ASSEMBLING AND USING YOUR

Heathkit

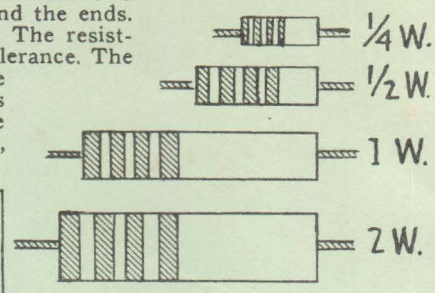
Signal Generator
Model SG-6

THE HEATH COMPANY
BENTON HARBOR, MICH.

PRICE $1.00

USEFUL INFORMATION FOR KIT BUILDERS

Resistors are identified by a color code used in several bands around the resistors. There are two general types of resistors. One, the uninsulated type, has the connecting wires bound around the ends. The other, the insulated type, has the wire connected internally and coming out the ends. The resistance code uses three bands or colors, while a fourth, usually silver or gold, indicates the tolerance. The colors are arranged so that the first two indicate the first two figures of the resistance, while the third indicates the number of digits (zeros or multiplier) which follow the first two figures On uninsulated resistors, the body is the first figure, the end color the second figure, and the dot the number of digits. On insulated resistors, the band nearest the end is the first figure, the next band is the second figure and the third band the number of digits.



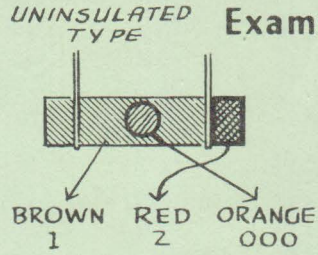
WATTAGE SIZES

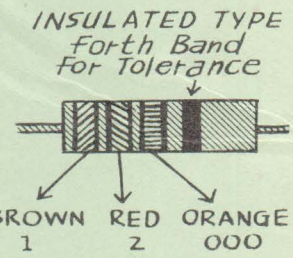
WATTAGE. Resistors are rated as to wattage (power dissipation) according to size. The chart shows approximate sizes which vary with manufacturers. To determine wattage size necessary multiply current through resistor in amperes by voltage drop across resistors in volts. Example — A plate loading resistor for a tube drawing 10 milliamperes (.01 Amperes) has a voltage on one side of 300 volts and on the other side 200 volts, giving a drop of 100 volts. Therefore 100 volts × .01A. = 1 Watt.

A higher wattage resistor can always be substituted for smaller size.

Uninsulated Insulated Color	Body Color First Ring First Figure	End Color Second Ring Second Figure	Dot Color Third Ring Number of Digits
Black	0	0	None
Brown	1	1	0
Red	2	2	00
Orange	3	3	,000
Yellow	4	4	0,000
Green	5	5	00,000
Blue	6	6	000,000
Violet	7	7	0,000,000
Grey	8	8	00,000,000
White	9	9	000,000,000

Examples





Some Popular Sizes of Resistors

RESISTANCE IN OHMS	BODY OR FIRST BAND	END OR SECOND BAND	DOT OR THIRD BAND
50	Green	Black	Black
250	Red	Green	Brown
1500	Brown	Green	Red
30,000	Orange	Black	Orange
220,000	Red	Red	Yellow
1 Megohm	Brown	Black	Green

The fourth ring or other end may be silver (10% tolerance) or gold (5% tolerance) or it may be omitted entirely which indicates 20% tolerance.

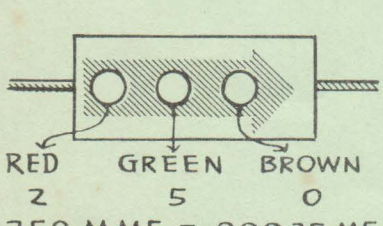
Condenser Code

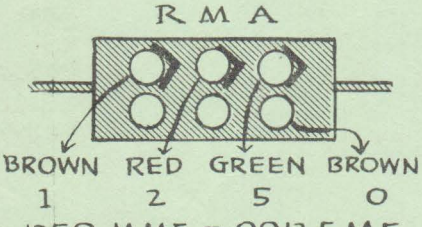
Condensers use the same code as resistors and are read in micromicrofarads.

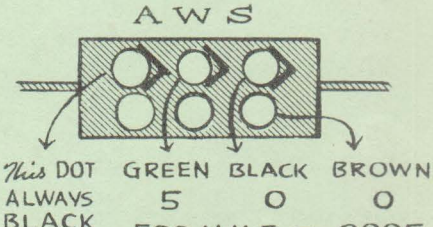
If there is one row of dots, they are read in direction of arrow or if manufacturer's name appears in the same direction as name. If two rows of dots appear, it can either be of two different codes: The RMA or the AWS (American War Standard). In the RMA, the top row of dots are the first three figures (carried to three figures), the bottom row are left to right the voltage rating, tolerance, and decimal multiplier.

In the AWS code, the top row of dots are the first three figures while the bottom row are, left to right, characteristic, tolerance, and decimal multiplier.

Examples







Some Commonly Used Sizes of Condensers

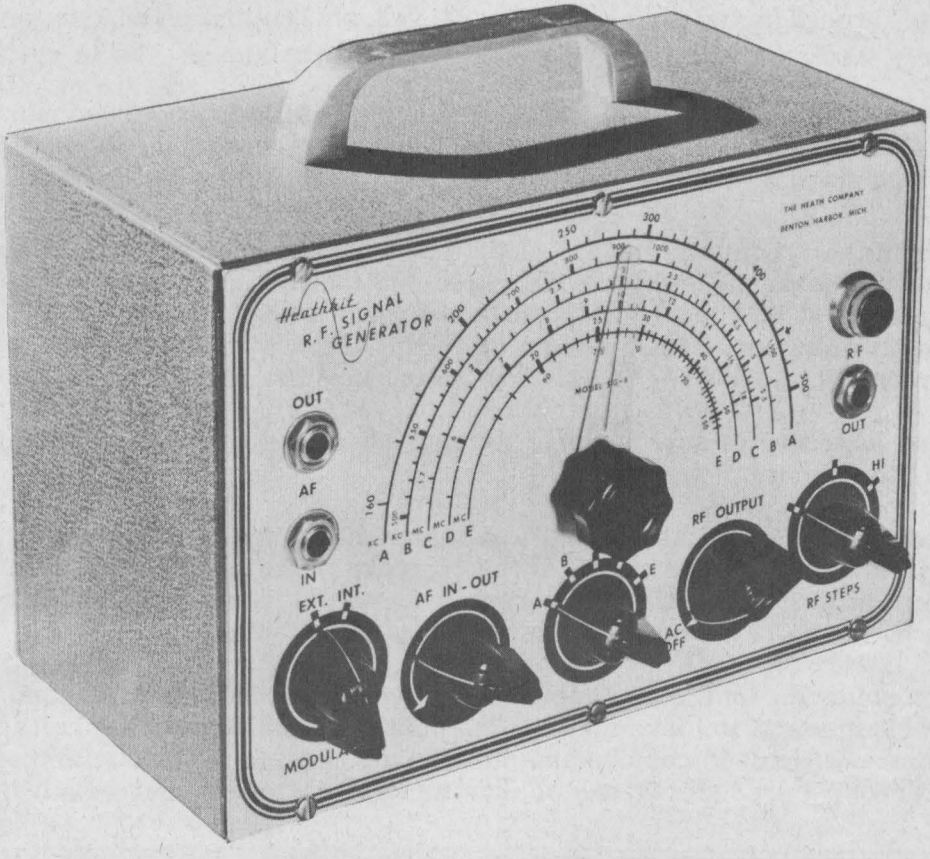
MMF.	MF.	FIRST DOT	SECOND DOT	THIRD DOT
10	.00001	Brown	Black	Black
50	.00005	Green	Black	Black
100	.0001	Brown	Black	Brown
250	.00025	Red	Green	Brown
500	.0005	Green	Black	Brown
1000	.001	Brown	Black	Red
3000	.003	Orange	Black	Red
10,000	.01	Brown	Black	Orange

The tolerance rating corresponds to the color code, i.e., red — 2%, green — 5%, etc.

The voltage rating corresponds to the code multiplied by 100. Example: Orange dot — 300 volt rating; Blue — 600 volt rating.

Assembly and Operation of the Heathkit Signal Generator

Model SG-6



SPECIFICATIONS

FREQUENCY RANGE

Band A	160 Kc to 510 Kc
Band B	500 Kc to 1,650 Kc
Band C	1.65 Mc to 5.7 Mc
Band D	5.4 Mc to 19 Mc
Band E	17 Mc to 50 Mc
Calibrated Harmonics	51 Mc to 150 Mc

RADIO FREQUENCY OUTPUT	In excess of 100,000 microvolts.
MODULATION FREQUENCY	Approximately 400 cycles
AUDIO OUTPUT	1½ to 2 Volts
AUDIO FREQUENCY INPUT	Approximately 5V across 1 Megohm

TUBES

6C4 RF Oscillator	6C4 Audio Oscillator or Audio Amplifier

POWER REQUIREMENTS	105-125V. 50/60 cycles

The Heathkit Model SG-6 Signal Generator has been designed so that with simple easy assembly the kit builder can construct a signal generator which will give him excellent performance and is both pleasant and easy to use. This generator has been engineered so that it will be valuable to the radio repairman, ham, or experimenter over a wide range of uses in addition to being a rugged and highly dependable piece of test equipment made of the highest quality parts throughout.

PRELIMINARY INSTRUCTIONS AND NOTES

Before starting construction be certain to read the manual through completely and note all diagrams and pictorials. In the step by step procedure, when actually assembling and wiring, read the whole article through (articles are numbered 1, 2, 3, etc.) so that no suggestions in the article will be missed.

To facilitate describing the location of parts, solder lug positions have been numbered, and tube socket positions have been lettered as in Figure 1. Refer to this figure when instructions say, "mount solder lugs 4 and 5, etc."

Also note that both the schematic diagram and Figures 5 and 11 show all switch contact lugs numbered. The code is as follows: for example, M3 indicates, M for modulation switch and 3 for contact solder lug 3. BR6 means, B for bandswitch, R for rear deck, and 6 for contact lug 6. Therefore when mounting switches, be sure to mount them with the same relative position as shown in the pictorials. Likewise, be sure and mount tube sockets as pictured.

When wiring, and instructions say, "connect to right hand lug of the two lug terminal strip, etc." consult Figure 1 for clarity.

It is recommended that tube sockets A and B on figure 1 be actually labeled A and B on the chassis with a pencil. Also writing the names of the controls on the inside of the chassis where wiring is done will reduce the possibility of wiring to improper controls by mistake. An A, B, C, D, or E written by the coils on the sub-chassis might prove helpful.

Read the note on soldering on the inside of the back cover. Make a good mechanical joint of each connection with clean metal to clean metal. Use only good quality rosin core radio type solder. Pastes or acids are difficult to remove and minute amounts left combine with moisture from the air forming a corrosive product. Weeks or months later corrosion may result in untimely failure.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTES ARE USED.

Small changes in parts may be made by the Heath Company. Any part supplied will work just as well as the part for which it was substituted. All substitutions will be of equal or better quality than the original, and will be made in order that a minimum delay will occur in filling your order.

Resistors and controls have a tolerance rating of plus or minus 20% unless otherwise stated. Therefore a 100K ohms resistor may test between 80K and 120K ohms. The letter K stands for 1,000 and M for 1,000,000. Thus, a resistor marked 90K=90,000 Ohms, etc. Frequently condensers show an even greater variation such as minus 50% to plus 100%. This Heathkit is designed to accomodate such variation.

The tube socket pins are numbered from 1 to 7 starting at the spacing and reading clockwise when viewed from the bottom. See Figure 2.

A circuit description is included in a later section of this manual so that those with some knowledge of radio will be able to obtain a clearer picture as to the actual workings of this equipment. It is not expected that those with little radio experience will understand the description completely, but it should be of help in the event that they desire to become more familiar with circuit operation and thus learn more from building the kit than just the placing of parts and wiring. In any case, this section points out the use of the various controls and switches.

STEP BY STEP ASSEMBLY

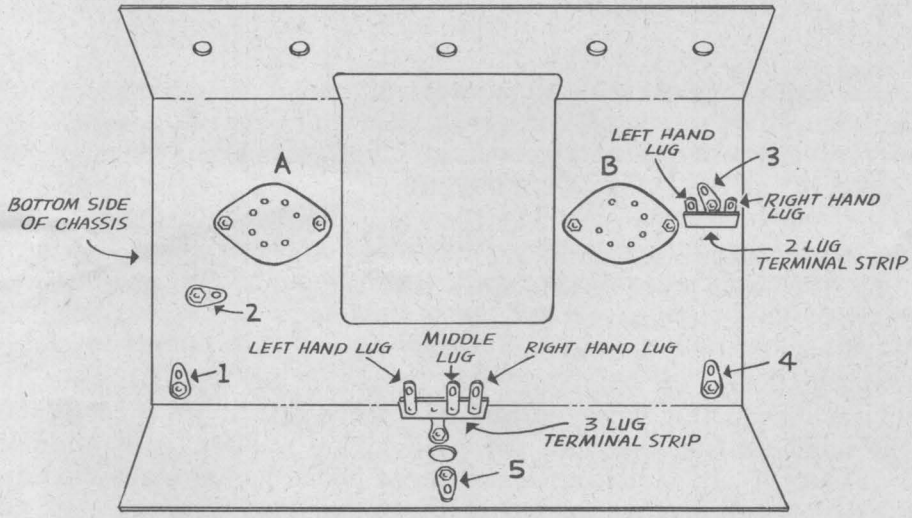
Use of bare wire where indicated will facilitate wiring, but insulated wire may be used. Place spaghetti (insulated sleeving) over bare wires on condensers or resistors where necessary to prevent the leads from accidentally touching other bare wires or metal parts.

(S) means solder (NS) means do not solder yet

Begin by checking the parts against the parts list. Identify each part, using the charts on the inside of the cover of this manual where necessary. Thus, you will avoid throwing away any small parts with the packing.

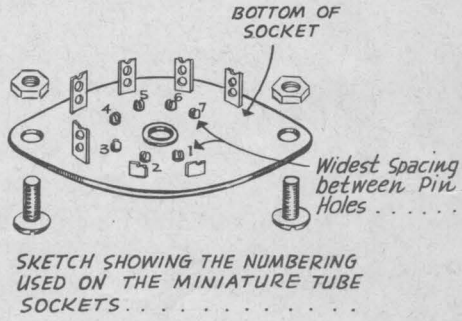
MOUNTING OF PARTS ON CHASSIS

1. On the chassis (SG62) mount with 3-48 x $\frac{1}{4}$ screws (SW34) and 3-48 nuts (SW35) the miniature tube sockets (SW26) as shown in pictorial 1. (Sockets A and B of Fig. 1) Note that the widest spacing of the pin holes is toward the center of the chassis. This spacing is indicated in Fig. 2 as is the pin numbering used for such socket. Observe that the numbering is clockwise starting from the spacing, and is read on the under side of the socket. Install the four $\frac{3}{8}$ rubber grommets (O35) in the holes in the chassis.



NOTATIONS AS USED IN INSTRUCTIONS

Fig. 1



SKETCH SHOWING THE NUMBERING USED ON THE MINIATURE TUBE SOCKETS . . . . . .

Fig. 2

2. Mount the power transformer (V98) on the chassis by means of two 6-32 x $\frac{3}{8}$ screws and two 6-32 nuts using a #6 lockwasher directly under the nut. Mount the 2 lug terminal strip (S32) and a solder lug (lug 3) with a 6-32 x $\frac{3}{8}$ screw and nut. Next comes the 3 lug terminal strip (SW37) fastened by a 6-32 x $\frac{3}{8}$ screw, lockwasher, and nut.

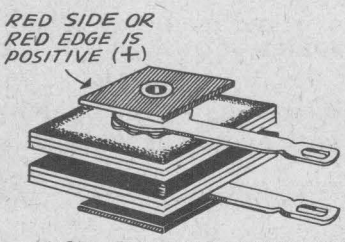
3. On top of the chassis, with two 6-32 x $\frac{3}{8}$ screws, fasten the AF choke marked SG-61, and on the under side of the chassis on each of the two screws place first a solder lug (lugs 1 and 2) and fasten with a nut. The choke should be placed so that its two leads are on the side nearest the closest grommet and the leads should be passed through this nearby grommet.

4. On the under side of the chassis mount the selenium rectifier (V97) with a 6-32 x 1 screw and a lockwasher under the nut. Mount it with the red or red edged side visible (see Fig. 3) and its solder lugs pointed in direction as shown in pictorial 1.

5. Mount solder lugs 4 and 5 with a 6-32 x $\frac{3}{8}$ screw and nut.

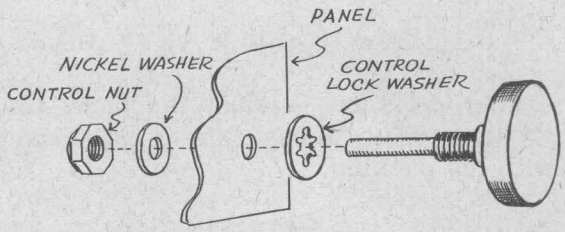
MOUNTING OF PARTS ON FRONT PANEL

6. Place the panel (SG52) against the front of the chassis and using a control lockwasher, nickel washer, and control nut as shown in Figure 4, mount in turn, the "EXT - INT" modulation switch (SG51), the attenuator switch (SG50), the AF "IN - OUT" control (O56) and the RF output control (SG11). Line up these controls with lugs and contacts in the same positions as shown in Figure 5.



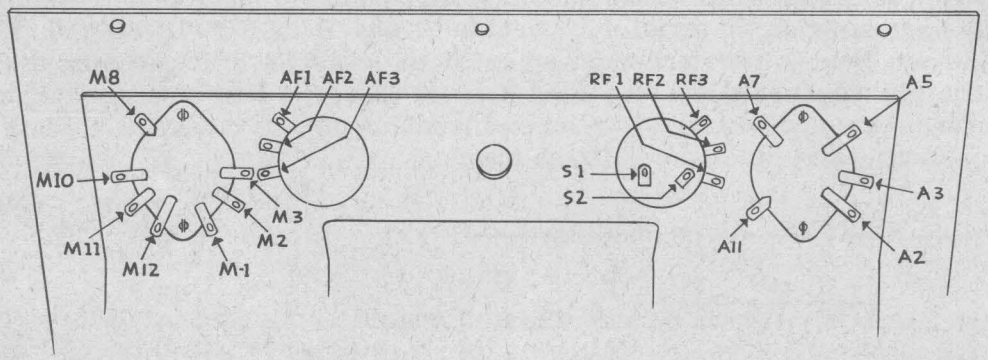
V97 SELENIUM RECTIFIER

Fig. 3



HOW TO MOUNT CONTROLS & SWITCHES

Fig. 4

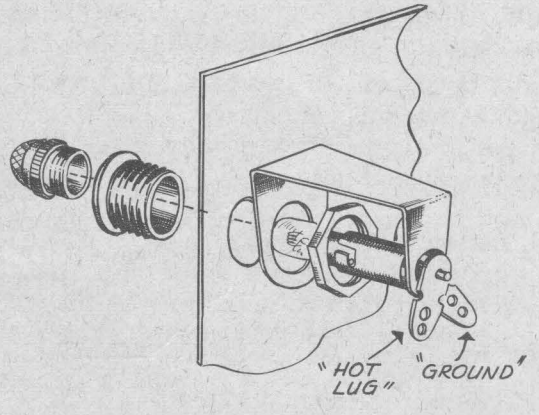


MOUNT ALL CONTROLS WITH LUGS
LOCATED AS SHOWN ABOVE . . . . .

Fig. 5

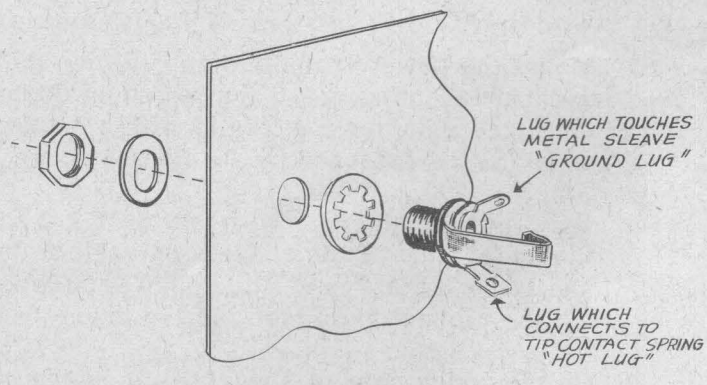
7. Assemble and mount the pilot light as shown in Figure 6. This uses the pilot light lamp (O39) socket (O52), nut (O40), bushing (O41) and jewel (O42). Note that the pilot light mounting is just above the RF output phone jack hole. (Pictorial 2)

8. Next come each of the 3 phone jacks (K17): RF "OUT," AF "OUT," and AF "IN." Mounting is as follows: place a control lockwasher on the threaded section before slipping it through the hole in the panel, slip the threaded section through, put on a nickel washer (on outside of panel) and fasten with a nut. (Figure 7) In mounting these three phone jacks, make certain that the soldering lugs and the clip which touches the tip of the phone plug are oriented as shown in pictorial 2. Otherwise, the wiring to these plugs could easily interfere when the chassis is slipped into the cabinet.



PILOT LIGHT ASSEMBLY

Fig. 6



PHONE JACK ASSEMBLY

Fig. 7

Sufficient parts are now mounted so that wiring can begin.

9. Wire in the power transformer (V98) as shown in pictorial 1 and as follows: twist the two black leads together, cut them to proper length, and fasten them to the two outside lugs of the three lug terminal strip (NS). Fasten one yellow lead to solder lug 1 (NS) and the other yellow lead to pin 4 of tube socket A (NS). One red lead goes to solder lug 1 (NS) and the other red lead connects to the bottom lug (lug furthest from the red edged insulator piece) of the selenium rectifier (S). Wire from pin 4 of socket A (S) to pin 4 of socket B (NS). Note that this wire follows along, and is close to, the bend of the chassis. Wire from pin 4 of socket B (S) to the pilot light "HOT" solder lug (S) (see Fig. 6) passing the wire through the nearby rubber grommet. Ground the pilot light's "GROUND" solder lug to the pilot light frame (S). Wire from pin 3 of socket B (NS) to solder lug 3 (NS). Wire from pin 3 of socket A (NS) to solder lug 2 (NS).

10. To the left hand lug of the 3 lug terminal strip, fasten one lead of a .001 MFD condenser (SG46) (NS) and this condenser's other lead connects to solder lug 5 (NS). Note that lead near "outside foil" or black ring marking on body of condenser is the lead which goes to the solder lug (ground). Hereafter, whenever condensers are grounded, have the outside foil lead as the grounded lead. Connect the other .001 MFD condenser to the middle lug of the 3 lug terminal strip (NS) and its outside foil lead to solder lug 5 (S).

11. Note that the "RF output - AC off" control has two solder lugs protruding from the back of it. Twist two pieces of wire together, and wire from control's back lugs, (lugs S1 and S2, Fig. 5) (S) to the middle (NS) and right hand solder lugs (S) of the 3 lug terminal strip. Refer to pictorial 1.

12. Wire from the upper lug (the lug nearest the red edge insulator piece) of the selenium rectifier (S) to the right hand lug on the two lug terminal strip (NS). To this right hand lug also connect one lead (on the side marked positive or with a +++ marking) of the dual 20 MFD condenser (K13) (NS). The single lead at the other end of the condenser goes to solder lug 4 (S). The other positive lead goes to the left hand lug of the two lug terminal strip (NS). Wire the 2700 resistor (K10) between the right hand lug of the 2 lug terminal strip (S) and the left hand lug (NS). To this left hand lug also connect one lead of the 5600 resistor (G12) (S) and the resistor's other lead to pin 5 of socket B (NS). Wire from pin 5 of socket B (S) to pin 1 of socket A (S). This wire follows along the bend of the chassis.

13. SOCKET B: Wire to socket B as follows: to pin 1 connect one lead of a .01 condenser (T13) (S) and fasten the outside foil lead to solder lug 3 (S). Fasten to pin 6 a lead of the 27K resistor (FM36) (NS) and connect the other lead of this resistor to pin 3 (S).

14. SOCKET A: Socket A wiring is as follows: to pin 3 connect one lead of a 330 resistor (AR25) (NS) and the resistor's other lead to pin 7 (S). To pin 3 connect one 100K resistor lead (012) (S) and the other lead goes to pin 6 (NS). Wire from pin 5 (S) to the "EXT - INT" modulation switch contact M12(S). Connect one lead of a .05 condenser (AR28) to pin 6 (S) and the outside foil lead of this condenser fastens to "EXT - INT" modulation switch contact M2 (S).

15. MODULATION SWITCH: Considering now the wiring of the modulation switch (see Fig. 5 showing numbering of switch contacts) wire as follows: connect a 390K (SG54) resistor between lugs M8 (NS) and M10 (S) and be certain that the resistor leads are passed through the solder lug holes in direction as shown in pictorial, otherwise difficulty might be encountered when trying to slip the chassis into the cabinet. To switch lug M11 fasten a .1 condenser (slip spaghetti over the condenser lead) (O49) (NS) and the condenser's outside foil lead goes to solder lug 1 (NS). To lug M3 connect one lead of a .02 condenser (use spaghetti) (O25) (NS) and fasten the outside foil lead to solder lug 1 (S). Twist the leads of the AF choke and connect one of them to contact M11 (S) and the other one to contact lug M3 (S). Connect one lead of a .01 condenser (T13) to contact lug M1 (S) and the condenser's other lead to solder lug AF2 (NS) of AF "IN-OUT" control. From contact lug M8 connect a lead of a .01 condenser (S) and the outside foil lead goes to lug AF1 (NS).

16. AF IN-OUT CONTROL: To lug AF3 fasten a wire (S) and connect it to solder lug 2 (S). Connect a piece of wire to AF2 (S) pass it through the nearby grommet, and fasten to the AF "OUT" phone jack "HOT" lug (Fig. 7). To AF1 connect a piece of wire (S), pass it through the nearest grommet, and fasten it to the AF "IN" phone jack "HOT" lug (S).

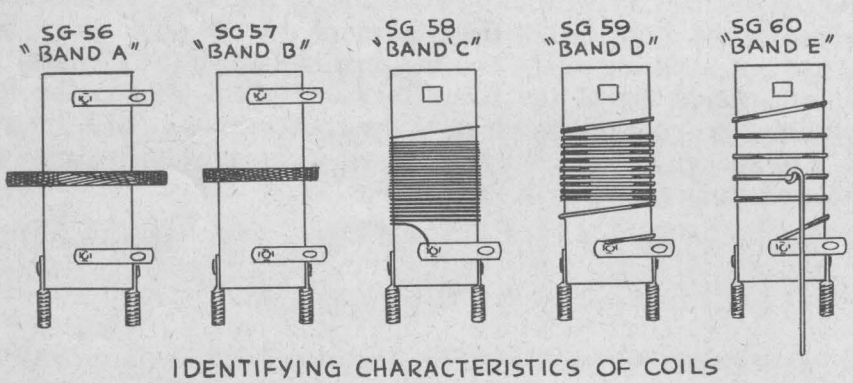
17. RF OUTPUT CONTROL: To lug RF1 connect (use spaghetti) a 10K resistor lead (011) (S) and the resistor's other lead goes to pin 7 of socket B (NS). Connect a short piece of wire from lug RF2 (S) to lug A7 (NS). Fasten a piece of stiff bare wire to lug RF3 (S), slip it through lug A11 (NS), pass the wire through the nearby grommet, and then connect it to the "GROUND" lug of the RF "OUT" jack (S).

18. ATTENUATOR SWITCH: To lug A7 connect a lead of a 620-680 resistor (SG53) (S) and the resistor's other lead fastens to contact A5 (NS). Connect the other 620-680 resistor between lugs A5 (NS) and A3 (NS) making certain that the resistor does not protrude so that it will interfere with slipping the chassis into the cabinet. Connect a 47 ohm resistor (TS29) between solder lugs A5 (S) and A11 (NS). The other 47 ohm resistor goes between contact lugs A3 (S) and A11 (S). Connect a length of wire to lug A2 (S) pass it through the nearby grommet, and fasten it to the RF "OUT" jack's "HOT" lug (S).

19. Pass the line cord (O78) through the grommet in the very back of the chassis, and knot the cord at a convenient length so that by pulling on the cord, a strain will not be placed on connections of cord to equipment. These connections are as follows: one lead of the cord goes to the left hand solder lug of the 3 lug terminal strip (S) and the other lead connects to the middle solder lug of the 3 lug terminal strip (S).

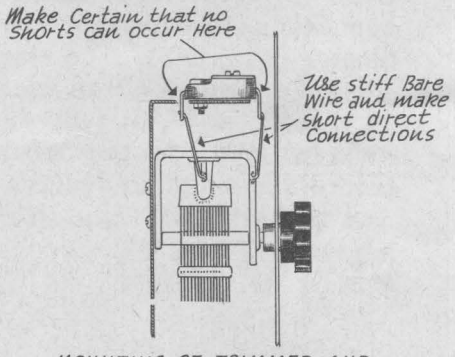
THE TURRET COIL ASSEMBLY AND SUB CHASSIS WIRING

20. Mount the coils (SG56, SG57, SG58, SG59, and SG60) on the sub-chassis as shown in pictorial 3, and place a lockwasher under each of the 6-32 nuts used (see Fig. 8 for identification of coils.) Mount the 4-30 MMF trimmer condenser (SG55) with two 4-40 x $\frac{3}{8}$ screws and nuts. (Fig. 9)



IDENTIFYING CHARACTERISTICS OF COILS

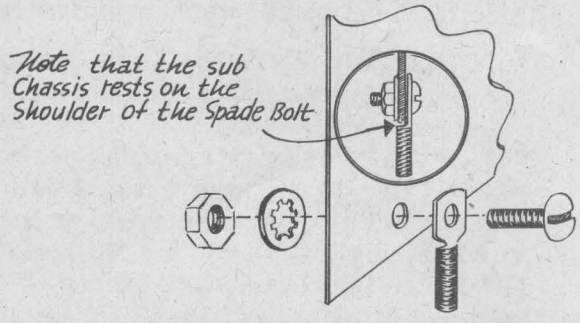
Fig. 8



MOUNTING OF TRIMMER AND CONNECTIONS TO TUNING CONDENSER

Fig. 9

Mount the tuning condenser (SG40) (keep the plates fully meshed to avoid damage) using three 6-32 x 3/16 screws and with a solder lug under the screw furthest from the center coil. Use lockwashers under the two other screws. Fasten the band selector switch (SG49) to the sub-chassis using a control lockwasher and nut. (See pictorial 3.) Mount the two spade bolts (G32) using on each bolt a 6-32 nut, and a lockwasher under the nut. (Fig. 10.)



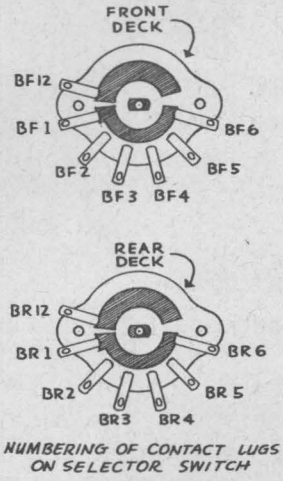
SPADE BOLT ASSEMBLY

Fig. 10

NOTE: IN ARTICLES 21 AND 22, IN ALL CASES USE STIFF BARE WIRE

A good way to prepare the supplied length of bare wire for wiring purposes is to uncoil the wire and place one end in a vise, for instance, and with a pair of pliers, stretch the wire about ¼". The stretching cold-works the wire so that it becomes stiffer (therefore better for wiring), and it also removes kinks.

21. Note carefully pictorial 3 showing the wiring of the coils to the selector switch and the wiring of the selector switch. Observe Fig. 11 carefully for contact numbering.



NUMBERING OF CONTACT LUGS ON SELECTOR SWITCH

Fig. 11

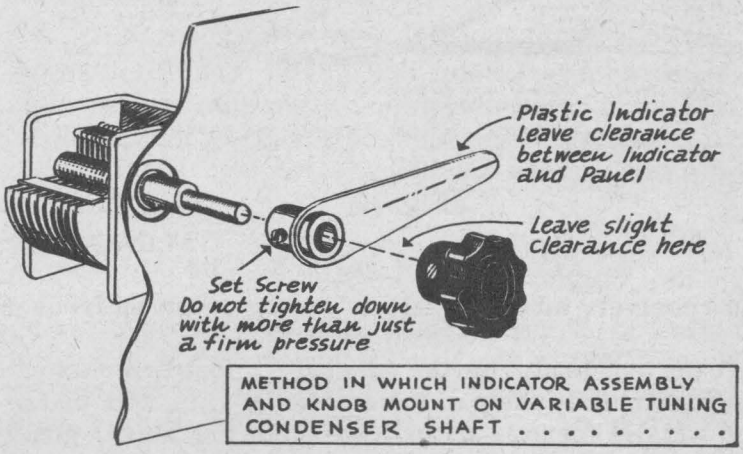


Fig. 12.

Make connection from the selector switch rear deck contact lug BR12 (S) to the front deck contact lug BF12 (S) and continue the wire to the nearby solder lug on the sub-chassis (S).

SWITCH AND COIL CONNECTIONS: Bottom lug (if present) of coil E leave blank. (The bottom lug is the lug nearest the spade bolts.) The wire tapped about midway of coil E connect to BF5 (S). Bottom lug of coil D (S) to BF4 (S). Bottom lug coil C (S) to BF3 (S). Bottom lug coil B (S) to BF2 (S). Bottom lug coil A (S) to BF1 (S). Top lug coil E (S) to BR5 (S). Top lug coil D (S) to BR4 (S). Top lug coil C (S) to BR 3 (S). Top lug coil B (S) to BR2 (S). Top lug coil A (S) to BR1 (S). Make certain that none of the wires of above connections touch or could touch each other with slight jarring. From BR6 (NS) connect a wire to the nearest stator solder connection of the tuning condenser (S) (see pictorial 3). (Stator plates are those plates of the condenser which do not rotate, that is, they are the stationary plates.) See Fig. 9 and make the short direct connection from the trimmer condenser (S) to the nearest stator plate solder lug (S). Connect from the trimmer (S) to the tuning condenser frame (S). Use bare wire for these two connections.

22. The sub-chassis should now be mounted on the main chassis by means of the spade bolts and two 6-32 nuts, a lockwasher being placed under each nut.

Connect the 150 MMF condenser (AR26) between BR6 (S) and pin 6 of tube socket B (S). Make a short direct connection from BF6 (S) to pin 7 of socket B (S).

The wiring of the signal generator is now completed.

23. Place the five pointer knobs (O51) on the control shafts and fasten each with the small set screw that is in the knob. Fully mesh the variable tuning condenser, and with a set screw (TS55) fasten (do not tighten down the screw very hard) the indicator assembly (SG45) on the control shaft so that the hair line coincides with the left end of the dial scale. Be sure that the plastic indicator does not rub against the panel but rather has a little clearance. Fasten knob SG44 on the tuning condenser shaft and leave a slight clearance between the knob and the plastic indicator. Note Figure 12.

24. Observe that the phone plug (V41) cap unscrews from the plug tip assembly. Assemble the test lead as shown in Fig. 13 checking closely to see that the connection of the inner conductor goes to the proper solder lug of the phone plug. Screw the cap over the plug before attaching the alligator clips (V44).

Plug the 6C4 tubes into their sockets and the generator is ready for test.

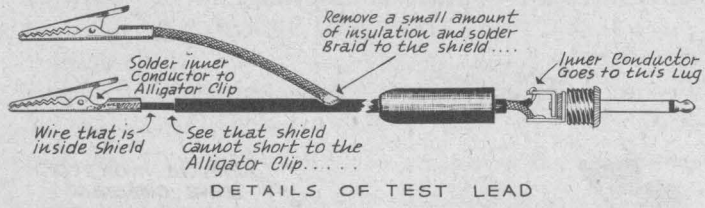


Fig. 13

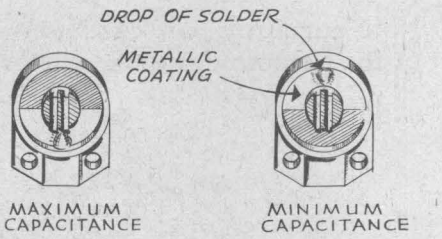


Fig. 14

CALIBRATION

On a receiver, tune in a strong station of known frequency between 1,200 and 1,600 Kc.

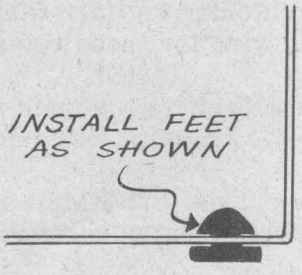
Place the test lead from the generator close to the antenna of the receiver and tune the generator to approximately the same frequency. This will cause a whistle in the receiver. The lowest pitch whistle (zero beat) indicates that the signal generator and station are on the same frequency. Now set the generator's plastic indicator to read the same frequency as the station, and adjust the trimmer to again give zero beat. The trimmer should be nearly in the minimum capacity position. (Fig. 14). The calibration will now hold quite accurately on all bands.

The calibration on the higher frequency bands may be upset by excessively long leads on the tuning assembly. Such variations in inductance cannot be compensated for by trimmer adjustment.

If the trimmer is in the minimum capacity position before zero beat can be obtained, there is an excessive amount of distributed capacity due to wiring in the tuning circuits. Make sure all the "hot" leads (from the top lug on the coils to the switch, and from the switch to the tuning condenser and trimmer) are at least a quarter inch away from the metal chassis and all other wiring.

After calibration is completed, place the rubber feet on the cabinet (T32) (Fig. 15) and fasten on the carrying handle (O79) using two 10-24 x $\frac{3}{8}$ handle screws (O30). Slip the chassis into the cabinet and using #6 x $\frac{3}{8}$ sheet metal screws (O102) fasten the panel to the cabinet. In the back of the cabinet, fasten the chassis to the cabinet using sheet metal screws.

Fig. 15



ACCURACY

Any signal generator is designed as a convenient and controllable source of modulated or unmodulated signals. No signal generator is designed as a frequency standard. Expensive standard signal generators have fairly accurate (3-20%) attenuators which control the output voltage, and the calibration accuracy is rarely closer than 1%. The Heathkit generator may be expected to fall within 2-3% of the frequency calibration, which is quite satisfactory for service work and alignment. In receiver alignment, the frequency at which the particular adjustment is made is rarely critical, but the adjustment itself for maximum signal output from the receiver is frequently quite critical.

For accurate calibration of home built receivers or equipment proceed as follows: make a rough calibration with the signal generator. Then, with a receiver, tune in WWV (Bureau of Standards) at 2.5, 5, or 10 Mc. Set the signal generator to a suitable sub harmonic such as for instance 500 Kc, and adjust the generator for zero beat. Now the harmonics of the signal generator occur very accurately every 500 Kc and these harmonics may be used to give accurate calibration points at 500 Kc intervals such as 2,500 Kc, 3,000 Kc, 3,500 Kc, 4,000 Kc, etc. These known frequency points can be marked on the dial of the equipment being calibrated. The object of the rough calibration is merely to furnish a means of identifying for example the 3,000 Kc point from the 2,500 Kc or 3,500 Kc points. For calibration of higher frequency equipment, a choice of a higher sub harmonic will reduce confusion between the multitude of harmonics and will also insure adequate signal strength.

When checking the calibration accuracy of the Heathkit Generator, the most convenient standards of comparison, of sufficient accuracy, are broadcast stations of known frequency. Crystal oscillators of standard frequencies, when zero beat against WWV, are also convenient to use, if available. The use of receiver dial calibrations is frequently not of sufficient accuracy to warrant consideration.

USE OF R.F. SIGNAL GENERATOR

This Signal Generator can be used to align radio receivers. It furnishes a source of radio frequency or modulated radio frequency by means of signal generator fundamental frequencies between 160 Kilocycles and 52 Megacycles (1 Megacycle=1,000 Kilocycles) and useful calibrated harmonics of the signal generator furnish output to over 150 Megacycles.

Wherever possible, the recommendations of the manufacturer of the radio being aligned should be used. When this is not available, the following procedure can be followed.

Output Indication. With the new types of receivers, especially those using AVC (automatic volume control), a visual means of indicating resonance is desirable. If convenient, in all receiver alignments, the AVC should be disabled during the process of alignment. Otherwise a signal weak enough to not operate the AVC should be used.

IF Alignment. Connect the signal generator shield to chassis and clip the shielded wire to the signal grid terminal on the converter tube socket. Set the signal generator to the IF frequency required. RMA standard is 455 Kc, but other frequencies like 262 and 175 Kc are sometimes used. Adjust generator output for minimum readable output indication. Adjust IF transformers starting with the one nearest the second detector and working forward. The adjustment mechanism consists generally of two screws which operate trimmer condensers, or iron cores inside the coils. They may be located on top, on the side, or on the top and bottom of the IF transformer. Turn the adjusting screw for maximum output, reducing the signal generator output if necessary to keep the output indicator from going off scale.

Oscillator Alignment. With the generator connected as above, set the generator dial to the highest frequency marked on the receiver dial (1,600 or 1,720 Kc). Set the receiver dial to this same frequency. Adjust the receiver oscillator trimmer to bring in the signal. An additional adjustment is often provided in the form of a padding condenser or an iron core. This is generally adjusted at 600 Kc and its final adjustment is made later.

RF Alignment. Using a 200 MMF condenser between generator and antenna post, set receiver and generator to 1,400 Kc. Adjust antenna (and RF, if used) trimmer (frequently located on the tuning condenser) for maximum output. Set generator to 600 Kc and "rock" tuning condenser through the signal while adjusting the oscillator padder for maximum output at resonance.

For receivers with a loop antenna, couple the signal through a single turn loop connected to the generator output.

Tuned radio frequency receivers are aligned as shown under RF Alignment.

The AF "Output" source can be used to test audio amplifiers. To make such tests, plug the test lead into the AF "OUT" jack and throw the modulation switch to internal position. Connect the alligator clip on the braided lead to the chassis of the amplifier under test. The alligator clip on the center conductor, when touched to the grid (through a .05 MFD condenser) of the audio stage should produce an audible output of approximately a 400 cycle note if the stage is operating correctly and is connected to a good speaker.

OUTPUT VOLTAGE

The RF signal strength going into the output control depends upon the strength of oscillation of the 6C4 oscillator. In all variable frequency oscillators, the amplitude will vary with the tuning condenser setting. With careful design, the variation may be minimized. In the Heathkit signal generator, the variation is kept down to a ratio of about $2\frac{1}{2}$ to 1 on each band, except on band E where the L/C (inductance to capacitance) ratio becomes sufficiently unfavorable that oscillation may stop with the tuning condenser nearly fully closed. However, sufficient overlap is provided to insure complete frequency coverage. The maximum output on all bands is usually greater than 100,000 microvolts.

CIRCUIT DESCRIPTION

Incorporated in the design are the following features: the RF oscillator coils are precision wound and adjusted to calibration before shipment, thereby assuring maximum accuracy. The coils, bandswitch, and the tuning condenser all mount as a turret assembly so as to offer the advantage of short wiring leads and easy mounting of parts.

To prevent tuning past a desired RF output signal when operating the generator, the tuning condenser has a vernier drive (3 revolutions of the outside knob produce $\frac{1}{2}$ revolution of condenser rotors). This condenser varies the capacitance in the Hartley oscillator thus giving the band coverage. The individual bands are selected by means of the bandswitch which connects any one of the 5 coils acting as inductance in the Hartley oscillator.

The audio oscillator is a Colpitts oscillator which produces approximately a 400 cycle note of good wave form. This oscillator has the advantage of being a source of audio output by merely throwing the modulation switch to "INT" position and plugging into the AF output jack. This handy source of AF can be used for testing of audio amplifier stages, etc. When the modulation switch is in the "INT" position, the AF oscillator modulates the RF output.

External modulation can be obtained by plugging the external source into the AF "IN" phone jack on the panel and throwing the modulation switch to "EXT" position. Design is such that external modulation of small signal strength from a high impedance source can be used, and thus the versatility of the instrument is increased. The 6C4 tube which is in the audio oscillator circuit on "INT" modulation position, on "EXT" position acts as an audio amplifier to the external modulation.

The RF output circuit is of low impedance. This is accomplished by the use of cathode coupling to the output jack. The level of RF output is varied by means of the RF steps switch located on the panel. On this switch, "HI" indicates high RF output (therefore low attenuation). The middle position of the switch produces a lower RF output and, the maximum counterclockwise position gives the lowest RF output. (Maximum attenuation). With low attenuation, the smallest amount of resistance is in the cathode coupling circuit to the RF output jack. In the middle position of the steps switch, a single pi section is added and for highest attenuation, a second pi network is thrown into the circuit.

AC line input is connected to a high quality varnish impregnated power transformer. A ruby red pilot light on the front panel acts as a convenient indicator as to whether power is on or off. The 110V power line has both sides bypassed to minimize the signal feeding back through the power lines.

The power supply circuit consists of a selenium rectifier connected to one winding of the power transformer and thus half wave rectification is produced, the filtering being accomplished by an RC filter circuit.

A unique design feature is the convenient AF "IN-OUT" control which adjusts audio input if external modulation is employed and likewise adjusts the AF output level when using the generator as a source of audio output.

IN CASE OF DIFFICULTY

1. Recheck entire wiring. Follow each lead and color it on the pictorial with colored pencil. Most cases of difficulty result from wrong or reversed connections. (Often having a friend check the wiring will divulge an error being consistently overlooked.)

2. Be sure that the output is connected to the tip connection of the jack and that the output cable is not shorted inside the phone plug.

3. Check the voltages. The table below lists voltages from pins of the 6C4's to chassis. All readings are DC except where indicated. These voltages were measured with an 11 megohm input vacuum tube voltmeter. A normal variation of ± 15% is to be expected.

SOCKET A		SOCKET B	
Pin 1	60 - 80V	Pin 1	60 - 80V
Pin 2		Pin 2	
Pin 3	0	Pin 3	0
Pin 4	4 - 6V AC	Pin 4	4 - 6V AC
Pin 5	60 - 80V	Pin 5	60 - 80V
Pin 6	Very slightly negative	Pin 6	Anywhere between 2 - 15V negative on all bands except E which is 0 - 10V negative.
Pin 7	1 - 1.5V	Pin 7	0

Line Voltage 105 - 125V AC

With regular voltmeters, readings may be very much lower.

4. If you are unable to obtain results, write the Heath Company, giving all possible information, such as voltages obtained, indications if any, and all other helpful information.

5. If desired, your instrument may be returned to the factory. The Heath Company will inspect it and put it into operating condition for a charge of $3.00 plus the cost of any new parts or extra labor required due to damaged parts or improper construction.

NOTE: Before returning your instrument to factory, be sure to install all panel and chassis mounting screws, including those in rear of cabinet.
Tighten power transformer securely to chassis.
Attach a tag, giving name, address and trouble experienced, to your instrument.
Pack instrument in a rugged container, preferably wood using at least three inches of shredded newspaper or excelsior on all sides. Do not use folded newspaper. Do not ship in original carton only.
Ship by prepaid express if possible. Return shipment will be made by express collect. NOTE that a carrier cannot be held liable for damage in transit if packing, in HIS opinion is insufficient.

Prices subject to change without notice. The Heath Company reserves the right to change the design of its instruments without incurring liability for equipment previously supplied.

WARRANTY

The Heath Company limits its warranty on any part supplied with any Heathkit (except tubes, meters, and rectifiers, where the original manufacturer's guarantee only applies) to the replacement within three (3) months of said part which, when returned with prior permission, postpaid, was, in the judgment of the Heath Company, defective at the time of sale.

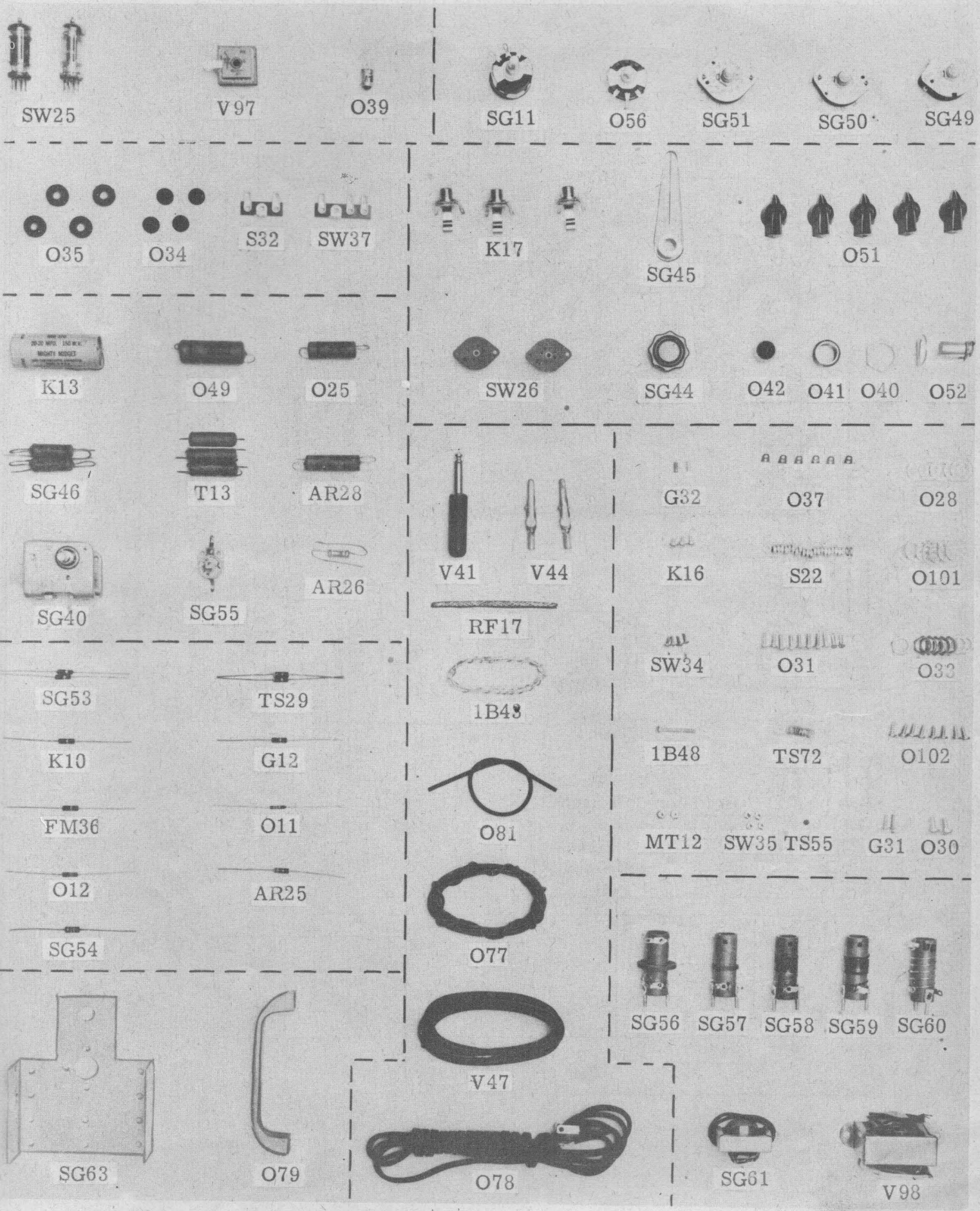
The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility for the operation of the completed instrument, nor liability for any damages or injuries sustained in the assembly or operation of the device.

HEATH COMPANY
Benton Harbor, Michigan

PARTS LIST SG-6

Part No.	Parts Per Kit	Description
Resistors		
TS29	2	47 Ohm
AR25	1	330 Ohm
SG53	2	620-680 Ohm
K10	1	2,700 Ohm
G12	1	5,600 Ohm
O11	1	10K Ohm
FM36	1	27K Ohm
O12	1	100K Ohm
SG54	1	390K Ohm
Condensers		
AR26	1	150 MMF
SG46	2	.001 MFD
T13	3	.01 MFD
O25	1	.02 MFD
AR28	1	.05 MFD
O49	1	.1 MFD
K13	1	20-20 MFD-150V
SG55	1	4-30 MMF Trimmer
SG40	1	360 MMF Tuning
Control-Switches		
SG11	1	10K Ohms Control with Sw.
O56	1	1 Megohm Control
SG49	1	5 Position Band Sw.
SG50	1	3 Position Attenuator Sw.
SG51	1	2 Position Modulation Sw.
Coils-Choke-Transformer		
SG56	1	Oscillator Coil Band A
SG57	1	Oscillator Coil Band B
SG58	1	Oscillator Coil Band C
SG59	1	Oscillator Coil Band D
SG60	1	Oscillator Coil Band E
SG61	1	AF Choke
V98	1	Power Transformer
Tubes- Lamp-Rectifier		
SW25	2	6C4 Tubes
O39	1	#47 Pilot Lamp
V97	1	Selenium Rectifier
Grommets-Feet-Terminal Strips		
O35	4	$\frac{3}{8}$ Grommets
O34	4	Rubber Feet
S32	1	2 Lug Terminal Strip
SW37	1	3 Lug Terminal Strip

Part No.	Parts Per Kit	Description
Sockets-Knobs-Jacks		
SW26	2	Miniature Tube Sockets
O52	1	Pilot Light Socket
O40	1	Pilot Light Nut
O41	1	Pilot Light Bushing
O42	1	Pilot Light Jewel
O51	5	Pointer Knobs
SG44	1	Knob
SG45	1	Indicator Assembly
K17	3	Phone Jacks
Hardware		
SW34	4	3-48 x $\frac{1}{4}$ Screws
SW35	4	3-48 Nuts
G31	2	4-40 x $\frac{3}{8}$ Screws
MT12	2	4-40 Nuts
K16	3	6-32 x 3/16 Screws
O31	10	6-32 x $\frac{3}{8}$ Screws
1B48	1	6-32 x 1 Screw
O102	8	#6 x $\frac{3}{8}$ Sheet Metal Screws
G32	2	6-32 Spade Bolts
S22	23	6-32 Nuts
TS72	20	#6 Lockwashers
O37	6	#6 Solder Lugs
TS55	1	8-32 x $\frac{1}{8}$ Set Screw
O30	2	10-24 x $\frac{3}{8}$ Handle Screws
O33	8	Control Nuts
O101	8	Control Lockwashers
O28	7	Control Nickel Washers
Clips-Plug-Wire		
V44	2	Alligator Clips
V41	1	Phone Plug
V47	1	Length Shielded Test Lead
O77	1	Roll Hookup Wire
1B43	1	Length Bare Wire
O81	1	Length Spaghetti
O78	1	Line Cord
RF17	1	Length Braid
Chassis-Parts-Cabinet		
SG62	1	Chassis
SG63	1	Sub Chassis
SG52	1	Panel
T32	1	Cabinet
O79	1	Handle
Manual		
SG-6	1	Instruction Manual


SW25
V97
O39
SG11
O56
SG51
SG50
SG49
O35
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S32
SW37
K17
SG45
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O49
O25
SW26
SG44
O42
O41
O40
O52
SG46
T13
AR28
G32
O37
O28
V41
V44
SG40
SG55
AR26
K16
S22
O101
RF17
SW34
O31
O33
SG53
TS29
1B43
K10
G12
1B48
TS72
O102
FM36
O11
O81
MT12
SW35
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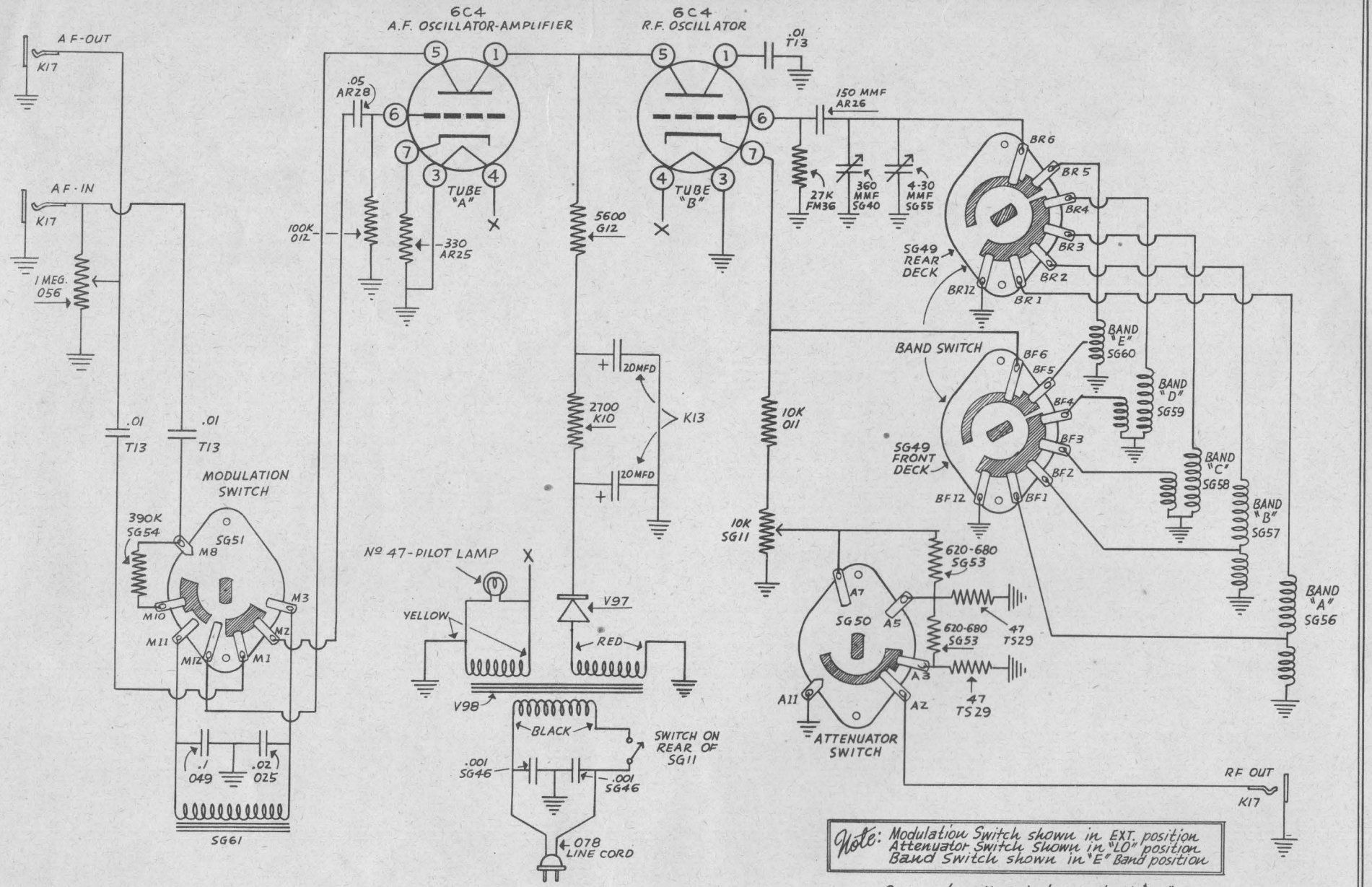
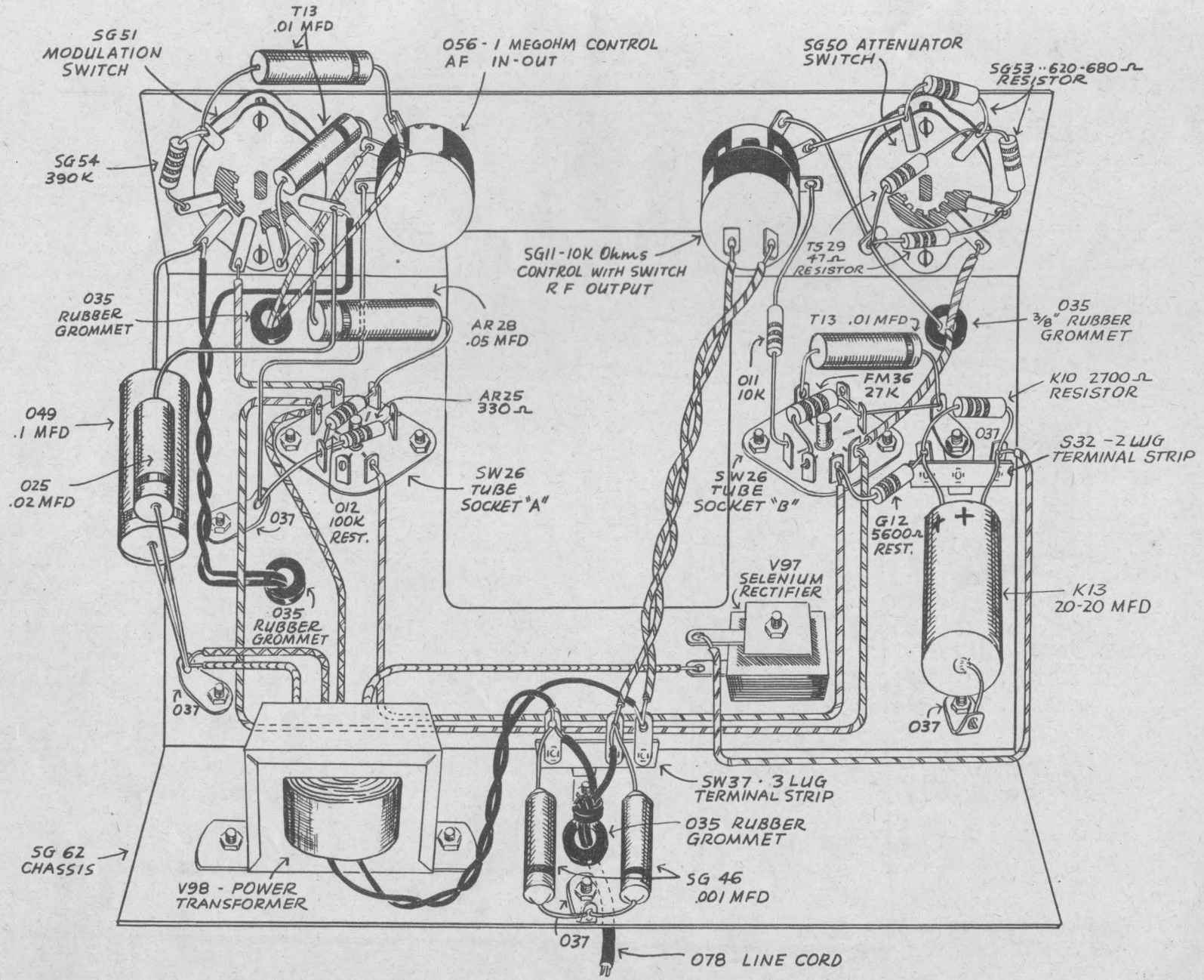
O79
O78
SG61
V98



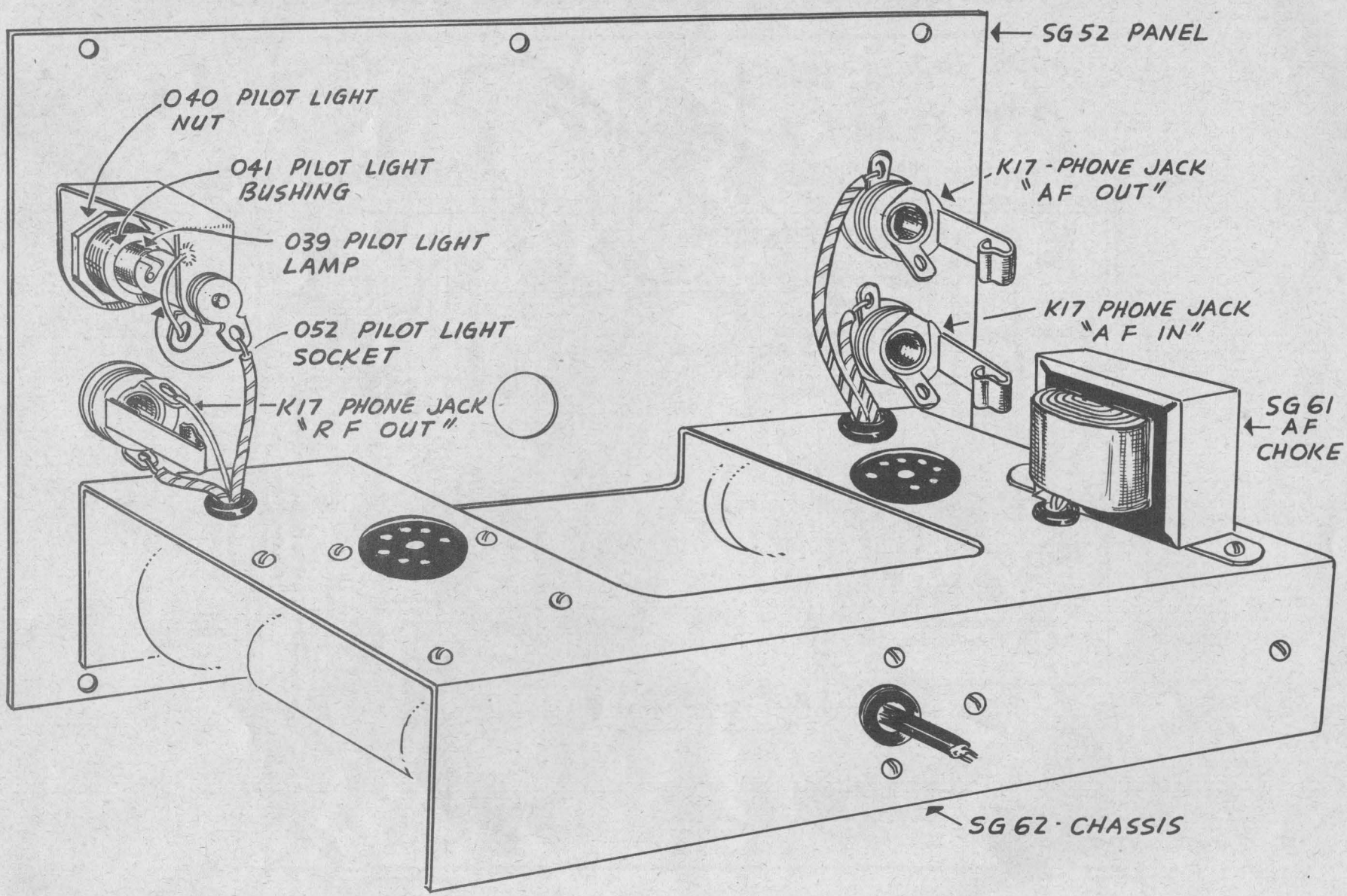
Note: Modulation Switch shown in EXT. position
Attenuator Switch shown in "LO" position
Band Switch shown in "E" Band position

Connect all points marked "X"

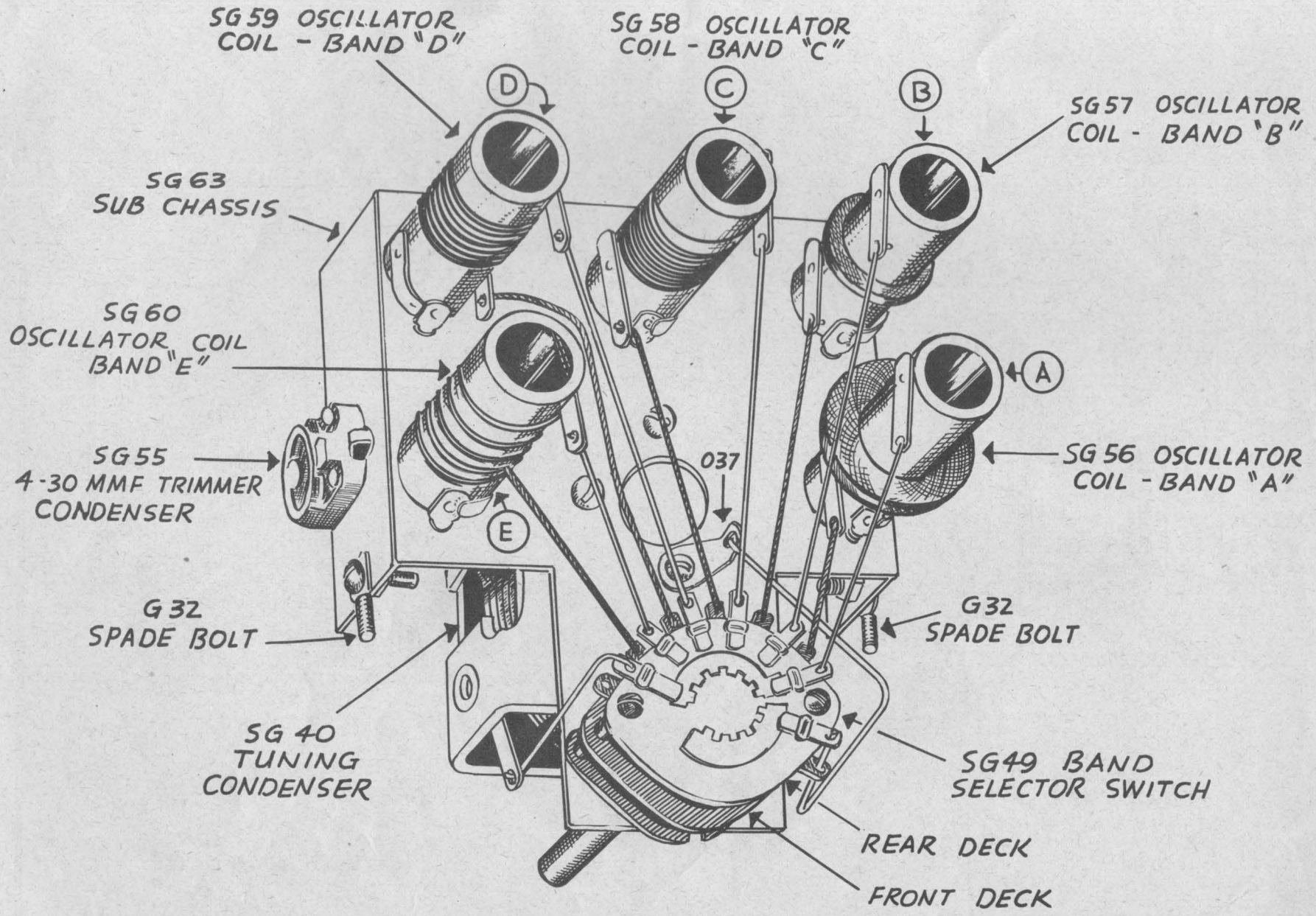
Circuit Diagram


T13 .01 MFD
SG51 MODULATION SWITCH
056 - 1 MEGOHM CONTROL AF IN-OUT
SG50 ATTENUATOR SWITCH
SG53 - 620-680Ω RESISTOR
SG54 390K
SG11 - 10K Ohms CONTROL WITH SWITCH R F OUTPUT
T529 47Ω RESISTOR
035 RUBBER GROMMET
AR28 .05 MFD
T13 .01 MFD
035 3/8" RUBBER GROMMET
011 10K
FM36 27K
K10 2700Ω RESISTOR
AR25 330Ω
049 .1 MFD
037
S32 - 2 LUG TERMINAL STRIP
025 .02 MFD
SW26 TUBE SOCKET "A"
SW26 TUBE SOCKET "B"
012 100K REST.
G12 5600Ω REST.
V97 SELENIUM RECTIFIER
K13 20-20 MFD
035 RUBBER GROMMET
037
037
SW37 - 3 LUG TERMINAL STRIP
035 RUBBER GROMMET
SG 62 CHASSIS
V98 - POWER TRANSFORMER
SG 46 .001 MFD
037
078 LINE CORD

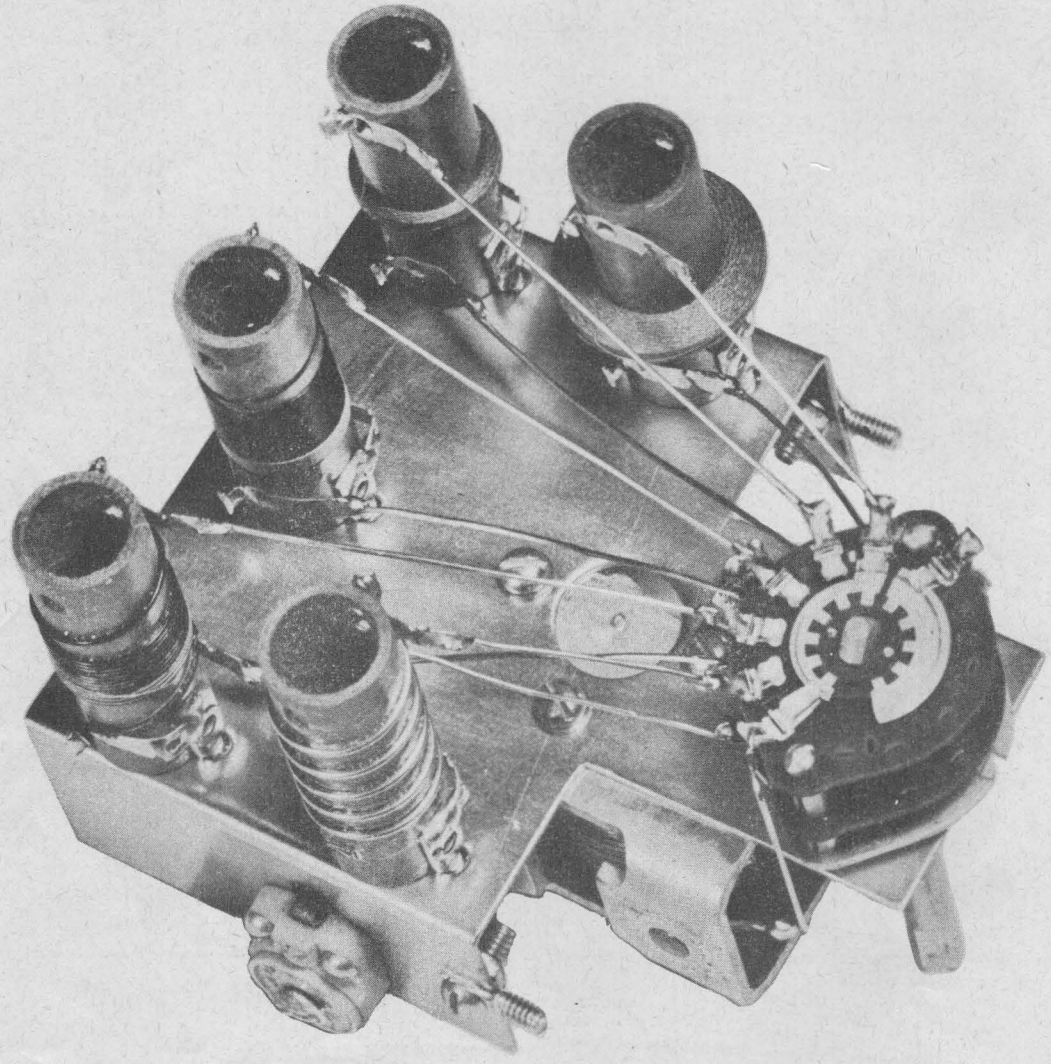
Pictorial 1


SG 52 PANEL
040 PILOT LIGHT NUT
041 PILOT LIGHT BUSHING
039 PILOT LIGHT LAMP
052 PILOT LIGHT SOCKET
K17 PHONE JACK "R F OUT"
K17 - PHONE JACK "A F OUT"
K17 PHONE JACK "A F IN"
SG 61 AF CHOKE
SG 62 - CHASSIS

Pictorial 2

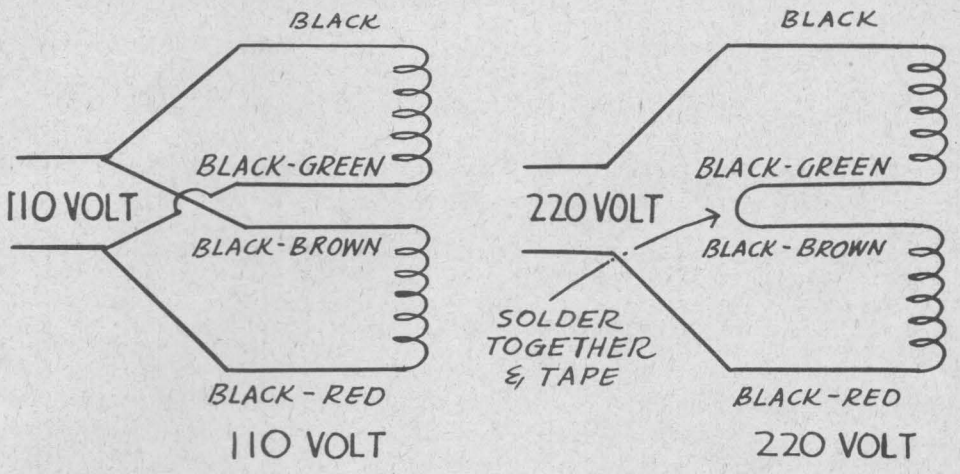


SUB CHASSIS ASSEMBLY AND WIRING



WIRING OF EXPORT TYPE 110/220 VOLT POWER TRANSFORMERS

These transformers have a dual primary for use on either 110 Volts or 220 Volts. Wire as shown.



Notes

Notes

R M A Color Code on Transformers

I.F. TRANSFORMERS

Blue — Plate Lead
Red — B + Lead
Green — Grid
Black — Ground or AVC

If center tapped other grid is green and black striped.

AUDIO TRANSFORMERS

Blue — Plate Lead
Red — B + Lead
Brown — Other Plate on Push Pull
Green — Grid Lead
Black — Ground Lead
Yellow — Other Grid on Push Pull

POWER TRANSFORMERS PRIMARY — BLACK

High Voltage Plate — Red
Center Tap Red and Yellow Striped

Rectifier Filament — Yellow
Center Tap Yellow and Blue

Filament No. 1 — Green
Center Tap Green and Yellow

Filament No. 2 — Brown
Center Tap — Brown and Yellow

Filament No. 3 — Slate
Center Tap — Slate and Yellow

Soldering

The most important thing in good soldering is to heat the joint and allow the solder to flow into it. The solder should melt from contact with the joint rather than with the iron. Never use pastes or acids in radio work.

Use only rosin core solder. Never depend on the solder to hold a joint. Always make a firm connection with the wire before applying solder. To tin a soldering iron (soldering cannot be done with the bare copper) file the surface lightly while the iron is hot and then quickly apply a generous amount of rosin core solder while the filed surface is still bright. Wipe off excess solder with a cloth.

Tin all four sides of the tip in this manner.

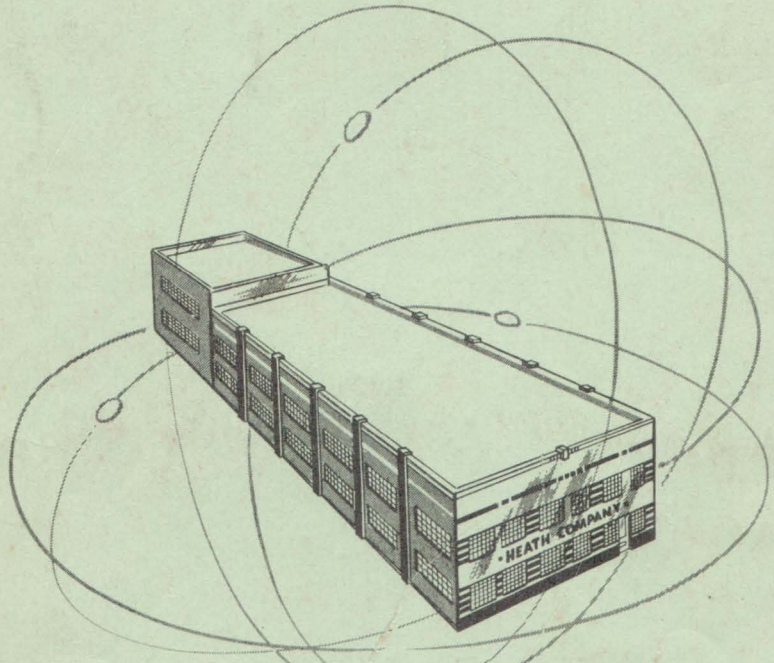
The terminals must be clean, and preferably tinned. On some terminals that are hard to solder to (nickel plated f.i.) it is desirable to pre-tin the surface before installation or connection. Clean (scrape or sandpaper) the surface, heat with iron and apply rosin core solder liberally. Wipe off or shake off excess solder.

Recommended Tools

A good electric soldering iron (100 watt with small tip)
Long or needle nose pliers 6".
Diagonal or side cutting pliers (5" or 6").
An assortment of screw drivers flat and Phillips type.
File. Round and flat types.
Purchase quality tools and you will enjoy and use them many years.
American Beauty soldering irons, Plomb, and Williams pliers are recommended.

Symbols Used in Radio Circuits

ANTENNA OR AERIAL	VARIABLE CONDENSER	QUARTZ CRYSTAL
CHASSIS OR GROUND	ELECTROLYTIC CONDENSER SHOWING POLARITY	CONNECTION OF TWO WIRES
AIR CORE COIL	SWITCH	NO CONNECTION
AIR CORE TRANSFORMER OR COIL	ROTARY SWITCH	FUSE
R.F. CHOKE	SPEAKER	PHONE PLUG
FILTER OR IRON CORE CHOKE . . .	METER	K = 1000
IRON CORE TRANSFORMER	PILOT LIGHT	M = 1,000,000
FIXED RESISTOR	PHONE JACK	OHM.
VARIABLE RESISTOR OR POTENTIOMETER	SUPPRESSOR, PLATE, SCREEN, GRID, VACUUM TUBE, CATHODE, FILAMENT	MF = MICROFARAD
FIXED CONDENSER		MMF = MICRO MICROFARAD



THE HEATH COMPANY

BENTON HARBOR, MICH.

083 4-17-48