

# Assembly and Operation of the

**HEATHKIT®**

## "MOHICAN" COMMUNICATIONS RECEIVER

MODEL GC-1A



**HEATH COMPANY,**  
BENTON HARBOR,  
MICHIGAN

**DAYSTROM, INCORPORATED**  
a subsidiary of

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\*Indicates foldout from indicated page.

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## SPECIFICATIONS

| Receiver Type: .....          | Ten transistor, general coverage, single conversion superheterodyne                                                                                                                                                                                                                                                                           |      |           |        |            |        |                 |        |           |        |            |        |             |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|--------|------------|--------|-----------------|--------|-----------|--------|------------|--------|-------------|
| Intermediate Frequency: ..... | 455 kc.                                                                                                                                                                                                                                                                                                                                       |      |           |        |            |        |                 |        |           |        |            |        |             |
| Frequency Coverage: .....     | <table border="1"> <thead> <tr> <th>Band</th><th>Frequency</th></tr> </thead> <tbody> <tr> <td>A.....</td><td>550 - 1600</td></tr> <tr> <td>B.....</td><td>1.6 mc - 4.0 mc</td></tr> <tr> <td>C.....</td><td>4.0 - 9.0</td></tr> <tr> <td>D.....</td><td>9.0 - 20.0</td></tr> <tr> <td>E.....</td><td>20.0 - 32.0</td></tr> </tbody> </table> | Band | Frequency | A..... | 550 - 1600 | B..... | 1.6 mc - 4.0 mc | C..... | 4.0 - 9.0 | D..... | 9.0 - 20.0 | E..... | 20.0 - 32.0 |
| Band                          | Frequency                                                                                                                                                                                                                                                                                                                                     |      |           |        |            |        |                 |        |           |        |            |        |             |
| A.....                        | 550 - 1600                                                                                                                                                                                                                                                                                                                                    |      |           |        |            |        |                 |        |           |        |            |        |             |
| B.....                        | 1.6 mc - 4.0 mc                                                                                                                                                                                                                                                                                                                               |      |           |        |            |        |                 |        |           |        |            |        |             |
| C.....                        | 4.0 - 9.0                                                                                                                                                                                                                                                                                                                                     |      |           |        |            |        |                 |        |           |        |            |        |             |
| D.....                        | 9.0 - 20.0                                                                                                                                                                                                                                                                                                                                    |      |           |        |            |        |                 |        |           |        |            |        |             |
| E.....                        | 20.0 - 32.0                                                                                                                                                                                                                                                                                                                                   |      |           |        |            |        |                 |        |           |        |            |        |             |
| Selectivity: .....            | 3 kc wide at 6 db down.                                                                                                                                                                                                                                                                                                                       |      |           |        |            |        |                 |        |           |        |            |        |             |
| Sensitivity: .....            | Band A - 10 microvolt = 10 db or better signal-to-noise ratio at 50 milliwatt audio output.<br>Band B, C, D and E - 2 microvolts = 10 db or better, signal-to-noise ratio at 50 milliwatt audio output.                                                                                                                                       |      |           |        |            |        |                 |        |           |        |            |        |             |

|                                       |                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Panel Controls: . . . . .             | RF GAIN.<br>VOLUME with ON/OFF switch.<br>MAIN TUNING.<br>BANDSPREAD TUNING.<br>BFO with ON/OFF switch.<br>AVC switch.<br>ANL switch.<br>Spring loaded DIAL LIGHT switch.<br>ANTENNA TUNING.<br>BAND SWITCH.                                                                                                                                                                 |
| Rear Apron: . . . . .                 | External antenna.<br>Muting terminals.<br>Phone jack.                                                                                                                                                                                                                                                                                                                        |
| Semiconductor Complement: . . . . .   | 2N1396..... RF Amplifier.<br>2N1225..... Mixer.<br>2N1225..... Oscillator.<br>2N373..... 1st IF Amplifier.<br>2N373..... 2nd IF Amplifier.<br>2N373..... 3rd IF Amplifier.<br>2N407..... Audio Driver.<br>2N407..... Audio Output (2).<br>2N409..... BFO.<br>1N2326..... Compensating Diodes (2).<br>1N754..... Zener Voltage Regulator.<br>HD2257..... Germanium Diodes (3) |
| Battery Life (8 "C" cells): . . . . . | Up to 400 hours normal intermittent service.                                                                                                                                                                                                                                                                                                                                 |
| Output: . . . . .                     | 400 milliwatts at 10% distortion.                                                                                                                                                                                                                                                                                                                                            |
| Power Required: . . . . .             | 12 volts at <u>35 ma</u> - 50 milliwatt output.                                                                                                                                                                                                                                                                                                                              |
| Weight: . . . . .                     | 17 lbs.                                                                                                                                                                                                                                                                                                                                                                      |
| Shipping Weight: . . . . .            | 20 lbs.                                                                                                                                                                                                                                                                                                                                                                      |
| Size: . . . . .                       | 6-7/8" high x 12" wide x 10" deep.                                                                                                                                                                                                                                                                                                                                           |

## INTRODUCTION

The HEATHKIT® Mohican, Model GC-1A, is a fully transistorized general coverage receiver, designed primarily for amateur and SWL use. Many new circuit components and design concepts have been used, to provide the amateur or SWL with a portable receiver having many features of the higher priced units. Provisions for external muting are included. Reception of CW and SSB signals is made possible with the BFO. Also featured is a slide rule dial, RF gain control, antenna trimmer, and calibrated band-spread on the amateur bands.

The Mohican circuit layout is shown in the Block Diagram in Detail 1.

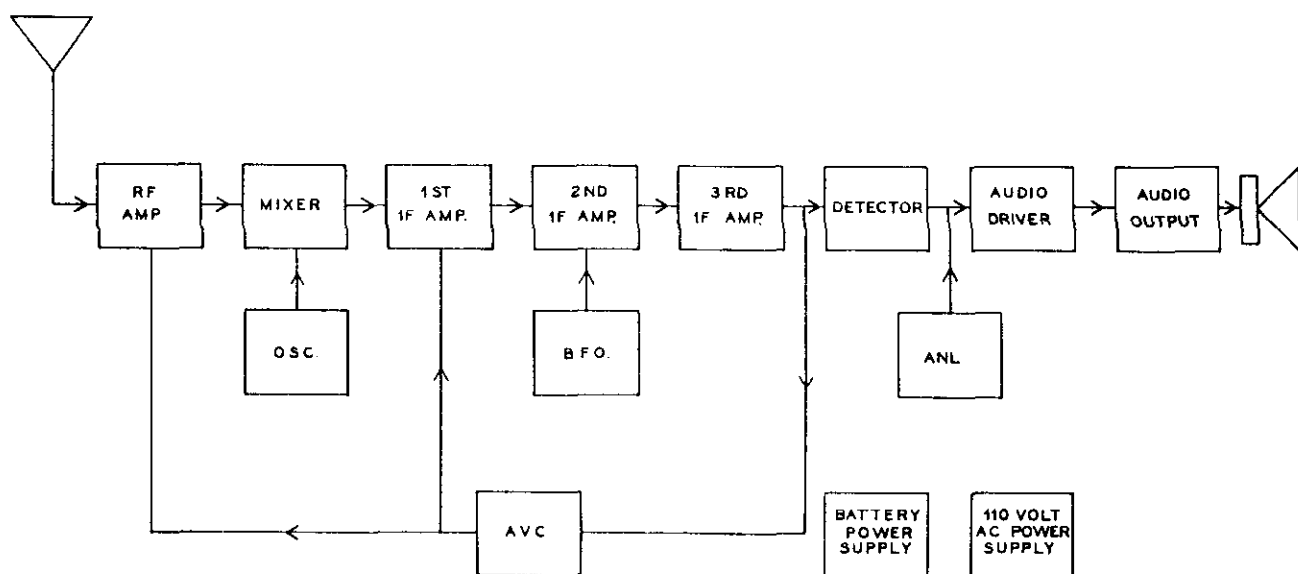
The RF amplifier, mixer and oscillator sections use high frequency (100 mc alpha cutoff) drift transistors. In the manufacturing of a drift type transistor, the base impurity is controlled so that a high impurity density exists at the emitter, giving a low base resistance; a low impurity density exists at the collector, producing a low collector capacitance. The density of the

impurity decreases exponentially from the emitter to the collector; hence, the name drift (field) transistor. This drift field accelerates the carrier charges, reducing transit time and in this way improves the high frequency operation.

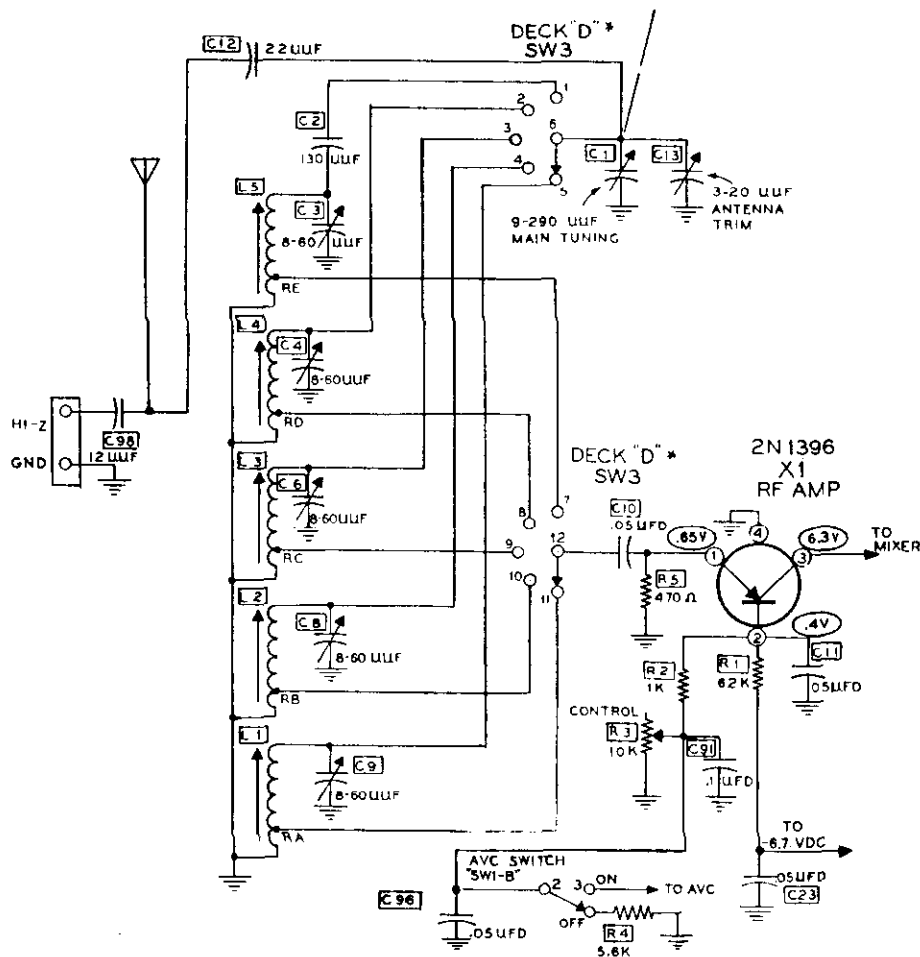
The IF amplifier sections (1st, 2nd and 3rd) use "transfilters" for shaping the band-pass. These transfilters use the piezoelectric effect of ceramic. No alignment is required and a fixed narrow band-pass is achieved.

The beat frequency oscillator uses the variable capacity effect of a diode for tuning, thereby eliminating the need for linkage that would be required for a variable capacitor. A potentiometer, on the front panel, varies the back bias voltage of a diode resulting in a change of the diode capacity, which tunes the BFO tank circuit.

Batteries or 110 volt AC power supplies are available for use with this receiver. Either supply attaches to the receiver through a plug-in power cable, and then may be snapped into the rear of the formed steel cabinet.



Detail 1



Detail 2

**RF Amplifier Section****CIRCUIT DESCRIPTION**

Refer to Detail 2.

A 2N1396 transistor X1 is used as the RF amplifier. This stage is operated in a grounded base configuration to maintain a flat alpha gain (current gain between emitter and collector) over a wide frequency range. The current gain of a grounded base transistor is always less than unity, however, due to the low input resistance and the high output resistance the voltage gain is quite large.

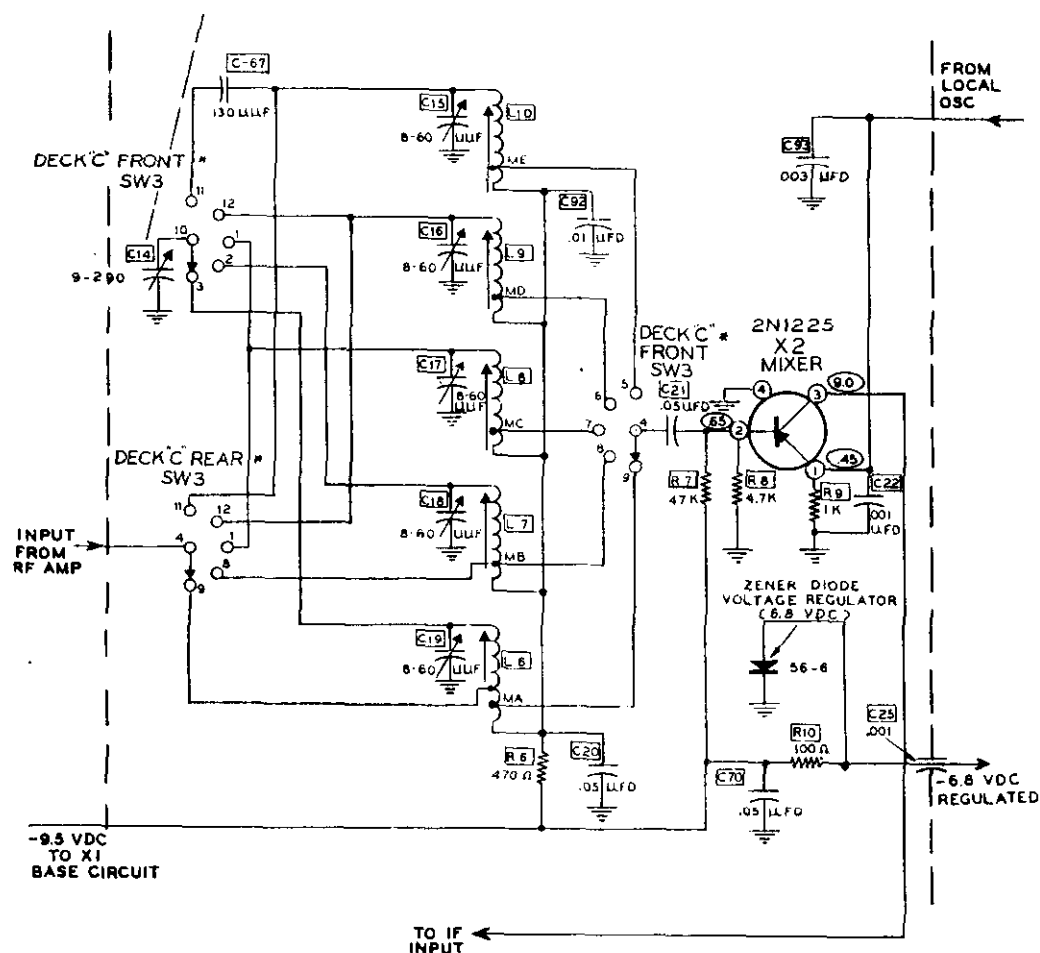
Base bias is set by the voltage divider network consisting of resistor R1 and R2, in series with the parallel combination of resistors R3 and R4. With AVC OFF, base bias is taken from the junction of R1 and R2 and can be varied with the RF gain control R3. With the AVC ON, the RF gain control R3 is placed in parallel with the AVC supply through switch SW1.

The built-in whip antenna connects to the switch selected antenna coil through C12. The signal is

then coupled from the low impedance coil tap, through C10, to the emitter of the RF amplifier. An external antenna input has been provided and is accessible on the chassis rear apron. This signal input is coupled through C98 to reduce loading effects and retain the selective properties of the antenna coil.

Capacitor C11 provides an RF ground and prevents loss caused by degeneration across the bias network. The case of X1 is grounded to act as an RF shield.

The band switch connects the antenna coil for the selected band in parallel with the main tuning capacitor section C1. The signal from the collector of the RF amplifier is coupled to the mixer base through the corresponding mixer coil. The variable capacitor C13 parallels the main tuning capacitor C1 and provides front panel tuning to compensate for antenna variations.



Detail 3

### Mixer Section

Refer to Detail 3.

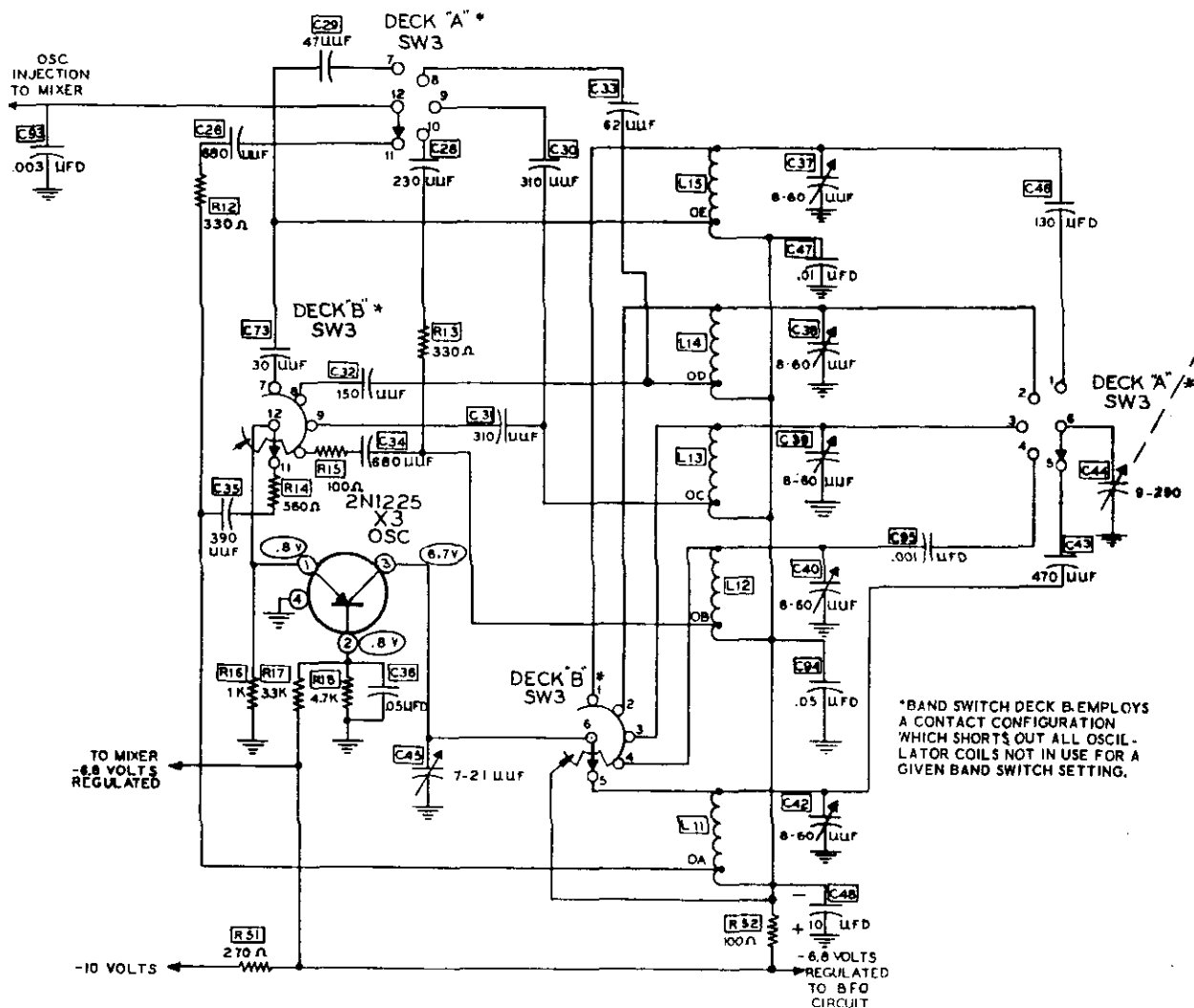
A 2N1225 transistor X2 is operated in a common emitter configuration as the mixer. A transistor operated in this configuration has a high beta gain (current gain between the base and collector). A voltage divider network consisting of R7 and R8 provide the base bias. The incoming signal from the collector of the RF amplifier is fed to the top (or the tap) of the mixer coil as required for proper impedance matching. The signal is then fed from the mixer coil, through C21 DC blocking capacitor, and into the base of the mixer. The mixer coil is tuned by main tuning capacitor section C14. The local oscillators output is injected into the emitter of the mixer transistor through the coupling capacitors, as described in the oscillator section. C22 and C93 bypass the mixer emitter and in conjunction with the coupling capacitors in the oscillator section, correctly set the oscillator injection level for the desired band.

The IF output of the mixer is applied to the IF input transformer primary (see Detail 5) from which the mixer collector voltage is derived. Resistor R9 establishes the DC operating point of the emitter and also compensates for circuit or transistor variations.

### Oscillator Section

Refer to Detail 4

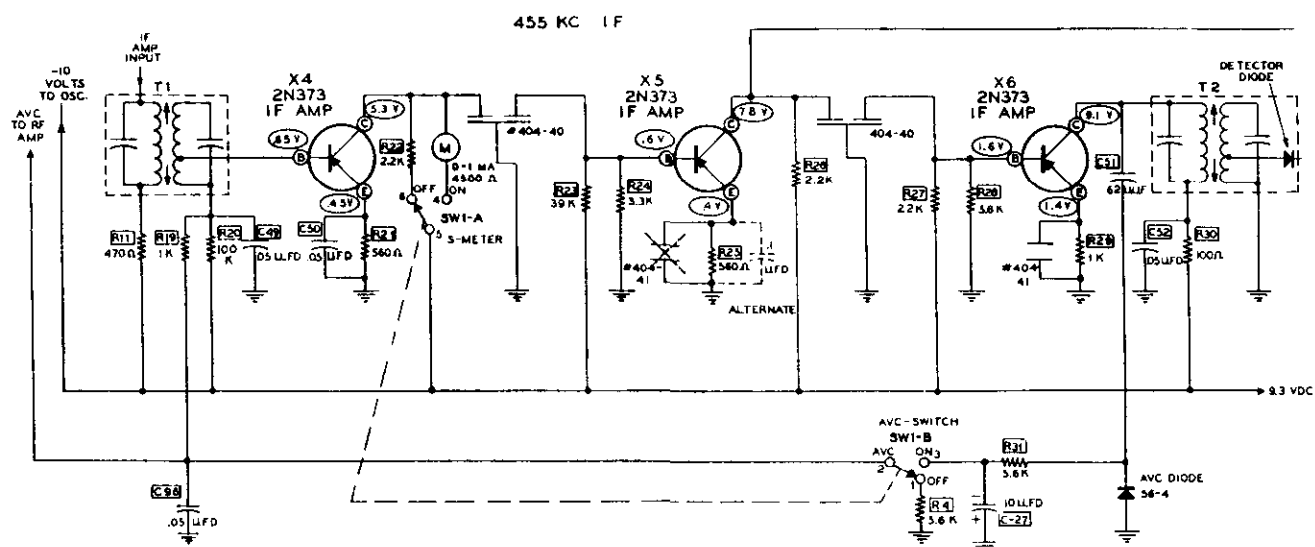
A 2N1225 transistor X3, operated in a common base configuration, is used as the local oscillator. Base bias is set by the voltage divider network consisting of R17 and R18. The base is effectively placed at RF ground with the bypass capacitor C36. Emitter feedback is coupled from the oscillator coil tap through the series capacitors and resistors as selected by the band



Detail 4

switch. These capacitors keep the DC collector voltage off the emitter and, in conjunction with the tap placement, establish the feedback required for proper operation of the oscillator. The main tuning capacitor, section C44, is band switch connected to the desired oscillator coil. C43 is placed in series with C44 to provide proper oscillator tracking on band A, and C95 provides the same function on band B. (C46 is placed in series with C44 to provide the proper tuning capacitor range on band E.) The tuning range of C44 does not require compensation for bands C and D. The collector voltage is applied through the oscillator coils, the start of which is heavily bypassed by C47, C48 and C94 capacitors. Variable capacitor C45 is tied directly to the collector of the oscillator and provides electrical bandspread. The R-C networks in the oscillator output circuit set the proper oscillator injection level to the mixer for each band.

The Zener diode (see Detail 3) is a device which has a predetermined breakdown potential when placed in service with reverse voltage applied. The properties of this type of diode are such that below the breakdown potential, the device passes negligible current similar to conventional diodes operated within their normal limits of reverse voltage. When breakdown does occur in a Zener diode, any further increase in reverse voltage results in a very large increase in current through the diode. R51 serves to limit this current, with the combination forming a very effective voltage regulator circuit which is necessary for the stabilization of the "front end" (local oscillator, mixer and RF amplifier) at the higher frequencies. This regulated voltage is also supplied to the BFO circuit. The action of a Zener regulator is very similar to a gaseous discharge regulator, i.e., OA2 etc.



Detail 5

### 455 kc IF Amplifier and Detector

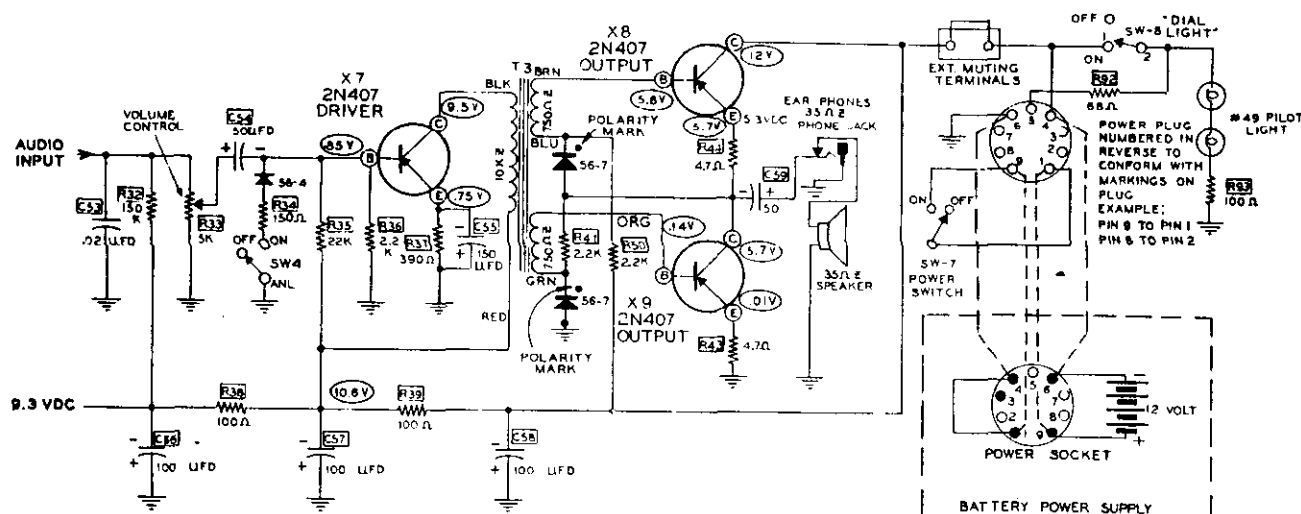
Refer to Detail 5.

Three 2N373 transistors X4, X5 and X6, operated in a common emitter configuration, are used as the IF amplifiers.

The output of the mixer (455 kc) is inductively coupled to the base of the 1st IF amplifier through the input IF transformer T1. The circuitry for the three IF stages are similar in configuration. The secondary of T1 has been tapped down to match the base input impedance of X4. Base bias of X4 is set by the voltage divider network of resistors R19 and R20. R19 is switched in series with resistor R4 to ground in AVC OFF position. With the AVC ON, R19 is placed in series with the AVC isolating resistor R31. The emitter of X4 is stabilized by resistor R21 and bypassed by C50 to eliminate degeneration caused by placing the emitter above the chassis potential. The collector voltage is applied through resistor R22 or through the 1 ma meter (4.5 KΩ internal resistance) as selected by AVC switch SW1. The output of X4 is fed into the transfilter (#404-40). This device uses the piezoelectric effect of a ceramic material to produce a narrow band-pass at 455 kc with a high input impedance and a low output impedance. The operation of the

transfilter is not dissimilar to the more familiar crystal lattice filter. In the emitter circuits of X5 and X6 there are other transfilters (#404-41). These are series tuned ceramic filter devices used in place of emitter bypass capacitors and are series resonant at 455 kc. The use of these transfilters provides an RF ground at 455 kc and further improves the IF skirt selectivity. The collector of X5 is coupled to the base of X6 through a transfilter in the same manner as the previous stage.

The output of the 3rd IF transistor X6 is coupled to the primary of the detector transformer T2. The signal is inductively coupled to the secondary of T2 and through the tap to the detector diode. Both T1 and T2 are double slug tuned to provide sharp band-pass characteristics. The AVC voltage is coupled from the collector by C51 and rectified by the diode (#56-4); the positive rectified AVC voltage is isolated by resistor R31 before being applied to the RF amplifier and the first IF amplifier. An increase in the signal level at the collector of X6 will cause an increase in the AVC voltage being applied to X1 and X4.



Detail 6

### Audio Section

Refer to Detail 6.

The audio section consists of a 2N407 driver X7 and two 2N407 transistors X8 and X9 operated in a modified push-pull circuit. The signal from the detector is coupled to the base of the driver transistor through C54. The audio control R33 controls the signal level being applied to the driver transistor. The voltage divider network, consisting of resistors R35 and R36, sets the base bias. The diode (#56-4), in conjunction with R34, makes up an automatic noise limiter which is switch selected by SW4. The emitter of the driver X7 is stabilized for circuit or manufacturing variations by R37. The emitter is bypassed by capacitor C55 to eliminate degeneration. This bypass capacitor is large, compared to the previous emitter bypass, to increase audio response. The driver collector voltage is applied through the primary of T3 from the filtered (-) minus supply line. The driver transformer T3 is designed with a high impedance primary to match the collector and a split low impedance secondary to match the base of the audio output transistors. Audio output transistor X8 has -12 volts applied directly to the collector from the battery; however, due to the voltage divider network, consisting of R41, R50, and the two 1N2326 compensating diodes, approximately 6 volts appear on the base leaving a 6 volt difference between the emitter and the collector.

The collector of X9 is at -6 volts and the emitter is at approximately chassis potential, leaving a 6 volt difference between the emitter and the collector. In this manner the two transistors run at equal voltage level. The audio output is coupled through C59 to the 35Ω speaker and then to ground. R43 and R44 are used to provide stabilization against transistor or circuit variations. R38, R39, C56, C57 and C58 are used as a filter network to keep audio signal voltage out of the IF amplifier stages.

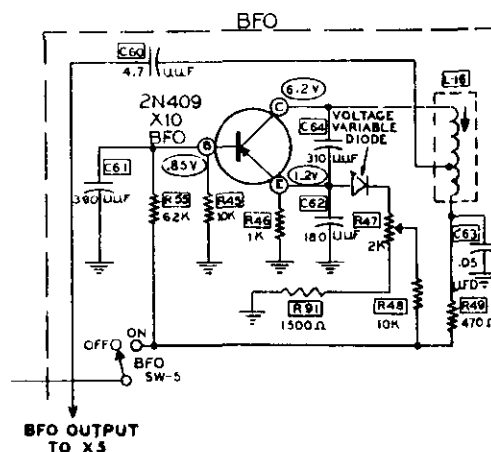
The 1N2326 compensating diodes in the base bias circuitry of the audio output stage provide a two-fold purpose. These diodes act as non-linear voltage regulators to maintain an approximate projected cutoff condition in the Class B output stage over large excursions of supply voltage, thus preserving good quality audio as battery voltages drop through usage. Germanium transistors are also subject to considerable collector current variation as a function of ambient temperature. These diodes have a negative temperature coefficient that nearly perfectly compensates for this effect over a wide range in temperature, preventing excessive battery drain at high temperatures and again maintaining good audio quality.

A 2-lug, rear apron mounted, screw terminal strip in the -12 volt leads from the power supply provides for external muting in fixed station use. These terminals are jumpered together in normal use. The power plug is wired to allow the front panel switch on the audio gain control to also remote switch an accessory AC power supply. When using an AC supply, pin 5 of the power plug is connected to the -12 volt lead through a 68  $\Omega$  resistor R92, thus turning on the pilot lights when the power switch is turned on.

### BFO

Refer to Detail 7.

A 2N409 transistor X10, operating in a common base oscillator circuit, is used as the BFO. The voltage divider network, consisting of R55 and R45, sets the base bias. C61 places the base at an effective RF ground. The 455 kc tank circuit is comprised of the series capacitors C64 and C62 in parallel with L16. Feedback is applied to the emitter through C64. The variable capacity phenomena of a diode with adjustable back bias is



Detail 7

used to tune the BFO through the band-pass of the receiver. R47 is used to vary the diode back bias voltage. The collector voltage is applied through R49, a decoupling resistor, and bypassed by capacitor C63. The output of the BFO is coupled from the tap on L16, through capacitor C60 to the collector of X5. SW5 turns the BFO ON or OFF as selected.

### CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating at a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

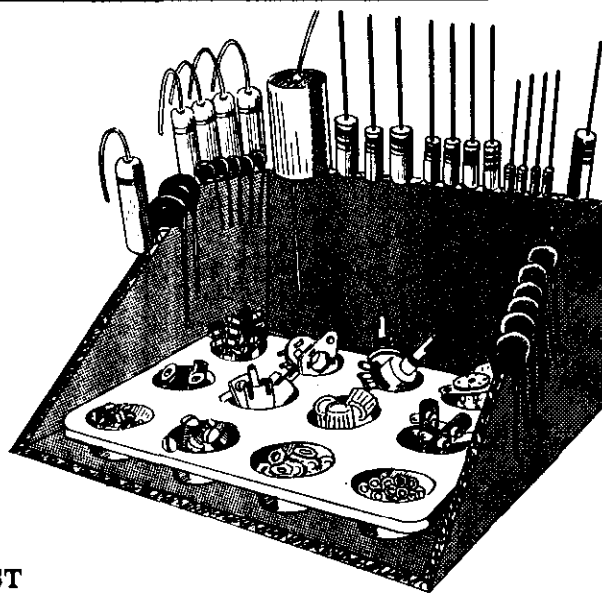
**UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST.** In so doing, you will become acquainted with the parts.

Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein. Include all inspection slips in your letter to us.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.

Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.

For parts identification when checking the parts list, refer to the Pictorial which folds out from page 15.



## PARTS LIST

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

## Resistors

|      |   |                                                  |
|------|---|--------------------------------------------------|
| 1-2  | 1 | 68 $\Omega$ 1/2 watt<br>(blue-gray-black)        |
| 1-3  | 7 | 100 $\Omega$ 1/2 watt<br>(brown-black-brown)     |
| 1-4  | 2 | 330 $\Omega$ 1/2 watt<br>(orange-orange-brown)   |
| 1-6  | 4 | 470 $\Omega$ 1/2 watt<br>(yellow-violet-brown)   |
| 1-9  | 6 | 1 K $\Omega$ 1/2 watt<br>(brown-black-red)       |
| 1-11 | 1 | 1500 $\Omega$ 1/2 watt<br>(brown-green-red)      |
| 1-14 | 1 | 3.3 K $\Omega$ 1/2 watt<br>(orange-orange-red)   |
| 1-16 | 2 | 4.7 K $\Omega$ 1/2 watt<br>(yellow-violet-red)   |
| 1-20 | 2 | 10 K $\Omega$ 1/2 watt<br>(brown-black-orange)   |
| 1-22 | 2 | 22 K $\Omega$ 1/2 watt<br>(red-red-orange)       |
| 1-24 | 1 | 33 K $\Omega$ 1/2 watt<br>(orange-orange-orange) |
| 1-25 | 1 | 47 K $\Omega$ 1/2 watt<br>(yellow-violet-orange) |
| 1-27 | 1 | 150 K $\Omega$ 1/2 watt<br>(brown-green-yellow)  |
| 1-42 | 1 | 270 $\Omega$ 1/2 watt<br>(red-violet-brown)      |
| 1-44 | 5 | 2.2 K $\Omega$ 1/2 watt<br>(red-red-red)         |
| 1-48 | 1 | 390 $\Omega$ 1/2 watt<br>(orange-white-brown)    |

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

## Resistors (cont'd.)

|       |   |                                                 |
|-------|---|-------------------------------------------------|
| 1-67  | 1 | 39 K $\Omega$ 1/2 watt<br>(orange-white-orange) |
| 1-95  | 3 | 560 $\Omega$ 1/2 watt<br>(green-blue-brown)     |
| 1-104 | 1 | 100 K $\Omega$ 1/2 watt<br>(brown-black-yellow) |
| 1-111 | 1 | 150 $\Omega$ 1/2 watt<br>(brown-green-brown)    |
| 1-113 | 3 | 5.6 K $\Omega$ 1/2 watt<br>(green-blue-red)     |
| 1-128 | 2 | 62 K $\Omega$ 1/2 watt<br>(blue-red-orange)     |
| 1-129 | 2 | 4.7 $\Omega$ 1/2 watt<br>(yellow-violet-gold)   |

## Capacitors

|        |    |                                          |
|--------|----|------------------------------------------|
| 20-40  | 1  | 470 $\mu$ pf silver mica                 |
| 20-98  | 1  | 12 $\mu$ pf silver mica                  |
| 20-99  | 1  | 22 $\mu$ pf silver mica                  |
| 20-100 | 1  | 30 $\mu$ pf silver mica                  |
| 20-101 | 1  | 47 $\mu$ pf silver mica                  |
| 20-103 | 1  | 150 $\mu$ pf silver mica                 |
| 20-104 | 3  | 130 $\mu$ pf silver mica                 |
| 20-105 | 1  | 180 $\mu$ pf silver mica                 |
| 20-106 | 2  | 390 $\mu$ pf silver mica                 |
| 20-107 | 2  | 680 $\mu$ pf silver mica                 |
| 20-109 | 2  | 62 $\mu$ pf silver mica                  |
| 20-111 | 1  | 230 $\mu$ pf silver mica                 |
| 20-112 | 3  | 310 $\mu$ pf silver mica                 |
| 21-14  | 2  | .001 $\mu$ fd disc ceramic               |
| 21-16  | 2  | .01 disc ceramic                         |
| 21-26  | 1  | .003 $\mu$ fd disc ceramic               |
| 21-29  | 1  | 4.7 $\mu$ pf tubular                     |
| 21-48  | 13 | .05 $\mu$ fd disc ceramic                |
| 21-53  | 2  | .001 $\mu$ fd ceramic feed-through w/nut |

| PART No.                                 | PARTS Per Kit | DESCRIPTION                            | PART No. | PARTS Per Kit | DESCRIPTION                       |
|------------------------------------------|---------------|----------------------------------------|----------|---------------|-----------------------------------|
| Capacitors (Cont'd.)                     |               |                                        | Hardware |               |                                   |
| 21-81                                    | 2             | .1 $\mu$ fd disc ceramic               | 73-1     | 1             | 3/8" rubber grommet               |
| 21-82                                    | 1             | .02 $\mu$ fd disc ceramic              | 73-4     | 5             | 5/16" rubber grommet              |
| 25-54                                    | 2             | 10 $\mu$ fd 10 V electrolytic          | 73-22    | 1             | 5/8" x 1-1/4" rubber grommet      |
| 25-97                                    | 1             | 100-100-100 $\mu$ fd 15 V electrolytic | 207-4    | 2             | 1/4" cable clamp                  |
| 25-98                                    | 2             | 50 $\mu$ fd 15 V electrolytic          | 250-7    | 7             | 6-32 x 3/16" RHMS                 |
| 25-99                                    | 1             | 150 $\mu$ fd 15 V electrolytic         | 250-8    | 6             | #6 sheet metal screw              |
| 26-24                                    | 1             | 20 $\mu$ fd variable                   | 250-28   | 6             | 6-32 x 1/4" slotted head setscrew |
| 26-62                                    | 1             | Tuning capacitor (3-section)           | 250-34   | 1             | 4-40 x 1/2" RHMS                  |
| 26-64                                    | 1             | 21 $\mu$ fd variable                   | 250-48   | 3             | 6-32 x 1/2" RHMS                  |
| 31-23                                    | 3             | Dual 8-60 $\mu$ fd trimmer             | 250-49   | 51            | 3-48 x 1/4" PHMS                  |
| 31-24                                    | 3             | Triple 8-60 $\mu$ fd trimmer           | 250-56   | 38            | 6-32 x 1/4" BHMS                  |
| Coil-Transformers                        |               |                                        | 250-89   | 10            | 6-32 x 3/8" BHMS                  |
| 141-3                                    | 1             | Coil set                               | 250-93   | 9             | 8-32 x 1/4" Allen head setscrew   |
| Consisting of:                           |               |                                        | 250-105  | 4             | 8-32 x 1/8" Allen head setscrew   |
| 40-274                                   | 1             | Band A oscillator coil (OA)            | 250-107  | 2             | 10-24 x 1/4" PHMS                 |
| 40-275                                   | 1             | Band B oscillator coil (OB)            | 250-172  | 1             | 3-48 x 3/8" PHMS                  |
| 40-276                                   | 1             | Band C oscillator coil (OC)            | 251-1    | 7             | Spade bolt                        |
| 40-277                                   | 1             | Band D oscillator coil (OD)            | 252-1    | 49            | 3-48 nut                          |
| 40-278                                   | 1             | Band E oscillator coil (OE)            | 252-2    | 2             | 4-40 nut                          |
| 40-279                                   | 1             | Band A mixer coil (MA)                 | 252-3    | 58            | 6-32 nut                          |
| 40-280                                   | 1             | Band B mixer coil (MB)                 | 252-7    | 14            | 3/8" control nut                  |
| 40-281                                   | 1             | Band C mixer coil (MC)                 | 253-9    | 2             | 3/8" OD #8 flat washer            |
| 40-282                                   | 1             | Band D mixer coil (MD)                 | 253-10   | 2             | 3/8" ID control flat washer       |
| 40-283                                   | 1             | Band E mixer coil (ME)                 | 253-11   | 4             | "E" ring                          |
| 40-284                                   | 1             | Band A antenna coil (RA)               | 253-22   | 1             | 3/8" ID flat washer               |
| 40-285                                   | 1             | Band B antenna coil (RB)               | 253-27   | 9             | 5/32" ID flat washer              |
| 40-286                                   | 1             | Band C antenna coil (RC)               | 253-34   | 8             | Fiber washer                      |
| 40-287                                   | 1             | Band D antenna coil (RD)               | 253-36   | 2             | Dished spring washer              |
| 40-288                                   | 1             | Band E antenna coil (RE)               | 254-1    | 70            | #6 lockwasher                     |
| 40-289                                   | 1             | BFO coil 455 kc                        | 254-3    | 2             | #10 lockwasher                    |
| 51-54                                    | 1             | Audio driver transformer               | 254-4    | 8             | 3/8" ID control lockwasher        |
| 52-35                                    | 1             | IF input transformer                   | 254-7    | 46            | #3 lockwasher                     |
| 52-36                                    | 1             | IF output and detector transformer     | 254-9    | 1             | #4 lockwasher                     |
| Sockets-Terminal Strips-Knobs-Connectors |               |                                        | 255-39   | 2             | Phenolic spacer                   |
| 431-2                                    | 1             | 2-lug terminal strip                   | 258-1    | 2             | Dial cord spring                  |
| 431-6                                    | 2             | 2-lug screw terminal strip             | 258-30   | 4             | Battery contact spring            |
| 431-15                                   | 1             | 1-lug terminal strip                   | 258-33   | 2             | Battery holder spring             |
| 431-38                                   | 2             | 3-lug terminal strip                   | 259-1    | 17            | #6 solder lug                     |
| 432-19                                   | 1             | 9-pin molded connector                 | 259-6    | 3             | #6 small solder lug               |
| 434-16                                   | 1             | 9-pin miniature wafer socket           | 259-10   | 3             | Control solder lug                |
| 434-83                                   | 2             | Pilot lamp socket                      | 260-11   | 2             | Spring catch Tinnerman            |
| 434-103                                  | 7             | Transistor socket                      | 261-13   | 4             | Plastic feet                      |
| 434-104                                  | 3             | Transistor socket                      | 262-4    | 2             | Spring catch pin                  |
| 436-4                                    | 1             | Phone jack                             | 262-8    | 20            | Terminal pin                      |
| 462-158                                  | 2             | 1-3/4" knob                            | 266-38   | 1             | 335 degree rotational stop        |
| 462-129                                  | 1             | 1-1/4" knob                            | 453-32   | 4             | 1-1/4" spacer                     |
| 462-130                                  | 4             | 11/16" knob                            |          |               |                                   |

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

## Controls-Switches

|        |   |                                              |
|--------|---|----------------------------------------------|
| 10-110 | 1 | 10 K $\Omega$ control (audio taper)          |
| 19-50  | 1 | 2 K $\Omega$ control w/push-pull SPST switch |
| 19-51  | 1 | 5 K $\Omega$ control w/DPST switch           |
| 60-1   | 1 | SPST slide switch                            |
| 60-6   | 1 | SPST slide switch (spring return)            |
| 60-13  | 1 | DPDT slide switch (untapped holes)           |
| 63-238 | 1 | Band switch                                  |

## Diodes-Meter-Lamps-Transistors

|        |   |                               |
|--------|---|-------------------------------|
| 56-4   | 3 | Crystal diode                 |
| 56-6   | 1 | Zener diode 1N754 (or equiv.) |
| 56-7   | 2 | Compensating diodes 1N2326    |
| 407-68 | 1 | Meter 0-1 ma edge reading     |
| 412-16 | 2 | #49 pilot lamp                |
| 417-14 | 3 | 2N373 transistor              |
| 417-25 | 1 | 2N1396 transistor             |
| 417-26 | 2 | 2N1225 transistor             |
| 417-27 | 1 | 2N409 transistor              |
| 417-28 | 3 | 2N407 transistor              |

## Sheet Metal Parts

|                  |   |                               |
|------------------|---|-------------------------------|
| 100-M250F323     | 1 | Chassis base                  |
| 100-M251F309-310 | 1 | Front panel                   |
| 100-M252         | 2 | 3" diameter dial pulley       |
| 100-M253F        | 1 | Supply mounting plate         |
| 100-M258F        | 1 | Dial backplate assembly       |
| 204-M293         | 1 | Bandspread mounting bracket   |
| 204-M294         | 1 | Power outlet mounting bracket |
| 205-M198F        | 1 | Top plate                     |
| 206-M122         | 1 | Shield plate (osc-mix)        |
| 206-M123         | 1 | Shield plate (mix-RF)         |
| 214-M7           | 1 | Battery housing               |

## Gears-Shafts-Bushings-Couplings

|        |   |                                |
|--------|---|--------------------------------|
| 451-15 | 1 | Gear tuning drive              |
| 451-16 | 1 | Gear tuning drive antibacklash |
| 452-4  | 1 | Roll pin 1/16" x 3/4"          |
| 453-82 | 1 | Shaft, phenolic 1/4" x 5-3/4"  |
| 453-89 | 2 | Shaft, dial drive 1/4" x 3"    |

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

## Gears-Shafts-Bushings-Couplings (Cont'd.)

|        |   |                                           |
|--------|---|-------------------------------------------|
| 453-90 | 1 | Shaft, 1/4" x 1-7/8"                      |
| 453-91 | 1 | Shaft, bandspread extension 1/4" x 3-1/2" |
| 455-9  | 4 | Bushing 1/4" x 3/8"                       |
| 455-11 | 1 | Shaft adapter                             |
| 455-13 | 2 | Bushing, 1/4" x 1/4"                      |
| 455-18 | 1 | Bushing 1/4" x 9/16"                      |
| 456-1  | 1 | Flexible 1/4" to 1/4" coupling            |
| 456-7  | 1 | Shaft coupling                            |

## Miscellaneous

|            |    |                                                                                                               |
|------------|----|---------------------------------------------------------------------------------------------------------------|
| 75-34      | 2  | Phenolic punched board (battery box)                                                                          |
| 75-38      | 1  | Phenolic antenna mounting plate                                                                               |
| 85-26F308  | 1  | Circuit board                                                                                                 |
| 89-16      | 1  | Length line cord                                                                                              |
| 90-120     | 1  | Cabinet                                                                                                       |
| 142-12     | 1  | Collapsible whip antenna                                                                                      |
| 209-28     | 1  | Grille (speaker)                                                                                              |
| 211-14     | 1  | Handle                                                                                                        |
| 340-2      | 1  | Length #20 bare wire                                                                                          |
| 343-4      | 1  | Length shielded wire                                                                                          |
| 344-1      | 10 | Lengths hookup wire: 1 orange, 1 blue, 1 black, 1 white, 1 gray, 1 green, 1 violet, 1 brown, 1 yellow, 1 red. |
| 346-1      | 1  | Length small sleeving                                                                                         |
| 346-5      | 1  | Length 5/16" sleeving                                                                                         |
| 349-3      | 1  | Length dial cord                                                                                              |
| 390-96     | 1  | Adhesive label                                                                                                |
| 401-33     | 1  | Speaker 4" x 6", 35 $\Omega$                                                                                  |
| 404-40     | 2  | TO-O1 transfilter                                                                                             |
| 404-41     | 2  | TF-O1 transfilter                                                                                             |
| 440-4      | 1  | 9-pin molded connector cap                                                                                    |
| 454-12     | 2  | Flywheel                                                                                                      |
| 463-18     | 2  | Dial pointer                                                                                                  |
| 464-14F311 | 1  | Plastic dial plate                                                                                            |
| 466-7      | 1  | Aluminum pulley                                                                                               |
| 490-1      | 1  | Alignment tool                                                                                                |
| 490-6      | 1  | Allen wrench                                                                                                  |
| 595-355    | 1  | Manual                                                                                                        |

### PROPER SOLDERING TECHNIQUES

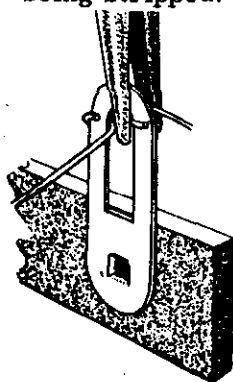
Only a small percentage of HEATHKIT® equipment purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest portion malfunction due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

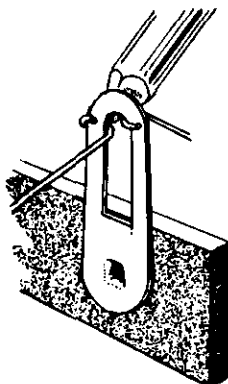
For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

### CHASSIS WIRING AND SOLDERING

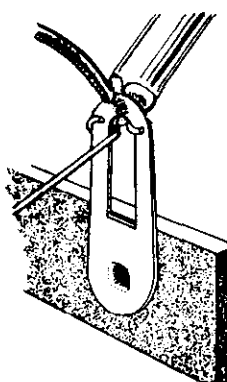
1. Unless otherwise indicated, all wire used is the type with colored insulation (hookup wire); the size of the conductor is the same for all colors of hookup wires furnished with this kit. In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the construction step.
2. To avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, care should be taken not to pull directly on the lead. Instead, hold the lead with pliers while it is being stripped.
3. Leads on resistors, capacitors and similar components are generally much longer than they need to be to make the required connections. In these cases, the leads should be cut to proper length before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points.
4. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving. Where the use of sleeving is specifically intended, the phrase "use sleeving" is included in the associated construction step. In any case where there is the possibility of an unintentional short circuit, sleeving should be used. Extra sleeving is provided for this purpose.
5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending or if the step states that the wire is not to be crimped, position the wire so that a good solder connection can still be made.
6. Position the work, if possible, so that gravity will help to keep the solder where you want it.
7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.



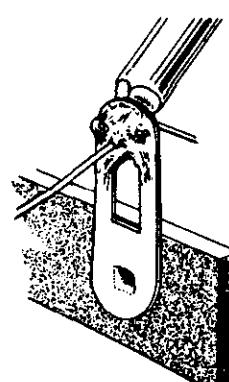
CRIMP WIRES



HEAT CONNECTION

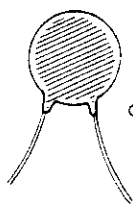


APPLY SOLDER

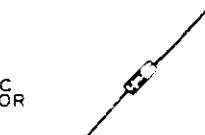
ALLOW SOLDER  
TO FLOW



SILVER  
MICA  
CAPACITOR



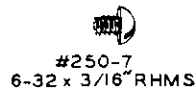
DISC  
CERAMIC  
CAPACITOR



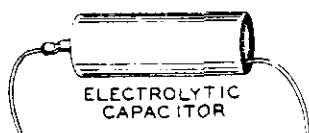
#56-4 CRYSTAL DIODE  
#56-6 MAY HAVE  
SIMILAR APPEARANCE



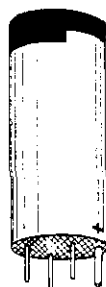
#21-53  
FEED-THROUGH  
CAPACITOR



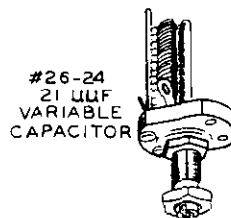
#250-7  
6-32 x 3/16" RHMS



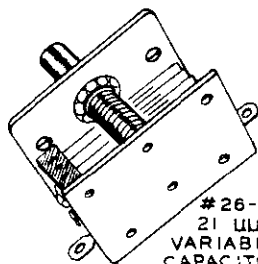
ELECTROLYTIC  
CAPACITOR



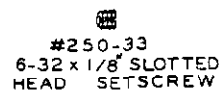
#25-97  
ELECTROLYTIC  
CAPACITOR



#26-24  
21 UUF  
VARIABLE  
CAPACITOR



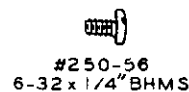
#26-64  
21 UUF  
VARIABLE  
CAPACITOR



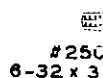
#250-33  
6-32 x 1/8" SLOTTED  
HEAD SETSCREW



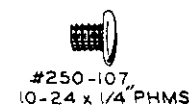
#250-4  
4-40 x 3/8"



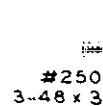
#250-56  
6-32 x 1/4" BHMS



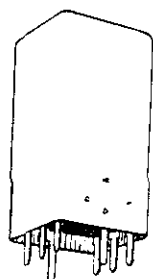
#250-6  
6-32 x 3/8"



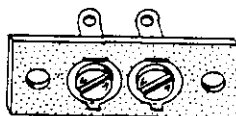
#250-107,  
10-24 x 1/4" PHMS



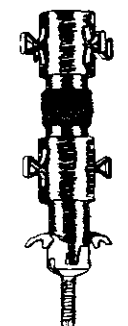
#250-107,  
10-24 x 1/4" PHMS



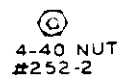
IF  
TRANSFORMER



#431-6  
2-LUG SCREW  
TERMINAL STRIP



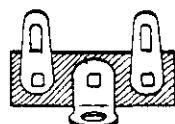
FRONT-END  
COILS



4-40 NUT  
#252-2



4-40 NUT  
#252-2



#431-2  
2-LUG TERMINAL  
STRIP



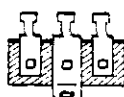
#431-15  
1-LUG TERMINAL  
STRIP



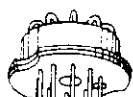
#253-11  
E-RING



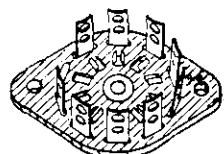
#253-11  
E-RING



#431-38  
3 LUG TERMINAL  
STRIP



#432-19  
9-PIN MOLDED  
CONNECTOR



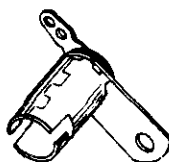
#434-16  
9-PIN MINIATURE  
WAFER SOCKET



#253-36  
DISHED SPRING  
WASHER



#253-36  
DISHED SPRING  
WASHER



#434-83  
PILOT LAMP  
SOCKET



#434-103  
TRANSISTOR  
SOCKET



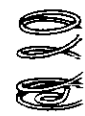
#434-104  
TRANSISTOR  
SOCKET



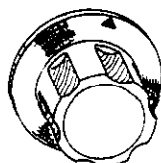
#436-4  
PHONE  
JACK



#3  
LOCKWASHER  
#254-7



#258-3  
BATTERY C  
SPRING



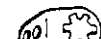
1 1/4" ALUMINUM  
KNOB



RUBBER  
GROMMET



#207-4  
1/4" CABLE  
CLAMP



#259-1  
#6 SOLDER  
LUG



#259-6  
#6 SMALL  
SOLDER LUG

#250-8  
#6 SHEET  
METAL SCREW

#34  
1/2" RHMS

#89  
8" BHMS

#172  
1/8" PHMS

NUT  
-3

#2  
LAT  
3/8" I.D.

SHER

CONTACT

G

#250-49  
3-48 x 1/4" PHMS

#250-93  
8-32 x 1/4" ALLEN  
HEAD SETSCREW

#251-1  
SPADE  
BOLT

#252-7  
3/8" CONTROL  
NUT

#253-34  
FIBER  
WASHER

#254-4  
3/8" CONTROL  
LOCKWASHER

#258-33  
BATTERY HOLDER  
SPRING

#259-10  
CONTROL SOLDER  
LUG

#260-11  
SPRING CATCH  
TINNERMAN

#262-4  
SPRING CATCH  
PIN

#19-50  
2 K $\Omega$  CONTROL  
W/ PUSH-PULL  
SPST SWITCH

#60-6  
SPST SLIDE  
SWITCH

#404-41  
TF-01 TRANSFILTER

#453-89  
3" DIAL DRIVE SHAFT

#453-91  
BANDSPREAD  
EXTENSION SHAFT

#440-4  
9-PIN MOLDED  
CONNECTOR  
CAP

#463-18  
DIAL POINTER

IN2326  
COMPENSATING  
DIODE  
#56-7

#262-8  
TERMINAL  
PIN

#19-51  
5 K $\Omega$  CONTROL  
W/ DPDT SWITCH

#100-M252  
3" DRIVE PULLEY

#454-12  
FLYWHEEL

POLARITY  
MARK

PLASTIC FOOT  
#261-13

#10-110  
10 K $\Omega$  RF GAIN

#60-2 OR #60-13  
DPDT  
SLIDE SWITCH

#455-11  
SHAFT ADAPTER

#404-40  
TO-01 TRANSFILTER

#456-1 FLEXIBLE  
SHAFT COUPLING

#456-7  
SHAFT  
COUPLING

#466-7  
ALUMINUM  
PULLEY

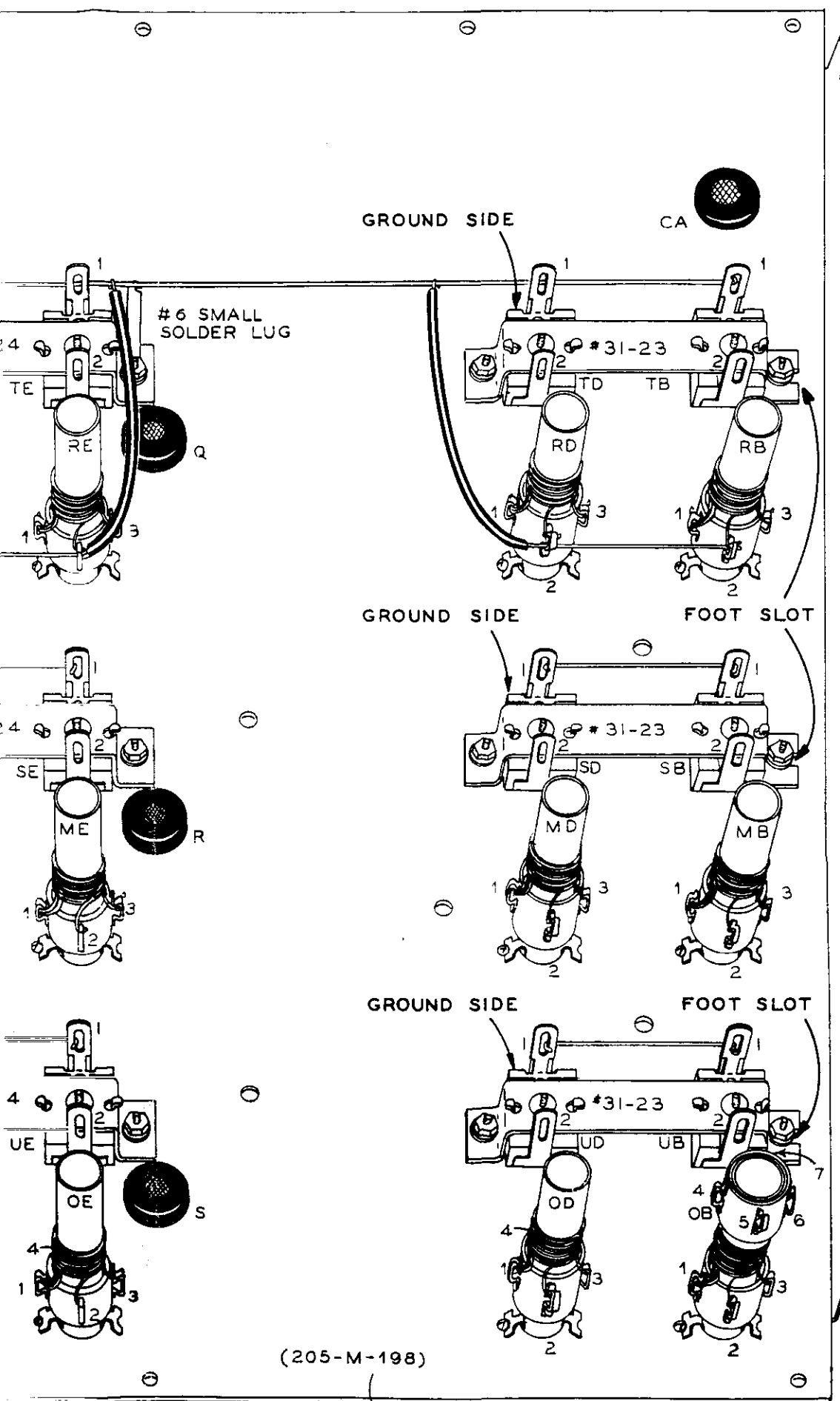
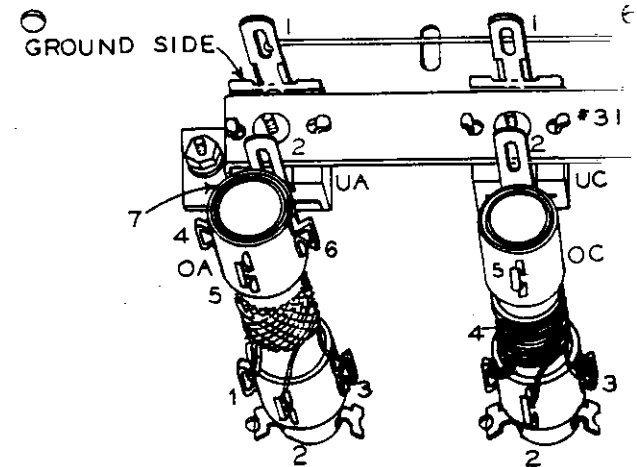
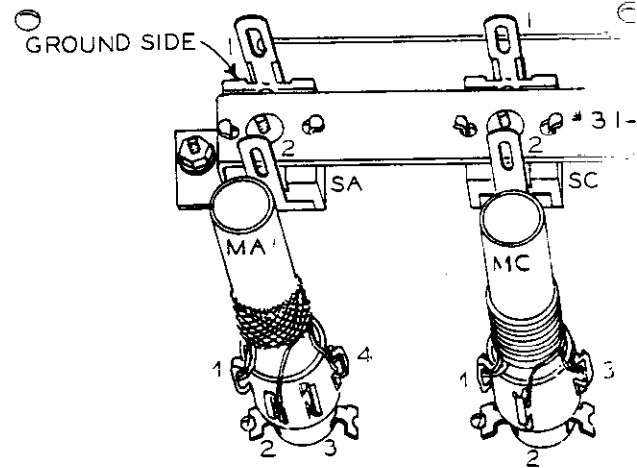
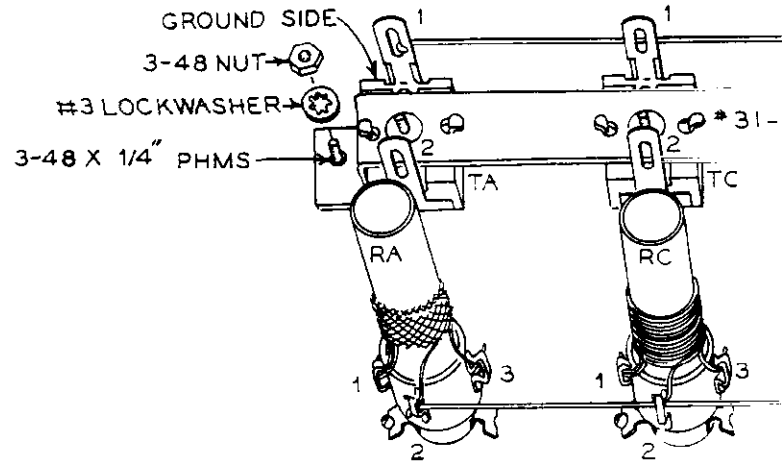
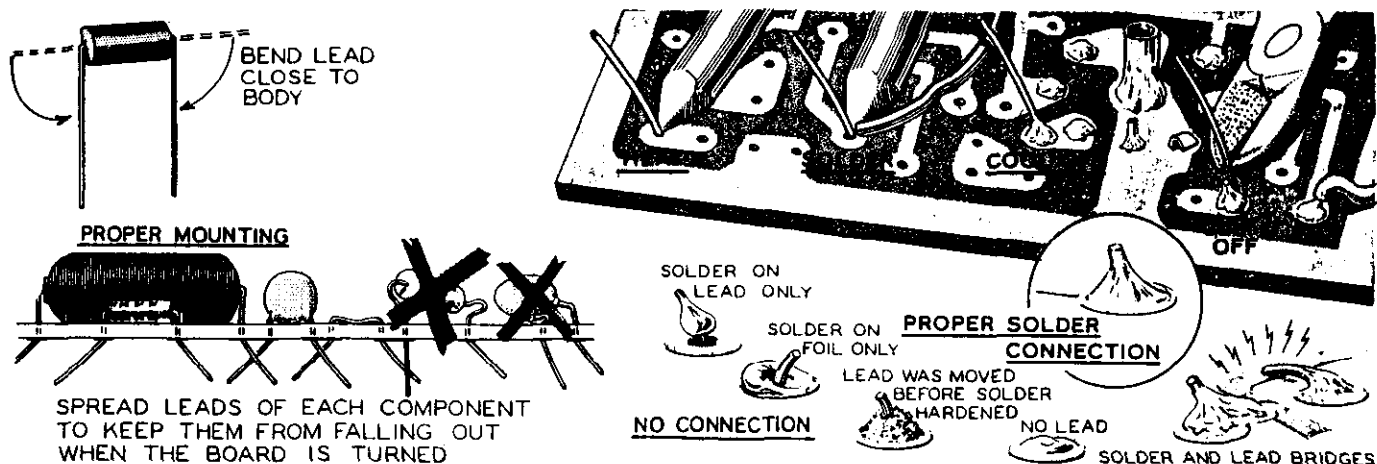


PLATE PARTS MOUNTING

Figure 1





Parts should be inserted as instructed, and the leads bent outward slightly, as illustrated, to lock them in place.

Components will be soldered in groups; after a group of components have been installed, instructions will be given to solder them. When the components have been soldered, diagonal cutters may be used to cut off the excess leads close to the board.

The actual technique of soldering leads to a circuit board is quite simple. Position the tip of the soldering iron so that it firmly contacts both the circuit board foil and the wire or lug to be soldered, as shown. Then the solder should immediately be placed between the iron and the joint to be soldered. Remove the solder as soon as it begins to melt and flow onto the lead and foil. Hold the tip of the iron in place only until the solder begins to flow outward over the foil; then remove the iron quickly.

Avoid overheating the connection. A soldering pencil or small iron (approximately 30 watts) is ideal for use in circuit board work. If a higher wattage iron or soldering gun must be used, precautions must be taken to avoid circuit board damage due to overheating.

The use of excessive amount of solder will increase the possibility of bridging between foil conductors or plugging holes which are to be left open for wires which may be added later on. If solder is accidentally bridged across insulating areas between conductors, it can be cleaned off by heating the connection carefully and quickly wiping the solder away with a soft cloth. Holes which become plugged can be cleared by heating the area immediately over the hole

while gently pushing the lead of a resistor through the hole from the opposite side, and withdrawing the lead before the solder re-hardens. Do not force the wire through; too much pressure before the solder has time to soften may separate the foil from the board.

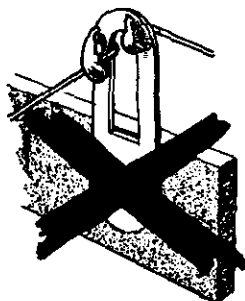
In cases where foil does become damaged, repairs can usually be made with little difficulty. A break in the foil can be rejoined with a small piece of bare wire soldered across the gap, or between the foil and the lead of a component.

### STEP-BY-STEP PROCEDURE

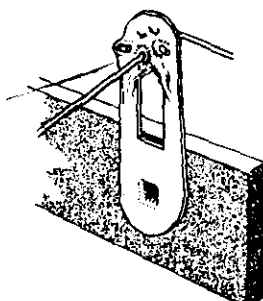
The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the Pictorial as it is added.

The large folded diagrams may be removed from the manual and attached to the wall above your working area but should be returned to the manual after the kit is completed.

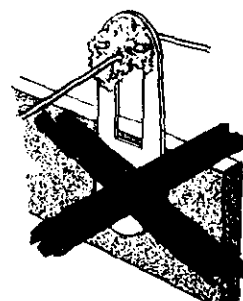
The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and



COLD SOLDER JOINT  
CONNECTION INSUFFICIENTLY  
HEATED



PROPER SOLDER  
CONNECTION



COLD SOLDER JOINT  
CONNECTION MOVED  
WHILE COOLING

8. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
9. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth bright appearance.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROsin CORE RADIO SOLDER" BE PURCHASED.

## CIRCUIT BOARD WIRING AND SOLDERING

Before attempting any work on the circuit board, read the following instructions carefully and study the figures shown. It is only necessary to observe a few basic precautions which will insure proper operation of the unit the first time it is turned on.

Proper mounting of components on the board is essential for good performance. A good general rule to follow is that all components on the board should be mounted tightly to the board, unless instructions state otherwise. All leads should be

kept as short as possible to minimize the effects of stray capacity in the wiring. Proper and improper methods of mounting are illustrated in the accompanying Figures.

Tubular capacitors and resistors will fit properly if the leads are bent, as shown. Disc capacitors will generally fit in place with no lead preparation other than determining that the leads are straight. Components with lugs normally require no preparation unless the lugs appear to be bent, in which case they can be straightened with a pliers.

the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a lead to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered. (In cases where a lead passes through a terminal or lug and then connects to another point, it will count as two leads, one entering and one leaving the terminal.)

The steps directing the installation of resistors and some capacitors include color codes to help identify the parts. Also, if a part is identified by a letter-number designation on the Schematic, its designation will appear in the construction step which directs its installation.

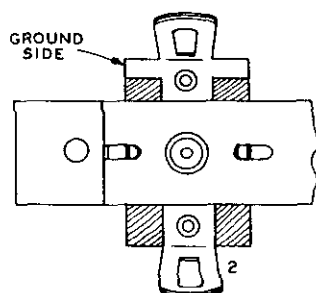
#### STEP-BY-STEP ASSEMBLY TOP PLATE - PARTS MOUNTING AND WIRING

Fold out Figure 1 for the following steps.

- (✓) Locate the top plate (#205-M198) and place in position shown in Figure 1.
- (✓) Locate the three dual trimmer capacitor brackets (#31-23), the three triple capacitor brackets (#31-24) and the coil set (#141-3).

NOTE: All three dual capacitor brackets are identical, as are the triple capacitor brackets. All coils and trimmer capacitors have two letter designations. On the coils the first letter indicates the function of the coil: R = RF amplifier, M = Mixer, O = Oscillator. For both the coils and capacitors the second letter indicates the band A, B, C, D, or E.

Before mounting the capacitor brackets, look closely at the capacitors (from the bracket side). Notice the difference between the two ends visible on either side of the mounting strip. It is mandatory that these capacitor brackets be mounted as shown in Detail 8 and Figure 1, or the associated coil will be shorted to ground.



Detail 8

TRIMMER CAPACITOR

- (✓) Mount 5/16" rubber grommets at holes Q, R, S, and CA.

#### OSCILLATOR SECTION

- (✓) Mount the dual capacitor bracket (#31-23) UD-UB with 3-48 x 1/4" PHMS. Make certain that the slotted mounting foot is next to the flanged edge of the top plate. Use a #3 lockwasher under each nut. Trimmer capacitor UD (C38) is used for oscillator alignment on band D AND UB (C40) for oscillator alignment on band B.
- (✓) Mount a triple capacitor bracket assembly (#31-24) UA-UC-UE with 3-48 hardware, as shown in Figure 1. These capacitors are used for oscillator alignment: band A = UA (C42), band C = UC (C39) and band E = UE (C37). Note ground side is toward the rear.
- (✓) Mount the band A oscillator coil (L11) marked OA by pressing the coil into the top plate cutout until the two spring tabs snap into place. Make certain that the locating tab is aligned with the slot at the edge of the mounting hole.
- (✓) Mount the band C oscillator coil marked OC (L13).
- (✓) Mount the band E oscillator coil marked OE (L15).
- (✓) Mount the band D oscillator coil marked OD (L14).
- (✓) Mount the band B oscillator coil marked OB (L12).

#### MIXER SECTION

- (✓) Mount the dual capacitor bracket (#31-23) SD-SB with 3-48 x 1/4" PHMS. Make certain that the slotted mounting foot is next to the flanged edge of the top plate. Use a #3 lockwasher under each nut. Trimmer capacitor SD (C16) is used for mixer alignment on band D, and SB (C18) is used for mixer alignment on band B.
- (✓) Mount a triple capacitor bracket assembly (#31-24) SA-SC-SE with 3-48 hardware, as shown in Figure 1. These capacitors are used for mixer alignment: band A = SA (C19), band C = SC (C17), band E = SE (C15). Note ground side of bracket as shown in Detail 8.

- (✓) Mount the band A mixer coil (L6) marked MA, by pressing the coil into the top plate cutout until the two spring tabs snap into place. Make certain that the locating tab is aligned with the slot at the edge of the mounting hole.
- (✓) Mount the band C mixer coil marked MC (L8).
- (✓) Mount the band E mixer coil marked ME (L10).
- (✓) Mount the band D mixer coil marked MD (L9).
- (✓) Mount the band B mixer coil marked MB (L7).

### RF SECTION

- (✓) Mount the dual capacitor bracket (#31-23) TD-TB with 3-48 x 1/4" PHMS. Make certain that the slotted mounting foot is next to the flanged edge of the top plate. Use a #3 lockwasher under each nut. Trimmer capacitor TD (C4) is used for alignment of the RF amplifier band D, and TB (C8) is used for alignment of band B.
- (✓) Mount a triple capacitor bracket (#31-24) TA-TC-TE with 3-48 hardware and place a #6 small solder lug on the mounting screw nearest the chassis center. These capacitors are used for alignment of the RF section: band A = TA (C9), band C = TC (C6), and band E = TE (C3). Note ground side of bracket as shown in Detail 8.
- (✓) Mount the band A RF amplifier coil (L1) marked RA, by pressing the coil into the top plate cutout until the two spring tabs snap into place. Make certain that the locating tab is aligned with the slot at the edge of the mounting hole.
- (✓) Mount the band C RF amplifier coil marked RC (L3).
- (✓) Mount the band E RF amplifier coil marked RE (L5).
- (✓) Mount the band D RF amplifier coil marked RD (L4).
- (✓) Mount the band B RF amplifier coil marked RB (L2).
- (✓) Connect one end of a 6" length of bare wire to lug 1 of capacitor TA (S-1). Connect the other end to lug 1 of capacitor TB (S-1). Hold the wire tight against lug 1 of capacitor TC (S-1), lug 1 of capacitor TE (S-1) and lug 1 of capacitor TD (S-1). See Figure 2. Now solder the ground lug mounted on the capacitor mounting foot adjacent to TE to this bare wire (S-1). Note that lugs of the trimmer capacitors are made up of two thicknesses; both must be soldered.
- (✓) Connect one end of a 2-3/8" length of bare wire to lug 1 of capacitor SA (S-1). Connect the other end to lug 1 of capacitor SE (NS). Solder the center point to lug 1 of SC (S-1).
- (✓) Connect one end of a 1-3/8" length of bare wire to lug 1 of capacitor SD (NS). Connect the other end to lug 1 of capacitor SB (S-1).
- (✓) Connect one end of a 2-3/8" length of bare wire to lug 1 of capacitor UA (S-1). Connect the other end to lug 1 of capacitor UE (NS). Now solder wire to lug 1 of UC.
- (✓) Connect one end of a 1-3/8" length of bare wire to lug 1 of capacitor UD (NS). Connect the other end to lug 1 of capacitor UB (S-1).
- (✓) Run a 4-1/8" length of bare wire through lug 2 of coil RA (NS), through lug 2 of coil RC (NS), through lug 2 of coil RE (NS). Slip a 1-1/2" length of insulating sleeving over wire and connect to the bare wire running between lug 1 of capacitor TE and lug 1 of capacitor TD, close to the ground lug. Solder all four connections.
- (✓) In a similar manner, run a 3" length of bare wire through lug 2 of coil RB (NS), through lug 2 of coil RD (NS). Slip a 1-1/4" length of insulating sleeving over this wire and connect to the bare wire between lug 1 of capacitor TE and lug 1 of capacitor TD. Position as shown and solder all three connections.

NOTE: Wire lengths and positions are quite critical. Follow step-by-step carefully to avoid unnecessary difficulties. In the following steps many wires will be installed by connecting to one end only. Form the wires as shown. The other end will be connected to the switch later. All wires should have 1/4" of the insulation removed from each end before installing, unless otherwise specified.

RF AMP SECTION WIRING

Refer to Figure 2 for the following steps.

- ( ) Remove 3/4" of the insulation from one end of a 4-1/4" length of orange hookup wire. Run this end through lug 2 of capacitor TA (NS) and connect to lug 3 of coil RA (S-1). Now solder lug 2 of capacitor TA. Form each wire as shown before proceeding with the next step.
- ( ) Connect one end of a 6-1/4" length of orange hookup wire to lug 1 of coil RA (S-1).
- ( ) Remove 3/4" of the insulation from one end of a 3-1/4" length of blue hookup wire. Run this end through lug 3 of coil RC (NS) and connect to lug 2 of capacitor TC (S-1). Now solder lug 3 of coil RC.
- ( ) Connect one end of a 4-3/4" length of blue hookup wire to lug 1 of coil RC (S-1).
- ( ) Connect one end of a 3/4" length of bare wire from lug 3 of coil RE (S-1) to lug 2 of capacitor TE (NS).
- ( ) Connect one end of a 2-3/4" length of black wire to lug 1 of coil RE (S-1).
- ( ) Remove 3/4" of insulation from one end of a 3-3/4" length of white hookup wire. Run this end through lug 2 of capacitor TB (NS) and connect to lug 3 of coil RB (S-1). Now solder lug 2 of capacitor TB (S-1).
- ( ) Connect one end of a 2-1/4" length of white hookup wire to lug 1 of coil RB (S-1).
- ( ) Remove 3/4" of the insulation from one end of a 3-1/2" length of gray hookup wire. Run this end through lug 2 of capacitor TD (NS) and connect to lug 3 of coil RD (S-1). Now solder lug 2 of capacitor TD.
- ( ) Connect one end of a 5/8" length of bare wire to lug 1 of coil RD (S-1).

This completes the preliminary wiring of the RF AMP SECTION.

MIXER SECTION WIRING

- ( ) Remove 3/4" of the insulation from one end of a 4" length of orange hookup wire. Run this end through lug 4 of coil MA (NS) and connect to lug 2 of capacitor SA (S-1). Now solder lug 4 of coil MA.
- ( ) Cut a piece of bare wire to 6-1/2" in length. Run it through lug 2 of coil MB (NS), then lug 2 of coil MD (NS). Now place a 2-3/4" length of sleeving on the end protruding from lug 2 of coil MD. (NOTE: The sleeving will appear longer than necessary, however, when the wire is formed against the chassis as shown in Figure 2, it will be the correct length.) Now run the wire through lug 2 of coil ME (NS), then lug 2 of coil MC (NS). Form wire as shown in Figure 2. Place a 1-1/8" length of sleeving on this lead and connect to lug 2 of coil MA (S-1). Now solder each of the remaining coil lugs through which the wire passed, except coil MB (NS).
- ( ) C92. Cut each lead of a .01  $\mu$ fd disc ceramic capacitor to 3/4" length. Connect one lead to lug 1 of trimmer capacitor SD (NS). Connect the other lead to the center of the wire running between the number 2 lugs of coils MD and MB (S-1). Position as shown.
- ( ) Cut one lead of a .05  $\mu$ fd disc ceramic capacitor C20 to 1/2" in length and the other lead to 3/4" in length. Connect the 3/4" lead to the bare wire running between lug 1 of capacitor SC and lug 1 of capacitor SE. Position as shown and solder. Connect the other lead to the wire running between lug 2 of coil MC and lug 2 of coil ME (S-1).
- ( ) Connect one end of a 5-1/2" length of orange hookup wire to lug 1 of coil MA (S-1).
- ( ) Connect one end of a 5-1/2" length of orange hookup wire to lug 3 of coil MA (S-1).
- ( ) Remove 3/4" of the insulation from one end of a 4-1/4" length of blue hookup wire and run this end through lug 3 of coil MC (NS) and connect to lug 2 of capacitor SC (S-1). Now solder lug 3 of coil MC.
- ( ) Connect one end of a 4" length of blue hookup wire to lug 1 of coil MC (S-1).

- (✓) Remove 3/4" of the insulation from one end of a 3-1/2" length of black hookup wire. Run this end through lug 2 of capacitor SE (NC) and connect to lug 3 of coil ME (S-1). Now solder lug 2 of capacitor SE.
- (✓) Connect one end of a 2-1/2" length of black hookup wire to lug 1 of coil ME (S-1).
- (✓) Remove 3/4" of the insulation from one end of a 5" length of white hookup wire. Run this end through lug 2 of capacitor SB (NS) and connect to lug 3 of coil MB (S-1). Now solder lug 2 of capacitor SB.
- (✓) Connect one end of a 2" length of white hookup wire to lug 1 of coil MB (S-1).
- (✓) Remove 3/4" of the insulation from one end of a 2-1/2" length of gray hookup wire. Run this end through lug 2 of capacitor SD (NS) and connect to lug 3 of coil MD (S-1). Now solder lug 2 of capacitor SD.
- (✓) Connect one end of a 1-1/2" length of gray hookup wire to lug 1 of coil MD (S-1).

This completes the preliminary wiring of the MIXER SECTION.

### OSCILLATOR SECTION WIRING

In addition to Figure 2, Details 9 and 10 have been provided to facilitate wiring. Figure 2A shows the reverse side of the oscillator coils and the wiring of components hidden on Figure 2. Detail 9 is an enlarged view of coils OA and OC and their associated components. Detail 10 is an enlarged view of coil OB and associated components.

- (✓) Cut both leads of a 330  $\Omega$  resistor R12 (orange-orange-brown) to 3/8" in length. Connect one lead to lug 1 of coil OA (NS). Connect the other lead to lug 4 of coil OA (NS).
- (✓) Cut both leads of a 680  $\mu\text{mf}$  silver mica capacitor C28 to 3/8" in length. Connect one lead to lug 4 of coil OA (S-2). Connect the other lead to lug 7 of coil OA (NS).
- (✓) Cut both leads of a 390  $\mu\text{mf}$  silver mica capacitor C35 to 5/8" in length. Connect one lead to lug 1 of coil OA (S-2). Connect the other lead to lug 5 of coil OA (NS).
- (✓) Remove 3/4" of the insulation from one end of a 4-3/4" length of orange hookup wire. Run this end through lug 3 of coil OA (NS) and connect to lug 2 of trimmer UA (S-1). Now solder lug 3 of coil OA.
- (✓) Connect one end of a 6" length of orange hookup wire to lug 6 of coil OA (NS).
- (✓) Connect one end of a 6-1/4" length of orange hookup wire to lug 7 of coil OA (S-2).

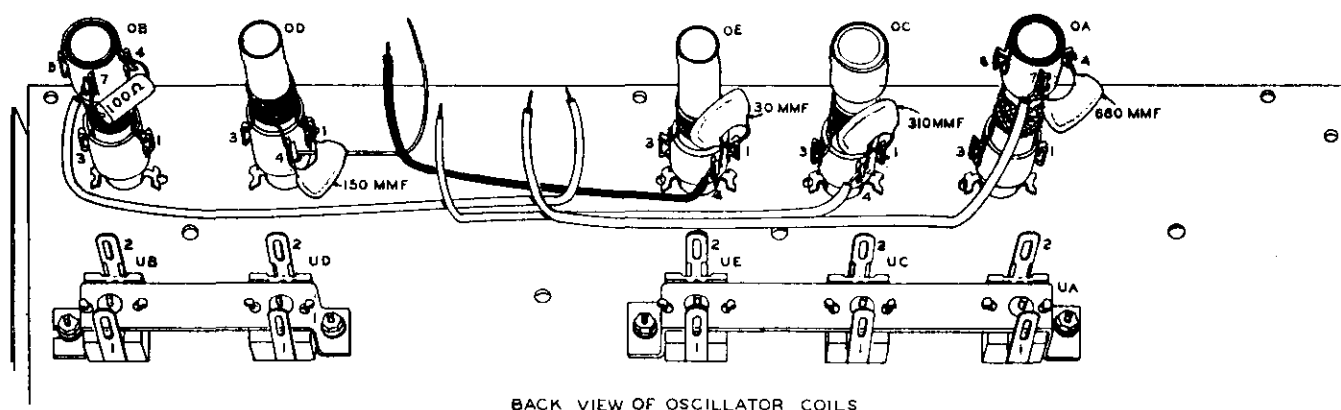
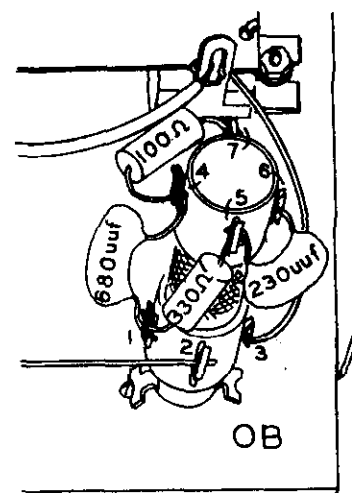
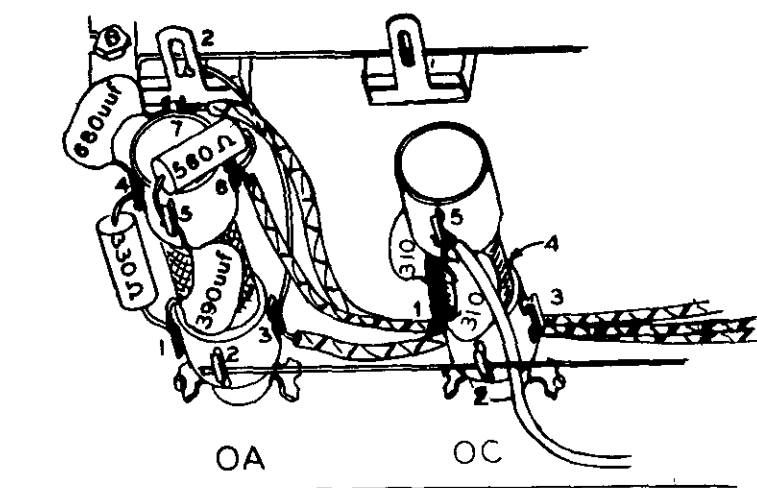


Figure 2A



Detail 9

- (✓) Cut both leads of a 560  $\Omega$  resistor R14 (green-blue-brown) to a 3/8" length. Connect one lead to lug 5 of coil OA (S-2). Connect the other lead to lug 6 of coil OA (S-2).
- (✓) Place a 1-3/4" length of sleeving over a 3" length of bare wire. Insert the longer bare end through lug 2 of coil OD (NS) to lug 2 of coil OB (S-1). Now solder lug 2 of coil OD (S-1) and leave the excess sleeving-covered lead free for the moment as it will be connected later.
- (✓) Place a 2" length of sleeving over a 4-1/4" length of bare wire. Insert the longer bare end through lug 2 of coil OE (NS), through lug 2 of coil OC (NS) to lug 2 of coil OA (S-1). Now solder lug 2 of coil OC (S-1) and lug 2 of coil OE (S-1). Leave the excess sleeving-covered lead at coil OE free for the moment as it will be connected later.
- (✓) Cut both leads of a 310  $\mu$ f silver mica capacitor C31 to 3/8" in length. Connect one lead to lug 1 of coil OC (NS). Connect the other lead to lug 4 of coil OC (NS).
- (✓) Connect one end of a 4-1/4" length of blue hookup wire to lug 4 of coil OC (S-2).
- (✓) Cut both leads of a 310  $\mu$ f silver mica capacitor C30 to 1/2" in length. Connect the lead to lug 1 of coil OC (S-2). Connect the other lead to lug 5 of coil OC (NS).
- ( ) Connect one end of a 4-3/4" length of blue hookup wire to lug 5 of coil OC (S-2).

Detail 10

- (✓) Remove 3/4" of the insulation from one end of a 3-5/8" length of blue hookup wire. Run this end through lug 3 of coil OC (NS) and connect to lug 2 of trimmer UC (S-1). Now solder lug 3 of coil OC.
- (✓) Cut both leads of a 30  $\mu$ f silver mica capacitor C73 to 1/4" in length. Connect one lead to lug 1 of coil OE (NS). Connect the other lead to lug 4 of coil OE (NS).
- ( ) Connect one end of a 3" length of black hookup wire to lug 4 of coil OE (S-2).
- (✓) Remove 3/4" of insulation from one end of a 3-3/4" length of black hookup wire. Run this end through lug 2 of capacitor UE (NS) and connect to lug 3 of coil OE (S-1). Now solder lug 2 of capacitor UE.
- (✓) Cut both leads of a 680  $\mu$ f silver mica capacitor C34 to 3/8" in length. Connect one lead to lug 1 of coil OB (NS). Connect the other lead to lug 4 of coil OB (NS).
- ( ) Cut both leads of a 330  $\Omega$  resistor (R13, orange-orange-brown) to 1/2" in length. Connect one lead to lug 1 of coil OB (S-2). Connect the other lead to lug 5 of coil OB (NS).
- (✓) Cut both leads of a 100  $\Omega$  resistor (R15, brown-black-brown) to 3/8" in length. Connect one lead to lug 4 of coil OB (S-2). Connect the other lead to lug 7 of coil OB (NS).

- (✓) Cut both leads of a 230  $\mu$ f silver mica capacitor C28 to 1/4" in length. Connect one lead to lug 5 of coil OB (S-2). Connect the other lead to lug 6 of coil OB (NS).
- (✓) Remove 3/4" of the insulation from one end of a 4-1/4" length of white hookup wire. Run this end through lug 2 of capacitor UB (NS) and connect to lug 3 of coil OB (S-1). Now solder lug 2 of capacitor UB.
- (✓) Cut both leads of a 150  $\mu$ f silver mica capacitor C32 to 1/2" in length. Connect one lead to lug 1 of coil OD (NS). Connect the other lead to lug 4 of coil OD (NS). See Figure 2.
- (✓) Remove 3/4" of the insulation from one end of a 3-3/4" length of gray hookup wire. Run this end through lug 2 of capacitor UD (NS) and connect to lug 3 of coil OD (S-1). Now solder lug 2 of capacitor UD.
- (✓) Connect one end of a 3/4" length of bare wire to lug 4 of coil OD (S-2).
- (✓) Cut both leads of a .05  $\mu$ f disc ceramic capacitor C94 to 5/8" in length. Connect one lead to the wire running between lug 1 of capacitor UC and lug 1 of capacitor UE. Position as shown in Figure 2 and solder. Connect the other lead to the wire running between lug 2 of coil OC and lug 2 of coil OE. Position as shown and solder.
- (✓) Cut both leads of a 10  $\mu$ f 10 V DC electrolytic capacitor C48 to 5/8" in length. Connect the (+) lead to lug 1 of capacitor UD (NS). Position as shown and connect the (-) lead to the wire running between lug 2 of coil OD and lug 2 of coil OB (S-1).

This completes the preliminary wiring of the OSCILLATOR SECTION.

### MOUNTING THE MAIN TUNING CAPACITOR

Refer to Figure 3 for the following steps. CAUTION: Keep plates of capacitor closed during assembly.

- (✓) Mount the main tuning capacitor (#26-62), using 6-32 x 1/4" BHMS. Place a #6 solder lug at locations M and N as shown, and a #6 lockwasher on the other mounting screw. Place three #6 x 1/16" thick flat washers between the top plate and the tuning capacitor, one on each screw as shown, then tighten securely. See that none of the tuning capacitor lugs are shorted to adjacent parts on top of the chassis.
- (✓) Connect one end of a 3-1/2" length of bare wire to lug 1 of capacitor UD (S-3). Run the other end through the ground lug N to lug 1 of capacitor UE (S-2). Now solder the ground lug.
- (✓) Connect one end of a second 3-1/2" length of bare wire to lug 1 of capacitor SD (S-3). Run the other end through the ground lug M (NS) and connect to lug 1 of capacitor SE (S-2). Now solder the ground lug.

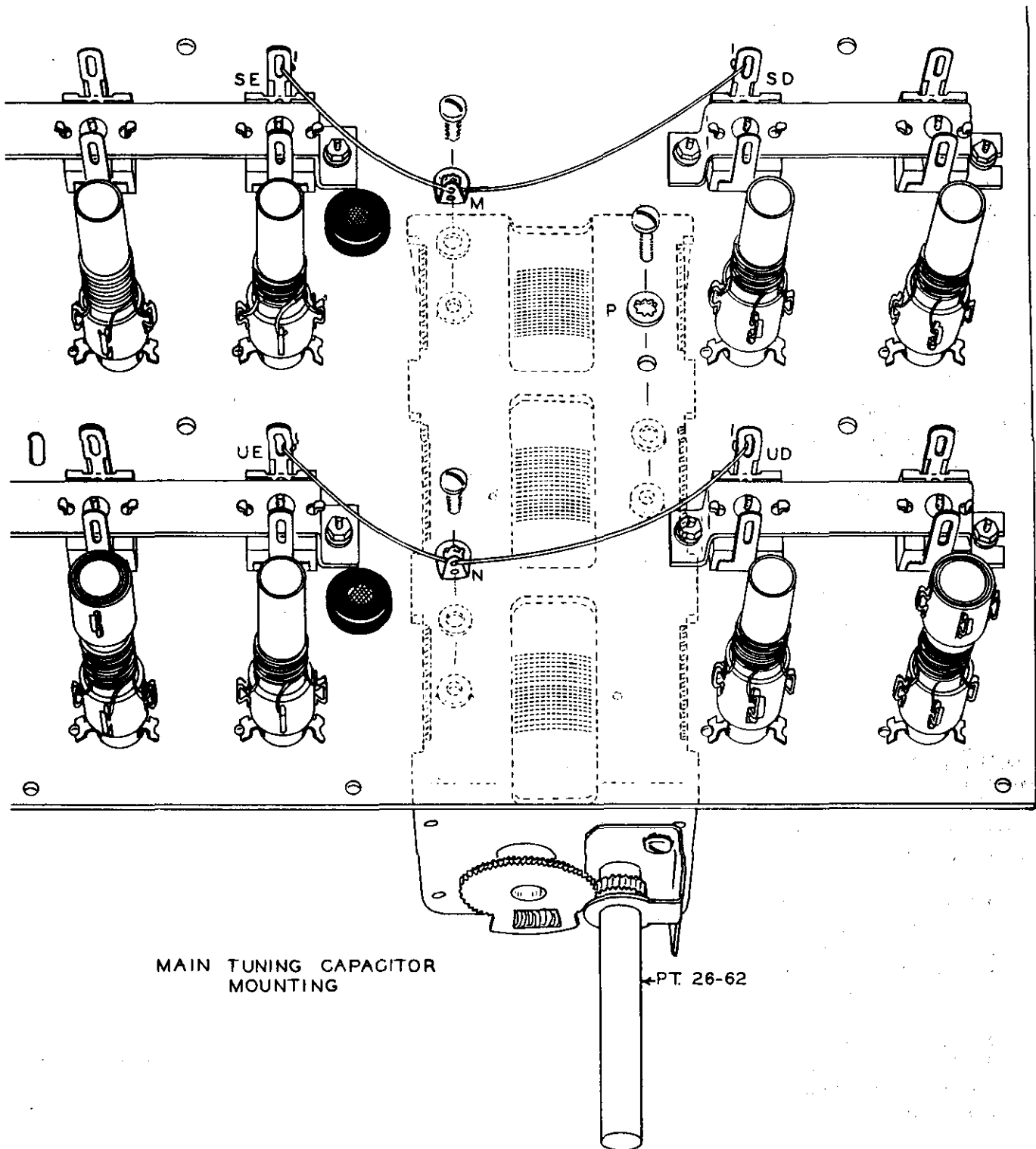


Figure 3

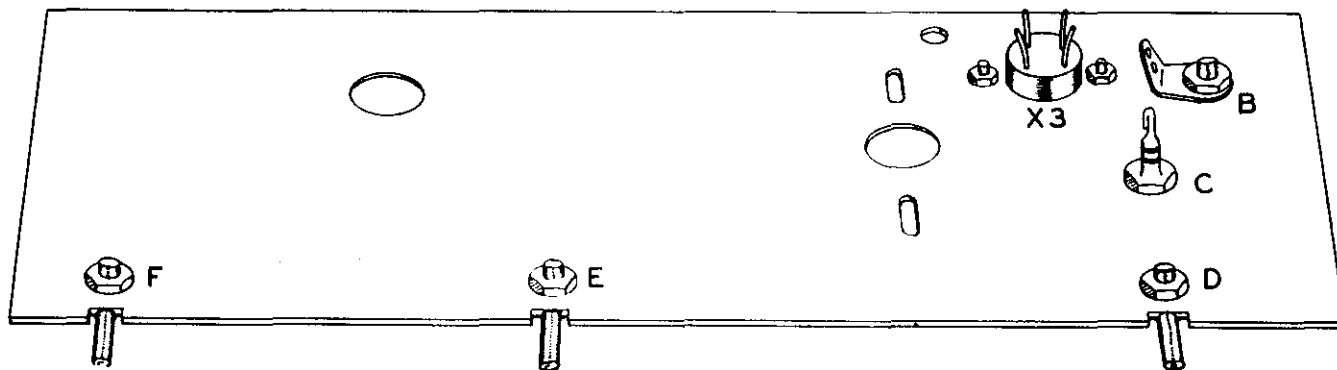
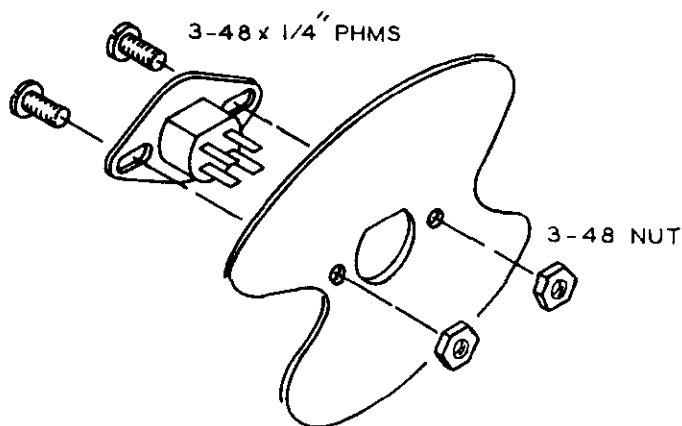


Figure 4



Detail 11

### OSCILLATOR-MIXER SHIELD PLATE PARTS MOUNTING AND WIRING

Refer to Figure 4, Figure 4A and Detail 11 for the following steps.

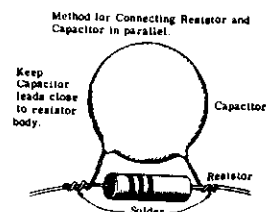
- (1) Locate the mixer-oscillator shield plate (#206-M122). Install three spade bolts at D, E and F. Place a 6-32 x 1/4" BHMS through the spade bolt, through the shield, a #6 lockwasher and fasten with a 6-32 nut.
- (2) Mount a #6 solder lug at hole B. Use a 6-32 x 1/4" BHMS and a 6-32 nut. Position lug as shown, and bend straight out from plate after mounting.
- (3) Mount the 4-pin transistor socket X3, as shown in Detail 11. Secure with two 3-48 x 1/4" PHMS and 3-48 nuts. (No lockwashers are used when mounting transistor sockets.)

- (4) Install a .001  $\mu$ fd feed-through capacitor C25 at location C. Secure with the 5/16" nut supplied. Handle with care.

NOTE: When connecting wires to the transistor socket pins, form a small loop in the end of the wire. Place this loop over the socket pin, crimp and solder as shown.

- (5) Connect one end of a 3/4" length of bare wire to pin 4 of transistor socket X3 (S-1). Connect the other end to the bottom hole in ground lug B (NS). See Figure 4A.

- (6) Cut both leads of a .05  $\mu$ fd disc ceramic capacitor C36 to 1/2" in length. Locate a 4.7 K $\Omega$  resistor (R18, yellow-violet-red). Wrap both capacitor leads around the leads of the resistor as shown in Detail 12. Solder both leads. AVOID OVERHEATING.



Detail 12

- (7) Cut one lead of the 4.7 K $\Omega$  resistor and .05  $\mu$ fd capacitor combination to 3/8" in length. Connect this lead to pin 2 of transistor socket X3 (NS). Position as shown and connect the other lead to the bottom hole of ground lug B (NS).

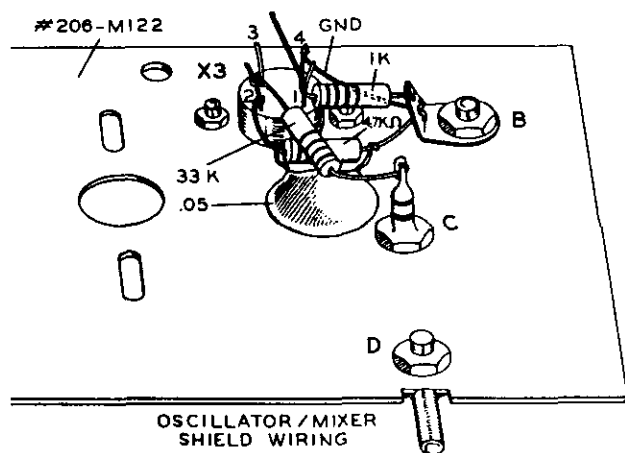


Figure 4A

- (✓) Cut one lead of a 1 K $\Omega$  resistor (R16, brown-black-red) to 3/8" in length. Connect this lead to ground lug B (NS). Leaving the lead full length, position as shown and wrap the other lead around pin 1 of transistor socket X3 (S-1). Let the excess lead extend straight out from pin 1 of transistor socket X3 (this lead will connect to a switch later).
- (✓) Cut both leads of a 33 K $\Omega$  resistor (R17, orange-orange-orange) to 3/8" in length. Connect one lead to pin 2 of transistor socket X3 (S-2). Connect the other lead to feed-through capacitor C (NS).

This completes the preliminary wiring of the OSCILLATOR-MIXER SHIELD. Set the shield aside for the present. CAUTION: The .001 feed-through capacitor mounted at C can be easily broken if accidentally dropped or jarred.

### MIXER-RF SHIELD PLATE PARTS MOUNTING AND WIRING

Refer to Figures 5 and 5A for the following steps.

- (✓) Locate the mixer-RF shield (#206-M123). Mount three spade bolts at locations J, K and L. Place a 6-32 x 1/4" BHMS through the spade bolt, through the shield, through a #6 lockwasher and fasten with a 6-32 nut.
- (✓) Mount a 3-lug terminal strip at location AA. Place a 3-48 x 1/4" PHMS through the shield plate. On the end of the screw protruding through the shield, place a #3 lockwasher, the 3-lug terminal strip, another #3 lockwasher, and secure with a 3-48 nut.
- (✓) Mount a 3-lug terminal strip at location BB in the same manner as in the preceding step.
- (✓) Using 3-48 x 1/4" PHMS and 3-48 nuts, mount transistor sockets X2 and X1 (no lockwashers).
- ( ) Bend transistor socket pin 4 on X1 down parallel to the plate, as shown in Figure 5.
- ( ) Connect a 1-1/4" length of #20 bare wire to pin 4 of transistor socket X2 (S-1). Insert the other end through the eyelet hole in lug 2, terminal strip AA (NS). See Figure 5.

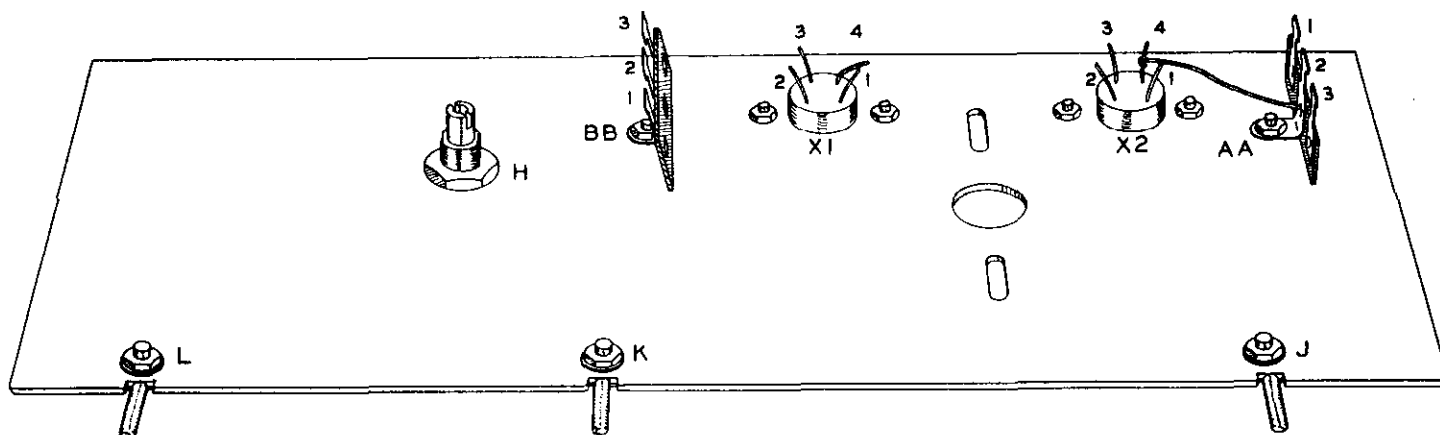


Figure 5

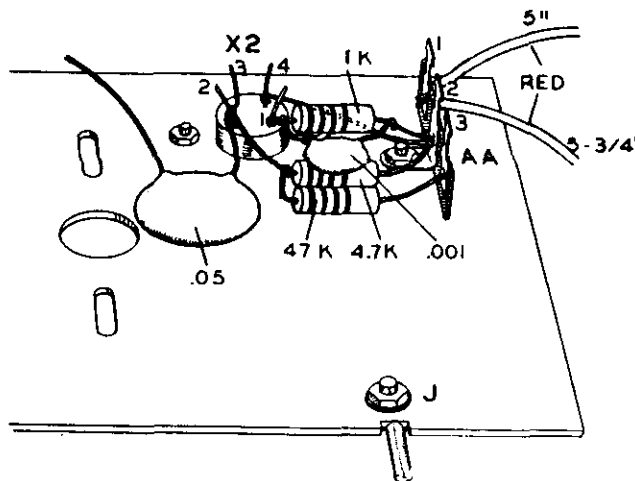


Figure 5A

Refer to Figure 5B for the following steps:

- (✓) Cut a 3-1/4" length of blue hookup wire. Connect one end to lug 1 of transistor socket X2 (S-2). Leave the other end free for the present.
- (✓) Connect one end of an 8" length of blue hookup wire to pin 3 of transistor socket X2 (S-1). The other end will be connected later.
- (✓) Cut both leads of a .05  $\mu$ fd disc ceramic capacitor C70 to 1/4" length. Connect one lead to lug 2 of terminal strip AA (NS). Connect the other lead to lug 3 of terminal strip AA (NS).
- (✓) Cut two lengths of red wire, 5" and 5-3/4". Insert one end of each wire in the eyelet hole of lug 1, terminal strip AA and solder (S-2). Leave the other ends free for the moment.
- (✓) Cut both leads of a .05  $\mu$ fd disc ceramic capacitor C96 to 3/8" length. Making certain the capacitor does not extend past the edges of the metal shield plate, connect one lead to lug 1 of terminal strip AA (S-1). Connect the other lead to lug 2 of terminal strip AA (NS).
- (✓) On transistor socket X1, connect a 1" length of bare wire from pin 4 (S-1) to the eyelet hole of lug 2, terminal strip BB (NS).
- (✓) Cut both leads of a 470  $\Omega$  resistor (R5, yellow-violet-brown) to 3/8" length. Insert one lead in the eyelet hole of lug 2, terminal strip BB (NS). Connect the other lead to pin 1 of transistor socket X1 (NS).
- (✓) Cut one lead of a .05  $\mu$ fd disc ceramic capacitor C10 to 3/8" in length and connect to pin 1 of transistor socket X1 (S-2). Slip a 1-1/4" length of insulating sleeving over the other lead and run it through hole N. This lead will be connected later.
- (✓) Cut both leads of a .05  $\mu$ fd disc ceramic capacitor C11 to 1/4" in length. Insert one lead in the eyelet hole of lug 2, terminal strip BB (S-3). Connect the other lead to pin 2 of transistor socket X1 (NS).
- (✓) Cut both leads of a 4.7 K $\Omega$  resistor (R8, yellow-violet-red) to 1/2" in length. Run one lead through the eyelet hole of lug 2, terminal strip AA (NS) and connect the other lead to pin 2 of transistor socket X2 (NS).
- (✓) Cut one lead of a .05  $\mu$ fd disc ceramic capacitor C21 to 3/8" in length. Connect this lead to pin 2 of transistor socket X2 (S-2). The other lead will be connected later.
- (✓) Cut one lead only of a 47 K $\Omega$  resistor (R7, yellow-violet-orange) to 1/4" in length. Bend the lead at a right angle to the resistor body and form a small hook in it. Insert the uncut lead through the eyelet hole of lug 3 terminal strip AA (NS) and crimp the hooked lead over the lead of the 4.7 K $\Omega$  resistor (which is connected to pin 2 of transistor socket X2) near the resistor body (S-1). Trim off the excess eyelet lead (NS).
- (✓) Refer to Detail 12 and connect a .001  $\mu$ fd disc ceramic capacitor C22 across a 1 K $\Omega$  resistor (R9, brown-black-red). Trim off excess capacitor leads and solder. **DO NOT OVERHEAT.**
- (✓) Cut one lead of the above combination to 1/4" length and form a small hook in it. Insert the longer lead through the eyelet hole of lug 2 terminal strip AA and connect the short lead to pin 1 of transistor socket X2 (NS). Trim off the excess eyelet lead and solder eyelet (S-3).

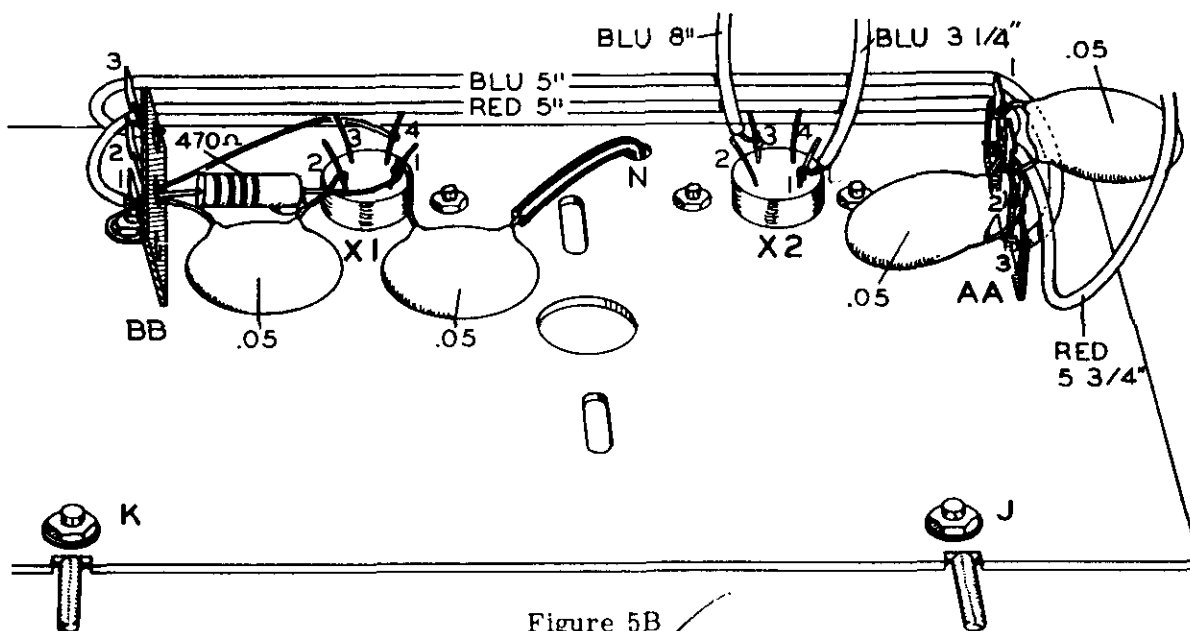


Figure 5B

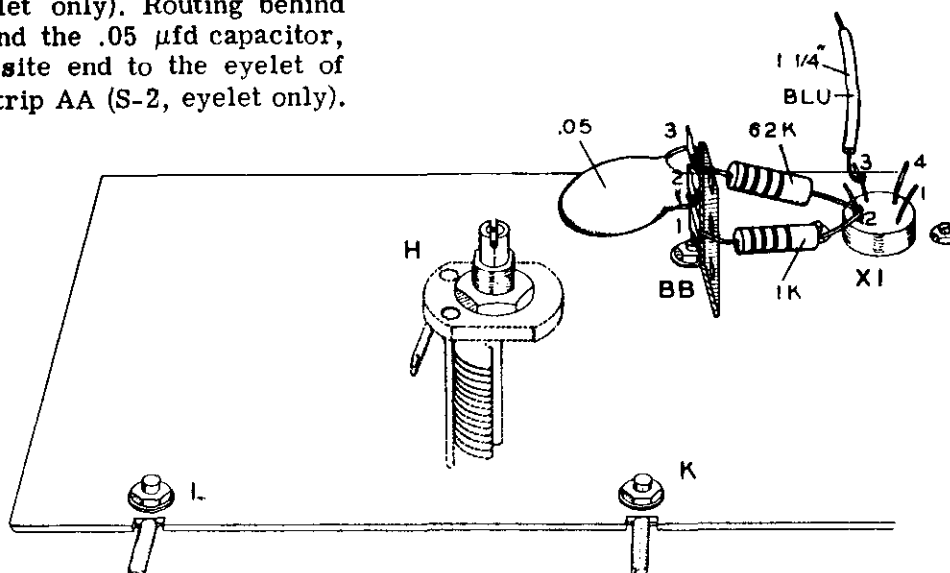
Refer to Figures 5B and 5C for the following steps:

- (✓) Cut both leads of a 62 KΩ resistor (R1, blue-red-orange) to 3/8" in length. Connect one lead to pin 2 of transistor socket X1 (NS). Connect the other lead to lug 3 of terminal strip BB (NS).
- (✓) Cut both leads of a 1 KΩ resistor (R2, brown-black-red) to 3/8" in length. Connect one lead to pin 2 of transistor socket X1 (S-3). Connect the other lead to lug 1 of terminal strip BB (NS).
- (✓) Connect one end of a 1-1/4" length of blue hookup wire to pin 3 of transistor socket X1 (S-1). The other end will be connected later.
- (N) Insert one end of a 5" length of blue wire in the eyelet of lug 3 terminal strip BB and solder (S-1, eyelet only). Routing behind both red wires and the .05 μfd capacitor, connect the opposite end to the eyelet of lug 3, terminal strip AA (S-2, eyelet only). See Figure 5B.

- ( ) Connect the free end of the shorter (5") red wire to lug 1 of terminal strip BB (S-2). See Figure 5B.
- (✓) Cut both leads of a .05 μfd disc ceramic capacitor C23 to 1/4" length. Connect one lead to lug 2 of terminal strip BB (S-1). Connect the other lead to lug 3 of terminal strip BB (S-2).
- (✓) Install the antenna trimmer capacitor C13 (#26-24) in hole H. Orient as shown. CAUTION: Keep plates meshed to prevent damage.

This completes the preliminary wiring of the MIXER-RF SHIELD PLATE ASSEMBLY. With the exception of lugs 2 and 3 of terminal strip AA, all lugs and socket pins should be soldered.

Figure 5C



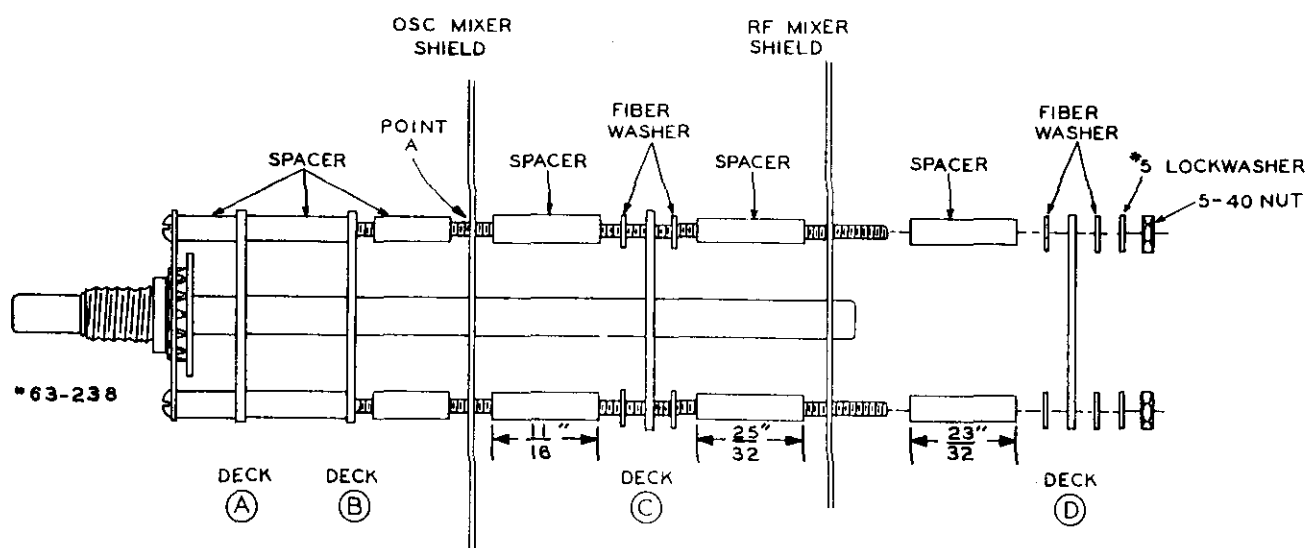


Figure 6

#### ASSEMBLY OF BAND SWITCH TO THE MIXER-RF AND OSCILLATOR-MIXER SHIELDS

Refer to Figure 6 for assembly of the shields to the band switch (#63-238) and Figure 7 for proper orientation of the switch wafers. The switch as supplied should be in its extreme counterclockwise position, as viewed from the knob end. It must be assembled to the shield plates while in this position, if the indicated positions of moving contacts shown in Figure 7 are to apply.

It should be noted that it is possible to place the wafers on the switch shaft in any of four positions, yet **ONLY ONE** of these positions will provide proper operation of the receiver. Observe these precautions in completing the following steps:

1. Do not disassemble the switch beyond point A (see Figure 6).
2. Make absolutely certain all switch wafers are oriented as shown in Figure 7. **CHECK THE POSITIONS OF THE TERMINALS AND FRONT MOVING CONTACT ON EACH SECTION.**

- ( ) Carefully disassemble band switch to point A.

- ( ) Place the oscillator-mixer shield (#206-M122) on the band switch (note position of contacts with respect to the switch rotor and shield plate). Orient as shown in Figure 7.
- ( ) Place a  $11/16$ " spacer on each stud, followed by a fiber washer.
- ( ) Now place the mixer Deck C on the switch studs. Check the rotor and switch; position carefully.
- ( ) Place a fiber washer on each stud, followed by a  $25/32$ " spacer.
- ( ) Now place the RF-mixer shield plate (#206-M123) on the switch studs. Position as shown.
- ( ) Place the remaining  $23/32$ " spacers over each stud, followed by a fiber washer.
- ( ) Slide the remaining Deck D on the assembly. Position as shown. Place a fiber washer, a lockwasher and a 5-40 nut on each switch stud. Snug each nut; do not tighten securely.

This completes the **BAND SWITCH-SHIELD PLATE ASSEMBLY.**

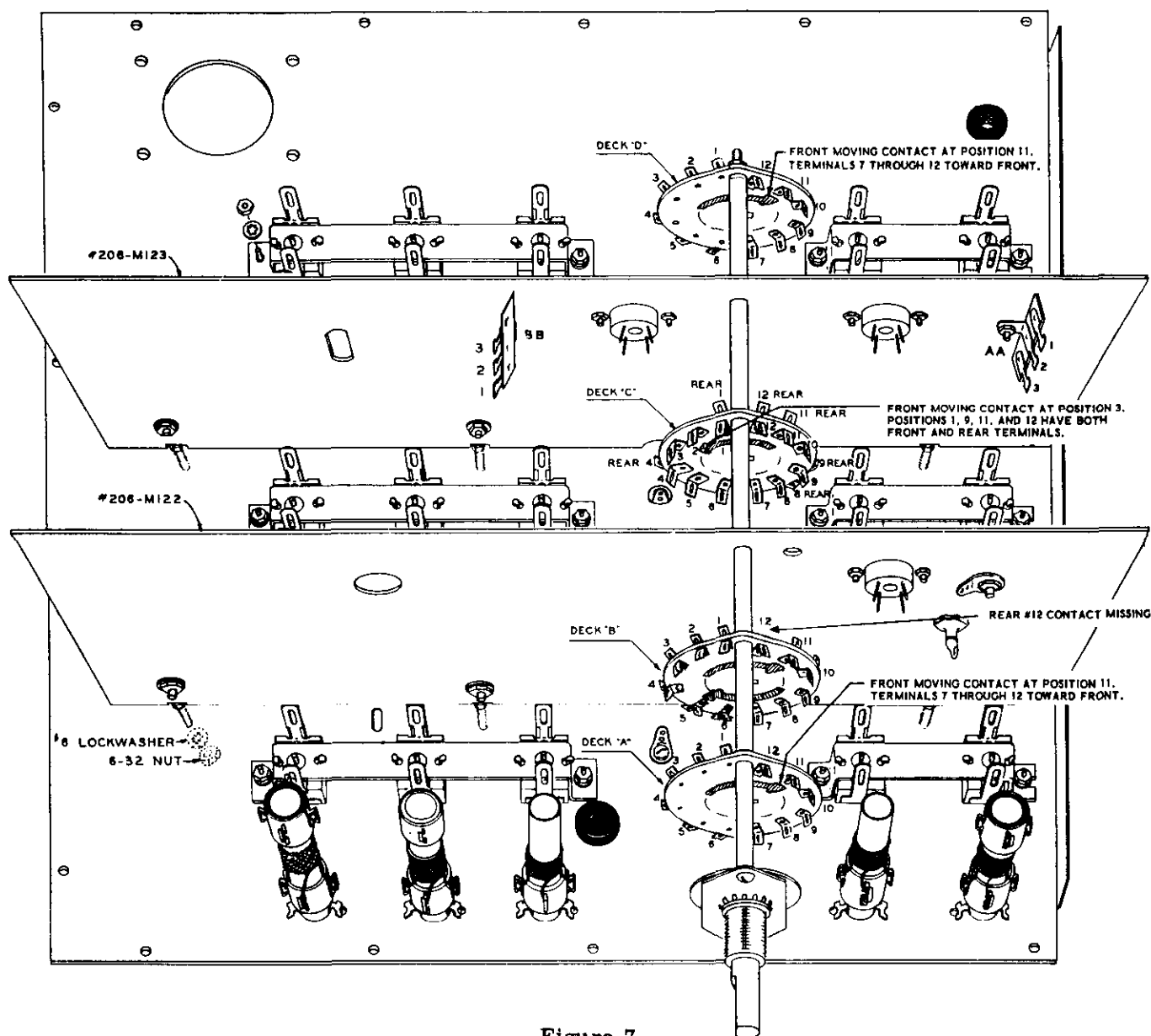


Figure 7

### ASSEMBLY AND WIRING OF THE BAND SWITCH TO THE TOP PLATE

Refer to Figure 7 for the following steps:

**CAUTION:** In the following step, make certain that no wires are pinched between the shield plates and the chassis top plate.

- ( ) Mount the band switch assembly to the top plate with the six spade bolts previously mounted on the shield plates. Secure with #6

lockwashers and 6-32 nuts. Now tighten the two nuts on Deck D of the band switch.

**NOTE:** The wiring between the band switch, transistor sockets and coils is quite critical. The following steps must be strictly adhered to so that wiring errors and/or abnormal circuit capacity due to wiring deviation are eliminated.

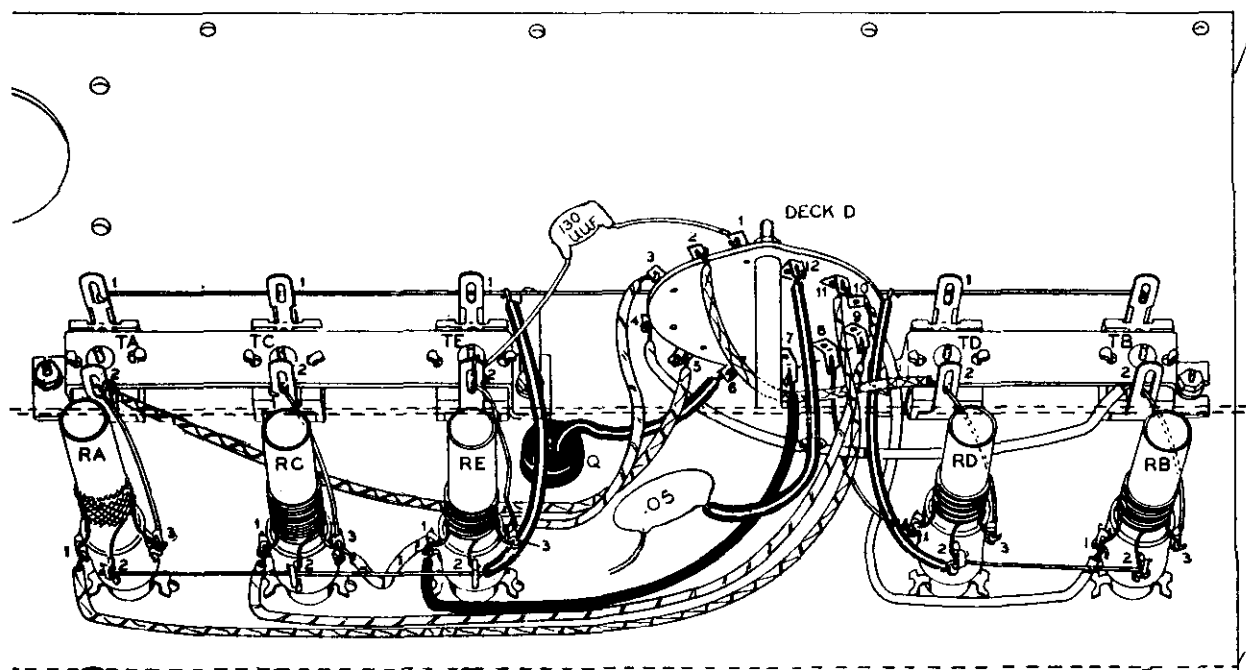


Figure 8

### RF AMP SECTION WIRING

Refer to Figure 8 for the following steps. In soldering the following switch terminals, be particularly careful to keep solder from flowing into the spring finger portion of the fixed switch contact.

- (✓) Place a 2-1/8" length of insulated sleeving over a 2-5/8" length of bare wire. Run one end of this wire through grommet Q and connect to the main tuning capacitor section C1 (S-1). Refer to Figure 26 on Page 55 for the connection. Connect the other end to lug 6, Deck D of the band switch (NS).
- (✓) Connect the orange wire from lug 2 of capacitor TA to lug 5, Deck D of the band switch (S-1).
- (✓) Connect the black wire from lug 1 of coil RE to lug 7, Deck D of the band switch (S-1).
- (✓) Connect the bare wire from lug 1 of coil RD to lug 8, Deck D of the band switch (S-1).
- (✓) Connect the blue wire from lug 1 of coil RC to lug 9, Deck D of the band switch (S-1).
- (✓) Connect the white wire from lug 1 of coil RB to lug 10 of Deck D of the band switch (S-1).
- (✓) Connect the orange wire from lug 1 of coil RA to lug 11, Deck D of the band switch (S-1).
- (✓) Connect the white wire from lug 2 of capacitor TB to lug 4, Deck D of the band switch (S-1).
- (✓) Connect the blue wire from lug 3 of coil RC to lug 3, Deck D of the band switch (S-1).
- (✓) Connect the gray wire from lug 2 of capacitor TD to lug 2, Deck D of the band switch (S-1).
- (✓) Cut both leads of a 130  $\mu\text{f}$  silver mica capacitor C2 to 1" in length. Connect one lead to lug 2 of capacitor TE (S-2). Connect the other lead to lug 1, Deck D of the band switch (S-1).
- (✓) Connect the lead of the .05  $\mu\text{f}$  disc ceramic capacitor coming from pin 1 of transistor socket X1 to lug 12, Deck D of the band switch (S-1).

This completes the preliminary wiring of the RF AMP SECTION.

MIXER SECTION WIRING

Refer to Figure 9 for the following steps.

- (✓) Slip a 3" length of insulated sleeving over a 3-1/2" length of bare wire. Run one end of this wire through grommet R. Connect this end to the solder lug on the main tuning capacitor C14 mixer section (S-1). See Figure 26 on Page 55 for this connection. Connect the other end to lug 10, Deck C - Front of the band switch (S-1).
- (✓) Connect the blue wire from lug 1 of coil MC to lug 7, Deck C - Front of the band switch (S-1).
- (✓) Connect the gray wire from lug 1 of coil MD to lug 6, Deck C - Front of the band switch (S-1).
- (✓) Connect the black wire from lug 1 of coil ME to lug 5, Deck C - Front of the band switch (S-1).
- (✓) Connect the white wire from lug 1 of coil MB to lug 8, Deck C - REAR of the band switch (S-1).
- (✓) Connect the orange wire from lug 1 of coil MA to lug 9, Deck C - FRONT of the band switch (S-1).
- (✓) Connect the orange wire from lug 3 of coil MA to lug 9, Deck C - REAR of the band switch (S-1).
- (✓) Connect the blue wire from pin 3 of transistor socket X1 to lug 4, Deck C - Rear of the band switch (S-1).
- (✓) Slip a 1-1/4" length of insulated sleeving over the free end of the .05  $\mu$ f capacitor connected to pin 2 of transistor socket X2. Position as shown and connect to lug 4, Deck C - Front of the band switch (S-1). Cut off excess lead.
- (✓) Connect the orange wire from lug 4 of coil MA to lug 3, Deck C - Front of the band switch (S-1).
- (✓) Connect the white wire from lug 2 of capacitor SB to lug 2, Deck C - Front of the band switch (S-1).
- (✓) Connect the blue wire from lug 3 of coil MC to lug 1, Deck C - Front of the band switch (S-1).
- (✓) Connect the black wire from lug 2 of capacitor SE to lug 11, Deck C - Rear of the band switch (NS).
- (✓) Cut both leads of a 130  $\mu$ f silver mica capacitor C67 to 1/4" in length. Connect one lead to lug 11, Deck C - Front of the band switch (S-1). Connect the other lead to lug 11, Deck C - Rear of the band switch (S-2).
- (✓) Connect the gray wire from lug 2 of capacitor SD to lug 12, Deck C - Front of the band switch (S-1).
- (✓) Run the blue wire from pin 1 of transistor socket X2 through the hole in the oscillator-mixer shield and connect to lug 12, Deck A - Front of the band switch (NS). See Figure 10.
- (✓) Cut each lead of a 470  $\Omega$  resistor (R6, yellow-violet-brown) to 3/4" in length. Place a 1/2" piece of sleeving over one end and connect this lead to lug 2 of coil MB (S-2). Connect the other lead to lug 3 of terminal strip AA (NS). See Figure 9.
- (✓) Cut both leads of a 100  $\Omega$  resistor (R10, brown-black-brown) to 3/8" in length. Connect one lead to lug 3 of terminal strip AA (S-3). Connect the other lead to feed-through capacitor C25 (NS).

NOTE: In soldering the Zener diode into the circuit, solder the connection quickly and use care to avoid overheating the diode.

- (✓) Cut both leads of the Zener diode to 1/2" in length. Connect the cathode (band end, see Figure 9 and Detail 9A) to lug 2 of terminal strip AA (S-3). Connect the anode lead to the feed-through capacitor C25 (NS).

This completes the wiring in the MIXER SECTION.

OSCILLATOR SECTION WIRING

Refer to Figure 10A and Figure 2A on Page 20.

- (✓) Connect the sleeving-covered lead (connected to lug 2 of coil OD) to lug 6, Deck B - REAR of the band switch (NS).
- (✓) Connect the sleeving-covered lead (connected to lug 2 of coil OE) to lug 6, Deck B - REAR of the band switch (S-2).
- (✓) Slip a 2" length of insulating sleeving over a 2-1/2" length of bare wire. Insert one end of this wire through grommet S. Connect this end to the solder lug on the main tuning capacitor C44 section (S-1). See Figure 26 on Page 55 for this connection. Connect the other end to lug 6, Deck A - Rear of the band switch (S-1).
- (✓) Connect one end of a 2-1/2" length of bare wire (place a 2" piece of insulating sleeving over it) to lug 6, Deck B - Front of the band switch (NS). Run the other end through grommet S. This end will connect to the band-spread capacitor later.
- (✓) Connect the black wire from lug 4 of coil OE to lug 7, Deck B - Front of the band switch (S-1).
- (✓) Connect the bare wire from lug 4 of coil OD to lug 8 of Deck B - Front of the band switch (S-1).
- (✓) Form a small hook in one end of a 2-1/2" length of black wire. Connect this hook to pin 3 of transistor socket X3 (S-1). Connect the other end to lug 6 of Deck B - Front of the band switch (S-2).
- (✓) Cut both leads of a 62  $\mu\text{mf}$  silver mica capacitor C33 to 1/4" in length. Connect one lead to lug 1 of coil OD (S-2). Connect the other lead to lug 8, Deck A of the band switch (S-1).
- (✓) Connect the blue wire from lug 4 of coil OC to lug 9, Deck B - Front of the band switch (S-1).
- (✓) Connect the blue wire from lug 5 of coil OC to lug 9, Deck A - Front of the band switch (S-1).

- (✓) Cut both leads of a 47  $\mu\text{mf}$  silver mica capacitor C29 to 1-1/4" in length. Slip a 1" length of insulated sleeving over each lead. Connect one lead to lug 1 of coil OE (S-2). Connect the other lead to lug 7, Deck A of the band switch (S-1).
- (✓) Connect the orange wire from lug 3 of coil OA to lug 5, Deck B - Front of the band switch (NS).

Refer to Figure 10B.

- (X) Cut both leads of a 470  $\mu\text{mf}$  silver mica capacitor C43 to 3/8" in length. Connect one lead to lug 5, Deck B - Front of the band switch (S-2). Connect the other lead to lug 5, Deck A of the band switch (S-1).
- (✓) Connect the white wire from lug 2 of capacitor UB to lug 4, Deck B - Front of the band switch (NS).
- (✓) Cut both leads of a .001  $\mu\text{fd}$  disc ceramic capacitor to 3/8" in length. Connect one lead to lug 4, Deck B - Front of the band switch (S-2). Connect the other lead to lug 4 Deck A of the band switch (S-1).
- (✓) Connect the blue wire from lug 3 of coil OC to lug 3, Deck B - Front of the band switch (NS).
- (✓) Connect a 1-1/8" length of bare wire between lug 3, Deck B - Front of the band switch (S-2) and lug 3, Deck A of the band switch (S-1).
- (✓) Connect the gray wire from lug 2 of capacitor UD to lug 2, Deck B - Front of the band switch (NS).
- (✓) Connect a 1-1/8" length of bare wire between lug 2, Deck B - Front of the band switch (S-2) and lug 2, Deck A of the band switch (S-1).
- (✓) Connect the black wire from lug 2 of capacitor UE to lug 1, Deck B - Front of the band switch (NS).
- (✓) Cut both leads of a 130  $\mu\text{mf}$  silver mica capacitor C46 to 3/8" in length. Connect one lead to lug 1, Deck B - Front of the band switch (S-2). Connect the other lead to lug 1, Deck A of the band switch (S-1).

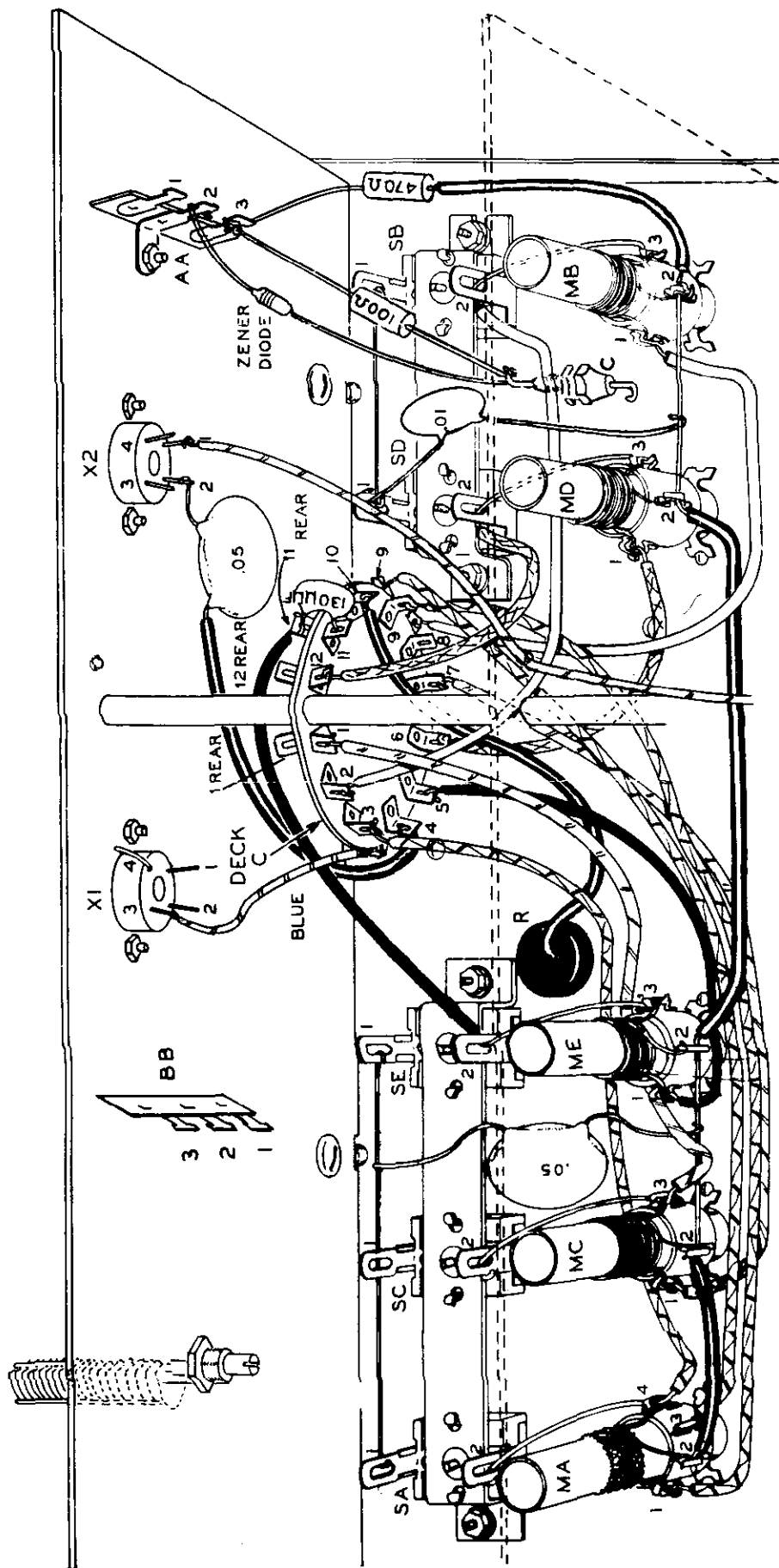


Figure 9

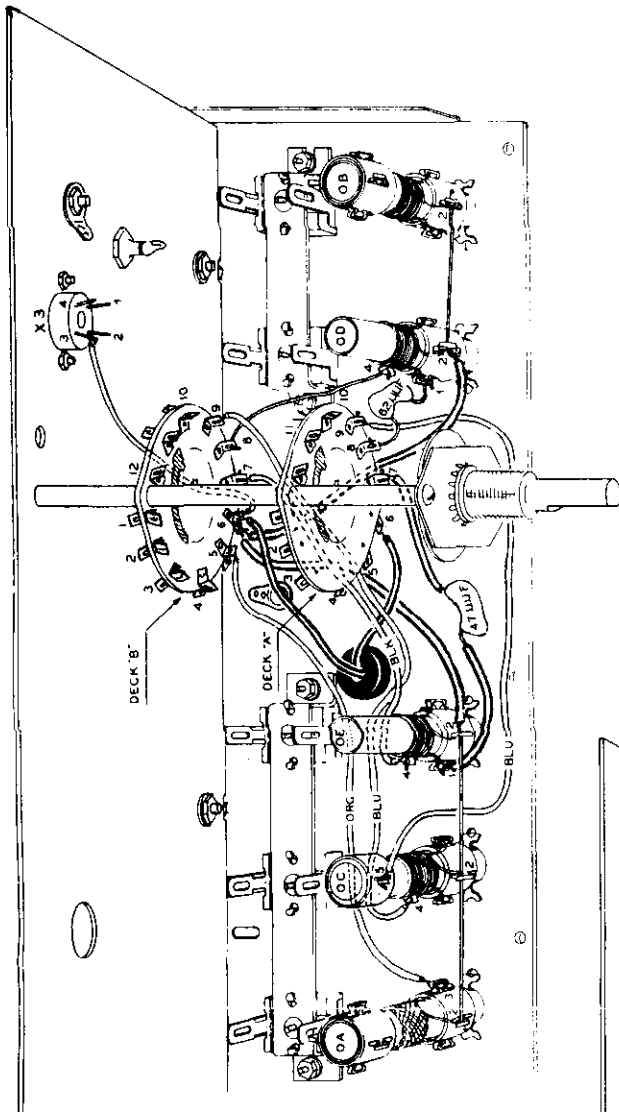


Figure 10 A

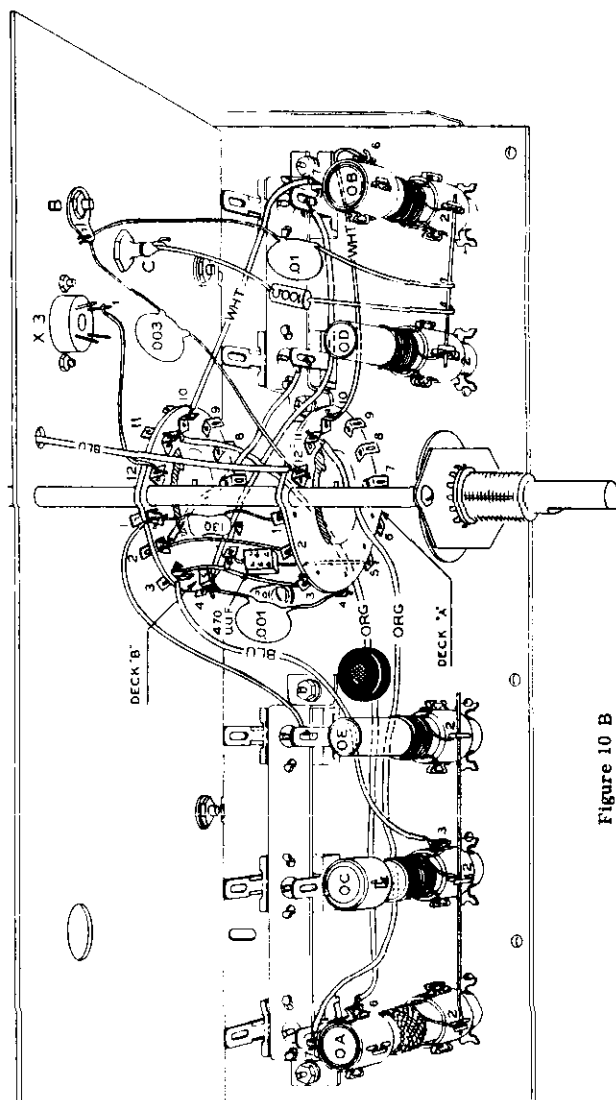


Figure 10 B

3.5

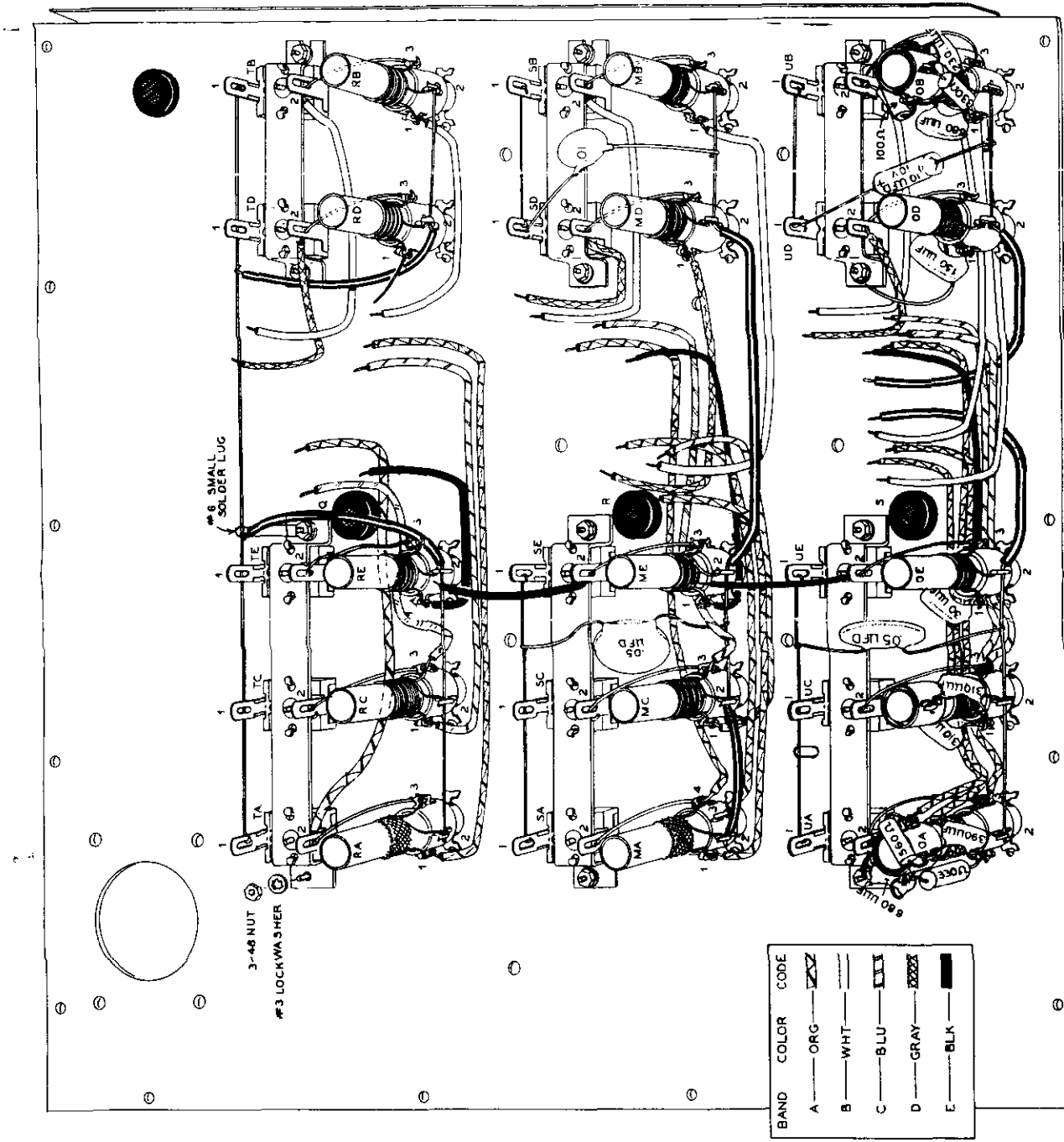
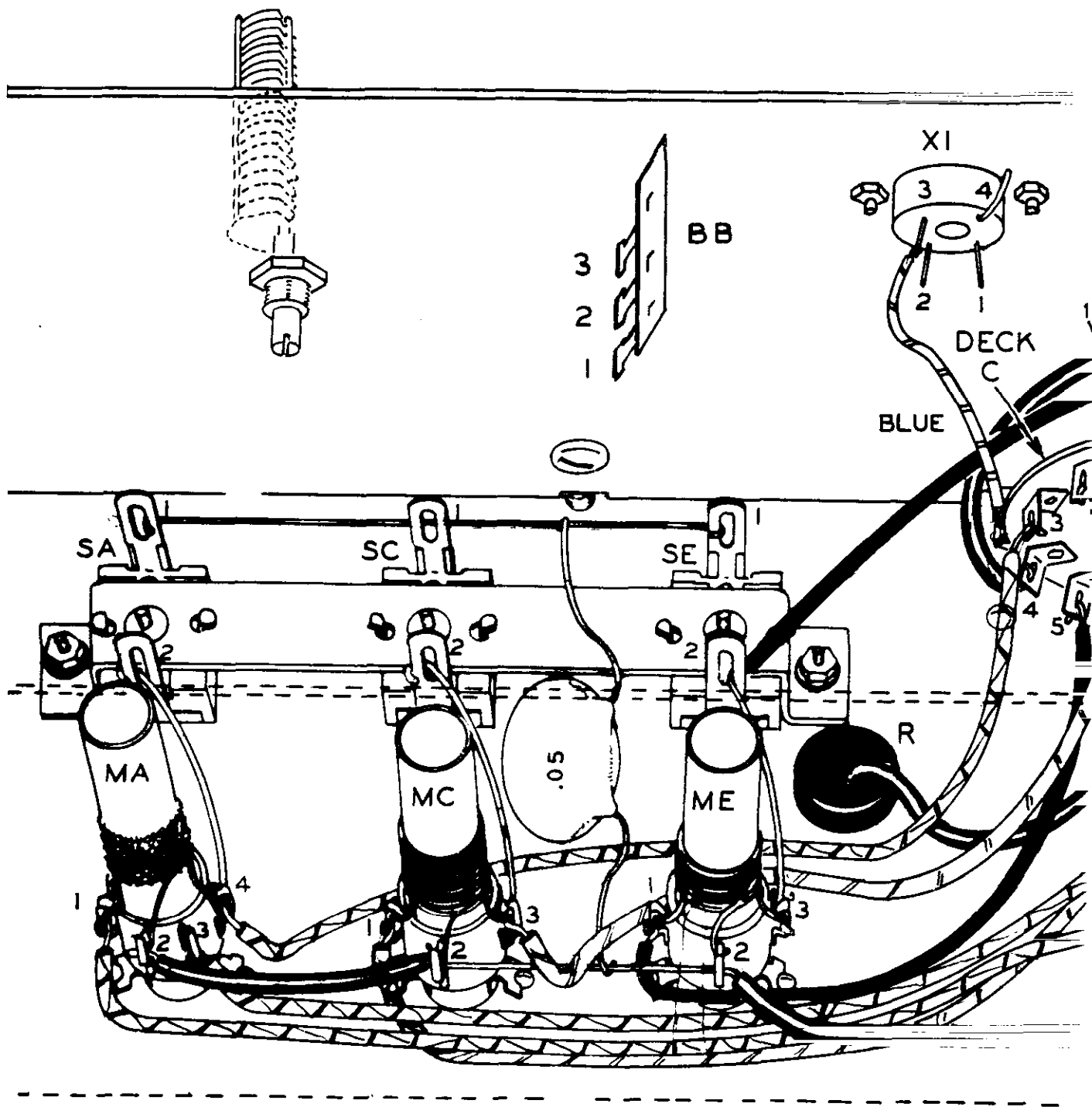
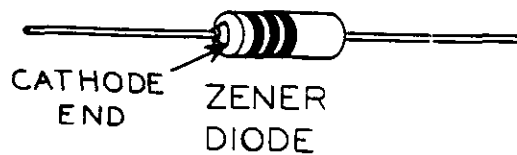
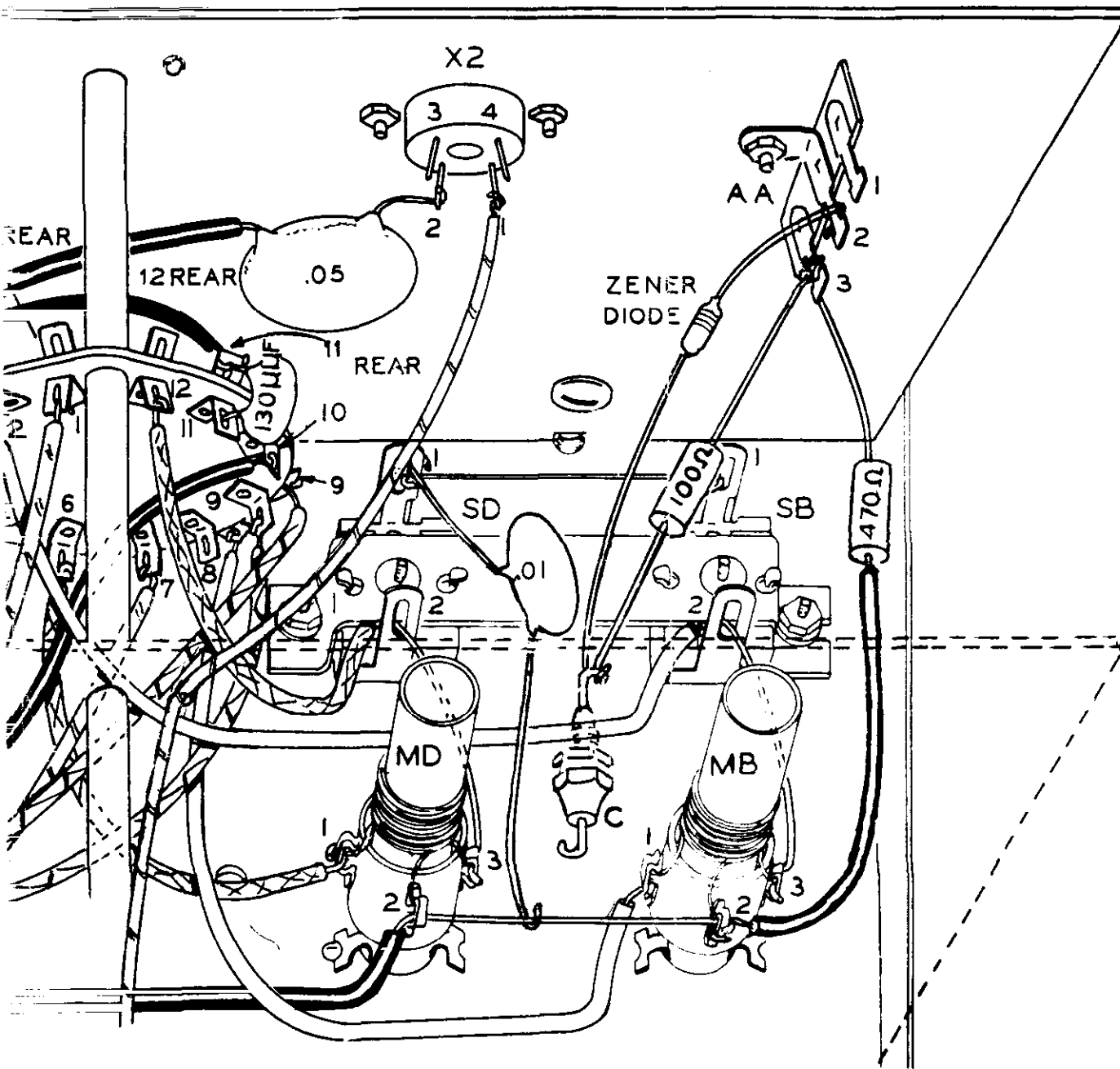


Figure 2



Figur:



Detail 9A

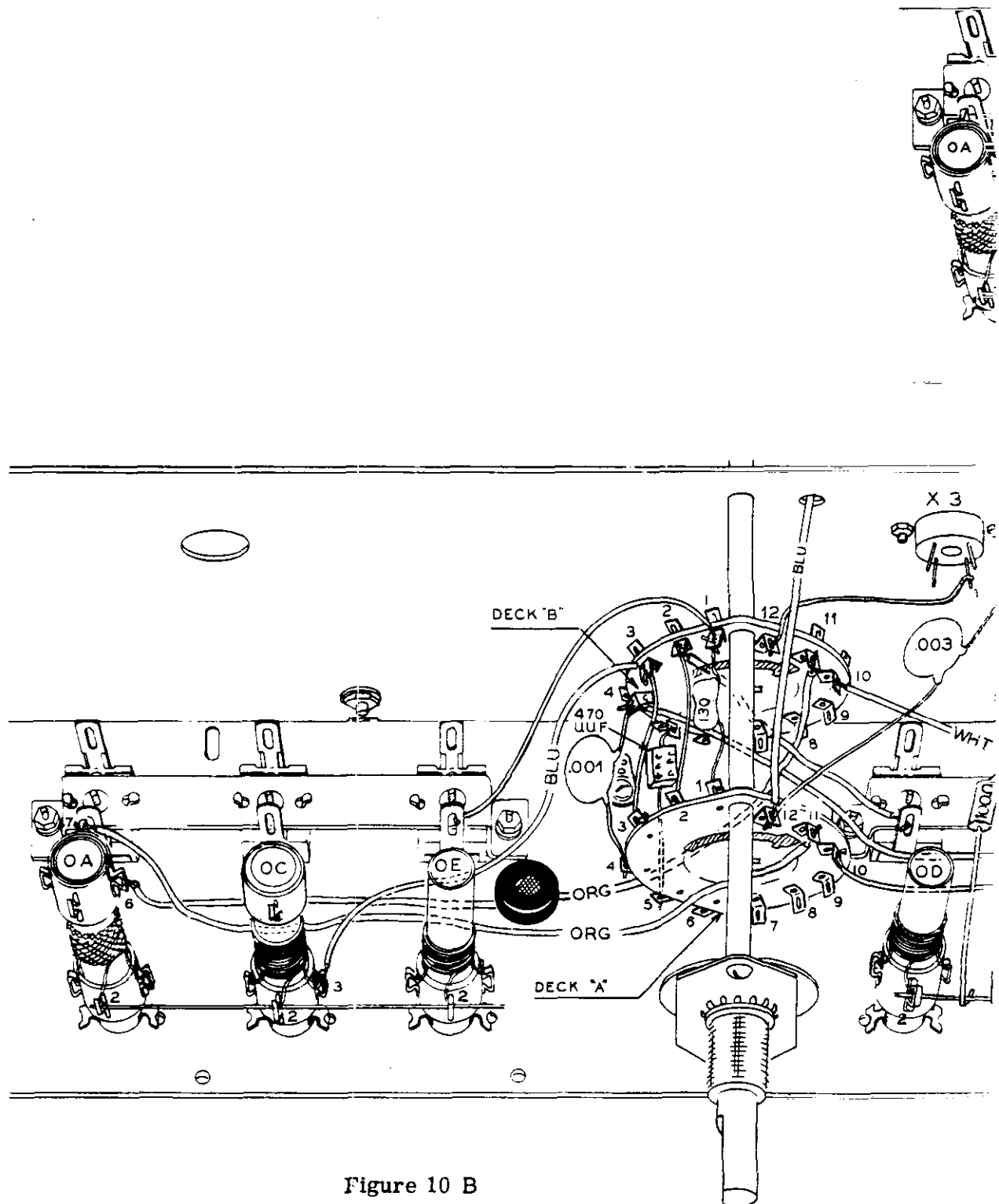


Figure 10 B

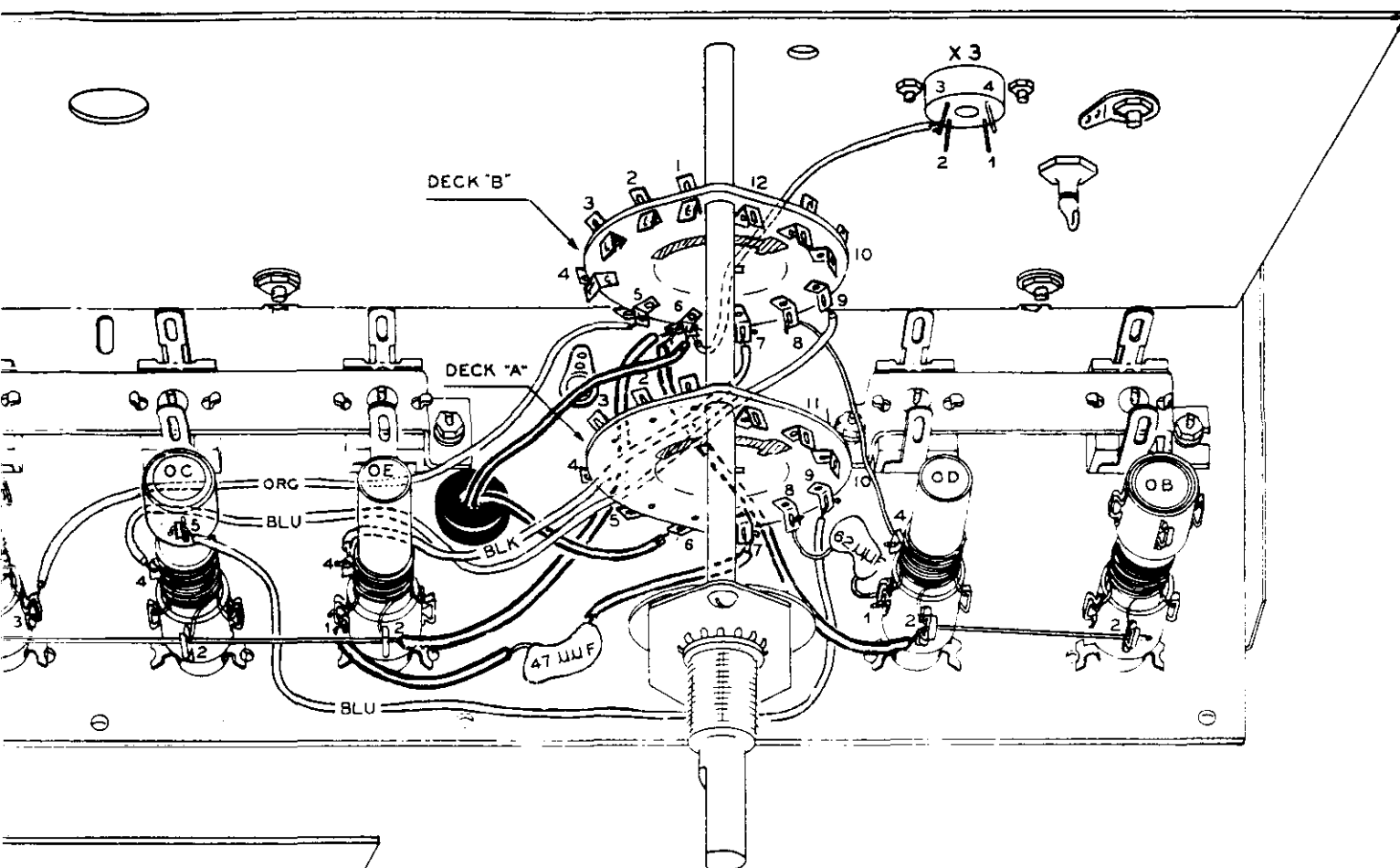
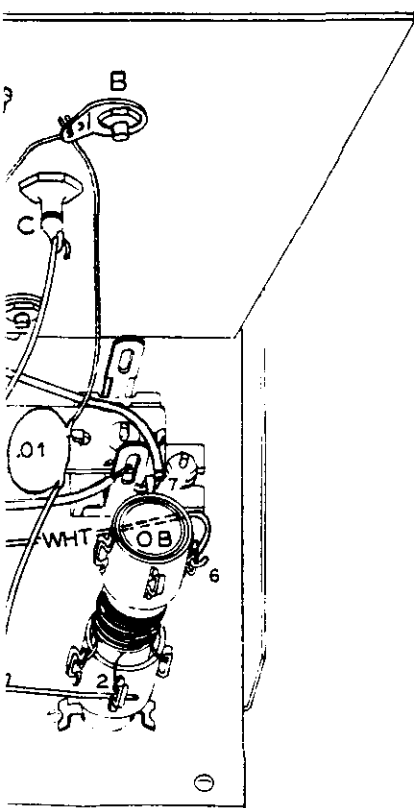
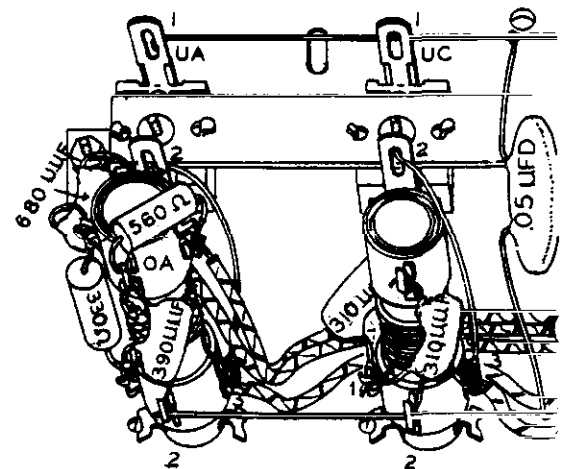
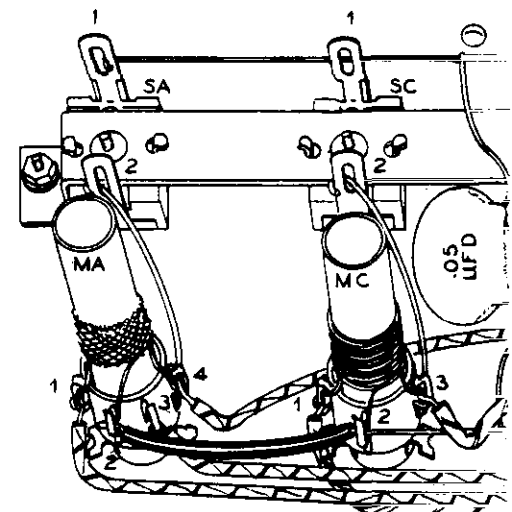
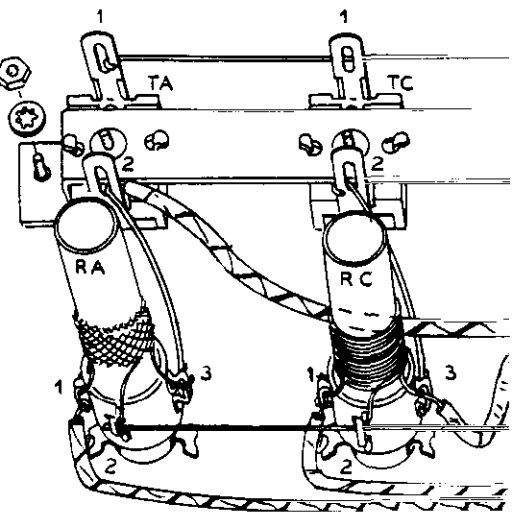


Figure 10 A



3-48 NUT  
#3 LOCKWASHER



| BAND | COLOR | CODE |
|------|-------|------|
| A    | ORG   |      |
| B    | WHT   |      |
| C    | BLU   |      |
| D    | GRAY  |      |
| E    | BLK   |      |

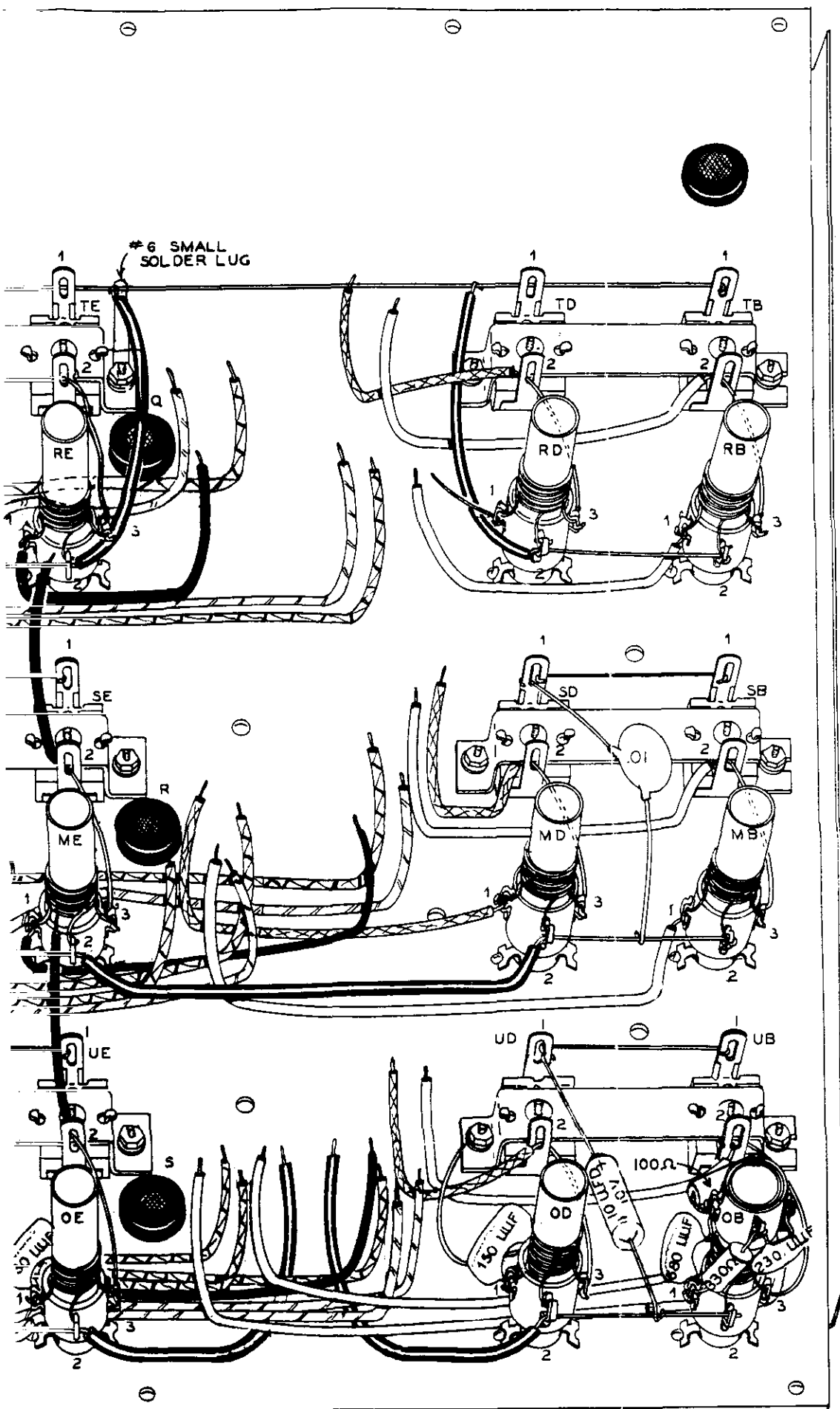


Figure 2

- (✓) Connect a 1 3/4" length of white wire from lug 7 on coil OB (S-2) to lug 10, Deck B - Front of the band switch (S-1).
- (✓) Connect a 2 1/2" length of white wire from lug 6 of coil OB (S-2) to lug 10 Deck A of the band switch (S-1).
- (✓) Connect the orange wire from lug 7 of coil OA to lug 11, Deck A of the band switch (S-1).
- (✓) Connect the orange wire from lug 6 of coil OA to lug 11, Deck B - Front of the band switch (S-1).
- (✓) Connect the bare wire from pin 1 of transistor socket X3 to lug 12, Deck B - Front of the band switch. Cut off the excess lead and solder.
- (✓) Cut both leads of a 100  $\Omega$  resistor (R52, brown-black-brown) to a 5/8" length. Connect one lead to feed-through capacitor C (NS). Connect the other lead to the bare wire running between lug 2 of coil OB and lug 2 of coil OD (NS).

- (✓) Cut both leads of a .01  $\mu$ fd disc ceramic capacitor to 1-1/8" in length. Connect one lead to ground lug B (NS). Connect the other lead to the bare wire running between lug 2 of coil OB and lug 2 of coil OD adjacent to the connection of the above 100  $\Omega$  resistor. Solder both the 100  $\Omega$  and .01  $\mu$ fd leads to the wire (S-3).
- (✓) Cut both leads of a .003  $\mu$ fd disc ceramic capacitor to 1-1/8" in length. Connect one lead to lug 12 of Deck A of the band switch (S-2). Connect the other lead to ground solder lug B (S-5).

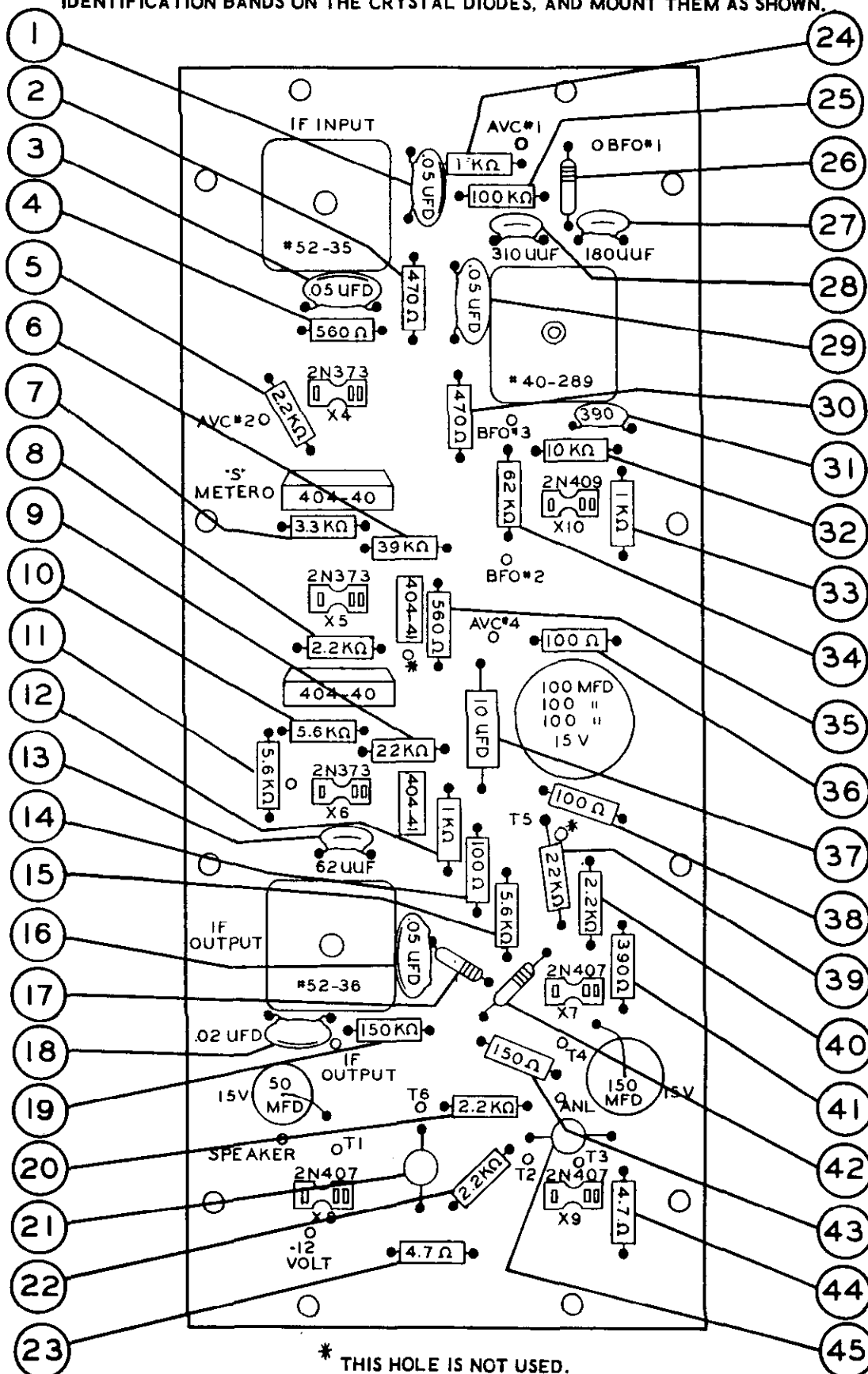
NOTE: Recheck all connections and wiring. Remove wire clippings, etc. Feed-through capacitor C (Oscillator Section) and lug 6, Deck D of the band switch should not be soldered at this time. A red and a blue wire in the Mixer Section will be left with a free end. Set the "Front End" assembly aside for the present.



1. (✓) Install the IF input transformer T1 (#52-35). Color dot on the base of the transformer must align with color dot on circuit board. Solder all seven pins.
2. (✓) Install a circuit board transistor socket at X4 (1st IF). Press socket into the circuit board as shown until the pins snap over the foil on the bottom of the board. Make certain the base pin is toward the front of the board. Solder all three pins.
3. (✓) Install a band-pass transfilter (#404-40), as shown in Detail. Solder all three pins.
4. (✓) Install a circuit board transistor socket at X5 (2nd IF). Press the socket into the board. Orient socket so that the base pin is toward the circuit board front. Solder all three pins.
5. (✓) Install a bypass transfilter (#404-41), as shown in Detail. Solder both pins.
6. (✓) Install a band-pass transfilter (#404-40), as shown in Detail. Solder all three pins.
7. (✓) Install a circuit board transistor socket at X6 (3rd IF). Press the socket into the circuit board until the pins snap into position. Make certain that the base pin is toward the front of the board, then solder all three pins.
8. (✓) Install a bypass transfilter (#404-41), as shown in Detail. Solder both pins.
9. (✓) Install the IF output and detector transformer T2 (#52-36). Color dot on the base of the transformer must align with the color dot on circuit board. Solder all eight pins.
10. (✓) Install a 50  $\mu$ fd electrolytic capacitor C59 as shown. Carefully observe polarity - See enlarged capacitor Detail. Solder both connections.
11. (✓) Install a circuit board transistor socket at X8 (audio output). Press the socket into the circuit board until the pins snap into position. Make certain that the base pin is toward the front of the board, then solder all three pins.
12. (✓) Install the BFO coil L16 (#40-289). The color dot on the base of the transformer must align with the color dot on the circuit board. Solder all eight pins.
13. (✓) Install a circuit board transistor socket at X10 (BFO). Press the socket into the circuit board until the pins snap over the foil on the bottom of the board. Make certain that the base pin is toward the front of the board. Solder all three pins.
14. (✓) Install the triple 100  $\mu$ fd electrolytic capacitor (C56, C57 and C58). The larger pin goes in the hole nearest the edge. Solder all four pins.
15. (✓) Install a circuit board transistor socket at X7 (audio driver). Press into the circuit board until the pins snap over the foil on the bottom of the board. Make certain that the base pin is toward the front of the circuit board. Solder ~~all~~ three pins.
16. (✓) Install the 150  $\mu$ fd electrolytic capacitor C55 as shown. Carefully observe polarity - See enlarged capacitor Detail. Solder both connections.
17. (✓) Install a circuit board transistor socket at X9 (audio output). Press into the circuit board until the pins snap over the foil on the bottom of the board. Make certain that the base pin is toward the front of the circuit board. Solder all three pins.

MOUNT EACH OF THE FOLLOWING COMPONENTS. BEND LEADS SLIGHTLY AFTER INSTALLING SO THAT THEY WILL NOT FALL OUT BEFORE SOLDERING. NOTE THE IDENTIFICATION BANDS ON THE CRYSTAL DIODES, AND MOUNT THEM AS SHOWN.

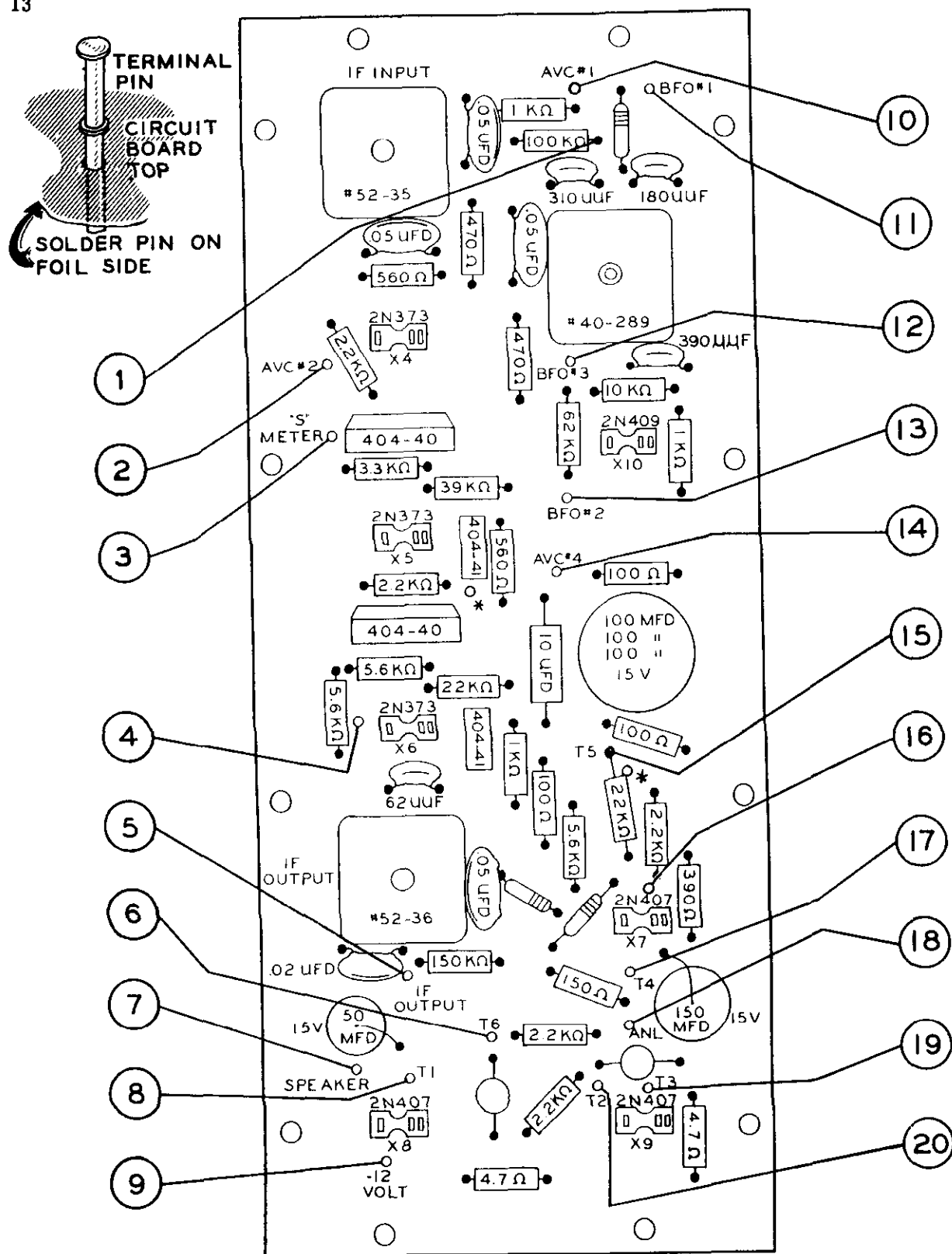
Figure 12



1. (✓) .05  $\mu$ f ceramic capacitor C49.
2. (✓) 470  $\Omega$  resistor (R11, yellow-violet-brown).
3. (✓) .05  $\mu$ f ceramic capacitor C50.
4. (✓) 560  $\Omega$  resistor (R21, green-blue-brown).
5. (✓) 2.2 K $\Omega$  resistor (R22, red-red-red).
6. (✓) 39 K $\Omega$  resistor (R23, orange-white-orange).
7. (✓) 3.3 K $\Omega$  resistor (R24, orange-orange-red).
8. (✓) 2.2 K $\Omega$  resistor (R26, red-red-red).
9. (✓) 22 K $\Omega$  resistor (R27, red-red-orange).
10. (✓) 5.6 K $\Omega$  resistor (R28, green-blue-red).
11. (✓) 5.6 K $\Omega$  resistor (R4, green-blue-red).
12. (✓) 1 K $\Omega$  resistor (R29, brown-black-red).
13. (✓) 62  $\mu$ f mica capacitor C51.
14. (✓) 100  $\Omega$  resistor (R30, brown-black-brown).
15. (✓) 5.6 K $\Omega$  resistor (R31, green-blue-red).
16. (✓) .05  $\mu$ f ceramic capacitor C52.
17. (✓) Crystal diode. Note marking bands, polarity is important. CAUTION: Do not overheat when soldering.
18. (✓) .02  $\mu$ f ceramic capacitor C53.
19. (✓) 150 K $\Omega$  resistor (R32, brown-green-yellow).
20. (✓) 2.2 K $\Omega$  resistor (R50, red-red-red).
21. (✓) Compensating diode type 1N2326. Dot on diode MUST correspond with circuit board point indicated.
22. (✓) 2.2 K $\Omega$  resistor (R41, red-red-red).
23. (✓) 4.7  $\Omega$  resistor 5% (R44, yellow-violet-gold).
24. (✓) 1 K $\Omega$  resistor (R19, brown-black-red).
25. (✓) 100 K $\Omega$  resistor (R20, brown-black-yellow).
26. (✓) Crystal diode. Note marking bands, polarity is important. CAUTION: Do not overheat.
27. (✓) 180  $\mu$ f mica capacitor C62.
28. (✓) 310  $\mu$ f mica capacitor C64.
29. (✓) .05  $\mu$ f ceramic capacitor C63.
30. (✓) 470  $\Omega$  resistor (R49, yellow-violet-brown).
31. (✓) 390  $\mu$ f mica capacitor C61.
32. (✓) 10 K $\Omega$  resistor (R45, brown-black-orange).
33. (✓) 1 K $\Omega$  resistor (R46, brown-black-red).
34. (✓) 62 K $\Omega$  resistor (R55, blue-red-orange).
35. (✓) 560  $\Omega$  resistor (R25, green-blue-brown).
36. (✓) 100  $\Omega$  resistor (R38, brown-black-brown).
37. (✓) 10  $\mu$ f 10 V electrolytic capacitor C27. Observe polarity.
38. (✓) 100  $\Omega$  resistor (R39, brown-black-brown).
39. (✓) 22 K $\Omega$  resistor (R35, red-red-orange). Leave end indicated free for the moment.
40. (✓) 2.2 K $\Omega$  resistor (R36, red-red-red).
41. (✓) 390  $\Omega$  resistor (R37, orange-white-brown).
42. (✓) Crystal diode. Note marking bands, polarity is important. CAUTION: Do not overheat.
43. (✓) 150  $\Omega$  resistor (R34, brown-green-brown).
44. (✓) 4.7  $\Omega$  resistor (R43, yellow-violet-gold).
45. (✓) Compensating diode type 1N2326. Dot on diode MUST correspond with circuit board point indicated.

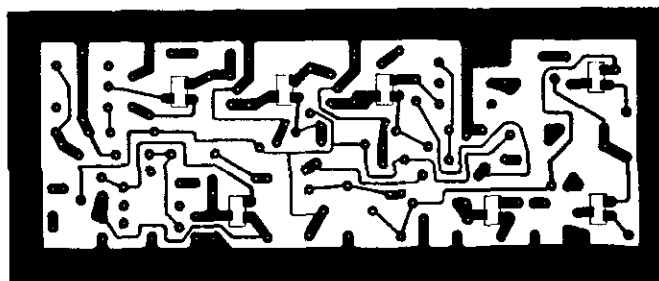
NOTE: WHEN CONNECTING WIRES TO THESE TERMINAL PINS LATER, SOLDER QUICKLY SO AS NOT TO OVERHEAT THE FOIL CONNECTION.

Figure 13



1. (✓) Solder the leads of all the components previously installed except the end of the 100 K $\Omega$  (R20, brown-black-yellow) resistor, nearest the right side of the board, as shown. Clip this lead so that approximately 1/8" protrudes from the foil side of the board. All other leads should be clipped next to the solder connection after soldering. This does not apply to terminal pins in the following steps.
2. (✓) Install the AVC terminal pin 2 from the top of the circuit board (S-1). See Detail.
3. (✓) Install the S-meter terminal pin from the top of the circuit board (S-1).
4. (✓) Install AVC terminal pin 3 from the top of the board (S-1).
5. (✓) Install the IF output terminal pin from the top of the circuit board (S-1).
6. (✓) Install the driver transformer terminal pin T6 from the top of the circuit board (S-1).
7. (✓) Install the speaker terminal pin from the top of the circuit board (S-1).
8. (✓) Install the driver transformer terminal pin T1 from the top of the circuit board (S-1).
9. (✓) Install the -12 volt supply terminal pin from the top of the circuit board (S-1).
10. (✓) Install the AVC terminal pin 1 from the top of the circuit board (S-1).
11. (✓) Install the BFO terminal pin 1 from the top of the circuit board (S-1).
12. (✓) Install the BFO terminal pin 3 from the top of the circuit board (S-1).
13. (✓) Install the BFO terminal pin 2 from the top of the circuit board (S-1).
14. (✓) Install the AVC terminal pin 4 from the top of the circuit board (S-1).
15. (✓) Install the driver transformer terminal pin T5 from the top of the circuit board (S-1). Connect the free end of the 22 K $\Omega$  resistor to this point (S-1).
16. (✓) Install the audio frequency input terminal pin AF from the top of the circuit board (S-1).
17. (✓) Install the driver transformer terminal pin T4 from the top of the circuit board (S-1).
18. (✓) Install the automatic noise limiter terminal pin ANL from the top of the circuit board (S-1).
19. (✓) Install the driver transformer terminal pin T3 from the top of the circuit board (S-1).
20. (✓) Install the driver transformer terminal pin T2 from the top of the circuit board (S-1).

Figure 14



FOIL VIEW CIRCUIT BOARD

- (✓) Before laying the circuit board aside, check the foil side against Figure 14. Check to see that no solder bridges have occurred between adjacent lands or conductors. If any have occurred, carefully run a soldering iron

across the bridge and remove the excess solder.

- (✓) If the soldered circuit board is correctly soldered and appears as shown in the above figure, set it aside until later.

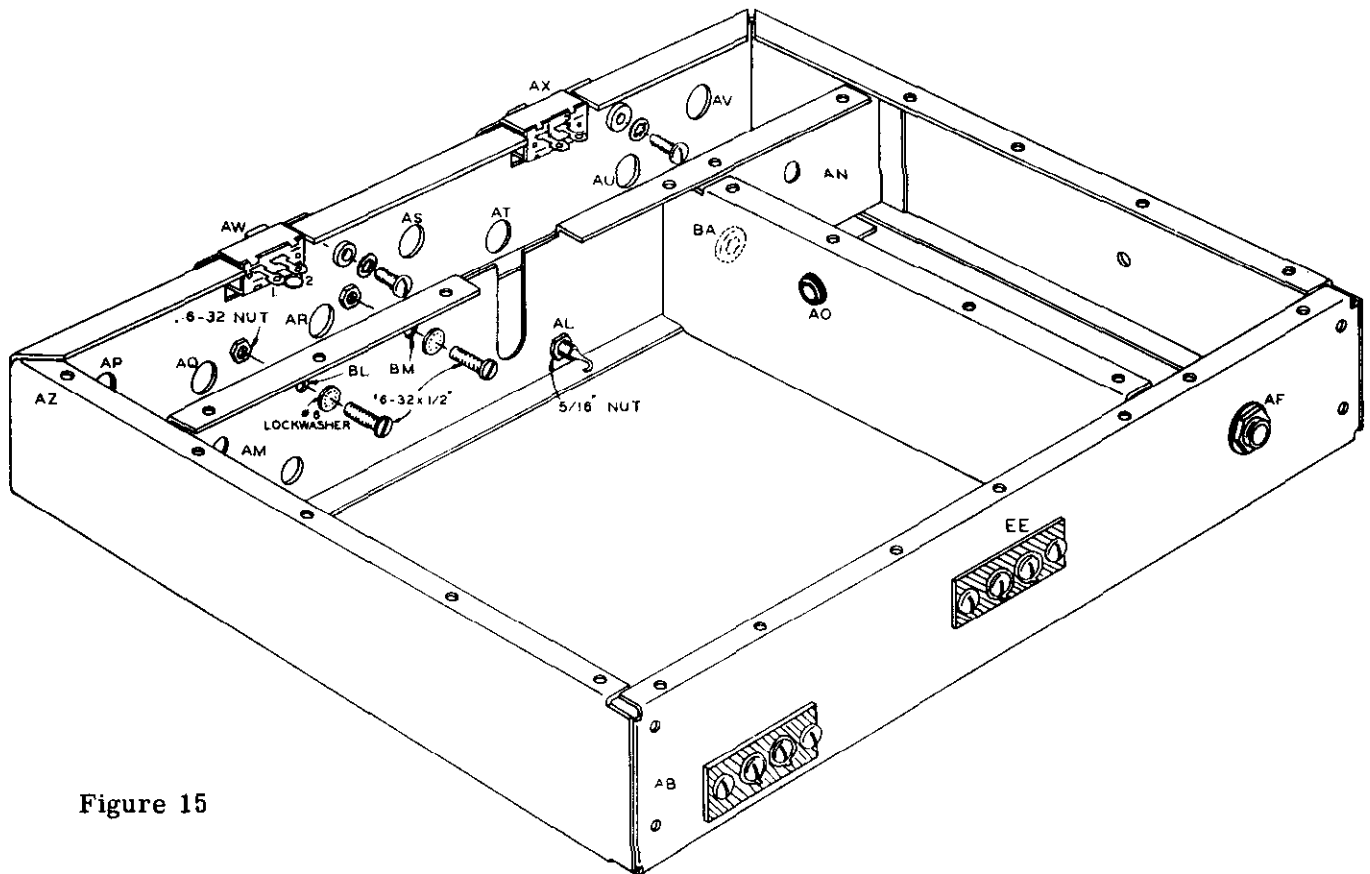
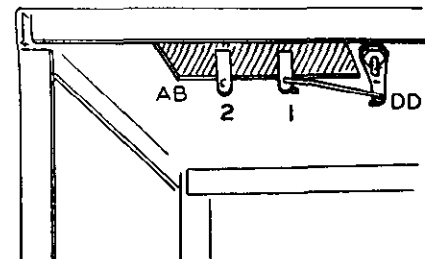


Figure 15

### PARTS INSTALLATION AND WIRING CHASSIS BASE ASSEMBLY

Refer to Figure 15 and Detail 13 for the following steps.

- ( ) Locate the chassis base (#100-M250) and mount the 2-lug screw terminal strip AB. The terminal strip is mounted from the outside, as shown, with 6-32 x 1/4" BHMS and 6-32 nuts. Under the nut nearest the center of the main frame use a #6 solder lug. On the other mounting screw place a #6 lockwasher and secure with a 6-32 nut.
- ( ) Connect a length of bare wire from lug 1 of terminal strip AB (S-1) to the adjacent chassis mounted ground lug (S-1).
- (✓) Mount the phone jack AF. Insert the phone jack with a control lockwasher on the bushing, through the chassis from the inside. Secure with a 3/8" control nut. See Figure 22.
- (✓) Mount the 2-lug screw terminal strip EE with 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts as shown. This is the external muting terminal strip.



Detail 13

- (✓) Mount a 5/16" rubber grommet at hole AO.
- (✓) Mount a single-pole-single-throw (SPST) slide switch SW4 at location AX, oriented as shown. This switch is not the spring

loaded one. Place a #6 lockwasher and a #6 - 1/16" flat metal washer on a 6-32 x 3/16" RHMS and insert through the chassis from the inside and into the tapped mounting flanges on each end of the switch. Tighten securely.

( ) In a similar manner mount a single-pole-single-throw (SPST) spring loaded slide switch SW7 at location AW, orienting as shown.

( ) Carefully install a .001  $\mu$ fd feed-through capacitor C68 at location AL. Insert the feed-

through capacitor through the chassis sub-frame from the front and secure with the 5/16" nut.

( ) Mount a 3/8" rubber grommet at hole BA.

( ) Install a 6-32 x 1/2" RHMS at location BL. Place a #6 lockwasher on the screw and insert through the chassis subframe as shown. Secure with a 6-32 nut.

( ) In a similar manner, install a 6-32 x 1/2" RHMS at location BM.

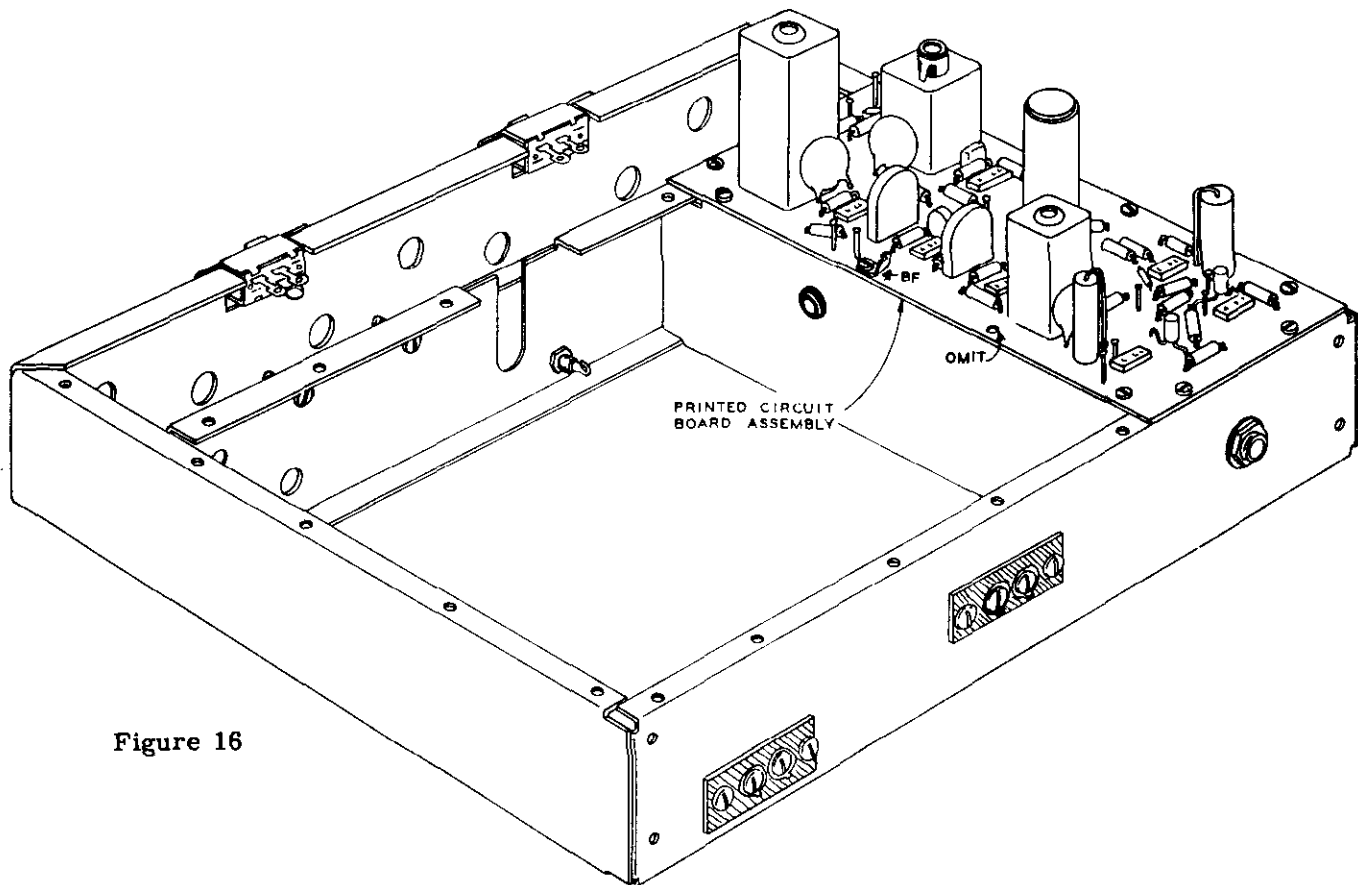


Figure 16

### FINAL ASSEMBLY

Refer to Figure 16.

( ) Locate the previously assembled printed circuit board. Place it on the main frame as shown. At location BF install a #6 small solder lug on top of the board, using a 3-48 x 1/4" PHMS, with a #3 lockwasher under

the nut and secure with a 3-48 nut. Place a 3-48 x 1/4" PHMS in each of the remaining mounting holes except for the one marked "omit". Place a #3 lockwasher and a 3-48 nut on each screw. After all screws have been installed (except the one intentionally omitted), tighten securely.

*power hole alignment here*

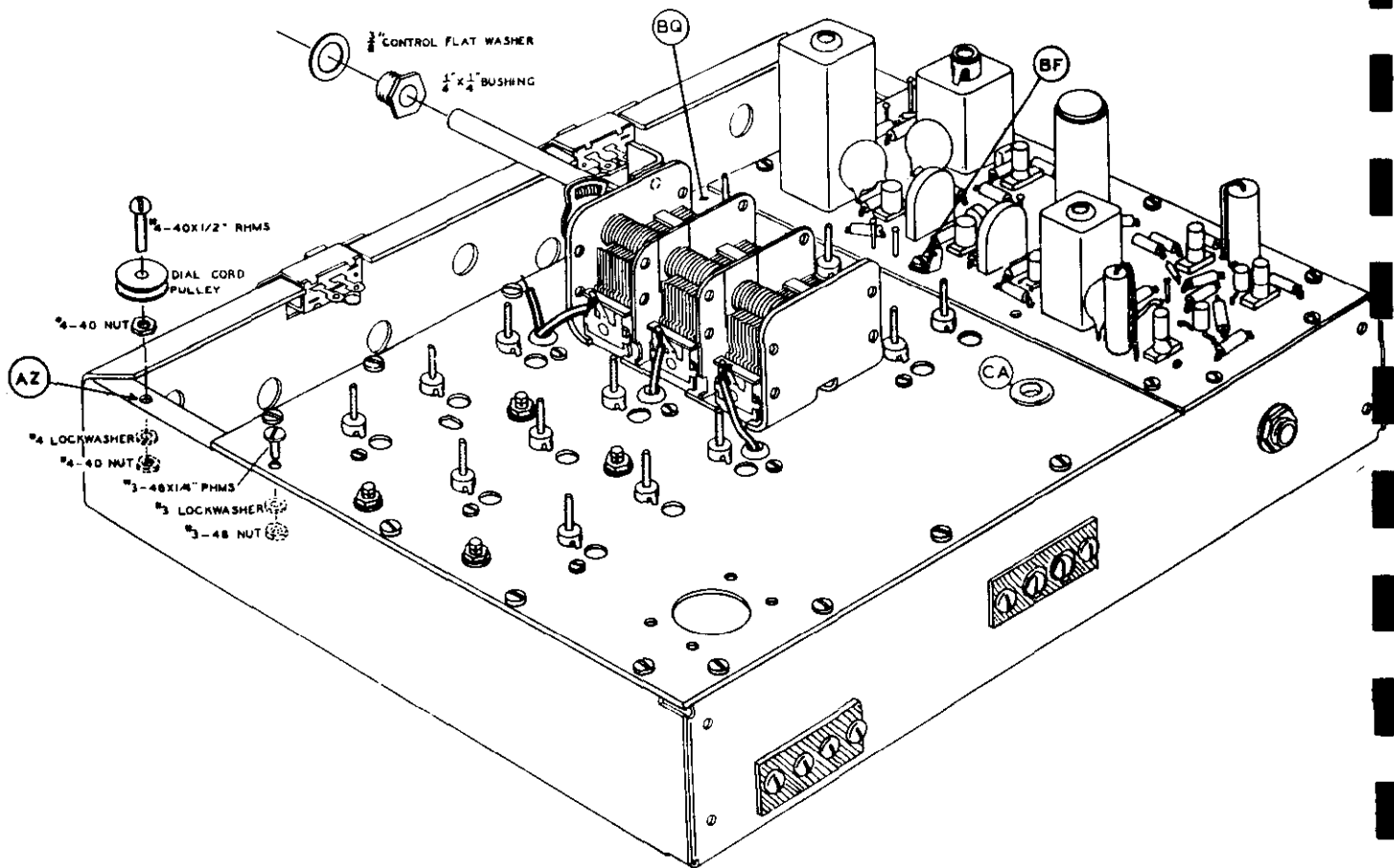
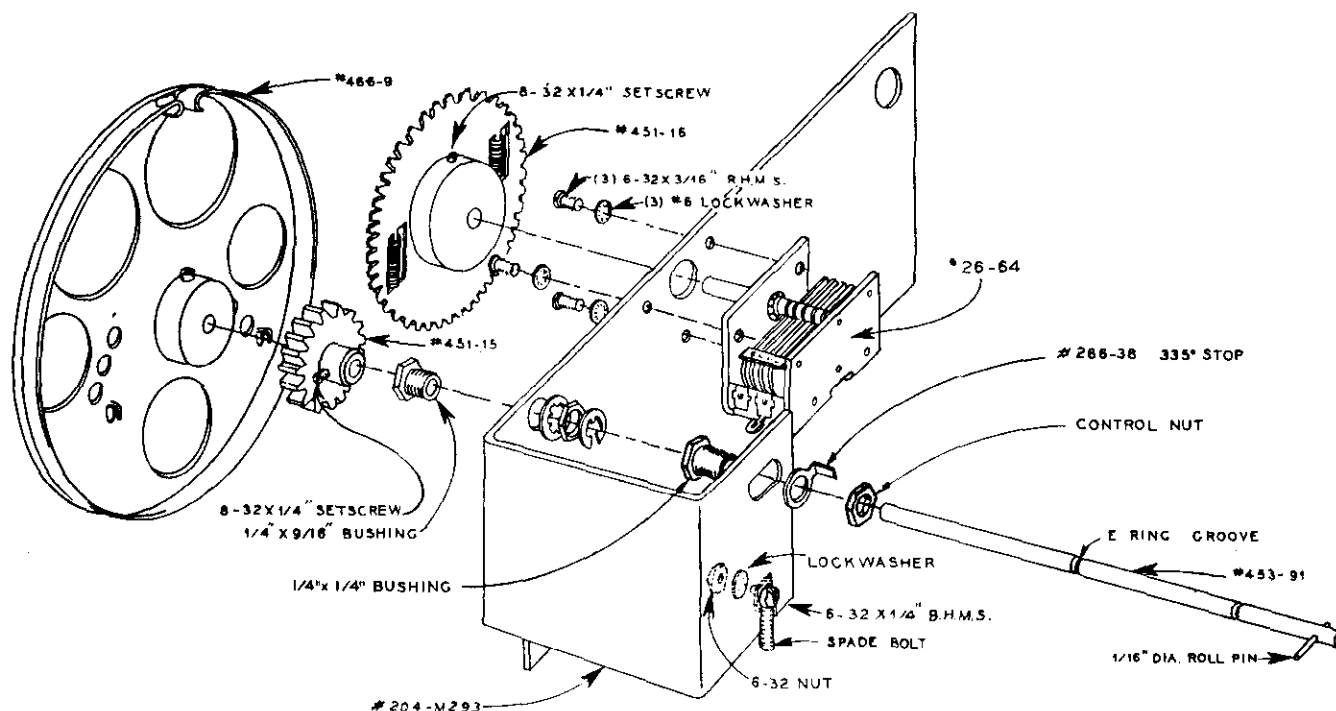


Figure 17

Refer to Figure 17 for the following steps.

- ( ) Locate the front end assembly. Place a 3/8" control nut on the BAND SWITCH as far as it will go, but do not tighten.
- ( ) Carefully place the front end assembly in the main frame, as shown. Check that all coils clear and that no wires are pinched between the top plate and the main frame.
- ( ) Secure the front end assembly to the main frame with twelve 3-48 x 1/4" PHMS, #3 lockwashers and 3-48 nuts. Do not place a mounting screw at location BQ. A cable clamp will be installed at this location later.
- ( ) Back off the 3/8" control nut, previously placed on the band switch bushing, until it loosely contacts the inside front of the chassis partition.
- (✓) Secure the band switch to the main frame with a 3/8" control lockwasher and a 3/8" control nut. The band switch bushing should fit near the bottom of the slot in the partition. Tighten nut carefully to avoid damaging the band switch.
- ( ) Locate the bandspread control bracket (#204-M293). Mount a spade bolt on the rear flange, as shown in Figure 18.
- ( ) In the slot above the spade bolt, mount a 1/4" x 1/4" bushing from the inside. Secure with a 335 degree rotational stop and a 3/8" control nut. Do not tighten at this time.
- ( ) Mount a 1/4" x 9/16" bushing in the front hole, nearest the bend, and secure tightly with a 3/8" control lockwasher and 3/8" control nut.



BANDSPREAD BRACKET ASSY

Figure 18

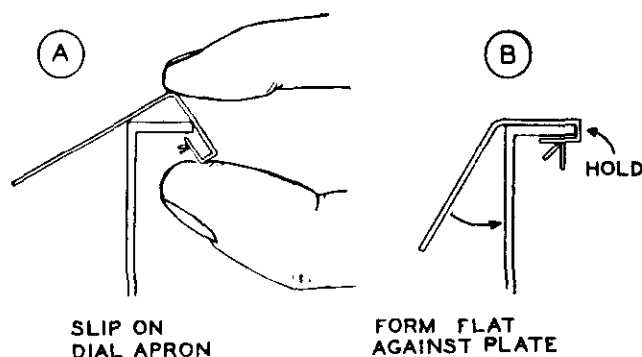
- (✓) Insert a 1/16" x 3/4" roll pin in the end of the 1/4" x 3-1/2" shaft (#453-91). Press the pin into the shaft until the end of the pin is flush with the opposite side of the shaft.
- (✓) Slide the 3-1/2" shaft into the bushing above the spade bolt. Push the shaft into the bushings until the E ring grooves are positioned next to the bushings. Snap E rings into the slots, as shown, to hold the shaft in position.
- (✓) Place the brass gear (#451-15) on the shaft end opposite the pinned end. Slide this gear back to within 1/32" of the bushing, install an 8-32 x 1/4" Allen head setscrew and tighten.
- (✓) Locate the bandspread capacitor (#26-64). Mount it to the bandspread bracket with 6-32 x 3/16" RHMS and #6 lockwashers under the screw heads. If the capacitor rotor stop hits one of the mounting screws, trim off 1/16" of the fiber with diagonal cutters.
- (✓) Place the antibacklash gear (#451-16) on the capacitor shaft (bushing first) until one of the

dual gears meshes with the brass gear. Hold the back gear and rotate the front gear clockwise one tooth, then push both gears into mesh with the brass gear. Install and tighten an 8-32 x 1/4" Allen head setscrew in the antibacklash gear. The brass and antibacklash gears should mesh smoothly without binding or appreciable backlash. It may be necessary to reposition the 1/4" x 9/16" shaft bushing slightly for a free turning adjustment of this gear assembly.

- (✓) Install an 8-32 x 1/4" Allen head setscrew in a 3" dial string pulley. Place this pulley hub first on the shaft, extending through the brass gear, until the shaft is approximately flush with the front of the dial hub bushing. Orient the pulley as shown (dial cord gap up with capacitor full mesh) and tighten the setscrew.
- (✓) Place a 3/8" control flat washer on a 1/4" x 1/4" bushing and slide the combination over the main tuning capacitor shaft, with bushing threads toward the front of the chassis. See Figure 17.



- (✓) Mount the bandspread bracket to the top plate and main frame, as shown in Figure 19. Place #6 lockwashers and 6-32 nuts on the two screws protruding through the slotted holes, and a #6 lockwasher and 6-32 nut on the spade lug. Align the bracket so that the bandspread pulley is parallel to the chassis partition, and the main tuning capacitor shaft horizontally centered in the elongated bracket hole. Push the main tuning capacitor bushing forward into the hole and lightly secure with a 3/8" control flat washer and nut. Now tighten the three 6-32 nuts and main tuning capacitor bushing. It is important at this time that both tuning shafts turn freely. It may be necessary to loosen and reposition the bracket, bushing, or three tuning capacitor mounting screws to accomplish this, but the effort is very worth while if smooth operating performance is to be expected.
- (✓) See Figure 19 and place an 8-32 x 1/4" Allen head setscrew in one of the 3" dial string pulleys. Install this pulley, hub first, on the main tuning capacitor until the shaft protrudes about 1/4" from the bushing. With the capacitor fully closed, the slot in the pulley ring should be at the top.
- (✓) Locate the 4-40 x 1/2" RHMS and place a dial string pulley on it. Run a 4-40 nut on the screw; leave enough clearance between the nut and the pulley to allow the pulley to turn freely.
- (✓) Place the 4-40 x 1/2" RHMS and pulley assembly through the chassis flange at location AZ. Secure with a #4 lockwasher and 4-40 nut. See Figure 17.
- (✓) Connect the lead coming from grommet S (the one with insulating sleeving) to the solder lug on bandspread capacitor C45 (S-1) as shown in Figure 26 on Page 55.
- (✓) Place a cloth on the work area to avoid scratching the front panel.
- (✓) Place the front panel (#100-M251F309-310) face down on the cloth and place a #6 flat fiber washer on each of the dial plate mounting studs. Trim one side of the washers flat, if necessary, to allow the washer to seat flat on the stud next to the bevel. After removing the protective paper, place the plastic dial plate on the four studs. See Figure 20.
- (✓) Next, place a 1/16" thick fiber washer on each of the four mounting studs.
- (✓) Using wire cutters or a similar tool, carefully trim approximately 1/16" off the end of each dial pointer.
- (✓) Place a dial pointer over each flange on the dial backplate, as shown in Detail 14. It may be necessary to reform the dial pointers flat against the front of the dial plate after they are installed. The end of the dial pointer should not rub against either the backplate or the dial (when installed).
- (✓) Now mount the dial backplate assembly (#205-M199F) on the four studs, oriented as shown. Fasten in place with #6 lockwashers and 6-32 nuts on the two bottom studs only.
- (✓) Place a #6 solder lug and a phenolic stand-off on the stud nearest the S meter. Place a #6 lockwasher and a phenolic standoff on the opposite side; tighten securely.
- (✓) Place a #49 pilot lamp in each pilot lamp socket.
- (✓) Insert the #49 pilot lamps through the dial backplate and into the plastic dial plate. Fasten in place with 6-32 x 1/4" BHMS and #6 solder lugs through the pilot light bracket and into the fiber standoff. Note that a single lug terminal strip is also mounted with this operation at the left hand location (as viewed from the rear). See Figure 20.
- (✓) Locate the signal strength indicating meter and mount it in the front panel, as shown. Secure in place with the spring clamp furnished.
- (✓) Install the DPDT slide switch and untapped mounting holes, as shown, in the AVC location, with #6 lockwashers and 6-32 nuts.



Detail 14

**NOTE:** Do not tighten the control and bushing nuts until all of the controls are mounted on the front panel. See Figures 21 and 22.

- ( ) Fasten the front panel to the chassis by placing a  $1/4" \times 3/8"$  bushing at locations marked AP (BANDSPREAD), AV (MAIN TUNING) and AQ (ANT. TUNING). Secure with  $3/8"$  control lockwashers and  $3/8"$  control nuts.
- ( ) In a similar manner, mount a  $1/4" \times 3/8"$  bushing at the location marked AS (BAND SWITCH).
- ( ) Place a control solder lug over the  $2\text{ K}\Omega$  control R48 (with the push-pull switch SW5) and fasten with a  $3/8"$  nut at location marked AT (BFO).
- ( ) Place a  $1/8" \times 3/8"$  flat washer over the  $5\text{ K}\Omega$  control R33 (with DPDT switch SW8), then a control solder lug. Orient as shown and secure with a  $3/8"$  nut at the location marked AU (VOLUME).
- ( ) Mount a  $10\text{ K}\Omega$  control at location marked AR (RF GAIN). Secure with a control solder lug and a  $3/8"$  nut.
- ( ) Make certain that the front panel is lined up square with the chassis, then tighten all of the control and bushing nuts, after checking for proper orientation of controls.
- ( ) See Detail 15 and locate two 3" tuning shafts (#453-89), two spring washers (#253-36), two E rings (#253-11), four 6-32 x  $1/4"$  slot head setscrews, and two flywheels (#454-12).
- ( ) Start two 6-32 x  $1/4"$  slot head setscrews in each flywheel.
- ( ) Insert one of the tuning shafts through bushing AV, through a flywheel (with the setscrews toward the panel), through a spring washer and into hole AN.
- ( ) Snap an E ring into the slot as shown.

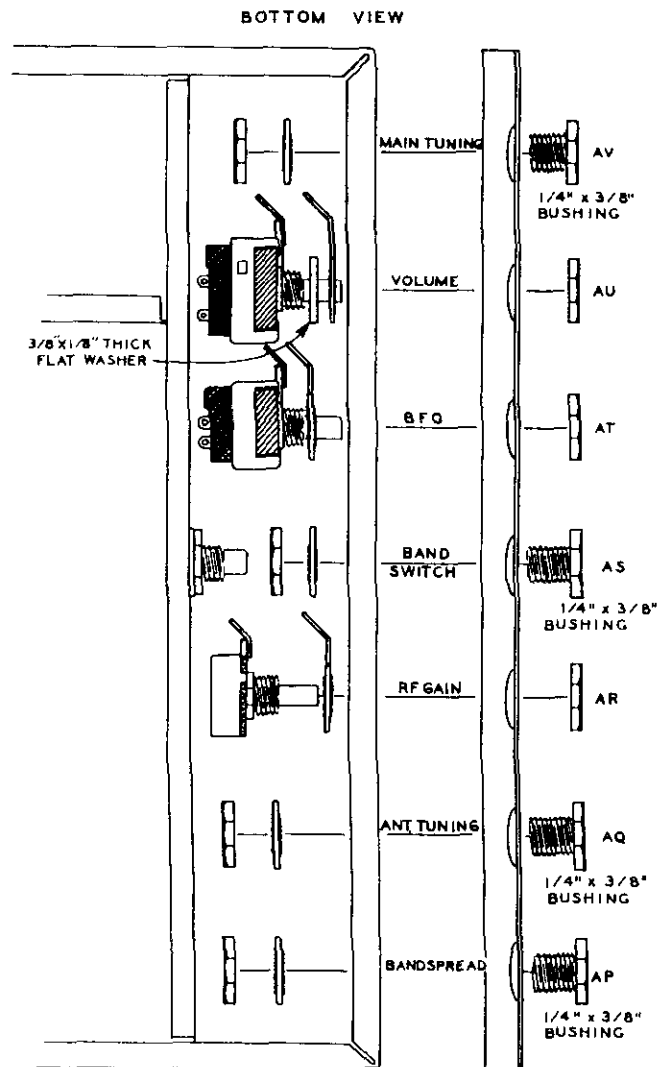
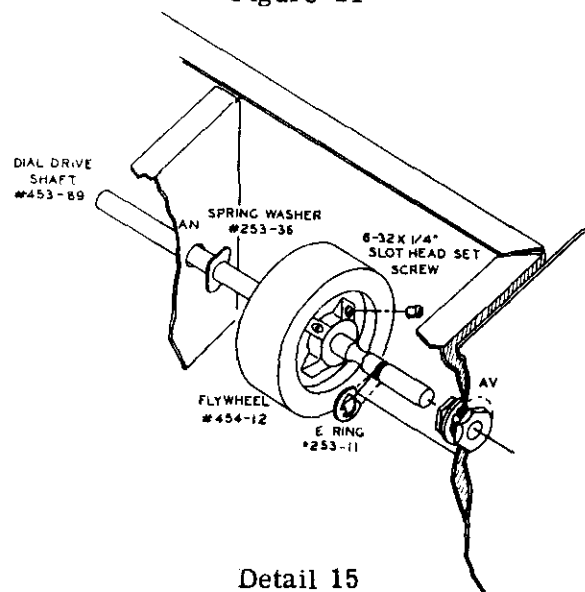


Figure 21



Detail 15

(✓) While holding the shaft forward with the E ring against bushing AV, slide the flywheel to the rear until a slight amount of tension is placed on the spring washer. By varying the pressure on the spring washer, desired flywheel action can be obtained. Holding the flywheel in position, tighten the setscrews. Be sure the flywheel is positioned against the spring washer or the dial drive shaft will have excessive end play and cause the knob to scratch the panel.

(✓) Insert the remaining 3" tuning shaft into bushing AP, through a flywheel (with setscrews toward the chassis front), through a spring washer and into hole AM. This flywheel assembly is exactly like Detail 15, except it is positioned at the opposite side of the chassis.

(✓) Snap an E ring into the slot as shown.

(✓) While holding the shaft forward with the E ring against bushing AP, slide the flywheel to the rear, until a slight amount of tension is placed on the spring washer. By varying the pressure on the spring washer, desired flywheel action can be obtained. Holding the flywheel in position, tighten the setscrews.

NOTE: It may be necessary to loosen and slightly reposition tuning control bushings AV and AP to produce a smooth, free turning flywheel action of these controls. A small amount of lubricant (light grease) on these and other bearing surfaces will also enhance the operational performance of the receiver. Use any lubricant sparingly and do not allow grease or oil to come in contact with any area where a dial string will be placed later, such as the "trough" shaped undercut portion of the tuning shafts.

(✓) Using 8-32 x 1/4" Allen head setscrews (two per knob), secure 1-3/4" knobs on the bandspread and main tuning shafts.

(✓) See Figure 22 and start two 6-32 x 1/4" BHMS into the 1/4" x 1/4" rigid shaft coupling. Place a shaft adaptor on the antenna tuning capacitor. Slide the 1/4" x 1/4" shaft coupling on the antenna capacitor shaft and tighten.

(✓) Insert the 5-3/4" insulated shaft through the antenna bushing AQ and into the 1/4" x 1/4" shaft coupler previously installed on the antenna tuning capacitor. Position the shaft so that it protrudes past the bushing on the front panel 1/2", then tighten the setscrew in the coupler.

(✓) Start an 8-32 x 1/8" Allen head setscrew in one of the 11/16" knobs. Place this knob on the insulated antenna shaft. Set the antenna capacitor at one-half mesh. Turn the knob until the red dot points up, then tighten the setscrew.

(✓) Rotate the RF gain control shaft to its mid-position. Place an 11/16" knob, in which an 8-32 x 1/8" Allen head setscrew has been started, on the shaft with the red dot up.

(✓) In the same manner, install a knob on the BFO control.

(✓) Rotate the volume control shaft counterclockwise until it clicks. Insert an 8-32 x 1/8" Allen head setscrew in an 11/16" knob. Place the knob on the shaft, orient the knob so that the red dot is aligned with the OFF position, then tighten the setscrew.

(✓) Locate the 1/4" to 1/4" flexible coupler and slide the coupler onto the band switch shaft until the end of the shaft is approximately at the center of the coupler. Secure the two screws holding the coupler to the shaft. See Figure 22.

(✓) Insert the 1/4" x 1-7/8" extension shaft (#453-90) through bushing marked AS and into the coupling previously installed on the band switch. Position so that approximately 3/8" protrudes from the front panel, then tighten the setscrews.

(✓) Check to be sure that the band switch is fully counterclockwise. Place an 8-32 x 1/4" Allen head setscrew in a 1-1/4" knob. Place this knob on the band switch shaft. Orient the red dot to align with the "A" position and tighten the setscrew.

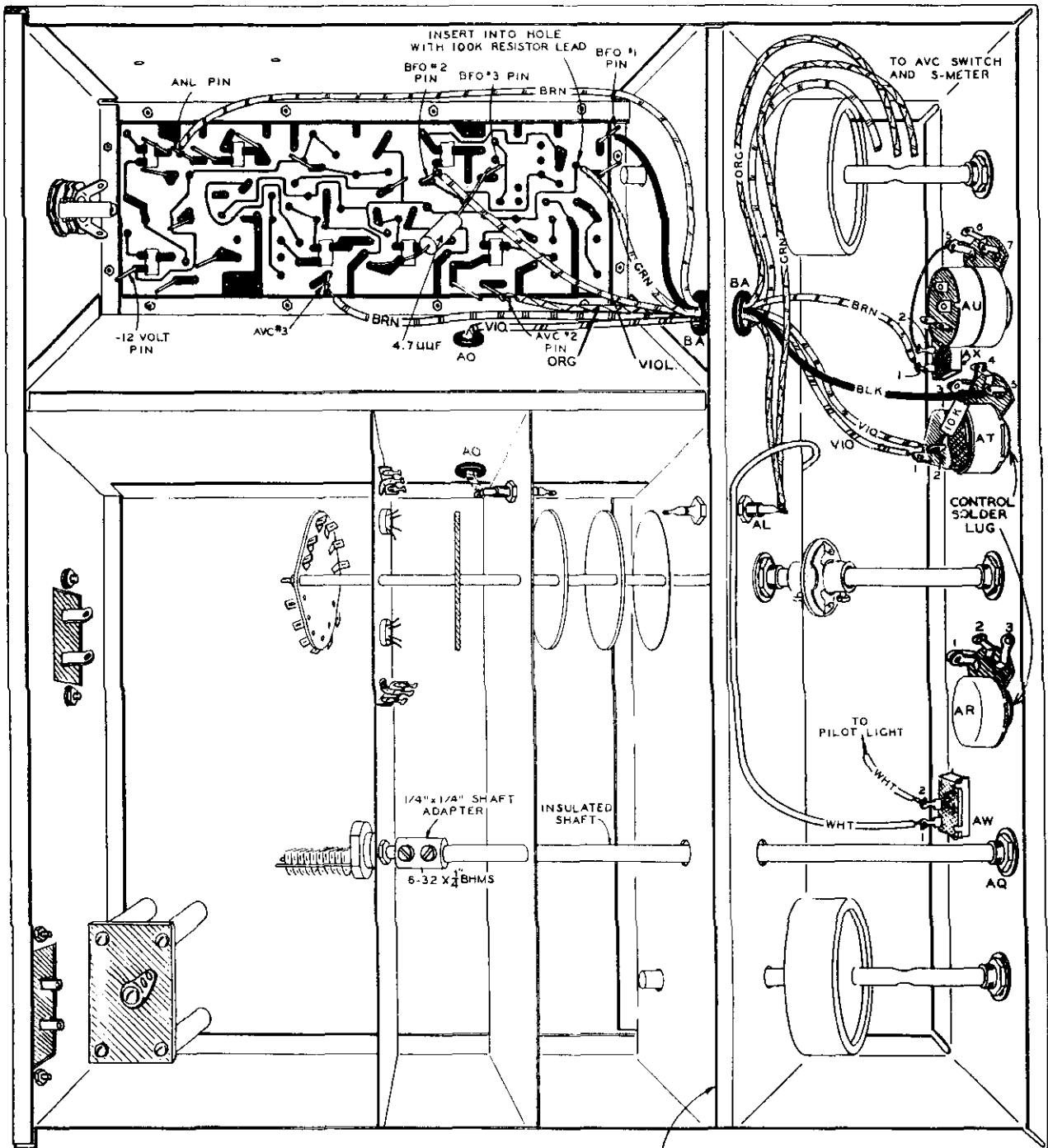


Figure 22

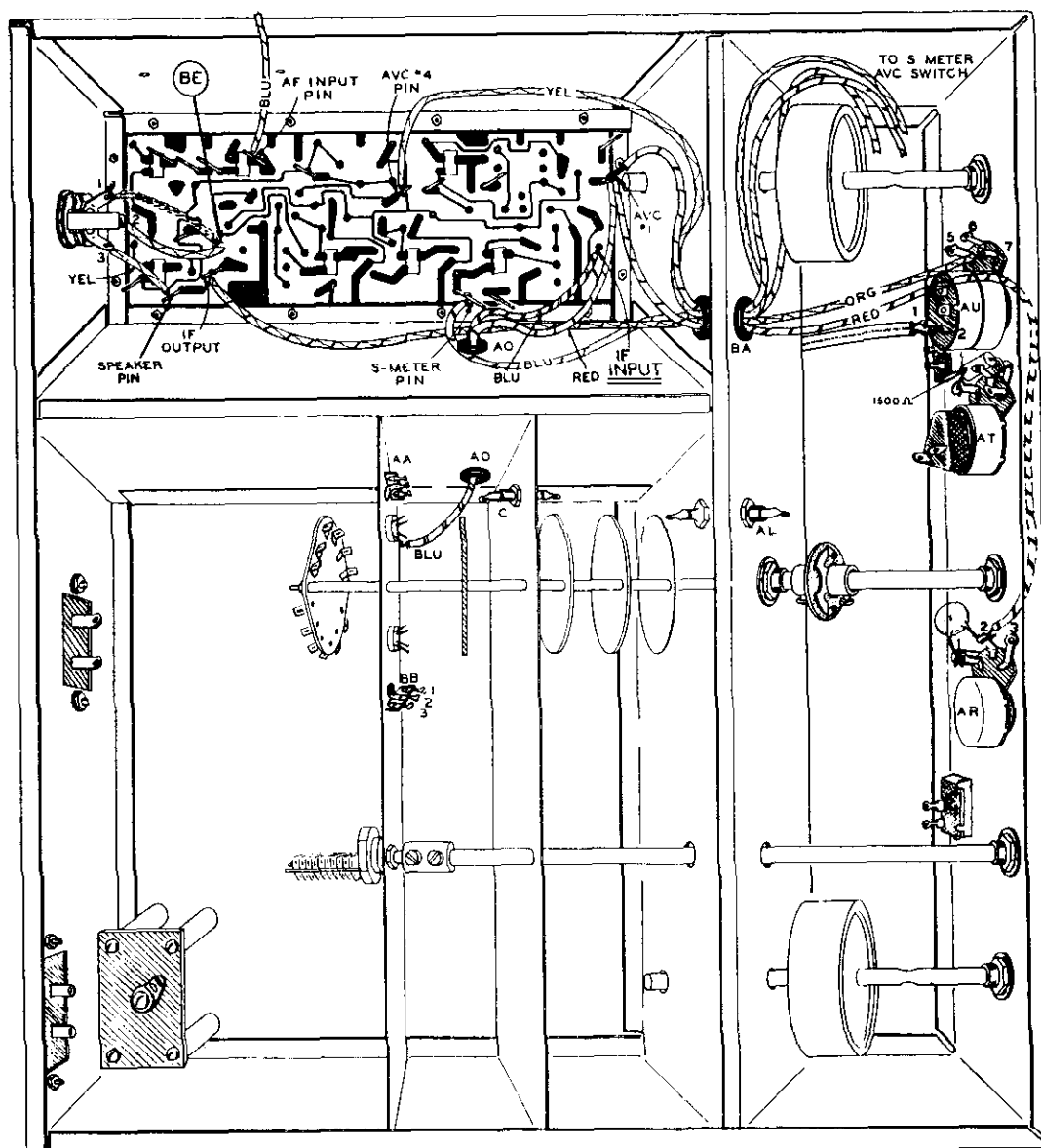
NOTE: THE PARTITIONS IN THIS DRAWING ARE SHOWN AS WEDGES TO ALLOW ALL PERTINENT POINTS TO BE VISIBLE.

### FRONT PANEL WIRING

Refer to Figure 22 for the following steps.

- (V) Connect one end of an 8" length of white hookup wire to lug 2 on the spring loaded pilot light switch AW (S-1). The other end will be connected later.
- (.) Connect one end of a 17" length of white hookup wire to lug 1 of switch AW (S-1). Run the other end of this wire over the chassis. This end will be connected later.

- (N) Connect one end of an 8" length of violet wire to lug 1 of BFO switch AT (S-1). Routing the wire through grommets BA and AO, connect the other end to feed-through capacitor C in the mixer compartment (S-3).
- (N) Connect one end of a 5-1/2" length of green hookup wire to feed-through capacitor AL (NS). Run the other end through grommet BA and connect to the projecting lead of the 100 K $\Omega$  resistor on the circuit board (S-2) as shown. Form the wire against the partition shield.
- (N) Connect one end of a 9" length of green hookup wire to feed-through capacitor AL (S-2). Run this lead up toward the AVC switch, as shown. Several leads will be positioned in this manner and connected later.
- (N) Cut both leads of a 1500  $\Omega$  (brown-green-red) resistor to 1/2" length. Connect one lead to lug 3 of control AT (S-1). Connect the remaining lead to the control solder lug (S-1). See Figure 23.
- (N) Cut both leads of a 10 K $\Omega$  resistor (R48, brown-black-orange) to 3/4" in length. Connect one lead to lug 4 of the BFO control AT (S-1). Connect the other lead to lug 2 of the BFO switch AT (NS).
- (N) Connect one end of a 7" length of violet hookup wire to lug 2 of the BFO switch AT (S-2). Run the other end of this wire through grommet BA and connect to the BFO terminal pin 2 (S-1).
- (N) Connect one end of a 5" length of black wire to lug 5 of BFO control AT (S-1). Run the other end through grommet BA and connect to BFO terminal pin 1 (S-1).
- (V) Cut both leads of a 4.7  $\mu$ f capacitor C60 to a 1" length. Connect one lead to BFO terminal pin 3 (S-1). Connect the other end to the #404-40 transfilter terminal that is circuit board connected to the collector of X5 (S-1). See Figures 22 and 24.
- (V) Connect one end of a 3" length of bare wire to lug 2 of ANL switch AX (S-1). Connect the other end of this lead to lug 5 of the VOLUME control AU (NS).
- (V) Bend the control solder lug until it touches lug 5 of AU and solder the two lugs and bare wire.
- (V) Connect one end of a 13" length of brown wire to lug 1 of ANL switch AX (S-1). Run the other end through grommet BA and connect to the ANL terminal pin (S-1). Position wire as shown.
- (V) Connect one end of a 9" length of orange wire to the AVC terminal pin 2 (S-1). Run the other end of this lead through grommet BA and up toward the AVC switch. This end will be connected later.
- (V) Connect one end of a 12" length of brown wire to AVC terminal pin 3 (S-1). Run the other end through grommet BA and up toward the AVC switch and S-meter.

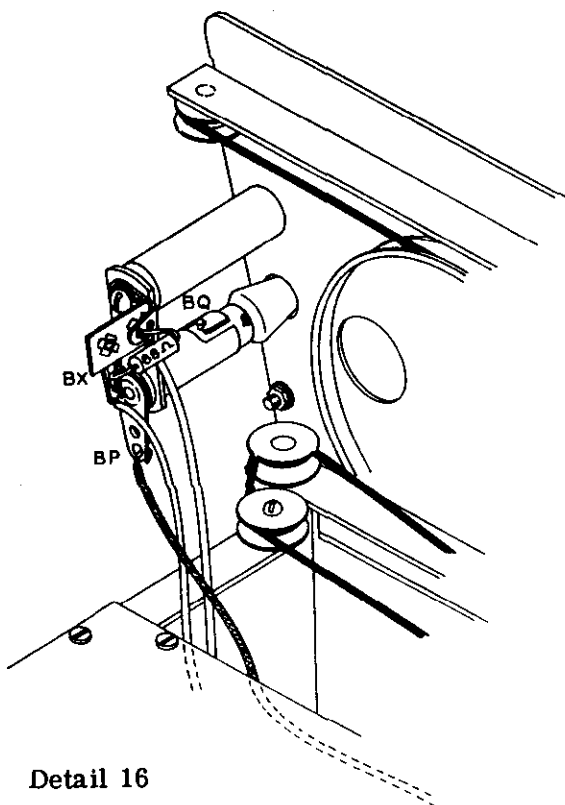


NOTE: THE PARTITIONS IN THIS DRAWING ARE SHOWN AS WEDGES TO ALLOW ALL PERTINENT POINTS TO BE VISIBLE.

Figure 23 .

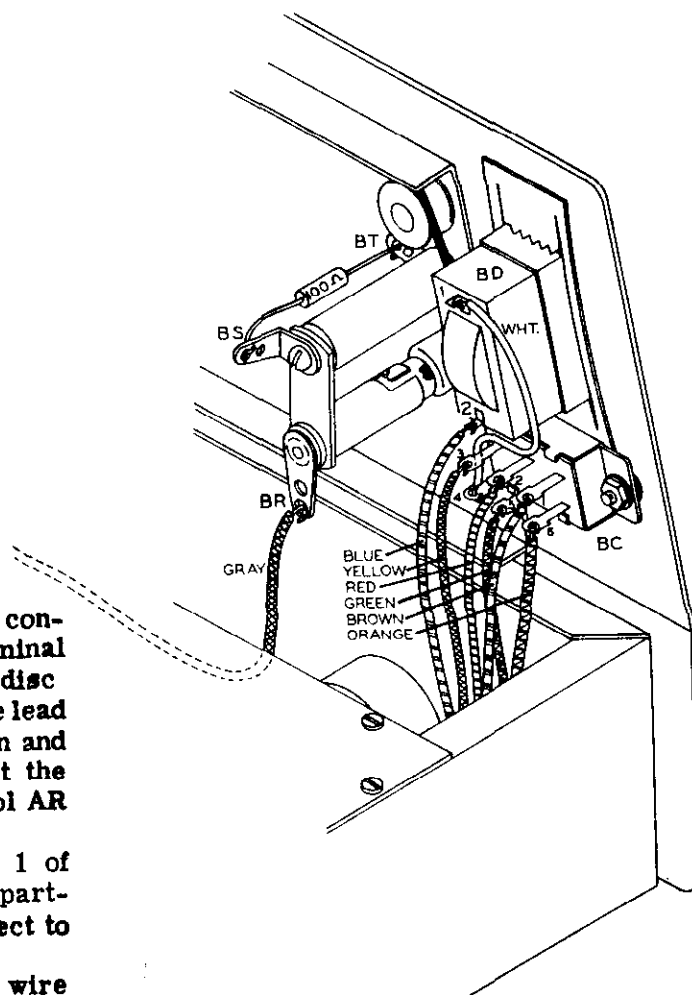
Refer to Figure 23 for the following steps.

- (1) Connect one end of a 10" length of blue hookup wire to the S-meter terminal pin (S-1). Run the other end of this wire through grommet BA and up toward the S-meter.
- (2) Connect one end of an 11" length of yellow wire to AVC terminal pin 4 (S-1). Run the other end through grommet BA and up toward the AVC switch. This end will be connected later.
- (3) Connect one end of an 8-1/2" length of orange hookup wire to lug 7 of the VOLUME control AU (S-1). Run the other end through grommet BA and connect to the IF output pin (S-1).
- (4) Connect one end of a 9" length of red wire to AVC terminal pin 1 (NS). Run the other end through grommet BA and up toward the AVC switch.



Detail 16

- (✓) Connect the green wire, previously installed, to lug 5 of the AVC switch BC (S-1).
- (✓) Connect the orange wire, previously installed, to lug 6 of the AVC switch BC (S-1).
- (✓) Connect the yellow wire, previously installed to lug 3 of the AVC switch BC (S-1).



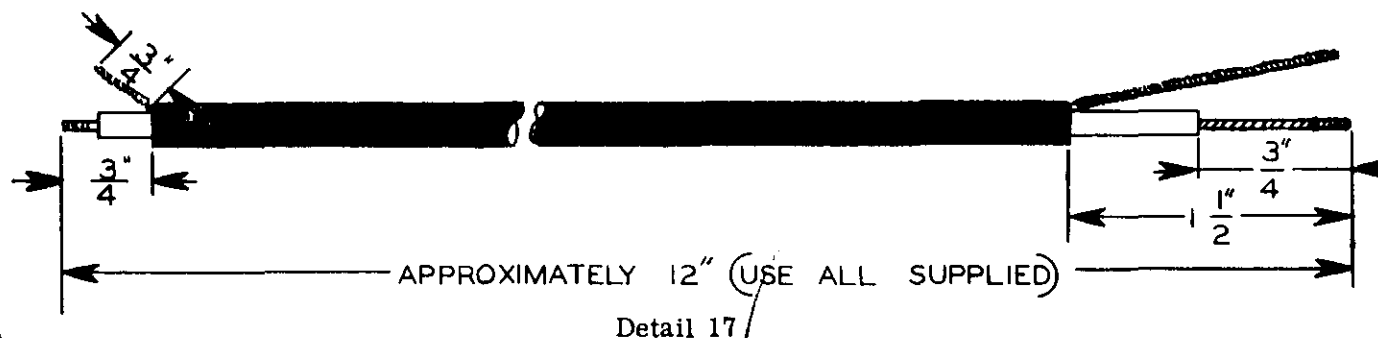
- (✓) On the RF GAIN control AR, bend the control solder lug so that it contacts terminal 1 (NS). Cut both leads of a .1  $\mu$ fd disc ceramic capacitor to 3/8". Connect one lead to the solder lug, terminal 1 junction and solder the entire connection. Connect the other capacitor lead to lug 2 of control AR (NS).
- (✓) Run the red wire (connected to lug 1 of terminal strip AA in the mixer compartment) through grommet AO and connect to AVC terminal pin 1 (NS).
- (✓) Connect one end of a 9" length of red wire to lug 2 of the RF GAIN control AR (S-2). Run the other end through grommet BA and connect to AVC terminal pin 1 (S-3).

Refer to Detail 16 for the following steps.

- (X) Connect one end of a 15" length of gray hookup wire to solder lug BP on the left pilot light socket (S-1). Connect the other end of this wire to the solder lug BR, above the right pilot light socket (S-1).

**NOTE:** The wires that connect to the S-meter and the AVC switch must be formed around the flywheel so that none of them interfere with the flywheel action.

- (✓) Connect the red wire, previously installed, to lug 2 of the AVC switch BC (S-1).
- (✓) Connect the brown wire, previously installed, to lug 1 of AVC switch BC (S-1).
- (✓) Connect the shorter white wire, coming from lug 2 on switch AW, to pilot light lug BQ (NS).
- (✓) Cut both leads of a 68  $\Omega$  1/2 watt resistor (blue-gray-black) to 3/8" length. Connect one lead to dial light terminal BQ (S-2). Connect the other lead to terminal lug BX (NS).



Detail 17

- (✓) Connect one end of a 23" length of white hookup wire to terminal lug BX (S-2). Route the wire down across the front opening of the chassis, then up over the chassis (between the circuit board and front end) toward the rear where it will be connected later.

- (✓) Cut both leads of a 100  $\Omega$  1/2 watt resistor (brown-black-brown) to 5/8" in length. Connect one lead to dial lamp terminal BS (S-1). Connect the other lead to ground lug BT (S-1).

**NOTE:** Use extreme caution to avoid applying an excessive amount of heat or tension to lugs BD1 and BD2 when soldering, or damage to the plastic meter case will result.

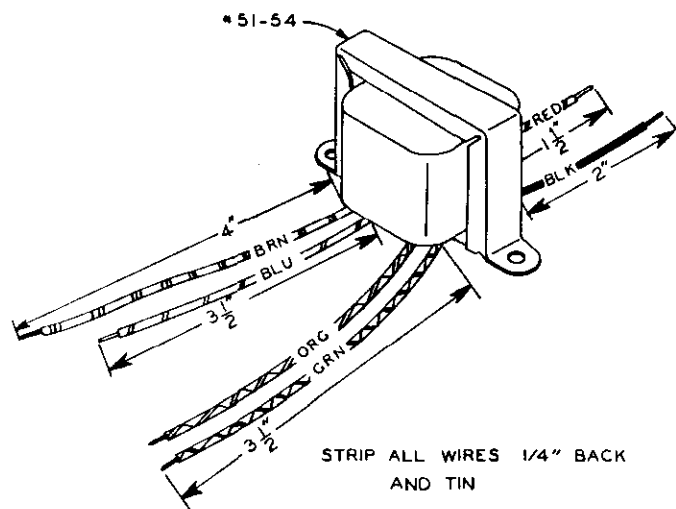
- (✓) Connect the blue wire, previously installed, to lug 2 of the meter BD (S-1).
- (✓) Connect one end of a 4" length of white hookup wire to lug 1 of the meter BD (S-1). Connect the other end of this lead to lug 4 of the AVC switch BC (S-1).
- (✓) Strip and tin both ends of an 18" length of 2-conductor line cord.
- (✓) On one end connect one lead to lug 1 of the VOLUME control switch AU (S-1). Connect the other lead to lug 2 of the VOLUME control switch AU (S-1). See Figure 23. Form the other end of this pair over the chassis between the front end assembly and circuit board, as shown in Figure 26.
- (✓) Prepare the length of shielded cable as shown in Detail 17. Tin the shield pigtails and the center conductor.

- (✓) Refer to Figure 23 and place the end with 1-1/2" of outer insulation removed through hole BE from the top of the circuit board. Run the center conductor lead through lug 2 of the phone jack AF and pull the lead through to the point where the end of the outer cable insulation is flush with the top of the board (but not under tension). Make connection and solder lug 2 (S-1). Connect the cable shield lead to lug 1 of phone jack AF (S-1).

- (✓) Connect one end of a 1-1/2" length of yellow hookup wire to lug 3 of the phone jack AF (S-1). Connect the other end of this lead to the speaker terminal pin (S-1). See Figure 23.

- (✓) Connect one end of a 2" length of blue wire to the AF input terminal pin (S-1). Leave the other end free for the present.

- (✓) Run the free end of the blue wire coming from pin 3 of transistor socket X2 through grommet AO and connect to the IF input transformer terminal on the circuit board (S-1). See Figure 23.



Detail 18

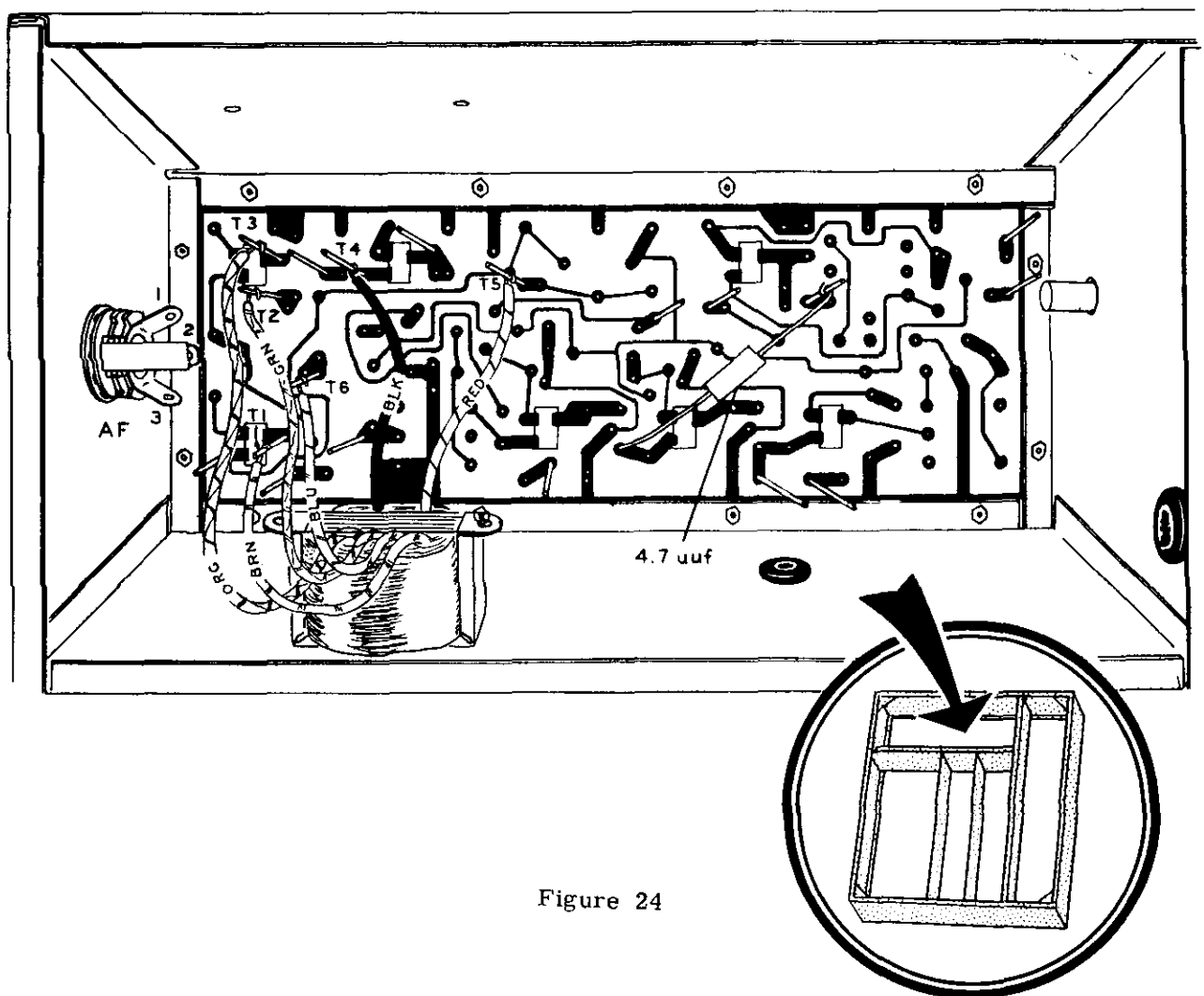


Figure 24

- ( ) Locate the driver transformer (#51-54). Cut the leads to the following lengths. See Detail 18. Use care not to place too much strain on the transformer leads.
- ( ) Cut the green lead to a length of 3-1/2"; strip 1/4" of insulation from the wire and tin.
- ( ) Cut the orange lead to a length of 3-1/2"; strip 1/4" of insulation from the wire and tin.
- ( ) Cut the blue lead to a length of 3-1/2"; strip 1/4" of insulation from the wire and tin.
- ( ) Cut the brown lead to a length of 4"; strip 1/4" of insulation from the wire and tin.
- ( ) Cut the black lead to a length of 2"; strip 1/4" of insulation from the wire and tin.
- ( ) Cut the red lead to a length of 1-1/2"; strip 1/4" of insulation from the wire and tin.

Refer to Figure 24 for the following steps.

- ( ) Position the receiver on its side with the circuit board up and the bottom facing toward you. Now set the driver transformer on the partition with the leads up, oriented as shown.
- ( ) Connect the red lead to terminal pin T5 (S-1).
- ( ) Connect the black lead to terminal pin T4 (S-1).
- ( ) Connect the orange lead to terminal pin T3 (S-1).
- ( ) Connect the green lead to terminal pin T2 (S-1).
- ( ) Connect the blue lead to terminal pin T6 (S-1).
- ( ) Connect the brown lead to terminal pin T1 (S-1).

Refer to Figure 25 for the following steps.

- (N) Mount the driver transformer, using 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts. Place a 2-lug no ground terminal strip CC over the mounting screw nearest the front of the chassis between the chassis and transformer mounting foot. Secure with a #6 lockwasher and 6-32 nut.
- (V) Connect the free end of the 2" blue lead previously connected to the AF input terminal pin, to lug 2 of terminal strip CC (NS).
- (V) Connect one end of an 8" length of blue wire to lug 1 of terminal strip CC (NS). Pass the other end through grommet BA and connect to lug 6 of the VOLUME control AU (S-1).
- (V) Cut both leads of a 50  $\mu$ f electrolytic capacitor C54 to 3/4" in length. Connect the positive (+) lead to lug 1 of terminal strip CC (S-2). Connect the negative (-) lead to lug 2 of terminal strip CC (S-2).
- (V) Locate the phenolic antenna mounting board and mount a #6 solder lug in the center hole, using a 6-32 x 1/2" RHMS. Secure tightly with a #6 lockwasher and 6-32 nut. NOTE: If the above screw should loosen, it will be difficult to remove the receiver from the cabinet after final assembly since the whip antenna would be difficult to remove from the loose screw.
- (V) Mount the four 1-1/4" standoffs to the bottom of the top plate, using #6 lockwashers and 6-32 x 1/4" BHMS. Place the washers between the standoffs and the plate.
- (V) Mount the antenna board to the four standoffs, as shown. Use 6-32 x 3/8" BHMS with #6 lockwashers under the screw heads.
- (V) Connect one end of a 3-1/2" length of black hookup wire to the lower stator support pin of the antenna trimmer capacitor (S-1). Connect the other end to lug 6, Deck D of the band switch (S-2).
- (V) C12. Trim each lead of a 22  $\mu$ f silver mica capacitor to 3/4" in length. Connect one lead to the upper stator support pin of the antenna trimmer capacitor (S-1). Connect the other lead to the whip antenna solder lug (NS).
- (V) Cut both leads of a 12  $\mu$ f mica capacitor to 1/2" length. Connect one lead to the whip antenna solder lug (S-2). Connect the other end to lug 2 of the external antenna terminal strip AB (S-1).

- (N) Cut the leads of a 270  $\Omega$  resistor (R51, red-violet-brown) to 3/4" in length. Connect one lead to feed-through capacitor C (S-3). Connect the other lead to feed-through capacitor AL (S-1).

- (V) Remove the protective paper from the back of the adhesive TRANSISTOR ORIENTATION label (#390-96). Apply label to the bottom side of the top plate as shown in Figure 25.

Refer to Figure 25 and Figure 25A for the following steps.

- (V) Connect a 4-1/2" length of red wire to the -12 pin on the top of the circuit board. Solder close to the board. Run the other end through grommet CA and connect to lug 1 of terminal strip EE (S-1).
- (V) Connect one end of a 9" length of black wire to the ground lug BF (S-1).
- (V) Connect one end of a 12" length of red wire to lug 2 of terminal strip EE (NS). Run the other end through grommet CA.
- (V) Connect the white wire from lug 1 of switch AW to lug 2 of terminal strip EE (S-2).
- (V) Slide a 1/4" plastic cable clamp over the 2-conductor line cord and the two white wires at the front of the chassis as shown. Place a 3/8" OD metal flat washer over a #6 sheet metal screw and secure the clamp to the chassis at location BQ as shown.
- (V) Cut a piece of 5/16" diameter insulating sleeving to an 8" length. Referring to Figure 26, slide this sleeving over the black, white and red wires (red from grommet CA) and the two conductor line cord. (These wires are to terminate at plug BH).
- (V) Place a 1/4" plastic cable clamp over the end of the sleeving at location BJ and secure to the chassis (through the printed circuit board hole) using a 3/8" flat washer and #6 sheet metal screw.
- (V) Locate the power plug cap (#440-4) and slip it over these leads as shown.
- (V) Locate the 9-pin molded power plug (#432-19) and connect the five leads as follows, after trimming each lead to within 3/8" of the sleeving and stripping.

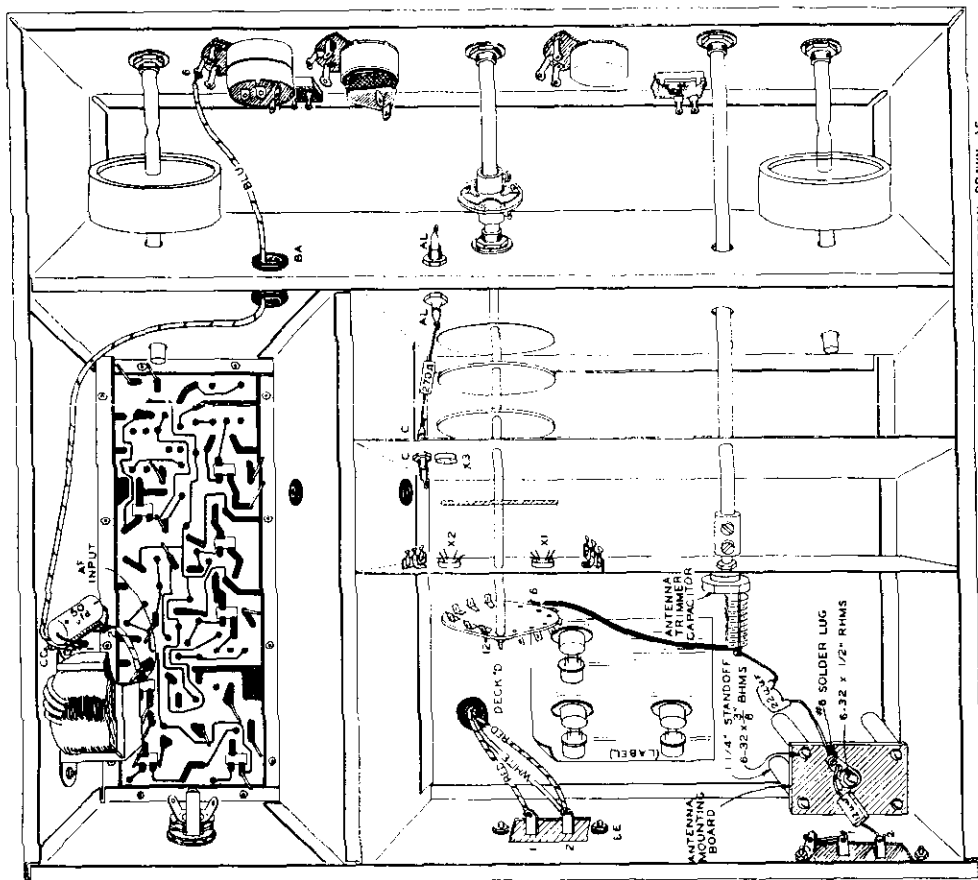


Figure 25

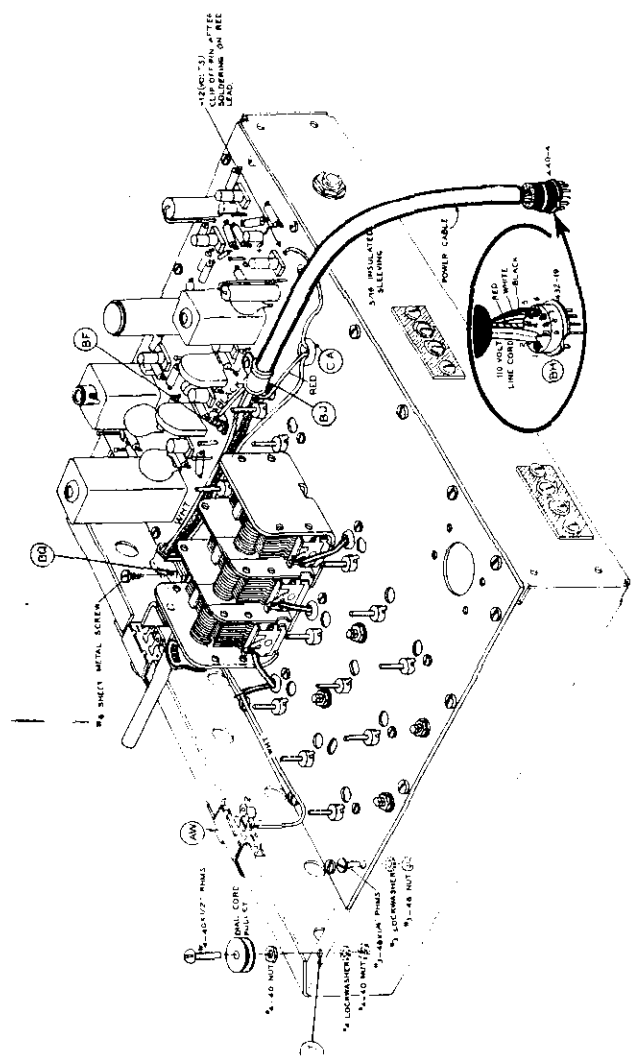
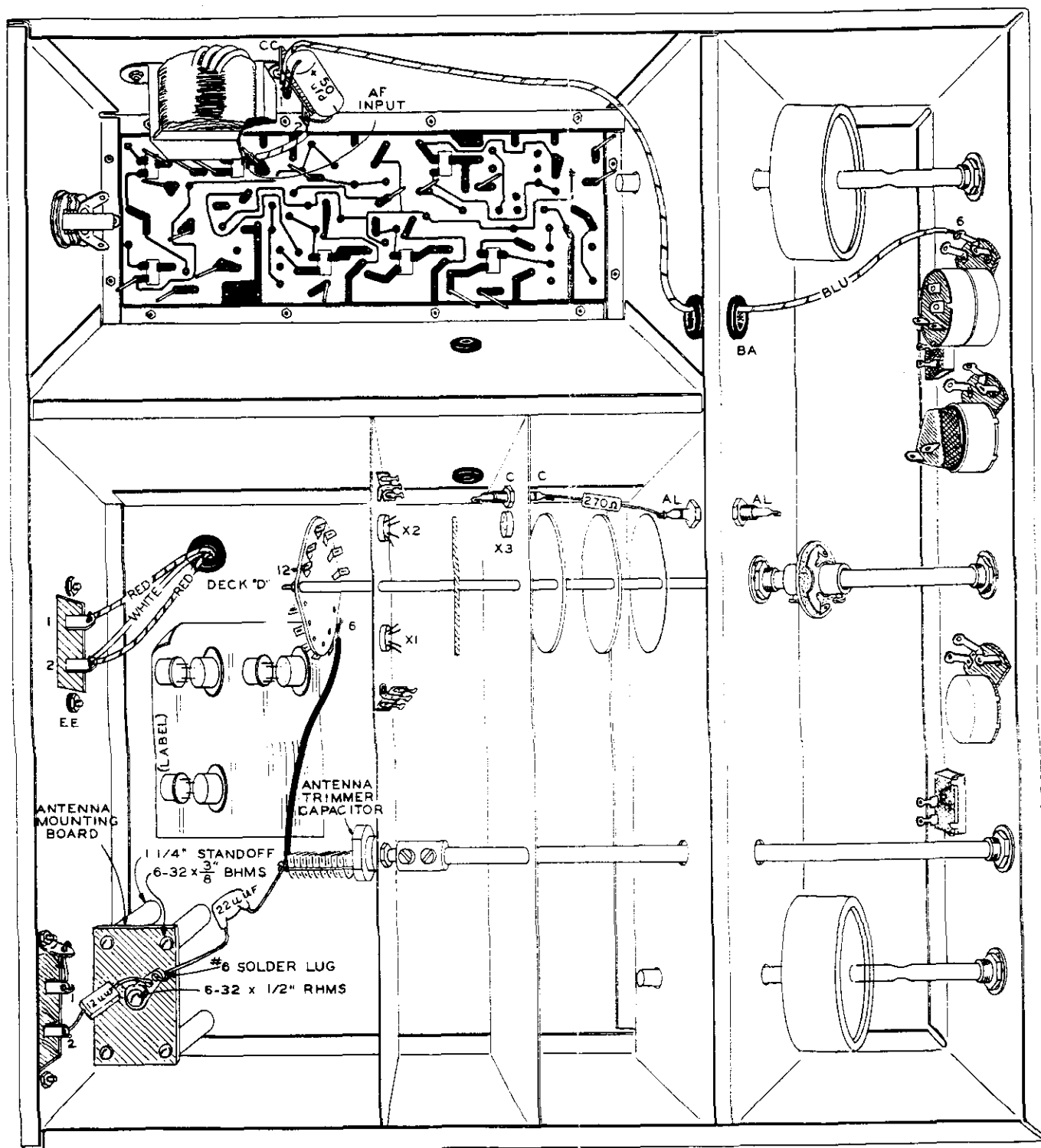


Figure 25 A



NOTE: THE PARTITIONS IN THIS VIEW HAVE BEEN DRAWN AS WEDGES TO ALLOW ALL PERTINENT POINTS TO BE VISIBLE.

Figure 25

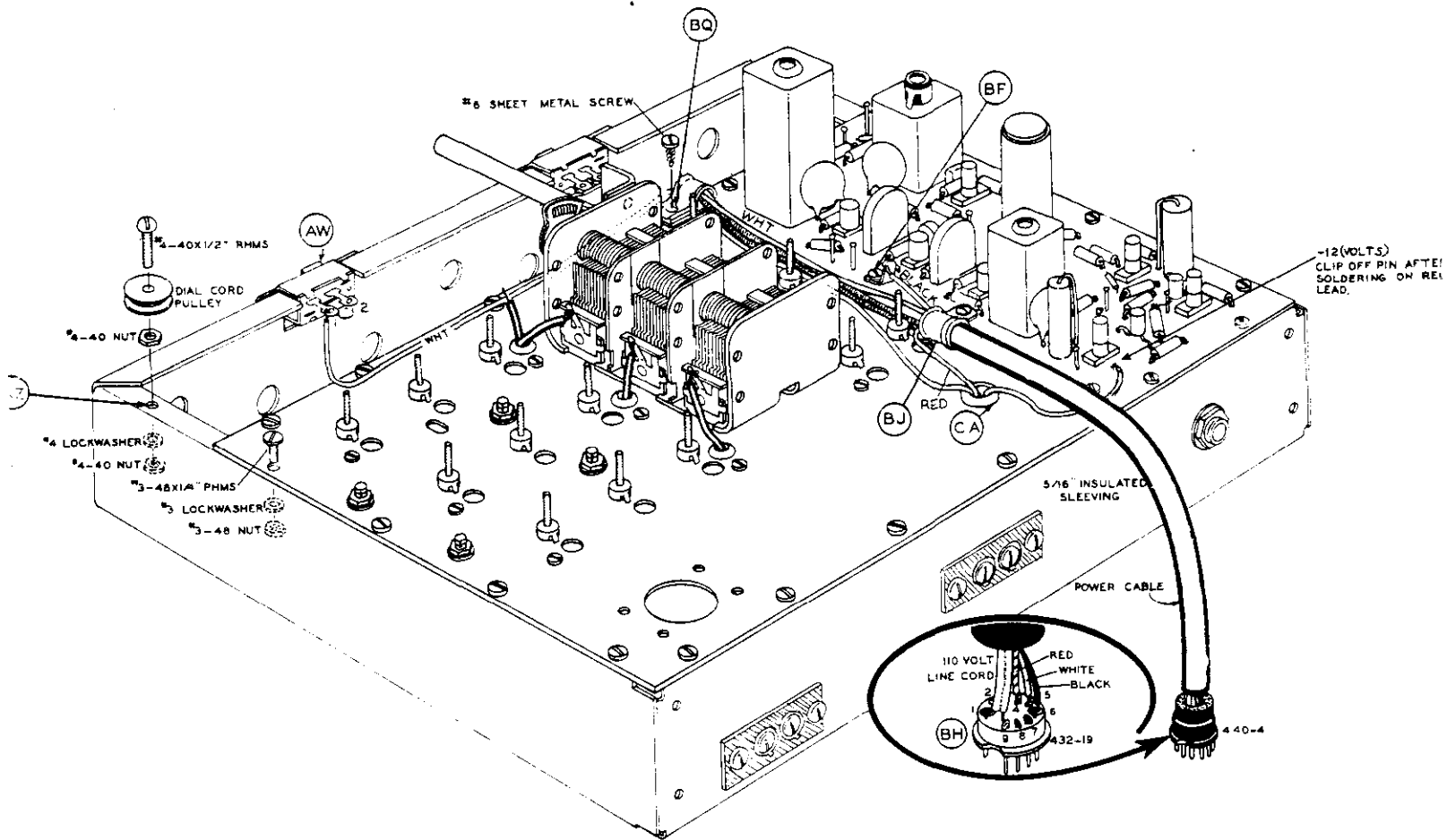


Figure 25 A

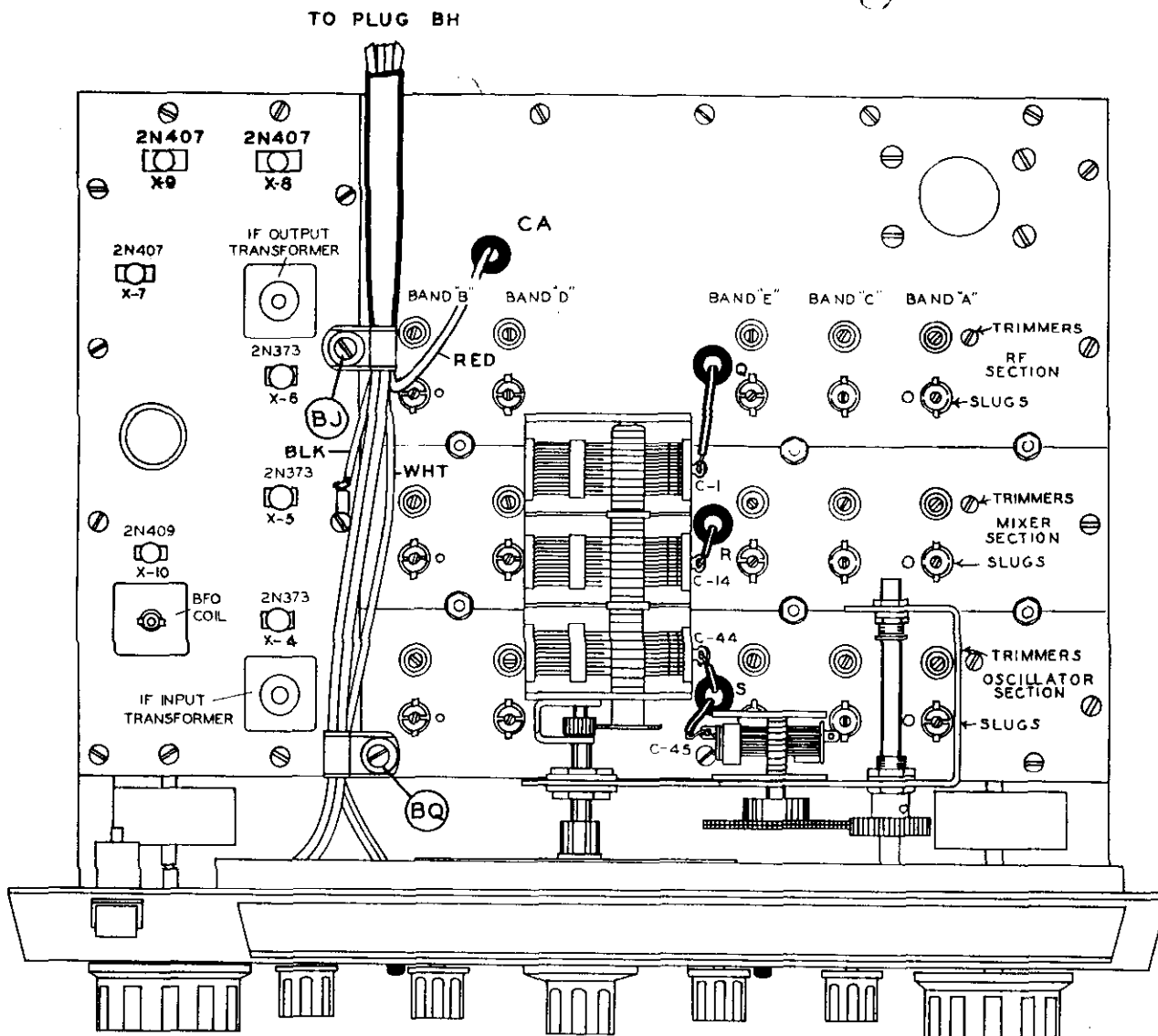
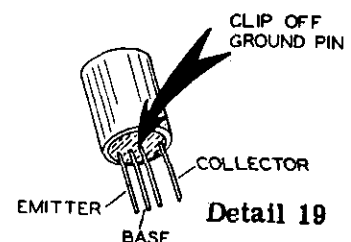


Figure 26

- ( ) Connect either lead of the 2-conductor line cord to pin 1 of the power plug BH (S-1).
- ( ) Connect the other lead of the 2-conductor line cord to pin 9 of the power plug BH (S-1).
- ( ) Connect the white lead to pin 5 of the power plug BH (S-1).
- ( ) Connect the black lead to pin 6 of the power plug BH (S-1).
- ( ) Connect the red lead to pin 4 of the power plug BH (S-1).
- ( ) Now check all connections to the power plug. Make certain that none of the wires are

shorting together. Slide the plug cap over the power plug until it seats against the flange.

- ( ) Install 2N407 transistors at locations X7, X8 and X9. (X8 and X9 should have the same color identifying dot.)
- ( ) See Detail 19 and carefully, so as not to destroy the transistor, clip the ground pin off the three 2N373 transistors as shown.
- ( ) Install a 2N373 transistor in sockets X4, X5 and X6.
- ( ) Install a 2N409 transistor at location X10.



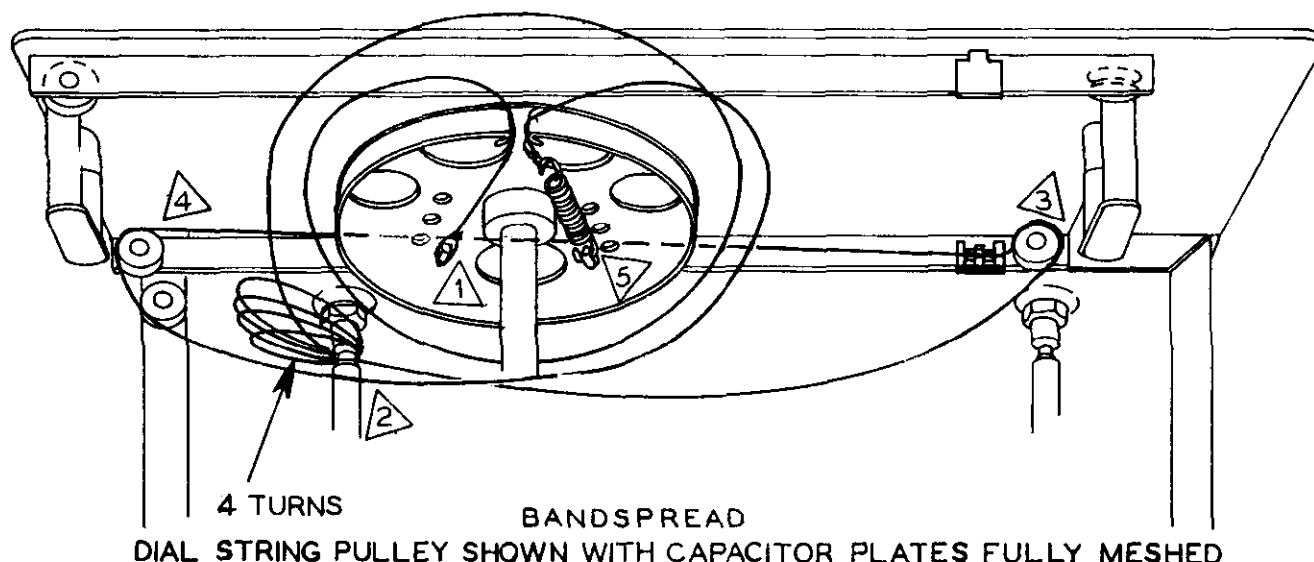


Figure 27

### DIAL STRINGING

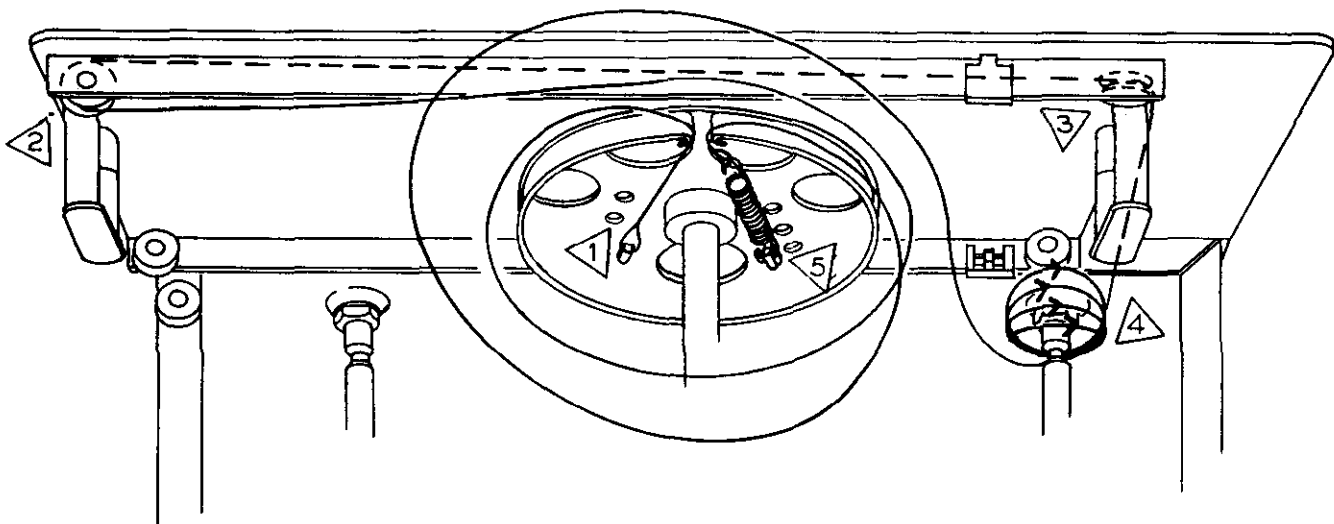
Refer to Figures 27 and 27A for the following steps.

- ( ) Referring to Figure 27, tie a small loop in one end of the dial cord. Hook this loop over the bandspread pulley lug marked **1**. Carefully follow Figure 27 and run the dial string counterclockwise around the pulley one complete turn. Now pass the dial cord around the tuning shaft counterclockwise four complete turns. Run the dial cord around the pulley marked with a **3**, as shown. Continue the dial cord around pulleys marked **4** and back to the main dial pulley. Make one half turn around the dial pulley counterclockwise and fasten to the dial cord spring. Hook the spring over the lug marked with **5**. Make certain that the dial cord has tension on it. The spring should be

stretched about  $\frac{3}{8}$ " beyond its normal length. Note: The dial cord springs are the smaller of the two spring types supplied.

- ( ) Rotate the BANDSPREAD knob counterclockwise until the bandspread capacitor is fully meshed. Place the dial pointer against the pulley. Now fasten the dial pointer to the dial cord by bending the metal tabs over the string. Final positioning of the dial drive pulley will be accomplished later per the instructions in the section on RECEIVER ALIGNMENT.

**NOTE:** An extra precaution against slippage of the dial pointer is to put glue or coil dope on the metal tabs holding the pointer to the dial cord.



MAIN TUNING  
DIAL STRING PULLEY SHOWN WITH CAPACITOR PLATES FULLY MESHED

Figure 27A

- ( ) Referring to Figure 27A, tie a small loop in one end of the dial cord. Hook this loop over the main tuning dial pulley lug marked **1**. Run the dial cord through the pulley opening, then counterclockwise one complete turn around the main dial cord pulley. Continue the dial cord around the plastic pulley marked **2**, on over the pulley marked **3**, then clockwise four turns around the main tuning shaft marked **4**. Continue the dial cord up over and once around the main tuning pulley. Place a dial cord spring on the dial cord and fasten. Hook the other end of the spring over the lug marked **5**. Make certain that there is a tension on the dial cord.
- ( ) Rotate the main tuning knob counterclockwise until the MAIN TUNING capacitor is fully meshed. Slide the dial pointer to the extreme right, viewing it from the rear of the front panel. Now fasten the pointer to the dial cord by inserting the string between the metal tabs, then bending them over until they securely grip the cord. Final positioning of the dial drive pulley will be accomplished later per the instructions in the section on RECEIVER ALIGNMENT.

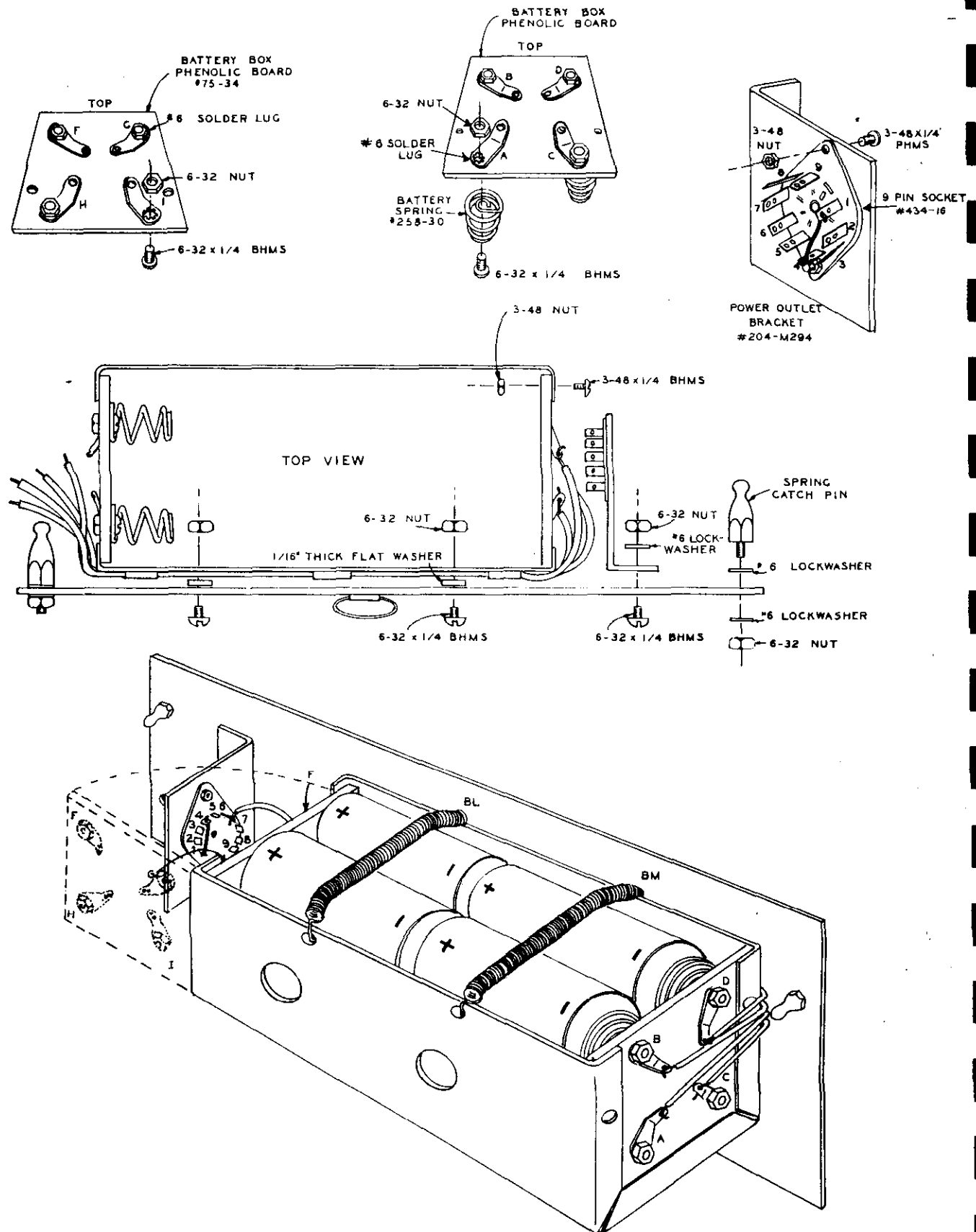


Figure 28

**BATTERY BOX ASSEMBLY**

Refer to Figure 28. for the following steps:

(✓) Mount four #6 solder lugs to one of the insulating boards, using 6-32 x 1/4" BHMS and 6-32 nuts. Orient lugs as shown, with regard to board mounting holes, then tighten securely.

(✓) Mount four #6 solder lugs as shown, on the other insulating board. Use 6-32 x 1/4" BHMS. Place a screw through the battery springs, through the board. Place a #6 solder lug on the screw, orient as shown and secure with a 6-32 nut. A battery spring mounts on the reverse side of each solder lug.

(✓) Locate the power outlet bracket (#204-M294). Install a 9-pin socket oriented as shown, using 3-48 x 1/4" PHMS and 3-48 nuts. Tighten securely. Now clip approximately 1/8" off each socket lug.

(✓) Connect a 1" length of bare wire between lug 1 (S-1) and lug 4 (S-1) of the 9 pin miniature socket. Use care to avoid shorting to other lugs.

(✓) Mount the insulating boards in the battery box as shown, using 3-48 hardware. Make certain that the insulating board, with the springs installed, is at the proper end. See Figure 28.

**NOTE:** Care must be taken so that the wires running along the back do not cross over or they are liable to be pinched and short circuited when the box is assembled to the mounting plate.

(✓) Connect one end of a 7-1/2" length of blue wire to lug A on the phenolic board (S-1). Connect the other end to lug F on the phenolic board (S-1). Make certain the wire forms around the box, as shown.

(✓) Connect one end of a 7-1/2" length of orange wire to lug B (S-1). Connect the other end to lug H (S-1).

(✓) Connect one end of a 7-1/2" length of white wire to lug D (S-1). Connect the other end to lug G (S-1).

( ) Connect one end of an 8-1/2" length of red wire to lug C (S-1). Leave the other end free for the present.

(✓) Connect one end of a 1" length of black hookup wire to lug I (S-1). Leave the other end free for the present.

(✓) Install the closed end of the heavy battery springs in holes BL and BM. These will be used to hold down the batteries later.

(✓) Using 6-32 x 1/4" BHMS, mount the battery box to the power mounting plate. Place a #6 x 1/16" flat metal washer between the plate and the battery box. Make certain the wires clear the metal washer and are not pinched or shorted to ground. Secure with a 6-32 nut, as shown.

(✓) Mount the power outlet bracket to the backplate with 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts.

(✓) Connect the black lead from lug I to pin 9 (S-1).

(✓) Connect the red lead from lug C to pin 6 (S-1).

(✓) Install two spring catch pins as shown. Note that there is a #6 lockwasher on each side of the mounting plate. Secure with 6-32 nuts.

( ) Now place eight size "C" cells in the battery box. These are the medium size flashlight type. All batteries are oriented in the same direction as shown in Figure 28. Snap the retaining springs BL and BM into the holes provided to keep batteries in place. Batteries are not supplied with your GC-1A due to the possibility of aging during storage.

**This completes the battery power supply.**

## CABINET ASSEMBLY

( ) See Figure 29 and complete the outlined steps.

1. ( ) MOUNT TWO SPRING CATCHES ON THE SPOT-WELD STUDS ON THE REAR OF THE CABINET. SECURE WITH #6 LOCKWASHERS AND 6-32 NUTS.

NOTE: AFTER ALIGNMENT SLIDE THE CHASSIS INTO THE CABINET. INSERT THE WHIP ANTENNA IN THE 5/8" RUBBER GROMMET, UNTIL IT ENGAGES THE MOUNTING SCREW. THEN ROTATE IN A CLOCKWISE DIRECTION, UNTIL IT IS TIGHT AGAINST THE NUT ON THE ANTENNA MOUNTING BOARD.

- ( ) MOUNT THE 5/8" GROMMET, AS SHOWN.

4. ( ) FASTEN THE HANDLE TO THE CABINET WITH TWO 10-24 x 1/4" PHMS AND #10 LOCKWASHERS. NOTE: HANDLE MAY BE PLACED ON TOP OR SIDE OF CABINET.

5. ( ) MOUNT THE SPEAKER BY FIRST PLACING THE SPEAKER GRILL OVER THE FOUR STUDS, INSIDE THE CABINET. NEXT PLACE THE SPEAKER OVER THESE FOUR STUDS, WITH THE SPEAKER TERMINALS TOWARD THE FRONT OF THE CABINET. SECURE WITH A #6 LOCKWASHER AND 6-32 NUT ON EACH STUD.

6. ( ) CONNECT THE SHIELD OF THE AUDIO CABLE TO LUG 1 AND THE CENTER CONDUCTOR TO LUG 2. SOLDER BOTH CONNECTIONS.

3. ( ) INSTALL THE FOUR PLASTIC FEET USING 6-32 x 3/8" BHMS, #6 LOCKWASHERS AND 6-32 NUTS, AS SHOWN.

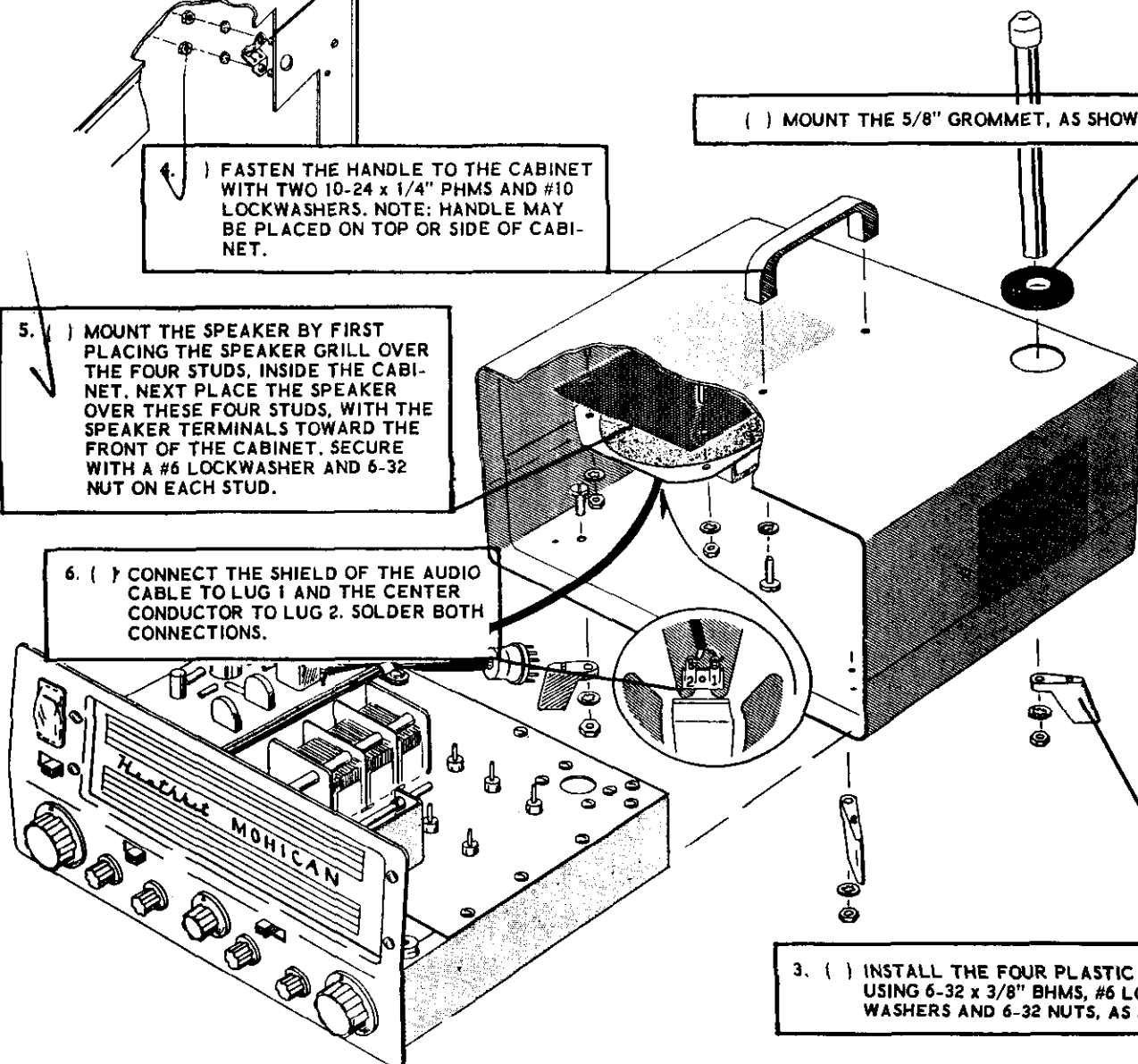


Figure 29

## RECEIVER ALIGNMENT

It has been found that a large number of the kits returned for service are accurately constructed but badly misaligned. The necessity of accurately following the alignment instructions cannot be overemphasized.

PRELIMINARY TESTS

- ( ) Rotate the VOLUME control counterclockwise to the OFF position.
- ( ) Place the AVC switch in the ON position.
- ( ) Place the ANL switch in the OFF position.
- ( ) Rotate the RF GAIN control fully clockwise.
- ( ) Connect one end of a 1-1/2" length of bare wire to screw 1 of the muting terminal strip EE. Connect the other end to screw 2 of terminal strip EE. This may be removed later as explained in the OPERATION section.
- ( ) Plug the power plug BH into the power outlet socket on either the battery box or the 110 volt AC Power Supply, Model XP-2.
- ( ) Turn the VOLUME control clockwise until a click is heard. If the 110 volt supply is used, the dial lights should light to full brilliance when the receiver is turned ON. If the battery supply is used, it will be necessary to slide the spring loaded pilot light switch to the ON position and check to make sure that the pilot lights light to full brilliance. If the pilot lights fail to light, turn the power OFF immediately and refer to the IN CASE OF DIFFICULTY section before proceeding with the alignment instructions.

NOTE: If the 110 volt power supply is used, disconnect the line cord from the wall receptacle before proceeding with any further checks on the receiver as 110 volts AC appear at the switch lugs on the rear of the VOLUME control.

- ( ) If everything appears normal and no heating, due to incorrect or shorted wiring is evident, proceed with the alignment instructions.

ALIGNMENT OF THE IF AMPLIFIER

NOTE: The transfilters set the width and center frequency of the top portion of the IF passband and the IF input and output transformers need only be peaked for maximum gain and skirt selectivity.

Equipment Required: An RF signal generator, such as the HEATHKIT® RF Signal Generator, capable of tuning to 455 kc and having some means of modulating the RF signal.

A multimeter or vacuum tube voltmeter, such as the HEATHKIT® Multi-meter or VTVM.

- ( ) Turn the VOLUME control counterclockwise to the OFF position.
- ( ) Connect the hot lead of the RF signal generator through a 0.1  $\mu$ fd capacitor to the IF input terminal. An extra capacitor is supplied with the kit for this purpose. Connect the ground lead to the chassis. See Figure 23 on Page 50.
- ( ) Connect the multimeter or vacuum tube voltmeter across the speaker terminals. Switch the meter to the AC 1.5 volt range.
- ( ) Turn the VOLUME control clockwise until it stops.
- ( ) Turn the signal generator on and apply approximately 30% modulation. Set the signal generator at 455 kc.
- ( ) Adjust the top slug in the IF input transformer, with the plastic alignment tool provided, until the output meter reads maximum. Now adjust the bottom slug in the IF input transformer (from the top) until the output meter reads maximum. Repeat these adjustments until all interaction is eliminated. These adjustments should be made with the minimum amount of input signal required to indicate on the output meter to prevent overloading.

- (✓) Adjust the top slug in the IF output transformer until the peak reading is obtained on the output meter. Now adjust the bottom slug in the IF output transformer (from the top) until peak reading is obtained on the output meter.

- (✓) Turn the receiver OFF.

**NOTE:** This completes the preliminary alignment of the IF amplifier. The final alignment of the IF input transformer will be completed after alignment of band A. Disconnect the signal generator. Leave the output meter connected for alignment of the rest of the receiver. (See NOTE under FRONT END ALIGNMENT.)

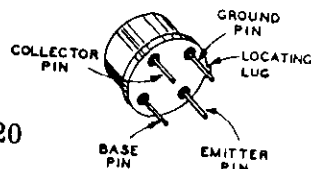
### FRONT END ALIGNMENT

**Equipment Required:** An RF signal generator capable of delivering a modulated signal within a frequency range of 500 kc to 30 mc.

A vacuum tube voltmeter or a multimeter.

**NOTE:** The built-in signal indicating meter can be used equally well to align the front end assembly. If the built-in meter is used, align the following stages with enough signal to indicate about 5 on the meter.

- (✓) Install a 2N1396 transistor in the RF amplifier transistor socket X1 as shown on the label previously installed in the RF SECTION of the tuner assembly. See Figure 25 (fold-out on Page 54).



Detail 20

- (✓) Install a 2N1225 transistor in the mixer socket X2, and the oscillator socket X3. Orient as shown.
- (✓) Connect the hot lead of the RF signal generator to the external antenna input terminal on the rear of the chassis. Connect the ground lead to the "GND" terminal.
- (✓) If an output meter is used it should be set on the AC range and connected across the speaker terminals.

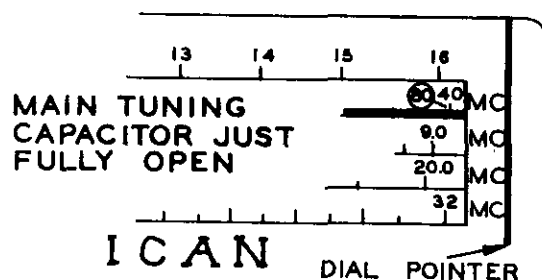


Figure 30

- (✓) Loosen the setscrew in the dial string pulley on the main tuning capacitor. With the main tuning capacitor just fully open, set the dial pointer as shown in Figure 30 and retighten the setscrew. Check to make certain that this alignment is correct or the receiver's calibration will be incorrect.

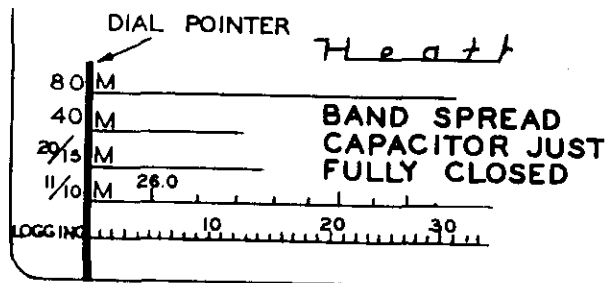


Figure 31

- (✓) Loosen the setscrew in the bandspread dial string pulley. Rotate the bandspread knob until the dial pointer is aligned with the vertical line on the left end of the calibrated bandspread portion of the dial as shown in Figure 31. Now rotate the bandspread capacitor shaft until it is at full mesh. Now tighten the setscrew.
- (✓) Loosen the nut on the rear bushing of the bandspread tuning shaft, until the stop will rotate freely. Rotate the bandspread knob clockwise until the dial pointer aligns with the "SET" mark. Now adjust the 335 degree rotational stop so it rests against the pin, in the shaft, thereby providing a positive stop at the high end of the bandspread scale. Now tighten the nut.
- (✓) Check to make sure that the bandspread capacitor is nearly fully open and the dial pointer is aligned with the "SET" position on the bandspread portion of the dial. This setting will remain in this position for the remainder of the alignment instructions.
- (✓) Set the antenna tuning capacitor to one-half mesh.

- (✓) Rotate the RF GAIN control fully clockwise.
- (✓) Set the band switch to band A (550 kc to 1600 kc).
- (✓) Make certain that the BFO knob is in its OFF position. The knob should be all the way in, on this push-pull switch.
- (✓) Place the ANL switch in OFF position.
- ( ) Place the AVC switch in the ON position.
- ( ) Now turn the receiver ON and the VOLUME control clockwise about one-half turn.

#### BAND A ALIGNMENT

- ( ) Tune the signal generator to 1500 kc. Apply 30% modulation to the RF signal.
- ( ) Rotate the MAIN TUNING knob until the dial pointer indicates 1500 kc.

NOTE: In all alignment steps, as the adjustments peak, reduce the signal generator's output to the lowest possible level so as not to overload the receiver. If aligning with the built in signal indicating meter, the input signal should be decreased, as the slugs and trimmers peak, to midscale reading, about "5" on the meter.

- ( ) Refer to Figure 26 on Page 55 for the location of the alignment adjustments. Notice that the chassis top plate has been screened in vertical rows showing the band letter and in horizontal rows showing the RF, mixer, and oscillator sections and the associated coil slug and trimmer adjustments.

(✓) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 1500 kc. If the signal heard was lower in frequency than 1500 kc, rotate the band A oscillator trimmer screw counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 1500 kc, rotate the band A oscillator trimmer screw clockwise until the signal is heard and peaked on the meter.

- (✓) With the receiver and signal generator still set at 1500 kc, adjust the band A mixer trimmer until the peak meter reading is indicated.

- (✓) Once again, with the receiver and signal generator set at 1500 kc, adjust the band A RF amplifier trimmer until the peak meter reading is indicated.

- ( ) Tune the receiver to 600 kc.
- ( ) Set the signal generator to 600 kc.

NOTE: The RF amplifier, mixer and oscillator coils are supplied preset to the normal required inductances, so only a very slight amount of adjustment should be required to correctly align the bottom end of each band. If a large number of turns is required to bring the coil into resonance, recheck the circuit wiring.

- ( ) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 600 kc. If the signal heard was lower in frequency than 600 kc, turn the band A oscillator coil slug counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 600 kc, turn the band A oscillator coil slug clockwise until the signal is heard and peaked on the meter.

- ( ) With the receiver and signal generator still set at 600 kc, adjust the band A mixer coil slug until the peak meter reading is indicated.

- ( ) Once again, with the receiver and signal generator set at 600 kc, adjust the band A RF amplifier coil slug until the peak meter reading is indicated.

- ( ) Due to the interaction between the coil and the trimmers, repeat the preceding 8 steps several times in sequence until the signal is correctly aligned to the calibration points. Be sure to accurately reset the signal generator each time to the proper frequencies during this sequence of operations.

- ( ) Temporarily place a small piece of tape on the six alignment screws for band A to eliminate the possibility of turning one of these adjustments during the completion of the alignment.

- ( ) Set the receiver and signal generator to 1600 kc. Now adjust both the upper and lower slugs in the IF transformers for peak output.

This completes the band A and IF amplifier alignment.

**BAND B ALIGNMENT**

- (✓) Tune the signal generator to 3.8 mc. Apply 30% modulation to the RF signal.
- (✓) Set the band switch to band B.
- (✓) Rotate the main tuning knob until the dial pointer indicates 3.8 mc.
- (✓) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 3.8 mc. If the signal generator was lower in frequency than 3.8 mc, rotate the band B oscillator trimmer screw counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 3.8 mc, rotate the band B oscillator trimmer screw clockwise until the signal is heard and peaked on the meter.
- (✓) Leave the receiver set at 3.8 mc. Tune the signal generator to 4.71 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 2.89 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc below the incoming signal. If this should occur, decrease the trimmer capacity by turning the band B oscillator trimmer counterclockwise until the second signal is heard and peaked on the meter.
- ( ) With the receiver and signal generator set at 3.8 mc, adjust the band B mixer trimmer until the peak meter reading is indicated.
- ( ) Once again with the receiver and signal generator set at 3.8 mc, adjust the band B RF amplifier trimmer until the peak meter reading is indicated.
- ( ) Tune the receiver to 1800 kc.
- ( ) Set the signal generator to 1800 kc.
- ( ) Tune the signal generator back and forth until the modulated alignment signal is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 1800 kc. If the signal heard was lower in frequency than 1800 kc, turn the band B oscillator slug counterclockwise until the signal peaks on the meter. If the signal heard was higher in frequency than 1800 kc, turn the band B oscillator slug clockwise until the signal peaks on the meter.
- ( ) With the receiver and signal generator still set at 1800 kc, adjust the band B mixer slug until the peak meter reading is indicated.
- ( ) Once again with the receiver and signal generator set at 1800 kc, adjust the band B RF amplifier slug until the peak meter reading is indicated.
- ( ) The coils and trimmers will interact and the preceding steps should be repeated until the peak output falls on the two alignment points.
- ( ) Temporarily place a piece of tape on the six alignment screws on band B.

This completes the band B alignment.

**BAND C ALIGNMENT**

- ( ) Tune the signal generator to 8.5 mc.
- ( ) Set the band switch to band C.
- ( ) Rotate the MAIN TUNING knob until the dial pointer indicates 8.5 mc.
- ( ) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 8.5 mc. If the signal generator was lower in frequency than 8.5 mc, rotate the band C oscillator trimmer screw counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 8.5 mc, rotate the band C oscillator trimmer screw clockwise until the signal is heard and peaked on the meter.

- ( ) Leave the receiver set at 8.5 mc. Tune the signal generator to 9.41 mc. A second signal should be audible. This is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 7.59 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc below the incoming signal. If this should occur, decrease the trimmer capacity by turning the band C oscillator trimmer counterclockwise until the second signal is heard and peaked on the meter.
- ( ) With the receiver and signal generator set at 8.5 mc, adjust the band C mixer trimmer until the peak meter reading is indicated.
- ( ) With the receiver and signal generator still set at 8.5 mc, adjust the band C RF amplifier trimmer until the peak meter reading is indicated.
- ( ) Tune the receiver to 4.5 mc.
- ( ) Set the signal generator to 4.5 mc.
- ( ) Tune the signal generator back and forth until the modulated alignment signal is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 4.5 mc. If the signal heard was lower in frequency than 4.5 mc, turn the band C oscillator slug counterclockwise until the signal peaks on the meter. If the signal heard was higher in frequency than 4.5 mc, turn the band C oscillator slug clockwise until the signal peaks on the meter.
- ( ) Leave the receiver set at 4.5 mc. Tune the signal generator to 5.41 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 3.59 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc below the incoming signal. If this should occur, decrease the oscillator inductance by turning the band C oscillator slug counterclockwise until the alignment signal is heard.
- ( ) With the receiver and signal generator set at 4.5 mc, adjust the band C mixer slug until the peak meter reading is indicated.
- ( ) With the receiver and the signal generator still set at 4.5 mc, adjust the band C RF amplifier slug until the peak meter reading is indicated.
- ( ) The coils and trimmers will interact and the preceding steps should be repeated until the peak output falls on the two alignment points.
- ( ) Temporarily place a piece of tape on the six alignment screws on band C.

This completes band C alignment.

#### BAND D ALIGNMENT

- ( ) Tune the signal generator to 19.0 mc.
- ( ) Set the band switch to band D.
- ( ) Rotate the MAIN TUNING knob until the dial pointer indicates 19.0 mc.
- ( ) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 19.0 mc. If the signal generator was lower in frequency than 19.0 mc, rotate the band D oscillator trimmer screw counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 19.0 mc, rotate the band D oscillator trimmer screw clockwise until the signal is heard and peaked on the meter.
- ( ) Leave the receiver set at 19.0 mc. Tune the signal generator to 19.91 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 18.09 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc below the incoming signal. If this should occur, decrease the trimmer capacity by turning the band D oscillator trimmer counterclockwise until the second signal is heard and peaked on the meter.

- ( ) With the receiver and signal generator set at 19.0 mc, adjust the band D mixer trimmer until the peak meter reading is indicated.
- ( ) With the receiver and signal generator still set at 19.0 mc, adjust the band D RF amplifier trimmer until the peak meter reading is indicated.
- ( ) Tune the receiver to 9.5 mc.
- ( ) Set the signal generator to 9.5 mc.
- ( ) Tune the signal generator back and forth until the modulated alignment signal is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 9.5 mc. If the signal heard was lower in frequency than 9.5 mc, turn the band D oscillator slug counterclockwise until the signal peaks on the meter. If the signal heard was higher in frequency than 9.5 mc, turn the band D oscillator slug clockwise until the signal peaks on the meter.
- ( ) Leave the receiver set at 9.5 mc. Tune the signal generator to 10.41 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 8.59 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc below the incoming signal. If this should occur, decrease the oscillator inductance by turning the band D oscillator slug counterclockwise until the alignment signal is heard.
- ( ) With the receiver and signal generator set at 9.5 mc, adjust the band D mixer slug until the peak meter reading is indicated.
- ( ) With the receiver and the signal generator still set at 9.5 mc, adjust the band D RF amplifier slug until the peak meter reading is indicated.
- ( ) The coils and trimmers will interact and the preceding steps should be repeated until the peak output falls on the two alignment points.

- ( ) Temporarily place a piece of tape on the six alignment screws on band D.

This completes band D alignment.

BAND E ALIGNMENT — Local OSC is on low side.

- ( ) Tune the signal generator to 31.0 mc.
- ( ) Set the band switch to band E.
- ( ) Rotate the main tuning knob until the dial pointer indicates 31.0 mc.
- ( ) Slowly tune the signal generator back and forth until the audio note is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 31.0 mc. If the signal generator was lower in frequency than 31.0 mc, rotate the band E oscillator trimmer screw counterclockwise until the signal is heard and peaked on the meter. If the signal heard was higher in frequency than 31.0 mc, rotate the band E oscillator trimmer screw clockwise until the signal is heard and peaked on the meter.
- ( ) Leave the receiver set at 31.0 mc. Tune the signal generator to 30.09 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the receiver is correctly aligned. Tune the signal generator to 31.91 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc above the incoming signal. If this should occur, increase the trimmer capacity by turning the band E oscillator trimmer clockwise until the second signal is heard and peaked on the meter.
- ( ) With the receiver and signal generator set at 29.0 mc, adjust the band E mixer trimmer until the peak meter reading is indicated.
- ( ) With the receiver and signal generator still set at 29.0 mc, adjust the band E RF amplifier trimmer until the peak meter reading is indicated.
- ( ) Tune the receiver to 20.5 mc.
- ( ) Set the signal generator to 20.5 mc.

- ( ) Tune the signal generator back and forth until the modulated alignment signal is heard. Check the frequency of this signal as indicated on the signal generator. Return the signal generator to 20.5 mc. If the signal heard was lower in frequency than 20.5 mc, turn the band E oscillator slug counterclockwise until the signal peaks on the meter. If the signal heard was higher in frequency than 20.5 mc, turn the band E oscillator slug clockwise until the signal peaks on the meter.
- ( ) Leave the receiver set at 20.5 mc. Tune the signal generator to 19.59 mc. A second signal should be audible; this is the image frequency. This signal should be down in magnitude when the tuner assembly is correctly aligned. Tune the signal generator to 21.41 mc. If the alignment signal is heard at this frequency, the oscillator is incorrectly set 455 kc above the incoming signal. If this should occur, increase the oscillator inductance by turning the band E oscillator slug clockwise until the alignment signal is heard.
- ( ) With the receiver and signal generator set at 21.0 mc, adjust the band E mixer slug until the peak meter reading is indicated.

- ( ) With the receiver and the signal generator still set at 21.0 mc, adjust the band E RF amplifier slug until the peak meter reading is indicated.
- ( ) The coils and trimmers will interact and the preceding steps should be repeated until the peak output falls on the two alignment points.
- ( ) Remove the tape that was temporarily placed on the band A, B, C and D adjustment screws.

This completes alignment of the tuner assembly.

#### BFO ALIGNMENT

- ( ) Set the BFO control to its center position and pull the knob out (this turns the BFO on).
- ( ) Turn the adjustment screw in the BFO coil until zero beat is produced with a properly centered incoming signal.

This completes the alignment of the receiver. Disconnect the signal generator and audio output meter. See Figure 29 on Page 60 and place the receiver in the cabinet. Install the antenna. Place four #6 sheet metal screws in the rear of the cabinet. Tighten securely.

### OPERATION

**VOLUME:** Advancing the control marked VOLUME from counterclockwise position turns on the power and controls the audio output of the receiver.

**RF GAIN:** Controls the sensitivity of the RF amplifier. In general this control should be ON (clockwise). However, by backing off the control, blocking of the receiver by extremely strong signals can be prevented.

**BAND SWITCH:** Changes bands as indicated on the front panel.

**ANT TUNING:** This control peaks the RF amplifier and should be readjusted for each band.

**ANL:** The ANL switch provides audio clipping of high noise pulses to provide reduced noise in the audio output.

**AVC:** The AVC switch serves a dual purpose of shutting off the S-meter and removing AVC from the RF amplifier and 1st IF stage. With AVC OFF, the RF gain control provides excellent control over receiver sensitivity.

**BFO:** The BFO control turns on and adjusts the frequency of an oscillator whose center frequency is 455 kc. This signal is injected into the emitter of the 2nd IF amplifier. This produces an audible beat note in the speaker, allowing reception of CW, SSB, and teletype signals.

**PHONE JACK:** This jack provides a convenient method of connecting a set of earphones. The speaker is automatically cut out when an earphone jack is inserted in the receptacle. Although earphone output impedance is approximately 35  $\Omega$ , headsets of nearly any nominal impedance should prove satisfactory.

**MAIN TUNING:** The MAIN TUNING knob is used to tune the five bands on the top half of the dial. The main tuning is calibrated accurately only when the bandspread tuning knob is full clockwise.

**BANDSPREAD:** BANDSPREAD is used to tune the calibrated ham bands or to be used with the logging scale on the bottom half of the dial. With the bandspread tuning knob set full clockwise, set the main tuning pointer over the point indicated by the circle on the main dial containing the wavelength number (80 M, 40 M, 10 M, etc.), corresponding to the bandspread dial desired. Now, tuning the receiver with the bandspread tuning knob gives an expanded frequency scale for the amateur frequency band being used.

Using the logging scale, it is possible to return to any particular frequency within the tuning range of the receiver by noting the main tuning point and the logging scale reading.

**GROUND:** Whenever possible, it is recommended that a ground wire be connected to the ground screw of the rear antenna terminals. This will improve reception of signals regardless of the antenna utilized.

#### TUNING AM SIGNALS

The receiver controls should be set as follows:

|                      |                                       |
|----------------------|---------------------------------------|
| VOLUME. . . . .      | ON one-half turn (clockwise).         |
| BFO. . . . .         | OFF (pushed in).                      |
| BAND SWITCH. . . . . | Desired band.                         |
| RF GAIN. . . . .     | Full ON (clockwise).                  |
| ANT. TUNING. . . . . | Peaked after tuning in signal.        |
| ANL. . . . .         | OFF (unless excess noise is present). |
| AVC. . . . .         | ON (unless copying a weak signal).    |

Tune signal to peak reading on S-meter, adjust VOLUME control for desired output level. Peak the antenna tuning. If signal is extremely strong, turn the RF GAIN control counterclockwise to reduce possible distortion.

TUNING SSB OR CW SIGNALS

The receiver controls should be set as follows:

|                   |                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------|
| VOLUME. ....      | ON — nearly fully clockwise.                                                                                                  |
| BFO. ....         | ON. Set with the red pointer to the left index mark (pulled out) for lower sideband and to the right mark for upper sideband. |
| BAND SWITCH. .... | Desired band.                                                                                                                 |
| RF GAIN. ....     | Reduce (counterclockwise) to eliminate RF amplifier gain after tuning in CW or SSB signal.                                    |
| ANT. TUNING. .... | Peaked after tuning in signal.                                                                                                |
| ANL. ....         | OFF (unless excessive noise is present).                                                                                      |
| AVC. ....         | OFF.                                                                                                                          |

Tune in the signal, turn the VOLUME control full ON and control the audio output with the RF GAIN control. A slight amount of readjustment of the BFO will probably be required to accurately tune a SSB station to the desired pitch.

FIXED STATION RECEIVER

When using this receiver with a transmitter, the muting terminals on the rear of the chassis should be used. These terminals are in the -12 volt supply lead and protect the receiver from overload and possible damage when being used in close proximity to a transmitter.

Using an external switch or a relay, the terminals 1 and 2 of the muting terminal should be open (disconnected) during the transmit period and closed (connected) during the receive period. The jumper wire used in normal operation must be removed for this type of operation.

In using this receiver in close proximity to a transmitter, i. e., as the station receiver, it is desirable to short the antenna terminal to the ground terminal during transmit conditions. Excessive signal in the "front end" of the receiver may cause failure of the RF amplifier transistor.

## IN CASE OF DIFFICULTY

If upon completion of your receiver, you find that it does not function properly, observe the following; presented in approximately their order of probability:

**SOLDERING:** From past experience, it is found that a large percentage of those kits that require service after completion are wired accurately but have poor or unsoldered connections. It is suggested that all soldered points be checked, and that you reheat any connections that look doubtful. This is particularly important where transistors are employed as they are inherently low impedance devices and cold solder joints can cause considerable difficulty.

Examine all connections carefully for excessive solder or loose bits of solder and wire clippings that may be causing short circuit between adjacent terminals. Transistor sockets are especially vulnerable because of their close spacing. If necessary, carefully bend the terminals away from each other to avoid possibility of any short circuit.

Recheck the soldering of the printed circuit board connections. Make certain all points are soldered and that no conductors are bridged by "blobs" of solder or wire clippings. Check for loose terminal pins.

**CIRCUIT WIRING:** Recheck the wiring. Trace each lead in colored pencil on the pictorials as wiring is followed in the receiver (or per the schematic if you are a more experienced builder). Many cases of difficulty result from wrong connections; having a friend check the wiring will often reveal a mistake consistently overlooked. Check the values of components used, in particular, those on the printed circuit board - color coding of resistors, polarity of diodes and electrolytic capacitors, and physical positioning of the IF transformers having symmetrical terminal configurations. The circuit board should be checked against Figures 11 and 12 in a step-by-step fashion. As an example of a common error, a 470  $\Omega$  resistor is easily confused with a 4.7  $\Omega$  resistor if one fails to note the difference in the third (brown or gold) identifying band. There are many other frequently confused similarities.

**BATTERY POLARITY:** If a reliable DC voltmeter is available, turn the set on and check

that the voltage at the jumpered external muting terminals is approximately 12 volts negative with respect to chassis ground. If a reverse polarity exists, components may have been damaged also.

In the absence of a meter, make certain that the batteries are installed all in the same direction, as shown in Figure 28. The pressure contact springs in the box end should be against the negative (flat surfaced end) of the batteries. Check to be sure that the battery retaining springs do not hold the individual cells from making contact with each other. Tapping the box on end will frequently cure a poor battery-to-battery contact.

Under normal operation, the receiver should continue to function properly as batteries discharge - down to approximately nine volts. For broadcast band performance, the receiver will operate at the six volt level with some loss in audio volume. Due to the compensating diodes used, distortion at low levels should not be objectionable. At the higher frequencies, low battery voltage may result in considerable local oscillator instability due to loss of zener voltage regulator action. A convenient check of relative battery condition is to tune in a station on band D or E and slide the DIAL LIGHT switch on. A severe change in tuning indicates weak batteries.

**CIRCUIT VOLTAGES:** Compare voltages at each transistor socket with those indicated on the Schematic Diagram and the chart on Page 71. Note the conditions under which the measurements were made. The regulated voltage at the zener diode should be 6.8 volts  $\pm 10\%$  and many other voltages, particularly those in the "front end", are dependent upon this nominal 6.8 center value. If the zener voltage is, for example, high other voltages may very well be high by the same percentage. All measurements should be made with a vacuum tube voltmeter such as the HEATHKIT\* V-7A or its equivalent. All voltages are negative with respect to chassis ground. Large discrepancies, particularly in collector voltages, indicate improper wiring or a defective component.

If any short circuits or wiring errors exist, the batteries may have become discharged. If this is the case, substitute new batteries after correcting the difficulty.

**TRANSISTOR PLACEMENT:** Referring to Detail 19 and Figure 26 (page 55) and Detail 20 (page 62) check that the transistors are properly installed and in their correct location. The under-the-chassis "front end" transistors should have their leads in the four outermost socket holes and the transistor indexing tabs should be facing the circuit board side of the chassis. Some loss in performance at the higher frequencies will be noted if the 2N1225 and 2N1396 transistors are interchanged.

**LOW BATTERY VOLTAGE:** The voltage of a new set of batteries under normal receiver load should be approximately 12 volts. Assuming the battery box is wired correctly, considerably less voltage than this indicates either poor batteries or excessive receiver drain due to a circuit fault. If a milliammeter is available, temporarily remove the jumper at the EXTERNAL MUTING terminals and connect the meter to the terminals. This current drawn by the receiver (without dial lamp load) should not appreciably exceed 30-35 ma.

### TEST CONDITIONS:

|                       |                                      |
|-----------------------|--------------------------------------|
| SUPPLY VOLTAGE: ..... | 12.0 volts                           |
| VOLUME CONTROL: ..... | Switch ON, but full counterclockwise |
| BFO SWITCH: .....     | OFF (in) - ON for X10 check only     |
| BANDSWITCH: .....     | "A" position                         |
| RF GAIN: .....        | Full clockwise                       |
| MAIN TUNING: .....    | Set at 1 mc ("10")                   |
| AVC: .....            | ON                                   |
| ANL: .....            | OFF                                  |
| NO ANTENNA: .....     | No input signal                      |

| Transistor | Emitter | Base<br>(negative volts DC) | Collector |
|------------|---------|-----------------------------|-----------|
| X1         | 0.4     | 0.65                        | 6.3       |
| X2         | 0.45    | 0.65                        | 9.0       |
| X3         | 0.8     | 0.8                         | 6.7       |
| X4         | 0.45    | 0.65                        | 5.3       |
| X5         | 0.4     | 0.6                         | 7.8       |
| X6         | 1.4     | 1.6                         | 9.1       |
| X7         | 0.75    | 0.85                        | 9.5       |
| X8         | 5.7     | 5.8*                        | 12.0      |
| X9         | .01     | 0.14*                       | 5.7       |
| X10        | 1.2V    | 0.85                        | 6.2       |

The following are more specific cases of possible difficulty, assuming the builder has had some degree of success in getting the receiver to operate properly.

**POOR SENSITIVITY:** The most frequent cause of weak reception is poor alignment. If this is not the case and, assuming there is ample undistorted volume (i.e., the audio circuitry is working properly), the more probable causes follow:

First, determine whether the receiver lacks sensitivity on all bands. Should band C appear normal with all other bands weak, the most likely cause is an incorrectly oriented band switch wafer - particularly wafer Deck D. Carefully check the positioning of the wafers against Figure 7 on Page 29.

With audio and RF GAIN controls fully advanced, the receiver should have a moderate hiss level, providing the mixer stage and all circuitry beyond (entire printed board) is working properly. If the oscillator section is working, removal of X3 will cause a considerable drop in hiss level; removal of X2 will cause the receiver to go "dead" if the BFO is off.

High apparent sensitivity with poor signal-to-noise ratio would indicate difficulties in the RF stage (X1 and circuitry) or in the input circuitry to mixer stage X2. Refer to Detail 8 on Page 17 and fold-out Figure 1 and make certain that the

\*Voltage across compensating (1N2326) diodes should be approximately 140 MV at room temperature.

Voltage at junction of zener diode (1N754) and feed-through capacitor should be 6.8 volts  $\pm$  10%.

trimmer capacitors are properly oriented with the ground side of all trimmers toward the chassis rear. Difficulties on alternate bands only would indicate this trouble.

If the first IF amplifier stage (X4) and the RF/IF gain control system is working properly, rotating the RF GAIN control fully clockwise should cause the panel meter to read approximately "0". Fully counterclockwise, the meter should read near "10". The AVC switch must be on for this check. With AVC off, the meter should read "10". The "S" meter does have provisions to "zero" the meter pointer mechanically at "10" - a brass tab at the rear of the meter. Such an adjustment should be attempted only as a final adjustment. When the receiver is ready to install in its case, all power should be turned off.

**TRANSISTOR INTERCHANGEABILITY:** Many types of germanium transistors are constructed identically but sorted for particular characteristics. This means that, providing their leads are properly connected, they may often be interchanged with other types without appreciable change in performance.

As an example, the 2N1396 RF transistor is essentially a somewhat better or premium type 2N1225 and, at the lower frequencies, these may be interchanged with little noticeable effect. Many 2N409's will work well in the IF strip or as the AF driver, in some cases, even in the AF output stage. The 2N407's are primarily for medium signal audio applications and usually do not work well for IF or RF applications.

With AVC on, if the "S" meter changes by at least two-thirds full scale in varying the RF GAIN control from one extreme to the other, this stage provides a convenient means of checking other transistors. Any transistor in this receiver may be placed in the X4 socket (leads properly positioned) for check purposes. If the "S" meter will change by at least half-scale in varying the RF GAIN control end-to-end, it is a fair assumption that the particular transistor in question will work properly in its normal application.

Bearing in mind the above, if there is good reason to suspect a faulty transistor, other transistors in the receiver may be substituted into the particular stage in question as an additional check. The BFO transistor (2N409) may, for test purposes, replace any other transistor on the circuit board although it may produce considerable distortion if used as one of the output transistors (X8 or X9).

**BFO FAILS TO CENTER PROPERLY:** In an occasional 2N409 transistor, an abnormal variation of collector capacity prevents proper adjustment of the BFO to 455 kc. This transistor may be interchanged with one of the 2N373 IF transistors (X6), and if all appears to function properly, this is an entirely acceptable solution.

**AUTOMATIC NOISE LIMITER:** Should the ANL circuit fail to operate, the probable cause is the polarity of the diode (or a defective diode) immediately adjacent to transistor socket X6.

**MILD AUDIO DISTORTION:** Small amounts of audio distortion can be the result of improper values of components on the circuit board or a pair of 2N407 transistors that are not "matched". The 2N407 transistors bear a color dot on the top of their enclosure. The transistors at locations X8 and X9 should be of the same color for proper balanced operation. If all three 2N407's have the same color dot, interchanging transistors may be helpful.

**SEVERE AUDIO DISTORTION:** The most probable cause of this difficulty is the erroneous placement of a 470  $\Omega$  resistor where a 4.7  $\Omega$  resistor should be in the emitter circuits of X8 or X9. Another frequent cause is the interchanging of the driver transformer leads, i. e., blue and brown or green and orange.

If a defective component is discovered or if trouble persists, refer to the REPLACEMENT or SERVICE sections of this manual.

**NOTE:** If either #49 pilot light should burn out, when using the 110 volt supply, replace immediately as these lights are used as part of the supply regulation circuit.

In the event the circuit board for the GC-1A is accidentally damaged, a repair kit may be purchased from the Heath company.

This kit includes all board mounted parts; it does not include the transistors which may be removed from the damaged board.

When ordering this repair kit, please identify it as follows:

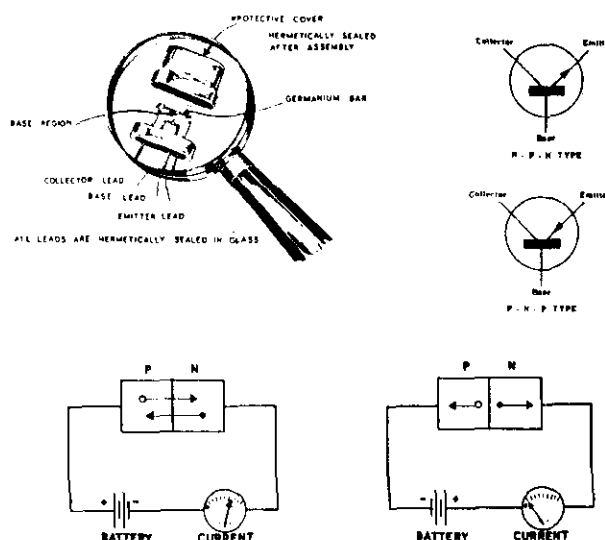
R-GC-1A Repair Kit, Circuit Board - \$16.95

## INTRODUCTION TO TRANSISTORS

Transistors have been one of the most important recent developments in the field of electronics. Although they have been available commercially for only a few years, they have already found application in every branch of the art. They can assume the duties of vacuum tubes in many applications, and in such capacity they are employed in the "Mohican" Model GC-1A Receiver.

Because of their small size, transistors possess very little mass or inertia. As a result they are not subject to the shock, vibration and microphonic faults of tubes. Transistors do not contain a heater or filament, require no warmup and consume no power which contributes nothing to useful audio output. Because no heat is generated within the cabinet, longer life can be expected from other components subject to deterioration from heat. Transistors operate on very low potential or voltage, measured in volts rather than tens or hundreds of volts as with tubes. This makes battery operation very feasible and eliminates completely the shock hazard found in most tube equipment. Transistors have an extremely long life expectancy. Average life of transistors has not yet been definitely established simply due to lack of time to arrive at representative figures. Transistors have been in continuous operation for years without failure. Most failures are caused by improper use rather than by deficiencies in the basic design. As with any good thing, there are also limitations to the capabilities of transistors. Primarily, these limitations involve power handling capabilities, high frequency limitations and extreme temperature limitations. None of these limitations are approached in their application in the GC-1A Receiver. One precaution must be observed, however. The batteries must be installed exactly as instructed or damage to the transistors may result. Also, it is good practice never to remove or insert a transistor with the receiver turned ON.

It might be of interest to note here some of the production problems connected with the making of a transistor. The germanium must first be refined to an extremely high degree of purity. The rigid requirements would compare to allowing no more than one kernel of corn in several carloads of wheat. The pure germanium is then "doped" with precisely controlled amounts of other elements to obtain the proper alloy necessary for transistor action. More will be said about the doping process later. The center layer or "meat" of the sandwich may be only 1/1000 inch thick. This layer must be precisely located, and a wire attached. The entire process must be performed under "operating-



room" clean conditions. Any contamination of the transistor may be cause for failure. The assembly is then hermetically sealed in a protective case, often with an inert compound to assist in conducting heat away from the assembly. The drawing shows a typical transistor assembly.

As mentioned before, the germanium must be doped to obtain the characteristics needed for transistor action. Different materials are used to produce a "P" or an "N" type germanium. "P" type germanium means that the pure metal has been modified so that there is an electron deficiency in the natural crystal structure, often referred to as a "hole." "N" type germanium means that an electron excess is created in the natural germanium crystal. Transistors are produced in both NPN and PNP configurations, the letters indicating the type of germanium in each of the layers.

The middle layer of the sandwich is called the base. One outside layer is called the emitter and the other one the collector. The junctions formed between the emitter and base and between the collector and base have a characteristic similar to that of a diode rectifier, in that the junction will conduct current much more readily in one direction than the other. When voltage is applied across a junction with positive voltage applied to the "P" type region and negative voltage to the "N" type region, a current consisting of two components will flow. Electrons will flow from the "N" region across the junction to the "P" region. If the polarity of the applied voltage is reversed, the electrons and holes move away from the junction and for practical purposes, no current will flow. The drawings illustrate this effect.

## GLOSSARY OF RADIO TERMS

While by no means complete, this glossary should assist those who are not familiar with radio terminology. The definitions apply to all radios in general but in many cases refer to the GC-1A Receiver specifically. Further information may be obtained from texts available at most public libraries.

**AC:** Alternating Current. An electrical current that reverses its direction of flow at regular intervals. House current makes 120 reversals every second. Two reversals are necessary to complete one cycle, hence 60 cycles. Much higher frequencies appear in radio circuitry, up to many millions of cycles per second.

**AF:** Audio Frequency. Those frequencies that fall within the range of the human ear, approximately 20 to 20,000 cycles per second. Remember that the ear can only hear mechanical vibrations in the air, not electrical currents.

**AVC:** Automatic Volume Control. Circuitry employed in a receiver to adjust the gain in opposite proportion to the strength of the received signal. Used to reduce the effects of faded signals, or "blasting" when tuning from a weak to a strong signal.

**Amplifier:** A circuit designed to increase the strength or amplitude of weak signals. Ideally the output signal is an exact magnified reproduction of the input signal.

**Ampere:** The unit of measurement of current flow. The number of electrons passing a point in one second.

**Antenna:** A system of conductors used to radiate or intercept radio signals.

**Capacitor:** A component consisting of conducting plates separated by an insulating material. Various materials and construction are used in the capacitors in the GC-1A. Deposited silver plates on ceramic for the disc capacitors, aluminum foil plates separated by a chemical oxide for the electrolytic capacitors, and sheet aluminum separated by air for the variable tuning capacitor. Capacitors are used to pass AC while blocking DC and also to tune or "resonate" electrical circuits to a desired frequency.

**Coil:** A component consisting of wire or some other conductor wound in turns on a suitable form. The number of turns and the size, shape, and material used for the form are determined by the application. Coils are often used with capacitors to form "tuned" circuits.

**Condenser:** See Capacitor

**Conductor:** Any material that permits easy passage of an electrical current.

**Converter:** Circuitry designed to combine the signal from the radio station with a self-generated signal to produce a new signal at a different frequency. See Heterodyne.

**Current:** Generally the movement of electrons through a conductor. In vacuum tubes electron flow occurs in the vacuum. Movement of "holes" can constitute current flow in transistors.

**DC:** Direct Current. An electrical current that flows in one direction only.

**Detector:** A component used to extract the intelligence or desired information from a radio signal. In the GC-1A this intelligence consists of the speech or music transmitted by the radio station.

**Diode:** A two element or two terminal device capable of passing an electrical current in one direction only. Used as a detector in the GC-1A.

**Frequency:** Repetition rate of an alternating current or of the vibration of the loudspeaker cone. Measured in cycles per second.

**Ground:** An electrical connection to the earth. Also the reference point for signals and operating voltages in electronic equipment, usually the chassis.

**Heterodyne:** The result of combining signals of different frequencies in order to obtain a signal of new frequency. Either the sum or the difference frequency of the two is generally the desired resulting frequency. Also known as "beat."

**IF:** Intermediate Frequency. The heterodyne or beat frequency produced by the converter in a superheterodyne receiver. Most of the amplification and selectivity of the radio signals is accomplished at this frequency. An IF of 455 kc is employed by the GC-1A.

**Inductance:** The property of a coil to oppose any change in the magnitude of an electrical current flowing in it.

**Insulator:** Any material that does not permit easy passage of an electrical current.

**KC:** Kilocycle - 1,000 cycles.

**MC:** Megacycle - 1,000,000 cycles, 1,000 kilocycles.

**Megohm:** 1,000,000 ohms.

**Microfarad:**  $\mu\text{fd}$  - A unit of capacity. Refers to the electrical "size" of a capacitor.

**Ohm:**  $\Omega$  - The unit of electrical resistance.

**Oscillator:** Circuitry designed to generate AC at some desired frequency when operated from a DC source. Usually some circuit element or elements are adjustable so that a desired frequency may be obtained.

**RF:** Radio Frequency. Those frequencies employed for transmission of radio signals, from 10 kilocycles to 100,000 megacycles by government regulation.

**Resistor:** A component designed to oppose the flow of current. The degree of opposition or resistance is measured in units called "ohms." Resistors are used to reduce current or voltage to a desired value, to provide isolation between circuits or to provide a load across which a useful signal may be developed. Resistors used in the GC-1A are made of a carbon compound housed in an insulating protective sleeve. Wire leads sealed in each end provide electrical connection to the resistance material.

**Selectivity:** The ability of a receiver to separate radio stations operating on adjacent channels. In the broadcast band these channels are assigned at 10 kilocycle intervals, i.e. 950 kc, 960 kc, 970 kc, etc.

**Sensitivity:** A figure that expresses the signal strength required at the receiver antenna to produce a specified amount of sound from the loudspeaker.

**Superheterodyne:** A radio circuit that heterodynes or converts an incoming signal of any frequency in its tuning range to a signal of constant frequency before amplification and detection. This is accomplished by combining the incoming signal with one from a self-contained oscillator that is automatically tuned by the station selector. In the GC-1A, the oscillator signal is always 455 kilocycles higher in frequency than the incoming signal. The resultant signal therefore is 455 kilocycles, the intermediate frequency. Amplification of the radio signals may then be accomplished at a fixed frequency. This makes it possible to design maximum efficiency into the IF amplifiers. Improved selectivity and sensitivity are advantages of the superheterodyne circuit.

**Transformer:** A component designed to couple AC signals or energy from one circuit to another. Construction can vary widely depending on the application but generally consists of insulated coils of wire wound on a common form. The form may be of sheet iron for power or audio transformers, or powdered iron or air for IF and RF transformers. Transformers are employed for one or more of several reasons: they provide coupling of signals while isolating the DC operating voltages of the coupled circuits; they are capable of producing AC voltage "step-up" or "step-down;" they may be tuned to provide selective coupling of signals as the case of the IF transformers used in the GC-1A; they provide proper impedance matching between coupled circuits. The last application can be compared to the function of the transmission of your automobile. The transmission is designed to provide the most efficient match or coupling between the source of power (the engine) and the load (the rear wheels).

## SERVICE

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT® equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT® equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under "IN CASE OF DIFFICULTY." Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under "IN CASE OF DIFFICULTY." Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available.

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT® Service Centers will honor the regular 90 day HEATHKIT® Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT® equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT® dealer in order to be eligible for parts replacement under the terms of the Warranty.

NOTICE: In all correspondence to the Heath Company concerning this receiver, it should be referred to by the model number printed on the chassis.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT® equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

### REPLACEMENTS

Material supplied with HEATHKIT® products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

- A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.
- B. Identify the type and model number of kit in which it is used.

C. Mention date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

In the event the circuit board for the GC-1A is accidentally damaged, a repair kit may be purchased from the Heath Company.

The kit includes all board mounted parts; it does not include the transistors, which may be re-

moved from the damaged board.

When ordering this repair kit, please identify it as follows:

Kit No. R-GC-1A Repair Kit, Circuit Board-\$16.95

## SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

**ATTACH A TAG TO THE EQUIPMENT BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED.** Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with

gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: **HEATH COMPANY**  
Benton Harbor, Michigan

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in **HIS OPINION**, the article is inadequately packed for shipment.

## WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

**NOTE:** The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY



