



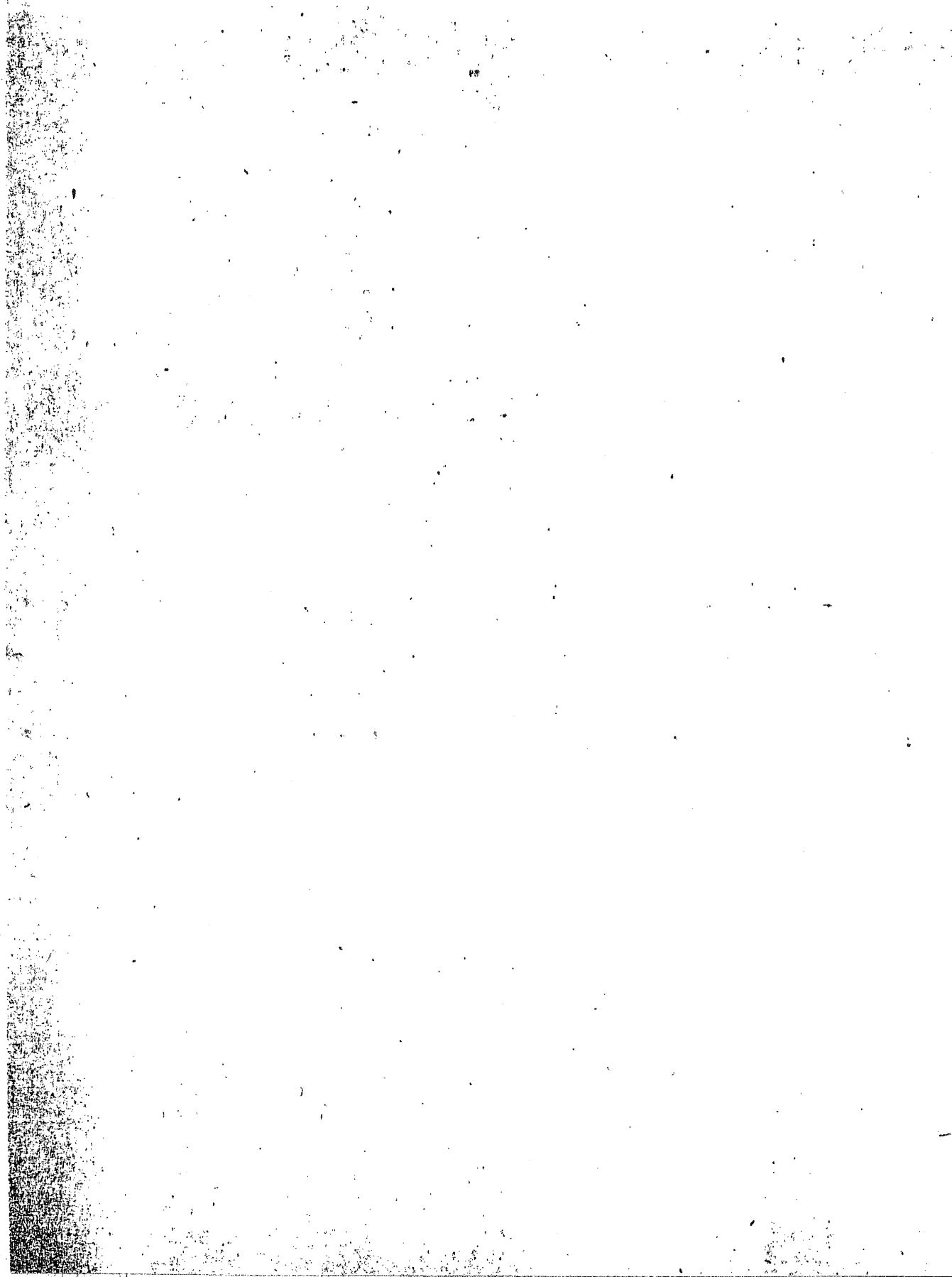
**CANADIAN ARMY
OPERATOR'S HANDBOOK**

TEST SET, RADIO CTS-3/PRC

**Prepared Under The Direction
Of
The Chief Of The General Staff
By**

The Directorate Of Electrical & Communications Development

January, 1955



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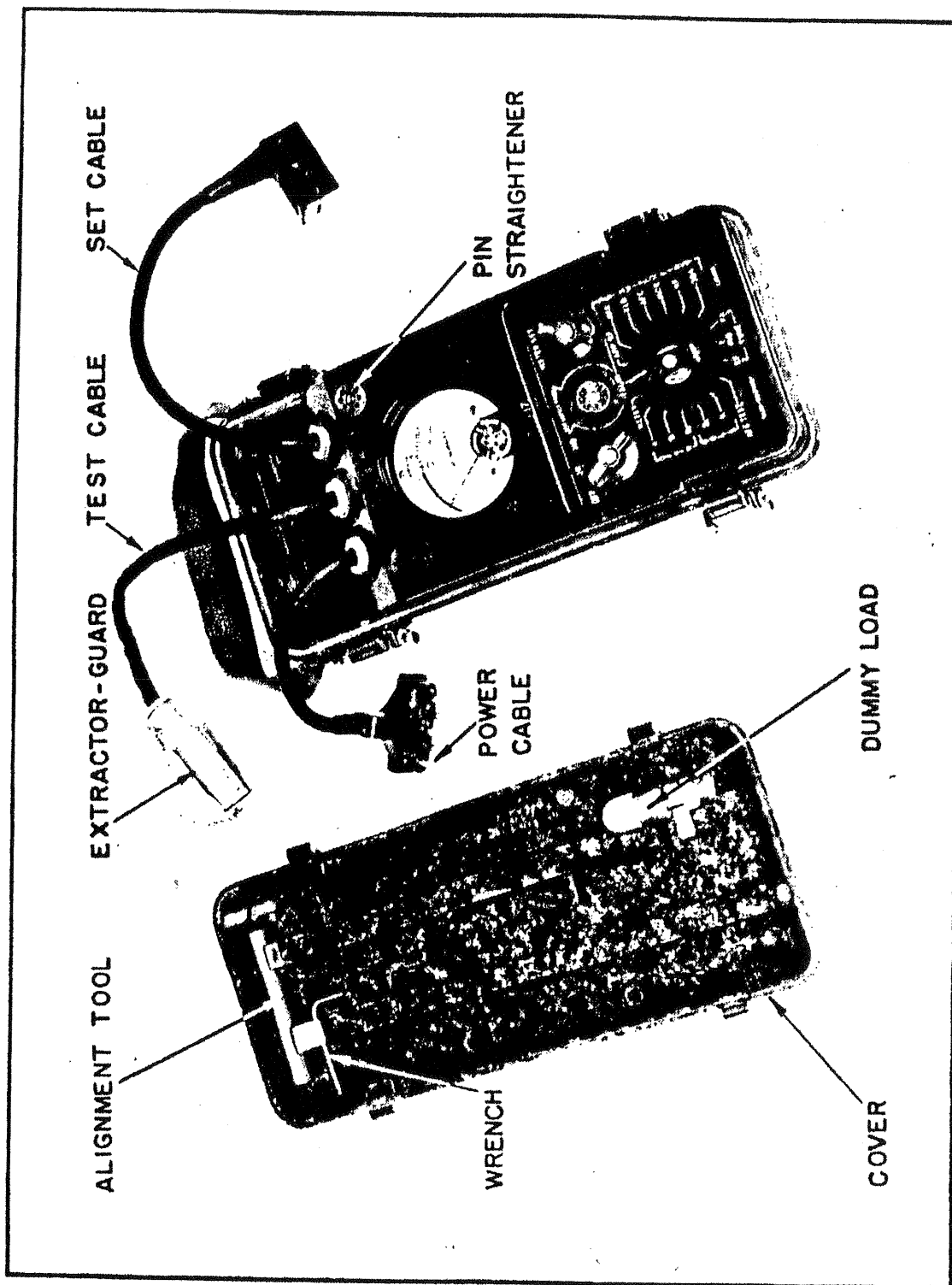


Plate 1.—Test Set, Radio CTS-3/PRC

CHAPTER 1

INTRODUCTION

1.1 Purpose

Test Set, Radio, CTS-3/PRC is a functional test set designed primarily for Radio Set CPRC-26. The set provides unit maintenance personnel with a convenient means of re-aligning Radio Set CPRC-26 when channel crystals have to be changed for tactical reasons; and of testing the emission of the tubes, including those used in the sealed plug-in units. Facilities are incorporated which allow the power supply, Battery, dry, BA-289/U, to be metered. Certain plug-in units used in Radio Set AN/PRC-510 can also be tested.

1.2 General Description (See Plate 1)

The test set is a milliammeter/vacuum tube voltmeter with switching facilities which permit measurement of various circuit conditions. The set is housed in a shock-resistant (medium impact fabric-filled), moulded, phenolic case with cover and web carrying handle. All controls are on the front panel and are recessed for protection. The equipment is gasket sealed and immersion-proof. The various tools and accessories supplied with the set are housed within it. Three multi-conductor connectors are used, one connecting the test set to the battery, and the other two connecting the test set to the radio set under test.

1.3 Dimensions and Weights

TABLE 1.—DIMENSIONS AND WEIGHTS

Dimensions (in.)			Weight (lb)
Length	Width	Height	
11½	5½	4	6½

1.4 Power Requirements

The test set is powered by Battery, dry, BA-289/U, the same battery as used in Radio Set CPRC-26.

1.5 Tools and Accessories

The following tools and accessories are provided with the test set:

- (a) Alignment tool, electronic
A socket-type tool for trimmer condenser adjustments.
- (b) Dummy load, electrical
When connected to the CPRC-26 homing antenna socket it provides correct loading for the radio set while under test.
- (c) Extractor-Guard
A tweezer-type tool to remove plug-in units; fits over end of test cable plug to protect pins from damage.
- (d) Wrench, hex, L-shaped, 5/64-in.
Used to disassemble Radio Set CPRC-26.
- (e) Pin Straightener
A built-in jig for straightening the pins of plug-in units.

1.6 Component List

TABLE 2.—COMPONENT LIST

TEST SET, RADIO, CTS-3/PRC

Item	Cat No.	Designation	Total
1	4Z1001200	TEST SET, radio, CTS-3/PRC	1
2	1Z1011762	including: ALIGNMENT TOOL, electronic, CPRC-26	1
3	4Z1011967	DUMMY LOAD, electrical	1
4	3Y1011963	including: BULB, type W47	1
5	4Z1011969	EXTRACTOR-GUARD	1
6	1Z1004250	TUBE, electron, 5672 JAN (1 spare)	2
7	1F209062	WRENCH, hex, L-shaped, 5/64-in.	1
8		P & S Supply Operator's Handbook—Test Set, Radio, CTS-3/PRC	1

CHAPTER 2

OPERATING INSTRUCTIONS

2.1 Controls (See Plate 1)

TABLE 3—CONTROLS

Control	Function
OFF-ON-MO	A three-pole, three position rotary switch in the battery supply circuit to the test set. The OFF-ON positions control all circuits except the A DRAIN and A VOLTS. The MO position is springloaded and is associated with the TUNE MO position of the TEST switch. This position allows the potential at the cold end of the AFC discriminator (ie MO grid bias) to be measured. In the ON position it measures the DC output from the discriminator superimposed on the MO grid bias.
METER SET	A potentiometer control for adjusting the VTVM residual deflection in the AFC TEST, TUNE RF and TUNE MO positions of the TEST switch.
TEST SWITCH	
METER	Measures the screen grid current of the subminiature tube used in the test set as a check on the operation of the test set.
A DRAIN	Filament supply current drain of radio set under test.
B ₁ DRAIN	Battery HT ₁ (45 V) current drain of radio set under test.
B ₂ DRAIN	Battery HT ₂ (90 V) current drain of radio set under test.
B ₂ VOLTS	Battery HT ₂ (90 V) supply voltage of radio set under test.
A VOLTS	Filament supply voltage (1.5 V) of radio set under test.
AFC TEST	Bias voltage developed by AFC amplifier tube.
TUNE RF	Bias voltage developed by IF limiter tube.

TABLE 3—CONTROLS (Continued)

Control	Function
TUNE MO	Voltage at hot and cold ends of AFC discriminator as selected by the OFF-ON-MO switch.
TUNE PA	Voltage drop from HT ₂ to the screen grid of PA tube.
3B4	Checks emission only of tube.
AF	Checks emission only of tube in AF amplifier plug-in unit.
MOD	Checks emission only of tube in modulator plug-in unit.
AFC	Checks emission only of tube in AFC amplifier plug-in unit.
XLO	Checks emission only of tube in crystal oscillator plug-in unit.
MIX	Checks emission only of tube in mixer plug-in unit.
AMP RF	Checks emission only of tube in RF amplifier plug-in unit.
IF & LIM	Checks emission only of tube in IF amplifier or limiter plug-in unit. Note: The IF amplifier and pulse generator plug-in units of Radio Set AN/PRC-510 may be tested in this position.
UNITS SOCKET	A 7-pin socket set in panel of test set. It is associated with the TEST switch and takes the various plug-in units and tubes under test.
RESET	A circuit breaker for meter protection. It is resettable from the front panel.
PIN STRAIGHTENER	A built-in jig for straightening the pins of plug-in units.
POWER CABLE	A 5-conductor cable terminating in a 5-pin plug. It connects to Battery, dry, BA-289/U to provide power to the test set and to the radio set under test.

TABLE 3—CONTROLS (Continued)

Control	Function
SET CABLE	A 5-conductor cable terminating in a 5-pin connector. It connects to Radio Set CPRC-26 battery plug to provide power from the test set battery to the radio set under test.
TEST CABLE	A 5-conductor cable terminating in a 7-pin miniature plug. It plugs into the radio set TEST socket.

WARNING

AVOID LEAVING THE TEST SWITCH IN THE AFC TEST, TUNE RF AND TUNE MO POSITIONS WHEN THE TEST PROBE IS NOT PLUGGED INTO THE TEST SOCKET OF THE RADIO SET.

2.2 To Check Test Set, Radio

- (a) Connect a good battery to the test set. The battery from the Radio Set CPRC-26 under test may be used.
- (b) Turn TEST switch to METER.
- (c) Turn OFF-ON-MO switch to ON. The meter should read in the GOOD range, indicating a serviceable tube in the test set.

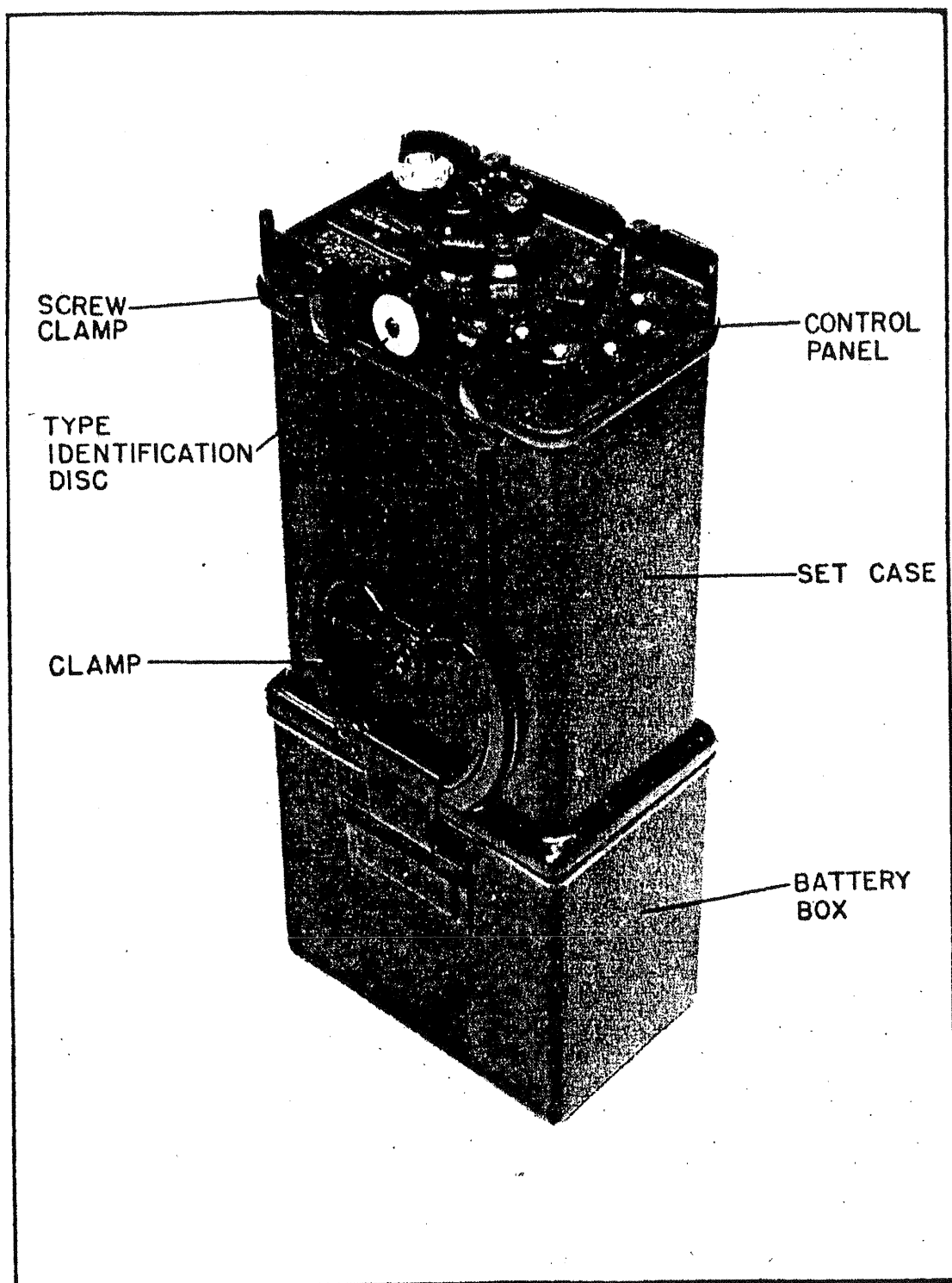


Plate 2.—Radio Set CPRC-26 Receiver-Transmitter

CHAPTER 3

TESTING OF RADIO SET CPRC-26

3.1 To Disassemble Radio Set CPRC-26

This section describes the procedure for disassembling Radio Set CPRC-26 in order to test plug-in units, change crystals, etc.

(a) To Remove Set From Case (See Plate 2)

- (1) Remove the battery box by releasing the holding clamps on the sides of the set case.
- (2) Remove the six screws located around the battery plug at the bottom of the set case.
- (3) Using the wrench, loosen the four screw clamps located around the edge of the control panel. Swing them back. These clamps are removable; be sure not to lose them.
- (4) Pull the set assembly from the set case by the control panel.
- (5) Examine the humidity indicator card located on the inside of the set case IMMEDIATELY to ascertain whether or not an excessive amount of moisture is present in the set.

(b) To Replace Plug-in Units (See Plates 3 & 4)

- (1) Remove set from case as described in (a) above.
- (2) Remove the screw and lockwasher from one end of the unit retainer and release the spring clip at the other end. Remove the unit retainer and plastic retaining plate.
- (3) Remove plug-in unit by gripping the button on top of the unit with the extractor and pulling straight up.
- (4) Replace plug-in unit. When replacing plug-in units, care must be taken to avoid damaging pins through misalignment and force. Check to ensure that all pins are straight and in their proper position before inserting plug-in unit. Use the pin straightener jig on the test set to straighten bent pins.

- (5) Replace retaining plate and unit retainer.
- (6) Refer to Table 5 for realignment required.
- (7) Realign radio set as described in Section 3.4.
- (8) Check and reseal the radio set as detailed in Sections 3.1 (d) & (e).

(c) To Change Crystals (See Plate 5)

- (1) Remove set from case as described in Section 3.1 (a).
- (2) Invert chassis and release spring clips holding the crystal bank in place. Remove crystal bank by pulling up.
- (3) Plug new crystal bank in place, making certain that channel numbers (1 to 6) on top of crystal bank correspond with the numbers on the edge of the trimmer deck shield (Plate 6).
- (4) Replace circular type identification disc (Plate 2) on edge of control panel with the disc supplied with the new crystal bank. Place original disc between crystals of crystal bank removed.
- (5) Realign radio set as described in Section 3.4.
- (6) Check and reseal the radio set as detailed in Sections 3.1 (d) & (e).

(d) Visual Inspection of Assembly

Whenever Radio Set CPRC-26 has been removed from its case, a visual inspection of the following points should be carried out before the set is returned to its case:

- (1) Check overall assembly to ensure that no components are damaged or broken.
- (2) Check that all plug-in units and tubes are firm in their sockets.
- (3) Check that the unit retainer is properly secured in place.
- (4) Check that the crystal bank is properly secured in place.
- (5) Check that the rubber gaskets in the groove on the inside of the control panel and on bottom of the set case are clean, undamaged and fitting properly.

(e) To Reassemble Radio Set CPRC-26

As the components of Radio Set CPRC-26 may be affected by dampness, the chassis should be thoroughly dry whenever testing and aligning is being carried out. If at all possible, the set should NOT be opened (ie unsealed) in a damp atmosphere.

Before returning the set assembly to its case, thoroughly dry both the set assembly and case with warm air. Plug in a fresh desiccator unit and immediately return assembly to its case and reseal the set. **DO NOT REMOVE DESICCATOR FROM ITS WRAPPING UNTIL THE SET IS READY FOR SEALING.**

Note: (i) When resealing, care should be taken that the four screw clamps on the control panel and six screws around the battery plug at the bottom of the set are tightened just sufficiently to obtain a good seal. Further tightening will not result in a better seal, but may cause damage to the screw clamps or battery plug.

(ii) For more detailed information and current practice on the drying of the radio set and the disposal of used desiccator units refer to Canadian Army EME Manual ELECT I 163, 164.

(f) To Reactivate Desiccator Units

As an emergency expedient, if fresh desiccators are not available, the used desiccator may be reactivated. Heat the desiccator unit in an oven at a temperature of 170-175°F and NOT more than 180°F for at least six hours. This time is required to drive off the bulk of the water adsorbed by the silica gel. Units need not be dried more than this, although they will not be damaged if left in the oven for a longer period.

If reactivated desiccators are not to be used immediately, they should be stored in small, individual, airtight containers. On no account should freshly activated units be left exposed out of the drying oven for more than 20 minutes. Units exposed to the atmosphere for longer than 20 minutes are to be considered "wet" and should be reactivated.

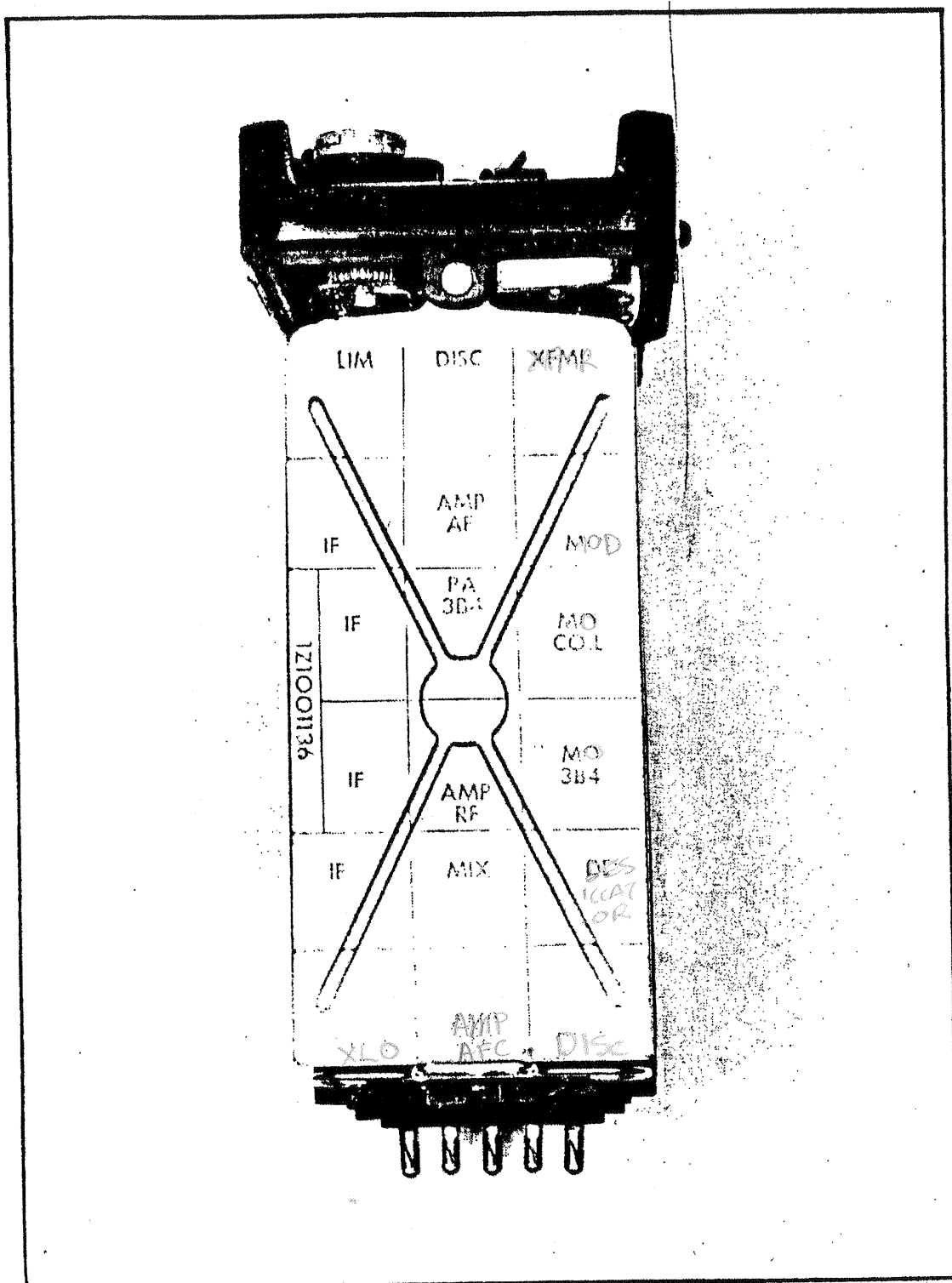


Plate 3.—Radio Set CPRC-26 Receiver-Transmitter Removed From Case

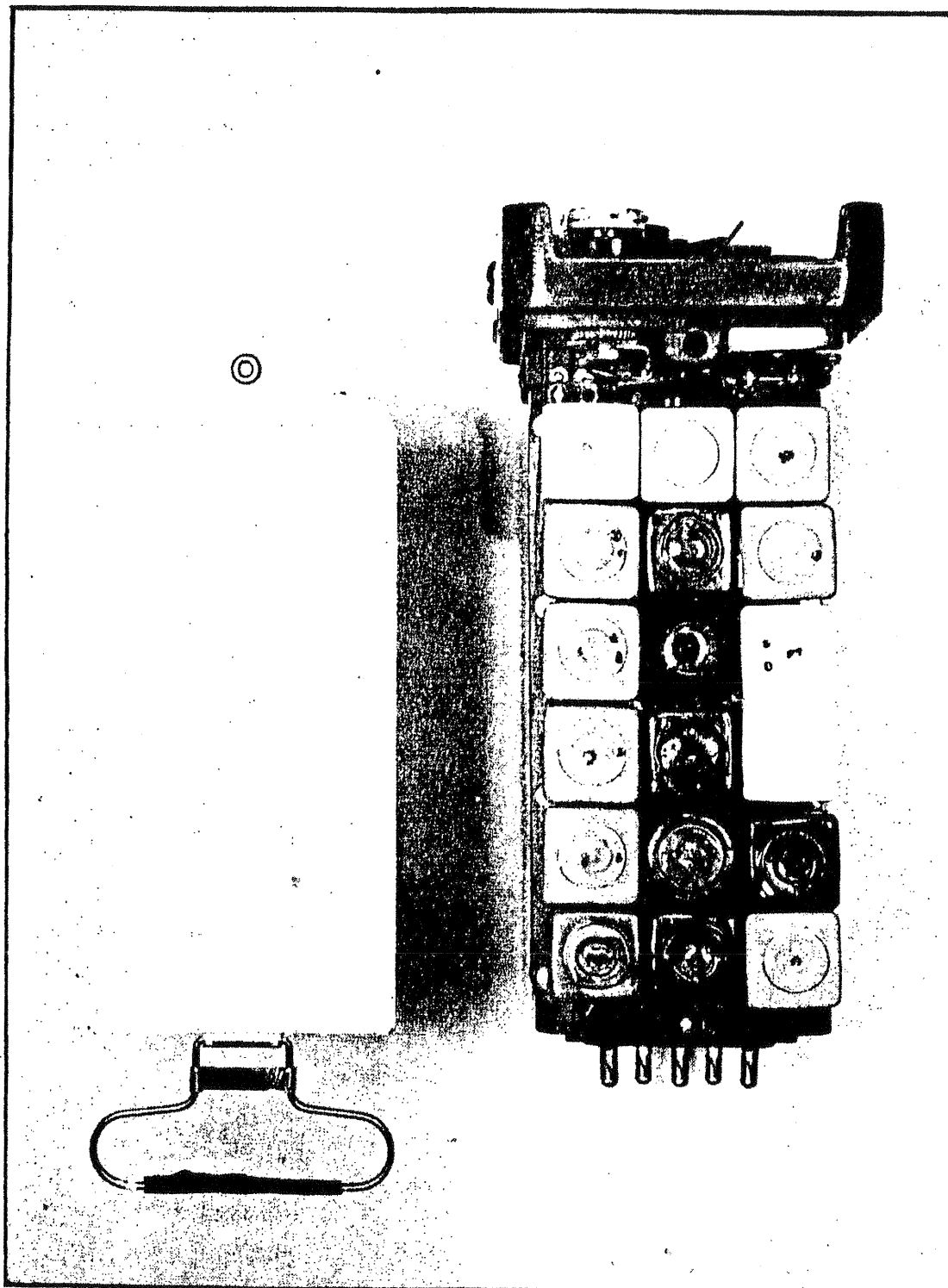


Plate 4.—Radio Set CPRC-26 Receiver-Transmitter With Unit
Retainer Removed

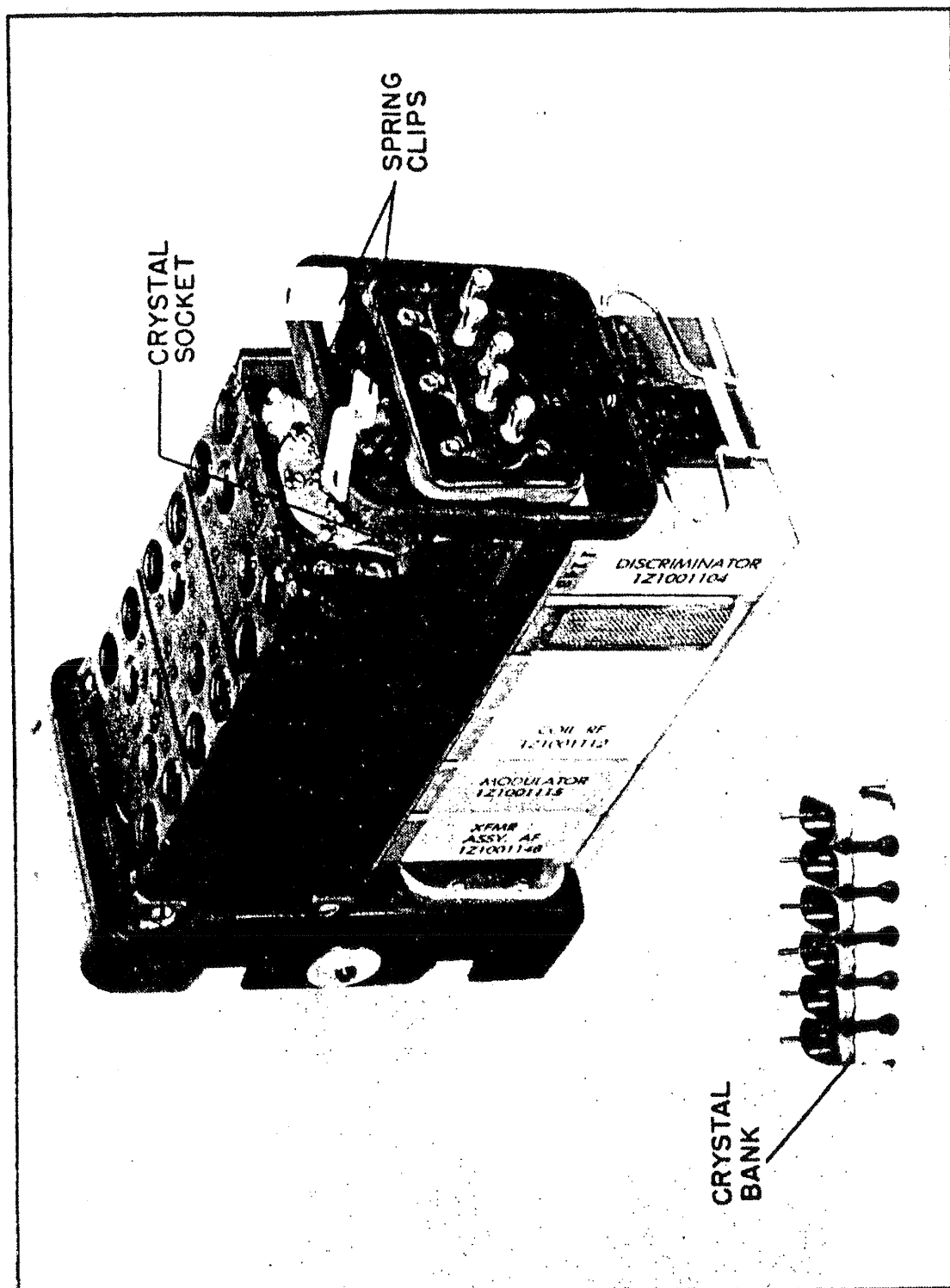


Plate 5.—Radio Set C-PRC-26 Receiver-Transmitter With Crystal Bank Removed

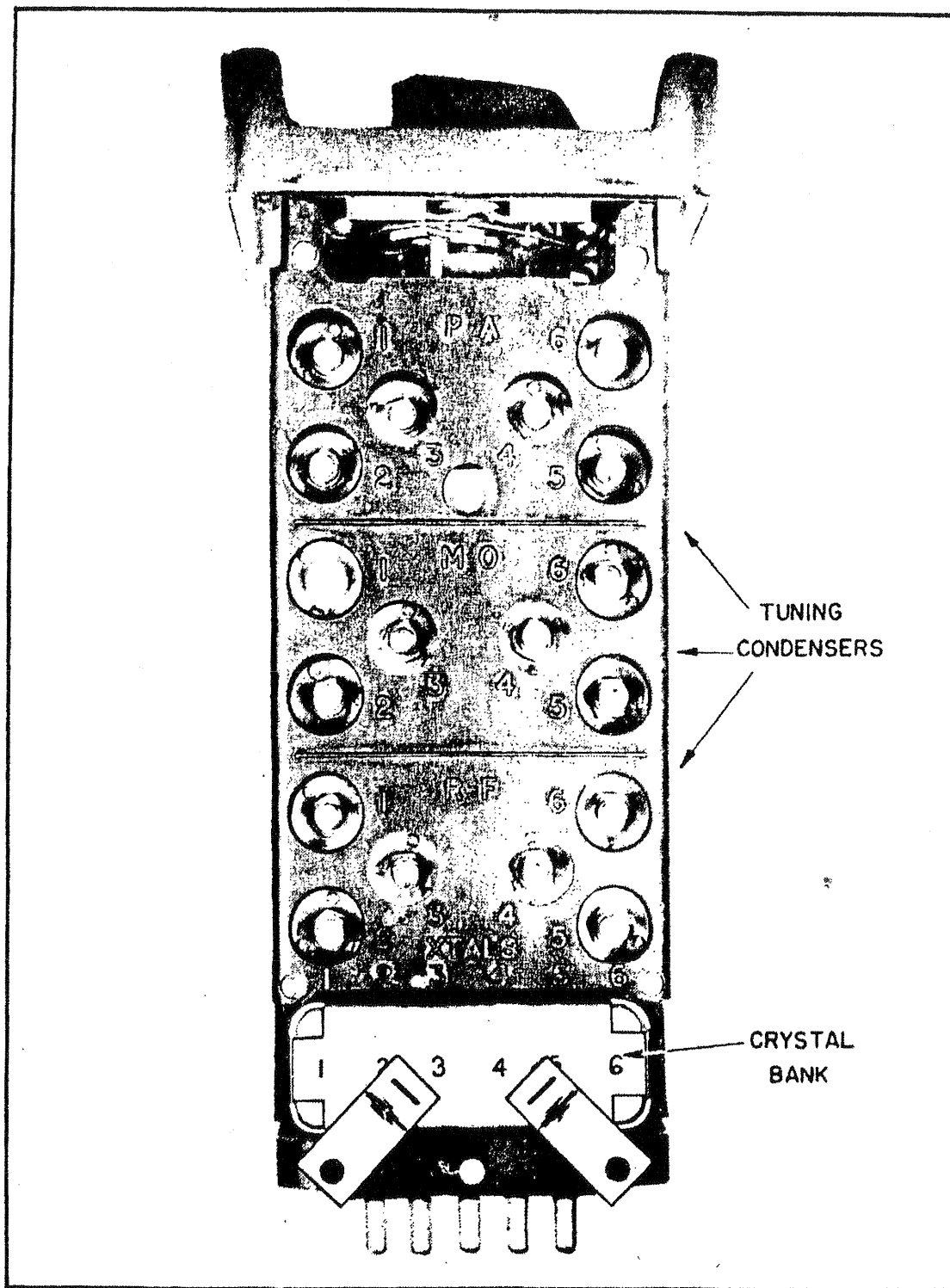


Plate 6.—Back of Radio Set CPRC-26 Receiver-Transmitter

3.2 General Tests for Radio Set CPRC-26

- (a) Connect up and check the test set as described in Section 2.2.
- (b) Connect test set power cable to the radio set battery plug.
- (c) Connect dummy load to homing antenna socket. (Plate 7)
- (d) Plug handset into 10-point socket.
- (e) Turn TEST switch to A DRAIN and OFF-ON-MO switch to ON.
- (f) Turn OFF-QUIET-LOUD switch on radio set to either QUIET or LOUD.
- (g) Check meter reading on test set on both transmit and receive. The meter reading should be approximately 0.56 amp on receive and 0.85 amp on transmit.
- (h) Turning the TEST switch, check the remaining current and voltage in a similar manner. The meter readings should be approximately as shown in Table 4.

TABLE 4.—TESTS AND TYPICAL METER READINGS

Test Switch Setting	Meter Readings	
	Receive	Transmit
A DRAIN (1)	0.56 amp	0.85 amp
B ₁ DRAIN (2)	14 ma	10 ma
B ₂ DRAIN (3)	3 ma	30 ma
B ₂ VOLTS	Good	Good
A VOLTS	Good	Good

(1) Top scale (2) Centre scale (3) Bottom scale

Note: (i) The figures in the above table are average and will vary somewhat depending on the condition of the battery used. If the meter reading is off scale in any one of the DRAIN positions, it indicates a possible short in that portion of the circuit. In that case, the plug-in units and tubes should be pulled out one by one until the short disappears.

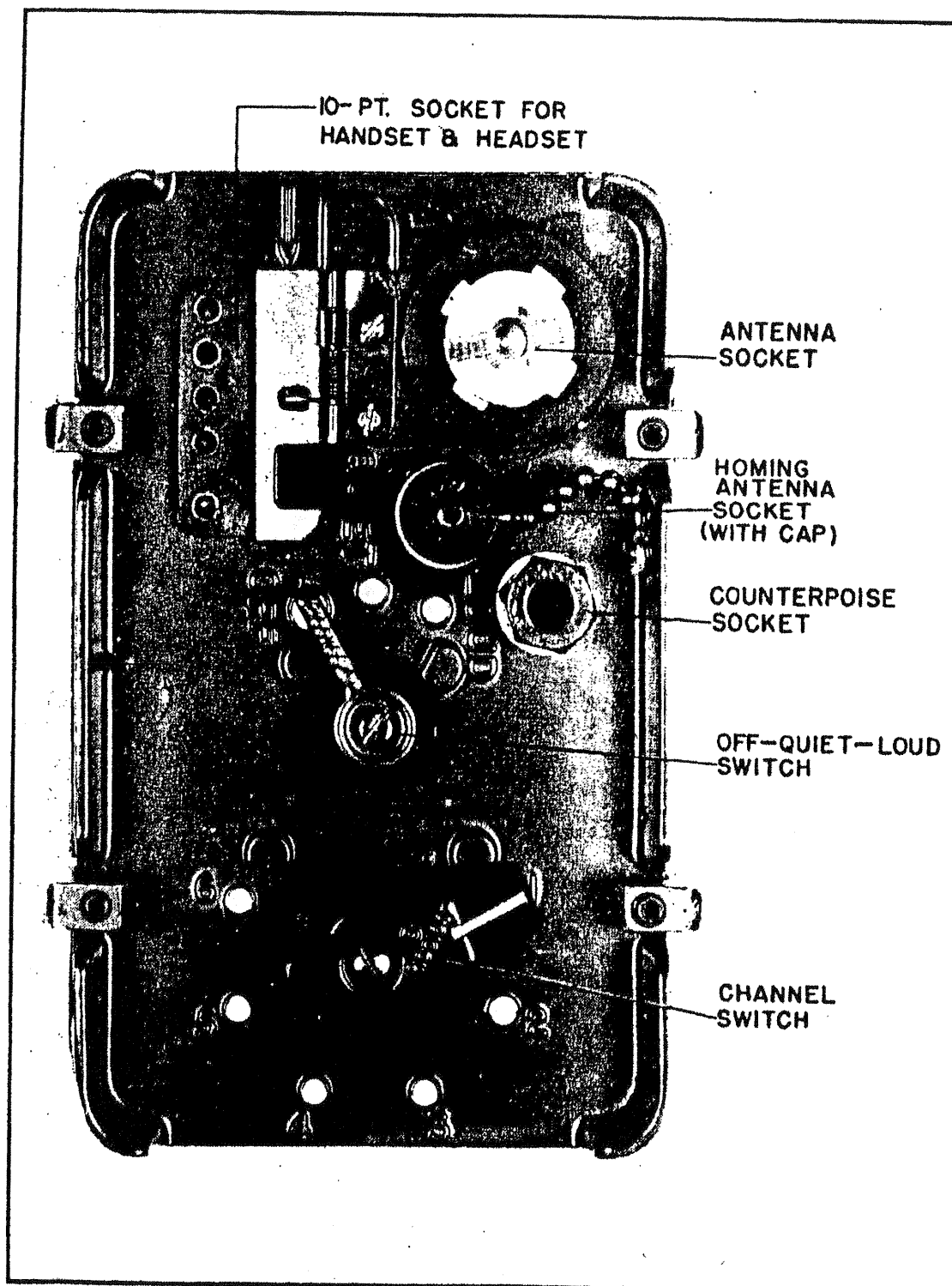


Plate 7.—Control Panel of Radio Set CPRC-26

Replace faulty unit or tube with a serviceable (tested) one and retest the current drains.

- (ii) In the A DRAIN and A VOLTS positions the test set functions with the OFF-ON-MO switch OFF or ON.

3.3 To Test Plug-in Units and Tubes

Note: Follow the sequence given below. Do NOT plug units or tubes into the test set until the TEST switch has been set to the correct position for the unit under test; damage to the unit or tube may result.

- (a) Connect up and check test set as described in Section 2.2.
- (b) Disassemble radio set as described in Sections 3.1 (a) & (b).
- (c) Turn TEST switch to IF and LIM.
- (d) Remove an IF unit from radio set and insert in the UNITS socket on the test set.
- (e) Turn OFF-ON-MO switch to ON.
- (f) Read condition of IF unit directly from meter scale (GOOD-BAD). If the needle comes to rest in the BAD section or 'jumps' off scale hard, replace the unit with a new one. Test new unit in the same manner before installing it. Good units in some cases may give a very high reading that is above or off the scale.
- (g) Test remaining IF units as detailed above. Then proceed with the remaining units and tubes, turning the TEST switch to the appropriate position, BEFORE plugging in the units or tubes.
- (h) Realign radio set, if necessary, as detailed in Section 3.4. When a plug-in unit is replaced, complete realignment of the set is not necessary in every case. Table 5 lists the units and realignment required.

**TABLE 5.—PLUG-IN UNITS REPLACED AND REALIGNMENT
REQUIRED**

Unit	Realignment Required	
DISC (AUDIO & AFC)	NIL	Even if realignment is not indicated, it may prove beneficial to repeak RF and PA trimmers for maximum performance and adjust MO for correct frequency as detailed in Section 3.4 (e).
XLO	NIL	
IF (4)	NIL	
LIM	NIL	
AMP AFC	NIL	
AMP AF	NIL	
XFMR	NIL	
AMP RF	As detailed in Sections 3.4 (b) & (d)	
PA (3B4)	As detailed in Sections 3.4 (b)	
MO (3B4)	As detailed in Sections 3.4 (b), (c) & (d)	
MO (or RF) COIL	As detailed in Sections 3.4 (b), (c) & (d)	
MOD	As detailed in Sections 3.4 (b), (c) & (d)	
MIX	As detailed in Sections 3.4 (b), (c) & (d)	

3.4 Alignment Procedure

(a) General (See Plate 8)

Align the various stages in the order described in this section. The following preliminary steps and information apply for all the sections.

- (1) Connect up and check test set as described in Section 2.2.
- (2) Disassemble radio set as described in Sections 3.1 (a) & (b).
- (3) Connect test set power cable to the radio set battery plug.
- (4) Remove desiccator and insert test cable in radio set TEST socket.

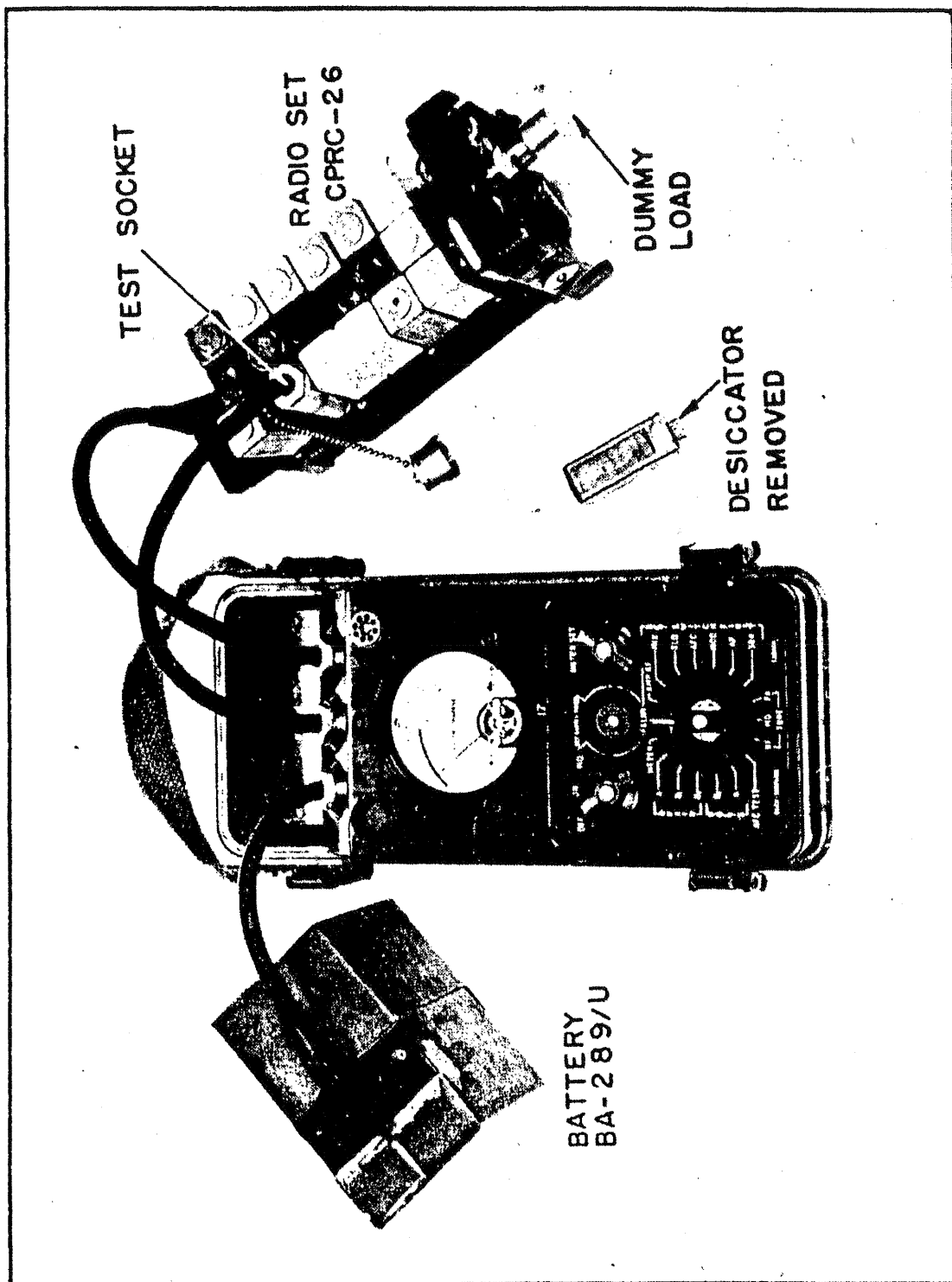


Plate 8.—Test Set, Radio CTS-3/PRC Connected to Battery BA-289/U and Radio Set CPRC-26

- (5) Connect dummy load to homing antenna socket.
- (6) Plug handset into 10-point socket.
- (7) Use the alignment tool to adjust all condensers to the full out (counter-clockwise) position until no threads show on the condenser shaft. DO NOT UNSCREW CONDENSERS ANY FURTHER THAN NECESSARY OR THEY WILL SHORT AGAINST THE SHIELD. (See Plate 6)

Note: The handset need not be plugged into the 10-point socket for transmit and receive switching. A jumper across holes 3 and 4 of the socket (counting up in Plate 7) will place the set on transmit. To change to receive, place jumper across holes 2 and 3. This will leave both hands free.

(b) RF and Initial PA Tuning (Set on receive)

- (1) Turn TEST switch on test set to TUNE RF, then OFF-ON-MO switch to ON.
- (2) Turn OFF-QUIET-LOUD switch on radio set to either QUIET or LOUD.
- (3) Turn CHANNEL switch to Channel 1.
- (4) Adjust the METER SET control on the test set to bring the needle to left hand zero on the meter scale.
- (5) Tune RF condenser 1 for maximum reading on the meter.
- (6) Tune PA condenser 1 for maximum reading on the meter.
- (7) Retune RF condenser 1 for maximum reading on the meter.
- (8) Turn CHANNEL switch to Channel 2, 3 etc and repeat the above for each channel, tuning the RF and PA condenser associated with each channel.

Note: As tuning progresses, the needle may deflect off scale to the right, Keep needle in the centre of the scale by adjusting the METER SET control.

(c) Initial MO Tuning

- (1) Turn TEST switch on test set to TUNE MO, then OFF-ON-MO switch to ON.

- (2) Turn CHANNEL switch to Channel 1.
- (3) Switch the radio set to transmit and adjust the METER SET control to bring the needle to the centre demarcation line on the meter scale.
- (4) Turn MO condenser 1 in (clockwise) gradually. As the master oscillator approaches the correct operating frequency, the meter needle will deflect sharply to the right and go off scale. Continue turning SLOWLY clockwise until the needle returns and moves off to the left of the demarcation line. Turn the condenser counter-clockwise until the needle rests at the demarcation line.
- (5) Turn CHANNEL switch to Channel 2, 3 etc and repeat the above for each channel, tuning the MO condenser associated with each channel.

(d) Final PA Tuning

- (1) Turn TEST switch on test set to TUNE PA, then OFF-ON-MO switch to ON.
- (2) Turn CHANNEL switch to Channel 1.
- (3) Switch the radio set to transmit.
- (4) Tune PA condenser for maximum reading on the meter; this will be maximum brightness of the dummy load.
- (5) Turn CHANNEL switch to Channel 2, 3 etc and repeat the above for each channel, tuning the PA condenser associated with each channel.

(e) Final MO Tuning.

- (1) Turn TEST switch on test set to TUNE MO, then OFF-ON-MO switch to ON.
- (2) Turn CHANNEL switch to Channel 1.
- (3) Switch the radio set to transmit. Turn the OFF-ON-MO. switch to the MO position and adjust the METER SET control to bring the needle to the centre demarcation line on the meter scale. Release MO switch to ON.
- (4) Switch the radio set to receive for approximately five seconds and then return to transmit. This allows for hysteresis in the modulation transformer.

- (5) Tune MO condenser 1 to bring needle back to the centre demarcation line.
 - (6) Check the tuning by turning the OFF-ON-MO switch to MO. When the channel is correctly tuned there will be no deflection of the needle from the demarcation line, indicating that the voltage at each end of the AFC discriminator is the same.
 - (7) Turn CHANNEL switch to Channel 2, 3 etc and repeat (4) and (5) above for each channel, tuning the MO condenser associated with each channel.
- (f) Sidetone Check
 With the handset plugged into the 10-point socket, check that sidetone is present on all channels. The presence of sidetone gives a good indication that all stages of the transmitter are functioning properly and that the transmitted signal is being modulated and is approximately at its correct frequency.

3.5 Fault Finding

Table 6 lists the more common faults that may occur in Radio Set CPRC-26, their causes and remedy.

TABLE 6.—RADIO SET CPRC-26—COMMON FAULTS

Symptom	Probable Fault		Action to be Taken
RECEIVE—Weak or dead TRANSMIT—No sidetone	MIX AMP AF XFMR XLO	unit defective unit defective unit defective unit defective	Replace defective unit and refer to Table 5 for re-alignment required
RECEIVE—Weak or dead TRANSMIT—Normal	MIX AUDIO DISC LIM IF AMP RF XFMR	unit defective unit defective unit defective unit defective unit defective unit defective	Replace defective unit and refer to Table 5 for re-alignment required
RECEIVE—Normal TRANSMIT—No sidetone	MOD AMP AFC AFC DISC XFMR MO PA	unit defective unit defective unit defective unit defective unit defective tube defective	Replace defective unit and refer to Table 5 for re-alignment required.

- Note:** (i) In addition to the above faults, weak signals or inaccuracy of transmitter signal can be caused by misalignment of the tunable RF circuits. Try alignment in accordance with Section 3.4.
- (ii) The AFC TEST position of the TEST switch may be used for fault finding purposes. For example, on transmit the presence of a voltage indicates that the XLO and MIX units are working properly. The AFC TEST may also be used in some cases as an alternative method of tuning the RF amplifier for maximum deflection on transmit.

CHAPTER 4

TESTING OF RADIO SET AN/PRC-510

4.1 *To Test Plug-In Units and Tubes*

The use of Test Set, radio, CTS-3/PRC for the testing of Radio Set AN/PRC-510 is limited to the testing of certain plug-in units only. The plug-in units that can be tested are the IF plug-in unit and pulse generator. These are tested as described in Section 3.3 (a) to (f) with the TEST switch set to the IF & LIM position in both cases.

CHAPTER 5

MAINTENANCE AND REPAIR

Note: THIS SET IS SEALED AND MUST NOT BE OPENED EXCEPT BY AUTHORIZED TRADESMEN.

5.1 *Operator's Maintenance*

- (a) Keep the set, cables and accessories clean and dry.
- (b) Examine the cables periodically for loose connections and wear or breaks in the insulation. In particular, check miniature plug on test cable for bent pins and if necessary straighten on pin straightener jig.
- (c) Keep extractor-guard on test plug when not in use.

5.2 *Unit and Field Repairs*

Unit and Field Repair instructions on Radio Set CPRC-26 and Test Set, radio, CTS-3/PRC are contained in the following Canadian Army EME Manuals:

Radio Set CPRC-26 ELECT I 160-9 series

Test Set, Radio, CTS-3/PRC ELECT Z 740-9 series

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1955