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SIGNAL CORPS TECHNICAL INFORMATION LETTER

SEPTEMBER·1943

ARMY SERVICE FORCES · OFFICE OF THE CHIEF SIGNAL OFFICER

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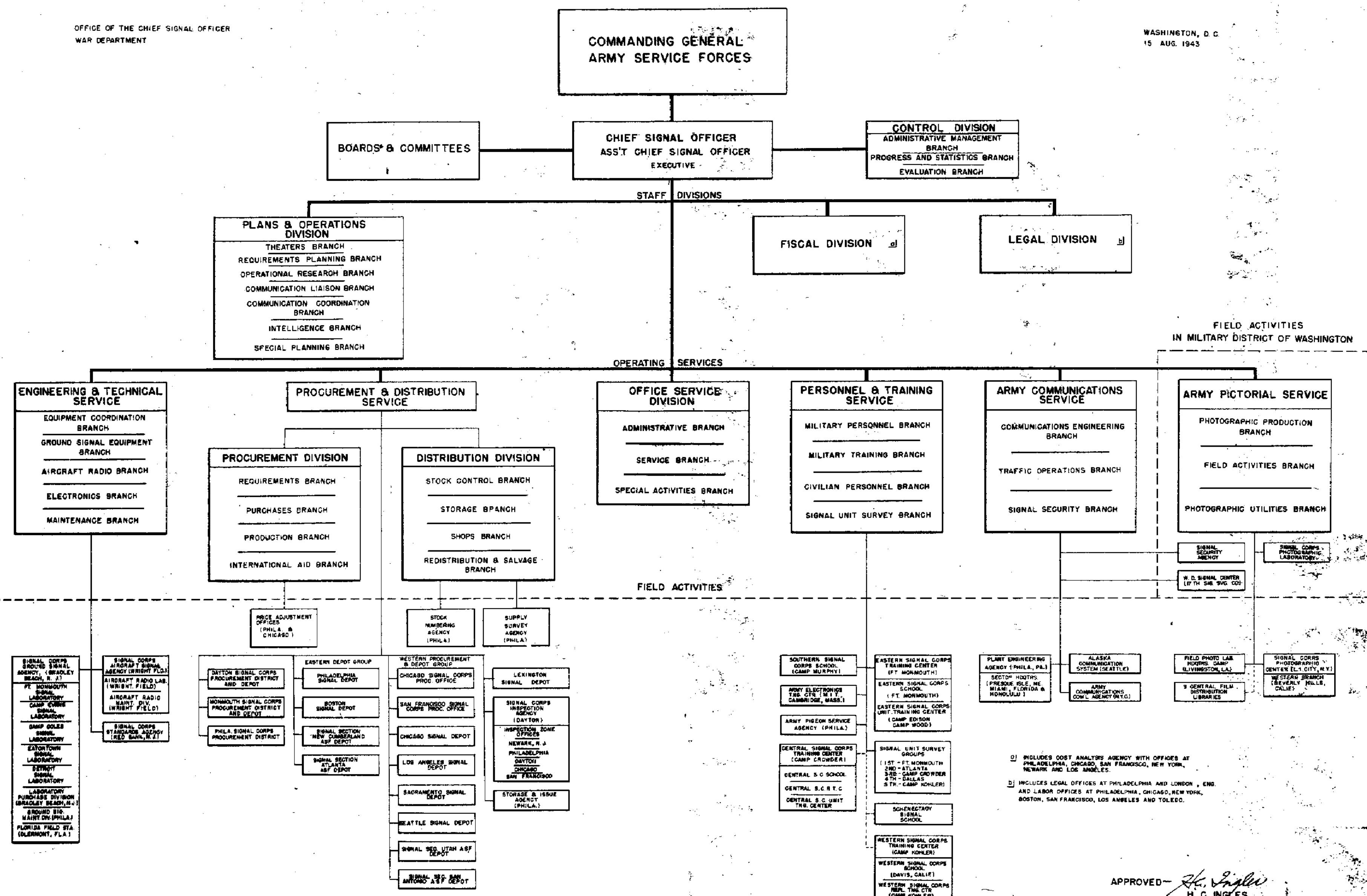
By [illegible] NARA Date 1/25/11

OFFICE OF THE CHIEF SIGNAL OFFICER
WAR DEPARTMENT

WASHINGTON, D. C.
15 AUG. 1943



a) INCLUDES COST ANALYSIS AGENCY WITH OFFICES AT PHILADELPHIA, CHICAGO, SAN FRANCISCO, NEW YORK, NEWARK AND LOS ANGELES.

b) INCLUDES LEGAL OFFICES AT PHILADELPHIA AND LONDON, ENG. AND LABOR OFFICES AT PHILADELPHIA, CHICAGO, NEW YORK, BOSTON, SAN FRANCISCO, LOS ANGELES AND TOLEDO.

APPROVED— H. C. Ingles
H. C. INGLES
MAJOR GENERAL
CHIEF SIGNAL OFFICER

SIGNAL CORPS TECHNICAL
INFORMATION LETTER

Number 22 September 1943

RESTRICTED

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WAR DEPARTMENT · ARMY SERVICE FORCES
OFFICE OF THE CHIEF SIGNAL OFFICER
EXECUTIVE OFFICE · SPECIAL ACTIVITIES BRANCH

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SCTIL

PURPOSE

Signal Corps Technical Information Letter (SCTIL) is issued monthly for the purpose of keeping officers in charge of field activities informed on the newest training methods, operational procedures, equipment under development, standardization or procurement, and providing other pertinent information as coordinated in the Office of the Chief Signal Officer.

SOURCE OF MATERIAL

This Letter is compiled largely from information available in the divisions and branches of the Office of the Chief Signal Officer. All Signal Corps training centers and other agencies are invited to submit items of general interest. Such items should reach the Office of the Chief Signal Officer (SPSAY) not later than the 15th of each month for inclusion in the Letter of the following month.

DISTRIBUTION

Distribution of the Letter is made to army, corps, and division signal officers; commanding officers of signal companies and battalions; service command and department signal officers; post, camp, and depot signal officers; the signal officers of bases and task forces; Signal Corps inspection zones, procurement districts, training centers and laboratories; directors of Signal Corps ROTC units; signal officers of Army Air Forces and Army Ground Forces headquarters and major commands; overseas headquarters; units of the Office of the Chief Signal Officer and of Headquarters, Army Service Forces.

If any such activity is not receiving the letter or is receiving too few or too many copies for its present needs, a memorandum addressed to the Chief Signal Officer (SPSAY), Washington, will rectify the condition.

* * * * *

This Letter is for information only. Requisitions for new types of equipment should not be submitted on the basis of data contained in this Letter.

24-48553ABCD

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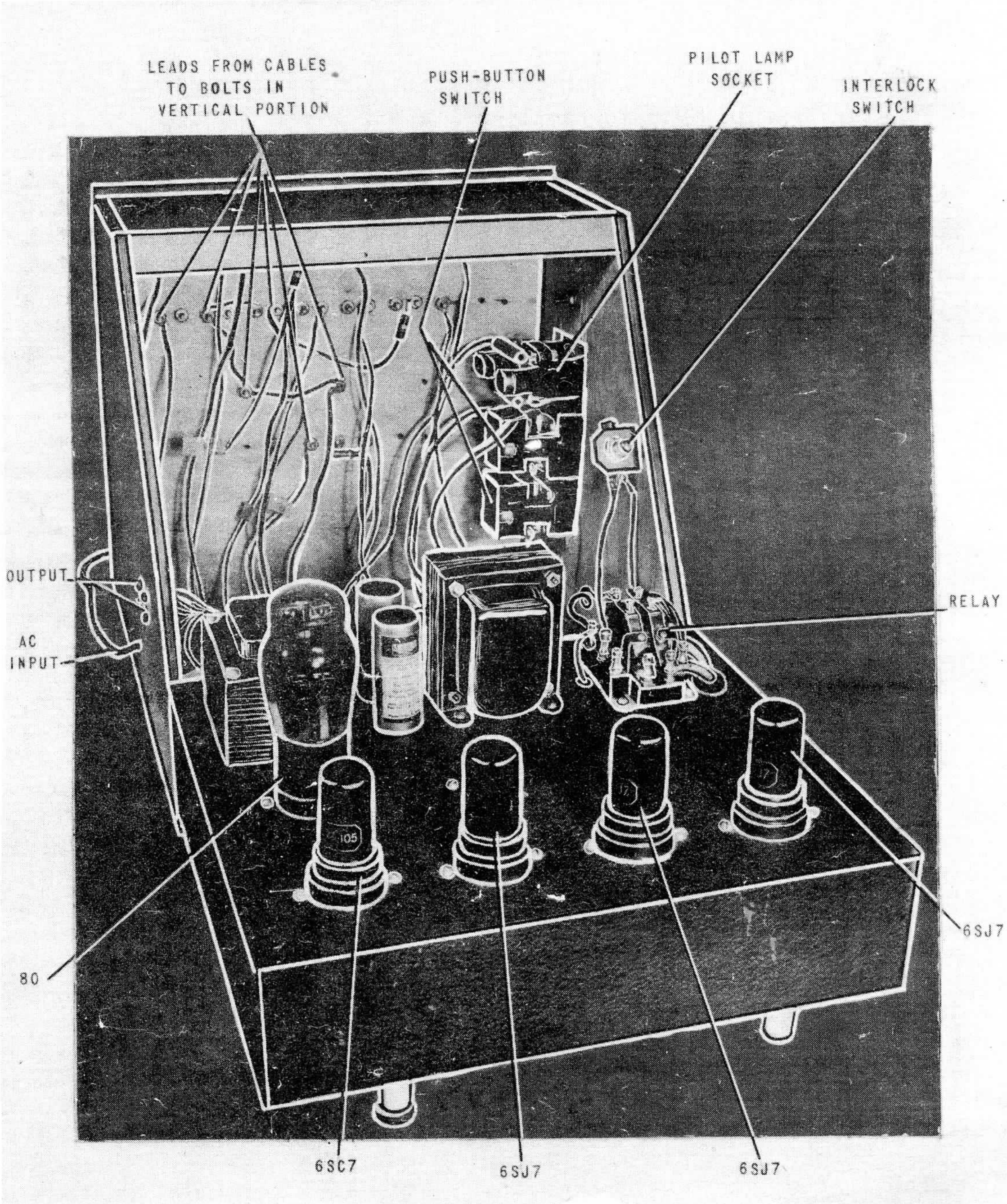


FIG. 1 - A TRAINING AID DEVELOPED AT THE SOUTHERN SIGNAL CORPS SCHOOL TO PROVIDE A PRACTICAL TEST OF THE STUDENT'S TROUBLE SHOOTING ABILITY.

VISUAL TRAINING AIDS

TESTING TROUBLE SHOOTING ABILITY

One of the most important phases in the training of maintenance men is the actual tracing down of trouble in equipment. After the principles upon which a circuit is based have been studied and the student has learned how the circuit functions and is operated, he must know how the circuit behaves when something is wrong and how to detect the fault. In order to give the student this experience, it is the normal practice for the instructor to introduce defects in the circuit of the equipment under study and the student locates these by whatever form of trouble shooting is applicable to the particular equipment.

It is of the greatest importance that a student recognize certain troubles that are inherent in fundamental circuits, such as detectors, different types of a-f or i-f amplifiers, multivibrators, cathode followers, etc.,

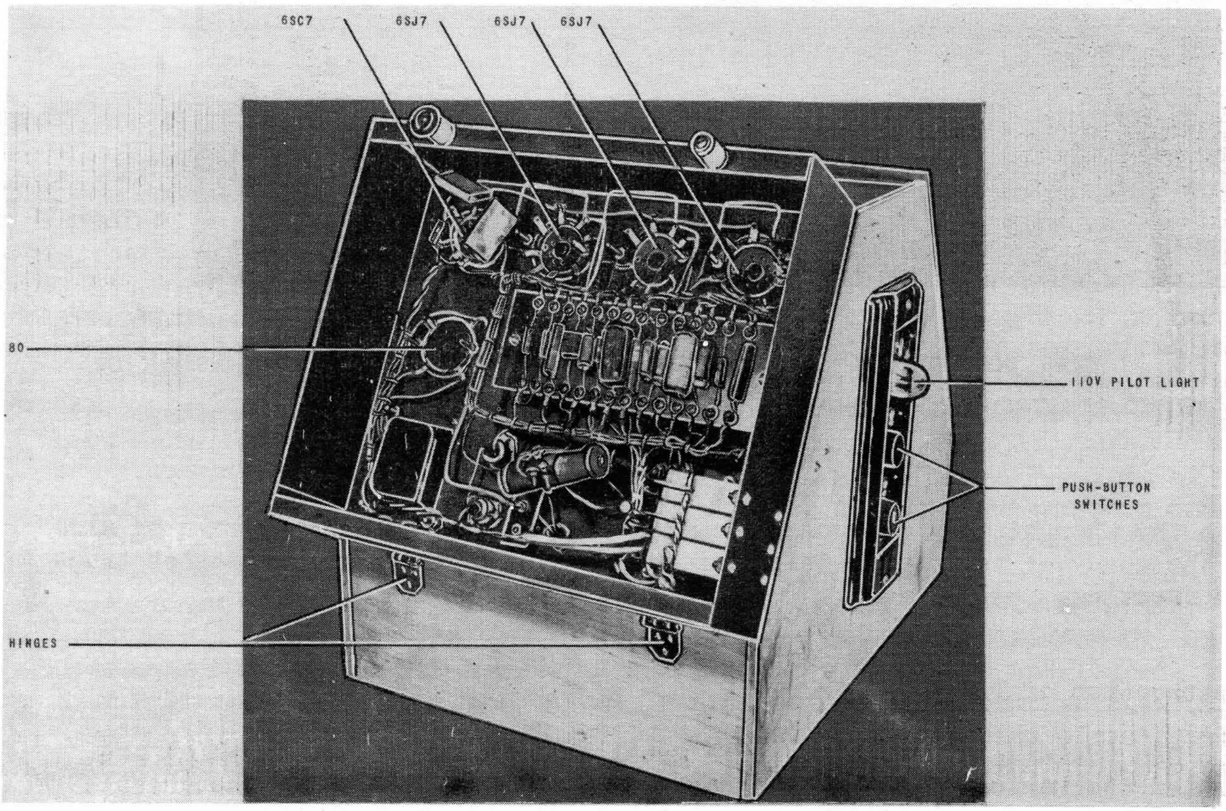


FIG. 2- POWER IS APPLIED BY THE INTERLOCK SWITCH AND TROUBLE SHOOTING IS FACILITATED WHEN THE CHASSIS IS SWUNG INTO POSITION SHOWN.

which he will find incorporated in more complex equipment. In order to give the students in the pre-Radar course at the Southern Signal Corps School such information and experience, the trouble shooting training aid shown in the accompanying illustrations was developed. Its description is presented here

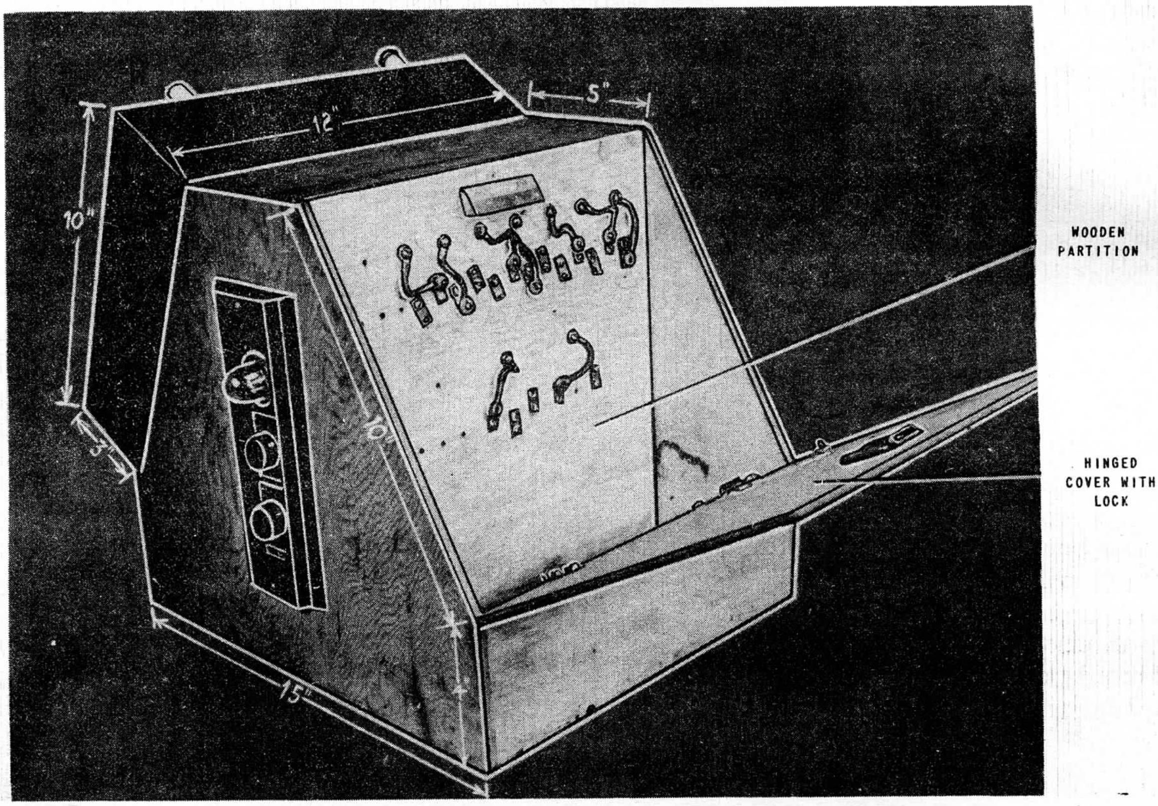


FIG. 3- REAR COMPARTMENT OF BOX SHOWING OPEN LID WITH LOCK. THE INSTRUCTOR INTRODUCES TROUBLE BY SHIFTING CONNECTIONS OF THE SNAP-ON LEADS.

with the thought that the underlying ideas could be applied to training aids in the study of telephone, telegraph, teletype, or radio communication trouble shooting.

Construction of Training Aid

The training aid consists of a metal chassis on the top of which are mounted the various circuit components, as shown in Figure 1. The chassis is attached to the plywood box by hinges at the top rear of the chassis, as may be seen in Figure 2. Here also are shown the tube sockets, resistors, condensers, etc., and the cabled wiring, which is divided into two main cables and brought out through the top rear of the chassis and down into the bottom

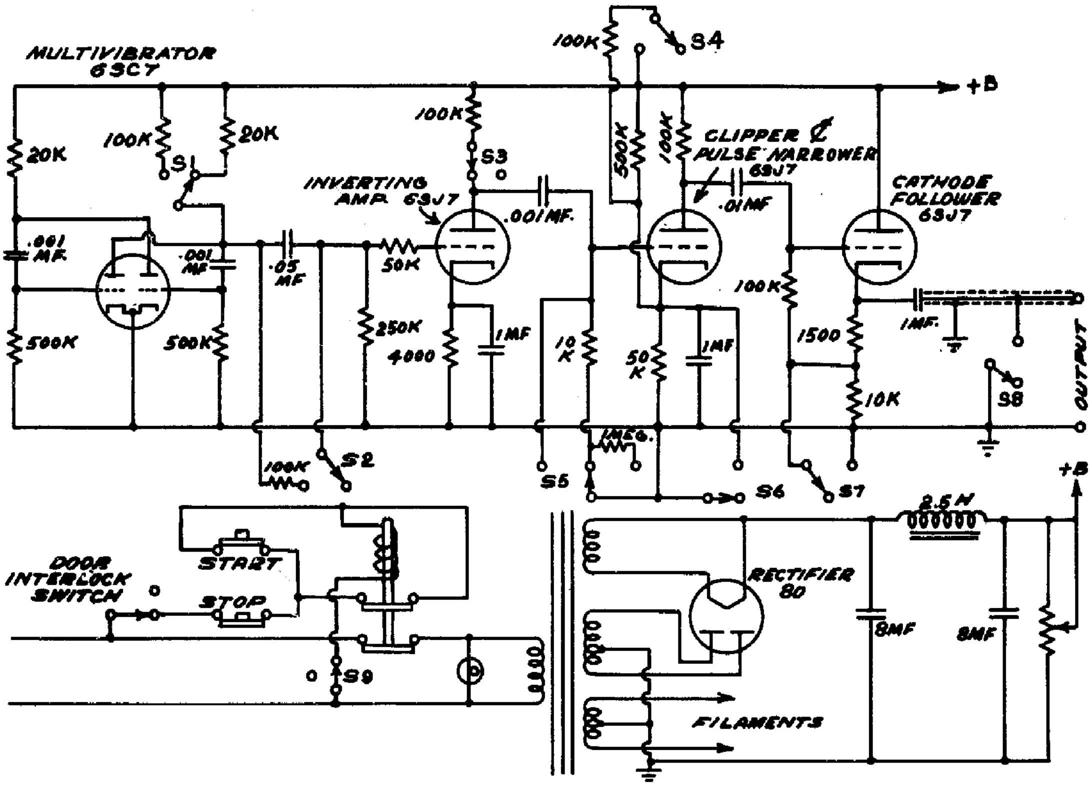


FIG. 4- SCHEMATIC CIRCUIT OF THE COMPLETE UNIT.

of the wooden box. The leads in these cables are then brought up to the small bolts in the wooden partition that divides the wooden box approximately in half. This partition is perpendicular to the bottom of the box and is fastened in place just to the rear of the push-button switches, as in Figure 1.

The opposite side of this partition is shown in Figure 3. Some of the leads shown in Figure 1 go to the bolts holding the male Nu-Way snap connectors and others to the short leads at the ends of which are soldered a female connector. These are indicated as switches S1, S2, etc., in the schematic diagram of the circuit of the unit in Figure 4 and they could be small switches if such were available. These connections can be hidden by the cover (shown open in Figure 3). When this cover is closed and locked, the student cannot see what changes the instructor has introduced into the circuit. The 110-volt, a-c leads are brought into the left side of the wooden box immediately below the two output terminals of the cathode follower, as shown in Figure 1. The dimensions of the unit are shown in Figure 3.

It was desired to include in this unit examples of push-button switches, a door interlock switch, and a relay. When the chassis is placed in the closed position of Figure 2, its top automatically closes the door interlock switch.

Method of Instruction

This trouble shooting training aid is one of the last experiments given the students in the pre-Radar course at the Southern Signal Corps School. They have studied the different types of circuits that are embodied in the training aid and, as will be explained in a moment, this unit not only tests their ability to locate the defects in a circuit, but it also provides a test of their ability to recognize the type of circuit, as well as an opportunity to observe oscilloscope patterns, to make voltage and resistance readings, and to analyze their findings.

At the start of the experiment, the student is given the training aid with the hidden connections arranged so that the unit is in normal working order. He is also given the incomplete schematic diagram of Figure 5.

By circuit tracing, he discovers what condensers and resistors are connected to the grids and plates of the 6SC7 tube, where the cathode is connected, and so completes the schematic of Figure 5. He then determines how the tube is being used in the circuit and that it is a multivibrator. Next he studies the operation of the relay and the associated switches, after which he observes the wave-forms, existing at various points in the circuit, with a test oscilloscope. From the images obtained and study of Figure 5, he determines the type of circuit in each stage. Following this, the student takes voltage and resistance readings between ground and the grid and plate of each stage.

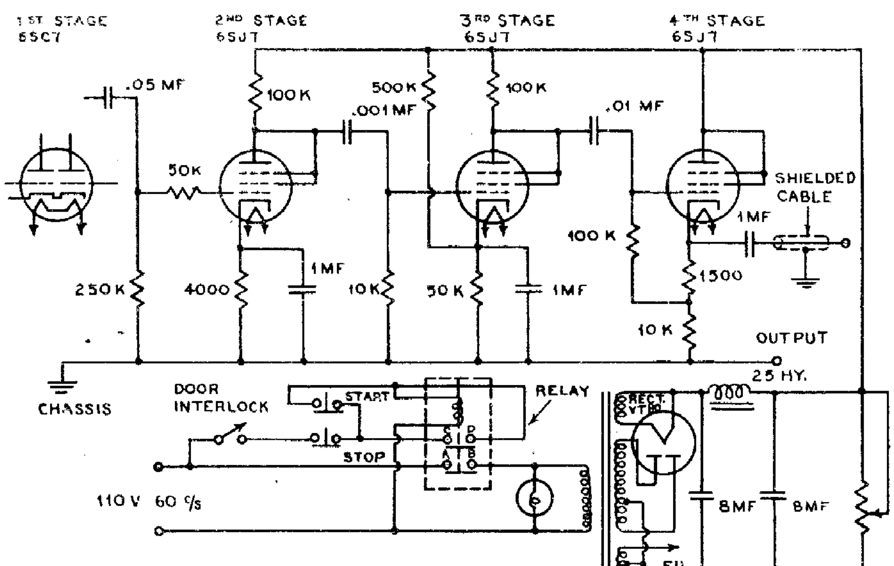


FIG. 5- THE INCOMPLETE CIRCUIT SUPPLIED TO THE STUDENT HIS FIRST JOB IS TO COMPLETE THIS CIRCUIT BY SIGNAL TRACING METHODS.

When his recorded oscillograms and voltage and resistance readings have been checked by the instructor, the student is sent away while the instructor introduces defects in the unit. For instance, he might change the connection of switch S1, Figure 4, from the 20,000-ohm resistor to the 100,000-ohm resistor. He might open switch S3, removing the plate supply from the inverting amplifier. A defective tube might be substituted for the good one in the third stage. Switch S6 might be closed, shorting out the 50,000-ohm resistor and 1-mf condenser. If he closes switch S8, it grounds the shielded lead in the cathode-follower input. After the desired changes in the connections at the rear of the partition have been effected, the lid is closed and locked, and the student recalled to start this trouble shooting.

The student is instructed to start at the input of the training aid and work towards the output. If the power unit is working properly, as it would be if switch S9 were left in its normal position, the student should first discover that the output wave-form of the 6SC7 was asymmetrical. He would analyze the cause of this and discover the 80,000-ohm difference in the plate circuit, caused by the throwing of switch S1. He would report this defect to his instructor, who, after questioning the student to see if he really understood what he had done, would then unlock the lid, change the switch S1 back to its normal position, and the student would go on to trouble shoot the remainder of the unit.

In the event that a student reports a defect to the instructor that is farther along in the unit than he should be, he is told to go back again and trace the trouble in a logical order. For example, if the student reported the grounding of the output lead of the cathode follower before he discovered the defecting tube in the third stage, he would be instructed to go back over the circuit again. Every effort is made to have the students progress logically through the unit in the way they should go through a more complicated piece of equipment.

The field for application of trouble shooting training aids similar to the one described here is practically unlimited.

SIGNAL TRACING UNIT TRAINS RADIO TROUBLE SHOOTERS

A demonstrator board has been developed at the Central Signal Corps School, Camp Crowder, Missouri, to teach students in the Elements of Radio Section of the Radio Division the proper method of rapid localization of trouble in a radio receiver that is not functioning. The board was developed and constructed by members of the Section. Students in this CSCS course have found this training aid interesting enough that the problem of teaching the student to trace such circuits has been greatly simplified. The board consists of 24 push buttons placed at various points on the diagram of a conventional superheterodyne receiver. Attached to the board by means of a three-foot connecting cable is a box labeled "Signal Generator." The board and the Signal Generator box are shown in Figure 1. Figure 2 shows the rear of the board with the buttons and contacts in place.

Operation

The Signal Generator box has three push buttons which are marked "RF," "IF," and "AF." At the end of the board is a series of lamps in a vertical row with a thermometer painted around them. This is used as the student's "scoreboard." Presuming that the diagram is an actual receiver, the student is asked to locate an imaginary trouble in it by means of a signal generator. To properly localize the trouble, the student should use an audio-frequency generator to check the "AF" section of the receiver first. By pressing the "AF" button on the Signal Generator box and the button at the plate of the last audio amplifier tube simultaneously, the bottom lamp is lighted in the thermometer. This lamp stays on when the buttons are released. This operation simulates checking the output transformer and speaker of the receiver. Pressing any other combination of buttons will not light the lamp in the thermometer. The next step is to apply a signal to the grid of the last audio amplifier tube. The student does this by again pressing the "AF" but-

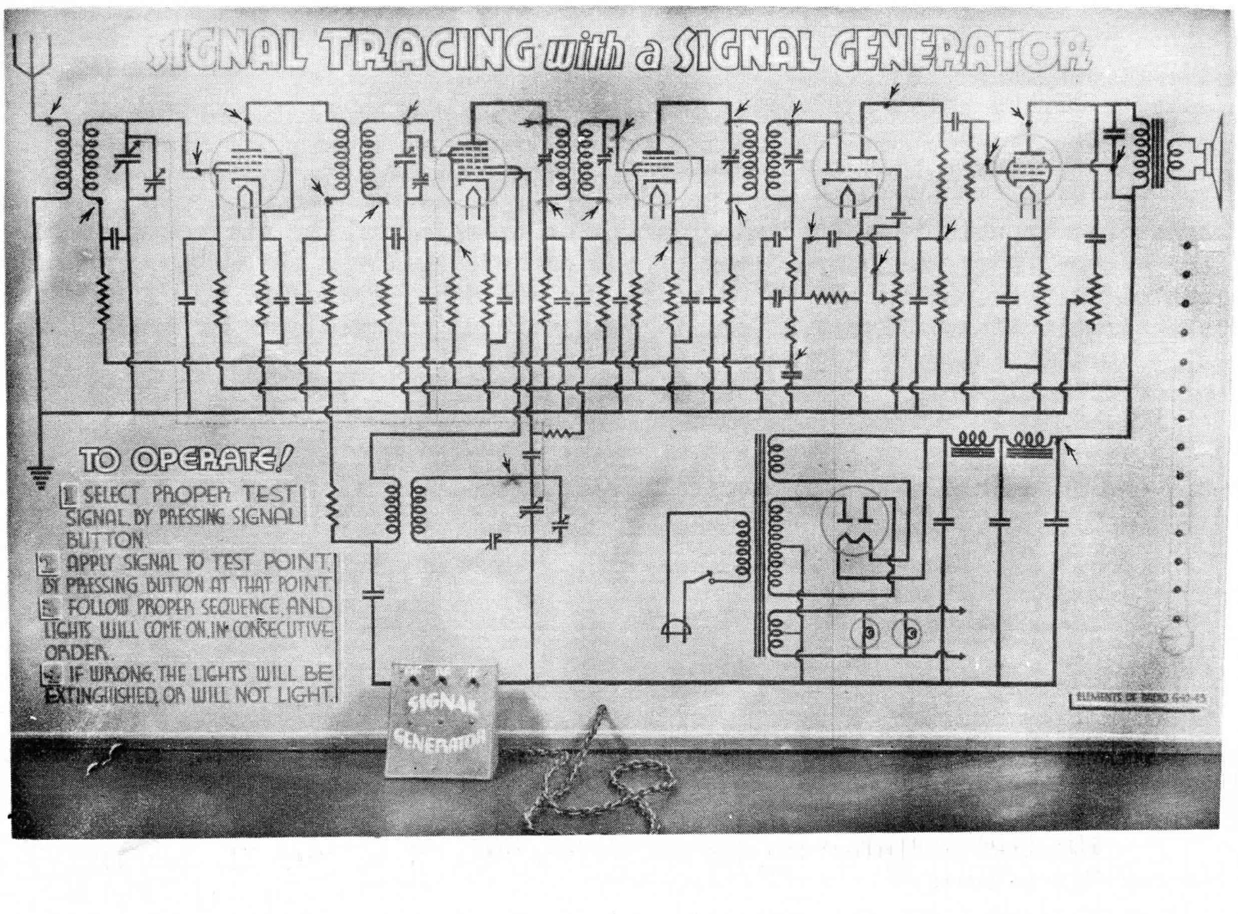


FIGURE 1 - FRONT VIEW OF THE SIGNAL TRACING DEMONSTRATION BOARD. ARROWS INDICATE STRATEGICALLY LOCATED PUSHBUTTONS. THE THERMOMETER AT THE RIGHT SCORES SUCCESSFUL TRACING.

ton on the Signal Generator box and the button on the grid of the last audio stage. With this operation the next lamp in the thermometer will light.

Should the wrong button be pressed, one of two things will happen. If a button is pressed where no signal is present at any time, such as the high voltage connection of the power supply, the lamps that have been previously "scored" will go out, requiring the student to start at the beginning again. Should he push a button where a signal is normally present but skip over an important stage, no lamp will light. Thus by pressing the "AF" button and the proper buttons on the diagram he can simulate checking the entire "AF" section of the receiver.

After he has progressed to the second detector it will be necessary for him to use the button marked "IF" on the Signal Generator box. Using this button the student may check the entire "IF" section of the receiver. Again if a button is pressed on the receiver where no signal is ever present, all

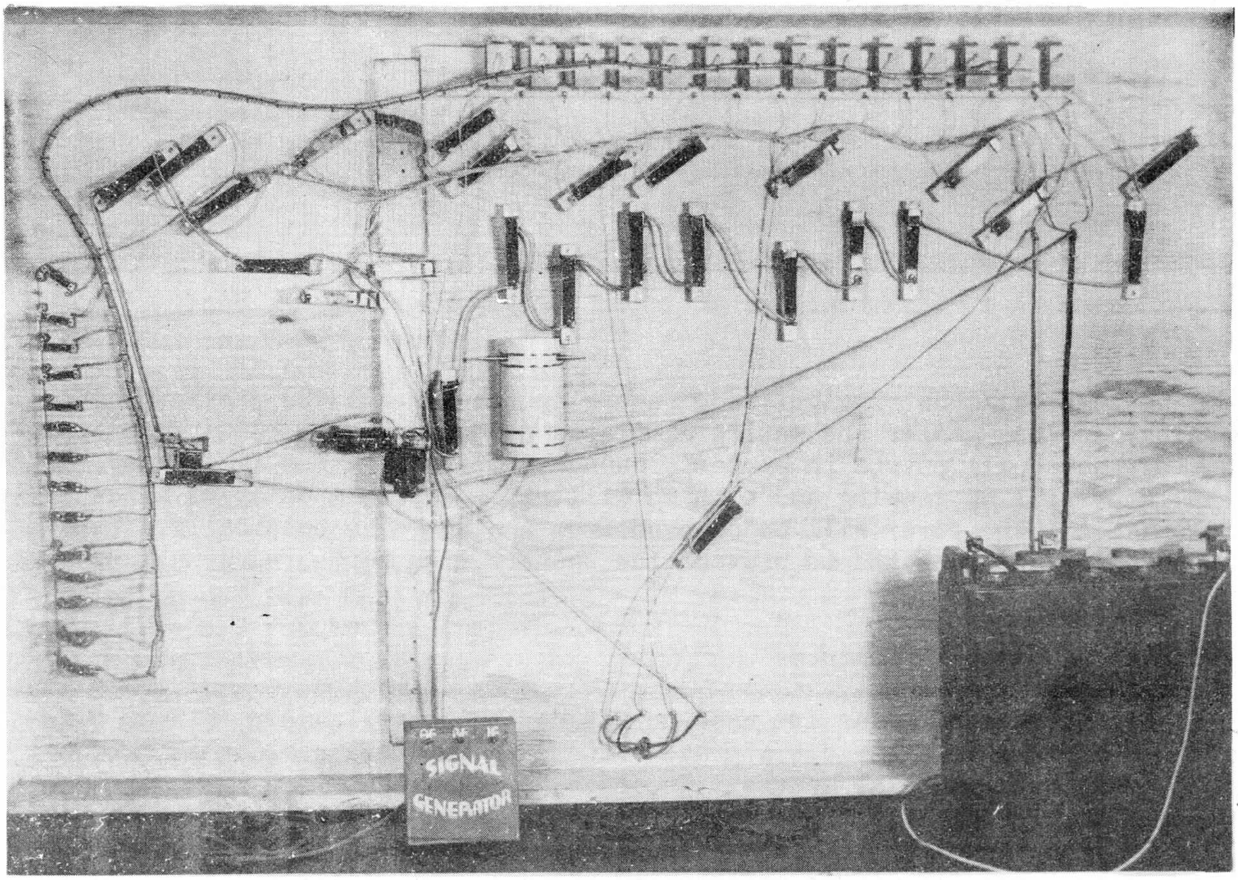


FIGURE 2 - REAR VIEW OF THE BOARD SHOWING PUSH-BUTTON SWITCHES MOUNTED. RELAYS ARE MOUNTED AT THE TOP OF THE BOARD.

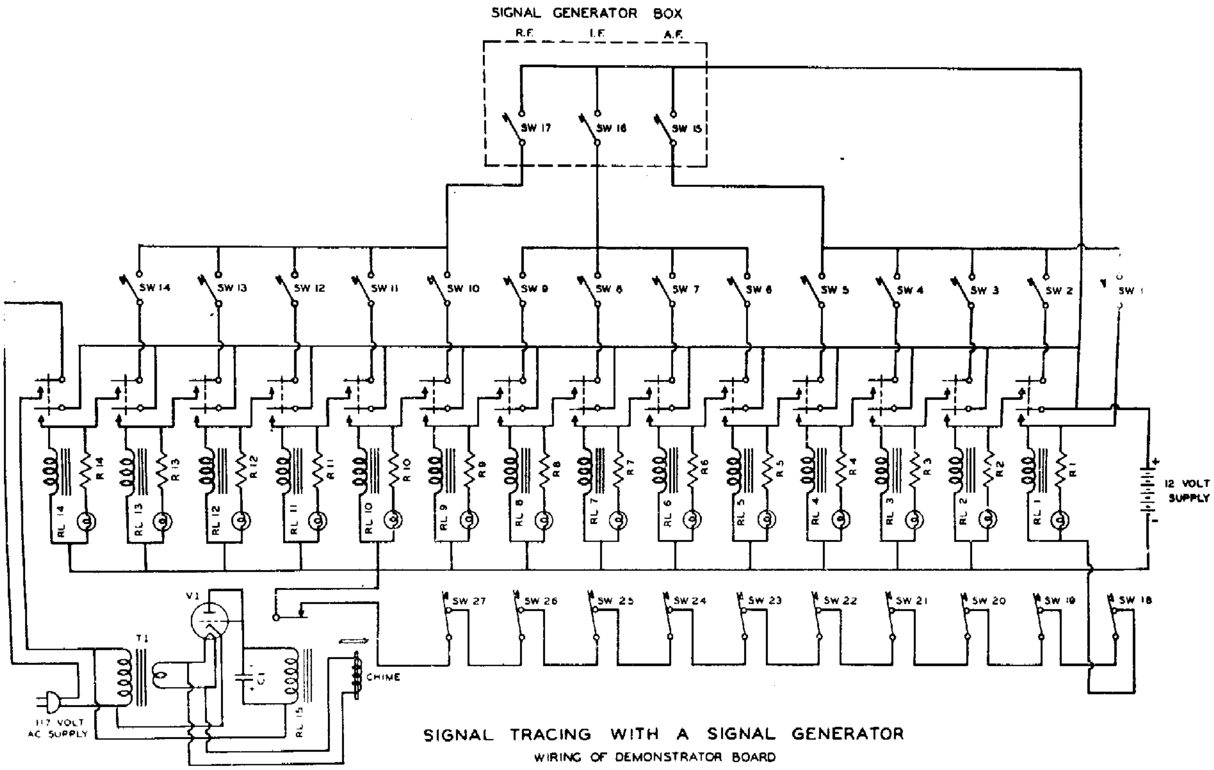


FIGURE 4 - WIRING DIAGRAM OF SIGNAL TRACING DEMONSTRATION BOARD.

of the lamps will be extinguished, requiring tracing all the previous work again. In this manner the entire simulated receiver is checked. When after having tested all points in proper sequence the final button is pressed, all the lamps will be glowing and a chime will ring. After a delay of a few seconds, all the power will be removed from the board automatically. This feature was incorporated to prevent the battery from being run down.

Function of Circuit Elements

Two sources of power are used on the demonstrator; namely, direct current obtained from a 12-volt storage battery and 117 volts alternating current from the commercial source. In order to light the first lamp, it is necessary to close switch 1 and switch 15 (see Figure 4). This allows current to flow from the battery through the normally closed contacts of relay 15, through the normally closed switches 18 through 27 inclusive, through relay 1, switch 1 and switch 15 back to the battery. The bottom set of contacts as shown in Figure 4 will effectively short circuit switch 1 and switch 15 causing the relay to hold. The first lamp, being in parallel with relay 1 will stay lighted. Resistor 1 is used to drop the voltage to the proper value for the pilot light. Should any one of the switches 18 through 27 be pushed next, relay 1 will not hold and the lamp will be extinguished.

As switches 1 through 5 are placed in the "AF" section of the receiver, 5 lamps may be scored by pressing switch 15 through 5 in consecutive order. At this point it will be necessary to press switch 16 and switches 6 through 9 in consecutive order, so the next 4 lamps may be turned on. In like manner the remainder of lamps are caused to glow. At the moment the last lamp is turned on, the top set of points on relay 14 close the 117 volt circuit to the transformer 1. The 6.3-volt secondary of this transformer will cause the chime to ring indicating that the student has completed the signal tracing successfully. The cathode of the vacuum tube will then begin to heat and when it has reached operating temperature, it will rectify the line voltage, causing current to flow through the normally closed relay 15 which releases all relays and opens the 117 volt and the battery circuits.

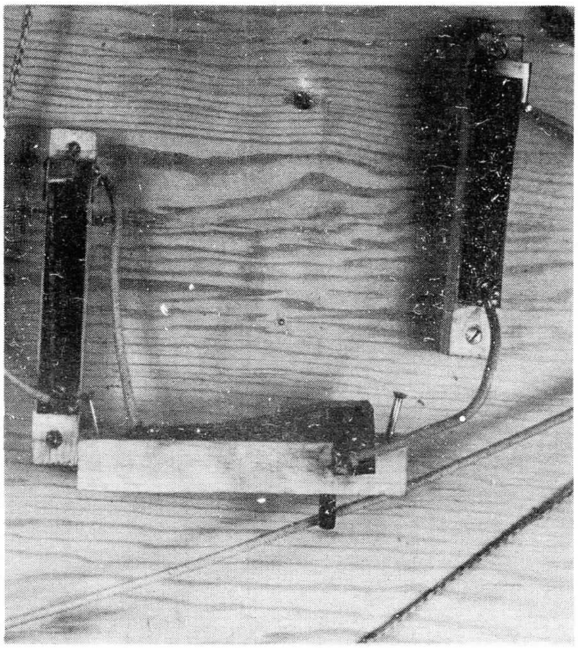


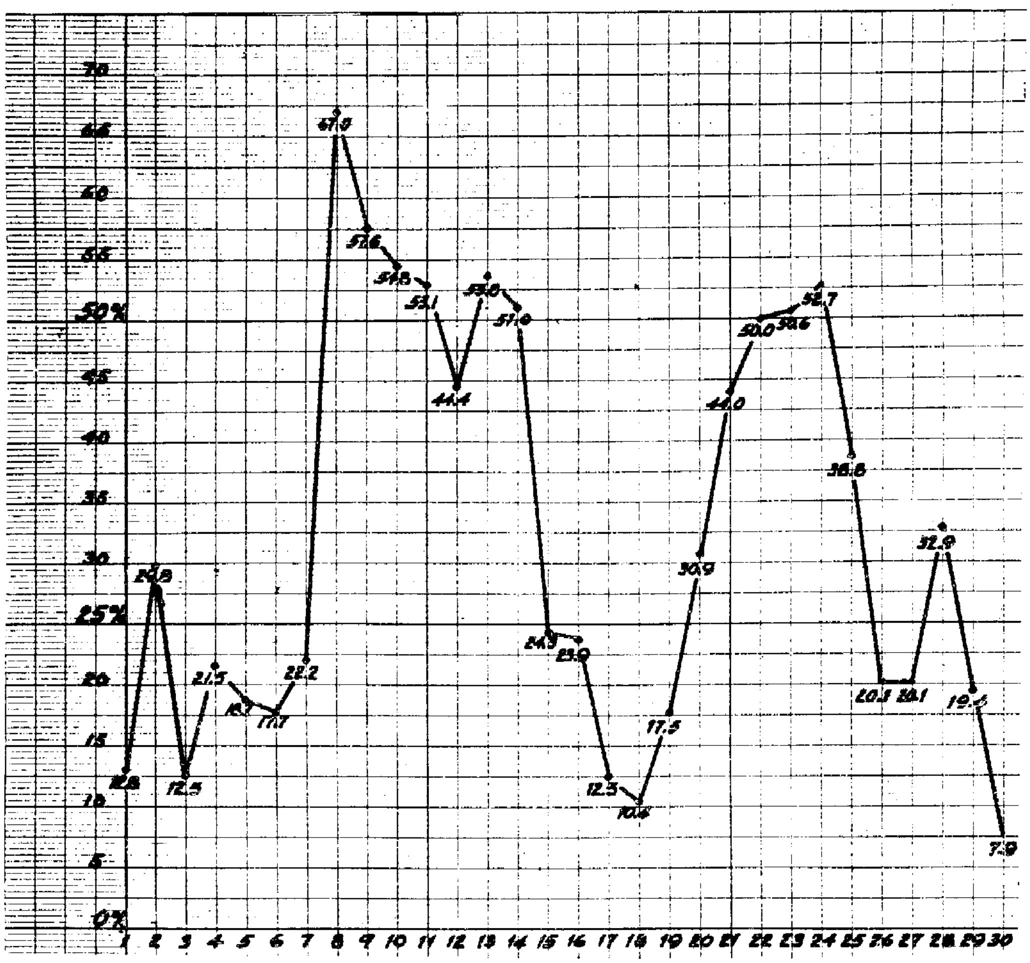
FIGURE 3- CLOSE-UP OF NORMALLY CLOSED PUSH-BUTTON SWITCHES. LOWER SWITCH SHOWS SIDE VIEW OF CONSTRUCTION.

Construction

All parts and material used in construction were those which were on hand. All relays with the exception of relay 15 were Antenna Relay BK-13, as used in the Radio Receiver BC-312. Relay 15 was salvaged from a pin ball machine and rewound with fine wire salvaged from an old audio transformer. The filament transformer is a standard 117 volt to 6.3 volt secondary. The tube is a slow-heater type such as a VT-76 or a VT-37. The condenser across relay 15 is of the electrolytic variety and has a capacity of 16 microfarads with a working voltage rating of 150 volts. The chime is a commercial door chime. All switches were made using 1/4 inch bakelite rod for the buttons and 5/8 inch wide black iron crating strap as spring material for the contacts. Figure 3 shows a button switch removed from the board so that the construction of the switch may be observed. Care was taken to see that the switches provide good low resistance contact as the relays require nearly a full 12 volts for proper operation. Resistors 1 through 14 are each 50 ohms with a wattage rating of at least 1 watt. These are used to drop the voltage to the 6.3 volt .15 ampere pilot lights.

RADIO BLACKOUT DATA

The following contribution is from a battalion commander in the Northwest Service Command:



Inclosed is a graph showing the percentage of radio blackout for the month of June. Percentages indicate the proportion of scheduled operating time during which signals were blotted out by fading to a degree which made copying impossible. The intensity of blackout in this part of the world is very striking and this form of atmospheric interference has been the major obstacle to radio operations here. Of particular interest is the definite cyclical nature of the blackout period. Further studies are being made of this phenomena and it is thought that this information may be of interest to other radio nets operating under comparable circumstances.

NOTES ON

COMMUNICATIONS IN THE TUNISIAN CAMPAIGN

Material presented herewith is from Training Memorandum No. 40, Allied Force Headquarters.

The points listed below are some of the weaknesses in signal communications that were observed during the Tunisian campaign. These points are enumerated here so that all signal units may direct their training to anticipate and overcome similar problems in future operations.

While some weaknesses are due to equipment, the greatest weakness, by far, is the human element which shows up from lack of training. The only solution for this problem is continuous and concentrated training, since no signal unit is ever sufficiently trained and no communications system is ever perfect.

RADIO OPERATIONS

Netting of Stations

Too many times radio stations were slow in establishing communication and sometimes completely failed to have contact because of improper netting of stations. This is largely a problem of manipulation of the set. The solution is training of operators under field conditions with continued practice in netting until it can be done accurately and in a minimum of time.

Operation of Sets on Minimum Power

The failure to operate sets on the minimum power required is a common weakness. Occasions were observed when SCR-299's were operated on 400 watts when 75 watts would have been much more satisfactory. A general reduction in power by all stations will result in less interference for all. The question of power output not only affects communications but also is an important factor in the frequency allocation problem and in signal security. As stated in the following paragraph, dependence on high power and a strong signal is a hindrance to reliable communication. Furthermore sets using high power generally require clear channels and as the numbers and concentrations of SCR-299's increase the problem will become greater and may even result in an actual decline in radio communications. At one time during the Tunisian campaign, II Corps was using 8 SCR-299's for communication with subordinate units. Consider what will result when additional divisions, corps, and armies are concentrated on a proportional scale. Low-power operation also improves signal security since it becomes more difficult for the enemy to identify stations and to intercept traffic. The Germans make a special point of using low power. A case actually occurred where a German control station was heard giving a reprimand to an out station for sending too strong a signal.

Receiving Through Interference

On different occasions radio communication failed because of inability of operators to read through interference. This type of training is very necessary since this factor permits a reduction in wattage output and the use of weaker signals, both of which have important effects on radio communication (see preceding paragraph). Much specific training in reading weak signals through interference is needed by practically all operators (*). This can be had by producing artificial interference in training sets, also by practice under unfavorable field conditions, and by continued practice in reading lowest possible strength signals. Operators must be taught that an R5 signal is not necessary and that it is actually undesirable during operations.

Signal Security

When future intentions are made known to the enemy through the interception of signal traffic, the problem ceases to be the particular worry of the Signal Corps and becomes of greatest importance to all. Some of the most noticeable violations of signal security have been due to use of voice radio in the clear, by other than signal personnel — solely because of lack of training and forethought. Another factor, not fully utilized, is frequency changing for security purposes. One U. S. Division used a daily change of frequencies for a period. While this practice approaches an ideal, it will undoubtedly present some very difficult problems if used extensively in large scale operations. * * * Proper changing of frequencies permits radio to be used offensively in confusing the enemy and in hiding operations.

NOTE: (*)-Intensive training has now been adopted in the Signal Corps schools to increase the ability of radio operators to copy through noise and interference. This is accomplished by superimposing noise and interference on the practice tapes. Recordings of actual transmissions taken from the air, special records such as battle noises or atmospherics, or the output of keyed oscillators are some of the interference sources used.

The volume of the noise during the last 15 minutes of each class period is increased until it is impossible for any student to copy the signals. In this manner, all students receive practice in copying through the maximum amount of static and interference and the type can be varied to simulate all conditions.

Location of Sets

Some weaknesses were observed in location and siting of sets which resulted in inferior communications. A few recommendations are:

1. Proper location according to terrain. A good discussion of this is found in "Notes on Radio Transmission, AFHQ, OCSigO," March 1, 1943.
2. Do not have all your eggs in one basket. Use of remote control has become almost standard practice. However, all receivers should not be installed in a single vulnerable location and transmitters should also be dispersed to prevent interference.

Power Supply Equipment

Only one point concerning equipment will be mentioned and this concerns power supply units. Scarcity of spare units and repair parts made long life an especially important consideration. The life of all units can be prolonged by proper cleaning and servicing at regular intervals before a breakdown occurs. A thorough maintenance schedule, consistently adhered to, is recommended for all power supply units.

WIRE OPERATIONS

Interruptions by Test Personnel

It has been estimated that a large percentage of long distance circuit interruptions were caused by our own test personnel cutting in on circuits without first calling up wire chiefs at both ends of the circuit and telling them that the circuit would be out temporarily. This is solely a weakness in training.

Interruptions from Dust

Other interruptions of circuits were caused by dust and dirt due to poor maintenance in locations having relays, repeater equipment, etc. This is a continuous problem that requires constant supervision.

Reporting Interruptions

At other times circuits remained interrupted longer than was necessary because of failure of operators to report circuits out and because of failure of wire chiefs to promptly report interruptions and take immediate steps to locate trouble.

Switchboard Operations

Weaknesses of switchboard operations during the campaign were the same ones common to all switchboards, but as stated many times before, to give good service a busy switchboard must have a chief operator on duty to eliminate operators' conversations with subscribers, to keep constant check on the service by seeing that connections are taken down promptly, that busy trunk circuits are not held idle, that operators are courteous, etc.

Line Construction

One special problem confronting line construction crews was their lack of familiarity with French line construction, such as transpositions schemes on reconstructed lines. Similar problems will arise in all areas having construction systems different from those existing in U. S. and all construction personnel should have advance information concerning types of construction to be found before being thrown into the middle of an urgent reconstruction job in a strange land.

Damage to Lines

A final cause of interruptions in wire communications was due to the common American out-door sport of roadside marksmanship, particularly where insulators were the target. All signal personnel should be continually on the alert to apprehend and prevent this type of damage.

SIGNAL SUPPLY

Qualification of Supply Officers

Assuming that the supplies are available in rear areas and in the zone of interior, the question of supply for tactical units resolves itself, to a great extent, to the individuals holding the supply jobs. An alert, aggressive depot commander will see to it that supplies are sent forward where another lacking push will fail. An alert aggressive depot commander will unpack and find out about every item in his stock and know what it is used for. He will not allow certain items to accumulate in a rear corner because he hasn't been told what to do with them. An alert, aggressive supply officer will build up his stock of essential items and anticipate future shortages without waiting until his stocks on hand are exhausted. This list could be made much longer but one recommendation for good signal supply is carefully selected supply officers who have the necessary personal qualifications.

MAINTENANCE INFORMATION

ANTENNA MOUNTING BLOCK FOR SCR-509-( ) and SCR-609-( )

These antenna mounting blocks have a threaded stud onto which the antenna is screwed. This stud was formerly made of brass, and there have been cases where the stud broke off at the top surface of the block. A change in design has now been made to prevent breakage. The stud is now made of stainless steel. All new radio sets SCR-509-( ) and SCR-609-( ) are furnished with steel studs, and the antenna mounting blocks carried in depot stock are similarly equipped. Blocks with broken studs should be replaced with new blocks requisitioned through the usual channels. The stock number of this part is 2Z734.

REEL UNIT RL-31

Frames of this reel unit are now made of steel tubing in place of aluminum. Strength is greatly increased and repairs are simplified since the steel can be welded easily. When old aluminum frames are replaced by new steel parts, the aluminum should be turned in for salvage through regular channels as scrap aluminum.

<u>Controlled Items</u>

For some time to come there will be shortages of critical items and, while this shortage exists, the issue of critical items must be placed under the control of the signal officer who is responsible for their tactical use. This is the only way of insuring that the critical items reach those units which need them most. While this aspect was not a weakness during the Tunisian campaign, it is of sufficient importance for future operations to be mentioned here.

SUMMARY

In summarizing the weaknesses mentioned above, it must again be emphasized that practically all these points are due to the individual element. Practically all of them can be overcome or greatly reduced with proper and adequate training. Training must be progressive and continuous regardless of the present state of proficiency.

SERVICE DATA ON

ANTI-TANK MINE DETECTORS

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Comprehensive information on anti-tank mine detectors now in active use by our forces is included in Technical Manual TM 11-1122, but at present distribution of this manual is inadequate with the result that many maintenance and repair units in the field are called upon to service the equipment without having proper information to enable them to do so with maximum effectiveness and efficiency. To aid in the dissemination of this information, therefore, it has been considered advisable to utilize the Signal Corps Technical Information Letter as a medium for widespread distribution of this service data, particularly among overseas units.

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There are various models of equipments for detecting the presence of land mines. A widely used series developed by the Corps of Engineers and turned over to the Signal Corps for issue and maintenance consists of Detector Set SCR-625-A, SCR-625-B, SCR-625-C, SCR-625-D, and SCR-625-E (Anti-tank Mine, Portable), and Detector, Anti-tank Mine, Portable, M-1. The last mentioned nomenclature was applied to the original equipment as issued by the Corps of Engineers (before Signal Corps nomenclature Detector Set SCR-625-( ) was assigned) but appears on only a few of the sets. The differences in these various equipments are extremely minor. The same service data therefore apply to all.

Detector Set SCR-625-(*) (as all the equipments will be called in this article) will indicate the presence of mines such as standard American anti-tank mines at a distance of 24 inches, and under these conditions there will be a reading of 6 on the indicating meter. There are also audible indications in a resonator. Detection of the mine is possible at greater distances but the indications are correspondingly reduced.

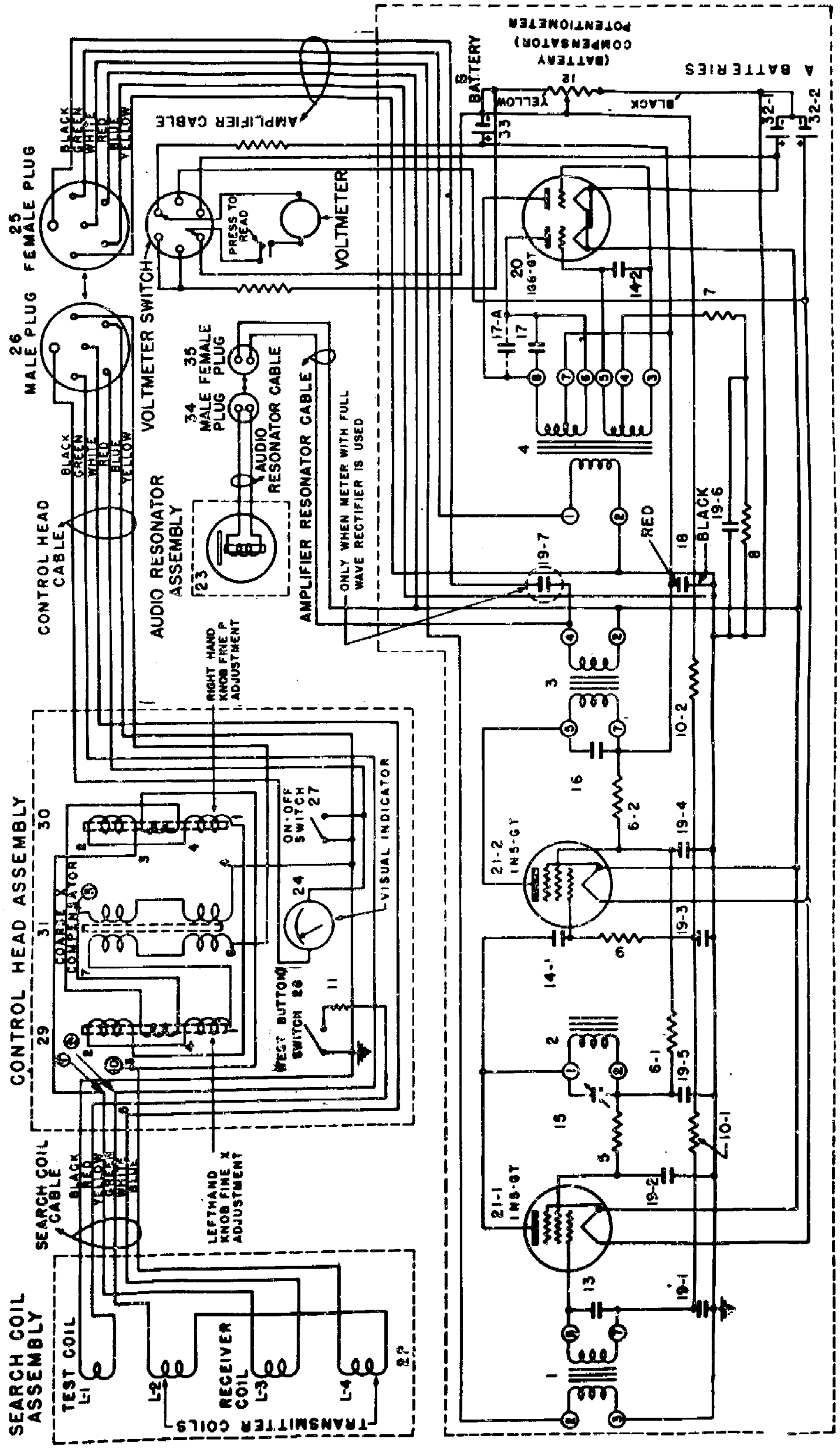
Component parts of these detectors are:

Quantity	Article	Size (in inches)
1 each	Amplifier BC-1141-(*)	14 x 6 x 5
1 each	Bag BG-151-(*)	16 x 7 x 6
2 each	Battery BA-30, not installed	1-1/4 Dia. x 2-1/2

(Cont'd)

Quantity	Article	Size (in inches)
1 each	Battery BA-38, not installed	11-1/2 x 1-1/4 x 1-1/4
1 each	Chest CH-156-(*)	28-1/4 x 8-1/4 x 15
1 each	Control Box BC-1140-(*)	7 x 7 x 5
1 each	Handle M-350-(*)	1-1/8 dia. x 28-1/2
2 each	Resonator M-356-(*), 1 in use — 1 spare	3 dia. x 3
1 each	Search Coil C-446-(*)	13 dia. x 1
2 each	Technical Manual TM 11-1122	5-1/2 x 8-1/2 x 1/4
1 each	Tube, type 1G6GT, Installed	1-1/2 dia. x 3
2 each	Tube VT-146 (IN5GT), Installed	1-1/2 dia. x 3-1/2
1 each	Strap ST-56 (when issued)	

DETECTOR SET SCR-625-D PROVIDES BOTH AUDIBLE AND VISUAL INDICATIONS OF THE PRESENCE OF BURIED METALIC MINES.



Schematic Circuit Diagram, SCR-625-(*)

The circuit diagram is shown herewith and is similar to the one which appears as Figure 16, page 38, of the technical manual except that in the present diagram numbers have been inserted to facilitate point-to-point references made later in this article.

The equipment operates on the principle of a balanced mutual-inductance bridge, with three of the inductances contained in Search Coil 22 serving as the main component of the bridge.

The following details on functioning and maintenance are quoted from the Technical Manual:

THEORY OF OPERATION

Detector Set SCR-625-(*) operates on the principle of a balanced mutual inductance bridge as shown in Figure 9.

1. Three of the inductances contained in Search Coil 22 (Figure 16) constitute the main component of the bridge.

2. Inductances L2 and L4 are connected to a source of sine-wave voltage. This voltage at a frequency of 1,000 cycles per second is generated by a push-pull oscillator circuit.

3. Inductance L3 is connected to a tuned two-stage audio amplifier, the output voltage of which is applied to a resonator (23) and an 0-1 milliampere rectifier-type meter (24).

4. Inductances L2 and L4 are connected in series so that their fields oppose and the combined mutual inductance with respect to coil L3 is approximately zero. A complete balance is accomplished by the use of tuned compensator coils (29, 30 and 31) contained in the control box. When the mutual inductance between two transmitting coils (L2 and L4) and the receiving coil (L3) is zero, there will be no signal voltage at the input of the amplifier. The presence of metal in the field of these coils changes their mutual inductance, and a signal voltage is induced in the receiving coil (L3). Because the receiving coil (L3) is coupled to the input of the amplifier, an increased signal voltage is supplied to the resonator (23) and to the indicating meter (24).

5. The <u>reactive</u> balance of the bridge is accomplished by the adjustment of two controls. One of these controls (31) provides coarse compensation. The other is used as a fine control after the coarse compensation has been approximated. The balance is accomplished by the adjustment of the coupling between the primary and the properly phased secondary of coils 29 and 31, respectively, by means of <u>iron</u> cores.

6. The <u>resistive</u> balance of the bridge is accomplished by the adjustment of the coupling between the primary and the properly phased secondary of coil 30 by means of a <u>brass</u> core.

7. The test circuit, consisting of one turn of wire (L1) contained in the search-coil assembly, a resistor (11) and a test-switch button (28) in the control box, are used as a reference circuit in adjusting the battery

compensator (12) (at lower right corner of diagram). When the test-switch button (28) is closed, a partial shorting of test coil L1 results, upsetting the resistive and reactive balance between the transmitter coils (L2 and L4) and the receiver coil (L3). The signal appearing at the output of the amplifier, when this test circuit is used, is about the same as would be produced by an anti-tank mine eight inches in diameter, the center of which is located 24 inches from the search-coil center. The deflection on the visual output meter for this condition is 6.

Functioning of Amplifier

1. The voltage produced in the receiving coil (L3) is applied to the grid of tube 21-1, through transformer 1, the secondary of which is tuned to 1,000 cycles by capacitor 13.
2. The plate circuit of tube 21-1 is tuned to 1,000 cycles by means of choke 2 and trimmer 15.
3. The signal voltage developed is coupled to tube 21-2 through coupling capacitor 14-1.
4. Negative grid bias voltage for tubes 21-1 and 21-2 is derived from the voltage drop across potentiometer 12 in series with the negative side of the "B" supply circuit. The voltage is then applied through resistors 10-2 and 10-1, which serve, in conjunction with the by-pass capacitors 19-1 and 19-3, to decouple the stages.
5. The plate of tube 21-2 is coupled to the resonator (23) and the output meter (24) through transformer 3.

Functioning of Oscillator

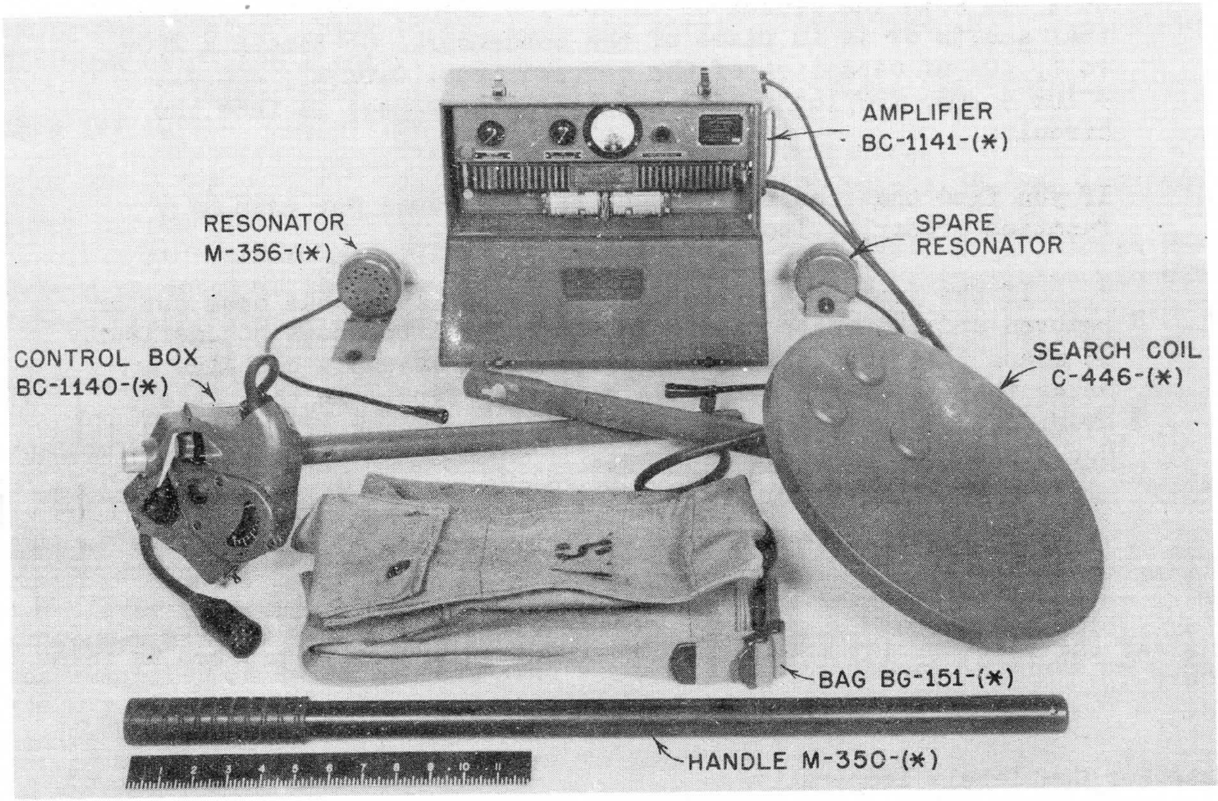
1. The oscillator circuit comprises tube 20, transformer 4 in push-pull arrangement, and their associated parts.
2. The frequency of oscillation is controlled by the inductance of the plate and grid windings of transformer 4 and the capacity of capacitors 17 and 14-2.

Functioning of Resonator

1. Audible indication of the presence of metal is given by acoustic resonator 23. This is an earphone encased in a housing.
2. The acoustic selectivity of the resonator housing produces an amplified 1,000-cycle note.

Functioning of Visual Indicator

The visual indicator (24) is a full-wave rectifier-type 0-1 milliammeter with pole pieces so shaped that logarithmic relationship exists between the voltage applied to the meter and the needle deflection obtained. The meter



COMPONENTS OF DETECTOR SET SCR-625-(*)

is connected in series with capacitor 19-7 and across the output transformer 3. In detector sets using half-wave rectifier meters, capacitor 19-7 is not used.

MAINTENANCE

NOTE:—If you have replaced the entire search coil assembly, including Control Box BC-1140-(*) and the needle of the meter in the control box reads higher than normal while at the same time the audio output of the resonator is lower than normal, it means that the meter in the new control box is of the full-wave rectifier type. Proceed as follows:

Locate capacitor 19-7. (On some circuit labels it is shown as C-14. In some detector sets the capacitor is shorted out. In some the capacitor is not included.) Cut the jumper that shorts or is in place of the condenser. Or obtain a 200-volt, .04 mf capacitor of the correct type (0.04 mf, 200 v., - 10% + 20%, 1-7/16" x 3/4" x 5/16") and connect it into the circuit.

If you find that the replacement assembly does not seem to function properly, look for the following:

If the jumper, shorting out capacitor 19-7, has been cut or removed and the meter needle in the control box does not deflect, it means that the replacement search-coil assembly contains a meter that is of the half-wave rectifier type. In that case short capacitor 19-7 out of the circuit by means of a jumper. <u>But Don't Remove It From the Set</u>.

TROUBLE LOCATION AND REMEDY

If the detector set should fail to function properly, proceed as follows:

<u>Detector Completely Inoperative</u>

1. Check batteries with Test Set I-56-(*) for proper voltage. Battery BA-38 should read a minimum of 70 volts. Batteries BA-30 should have a minimum voltage of 1.1 volts. If batteries are below these minimum values, replace them.
2. If a test set is not available, check the batteries by substitution. Replace the batteries one at a time, starting with Battery BA-38, and observe whether set operates with replacement.
3. Check battery contacts for proper fit. Batteries should fit tightly between the contacts, and contacts should be bright and clean.
4. If repairs cannot be made to the contact assemblies, it will be necessary to replace them.

<u>Test of Resonator M-356-(*)</u>

1. Disconnect the resonator cable, detaching the resonator.
2. Remove the spare resonator from the bottom of the chest by unsnapping the dot fastener.
3. Connect the spare resonator to the resonator cable and check the detector for restored operation.
4. If a spare resonator is not available, the resonator may be tested with an ohmmeter. Touch the leads from the ohmmeter across the resonator plug. The reading of the meter should be approximately 1,000 ohms, for a good resonator.

5. If there is no continuity reading, inspect the connections of the cable for breaks. Check to see that the screws holding the lugs in Plug PL-54 (when used) are tight.

6. If these tests fail to locate the trouble, dismantle the resonator case for further inspection as follows:

<u>a</u>. Remove the two screws on the rim of the resonator case and the screw on the flat bracket.

<u>b</u>. Carefully pry the two halves of the case apart with a screw driver inserted in the hole that the cable runs through, taking care not to damage cable wires.

<u>c</u>. Inspect the terminals on the bakelite case of the headphone (Receiver R-14) for loose, broken, or corroded connections.

<u>d</u>. Test the headphone with an ohmmeter, and if open-circuited, replace it.

Test of Resonator M-356-(*) Without Instruments

If no instruments are available, test the resonator for continuity with a Battery BA-30. If a click is heard when the battery circuit is completed, the resonator is satisfactory. The absence of these clicks indicate an open circuit, and that the resonator should be tested according to 6 in the preceding paragraph.

Test of Search Coil C-446-(*)

To determine whether the search-coil is open-circuited:

1. After opening the amplifier, unsolder the wires from the amplifier cable at their respective terminals on the cable mounting strip and mark the conductors and the corresponding lugs on the terminal strip.

2. Connect the 6th terminal (counting from left to right) to terminal 1.

3. If this connection causes no deflection of the meter or sound in the resonator, check the amplifier according to instructions on that subject. If there is a deflection or sound, it will be an indication that the amplifier and oscillator are functioning properly, and the trouble is in the exploring-rod assembly. It is now necessary to locate the trouble in either the control box, search-coil, or cabling.

4. To test receiver loop and its compensating coil windings, hold the bare end of the No. 5 wire against the 1st terminal, and the No. 6 wire against the 6th terminal. Proper continuity of the receiver loop and the secondary windings of the compensator coils will be indicated by a tone in the resonator, and a deflection of the output meter. A defect will give no indication.

5. To test the oscillator loop and its compensating coil windings, resolder the No. 1 wire to the 1st terminal, and touch the No. 2 wire to the 6th terminal. A tone in the resonator and a deflection of the output meter will indicate proper continuity of the oscillator loop and primary winding of the compensating coils. A defect will give no indication. These tests will serve

to localize the trouble as to the receiver loop circuit or the oscillator loop circuit.

6. If the trouble cannot be isolated by following the preceding instruction, then invert the control box and remove the bottom plate. DON'T DAMAGE THE GASKET.

7. Detach the three screws from the back of the control box, pull up the coarse adjustment coil until it is vertical.

8. If an ohmmeter is available, take readings across the coils and loops according to the resistance and continuity table.

9. If any coil or loop appears to be open, replace it.

10. If an ohmmeter is not available, connect two long wires to the 1st and 6th terminals (counting from left to right) of the cable mounting strip. Turn on the detector set.

11. Touch the other ends of these wires to the various coils in the same manner as test leads of an ohmmeter.

12. A tone in the resonator and a deflection of the output meter will indicate proper continuity of the coils and loops.

Resistance and Continuity Table

Make resistance and continuity tests with the batteries removed. This will prevent voltage building up across resistors and capacitors. Any voltages set up in the unit may cause serious errors in reading the ohmmeter ranges, and they may damage the test instrument. Ohmmeter readings will be most accurate when taken on the upper half of the scale. Meter readings within 30 percent of the tabulated values will, in most cases, indicate correct operation of the device.

Before measuring, the battery compensator (12) should be turned to the left and all cables disconnected.

Article	Point to Point		Reading	Probable Cause of Incorrect Reading
Transformer 1	2	3	2.25	Open or shorted transformer
	5	7	1350	Open or shorted transformer
Choke 2	1	2	2150	Open or shorted transformer
Transformer 3	2	4	73	Open or shorted transformer
	5	7	1365	Open or shorted transformer
Transformer 4	1	2	1.42	Open or shorted transformer
	3	4	237	Open or shorted transformer
	4	5	237	Open or shorted transformer
	6	7	375	Open or shorted transformer
	7	8	375	Open or shorted transformer
Capacitor 18	Red Wire	Black Wire		Shorted Capacitor
Potentiometer 12	Yellow Wire	Black Wire	750	Open control

(Cont'd)

(Cont'd)

Article	Point to Point		Reading	Probable Cause of Incorrect Reading
Coil 29	1	2	0	Open coil winding
	3	4	.1	Open coil winding
Coil 30	1	2	.25	Open coil winding
	3	4	.5	Open coil winding
Coil 31	3	4	.45	Open coil winding
	6	7	2.5	Open coil winding
	1	5	24.0	Defective search coil
	9	10	20.0	Defective search coil
Switch 28	1	2	0	Defective search coil

Amplifier BC-1141-(*) Inoperative

Amplifier trouble may be localized into two sections, either the tuned oscillator circuit or the amplifier circuit. To determine which is inoperative, proceed as follows:

1. To test the oscillator circuit, connect a resonator between terminal 1 and 2 (counting from left to right) of terminal strip 59. (This is the longer of the two terminal strips mounted beneath the tube shelf.) A 1,000-cycle note in the resonator will indicate that the oscillator is functioning and that the trouble is in the amplifier circuit. No tone in the resonator will indicate that the oscillator is not functioning. One of the following troubles will usually be the cause of no oscillation:

a. Defective tube (20)
b. Broken wiring or loose connection
c. Defective transformer 4.

2. To test the amplifier circuit use a Battery BA-30, and connect its terminals momentarily to terminals 5 and 6 (counting from the left) of terminal strip 59. A deflection of the output meter will indicate proper functioning of the amplifier. No deflection of the output meter will indicate a defect in the amplifier circuit.

3. Following are checks to determine some of the more common trouble found in the amplifier circuit:

a. Connect a wire to terminal 1 of terminal strip 59 and momentarily touch terminal 9 with the other end. This should cause a deflection of the output meter. If there is no indication, test the male (26) and female (25) connectors of the connecting cables, and, if they show continuity, replace the output meter.

b. Substitute a new tube in each socket and test the amplifier for operation. If the amplifier does not function, look for broken wires and loose connections.

c. Test transformers and choke windings according to the resistance and continuity cable. Check "B" voltage terminals of the transformers for shorts to ground.

d. With an ohmmeter, check all resistors and capacitors, and the battery compensator (12), following the schematic diagram.

e. If all tests fail, replace the whole amplifier chassis with a new one. After any repairs or replacements have been made, always realign the equipment, and readjust the battery compensator (12) (see later description of alignment procedure).

REMOVAL OF PARTS

To Replace Search-coil

1. Remove bottom plate of the control box by detaching screws.
2. Remove the three screws on the back of the control box and pull the coarse adjustment coil (31) in center into a vertical position.
3. Unsolder the four wires coming in through the back of the control box and going to the terminal lugs on the coil (31). Note proper connections for later replacement.
4. Unsolder the two wires going to the terminals on test-button switch 28.
5. Detach the search-coil assembly from the control-box assembly by loosening the thumbnut on the search-coil support and unmesh the bayonet joint, separating the two assemblies.
6. Unscrew the two screws holding the metal rod that serves as the control-box extension and pull off the rod, sliding it back on the cable.
7. This exposes the cable clamp nut which should be unscrewed, allowing the cable to be pulled out of the control box.
8. Slide the clamp nut, packing ring, washer and metal rod off the cable, completing the removal of the search-coil.
9. Secure a new search-coil and thread the cable through the rod, starting from the end with the thumbnut.
10. Push the cable through the clamp nut, metal washer, and packing ring and into the control box leaving about four inches of wire protruding inside.
11. Slide the extension rod up onto the projection of the control box and fasten in place with the two screws.
12. Twist together the pairs of red and black, blue and white, and yellow and green wires.
13. Thread the twisted wires into the control box and solder them to the proper terminal lugs.
14. Push the coil back into place and replace the three screws.
15. Replace rubber gasket, bottom plate, and screws.

To Replace Fine "X" or Fine "R" Coils

1. Detach bottom plate on the control box by unfastening the screws.
2. Detach the adapter from the front of the control box by removing

the four screws.

3. Unsolder the wires from the terminal lugs of the coil, making note of connections so they can be properly reconnected.

4. Unfasten the screws on top and bottom of control knob and pull the assembly forward and out of the case.

5. Install the new coil and the gasket removed with the old coil.

6. Solder the four wires on the new coil to the proper teminals.

7. Replace the two screws fastening the coil to the control box.

8. Replace the adapter in the original position.

9. Replace the rubber gasket, bottom plate and screws.

To Replace Coarse Compensator

1. Detach bottom plate on the control box by unfastening screws.

2. Remove the three screws on the back of the control box and pull the middle coil into a vertical position.

3. Unsolder the wire or wires from coil, one terminal at a time, and solder them on the corresponding terminal of a new coil. This method will prevent any errors in wiring. If possible, tag each wire and its corresponding terminal.

4. Place the coil in the control box and replace the three screws.

5. Replace the rubber gasket, bottom plate, and screws.

To Replace Output Meter

1. Detach bottom plate on the control box by unfastening screws.

2. Remove the two terminal lugs on the back of the meter, by removing the nuts and lockwashers.

3. Remove the front cover (72) on the control box by unfastening the four screws around its edge.

4. Remove the old meter and install a new one.

5. Replace front cover, making sure to install the gasket and rubber packing ring.

6. Replace the lugs on the meter terminals and secure nuts.

7. Replace the rubber gasket, bottom plate, and screws. Note: Read the special note at the beginning of the MAINTENANCE section of this article before doing anything else.

To Replace Amplifier Transformer

1. Unscrew the locking screw (at the left of flashlight cells) on the front panel.

2. Lift the panel out of box by means of the knob above the locking screw.

3. Remove the screws fastening terminal strip 58 (the shorter of the two strips).

4. Unsolder the leads from terminal strip 59 to terminal strip 58, noting proper connections for later replacement.

5. Remove the nuts holding the rubber mounts between the chassis and the panel.

6. Slide the amplifier chassis free of the panel.
7. Unsolder the leads going to the defective transformer, noting proper connections.
8. Remove the two screws holding the transformer.
9. Install the new transformer in the same position.
10. Solder the wires back on the transformer terminals.
11. Slide the chassis back in place on the panel.
12. Replace nuts on the rubber mounts.
13. Resolder the leads from the terminal strip.
14. Replace the two screws and nuts holding the terminal strip.

ALIGNMENT PROCEDURE

To Align Amplifier

The trimmer (15) used to tune the inductance (2) is the only tuning adjustment on the amplifier. If 15 is believed to be out of adjustment or has been replaced, proceed as follows:

1. Rotate either the Fine X (29) or Fine R (30) adjustment knobs until the visual indicator (24) reads 4 and a signal is heard in the resonator (23).
2. Turn adjustment screw of trimmer (15) in the direction that causes an increase in signal as indicated by the visual indicator and resonator.
3. Continue to adjust trimmer (15) until rotation in either direction causes a decrease in signal strength.
4. Adjust the battery compensator (12) until the visual indicator reads 2. Then readjust trimmer (15) for maximum signal.
5. If available, dab a small amount of wax, glue or cement on adjustment screw of the trimmer to prevent further movement.

NOTE: Readjustment of Fine "R" Compensator

If Search Coil C-446-(*), Control Box BC-1140-(*), or Fine "R" Compensator has been replaced and the balance position of the Fine "R" (right hand knob) control is not approximately 4 turns out from the full "in" position, the following adjustments should be made.

1. Remove 2 screws holding Fine "R" Compensator in Control Box BC-1140-(*).
2. Break cement seal that holds coil form to spindle support.
3. Remove coil form from support.
4. Break seal on nuts holding brass core on threaded spindle.
5. Turn both nuts and brass core either in or out on the spindle the same number of turns needed to bring the control knob to a position approximately 4 turns out from the full "in" position; e.g., if the Fine "R" control knob balances at 7 turns out, the brass core should be screwed in on the spindle, 3 turns.
6. Seal both nuts on the spindle with DuPont Household or similar cement.
7. Replace coil form on spindle support with the same cement.
8. Replace Fine "R" Compensator in Control Box BC-1140-(*) and secure with the 2 screws.

PART II

Varistors (Copper Oxide Rectifiers)

The copper-oxide rectifier or "varistor" is generally superseding the vacuum tube as modulators and demodulators in carrier systems. The varistor has the advantage of low cost, small size, stability, lower power consumption and apparently infinite useful life. For the benefit of those readers not acquainted with the action of a varistor, a brief description is included. The copper oxide rectifier is composed of two or more plates of copper and copper oxide held together under considerable pressure. Its essential characteristic for use as a modulator or demodulator is its variation in resistance with magnitude and polarity of applied voltage. This is illustrated in Figure 5. It is seen that the resistance of the varistor varies from a high value when the copper is positive to a low value when the polarity of the applied voltage is reversed.

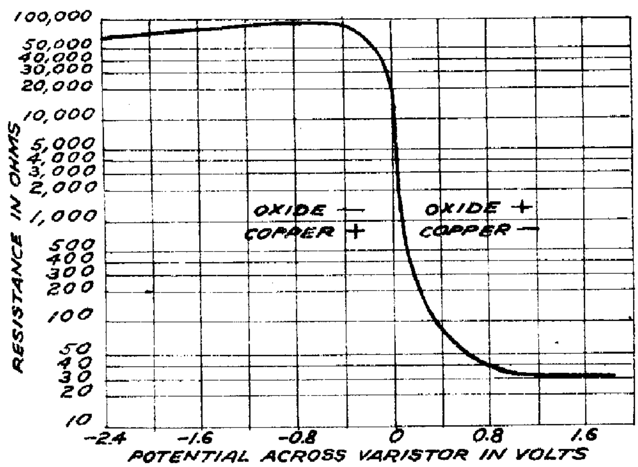


FIG. 5.

RESISTANCE CHARACTERISTIC OF COPPER OXIDE RECTIFIER

In carrier circuits, the varistors comprising the modulators and demodulators are usually connected in a balanced bridge arrangement as shown in Figure 6 (a). The open arrow represents the copper oxide and the cross bar at the tip of the arrow represents the copper, conductivity being in the direction of the arrow.

Referring again to Figure 5, it is seen that the resistance of the varistor is affected by both the magnitude and polarity of the applied voltage. Therefore, the varistor can be made to act as a variable resistance by varying the magnitude and direction of the potential applied across its terminals. In carrier circuits the carrier voltage C is made large compared with the signal or voice voltage V and under such conditions the resistance of the varistors varies in accordance with the magnitude and direction of the carrier voltage only. When the carrier voltage is positive, the varistors present a low resistance or practically a short-circuit across the terminals A-B as shown in Figure 6 (b). Therefore, when the carrier voltage is positive, the voice or signal V does not cause any current to flow in the output R, being short circuited by the varistors. The assumption made here is that the varistors are perfect rectifiers or that the resistance is so low that no current from the signal voltage flows beyond points A-B during this period.

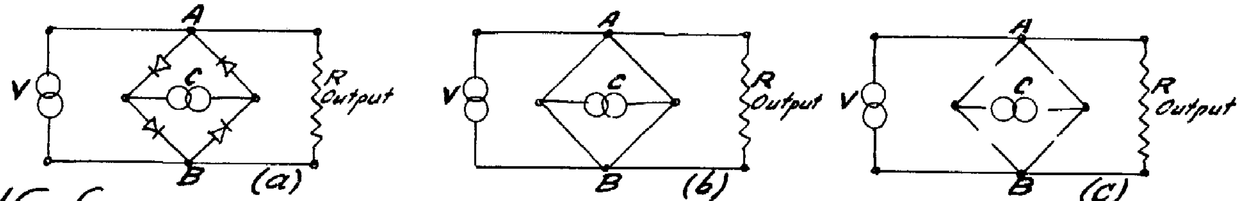


FIG. 6. OPERATING PRINCIPLES OF BALANCED MODULATOR

When the carrier voltage reverses in polarity, the conditions shown in Figure 6 (c) obtain. Here the varistors present a high impedance across terminals A-B (assumed sufficiently high to act as an open circuit) and current flows through output R due to voltage V.

The carrier voltage, therefore, in controlling the resistance of the varistors, causes them to act as a short circuiting switch across points A-B operating at the frequency of the carrier voltage. The voice or signal current is effectively "chopped up" at carrier frequency and the output current or current in load resistance R is shown in Figure 7. For simplicity a sine wave voice voltage is assumed.

Keeping in mind the fact that the carrier is an alternating current, and that it reverses many times during each cycle of the signal voltage, it is seen that as the signal current starts from zero (Figure 7) it flows for a short time (while the carrier voltage holds the varistor resistance high or holds the imaginary short circuiting switch open) until time X. At that

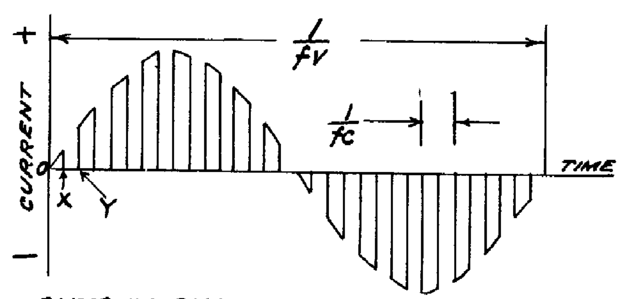


FIG. 7. OUTPUT CURRENT OF BALANCED BRIDGE MODULATOR

RESTRICTED

point the carrier voltage reverses which causes the varistor resistance to drop to a low value, thereby causing the signal current to drop to zero (imaginary short circuiting switch closes). The resistance remains low during the positive carrier cycle and, therefore, during that interval the signal current cannot flow in the output circuit. At time Y the carrier voltage again reverses, thereby increasing the resistance of the varistors across A-B and the signal current again flows in the output. Between points X and Y the signal voltage has increased in amplitude and the current at that instant increases proportionately. This opening and closing effect continues throughout the cycle of the signal voltage resulting in a current of fundamental frequency f_v chopped or modulated at carrier frequency f_c.

If this output current wave is analyzed, it will be found that the carrier itself is not present, being suppressed by the balanced bridge arrangement of the varistors. The original signal is present at reduced amplitude, together with the sum and difference frequencies C + V (upper side band) and C - V (lower side band).

As covered before, the desired side band is selected by suitable filters.

In the demodulator circuit, the same arrangement of varistors is used and the voltages applied are the side band which was transmitted over the line and a carrier voltage of the same frequency as that in the modulator. All products of modulation are present in the output circuit of the demodulator (carrier being suppressed), the side band and carrier frequencies interacting to produce the original voice frequency signals.

Other arrangements of the varistors are used in carrier circuits, however, the fundamental principles involved are the same. In any case modulation and demodulation are accomplished by the carrier current varying the resistance of the varistors and thereby controlling the flow of the voice currents.

Carrier Suppression

It was shown before that it is not desirable to transmit the unmodulated carrier current over the line but that it is required at the demodulator to react with the transmitted side band to reproduce the original voice signal.

Referring to Figure 6, it is seen that points A and B are at equal potentials (similar to a balanced Wheatstone Bridge) insofar as the carrier voltage is concerned. It may also be seen that in Figure 6 (b) the varistors offer a low resistance path (compared to the output resistance) to the carrier generator during one half of the carrier current cycle. Under the conditions shown in Figure 6 (c) the varistors present an open circuit to the carrier current. Therefore, no carrier currents will flow through the output circuit or load resistance R. In other words, the carrier is suppressed by the balanced bridge arrangement of the varistors.

In the vacuum tube modulator and demodulator, carrier suppression is accomplished by use of the circuit shown in Figure 8.

It should be noted that the voltage e_v produces equal voltages ($e_v \div 2$) in the grid circuits of tubes 1 and 2, but of opposite polarities acting to make the grid of tube 1 positive and tube 2 negative. The carrier voltage e_c is applied so as to make the grid of both tubes positive or negative at the same instant. The alternating voltage applied to each grid at the instant shown will be:

Tube 1 $$e_1 = e_c + \frac{e_v}{2}$$

Tube 2 $$e_2 = e_c - \frac{e_v}{2}$$

The effect of the carrier voltage e_c is to produce equal changes in the plate currents of the two tubes. These current changes will not only be equal but will be in the same direction, that is, the plate currents of tubes 1 and 2 will increase or decrease at the same time. However, since these equal currents flow in opposite directions in transformer T3, the magnetic effects of the currents cancel and no current due to carrier voltage appear in the secondary. The voice or signal voltage, however, produces opposite variations in the plate currents, that is, for the instant shown the plate current of tube 1 will increase due to the signal voltage and the plate current of tube 2 will decrease. The magnetic effects of a decreasing current in one-half of the primary and an increasing current in the other half of the primary is to induce voltages in the same direction in the secondary. Therefore, voltages will appear in the secondary of T3 due to the signal or voice voltage in the grid circuit. Reference to the arrows in Figure 8 will further illustrate the actions that take place in the balanced tube modulator.

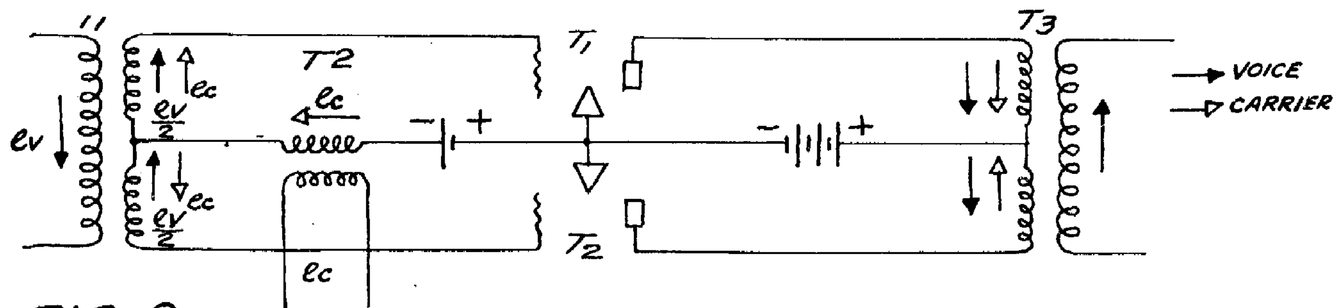


FIG. 8. BALANCED MODULATOR CIRCUIT

Since this is a modulator circuit, the usual side-band frequencies will be present in the output circuit while the unmodulated carrier will be suppressed by the balanced tube arrangement.

It should be noted that no high frequency currents appear in the output of the balanced modulator (vacuum tube or varistor) unless a signal is applied to the input. In discussing suppression of the carrier current, it has been assumed that perfect balance is obtained in the vacuum tube circuit and in the varistor bridge arrangement. In actual practice perfect balances can not be obtained and the result is a carrier current considerably reduced but not completely eliminated.

Filters

Successful operation of carrier circuits depends on being able to separate the wanted from the unwanted frequencies. Such separation is accomplished by use of filtering equipment which may be designed to pass frequencies above or below certain values or a band of frequencies between two desired values. Actually, a filter is simply a network so designed that it presents a low impedance to (accepts) the wanted frequencies and a high impedance to (rejects) the unwanted frequencies insofar as the output of the filter is concerned. Basically, filters are composed of various arrangements of inductances and capacitors. In the higher frequencies, however, crystal filters are employed. Crystal filters have a sharper cut-off than filters containing inductance coils, since the effective resistance of the coils increases at the higher frequencies, thereby reducing the sharpness of the filters. Filters are designed to present the proper impedance to the circuit at the frequencies to be accepted. Simple types of filters are shown in Figure 9. No attempt is made in this article to present technical data on filter design; those readers desiring such information are referred to "Transmission Networks and Wave Filters" by T. E. Shea, published by D. Van Nostrand Company. Information on filter design and applications is also contained in "Principles of Electricity Applied to Telephone and Telegraph," to which reference was made earlier.

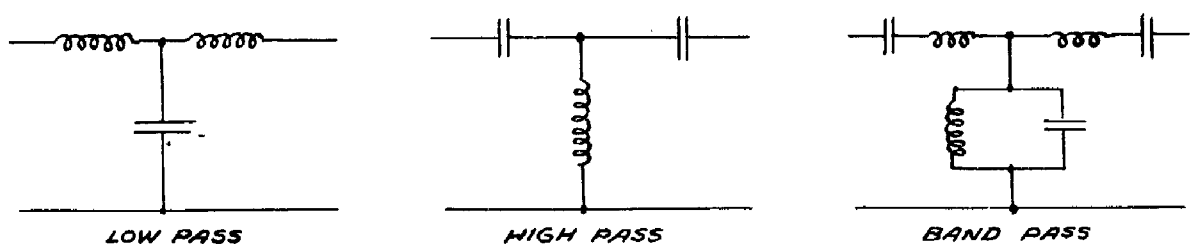


FIG. 9. FUNDAMENTAL FILTER CIRCUITS

Voice Frequency Carrier Telegraph

Carrier equipment is also being used by the Signal Corps to provide telegraph circuits for both tactical and fixed plant installations. The carrier telegraph system is somewhat simpler than the carrier telephone system in that only a single frequency constant amplitude current is involved in each carrier channel. Signals are transmitted by sending "spurts" of tone for the dots and dashes of the Morse Code or for the code signals of the teletype, while no tone is transmitted during the spaces between the characters. The winding of the sending relay is in series with the telegraph key or automatic sender and the sending relay contacts control the transmission of the tone from the generator to the line. Referring to Figure 10, it is seen that when the telegraph key is closed the sending relay contacts are held open and the carrier generator transmits carrier tone to the line through the channel filter. When the key is open the contacts short-circuit the carrier generator output, and no tone is transmitted during that period.

Frequencies used lie within the voice range (425 for channel 1 to 2295 for channel 12), therefore, simulataneous voice transmission is not possible. The standard system consists of 12 channels. However, in commercial practice the number of channels has been extended to 18.

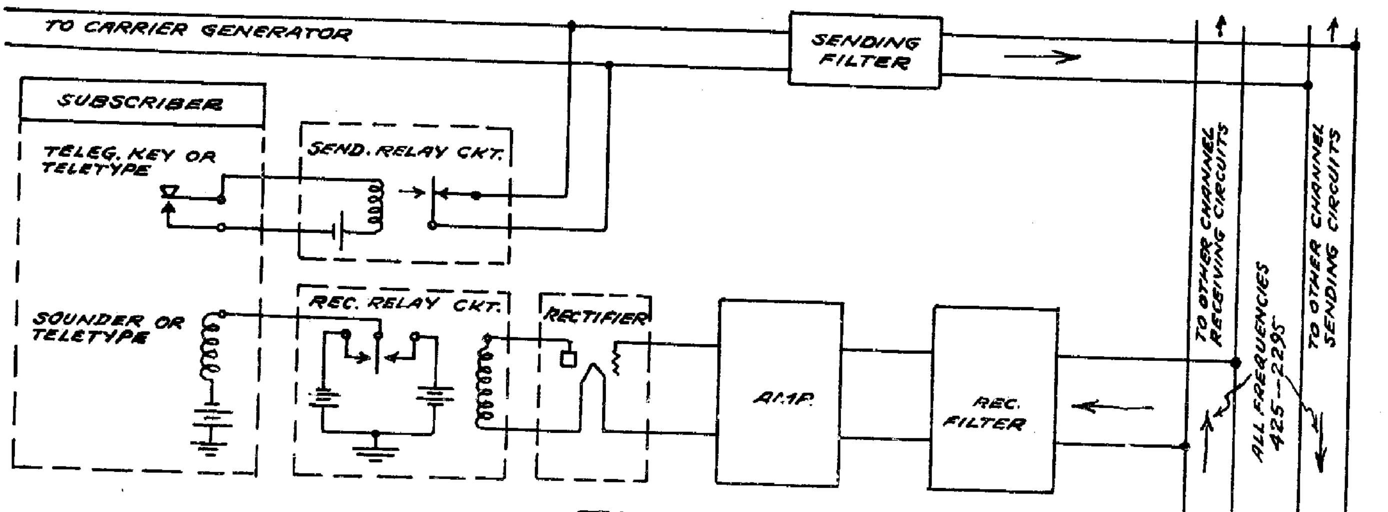


FIG. 10
VOICE FREQUENCY CARRIER TELEGRAPH SYSTEM
SIMPLIFIED. SCHEMATIC OF ONE CHANNEL OF ONE TERMINAL

At the distant terminal the "spurts" of tone are amplified and then impressed on the grid circuit of a vacuum tube rectifier. This results in an increase in the plate current during the periods in which the tone is transmitted. During those periods the plate current rises sufficiently, due to the rectified carrier current, to operate the receiving relay which is connected in the plate circuit. A telegraph sounder or teletype is connected to the contacts of the receiving relay to translate its operations into sound or a printed message. It should be noted that each dot or dash, or teletype code signal contains several cycles of the carrier current and that the receiving relay does not follow these individual variations of the carrier; instead, it follows the overall increase in plate current which occurs while the carrier current is transmitted. In other words, the relay operates only once while the key is held closed or while the tone is being transmitted. In the line circuit all twelve frequencies are transmitted simultaneously, each channel having a filter at both terminals to exclude the currents from the other channels. In the local loop or subscriber's circuits the operation is similar to any d.c. telegraph circuit.

The voice frequency telegraph carrier system may operate directly over a telephone line at its normal frequencies (425-2295) or the entire band of frequencies may be transmitted over one channel oi a carrier telephone system. In the latter case the entire band of frequencies (425-2295) modulate the carrier current of the carrier telephone channel in the same manner as the band of frequencies contained in the normal voice currents (200-3000).

A simplified diagram of one channel of a voice frequency telegraph carrier system is shown in Figure 10.

The carrier telegraph system is normally operated on a 4-wire basis; that is, transmission in opposite directions is on separate pairs, the same carrier frequency being used for both directions of transmission in each channel. If operated over a C carrier channel (3-channel standard carrier telephone as illustrated in Figure 11), effective 4-wire operation is obtained by the frequency separation in opposite directions of transmission. If it is desired to operate the voice frequency carrier telegraph system on a 2-wire basis, half the channels are used for one direction of transmission and the other half for transmission in the opposite direction.

Carrier Repeaters

Repeaters are required on long carrier circuits to maintain the level of the carrier currents above the level of the noise currents in the line. The spacing of the repeaters is affected by the type of facility, the frequencies transmitted and, for open wire lines, the weather conditions that prevail in the particular territory. On commercial open wire circuits the spacing averages about 150 miles. Carrier repeaters consist of two one-way amplifiers, one amplifier for each direction of transmission. The carrier repeater amplifies the currents of all carrier channels; the normal voice frequency currents (200-3000) are, however, shunted around the carrier repeater by use of low pass filters and amplified by voice frequency repeaters. This is illustrated in the typical 3-channel system of Figure 11.

Carrier current suppression is of particular importance to repeater design since the amount of energy to be amplified is considerably reduced by removal of the unmodulated carrier. It is important that the carrier repeater be capable of amplifying the carrier currents without introducing distortion. To avoid distortion earlier carrier systems employed amplifiers and repeaters of the push-pull type, but in recent design feed-back amplifiers and repeaters have been adopted.

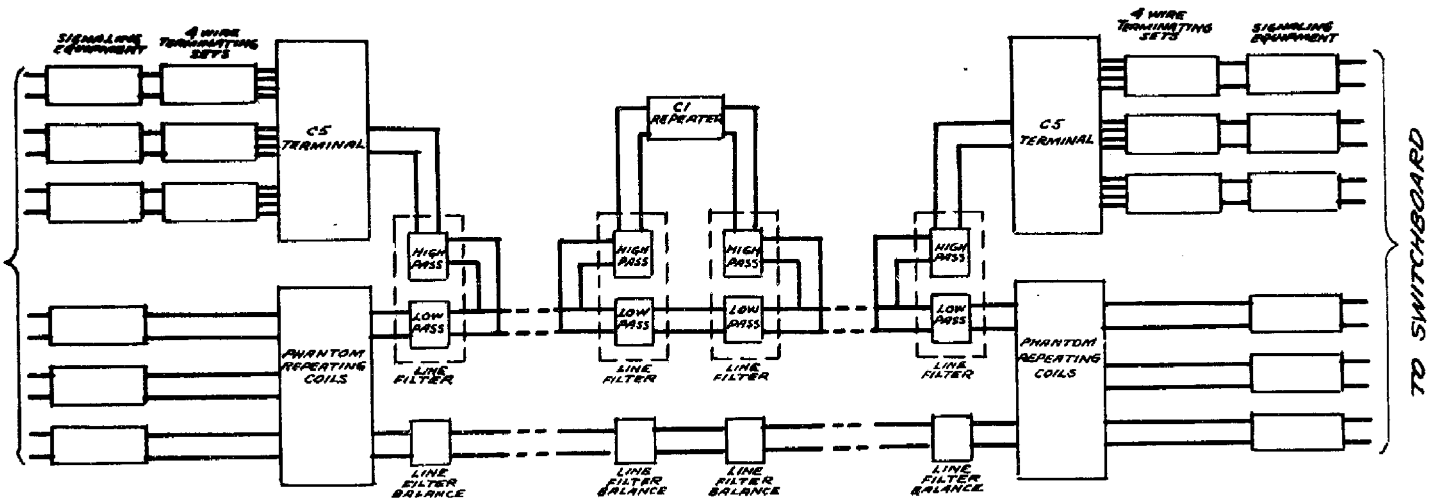


FIG. 11. SCHEMATIC OF A 3-CHANNEL CARRIER TELEPHONE SYSTEM WITH ONE REPEATER.

Two-wire and Four-wire Operation

Carrier systems may be operated on either a 2-wire or 4-wire basis. If 2-wire operation is used, that is, the same line wires are used for both directions of transmission, different carrier frequencies are used for opposite directions of transmission. In C carrier systems (operating 2-wire) carrier frequencies of approximately 6,000 to 13,000 are used in one direction and frequencies of approximately 21,000 to 28,000 in the opposite direction. In 4-wire operation where separate pairs are used for opposite directions of transmission, the same carrier frequencies may be used in both directions. This method also has the advantages of requiring a smaller frequency band for the entire system, requires less filtering equipment and entails no balance considerations. However, twice the line facilities are required. In commercial practice the 3 channel type C carrier system is operated over one pair of an open wire line. Each channel, therefore, has two carrier frequencies, one for transmitting and one for receiving. At repeater points the frequencies used in opposite directions are separated by "directional" filters which derive their names from their function of separating the directions of transmission. Actually they are band pass filters, each filter being designed to pass all the frequencies used in one direction and exclude those frequencies used in the opposite direction. In any case, the channels of the carrier terminals are operated on a 4-wire basis, one 2-wire circuit to the modulator (transmitting) and one 2-wire circuit from the demodulator (receiving). The input of the modulator and the output of the demodulator are connected to a 4-wire terminating circuit, the 2-wire side of which is connected through the necessary terminal equipment to the switchboard or to another circuit.

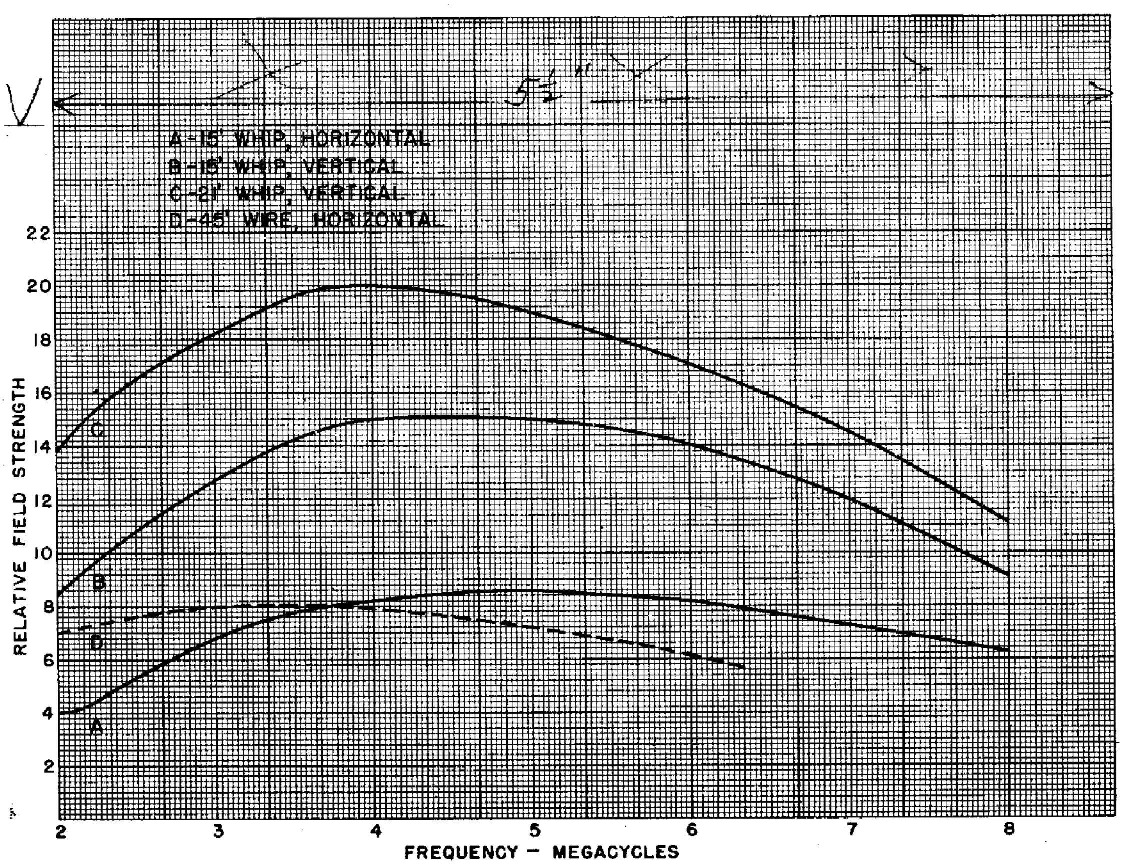
COMPARISON OF ANTENNAS WITH SCR-299

TO SWITCHBOARD

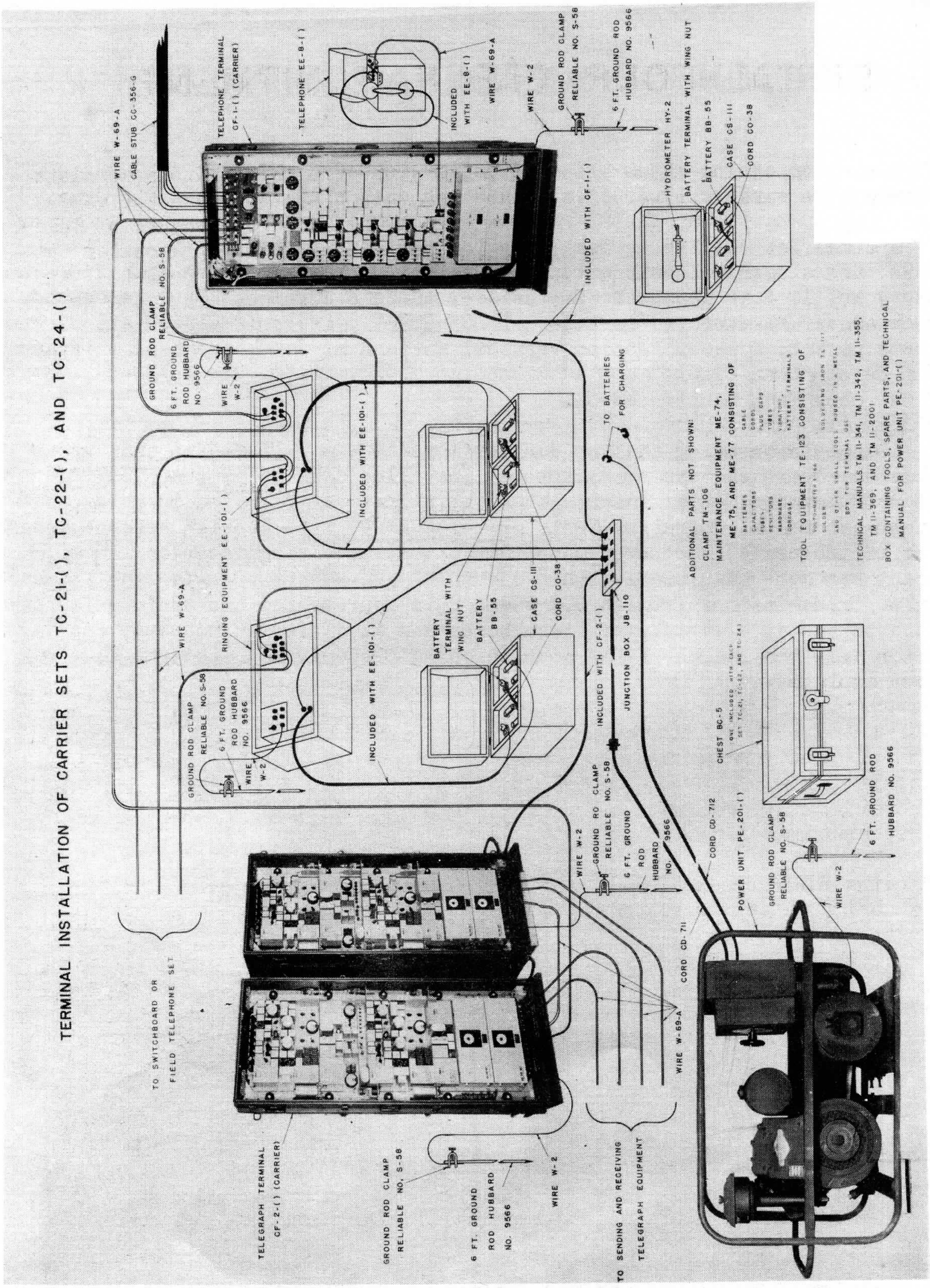
The accompanying chart illustrates the recorded relative field strength obtained when various types of antennas are used with Radio Set SCR-299-( ).

A comparison of the curves indicates that superior transmission is obtained when a vertical whip antenna is employed. A memorandum from Field Laboratory No. 1, Fort Monmouth, New Jersey, dated 4 November 1942, recommends that wherever stationary operation of SCR-299-( ) is contemplated and circumstances permit, a seven section vertical antenna be used, and that this antenna be composed of one each Mast Section MS-49, MS-50, MS-51, MS-52, MS-53, and two each Mast Section MS-54.

It should be noted that no doublet antenna was included in this group of tests. Where the use of a properly installed doublet is practical, it will produce much better results than the whips. As reported in this publication last month (Operating Tests of the SCR-299 with Doublet Antenna, pages 21 to 24 inclusive) the power output at a test receiving location 120 miles distant was more than trebled when a doublet was substituted for the standard whip on transmissions from an SCR-299. This represented the minimum improvement obtained at a variety of frequencies and at different hours of the day, in each case the length of the doublet being properly adjusted for the frequency employed.



RESTRICTED



TERMINAL INSTALLATION OF CARRIER SETS TC-21-( ), TC-22-( ), AND TC-24-( )

SPIRAL-FOUR CABLE EQUIPMENT

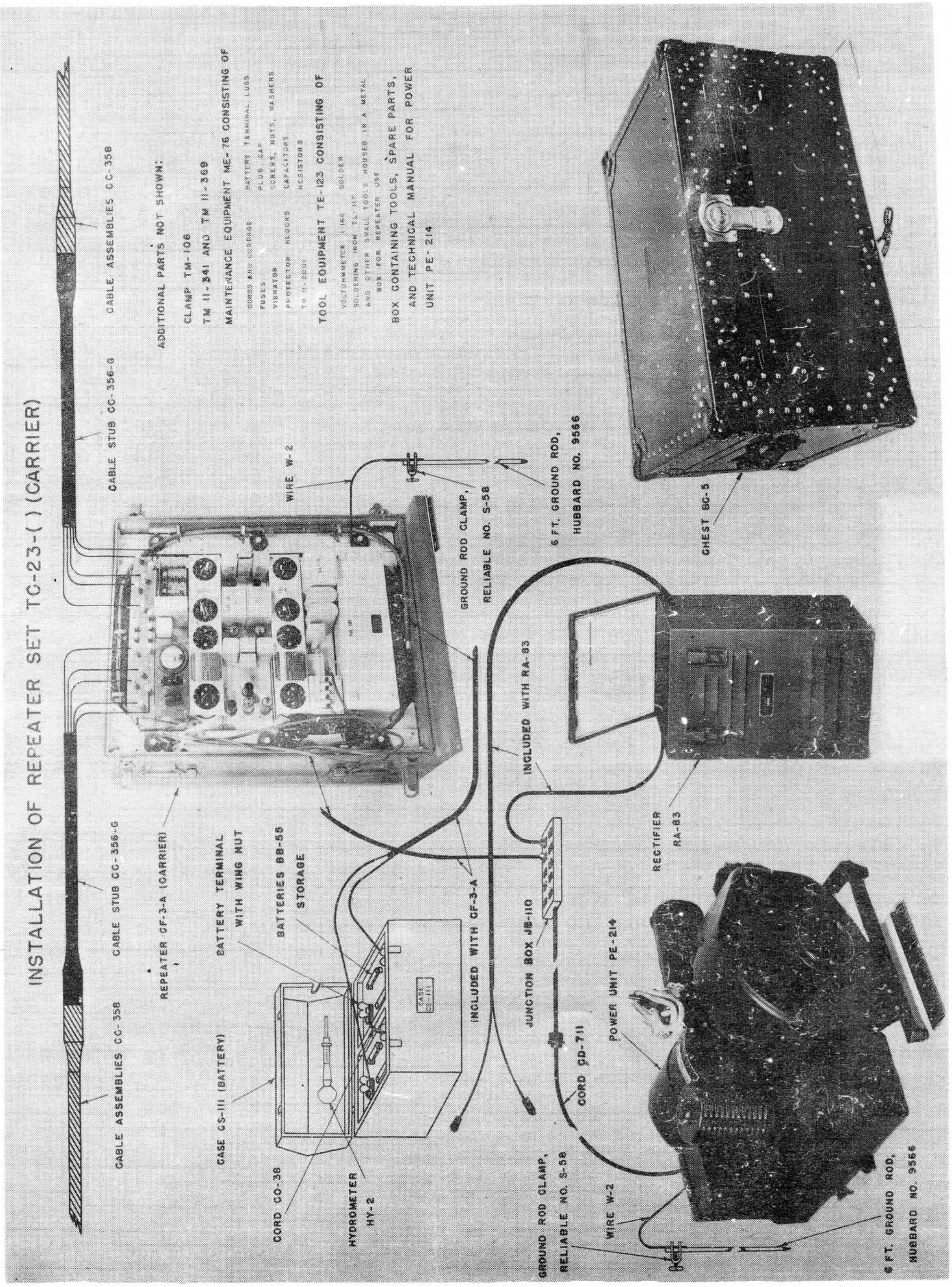
The carrier equipment developed for use with Spiral-Four Cable consists of Telephone Terminal CF-1-( ), Telegraph Terminal CF-2-( ), Repeater CF-3-( ) and Ringing Equipment EE-101-( ), which are the major components of Telephone Terminal Set TC-21-( ), Telegraph Terminal Set TC-22-( ), Repeater Set TC-23-( ) and Ringer Set TC-24-( ), respectively. TC-21-( ), TC-22-( ), and TC-24-( ) are used at terminal stations and TC-23-( ) is used at repeater stations which are employed at intervals of approximately 25 miles in a spiral-four cable system. The diagrams on the opposite and next pages illustrate their applications.

Telephone Terminal CF-1-( ) provides for the simultaneous transmission of four voice-frequency telephone circuits over the Spiral-Four Cable. In addition, the two pairs of the cable are simplexed, one circuit being used as a d.c. signalling circuit between terminals and repeaters and the other may be used for local teletype circuits. CF-1-( ) is housed in a bay 5' 6" high, 2' 4" wide and 1' 7" deep and weighs approximately 475 pounds. This terminal requires approximately 60 watts of a.c. power at 115/230 volts, 50-60 cycles, or 12-volt storage battery emergency standby.

Telegraph Terminal CF-2-( ) provides for four simultaneous telegraph circuits over any good-quality telephone circuit. When used on the Spiral-Four carrier system, it is ordinarily employed on Channel No. 3 of Telephone Terminal CF-1-( ). CF-2-A consists of two bays, each 5' 6" high, 2' 3½" wide and 1' 7" deep. Each bay weighs approximately 525 pounds. CF-2-( ) requires approximately 450 watts of a.c. power and is designed for a 115/230 volt, 50-60 cycle power source, but does not have provision for 12-volt storage battery emergency standby.

Ringing Equipment EE-101-( ) is used for converting 20 cycle ringing signals to 1000/20 cycle signals, and vice versa, for transmission through the repeatered circuits of the carrier telephone system. EE-101-( ) is 11-5/8" high, 21-1/4" wide and 14-3/4" deep and weighs 95 pounds. This ringing equipment provides ringing facilities for two circuits. EE-101-( ) requires approximately 30 watts of a.c. power and is designed for a 115/230 volt, 50-60 cycle power source, or 12-volt storage battery emergency standby. The telephone terminal set, telegraph terminal set and two ringer sets for each terminal location are powered by Power Unit PE-201-( ) which is rated at 700 watts a.c. and 300 watts d.c. Two 6-volt storage Battery BB-55, contained in Case CS-111, are connected to each ringing equipment and the telephone terminal at all times in order that telephone service will not be interrupted in case of failure in the a.c. power source. This is accomplished by an automatic throw-over relay contained in the ringing equipments and the telephone terminal.

Repeater CF-3-( ) is 2' 10" high, 2' 4" wide and 1' 2" deep and weighs approximately 225 pounds. This repeater handles all four channels produced


INSTALLATION OF REPEATER SET TC-23-( ) (CARRIER)
CABLE ASSEMBLIES CC-358
CABLE STUB CC-356-G
CABLE STUB CC-356-G
CABLE ASSEMBLIES CC-358
ADDITIONAL PARTS NOT SHOWN:
CLAMP TM-106
TM 11-341 AND TM 11-369
MAINTENANCE EQUIPMENT ME-76 CONSISTING OF
CORDS AND CORDAGE
BATTERY TERMINAL LUGS
FUSES
PLUG CAP
VIBRATOR
SCREWS, NUTS, WASHERS
PROTECTOR BLOCKS
CAPACITORS
TM 11-2001
RESISTORS
TOOL EQUIPMENT TE-123 CONSISTING OF
VOLTOHMMETER I-166
SOLDER
SOLDERING IRON TL-117
AND OTHER SMALL TOOLS HOUSED IN A METAL BOX FOR REPEATER USE
BOX CONTAINING TOOLS, SPARE PARTS, AND TECHNICAL MANUAL FOR POWER UNIT PE-214
REPEATER CF-3-A (CARRIER)
CASE CS-111 (BATTERY)
BATTERY TERMINAL WITH WING NUT
BATTERIES BB-55 STORAGE
CORD CO-38
HYDROMETER HY-2
INCLUDED WITH CF-3-A
INCLUDED WITH CF-3-A
WIRE W-2
GROUND ROD CLAMP, RELIABLE NO. S-58
6 FT. GROUND ROD, HUBBARD NO. 9566
INCLUDED WITH RA-83
JUNCTION BOX JB-110
CORD CD-711
POWER UNIT PE-214
RECTIFIER RA-83
CHEST BC-5
WIRE W-2
GROUND ROD CLAMP, RELIABLE NO. S-58
6 FT. GROUND ROD, HUBBARD NO. 9566

by CF-1-( ) and has the same d.c. signalling arrangement as CF-1-( ). The repeater requires 30 watts of a.c. power and is designed for 115/230 volts, 50-60 cycles a.c., or 12-volt storage battery emergency standby. Power Unit PE-214-( ), rated at 300 watts a.c., supplies a.c. power to the repeater and charges the standby storage battery through Rectifier RA-83-( ).

As a means of facilitating the requisitioning, issuing and shipping of complete systems as units, and supply coordination of tactical carrier equipment and Spiral-Four Cable, complete 100-Mile carrier systems are being shipped to theater "pools" to build up stocks of carrier system components and tool, test and maintenance equipments which can be issued to using organizations at the discretion of the theater commander to fill requirements for various system lengths. Accordingly, carrier components and Spiral-Four Cable are not authorized for issue on T/BA and will be handled only on a "pool" issue or special issue basis.

A "pool" issue parts list has been prepared for the 100-Mile Carrier System. The items on this list are divided into four classifications, as follows: Basic Equipment, Linemen's Test Equipment and Maintenance Supplies, Unit Replacements, and Depot Spares. The "Basic Equipment" classification covers sufficient carrier equipment sets, spiral-four cable and accessories, to set up a 100-Mile Carrier System in an operating condition. The "Linemen's Test Equipment and Maintenance Supplies" classification covers equipment to be divided among the two terminal stations and three repeater stations in a 100-mile system for the use of cable patrol and maintenance crews in maintaining spiral-four Cable. The "Unit Replacements" classification covers spare replacement units to be substituted for major components of the system when major repair or salvage is required. The "Depot Spares" classification covers quantities of spare and replacement parts required for depot stock. Repair and replacement parts for first and second echelon maintenance are included on the parts lists of the four carrier sets.

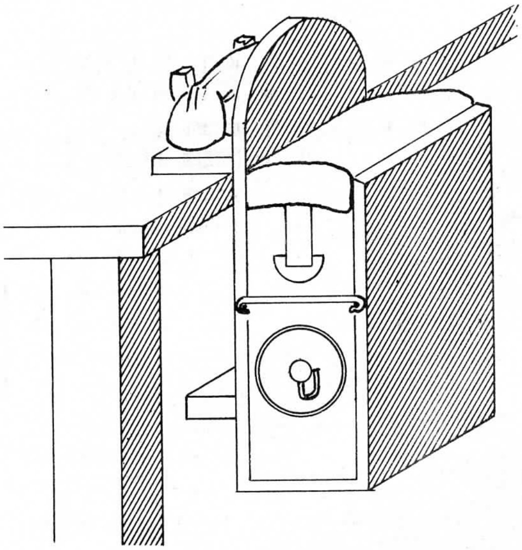
. COMBINED RADIOTELEGRAPH PROCEDURE, FM 24-10

Inquiries have been received by Communication Coordination Branch regarding the Morse Character $\overline{P}$ listed in Article 4 b of FM 24-10. $\overline{P}$, commonly called "tilded" P, is not a mistake. It is written $\overline{P}$ and is transmitted as "dit dah dah dit dah."

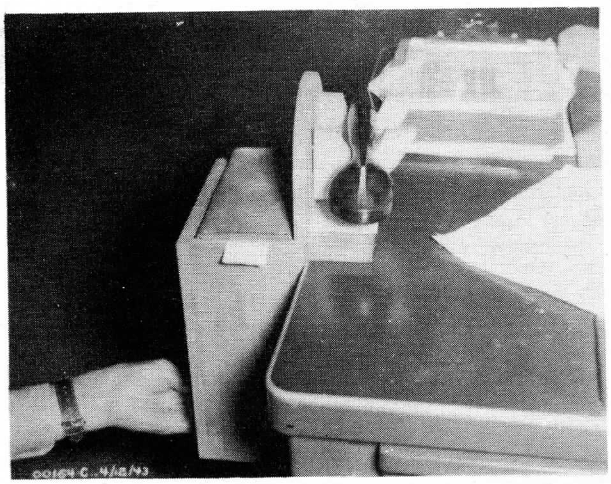
As indicated, $\overline{P}$ is used in SYKO transmissions only. SYKO is a form of aircraft code which requires an extra character. If SYKO is used, the need for the use of $\overline{P}$ will be apparent. If SYKO is not used, $\overline{P}$ will not be encountered.

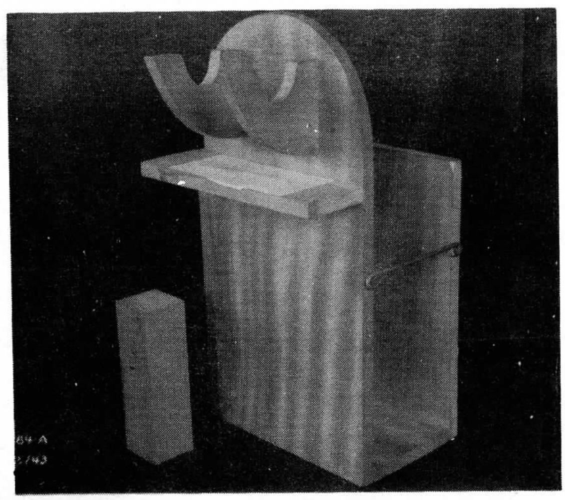
PERMANENT MOUNTING FOR EE-8-A

The accompanying illustrations show a mounting box used for permanent mounting of Telephone EE-8-A at one overseas base. To quote the Signal Officer of this installation:



"Telephone instrument installations at ATC bases in this theater are of a permanent nature with few exceptions. When installations were first made, considerable trouble was experienced by having the telephones knocked off desks and tables, and there was no satisfactory wall mounting. The present box (as illustrated herewith) is highly adaptable and has proved the solution to the permanent installation problem."





Possible variations from this exact design that have been suggested to meet specific needs include the following:

1. Handset cradle on top or side would aid wallmounting.
2. Cut away end piece so magneto crank handle is toward operator regardless of whether phone is mounted on right or left of desk or table.
3. Extend back piece to facilitate secure mounting on wall or desk.
4. Provide space for external batteries.
5. Omit cradle on common battery models.

LABS AID AUGMENTED QUARTZ PROCUREMENT

Since the outbreak of the war, the manufacture of crystals in this country has grown in a few short months from small laboratory production to a full-grown industry. This rapid development has resulted in an unprecedented demand for tons of raw quartz needed for the manufacture of oscillator plates.

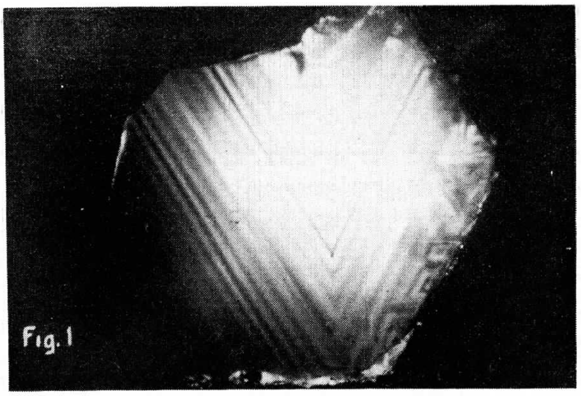
Quartz in its various forms is a common mineral found in abundant quantities throughout the world. It is the principal constituent of most sands. It occurs in a variety of colors and forms such semi-precious stones as amythest, topaz, and onyx. Chemically, quartz is silicon dioxide.

When it occurs in the crystalline form, it is sometimes called mother quartz. Well formed crystals occur as long hexagonal prisms capped on one or both ends by six-sided pyramids, or they may be found as irregular masses, the natural faces of which have failed to form or have been destroyed by time and geological agents. The surfaces of the end pyramids are usually smooth planes, while the prism faces may be broken by numerous striations or growth lines parallel to the intersection of prism and cap faces. Only large single crystals of quartz are suitable for the manufacture of radio oscillator plates.

Crystalline quartz large enough for radio use is relatively rare. At present the major portion of commercial radio quartz is imported from Brazil where it is mined for the most part by comparatively primitive methods. While quartz from California, Arkansas, and other domestic locations is equally well suited for making radio crystals, it has not yet been mined in sufficient quantities to supply the present needs. Numerous surveys are being carried out at present to find and develop sources of supply within the United States.

Efficient procurement of quartz crystal in Brazil has necessitated the setting up of inspection laboratories in Rio de Janeiro, the center of quartz purchasing. More recently, laboratories have been installed in other cities in Brazil and in some of the more remote parts of the interior near the mining operations. These laboratories were staffed by Signal Corps quartz inspectors trained at the Camp Coles Signal Laboratory but these inspectors are now training Brazilians for this work. The inspection of quartz in Brazil has enabled government purchasers to cull out that which is of poor quality. This, in turn, has resulted in the saving of valuable shipping space and has made possible more accurate evaluation of the quartz purchased by the U. S.

Inspection of raw quartz in the United States has also been aided by the Signal Corps at the Bethlehem Field Section of The Toms River Signal Laboratory. Here many tons of the smaller quartz crystals imported by the Metals Reserve Corporation have been inspected and classified prior to sale to the crystal industry. As a result of the opening of this inspection facility to supplement the main inspection depot at the National Bureau of Standards, quartz crystals as small as a quarter of a pound have been made available to industry at an earlier date than would otherwise have been possible.



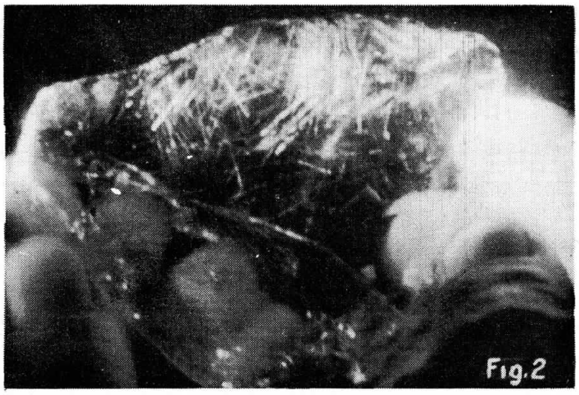
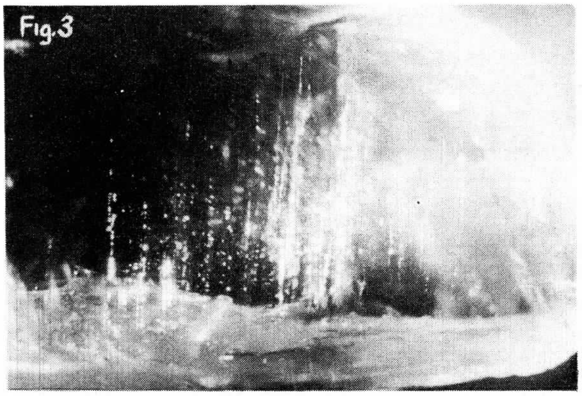


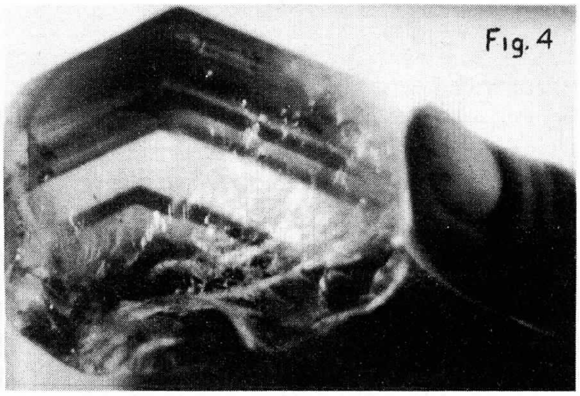
Figure 1. Quartz containing optical twinning as seen when viewed in polarized light. The triangular pattern of the bands is due to optical twinning.

Figure 2. Quartz containing blue needles when viewed in an intense beam of light with the crystal immersed in oil. The needles appear as numerous, extremely fine filaments, bluish in appearance and interlaced in random directions.

Figure 3. Quartz containing "chuva" viewed in an intense beam of light with the crystal immersed in oil. It appears as disjointed needles upon which are superimposed tiny bubbles. The similarity in appearance to falling rain gives it its name, the Portuguese word for rain.

Figure 4. Quartz containing "phantoms" as seen in an intense beam of light. There are a number of alternate dark and light bands, the sides of which are parallel to the faces of the crystal. They are called phantoms because they have a rather ghost-like appearance.





Large perfect quartz crystals are seldom found. The majority of crystals contain certain defects which make only part of a crystal suitable for the manufacture of oscillator plates. An understanding of the nature of these defects and their effects upon the oscillating plate is essential if raw quartz is to be graded properly before importing it into this country. Furthermore, manufacturers buying quartz must have some sort of yardstick to measure the value of the quartz that they are getting, and to estimate how many pounds they will need to fill their orders. Accordingly, extensive studies have been conducted concerning the nature of the various flaws in quartz, and equipment and techniques have been developed for evaluating the magnitude of such flaws.

One of the most common flaws found in a quartz crystal is twinning. Twinning is the result of unlike orientation of different parts of a crystal resulting in different optical and electrical properties in the several parts. Two types of twinning are common — optical and electrical. Optical twinning is so called because it can be detected by the optical rotation of polarized light as it passes through the quartz. Figure 1 is a photograph of a piece of quartz containing optical twinning. Electrical twinning, on the other hand, cannot be detected by optical means, nor can it be observed inside the mother crystal by any known means. Crystallographers can identify electrical twinning by a careful examination of the crystal surface. But there is no way of knowing the extent of which electrical twinning may penetrate into a crystal. Both optical and electrical twinned areas are readily identified after the quartz has been cut and etched in hydrofluoric acid.

A second class of defects includes cracks, bubbles, and inclusions of foreign materials which are readily seen in ordinary light. Those parts of the mother crystal containing defects in this class are unsuitable for use in the manufacture of oscillator plates. However, if the mother crystal contains a space as small as 1/4 of its volume which is free from twinning, cracks, bubbles and foreign inclusions, it is generally cut, and the bad portions are eliminated in the manufacturing process.

There is a third class of defects which are generally invisible except when examined in an oil bath with an intense beam of light such as is produced by an arc lamp or a high power projection lamp. This class of defects includes blue needles, chuva, veils, phantoms and microscopic bubbles. Photographs of a number of these are shown in Figures 2, 3, and 4. Recent tests by the Signal Corps have shown that the defects in this class apparently do not materially affect the properties of the oscillator plate. Crystals prepared from quartz known to contain large amounts of these defects were equal in quality to oscillator plates made from the highest grade of quartz.

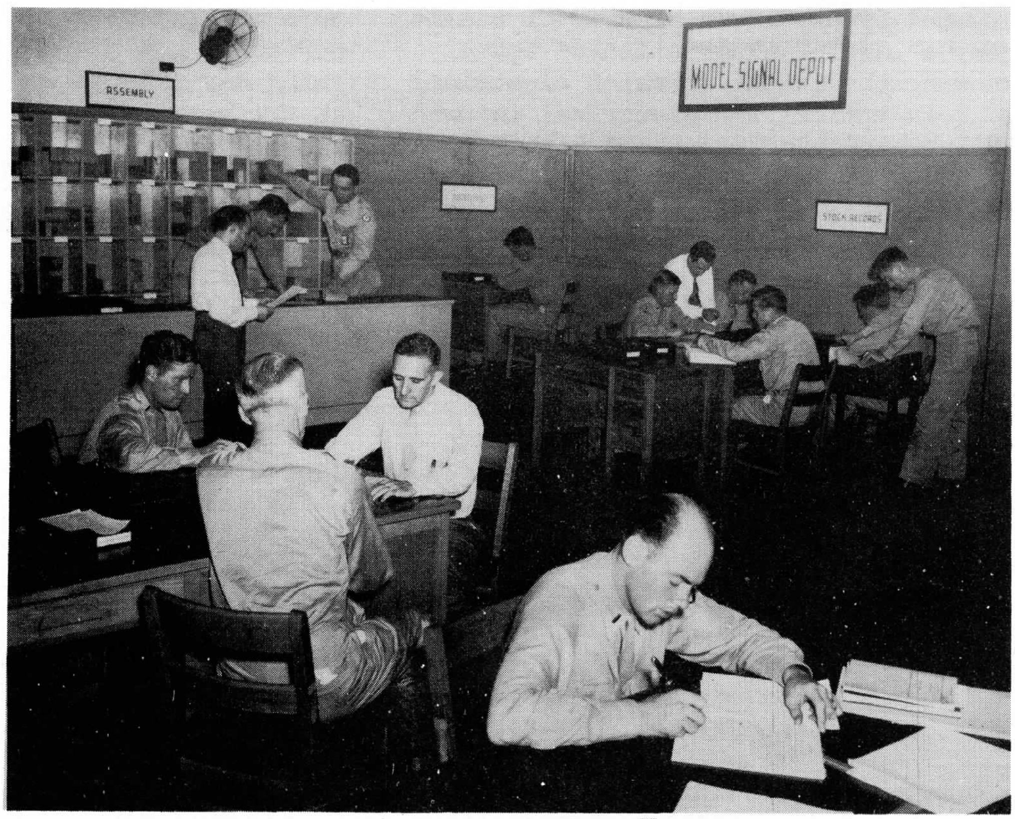
An important result of these investigations has been the rewriting of crystal specifications to remove restrictions which prohibited the use of quartz containing blue needles, chuva, phantoms, veils and other defects, which experience now shows do not affect the performance of crystals. The impending shortage of raw quartz has been materially alleviated by the use of this poorer grade material.

MODEL SUPPLY STATION AND DEPOT

The Officers School, Philadelphia Signal Depot, has in operation a unique plan for training officers and enlisted men in signal supply activities. This plan was developed from a suggestion offered by the Commanding General of the Depot, Brigadier General A. A. Farmer, who maintains a keen interest in training procedures, particularly in making them more vivid and realistic. The distinctive feature of the plan is the model station and supply depot, in which the activities connected with supply work are actually performed by the students.

Actual Supply Situations

Experience in the use of the plan has shown that the students learn the work quicker and with greater interest. Under the methods of conference and lecture, there was a tendency for students to lose sight of the overall sig-



FOLLOWING REQUISITIONS FROM REQUISITION CONTROL INTO STOCK RECORDS; ASSIGNING CV NUMBERS; PREPARING SHIPPING TICKETS, PACKING LISTS, PACKERS MEMORANDUMS, BILLS OF LADING; MAKING PROPER ENTRIES ON STOCK RECORD CARDS; AND SHIPPING REQUISITIONED SUPPLIES.

RESTRICTED

EDITING THE REQUISITION AT THE STATION, PREPARING TALLIES, ASSIGNING CV NUMBERS, AND REQUISITIONING SUPPLIES FROM THE DEPOT.

nificance of supply procedures, to get lost in a maze of mere forms; but the model supply station and depot bring order, meaning, and correct emphasis to the subject. There the student officers encounter primarily the situation, and the forms enter naturally as necessary elements in a sensible solution of a concrete supply problem. Each student officer is given the opportunity to act as officer-in-charge of each of the branches of supply simulated, and to "follow through" in working out practical problems involving the various functions of supply stations or depots. The problem then becomes not, "Who signs the affidavit on the report of survey?", but "You are a station property officer and, after requisitioning, receive a shipment from a depot containing 6 damaged HS-22-A's. What action will you take?" The first problem is answered and done with quickly, and in answering it the student officer gives evidence only of having memorized a single pertinent fact. The second problem is wide in its implications, and leads the student officer, in its unraveling, through a process which involves not only the complete preparation of the report of survey, but also entries on the stock record cards, gathering of exhibits, and relationships with the shipping and commanding officers. When the problem is solved, the student has the satisfaction of knowing that he has exercised his ingenuity, not merely recalled a fact.

Another advantage of the plan is the inter-relationship between the model station and the model depot. The student officers have the opportunity of following and participating in a transaction in all its details from the preparation of the station requisition through the processing of the requisition at the depot to the final receipt of the material at the station. The rapidity with which transactions can be made to take place between the station and the depot makes this instructional method superior even to actual observation of station and depot work; for situations of varying kinds can, on this smaller scale, be developed and handled in one day, whereas in actual practice such situations might occur only occasionally and would require a period of perhaps a week or more for completion. Furthermore, in the model organizations, each student officer must do his own paper work from beginning to end. He is not assisted by supply sergeants or clerks who in actual practice are ready to take the burden off their officer's shoulders, but who nevertheless cannot relieve him of his responsibility. The student officer learns to dig in and do the work which he will later supervise.

Easy to Install

Other supply schools which may be interested in this new method need not fear that it is too elaborate or difficult to install. At the Philadelphia Signal Supply Schools it is installed in one partitioned room of average classroom size, and easily obtainable equipment is employed. The chief articles of furniture are desks, chairs, and office trays. The stock, in both the station and the depot, consists of small wooden blocks, labeled with the correct nomenclature and stored in wooden bins. Approximately 30 items are all that is necessary to develop even the most complicated problems. The stock record cards, being few, are kept in a single tub file at both station and depot. As for the warehouses, they contain only a few sample boxes, properly packed and marked, which can be studied at first hand, and which need not be moved, since it is with paper work and procedure that the student officers are mainly concerned.

Of course, both the station and the depot must be equipped with all the necessary forms and records. The model station in the Philadelphia Signal Supply Schools works mainly with the following: register of property received, tally-in and tally-out registers (and naturally tallies), over, short and damaged reports, reports of survey, memorandum receipts and the memorandum receipt account, station stock record cards for expendable and non-expendable items, and T/O's, T/E's, and T/BA's.

The model depot is departmentalized after the manner of the Philadelphia Signal Depot. The requisition control desk, which prepares the requisition for expeditious handling, uses T/O's, T/BA's, T/E's, a requisition register, and requisition record and routing folders. The stock records desk, which prepares the shipping tickets for requisitioned material and maintains the stock record cards, is supplied with a tub file of stock record cards, stock reports, shipping tickets, a consolidated voucher register, and a requisition control chart. The assembly desk handles the items in bin stock, preparing requests for material from the warehouse when necessary, and maintaining a control voucher register. The packing desk uses a packing number register, packing memos, and packing lists. The transportation desk requires bills of lading and RA cards, and the shipping desk requires tally-outs. To round out the depot's activities there is a receiving desk, working with receiving reports and tally-ins.

Students Enthusiastic

The chief point in favor of this new instructional method is that it gets results. Student officers who have participated in the work of the model or-

ISSUING MATERIAL FROM THE WAREHOUSE, PREPARING TALLY-OUT, ASSIGNING A TALLY NUMBER AND CV- NUMBER, AND MAKING "DROPS" FROM THE STOCK RECORD CARD.

ganizations have expressed a decided preference for the method. They have shown more interest, and they have learned more quickly. They have, in fact, learned signal supply, not merely been exposed to it. Of course, a few initial classes are necessary before the students are ready to enter the model organizations, and at Philadelphia these are made to move along rapidly with the aid of specially prepared training manuals and reference materials. Once the students complete the preparatory classroom work, however, the instructor is able to act mainly as an adviser, guiding the students individually whenever they encounter some aspect of their supply problem which they cannot quite handle. In the main, the student officers are on their own -- learning not by passive listening, but by doing.

MILITARY ORGANIZATION

The 301st Signal Operations Battalion was ordered transferred permanently from Camp McCain, Miss., to Camp Atterbury, Ind., moving by way of the Tennessee Maneuver Area for duty until about 20 November 1943.

The 5th Armored Signal Battalion is being reorganized without change of station or assignment, and concurrently is redesignated the 310th Signal Operation Battalion. Its authorized strength is 28 officers, three warrant officers and 631 enlisted men.

The 89th Signal Company has been redesignated the 89th Signal Platoon.

The 295th Signal Company (Special) has been attached to the Amphibious Force, U. S. Atlantic Fleet, for amphibious training only, at its present station, Camp Bradford, Va.

The 17th Signal Operations Battalion has been transferred from Camp Crowder, Mo., via temporary station at Bend, Ore., to Fort Lewis, Wash.

Transfer of the 90th Signal Company from Camp Barkeley, Texas, to the Desert Training Center, was ordered, in coordination with the arrival of the 11th Armored Division at Camp Barkeley.

The 930th Signal Battalion (Air Support Command) was ordered to make a temporary change of station from Alachua Army Air Field, Gainesville, Fla., to Redmond Army Air Field, Redmond, Ore.

The 798th and 799th Signal Aircraft Warning Platoons were disbanded 20 August 1943 and all personnel thereof transferred to Signal Aircraft Warning Units, TRU type, under the control of the Commanding General, Third Air Force.

ACTIVATIONS

Organization	Place	Date
1364th Signal Company, Wing	Pinedale, Calif.	1 September
1365th Signal Company, Wing	Pinedale, Calif.	1 September
1366th Signal Company, Wing	Pinedale, Calif.	1 September
989th Signal Service Company	Fort Monmouth, N. J.	1 August
82nd Signal Battalion	Fort Ord, Calif.	
1st Radar and VHF Installation and Maintenance Unit (Aviation)	Springfield, Ill.	10 August
Hq and Hq Squadron, 70th Fighter Wing	Seattle, Wash.	15 August
Hq and Hq Squadron, 71st Fighter Wing	March Field, Calif.	15 August

PERMANENT CHANGES OF STATION

Organization	From	To
79th Signal Company	Camp Forrest, Tenn.	Desert Training Center
8th Signal Company	Desert Training Center	Camp Forrest, Tenn.
566th Signal Company	Camp Blanding, Fla.	Camp Robinson, Ark.
147th Signal Armored Company	Desert Training Center	Fort Benning, Ga.
281st Signal Pigeon Company (less 3rd platoon)	Fort Meade, Md.	Fort Jackson, S.C.
218th Signal Depot Company	Camp McCain, Miss.	Camp Breckinridge, Ky.
387th Signal Company, Aviation	Pinedale, Calif.	AAF, SAT, Orlando, Fla.
931st Signal Battalion (Air Support Command)	Esler Field, La.	Alachua Field, Gainesville, Fla.
Hq and Hq Company, IX Corps	Desert Training Center	Camp McCain, Miss.
151st Signal Armored Company	Camp Polk, La.	Camp Barkeley, Texas

REORGANIZED

The following Corps Headquarters and Headquarters Companies, each with an authorized strength of 62 officers, five warrant officers and 236 enlisted men:

Unit	Assignment
Hq and Hq Company, III Corps	Second Army
Hq and Hq Company, IV Corps	Separate
Hq and Hq Company, VIII Corps	Third Army
Hq and Hq Company, IX Corps	Third Army
Hq and Hq Company, X Corps	Third Army
Hq and Hq Company, XI Corps	Second Army
Hq and Hq Company, XII Corps	Second Army
Hq and Hq Company, XIII Corps	Separate
Hq and Hq Company, XV Corps	DTC

The 574th Signal Aircraft Warning Battalion, without change of station or assignment, to the Third Air Force. Authorized strength is 70 officers, 16 warrant officers, and 1296 enlisted men.

The 761st Signal Aircraft Warning Company, redesignated the 761st Signal Aircraft Warning Company (Special) and reorganized without change of station or assignment. Authorized strength is 11 officers, 323 enlisted men.

The 333rd and 335th Signal Companies, Wing, redesignated the 333rd and 335th Signal Companies, Troop Carrier Wing, respectively, and reorganized without change of station or assignment. Authorized strength of each is seven officers and 127 enlisted men.

O. C. SIG. O. LIBRARY

Following are a few of the books added to the collection in the Signal Corps Reference Library, 5B135, Pentagon Building, during the last month.

Electrical Engineering by E. E. Kimberly. International Textbook, 1939. 342p. TK145.K5.

Electrical and Radio Dictionary by C. H. Dunlap and E. R. Hahn. Revised and enl. ed. American Tech. Soc., 1943. 110p. TK9.D78.

Military French by Francois Denoeu. Heath, 1943. 355p. PC2120.S7D38.

Principles of Magnaflux Inspection by F. B. Doane. 2d ed. Photopress, 1942. 288p. TA460.D5.

Clouds, Air and Wind by Eric Sloane. Devin-Adair, 1941. 74p. QC863.S6.

The Microscope by S. H. Gage. 17th ed. Rev. Comstock, 1941. 617p. QH207.G2.

Lighting for Photography by Walter Nurnberg. 2d ed. London, Focal Press, 1942. 172p. TR590.N8.

Mortensen on the Negative by William Mortensen. Simon, 1941. 283p. TR290.M6.

The Observer's Book on Radio Navigation by W.J.D. Allan. Chemical Pub. Co., 1941. 106p. TL695.A4.

Radio Interference Suppression by G. W. Ingram. London, Electrical Review, 1939. 154p. TK6553.I55.

Television for Beginners; Theater Television by J. R. Cameron. Cameron Pub. Co., 1940. 94p. TK6630.C22.

Thermionic Valve Circuits by Emrys Williams. London, Pitman, 1942. 174p. QC544.V3W5.

Vector and Tensor Analysis by H. V. Craig. McGraw, 1943. 434p. QA261.C77.

The 339th Signal Company, Wing, redesignated the 339th Signal Company, Troop Carrier Wing, and reorganized without change of station or assignment.

The 929th Signal Battalion, Air Support Command, redesignated the 929th Signal Battalion, Separate, Air Support Command, and reorganized without change of station or assignment. Authorized strength is 35 officers, one warrant officer, 695 enlisted men.

EQUIPMENT NOTES

EQUIPMENT COORDINATION

DIRECTIVES FORWARDED TO THE SIGNAL CORPS BOARD

Date	No.	Subject
19 July 1943	539	Hammers, Claw
12 August 1943	540	Testboard BD-103

SIGNAL CORPS BOARD REPORTS APPROVED BY THE CHIEF SIGNAL OFFICER

Signal Corps Board Case No. 528 - Service Test of Semi-Trailer, 6-Ton Gross 2-Wheel, Expansible Van. Approved 15 July 1943.

The Signal Corps Board was directed to test one Semi-Trailer, 6-Ton Gross 2-Wheel, Expansible Van to determine the need for such a vehicle for issue to Signal Corps troops. The Signal Corps Board examined the trailer and requested the Automotive Section, Fort Monmouth Signal Laboratory to make specific road tests and technical inspections.

The roadability of the loaded trailer was found to be good, although the center of gravity of the vehicle is high. This fact would contribute to easily overturning the trailer. The test load, evenly distributed sandbags weighing 5,000 pounds, would result in a rather abnormally low center of gravity for the loaded van.

The trailer exceeded the height limitation of 10 feet 6 inches prescribed by AR 850-15. The weight of the van empty is slightly over 5 tons, allowing only one ton for load if the 6-ton gross weight is not exceeded.

The Signal Corps Board concluded that no military need exists in the Signal Corps for this vehicle at the present time. It was found to be unsuitable in its present form and the following changes should be made in the event a military requirement develops:

1. The body made waterproof and dustproof.
2. The center of gravity be reduced to permit high-speed driving over rough terrain.
3. The overall height be reduced to conform to the specifications

set forth in AR 850-15.

The Signal Corps Board recommended that no further consideration be given at the present time to this vehicle for Signal Corps use.

Signal Corps Board Case No. 526 - Basis of Issue for Curtain, Gasproof, M1. Approved 20 July 1943.

Curtain, Gasproof, M1, is a fabric curtain having an outer impermeable fabric covering with wooden slats and weights attached, and is supplied by the Chemical Warfare Service. The present basis of issue being two per 20 individuals, or major portion thereof. Two of the curtains are used to gasproof the entrance to a gasproof shelter, such as a dugout, or a building lacking suitable wooden or metal doors.

Collective protectors now standardized or being standardized are intended to provide uncontaminated air to occupants of ventilated shelters during a prolonged gas attack.

This study was made for the purpose of determining the feasibility of restricting the Basis of Issue of Curtain, Gasproof, to Collective Protectors, M2, M3, and M4.

The Signal Corps Board concluded that until such time as Collective Protectors, M2, M3 and M4 are available in sufficient quantities to adequately protect combat and service troops from possible gas attacks, no change should be made in the present basis of issue. To restrict the basis of issue to protective collectors at present would subject troops to grave danger from gas attack with no provision for either standard or improvised gas shelters.

The approved recommendation in Case No. 526 provided that a copy of the report be forwarded to the Commanding General, Army Service Forces, recommending that until such time as collective protectors equipped with gasproof curtains can be made available in theaters of operation, the present Basis of Issue for Curtain, Gasproof, M1, be retained on Tables of Basic Allowance and Tables of Equipment for Signal Corps organizations under the control of the Army Service Forces.

Signal Corps Board Case No. 519 - Electrical Systems for Operation of Signal Corps Equipment in Truck, 1/4-Ton, 4x4 and

Signal Corps Board Case No. 519, Supplement I - Vehicular Battery Equipment for Radio Set SCR-193. Approved 28 July 1943.

Several Signal Corps Radio Sets require 12-volts D.C. for their power supply. Other radio sets can be made to operate on either 6 or 12 volts, but operate much more satisfactorily from a 12-volt supply.

The Signal Corps Board tested four types of 12-volt electrical systems installed in O-Trucks, 1/4-Ton, 4x4, to determine the most satisfactory system for use with vehicular radio sets.

The following 12-volt systems were tested:

1. A 55-ampere power take-off system independent of the starting and lighting system of the car.
2. A 26-ampere engine mounted generator with a 12-volt battery of the same dimensions substituted for the ordinary 6-volt battery.
3. A 50-ampere engine mounted generator with one 6-volt battery mounted in the cowl and one 6-volt battery mounted between the front seats.
4. A 40-ampere engine mounted generator with an additional 6-volt battery mounted under the cowl.

The equipment was tested for ability to meet maximum field requirements, interchangeability with existing field installations, freedom from maintenance or part failures, and the effect on performance and general utility of the vehicle.

The Signal Corps Board concluded that an urgent need exists for a 12-volt system for O-Truck, 1/4 Ton, 4x4 and that the 50-ampere system with two 6-volt batteries mounted between the front seats was the most satisfactory system.

The approved recommendations in this case were as follows:

1. The following components are most suitable for field conversion and factory production of a 12-volt electrical system for the standard O-Truck, 1/4-Ton, 4x4:

<u>a</u>. 12-volt starting, lighting and ignition parts
<u>b</u>. 12-volt 50-ampere generator (Ford Model GPA) including proper mounting brackets
<u>c</u>. 50-ampere regulator
<u>d</u>. Battery box to hold two type 2H batteries to be mounted between the front seats.
<u>e</u>. All necessary wiring and radio interference suppression parts.

2. Further development work is indicated to provide a fan belt satisfactory for driving the generator without slippage and without the need for frequent tightening.

<u>Signal Corps Board Case No. 527</u> - Test of Packboard, Plywood. Approved 30 July 1943.

The Quartermaster Corps has developed Packboard, Plywood, as a means for producing greater efficiency in the manual transport of equipment and supplies. It is designed to eliminate the hardship and discomfort of personnel, due to multiplicity of small items, or sharp corners, protuberances, and irregular dimensions of equipment. The use of the packboard was also considered a means of reducing physical strains and ruptures due to improper distribution of weight, and of allowing greater freedom for offensive or defensive action on the part of the carrier.

The Signal Corps Board tested the packboard and also examined them in the light of the special requirements of Signal Corps troops. The tests included severe abuse by dropping weights upon the boards, throwing them about roughly, immersion in water followed by sun drying, and special tests of the attachments for strength and utility.

The Signal Corps Board concluded that a military need exists for Packboard, Plywood, in the Signal Corps for use in special operations and emergency situations. It is of material value in increasing the efficiency of personnel when engaged in manually transporting Signal Corps equipment and supplies. It was also found that the use of Packboard, Plywood, materially reduces the physical discomfort and potential disability of personnel who may be required to transport Signal Corps equipment and supplies for extended periods of time.

The Signal Corps Board recommended that the Signal Corps representative on the Quartermaster Technical Committee be instructed to:

1. Approve standardization of Packboard, Plywood, when constructed in accordance with the specification under which samples Nos. 081 and 085 were procured, provided the design is modified to protect the tie-cords which are used to hold the canvas back-piece in place.
2. Communicate to the Quartermaster Technical Committee that the Signal Corps has no normal requirement for the special attachments for carrying five-gallon gasoline containers; however, if these attachments are required by other using arms, there is no objection to the issue of the attachments with the packboard, or as a component part.

It was also recommended that Packboard, Plywood, be made available to Signal Corps organizations for use when the necessity arises through a basis of issue to be determined by the Commanding Generals of the Army Ground Forces, Army Air Forces and Combined Task Forces; but that the Packboard, Plywood, not be placed on Tables of Basic Allowances and Tables of Equipment for Signal Corps organizations at the present time.

Signal Corps Board Case No. 534 - Test of Raincoat, Experimental, OQMG-T-140. Approved 4 August 1943.

The Signal Corps Board conducted a service test of Raincoat, Experimental, OQMG-T-140 which had been developed as a substitute for rain repellent garments coated with synthetic resin materials.

With the advent of war, sources of rubber have been seriously restricted, thereby necessitating the development of substitutes for rubber in the manufacture of raincoat materials. Raincoats made of synthetic resin materials are reasonably satisfactory at the present time, but lack the strength and wearing quality of the Raincoat, Rubberized.

The Quartermaster Corps developed the Raincoat, One-Piece Shoulder, Sleeve and Yoke as a partial means of overcoming strength deficiencies in the present Raincoat, Synthetic Resin Coated. Twenty-five raincoats were furnished by the Office of the Quartermaster General for service testing by officer and enlisted personnel to determine the value of the garment for Signal Corps use.

The Signal Corps Board concluded that the design of Raincoat, Experimental, One-Piece Shoulder, Sleeve and Yoke, is unsatisfactory for use in the Signal Corps and should not be established as an alternate construction in raincoat specifications. Further Quartermaster Corps raincoat design development work should be modified to provide:

1. Greater shoulder freedom at armpit (construction similar to G.I. field jacket).
2. New collar construction to permit water-tightness at throat. (Use of a drawstring or strap arrangement suggested.)
3. Protection against the entrance of water into the pockets, or, if this is not feasible, small drainage eyelets at bottom of raincoat pockets to permit collected water to drain down outside of coat.
4. Greater strength of buttons and buttonholes.

The Signal Corps Board recommended that the Signal Corps representative on the Quartermaster Technical Committee be instructed to disapprove:

1. Standardization of Raincoat, Experimental, One-Piece Shoulder, Sleeve and Yoke.
2. The inclusion of "One-Piece Shoulder, Sleeve and Yoke" construction as an alternate construction in raincoat specifications.

GROUND SIGNAL

HOW TO CARE FOR MICROPHONE T-45

While Microphone T-45 is more rugged than microphones commonly found in broadcasting stations or in commercial telephones, it nevertheless requires certain care if it is to give its best performance.

Microphone T-45 is a midget microphone, worn on the upper lip. The frequency response is 200 to 4000 cycles at normal altitude. To increase intelligibility, it is provided with a breath shield to act as a baffle against the puffs of air which would otherwise cause a rasping sound when such fricatives as "v", "f", "s" and "z" are pronounced. While the breath shields are removable, they should be left in place; taking them off and putting them on too often may cause them to break. However, two shields are provided with each microphone. While the shields are not 100 percent effective, they greatly increase the intelligibility of transmission. One point to watch when using the T-45 in a high wind or a moving vehicle is to face into the wind; otherwise wind blowing under the breath shield may cause a whistling sound on the circuit.

Under the breath shield, on the front and back of the microphone, there are openings. Ambient noise enters through both of these in equal volume and cancels itself, while speech enters the side nearest the mouth of the user with much greater intensity than it does the side away from the mouth. This differential in sound pressures operates the microphone. Both of these openings are provided with small elastic membranes which constitute a moisture seal. These membranes should never be touched. If they should become punctured or damaged through inadvertance, the microphone should be replaced as soon as possible.

With the sealing membranes intact, Microphone T-45 can stand total immersion for ten minutes without ill effect. When the droplets are shaken out of the speech openings, it is as good as new. However, in tropical climates, the high humidity often causes electrical equipment to perform less well than normally, so any extra care given T-45 under such conditions will be rewarded with longer trouble-free performance. If the microphone has suffered prolonged exposure to moisture, it is well to bake it gently for ten to fifteen minutes by putting it on the radiator of a car (NOT the engine block; that would be too hot!) in order to dry it out.

Normally this microphone generates a slight amount of heat, due to the current passing through it. If switched on for two or three minutes before each use, heating will help dry it out and thus improve performance.

The microphone proper is supported by a metal mounting bracket which has two upstanding metal arms. These arms should not be bent to any great degree, for they may be broken; they may be bent slightly to position the microphone directly opposite the lips of the wearer — the position which provides optimum performance — or to increase the wearer's comfort.

The carbon granules in the T-45 are maintained under slight pressure, so that the microphone will function in any position. For this reason, there is some tendency for them to pack when the T-45 has been lying unused for a long time, and sometimes when the current is first switched on. Therefore (although this will shock broadcasting station engineers), the T-45 should be tapped vigorously against the heel of the hand each time before it is put on, and occasionally should be tapped with the finger while in use, particularly if the output seems low. Tapping will generally produce a definite improvement. It will not cause the carbon granules to char, due to the constant pressure which is maintained.

If the care suggested in the previous paragraphs does not cause the microphone to function perfectly, it should be turned in for repair or replacement. Under no circumstances should any attempt be made to take apart the bakelite unit by removing the four screws which help to hold the two halves together. The case is also cemented shut, and any attempt to open it will probably ruin it beyond repair, for the interior is a precision assembly job, from which moisture is hermetically sealed. It is not designed to permit repair anywhere except at the factory, for the diaphragm is loaded on both sides with accurately measured carbon grains, which will spill out if the case is opened. These cannot be replaced in the field repair shops because special tools, found only at the factory, are needed.

ADJUSTMENT OF COMMERCIAL MODEL TELETYPEWRITER FOR TACTICAL USE

Reports from the field have indicated a need for some method of adapting the fixed signal circuits of commercial teletypewriters (such as Teletype Models 15 and 19) to the variable line conditions usually encountered in tactical applications.

A variable resistor, Stock No. 4T505000, which is now under procurement and will soon be available in depot stock, provides a simple and practical means of adjusting commercial teletypewriters to meet a variety of line conditions, such as those resulting from the use of simplexed field wire lines laid on the ground. This variable resistor is intended to replace the present 8000-ohm fixed resistor used in the line relay biasing circuit of Teletype Models 15 and 19, their physical dimensions and mounting facilities being identical. Installation can be accomplished in approximately 15 minutes.

Packed with each variable resistor, Stock No. 4T505000 is an instruction sheet and wiring diagram covering detailed procedure for installation and use.

For emergency operation in the event Stock No. 4T505000 is not available, any 5000-ohm, 25-watt variable resistor or rheostat may be used, mounted in a convenient location and connected as indicated in the above-mentioned instruction sheet, which is herewith quoted in its entirety, accompanied by the related wiring diagram.

Instructions for Installing Variable Resistor Stock No. 4T505000

The purpose of this variable resistor is to provide a means by which the relay biasing circuit in commercial type teletypewriters (such as Teletype Models 15 and 19) may be adjusted to compensate for variations in the spacing bias of signals, due to changes in line leakage and capacity to ground. Such changes are most likely to cause difficulty with neutral operation over simplexed field wires.

To install this resistor on Model 15 or 19 teletypewriters, remove the cover of the teletypewriter unit, and proceed as follows, with reference to the wiring diagram on the reverse side of this sheet:

1. Disconnect the spliced yellow wire and the jumper wire "A" which are connected to one end of the 8000 ohm fixed resistor "B" (located just below the relay mounting).

2. Remove the 8000 ohm fixed resistor "B" and install in its place the variable resistor, Stock No. 4T505000, the dimensions of which are adaptable to the mounting provided for the 8000 ohm fixed resistor.

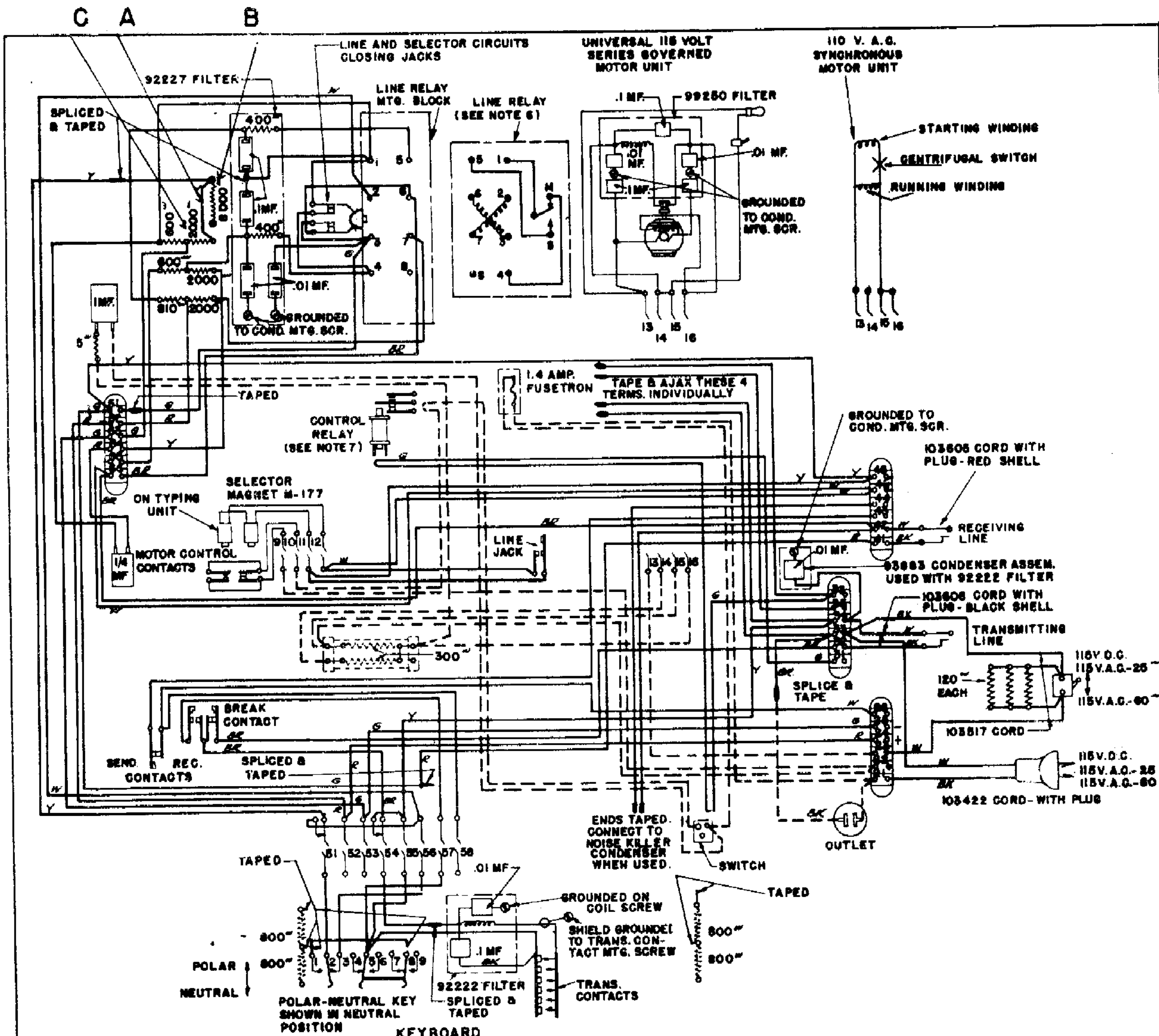
3. Connect the spliced yellow wire to one end of Stock No. 4T505000 resistor and the jumper wire "A" to its adjustable tap. (Use for this purpose the screws and nuts salvaged from the 8000 ohm fixed resistor just removed.) This arrangement will provide for variations in biasing current of from 12 to 27 milliamperes, by suitable adjustment of the variable resistor tap and will cover operation on low values of line current (up to 40 milliamperes).

4. If operation is to be with higher line current values (up to 60 milliamperes), connect a shunting jumper wire across the 2000 ohm section of the 2600 ohm resistor "C". (This resistor is located at the top of the relay bracket and is usually the one nearest the rear of the printer.) This arrangement will permit the variable resistor to adjust the biasing current to any value from 15 to 55 milliamperes.

5. CAUTION. There are two 2600 ohm resistors in the group located at the top of the relay bracket. It is important that the wiring be traced carefully, with reference to the diagram on the opposite side of this sheet, to correctly locate resistor "C". Shorting of the wrong 2600 ohm resistor will re-

sult in damage to the relay contacts and/or the selector magnet.

6. Operation. The variable resistor should be set at the point giving best reception of copy. This point may be



ACTUAL WIRING-15 PRINTER SET WITH KEYBOARD

easily located by moving the resistor adjustment toward one end (while receiving a test message) until errors appear, then moving the adjustment toward the other end until errors again appear. A setting midway between these points will be correct for the existing line conditions.

MINIMUM PERMISSIBLE VOLTAGE AT TIME OF ISSUE

SIGNAL CORPS DRY BATTERIES

Office of the Chief Signal Officer
Engineering and Technical Service
Ground Signal Equipment Branch

1 August 1943

COLUMN I Battery Type	COLUMN II Voltmeter Resistance Per Volt	COLUMN III Resistance (in ohms) In Parallel With Voltmeter	COLUMN IV Minimum Voltage Permissible Before Issue After 15 Sec. Discharge	COLUMN I Battery Type	COLUMN II Voltmeter Resistance Per Volt	COLUMN III Resistance (in ohms) In Parallel With Voltmeter	COLUMN IV Minimum Voltage Permissible Before Issue After 15 Sec. Discharge
BA-1	100	13.33	2.80	BA-42	100	7.5	1.40
BA-2	1000	2500	21.00	BA-43 (A Section)	1000	4.3	1.45
BA-8	1000	1250	21.75	BA-43 (B Section)	1000	7500	84.00
BA-9	100	20	3.90	BA-43 (C Section)	1000	40000	42.00
BA-15A	100	10	1.45	BA-44	100	3	5.60
BA-23	100	6	1.45	BA-48 (A Section)	1000	5	1.45
BA-26	1000	1000 ohms / 22.5 volt section	21.75 / 22.5 volt section	BA-48 (B Section)	1000	9000	84.00
BA-27	100	20	4.05	BA-49 (A Section)	1000	3	1.40
BA-28	100	50	4.20	BA-49 (B_1 Section)	1000	3000	63.00
BA-30	100	6.66	1.35	BA-49 (B_2 Section)	1000	3000	63.00
BA-31	100	20	3.90	BA-50	1000	12	2.70
BA-32 (A Section)	1000	7.5	2.90	BA-51	1000	2000	63.00
BA-32 (B Section)	1000	3600	134.40	BA-53	1000	3800	42.00
BA-32 (C Section)	1000	540	12.60	BA-56	1000	3500	42.00
BA-32 (K Section)	1000	90	4.20	BA-57 (A Section)	1000	4	1.40
BA-33	1000	15000	126.00	BA-57 (B Section)	1000	7500	84.00
BA-34	100	35	6.50	BA-58	1000	20	1.35
BA-35	100	6	1.45	BA-59	1000	1500	42.00
BA-36	1000	3000	42.00	BA-63	1000	3800	42.00
BA-37	100	5	1.40	BA-65	100	6	1.45
BA-38	1000	3000	95.00	BA-70 (A Section)	1000	8	4.35
BA-39 (A Section)	1000	37.5	7.00	BA-70 (B_1 Section)	1000	1290	84.00
BA-39 (B Section)	1000	3600	140.00	BA-70 (B_2 Section)	1000	860	56.00
BA-40 (A Section)	1000	2.3	1.45	BA-80 (A Section)	1000	8	4.35
BA-40 (B Section)	1000	2000	84.00	BA-80 (B_1 Section)	1000	1290	84.00
BA-41 (-A to +B_1 Terminals)	1000	25770	28.00	BA-80 (B_2 Section)	1000	860	56.00
BA-41 (-B_2 to + B_2 Terminals)	1000	54230	56.00				

DRY-BATTERY TESTING

A ready-reference chart of requirements for the testing of Signal Corps dry batteries to determine fitness for issue has just been released by the Engineering & Technical Service and is shown on opposite page. Intended for guidance of domestic depots, it may be used wherever proper facilities are available. Approximate values of resistors may be used for rough checking in the field, but the voltmeter resistances indicated in Column Two should be considered minima, in order to avoid excessive drains on the batteries.

Procedure for Testing

Following is the recommended procedure:

"Each battery which is to be investigated shall be tested with a voltmeter having an accuracy within 2-1/2 percent at full scale and having that resistance per volt which is shown for such battery in Column II of the following table. The resistor, shown for that battery in Column III of the table, shall be connected in parallel with the voltmeter. (The resistors should have an accuracy of plus or minus 0.5 percent for resistances up to and including 2500 ohms and of plus or minus 1.0 percent for resistances above 2500 ohms.) The leads of the voltmeter shall then be brought into firm contact with the terminals of the battery. If, at the end of fifteen seconds, the voltage is less than the voltage shown for that battery in Column IV of the table, the battery shall be rejected.

"Example: To test Battery BA-30, a voltmeter having a resistance of 100 ohms per volt (Column II) is connected in parallel with a resistance of 6.66 ohms (Column III), having an accuracy of plus or minus 0.5 percent. If, at the end of fifteen seconds of contact of the voltmeter leads with the battery terminals, the battery voltage is less than 1.35 volts, the battery is rejected."

Quantity Tests

The following table, which appears in Specification 70-21 governing Signal Corps dry batteries, indicates the number of samples to be taken from lots of various sizes for production control. It is reprinted here in order that it may afford some guidance to Depots, Sub-Depots, etc., where it may be desired to apply the tests outlined above.

Number in Lot	Total No. To be Tested	Number in Lot	Total No. To be Tested	Number in Lot	Total No. To be Tested
1 to 10	All	1501 to 2000	8	3501 to 4000	16
10 to 50	2	2001 to 2500	10	4001 to 4500	18
51 to 100	4	2501 to 3000	12	4501 to 5000	20
101 to 1500	6	3001 to 3500	14	5001 to 5500	22

(Cont'd) Number in Lot	Total No. To be Tested	Number in Lot	Total No. To be Tested	Number in Lot	Total No. To be Tested
5501 to 6000	24	20001 to 25000	46	100001 to 125000	68
6001 to 6500	26	25001 to 30000	48	125001 to 150000	70
6501 to 7000	28	30001 to 35000	50	150001 to 175000	72
7001 to 7500	30	35001 to 40000	52	175001 to 200000	74
7501 to 8000	32	40001 to 45000	54	200001 to 250000	76
8001 to 8500	34	45001 to 50000	56	250001 to 300000	78
8501 to 9000	36	50001 to 60000	58	300001 to 400000	80
9001 to 9500	38	60001 to 70000	60		
9501 to 10000	40	70001 to 80000	62	Plus 2 batteries for each additional 100000 in lot	
10001 to 15000	42	80001 to 90000	64		
15001 to 20000	44	90001 to 100000	66		

CHANGING ANTENNA SILHOUETTE

In a paragraph under the heading "Radio Sets SCR-509, SCR-510, SCR-609 and SCR-610," on page 48 of the July 1943 issue of SCTIL, it was stated that instances are known where sections of antenna were removed when a low antenna silhouette was required, thus detuning the transmitter and overloading the output tubes, with a consequent reduction in tube life. "The issuance of 15 feet of Rope RP-5 and fittings for tying down the antenna, instead of removing sections, is planned," the paragraph concluded.

This statement has aroused some comment, readers pointing out that changing the vertical angle of the antenna would cause some detuning also. This is realized by the Ground Signal Equipment Branch, which explains that the primary purpose of the rope is to tie the antenna down while the vehicle in which the set is installed is in motion; the antenna can be erected much more quickly by merely releasing the rope than it could have been were the replacement of removed sections necessary. Further, when the set is operated under trees, less detuning will result from drawing the antenna slightly from the vertical by means of the rope than from removing sections, and tube life will consequently be prolonged. Of course, optimum performance can be expected only when the set is operated with the antenna in the position for which it was designed.

VARIATIONS IN FACSIMILE EQUIPMENT RC-120 AND ALTERATIONS IN TECHNICAL MANUAL

Facsimile Equipment RC-120 is a transceiver intended for use on wire lines. It sends or receives page copy, reception being accomplished by either of two processes: the use of a chemically sensitized paper, discolored by modulated current passing from a stylus through the paper to a revolving drum; and a photographic process, wherein a modulated spot of light is directed on photographic film or paper carried by the revolving drum. The photographic process, obviously, must be carried out in darkness, which is achieved either through the use of a darkroom or of Bag BG-140, a sort of changing bag which encloses the mechanism but permits the insertion of the operator's hands without admitting light.

When the equipment is in operation, the operator must make frequent observations of a db meter. This meter is mounted on the panel of the Facsimile Receiver FX-1 (part of Facsimile Equipment RC-120) and is concealed when Bag BG-140 is in use.

In early models of RC-120, a separate meter, with long leads, was provided for use under these conditions; in later models, the panel meter was made readily removable and provided with long leads, so that it could be brought outside BG-140. In this way, one meter was made to do the work of two in each equipment. The technical manual, TM 11-375, was quickly modified to take care of the changed equipment, but no change was made in the TM number, nor the publication date appearing on the cover. Therefore, some operators of the older equipment may have been issued the newer TM, and vice versa.

The following will explain why certain paragraphs which appear in the older TM are omitted from the newer one and will give corrections which have been made in the later printings of the TM. It should be noted, as well, that a new technical manual for Facsimile Equipment RC-120 is in preparation and should be available for distribution within a few months.

The following references apply to either of the printings of TM 11-375:

Paragraph 2j, omitted from the newer book, covers the external db meter, which is not included with the newer RC-120.

Paragraph 4b, same as above.

Paragraph 4f calls for 2 pads of message paper in the older printing and for 3 pads in the newer one.

Paragraph 5d (1)(b) in the old book gives instruction for putting the external db meter in operating position. This is omitted from the new book. However, the method is similar to that described in Paragraph 5d (1)(c) in the new book.

Paragraph 5d (1)(c) in the new book states: "Remove the db meter from the front panel of the transceiver by loosening the two thumb nuts on the meter case. Lift the meter from the hole. Put the meter through the sleeve in the top of the tent and tie the draw string tight to make the hole light-proof."

In the old book, this paragraph covers power connections, stating, "Place the transceiver on the bottom of the tent and insert the power cable and coupling device lead through the sleeve on the right side of the bottom. Draw the tie-cord tight to make the sleeve light-proof."

Par. 5d(1)(d) in the new book omits the sentence which says, "Plug in the external meter by placing your hands through the hand-and-arm sleeves."

Paragraph 6b(7) in the new book omits the line which calls for a check of the panel db meter with the external db meter, when operating under extremely hot conditions.

Paragraph 7a(2) in the new book adds a reference to Paragraph 5d(1)(c) but is otherwise unchanged.

Paragraph 7c(3) adds a reference to Paragraph 5d(1)(c), as above.

Paragraph 8a(2)(c) is clarified by substituting the words "For photograph recording as a positive..." for "For direct recording as a positive paper..."

Paragraph 10a(1)(e) has been corrected in the newer printings to specify the output impedance of most Army radio sets as approximately 4000 ohms, and to recommend the use of a 4000-to-600 ohm transformer to match this output to the input of the facsimile transceiver.

Paragraph 11 — The CAUTION note has been changed to refer to Power Supply PE-140, instead of PE-150.

Paragraph 11b now correctly makes reference to Figure 7, which illustrates the transmitter optical system, instead of to Figure 9, as in the old book.

Paragraph 11c calls for a hydrometer reading of 1.250 on the battery when PE-150 is used, instead of the lower reading previously specified.

Paragraph 13g now mentions capacitor C3 correctly as a decoupling capacitor rather than a coupling capacitor. However, in reprinting the paragraph, the positive (+) sign has accidentally been dropped from RB+, at the end of the final sentence. This sign should be restored.

Paragraph 15d(2) — The next to last sentence of this paragraph has been corrected to refer to the replacement of the 7L7 or 7C5 tubes. "7C7" should be changed to "7L7" in older printings of the TM.

Paragraph 15f(2) — In the last sentence of this paragraph, "defective 7C7's" has been changed to "defective 7C5's." This change should be made in older printings.

Paragraph 15h has had a note added, as follows: "NOTE: The neon lamp in Facsimile Transceiver FX-1 and Power Supply PE-140 is used as a voltage regulator. On serial number 116 and higher, this lamp has been changed to Sylvania Voltage Regulator R-1160, and resistances R2 and R81 have been increased in value. When replacing a voltage regulator (neon) lamp in Facsimile Transceiver FX-1, follow the instructions for shunting R1 and R2 in Paragraph 15h."

Paragraph 16b has had its seventh sentence changed to refer to replacement of "neon bulb, 7L7, or 7J7." The 7C7 mentioned in early printings should be changed. An explanation of component changes has been inserted in this paragraph, as follows: "The 7J7 tube (241), used as input and mixer tube in Power Supply PE-140, is being discontinued and replaced in the spare parts by a 7S7. These two tubes are directly interchangeable in Power Supply PE-140 without modifications or circuit changes. The 7S7 tubes in the spare parts are labeled: 'This 7S7 Vacuum tube is to be used as a replacement for vacuum tube 7J7 in Power Supply PE-140'."

Paragraph 17f has had its last sentence, referring to the external db meter, deleted.

Paragraph 19a and b have had the words "1000 ohms per volt" added following "all readings are from ground."

Paragraph 20, Table of Replaceable Parts," has been expanded approximately 25 percent in later printings of TM 11-375, and now affords far better descriptions of minor components which might have been difficult to identify from the earlier descriptions.

Replacement of Voltage Regulator Lamp

Voltage Regulator R-1160 used in FX-1 and PE-140 will glow regardless of polarity, but it must be properly poled for correct regulator action. The base sockets are not polarized; therefore, it is necessary, when making a replacement, to determine the positive and negative terminals of each in order to insert the lamp with the polarity matched. The lamp will be supplied with one terminal marked "Positive" (+) and the polarity of the socket must be determined by a voltmeter measurement.

With a voltmeter, measure the voltage across the contacts of the socket with the lamp inserted to determine the positive and negative leads to the socket.

Turn off the power and reverse lamp in socket, if necessary to make the positive terminal of the lamp contact the positive terminal of the socket.

Replacement of a neon lamp in the FX-1 will sometimes result in RB+ (Regulated B+) higher or lower than the required 240 to 350 volt range. Resistors R1 and R2 shall be adjusted as directed in paragraph 15h of TM 11-375. Instructions given in paragraph 15h to reverse the position of the lamp in its socket shall be disregarded.

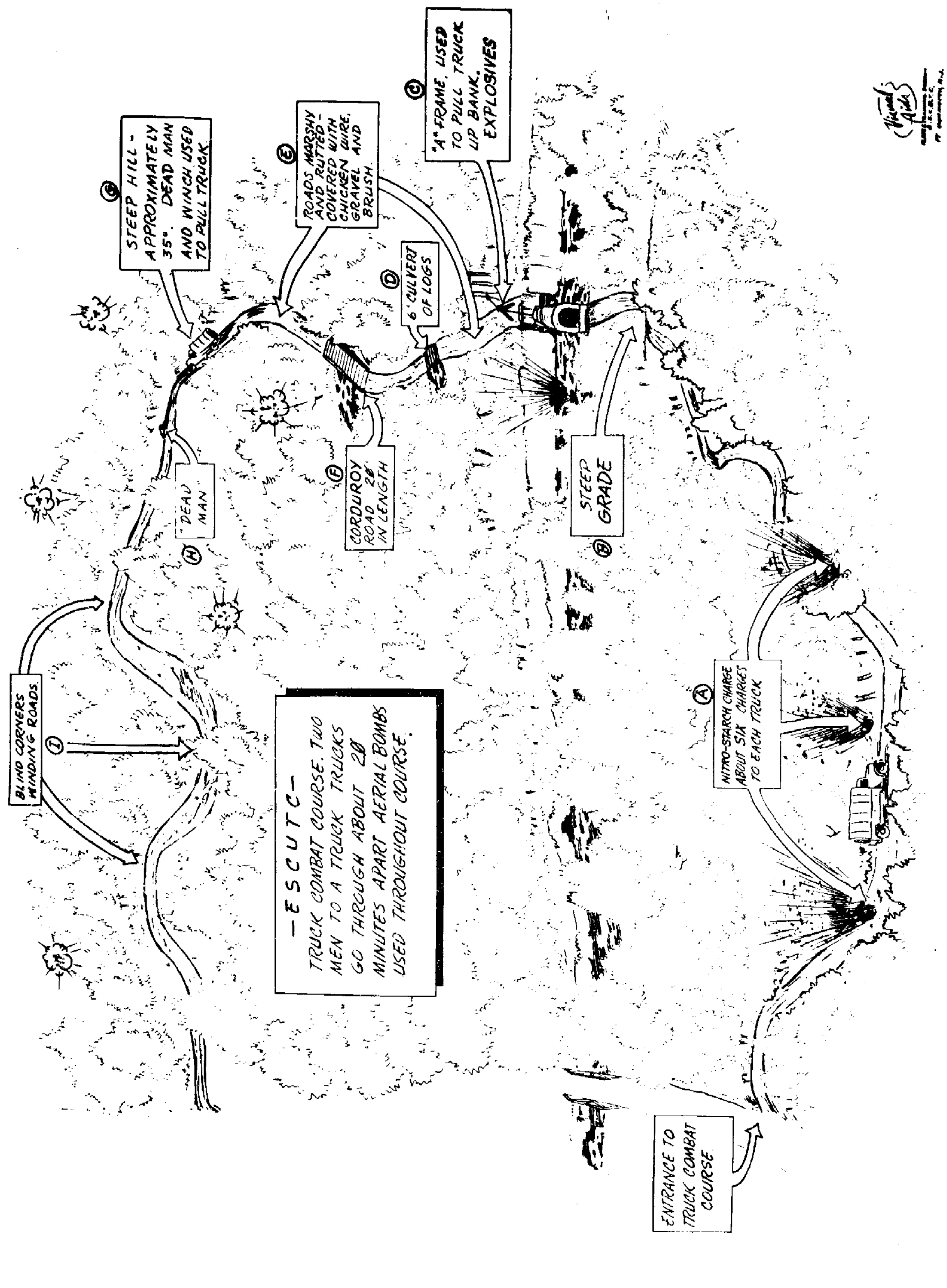
Replacement of a voltage regulator lamp in the PE-140 will sometimes result in poor regulation and incorrect voltage across the exciter lamp. The voltage across the exciter lamp may be corrected by the following procedure:

1. Operate FX-1 on well charged battery and turn to "Set Range Position."
2. With dip on black and 0 db on white, turn to the white of the phasing ring.
3. Turn off FX-1, remove battery and plug in PE-140.
4. Without moving any dials of FX-1, turn on power. Adjust R82 and R91 of PE-140 until db meter reads plus 1 db.

To correct regulation set up as in Step 4 above. The reading should not vary more than 1/2 db when the input voltage of the PE-140 is varied slowly or rapidly from 100 to 130 volts. To adjust the regulation, vary R91 and R82, always bringing the meter back to plus 1 db.

The latest published issue of TM 11-375 for Facsimile Equipment RC-120 contains all the alterations cited above; the earliest issue contains none of them. There was, in addition, an intermediate issue bearing the same TM number and date, which contained several of these changes, plus a number of others which have since been deleted.

An additional deletion, not shown in any of the versions, should also be made. In Paragraph 5d, the words "or as a transmitter" should be struck out of the sentence, "When the transceiver is to be used as a receiver or as a transmitter on which copy will be received photographically, some form of darkroom will be necessary."


BLIND CORNERS WINDING ROADS.
(I)
— E S C U T C —
TRUCK COMBAT COURSE. TWO MEN TO A TRUCK. TRUCKS GO THROUGH ABOUT 20 MINUTES APART. AERIAL BOMBS USED THROUGHOUT COURSE.
(H)
"DEAD MAN"
(G)
STEEP HILL - APPROXIMATELY 35°. DEAD MAN AND WINCH USED TO PULL TRUCK.
(F)
CORDUROY ROAD 20' IN LENGTH
(E)
ROADS MARSHY AND RUTTED - COVERED WITH CHICKEN WIRE, GRAVEL AND BRUSH.
(D)
6' CULVERT OF LOGS.
(C)
"A" FRAME, USED TO PULL TRUCK UP BANK. EXPLOSIVES
(B)
STEEP GRADE
(A)
NITRO-STARCH CHARGE ABOUT SIX CHARGES TO EACH TRUCK
ENTRANCE TO TRUCK COMBAT COURSE

MILITARY TRAINING

COMBAT DRIVING COURSE

Truck drivers at the Eastern Signal Corps Unit Training Center are now going to the field steeled against the shock of initial contact with the enemy by the experiènce of piloting their vehicles through rugged terrain obstacles under simulated combat conditions.

Much of the combat driving course is a heavily wooded area which was untouched terrain before the Motor Vehicle Division, Plans and Training Section. laid out the narrow winding road.

The situation is set up as a tactical problem (illustrated opposite) and explained to the student drivers as follows:

Lieutenant X, in charge of the supply convoy proceeding from Corps to Division, discovers that the route makes it necessary to cross a field that is being shelled by indirect fire of light German artillery. He assembles his drivers and tells them that the convoy will cross the field, one vehicle at a time, at intervals of 20 minutes. The point of dispersal is indicated to the drivers on the lieutenant's map. Leaving Sgt. Y in charge of the convoy for the purpose of dispatching, he proceeds with the lead vehicle across the field under "shellfire." (Illustration A - 1-lb. nitro-starch charges, detonated automatically by trip wires, shower dirt and debris upon the truck.)

At the assembly point on the far side of the field, Lieutenant X descends a 45 percent slope (Illustration B), reconnoiters the route, and finds that a stream must be forded. The far bank of the stream, however, is too steep and slippery to be negotiated by normal means, so he constructs an "A" frame which is attached to each truck winch and overcomes the obstacle. During this operation, enemy "mortar fire" upon the water throws a curtain of spray upon the men. (Illustration C - two 1-lb. nitro-starch blocks, planted in stream, detonated by remote control.)

Further reconnaissance discloses that soft ground and steep grades are ahead and only careful driving and the use of assistant drivers will make the area passable. Successive vehicles are warned. Soft spots are covered with chicken-wire, gravel, and brush; deep ruts are filled with branches (Illustration E - work done on the spot); a 6' culvert of logs is crossed and a corduroy road, 20' in length, is carefully negotiated (Illustrations D and F - permanent installations).

A 35 percent grade is encountered, and the lieutenant finds it necessary to use a "dead man" and winch operation to climb the slippery slope (Illustration G - "dead man" permanently installed). Still separated by 20-minute intervals, the trucks complete the run by following a winding dirt road, while aerial bombs burst overhead and resound across the entire area of the course. (Illustration I - Aerial Salutes, 5-sec. delay, 3-in.)

It requires approximately an hour to send a truck across the combat course. Five cadre men set and control the charges. Each of these men has received thorough instruction and practice in his particular job and the necessary safety measures.

One driver remarked upon completing the run, "After the first few explosions, you figure you can't tell where the next one's coming from, so you steady your nerves, shoot straight ahead and hope for the best." That about sums up the attitude instilled in all men by the combat driving course.

SPECIALIZED TRAINING FOR OFFICERS

Because the schooling of a soldier is a continuous part of his army life, a new continuing training program has been established for the officer cadre at the ESCUTC. Previous officer training consisted of a series of weekly one-hour presentations of a non-sequential variety of subjects. In contrast with this, the new series offers six five-hour courses which are designed to familiarize officers, in groups of thirty or less, with a specific field.

Aimed at the dual objective of improving officers' qualifications for their present assignments and preparing them for the variety of demands made by the exigencies of war, the following courses are included:

1. Administration and Supply
2. Message Center Operation
3. Wire Communication
4. Radio Communication
5. Wire Line Communication
6. Motor Transport

Subjects were announced in advance and officers were required to indicate their first, second and third choices. It was found possible to give everyone either his first or second choice; and, since upon the completion of one subject an officer immediately enters another, all three choices will be covered within a period of fifteen weeks.

The problem which looms largest in such training is, of course, that of limited time versus extensive subject matter. After a detailed investigation, it was decided that each of the five one-hour lessons in a given subject would be presented by a different officer from the school division concerned, and that the five hours would be integrated and supervised by the officer in charge of the school. This meant, first, that each officer would be able to devote ample time to preparation and rehearsal of his one-hour presentation, to secure the necessary training aids and to organize his non-commissioned assistants. It also meant that no officer would miss more than one hour of the class he himself was attending.

Complete training guides were immediately prepared by the schools in collaboration with the Training Standards Division, Plans and Training Section. Individual officers were given assignments with instructions to cover material thoroughly and intensively with maximum utilization of the demonstration and performance methods of training.

During the first week of the school majors were found digging holes for poles and captains were seen peering down into the gears of a cut-away truck chassis. It is anticipated that, upon completing each subject, an officer will have sufficient background in that field not only to pursue further useful study on his own time but also to direct such activity in an emergency.

NEW PUBLICATIONS

The following new field manuals and technical manuals of particular interest to the Signal Corps have been published and may be obtained through regular Adjutant General channels:

TM 11-630, Radio Set SCR-506-A, February 1943
C1, TM 11-302, Charging Set SCR-169, 12 May 1943
FM 24-13, Air Extract of Combined Operating Signals, 30 June 1943
FM 24-22, Combined Visual Signaling (V/S) Procedure, Short Title - C.C.B.P. 5, 12 May 1943
FM 24-23, Combined Visual Signaling (V/S) Procedure, Short Title - C.C.B.P. 6, 12 May 1943.

NEW FILM STRIPS

Telephone Central Office Set, TC-4

Three film strips on the Telephone Central Office Set, TC-4, have been produced by the Signal Corps. Illustrated Instructor's Reference Books will be published. The following is a brief resume of the subject material contained in each strip:

FS 11-25 - "Telephone Central Office Set, TC-4, Part I, Introduction," covers the component parts and weights, the general features and capabilities of the TC-4, the features of Switchboard BD-96 and Panel BD-97.

FS 11-26 - "Telephone Central Office Set, TC-4, Part II, Installation and Maintenance," depicts the general conditions in selecting a suitable site, setting up the switchboard, setting up the panel, connecting the ringing power, mobile installation, inspecting and testing, and operator maintenance.

FS 11-27 - "Telephone Central Office Set, TC-4, Part III, Operation," shows local battery calls, ringing-off supervision, common battery trunk calls, dial calls, conference calls, use of night alarm circuit, dual operation at the single position and grouping of switchboards.

Truck K-44-B and Earth Borer Equipment HD

The Signal Corps has produced two film strips on the "Truck K-44-B and Earth Borer Equipment HD." Supplementary notes in the form of Illustrated Instructor's Reference Books will be published to accompany the strips. The following is a brief resume of the subject matter in each film strip:

FS 11-20 - "Truck K-44-B and Earth Borer Equipment HD, Part I, Introduction and 1st Echelon Maintenance," introduces the component parts of Truck K-44-B and Earth Borer Equipment HD and shows the proper lubrication of Earth Borer Equipment HD.

FS 11-21 - "Truck K-44-B and Earth Borer Equipment HD, Part II, Operation," shows the successive steps in the operation of the Truck K-44-B and Earth Borer Equipment HD and includes some safety precautions.

Rhombic Antennas

Two film strips on "Rhombic Antennas" are available.

FS 11-15 - "Rhombic Antennas, Part I, Engineering Principles of Rhombic Antennas," covers the engineering principles of rhombic antennas. An Illustrated Instructor's Reference Book will be published to accompany the film strip.

FS 11-16 - "Rhombic Antennas, Part II, Erection of Rhombic Antennas." The major steps involved in erecting a rhombic antenna, such as unloading equipment, digging post holes, installing wires, and guying poles are shown in this strip.

Maintenance of Field Wire Circuits

Three film strips on "Maintenance of Field Wire Circuits" have been recently produced.

FS 11-22 - "Maintenance of Field Wire Circuits, Part I, Prevention of Trouble," covers steps used in the prevention of trouble on field wire lines. It points out the three hazards which must be considered — friendly troops, enemy troops, and the elements.

FS 11-23 - "Maintenance of Field Wire Circuits, Part II, Detection of Trouble," shows kinds of trouble, probable locations and testing methods

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and procedure. It provides a visual aid to teach the use of the field telephone as a testing device on field wire circuits.

FS 11-24 - "Maintenance of Field Wire Circuits, Part III, Localization and Correction of Trouble," covers procedure in localizing and correcting trouble, and shows how coordinated effort, based on line installation records, will restore service with the least possible delay.

TRAINING FILMS AND FILM STRIPS

Following are listed training films and film strips pertaining to Signal Corps activities. All items listed were available as of August 1. Those marked with an asterisk (*) are new ones distributed during June and July.

TRAINING FILMS

TF No.	Title	Running Time (Minutes)
11-157	Military Courtesy and Customs of the Service	26
11-168	The Basic Principles of Skiing	38
11-177	Basic Signal Communication - Field Wire Splices	21
11-178	Basic Signal Communication - Field Wire Ties	9
11-184	Conduct of Physical Training	30
11-205	Safeguarding Military Information - Cryptographic	21
11-225	Interrogation of Prisoners	37
11-235	Articles of War	47
11-257	Care and Maintenance of Tapered Roller Bearings	31
11-262	Point Control of Traffic	26
11-274	Pistol Bullseyes	20
11-296	Techniques and Mechanics of Arrest and Search of Persons	69
11-297	Basic Signal Communication - Field Wire Line Construction	20
11-298	The Mitchell Camera	17
11-321	Combat Counter Intelligence	20
11-324	Safeguarding Military Information	12
11-325	Safeguarding and Proper Handling of Classified Materiel	18
11-382	Know Your Enemy	44
11-383	Friend or Foe	55
11-397	Basic Signal Communication - Field Wire Laying Equipment	20
11-551	The Motor Vehicle Driver - Responsibility Nomenclature, Fire Regulations, Accident Prevention	25
11-552	The Motor Vehicle Driver - Hand Signals, Road Rules and Regulations	13
11-553	The Motor Vehicle Driver - Elementary Driving Instruction and Inspection	25

TF No. (Cont'd)	Title	Running Time
11-554	The Motor Vehicle Driver - Difficult Driving	18
11-555	The Motor Vehicle Driver - Traction Aids and the Winch	27
11-556	The Motor Vehicle Driver - Map Reading	9
11-557	The Motor Vehicle Driver - Marching and Night Driving	21
11-558	The Motor Vehicle Driver - First Echelon Maintenance	35
11-559	The Motor Vehicle Driver - Loading, Trouble Shooting, Reports, and Vehicle Abuse	27
11-590	Climbing and Working on Poles	15
11-621	Care and Release of Pigeons in the Field	10
11-622	Electricity and Magnetism - Part I - Elements of Electricity	14
11-629	Radio Set SCR-270 - Locating and Reporting Targets	18
11-671	Message Center Procedures - Part I - Outgoing Messages	19
11-691	Description and Use of the Converter M-209-A	25
11-951	Pole Line Construction - Part I, Erecting Telephone Poles	18
11-952	Pole Line Construction - Part II, Installation of Cross Arms	9
11-968	Pole Line Construction - Part III, Installation of Special Cross Arms	13
11-1064	Message Center Procedure - Part II, Incoming Messages	10
11-1069	Pole Line Construction - Part IV, Fundamentals of Guying	10
11-1070	Pole Line Construction - Part V, Installations of Anchors	9
11-1071	Pole Line Construction - Part VI, Installation of Guys	10
11-1082	Oscilloscope Target Interpretation	13
11-1088	Pole Line Construction, Part VII, Stringing Open Wires	18
* 11-1159	Field Wire Boom Equipment	21

FILM STRIPS

FS No.	Title
11-3	Film Strip Preparation
11-4	Operation of Motion Picture Projectors - Part 1, 16mm Bell and Howell
* 11-5	Operation of Motion Picture Projectors - Part II, 16 mm AMPRO
* 11-6	Operation of Motion Picture Projectors - Part III, Portable 16mm RCA
* 11-7	V... Mail
11-8	Elementary Speed Graphic Operations
11-9	Radio Sets SCR-608 and SCR-628 - Part I, Introduction
11-10	Radio Sets SCR-608 and SCR-628 - Part II, Installation
* 11-11	Radio Sets SCR-608 and SCR-628 - Part III, Operation
11-12	Radio Sets SCR-608 and SCR-628 - Part IV, Presetting Radio Transmitter BC-684
11-13	Radio Sets SCR-608 and SCR-628 - Part V, Presetting Radio Receiver BC-683

MILITARY PERSONNEL

WAAC SIGNAL CORPS TRAINEE PROGRAM DISCONTINUED

Women's Army Auxiliary Corps Headquarters informed Military Personnel Branch that all Service Commands were directed on 17 July 1943 to discontinue immediately the enrollment of women under the WAAC Signal Corps Trainee Program. All WAAC civilian training classes are to close prior to 30 September 1943 and women who have enlisted in the WAAC Signal Corps Trainee Program are not to be enlisted in the new Women's Army Corps while they are in school. This action by WAAC Headquarters was due to the fact that no provisions were made in the new legislation setting up the Women's Army Corps for inactive duty status for WAC personnel, and consequently reserves in the WAC are considered illegal. Girls who are currently enrolled in the WAAC Signal Corps training classes may enlist in the WAC as soon as they have completed their courses as mechanic learners, and it is believed that the Signal Corps will have first choice of those who come into the WAC, thus placing the skills and qualifications of such enrollees at the disposal of the Signal Corps for the purpose of replacing enlisted men. Proposal is now being made of a substitute plan whereby WACs may choose the Signal Corps as their branch of service and be earmarked for communications training in the WAC, thereafter to be assigned to signal duty. WAC Headquarters favors this substitute plan and the benefit to the Signal Corps will be the fact that high caliber, technically trained WACs may become available for replacement of Signal Corps enlisted men who are now performing specialized communications duty.

STATUS OF MILITARY PERSONNEL UNDER JURISDICTION OF THE CSigO

As the manpower situation of the Nation became more and more acute, the Commanding General, ASF, informed the War Manpower Commission and all activities under his command that a reduction of one hundred five thousand people would be effected as soon as possible, including both military and civilian personnel. The Chief Signal Officer, in accordance with this directive took a cut of 20 percent in military personnel in Washington and a substantial reduction of 20 percent in both civilian and military personnel on duty in the field. The deadline for the accomplishment of this reduction was set for 30 September 1943 in Washington, and 31 August 1943 in the field.

General Somervell stated in one of the directives relating to this reduction in personnel, "It is my desire that you provide for future needs by readjustment within your present authorized strength and by curtailment of all activities, however desirable, which are not essential to your mission. It is not expected that increases of any kind will be requested unless there is a decided change in requirements and missions."

In order to comply with the letter and the spirit of these directives, certain civilians were relieved from duty and a certain number of officers were transferred out of their present assignments. In order to effect the reduction with the least disruption of essential activities, representatives of Military Personnel Branch and Civilian Personnel Branch met with the Chiefs of Services and formulated new personnel authorizations for issuance to all activities under the Chief Signal Officer. In this way, it was possible to take advantage of the economies in operation and increased efficiency resulting from surveys and recommendations made during the past ten or twelve months in accordance with directives from the Commanding General, Army Service Forces, on work simplification, decentralization of authority to act, improvement of reporting and record systems, and other projects designed to effect the maximum utilization of personnel with the minimum of operations and the utmost in efficiency.

Military Personnel Branch is coordinating activities of the Signal Corps in order to make the readjustments indicated by the Commanding General, Army Service Forces. These activities include making provisions for the reclassification of officers and determination of action to be taken in the cases of unsatisfactory performance of duty.

DISPOSITION OF SURPLUS OFFICERS IN REPLACEMENT POOLS

As a result of a review made by ASF of the surplus officers in the various arms and services under ASF, plans are being made for the transfer of officers from Signal Corps Officer Replacement Pools to the Corps of Engineers and the Transportation Corps where shortages now exist. Arrangements have been made with the Transportation Corps to transfer approximately sixty officers now assigned to the various Signal Corps Officer Replacement Pools, who appear to be more fully qualified for Transportation Corps than for Signal Corps duties. Review is being made of the records of those officers in the pools, regardless of grade, who have sufficient qualifications in the field of transportation to merit their transfer. Transfers to the Corps of Engineers for certain combat and service Engineer units will be effected by calling for volunteers among 1st and 2d lieutenants assigned to Signal Corps Officer Replacement Pools.

The actual selection of these officers will be made by representatives of Military Personnel Branches of both the Corps of Engineers and the Signal Corps. Opportunity will be given to all pool officers to volunteer for transfer to the Corps of Engineers under this program, although those who have one or more years of civilian experience in the communication field or in electrical manufacturing, or have three or four years of college work in electrical engineering, electronics, physics, or communications engineering will not be considered eligible for transfer. All engineer reserve officers and those whose civilian experience does not include Signal Corps specialties, and thus are considered to be of more value to the Corps of Engineers than the Signal Corps will be included, as well as members of Officer Candidate School graduating classes, and graduates of the following Company Officer's Courses: Fundamentals of Electricity, Field Wire, Motor Transport, and Long Lines Outside.

These provisions are made in order to effect the transfers to both the Corps of Engineers and the Transportation Corps with the utmost impartiality and justice. Volunteers are requested for the Corps of Engineers, inasmuch as their needs represent a sizable number of officers for certain combat and service units. In any event, records of the officers concerned are to be reviewed by Military Personnel Branch and, based upon the qualifications of the officers in question, such transfers will be authorized according to the best interests of the service.

PROMOTIONS OF OFFICERS UNDER JURISDICTION OF THE CSigO

In addition to the restrictions concerning time in grade required for promotion of officers to the grades of Colonel and Lieutenant Colonel (a minimum of nine months in grade for Lieutenant Colonel, and a minimum of twelve months in grade for promotions to Colonel) as stated in the August issue of the Signal Corps Technical Information Letter, the Chief Signal Officer directed that a temporary ban on all promotions to and in field grade be put into effect for all agencies and activities under his jurisdiction. This ban curtailed all such promotions between 28 June 1943 and the latter part of August, due to reductions in personnel and the necessary clarification of allotments to the field. New allotments are now being issued for both officers and civilians, with the result that promotions which have been held up will soon be released, provided that they conform to the new regulations. Inasmuch as promotions to the grades of Colonel and Lieutenant Colonel could not be made as long as officers needed in these grades were on duty at Signal Corps Officer Replacement Pools, surveys are being made in order to determine how many of these officers can be utilized to fill vacancies for which promotions were requested. Continued emphasis is to be given to more effective utilization of field grade officers on duty at Signal Corps Officer Replacement Pools, and present regulations and directives will inevitably result in a sizable reduction in the number of promotions to be given in the future. Each headquarters is also directed to submit a monthly report through channels to the Commanding General, Army Service Forces, beginning August 1943, of the number of Colonels and Lieutenant Colonels under their jurisdiction assigned to officer pools or who are surplus, including those attached to units, carried in overstrength, or otherwise carried. Data to be submitted for these officers will include name, grade, serial number, arm or service, age, present assignment, experience and qualifications in brief. This report will assist in the proper disposition of surpluses and assure the correct placement of qualified field grade officers under the jurisdiction of the Chief Signal Officer.

PROMOTIONS

The following promotions have occurred among Signal Corps personnel from reports received during the period of 16 July 1943 to 12 August 1943:

Lt. Col. to Colonel (Temporary)

Byrne, Thomas Francis
Duffy, Marcellus
Millar, Julian Zimmerman
Vanderblue, Charles Sherlock

Major to Lt. Col. (Temporary)

Chamberlin, Henry Reed
Dias, Arthur Francis
Dunklee, Carl Otis
Steele, Clayton Sorensen

Captain to Major (Temporary

Addington, James Roland
Akin, Leroy
Borgman, Theodore Joseph
Bowman, Ralph Oliver
Bradford, Ivan Earl
Brown, Horace Dwight
Brown, Richard Alphonsus
Callahan, William George
Cauble, Gordon B.
Christofk, Robert Richard
Colinan, George Harper
Crawford, John
Dean, John Randolph
Dorsey, William Rinaldo, Jr.
Farinholt, William Wortham
Fitchie, Robert George, Jr.
Fite, Randolph Victor
Fitzgerald, Thomas Frederick
Gardner, Lyman Spencer
Giles, George Hartwell
Godfrey, J. W.
Gould, Gordon Thomas, Jr.
Greulich, Richard Alan
Hampton, Virgil Howard
Haynes, Daniel Guilford
Hendricksen, Ralph Eugene
Hulley, John Richard
John, Arthur Robert
Johnson, Russell Earl
Kromann, Alvin Delmar
MacCartney, John William
McAllister, Cecil Michael
Mitchell, Gordon Sylvester
McClintock, Donald Wilbur
Morang, Raymond Edward
Norton, John Edward
O'Prey, Nicholas J.
Popkess, George Edwin, Jr.
Prentiss, Harry Alvin
Pugh, Thomas Arden
Raney, Maynard Clayton
Reed, James Rufus
Rich, Gerald Charles
Rogers, James Milton
Scanlan, John Maurice
Schmitz, Arthur Hugh
Sunderland, Paul Ulysses, Jr.
Sweeney, John Patrick
Timmens, Daniel Mathias
Tresham, Edward Vincent
Weggenmann, William Smith
Wetzel, John Hubert

RETIREMENT OF OFFICERS OVER SIXTY YEARS OF AGE

Instructions have been received from The Adjutant General to retire as of 30 September 1943, or thereabouts, all officers on duty with the Signal Corps who are over 60 years of age. Accordingly, all officers under the jurisdiction of the Chief Signal Officer who have reached the statutory age of retirement on or before 30 July 1943 are to enter on terminal leave status at the earliest practicable date, and in any event not later than 30 September 1943. Officers reaching the statutory age for retirement at a future date will enter on terminal leave in time to allow them to complete such leave and be relieved from active duty on the last day of the month in which statutory retirement age is reached.

Some of the most outstanding Signal Corps officers in the service are affected by this ruling, among whom are numbered men who have seen active service in the Philippine Insurrection, in the Panama Canal, World War I and many who were extremely active in Signal Corps recruiting campaigns and National Defense plans prior to this war. The experience of these officers has been extremely valuable during World War II when the rapid expansion of the Signal Corps and the need for procuring technical equipment on a large scale demanded the services of men who were familiar with Army procedures and Signal Corps functions in particular.

Needless to say, the Signal Corps is sorry to see these officers retire, and, because of their worth to the service, it is hoped that some of them will be able to continue to be of service to their country in a civilian capacity. Certain war agencies, among others the War Manpower Board, have already expressed their desire for the distinguished services of these men as consultants, investigators and experts in scientific and technical matters closely related to Signal Corps activities. The names, present assignments and dates of retirement of the first officers under the jurisdiction of the Chief Signal Officer to be retired under the present directive are as follows:

Name	Present Assignment	Date of Retirement
* Lt. Col. Alexander E. Whitworth	On 19 July 1943 ordered to proceed to his home at San Antonio, Texas.	10 September 1943
* Colonel William A. Graham	Western Branch, Signal Corps Photographic Center, Beverly Hills, California.	30 September 1943
* Colonel Murray B. Dilley	Philadelphia Signal Depot Philadelphia, Pennsylvania.	31 January 1944
* Colonel Robert G. Forsythe	Signal Section, San Antonio Army Service Forces Depot, San Antonio, Texas.	31 January 1944

(Cont'd) Name	Present Assignment	Date of Retirement
* Colonel Fred G. Miller	Signal Unit Survey Branch, Office of the Chief Signal Officer, Washington, D. C.	31 January 1944
* Colonel Bertram J. Sherry	Dayton Signal Corps Procurement District and Depot, Dayton, Ohio.	31 January 1944
* Colonel Gilbert L. Thompson	Philadelphia Signal Corps Procurement District, Philadelphia, Pennsylvania.	31 January 1944
Colonel Philip Fox	Army Electronics Training Center, Cambridge, Mass.	10 November 1943
Lt. Col. Paul D. Meek	Philadelphia Signal Depot Philadelphia, Pennsylvania.	10 November 1943
Major Richard W. Sears	Signal Corps Photographic Center, Long Island, N. Y.	10 November 1943
Major Leon A. Souder	Philadelphia Signal Depot Philadelphia, Pennsylvania	29 November 1943
Major John J. Wray	Traffic Branch, Army Communications Service, OCSigO, Washington, D. C.	7 November 1943
Major Lawrence J. Corsa	Fort Monmouth Signal Laboratory, Signal Corps Ground Signal Agency, Bradley Beach, N. J.	30 October 1943
Colonel Thomas L. Clark	Sacramento Signal Depot, Sacramento, California.	30 November 1943

* As of 16 August 1943, War Department orders have already been sent out on these officers.