian Post and Telegraph Department steel poles with iron cross arms and fittings.

(Continued on p. 47)

HOW THE NAVY USES SIGNAL CORPS EQUIPMENT

Communications Equipment, Bought by the Army for the Navy, Is Used for Amphibious Operations and at Advance Bases

THAT JOINT Army-Navy operations are established practice in this war is well understood. Not only have overwater landings, such as those in North Africa, Sicily, Italy, the Solomons, New Guinea, and . . . made this clear, but the increasing tempo of warfare in the Pacific has made this method the only one in that area.

Army-Navy cooperation is essential for the success of such operations. That such cooperations exist is implicit in the successes American arms have won thus far. A little known aspect of this cooperation, however, is the use of Army signal equipment by the Navy. A substantial amount of Signal Corps radio sets, and some wire supplies also, are purchased by the Army for the Navy.

The Navy uses this equipment mainly for amphibious operations, when Navy shore parties are operating, sometimes for days, on land. This equipment is also used for Navy advance bases, especially in the Pacific, for shore stations in this country and for major bases in the Atlantic as well as the Pacific.

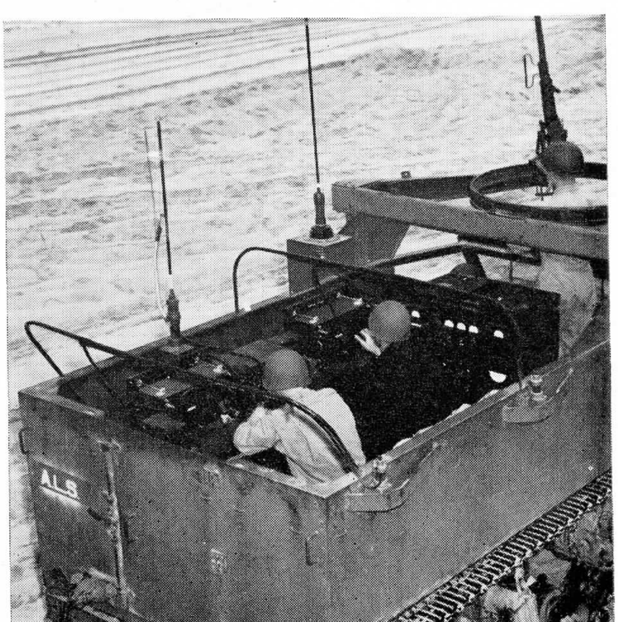
It is the purpose of this article to enumerate briefly the Army communications equipment used by the Navy and to recount the use to which the sea service puts it. No note will be taken of the Marine Corps' use of Army signal equipment, since its operations are akin to the Army's.

Before detailing the use to which the Navy puts this equipment, an account of landing procedures is in order.

Accompanying the first wave of assault troops ashore are two distinct "parties." Both have clearly defined jobs. One such group is the Navy Beach party. The Navy officer in charge of this party is the Beachmaster. In general, the Beachmaster is in control of water traffic to the beachhead. It is his job to bring succeeding waves of assault boats, landing craft with personnel and supplies, *Dukws*, *Alligators*, *Buffaloes*, etc., ashore in the most expeditious and favorable manner possible. He tells the commanders of such craft where to land, when to land, when to leave, and what routes to take to and from the larger transports, standing off shore.

The second such group is the Army shore party. The functions of the shore party are to unload men and supplies, direct personnel forward to the front line, set up supply dumps, feed supplies and ammunition to the combat troops, arrange for beach security, and in general to organize the beach for the best possible prosecution of the operation.

Naturally, both the Beachmaster and the shore party commander have their own communications facilities. However, there is a third group which furnishes communication for both the Beachmaster and the shore commander. This organization is the Joint Assault Signal Company, which, in addition, integrates the communications of the combat troops with higher headquarters, furnishes a radio net to Navy vessels for gunfire support, and another net to either Navy carriers or a more distant airfield, for air support.



ARMY AND NAVY COMMUNICATION MEN WORK SIDE-BY-SIDE ON THIS HALF-TRACK-MOUNTED SCR–299.

BEACH RADIOMEN DIG IN QUICKLY AND MAINTAIN CONTACT WITH LANDING CRAFT THROUGH THE SCR–610.

Since, however, JASCO is set up for land operations, and since most of its personnel and equipment is furnished by the Army, no mention will be made of its part in the use of Signal Corps equipment. Nor will this account include mention of the shore party communications, since it too is Army.

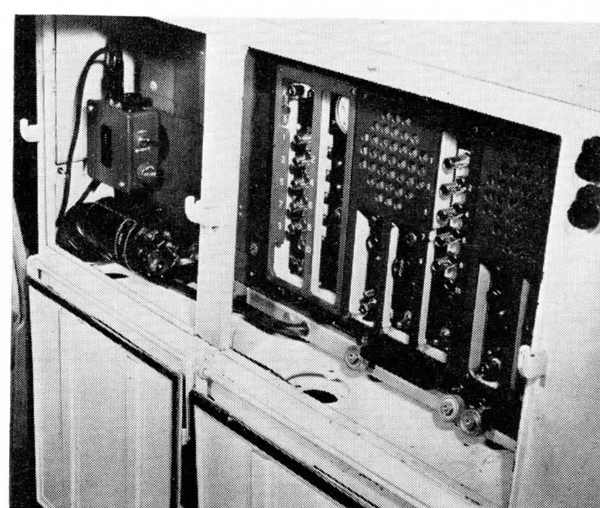
The Beachmaster has a variety of means to accomplish his primary duty—the control of boat traffic. Along with such Navy equipment as blinkers, flags, and radio sets, he uses the Army's portable manpacked Radio Sets SCR–300 and SCR–511. With these sets he has constant communication with the assault boats as they come in bringing more and more combat troops. In many cases the Beachmaster has need to communicate with his assistants at various subdivisions of the beachhead, or with the shore party commander. For this purpose he uses the Signal Corps' 75-watt radio sets—the ground SCR–188 and the vehicular SCR–193.

To control the larger landing craft, the Beachmaster has, mounted in his command car, the 35-watt push button tuning FM operated Radio Set SCR–608. This set communicates with similar equipment on LCI's, LST's and LVT's, or with the same or equivalent sets on the transports. The APA's and AKA's also use these sets for contact with landing craft or with the Beachmaster. Many of the craft that ply between the transports and the beach are equipped with the FM push-button tuned Radio Set SCR–528.

So much for amphibious operations.

At its advance bases, the Navy naturally uses more wire equipment than during a landing operation. Among such equipment supplied by the Army are: the 12-line, portable Switchboard BD–72; the 10-line, portable Teletypewriter Central Office Set TC–3; the reperforator Teletype-

(Continued on p. 47)



THE SCR–508, IN A WATERPROOF CABINET, INSTALLED IN AN LVT.

TIMBER

Logging Is But One of the Jobs Signal Men Do in New Guinea

"SIGNAL CORPS troops will install, maintain, and operate all signal communication within armies."—AR 105–15.

AR 105–15 doesn't tell all that this job may involve. No man, nor no regulation, could foretell all the ramifications of the job of "installing, maintaining and operating communications" in a theater of operations like the Southwest Pacific. It doesn't tell about operating ships, about building roads, about running a jeep railway, about the myriad sideshows clustered about the big tent of combat communications.

It doesn't tell, for instance, about running a logging camp.

Yet that is the job that has fallen to some Signal Corps units like the Second Platoon of Company C, Construction, of the—Signal Battalion.

The Second Platoon of Company C, reinforced by about 20 men from Headquarters Platoon, is a detachment with a strength of 113, that has established its main camp on the side of a hill close to Port Moresby, New Guinea. Its mission is signal construction work at Port Moresby. Its parent company is elsewhere in New Guinea.

The network of communications around Port Moresby requires poles, poles and more poles. Poles for new lines. Poles for replacements. The life span of a native pole in this tropical island where the forces of nature so stubbornly defy civilization is from 3 to 10 months.

Dry rot and insects—ants and termites—devour the insides of the poles. Torrential rains eat away the bases. Furious storm winds buffet them. Unless the danger signs are discovered in time, they crash to the ground with their vital wires, or if they stand in a hollow, they may suddenly shoot into the air as the wires, suspended from higher poles, exert their pull on the weakened ones. Sometimes poles are found dangling a foot and half above the ground.

Poles are like so many items in the advance area that are requisitioned with a welder's torch, or a forge, or an axe, and some ingenuity. When a shortage of poles developed in October 1943, the officers of the Company C detachment got in their jeep and went on a reconnaissance for the material to make them.

They found what they wanted at Uberi, which is a name and a location and little more, with an Air Force logging camp the nearest habitation. But it is a historic name, for it was here, high in the Owen Stanley Mountains about 40 miles from Port Moresby, where the bloody Kokoda Trail begins, that the Japanese made their furthest penetration to a scant perimeter that marked all that was left of New Guinea for the United Nations. It was here that the Australians made their final stand and stopped the headlong rush of the Japs across the face of the Eastern Hemisphere—stopped it and turned it.

It was in this spot that the platoon set up a half dozen wall tents and a canvas mess shelter, converted a light truck into a chuck wagon, left 18 men, and reported itself in the logging business.

The area abounded in black trees of a species that make the best poles. These last from 9 to 10 months.

Permission was obtained from the Australian authorities, and the crew began working along a ridge. As they felled the trees, they cleared a road along the ridge for their trucks. When the road was through, they began working down the slopes, making chutes to each scene of operation.

> The story of the little unit of Signal Corps soldiers cutting poles up in the Owen Stanley Mountains of New Guinea is told here not because the unit is unique, but because it is typical.
>
> There have been, and are, many such Signal Corps projects. One Signal construction battalion cut 4,500 poles in the same vicinity. Company — of the — Signal Battalion cut its own poles for the Lae-Nadzab section of the Markham River Valley Line. There are numerous other instances.
>
> This article simply seeks to tell of a little-known phase of Signal Corps activities in the Southwest Pacific Area.

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When a tree crashes down it is topped (the top foliage cut off), roofed (the top chopped to the form of an inverted V), then a cable is run down from the winch of a truck driven to the brink of the chute. A chain on the end of the cable is fastened to the tree, and the winch drags it up the chute.

When two or three trees reach the ridge, the truck drags them back to the loading depot near camp. There the trees are trimmed of small branches, and lose their last vestige of identity as trees; becoming, henceforth, poles.

They are not creosoted, as has been done in some areas, to protect them from insects. It is the opinion of Second Platoon officers that unless poles can be pressure creosoted to considerable depth, the outer coating is of no avail, since insects penetrate wherever climbers' spikes have made a hole.

Only one officer and one enlisted man of the Platoon had had any logging experience in civilian life, but all soon learned the tricks of the trade—how to work the rip saw, how to swing the axes properly, how to predetermine just where a tree is to fall, how to saw up rather than down through a log braced up on one end so that the weight of the log will spread the cut instead of squeezing it together, thus preventing the saw from being pinched.

Logging is dangerous, especially for amateurs. A falling tree can kill a man—one did when the — Signal Battalion was felling trees between Lae and Finschhafen. A tightening winch line fastened to a log will straighten out with leg-breaking force. But no soldier has been killed or injured on this job.

The platoon commander specified a minimum of 10 poles delivered every day, but the usual number is 12.

Getting the poles back to Port Moresby was a problem. First of all, the Platoon's two-wheel pole trailers would not stand up under their heavy loads on the rough roads. One day a Platoon officer, driving along in his jeep, discovered an abandoned copper mine 20 miles from Port Moresby, and, nosing around the property, noted an old railway line going to rust. That, with an acetylene tank borrowed from the Engineer Corps and some help on the heavy welding from the Ordnance Department, is how the platoon's trailers happened to be reinforced with steel rails. The tires of the trailers couldn't stand the extra strain, so the platoon equipped them with dual wheels.

They have also built a roller on the front bumper of a 2½-ton, 6 by 6 truck, an "A" frame

WORKING A CROSS-CUT SAW AT A SIGNAL CORPS LOGGING CAMP IN NEW GUINEA. THE NATIVES CALL THIS TOOL THE "YOU-PULLEM-YOU-PUSHEM-BIG BROTHER-OF-AX."

of 4- and 3-inch pipe on the back, and a roller on the top of the cab so that a cable from the winch can be run over the top of the truck and off the back, enabling poles up to 40 feet to be set up without the use of pikes.

The 2½-ton trucks are thus able to substitute for K–43 ton-and-a-half construction trucks, which, according to the Signal Officer at Port Moresby, have proved unsatisfactory. Their four wheels are inadequate to support their weight and they buckle in the center, he says. The Base had adopted the policy of having all K–43 frames reinforced by Ordnance, but a 6 by 6 construction truck is needed and even the reinforced four by fours have failed to meet the strain.

The road up to Uberi is a scenic masterpiece and an arterial monstrosity. It passes breathtaking Rouna Falls and its crumbling edges spill over the brink of 1,000-foot precipices. It cuts back and forth like jagged lightning up the side of the verdant mountain. A long stretch of it is built to accommodate only one vehicle and even that design appears optimistic in spots. In bad weather there are flooded areas from mountain streams and mud holes more than hub deep,

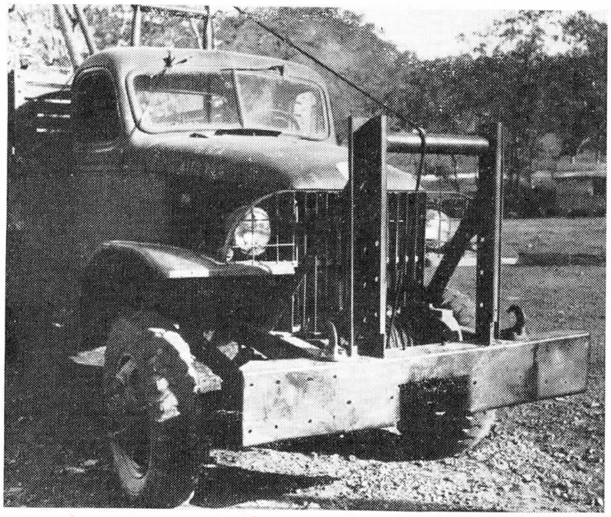
A SIGNAL MAN RIDES TWO FRESHLY CUT LOGS UP THE TIMBER CHUTE.

A TRUCK DRAGS NEW FELLED TREES BACK TO THE LOGGING CAMP.

and the weather in the Owen Stanleys is generally bad. There are no speed laws. None are needed. The slippery terrain and the yawning precipices are natural MP's. At least two Army trucks have gone over the side already. In each case the driver rode them 800 feet to the bottom. One survived, with broken bones. None of the Second Platoon's trucks have been lost.

Ordinarily a two-and-a-half-ton makes the haul, but when the weather is exceptionally bad, the 4-ton truck is sent. Poles more than 40 feet have to be cut short because they are too long to negotiate the 180° turns.

Company A of the — Signal Construction Battalion (Aviation), when it was cutting poles in the same neighborhood, improvised more elaborate hauling equipment. Men of that outfit converted a 1½-ton Chevrolet cargo truck into a tractor on which was mounted a "fifth wheel bunker," with a trailer made from the rear wheels and springs of a Federal truck and a tongue attached from the tractor to the bunker. Company A, operating on a larger scale, lost two loads of poles in 11 months' work that started in November 1942. One went when the tractor and trailer jack-knifed on the steep road at a sharp bend, and the other was dumped when the tractor



ROLLER ON FRONT BUMPER AND CAB ROOF OF CONSTRUCTION TRUCK.

brakes failed and the tractor-trailer was run into the mountainside to avoid going over the brink.

The — Battalion Platoon, after a month, had cut a surplus of poles and the job was called off. But by January 1944, the demand for poles was on again and a new camp was established in the same vicinity but nearer uncut timber. The job has been in progress since.

At this writing, there are 14 soldiers in the camp, with a technical sergeant in charge. An officer visits them every 3 or 4 days. The camp is well policed, despite the mud, and the men are robust and muscular from swinging axes, pulling saws and rolling logs all day. The crews are rotated every month or so, but the men like duty at the logging camp. While the rest of New Guinea swelters in steaming heat, it is always cool at their mountain retreat.

An American soldier of Chinese ancestry is cook and whoever comes in early from logging pitches in on KP. The Signalmen have strung a field wire from the generator in the nearby saw mill and have electric lights.

The Medical Corps, after a survey, announced that the area is nonmalarial. But it is not free of New Guinea's ever-present insects. Some of them, in this area, are thick armored monsters as much as 3 inches long.

The remainder of the Platoon, not engaged in logging, has been erecting radio antenna towers around Port Moresby, including three on Razorback Ridge which the Royal Australian Air Force acknowledged in a letter of commendation it had "rated as impossible."

Razorback Ridge towers 500 feet in the vicinity of Port Moresby, with sides too steep for a man to walk up. Specifications called for three poles with three double doublet antennae, the poles to be sunk in 4 cubic feet of concrete in the solid rock, and supported by four-way guys at three points along each pole, the guys to be anchored each in a cubic yard of concrete.

The Second Platoon estimated it could do the job in a month. The prefabricated poles, 2 by 10 timbers, were hauled to the top in sections.

To haul up the concrete, a sort of "ski-lift" was devised by attaching pulleys to guyed-up trees at the top and bottom, connected by a 6,000-pound strand cable with a cable platform riding it on rollers. The concrete was then hauled up in barrels by the power takeoff on the side of a K–43 construction truck.

The 2 by 10's, weighing 6 tons each when assembled into 80-foot poles, were so limber they had to be pulled up with 1-inch ropes tied at three different places and they had to be pulled up without any slips because if one fell there was no room on the narrow ridge for the men to escape from it.

The Signal Corps troops, working 8 and 9 hours a day, 7 days a week, finished the job a week ahead of their own estimate.

MULTI-CHANNEL RELAY SYSTEM

CORRECTION

The formula for estimating the maximum operating distance between transmitter and receiver of a radio relay system was given on page 51, SCTIL No. 30, May 1944, as:

$$D = \sqrt{2H_t} - \sqrt{2H_r}$$

This is incorrect.

The correct formula is:

$$D = \sqrt{2H_t} + \sqrt{2H_r}$$

MODULATOR ASSEMBLY AN/GRA-1

An Audio Generator Permits the Use of Radio With Sound Ranging Equipment

MODULATOR ASSEMBLY AN/GRA–1 is under development to provide a radio relay system for sound ranging when used in conjunction with Radio Set SCR–610. This modulator equipment is suitable for operation with the present Sound Ranging Set GR–3–C or the new GR–8 and can replace or supplement any wire lines normally required between the sound ranging microphone and the central station recorder.

Sound Ranging Set GR–3–C was designed to detect the sound of artillery fire or shell detonation and record the difference in arrival time of the sound wave at a maximum of eight microphone locations. The microphones may be placed in various geometrical figurations (line, arc, triangle, space array) at intervals up to a maximum of two thousand yards. Either one or two outposts are located forward of the array of microphones at a distance sufficient to intercept the sound wave and start operations of the recording equipment before the sound reaches the microphones.

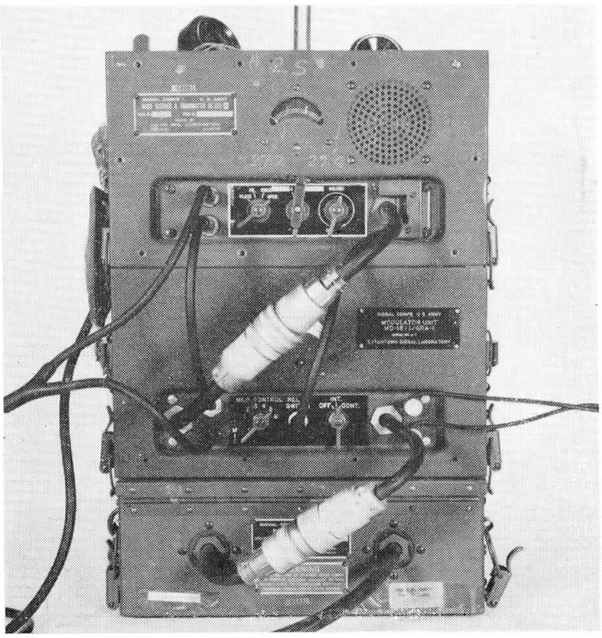
The signal detected by each microphone is locally amplified and normally transmitted over wire lines to a central station where it is recorded photographically by an oscillograph. The record exhibits identifying characteristics of the sound waves and is used for reading the differences in times of arrival of the same sound at the different microphones. From these time differences the location of the operating gun can be determined.

About 10 miles of Wire W–110–B are utilized between the microphones and the central station. The microphone array generally is spread over an area of 10 to 15 thousand yards. The problem of maintaining the wire network is frequently aggravated by troop and vehicle movements across the wire lines, since the sound ranging installation is generally within the combat area. In addition, the time necessary for setting up the sound ranging apparatus is primarily dependent upon the length of time required to lay the wire. In general, a flat terrain provides the most suitable area for the laying of wire. However, in zones similar to the Italian combat areas, sound ranging installations may be required in topography which may not provide more than a mile or two of level ground separated by gullies or mountains.

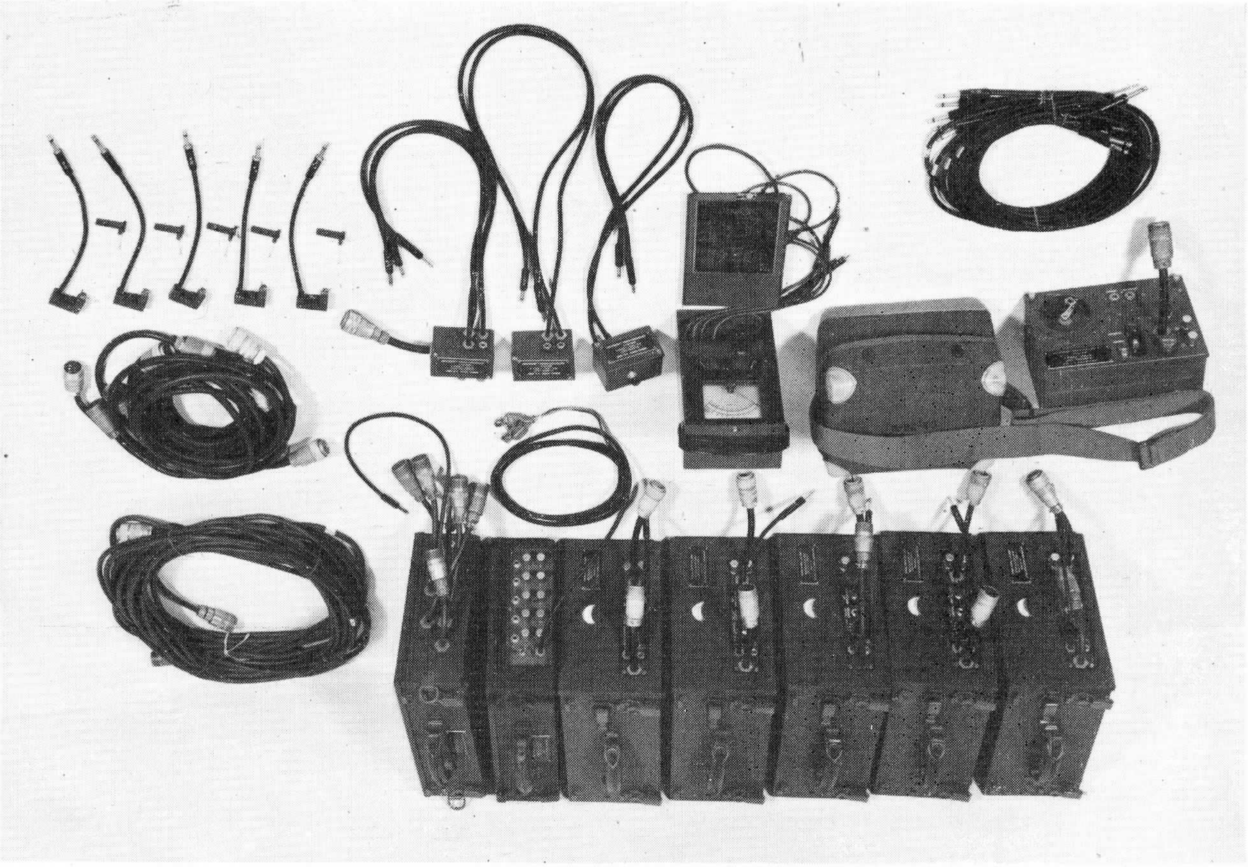
The apparent solution to this problem in sound ranging appears to be the utilization, in place of the wire lines, of a radio set at each microphone position to transmit sound waves picked up by the microphone to a receiver at the recording station, for input into the oscillograph equipment. However, the sound ranging artillery transient picked up by the microphone is of the order of 5 to 25 cps. Accordingly, no standard radio set can be utilized for this purpose since the audio-frequency range of standard Signal Corps radio sets cuts off well above 25 cps.

SOLUTION UNIQUE

With our entry into Italy, the need for a radio relay for sound ranging became increasingly pressing. Although the development of a special radio set for use in sound ranging was possible, the development, procurement, and issue of special new radio equipment is an extensive pro-



MODULATOR UNIT CONNECTED TO SCR–610 AS AT A MICROPHONE POSITION.



COMPONENT PARTS OF AN/GRA–1, WHICH ENABLES RADIO TO REPLACE WIRE IN SOUND RANGING EQUIPMENTS.

cedure. Therefore, as unique stop-gap solution, Modulator Assembly AN/GRA–1 was presented. This equipment includes a modulator unit which generates an audio tone of frequency about 2,500 cps, which is modulated by the subaudio frequencies picked up by the sound ranging microphone. This modulated audio tone is transmitted through any standard radio set at the sound ranging microphone to a similar radio set at the central station oscillograph equipment. A demodulator, also part of AN/GRA–1, filters out the audio tone, and the remaining signal, identical with that picked up by the sound ranging microphone, is then recorded.

By utilizing separate carrier frequencies for each radio channel, the records from each microphone are differentiated and correctly channelized into the sound ranging recorder.

Satisfactory application of the Modulator Assembly AN/GRA–1 in sound ranging is therefore completely dependent upon the standard radio set in conjunction with which the assembly is utilized. It is necessary that the radio set be distortion-free in transmission and reception at about 2,500 cps, the generated audio tone. Further, the radio set should have a range of about five miles or better in order to cover the anticipated distance between any microphone position and the recorder.

Modulator Assembly AN/GRA–1 is equipped with necessary plug connections and accessories for operation with Radio Set SCR–610. Twenty-five models of AN/GRA–1 are being fabricated at the Signal Corps Laboratories for extended service test by Field Artillery observation battalions in overseas theaters. Signal Corps enlisted personnel have been trained in the operation, adjustment and maintenance of these equipments and will accompany the modulator assemblies to the overseas theaters. A number of these modulator assemblies, accompanied by trained personnel, have already been shipped.

SIGNALS ON BOUGAINVILLE

"Trouble" Men Protect Wire Lines—Other Activities of 37th Division Signal Company

THE FOLLOWING information is condensed from the report of the Signal Officer, 37th Infantry Division, on Signal operations on Bougainville 8 November 1943 to 31 January 1944. Tactical operations during this period were of a defensive nature.

Several notable departures from normal field wire construction methods were practiced within this Division. In general all circuits were installed overhead with each circuit appearing in the same relative position on each pole. Circuits were equally sagged. On occasions when cabled field wire was required a cable binder designed by members of the Signal Company was used. It was found that the use of this binder enabled the company to wrap the cable three times as fast as was possible by hand. An expedient which proved valuable in avoiding and restoring interrupted service was the attachment of a trouble man or trouble team to any Seabee or Engineer unit working in the vicinity of any of the Division's wire lines.

The normal divisional wire system was modified in this Division by providing one additional circuit between regiment and battalion switchboards. Direct local circuits provided from G–3 to each regimental S–3 proved extremely valuable in expediting G–3 communications. The Division Artillery had been provided with a Telegraph Central Office Set TC–4 in place of the two Switchboard BD–72 authorized by the Table of Equipment.

The usual difficulties in radio communication in tropical and jungle country were encountered and were partly overcome through the use of flat

THE 37TH SIGNAL COMPANY SWITCHBOARD INSTALLED IN A SANDBAGGED DUGOUT. NOT SHOWN IS THE PYRAMIDAL TENT WHICH ALLOWS NIGHT LIGHTING.

CABLE BINDER DESIGNED BY SIGNALMEN OF THE 37TH DIVISION.

top wire antenna cut to frequency wherever possible.

Following accepted practice the message center was dug in for protection; however, it was covered with a pyramidal tent to permit use of covered lights and provide more room. Scheduled messenger runs were made four times daily to all units of the Division.

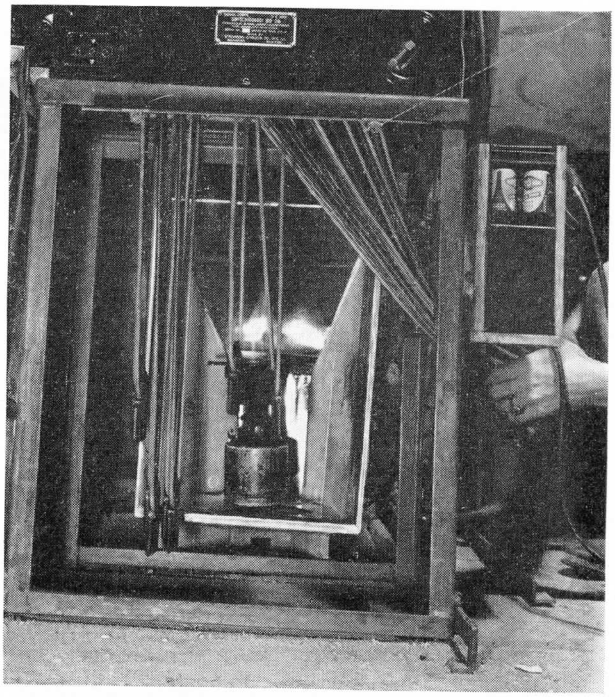
Photographic supplies suffered considerable damage at first due to improper tropical packing. This difficulty was overcome by drying all packaged film, paper, etc., then dipping the packaged items in heated paraffin. Processing difficulties were overcome through the use of an improvised ventilating system. Running water was obtained from laboratory and dark room by the use of discarded gasoline drums and rubber hose.

As in other tropical locations the main sources of trouble in Signal equipment was found to be moisture. Unit replacement of unserviceable items was practiced wherever possible. Periodic servicing of Radio Set SCR-284-( ) and Switchboard BD-71 and BD-72 was accomplished by a scheme of continuous rotation of such equipment between the Signal Company and other units of the Division.

The servicing of switchboards consisted in dismantling the switchboard, drying all components individually in a locally constructed drying oven, boiling cords and cable forms in beeswax; checking of all components and replacement of worn or defective parts followed by reassembly and a complete operating test.

The service routine for Radio Set SCR-284-( ) consisted in removing transmitter and receiver from case, removing cover from the generator and drying each in the drying oven for at least one hour, checks covering generator voltage, loose bushings or end play in the armature, battery voltage, wire insulation, condensers; replacing weak tubes, cleaning corrosion from all wires and connections and cleaning commutators and relay points; resoldering loose wire connections; followed by reassembly, calibration and operating test.

The last step in each routine was painting the outside case. Each serviced item was tagged and dated. Other preventive maintenance practices included placing radio sets in the open to air when weather conditions permitted, greasing of antennae and the use of small stoves or gas lanterns with reflectors placed under switchboards to dry switchboard cables.



TO KEEP SWITCHBOARD CABLES DRY, THIS HEAT-REFLECTING OVEN WAS IMPROVISED ON THE ISLAND.

AIR FORCE WIRE SYSTEMS

Wire Is Used Extensively at Air Bases for Speedy Dependable Communications

THE ARMY Air Forces require tactical communication channels in the same manner as any other component of the Armed Forces. Each commander wishes to be able to communicate directly with his subordinates and his superior. Because wire is generally the most reliable means of signal communication, it naturally follows that the AAF will place primary dependence on wire for their ground channels. In this discussion, the requirements of the smallest tactical unit will be dealt with first and the system will be built up through the group, wing, division, command to the Air Force headquarters. Administrative installations will be briefly mentioned where these tie in with the tectical system.

SQUADRON REQUIREMENTS AND EQUIPMENT

The usual Army Air Force Airplane Squadron contains the following sections:

Headquarters	Photographic
Supply	Radar
Mess	Intelligence
Transportation	Operations
Ordnance	Chemical
Armament	Medical
Communications	Technical Supply
Engineering	

Each one of these sections will want a telephone and will usually persuade the squadron commander to have one installed for them. In addition, there will be a message center, radio station and possibly a control tower that require one or two telephones each. Hence, most squadrons are given a basic allowance of 25 Telephone EE–8–( ) so that the squadron commander may communicate directly with each of his section chiefs. These telephones are served in the squadron by a Telephone Central Office Set TC–12. If not available, two BD–72's or a TC–4 are sometimes substituted.

A squadron also is authorized a public address system, AN/TIQ–3 for squadron announcements.

For communication with its group headquarters and/or a service center, the squadron will employ its Teletypewriter EE–97–( ) or several Telegraph Set TG–5–( ). These may be hooked up in a loop circuit or as a private line depending on circuits available and directives from higher headquarters.

A switchboard SB–6–( )/GG is supplied to make the task of changing a teletypewriter set from one circuit to another only a matter of shifting the plugs of that switchboard.

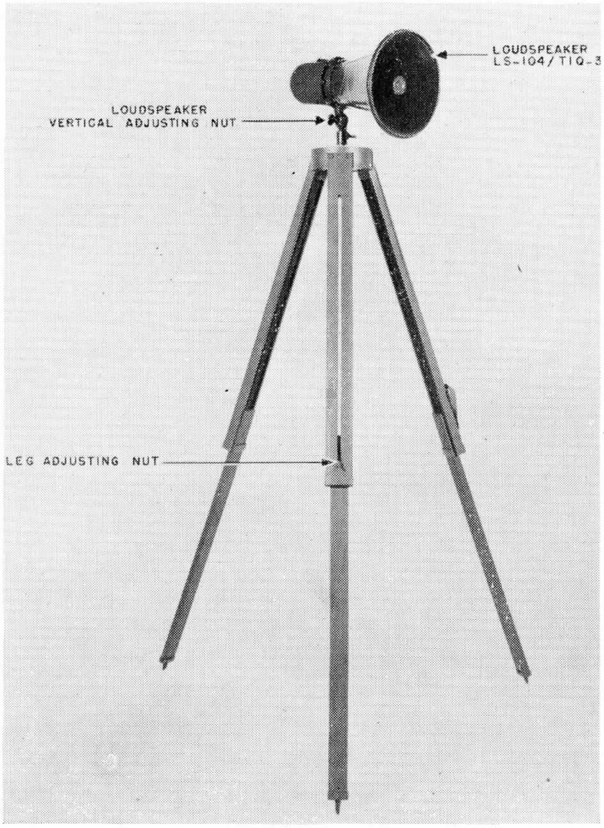
Six miles of field Wire W–110–B are available for making up the outside telephone plant of a squadron.

GROUP REQUIREMENTS

The general number of circuits between a squadron and its group headquarters is two tactical channels. An administrative channel is required so that the squadron may reach its service center. The tactical channel will usually be a physical pair with a simplexed teletype channel superimposed. These channels may be run through a switching central before reaching the group headquarters or service center. It is desirable to have direct circuits in all cases. Squadrons in the Air Defense Command are always connected directly to their control center (area or region) by at least one telephone circuit. These circuits may not be switched.

In case these circuits are long, Signal Corps troops of the Air Force are responsible for their installation. A Signal construction battalion is capable of installing standard open wire line, rapid pole line, spiral four, field wire, and aerial or underground lead covered cable. Air Corps troops are equipped with only Axle RL–27–( ) and a few Reel Unit RL–31–( ) and hence are not capable of constructing field wire lines more than 1 or 2 miles long.

Group headquarters is usually not capable of operating by itself and is attached to one of its squadrons. The squadron to which it is attached will take care of the communication facilities for the group headquarters as well as its own without



ASSEMBLED LOUDSPEAKER AND STAND OF PUBLIC ADDRESS SET AN/TIQ–3.

any additional equipment. (Fighter group headquarters have some radio equipment.) Since only two Teletypewriter EE–97 are provided, the usual hookup for group to squadron will be loop circuits, one connecting all squadrons and another connecting all squadrons with a service center.

WING AND SERVICE COMMAND REQUIREMENTS

The use of teletype becomes more extensive in higher headquarters and teletype switching centrals will be employed. A Telegraph Central Office Set TC–3 will be found at service centers, wings, and higher headquarters. These teletypewriter switchboards may be employed to provide more flexibility in the wire system in the case of group to squadron and group to higher headquarters. Instead of providing a loop circuit for administrative traffic, a separate channel from each squadron to service center may be installed. It must be remembered, however, that in switching telephone or telegraph circuits the switching central must be operated by a superior headquarters or by Signal Corps personnel. The reason for this is that a line depending on switching facilities at another squadron or group headquarters will probably be left "hanging" when that squadron or group headquarters moves out of the vicinity. Superior headquarters switching centrals and those run by Signal Corps troops will not likely vacate an area before a lower unit does. If it does, it will splice lines through and notify all concerned of its action.

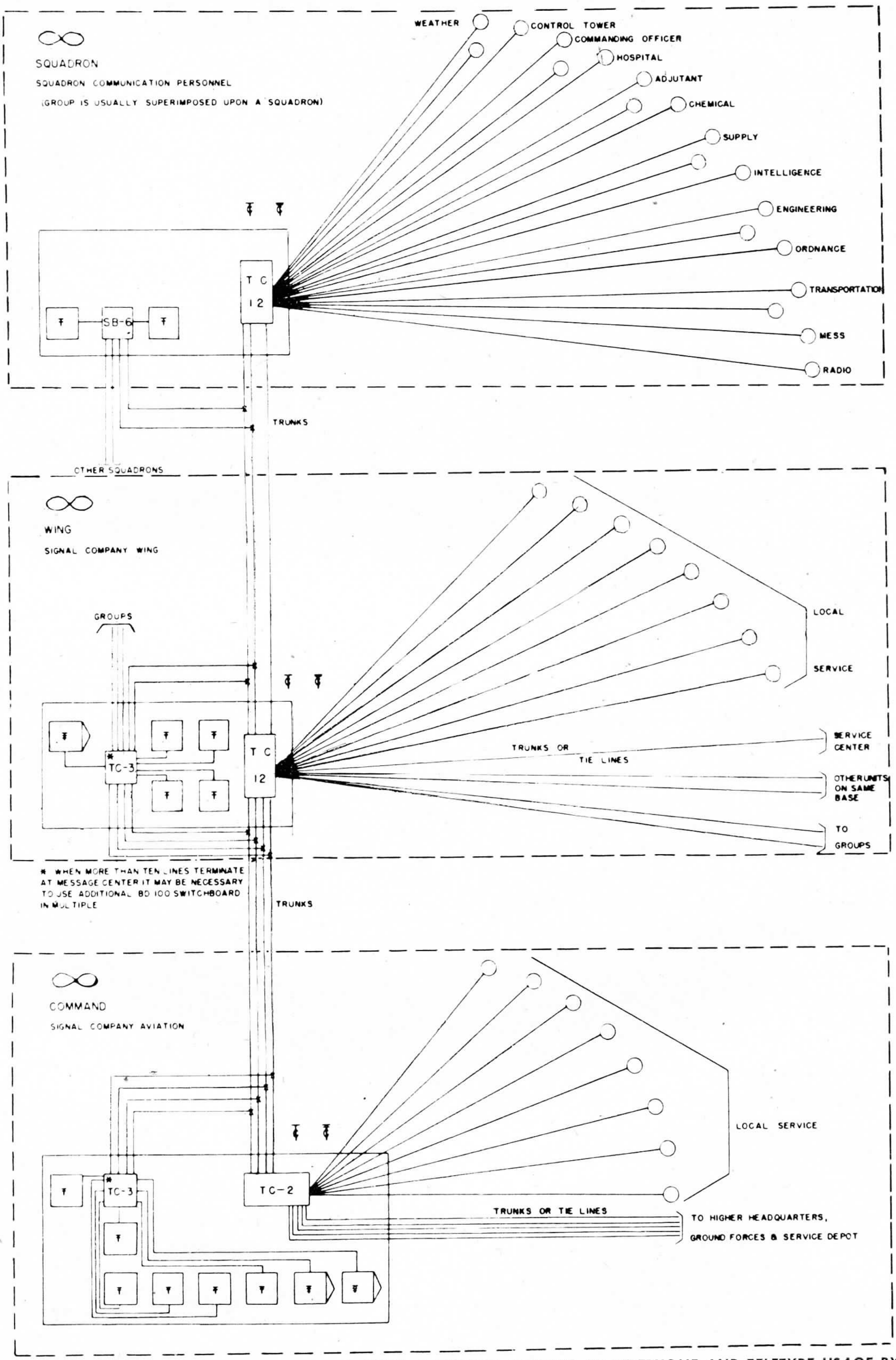
Telephone facilities at all higher headquarters are more extensive than at group and squadrons. At wing headquarters and service centers, Telephone Central Office Set TC–4 or multiplied TC–12's are employed, and in the case of more stabilized situations commercial type common battery switchboards may be used.

Two telephone and two teletype channels are usually required between wing and lower headquarters. Since wing headquarters is served by Signal Corps troops, the switching facilities may also serve for other Air Force installations.

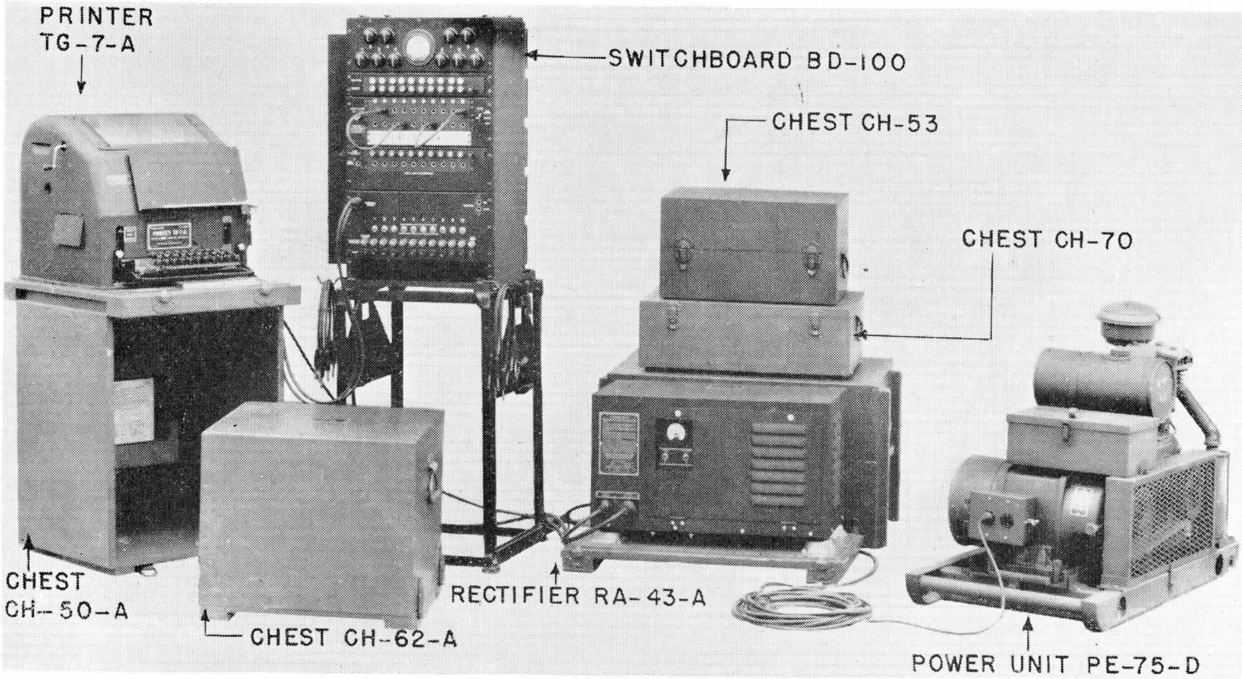
COMMAND AND HIGHER HEADQUARTERS

From command to subordinate headquarters, a minimum of two telephone and two teletype circuits are required. These installations are not likely to move their location frequency and are provided with more elaborate wire facilities. A telephone Central Office Set TC–2 for telephone switching and a Telegraph Central Office Set TC–3 for teletype switching is provided. More equipment may be obtained if the need arises and commercial type common battery equipment may be installed at an Air Force or Air Defense Command Headquarters.

The lines are normally long between command and Air Force headquarters and multiple channels are required. If spiral four cable CC–358 is used the circuits will normally terminate in carrier Telephone Terminal CF–1 and carrier Telegraph Terminal CF–2. In case it is desirable to operate this carrier system on open wire, a packaged Type H carrier terminal is now available, but a Carrier Hybrid CF–7, used in conjunction with carrier Telephone Terminal CF–1 will serve to provide satisfactory operation on open wire. The usual transmission range of CF–1 equipment on spiral four cable using aerial or surface construction is 150 miles. This may be increased to 400 miles by burying the cable. Repeater stations (CF–3) are required every 25 miles.



THIS SCHEMATIC DIAGRAM OF AN AIR FORCE WIRE NET IS A TYPICAL EXAMPLE OF TELEPHONE AND TELETYPE USAGE BY THE ARMY AIR FORCES.

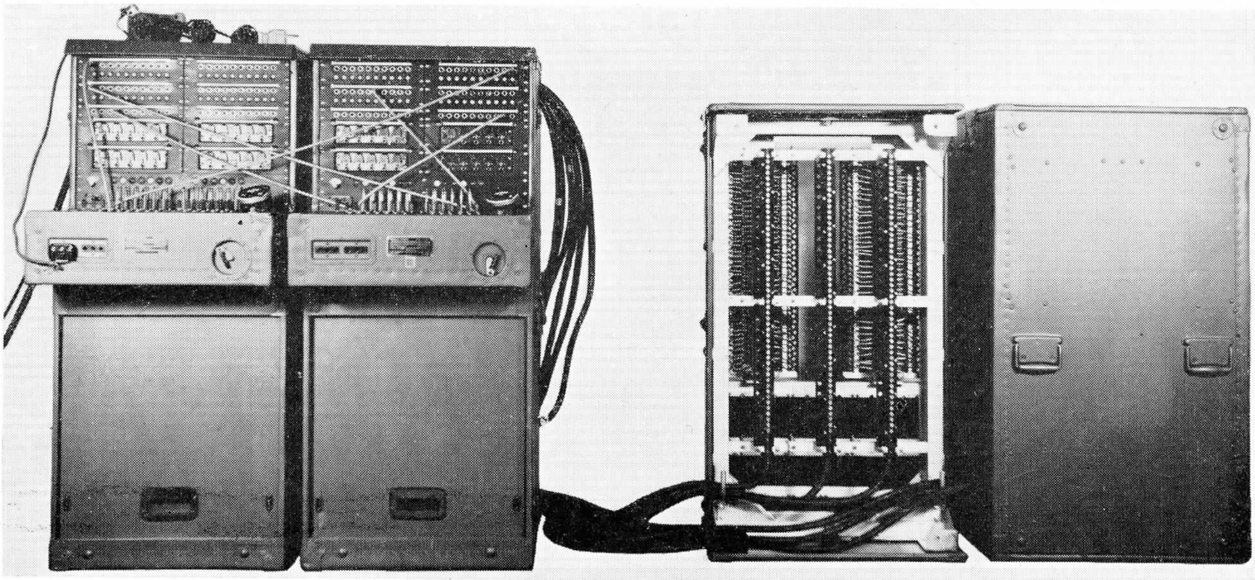


PREPARED FOR OPERATION ARE THESE COMPONENT PARTS OF TELEGRAPH CENTRAL OFFICE SET TC-3.

The transmission range of a carrier system on open wire will vary with the type of line wire used, and the terminal and repeater equipment available. Some idea of relative range can be obtained from the table below. Wire W-153, the wire most frequently used in tactical open wire construction, is .080 copper-steel of 40 percent conductivity. Heavier wire, 104 copper-steel of 40 percent conductivity, may be used in more permanent construction. Other types of wires may also be available. The table is based on high-grade "via" trunks of six db net loss.

Wire	Terminal	Applique	Repeater	Spacing	Range
CC-358	CF-1				45
CC-358	CF-1		CF-3	25	150
CC-358 (buried)	CF-1		CF-3	25	400
W-153	CF-1	CF-7			65
W-153	CF-1	CF-7	CF-3	48	192
104CS(40%)	CF-1	CF-7			97
104CS(40%)	CF-1	CF-7	CF-3	70	280
W-153	Type H				95
W-153	Type H		Type H	73	220
104CS (40%)	Type H				145
104CS (40%)	Type H		Type H	113	340

(Continued on p. 31)



SWITCHBOARD BD-89-A AND CABINETS BE-79 CONNECTED AS ONE INSTALLATION. THESE ARE PART OF TELEPHONE CENTRAL OFFICE SET TC-2.

TRANSMISSION SECURITY TRAINING

Proper Security Pays Off in Lives and Equipment

SOMEWHERE IN North Africa a pilot returning from a bombing mission grows careless and idly "chats" away the security of an airbase. Does the enemy take advantage of this opportunity? Here is an extract from a report on the resulting enemy raid:

"———Airbase suffered surprise bombing. Severe loss of life and bombing planes sustained."

How important is that vital element called radio silence? Like a protective mantle it affords a security upon which might depend success or failure of a mission.

Visualize a tank destroyer battalion moving into position for attack. Radio silence has been ordered. On the left flank of the movement a tank detachment becomes lost in rough and wooded country. The tempo of the attack is fast, and the utmost coordination is required. The officer in charge of the detachment tosses his security to the wind by sending a call to headquarters for bearings. Receiving no answer, he becomes panicky and calls repeatedly. Enemy planes are informed by their radio intelligence of the detachment's whereabouts and lose no time in eliminating the Shermans.

Violations such as these are inexcusable. A low degree of radio transmission security soon takes a high toll in the loss of lives and equipment.

Radio, when properly operated, furnishes a quick and valuable means of communication. It is sometimes the only available method and is highly essential for control of fast moving operations. Radio, however, is the least secure means of communication because it is highly vulnerable to enemy interception. Every time a transmitter is placed in operation it must be assumed that enemy interception takes place. Recognition of this fact alone should make every radio operator security conscious.

An analytical study of consolidated reports from all theaters and commands has made evident the fact that the training of personnel in transmission security has not been sufficient to meet the current security needs of present-day Army communications systems.

Radio intelligence is one of the enemy's best organized means of obtaining information concerning our plans, troop dispositions, and operations. In order to utilize transmission security as an effective countermeasure, a high degree of training for all communication personnel is required. This training must be continuous in order that personnel will be well informed on current procedure and alert to "leaks" provided by deviations from prescribed procedure.

The outline presented in this article is a suggested training course on radio transmission security. Since the reference material available is limited, it is suggested that the instructor use practical demonstrations as much as possible, on the basis of equipment available.

SUGGESTIONS FOR DEMONSTRATIONS

A. Set up at different points in the classroom two radiotelegraph sets. Select at random from the class two operators, each of whom should be given a batch of dummy messages and a schedule, with no instructions other than to send the traffic. Silence must be observed in the classroom so that students may hear the transmissions. As the messages are sent back and forth, violations are likely to occur. The members of the class should be instructed to take notes on the transmissions, particularly observing any deviations from prescribed procedure and any violations in security. When all the messages have been sent, a class discussion should be held to criticize the methods of the operators. The instructor should then discuss with the class the serious consequences that would have resulted from the violations had the transmissions occurred in actual tactical operations. In this way the students are impressed with the fact that violations frequently occur and that operators should be constantly on the alert to avoid discrepancies in procedure and security.

B. Set up one radiotelegraph set screened from view of the class, with a loudspeaker to amplify sounds of code. Appoint three students—A, B, and C, to act as radiotelegraph operators. One

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COURSE *Radio Transmission Security*

Total hours allotted 11

Subject	Scope	Text reference	Method presentation	Total hours
Introduction to radio Transmission Security.	1. Definition of Radio Transmission Security.	TM 11–454, paragraph 129.	Lecture	1 ½
	2. Importance of Radio Transmission Security.	TM 11–454, paragraphs 130 and 136.		
	3. How Radio Transmission Security is achieved.	TM 11–454, paragraph 131.		
	4. Relation of security to other communication requirements.	TM 11–454, paragraph 132.		
(Training Film)	"Radio Transmission Security" (Demonstrates results of failure to observe measures prescribed for security.)	TF 11–2044	Showing of film	¾
Personal Censorship	1. Importance of personal censorship	TM 11–454, paragraph 137.	Lecture	¼
	2. Radio operator's part	TM 11–454, paragraph 133.		
	3. Illustrations of personal censorship			
Radio as a Means of Communication.	1. When and why radio is used	FM 24–5, paragraph 96.	Lecture	¼
	2. Security of radio as a means of signal communication.	FM 24–5, paragraph 96c.		
Monitoring Stations	1. Purpose of monitoring stations		Lecture demonstration.	2¼
	2. Purpose of discrepancy reports	TM 11–454, paragraph 144.		
	3. Practical demonstrations	See suggestion 3		
Net Control Station	1. Responsibility of NCS	TM 11–454, paragraphs 30, 32, and 33.	Lecture demonstration.	1
	a. To insure correct procedure	FM 24–10, paragraph 88.		
	b. To enforce security rules	FM 24–5, paragraph 118.		
Violations and Their Results.	1. Violations listed		Lecture	3½
	2. Dangers of violations illustrated	TB SIG 2	Demonstration	
Conclusion	1. Emphasis on importance of Radio Transmission Security.	TM SIG 2	Lecture	½
	2. Review of all material given in course	All references listed		
Examination [1]	Examination on all material studied in course.		Examination	1

[1] Sample examination forms are available and upon request will be furnished in the desired amounts by the Chief Signal Officer.

operator will be instructed to manifest peculiarities in sending. The other two will be instructed to transmit rhythmically and uniformly in order to emphasize the difficulty of recognizing an operator with a "mechanical fist." The class will be informed that each operator will send the same message containing letters which, if transmitted carelessly, would cause confusion; A transmitting first, B, second, and C, third. The students will listen attentively to each operator and note any peculiarities in transmitting habits. Then the class will be informed that the three operators will repeat the message, but in a different order. The operators will be instructed to transmit in a different order, i. e., B might transmit first, C, second, and A, third. The members of the Class will then attempt to identify each of the operators. Thus it will be illustrated that the operator with characteristic transmitting habits is easily recognized and may jeopardize the safety of his entire unit.

C. In one room, set up a radio net with a net control station and four subordinate stations. In another room, out of earshot of the radio net, set up an intercept station. Students should be assigned as follows:

One to the net control station.

One to each of the subordinate stations.

Two to the intercept station.

The remaining members of the class will be divided into two sections, each section to observe the operations in both the radio net room and the intercept room for a specified period of time. The radio net is given dummy traffic and schedules, with instructions for the operators of two subordinate stations to follow prescribed procedure, i. e., report into the net control station in correct order, authenticate when net is opened, etc., while the other two stations are instructed to deviate somewhat from prescribed procedure. The intercept station will be instructed to intercept all traffic emanating from the radio net. Observers will note discrepencies in sending and receiving, and the valuable information which enemy intercept stations can obtain from such discrepancies as the following: breaking radio silence when not authorized, transmitting unnecessarily or excessively, sending in a controlled net without permission. This demonstration provides good practice for radio operators, is a practical means of illustrating all types of violations, and shows the necessity for Army monitoring stations.

TRAINING RADIO OPERATORS IN SECURITY PROCEDURE

The Enlisted Men's School, Eastern Signal Corps Schools, has put into operation a new teaching technique for training student operators in the importance of security and radio discipline.

A student operator guilty of a violation of security or procedure in handling traffic over a student net, receives a personal letter detailing the violation from the Officer in Charge of the Code and Traffic Section of the School.

The letter refers to the manual by paragraph and page number, where applicable, or indicates condition to be corrected, and demands a reply from the student within 24 hours. The student, in order to make an intelligent reply, must read and study the sections of the manual which have been violated.

The supervision of net traffic which lies behind this system consists of a continuous watch over all student net traffic by student intercept stations. The intercept station also maintains a continuous tape recording of all traffic.

As soon as a violation is observed, a memorandum of it, together with an extract from the tape, is forwarded to the Officer in Charge. He promptly reduces it to letter form, attaches the tape extract and makes arrangements for the student to receive these within 24 hours after the violation has occurred.

This teaching method has emphasized the importance of radio security and procedure in a striking manner. Students have cooperated and have shown that they understand and appreciate the value of the supervision. In addition, the knowledge that the violation will be noted on the student's permanent record card, has contributed much to the serious attention which is given to the replies which are prepared and forwarded to the Officer in Charge.

AIR FORCE

(Continued from p. 28)

Packaged voice frequency repeaters are available for use on the voice frequency channel when Type H carrier telephone systems are employed.

Two telephone and two teletypewriter channels are normally required between command or Air Force headquarters and subordinate headquarters.

In situations where wire is not available or it is physically impossible to install wire circuits, a radio carrier terminal is available. The AN/TRC–1 system provides a means for bridging the gap between two CF–1 carrier terminals when wire is not available. Radio Repeater Station AN/TRCX4 may be used in this system to extend range.

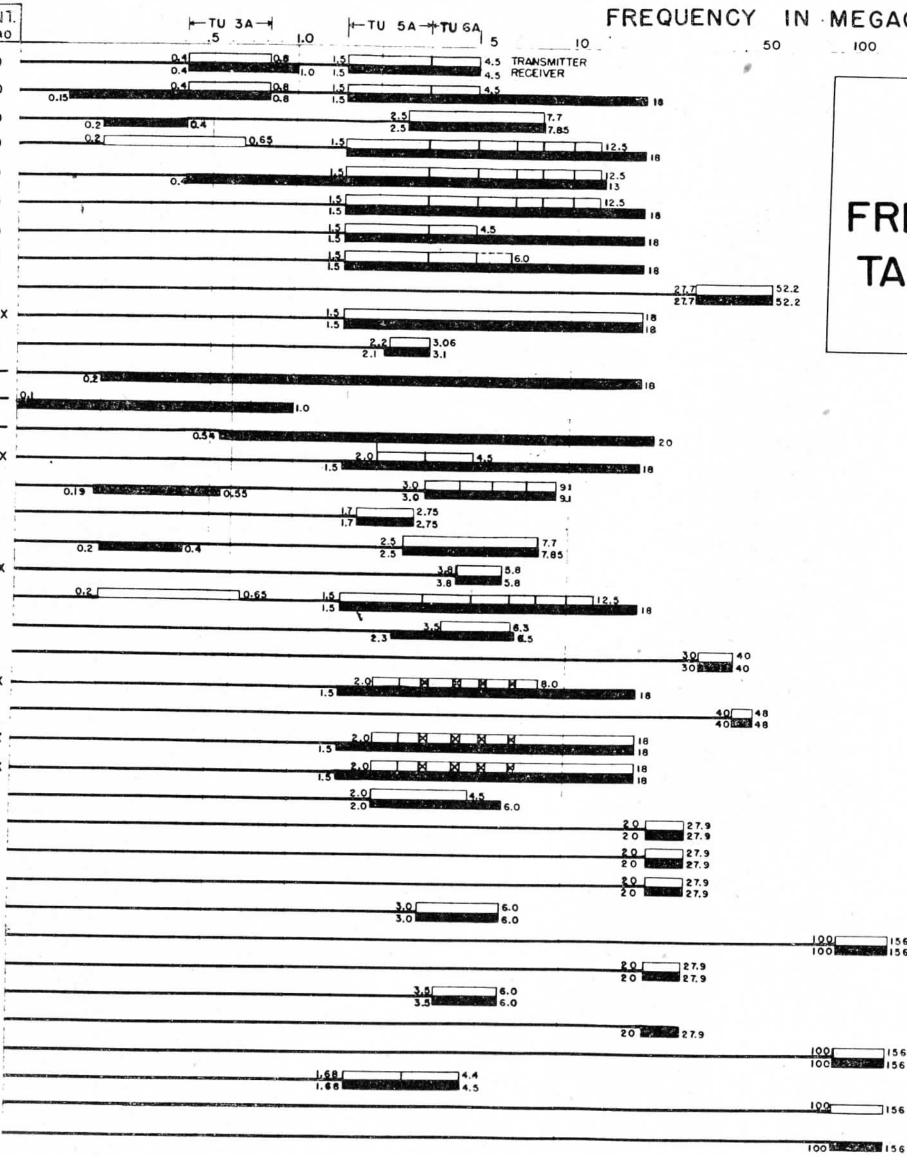
The SCS–5 or the newly developed operations center AN/TTQ–1 is normally used for Air Defense Control Centers and Air Force Tactical Control Centers. This equipment is a system of telephones, switching keys, and switchboards. All telephone, telegraph, radio speech, keying, and control circuits terminate in this equipment.

FREQUENCY COVERAGE TACTICAL RADIO SETS

ARMY SERVICE FORCES
OFFICE OF THE CHIEF SIGNAL OFFICER
WASHINGTON 25, D.C.

SPSOL 440210

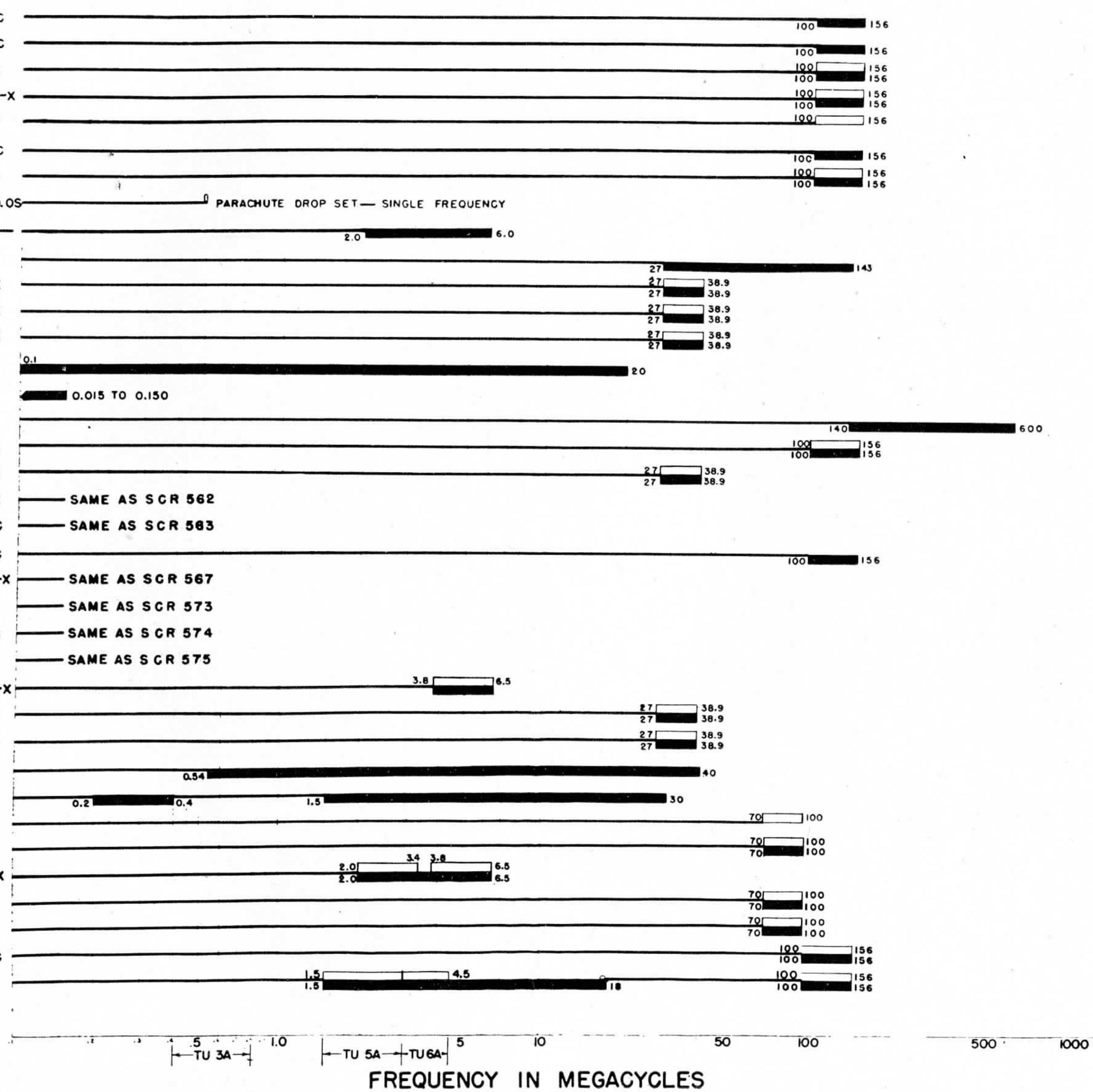
SCR NO.	USE	POWER WATTS	EMIS. A1,2,3	CONT. X-MO
177-A		75	1,2,3	MO
177-B		75	1,2,3	MO
183	∞ LS	2	1,2,3	MO
187	∞ LS	80	1,2,3	MO
188	∞	75	1,2,3	MO
188-A	∞	75	1,2,3	MO
193		75	1,2,3	MO
193()		75	1,2,3	MO
194	OBS.	0.5	3	MO
197	LS	400/125	1,2,3	MO-X
203	LS	7.5	1,2,3	MO
206	LS	—	1,2,3	—
243		—	1,2,3	—
244		—	1,2,3	—
245		10	1,2,3	MO-X
274-N	∞	40/25	1,2,3	MO
281		15	3	X
283	∞ LS	2	2,3	MO
284	LS	20 MAX.	1,3	MO-X
287	∞	80	1,2,3	MO
288		4	1,3	MO
298		25	FM-30	X
299	LS	400/300	1,2,3	MO-X
300		2	FM-30	MO
399		400/300	1,2,3	MO-X
499		400/300	1,2,3	MO-X
506		100/24	1,3	MO
508		25	FM-30	X
509		1.8	FM-30	X
510		1.8	FM-30	X
511		0.75	3	X
522	∞	6	3	X
528		25	FM-30	X
536		0.15	3	X
538		—	FM-30	X
542	∞	6	3	X
543		45	3	X
562		50	2,3	X
563		—	1,2,3	XC



LEGEND

∞	AIRBORNE
LS	LIMITED STANDARD
AM	AMPLITUDE MODULATION
FM-30	FREQUENCY MODULATION *(BAND WIDTH, 30 KC)*
CONT.	CONTROL (TYPE OF)
EMIS.	EMISSION (TYPE OF)
MAX.	MAXIMUM
MO	MASTER OSCILLATOR
X	CRYSTAL
XC	CRYSTAL CALIBRATOR
MOD. OS.	MODULATED OSCILLATOR *(TONE MODULATION)*
TU	TUNING UNIT
SS	SUBSTITUTE STANDARD

564		—	1,2,3	XC
565		—	1,2,3	XC
566		6	3	X
567		50	2,3	MO-X
573		50	2,3	X
574		—	1,2,3	XC
575		6	3	X
578		2.5	2	MOD. OS
593		—	3	—
607		—	AM/FM	
608		35	FM-30	X
609		2	FM-30	X
610		2	FM-30	X
612		—	AM/FM	
614		—		
616		—	AM/FM	
624		6	3	X
628		35	FM-30	X
632		50	2,3	X
633			1,2,3	XC
634		—	1,2,3	XC
637		50	2,3	MO-X
643		50	2,3	X
644		—	1,2,3	XC
645		6	2,3	X
694		25 MAX.	1, 3	MO-X
808		35	FM-30	XC
828		35	FM-30	XC
AN GRR-2	SS	—		
AN GRR-3	LS	—	1,2,3	
AN TRA-1		250	FM-60	X
AN TRC-1		50	FM-30	X
AN TRC-2		20 MAX.	1,3	MO-X
AN TRC-3		50	FM-60	X
AN TRC-4		50	FM-60	X
AN GRC-2		6	1,2,3	XC
AN VRC-1		75/6	1,2,3/3	X



TRANSPORTING SMALL TRAILERS

Pickabacking Is One Way of Packing This Type of Equipment for Movement

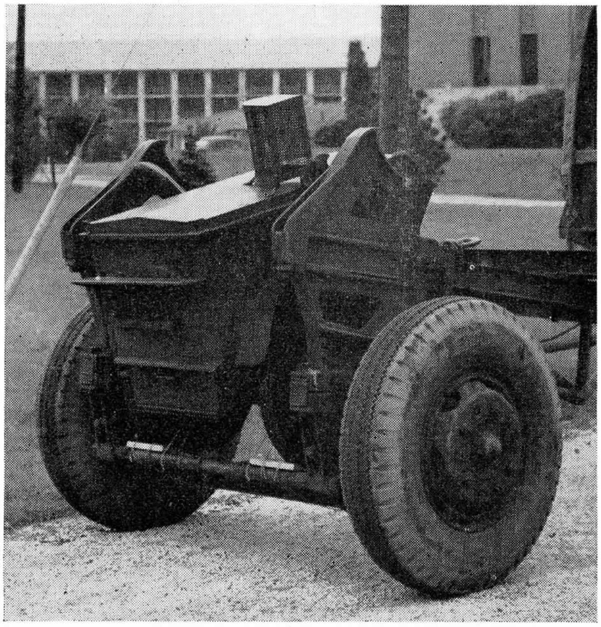
IT MAY often be necessary for a signal construction unit to move long distances in a theater of operations with all of its equipment over primitive roads and across rough country. Specific reference is made to the Signal Construction Company, Heavy, which is equipped with Trailer K–36–( ), K–37–( ) and K–38–( ), various special motor vehicles, and standard cargo and personnel vehicles. The Signal Construction Company, Light, may also be fully equipped with the same vehicles "when authorized by Theater of Operations Commander."

A fully loaded Trailer K–38–( ) (Cable Splicers') will suffer damage to the body and running gear if towed at high speeds or over rough roads because of its small size and necessarily light construction. The following expedient has been devised and is suggested as a means of carrying this trailer when truck transportation is not available. This method can also be used to reduce the space required when loading the equipment on railroad cars and aboard ship.

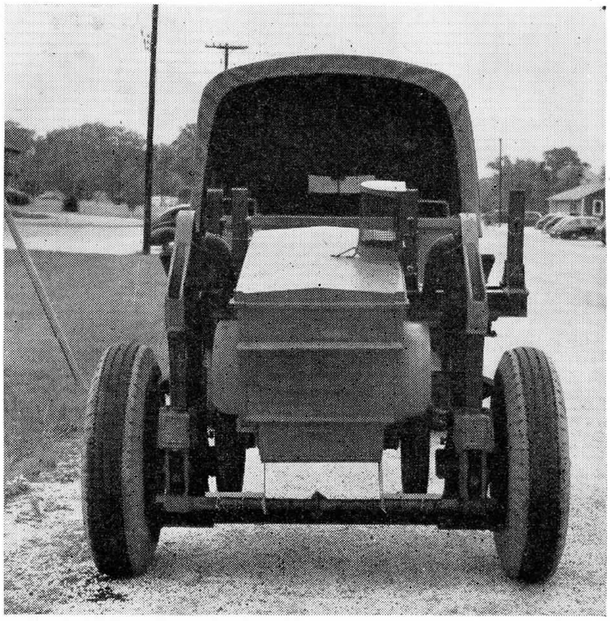
The Trailer K–37–( ) is a combination trailer furnished with accessories for transporting either poles or large cable reels. This trailer is so constructed that a pair of saddles may be mounted on the trailer spring pedestals after removal of the rear bolster assembly. The space between the pedestals is about 45 inches. Trailer K–38–( ) is about 40 inches wide over-all and it will fit into the space between the pedestals, its wheels resting on the axle and cross member of the Trailer K–37–( ). The tongue of Trailer K–38–( ) will lie on top of the front bolster of Trailer K–37–( ).

Trailer K–38–( ) can be loaded on Trailer K–37–( ) in about 15 minutes by three men. Necessary equipment is two wood blocks, 1 x 10 x 12 inches and enough .109 GI wire to make the required ties. Two planks about 1 x 10 x 48 inches would be helpful as skids but are not essen-

TRAILER K–38 AND TRAILER K–37 LINED UP PRIOR TO LOADING. THIS IS THE FIRST STEP IN THE SUGGESTED OPERATION.



THE K–38 IS MOUNTED AND SECURED IN THE K–37 AS SHOWN.



A REAR VIEW OF THE K–38 PICK-A-BACKED ONTO THE K–37 AND LASHED FAST.

tial. The steps required are set forth in detail below:

Raise foot of Trailer K–38–( ) into traveling position and secure.

Have Trailer K–37–( ) attached to towing vehicle pintle, or resting with tongue support on the ground. Bring Trailer K–38–( ) behind Trailer K–37–( ) in such fashion that K–38–( ) tongue points into space between K–37–( ) pedestals. Roll K–38–( ) up into the space, placing the towing eye on top of the front bolster of the K–37–( ). The K–38–( ) wheels will then rest upon the K–37–( ) axle and cross member.

Tie the K–38–( ) towing eye to the K–37–( ) bolster with several turns of .109 GI wire. Raise the K–38–( ) wheels one after the other, and slide a 1 x 10 x 12 inch block under each wheel so that the blocks rest on both the axle and cross member. Make sure the outer edges of the blocks are against the pedestal brackets on the axle.

Using .109 GI wire, tie the K–38–( ) axle to the cross member of the K–37, making sure that the two ties pass between the spring clips of the K–38–( ) trailer and lie against the inside edges of the wheel blocks. Tie both blocks down to the K–37–( ) axle and cross member to prevent fore-and-aft movement. The position of the blocks between the pedestal brackets and the K–38–( ) axle ties will prevent lateral movement.

The Trailer K–37–( ) rear bolster assembly and cable reel spindle are placed on the trailer frame ahead of the Trailer K–38–( ) body and fastened with .109 GI wire. The handles of the stanchions are held up by wire ties to prevent loss of the stanchions.

Attach safety rope to towing vehicle and place Trailer K–37–( ) towing eye in the towing vehicle pintle hook.

The above method can be applied with equal facility to transporting the Corps of Engineers Model 6R50 Mobile Air Compressor when necessary, since the important dimensions of this unit are similar to those of Trailer K–38–( ).

PASS THE AMMUNITION

The Signal Corps Technical Information Letter is ammunition—ammunition for better communications. It presents technical and tactical facts that help Signal officers and men improve the quality of the Signal Service of the Army.

No one would consciously hoard ammunition; yet, if this copy of SCTIL is put in a desk, another Signal man is being deprived of valuable ammunition.

Pass this copy on. Someone else needs the information, too!

NEW GERMAN RADIO EQUIPMENT

The "Bug" and Its Control—Man Packed Radio Set Similar to SCR–300

PRELIMINARY INVESTIGATION of the German remote controlled Type EP3RA radio set used for the "Bug" or Type B–4 tank which first showed up on the Anzio beachhead, indicates the following:

The apparatus consists of a radio receiver and a separate audio filter network. The latter operates on the electronic relay system. The function is to control remotely the vehicle from an external position.

Highlights of the equipment are as follows:

Frequency 24.6 mc.

Intermediate frequency 464 kc. per second.

High frequency oscillator, crystal controlled.

Superheterodyne.

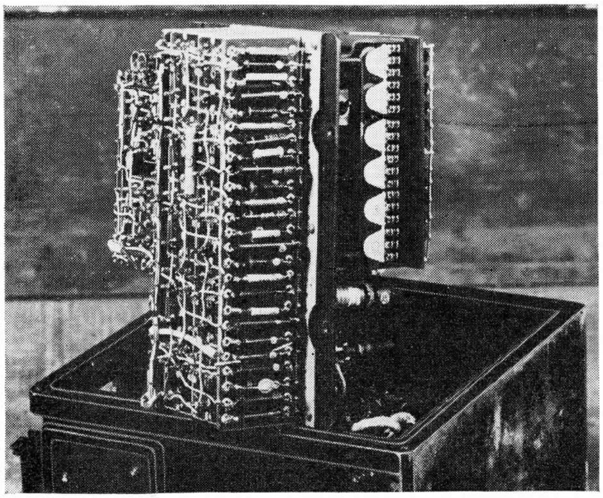
Receiver easily removable and a new unit substituted; consequently, the frequency of operation can be changed in a few seconds.

The audio filter unit, unlike the receiver, cannot be easily removed.

It is not accessible and is very difficult to dismount.

Antenna is a flexible rod, four feet in length, mounted on the front part of the vehicle.

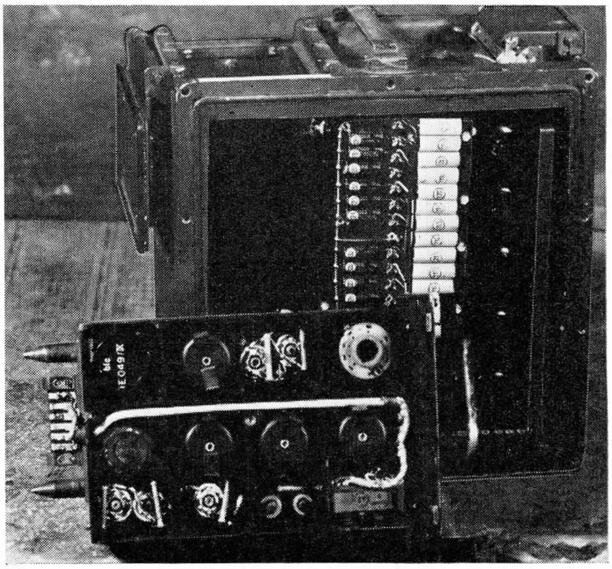
When a signal, modulated by an audio frequency that will pass through one of the tuned audio circuits, is received, it is amplified and fed to the proper grid circuit. The signal changes the bias of the particular tube until sufficient



AT THE TOP RIGHT OF THIS AUDIO FILTER SYSTEM ARE THE SIX RELAYS.

current flows in the plate circuit to excite the proper relay.

There are six of these circuits and relays. They control external circuits by means of a 20-contact connector at the top of the housing. In turn,



TO THE LEFT OF THIS UNCOVERED RECEIVER ARE THE CONNECTOR AND LOCATOR PINS.

these, external circuits control the hydraulic system which operates the tank controls.

The vehicle is driven to the point of departure by means of push buttons on the master control position. There are three buttons on this unit: Start, Stop, and Remote Control. The driver dismounts after having set the master control to the remote position. The vehicle is then operated by means of a transmitter which is modulated by various oscillators, or an oscillator having several tuned circuits.

No attempt was made by the enemy to destroy the tank or the radio control apparatus.

This is a brief description of the components of this apparatus and its method of control. Further study is now being made in this country at Signal Laboratories.

NEW MAN-PACKED SET

For short range "company to battalion" and "observation post to battery" communications the Germans have heretofore been using the Torn. Fu.f and Fu.b, two-man walkie-talkie radio sets, that weigh more than 80 pounds. Because of this weight and also the use of critical materials, a new set was designed and is now being used by the German Army. It is known as the Torn. Fu.g and is a one-anm pack set similar to our Radio Set SCR–300.

The Fu.g can be used in a stationary position or on the move and can communicate with any other set of comparable frequency range. When stationary, or moving with a whip antenna, it has a range of 15 miles on W/T and 7 miles, R/T. When the operators at both ends are prone with set on back using whip antenna, the Fu. g has a range of approximately 7 miles for W/T and 3.5 miles for R/T.

Two-way telephony and telegraphy (CW) are both possible in a stationary position and on the move.

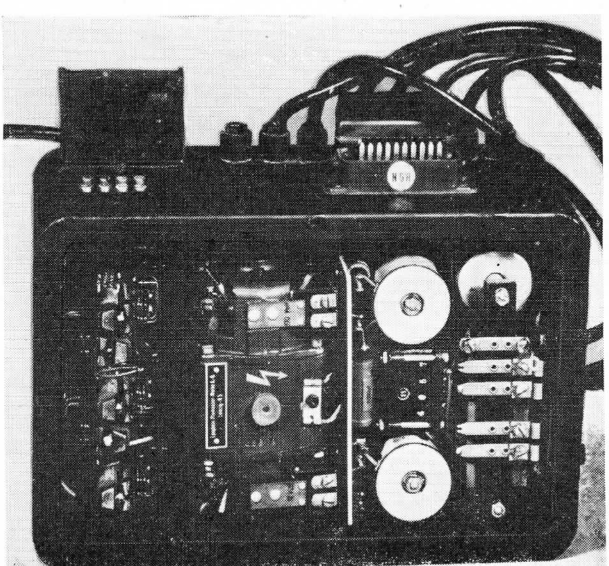
The frequency range of Fu.g is 2,500 to 3,500 kc., approximately 85–120 m. The transmitter is MOPA and does *not* have a crystal controlled oscillator. There is no arrangement for pre-set frequencies.

The unit is powered by one storage battery and a built-in vibrator unit. The battery capacity is about 15 hours. It weighs about 36 pounds.

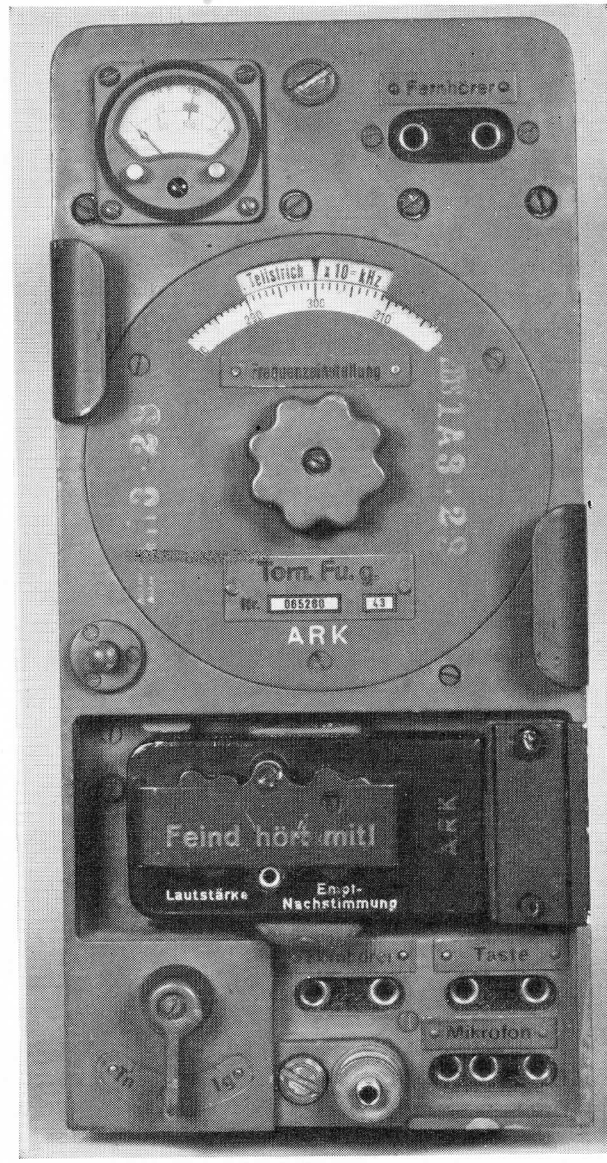
The following special instructions are issued to using German troops:

(a) While sending or receiving, the aerial (whip) must not touch trees, bushes, etc., or communication will be interfered with.

(b) On the march through thick undergrowth or under trees with low hanging branches, the greatest care should be taken of the aerial tuning coil. If it gets damaged, the set is quite unusable. Therefore use no force if the aerial gets caught in branches, etc.



REAR VIEW OF MASTER CONTROL RECEIVER BOX SHOWING POWER SUPPLY AND AUDIO FILTER UNIT.



THE TORN. FU.G, THE NEW GERMAN PACK RADIO SET.

(c) If the substitute aerial for the whip is being used (rod sections) especial care must be taken when passing through the woods, or, when possible, the aerial rods will be removed until it is necessary to enter into communication.

(d) If it is necessary for the operator to lie down while in communication, the aerial tuning will be upset. Even with the lid on, one sees that the aerial current reading has noticeably decreased. When maximum range is desired always retune the aerial for maximum deflection. The same applies when the operator gets up again. At shorter ranges, retuning is not necessary. It is simpler to compensate for a reduction of volume by tuning up the volume control.

EQUIPMENT NOTES

SIGNAL CORPS BOARD

CASES APPROVED BY THE CHIEF SIGNAL OFFICER

Case No. 542—Service Tests on Synthetically Insulated Wire W–110–B

The Signal Corps Board in collaboration with other agencies made a study of the comparative ability of field wire insulated with Buna S synthetic rubber to serve as a substitute for field Wire W–110–B. The agencies included the Infantry Board, Field Artillery Board, Mountain Warfare Board, Desert Warfare Board, and the 100th Infantry Division. The conductors of the wires tested were identical to that of Wire W–110–B.

The critical situation in regard to the available supply of rubber during 1943 made it evident that a synthetic insulation must replace the natural rubber used in Wire W–110–B. Development work indicated that Buna S approaches the properties of natural rubber in chemical structure and in physical and electrical characteristics more closely than other synthetics, which makes it especially suitable as an insulation.

It was found that compounds of Buna S could be made to possess good electrical characteristics but exhibited inferior physical properties, or, conversely, could be produced with poor electrical characteristics and good physical properties. Two compounds were developed which appeared to have suitable electrical and physical properties but excelling in neither. Five hundred miles of development field wire were produced using one compound and five hundred miles using the other, all wire being furnished in 1-mile lengths and manufactured substantially in accordance with the specification for standard W–110–B.

The Signal Corps Board conducted preliminary service tests in order to compare the electrical characteristics of the two development types with that of standard Wire W–110–B. The information obtained from these tests was used in preparing specification 71–478–E embodying Buna S insulation. Meanwhile the agencies were conducting tests on the two development types. The extended service tests were conducted to obtain information regarding:

Electrical charactertistics.

Telephone transmission qualities, either loaded or nonloaded.

Mechanical and handling properties.

Aging properties.

The reports from the various agencies were evaluated and confirmed previous findings.

Twenty-five miles of field wire, manufactured to specification 71–478–E, were given a limited service test by the Signal Corps Board. This wire showed no appreciable difference in handling and mechanical qualities when compared with rubber insulated Wire W–110–B.

During the tests conducted by the Signal Corps Board, low insulation resistance faults were experienced on the surface lines of both the Buna S insulation and standard rubber insulated wires due to splices leaking during wet weather. When Wire W–110–B is prepared for splicing according to the instructions contained in paragraph 185 b (3), FM 24–5, Signal Communication, a 4-inch section is crushed and 3½ inches of insulation and braid removed from the conductors. The faults were due to ruptures in the one-half inch section of insulation remaining.

The ruptures were eliminated by crushing this section lightly using only enough pressure to loosen the braid. The loosened braid was then pushed back over the one-half inch section exposing only undamaged insulation.

As a result of the tests the Signal Corps Board concluded that wire manufactured to specification 71–478–E is the best substitute for standard rubber insulated Wire W–110–B known at the present time.

The approved recommendations in this report provided for the recognition of wire manufactured to this specification as meeting the approved military characteristics for field Wire–110–B and for the inclusion in the next revision of film strips and training literature of precautions to be observed in splicing field wires when using the methods outlined in FM 24–5, "Signal Communication".

Case No. 546—Service Test of Field Wires With Over-All Braid

The Signal Corps Board studied and tested three development types of field wires, each having a braid over-all instead of a braid on each conductor. Two of the types, one of which is twisted pair, the other a parallel lay construction, had stranded conductors identical with W–110–B. The other type was composed of a parallel extruded pair of solid copper conductors each having a diameter of .0401 inches (No. 18 AWG), with a lead foil paper shield and cotton braid over-all.

Laboratory tests on the development types had indicated that wires with a over-all braid are superior to the standard Wire W–110–B in electrical stability under wet and dry conditions and in resistance to crushing. It also appeared that production facilities might be increased if the over-all braided type field wire were produced since only one braiding operation would be required to cover both conductors instead of a separate operation for each conductor of the pair.

The purpose of the test was to determine under field conditions the relative advantages and disadvantages of the development types when compared to the standard Wire W–110–B.

The Signal Corps Board constructed a 10-mile ground loop of each of the three development types of wire in the vicinity of Fort Monmouth, N. J. A 10-mile loop of Wire W–100–B was already available along the route used and was employed as a control facility for comparison with the test loops.

The facilities established were subject to frequent transmission, insulation and noise tests in addition to normal maintenance and trouble clearing procedures. Tests and studies were made of the handling, laying and tying properties as well as splicing techniques and the effects of traffic abrasion.

The results of the service test showed that the development types with over-all braid were slightly superior to standard wire W–110–B in electrical characteristics and resistance to abrasion but were inferior to handling, tying and splicing properties. The Signal Corps Board concluded that none of the development types tested possess sufficient advantages over the standard field wires to warrant standardization.

GROUND SIGNAL

CRYSTAL KIT MC–535 AND MC–537

Crystal Kits MC–535 and MC–537 for use with Radio Set SCR–694–( ) were classified as standard in April 1944. Crystal Kit MC–535 provides a crystal pool for the Infantry division and similar units. Crystal Kit MC–537 provides a kit of crystals for training purposes.

Radio Set SCR–694–( ) can be master oscillator controlled or preset on two crystal channels, and no crystals will be issued as component parts of the radio set. There are 270 crystal controlled channels available, spaced at 10 kc. intervals throughout the frequency range of Radio Set SCR–694–( ).

Crystal Kit MC–535 comprises three each Case CS–140, each case containing 900 crystals in Crystal Holder FT–243. Ten duplicate crystals are provided on each of the 270 channels which are available throughout the frequency range of 3,800 to 6,490 kilocycles.

The basis of issue of Crystal Kit MC–535 appears on tables as follows: T/O and E No. 11–7, 11–16, 11–200–1 and T/A No. 11–2.

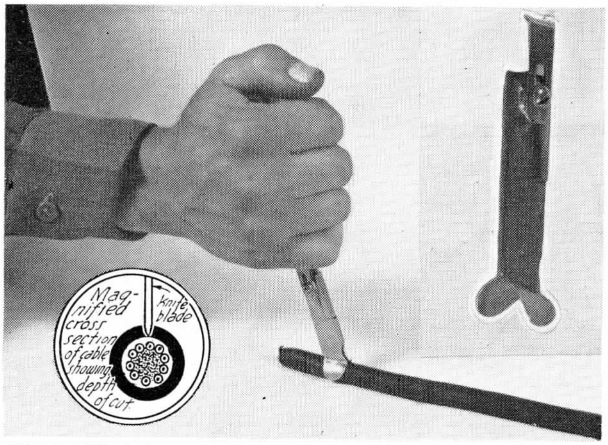
Crystal Kit MC–537 comprises two each Case CS–137, each case containing 100 crystals in Crystal Holder FT–243. Ten crystals are provided on each of 20 channels for operation of Radio Receiver and Transmitter BC–1306–( ) on frequencies in the band of 3,800 to 6,490 kilocycles. For training purposes the crystals will be issued separately from the sets to replacement training centers.

The basis of issue of Crystal Kit MC–537 appears on tables as follows: T/A 6–1, 6–2, 7–1, 7–2, 7–4, 7–5, 20.

TESTING OF WIRE W–143

Headquarters, Fifth Army, has reported that a considerable amount of trouble has been experienced with Wire W–143–T5 by Army Signal units in that theater as a result of the use of pointed test picks or test clips on this wire.

Prior to standardization some Wire W–143 was manufactured with a lead foil shield and was designated Wire W–143–T5. Due to the shielded construction of this wire, pointed test picks or test clips should not be used in connecting test equipment to the line at points where the braid and shielding tape have not been removed. The passage of the test pick or the point of the test



GUIDE SHIELD CONTROLS DEPTH OF CUT WHEN SLITTING CABLE INSULATION.

clip through the shielding tape tends to cause cones of the lead foil to come in contact with the conductors resulting in a high resistance path or direct short between the conductors of a pair.

Wire W–143 now being procured has a carbon back paper shield of relatively high resistance in which the above condition will not be so pronounced. However, since Wire W–143 is intended for use in long-range voice frequency circuits, the repeated use of pointed test picks or test clips along the line produces leakage points which greatly diminish the range and quality of transmission. These punctures also are potential sources of grounds in wet weather.

Tests therefore should be made on Wire W–143 only at terminal strips, splices, or at loading coil connections. Test points consisting of terminal strips should be installed as required, usually at 4- or 5-mile points. If Loading Coils C–114–( ) are employed, they may be used at test points.

SPLICING FIELD CABLES

The rubber jackets on Cable WC–534 (5-pair), WC–535 (10-pair) and WC–548 (spiral-four) are tough and extreme care must be taken when cutting the jacket lengthwise to prevent the conductor insulation from becoming punctured. The depth of the slit may be controlled by a handy device developed by the Signal Corps Board. This device is used in slitting the outer covering of field cables in preparation for expedient splices as outlined in paragraph 22, TM 11–371.

The material used is easily obtainable and any lineman can make this device with simple tools.

It is believed that the illustrations and blueprint of the pattern are sufficiently clear to give an idea of how the device looks and is used.

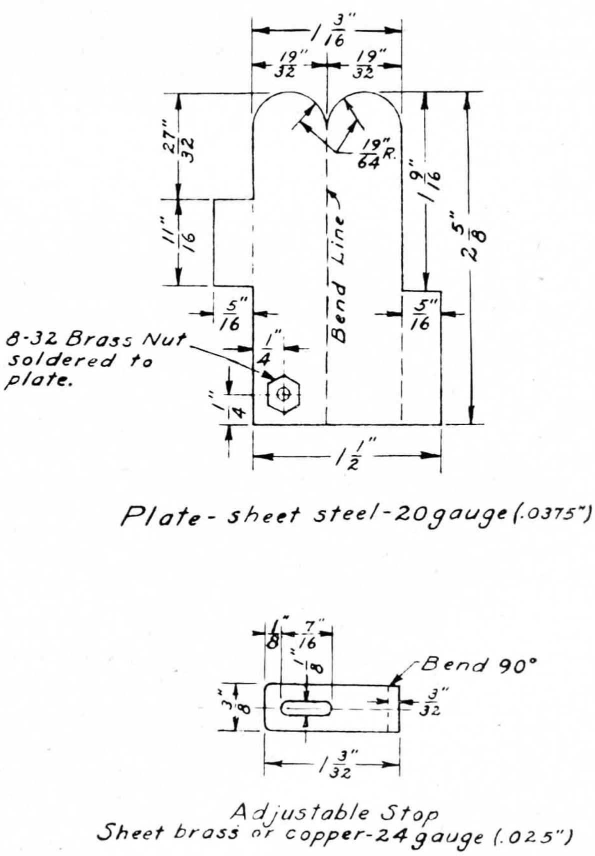
Its major advantages are safety to the lineman and definite adjustment as to depth of cut which prevents damage to the conductors.

PLIERS TL–107

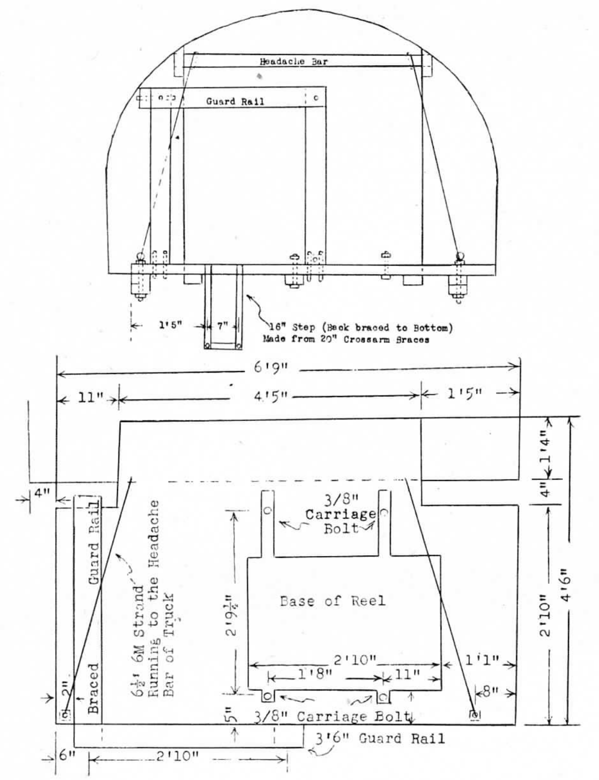
Troops in the Mediterranean area have materially reduced losses of Pliers TL–107 by welding a loop of heavy wire to the inner side of one of the handles of the pliers and tying a thong to the loop. The other end of the thong is tied to the belt of the lineman who uses the pliers.

TRUCK PLATFORM FOR REEL UNIT RL–26–A

To permit the practical use of Reel Unit RL–26–A on construction truck K–43–( ) one Signal construction battalion in the Mediterranean area built a platform of 2-inch lumber at the rear of and extending behind the truck. This was necessary since it is impossible to place and remove the reel axles when the RL–26–A is inside the truck, according to a report in the May *Monthly Bulletin*, issued by the Chief Signal Officer, AGHQ.



PATTERN FOR MAKING SHIELD FOR KNIFE FOR USE IN SPLICING FIELD CABLES.



DRAWING OF PLATFORM FOR MOUNTING RL–26–A ON CONSTRUCTION TRUCK. UPPER SKETCH IS REAR VIEW TO SHOW METHOD OF BOLTING.

The platform with RL–26–A is easily removed from the truck when not required by disconnecting the upper ends of the supporting guy strands. The platform rests on the bed of the truck and against the rear of the chassis. It is not bolted to the truck.

Reel Unit RL–26–A is bolted to the platform, leaving a 6-inch margin at the right and rear of the platform. This allows ample room on the left to operate the reel unit and to enter or leave the truck. This arrangement also leaves the entire bed of the truck free for men and material.

MODIFICATION OF REEL RL-17

In accordance with the approved recommendations of the Signal Corps Board (Case No. 440, Supplement II), the procurement information for Reel RL–17 has been revised to include plate shields on each of the four guard pins of the reel in order to eliminate kinking of the wire.

Inasmuch as reports from the field indicate that means are being improvised to overcome this difficulty, a drawing of the plate shield to be provided in future procurements of Reel RL–17 is reproduced below. It is believed that this plate shield can be made from materials available in the field.

AIRCRAFT RADIO

KEEPING WATER OUT OF MICROPHONE ANB–M–C1

Difficulty with Microphone ANB–M–C1, due to moisture penetration, has been reported recently. This moisture, caused apparently by high-altitude condensation, is forced around the side of the microphone into the cavity of Oxygen Gas Mask A–14 and thus into the microphone unit through the pressure-equalization hole in the rear of the unit.

Before Microphone ANB–M–C1 is installed in the mask, a small pressure-relief vent *must* be provided between the microphone cavity and the outside atmosphere. Such a vent is necessary to the proper functioning of the microphone at various altitudes, and will help prevent microphone failures due to the passage of moisture from the interior of the mask into the interior of the microphone unit.

A clean hole of .020-inch diameter will provide a sufficient leak. Under no conditions should the hole be greater than .030-inch diameter. The necessary hole should be burned through the back wall of the microphone cavity in the location and manner described below:

To locate the hole push the rubber suspension strap nearest the microphone cavity down until its bottom edge touches the top of the bulge which covers the exhalation valve (marked "A" in fig. 1) and merges with the lowest part of the microphone cavity. To hold the strap in this position, it must be cemented in place. Clean the under surface of the upper suspension strap and the outer surface of the microphone cavity with naphtha. Allow to dry, then apply rubber cement to the under surface of the upper suspension strap along the area which rests upon the surface of the microphone cavity. Secure the strap in place. Allow at least one-half hour for the cement to dry prior to using the mask.

The hole should then be made approximately three-sixteenths inch above the upper edge of the strap along the vertical centerline of the microphone cavity and the nosepiece.

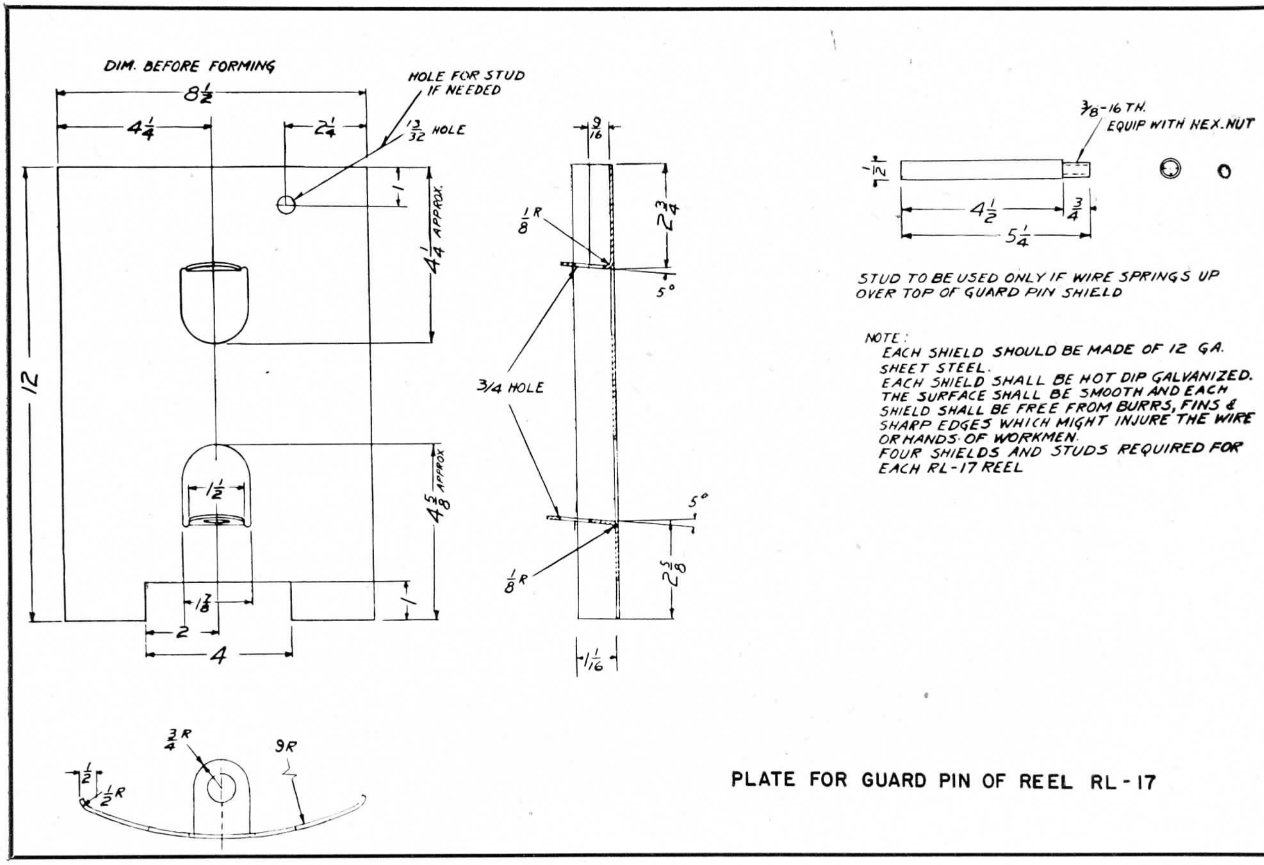


PLATE FOR GUARD PIN OF REEL RL-17

Heat any one of the following items to a dull red:

Stiff copper wire, AWG No. 21 (0.029-inch) through No. 24 (0.020-inch).

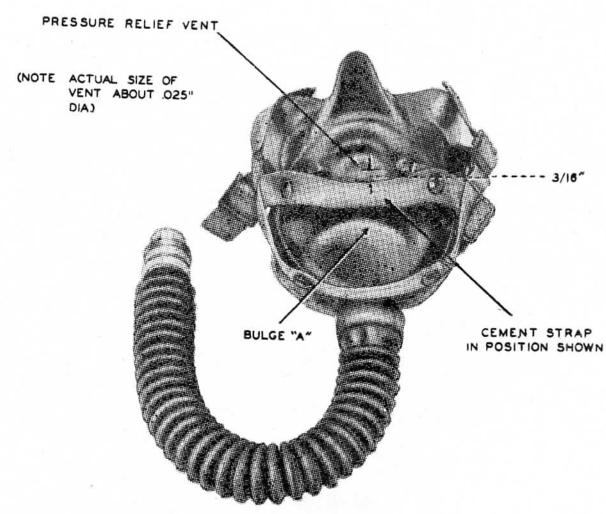
Stiff steel wire, BWG No. 22 (0.029-inch) through No. 25 (0.025-inch).

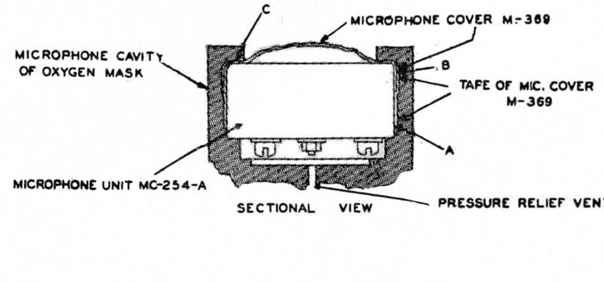
Shank of drill, No. 69 (0.029-inch) through No. 76 (0.020-inch).

Steel needle (0.020- to 0.030-inch diameter).

Quickly plunge the hot drill, wire or needle through the back wall of the cavity. Wiggling the wire during this operation should be avoided as this will result in too large a hole.

If the microphone is removed from the mask, the hole at the end of the cord duct must be plugged and the pressure relief vent must be closed with rubber cement before the oxygen mask may be used safely. (Rubber cement supplied with an airplane de-icer kit is suitable for this application and should be readily available at all air fields.)





SECTIONAL VIEW

TELEGRAPH CENTRAL OFFICE SET TC–3

Preventive maintenance is of vital importance in the conduct of Signal Corps operations. As ordinarily practiced it consists of systematic inspections, lubrication, and adjustment of communication equipment. The Chief Signal Officer, NATOUSA, has approved the routine outlined for the maintenance of Telegraph Central Office Set TC–3 which it is believed will be of interest to Signal Officers who are operating similar installations.

Description of forms used in connection with this routine are as follows:

Master Routine Schedule TC–3.

Job Schedule.

Job Card.

The master routine schedule, figure 1, lists the basic routines considered essential for the proper maintenance of the Telegraph Central Office Set TC–3, together with the minimum frequency at which the routines should be made and the technical manual (section and paragraph) describing the proper method of performing a given routine.

The job schedule, figure 2, is posted for one month by filling in the associated job number as shown on the master routine schedule. A solid line is drawn in the upper portion of the blocks under the date assigned for performing the particular routine opposite the job number for each day of the month for daily routines. A broken line is drawn underneath the solid line where the routine test is performed on the date scheduled. This broken line reflects the actual day or days that the test is made. After some experience in making

MASTER ROUTINE SCHEDULE FOR TC-3 SWITCHBOARD

Form No. M-16 — OM-15, issued 9 May 1944

Item	Reference	Job No.	Frequency of routine
SWBDS. and other TTY equip., cleaning	Mtce. inst. OM-17	1	Daily
TTY. motors (oper. machs.) speed check.	TM 11-353, para 10A.	2	Do.
TTY. ribbons (opr. mach.) inspection.	TM 11-353, para 18A.	3	Do.
Local bias (all lines) adjustment of.	Add "D" to OM-16A1.	4	Do.
Line bias (all lines) adjustment of.	Add "D" to OM-16A1.	5	Do.
Line current (all lines) adjustment of.	TM 11-358, para 14	6	Do.
Rectifier output, adjustment of.	TM 11-358 APP. and TM 11-954.	7	Do.
Night alarms, test of	Mtce. inst. OM-15	8	Do.
SWBD plugs, cleaning of	TM 11-335 para 42	9	Weekly
Frayed cords, bent plugs, inspection.	Mtce. inst. OM-13.	10	Do.
Oper's mach., cleaning, lubrication.	TM 11-353, para 75-87.	11	Do.
Test perforator, cleaning, lubrication.	TM 11-353 para 79	12	Do.
SWBD lamps, fuses and fuse ind., inspect.	TM 11-358, para 29, 30 and 31.	13	Monthly
BK-27-A relays, cleaning, adjustment.	TM 11-358, para 26 and add "A" to OM16A.	14	Do.
Calibration of bias meter	TM11-358, para 32 and add "D" to OM-16A1.	15	Semiannually.
Power unit	TM 11-900 test run	16	Weekly.

FIGURE 1.—BASIC ROUTINES CONSIDERED ESSENTIAL IN TC–3 MAINTENANCE.

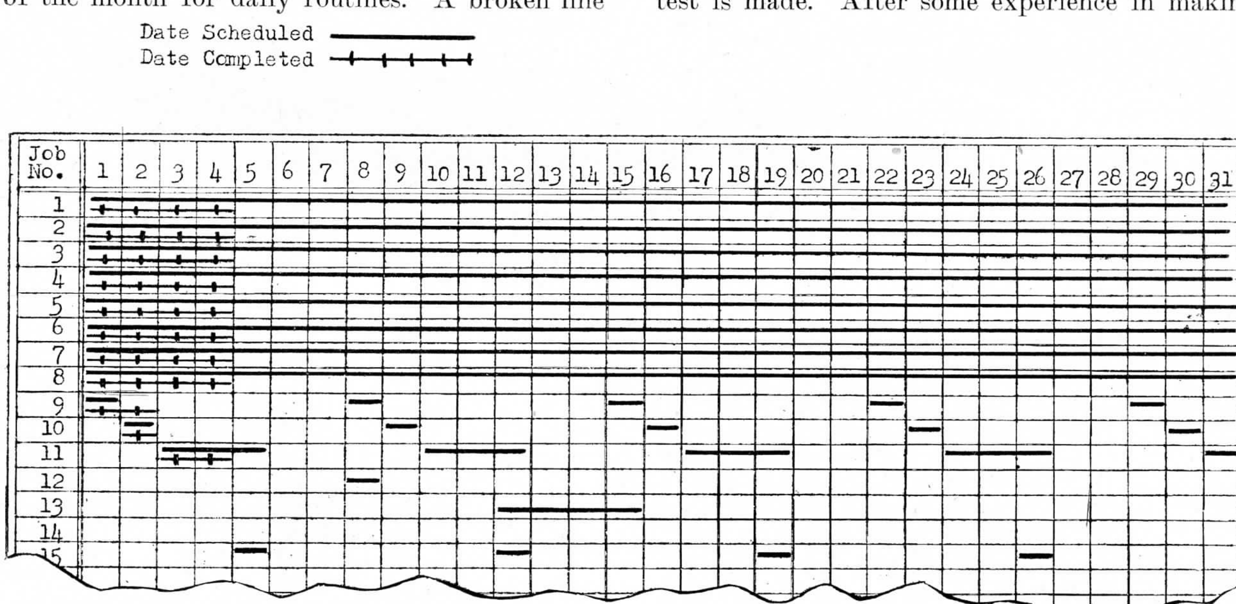


FIGURE 2.—JOB SCHEDULE USED IN MAINTENANCE OF THE TELEGRAPH CENTRAL OFFICE SET TC–3.

FORM M-13

JOB NO. 14 CLEANING & ADJUSTMENT OF BK-27-A RELAYS			FREQ. MONTHLY	UNITS 70
Date	Units tested	Trouble report	Trouble found	Tester
13 April 44	1–10	None	None	W. M.
14 April 44	11–20	None	None	C. H.

FIGURE 3.—JOB CARD FOR EACH DETAIL OF MAINTENANCE.

these tests it has been found necessary to schedule some routines over a period of several days.

A job card, figure 3, is prepared for each job listed on the master routine schedule, listing the job number, name of routine, frequency, and number of units to be tested. All troubles encountered while making routine tests are recorded on the proper job card regardless of whether the trouble disappears or is definitely located. As the schedules and job cards are replaced with new ones, the old copies are filed at the switchboard installation by the wire chief for future reference.

Information and methods for performing the duties which are listed in the Master Routine Schedule can be found in the pertinent technical manuals. In general, operating personnel are responsible for the daily routines and the trained maintenancemen responsible for the weekly, monthly, and semiannual maintenance. In the preparation of the instructions due consideration is given to the sequence of the jobs with special emphasis on the importance of including all necessary operations. The plan with appropriate changes can be applied to other major items of signal equipment.

ASSAULT WIRE W-130-( )

POLYETHYLENE, the latest advance in synthetic insulating material, has been made available for use on assault wire. This material has superior properties to other materials used for insulating this wire.

Assault wire, consisting of 1 copper and 6 steel strands per conductor, was originally insulated with Laytex rubber and known as Wire W–130. Late in 1943, production of assault wire was partially converted from Laytex rubber insulation to Vinylite insulation. Nomenclature "Wire W–130–A" was assigned to the Vinylite insulated wire. This type insulation was found to be mechanically superior to Laytex rubber, although it weighs more and provides slightly less talking range. Wire W–130–A presents a shiny, black appearance.

Production of assault wire is now being converted from Vinylite insulation to Polyethylene insulation. Initial quantities of Polyethylene insulated wire were designated Wire W–130–A. However, nomenclature "Wire W–130–C" has now been assigned to present and future production of wire with Polyethylene insulation. Wire W–130–C has a dull, brown appearance and its electrical properties are superior to those of Wire W–130–A. It is better than Laytex insulated wire and only slightly inferior to Vinylite, with respect to resistance to abrasion and cutting. Both Wire W–130–A and W–130–C are classified Standard.

Due to the fact that manufacturing facilities for insulating wire with Polyethylene and Vinylite are not adequate at this time to meet the total assault wire requirements, Wire W–130 has been retained as Substitute Standard and another wire, Wire WD–3/TT, has also been adopted as Substitute Standard. Wire WD–3/TT is similar in construction to Wire W–130 except that it has an impregnated cotton braid over each conductor. Electrically, Wire WD–3/TT exhibits electrical characteristics similar to Wire W–130 but mechanically it is much sturdier. It is about ⅓ heavier and 2½ times as bulky as Wire W–130.

PRINCIPAL CHARACTERISTICS OF ASSAULT WIRES

	W–130	*W–130–A*	*W–130–C*	*WD–3/TT*
Insulation	Laytex Rubber	Vinylite	Polyethylene	Laytex with braid
Classification	Substitute Standard	Standard	Standard	Substitute Standard
Avg. Wt./Mile (lbs.)	29.	37.	27.	43.
Talking Range, Dry (miles)	9.6	8.3	10.2	10.0
Talking Range, Wet (miles)	5.6	4.5	6.1	5.5
Color	Grey	Black	Brown	Greyish Black braid

[*All of these wires have one copper and six steel strands per conductor*]

MILITARY PERSONNEL

CHANGES IN SIGNAL TABLES OF ORGANIZATION

There have been three recent changes in Signal Tables of Organization that are of major importance.

The first involves the conversion of many Signal Construction Battalions, Light, into Signal Construction Battalions, Heavy. These units have been recently transferred from the training jurisdiction of the Ground Forces to that of the Chief Signal Officer. Subsequently, the T/O's have been changed from 11–25 to 11–65. This change results in little difference of strength, primarily only an increase of two (2) officers, but it does involve a difference in the tactical assignment of the unit. The Signal construction battalion, heavy, is normally assigned to the zone of communication in theaters of operation and its functions include the installation of permanent and semipermanent open wire or cable. The heavy construction battalion is capable of building between 10 and 16 miles per day of permanent pole line carrying two open wire circuits.

Camp Murphy, Fla., was designated as one of the posts to conduct the training of these battalions. This is the first time that units of this size have been brought into Camp Murphy. The terrain at this camp allows for plenty of space for pole line construction under near-tropic conditions.

Another change in T/O is involved in the redesignation of the Signal port service companies to Signal service companies. The War Department proposes to reorganize these units under the Signal composite T/O 11–500 and rescind T/O 11–327. Under the new T/O there is a substantial saving in the use of personnel. All units already organized and to be organized will be affected.

The third change is one which is applicable to all T/O's and involves a reduction in the number of basics provided for each unit. This change, which is covered in WD Circular 201, dated 22 May 1944, provides that all T/O's will be limited in the number of basic privates to 5 percent of tabular strength. Since most T/O's of Signal type units have 10 percent basics, this change involves a reduction in personnel. The change was effective upon publication of the circular and applies to all units except those on the front lines.

PREACTIVATION TRAINING

Two units, the 540th and 541st Signal Heavy Construction Companies, stationed at Camp Crowder, Mo., are now being formed for training under the new preactivation directive. These are the first Signal units to be organized under the plan known as "Building Army Service Forces Non-Divisional Units" as opposed to the previous procedure of "direct activation."

Army Service Forces inaugurated in April 1944 this new plan of preactivation training which is a similar procedure to that of building and Infantry division. Starting with D—day, the activation date, as a basis, a preactivation directive is published on D−135, i. e., 135 days prior to the activation date. By D—day the unit is ready for unit training. A chronology of the events under the preactivation method as compared to the old direct activation method is shown herewith.

Direct Activation Method

D—60	Activation order issues.
	Personnel for unit reports at place of activation:
D—7	C. O. reports.
D—4	All other officers, warrant officers, report.
D—3	Cadre reports.
D—Day	Enlisted fillers report.
D—1	Training begins.
	NOTE. — Equipment delivered at station of activation from D—7 to D.

D—165 to D—165	Pre-activation order issues.
D—135	
D—105	All personnel assemble at station of pre-activation training.
D—98	Training begins.
D—60	Activation order issues.
D—30 to D—10	Equipment delivered to station of activation.
	Personnel for unit are at (or report at) station of activation:
D—7	C. O. reports.

		D—4	All other officers, warrant officers, report.
		D—3	Cadres report.
		D—Day	Enlisted fillers report.
		D+1	Unit Training begins.
D+153	Readiness date. Training completed (including furloughs).	D+55	Readiness date. Training completed (including furloughs).
Total days, 213.		Total days, 220 to 190.	

This new procedure possesses numerous advantages, one of which is the provision of RTC and school training for enlisted personnel. The Signal Corps at the present time is not utilizing this procedure to the same extent as the other Arms and Services inasmuch as the three Signal training battalions at Signal schools provide a reservoir in which RTC and school training can be given prior to the activation date of Signal units. These three training battalions—the 840th, 847th, and 848th at Camp Kohler, Camp Crowder, and Fort Monmouth respectively in effect have been conducting preactivation training. Personnel assigned to the training battalions receive RTC, school and team training. Teams under T/O 11–500 are formed and trained so that when a Signal unit under T/O 11–500 is formed with training battalions as a source of personnel, it is usually only necessary to put the teams together and begin unit training on the date of activation. These training battalions will be reduced to only a nominal strength at the end of the year. Consequently it will probably be 1945 before the Army Service Forces preactivation training program is followed by the Signal Corps other than for miscellaneous type units such as the two construction companies now at Camp Crowder. However, as of that date it is probable that all units will be formed under preactivation directives.

OFFICER MALASSIGNMENT SURVEY

During the tremendous expansion of the Signal Corps to meet the demands for communications personnel, there were not enough officers available to allow for proper classification. As a result many "round pegs" found themselves in "square holes." In some cases highly technically trained officers were performing routine administrative duties while others were assigned to jobs entirely foreign to their training and background.

The misuse of personnel was not felt until losses incurred by filling overseas requisitions, newly activated units, etc., and the curtailment of the officer procurement program, created a shortage in some categories of specialized skills needed to fill positions of a technical or special nature peculiar to the Signal Corps.

This same situation was recognized in all services of Army Service Forces, so in order to determine the number of officers malassigned and to institute corrective action, the Assignment Review Board was appointed by the Chief Signal Officer at the direction of the Commanding General, Army Service Forces. An Advisory Committee, consisting of officers chosen from activities under the Chief Signal Officer who were experienced in personnel work, was set up to assist the Board.

In October 1943 an Executive Office Memorandum was circulated to all Services, Divisions and Branches in the Office of the Chief Signal Officer and to all field activities under his jurisdiction, with copies to the Service Commands, requesting that officers assigned to those activities accomplish two questionnaires. One questionnaire required a detailed description of the position held by the respective officer, the other a review of his civilian and military background.

More than 3,000 sets of questionnaires were reviewed by the Assignment Review Board. Each assignment was rated "good", "fair" or "malassigned" in accordance with the degree the officer's qualifications matched those which would be required of a replacement.

Preliminary reports were forwarded to the commanders of the activities stating the tentative ratings given each officer and the reasons why that officer was so rated. The commanders were requested to add their comments on the officers rated "fair" and "malassigned" with respect to the individual officer's native ability, adaptability and other factors not disclosed by the questionnaire, in order that the Board might have the benefit of each commander's intimate personal knowledge of the officers in his command. In many cases it was found that the officer, although lacking technical training and experience, had proved himself to be efficient and capable of performing his assigned duties through on-the-job training, natural ability, and perseverance and his rating was changed to "good". The Chief Signal Officer further requested that necessary action be taken to correct malassignments where possible. Immediate action was taken. The officers involved were either reassigned or given new duties.

A substantial reduction has been made in the number of fair and malassignment cases. Officers with special skills and technical abilities have been reassigned to duties which utilize their abilities; other officers have been reassigned to replacement pools for further training. As older officers become available, younger officers will be assigned to duty with troops.

The objective is and will remain—the proper officer in the proper position throughout the Signal Corps.

IMPROVING WIRE

(Continued from p. 14)

In order to reduce the amount of labor and materials required and to ease the problem of getting materials through the jungle land, it has been the practice to string lines from peak to peak whenever possible. Spans from one-half to one mile in length are common.

Long lines are constructed by tying field wire or English field cable D–8 with a clove hitch on every fourth pole. The basket weave hitch is now replacing the clove hitch since it has been found that it decreases the effects of abrasion and allows an inner conductor on the arm to be easily repaired. The "bush arms" of the intervening poles have slots cut into them in which the twisted pair is placed. Many lines have been constructed with each pair of D–8 field cable forming one side of a metallic circuit. These wires are supported on cross arms mounted on either the 12- or 15-foot "ballies." As a general rule the pairs are tied and spaced approximately 3 inches apart. The open wire line follows the usual principles of ordinary wood-pole construction except that the cross arms carry only eight pins.

The average life of untreated wooden poles is relatively short due to rotting and the effects of ants. Creosote has not been available. Charring the butts is not generally practicable since unfortunately it is a slow process and the construction demands do not afford time.

NAVY USE

(Continued from p. 16)

writer Set TC–16 and the page-type Printer Teletypewriter Set EE–98–A. Normal wire facilities are furnished by Wire W–110–B and Wire W–143, as well as by the ubiquitous Telephone EE–8.

For point to point radio communications, field Radio Set SCR–188 and vehicular Radio Set SCR–193 are used. The high-powered mobile Radio Set SCR–399 is used for long distance radio traffic.

In the aircraft radio field, the Navy uses the Signal Corps' VHF airborne command Radio Set SCR–522 and SCR–542. For its VHF fighter control system, the Navy uses the Signal Corps' mobile Radio Set SCR–573 and SCR–574, the transmitting and receiving stations at the Army's fighter control system. For DF in this system, the Navy uses its own mobile station. Components of these two vehicular installed stations, Transmitter BC–640 and Receiver BC–639 are used similarly by the Navy for fixed fighter control and are known, after the addition of accessories, as Transmitting Equipment RC–259 and Receiving Equipment RC–258. The air transportable, VHF ground station, Radio Set SCR–624–A, is also used by the Navy for advance air field control tower installation for ground-air contact. The SCR–522/542 are also ship-installed for ship-to-air communications.

For training Navy pilots to land and take off from land simulated carrier decks, the Navy has found the small, voice, portable Radio Set SCR–536 invaluable. This set is also used for airship landing practice at Lakehurst and other lighter-than-air Navy stations.

These, then, are the uses, the Navy makes of Army signal equipment. As the war progresses, and the sea force and the land force become welded more and more into a close-knit fighting force, the inter-service use of each other's equipment will become an accepted fact. Communications equipment is just one illustration of their growth together.

FIGHTING THE UNCOMMON COLD

Winterization Kits for Army Vehicles Now Available

WHAT THE common cold is to men, the uncommon cold is to motor vehicles—that paralyzing cold of steady, below-zero temperatures we so often have to cope with in this "global" war.

Just how much time can be lost when vehicles are left to the mercies of the weather overnight, is well illustrated in the incident of the two vehicle companies operating in a cold weather area during the early days of the war.

At the end of one particular day, one unit commander issued orders for each driver to drain the oil and coolant from his vehicle and to remove the battery. These items were then stored in a heated building overnight, since a temperature drop had been predicted. The other commander took no steps further than having the coolant in his vehicles checked to see that it contained sufficient antifreeze for the expected temperature drop. The next morning, within a comparatively short time, the first unit was operating full force, the heated oil and coolant and warm batteries having enabled the drivers to start their vehicles immediately. The second outfit had only about three vehicles in operation by early afternoon!

Naturally, the process used by the first unit, though commendable is not particularly efficient, inasmuch as it takes considerable time and effort. That is why the Army has developed an imposing array of winterization equipment. This winterization equipment, now available, will help get vehicles going on the coldest mornings and keep them from struggling through the winter.

For general purposes, this equipment is grouped into two general classes. Class A items are termed "improvements to the basic vehicle which will be made on all applicable vehicles for future production." That means vehicles may have them already, but if they do not they can still be installed. For example, the brackets needed to install windshield and door port hole covers must be attached to the vehicle as permanent installations, and therefore are called Class A items. The covers themselves, however, are Class B items, or "items which may be quickly and easily installed and which are necessary for vehicles which are expected to operate in subzero temperatures."

What actually will be ordered is one of the Winterization Kits, Interim Kits or Auxiliary Cold Starting Aid Kits, depending on the type of vehicles concerned. The Interim Kit, or "quickie" kit, is simplest of all. It contains an underchassis heater and a shroud, and to be requisitioned, the kind of vehicle it is to be used with must be stated. In general, these kits are used on vehicles for which no other winterization equipment is provided.

The Auxiliary Cold Starting Aid Kits, or "slave" kits, are more elaborate than the "quickies" but they are not so complete as the Winterization Kits. "Slave" kits contain heaters, auxiliary batteries and other electrical equipment which is used as an aid to starting in cold weather. Their prime use is for servicing of groups of vehicles which have no specific winterization equipment.

It is the Winterization Kit which will be of most value to personnel operating vehicles in areas where the temperature stays below zero consistently. These kits are complete, and are designed for specific vehicles. Basic equipment included in a winterization kit is comprised of a battery heater, a cab and engine compartment heater, and radiator and louver covers—all of which are permanent installations and thus are always ready for use with a minimum of preparation. Depending on the vehicle, there are numerous other items found in the various kits. Therefore, when requisitioning one of them it is necessary to look up the listing given in War Department Supply Bulletin 9–16 (SB 9–16), dated 2 March 1944, to find the number of the kit specified for the particular vehicle. This bulletin also lists territories for which winterization equipment will be furnished, so it will have to be referred to for eligibility.

Needless to say, the installation of winterization equipment, no matter how complete it may be, is not a panacea for cold weather operating problems. For, without the proper attention to other phases of operation, no equipment can be expected to perform effectively. Instructions in OFSB 6–11, "Cold Weather Lubrication and Service of Combat Vehicles and Matériel," must be faithfully followed in connection with the use of winterization equipment.

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