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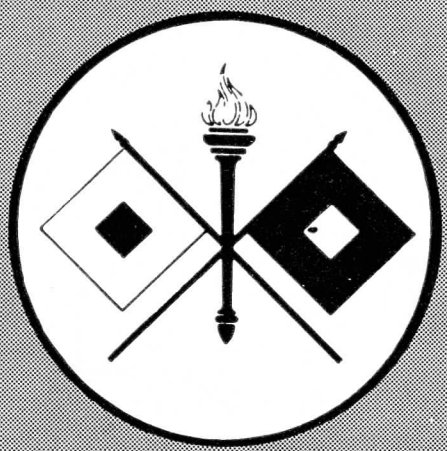
SIGNAL CORPS
Technical Information Letter

JUNE · 1945

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: T of Opns (25), except POA (50); SHAEF Main (5); USAFFE (25); A Groups (25); A (10); CHQ (10); Base Comds (10), except UK (20); Island Comds (10); Depts (10); D (7); AF (10); AAF Comds (7); W (4); G (4); AAFWS (2); SigAS (2); Bn 11 (6); C and separate Dets 11 (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.

Publication approved by Bureau of the Budget, Executive Office of the President.

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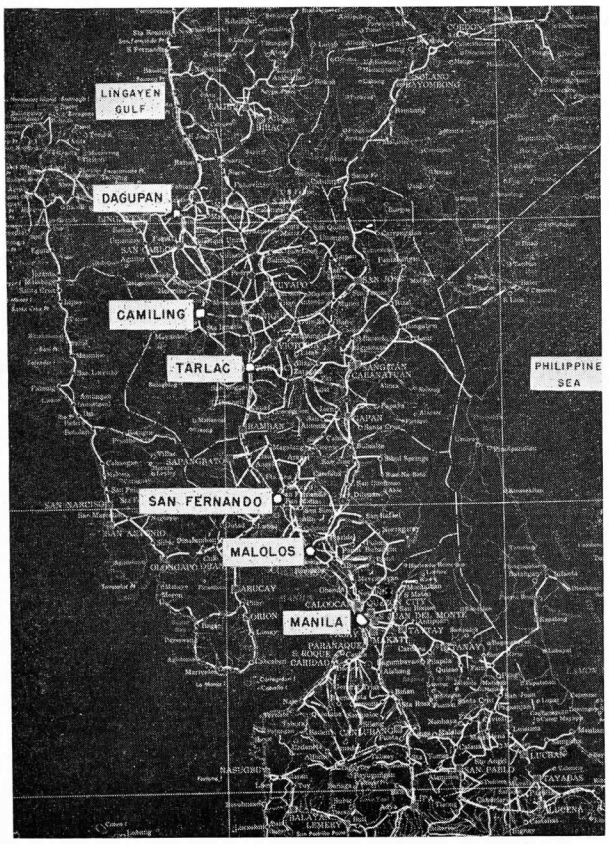
RADIO RELAY EQUIPMENT
IN THE
PHILIPPINE OPERATION

BY 11 October 1944, all ships of the CP fleet* were equipped with v–h–f radio relay and associated carrier equipment and corresponding shore terminals set up for test. Vertical single dipole antennas were installed on ships so as to eliminate fading as the ships swung at anchor. Results of various tests proved conclusively that solid circuits could be maintained through shore-based switching facilities on both voice and teletype.

In view of the fact that the shore-based equipment was scheduled to land on Red Beach, Leyte Island, at H-plus-2 hours, corresponding shore terminals were loaded aboard the deck of each ship. Personnel for operation of the shore-based equipment and message center were briefed on their mission and placed aboard the ship which carried their equipment.

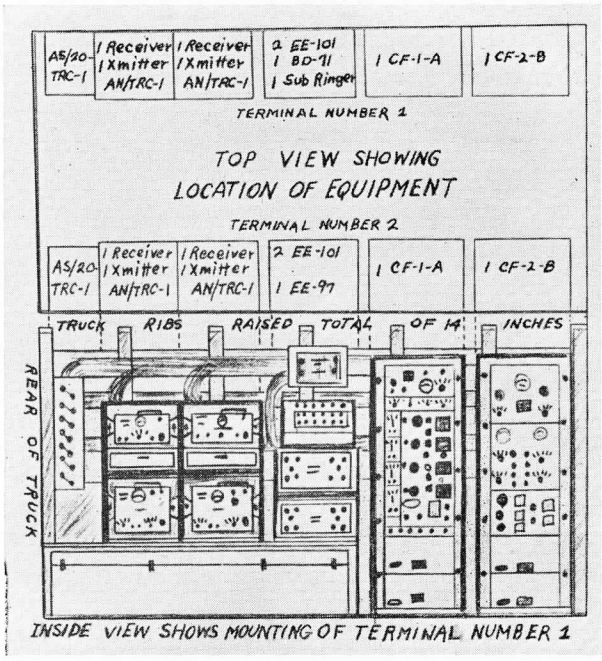
*Composed of ships converted into floating communication centers.



On the day before the convoy was scheduled to leave Hollandia for Leyte it was decided to equip a 1½-ton truck with a v–h–f radio relay terminal for the purpose of handling several special broadcasts planned by General MacArthur. Although time was short the job was completed, tested and placed aboard a Navy transport 4 hours before sailing time. Previous to departure from Hollandia arrangements were made with the Navy for the use of three LCM's to unload shore-based equipment and the truck outfitted for special broadcast work.

The CP fleet arrived off Red Beach, Leyte Island, at H-minus-4 hours and preparations for unloading shore-based radio relay equipment began immediately. At H-plus-1 hour the CP fleet moved to within 4 miles of Red Beach and the v–h–f equipment was loaded into LCM's. At H-plus-2 hours the LCM's headed for the beach. Although enemy mortar fire was extremely heavy the equipment was landed and drawn up on the beach without damage. Several casualties, however, were suffered among message center operating personal aboard another landing craft. It took approximately 25 minutes to establish communications with the CP fleet. For several hours previous to the landing a simplex voice and teletype circuit had been established and this was continued at the shore terminal so as to coordinate the movement of equipment to the beach. At H-plus-5 hours General MacArthur came ashore and made his famous *I have returned* broadcast. This broadcast was picked up from shore by GHQ afloat and rebroadcast to the Philippines. A Signal Corps communication ship picked up the broadcast from the beach and recorded it for retransmission to the United States later that day. Because of the flexible situation and heavy mortar fire being laid down on Red Beach it was decided to move the shore based terminals to a *cooler corner*.

Reconnaissance showed that the town of Tacloban some 4 miles away was fairly clear of enemy troops. All equipment was therefore moved, at night, to the Provincial Capitol Building in Tacloban where all circuits were installed and in opera-

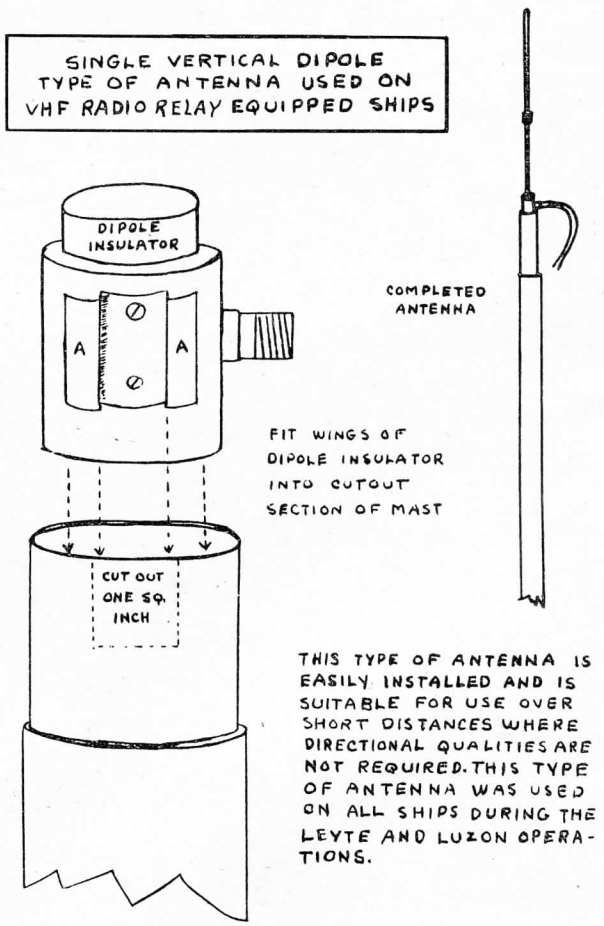


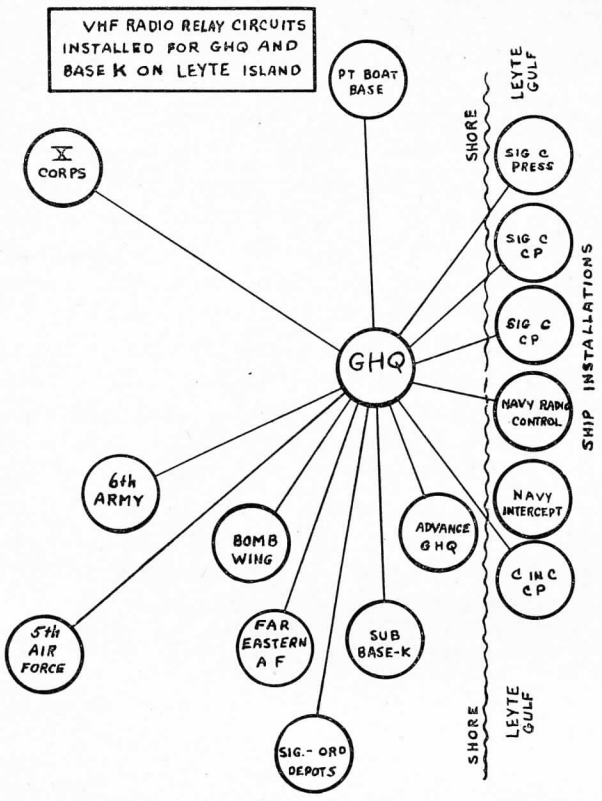
METHOD USED IN MOUNTING AND CABLING TWO VHF RADIO RELAY TERMINALS IN 2½-TON, 6 x 6, TRUCK. COMPLETE INSTALLATION REQUIRED LESS THAN 1 HOUR.

tion with the CP fleet by A-plus-2. Feeder lines were installed to the Advance GHQ Message Center and Sixth Army. With the ship-to-shore circuits now in full operation it was possible to transmit teletype messages and voice conversations from the beachhead to any base required. By way of comparison it took approximately 10 days to install on shore and place in operation the same amount of equipment which the CP fleet was able to place in operation within 8 hours. Thus the CP fleet, with the help of v–h–f radio relay equipment had proved itself a highly satisfactory medium of communications that could be placed into operation as soon as a beachhead was established.

Within 30 days after the landing of our troops on Leyte Island, a total of 18 v–h–f radio relay terminals were in operation. Original planning called for Team K of the 989th Signal Service Company, attached to CP fleet to operate only 8 v–h–f terminals—four on ships and four corresponding shore stations. However, due to unforeseen difficulties caused by enemy action, continuous rain and typhoons, the Base *K* signal construction units were unable to install and maintain wire communications to the various units and headquarters spread along the eastern coast of Leyte for a distance of 40 miles. Therefore, Team K was called upon to install additional v–h–f terminals so as to maintain reliable communications. This continual requirement for additional v–h–f terminals necessitated the splitting of spare equipment so as to maintain unreliable wire circuits. By 18 December 1944, a total of 22 v–h–f radio relay terminals had been installed and were being operated by Team K of the CP fleet. It might be well to mention here that all network broadcasts and press releases originating from the Public Relations Office in Leyte from 20 October 1944, until 2 January 1945, as well as numerous remote broadcasts from the front lines were carried from shore to ship transmitters for rebroadcast by v–h–f radio relay equipment.

On 3 December 1944, signal plans for the Luzon operation were being formulated. Here again v–h–f radio relay equipment was to play a major role in the communications picture. Not only were additional ships added to the CP fleet, but this time v–h–f radio relay equipment was to form a vital system of communications back to the CP ships from the forward areas as infantry units





moved down the Luzon Plain, culminating in a complete system from Manila back to GHQ CP fleet, a distance of 130 miles. In order to accomplish this mission it would be necessary to move the equipment as fast as the tactical command posts were able to move. This called for mobile mounted equipment and a request was made and granted for six 2½-ton, 6 x 6 trucks. As soon as the trucks were received the job of mobile mounting and cabling two complete v–h–f radio relay terminals in each vehicle was started. Each terminal was so cabled that a minimum amount of time was required for installation. All voice channels were wired into a BD–71 switchboard placed in each truck. These switchboards in turn were wired with 50 feet of paired cable so as to enable the operator to take the board out of the truck and into a foxhole but still be able to monitor all circuits. A monitor teletype machine was also installed in each truck so as to check the circuits of both systems. A BD–91 switchboard was carried in each truck in case the vehicle was to act as a message and switching center. Power was supplied by a trailer-mounted PE–95 with one PE–75 as a stand-by. Personnel operating each truck consisted of four v–h–f and carrier specialists, one switchboard operator and one power maintenance man. Each two trucks were supplied with a message center officer and two code clerks. The officer also was supplied with all codes and strip boards.

Although enemy opposition was not as great on White Beach Three in Lingayen Gulf as that encountered in Leyte, nevertheless the surf encountered on the beach created a great many difficulties and resulted in the loss of one power unit and the soaking of most of the equipment. Quick work was necessary to save the equipment and after power had been applied for several hours most of the equipment was found to be in good working order. Five systems were immediately set up with the CP fleet in the town of Dagupan, with lines to the Advance GHQ Message Center and Sixth Army.

As soon as forward infantry units secured the town of Camiling, approximately 25 miles down the valley from Dagupan, a truck was sent down the road and an advance message center was set up with lines going to XIV Corps, 37th Division and 148th Infantry. A second truck was then sent forward with the 148th Infantry, with the city of Tarlac 27 miles away as the next objective. A few days later the advance message center was moved to Tarlac and the station at Camiling converted into a relay station. Due to the fact that the advance echelon of GHQ moved into the Tarlac area, this terminal was set up back to back, as another v–h–f truck moved 24 miles closer to Manila and established another advance message center at San Fernando. Three days later the San Fernando Terminal was converted to a relay station when the terminal and advance message center was moved to Malolos, 22 miles away. All during the various moves down the Luzon Valley, members of the General Staff were constantly visiting the forward areas and great deal of traffic on both telephone and teletype trunks was handled.

On 5 February 1945, shortly after the advance units of the First Cavalry Division entered the city of Manila the first v–h–f radio relay truck was operating a circuit back to Lingayen Gulf 130 miles away. This initial installation in the city of Manila was located well within the city limits and was in operation several hours before the destruction of the city began. A parallel circuit was soon required to handle all traffic from the city to

(Continued on p. 10)

WIRE WD-1/TT

IT HAS long been recognized that the ideal field wire would be one which combined the small size and weight of Wire W–130–( ) with the greater talking range, tensile strength and durability of Wire W–110–B. Development has been completed on a new general purpose wire, for use by troops in forward areas, which approaches this ideal. This wire has better physical and electrical characteristics than Wire W–130–( ) and is much lighter in weight and less bulky than Wire W–110–B. Nomenclature *Wire WD–1/TT* has been assigned.

Wire WD–1/TT is a twisted pair, field telephone wire, each conductor of which consists of four copper and three steel strands, each 0.011 inch in diameter. Each stranded conductor is separately insulated with a polyethylene compound and covered with an extruded nylon jacket. The wire weighs 47 pounds per twisted-pair mile and has a minimum breaking strength of 85 pounds per single conductor. The voice frequency talking range of Wire WD–1/TT between two Telephone EE–8–( ) is 11 miles wet and 18 miles dry.

This wire is sufficiently flexible for use as an assault wire, has a range approximately equal to that of Wire W–110–B, and is only slightly less durable. The polyethylene insulation gives Wire WD–1/TT its excellent electrical characteristics, while the tough nylon jacket accounts for its durability. The accompanying table gives a comparison between Wire WD–1/TT, Wire W–110–B and wires of the W–130–( ) type.

The Infantry Board service-tested an experimental quantity of wire which was the same as Wire WD–1/TT except that it did not have the nylon jacket. It was found that exposure to the weather for a period of 2 months has no appreciable effect upon the physical or electrical characteristics of the polyethylene insulation. The Infantry Board also found that immersion in fresh water for 45 days, in salt water for 8 days, or in oil for 21 days, has no noticeable effect upon the electrical characteristics of the wire. However, it was considered that the type of wire tested did not have sufficient cutting and abrasion resistance and for this reason the design of the wire was changed to provide the tough nylon jacket.

Wire WD–1/TT has been classified *Standard*, for issue in place of assault Wire W–130–( ) when available in sufficient quantities. Eventually it may replace Wire W–110–B to a limited extent, particularly where weight and bulk are primary factors.

Production of this wire began in May 1945. However, initial production will be relatively small because of the present short supply of required materials.

Initially, Wire WD–1/TT will be issued on reels. Development has been initiated on Wire Dispenser MX–306/G for containing approximately one-half mile of Wire WD–1/TT. This dispenser will be similar to and of substantially the size as Wire Dispenser MX–301/G which contains approximately ¾-mile of Wire W–130–( ).

Comparison of field wire characteristics

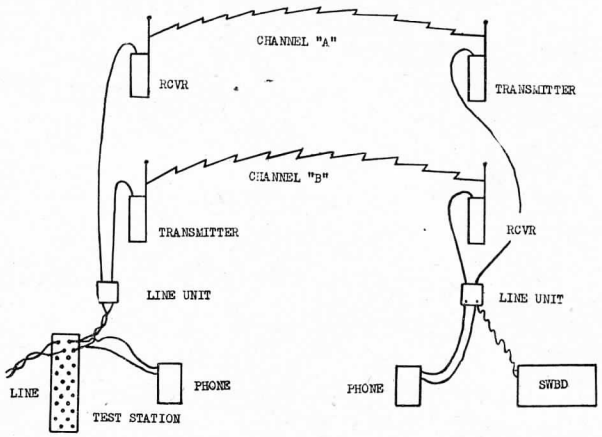
Characteristics	WD–1/TT	W–130	W–130–A	W–130–C	WD–3/TT	W–110–B
Number and size of copper strands per conductor	4 0.011″	1 0.010″	1 0.010″	1 0.010″	1 0.010″	1 0.014″ (2) 0.013″
Number and size of steel strands per conductor	3 0.011″	6 0.0095″	6 0.0095″	6 0.0095″	6 0.0095″	4 0.013″
Insulation	Polyethylene	Rubber laytex	Polyvinyl chloride	Polyethylene	Rubber laytex	Buna S
Insulation covering	Nylon jacket	None	None	None	Impregnated textile	Impregnated textile
Diameter of finished conductor, average	0.080″	0.063″	0.063″	0.063″	0.085″	0.147″
Weight, pounds per twisted pair mile, average	48	29	37	27	43	135
Breaking strength, pounds per trusted pair	150	55	55	55	70	145
Resistance to abrasion and cutting at ties	Very good	Fair	Good	Fair	Good	Very good
Talking range:						
Wet	11.0	5.6	4.5	6.1	5.5	11.0
Dry	18.0	9.6	8.3	10.2	10.0	18.0

USE OF SCR–300 AS A RADIO LINK

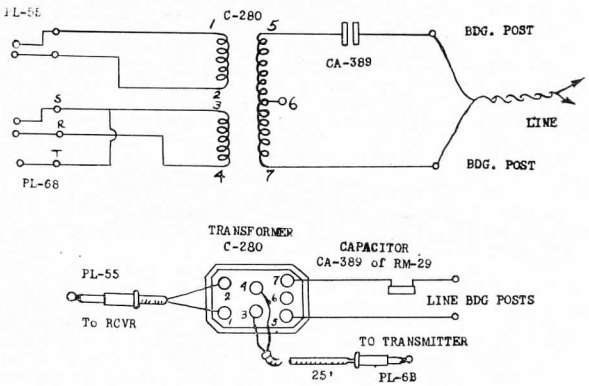
DURING THE battle of the Hurtgen Forest, the road running from Germeter through Hurtgen to Brandenberg, Germany, was under direct enemy observation and was being shelled continuously. Wire between 8th Infantry Division and a regiment at Brandenberg was being knocked out every few hours. The entire area was mined heavily so that it took a mine-sweeping detail 5 days to clear a path cross-country between Germeter and Brandenberg—a distance of 2 miles. Even after two wire circuits were laid cross-country, artillery fire too often cut them and also pinned down the trouble-shooting teams. This problem was solved by using an improvised radio link between Germeter and Brandenberg as an emergency channel of communication while all wire lines were out.

Four Radio Set SCR–300 (two at each end of gap) gave a single talking circuit connecting the ends of the wire. Of the two radio sets at one terminal, one was used for reception, the other for transmission. They operated on separate frequencies, six or more channels apart.

A coupling unit connected the transmitter and receiver to the line. The line-impedance-matching transformer (C–280) of a remote control unit RM–29 was used for this purpose. Cords from this unit connected to the sets. One cord, terminating in a plug PL–55, connected to the receiving set; the other, terminated by a plug PL–68, went to the set used for transmission. The latter cord was about 25 feet long, so the two sets could be placed far enough apart to minimize interference between them.



SCR–300 SET-UP AS RADIO RELAY DURING HURTGEN FOREST BATTLE SUCCESSFULLY USED TO SPAN A HEAVILY SHELLED ROAD.



CIRCUIT DIAGRAM OF LINE UNIT USED WITH SCR–300 RADIO RELAY SYSTEM OPERATED BY EIGHTH INFANTRY DIVISION.

Radio Set SCR–300 is so designed that when a hand-set is plugged into it the PL–55 causes the battery connection to be made within the set. The set would thus be inoperative with the phone jack empty; so a PL–55, with no connections, was plugged into the phone jack of the transmitter.

Ordinarily, depressing the butterfly switch on a hand-set switches the 300 from reception to transmission. The same effect was achieved, in this case, by connecting together the *tip* and *sleeve* of the PL–68. When the PL–68 was plugged into the microphone jack of the transmitter, the extra PL–55 into its phone jack, and the set turned on, it transmitted continuously until turned off.

Preferably the sets were located in an elevated position near a switchboard or test station. A telephone (on a terminal strip in the line, or connected to the line terminals of the coupling unit) was used to supervise the circuit. When wire communication failed at a point between the two terminals of the link, operators stationed near each terminal turned on both transmitter and receiver, and made contact, talking and listening on the telephone. The volume control on each operator's receiver was set at the point giving the clearest speech. Increasing the volume too much caused feed-back and howling.

When an operator heard a call from the other side of the radio link (cannot ring through this link), he rang his board, and told the switchboard operator the number or exchange wanted. When the connection was made, he cautioned both parties (if the switchboard operators had not) that the conversation was over radio link.

AVOIDING STEREOTYPES

A Little Ingenuity by the Writer Helps Prevent Disclosing the Key to the Enemy

REQUEST MORTAR FIRE ON HILL *FIVE ZERO NINE.*

This message was enciphered by Converter M–209 and sent from the message center of an armored division in the European Theater of Operations. Suppose that it had been intercepted by enemy intelligence. The stereotypes at the beginning and end of this one message probably would not have been enough to enable the enemy to break into the daily key. With the aid of other stereotyped messages, however, the enemy might have reconstructed the pin and lug settings for the day and read all messages as easily as any of our own code clerks.

Finding a stereotyped word is partly a matter of guesswork. But tests can be applied to cipher text which show whether or not an assumption is correct. When the stereotype has been located, it can be compared with its cipher text, and, in the case of the M–209, a portion of the pin and lug setting can be reconstructed. This is possible because only one combination of pins and lugs will convert a given plain text sequence into a given cipher text sequence. That combination can be deduced when both sequences are known.

Stereotyped phraseology reduces the security of most cryptographic systems for similar reasons.

According to a study of 540 tactical messages transmitted by the same armored division, the message quoted above was typical of 23 percent of its enciphered traffic. The figures for other tactical units are comparable.

Although the cryptographic security officer may correct stereotyped beginnings and endings by authorized means, to expedite message handling the writer is still obligated to guard against repeated use of the same words and phrases.

It should be remembered that the compromise of a single message and the information it contains is not usually the important consideration. It may take an enemy cryptanalyst several hours to break a message. After he has succeeded, however, and if he has reconstructed the cipher key, he can immediately read all other intercepted messages in the same system.

When stereotypes form the basis of cryptanalysis, solution can be delayed greatly if stereotyped words occur in the middle of a message instead of at either end. Stereotyped phraseology anywhere in a message is undesirable, however, for the information in some messages must remain concealed long after the message has been sent. As has been indicated, the security of one message depends on the security of all other messages sent in the same daily key.

Little can be done by the writer to avoid stereotyped phraseology and standardization of form in messages such as the following: *FOR* SURG CAS A CO FORTY TWO B CO *ELEVEN.* The first two words of this message should have been omitted, but a stereotyped message remains. Short routine reports will be taken care of by the cryptographic security officer or code clerk who will apply padding before the message is enciphered. Padding has been authorized for the specific purpose of concealing the length and stereotyped phraseology of such reports which are transmitted periodically and contain the same type of information from day to day.

A great deal *can* be done by the writer to avoid the repeated use of the same words and phrases in messages such as the following, taken from actual traffic (numbers indicate examples to be discussed more fully):

(1)
NEED REPLACEMENTS FOR THE MEN KILLED
(2)
WOUNDED AND MISSING IN *ACTION*

ARTY FALLING ON ENEMY POSITION *THREE*
(3)
FOUR SIX SIX ONE FOUR

(4)
START OF MSG PAREN ATT DIV SURGEON PAREN
(4)
TWO LITTER RACKS GIVEN TD BN *THAT IS ALL*

STATION HOSPITAL REGISTER REVEALS SOLDIER IN QUESTION WAS REMOVED—TH GENL ON
(5)
TENTH OF *MARCH*

(6)
OBOE SIX REQUESTS NEW JEEP IN EXCHANGE
(3)
FOR OLD *ONE*

These examples serve to illustrate the following prevalent stereotype violations as evidenced by the study made:

(1) Local stereotypes.
(2) Specific words classed as universal stereotypes.

(3) Numbers.
(4) Punctuation.
(5) Months.
(6) Phonetic-alphabet components.

Local stereotypes, illustrated by example (1), are dangerous to cryptographic security at the beginnings or endings of messages originated by a particular headquarters. In the study cited, local stereotypes accounted for 49 percent of all stereotypes. Local stereotypes are easily overlooked if checks are not made by cryptographic personnel to determine which words and phrases appear too often in outgoing traffic. If a word appears in 5 percent of the beginnings or endings of messages transmitted during one week, it should be considered a stereotyped beginning or ending for the following week.

Universal stereotypes, illustrated by examples (2) through (6), are stereotypes at the beginning or ending of *any* message at any time and constitute a dangerous threat to cryptographic security when used. This type of violation, including both *specific* words, (2), and *types* of words, (3) through (6), accounted for the remaining 51 percent of violations in the study made.

The 5 messages cited could have been written just as easily, and without stereotypes, as follows:

NEW M E N NEEDED TO REPLACE KILLED WOUNDED AND MISSING

ARTY FALLING ON THREE FOUR SIX SIX ONE FOUR ENEMY POSITION

GAVE TWO LITTER RACKS TO TD BN

STATION HOSPITAL REGISTER REVEALS SOLDIER IN QUESTION WAS REMOVED MARCH TENTH TO —TH GENL

IN EXCHANGE FOR OLD ONE OBOE SIX REQUESTS NEW JEEP

Security officers may distribute to message writers lists of local stereotypes and the list of universal stereotypes given in paragraph 9a of the War Department publication, *Instructions for Avoiding Stereotypes in Classified Messages*, dated 1 January 1945. Otherwise writers cannot be expected to be familiar with words and phrases to be avoided in drafting messages. Particular attention should be paid to the list of *specific* words which are universal stereotypes. Use of these words is responsible for nearly 25 percent of all stereotypes. Almost one-half of these specific words contain the prefix RE. Words such as REQUEST, REPORT, REFERENCE, REPEAT, REPLY, etc., are extremely stereotyped and should never be used at the beginning of a message.

That message writers have a tendency to overlook stereotyped endings is evidenced by the fact that 62 percent, or almost two-thirds, of the stereotyped messages studied ended with numbers, punctuation, geographical names, or other stereotyped words or phrases. Enemy cryptoanalysts may locate suspected stereotypes in the endings of messages as easily as in the beginnings.

To avoid stereotyped beginnings and endings and to vary a message in form and wording without change in meaning, the writer need only exercise a little ingenuity. As an illustration, the stereotyped message at the beginning of this article could have been phrased in any of the following ways without a change of meaning.

Original stereotyped message:

REQUEST MORTAR FIRE ON HILL FIVE ZERO NINE

Paraphrased versions:

NEED SUPPORT ON HILL FIVE ZERO NINE WITH MORTAR FIRE

MORTAR FIRE ON HILL FIVE ZERO NINE REQUESTED

URGENT THAT ON HILL FIVE ZERO NINE WE HAVE MORTAR FIRE

MORTAR FIRE REQUESTED ON FIVE ZERO NINE HILL

It's the little things that make a big difference when it comes to taking care of communications equipment—little things like removing the batteries from telephones, radios, and flashlights when putting them away for the night, so they won't corrode.

SIGNAL ACTIVITIES, IX TAC

Aircraft Control and Buzz-Bomb Warning Among Achievements of Communication Personnel

ACTIVITIES OF signal units with the IX Tactical Air Command, which worked so closely with ground troops in their sweep through occupied Europe into Germany, are highlighted below.

Radio operators from the 926th Signal Battalion (Separate), Tactical Air Command, on headquarters ships in the Channel maintained contact with Air Force Headquarters in England during the initial stages of the invasion. Starting on D-plus-1, and for the next 10 days, construction platoons and operations detachments waded ashore on Omaha and Utah beaches and immediately went to work running lines from air strips and landing fields still under construction to wing and command headquarters. Cross-channel f–m radio telephone was established to coordinate air operations on the Continent with those in the United Kingdom.

The light construction companies working directly with the wings, built a mammoth spiral-four spider web linking all groups and squadrons with what was then, for tactical purposes, the Ninth Air Force Headquarters on the Continent. By the end of July, the operations company at headquarters was handling more than 500 teletype messages, 4,500 pieces of official mail, 180 radio messages, and more than 4,000 telephone calls each day. Following the St. Lo break-through, this unit dashed forward with the First U. S. Army through France and into Belgium, maintaining all the while, radio, radio telephone, and land line communication back to the air fields from which the planes flew.

Outpost repeater stations for both spiral-four and frequency modulated radio were established along the way, linking headquarters and Fighter Control Center with airfields sometimes 200 miles apart. Construction companies also provided the wire links from fighter control to the advance radar units so that friendly and enemy air activity over the front could be plotted and controlled.

Wire teams maintained more than 183 miles of open wire, installed and maintained 2,966 miles of spiral-four and recovered more than 2,500 miles of cable. Throughout the whole show, headquarters was always in direct communication with its subordinate units by telephone and teletype. At times cooks, clerks, supply and motor personnel became linemen to keep the circuits in and working or to establish new circuits. As the front became more stabilized, Belgian and French underground facilities were rehabilitated and used to supplement and sometimes replace some of the long sections of spiral-four stretching back to airdromes, and laterally to adjacent commands and forward to radar sites.

WIRE FACILITIES BUILT

Immediately upon assignment in February 1944, the 433rd Signal Heavy Construction Battalion was given the mission of building the necessary wire communication facilities to tie in IX Tactical Air Command Headquarters with the wings and groups of the command. Various types of wire plant were constructed to provide the wire nets including RPL, MAL, standard American open wire and spiral-four cable. Aside from providing the required wire circuits for the command, their mission in Britain served another purpose. It gave the battalion a first hand picture of the circuits required for an air force to be effectively operational. It also served to perfect the coordination of the teams, sections, platoons, and companies to a high degree. These factors later proved invaluable on the beaches of Normandy. The battalion landed in France on D-plus-10 and at once started to tie in the air strips then under construction near Omaha and Utah beaches. The principal means of providing communication between headquarters and the air strips was spiral-four cable. A German coastal defense cable was rehabilitated and put into service. This cable provided communication for two air strips and in addition provided liaison circuits with the British. All circuits were installed and operating prior to the completion of the airfields.

As other air strips were constructed, open wire and spiral-four was placed to them. On many occasions the wire crews encountered artillery fire but in all cases the circuits were ready for use before the strips became operational. Before the break-through at St. Lo, the battalion replaced the spiral-four cable with open wire to the air strips and extended the lines consisting of two 20-

wire pole-lines, toward St. Lo. After St. Lo these open wire lines were extended to Canisy. From there the rapid advance of the armies caused one lead to be dropped but the other was extended to Domfront, a distance of about 100 miles. At that time, the break-through had started. Open wire construction proved too slow so the battalion moved forward more rapidly, leaving a trail of three spiral-four cables behind. This trail extended from Domfront, France, to Verviers, in Belgium. Since supplies were the big problem, trucks were used to move and lay cable in the daytime, and to bring up supplies at night for the next day's work. After the rapid advance, the Battalion then built permanent communication facilities to the airfields and various units of the IX Tactical Air Command. This was accomplished by rehabilitating commercial Belgian telephone plant, German military cable and wire, and building standard American open wire lines. On two airfields used by the American Air Forces, two complete German underground cable systems were rehabilitated and put to use. The proposed axis of two arms of standard American open wire were extended as far as the tactical situation permitted.

1,300 MILES OPEN WIRE

Work performed by this battalion included 1,300 circuit miles of standard American open wire, 635 circuit miles of German and Belgian wire rehabilitated, 1,500 miles of spiral-four placed, and 25 sheath miles of German military cable rehabilitated.

The 332d Signal Company, Wing, since early December 1943, furnished signal communications for the 70th Fighter Wing, key control wing of the IX Tactical Air Command.

On D-plus-1, elements of the 332d landed on Omaha Beach with the 70th Fighter Wing and immediately became the focal point for all Ninth Air Force communications until the St. Lo breakthrough. Communications were set up with a minimum of delay and maintained at a high degree of efficiency throughout the stated period. During this stage the volume of traffic, by all means, was far in excess of that contemplated under the unit's table of organization, or for the handling of which the unit had been trained. Operation was continuous, and the high standard of excellence achieved and sustained, together with the huge quantity of traffic handled, contributed materially to the success of the campaign.

NOT ONCE OUT OF SERVICE

From that period on, the 332d continued to serve the 70th Fighter Wing in its rapid advance into Belgium. It is the proud boast of this organization that never once have they been out of service, nor has the message failed to get through.

The 555th Signal Aircraft Warning Battalion joined the IX Tactical Air Command in December 1943, and immediately took the field as a tactical element of the command in air operation for the air battle of Europe in which role they continued until May 1944.

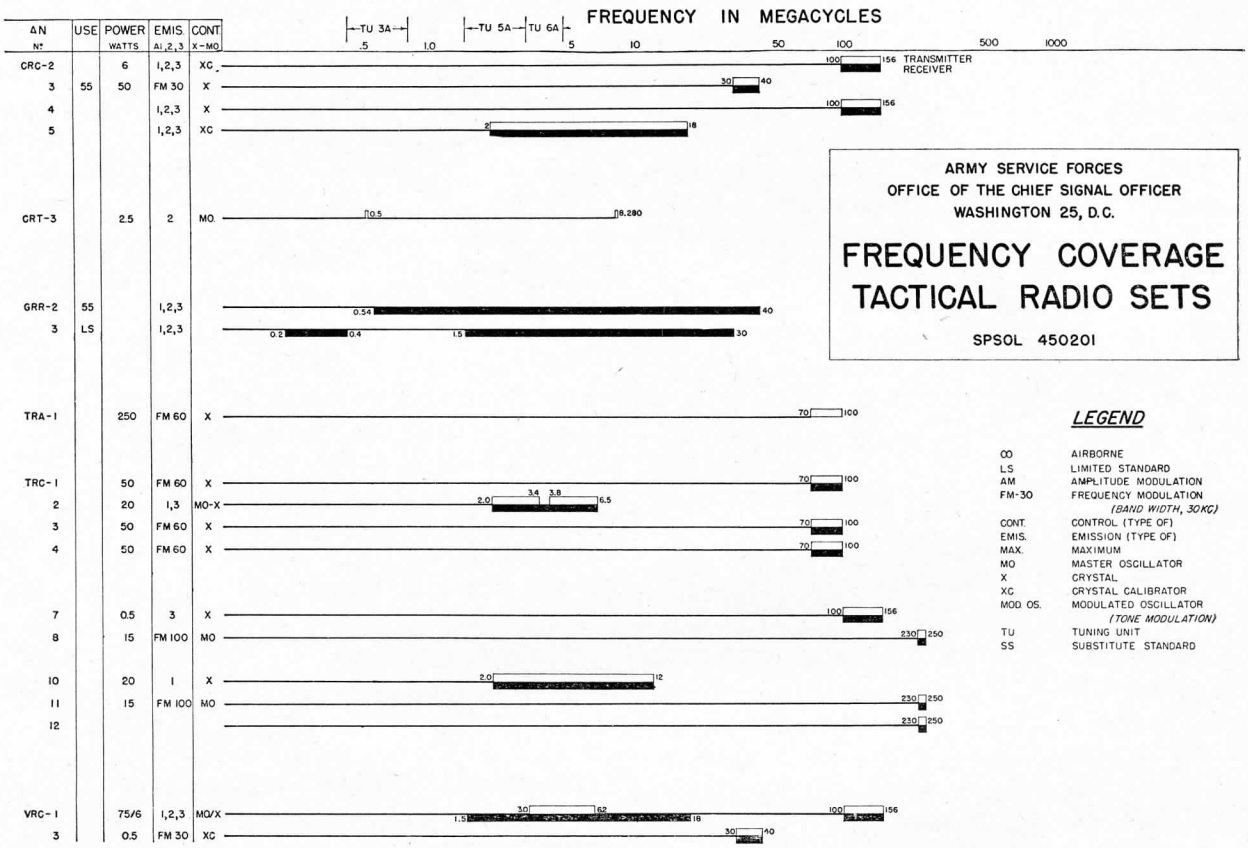
The first echelons of this organization landed on the continent on D-plus-1 and immediately commenced 24-hour operation of aircraft warning service under the hazards then prevailing. From Normandy's Omaha and Utah beaches across France, through Belgium, into Holland, Luxembourg, and finally, into Germany, the Battalion followed closely on the heels of the advancing First U. S. Army. A total of more than 3,500 aircraft missions against enemy air and ground targets have been controlled by units of this organization. These missions resulted in destruction and damage to more than 400 enemy aircraft, dispersion of enemy missions, destruction of tanks, motor vehicles, railroad equipment, artillery, ammunition and supply dumps as well as other military objectives located in enemy territory.

Despite the adverse conditions under which operations were conducted, the consistent and superlative performance of radar quickly won the full confidence of pilots whose planes it controlled. Polled to determine what nonflying help made the greatest contribution to a successful mission, pilots of one group unanimously and without reservation voted in favor of a principal element of this Battalion. Other fighter groups of the Ninth Tactical Air Command voiced similar testimonials of their valuable assistance rendered in the accomplishment of both planned and emergency missions.

Secondary to the control of aircraft missions, early warning *Buzz-Bomb* service was provided by the stations of the battalion to several of the liberated cities and villages. During one month, a peak of 1,107 V–1's were directed toward these areas. Another function of the radar units

which called further attention to their value was the coordinated receipt and transmission of enemy air intelligence with the antiaircraft groups, which served to further diminish an already decimated Luftwaffe.

Affected, as were all, by the December *Battle of the Bulge*, in the Bastogne area, units of the battalion were forced to evacuate their positions and re-site equipment in a matter of hours. Missions continued to be controlled against enemy advances from these new points. The loss of technical equipment was negligible, a feat which was largely due to preplanning and the personal courage and teamwork of every man.



THIS CHART INCLUDES SOME OF THE NEWER TACTICAL RADIO SETS AND SHOULD BE CONSIDERED A SUPPLEMENT TO THE CHARTS PUBLISHED IN SCTIL NO 32, JULY 1944.

PHILIPPINE

(Continued from p. 3)

rear echelons. In view of the fact that previous arrangements had been made for two parallel systems it took only several hours to line up the second circuit in each truck located at intervals up the Luzon Valley. As infantry units pushed forward to South Manila across the Pasig River, the v–h–f radio relay terminals were moved into the Escolta section of town where the permanent offices of GHQ were to be located. From 5 February 1945 until 7 March 1945 all network broadcasts and press releases originating from Manila were carried to the press ship in Lingayen Gulf over the v–h–f radio relay systems. On 10 March 1945, a total of 16 v–h–f radio relay terminals were handling approximately 75 percent of the traffic on voice and teletype in and out of the city of Manila to remote points on Luzon.

SAIPAN COMMUNICATIONS

Notes on Signals in the Capture of Saipan by Marine Corps and Army Troops

THE ISLAND of Saipan was secured by U. S. Marine troops and U. S. Army troops after a 25-day campaign that began with the landings on 15 June 1944. Saipan, one of the Marianas, is a mountainous island 14 miles long and 2½ miles in width except in the center where it is 5½ miles broad. It contains 72 square miles of land and has a mountain range down the center of the northern three-quarters of the island. The highest peak is Mount Tapotchau.

Landings were made on the southwest by the 2d and 4th Marine Divisions after several days of naval bombardment and air strikes which destroyed or neutralized beach defenses. However, during the first 4 days, Jap artillery and mortar fire was particularly heavy on the beach and caused large casualties.

On D-plus-1 and D-plus-2 the Japs staged several counterattacks, attempting to drive U. S. troops back into the sea. These, however, were all repulsed. On D-plus-3, Aslito Air Field was captured by the 27th Infantry Division which had landed the previous day and on D-plus-5, most of the southern end of Saipan had been secured.

Mount Tapotchau was captured on D-plus-10 and for the next 2 weeks the operation assumed a mopping up character.

The following notes have been extracted from the report by the Signal Officer, Headquarters Northern Troops and Landing Force (the amphibious force for the operation).

A chronological résumé of the communications aspects of this operation follow:

March 15	Communication planning began.
April 26 to 28	Command post exercises held in Hawaii.
May 8	Message center personnel, Hq, NT&LF, embarked.
May 10	Command post, Hq, NT&LF, opened aboard USS Cambria.
May 11 through 20	Rehearsals for operation.
May 28	Signal instructions issued.
June 15	D-day.
June 16	Advance message center, Hq, NT&LF, opened ashore.
June 17	Advance command post, Hq, NT&LF, opened ashore.
June 17	Aircraft warning detachment landed.
June 18	Antiaircraft communication system in operation.
June 19	Wire in to 2d Marine Division.
June 20	Mobile communication unit in operation.
June 21	Signal battalion completed unloading.
June 24	Air Defense Communication Center in operation.
June 29	Base visual station in operation.
July 1	First issue of signal equipment mbade by 7th Signal Depot.
July 9	End of organized resistance.

All trunk lines installed by corps were placed on supports. Two hundred 2 by 4's, 20 feet long, and 200 lance poles were brought from Hawaii. As soon as one section of line was abandoned, the poles were recovered and used in another section. Later a quantity of captured Jap poles were used. Subordinate units stringing wire behind Corps wire teams were quick to take advantage of these pole runs in order that their wire might be off the ground.

Test stations were installed at regular half-mile intervals, and at other points where required. This system provided numerous testing points and greatly facilitated running down trouble. Test stations were covered, or otherwise protected from rain in order that excessive leakage might be avoided at those points.

A corps wire maintenance crew was placed at each division CP. This was done in order that a crew could start from each end of a trunk line and thus save time in locating trouble. This procedure was followed throughout the operation.

Divisions made a special effort to lay wire that could be employed by headquarters, NT&LF, and the Garrison Force.

Instances of wire lines being deliberately lowered were brought to the attention of the signal officer. Investigation showed that where 75 mm batteries had been located close to telephone lines, shells had struck telephone wires and exploded, injuring members of battery crews. The commanders of these units had therefore lowered nearby telephone lines.

EQUIPMENT EXPENDITURE 27th INFANTRY DIVISION

TO AND INCLUDING 10 JULY '44

	Radio Repair	27th Sig. Co.	105 Inf.	106 Inf.	165 Inf.	Div. Arty.	27th Ren. Tr.	762 Tank Bn.	88th Cml Bn.	1341 Eng. Gp.	34th Eng. Bn.	1165 Eng. Gp.	5th Corps Sig. Dump	24th Marine Co.	772 Amph Tractor
Antenna, AN-130				4										2	
Antenna, AN-131															
Battery, BA-2			5												
Battery, BA-9								9			17				
Battery, BA-27				27		64				100		1,000			
Battery, BA-30		200			200	800									
Battery, BA-37			380	480	1,125		90	100							
Battery, BA-38			370	610	1,115		45	90			16		124		
Battery, BA-39			32		110	48	20	48			16		124		
Battery, BA-40			96	116	107	112	40	64					10		
Battery, BA-41			20		10	28					27	24			
Battery, BA-43			28		202		8		32						
Battery, BA-70		18	120	80	211			16							
Cord, CD-318 w/switch					1										
Cord, CD-501						1									
Case, CS-79				2				1						1	
Hand-set, TS-10C				2				15	1						
Hand-set, TS-13						1									
Head-set, HS-30						2									
Insulator, IN-106			8			5	3	12							
Mast Sec., MS-50			8	2			3	12							
Mast Sec., MS-51			8	2			3								
Mast Sec., MS-52								1							
Mast Base, MP-48		30		100	100	100									4
Msg Book, M-210								12							
Microphone, T-17								23							
Microphone, T-30															
Power Unit, PE-103A	1														
Radio Set, SCR-300	6														
Radio Set, SCR-536	12			3											
Receiver and Transmitter, BC-654	1														
Reel Equipment, CE-11				4											
Reel Unit, RL-31				1											
Reel Unit, RL-39				4											
Telephone, EE-8A			8			2									
Tool Equipment, TE-33		9		16	6	14									
Transmitter, BC-603								2							
Transmitter, BC-604								2							
Tube, VT-4C	9					1									
Tube, VT-25	2														
Tube, VT-147						1									
Tube, VT-164						2		25							
Tube, VT-165						1		11							
Tube, VT-171								2							
Tube, VT-172								2							
Tube, VT-173								2							
Tube, VT-174								4							
Tube, VT-177						2	2	2							
Tube, VT-178						4	2	2							6
Tube, VT-179	8					6	8	4							
Tube, VT-182	3					10	4	6							6
Tube, VT-183	2					2	2	2							
Tube, VT-185	7					8	8	8							
Tube, VT-187															20
Tube Kit f/SCR-510								12							
Tube Kit f/BC-603								12							
Tube Kit f/BC-604								12							
Tube Kit f/BC-605								12							
Wire, W-110-B		89	37	37	14	90									
Wire, W-130		7	19	14	22	15									

APPENDIX 2 TO ANNEX LOVE TO OPERATION PLAN NO. 3–44

1. Standard Signals for Air Raid Warning Conditions, Air Raid Alarms, and control of Antiaircraft Fire.

a. AIR RAID WARNING CONDITIONS.

Visual	*Radio* (Plain language message)	*Meaning*
"ZEBRA" Flag	"FLASH RED"	Air attack imminent, enemy aircraft in vicinity.
"TWO" Pennant	"FLASH BLUE"	Air attack probable, unidentified aircraft in vicinity.
"ONE" Pennant	"FLASH WHITE"	All clear, aircraft identified as friendly. (Hostile aircraft no longer in vicinity)

b. AIR RAID ALARM (FLASH RED).

Ten second blasts with 5 second intervals for a period of 2 minutes on siren from base or senior ship in harbor.

c. ALL CLEAR (FLASH WHITE.)

Long blast for 1 minute on all sirens.

2. Control of antiaircraft fire ashore will be exercised by the CO AA Artillery until such time as the island Air Defense Control Center has been established and liaison has been effected. Prior to the establishment of the Island ADCC, HQ AW Warning Squadron Five will advise CO AA Artillery of fleet fire condition.

a. CONTROL OF ANTIAIRCRAFT FIRE.

Visual	*Radio* (Plain language message)	*Meaning*
GREEN Flag	"CONTROL GREEN"	All guns hold fire on air targets.
YELLOW Flag	"CONTROL YELLOW"	All guns fire on any air target.

b. When flag signals for air raid warning conditions and control of gunfire are flown simultaneously, the Control Flag will be flown UNDER the Condition Flag.

c. Shore parties shall conform to the existing Air Raid Warning Conditions and notify Headquarters Northern Troops and Landing Force of the air warning conditions as indicated by visual flags observed from ships off shore.

From D-day to D-plus-25, approximately 2,275 miles of wire were installed on the island of Saipan.

Corps wire teams salvaged 190 miles of W–110 wire. This wire was not all wire installed by corps signal battalion, but salvageable wire laid by any unit.

At D-plus-6 the following wire system was in effect:

	Trunks
2d Marine Division	4
4th Marine Division	4
27th Infantry Division	4
Corps Artillery	4
Antiaircraft Artillery	2
Corps Reserve	1
Locals	46

Thirty minutes from originator to addressee was considered the maximum time delay for landing force messages. Signal officers noting an excessive delay would notify net control stations of the time delay noted. Net control stations would then take steps to reduce the time delay to not more than 30 minutes.

The maneuverability of most Army units depends almost as much on Signal Corps equipment as on their own, for any break-down in communications, whether from loss or partial disruption, may make it impossible for units to move. That is why maintenance of signal equipment is far more important than it might seem at a glance.

PACKING SIGNAL EQUIPMENT

Improvements Made in Packaging of Signal Corps Items Pay Off at the Fronts

IT BECAME evident early in the war that even the best commercial packing was not good enough to guarantee safe delivery of Signal Corps equipment to theaters of operation. Packing which had proven adequate under normal peacetime conditions was generally satisfactory as long as the flow of equipment was to training points within the limits of the continental United States. As the war progressed, however, and overseas theaters were opened, the emphasis shifted from domestic to overseas delivery, with the consequent increased hazards of wartime transportation and storage.

In order to protect against these increased hazards, the Signal Corps found it imperative to establish its own Packaging Division to develop packs that would stand up under rough handling and that would protect the contents against breakage, corrosion, mold, fungus and all other forms of deterioration, whether in warehouses or in open storage, in dry or humid climates, in temperatures ranging from the cold of Iceland to the heat of the tropics. To further complicate the problem, the greater proportion of signal equipment is of an extremely delicate and fragile nature, such as, for example, electronic tubes, radio and radar sets, meters, photographic and recording devices. It ranges in weight from grams to tons, and in size from a fraction of a cubic inch to thousands of cubic feet.

Immediately available for application were the principles and minimum requirements for overseas packaging and packing as outlined in U. S. Army Specification 100–14, and the various methods of preservation as explained in ASF Manual M 406. Both these publications, however, were general in scope, and their use in connection with Signal Corps equipment required not only a knowledge of the nature of that equipment, but also a familiarity with the problems of transportation, storage and distribution involved. The Signal Corps was therefore faced with the necessity of interpreting these general principles to contractors and to inspectors as they applied to each item of equipment.

As a primary measure, detailed packaging specifications, requiring a minimum of interpretation, were written covering major items. Other specifications were written to cover the packaging and packing of an entire class of items, such as dry batteries, fixed capacitors, fixed resistors. Meetings held with interested contractors prior to issuance of such specifications provided an opportunity for full discussion of problems and principles. The resulting specifications, therefore, not only met Signal Corps requirements, but were acceptable to industry.

ENGINEERS STATIONED AT ZONES

The continual development of new equipments, with an ever increasing attendant number of packing problems calling for immediate solutions, led to the assignment of Packaging Division, Storage and Issue Agency, personnel to liaison units stationed at the various inspection zones, permitting instant availability of packaging engineers to visit contractor's plants.

The writing of a separate specification to cover the packaging and packing of each item of Signal Corps equipment was impossible because of the number of items involved, and it gradually became apparent that detailed specifications, even on major items, were impracticable. Packaging engineers could not keep pace with the tremendous volume of new equipments being produced. The packaging materials specified were often unavailable at the time equipment was ready to be packed, and it was necessary to authorize a substitute material in order to prevent delay in delivery. Equipments were constantly being changed and improved as operation in the field required, making the original specification obsolete within a few months of its issuance. Furthermore, as inspectors and contractors became more familiar with Signal Corps packaging problems and requirements, the need for detailed specifications lessened.

The experience already gained by the Packaging Division was then coordinated in the writing of general specifications, under the titles of *Signal Pack* and *Standard Pack*, which classified the majority of items of signal equipment and set forth the principles of packaging for each type or class

in such a way as to guide both contractors and inspectors toward adequate packaging. The emphasis was thereby shifted from detailed specifications calling for certain definite materials to general instructions calling for certain definite degrees or units of protection available in a number of ways, and permitting interchangeability of materials affording equal results.

USE OF PACKS TAUGHT

Representatives of the Packaging Division toured the inspection zones and depots, lecturing on the use of Signal Pack and Standard Pack. Through the various inspection zone liaison units, a close cooperation with the Inspection Agency is maintained and full assistance offered in training inspection personnel. Other representatives have been assigned to work through the production field offices in order to expedite packaging by contractors wherever problems of material procurement or interchangeability occur. A Materials Branch has been established within the Packaging Division to test and evaluate new packaging materials, to recommend the substitution of noncritical materials, and to assist contractors in securing sufficient quantities of material to insure that delivery of needed equipment will not be delayed.

By December 1944, the problems confronting industry in packaging for the various service forces of both Army and Navy necessitated the establishment of some agreement and uniformity of procedure amongst the services. To secure such uniformity, and to thereby speed the overseas shipment of war material, the Army Packaging Board and the Joint Army-Navy Packaging Board were established.

As a result, contractors manufacturing the same article for different services may standardize packaging for all, tests of materials or methods performed by one service branch are now made available to all services, and packaging material manufacturers approved by one service are now available to serve all.

Although tremendous progress has been made in securing successful shipment overseas, and the coordination and cooperation among services has helped the flow of matériel to all theaters, new problems are constantly arising. The termination of hostilities in Europe has focused attention upon the transfer of equipment to the Pacific, and packaging personnel have been assigned to Mediterranean Theater of Operations and European Theater of Operations. Packaging teams now undergoing training at signal depots for work overseas are directly under Office of the Chief Signal Officer, but the Packaging Division is constantly available for consultation. Overseas requisitions for packaging materials are being expedited, and assistance is being given in preparing instructions for adequate repackaging in the field.

With the shift of transportation to the Pacific, the employment of maximum protection for equipment becomes increasingly essential. The facilities for handling and storage are generally inadequate, climatic conditions are varied and extreme, and the time elapsing between shipment and delivery is considerably longer than that involved in shipments to European theaters. All these factors give rise to additional problems in procurement of packaging materials and the need for constant improvisation of new packs.

OVERSEAS REPORTS STUDIED

Officers assigned to overseas duty or sent on special missions have contributed their reports of conditions under which shipments must be handled, transported, and stored, and of actual damage which has occurred under these conditions. Taking advantage of all such reports, packs have been redesigned so as to afford greater protection. In those cases where packaging could not provide the physical protection required to prevent breakage, the matter has been taken up with the laboratories, and the equipment itself has often been redesigned.

Packaging Division personnel are now available to the laboratories and packaging problems are given consideration in the development of new equipment. The results of the overall program are distinctly encouraging. Contractors have been made aware of the peculiar hazards and problems involved, and are contributing their invaluable cooperation. The several thousand inspectors have been made *packaging conscious*. Reports of damage occurring as a result of improper or inadequate packaging have been sharply reduced. While not yet reached, great strides have been made toward the ultimate goal, which is the delivery of *all* signal equipment at destination in serviceable condition.

PACKAGING AND PACKING TRAINING

THE INCREASED importance of proper packaging and packing of Signal Corps equipment to reach the fighting fronts in usable condition has made it necessary to develop an extensive training program for personnel in Signal Corps depots and signal sections of ASF depots in the United States. Previous to March 1945, such training was done in special classes conducted by the U. S. Forest Products Laboratories' instructors at Madison, Wis.

It became apparent early in 1945 that the need for training on packing signal equipment was increasing rather than diminishing, so a training program was developed by Storage Branch, Procurement and Distribution Service, and Civilian Training Station, Personnel and Training Service, Office of the Chief Signal Officer. The program worked out was based on two broad fields of training: (1) Centralized training conferences for depot packing supervisors, conducted by a selected Signal Corps training team, and (2) intensified on-the-job training of workers in packing lines of each depot.

In order to carry out the first phase of this training program, three Signal Corps instructors were selected and a complete 9-day conference program was developed with the cooperation of authorities at Forest Products Laboratories. Because of the division of work loads and the assignment of personnel in the depots, it was decided to divide the conference into three divisions: (1) Corrosion Prevention (24 hours), (2) Packing (32 hours), and (3) Marking and Carloading (16 hours).

This division permitted a depot to send supervisors only to those sessions pertaining to their particular work. It also permitted the training to be closely related to the actual depot operations.

It was further decided, in the interests of saving traveling time and time lost from the production line, that three training centers would be used. They were Chicago Signal Depot, Philadelphia Signal Depot, and Ogden ASF Depot. Quotas were established and depot supervisory personnel were directed to proceed to the nearest training center.

It was explained in each conference that the supervisors were receiving this training in order that they could return to their assignments and, in turn, train the workers under them. In order to derive the maximum benefits from these conferences, the enrollment was limited to 25 carefully selected supervisors and officers, and ample opportunity was given for individual work on actual equipment. The sessions were strictly informal, with a maximum use of questions and answers, and included a number of sessions devoted to specific problems brought up by the supervisors. Course outlines were printed and each supervisor filled in the information as the conference proceeded, enabling him to return to his depot with a complete reference book in his specialty. In addition, all the latest Joint Army-Navy specifications and additional materials were furnished to each person.

A special 6-container processing and drying table, heating tanks, and other training aids were developed as a trainer's kit and shipped from one center to the next. In addition, each of the three centers furnished items from stock and materials for processing and as this work was completed by the trainees in the conference, the items were returned or shipped, as appropriate. Complete classroom facilities were furnished at each training center, including space for the necessary individual work.

In developing and proceeding with this first phase of the over-all training program, it was evident that the personnel selected for each conference session were of high caliber and were thoroughly familiar with the practical operation of processing, packing, and shipping lines. It was therefore necessary to concentrate on giving them information and skills which would enable them to satisfactorily train the workers under their supervision in each depot. Present indications are that the conferences were highly successful in attaining this goal.

The second phase of the program, intensified on-the-job training in each depot, is proceeding along the following general lines: (1) Specialized training of line workers by the supervisors, (2) training assistance by civilian training sections of each depot, (3) visits to each depot by Signal Corps instructors of the training team used in the first phase, and (4) coordination of Storage Branch and Civilian Training Section, Office of the Chief Signal Officer.

This phase of the training program will be a continuous effort to improve the work output of the individual workers in the depot lines. It will be the responsibility of the supervisors to be good instructors.

It is estimated that the above program, in addition to providing a more practical approach to meeting the specific training needs in Signal Corps depots, has effected a considerable saving in time and money, as compared to continuing the 1944 method of sending large numbers of personnel to Madison, Wis. Because less travel time is needed under the new program and because the supervisors attend only that session of the conference related to their work, a saving of 64 percent in time lost from the job has been achieved. The total estimates also indicate that a comparative saving of 58 percent occurred in the costs of the training as now conducted.

PIGEONS ON D-DAY

Birds Used for the Invasion of France Were Carefully Selected for Ability

THE 2d Platoon, 280th Signal Pigeon Company, arrived in the European Theater of Operations 12 September 1942, and upon arrival at its final destination immediately engaged in instructing tactical troops that were present in the theater. This platoon instructed various corps and divisions in the care and use of pigeons and their equipment, this training continuing up to D-day. The corps and divisions trained in pigeon communication by the platoon formed most of the units comprising the First U. S. Army.

The tactical mission of the platoon was to supply pigeon communication from the shores of Normandy to the United Kingdom for the First U. S. Army.

The terrain of the British coast from the Straits of Dover to Portsmouth varies from tidal mud flats at water level, to chalk cliffs and ridges 100 to 400 feet high. The terrain is chiefly rolling downland interspersed with cultivated fields bounded by hedgerows. From Portsmouth to Plymouth the land is largely the same as that mentioned in preceding sentence, except barren moorland, rocky ridges, and mountains extending to 600 feet in height characterize Dartmoor, Bodmin Moor and Cornwall, the areas surrounding Plymouth. The topography of France from the Cherbourg Peninsula to Dunkirk may be compared to that along the English coast.

EMPLOYMENT IN THE INVASION

The pigeons used in the invasion of France were limited to 540 carefully trained and selected birds issued to using formations. Returns of operational messages were still further limited, although the number of pigeons homing to the UK without messages were numerous. While the percentage of returns was not as large as originally anticipated, it is believed the pigeon returns were creditable when adverse weather conditions are considered.

The chief detriment was the head-on winds prevailing either steadily or in squalls from D-day on. Further, quantities of pigeons were kept basketed by using formations for as long as 8 days prior to use. This long confinement naturally impaired the pigeons' condition.

Pigeons issued to using formations were employed for carrying ammunition status reports, undeveloped negatives (film), emergency messages, when other means of communication failed, messages when radio silence prevailed.

Two Types of Lofts Used

Lofts used fell into two categories—Civilian National Pigeon Service lofts (NPS) and RAF lofts.

The NPS lofts were organized under the Air Ministry early in the war, and allotted to the Special Section of the British Army Pigeon Service. These lofts were called Special Service lofts, and prior to their use by this organization, were employed by the British Army for obtaining intelligence reports from Allied sympathizers living on the European continent, and especially the areas of France attacked by the First U. S. Army. The RAF lofts were established by the Air Ministry for the purpose of carrying SOS messages from distressed aircraft forced down in the southern coastal waters of Great Britain. The lofts were obtained from the British Army and Air Ministry, under a SHAEF directive, after several months of the closest liaison between the British Army Pigeon Service, the Air Ministry, and this organization.

The pigeons were raised in the lofts used, and were naturally well settled and acclimated for the rigors of channel flying, which condition dictated their choice. Months before these lofts were officially taken over, their training was changed in accordance with the prebattle plans of the invasion. This was made possible without breaking security, through the enthusiastic aid of the Special Section, British Army Pigeon Service, which allowed the personnel of 2d Platoon, 280th Signal Pigeon Company, to start training the birds.

The training started in January 1944, while the lofts were still under direct command of the British Army Pigeon Service. Pigeons were tossed several times weekly, distance depending on weather conditions. Birds from Plymouth were tossed along the coast from Isle of Wight in the east, down to Falmouth in the west. Birds from Portsmouth were tossed from Weymouth in the east and Brighton in the west. As the weather improved

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and spring drew near, arrangements were made with the U. S. Navy to have personnel of this organization toss pigeons over water from LCT's from as far as 20 miles air line off shore. Birds that had been so trained were used on large pre-invasion amphibious exercises, where they rendered great service. Pigeons were also used in smaller exercises rehearsing certain phases of the coming operation. Thus, when birds were issued for the invasion, only NPS pigeons of known ability and RAF pigeons recommended by the Air Ministry were used.

The personnel of 2d Platoon, 280th Signal Pigeon Company, have a high degree of training, 49 percent of the men with 3 years or more service in the Army, 46 percent with more than 2 years' service, and only 5 percent with less than a year in the Army. Of the total strength of the platoon, 75 percent of the platoon have had 5 to 15 years' experience, averaging 9 years each, in breeding, training, and racing pigeons in civilian life. All men have received continuous training in pertinent subjects. They were qualified tactically and administratively in all their duties during the invasion, and special training was given men assigned as messengers for the purpose of patrolling lofts and delivering messages to combined headquarters message centers located at Plymouth and Portsmouth.

METHOD OF ISSUING PIGEONS

Pigeons were issued to using formations in the marshaling areas just prior to embarkation. As the time and place of embarkation of using formations could not be accurately known, arrangements were made for these units to contact the platoon headquarters at Plymouth, which in turn ordered the appropriate detachments of the platoon to make deliveries. As deliveries had to be made on very short notice, 21 jeeps were kept in readiness at both Plymouth and Portsmouth. However, some using units embarked many days prior to D-day and other units called for their pigeons before they were actually supposed to embark. These circumstances accounted for pigeons being kept basketed for as long as 8 days prior to their use. Whenever possible, replacements were made to units that had called for their birds too soon. Due to the fact that units embarked at one point in England and the boats moved to other ports, it was not always possible to make these replacements. At this stage, it became necessary to tour the invasion fleets in a boat and search out the unit requiring replacements. This was done, but only a percentage of replacements could be made before sailing time.

Feed Included With Birds

Pigeons were issued in 2-bird crates and 10-bird cages, accompanied by empty 4-bird containers, so that pigeons would be confined in 4-bird containers for as short a time as possible. Instructions and an extra week's supply of feed in cloth bags were wired on top of the crates. Birds were transferred from crates to these containers just before or when the invasion crafts were on their way to France. It is reported that several of the crates, cages, and containers were damaged on the beaches of Normandy. The loss of this equipment was anticipated and a signature was taken for all equipment issued.

Message center personnel of major organizations had been instructed by this unit in the care and handling of pigeons and the signal officers concerned were fully versed in the capability and limitation of pigeons as a means of communication. From reports based on personal observation of an NCO of this command who visited Normandy, pigeons were cared for in an excellent manner by message center personnel.

Messages received at the lofts were carried by special messengers of this platoon to the message centers of the combined headquarters of either Plymouth or Portsmouth. The combined headquarters concerned forwarded the message to the addressee by the most expedient means of communication. Signal Corps Message Envelope M40 was used in delivering messages from lofts to combined headquarters message centers, and the envelopes retained by the messenger as a receipt.

It was anticipated that some pigeons would get back to England but not necessarily to their lofts. To cover such a contingency, the Air Ministry furnished all police with Defense Regulations 9, paragraph 4, British War Office. This Defense Regulation deals with the disposal of stray, injured or dead homing pigeons, and through this information all police stations were prepared for just such an occasion. Message pads issued with pigeons bore a stamp stating that it was an operational message, and that the finder should call the message to the British War Office.

The average distance was approximately 125 miles air line in those cases where pigeons flew di-

rect from the point of liberation to their loft; however, it is believed that a large percentage of birds flew a greater distance by following the coast of France to Dunkirk, crossing to England over the Straits of Dover (the narrowest crossing of the Channel) and down the English coast to their lofts. A great majority of birds returning to England carried no messages, and as time of liberation is not known, an estimate of average speed cannot be derived.

It is understood that communications were extremely good. Radio operated successfully from D-day and messenger boats operated on schedule from the beachheads, commencing with D-day. Airplane messenger service commenced with the capture of landing fields suitable for use by liaison planes. Because of these facts, the occasion for the greatest utility of pigeons never arose; thus accounting for the small number of operational messages carried.

FAN SHROUD AND SHIELDS

THE COOLING system requirements for military vehicles have been carefully worked out to insure that the engine will not overheat. These requirements led to the installation of the fan shroud, air shield, hood, and fan to force air through all sections of the radiator.

With the fan operating, the shroud and shield act as a *tube* to channel air through the radiator in a steady stream that has the greatest possible cooling effect on the water in the radiator. They also keep air from recirculating within the engine compartment or from being pulled from areas other than through the radiator, as shown in figure 1.

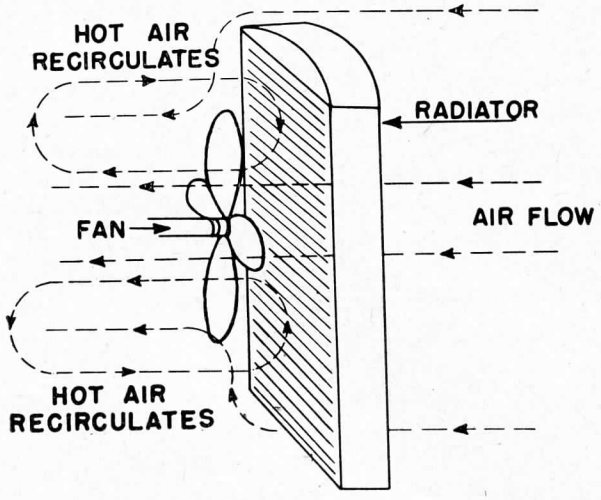


FIGURE NO. 1
WITHOUT SHROUD

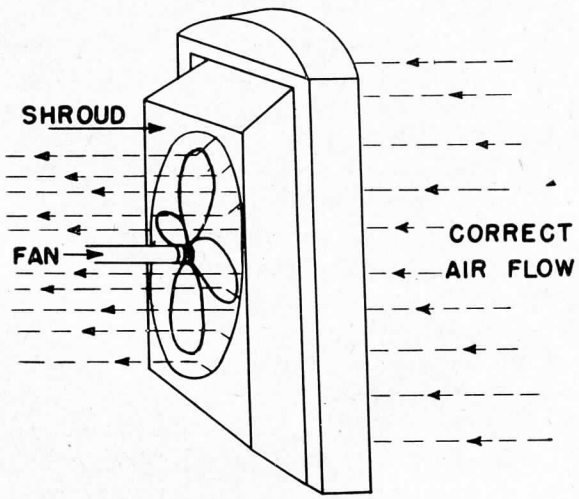


FIGURE NO. 2
WITH SHROUD

Removing the hood, or even leaving it open, causes trouble because the hood is considered an extension part of the *tube* to channel the air forced through the radiator to flow back over the engine. With the shroud and shields installed and the hood closed, only cool air circulates through the radiator, as shown by figure 2.

CONTRACT TERMINATIONS

Signal Corps Goal Is Fast, Fair, and Final Settlements for Equipment Producers

THE SIGNAL Corps radio operating in a tactical net in some distant field of combat is but one of thousands of pieces of equipment which was manufactured in the factories of the United States. Behind it, and all the other materials of war, is the steady stream of production that has aided our fighting men to victory in Europe and is now enabling them to defeat Japan.

Everyone knows that the vast production for war must some day be brought to a halt. Few, however, are fully aware of the magnitude of the job of shutting off the tremendous source of supply. The task of converting from war to peace, in fact, is considered by many experts to be more difficult than that of converting from peace to war.

WAR AND CONTRACTS

This has been, and still is, a contract war. When America became the *Arsenal of Democracy*, hundreds of thousands of contracts were awarded to suppliers in every corner of the country. More are still being awarded. Many contracts already have run to completion and thousands more will do so before VJ-Day. But because no one knows when or where the last shot will be fired, countless contracts in effect, and others still unwritten, will be terminated short of completion.

Termination of contracts is by no means solely dependent upon the ending of the war. Contracts have been cancelled almost from the start, due to changes in logistics, improvements in design, revisions in requirements based upon combat experience and similar factors.

Early in the war, the Signal Corps organized for contract terminations much in the same manner as for procurement. Sole responsibility for terminations was placed in the hands of the procurement districts, which set up separate contract adjustment divisions. In a sense, the termination organizations were geared to handle *procurement in reverse*. The task was unique. Never before had there been such complex problems of law, finance, engineering, accounting, and property disposal.

It soon was found that a new philosophy was required to cope with the maze of perplexing details that followed in the wake of terminations. The experience gained in World War I was far from satisfactory. The record in that war is one of lengthy litigation and confusion. A repetition of this history on a larger scale, due to the vast increase in procurement in World War II, would be disastrous.

The new philosophy took the form of negotiated settlements. Determined to accomplish fast, fair, and final settlements, the Signal Corps and other services cut red tape to the minimum. By authority of the War Powers Act of 1941, they made negotiated settlements the rule rather than the exception. Previously, although this method of terminating contracts has precedents which date back to the Civil War, it was rarely employed.

The basic theory of negotiated settlements is that reasonable people, supplied with pertinent facts, can settle a claim; that is, reach an agreement, without recourse to courts of law.

The Contract Settlement Act of 1944 supplied the necessary working tool to put the policy of accomplishing fast, fair and final settlements into effect. This legislation was a tremendous step forward in spelling out definite procedure and establishing principles without which negotiation would be hamstrung. Contracting officers, for example, were empowered to make final settlements directly with contractors, without the necessity of a review by the General Accounting Office before payment. The contracting officer himself was freed of all personal liability except for fraud, and all settlements were made final, except for fraud.

The act also provided for the establishment of the Office of Contract Settlement, with an Appeal Board, an Advisory Board and various Advisory Committees. To it was assigned jurisdiction over all government contracting agencies in policy matters pertaining to contract terminations.

JTR PROVIDES UNIFORMITY

The principles for contract terminations were laid down by the Contract Settlement Act of 1944, but it remained for the Joint Termination Regulation (JTR) to provide uniform procedures for both the Army and the Navy. JTR eliminates

conflict that formerly existed in settlement actions by various government agencies, acting under independent instructions. Emphasis in the JTR, as in the Act, is on fair and speedy settlements by negotiation rather than by legal formula.

Prior to the adoption of JTR on 1 November 1944, procedure was governed by individual directives from the Office of the Chief Signal Officer which gradually gave way to a special section of Signal Corps Procurement Instructions (sec. 15), known as the Signal Corps Contract Termination Manual. The Signal Corps was one of the first services to produce such a manual, a document that is still in force.

Within the Office of the Chief Signal Officer, staff supervision of contract terminations was made a function of the Contract Termination Branch, Contract Adjustment Division, Procurement and Distribution Service. Constant contact is provided with the field offices in the interpretation of regulations and liaison is maintained between the districts and higher authority. Reports are required on many phases of activity on a daily and monthly recurring basis. A unique feature of Signal Corps practice is the holding of monthly *forecast meetings* in the districts. At these meetings the various steps in the settlement of cases are forecast in advance and these dates are scored for accuracy at the next meeting. The practice has proven to be effective in achieving a reduction of the pending case load in a systematic manner to the benefit of both Signal Corps and the contractors.

Contract terminations in the Signal Corps were few during the first 18 months after Pearl Harbor. During this entire period only 186 terminations, an average of about 10 a month, were authorized. Only 70 actual settlements were accomplished, including some at no cost to the Government. As the tempo of war increased, field experience dictated changes in the procurement program, necessitating more frequent terminations. The largest number of cases closed in a single month in 1943 was 187 in November. The peak was reached in June 1944, when 372 cases were settled.

How well the Signal Corps has kept pace with the influx of terminations can be judged by the record. As of the end of April 1945, although a total of 4,515 terminations had been authorized, the number of pending cases in which final settlement had not been reached was down to 275 cases.

Termination summary

	30 June [1] 1943	31 Dec. 1943	30 June 1944	31 Dec. 1944	30 Apr. 1945
Number of terminations	186	826	1,942	958	693
Dollar value [2]	283,491	249,767	321,143	87,353	22,981
Backlog of pending cases	113	272	828	460	275
Dollar value [2]	269,992	280,539	392,195	305,105	63,299

[1] Includes period 7 Dec. 41 to 30 June 43.
[2] In thousands, including revisions.

PRETERMINATION PLANNING

In recent months much attention has been given to pretermination planning and subcontractor training by the Signal Corps. Pretermination planning seeks to reach agreements with contractors in advance so that problems arising from auditing and property disposal are solved before they become an obstacle to speedy settlements. In the field of subcontractor training, the Signal Corps has taken a leading part, beginning with a Nation-wide tour by a group of experts in 1944 to acquaint contractors with termination procedure. This was followed by the launching of a training program now in progress. Nearly 600 subcontractors already have attended 30 *clinics* where trained teams have instructed them on the proper manner to file claims. Many more are scheduled to attend future clinics.

The disposal of termination inventory, consisting of undelivered items, work in process and raw materials, has become one of the most difficult problems of terminations. Effort is made to have the contractor retain or dispose of such property as is not required by other government agencies. Where property is not acceptable to the contractor and no immediate market can be located by him, the Government must decide whether to take title or to scrap. If the Government takes title, the material may be disposed of in several ways, either by removing it to a government depot for stock replenishment after packing for overseas shipment; by transfer to government disposal agencies such as are provided by the Reconstruction Finance Corporation and the Defense Supplies Corporation, or by storage for future use. In any event, it is worth noting that the Signal Corps itself actually sells no termination inventory at any time.

To augment the activity carried on by the districts, special field units consisting of personnel

trained in auditing and property disposal are assigned as resident representatives in the contractors' plants. They perform services not only for their own district, but also for other Signal Corps districts and in some instances, under the *consolidated program*, for other War Department technical services and Navy bureaus. Such a procedure is now the responsibility of the Signal Corps at such companies as Federal Telephone and Radio Corporation at Newark, N. J., and Zenith Radio Corporation at Chicago.

A recent development is the setting up of *direct settlements* on a company-wide basis. Under this procedure, one service of the War Department or the Navy is given sole responsibility not only for the auditing and property disposal of certain contractors, but for complete negotiation and settlement of all claims arising out of all War or Navy Department contracts held by the assigned contractor. One of the largest contractors in the country, General Electric Co., has been assigned to the Signal Corps under this plan. In addition to War and Navy contracts, the assignment of General Electric Co. to the Signal Corps also carries with it the responsibility for effecting settlement of terminated Maritime Commission contracts. Seven field units have been assigned to 7 principal plants of the company and will handle the settlement of all terminated contracts in 49 plants of the company which are scattered from coast to coast. The consolidated program and direct settlement program will do much to simplify and speed up satisfactory settlements.

Another device intended to expedite settlements is the delegation of authority to responsible contractors to finally settle claims of their subcontractors of $10,000 or less without prior approval of the contracting office. Approximately 250 of these delegations of authority have been extended by the Signal Corps to principal contractors. Procedures have been established to periodically review the operations of these contractors in order to be assured that the authority is being properly exercised.

With the existing organization functioning with increasing efficiency it is believed that the vast number of terminations still to come will be quickly settled in a manner equitable to both the government and the contractor. Only when the producers of war materials have been promptly paid and their plants cleared can they reconvert for civilian production.

CORRECTION

(Upper-Air Observations)

IN THE article on *Upper-Air Observations* in SCTIL No. 42, May 1945, nomenelature of the radiosonde modulator was in error. The correct nomenclature is Radiosonde Modulator ML–310( )/AMT–1. Reference was also made to the rate of ascension of the sounding balloon as 12 feet per minute. This should have read 1200 feet per minute. In addition, due to a typographical error, the minus sign before the temperature at which the balloon bursts was omitted. The correct temperature is approximately *minus* 70° F.

INTRODUCING EQUIPMENT

New Equipment and Techniques Are Explained to Overseas Troops by NEID Teams

NEW EQUIPMENT Introductory Detachment (NEID), Specialized Training Section, SCGSA, was activated in September 1944. It absorbed the functions and personnel of the Field Instructors Detachment, Southern Signal Corps School, Camp Murphy, Fla.

The primary mission of NEID is the introduction to overseas theaters of new, complex signal equipment or of new techniques in the employment of signal equipment.

The secondary mission of NEID is the accumulation of information regarding the tactical and technical performance and maintenance of signal equipment and similar related problems and the forwarding of this information to the chief signal officer.

These missions are accomplished by the use of the project and team technique. There is one project per equipment or per technique for training purposes. Personnel of each project are organized into teams for the particular introductory mission in the theater where required.

The training of NEID teams is accomplished normally prior to the setting up of formal courses of training in the zone of interior so that special training must be arranged. The emphasis of this NEID training has three aspects.

1. A thorough technical knowledge of the equipment. This includes both operation and maintenance.

2. A thorough knowledge of the tactical application of the equipment or technique.

3. Acquisition of all information which may assist in expediting delivery and theater use of the equipment or technique.

Thus the objective of this training is to supply the theaters of operations with personnel who have not only a high degree of technical knowledge but also a complete understanding of the tactical and logistical problems which may arise in connection with the equipment.

In the process of preparing personnel for overseas missions, NEID teams become the focal point through which various functional groups of the Signal Corps as well as other interested arms and services funnel appropriate information and techniques necessary for the proper introduction of equipment either new or improved.

As a result of direct contact with various interested groups, the NEID team is able to follow a flexible program adjusted to the needs of the particular equipment. Thus the technical training is ordinarily conducted in conjunction with the laboratory or manufacturers of the equipment. NEID personnel may assist in writing and editing the technical manuals for operation and maintenance. The growth in understanding of the equipment by NEID personnel is furthered by participation in various tests which the equipment must undergo before being accepted. NEID personnel work at the research laboratories (MIT, Johns Hopkins, NRL, etc.) and assist in research and development by conducting tests and aiding in development work generally. When first models are delivered to the signal laboratories for tests, NEID men already familiar with the technical aspects, often assist in these tests as well as in the field and performance tests.

The nature of this training is such as to bring to the theaters the insight which is gained by a close association not only with the early stages of development, testing, procuring, etc., of the equipment but also with the designers and inventors themselves and other personnel intimately concerned with these problems. Close coordination with the various contracting, distributing and servicing agencies such as the Monmouth Procurement District, Storage and Issue Agency at Philadelphia; Maintenance Division, SCGSA; Maintenance Branch, Office of the Chief Signal Officer, the various ports of embarkation as well as the theaters, provides an over-all logistical picture of the equipment and enables the NEID team to follow the equipment from its inception to the time it arrives in the theater and is introduced.

Typical tasks undertaken by NEID follow:

1. The NEID project officer, through the liaison officer of the arm involved, secures their plans for use of the equipment and at their invitation attends the planning conferences on training, development, and tactical use.

2. This is followed by a period of study of the organization and operations of the using arm at their training center, stressing study of the problems to be met with the equipment to be introduced. The inclusion of field problems and experience with the using arm is a must.

3. Assistance is also proffered to the using arm and signal training centers in establishing their own training to follow. In cases where practical training is already established at signal training centers their course is included in the NEID schedule.

Some of the equipment introduced by NEID follows:

1. Radio Sets AN/TRC–1, AN/TRC–3, AN/TRC–4.
2. Radio Set AN/VRC–3.
3. Radio Set SCR–694 ( ) and AN/TRC–2.
4. Radar Sets SCR–615, SCR–527, SCR–627.
5. Radio Equipments RC–145, RC–184, RC–127, RC–207, RC–215, RC–192.
6. Radar Set SCR–584 (including introduction of techniques of improving performance, modifications, and new techniques of employment).
7. Facsimile Equipments RC–58 and RC–120.
8. Radar Sets AN/TPS–1, AN/TPS–2, AN/TPS–3.
9. Radar set SCR–547.
10. Radar Set SCR–545.
11. Radar Set AN/CPS1–5.
12. Radar Set AN/TPS–10.
13. Moisture and Fungus Proofing Techniques.
14. Radio Set AN/MRD ( ).
15. Radio Link AN/TRC–6.
16. Radio Set AN/TPL–1.
17. Mine Detectors SCR–625 and AN/PRS–1.
18. Moving Target Indicators.
19. Interrogation of enemy scientific personnel.
20. Counter Mortar Equipment Techniques.

To summarize. An NEID team on arrival in the given theater of operations with new equipment can be expected to:

1. Install and demonstrate the equipment (with the aid of theater personnel on large equipments).
2. Establish and operate training in installation, operation, and maintenance in the communications zone or forward with units as may be required.
3. Provide complete information concerning significant advantages and limitations based on development tests.
4. Supply information concerning availability of equipment, spare parts, test equipment, accessories, and pertinent publications for the particular equipment and their basis of issue.
5. Be familiar with the tactical use of the equipment.
6. Reflect pertinent operational and technical data concerning theater use and experience with the equipment through the medium of interim and final reports which may include appropriate recommendations for correction or improvement of design, construction, inspection, packaging or shipment markings.

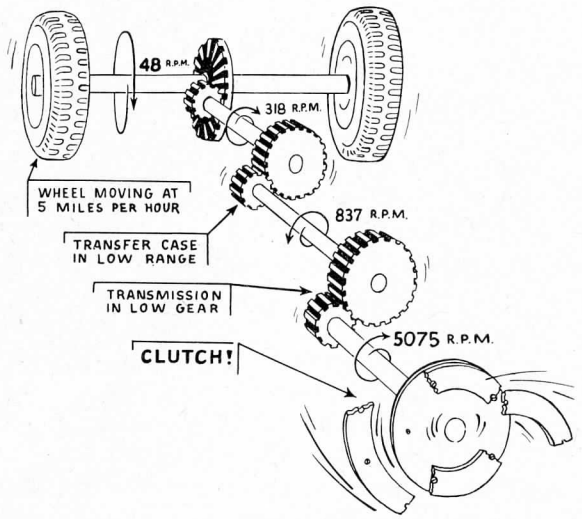
CLUTCH PRECAUTION

THE PRACTICE of coasting a vehicle with the transmission and transfer case in low gear range by disengaging the clutch causes serious damage. When the clutch is disengaged the driven disk will be rotated by the movement of the vehicle, from the wheels up through the power train. During that time, there is no pressure on the driven disk to assist in holding the clutch lining in place.

On a 2½-ton, 6 x 6, the combination of gear ratios, when both the transmission and the transfer case are in low range, will cause the clutch-driven plate to rotate 105 time as fast as the wheels. When the vehicle is coasting at one mile per hour the clutch driven disk is turned 1,015 revolutions per minute. Therefore, its speed at 5 miles per hour will be 5,075 revolutions per minute. At speeds above 5 miles per hour the plate is caused to spin so fast that the lining may be badly damaged or thrown from the disk by centrifugal force.

When descending a hill with the transmission and transfer case in low range so the engine can be used as a brake, the clutch should not be disengaged to coast off the bottom of the grade. Or, when the engine stalls while climbing a steep grade with the transmission and transfer case in low range, the vehicle should not be allowed to roll back at a speed of over 3 or 4 miles per hour with the clutch disengaged.

It must be remembered that military vehicles cannot be compared with commercial vehicles in this phase of operation because the military vehicle's transfer case makes its gear reduction much greater than that of the commercial vehicle.



CLUTCH DISK SPINS MORE THAN 100 TIMES FASTER THAN WHEEL; DON'T COAST BY DISENGAGING THE CLUTCH.

Equipment Notes

ARMY PICTORIAL

ALIGNMENT METHOD FOR CAMERA PH–47–( )

In the course of inspection of Camera PH–47–( ) (Speed Graphic) at the Holabird Signal Depot it was observed that, when opened to normal position, the beds on some of these cameras were not level with the bottoms of the camera body. This condition caused the plane of the lens to be slightly off parallel in respect to the focal plane. Investigation of a method of alignment was conducted by Pictorial Engineering & Research Laboratory Division, Signal Corps Photographic Center. A means of correcting this condition was devised by the use of properly designed mirrors located in the lens board and ground glass positions of the camera.

The procedure follows:

1. Replace the ground glass at the rear of the camera with a mirror on which two cross lines have been etched through the center on the silver coating (fig. 1A). When viewed against the light, these lines will be transparent.

2. Replace the lens board with a clear glass plate on which a ¾-inch diameter circle of silver is centered with the silver portion to the inside of the camera (fig. 2). The following method is used to obtain the circle of silver: outline a circle ¾-inch in diameter through the center of the silvered surface of the mirror. Shellac or varnish this circle. Swab the remainder of the silvered side with potassium ferrocyanide. Rinse completely with running water. Swab with a 20–30 percent solution of sodium hyposulphite. Continue alternately rinsing with water and swabbing with sodium hyposulphite until the silver has been completely removed. Remove any remaining specks of silver with a pointed steel stylus (fig. 1B).

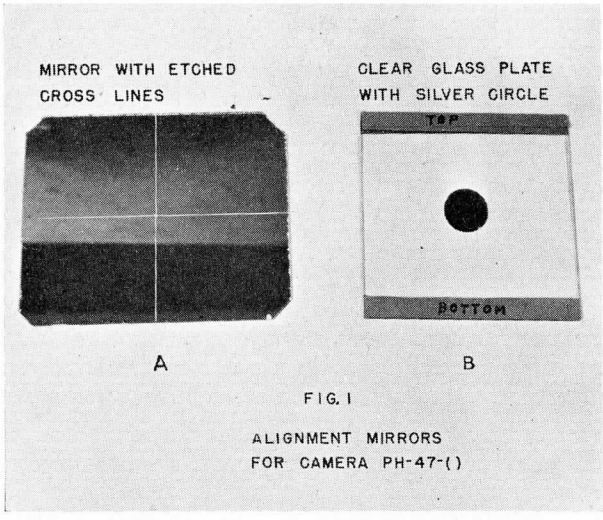


FIG. 1
ALIGNMENT MIRRORS FOR CAMERA PH-47-( )

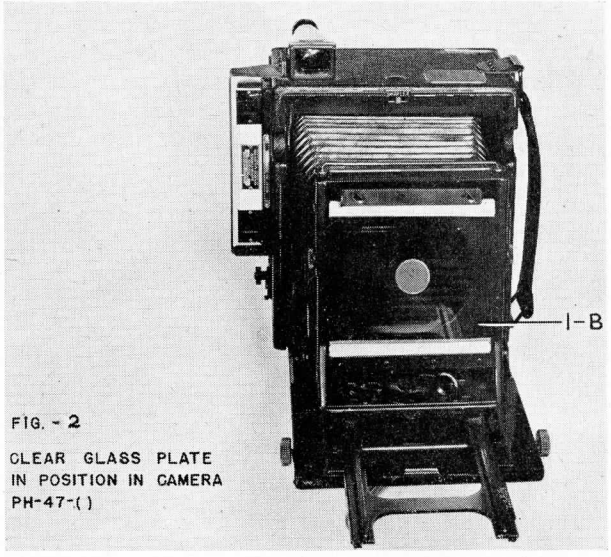


FIG. 2
CLEAR GLASS PLATE IN POSITION IN CAMERA PH-47-( )

3. When looking through juncture of the cross lines of the mirror from the rear of the camera, a multiple series of images of the cross lines will be seen in the circle of silver on the glass (fig. 3). Three reflections are required as a minimum acceptable standard for this method of alignment of Camera PH–47–( ).

Figure 3A shows what the observer will see if the camera is not correctly aligned, i. e., three or more images of the cross lines are not visible in the circular mirror mounted in the lens board.

Figure 3B shows what the observer will see if the camera were aligned to be just acceptable. The theory behind this type of alignment is that, as the lens and film plane approach absolute parallelism, the number of images of the cross line would increase to an infinite number until all the lines would appear on top of each other in the center cross at a point of absolute parallelism. As the plane increases in angular deviation, the number of reflected images of the cross line decrease to an extent where no reflected image would appear in the mirror.

When the images in the mirror show vertical misalignment, check the angle between the bed of the camera and the front of the body for lack of perpendicularity. When

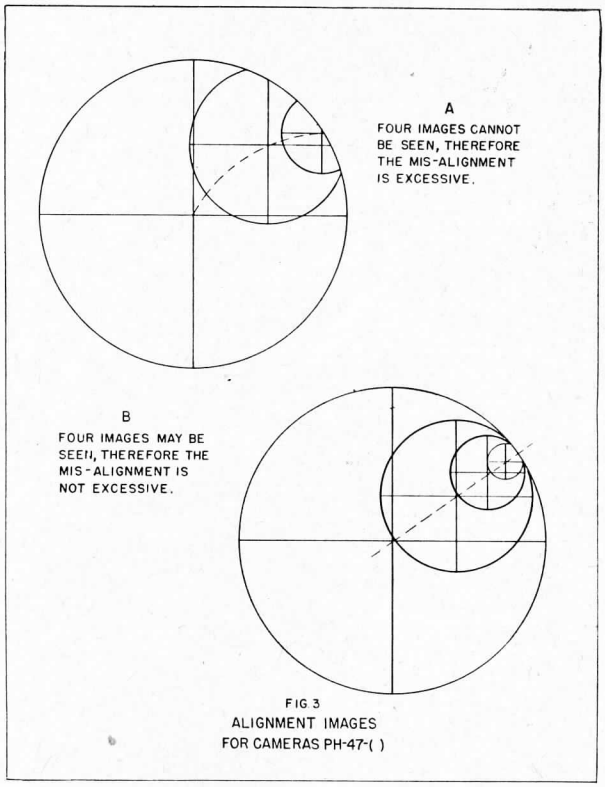


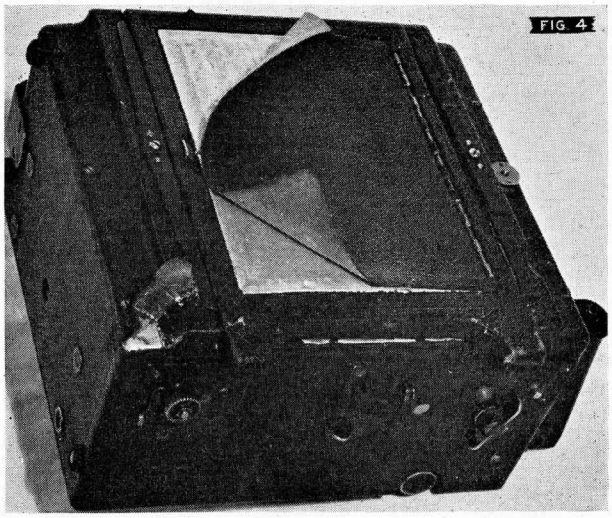
FIG 3
ALIGNMENT IMAGES
FOR CAMERAS PH-47-( )

horizontal misalignment is indicated, adjustment of the lens standard on the bed should be made. After either type of alignment has been made, check the image on the ground glass for focus at infinity.

CAMERA GLUES FOR HUMID CONDITIONS

Reports received from combat photographers stating that the leather coverings used on cameras peel off quite readily in hot and humid areas (fig. 4) were investigated by Pictorial Engineering & Research Laboratory to determine a suitable adhesive with the following properties:

1. Strong adhesion of covering materials to the bare metals and woods used in the construction of cameras.
2. Little or no preparation required before using.
3. Easily applied and evenly spread by brush application.



4. Pressure required for satisfactory adhesion applicable by hand.
5. Heat required no higher than room temperature.
6. Fungus and moisture resistant.
7. Noncorrosive, nontoxic, and noninflammable.
8. Minimum storage life of 6 months.

It was found that Cement, Rubber, Signal Corps Stock No. 6G202.3, which is supplied in 1-quart containers, and Cement, Gasket, Signal Corps Stock No. 6G202.4, supplied in 5½-inch, 1-ounce tubes, met these requirements.

The following method of application should be employed when this adhesive is to be applied:

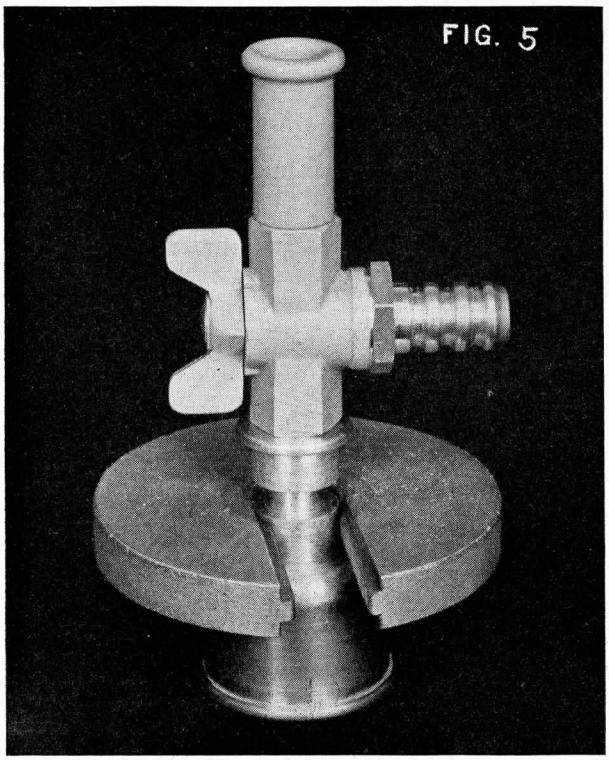
1. Clean each surface thoroughly.
2. Coat with adhesive.
3. When surfaces are dry to the touch (approximately 1 hour) apply another coat of adhesive to one surface only.
4. Press the two surfaces together.
5. Adhesion will take place immediately but the camera should not be used for 3 days in which time maximum strength is reached.

The glue should be stored tightly sealed and away from heat to prevent premature vulcanizing or jellying.

ELECTRONIC EQUIPMENT

BALLOON NOZZLE ML–373/GM

In procuring Calcium Hydride Charges ML–304A/TM and ML–305A/TM, it has been found expeditious to procure material of 90 percent purity in order to reduce shipping weight. However, the rate of generation of hydrogen with 90 percent pure calcium hydride used in Generator ML–303/TM is faster than with other processes of generation and is not subject to mechanical control. Standard balloon inflation equipment was found to be unsatisfactory in that the gas channel was



inadequate and back pressure was introduced which caused a loss of gas. In order to meet this requirement, Balloon Nozzle ML–373/GM (fig. 5) was designed to operate satisfactorily with all available hydrogen generators used for the local generation of gas for inflating 30-gram and 100-gram pilot balloons.

Balloon Nozzle ML–373/GM consists essentially of a three-way commercial valve with suitable nozzles attached to two of the openings. The flow of gas is possible through only one of these at a time. A third opening is provided with a means for attaching Hose ML–81. The weight of the device is 132 grams, the appropriate free lift required for 30-gram pilot balloons. A loose weight may be attached in order to increase the weight to 575 grams, the appropriate free lift for 100-gram balloons.

As soon as Balloon Nozzle ML–373/GM becomes available in sufficient quantities, it is contemplated that Cock ML–56 and Cock ML–201–A will be entirely replaced.

COMMUNICATION EQUIPMENT

IMPROVING THE AN/TRC–1, 3, AND 4

Recently the Signal Corps Ground Signal Agency evolved modifications which alleviate or eliminate reported unsatisfactory performance of components of Radio Set AN/TRC–1, Radio Terminal Set AN/TRC–3 and Radio Relay Set AN/TRC–4, and substantially improve the general performance of these sets. These modifications, which can be effected with materials that should be available in the field are described below. Regular modification work orders covering these modifications are being prepared for publication.

In order to prolong the life of the crystals, Radio Transmitter T–14( )/TRC–1 should be modified by removing Resistor R6 (50,000 ohms) from the plate circuit of the crystal oscillator stage and replacing it with a resistor having a value of 150,000 ohms. This change is shown in figure 6.

Several sources have reported little or no output from Radio Transmitter T–14( )/TRC–1 over a 2-mc. band in the vicinity of 80 megacycles. The changes detailed in figure 6 (excluding that pertaining to R6, covered above) will eliminate this *dead spot* and improve the performance of the transmitter in general.

To prevent tendency of the receiver to oscillate, Radio Receiver R–19( )/TRC–1 should be modified as shown in figure 7.

To provide protective bias for final amplifier tubes, Radio Transmitter T–14( )/TRC–1 should be modified as shown in figure 8.

To provide protection for Transformer T–7, Radio Transmitter T–14( )/TRC–1 should be modified by incorporating a 250-ma. fuse in the circuit of relay rectifier RE–1. Fuse F–1 in the cathode circuit of Tube JAN–829B (VT–259) is no longer necessary when the modification to provide fixed bias for Tube JAN–829B has been applied (fig. 8). Therefore, fuseholder F–1 should be disconnected from the cathode circuit of Tube JAN–829B and connected in series with either of the two connections between Transformer T–7 and Rectifier RE–1.

In order to prevent harmonics at or near the receiver i–f frequencies from entering Radio Receiver R–19( )/TRC–1 (through the plus B con-

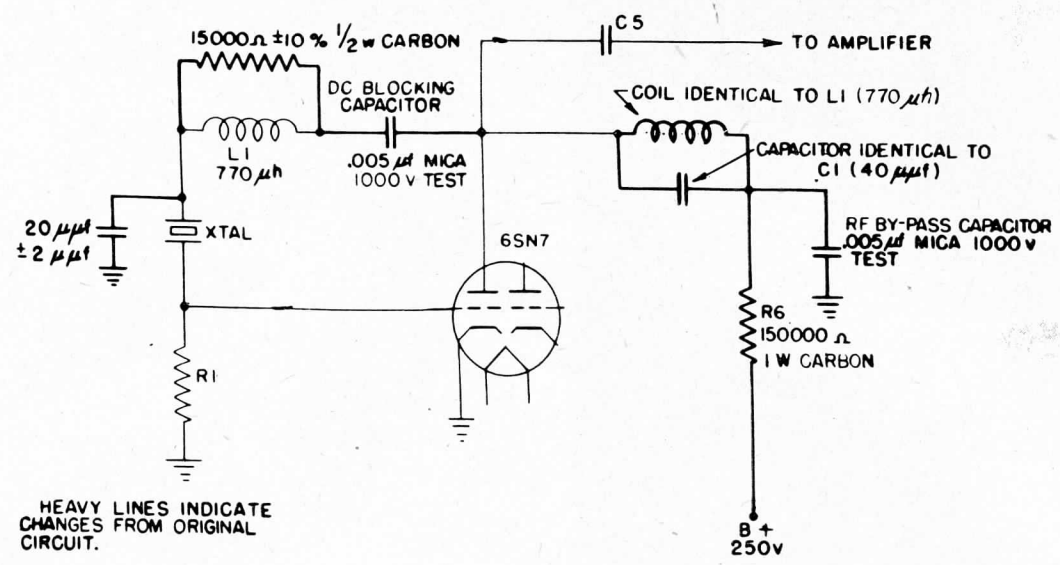


FIG.- 6

RADIO TRANSMITTER T-14( )/TRC-1
PROPOSED MODIFICATION OF CRYSTAL CIRCUIT
TO ELIMINATE DEAD SPOT WHICH OCCURS AT 83 TO 85 MC

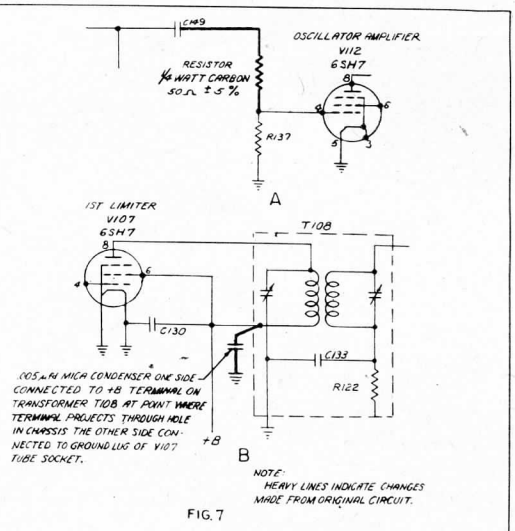


FIG. 7

RECEIVER R-19( )/TRC-1
MODIFICATIONS PROPOSED TO PREVENT
TENDENCY OF RECEIVER TO OSCILLATE

ductor of the power cable), and interfering with proper receiver alignment, test Oscillator TS–32 ( )/TRC–1 should be modified as indicated in figure 9.

In order to accomplish these modifications the following parts are required:

Radio Receiver R–19( )/TRC–1

Quantity per item	*Signal Corps Stock No.*	*Description*
1 ea	3RC10AE510J	Resistor: fixed; carbon; 51 ohms, ±5 percent; ¼ watt.
1 ea	3K4051222	Capacitor: fixed; mica; 5,100 mmf. ±5 percent; 500 vdcw.

Test Oscillator TS–32( )/TRC–1

1 ea	3C362-2	Coil, RF: choke; Galvin #24A35663; 120 mu h, 2 pie; (used in Radio Set SCR–609–A and SCR–610–A).

Radio Transmitter T–14( )/TRC–1

2 ea	3RC21AE392K	Resistor: fixed; carbon; 3,900 ohms ±10 percent; ½ watt.
1 ea	3RC21AE153K	Resistor: fixed; carbon; 15,000 ohms ±10 percent; ½ watt.

PROPOSED MODIFICATION OF RADIO TRANSMITTER T-14/TRC-1
OF RADIO SET AN/TRC-1
(TO PROVIDE PROTECTIVE BIAS FOR FINAL AMPLIFIER TUBES)

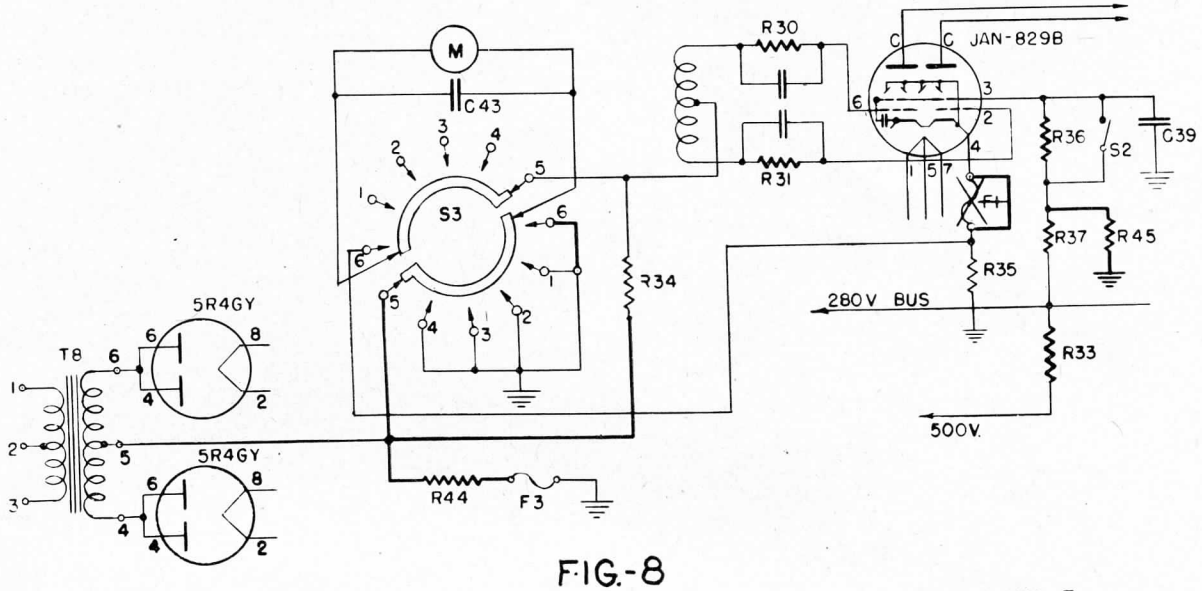


FIG.-8

COMPONENTS ADDED TO CIRCUIT

R44 75 Ω 10w ±10%
R45 30000 Ω 2w ±10%

COMPONENTS DELETED

F1 FUSE

COMPONENTS CHANGED IN CIRCUIT

R30 & R31 CHANGED TO 4000 Ω ½ w
R33 CHANGED TO 3500 Ω 25w
R36 CHANGED TO 60000 Ω 1w
R37 CHANGED TO 5000 Ω 10w
WIRING CHANGES OF S3 SWITCH ARE REQUIRED AS INDICATED.

1 ea	3RC30AF623J	Resistor: fixed; carbon;	62,000 ohms ± 5 percent; 1 watt
1 ea	3RC40AE303J	Resistor: fixed; carbon;	30,000 ohms ± 5 percent; 2 watt.
1 ea	3Z4875-3	Resistor: fixed; ww;	75 ohms ± 5 percent; 30 watt WL "Vitrohm Strip."
1 ea	3Z6500-136	Resistor; fixed: ww;	5,000 ohms ± 10 percent; 10 watt; Ohmite "Brown Devil."
1 ea	3D9020-15	Capacitor: fixed; ceramic;	20 mmf. ± 10 percent; 500 vdcw.
1 ea	3D9040-13	Capacitor: fixed; ceramic;	40 mmf. ± 5 percent; 500 vdcw.
2 ea	3K4051222	Capacitor: fixed; mica;	5,100 mmf. ± 5 percent; 500 vdcw.

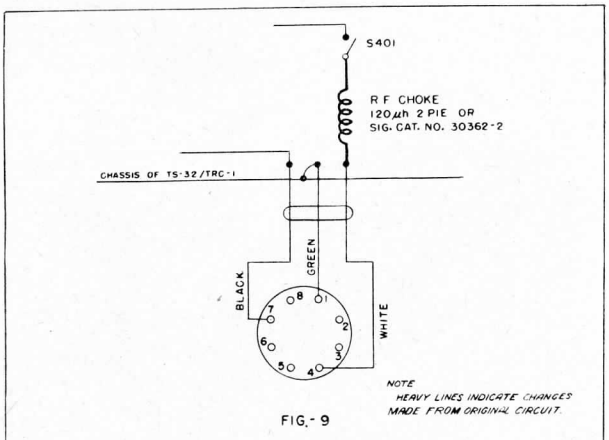
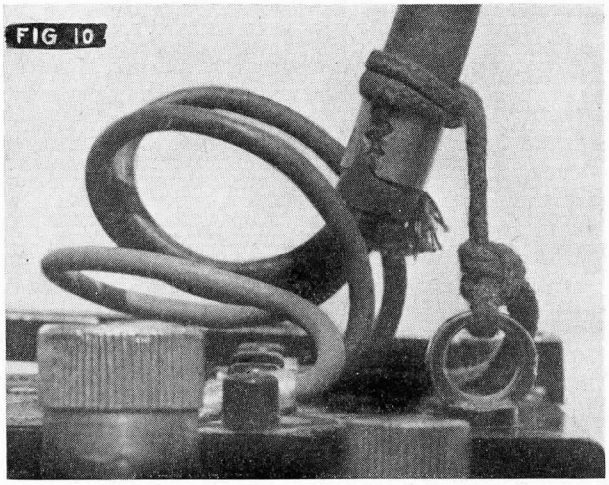


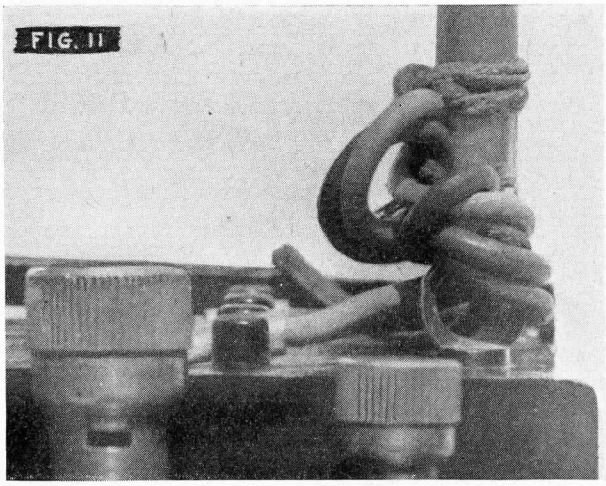
FIG.-9

TEST OSCILLATOR TS-32( )/TRC-1

MODIFICATION PROPOSED TO PREVENT HARMONICS, AT RECEIVER I F FREQUENCIES, FROM XTAL OSCILLATOR FROM ENTERING RECEIVER R-19 ( )/TRC-1 THROUGH +B CONDUCTOR OF THE INTERCONNECTING CABLE.

1 ea	3C320-8	Coil, RF: choke;	770 mu h; (used in Radio Transmitter T-14( )/TRC-1; ref: L-1).





FASTENING HANDSET CORD CC–333

A study of reports from repair sections of a Fifth Army signal depot company indicated an excessive and unnecessary amount of damage to Handset Cord CC–333 on Telephone EE–8–( ). During 1944, a total of 1,624 of these cords were replaced. In 90 percent of the cases, the conductors at the subset end were either broken or separated from the spade terminal. In addition, a large number of cords were repaired by shortening when the subset end became broken due to twisting.

Investigation showed that this condition was caused by the manner in which the cord is fastened to the screw eye of the Telephone EE–8–( ). Figure 10 shows the method by which the stay cord is tied by the manufacturer and the method generally in use in the field. This method does prevent strain on the 3-cord conductors from a straight pull, but does not secure the cord firmly enough to prevent strain when the cord is twisted. Figure 11 indicates strain caused for the latter reason.

To alleviate this condition, a new method of securing the cord was adopted by signal repair sections of Fifth Army. Investigation by the Signal Corps Board also resulted in a new method of tying this cord. The latter recommendation is illustrated in figure 12.

ELIMINATING SPURIOUS RADIATIONS

The following comes from an air depot in the India-Burma theater:

The Collins type 32 RA ( ) transmitter, having a power output of 75 watts on c–w is often installed in the operating room in proximity to the

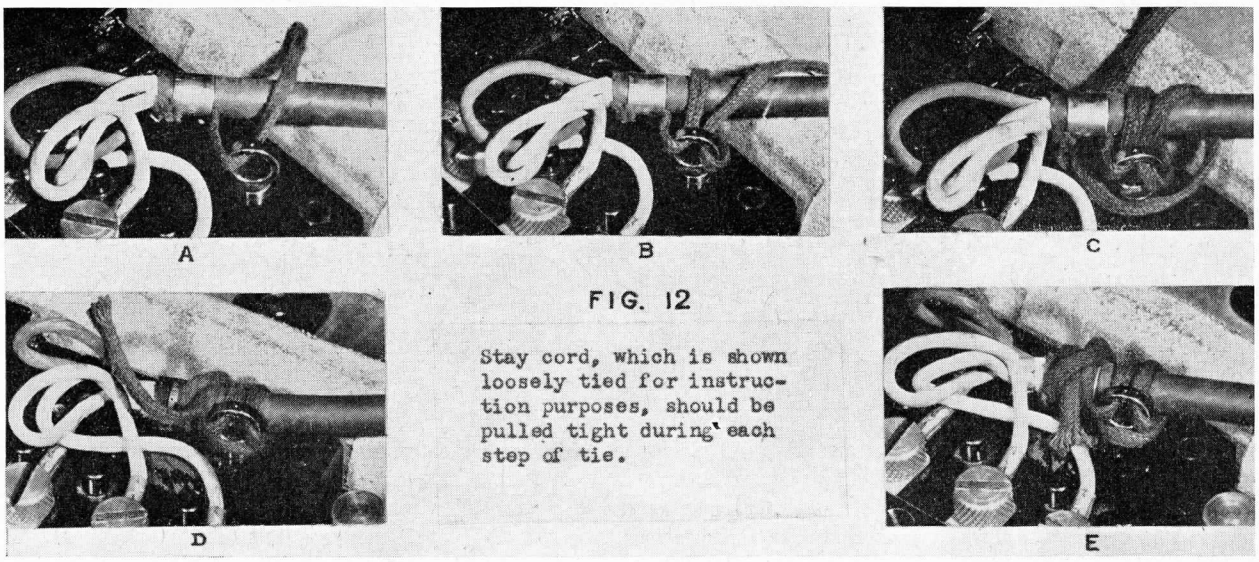


FIG. 12

Stay cord, which is shown loosely tied for instruction purposes, should be pulled tight during each step of tie.

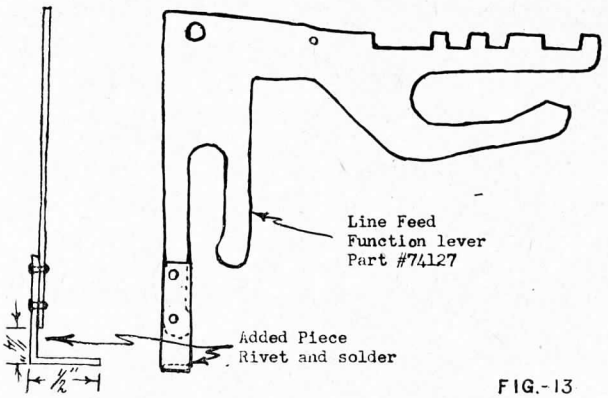


FIG.-13

receivers. Therefore, in order to use *break-in* operation, the transmitter must be keyed in the oscillator stage.

The oscillator employs a type 6L6 tube and may be operated either as a crystal oscillator or master oscillator. When using crystal control, the transmitter functions excellently and no discrepancies are noted. However, when using master oscillator frequency control, severe spurious radiations are present. These radiations, commonly known as *birdies*, are approximately 10 kilocycles apart and extend several hundred kilocycles on each side of the fundamental frequency, causing severe interference to adjacent channels.

Investigation disclosed that the cause of these spurious radiations was insufficient screen grid voltage on the 6L6 oscillator. The logical remedy would be to replace the screen resistor with one of a lower value which would raise the screen voltage the required amount. Proper size resistors are not always available, however, especially to units which are located in remote regions. A much simpler and equally effective remedy was discovered. By replacing the type 6L6 tube in the oscillator stage with a type 6V6 tube, the spurious radiations and instability disappeared.

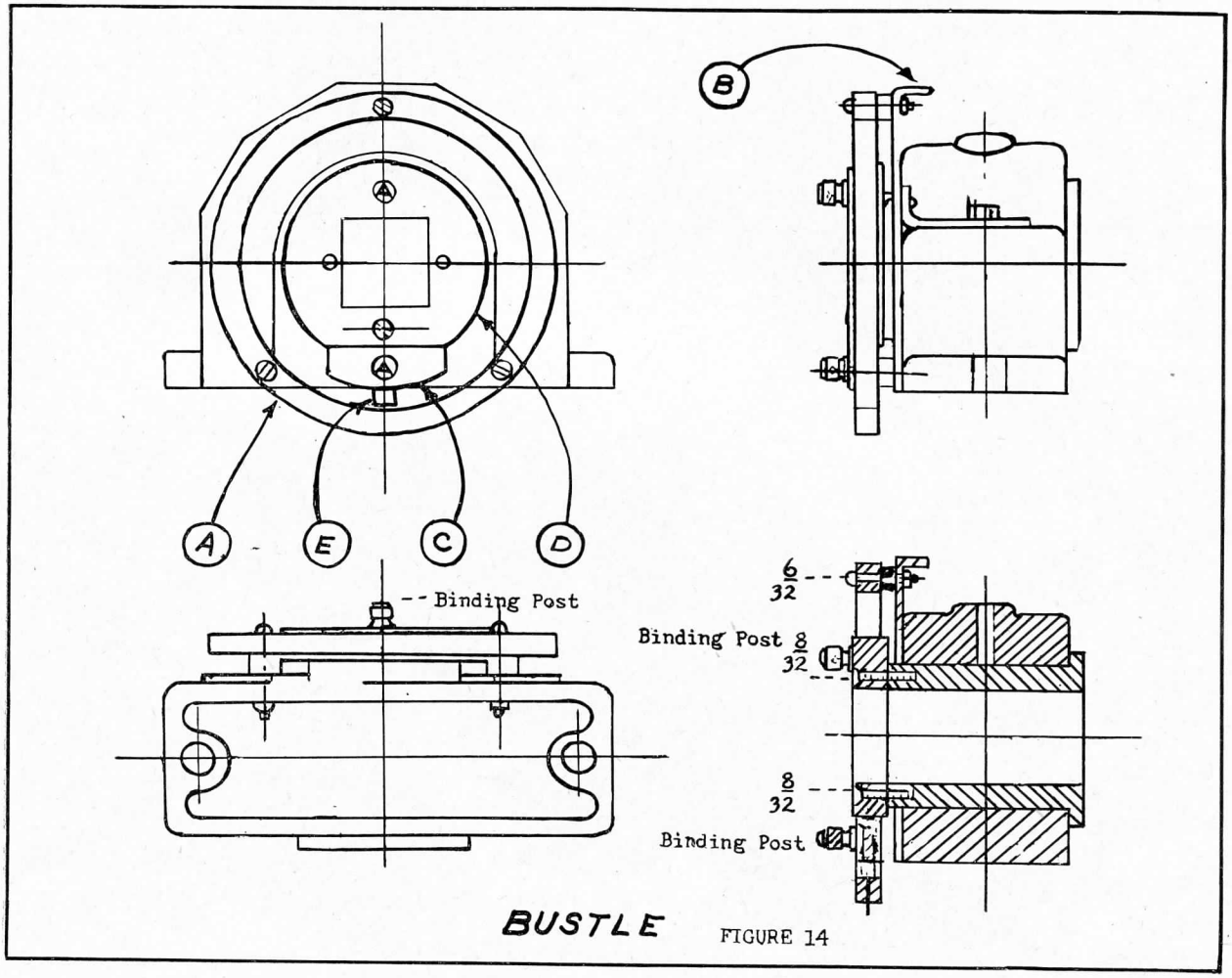


FIGURE 14

Two different signal installations were made in the India-Burma theater, both employing Collins 32 RA ( ) transmitters. At each station spurious radiations were present and in each case the trouble was remedied with a 6V6 tube.

LINE FEED IMPROVISATION

To prevent a teleprinter from overlining when a false carriage-return impulse is received, or when a line-feed impulse is lost, a carriage-return function lever is substituted for the line-feed function lever. This makes the machine line feed and carriage return instead of carriage return only. The machine will not, however, line feed on line-feed impulses.

A standard line-feed function lever, teletype part No. 74127, altered as illustrated in figure 13, and installed in function lever position No. 13, will allow the printer to line feed on line-feed impulses. Upon case *H* motor stop is not used on machines so altered, and therefore this improvisation is not applicable to tactical teletypewriter machines.

Parts required include: One function lever, part No. 74131, and one spring, part No. 74961.

This improvisation was developed by two members of the 17th Signal Service Company, War Department Signal Center, Military District of Washington.

COMMUNICATION ATTACHMENT FOR RL–26

The device illustrated in figures 14 and 15 is a constant communication attachment for Reel Unit RL–26. It permits personnel on a wire-laying vehicle to carry on normal telephone communication during the time the vehicle is in motion, in the act of laying or picking up field wire circuits. It was built and tested by the 151st Armored Signal Company in ETO.

The obvious value of this device is to enable a unit to have constant wire communication while moving from one bivouac area to another. It enables the advance units of a forward echelon group to carry on communication by wire, while in motion, and therefore permits rapid communication even though a *radio silence* is in effect. This also means that there is no break in communication during the moving of headquarters.

The records testify that no interference is de-

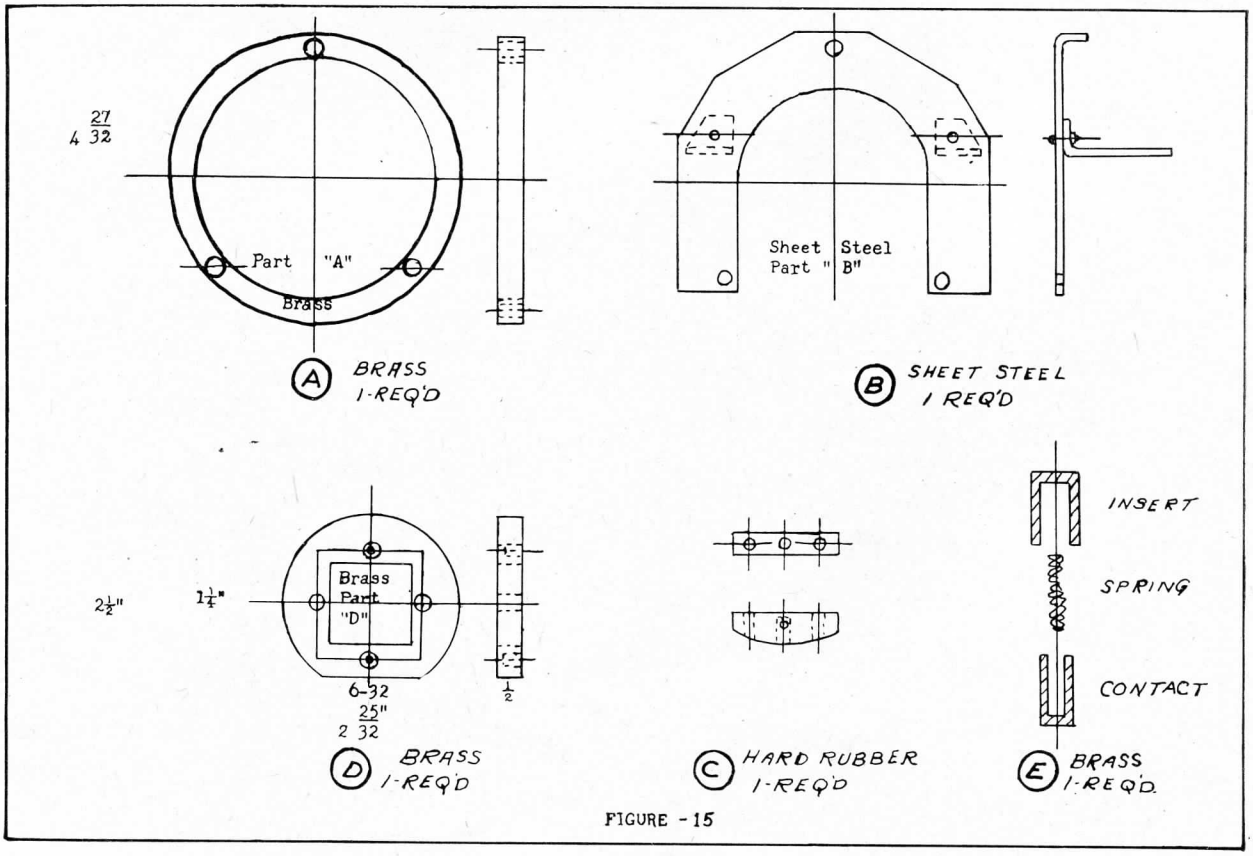


FIGURE - 15

tected on the circuit at normal operating speeds. Climatic conditions have no effect on the device. In all, it has been proven thoroughly practical, and of immense value to any group which finds necessary the frequent movement of phone installations.

The device is mounted on the outside top axle bearing of Reel Unit RL–26. Wire spool DR–5 is mounted in the normal way. The inside end of the field wire pair is fed through the 2 holes in the brass plate (part C in fig. 15), and attached to the two binding posts.

The phone used is then fastened with one lead to the large brass ring and one lead to the chassis of the reel unit.

During test operations, two phones, parallel, were wired into the circuit being laid. They provided constant communicatiton between the driver of the vehicle, the crew chief of the vehicle, and any other personnel at the terminal of the circuit. Tests have proven the decided advantage gained by allowing the wire teams to maintain constant communication at all times.

WATERPROOFING S–4 CONNECTIONS

Tests recently conducted on spiral-four cable as currently produced indicated that the connectors, when in good condition, are adequately waterproof for all uses except submarine application. In this use, the connectors should be taped in accordance with the instructions outlined in TB Sig 67, *Laying Field Cable Under Water*. A method of waterproofing spiral-four cable connections, devised and successfully employed by Company C, 3d Signal Battalion, is considered to have merit in underwater applications for supplementing the connector water seal and preventing moisture leakage, under normal usage, in connectors where the molded connector lips have been deformed or damaged from repeated use or mishandling.

The method involves the use of a rubber gasket approximately 1½ inches in diameter cut from old inner tubes and fitted between the connectors. Four holes approximately $\frac{9}{32}$ inch in diameter are cut in the gasket to fit over the connector terminals. Force enough to couple the connectors can then be exerted by hand. In order to further insure an adequate watertight connection for submarine applications, the taping of connectors with rubber and friction tape, in accordance with the instructions contained in TB SIG 67, is recommended.

Although a special mechanical jig was employed by Company C, 3d Signal Battalion, for locking the two cable connectors together, the use of such a device is considered unnecessary, as the connectors can be coupled by hand if the gaskets are made of inner tubing approximately 0.075 inch or less in thickness. A mechanical jig is not recommended for use since it may damage the connectors by exerting undue pressure in coupling.

MAINTENANCE

MOISTURE INDICATOR

A method of determining when equipment is dry through the use of an oscillator was developed in an overseas theater and has proven successful. The oscillator is used in conjunction with an oven to dry out radio sets and parts and is based on the principle that a beat frequency results when two frequencies are mixed together and that the output of two separate oscillators, one fixed and one variable with frequencies adjusted closely will be audible.

Parts were selected from material on hand. A two-plate condensor was built so that the distance between the plates could be adjusted from 0 to 4 inches. The plates were made of aluminum and were each 4 inches square for greater capacitance. This condensor was placed in the drying oven and the damp object placed between the plates to dry.[1] As the water evaporated, the dielectric constant of the object changed which in turn changed the capacitance of the condensor. The condensor was connected in parallel with the main tuning condensor of the variable oscillator, thus the change in capacitance changed the frequency of the variable oscillator. The output of this oscillator and the output of fixed crystal oscillator were fed into a mixer stage. Because the frequency of the variable oscillator was adjusted to match the frequency of the crystal oscillator, the mixer output was within audible range. A stage of audio was added to bring up the beat level so it could be heard.

[1] In practice this was a component taking longest to dry.

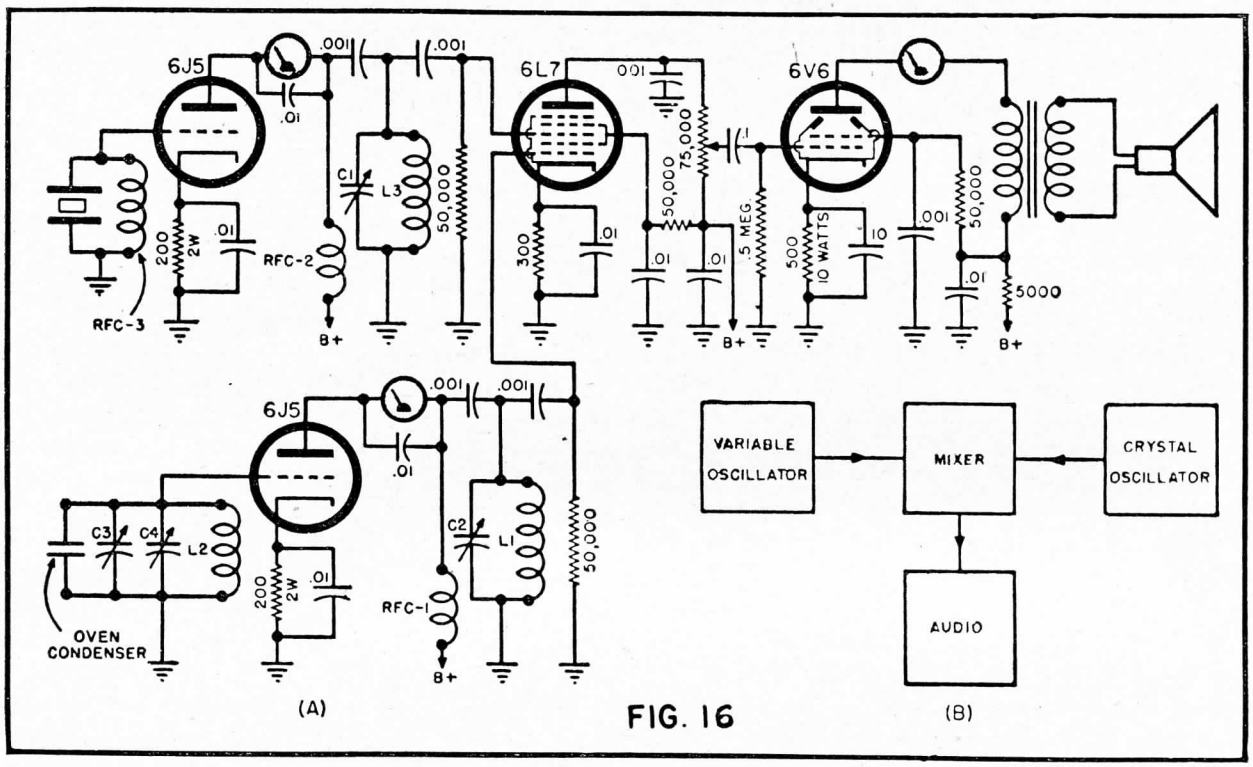


FIG. 16

In the plate circuit of each oscillator, a 0 to 25 d. c. milliammeter was placed as shown in the circuit diagram (fig. 16). The meters were not essential but did furnish a visual check on the functioning of the oscillators. A 0 to 100 d. c. milliammeter was placed in the output stage. This was necessary due to the fact that minute changes in capacitance of the variable oscillator were not always enough to be noticeable to the ear or when oscillator output were zero-beated. The d. c. milliammeter in the plate circuit of the 6V6 tube followed these variations and served as an indication of the zero-beat point. In the oscillators, 6J5's were used

The apparatus did not call for high output and the tub's current and voltage rating was low. Crystal frequency was 240 kilocycles—chosen solely because it was the only crystal available. In the variable oscillator, there was a three-plate variable condensor in parallel with the main tuning and over condensor. It was used because the variable condensor had to be adjusted for zero-beat, the point where there was a complete cancellation of output signal where no sound was heard from the speaker and there was no variation in the plate current of the 6V6. When tuning for the zero-beat, it was found to be the point of no sound directly between two sounds of rising pitch.

The two oscillators were constructed as nearly alike as possible with respect to size and location of components and were completely shielded so that there was no coupling between the two, ahead of the mixer stage. Although a crystal was used for one oscillator, this could have been a self-excited oscillator as long as care is taken to make it as stable as possible. Values for the components of the resonant circuits depended on the frequency used. These values should be chosen so that the circuits will resonate in the desired frequency. Coils RFC–1, 2 and 3 referred to in the circuit diagram are standard broadcast-type, r–f filter chokes and were obtained from salvage.

As the object dried, the variable oscillator shifted frequency and the beat frequency gradually built up to audio range. The output was zero-beat from time to time as the object dried. When it reached a condition where there was no further change in the output meter reading, the object was considered dry.

The mixer stage was the same as that on any superheterodyne. 6L7 common receiver mixer tube was used. The audio stage, employing a 6V6 volume was controlled by 75,000-ohm potentiometer in the grid circuit of this tube.

A shielded cable was used to connect the oven condensor to the variable oscillator. This eliminated outside interference and gave the oscillator more stability. Power supply was conventional, using an 80 rectifier tube and a 300-volt, 75-milliamp power transformer with a 6.3 and 5-volt filament winding.

VIBRATOR MAINTENANCE

Field reports indicate that certain difficulties have been experienced with the vibrator which furnishes 19-cycle supply in voice frequency Ringer TA–3/FT and Telegraph Terminal TH–1/TCC–1.

The vibrator is a 19-cycle, 12-volt, synchronous, metal can 3½ inches high with a 2¼-inch diameter. It has a plug-in type bakelite base which fits standard four-prong sockets. Contacts are of platinum thuthenium composition. Manufacturer's code is Oak 6260; Signal Corps Stock No. is 3H6694–12. Reference designation is VIB–2.

The construction of the vibrator is such that a very small clearance exists between the armature and the inside of the metal can top. When pressure is applied to the top of the can, as it is when pushing the vibrator into its socket, the thin metal can top has a tendency to buckle inwards and bind the armature. When this occurs, repairs may be made by opening the sealed can (soldering iron required) and pushing the top back in place. After repairs have been made, the can should be resealed with solder.

In order to prevent collapse of the metal can top, caution should be exercised when inserting the vibrator in its socket. Do not apply pressure to the center of the can top, but distribute the pressure evenly over the entire top surface.

DIESEL FUEL INJECTION NOZZLES

Performance of diesel engines depends largely on the efficiency of the fuel injection pump and

Trouble chart

DEFECT	*PROBABLE CAUSE*	*REMEDY*
1. Fuel oil leaking around nozzle holder.	1. Poor joint between nozzle tip body and holder not tight. 2. Nozzle hole plugged up or dirty.	1. Remove nozzle from holder, clean the ends forming the joint with a cloth. If necessary remove pit or erosion marks by careful lapping. See par. *7–c–(8)*. Tighten the nozzle cap nut with torque wrench. Do not use abrasives, grinding compound or hard sharp tools of any kind on these polished surfaces. Carbon may be removed with a clean wood splinter. 2. Dismantle and clean nozzle.
2. Fuel oil leaking excessively through nozzle holder bypass.	1. Joint between nozzle and holder not tight. 2. Nozzle plugged up or dirty. 3. Nozzle valve stuck shut. 4. Nozzle valve too loose in nozzle body.	1. Dismantle and clean as directed in 1. Reassemble and tighten nozzle to holder firmly. 2. Dismantle and clean nozzle as directed in 1. 3. Dismantle and clean. 4. Replace with new nozzle tip assembly.
3. Nozzle valve sticking shut or open.	1. Dirt in nozzle. 2. Improper lubrication of nozzle valve stems. 3. Insufficient lubricating qualities in fuel oil. 4. Nozzle body and valve corroded from water or acid in fuel oil.	1. Dismantle and clean. 2. Smear with good grade of light engine lubricating oil before assembling. 3. Drain fuel supply tank and refill with proper grade of Diesel fuel oil. In an emergency one quart of lubrication oil may be placed in each 5 gallons of fuel oil. This lubrication oil must be absolutely clean and free from water, grit and dirt or other foreign matter. 4. Replace with new nozzle tip assembly.
4. Dripping of nozzle.	1. Stuck nozzel valve or damage valve seat.	1. Soak nozzle in carbon tetrachloride or acetone and then remove carbon. If trouble has not been alleviated replace with new nozzle tip assembly.
5. Distorted spray pattern.	1. Nozzle tip cocked or nozzle valve damaged.	1. Soak nozzle in carbon tetrachloride or acetone and then remove carbon. If trouble has not been alleviated replace with new nozzle tip assembly.

Interchangeability of Bosch and Excello nozzle tip assemblies

Power unit	Engine manufacturer	Injection pump	Nozzle holder	Bosch Nozzle tip [1]	Excello Nozzle tip [2]
PE-85-L	Hill Diesel	Bosch 3H4585L/J2	Bosch AKB-35-SD-173	ADN-4-SD-24	39-NT-022.
			3H1905-1/H20	3H1905-1/N10	
PE-148-A	Witte	Bosch 3H1919-2/P61	Bosch AKB-5-OS-55	ADN-4-S-3	39-NT-019.
			3H1919-1H10	3H4512.3-1/N4	3H1911-1/T21.
PE-185-A-B	Buda	Excello 3H1911-1/P35	Excello 39TH-019-028		39-NT-019.
			3H1911-1/N11		3H1911-1/T21.
PE-205-A	Hill Diesel	Bosch 3H1905-1/P61	Bosch AKB-35-SD-173	ADN-4-SD-24	39-NT-022.
			3H1905-1/H20	3H1905-1/N10	
PE-207-A	Hill Diesel	Bosch 3H1905-1/P61	Bosch AKB-35-SD-173	ADN-4-SD-24	39-NT-022.
			3H1905-1/H20	3H1905-1/N10	
PU-53/FRC	Witte	Bosch 3H1919-1/P6	Bosch AKB-5-OS-55	ADN-8-S-3	39-NT-019.
			3H1919-1/H10	3H1919-1/N1	3H1911-1/T21.
HD-24	Witte	Bosch 3H1919-1/P6	Bosch AKB-5-OS-55	ADN-8-S-3	39-NT-019.
			3H1919-1/H10	3H1919-1/N1	3H1919-1/T21
HD-40	Witte	Bosch 3H1919-1/P6	Bosch AKB-5-OS-55	ADN-8-S-3	39-NT-019.
			3H1919-1/H10	3H1919-1/N1	3H1911-1/T21.

[1] Can only be used in Bosch nozzle holders.
[2] Can be used in either Bosch or Excello nozzle holders.

injection nozzle. Faulty operation of injection nozzles can be caused by dirt and a poor or improper grade of fuel. It is essential that injection nozzles be maintained properly and carefully.

The trouble chart indicates some of the common defects, presents the probable causes and recommended remedies that can be applied in the field. A chart showing the interchangeability of nozzle tip assemblies which can be used to advantage when necessary is shown above.

PE–43 AND 108 OVERHAUL

An aid in the overhaul of Power Unit PE–43 and PE–108 has been developed by an employe of a Signal Corps depot.

Power Units PE–43 and PE–108 have a Pioneer Gen-E-Motor generator as a power source. The brush yoke of this generator holds six brushes in place on the commutator. Each of these brushes is an assembly which consists of brush, spring, and pigtail.

To inspect, dress, or clean the commutator, or to change one or more brushes, or when moisture and fungusproofing is to be done, removal of the brush yoke with the brushes is the easiest and quickest method. Removing each brush separately before the yoke is removed is a longer process. However, when the brush yoke is removed—by loosening it and pulling it out—the six brushes dangle which permits them to be broken, chipped or reversed. Because of this the brushes often have to be reseated. On many units, one or more brushes become so badly damaged that they have to be replaced. Using this method, each of the 6 brushes have to be held in their sockets by a piece of string when the yoke and brushes are ready to be put back in place over the commutator.

A brush retainer sleeve (fig. 17) has been developed that overcomes this time-wasting method. After the metal guard, fan, and wires are removed from the commutator end of the generator, this sleeve is slipped in between the commutator and the brushes, holding each of the six brushes in its own socket. The yoke and sleeve are removed together and kept together until such time as the yoke has been put back in place over the commutator. The ½-by ⅜-inch cut-out is used for inspection

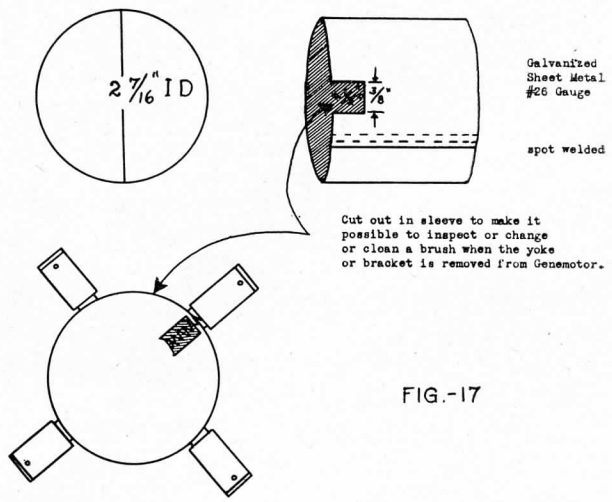


FIG.-17

Outside diameter of sleeve and diameter of commutator are identical. Brush holder with brushes is slipped from commutator onto brush retainer sleeve.

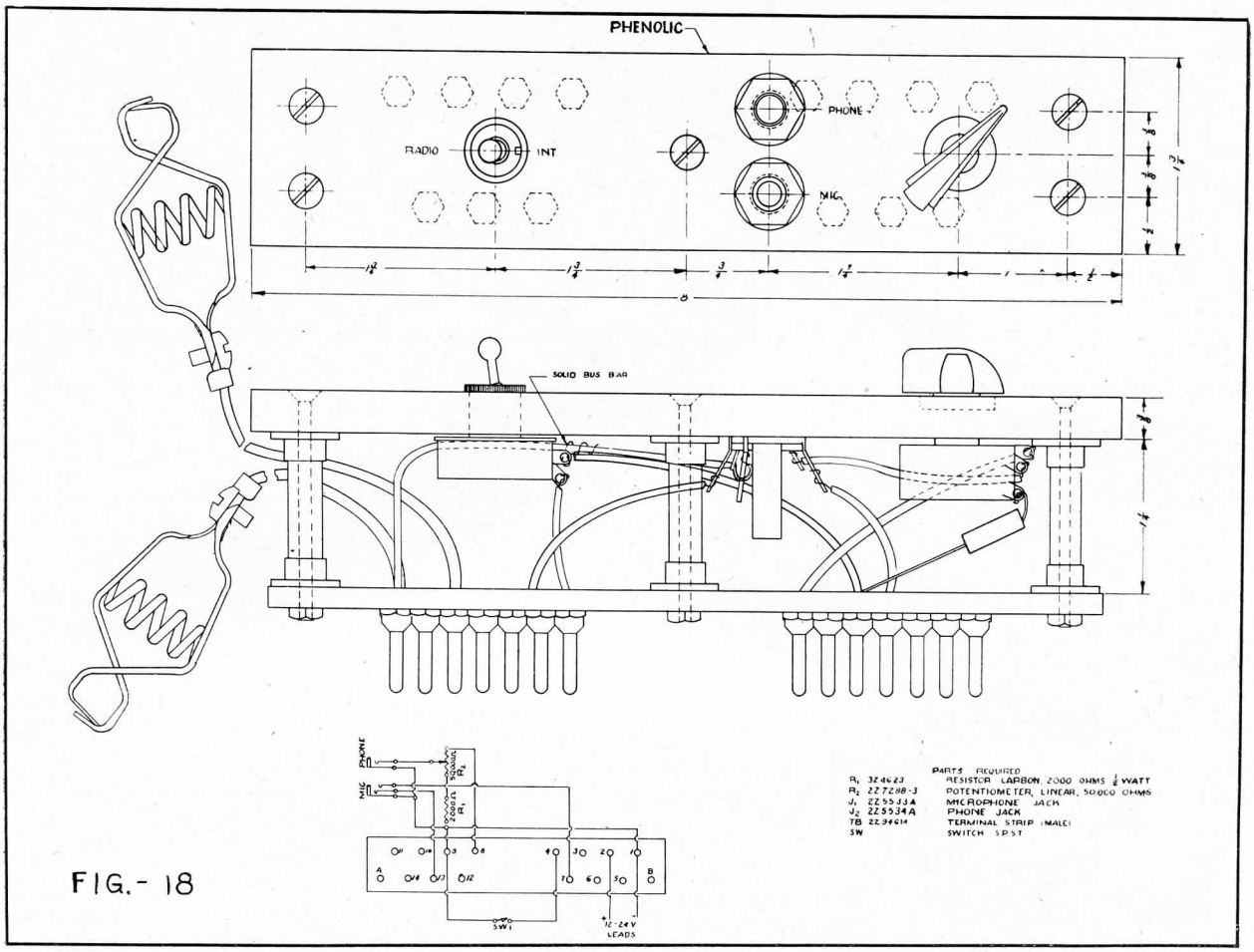


FIG.- 18

or replacement of each brush separately. No chipping or reversing of brushes results. Time and material are saved.

TEST PANEL FOR BC–367 AND 667

Difficulty has been experienced by using units when servicing Interphone Amplifier BC–367 or BC–667, part of Interphone Equipment RC–99. As a result of the design of the interphone equipment, it is not possible to operate the amplifier outside of its case. It is necessary to apply power to the amplifier through the terminal box leads and to check for correct operation at Control Box BC–606 or BC–739. If the equipment does not operate, there is no indication as to where the trouble may be located.

A test panel (fig. 18) may be fabricated in the field from parts which are used in Interphone Equipment RC–99, which would make operation of the interphone amplifier possible when removed from its case. By using the test panel, voltage readings may be taken at the tube sockets and the amplifier may be checked and repaired without returning the set to its case in order to check for operation. This results in repair of this equipment in much less time than would normally be required. Parts required to construct the test panel are as follows:

Quantity	*Sig. Corps Stock No.*	*Description*
1	2Z5533A	Jack JK–33–A (Microphone).
1	2Z5534A	Jack JK–34–A (Phone).
1	2Z7288–3	Potentiometer, Linear, 50,000 ohms.
1	3Z4623	Resistor, carbon, 2,000 ohms, ½ watt.
1	3Z9858–8.3	Switch, toggle, SPST.
1	2Z94614	Terminal Strip (Male).

Procedure for use of the above test panel is outlined below:

1. Remove amplifier from its housing by removing the panel holding screws.

2. Connect test unit to amplifier by inserting the

banana plugs of the test panel into receptacles of the amplifier.

3. Connect test panel battery leads to the proper storage battery potential (12–24 volts), observing polarity.

4. Insert headset and microphone plugs into the jacks provided in the test panel.

5. Turn amplifier switch on and check for its operation by means of the handset, microphone, and volume control which is located on the test panel.

REPLACING SWITCH SW–118

Information has been received from the manufacturer of Switch SW–229 that a quantity of Switches SW–229 were produced and given the designation *SW–118, No. 8905K683* prior to issuance of the new designation *SW–299.*

To eliminate confusion, when applying Modification Work Order SIG 20, issued in December 1944, for replacement of Switch SW–118 with Switch SW–229 on Chest Unit T–26 and T–46, switch should be first identified before proceeding with replacement. The chest units containing the improved type switch may be readily discerned by a rubber boot over the threaded portion through which the switch lever protrudes and by a *bat-shaped* switch lever. The switches having these identifying features should not be replaced unless defective, since they are identical to Switch SW–229.

This information will also apply to replacement of Switch SW–118 with Switch SW–229 on Head and Chest Set ES–3553 made by Kellogg Switchboard and Supply Co.

REPAIR INSTRUCTIONS AND SPECIFICATIONS

To help maintenance men repair signal equipment and to aid them in checking performance of repaired equipment, two new series of publications are being issued by the Signal Corps. Repair Instructions detail a step-by-step procedure for the repair of each item of signal equipment. Communication equipment will be covered in TM 11–4000 series; radar, TM 11–1500 series, and photographic equipment in the TM 11–400 and 2300 series. Repair Instructions for certain telephone and telegraph equipment will be contained in separate pamphlets, prefixed by the letter T. Repair Specifications are being issued in tentative series bearing the prefix REP. They will cover all signal equipment.

Both Repair Instructions and tentative Repair Specifications apply to fourth and fifth echelon repair installations. They are also available to tactical third and higher echelon maintenance units. As Repair Instructions become available they will be listed in field manual, FM 21–6, and distributed by the Adjutant General. Tentative Repair Specifications are being issued by the chief Signal Officer.

The value of Repair Instruction manuals is aptly stated in TM 11–4001, the first published which covers Radio Receivers BC–312( ) and BC–342( ): *Repair information is presented in the order in which the repairman actually should perform the various operations on the equipment in the repair shop. This procedure permits repair of the equipment in the shortest possible time, resulting in sensitivity, selectivity, and overall performance comparable to that of new equipment.*

Tentative Repair Specifications cover the inspection requirements to be used in determining the quality and acceptability of repaired equipment. In general, these specifications incorporate data on test equipment required to check the repaired product, and visual and mechanical, as well as electrical, inspection requirements.

In general, for the present, and until all major items of equipment have been adequately covered, specifications will be written for major components of equipment rather than for complete assemblies. In some instances, as in the case of dynamotors and electrical indicating instruments (meters), the class of equipment is being covered. After all major components have been covered, it is anticipated that specifications for complete assemblies will be prepared.

Tentative Repair Specifications and Instructions available as of this writing are listed below.

Repair Specifications

(Published through 25 May 1945)

TACTICAL COMMUNICATIONS EQUIPMENT

Number	*Date*	*Equipment*
1	23 Mar. 45	BC–191, TC–1, 10.
2	21 Mar. 45	BC–312, BC–342.
3	20 Mar. 45	BC–314, BC–344.
4	---do---	BC–603.
6	21 Mar. 45	BC–611.
7	6 Mar. 45	BC–659.
8	22 Mar. 45	BC–683.
9	20 Mar. 45	BC–684.
10	27 Mar. 45	AN–30–B, AN–45–G, H, AN–29–B, AN–29–C.
13	2 Apr. 45	FT–237.

Number	Date	Equipment
4	8 Mar. 45	RM-29.
15	2 Apr. 45	T-45.
18	10 Apr. 45	TL-122.
20	20 Mar. 45	SCR-625-( ).
21	15 May 45	SCR-211.
22	27 Mar. 45	PE-117.
23	8 Mar. 45	BC-610.
24	do	BC-620.
25	6 Mar. 45	BC-652.
26	12 Mar. 45	BC-653.
27	30 Mar. 45	BC-699.
28	6 Mar. 45	BC-745, 746, T-39.
30	12 Apr. 45	MP-48-A, MP-57.
32	18 Apr. 45	RA-36.
33	25 Apr. 45	RA-83.
34	19 Apr. 45	RL-31.
35	27 Mar. 45	PE-97.
36	do	BC-667.
37	3 Mar. 45	BC-728.
38	18 Apr. 45	BC-739.
39	do	BC-923.
40	7 May 45	BC-924.
41	12 Apr. 45	BR-19.
43	do	RA-34.
44	23 May 45	RM-12, RM-13.
45	28 Apr. 45	RL-35.
49	3 May 45	BD-90.
50	18 Mar. 45	BD-71, BD-72.
51	8 Mar. 45	BC-1000.
52	20 Mar. 45	CE-11.
53	8 Mar. 45	EE-8.
54	3 Mar. 45	I-56.
56	10 Apr. 45	RL-26.
57	20 Mar. 45	T-17.
58	3 Mar. 45	Dynamotors.
59	9 Mar. 45	Telephone, Hand Generator.
61	20 Mar. 45	EE-2.
63	22 Mar. 45	GN-45.
64	9 Apr. 45	I-72.
65	3 Mar. 45	I-77.
66	22 Mar. 45	PE-75.
67	9 May 45	PE-110.
68	2 Apr. 45	TG-5.
69	23 Mar. 45	Handsets (TS).
70	26 Apr. 45	BD-110.
71	23 Apr. 45	EE-87.
72	29 Mar. 45	BD-96.
73	10 Apr. 45	BD-57.
74	30 Mar. 45	BD-61.
76	7 May 45	I-51.
77	22 Mar. 45	DR-4, 5, 7, and 15.
79	29 Mar. 45	EE-89.
80	20 Mar. 45	HS-30.
81	27 Mar. 45	PE-77
83	29 Mar. 45	RL-27.
84	30 Mar. 45	SE-11.
85	3 Mar. 45	Meters.
86	17 Apr. 45	RA-43.
87	18 May 45	RC-120.
89	13 Apr. 45	T-30.
93	3 May 45	CV-2/TX.
94	9 Apr. 45	FT-250.
100	3 May 45	PE-214.
103	9 May 45	RA-74, 84, 94.
105	15 May 45	RA-87.
115	26 Apr. 45	LC-5.
117	25 May 45	SCR-284.
128	23 May 45	BC-197.
130	15 May 45	BC-606-H.
162	23 May 45	RA-91.

Repair Instructions

(Published through 22 May 45)

RADAR EQUIPMENT

TM No.	*Date*	*Equipment*
*11-1505	14 Aug. 44	SCR-296-A, Radio Set.
11-1506	4 Sept. 44	SCR-268, -B, -C; SCR-516, -C, -D, -E, Radio Sets.
11-1508	14 Sept. 44	RC-182-A and RC-282-A (Radio Equipments).
11-1510	25 Aug. 44	SCR-270-B, -C, -D, -E, -BA, -CA; SCR-271-A, -AA, -AAA, -AB, -B, -BA, -D, -E, -F, -G, -H, -J, -K, -L, and -M.
*11-1512	9 Sept. 44	SCR-582-A and SCR-582-T6.
*11-1515	29 Aug. 44	RC-127-A, Radio Equipment.
*11-1516	15 Jan. 45	RC-207-A, Radio Equipment.
*11-1517	19 Aug. 44	RC-150-B, -C, -D; RC-151-A, -D Radio Equipment.
*11-1518	20 Oct. 44	RC-148, -B, -C, Radio Equipment.
*11-1519	24 Aug. 44	SCR-527-A, Radio Set.
*11-1520	Dec. 44	SCR-627-A, Radio Set.
*11-1521	Dec. 44	RC-188-A, Radio Equipment.
*11-1524	10 Mar. 44	SCR-584, Radio Set.
*11-1526	22 July 44	SCR-602-A, SCR-602-T6, Radio Sets.
*11-1527	21 Oct. 44	SCR-545-A, Radio Set.
*11-1529	23 Oct. 44	SCR-588-B, Radio Set.
*11-1531	26 Aug. 44	RC-145-A, Radio Equipment.
*11-1532	14 Aug. 44	RC-184, Radio Equipment.
*11-1534	22 Sept. 44	RC-215-A, Radio Equipment.
*11-1539	10 Oct. 44	AN/TPS-2, Radio Set.
*11-1540	1 Mar. 44	AN/TPS-3, Radio Set.
*11-1541	Dec. 44	SCR-615-A, Radio Set.
11-1542	24 Oct. 44	SCR-636-A, Radio Set.
*11-1543	20 Sept. 44	AN/MPN-1, Radio Set.
11-1544	15 Dec. 44	AN/CPS-1, Radio Set.
*11-1546	21 Sept. 44	RC-350, RC-351, Radio Equipments.
*11-1550	20 Dec. 44	RC-246-A, Radio Equipment.
11-1552	27 Dec. 44	AN/TPL-1, Radio Set.
*11-1561	31 Aug. 44	SCR-682-A, Radio Set.
11-1570	16 Aug. 44	SCR-270, -BB, -CB, -EA, and SCR-271, -AAB, -AC, -BB, -DA, -EA, -FA, -GA, -HA, -JA, -KA, -LA, -MA, Radio Sets.

TACTICAL COMMUNICATIONS EQUIPMENT

11-4000	May 45	Radio, General.
11-4001	Mar. 45	BC-312 and BC-342, Radio Receivers.
11-4002	May 45	BC-314 and BC-344, Radio Receivers.
11-4003	do	BC-991-A, -B, Oscilloscopes.
11-4004	do	BC-978-A, Radio Transmitter (Target).
11-4005	do	BC-728-A, -C, Radio Receivers.
11-4008	do	BC-652-A, Radio Receiver.
11-4009	do	BC-1306, Radio Receiver and Transmitter.
11-4010	do	I-210-A, -B, -C, Alignment Indicators.

PHOTOGRAPHIC EQUIPMENT

11-400	18 Jan. 45	PH-261, Photographic Set.
11-401	22 Mar. 43	Training Film & Film Strip Project.
11-402	15 June 44	MC-364-A, -B, -C, Reproducing Equipment.
11-403	12 May 43	PH-385, Photo Darkroom Equipment.
11-404	29 May 43	PH-395, Photo Darkroom Equipment.
11-405	12 May 43	PH-406, Photo Darkroom Equipment.
11-406	24 Apr. 43	PH-398, Projector Equipment.
11-406-A	14 Feb. 44	PH-398-A, Projector Equipment.
11-408	23 Oct. 44	PH-222 & PH-222-A Projectors.
11-409	12 June 44	Photo Lab Organization & Oper. in SvC Departments & Posts.
11-409 C1	12 Sept. 44	Photo Lab Organization & Oper. in SvC Departments & Posts.
11-2300	Dec. 44	PH-542/UF, Enlarger (V-Mail).
11-2301	Feb. 45	PH-326, Densitometer.
11-2302	do	PH-513/GF, Paper cutter.

*This technical manual is distributed only to interested headquarters and to individuals whose duties require that they have it. This TM must be safeguarded in accordance with ptovisions of AR-380-5.

TM No.	Date	Equipment
11-2304	Mar. 45	PH-543/UF, Projector.
11-2305	Feb. 45	PH-512/GF, Developing Machine.
11-2309	do	PH-284, Reader.
11-2313	Mar. 45	Light Meter, Standard Foot-Candle.
11-2351	30 Sept. 44	PH-77, -A, -C, & PH-252-A, Exposure meters.
11-2352	26 Feb. 45	PH-104, Camera Equipment.
11-2353	23 Feb. 45	PH-270, Camera, PH-271, Recorder.
11-2354	Feb. 45	PH-75, Dryer.
11-2355	7 Oct. 44	PH-176, Dryer.
11-2357	1 Dec. 44	PH-131-A thru G, Projector.
11-2360	3 Nov. 44	515/MF, Mounting. (Camera Equipment).
11-2361	20 Feb. 45	PH-324, Camera.
11-2362	2 Jan. 45	PH-507/PF, Printer.
11-2364	9 Dec. 44	PH-501/PF, Camera.
11-2365	25 Jan. 45	PH-195-A, Camera. PH-205, Camera Equipment.
11-2366	5 Oct. 44	PH-383, Photographic Equipment.
11-2367	30 Oct. 44	AN/TFQ-3, Identification Equipment.
11-2368	do	PH-275, PH-275-A Enlargers.
11-2369	15 Oct. 44	PH-523/GF, Laminating Equipment.
11-2370	27 Feb. 45	PH-502/PF, Camera.
11-2375	17 Mar. 45	PH-125, Press.
11-2378	4 Oct. 44	PH-191-A, Timer.
11-2382	26 Feb. 45	PH-146, Print Straightener.
11-2384	Mar. 25	PH-402, Projector.
11-2385	do	PH-192, Printer.
11-2389	9 Jan. 45	PH-530/PF, Camera.
11-2394	Feb. 45	PH-253-C, Developing Equipment.
11-2395	20 Oct. 44	PH-550/GF, Electronic Timer.
11-2398	22 Feb. 45	PH-240-A, Washer.

TELEPHONE AND TELEGRAPH EQUIPMENT

T-301.01	1 Oct. 43	BD-71, Switchboard.
T-301.03	1 Oct. 43	EE-2-C, Switchboard Unit.
T-301.03A	30 Oct. 43	EE-2-( ), Switchboard Unit.
T-302.01	15 Sept. 43	EE-8, Telephone.
T-302.02	15 Oct. 43	EE-91, Telephone Box.
T-302.03	1 Oct. 43	Telephone Sets, Desk Stands.
T-302.04	1 Oct. 43	Telephone Sets Handset Type.
T-303.01	15 Feb. 43	P-16, Headset.
T-303.02	15 June 44	HS-30-( ), Head-Set.
T-303.05	15 Jan. 44	HS-20, Headset.
T-304.01	1 Oct. 43	HS-17, Head and Chest Set.
T-304.02	1 Oct. 43	HS-19, Head and Chest Set.
T-305.01	10 Aug. 44	T-17, Microphone.
T-305.02	15 Sept. 44	T-30-( ), Microphone.
T-305.05	15 June 44	T-45, Microphone.
T-305.06	30 Aug. 44	T-50, Microphone.
T-307.01	15 Sept. 43	TS-9-( ), Hand-Set.
T-310.01	20 Sept. 43	I-142, Test Set (Telephone).
T-330.01	15 Jan. 44	TG-5-A, -B, Telegraph sets.
T-378.05	1 Oct. 43	T-26, Chest Unit.
T-381.02	15 Sept. 43	MC-131, Ringer.
T-383.01	15 Feb. 43	R-2-A, Receiver.
T-383.03	15 Jan. 44	R-3, Receiver.
T-383.09	1 Oct. 43	R-21, Receiver.
T-383.10	1 Oct. 43	R-22, Receiver.
T-383.30	15 June 44	R-30-( ), Receiver.
T-385.01	15 Feb. 43	PL-5, Plug.
T-385.03	1 Oct. 43	PL-11, Plug.
T-385.05	15 Jan. 43	PL-55, Plug.
T-385.07	1 Oct. 43	PL-58, Plug.
T-385.09	15 Oct. 43	PL-68, Plug.
T-387.01	15 Sept. 43	EE-8, Carrying Chest for
T-391.01	15 Feb. 43	HB-4, Headband.
T-391.03	1 Oct. 43	HB-6, Headband.
T-391.10	15 June 43	HB-30, Headband.
T-391.24	1 Oct. 43	Headband, Wire Type.
T-392.03	15 Sept. 43	GN-38, Generator.
T-392.03	15 Sept. 43	GC-9, Crank.
T-392.04	15 Oct. 43	GN-41, Generator.
T-392.05	15 Oct. 43	GC-11. Crank.
T-396.01	15 Oct. 43	CO-76-A, Cord.
T-396.02	15 Feb. 43	CO-78, Cord.
T-396.05	1 Oct. 43	CC-59, Cord.
T-396.05	1 Oct. 43	CC-95-A, Cord.
T-396.09	15 Sept. 43	CC-333, Cord.
T-396.10	1 Oct. 43	CC-337, Cord.
T-396.11	1 Oct. 43	CC-341, Cord.
T-396.12	1 Oct. 43	CC-343, Cord.
T-396.13	15 Jan. 44	CC-335, Cord.
T-396.20	15 June 44	CD-620, Cord.
T-398.04	15 Sept. 43	C-105, Coil.
T-398.07	15 Oct. 43	C-125, Coil.
T-398.11	15 Sept. 43	C-158, Coil.
R-434.01	1 Mar. 44	Dynamotors.
T-501.01	15 Sept. 43	RL-26-A, Reel.
T-501.11	15 Sept. 43	Engine, Lausen-Ray-885.

For additional information regarding availability, supply, etc., address the Chief Signal Officer (SPSMA), Washington 25, D. C.

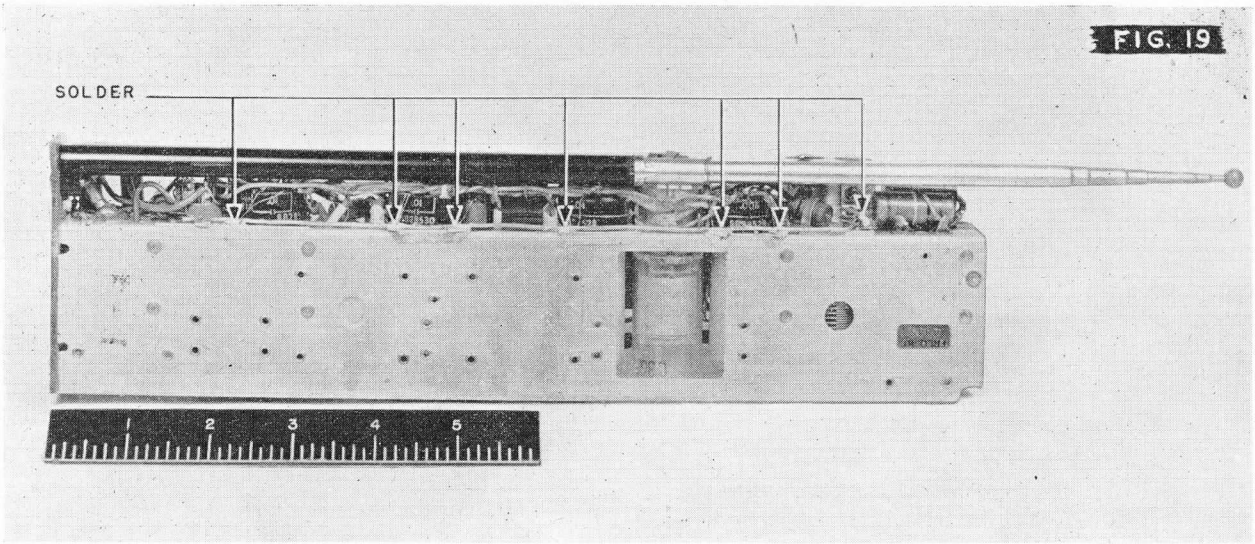
ERRATIC OPERATION SCR–536

Erratic operation of Radio Set SCR–536 is sometimes caused by improper grounding of socket ground plates. A procedure for correcting this difficulty follows:

Materials required—1 foot of #18 or #20 tinned copper wire; one 4–36 x 3/8-inch round head, binding head or fillister head screw with 1 shakeproof lockwasher and nut; one soldering lug; one #31 drill; one hand or electric drill.

Remove the chassis from the case of the Radio Receiver and Transmitter BC–611–( ) and remove all the tubes to prevent breakage. Remove the r–f tank coil located in the center of the chassis, for this is where most of the work is to be done. Directly at the rear of the plug, which holds the r–f tank coil, is a shield which is riveted to the chassis. Drill this rivet out and remove the shield from the chassis temporarily. Run the drill through the hole to insure that the screw will clear the hole. Clean the area around the hole, making sure it is free of fungiproofing lacquer or dirt, and scrape the chassis clean to insure a good ground. Slip the 4–36 screw into the hole from the top side of the chassis and place the soldering lug next to the chassis surface. Place the shield over the soldering lug, add the lockwasher and nut. Line up the shield properly and tighten the nut securely.

Cut the wire in two equal lengths and solder one end of each to the soldering lug underneath the shield. Bring the wire leads out under the antenna guide and wire cable and between the leads entering the i–f transformer L–4. Bend the wires so that one wire will run along the edge of the chassis length in one direction and the other wire will run in the opposite direction. These wires must be bent and located so that they will be as



close to the chassis as possible; otherwise difficulty will be experienced inserting the chassis back in its case.

Spot solder each wire at each of the socket ground plates where soldered connections already exist. The wire, running along the chassis toward the crystal mounting, will terminate at the radio ground located on the mounting plate assembly directly beneath Capacitor C–7. Cut off any excess wire and solder the end to the terminal lug. The other wire that runs toward the bakelite end plate will terminate at the last soldering terminal of the last socket ground plate; cut off all excess wire and solder.

The completed job should look similar to that in figure 19. Little trouble will be encountered in making this modification and it is estimated that the time should not exceed one man-hour.

ETO SIGNAL DEPOT

THE ARMY'S policy of employing civilian personnel wherever possible is paying dividends at the Signal Corps' largest depot in France, according to a recent report received by the chief signal officer. This depot does all fourth and fifth echelon repair work for ETO and is the central depot for all spare parts for the theater.

Although French civilians outnumber military personnel two to one, output has grown by leaps and bounds. In December, the depot carried 20,000 spare parts items in stock, totaling 225 tons. In March spare parts items in stock had jumped to 50,000, weighing 950 tons. Spare parts shipped forward every week amounted to 75 in December; as of the writing of the report this figure had reached 6,000. Repair jobs, both to installations and equipment amounted to 750 a week. Reclaimed wire, amounting to 435 reels, were being repaired weekly. During the first 3 months of 1945, soldiers and civilians completed 12,000 repair jobs. Specially ground crystals were turned out at the rate of 360 a week.

The depot is staffed by four signal companies, organized into a provisional battalion. It consists of a group of buildings on the outskirts of Paris, covering 425,000 square feet. When the Germans pulled out at the approach of the Allies last fall every skylight and window was broken, plumbing either broken or carted away and debris scattered knee deep throughout the buildings and grounds.

MILITARY PERSONNEL

TRAINING BATTALIONS REORGANIZED

STREAMLINING OF the Signal Corps enlisted training program with an eye toward developing men to the highest level of skill in one of five specification serial numbers was effected with the reorganization of two signal training battalions and the disbandment of a third. This move was made in order to have versatile personnel available with which to meet requirements.

The 840th Signal Training Battalion was dissolved at Camp Crowder, Mo., on 12 March by a letter order from The Adjutant General, while on the same date and by the same authority machinery was started for the reorganization of the 847th Signal Training Battalion at Camp Crowder and the 848th Signal Training Battalion at Fort Monmouth. Although the reorganization has been completed, the full extent of the program probably will not be realized until August 1945, because of difficulties encountered in procuring enlisted men suitable for this program.

The new program will feature the training of highly skilled technical specialists, such as those for mobile radio teams, radio carrier terminal teams, radio relay repeater terminal teams, code room maintenance augmentation teams, telephone carrier and repeater teams, telephone and telegraph installation teams, power teams and radio relay teams. The 848th Signal Training Battalion at Fort Monmouth is also concerned with the development of photographic assignment teams, newsreel assignment teams and a photographic laboratory team.

This training program has been set up so that the Signal Corps will be able to furnish long term specialists difficult to procure and train when new troop units are being activated. Specification serial numbers of enlisted men the Signal Corps was called upon to furnish to meet 1944 requirements and specification serial numbers that the Signal Corps will need for redeployment based on the latest available data were analyzed to determine in what specialties men should be trained. The result was that a training program was instituted that called for long term training beginning with one of five basic specialties, each of which has fundamental qualities that allow for instructing men in allied specialties in a relatively short period of time.

The five basic specialties are: radio repairman, repeaterman, radio operator, powerman and teletype mechanic. After a man has finished one of these basic specialties he continues through a succession of related courses until he reaches the highest level of skill in the same field, and thus can be used to fill a requirement calling for any one of several specification serial numbers. Upon reaching this point the man is given four weeks of team training at the completion of which his team is either used in the activation of a new unit or he is reassigned as an individual to meet loss replacement and rotational requisitions.

Such a program of progressive training requires men of intelligence and mechanical aptitude who can quickly absorb highly technical knowledge. Consequently, if at any point in the training stream it becomes apparent that a man is not qualified for further instruction in his long term course he is replaced and transferred out of the battalion to pursue courses demanding lesser technical skill.

This training will be conducted within an administrative framework that is unique in that the reorganized battalions have been given an authorized strength of 745 enlisted men each, plus a temporary authorized overstrength of 755 enlisted men each. It is intended to maintain the authorized strength at the 745 level, whereas the authorized overstrength of 755 will not be refillable, and will eventually disappear as men are shipped to meet Army Service Forces requirements.

If it doesn't work, report it! Use WD AGO Form 468.

BATTLE PARTICIPATION AWARDS

NORTHERN FRANCE

2d Signal Battalion
50th Signal Battalion.
56th Signal Battalion.
69th Signal Battalion (Corps).
92d Signal Battalion.
93d Signal Battalion.
26th Signal Construction Battalion.
29th Signal Construction Battalion.
32d Signal Construction Battalion.
33d Signal Construction Battalion.
34th Signal Construction Battalion.
35th Signal Construction Battalion.
36th Signal Construction Battalion (H).
38th Signal Construction Battalion.
39th Signal Heavy Construction Battalion.
40th Signal Construction Battalion.
41st Signal Construction Battalion.
43d Signal Construction Battalion.
17th Signal Operations Battalion.
302d Signal Operations Battalion.
305th Signal Operations Battalion.
310th Signal Operations Battalion.
3103d Signal Service Battalion.
3111th Signal Service Battalion.
3112th Signal Service Battalion.
255th Signal Construction Company.
257th Signal Construction Company.
258th Signal Construction Company.
261st Signal Heavy Construction Company.
262d Signal Construction Company.
267th Signal Heavy Construction Company.
270th Signal Construction Company.
535th Signal Construction Company.
818th Signal Port Service Company.
980th Signal Service Company (less Detachment A).
999th Signal Service Company.
3122d Signal Port Service Company.
3132d Signal Service Company.
3250th Signal Service Company.
3251st Signal Service Company.
3252d Signal Service Company.
3253d Signal Service Company.
3255th Signal Service Company (RI).
3256th Signal Service Company (RI).
3264th Signal Service Company.
336th Signal Company, Troop Carrier Wing.
286th Joint Assault Signal Company.
293d Joint Assault Signal Company.
294th Joint Assault Signal Company.
113th Signal Radio Intelligence Company.
114th Signal Radio Intelligence Company.
116th Signal Radio Intelligence Company.
118th Signal Radio Intelligence Company.
165th Signal Photo Company.
166th Signal Photo Company.
175th Signal Repair Company.
187th Signal Repair Company.
188th Signal Repair Company.
215th Signal Depot Company.
216th Signal Depot Company.
577th Signal Depot Company.
578th Signal Depot Company.
579th Signal Depot Company.
583rd Signal Depot Company.
246th Signal Operations Company.
277th Signal Pigeon Company.
282d Signal Pigeon Company.
297th Signal Installation Company.
298th Signal Installation Company.
2d Mobile Radio Broadcasting Company.
72d Public Service Battalion.
2d Signal Center Team.
3d Signal Center Team.
4th Signal Center Liaison Team.
6th Signal Center Liaison Team.
7th Signal Center Liaison Team.
208th Signal Radar Maintenance Unit (Type C).
211th Signal Radar Maintenance Unit (Type "C").
Enemy Equipment Intelligence Service, Detachment No. 10.

GERMANY

1st Signal Battalion.
2d Signal Battalion.
4th Signal Battalion.
54th Signal Battalion (less Company C).
56th Signal Battalion.
57th Signal Battalion.
59th Signal Battalion.
65th Signal Battalion.
97th Signal Battalion.
26th Signal Construction Battalion.
27th Signal Construction Battalion.
28th Signal Construction Battalion.
29th Signal Construction Battalion.
35th Signal Construction Battalion.
38th Signal Construction Battalion.
40th Signal Construction Battalion.
41st Signal Construction Battalion.
43d Signal Construction Battalion.
17th Signal Operations Battalion.
302d Signal Operations Battalion.
303d Signal Operations Battalion.
305th Signal Operations Battalion.
310th Signal Operations Battalion.
3112th Signal Service Battalion.
Hq/Hq Det, 3215th Signal Service Battalion.
3d Signal Company.
36th Signal Company.
45th Signal Company.
72d Signal Company (Special).
79th Signal Company.
100th Signal Company.
103d Signal Company.
209th Signal Company.
255th Signal Construction Company.
257th Signal Construction Company.
259th Signal Construction Company.
262d Signal Construction Company.
268th Signal Construction Company.
269th Signal Construction Company.
270th Signal Construction Company.
535th Signal Construction Company.
206th Signal Depot Company.
207th Signal Depot Company.
215th Signal Depot Company.
577th Signal Depot Company.
578th Signal Depot Company.
296th Signal Installation Company.
297th Signal Installation Company.
3137th Signal Motor Messenger Company.
3138th Signal Motor Messenger Company.
226th Signal Operations Company.
239th Signal Operations Company.
250th Signal Operations Company.
163d Signal Photo Company.
165th Signal Photo Company.
167th Signal Photo Company.
278th Signal Pigeon Company.
282d Signal Pigeon Company.
113th Signal Radio Intelligence Company.
114th Signal Radio Intelligence Company.
116th Signal Radio Intelligence Company.
117th Signal Radio Intelligence Company.
137th Signal Radio Intelligence Company.
175th Signal Repair Company.
177th Signal Repair Company.
178th Signal Repair Company.
3250th Signal Service Company.
3251st Signal Service Company.
3252d Signal Service Company.
3254th Signal Service Company.
3257th Signal Service Company.
3264th Signal Service Company.
3201st Signal Intelligence Detachment.
3284th Signal Service Detachment.
3285th Signal Service Detachment.
3202d Signal Service Section.
3210th Signal Service Section.
53d Signal Radar Maintenance Unit.
60th Signal Radar Maintenance Unit.
61st Signal Radar Maintenance Unit.
62d Signal Radar Maintenance Unit.
208th Signal Radar Maintenance Unit.
214th Signal Radar Maintenance Unit (Type "C").
215th Signal Radar Maintenance Unit (Type "C").
216th Signal Radar Maintenance Unit.
217th Signal Radar Maintenance Unit.
229th Signal Radar Maintenance Unit.
236th Signal Radar Maintenance Unit.

238th Signal Radar Maintenance Unit.
260th Signal Radar Maintenance Unit (Type "C").
286th Signal Radar Maintenance Unit.
287th Signal Radar Maintenance Unit.
288th Signal Radar Maintenance Unit.
1st Signal Center Team.
2d Signal Center Team.
3d Signal Center Team.
5th Signal Center Team.
4th Signal Center Liaison Team.
6th Signal Center Liaison Team.
3103d Signal Service Battalion.

NORMANDY

59th Signal Battalion.
59th Signal Battalion (Corps).
69th Signal Battalion (Corps).
26th Signal Construction Battalion.
29th Signal Construction Battalion.
33d Signal Construction Battalion.
34th Signal Construction Battalion.
36th Signal Construction Battalion (H).
38th Signal Construction Battalion.
41st Signal Construction Battalion.
301st Signal Operations Battalion.
302d Signal Operations Battalion.
3104th Signal Service Battalion.
261st Signal Heavy Construction Company.
262d Signal Construction Company.
268th Signal Heavy Construction Company.
270th Signal Construction Company.
275th Signal Construction Company.
208th Signal Depot Company.
216th Signal Depot Company.
221st Signal Depot Company.
577th Signal Depot Company.
579th Signal Depot Company.
581st Signal Depot Company.
582d Signal Depot Company.
297th Signal Installation Company.
298th Signal Installation Company.
166th Signal Photo Company.
816th Signal Port Service Company.
819th Signal Port Service Company.
990th Signal Port Service Company.
118th Signal Radio Intelligence Company.
179th Signal Repair Company.
188th Signal Repair Company.
980th Signal Service Company (less Detachment "A").
999th Signal Service Company.
24th Special Service Company.
3d Signal Center Team.
Forward Echelon, Hq. Com Z, ETO.
Detachment "A", WAC Detachment, Hq. Command, ETO.

BATTLE HONORS

GENERAL ORDERS
No. 26 WAR DEPARTMENT,
WASHINGTON 25, D. C., *9 April 1945.*

EXTRACT

* * * * *

The *2d Signal Company, 2d Infantry Division,* is cited for outstanding performance of duty in action from 16 to 19 December 1944, in Belgium. On 16 December 1944, the area of the *2d Infantry Division* was subjected to heavy shell fire which destroyed all wire communications between division and subordinate headquarters. Working in exposed positions under intense artillery fire, the wire personnel of the *2d Signal Company,* displaying courage and unflinching devotion to duty, reinstated circuits in record time. On the following day, an enemy attack threatened to envelop the company positions in * * *, Belgium, and the division command post at * * *. Telephone and radio operators, messengers, clerks, and cooks of the *2d Signal Company* unhesitatingly took up battle positions, and in the face of heavy fire from tanks and self-propelled artillery, inflicted many casualties on the enemy. Fierce attacks by German armor and infantry were defeated by courageous use of antitank guns and devastating small-arms fire as the company assisted in successfully defending the vital division installations. Meanwhile, urgently needed wire and radio communications were constantly maintained, often at great personal risk. On the 19th of December, the division was forced back by strong German elements, but the movement was greatly facilitated and expedited by the well-coordinated and superior wire communication net maintained by the *2d Signal Company.* Personnel of forward radio and switchboard centers were the last to leave the command post, regardless of heavy shell fire and infiltrating tanks and infantry. The courage, skill, and valor conspicuously exhibited by the personnel of the *2d Signal Company, 2d Infantry Division,* exemplified the highest traditions of the armed forces.

* * * * *

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL: G. C. MARSHALL,
J. A. ULIO, *Chief of Staff.*
Major General,
The Adjutant General.

FIGHTER-LIAISON INTERCOMMUNICATION

A NEED existed recently in the European Theater of Operations for communication betweet L–4 type liaison planes and high-performance aircraft. Since direct communication between a fighter's Radio Set SCR–522 and an L–4's SCR–509 is impossible, a relay system was devised to permit intercommunication. This system was as follows:

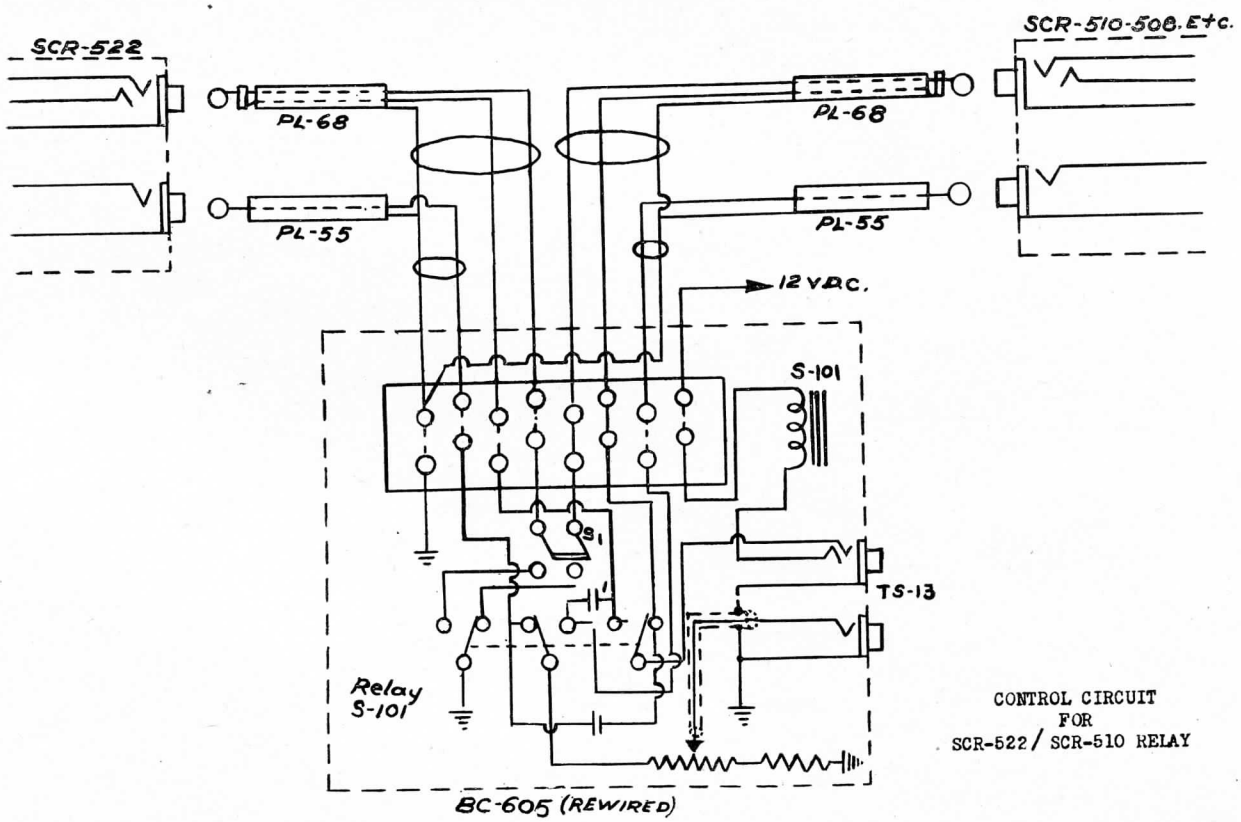
It was stipulated that the ground station should have control over the direction of transmission and be able to communicate with either type aircraft by means of a simple switching system. These requirements were met by mounting a Radio Set SCR–522 and SCR–510 in a ¼-ton jeep, with a control box to control the combination. The control box was improvised as illustrated in the accompanying diagram.

With the sets operating, the control cords plugged in, and the control handset butterfly switch in the normal position, the 510 transmitter was on the air being modulated by the output of the 522's receiver. In this position the fighter could talk to the L–4. When the butterfly switch on the TS–13 handset was operated, the 522 transmitter was on the air and was being modulated by the output of the 510's receiver, allowing the L–4 to talk to the fighter. This sequence was selected deliberately to prevent inadvertent jamming of the fighter channel by leaving the 522 on the air when the handset was laid aside.

If no transmission was desired, but the ground operator desired to monitor either channel, switch S1 was thrown to the OFF position. This disabled the transmitter control circuits, and by operating the butterfly switch he could monitor either channel desired.

The ground operator could transmit from his 510 or 522 by speaking into the control hand-set with switch S1 in the ON position. He could transmit on the 522 by operating the butterfly switch, or on his 510 by releasing the butterfly.

During a test excellent communication was maintained with an L–4 at 4,000 feet, 12 miles away. An SCR–522 in a half track was used to substitute for the fighter radio.



CONTROL CIRCUIT
FOR
SCR-522 / SCR-510 RELAY

ROVER JOE

ROVER JOE is a system initiated and used by the Fifth Army in Italy for front line air-ground cooperation. It provided a separate communication channel for ground requests for air separation and also for air briefing of pilots aloft.

As used in Italy, Rover Joe consisted of a controller group located well forward of the normal Army cooperating air units. It was composed of a ground section which kept up with the tactical situation on the ground and evaluated requests for air missions from ground commanders before turning them over to the air section, and an air section which also evaluated requests and if the target was found suitable for an air strike, briefed pilots in aircraft. The air section interrogated pilots after a mission was completed.

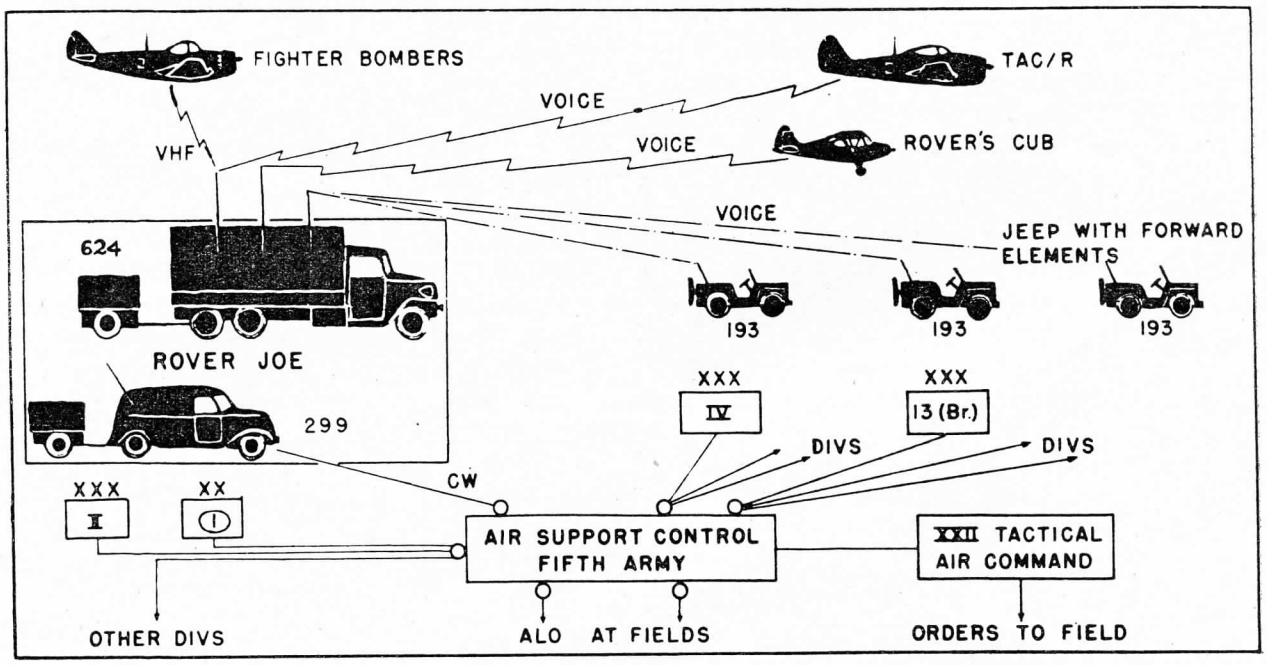
Fighter-bombers (P–47's) rendezvoused over Rover Joe every half hour.

Results of this system were more than satisfactory. One report included the following statement: *The terrific punch and suddenness of air fire power was brought to bear with amazing accuracy and at times within 600 yards of front-line troops without a single error being committed. Through this system a battalion commander could and did call for air strikes and had the target engaged within 15 minutes.* The average time elapsing between time of request and time of air attack for eight operational days last fall was 68 minutes.

The key to this speed and accuracy was good communications, using Signal Corps Radio Set SCR–193, SCR–299, and SCR–624.

The SCR–193's were mounted in jeeps and attached to key battalions of forward regiments. They represented a fast and reliable means of voice communication for all matters concerning Rover Joe targets such as requests, information as to the tactical situation, ground observation of air strikes, general weather reports, etc. An SCR–193 at Rover Joe acted as NCS for this net and was used to keep battalions advised as to acceptances and refusals of target requests, scheduled time of missions, reports on fighter-bomber attacks and other observations.

Radio Set SCR–299 at Rover Joe was used for contact with Fifth Army air-ground group and divisional headquarters. It acted as an outstation in the existing Army air-ground group net and as an alternate channel to regiments receiving cooperation from air units. SCR–299 was also



RADIO COMMUNICATION FACILITIES FOR ROVER JOE SYSTEM OF TACTICAL AIR GROUND LIAISON.

used at Rover Joe to monitor the Army air-ground net and regimental nets and to keep informed of air and ground activities outside its own sphere.

At Rover Joe Radio Set SCR–624 was used for air-ground communication with the SCR–522's in aircraft, for reporting in by pilots, orders for targets and air briefing on requests, information as to the ground situation and for interrogation of aircraft pilots after a mission was accomplished. It also provided a channel to tactical reconnaissance planes as to targets of opportunity, ground situation as it appeared to airborne spotters, and for other advice from the Tac/R planes to Rover Joe.

SPARE PARTS REQUISITIONING

ONE OF the biggest jobs in a large, fast-moving army is that of supplying its maintenance organizations with spare parts to keep equipment in operation. For there are very definite limitations to the *speed* with which equipment can be produced and moved to the front lines.

It is often necessary for supply headquarters to estimate probable unit requirements for certain items with little or no margin or error, and if unauthorized or otherwise erroneous activity occurs at any point in the line of supply, the system breaks down and shortages are created.

For example, according to careful estimates, a certain number of spare parts for a particular item of equipment will be required by each of many units, and depots are stocked accordingly. Now, suppose several units order in excess of their needs in order to build up their stock of the item. The extra quantity they demand is then no longer available at the depots for filling requisitions from other units, and a shortage is created.

This practice of *hoarding* is one of the main causes of shortages and it is due largely to the fear that orders will not be filled promptly. Yet 9 times out of 10, when requisitions are not filled quickly it is because they have not been properly made out, so depot personnel are unable to take care of them without delays. A high percentage of the items listed on requisitions received by depots are not correctly identified. This condition can be remedied if personnel concerned with ordering will keep a few things in mind when using catalogs and making out requests for material.

First, the right catalog should be used whenever possible. The present system of cataloging the Army's equipment is intended to simplify ordering by standardizing the catalogs for all technical services. This has been accomplished by issuing them in a series of sections bearing the title, *Army Service Forces Catalog*, with the abbreviations CW, ENG, MED, ORD, QM, SIG or TC identifying a catalog as one concerning a particular technical service. A complete outline of this catalog setup is given in Circular 304, War Department, 17 July 1944. It should be pointed out here that the No. 6 sections (sets, kits, etc.) and the No. 7 sections (organizational spare parts) will be of particular value to using troops.

An explanation of the contents and purpose of each of the catalogs, as well as instructions on how to fill out property issue slips and requisitions, is given, for signal equipment, in Army Service Forces Catalog SIG 1. SIG 2 is the index to all the titles of each publication comprising the Signal Corps catalog system. These two, then, might be called the key publications in the system, and should be studied carefully. The latest edition of SIG 2, which is issued at indefinite periods throughout the year, should be used to make certain that the shop library contains the latest catalogs.

Other publications giving information on the requisitioning sytem are TM 37–220, *Stock Control Manual for Posts, Camps and Stations*, 9 May 1944 and TM 37–250, *Basic Maintenance Manual*, November 1944. An important index, needed to keep complete, up-to-date files of maintenance publications involving use of spare parts, is FM 21–6, which now incorporates War Department Pamphlet No. 12–6 and lists technical manuals, technical bulletins, War Department Lubrication Orders, supply bulletins, modification work orders and forms and records concerned with maintenance.

An extremely important point, of interest to officers especially, concerns the availability of catalogs, technical bulletins and other publications connected with spare parts requisitioning and maintenance. Although each War Department publication is distributed automatically according

to predetermined lists, *any unit, whether it is on the distribution list or not, may requisition any publication it needs.*

In order to avoid confusion, obsolete catalogs should be disposed of immediately upon receipt of current issues. Shop supply officers should check shop libraries frequently and initiate requisitions for current catalogs themselves. Also, they should watch for revisions and changes to catalogs. These do not always show up in the indexes until some time after they are issued. Meanwhile, they may list parts which have recently been made available and which are badly needed, or they may cancel the availibility of parts which have previously been authorized. In the event that the latest authorized catalog is not available, for any reason, requisitioners should be especially careful in naming the catalog from which parts have been ordered.

When filling out a requisition, care must be taken to give *all* the information required, as outlined in SIG 1. This may involve what seems to be needless duplication of information, but there are reasons for listing everything called for on the requisition form.

It is also important that catalogs be studied carefully when requisitions or property issue slips are being filled out, so that advice given in the catalogs concerning obsolescence, interchangeability and substitution may be taken into account. For example, an item may be available separately or as part of a set. The catalog reveals this, and both numbers should be given in case one is out of stock. Or, study of the catalog may reveal that a part is available only for use on equipment in a certain serial number group and the equipment for which the requisitioner is ordering parts may not fall in this number group. Remember, only parts which are authorized and available may be ordered, with a few exceptions. Only by a thorough perusal of the catalog can this be determined.

A little attention to these phases of requisitioning procedure will iron out many supply problems and thus help to end the delays in spare parts requisitioning that mean headaches to maintenance men. It is to the advantage of both officers and enlisted men to take an interest in this problem. If everyone orders with care there will be spare parts to spare.

PREVENTIVE MAINTENANCE ROSTER

WAR DEPARTMENT AGO Form 460, *Preventive Maintenance Roster*, replaces the Duty Roster being used for preventive maintenance purposes and incorporates the best ideas used along these lines. WD AGO Form 460 is being distributed on the basis of two copies to each company. Additional copies can be requisitioned in accordance with WD Circular 264, 1944.

In designing the Preventive Maintenance Roster, two things were kept constantly in mind—versatility and simplicity. As a result, the new roster can be used for all types of equipment requiring preventive maintenance services—trucks, tractors, bulldozers, artillery, radios, generators—and it can be filled in quickly and accurately.

There are two important things to keep in mind in using the Preventive Maintenance Roster:

First, the roster should be completely filled in as prescribed in the new TM 37-2810 in advance of the month to which it applies. This makes it possible to plan work for the shop so it has just the right amount to keep it busy each day, and so the unit has the maximum number of vehicles available for actual service each day. The volume of work scheduled for the shop for each day can be determined by adding up the amount of work shown in each column on the right side of the form.

Secondly, the roster should be filled in initially in pencil. This makes it easy to make revisions if necessary. But the important reason is that by inking in the symbols after the servicing is actually performed, you have a record of work performed (ink) and work still to be done (pencil).

Thirdly, when a service is performed *out of turn* either before or after the day scheduled, the entry in ink will be made on the day scheduled and then circled, and not on the actual day the service was performed.

U. S. GOVERNMENT PRINTING OFFICE: 1945

OFF-FREQUENCY TRANSMISSION

Causes:

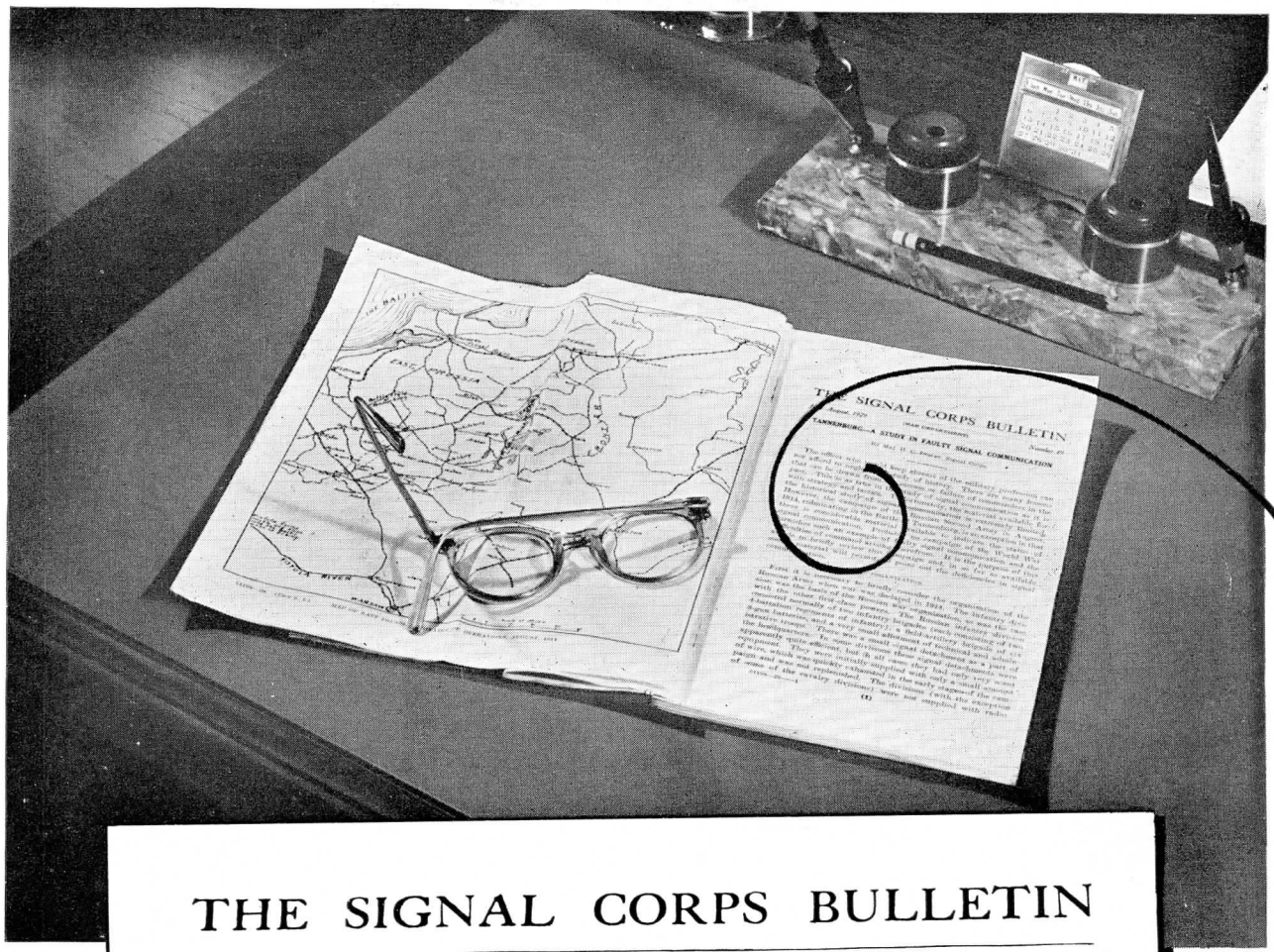
- Excessive Transmissions
- Use of Excessive Power

These Lead to:

- More Enemy Interception
- Jamming of Other Frequencies

CHECK ✓ *your* FREQUENCY

NOW IS THE TIME . . .



THE SIGNAL CORPS BULLETIN

July-August, 1929 [WAR DEPARTMENT] *Number 49*

TANNENBURG—A STUDY IN FAULTY SIGNAL COMMUNICATION

By Maj. H. C. INGLES, Signal Corps

The officer who would keep abreast of the military profession can not afford to neglect the study of history. There are many lessons that can be drawn from the success or failure of commanders in the past. This is as true in the study of signal communication as it is with strategy and tactics. Unfortunately, the material available for the historical study of signal communication is extremely limited. However, th

THE CHIEF SIGNAL OFFICER WROTE THE ABOVE 16 YEARS AGO. WHAT WAS TRUE OF WORLD WAR I MUST NOT BE REPEATED IN WORLD WAR II. THE HISTORY YOUR UNIT IS MAKING IS OF VITAL IMPORTANCE IN WRITING THE STORY OF COMMUNICATIONS IN THIS WAR. DO NOT NEGLECT THE OPPORTUNITY OF RECORDING IT NOW WHILE THE FACTS ARE AVAILABLE.