Superseded by I 164
Issue 2, 12 Nov 62

RADIO SET CPRC-26

Field and Base Repair

FAULT-FINDING

General

1. It is estimated that 80% of the faults encountered in the Radio set CPRC-26 will be repairable by replacement of the sealed plug-in units at forward repair areas within user units. The remaining 20% of the faults will probably be in the switching, plugs and sockets, or main chassis wiring. These few faults can be traced, found, and repaired using standard equipment and procedures with certain precautions as discussed at para 3.

Plug-in Units

2. Care must be taken when removing plug-in units and the 3B4 tubes to avoid bending the pins. Extractors should always be used to assist in removing the plug-in units.

Techniques

3. WARNING. Before working on this set, consult EME Manual Elec A 758 in regard to soldering of miniature components. Many components can be damaged beyond use by excessive heat; others can be forced out of their tolerance values. A soldering iron with a pencil bit should be used. Soldering should be done as quickly as possible. All component leads should be tinned prior to soldering. Special attention must be paid to the wafer type switch SW2 which is very brittle and may break when soldering operations are attempted. The axial leads from resistors should never be bent closer than 1/16-in from the end of the resistor element. Special care must be taken to avoid scratching the precision resistors R5 and R6. Many components must be cut from the terminals using needle nosed cutters. The remaining wire on the terminal can then be more easily removed. Care must be taken to see that the set remains dust free. Small particles of rosin will seriously disturb the alignment of the variable capacitors.

Drying

4. (a) As the Radio set CPRC-26 is susceptible to dampness it is recommended that the set should be thoroughly dry when returned to its case after repair and alignment. It has been found that the most satisfactory method of drying the sets is to keep them in an oven for approximately two hours at 122°F and at the same time circulate dry air around the sets to maintain the humidity at a maximum of 5%. Reactivation of the silica gel in the desiccator may be carried out by heating them for eight hours in an oven at 175°F. Immediately after final trimming, the set should be returned to its case, together with a FRESH desiccator, and sealed.

(b) Replacement of Gaskets. In every case when a panel mounted component is removed and replaced for any reason, new gaskets and seals are to be installed with the new or repaired component. The component is to be tightened only sufficiently to provide a proper seal. Over-tightening can cause a distortion leading to leakage. Components affected are: channel switch (SW1), OFF-QUIET-LOUD switch (SW2), tenpoint audio socket, homing antenna socket, antenna mounting base, battery plug, set to case gasket, and battery box to case gasket. The last two gaskets should be replaced whenever they fail to afford an effective seal. Gaskets will be sealed in place using adhesive coating EC 524 manufactured by Minnesota Mining and Manufacturing Co of Canada Ltd.

(c) Leak Testing. Leaks can be detected by immersing the set in hot water (150°F) containing any good chemical detergent. A sustained stream of bubbles forced from the set by the internally expanding air will indicate the leaks.

REPAIR INFORMATION

Dismantling and Assembling of Main Sub Assemblies

Removal of Trimmer Deck

5. (a) Release the two spring clamp mechanisms holding the crystal bank in place.

(b) Unsolder the black lead from the trimmer deck to C1 on the antenna loading coil terminal panel.

(c) Rotate channel switch to channel 4.

(d) Remove the four long bolts fastening trimmer deck to main chassis.

(e) Remove the two bolts fastening trimmer deck to front panel and separate the trimmer deck from the main chassis.

(f) To replace trimmer deck reassemble in reverse order.

To Disassemble Trimmer Deck

6. (a) Remove the six screws opposite each metal "H" plate which fasten the fibre plate to the trimmer deck shield and trimmer deck shield.

(b) Separate trimmer deck from trimmer deck shield.

Removal of Front Panel

7. (a) Remove the two bolts which fasten the front panel to the main chassis.

(b) Unsolder the black lead from C1 on antenna loading coil terminal panel.

(c) Refer to Fig 3. Unsolder the following leads from SW2. Care must be exercised when doing this as the switch wafer is very brittle and may break.

(i) brown lead from lug No. 9

(ii) yellow lead from lug No. 10

(iii) yellow lead from lug No. 11

(iv) red lead from lug No. 8

(v) black lead from lug No. 7

(vi) blue lead from lug No. 5

(d) Unsolder the orange, white and yellow leads from the audio socket and remove the front panel from the main chassis.

Removal of OFF-QUIET-LOUD Switch

8. (a) Refer to Fig 3. Unsolder all necessary leads from OFF-QUIET-LOUD switch SW2 to main chassis and to audio socket. Care must be exercised when doing this as the switch wafer is very brittle and may break.

(b) Remove switch knob (on front panel).

(c) Remove nut securing control switch to front panel and remove the switch.

(d) Replace OFF-QUIET-LOUD switch in reverse order ensuring that the cut-out portion of the bakelite is next to the band switch.

To Replace a Tube or Plug-in Unit Socket

9. (a) Remove all plug-in units and tubes from their sockets. Remove trimmer deck as detailed in para 5.

(b) Remove all connections from the socket to be replaced.

(c) Remove the fourteen screws which secure the laminated fibre plate to the main chassis.

(d) Remove the socket.

(e) Fit a new socket, re-wire the connections taking care not to damage wiring or components and reassemble.

(f) Place a dot of paint on the socket corresponding to the colour of the unit plugged into it.

Removal of Master Oscillator (MO) Section of Channel Switch

10.(a) Disassemble trimmer deck as detailed in para 6.

(b) Remove switch shaft.

(c) Unsolder lead from switch wafer to neutralization condenser and inter-chassis connector.

(d) Unsolder leads between MO condenser 3 and 4 and switch wafer.

(e) Remove nuts holding MO condenser 1, 6.

(f) Separate MO condenser 1, 6, from mounting plate and disconnect leads between them and switch section.

(g) Unsolder leads between MO condenser 2, 5 and switch section.

(h) Remove the two screws fastening the shield to the fibre plate.

(j) Lift up on shield sufficiently and remove the two screws fastening the switch section to the shield.

(k) To replace the switch section certain lugs must be cut short to prevent shorting. See Fig 4 for details.

NOTE: When re-wiring the crystal oscillator switch wafer, it is very important that lead dressing, wire type and size, soldering, etc be duplicated exactly, to insure that stray wiring capacities remain the same as before. Any screws or nuts not held by lock washers should be given a light coating of glyptal cement.

Trimmer Condensers

11.(a) Disassemble trimmer deck as detailed in para 6.

(b) Unsolder lead from trimmer condenser.

(c) Remove trimmer condenser mounting nut and remove condenser.

NOTE: (1) When trimmer condensers are replaced, a small amount of glyptal cement will be applied to all trimmer mounting nuts to prevent loosening.

(2) Do not disturb the positions of any leads unless absolutely necessary for repairs. When repairs are completed, readjust the leads to original positions. If necessary, compare with another set.

Handset Cable Assembly

12.(a) Remove microphone capsule from handset.

(b) Remove the two screws securing the pressel switch to the handle.

(c) Referring to Fig 5, unsolder the blue, yellow and red leads from the pressel switch.

(d) Unsolder the black lead from the microphone contact.

(e) Remove the screw securing the receiver assembly to the handle.

(f) Loosen the set screw on receiver assembly securing the white lead.

(g) Remove the phone tip from white lead (DO NOT LOSE IT).

(h) Loosen gland nut and slide up the cable.

(j) Check to make certain all connections from cable assembly are free and remove the cable assembly.

(k) Remove gland assembly (2 flat washers and rubber "O" ring) from cable.

(l) Assemble handset cable assembly in reverse order.

SPECIFICATION TESTING

Test Equipment

13.(a) The following items of test equipment are required in specification testing the radio set.

(i) Output meter rf (Marconi TF 957 or equivalent).

(ii) Heterodyne frequency meter (Gertsch Model FM-3 or equivalent).

(iii) Vacuum tube voltmeter (vtvm) (Test set Stark VT-9 or equivalent).

(iv) Frequency deviation meter (Marconi TF 934 or equivalent).

(v) Generators signal af, rf, Waveform Model 510B c/w matching transformer Model T10.

(vi) Generators signal rf (frequency modulated) (New London 100B or equivalent).

(vii) Generators signal rf (amplitude modulated) Advance Type B4A.

(viii) Frequency meter SCR 211.

(ix) Meters output power General Radio 583A.

Attachments to be supplied locally:

(x) Intermediate frequency (if) input attachment (Fig 1).

(xi) if stage shorting can (Fig 2).

(xii) Audio plug jumper switch (Fig 6).

(xiii) Output matching unit (Fig 8).

(xiv) Pilot lamp 6.3 volt No. 47.

(xv) Voltage divider pad (Fig 9).

(b) The specification testing is divided into two parts.

Part 1. Tests essential to establish communication between any two sets.

Part 2. Additional tests which will be carried out when a set appears in a workshop.

Part 1. Essential Tests

14. The set is expected to be fully lined up in accordance with EME Manual Elec I 163 using Test set radio CTS 3/PRC. If the test set is unavailable, proceed as follows:

Initial rf Tuning

(a) (i) Remove radio set from case and remove the unit retainer.

(ii) Remove the desiccator unit.

(iii) Replace two mounting bolts in battery plug using a flat washer between the mounting bolt and battery plug. This will prevent the rubber portion of the battery plug from separating when the battery is connected and disconnected from the radio set.

(iv) Turn ALL trimmer condensers (MO, PA, RF) counter-clockwise until no thread shows on the condenser shaft.

(v) Connect handset and battery to the radio set.

(vi) Connect a pilot lamp between homing antenna and chassis as a dummy antenna.

(vii) Turn channel switch to 1 and switch OFF-QUIET-LOUD switch to LOUD.

(viii) Turn rf condenser (Channel 1) for maximum noise as heard in handset.

(ix) Turn channel switch to each of the remaining channels and tune rf condenser for maximum noise as heard in handset.

Initial MO Tuning

(b) (i) Switch OFF-QUIET-LOUD switch to OFF.

(ii) Connect dc probe and ground lead from vtvm between pin 1 of the test socket and chassis. Replace headset with audio plug jumper switch.

(iii) Set up vtvm to read -5 v dc.

(iv) Turn channel switch to 1.

(v) Switch OFF-QUIET-LOUD switch to either QUIET or LOUD.

(vi) Switch radio set to transmit using audio plug jumper switch. The vtvm should read between 3 and 4 v dc.

(vii) Slowly turn MO condenser (channel 1) clockwise until vtvm needle swings to a maximum in the negative potential and then returns towards zero.

(viii) Back off condenser until vtvm measures approximately the same voltage as measured in (vi) above.

(ix) Turn channel switch to each of the remaining channels and repeat (vii) and (viii) above.

Final PA Tuning

(c) (i) Turn channel switch to 1.

(ii) Switch radio set to transmit.

(iii) Turn PA condenser (Channel 1) for maximum brilliance of pilot lamp used as dummy antenna or maximum indication on rf output meter.

NOTE: If 50 ohm non-inductive resistor is used as dummy antenna place dc probe of a vtvm set to read 90 v dc in pin 6 of test socket and tune PA condenser for a minimum reading.

(iv) Turn channel switch to each of remaining channels and repeat (iii) above.

Final MO Tuning

(d) (i) Turn channel switch to 1.

(ii) Connect dc probe and ground lead from vtvm between pin 4 and chassis and set to read -5 v dc.

(iii) Switch set to receive for ten seconds, then to transmit and record reading on vtvm at pin 4.

(iv) Remove dc probe from pin 4, connect to pin 1 of test socket and record reading on vtvm.

(v) Voltage readings on vtvm at pins 4 and 1 should be identical within 0.1 v.

(vi) If voltage readings differ by more than 0.1 v, return MO condenser for voltage reading obtained from pin 4 of test socket.

(vii) Switch radio set to receive for 10 seconds and return to transmit.

(viii) The voltages at pins 1 and 4 of test socket will be identical within 0.1 v and will lie within the limits of 2.5 to 4.0 v dc when the set is correctly tuned.

(ix) Turn channel switch to each of the remaining channels and repeat (ii) to (viii) above.

Final rf Tuning

(e) (i) Turn channel switch to 1 and switch radio set to transmit.

(ii) Place dc probe and ground lead between pin 7 of the test socket and chassis.

(iii) Set up the vtvm using the lowest dc scale available and repeak rf condenser (channel 1) for maximum reading.

(iv) Turn channel switch to each of the remaining channels and repeat (ii) to (iv) above.

(f) Check for the presence of sidetone in the receivers while modulating the transmitter. The absence of sidetone can be caused by a break in the automatic frequency control (afc) circuit, non-serviceable (NS) handset inserts, modulator or receiver audio stage.

Transmitter Power Output

15. Certain 3B4 pa tubes will deliver the correct output in one set but not in another although both sets are in perfect condition and the tube meets JAN specifications. 3B4 tubes used in the PA stage will be selected to give the required output. Tubes which will not deliver the correct output after being tried in several sets will be used as replacement mo tubes. Specifications require that the transmitter deliver a minimum of 300 milliwatts into a non-inductive load of 50 ohms throughout the frequency range. At the frequencies involved, it is difficult to get accurate readings using a resistor-ammeter combination across the antenna socket. The rf output is to be measured with an accurate instrument designed for this application.

Transmitter Dynamic Frequency Deviation

16. The dynamic frequency deviation test establishes the proper operation of the modulator. Connect the voltage divider pad across the output of the audio frequency generator. The voltage output of the pad is either 1/100 th or 1/10 th of the input voltage, ie, 40 db or 20 db down. Feed the output of the pad to the microphone input terminals.

Set the frequency of the audio generator at 1000 cycles per second (cps). Attach the frequency deviation meter to the homing antenna socket using the cable provided. Switch the set to QUIET and adjust the audio generator to give 30 millivolts (mv) input to the set. The deviation must be between 7 and 25 kc. Switch to LOUD, increase the audio input to the set to 300 mv and the deviation must be between 7 and 25 kc.

Transmitter Frequency

17.(a) Static. Using the heterodyne frequency meter in accordance with instructions attached to it, measure the transmitter frequency with no modulation on all channels. This frequency must lie between ±8 kc of the channel frequency.

(b) Microphonics Test. With the set secured in its case, strike any face of the set a sharp blow with the edge of the hand. The microphonic frequency deviation of the transmitter shall decrease to less than 1.5 kc within 10 seconds of being struck.

Transmit-Receive Frequency Difference

18. The difference between transmitted carrier frequency, and the receiver frequency, when on the same channel, must be less than 8 kc throughout the frequency range. To check this function, the heterodyne frequency meter is required, and is used as a signal source when checking the receiver, and as a frequency meter when checking the transmitter. The vtvm is required to check limiter grid voltage and audio discriminator output voltage. Remove the audio plug-in unit from the chassis to enable the audio discriminator voltage to be read at pin 4. Connect up the set and frequency meter, tuning the meter to the fre-

quency of the channel being tested and to the setting which gives maximum voltage at the limiter grid as read on a vtvm from pin 3 of the test socket to ground. Transfer the vtvm test probe to pin No. 4 of the audio plug-in socket and ground and slowly rock the frequency meter dial. It will be noted that a positive and negative output voltage is possible depending on the dial setting. The dial setting on the frequency meter which gives exactly 0 v output is the true receiver frequency. Switch to transmit and tune the frequency meter to zero beat with the transmitted frequency. The difference between transmitted frequency and the receiver frequency must be less than 8 kc. Failure to meet this specification usually indicates that the audio or afc discriminator has drifted off frequency. These units cannot be adjusted without removing them from their sealed cans. They must be exchanged for ones which will bring the transmit-receive frequency difference within tolerance.

Sensitivity (Signal plus Noise to Noise Ratio)

fm signal generator available

19.(a) Connect the frequency modulated (fm) signal generator, set up to deliver a cw signal, to the homing antenna socket and tune to the channel frequency. Set the level to 2 microvolts (uV). Connect the output matching unit between pins 4 and 5 of the output socket. Connect the vtvm to the output terminals of the matching unit and set to the lowest ac range. Switch the set to LOUD and adjust the signal generator for the minimum reading of the vtvm. Modulate the signal generator at 1000 cps with 15 kc deviation (standard modulation) and record the vtvm reading (signal plus noise). Switch off the modulation and again record the vtvm reading (noise). The sensitivity is the ratio of the signal plus noise to noise output of the set expressed in decibels, ie, $20 \log_{10} \frac{S+N}{N}$ All channels shall have a sensitivity better than 20 db except the 51.7 mc and 47.3 mc which shall be 18 db or better.

am signal generator available

(b) The quieting sensitivity is a measure of the sensitivity of the set. Record the noise output delivered by the set with no signal input using the output matching unit and vtvm. Introduce a cw signal at channel frequency to the homing antenna socket. Increase the signal level from zero until the noise output has dropped 10 db.

Example - noise level with no signal = 5 v

To find the -10 db voltage:

$$10 = 20 \log \frac{5}{x}$$

$$0.5 = \log \frac{5}{x}$$

$$3.16 = \frac{5}{x}$$

$$x = \frac{5}{3.16} \text{ approx equals } 1.6 \text{ v}$$

The rf signal required to cause this reduction should be less than 3 uV using a normal battery and less than 5 uV using a low battery.

PART 2. ADDITIONAL TESTS

Transmitter

Loop gain and automatic frequency control (afc) operation

20.(a) This test should immediately follow the measurement of the transmitter frequency on each channel. The afc circuits are required to correct any transmitter frequency drift up to ±250 kc. Having measured the transmitter frequency, remove the afc amplifier plug-in unit. Tune the mo 250 kc higher in frequency. Plug-in the afc amplifier and again measure the carrier frequency, which should be within 7.1 kc of the original carrier frequency. Loop gain is calculated by dividing 250 kc by the error frequency.

Example - Transmitter frequency before detuning = 50.00 mc
Transmitter frequency, mo detuned, afc paralized = 50.25 mc
0.25 mc

Transmitter frequency, mo detuned, afc operating = 50.005 mc
Error frequency = 50.000 - 50.005 = 0.005 mc

$$\text{Loop gain} = \frac{0.25}{0.005}$$

The minimum loop gain will be 35 throughout the frequency range.

Neutralization

(b) To test the neutralization, connect standard dummy load to homing antenna socket. Paralize the afc by removal of the afc amplifier plug-in unit and measure the emitted carrier frequency. Short the whip antenna socket to ground, and remeasure the carrier frequency. The frequency drift so produced must not be more than ±10 kc. The neutralizing screw, if replaced, will be turned to the maximum counter-clockwise position, cut off and cemented. This is a factory adjustment normally not needing workshop attention.

Master Oscillator Bias

(c) A portion of the bias developed by the master oscillator grid leak is used as bias on the afc and modulator tube V3. This bias varies with battery supply voltage and its variation compensates for oscillator frequency drift caused by change in the battery voltage. In order for V3 to operate on the correct portion of its characteristic curve, the bias must be 3.25 volts (v) plus or minus 0.75 v, throughout the frequency range. The bias voltage is measured from pin 4 on the test socket to ground using an accurate vacuum tube voltmeter (vtvm).

Audio Frequency Response

(d) Apply an audio signal of 1000 cps to the microphone input terminals using the voltage divider pad. Adjust the level of signal until a deviation of 15 kc is recorded on the frequency deviation meter and record for reference. Alter the audio frequency to 250 cps and adjust the level to give 15 kc deviation. This level must be within plus or minus 6 decibels (db) of the reference level. Change the audio frequency to 2000 cps and adjust the level for 15 kc deviation. This level must be within plus or minus 6 db of the reference level. Repeat the procedure at 100 cps where the input level must be at least 10 db up and again at 5000 cyc where the input must be at least 6 db up from reference level.

Receiver

Spurious response rejection ratios

Image Frequency

21.(a)(i) Apply an unmodulated rf input of 1 uV to the receiver. Adjust the frequency slightly for maximum limiter bias as measured from pin 3 of the test socket to ground using a vtvm. Note the bias voltage obtained. Set the signal generator to the image frequency (signal frequency minus twice the if frequency) and increase the rf level until the original reference limiter bias voltage is obtained. The image frequency rejection ratio, which is the ratio of this level to 1 uV, must be greater than 33 db. Check each channel.

Spurious Frequencies

(ii) Vary the rf input from 20 to 70 mcs. At frequencies which produce a limiter grid bias (other than signal or image frequencies) the rf level is adjusted to give a bias voltage of 1 v. The spurious response rejection ratio, which is the ratio of this rf level to 1 uV, must be greater than 59 db. Check each channel.

Intermediate Frequency Rejection Ratio

(iii) Introduce a cw rf signal of 4.3 mc at the homing antenna socket and adjust the input signal to obtain limiter bias obtained in para (i) above. The if rejection ratio, which is the ratio of input voltage to 1 uV, must be greater than 89 db. Check each channel.

Limiting Characteristics

(b) Inject a 5 uV carrier at signal frequency using standard modulation. Note the reading obtained on a 600 ohm audio output meter connected between pins 4 and 5 of the audio socket. This reading is taken as the reference output. With the output of the signal generator increased to 1000 uV, the output of the set must not vary more than 3 db for any input between 5 and 1000 uV.

Audio Frequency Power Output

(c) Apply an input of 1000 uV, at carrier frequency, with standard modulation to the homing antenna socket. With switch at LOUD position the audio output, as measured with a 600 ohm output meter connected between pins 4 and 5 of the audio socket, shall be greater than 6 milliwatts for all channels. The output shall decrease by 13 db $\pm$3 db when the set is switched to QUIET.

Audio Frequency Response

(d) Using the level obtained in the test detailed in para (c) (LOUD position) as a reference level, switch the modulating frequency to those specified hereunder, where the outputs should be attenuated by the figures listed. The deviation must remain constant at 15 kc.

100 cyc - greater than 3 db
250 cyc - less than 7 db
2000 cyc - less than 5.5 db
5000 cyc - greater than 7 db

Selectivity and Bandwidth

(e) The selectivity is determined by checking the response of the if amplifier in the following manner. Remove the rf plug-in unit and connect an rf signal generator between pin 6 of the rf unit socket and ground using the if input attachment shown in Fig 1 which can be made locally. This introduces the signal at the grid of the mixer. Set the generator frequency to 4300 kc and the output to 20 uV unmodulated. Attach the vtvm between pin 3 of the test socket and ground. Rock the signal generator to obtain a maximum negative reading on the vtvm. Adjust the signal level to produce a reference limiter grid bias of 1 v. The input should lie between 10-15 uV. Increase the signal level to twice the original level, and return the signal generator first to one side and

then to the other side of 4300 kc until the reference bias is again standing at 1 v. The two frequency readings should differ by 65 kc minimum, 85 kc maximum as measured with the frequency meter SCR 211. This is a measure of the bandwidth of the if in kc at the two times down points. Increase the signal input to 1000 times the original reference level. Vary the frequency either side of 4300 kc until the original bias level of 1 v is obtained. The two frequency readings should differ by 250 kc maximum. The center frequency of the if band pass is considered to be the frequency which falls midway between the two frequencies at the two times down points. This center frequency must be within 5 kc of 4300 kc. If this 5 kc cannot be met, individual if units must be changed until the one (or more) is found which causes the unsymmetrical response.

if Stage Gain Measurements

(f) Due to the design of this set, the usual methods of determining stage gains are not practical. However, if stage gains can be determined by the following procedure. Inject an unmodulated if signal as in para 21 (e), of sufficient amplitude to give 1 v limiter grid bias as measured with a vtvm from pin 3 of the test socket to ground. Record the input level. Remove an if plug-in unit and insert the if stage shorting can (see Fig 2). Increase the input until the bias level of 1 v is obtained again. The stage gain of the unit, which is the ratio of the two input levels, should be 23 db ±5 db.

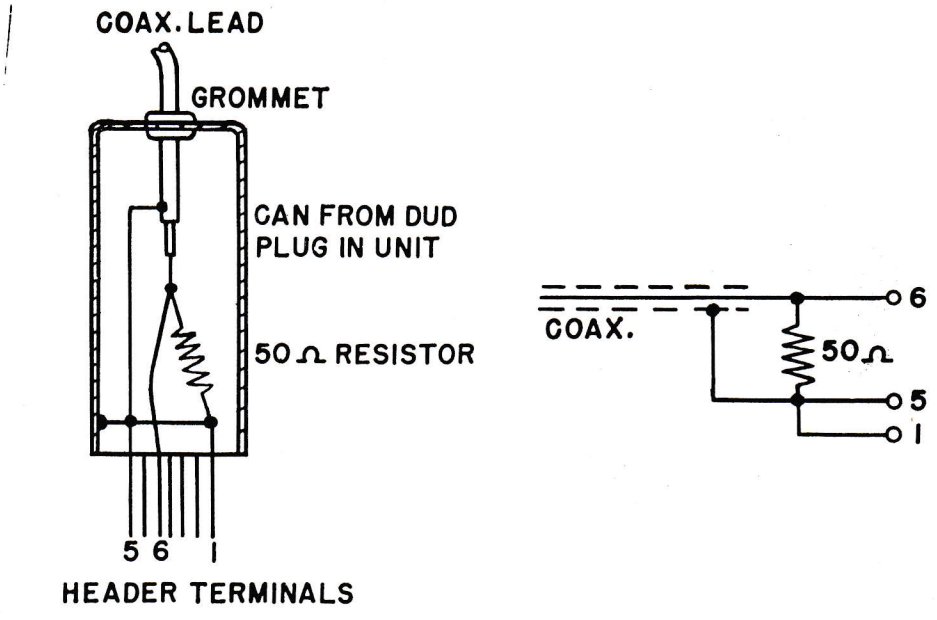

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Fig 1 - if input attachment

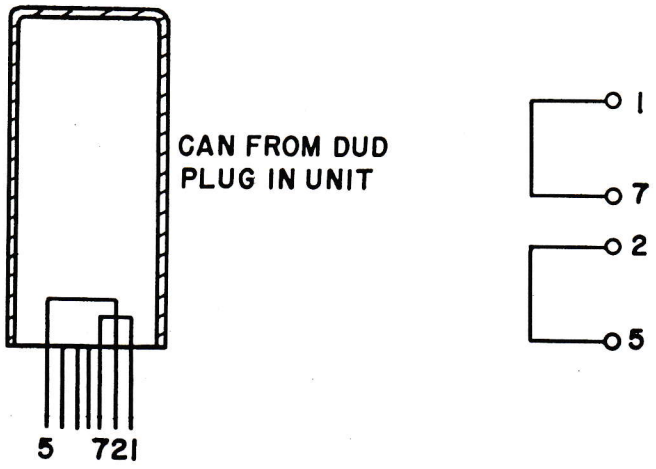

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Fig 2 - if stage shorting can

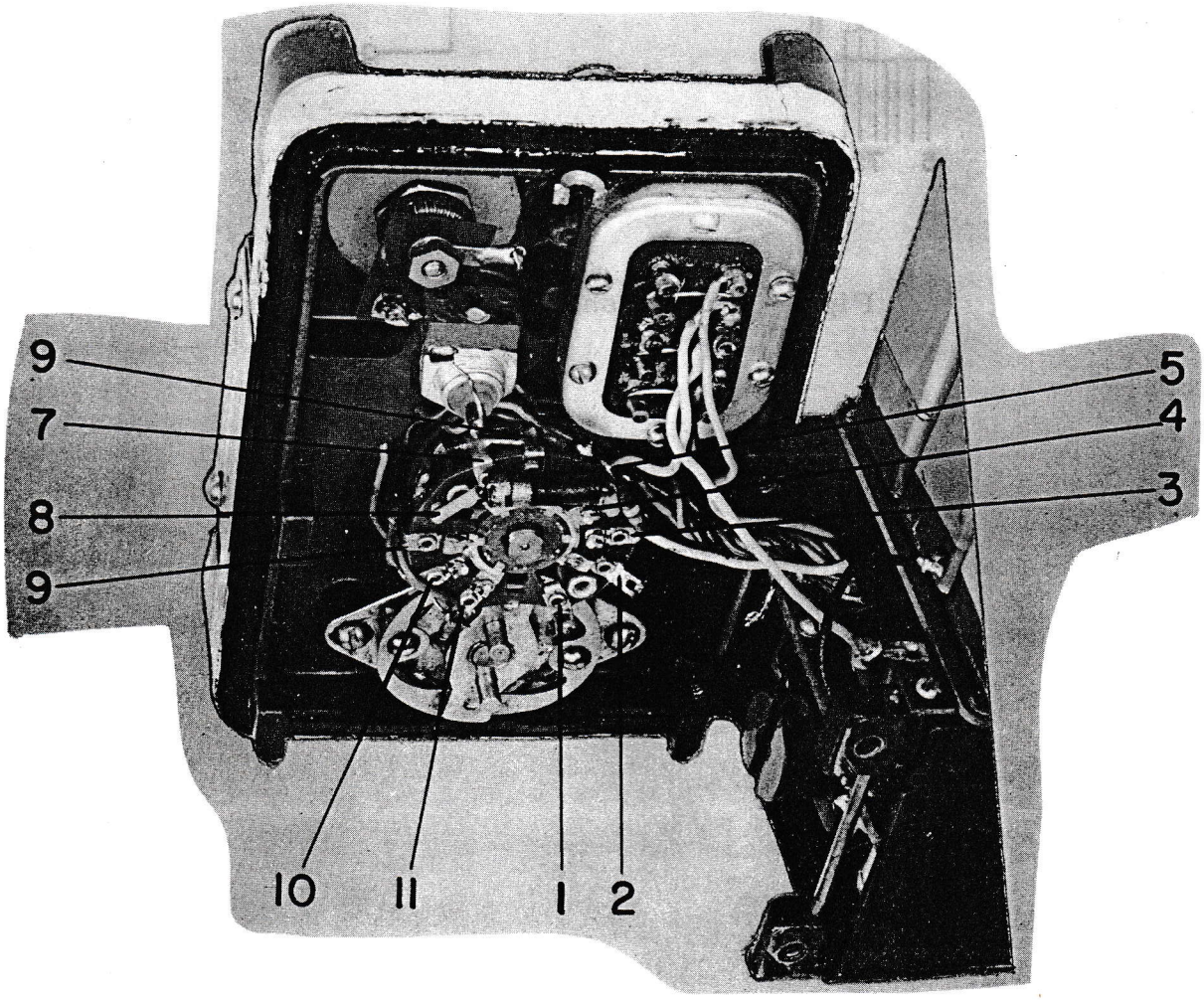
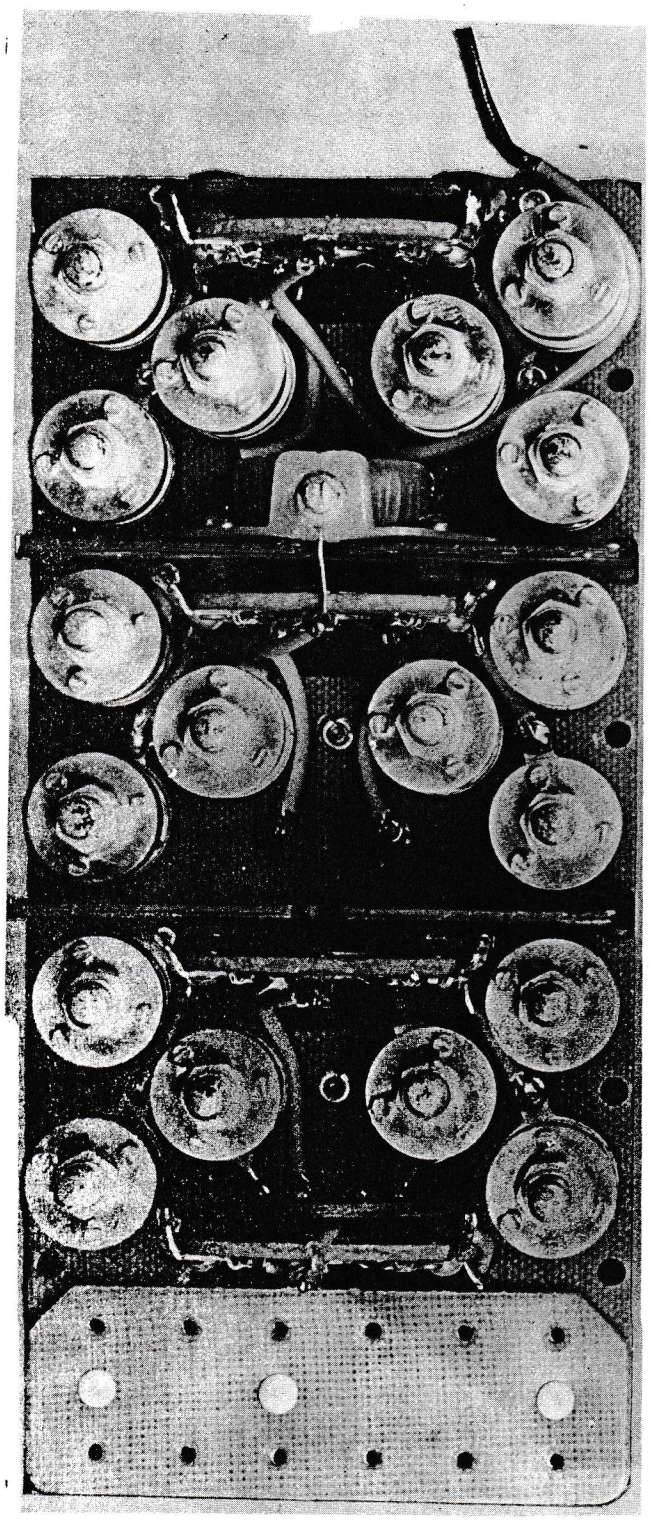
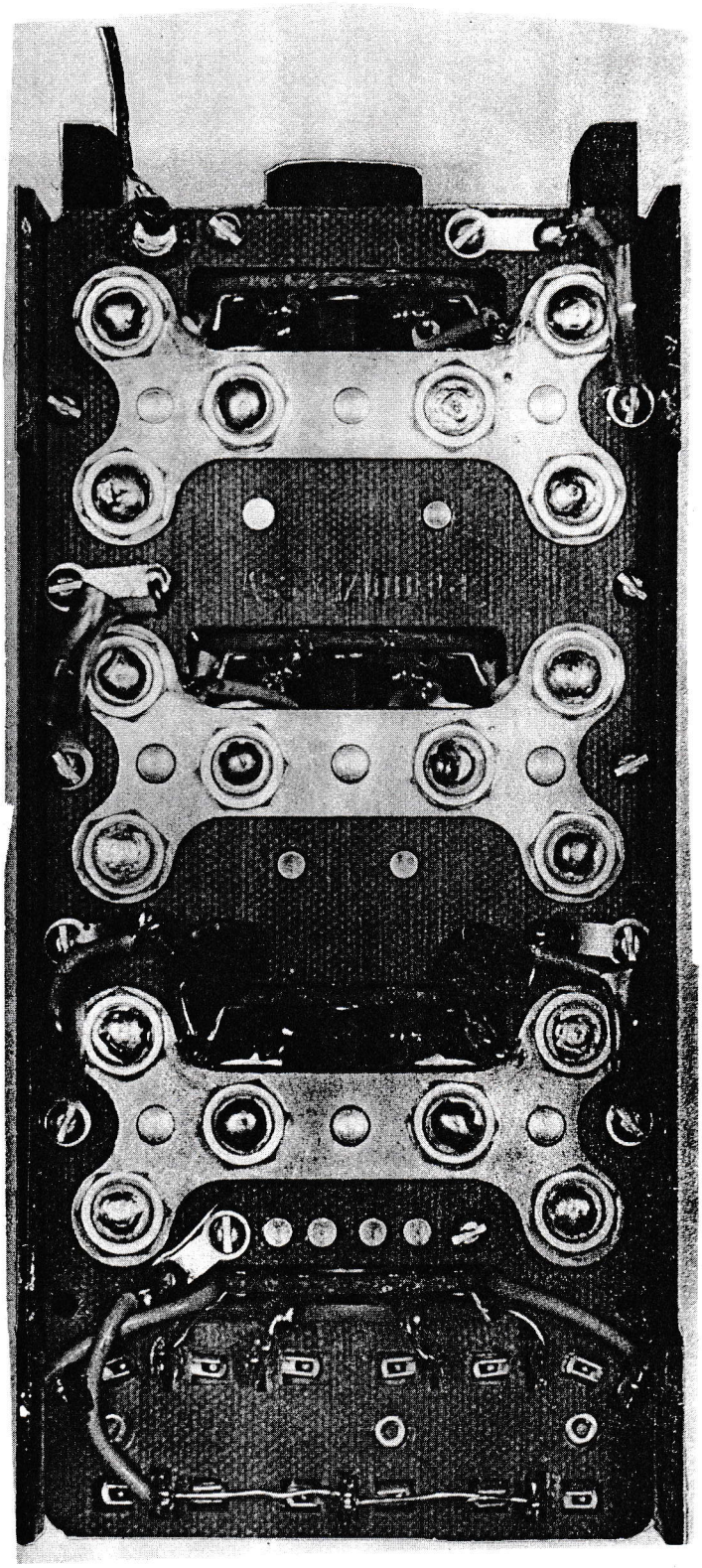


Fig 3 - Interior of front panel showing connections





(a) - Upper view

(b) - Lower view

Fig 4 - Channel switch
(a) - upper view
(b) - lower view

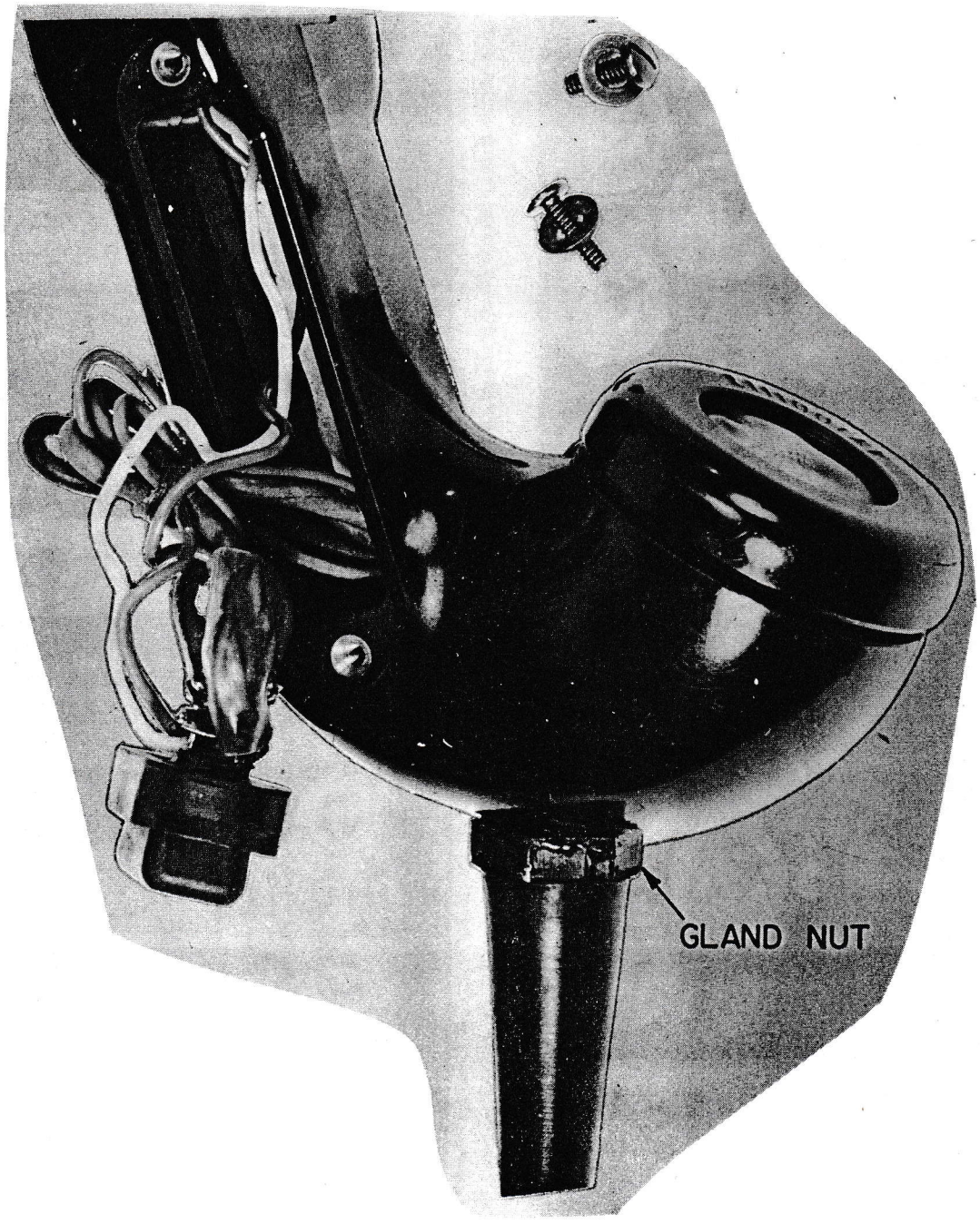
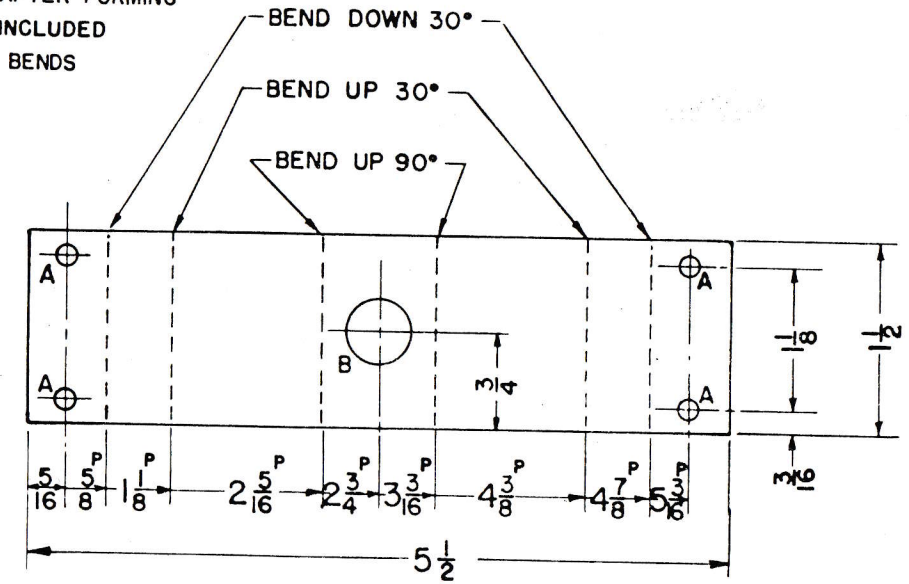


Fig 5 - Pressel switch, showing connections

NOTE-
1. OVERALL DIMENSIONS GIVEN ARE INSIDE-AFTER FORMING
2. BENDING ALLOWANCE HAS NOT BEEN INCLUDED
3. SEE THIS DRAWING FOR DIRECTION OF BENDS

HOLE	DRILL SIZE
A	#18 DR. (.169)
B	1/2" DIA.



LETTER "P" DENOTES PROGRESSIVE DIMS.

TITLE- HOUSING
MAT'L.- STEEL, S.A.E.1010, C.R. .037(#20U.S.S.GA)
FINISH- ANY APPROVED TYPE OF PAINT OR ELECTRO DIP
SCALE- 1:1

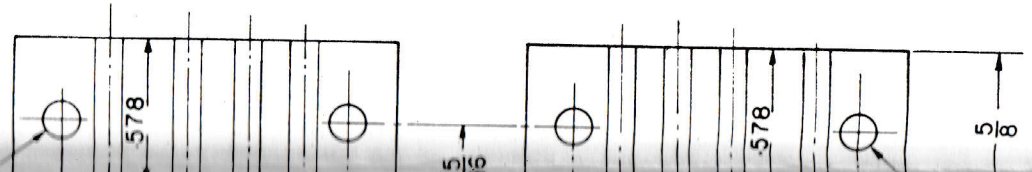
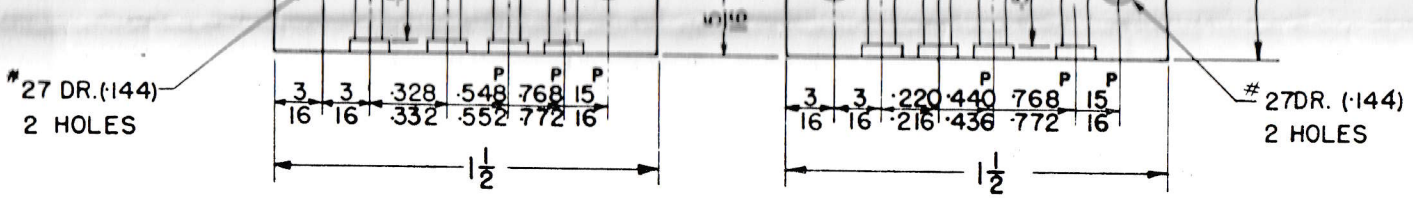
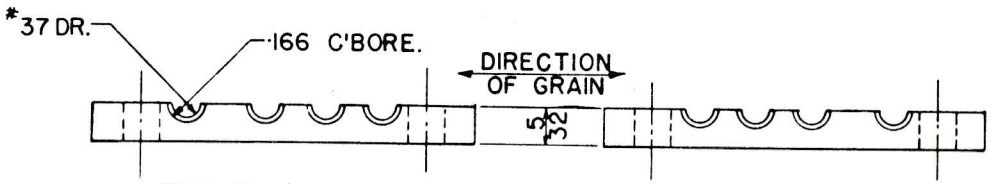
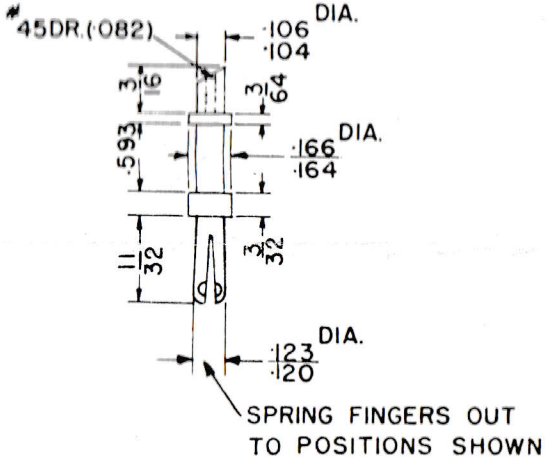


Fig 6 - Aud

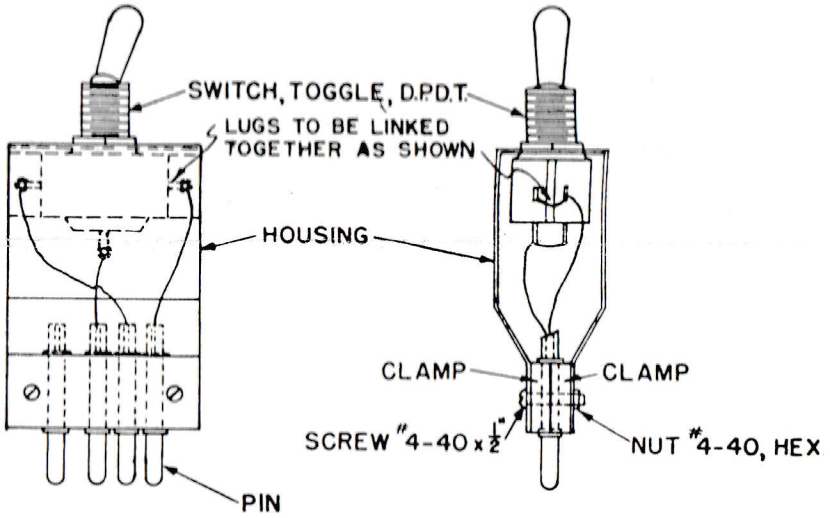




TITLE - CLAMP
MAT'L. - PHENOLIC LAMINATE SHEET, GR. P.B.E. (NEMA GR.XXX) SPEC. JCNAAF-P-13
SCALE - 2:1



TITLE - PIN
MAT'L. - BRASS S.A.E., 72 1/2H
FINISH - CLEAN
SCALE - 2:1



ASSEMBLY

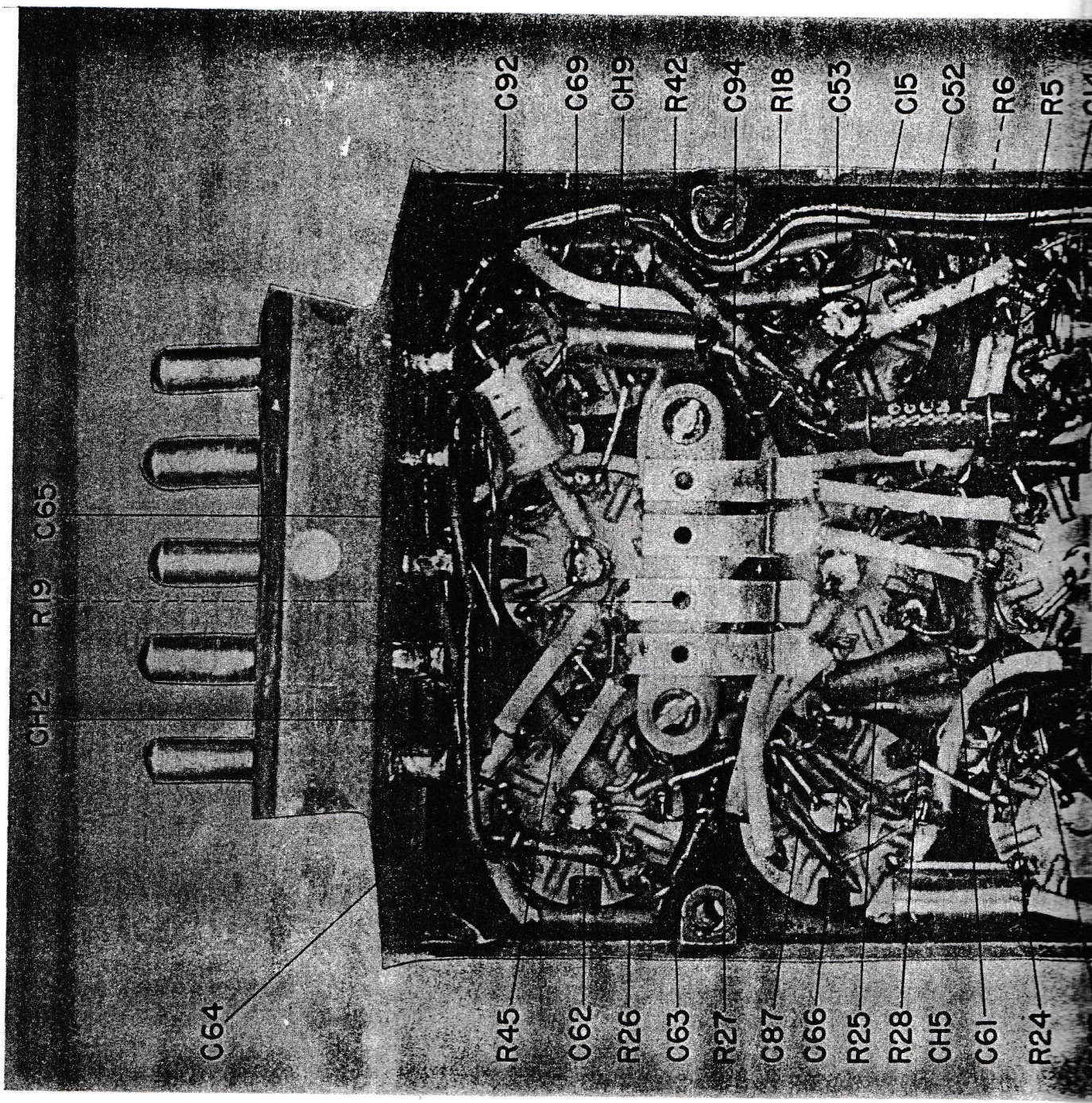
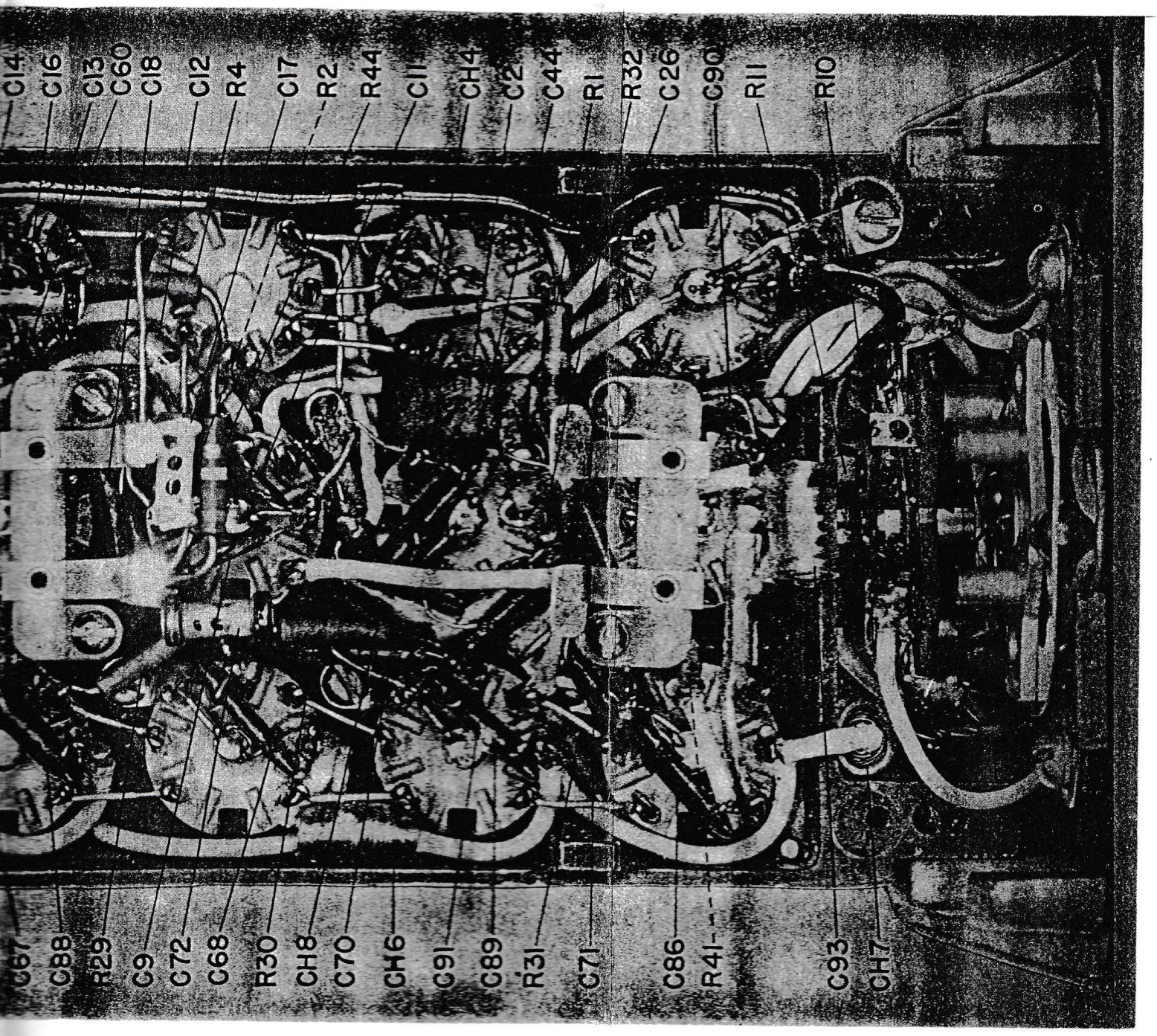


Fig 7 - Bottom view of socket



is showing component location

RADIO SET CPRC-26

Permissive Repair Schedule

RADIO SET CPRC-26	Item	STAGE OF REPAIR		
		Unit	Field	Base
ANTENNAE	1	replace	replace recon	rebuild
BAG CANVAS	2	replace	replace recon	rebuild
CASES:	3		recon	rebuild
Catches and fasteners	4	replace	replace	
Gaskets	5	replace	replace	
Hardware	6	replace	replace	
Knobs	7	replace	replace	
HANDSET - HEADSET:	8	replace	replace recon	rebuild
Cables	9	replace	replace	
Covers	10	replace	replace	
Gaskets	11	replace	replace	
Hardware	12	replace	replace	
Headband	13	replace	replace	
Microphone assemblies	14	replace	replace	
Receiver elements	15	replace	replace	
Switch	16	replace	replace	
RECEIVER - TRANSMITTER	17	adjust replace	replace recon	rebuild
Capacitors fixed	18		replace	
Chokes	19		replace	
Coils	20		replace	
Crystal units	21	replace	replace	
Desiccator and humidity indicator	22	replace	replace	
Gaskets	23	replace	replace	
Hardware	24		replace	
Panel assembly	25		replace	
Plug-in units	26	replace	replace	rebuild
Resistors	27		replace	
Seals	28		replace	

RADIO SET CPRC-26	Item	STAGE OF REPAIR		
		Unit	Field	Base
RECEIVER - TRANSMITTER (Con't)				
Sockets	29			rebuild
Antenna	30	replace	replace	
Audio	31	replace	replace	
Battery	32	replace	replace	
Tube	33		replace	
Switches	34			rebuild
ON/OFF	35	replace	replace	
Channel detent	36	replace	replace	
Channel shaft	37		replace	
Channel wafer	38		replace	
Terminal boards	39		replace	
Trimmers	40		replace	
Vacuum tubes	41	replace	replace	

END

RADIO SET CPRC-26

Field and Base Repair

Supersedes Issue 1 and 2

SUMMARY

1. This instruction details component replacement, alignment and performance testing procedures. An alternative alignment procedure, employing Test Set Radio CTS 3/PRC, is outlined in Elec I 163.

GENERAL

2. a. The majority of faults occurring in Radio Set CPRC-26 are repairable by replacement of plug-in units or tubes. The remaining faults will be caused by mis-alignment or component failure and appropriate action will be necessary.

b. Test equipment is referred to by its common name in this instruction (see Fig 1).

c. When tuning the SG-5007 to channel frequency three consecutive output peaks will be noted on the af wattmeter. Maximum output on the centre peak is the true channel frequency.

d. The "L" cursor is specified for the SG-5007 attenuator setting.

e. Standard modulation on the SG-5007 is 15 kc deviation at 1000 cps.

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TEST EQUIPMENT

Serial	Stock No.	Designation	Common Name	Qty
1	6625-21-104-4802	ADAPTER, Test, Kit Electronic Equipment	Adapter Kit	1
2	6625-21-101-8183	FREQUENCY METER, AN/URM-32	URM-32	1
3	6625-21-101-4801	GENERATOR, Signal, SG-5007/U	SG-5007	1
4	6625-00-309-5381	GENERATOR SET, Signal RF AN/URM-25D	URM-25D	1
5	6625-00-538-9007	GENERATOR, Signal AF/RF, Waveforms 510B	Audio Oscillator	1
6	6625-21-101-3150	TEST SET RADIO, VT-9A or Equivalent VTVM	VTVM	1
7	6625-21-101-3213	FREQUENCY METER, FR-5001/U	Deviation Meter	1
8	6625-21-101-4802	WATTMETER, RF, ME-5005/U	RF Wattmeter	1
9	6625-21-101-4829	WATTMETER, AF, ME-5006/U	AF Wattmeter	1
10	NPN	IF INJECTION UNIT, (see Fig 8)		1
11	NPN	TEST SOCKET SELECTOR SWITCH, (see Fig 10)		1
12	6750-21-101-9923	MAINTENANCE POWER SUPPLY, PP-351/U or Equivalent, or Battery, Dry, BA 289/U	Power Supply	1

Fig 1 - Test Equipment Required

REPAIR TECHNIQUES

3. a. Extractors will be used to remove tubes and plug-in units. Care must be exercised to prevent bending of pins.

b. Elec A 758 outlines procedures to be employed during soldering. This information, supplemented by the latest soldering techniques, will be employed to prevent component damage.

c. Defective components should be clipped loose with needle nosed cutters. The remaining wire can then be more easily removed from the terminals.

d. Component positioning and lead dressing are critical so replacement wiring must exactly duplicate the original.

e. Keep set dry and free from dust.

DRYING AND SEALING

4. Drying and sealing techniques are under revision at the present time, new techniques will be detailed in EME Manual Elec A 770. In the interim period the following procedures will apply:

a. The radio set will be opened under the driest possible conditions.

b. The length of time that the set is open will be held to a minimum.

c. A new desiccator and indicator will be fitted immediately before resealing.

REPLACEMENT OF GASKETS

5. a. Gaskets or seals are to be replaced whenever front panel components are replaced. The "set-to-case" and "case-to-battery box" gaskets are to be replaced whenever they fail to afford an effective seal. Gaskets will be sealed in place with a "rubber-to-metal" cement. Securing nuts and bolts will be only tightened enough to provide an effective seal.

b. Rubber "0" rings on the channel and control switches must be lubricated to ensure proper sealing. Grease silicone, Dow-Corning No. 4 (5970-00-224-5276, Insulating compound electrical) will be used. Other greases cause premature failure and will not be used. "0" rings which have been removed, will be cleaned and lubricated before reassembly.

REMOVAL AND REPLACEMENT OF PARTS

TRIMMER DECK

6. a. Release the spring clamps that hold the crystal bank in place.

b. Unsolder the black lead from C1 on the antenna coil terminal panel.

c. Rotate channel switch to channel 4.

d. Remove the four long bolts which hold the trimmer deck to the main chassis.

e. Remove the two bolts which hold the trimmer deck to the front panel. The trimmer deck can now be separated from the main chassis.

f. The trimmer deck is replaced in the reverse order.

DISASSEMBLY OF THE TRIMMER DECK

7. a. Remove the six screws (one at each end of the three "H" plates) which secure the fibre plate of the trimmer deck to the trimmer deck shield.

b. Separate the trimmer deck from the trimmer deck shield.

TRIMMER CAPACITORS

8. a. Disassemble the trimmer deck as detailed in the previous paragraph.

b. Unsolder lead from trimmer capacitor.

c. Remove trimmer capacitor mounting nut and remove capacitor.

d. A small amount of glyptal cement will be applied to trimmer capacitor mounting nuts after these capacitors are replaced. This prevents loosening.

MASTER OSCILLATOR SECTION OF CHANNEL SWITCH

9. a. Disassemble trimmer deck.

b. Remove switch shaft.

c. Unsolder leads from switch wafer to neutralizing capacitor and inter-chassis connector.

d. Unsolder leads from switch wafer to mo capacitors, channels 3 and 4.

e. Remove mounting nuts of mo capacitors, channels 1 and 6, and separate them from mounting plate. Unsolder leads from switch wafer to these capacitors.

f. Unsolder leads from switch wafer to mo capacitors, channels 2 and 5.

g. Remove the two screws which secure the adjacent shield to the fibre plate.

h. Move the shield enough to remove the two screws which secure the switch wafer to the shield.

i. Certain lugs of the replacement switch wafer must be clipped to prevent shorting. Use the original wafer as a guide.

TUBE OR PLUG-IN UNIT SOCKET

10.a. Remove all plug-in units and tubes.

b. Remove trimmer deck.

c. Remove all connections from socket to be replaced, being careful not to damage components.

d. Remove the 14 screws which secure the fibre plate to the main chassis.

e. Install and re-wire the new socket, being careful not to damage components.

f. Mark the new socket with a dot of paint of the same colour as its associated plug-in unit.

FRONT PANEL

11.a. Remove the four bolts which secure the front panel to the main chassis and trimmer deck shield.

b. Unsolder the black lead from C1 on the antenna coil terminal panel.

c. Refer to Fig 2. Unsolder those leads from switch SW2 which connect to the main chassis and are identified by colour.

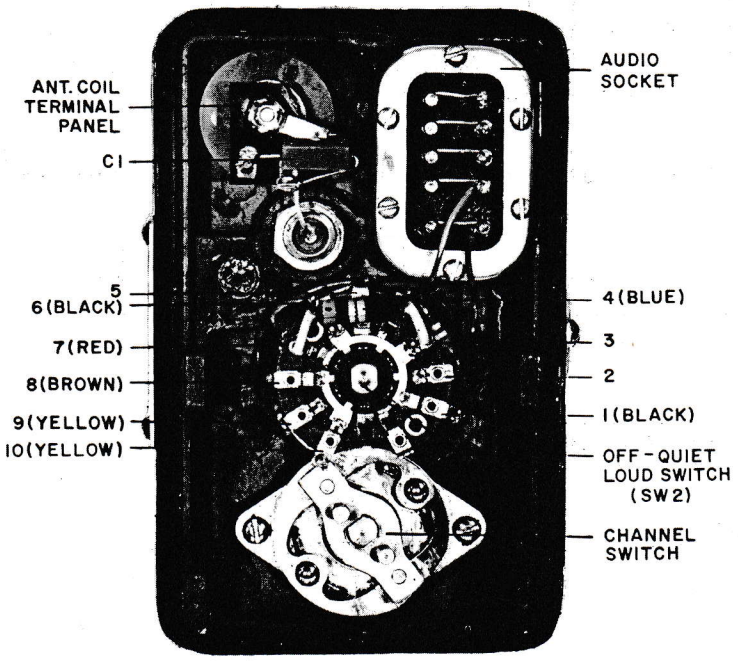

Fig 2 - Front Panel

d. Unsolder the orange, white and yellow leads from the audio socket and separate the front panel from the main chassis.

OFF-QUIET-LOUD SWITCH

12.a. Refer to Fig 2 and para 11. Unsolder necessary leads from the OFF-QUIET-LOUD switch to main chassis and audio socket.

b. Remove front panel switch knob.

c. Remove switch securing nut and remove the switch.

d. Replace switch in the reverse order, ensuring that the cut-out portion of the wafer is next to the band switch.

ALIGNMENT AND PERFORMANCE TESTING PROCEDURES

PRELIMINARY PREPARATION

13.a. Remove radio set from its case.

b. Remove the unit retainer and the desiccator unit.

c. Replace two mounting bolts in battery plug, using a flat washer between the mounting bolt and the battery plug. This secures the rubber portion of the battery plug and prevents separation when radio set is disconnected from power supply.

d. Connect the test equipment to the adapter test kit as shown in Fig 3. Test equipment connections will be made to the appropriate connectors on the adapter test kit with the exception of the URM-32. It will be connected to the CRO connector after completion of the initial test.

POWER SUPPLY

14.a. The power supply, will be adjusted for the following outputs:

A	1.25 v	B2	90.0 v
B1	45.0 v	C	-3.0 v

b. If this supply is not available, a battery pack will be used. Since output voltages of a battery in good condition are considerably higher than those specified, better results must be anticipated eg, higher transmitter output, higher receiver output etc. The effects of supply voltages on transmitter output is shown in Fig 4.

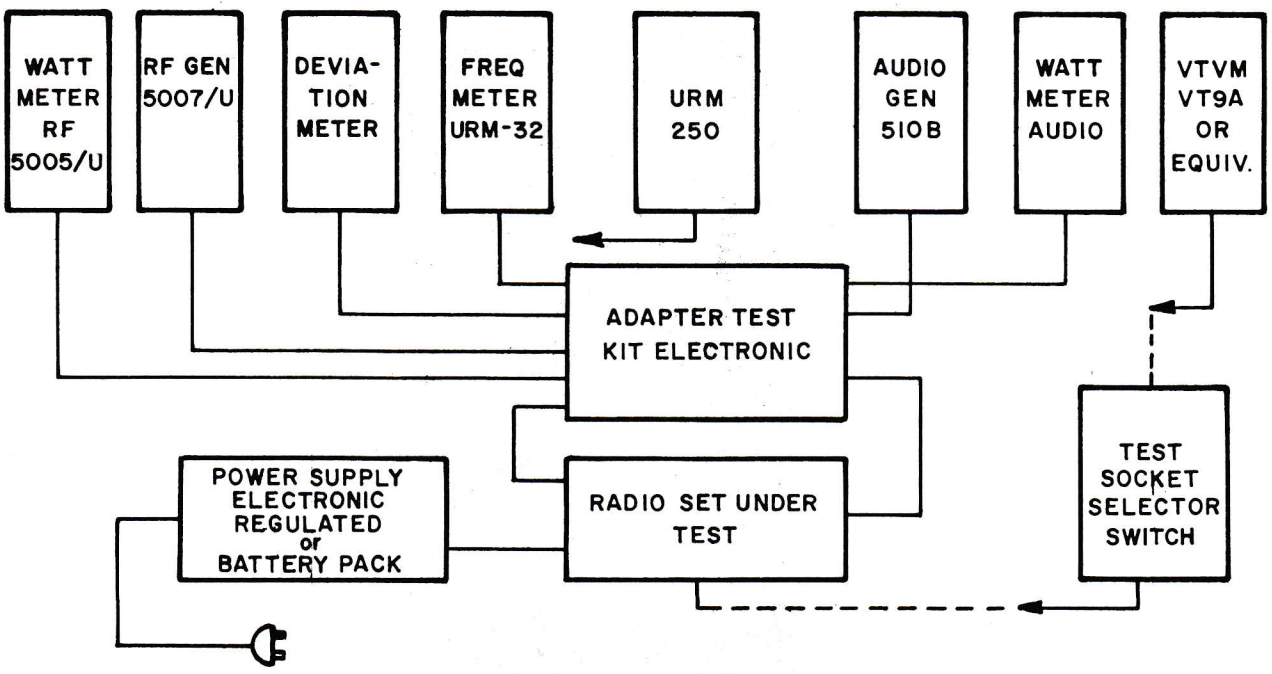

Fig 3 - Suggested Test Setup

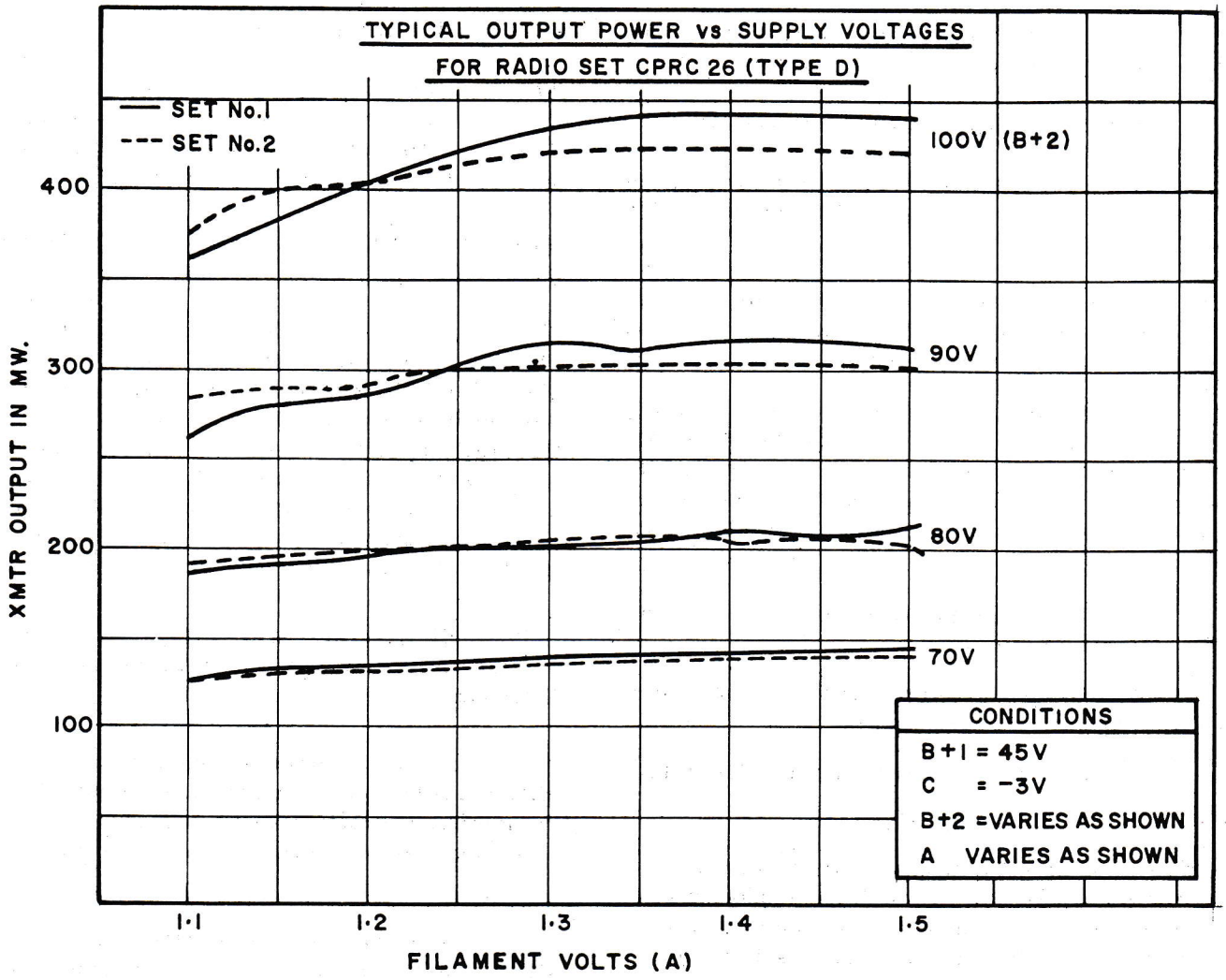

Fig 4 - Transmitter Output Versus Supply Voltages

IF SENSITIVITY AND BANDWIDTH

15.a. Remove the rf plug-in unit and insert the IF injection unit which is connected to URM-25D. Connect VTVM to pin 3 of test socket and tune the generator for maximum limiter bias. Adjust generator output for meter reading of -1v. Record generator output required.

b. Increase generator output to twice the level found in (a). Detune the signal generator above and below 4300 kc for -1v meter indication. Measure and record the frequencies at which these indications occur.

c. If the following standards are not met, individual IF units will be changed for this result.

(1) Sensitivity: not more than 40 uV for -IV limiter bias.

(2) Bandwidth (difference between frequencies found in (b): not less than 65 kc or more than 85 kc.

(3) Centre Frequency (sum of frequencies found in (b) divided by two): 4300 $\pm$ 5 kc.

d. Remove IF injection unit and replace rf plug-in unit.

CHANNEL ALIGNMENT

16.a. Initial Tuning

(1) Set channel switch to 1 and switch set to transmit.

(2) Adjust the appropriate mo and rf capacitor for maximum afc amplifier bias voltage at pin 7 of test socket.

(3) Adjust the appropriate pa capacitor for maximum output on rf wattmeter.

b. Final Tuning (set still on transmit)

(1) Measure the mo grid bias voltage at pin 4 of test socket. It should be between -2.5 and 4.0 v.

(2) Adjust the mo capacitor for zero afc discriminator voltage; ie, equal voltages at pins 1 and 4 of the test socket.

(3) Switch to receive for approximately 5 seconds to overcome the effects of ferrite modulator hysterisis then re-turn to transmit. Insure that the voltages at pins 1 and 4 are still equal. Re-adjust the mo capacitor slightly if necessary.

(4) Re-adjust pa capacitor for maximum rf wattmeter indication.

(5) Adjust rf capacitor for maximum voltage at pin 7 of test socket.

c. Repeat this procedure for all channels.

NOTE

It is suggested that transmit-receive error be measured immediately after the alignment of channel 1. Evidence of a misaligned discriminator unit is indicated by excessive transmit-receive frequency error. (See para 28).

TRANSMITTER POWER OUTPUT

17. Transmitter power is read directly from the rf wattmeter and should not be less than 250 mw. PA tube selection may be necessary to meet the power output specification.

TRANSMIT-RECEIVE FREQUENCY ERROR AND CHANNEL CALIBRATION

18.a. Connect the URM-32 to the CRO socket of the adapter kit. Set the channel switch to 1 and the OFF-QUIET-LOUD switch to LOUD. Set the function switch of the URM-32 to Mod. Carefully tune the frequency meter, using the audio wattmeter as an indicator, to the null between two modulation humps. This is the receiver centre frequency. Measure and record this frequency.

b. Switch the set to transmit. Measure and record the transmitter frequency on the URM-32.

c. Note the transmit-receiver error. This difference frequency must not exceed 8 kc. The transmitter output must be within $\pm$ 8 kc of the nominal channel frequency (see Fig 5).

d. Check that the transmitter frequency on all channels is within $\pm$ 8 kc of the nominal channel frequency.

Channel	Type A	Type D	Type E	Type F
1	50,000 kc	50,000 kc	50,000 kc	50,000 kc
2	50,200	50,200	52,400	53,400
3	51,600	50,400	52,600	53,600
4	51,800	50,600	52,800	53,800
5	52,000	50,800	53,000	54,000
6	52,200	51,000	53,200	54,200

Fig 5 - Channel Frequencies for Set Types

NOTE

Frequency tables for the URM-32 dial readings should be made to enable rapid frequency measurement. See Elec I 164 Instr 2, Fig 1.

AFC LOOP GAIN

19.a. Set channel switch to 6 and remove the afc amplifier. Switch the set to transmit. Detune the mo 250 kc above the measured channel frequency. Use the URM-32 to determine this frequency. Replace the afc amplifier and remeasure the output frequency. The error frequency should now be within 7.1 kc of the original channel frequency. Loop gain is determined by dividing 250 kc by the error frequency.

EXAMPLES:

Frequency after detuning w/afc paralyzed	-	50.250 mc
Frequency before detuning w/afc operational	-	50.000 mc
Difference of f1	=	0.250 mc
Frequency after detuning w/afc operational	-	50.005 mc
Frequency before detuning w/afc operational	-	50.000 mc
Difference of f2	=	0.005 mc

$$\text{Loop Gain} = \frac{f1\,(0.250)}{f2\,(0.005)} = 50$$

b. Minimum loop gain will be 35. Retune mo as detailed in para 16 b.

NEUTRALIZATION

20.a. Disable the afc by removal of the afc amplifier unit. Switch the set to transmit and measure the output frequency. Short the whip antenna socket to chassis and remeasure the output frequency. The difference between the measured frequencies must not exceed $\pm$ 10 kc.

b. The neutralization screw, if replaced, will be adjusted to minimize the effects of loading and then cemented in position. This adjustment is made at the factory and does not normally require workshop attention.

MICROPHONIC TEST

21.a. Switch the case-enclosed set to transmit on channel 1 and, while holding the set in one hand, slap it sharply on any surface with the edge of the other hand. The resultant deviation indicated on the deviation meter must return to the quiescent level in less than 10 seconds.

b. When microphonic tubes or plug-in units are replaced re-alignment may be necessary.

TRANSMITTER-FREQUENCY DEVIATION

22.a. Set the adapter kit AUDIO PADS switch to 26 QT. Adjust the af oscillator output for 1.5 vac at 1000 cps. Set the OFF-QUIET-LOUD switch to QUIET. Switch the set to transmit. Measure and record transmitter deviation.

b. Set the OFF-QUIET-LOUD switch to LOUD. Set the AUDIO PADS switch to 26 LD. Measure and record transmitter deviation.

c. The transmitter frequency deviation for both QUIET and LOUD operation must be between 7 and 25 kc. Check to ensure that sidetone is present.

TRANSMITTER MODULATION CHARACTERISTICS

23.a. Set the adapter kit AUDIO PADS switch to 26 QT and apply an input of 1000 cps from the audio oscillator. Set the OFF-QUIET-LOUD switch to QUIET. Switch the set to transmit and adjust the output of the audio oscillator to give 15 kc deviation on the deviation meter. Measure and record this audio voltage which is used as a reference and is referred to in Fig 6 as X and 0 db.

b. Repeat this procedure for the other frequencies tabulated in Fig 6 ie, adjust and measure the audio oscillator output required to give 15 kc deviation. The acceptable limits are expressed with reference to X and in db.

Frequency	Deviation	Audio Voltage Required	
		Reference X	Reference db
1000 cps	15 kc	X	0 db
100 cps	15 kc	more than 3.2 X	more than + 10 db
250 cps	15 kc	.5 X to 2 X	$\pm$ 6 db
2000 cps	15 kc	.5 X to 2 X	$\pm$ 6 db
5000 cps	15 kc	more than 2 X	more than + 6 db

Fig 6 - Frequency Response Data

RECEIVER SENSITIVITY (Signal Plug Noise to Noise Ratio)

24.a. Set the OFF-QUIET-LOUD switch to LOUD and adjust the SG-5007 for 1 uv output standard modulation at channel frequency (see para 20). Record the audio wattmeter indication.

b. Set the carrier switch of SG-5007 to CW and record the audio wattmeter indication.

c. The ratio between these recorded indications must be greater than 100:1 or 20 db. Repeat this procedure for all channels.

LIMITING CHARACTERISTICS

25.a. Set the SG-5007 for 2.5 uv output with standard modulation at channel frequency. Set the OFF-QUIET-LOUD switch to LOUD and record the audio wattmeter indication.

b. Increase the output of the generator to 500 uv and record the audio wattmeter indication. The ratio between these indications should not be more than 2:1 or 3 db.

AUDIO FREQUENCY POWER OUTPUT

26.a. Set the OFF-QUIET-LOUD switch to LOUD. Set the SG-5007 for 500 uv output with standard modulation at channel frequency. Record the audio wattmeter indication which should be greater than 6 mw. Set the OFF-QUIET-LOUD switch to QUIET. The decrease in output should be between 10:1 and 40:1 or 13 $\pm$3 db.

RECEIVER AUDIO FREQUENCY RESPONSE

27.a. Set the OFF-QUIET-LOUD switch to LOUD. Externally modulate the SG-5007 with the af oscillator to provide 15 kc deviation at 1000 cps. Measure and record the audio output power which is referred to in Fig 7 as "X" or 0 db.

b. Measure and record the audio output power for the other frequencies tabulated in Fig 7, while maintaining 15 kc deviation. Fig 7 specifies acceptable limits.

DISCRIMINATOR TEST

28. The following performance tests will be used to identify non-serviceable plug in units.

a. Inject the output of the URM-25D, accurately tuned to 4.3 mc, via the IF injection unit. Adjust the generator output for -2v at pin 3 of test socket.

b. Remove the af plug-in unit and measure the discriminator output at pin 4 of the af socket. This voltage must lie between 0 and +1.75 v.

c. Measure discriminator output at 4.3 mcs +and - 25 kc. It must exceed - and +6 v respectively.

d. Measure the frequency of the discriminator peaks, noting voltage present. Peak separation must exceed 100 kc and the smaller voltage must be at least 75 percent of the larger.

Frequency	Deviation	Output Power Relative to X	Attenuation Relative to 0 db
1000 cps	15 kc	X	0 db
100 cps	15 kc	less than 0.5 X	less than -3 db
250 cps	15 kc	more than 0.2 X	less than -7 db
2000 cps	15 kc	more than 0.3 X	less than -5.5 db
5000 cps	15 kc	less than 0.2 X	more than -7 db

Fig 7 - Frequency Response Data

RADIO SET CPRC-26

Amendment

1. This is not a new instruction, file this page in front of page 1.

2. Amend Figure 12 as follows:

a. Delete B+2 (PIN 6) - insert B+2 (PIN 5)

b. Delete PA (PIN 5) - insert PA (PIN 6)

(7640)

Done
30 Apr 64