

EICO 460

Oscilloscope

Construction Pages

Inserted at “staple page” location in EICO-460 “kit” boxes.

That is, the “Maintenance” section of the repair&operations manual, parts (a) and (b).

GENERAL INSTRUCTIONS

Care taken in the construction of this instrument will reward the constructor with many years of satisfactory service and greater confidence in his instrument. We urge you to not rush the construction, but to take all the time necessary for proper assembly and wiring.

Furthermore, we urge strongly that you follow the wire and parts layout shown in the pictorial diagrams as closely as possible. This is essential, because the position of wires and parts is quite critical in this instrument; changes may seriously affect the characteristics of the circuit.

UNPACKING THE KIT: Unpack the kit carefully and check each part against the parts list including those parts that are mounted to the chassis. If you have trouble identifying any parts, refer to the pictorial diagrams or the color code chart.

You may find that the value of a component will vary within the allowable circuit tolerance. As an example, a 470K ohm resistor may have substituted for it a 510K ohm resistor if the circuit is such as to allow this substitution. In general, resistors and controls have a tolerance of $\pm 20\%$ unless otherwise specified. Therefore a 100K resistor may measure anywhere between 80K and 120K ohms. Tolerances on capacitors are even greater, unless specified. Limits of $+100\%$ and -50% are usual for electrolytic capacitors.

CONSTRUCTION HINTS: USE THE BEST GRADE OF ROSIN CORE SOLDER ONLY, preferably one containing the new activated flexes such as Kester "Resin-Five", Ersin "Multicore" or similar types. **UNDER NO CIRCUMSTANCES USE ACID CORE SOLDER OR ACID FLUX** since acid flux can cause serious corrosion. Before soldering make certain of a good mechanical connection. Use a clean, freshly tinned soldering iron, no smaller than 100 watts, and place the solder on the joint (not on the iron) so that the solder is melted by the heat from the joint itself. Do not remove the soldering iron until the solder flows and check to see that the resulting joint is smooth and shiny when the solder has cooled. There are two extremes to be avoided; too little heat and too much heat. If too little heat is applied, the joint will appear pitted and grey, indicating a rosin joint which is unsatisfactory. On the other hand, if too much heat is applied to a joint, the parts connected to it may either change value, lose their protective coating, or break down. If you are soldering close to a part, hold the lead between the part and the joint being soldered with the tip of a pair of longnose pliers. The pliers will conduct the heat away and prevent the component from being unduly overheated. If for any reason it is necessary to resolder a joint, be sure to use new solder.

It should also be noted that the leads on transformers, capacitors, and resistors are very often longer than necessary. These leads should be trimmed to the proper length when wiring.

CONSTRUCTION PROCEDURE: The complete step-by-step mounting and wiring procedure follows. To keep the drawings uncrowded, unnecessary repetition of mounting or wiring details may be omitted. **Note:** The abbreviation (C) means connect but do not solder (until other leads have been connected). The abbreviation (S) means connect and solder.

() Fig. 1. Mount the 2K Ω CAL. potentiometer, R6, on potentiometer mounting bracket. Bend tabs in toward the shaft as shown. This last instruction does not apply if you are supplied with potentiometers of the snap-in type (blue plastic shafts).

() Fig. 1. Likewise, mount the 2K Ω DC. BAL potentiometer, R16.

() Fig. 1. In a similar manner, mount the 2 Meg Ω Astig. potentiometer, R81.

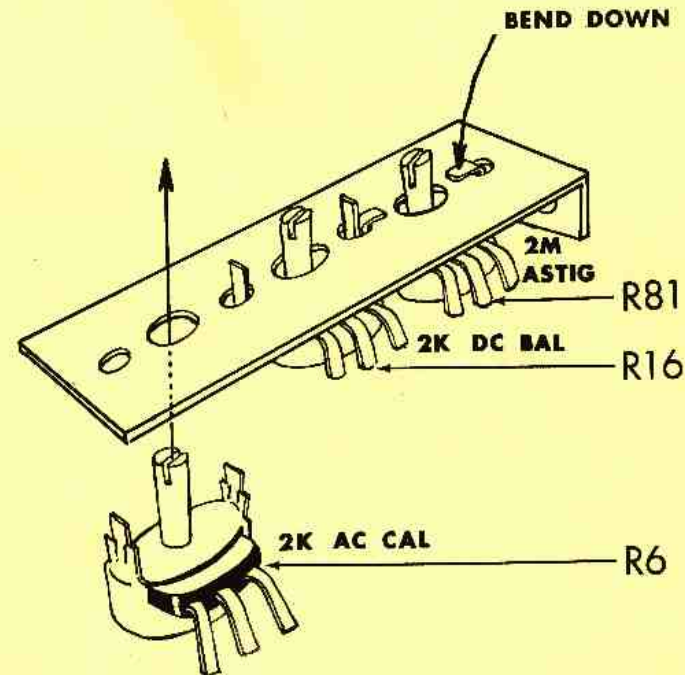


Fig. 1

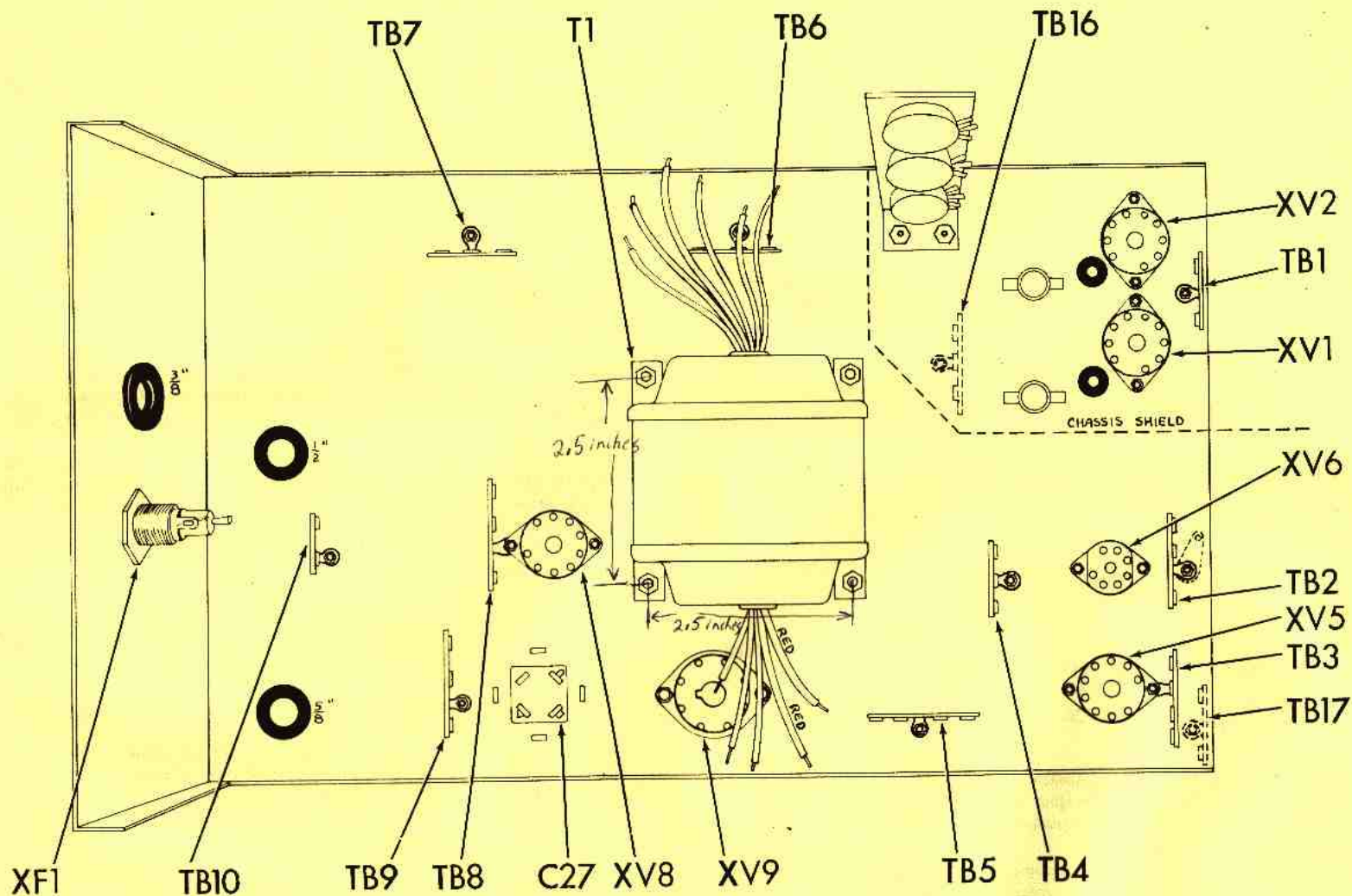


Fig. 2

arc

MAIN CHASSIS ASSEMBLY

() Fig. 2. Mount the octal socket, XV9, as shown. Use two #6-32 X 1/4 screws, two #6 hex nuts, and two #6 lockwashers. Be certain to locate the key as shown.

() Fig. 2. Mount the power transformer, T1, as shown. Use four #8-32 screws, four #8 hex nuts, and four #8 lockwashers. Note that the red leads must emerge from the side of the transformer nearest XV9.

() Fig. 2. Mount sockets XV5 and XV8 as shown. Use two #4-40 screws, two #4 hex nuts, and two #4 lockwashers per socket. In addition, use the three post two-right with ground terminal strip, TB3, with XV5 and a three-post two-right terminal strip, TB8, with XV8.

() Fig. 2. Mount sockets XV1, XV2, and XV6, as shown. Use two #4-40 screws, two #4 hex nuts, and two #4 lockwashers per socket.

() Fig. 2. Mount the following nine terminal strips as shown. Use one #6-32 X 1/4 screw, one #6 hex nut, and one #6 lockwasher per strip:

- | | |
|--------------------------------|---------------------------------------|
| () TB1 (two-post) | () TB9 (three-post two-right) |
| () TB4 (two-post with ground) | () TB10 (one-post right with ground) |
| () TB5 (four-post) | () TB16 (two-post with ground) |
| () TB6 (two-post with ground) | () TB17 (two-post) |
| () TB7 (two-post with ground) | |

Note that TB16 and TB17 are mounted on the top side of the chassis.

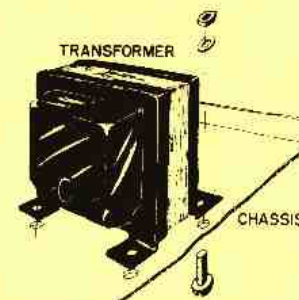
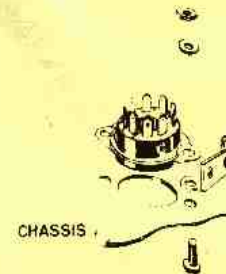
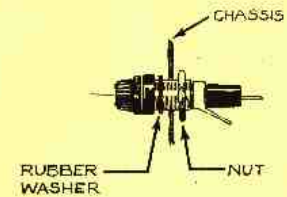
() Fig. 2. Mount TB2 and ground "B" as shown. Use a three-post two-right terminal strip, one #6 ground lug, one #6-32 X 1/4 screw, and one #6 hex nut. (ground lug "B" mounted on top of chassis)

() Fig. 2. Mount the electrolytic capacitor C27 as shown. Note carefully the position of the three code markers (triangle, semi-circle, and square) next to the prongs of the capacitor. Insert the mounting tabs into the slots in the chassis and twist the tabs somewhat less than a quarter-turn. DO NOT twist the tabs excessively or they will shear off.

() Fig. 2. Mount the fuse holder at the rear apron of the chassis, as shown. Use one rubber washer & one fuseholder nut. DO NOT tighten the nut excessively — however, the post should not have any motion when turned by the fingers in either direction.

() Fig. 2. Insert the 3/8", 1/2", 5/8" grommets and two 1/4" grommets in the appropriate holes as shown.

() Fig. 2. Mount the assembled pot bracket as shown. Use two #6-32 X 1/4 screws, two #6 hex nuts, and two #6 lockwashers.



() Fig. 2. The chassis shield is not mounted until after completion of the wiring. However the shield must be taken into account as certain wires will be dressed around it. These wires will be noted in the wiring steps by "SHIELD", and should be dressed into the chassis flange as they pass the pot. mounting bracket.

MAIN CHASSIS WIRING

() Fig. 3. Cut two 8" lengths of yellow wire. Strip the ends and twist the leads tightly together to form a "twisted pair". Connect one end of the twisted pair to XV9-2 & 7 (C). (This means connect one wire end to XV9-2 (C) and the adjacent wire end to XV9-7 (C)). Connect the other end of this pair to XV5-4 & 9 (C). (Shorten the lead to XV5-4 by 1 1/2" before connecting.)

() Fig. 3. Connect a piece of bare wire from XV5-4 (S) to XV5-5 (C).

() Fig. 3. Connect a 3" yellow twisted pair from XV5-5 & 9 (S) to XV6-3 & 4 (C).

() Fig. 3. Connect a 5" yellow twisted pair from XV6-3 & 4 (C) to XV1-4 & 5 (C). This pair must pass thru the shield slot.

() Fig. 3. Twist the yellow transformer leads and connect to TB2-1 & 2 (C).

() Fig. 3. Connect a short piece of bare wire from XV6-4 (S) to TB2-2 (C).

() Fig. 3. Connect a short piece of bare wire from XV6-3 (S) to TB2-1 (C).

() Fig. 3. Connect a 3" yellow twisted pair from XV1-4 & 5 (S) to XV2-4 & 5 (C).

() Fig. 3. Connect a yellow lead from XV2-4 (S) to R6-2 (S). Also, solder XV2-5.

() Fig. 3. Connect a 4" yellow twisted pair to TB2-1 & 2 (S). Leave the other end free.

() Fig. 3. Connect the red transformer leads to XV9-3 & 5 (S).

() Fig. 3. Twist the red-yellow, blue, and white transformer leads together. Connect the red-yellow to TB9-3 (C), the blue to XV8-5 (S), and the white to XV8-4 (S).

() Fig. 3. Connect the brown transformer lead to TB6-2 (C). (SHIELD)

() Fig. 3. Connect a black lead from TB6-2 (S) to R81-1 (S).

() Fig. 3. Twist the green transformer leads tightly and pass thru the 1/2" grommet, as shown.

() Fig. 3. Connect one end of an 18" black lead to TB10-2 (C). Then wrap the rest of the lead around the two black transformer leads to form an 18" twisted pair. Leave the ends near the front of the chassis free.

() Fig. 3. Connect one of the two black transformer leads to XF1-2 (S). Extend the other black transformer lead toward XV1

() Fig. 3. Connect one end of a 15" yellow twisted pair to XV9-2 & 7 (S). Pass the other end thru the 5/8" grommet.

() Fig. 3. Connect a 500 Ω 5W resistor, R77, from XV9-8 (C) to C27-B (C).

() Fig. 3. Connect a piece of bare wire from XV9-8 (S) to C27-A (S).

() Fig. 3. Connect three pieces of bare wire covered with spaghetti as follows:

() C27-B (S) to TB9-1 (C).

() C27-D (C) to TB9-3 (C).

() C27-C (C) to TB9-2 (C).

() Fig. 3. Connect a 500 Ω 5W resistor, R78, from TB9-1 (C) to TB9-2 (C).

() Fig. 3. Connect a red lead from TB9-1 (S) to TB7-1 (C).

() Fig. 3. Connect a 500 Ω 5W resistor, R79, from TB9-3 (C) to the capacitor twist prong which lies between C27-A and C27-D. Solder the resistor to the twist prong, and solder the prong directly to the chassis to ensure a good ground connection.

() Fig. 3. Connect a red lead from C27-C (S) to TB4-1 (C).

() Fig. 3. Connect a one foot red lead to TB9-2 (S). Pass the other end thru the 5/8" grommet.

() Fig. 3. Connect a 50 mfd 50V capacitor, C28 between TB9-3 (C) and TB10-1 (C). Note that the positive lead goes to ground (TB10-1). Use spag.

() Fig. 3. Connect the "outside foil lead" of a .1 mfd 1000V capacitor, C25, to TB10-1 (C). Pass the other lead thru TB8-1 (C) and connect to XV8-9 (S).

() Fig. 3. Connect the "outside foil" lead of a .1 mfd 1000V capacitor, C26, from TB10-1 (S) to TB8-2 (C).

() Fig. 3. Connect a 220K 1W resistor, R73, from TB8-2 (C) to TB8-1 (S).

() Fig. 3. Connect a 220K 1/2W resistor, R71, from TB8-2 (C) to TB8-3 (C).

() Fig. 3. Connect the "outside foil" lead of a .1 mfd 1000V capacitor, C23, to TB7-3 (C). Connect the other end to TB8-3 (C).

() Fig. 3. Connect a one foot green lead to TB8-3 (S). Pass the other end thru the 1/2" grommet.

() Fig. 3. Connect a green lead from TB7-3 (S) to XV6-2 (C).

() Fig. 3. Connect a red lead from TB7-1 (C) to R81-3 (S). (SHIELD)

- () Fig. 3. Connect a 2500Ω 5W resistor, R29, from TB7-1 (S) to TB6-3 (C).
- () Fig. 3. Connect a 2500Ω 5W resistor, R19, from TB6-1 (C) to TB6-3 (C).
- () Fig. 3. Connect a 16mfd 350V capacitor, C10, from TB6-3 (C) to TB7-2 (S). Note that the negative lead goes to ground (TB7-2).
- () Fig. 3. Connect a red lead from TB6-1 (S) to R16-2 (C). (SHIELD)
- () Fig. 3. Connect a brown lead from C27-D (S) to TB5-1 (C).
- () Fig. 3. Connect a 22K 1/2W resistor, R63, from TB5-1 (C) to TB5-2 (C).
- () Fig. 3. Connect a 470K 1/2W resistor, R68, from TB5-3 (C) to TB4-1 (C).
- () Fig. 3. Connect a 100K 1W resistor, R57, from TB5-4 (C) to TB4-1 (C).
- () Fig. 3. Connect a short red lead from TB4-1 (C) to TB4-3 (C).
- () Fig. 3. Connect an 8" red lead to TB4-1 (S). Leave the other end free.
- () Fig. 3. Connect a red lead from XV5-1 (S) to TB5-4 (C).
- () Fig. 3. Connect a 10mfd 150V capacitor, C15, from TB5-4 (S) to the ground lug on XV9 (S) as shown. Note that the negative lead goes to ground.
- () Fig. 3. Connect a 100Ω resistor, R55, from XV5-2 (S) to TB3-3 (C).
- () Fig. 3. Connect a 2.2K 1/2W resistor, R58 from XV5-3 (C) to TB3-4 (C).
- 15 () Fig. 3. Connect a 2.2 meg 1/2W resistor, R56, from TB3-3 (C) to TB3-4 (S).
- 16 () Fig. 3. Connect a 22K 1/2W resistor, R59, from TB3-2 (C) to TB3-4 (S).
- () Fig. 3. Pass one lead of a 2.2 meg 1/2W resistor, R46, thru TB3-2 (C) and connect to XV5-8 (C). Pass the other end thru TB3-1 (C) and connect to XV5-7 (S). (Use spaghetti.)
- () Fig. 3. Connect a 33K resistor, R49, from XV6-6 (C) to XV5-8 (S).
- () Fig. 3. Connect a 4.7K 2W resistor, R52, from XV6-7 (S) to TB4-2 (S).
- () Fig. 3. Connect a 10K 2W resistor, R48, from XV6-1 (C) to TB4-3 (C).
- () Fig. 3. Connect a 22K 1W resistor, R47, from XV6-1 (S) to XV5-6 (S).
- () Fig. 3. Connect a 22K 1/2W resistor, R50, from XV6-6 (S) to XV6-2 (C).
- () Fig. 3. Connect a 100K resistor, R51, from XV6-2 (S) to TB4-3 (S).
- () Fig. 3. Connect a piece of bare wire from XV6-5 (S) to TB2-3 (C).
- () Fig. 3. Connect a blue lead thru the 1/4" grommet from XV1-1 (S) to TB16-1 (C). (Fig. 10)
- () Fig. 3. Connect a blue lead thru the 1/4" grommet from XV2-1 (S) to TB16-3 (C). (Fig. 10)
- () Fig. 10. Connect a 47K resistor, R22, from TB16-1 (C) to TB16-2 (C).
- () Fig. 10. Connect a 47K resistor, R23, from TB16-3 (C) to TB16-2 (S).
- () Fig. 3. Connect a 100Ω resistor, R20, from XV1-9 (C) to XV1-2 (S).
- () Fig. 3. Connect a 100Ω resistor, R21, from XV2-9 (C) to XV2-2 (S).
- () Fig. 3. Connect a short blue lead from XV1-6 (S) to XV2-6 (C).
- () Fig. 3. Connect a short red lead from XV1-8 (S) to XV2-8 (C).
- () Fig. 3. Connect a 3.9K resistor, R13, from XV2-8 (S) to R16-2 (S).
- () Fig. 3. Connect an 820Ω 2W resistor, R11, from TB1-2 (C) to XV2-6 (S).
- () Fig. 3. Connect a brown lead from TB1-2 (S) to TB5-1 (S). This lead must pass thru the shield slot.
- () Fig. 3. Connect a .01mfd 500V disc capacitor, C9, and a 220K resistor, R12, from XV2-7 (S) to TB1-1 (C).
- () Fig. 3. Insert snap-in coils L1 and L2 as shown.
- () Fig. 3. Connect a 2.2K 2W resistor, R15, from L2-2 (C) to R16-1 (S).
- () Fig. 3. Connect a 2.2K 2W resistor, R17, from L1-2 (C) to R16-3 (S).
- () Fig. 3. Connect a 10K 1/2W resistor, R18, from L2-2 (S) to L2-1 (C).
- () Fig. 3. Connect a 10K 1/2W resistor, R14, from L1-2 (S) to L1-1 (C).
- () Fig. 3. Connect a short blue lead from L2-1 (S) to XV2-9 (S).
- () Fig. 3. Connect a short blue lead from L1-1 (S) to XV1-9 (S).
- () Fig. 3. Connect an 8" brown lead to TB9-3 (S). Pass the other end thru the 5/8" grommet.
- () Fig. 3. Connect a 2 foot grey lead to RB1-2 (S). Route the lead as shown and pass the other end thru the 5/8" grommet.
- () Fig. 3. Connect a red lead from XV1-3 (S) to XV2-3 (C).
- () Fig. 3. Connect a red lead from XV2-3 (S) to TB6-3 (S). (SHIELD)

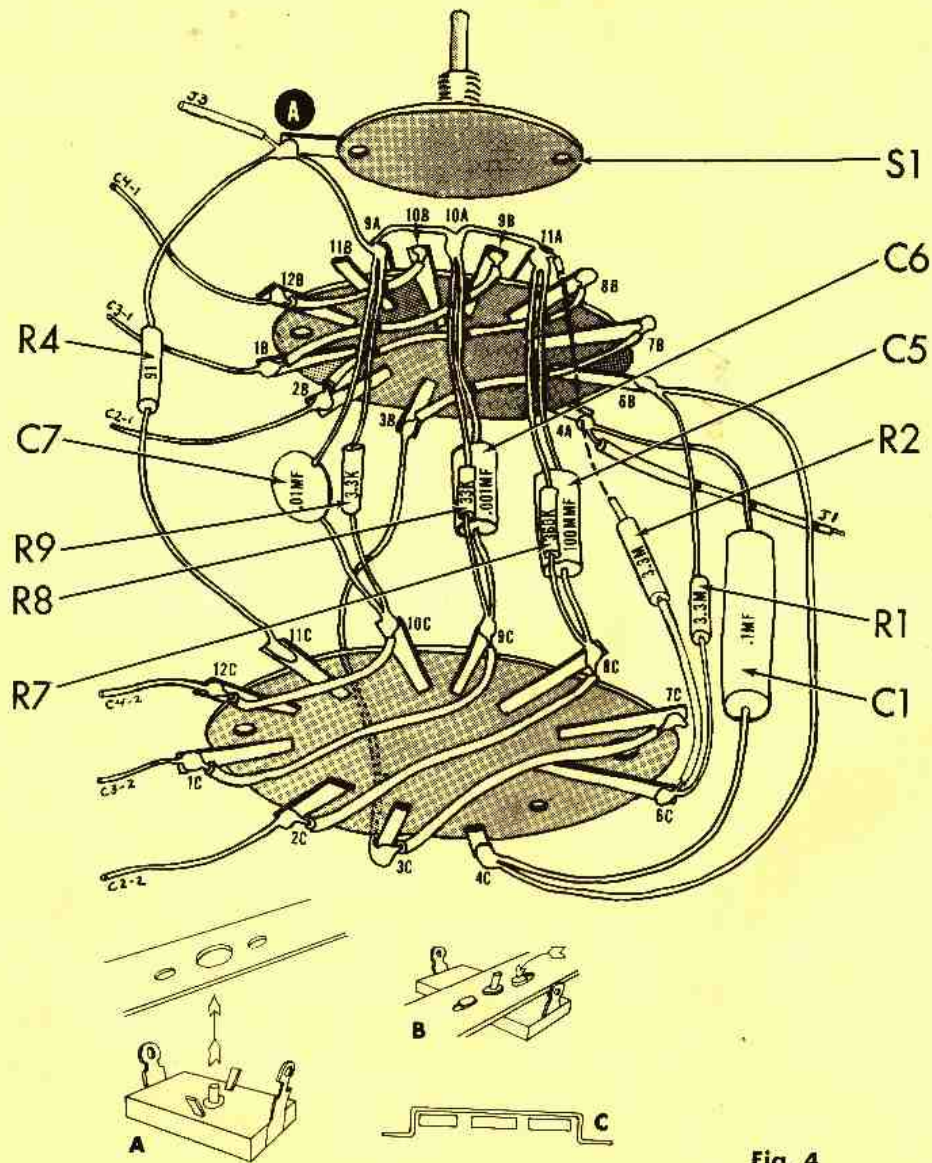


Fig. 4

VERTICAL INPUT SWITCH, S1, WIRING

() Fig. 4. Note the lug, identified as "ground A", which lies between (and identifies) terminals 1 and 12. Connect ten jumpers (use bare wire covered with spaghetti) between the following switch terminals:

- | | |
|---|---|
| <input checked="" type="checkbox"/> 12B (C) and 10B (S) | <input checked="" type="checkbox"/> 1C (C) and 9C (C) |
| <input checked="" type="checkbox"/> 1B (C) and 9B (S) | <input checked="" type="checkbox"/> 2C (C) and 8C (C) |
| <input checked="" type="checkbox"/> 2B (C) and 8B (S) | <input checked="" type="checkbox"/> 3C (C) and 7C (S) |
| <input checked="" type="checkbox"/> 3B (C) and 7B (S) | <input checked="" type="checkbox"/> 6B (C) and 4C (C) |
| <input checked="" type="checkbox"/> 12C (C) and 10C (C) | <input type="checkbox"/> 3B (S) and 3C (S) |

Fig. 4. Connect a 3.3 meg resistor, R1, from 6B (S) to 6C (C).

Fig. 4. Connect a 360K resistor, R7, and a 100 mmf capacitor, C5 from 11A (C) to 8C (S).

Fig. 4. Connect a 33K resistor, R8, and a 1000 mmf mica capacitor, C6, from 10A (C) to 9C (S).

Fig. 4. Connect a 3.3K resistor, R9, and a .01 mfd 500V disc capacitor, C7, from 9A (C) to 10C (S).

Fig. 4. Connect a 3.3M resistor, R2, from 11A (C) to 6C (C). Use spaghetti on both leads.

Fig. 4. Connect ground "A" (C), 9A (S), 10A (S), and 11A (S) by a piece of bare wire. Be careful not to short out any nearby switch terminals.

Fig. 4. Connect a 91 Ω resistor R4, from 11C (C) to ground "A" (C).

Fig. 4. Connect a 2" length of bare wire to the following terminals (leave the other ends free):

- | | | | |
|---|---------------------------------|----------------------------------|---------------------------------|
| <input type="checkbox"/> ground "A" (S) | <input type="checkbox"/> 1B (S) | <input type="checkbox"/> 12C (S) | <input type="checkbox"/> 1C (S) |
| <input type="checkbox"/> 12B (S) | <input type="checkbox"/> 2B (S) | <input type="checkbox"/> 2C (S) | |

Fig. 4. Connect a .1 mfd 600 V 10% capacitor, C1, from 4A (C) to 4C (S).

Fig. 4. Connect a 4" length of green wire to 4A (S). Leave the other end free.

Fig. 4. Assemble trimmers C2, C3, and C4 to trimmer bracket as shown in Figs. 4A, 4B, and 4C. Each of the trimmers is laid on the concave side of the bracket, tabs and mounting stud going into the corresponding holes as shown in Fig. 4A. The tabs on each trimmer are then bent over as shown in Fig. 4B. Fig. 4C is a profile view of the completed assembly.

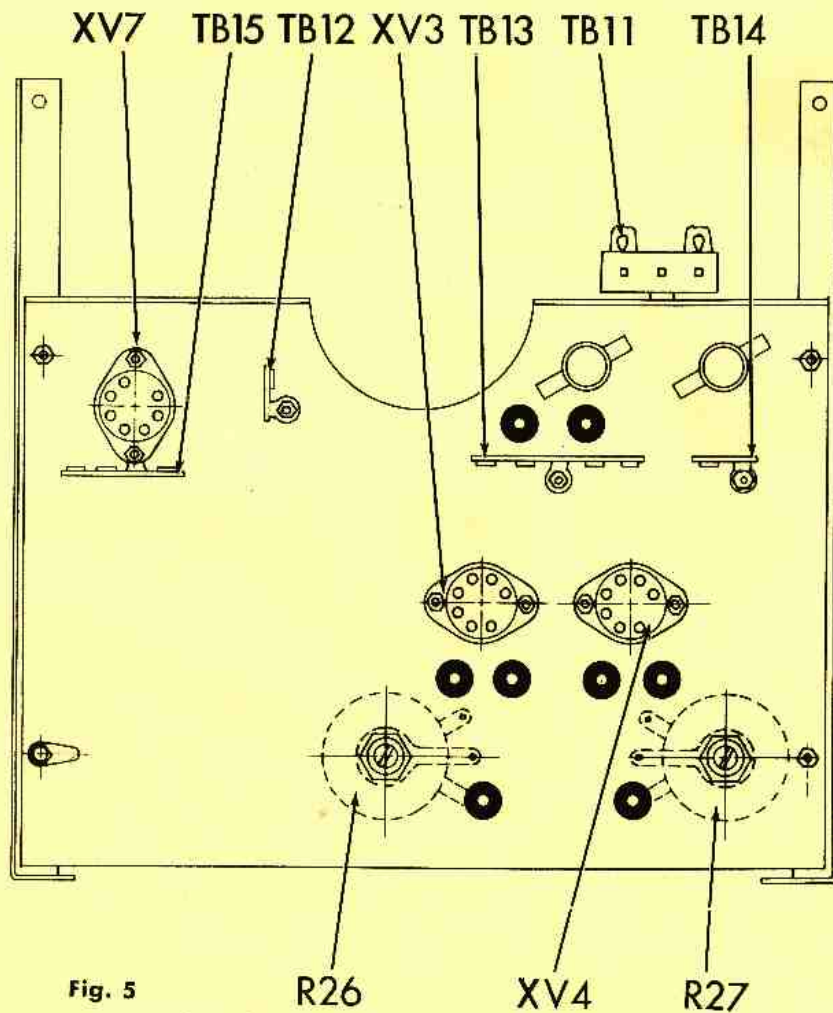


Fig. 5

REAR CHASSIS MOUNTING

() Fig. 5. Attach the two rear chassis supports to the rear chassis as shown. Use four #6-32 X 1/4 screws, four #6 hex nuts, three #6 lockwashers, and one #6 ground lug.

() Fig. 5. Mount the socket XV7 as shown. Use two #4-40 screws, two #4 hex nuts, two #4 lockwashers, and one three-post two-right terminal strip, TB15.

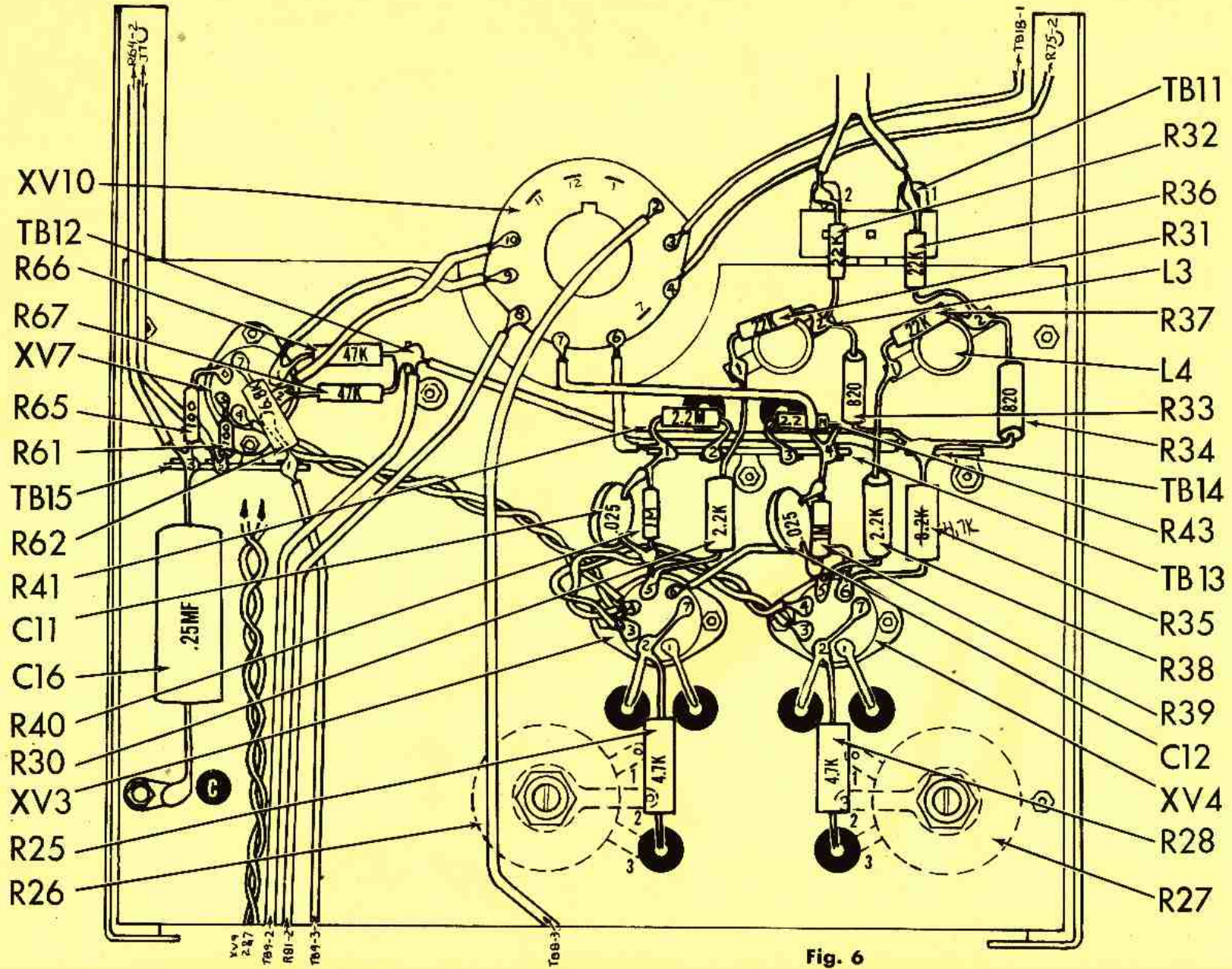
() Fig. 5. Mount sockets XV3 and XV4 as shown. Use two #4-40 screws, two #4 hex nuts and two #4 lockwashers per socket.

() Fig. 5. Mount the following terminal strips as shown. Use one #6-32 X 1/4 screw, one #6 hex nut, and one #6 lockwasher per strip:

- () TB11 (two-post)
- () TB12 (one-post right)
- () TB13 (four-post)
- () TB14 (one-post left)

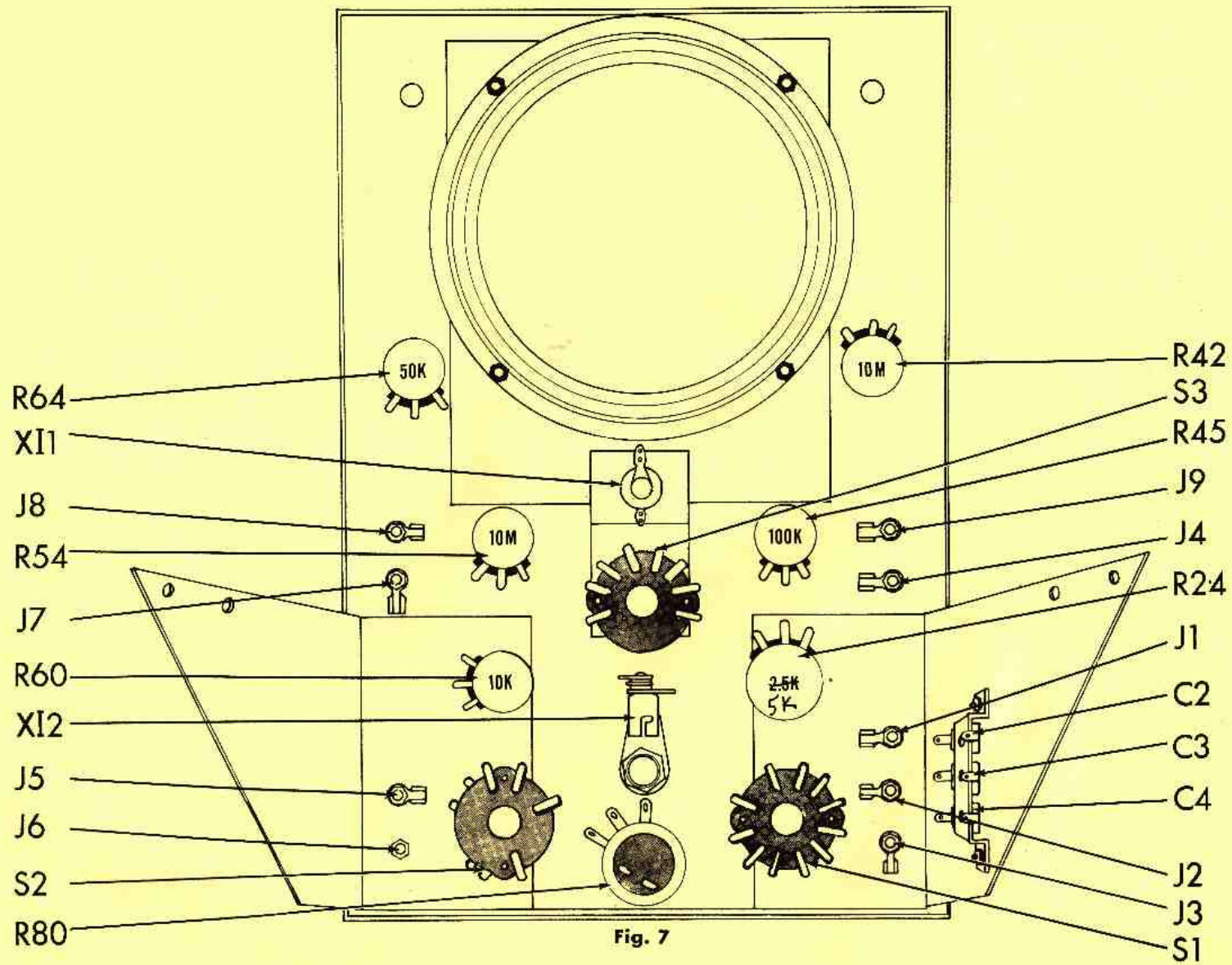
() Fig. 5. Insert eight 1/4" grommets as shown.

() Fig. 5. Mount the two 5000Ω pots., R26 and R27, as shown. Note that these pots. are mounted behind the chassis, with only the slotted shafts visible. Use one 3/8" lockwasher, and one pot. grounding lug per pot. Make sure that the ground lugs are under the center terminals.



REAR CHASSIS WIRING

- () Fig. 6. Connect a 4" yellow twisted pair from XV4-3 & 4 (S) to XV3-3 & 4 (C).
- () Fig. 6. Connect one end of a 5" yellow twisted pair to XV3-3 & 4 (S). Connect the other end to XV7-3 & 4 (C).
- () Fig. 6. Connect a 100 Ω resistor, R65, from TB15-3 (C) to XV7-6 (S).
- () Fig. 6. Connect a 100 Ω resistor, R61, from TB15-2 (C) to XV7-5 (S).
- () Fig. 6. Connect a .25 mfd 400V capacitor, C16, from TB15-3 (C) to ground "C" (S).
- () Fig. 6. Connect a 47K resistor, R66, from XV7-1 (C) to TB12 (C).
- () Fig. 6. Connect a 47K resistor, R67, from XV7-2 (C) to TB12 (C).
- () Fig. 6. Connect a red lead from TB12 (C) to TB14 (C).
- () Fig. 6. Connect a 6.8K resistor R62 from XV7-7 (S) to TB15-1 (C).
- () Fig. 6. Connect a red lead from XV3-6 (S) to XV4-6 (C).
- () Fig. 6. Connect an ^{4.7k}~~2.2K~~ resistor, R35, from XV4-6 (S) to TB14 ^C~~(S)~~.
- () Fig. 6. Connect a 4.7K resistor, R25, from XV3-2 & 7 to R26-3 (S), as follows: (Pass one lead of the resistor thru pin 2, straight across the socket, and thru pin 7, soldering at pin 7 only). The lower resistor lead must pass thru the 1/4" grommet, as shown, before being connected to R26.
- () Fig. 6. Connect a 4.7K resistor, R28, between XV4-2 & 7 and R27-3 (S) using the above procedure.
- () Fig. 6. Wrap the leads of a .025mfd capacitor, C11, around the leads of a 1 meg resistor, R40. Solder the wraps and snip off the excess capacitor lead, leaving the resistor leads full length. Connect this network between TB13-1 (C) and XV3-5 (C). Snip off the excess resistor lead.
- () Fig. 6. Repeat above procedure for C12 and R39. Connect between TB13-4 (C) and XV4-5 (C).
- () Fig. 6. Insert snap-in coils L3 and L4 as shown.
- () Fig. 6. Connect an 820 Ω 1W resistor, R33, from L3-2 (C) to TB14 (C).
- () Fig. 6. Connect an 820 Ω 1W resistor, R34, from L4-2 (C) to TB14 (S).
- () Fig. 6. Connect a 22K 1/2W resistor, R31 from L3-1 (C) to L3-2 (C).
- () Fig. 6. Connect a 22K 1/2W resistor, R37, from L4-1 (C) to L4-2 (C).
- () Fig. 6. Connect a 22K 1/2W resistor, R32, from L3-2 (S) to TB11-2 (C).
- () Fig. 6. Connect a 22K 1/2W resistor, R36, from L4-2 (S) to TB11-1 (C).
- () Fig. 6. Connect a 2.2K 2W resistor, R30, from XV3-5 (S) to L3-1 (S).
- () Fig. 6. Connect a 2.2K 2W resistor, R38, from XV4-5 (S) to L4-1 (S).
- () Fig. 6. Connect a 2.2 meg 1/2W resistor, R41 from TB13-1 (C) to TB13-2 (C).
- () Fig. 6. Connect a 2.2 meg 1/2W resistor, R43, from TB13-3 (C) to TB13-4 (C).
- () Fig. 6. Connect a 3" green lead from TB13-1 (S). Leave the other end free.
- () Fig. 6. Connect a 3" green lead to TB13-4 (S). Leave the other end free.
- () Fig. 6. Connect a 3" blue lead to XV7-1 (S). Leave the other end free.
- () Fig. 6. Connect a 3" blue lead to XV7-2 (S). Leave the other end free.
- () Fig. 6. Solder the potentiometer ground lugs under R26 and R27 to their respective rotors (center terminals).



FRONT PANEL ASSEMBLY

() Fig. 7. Mount the Vertical and Horizontal Input switches (S1, S2), the Vertical and Horizontal gain controls (R24, R60), and the two front brackets as shown. Use one 3/8" nut, one 3/8" lockwasher, and one 3/8" flatwasher per control. Do not tighten these four nuts as yet.

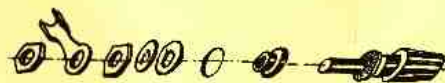
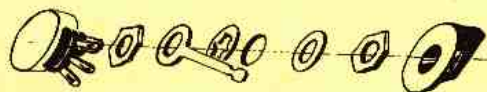
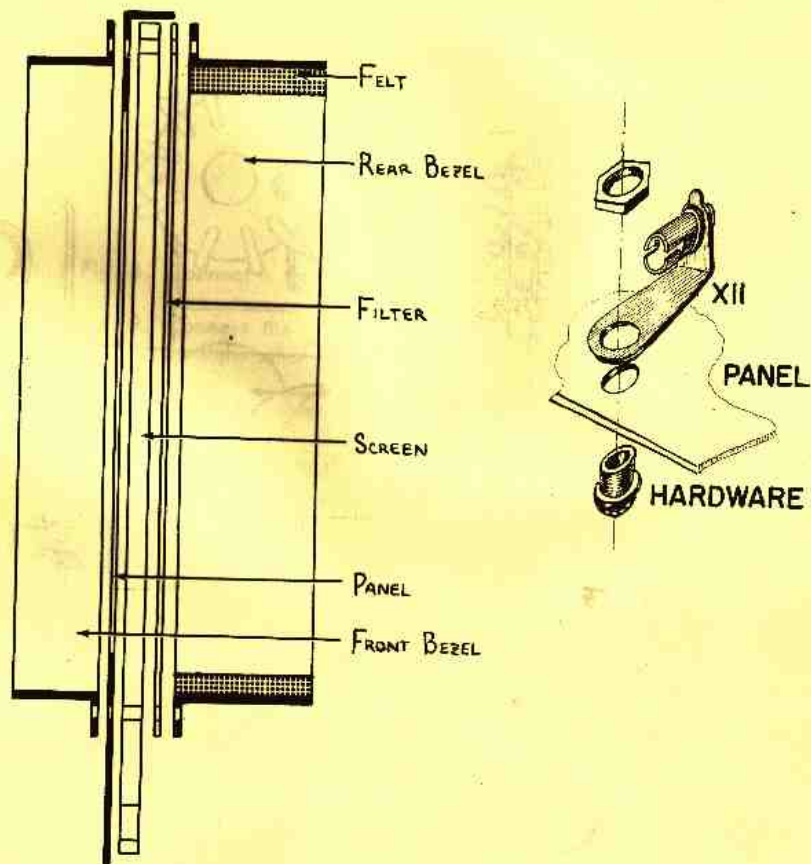
() Fig. 7. Assemble the five input binding posts, J1, J2, J3, J5, J6, as shown. Use one fiber shoulder washer, one fiber flat washer, one #8 lockwasher and one #8 hex nut for each post except the two ground posts, J3, J6 — these two do not require the fiber flat washers. Again, do not tighten the nuts until you have made certain that the three insulated posts are not grounded. Then tighten the binding posts and the four control nuts in the preceding step. Before tightening, orient each binding post so the small wire hole is horizontal.

() Fig. 7. Mount the Vertical Position (R42), Horizontal Position (R64), Phasing (R45), Sweep Vernier (R54), and Illumination (R80) controls as shown. Use two 3/8" nuts, one 3/8" lockwasher, and one 3/8" flat washer per control. In addition, use a pot. grounding lug under the arm of R42.

() Fig. 7. Assemble the four remaining binding posts, J4, J7, J8, J9, as shown. Use one #8 fiber shoulder washer, one #8 fiber flat washer, one #8 hex nut, and one #8 lockwasher per post.

() Fig. 7. Mount the bezel assembly as shown. Use the front and rear bezels (the front bezel is the shorter one), the screen, the green filter, the illumination bracket, the sweep selector switch (S3), snap-in pilot bracket (X11), one 3/8" lockwasher, one 3/8" flat washer, one 3/8" hex nut, four #6-32 X 3/8 screws, four #6 lockwashers, and four #6 hex nuts. Assemble the following components in sequence: front bezel, front panel, screen (markings away from the front panel, large hole down), green filter, and rear bezel. Fasten these together with the #6 hardware. Then mount S3 with illumination bracket by compressing the two long springy sides of the V-shaped metal portion of X11 and inserting the compressed ends in the hole in the illumination portion. Release the ends into the mating slots of the hole.

() Fig. 7. Mount the screw-in pilot assembly X12, as shown.



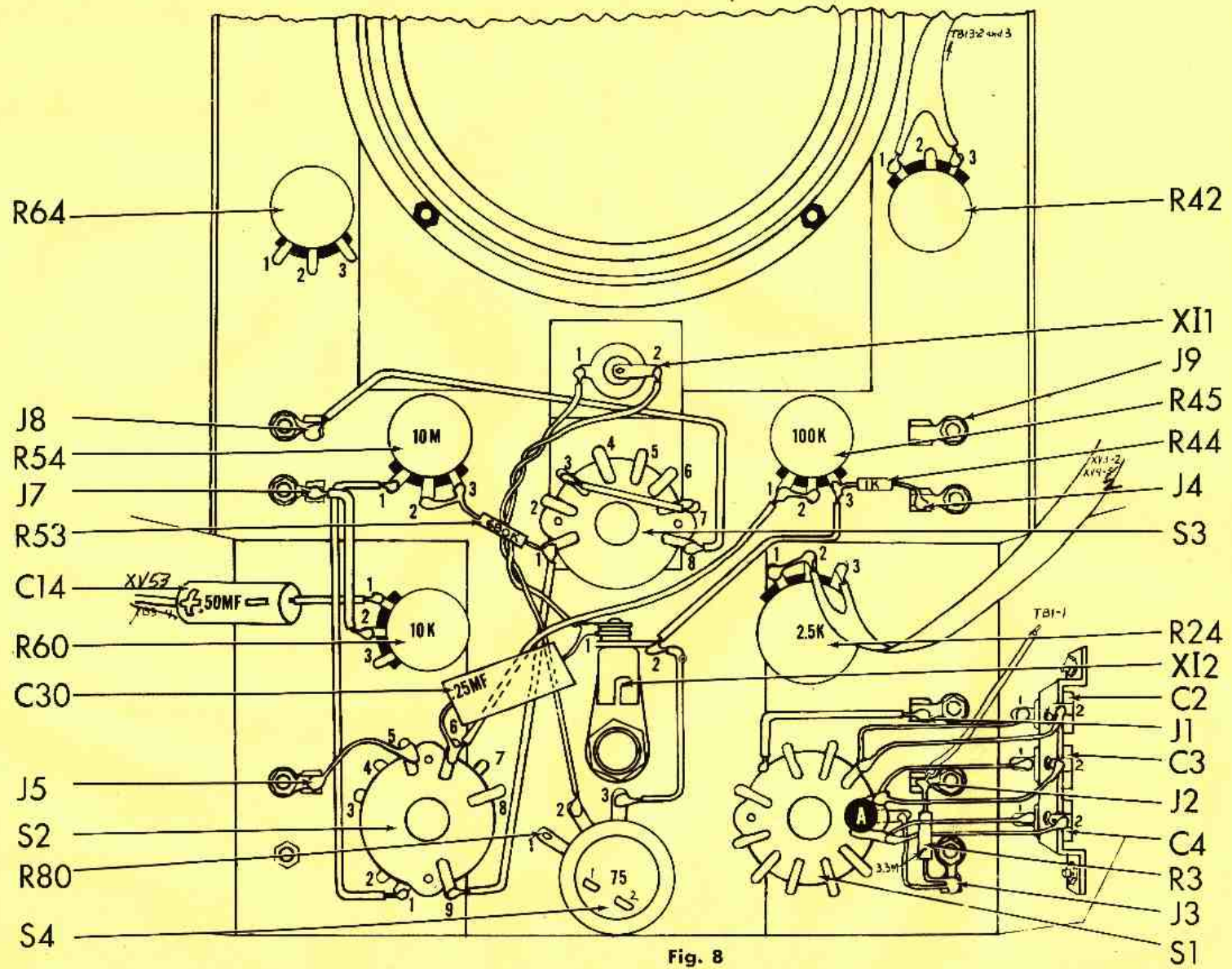


Fig. 8

FRONT PANEL WIRING

- () Fig. 8. Connect a 680K resistor, R53, from R54-2 & 3 (S) to S3-1 (C).
- () Fig. 8. Connect a short bare wire covered with spaghetti from S3-3 (S) to S3-7 (C).
- () Fig. 8. Connect a green lead from S3-1 (S) to S2-9 (C).
- () Fig. 8. Connect a .25mfd 400V capacitor, C30, from S2-6 (lug closer to panel) (C) to X12-1 (C). Note that the two lugs S2-6 are connected mechanically and electrically by the rivet.
- () Fig. 8. Connect a short black lead from X12-2 (C) to R80-3 (S).
- () Fig. 8. Connect a 7" yellow twisted pair from X11-1 & 2 (S) to X12-1 (C) and R80-2 (S).
- () Fig. 8. Connect a yellow lead from S2-6 (both lugs) (S) to R45-1 & 2 (S). Be sure to solder both lugs S2-6.
- () Fig. 8. Connect a yellow lead from R45-3 (C) to X12-2 (C).
- () Fig. 8. Connect a 1K resistor, R44, from R45-3 (S) to J4 (S). To make connection to this and the other posts, place a #8 solder lug on the existing #8 hex nut and secure by means of a second #8 hex nut.
- () Fig. 8. Connect a short piece of bare wire from J5 (S) to S2-5 (both lugs) (S).
- () Fig. 8. Connect a short piece of black wire from R60-2 (S) to J7 (C).
- () Fig. 8. Connect the negative end of a 50mfd 50V capacitor, C14, to R60-1 (S). Leave the other end free.
- () Fig. 8. Connect a green lead from S3-8 (S) to J8 (S).
- () Fig. 8. Connect a grey lead from R54-1 (S) to S2-1 (S).
- () Fig. 8. Connect the green lead from S1 to J1 (S).
- () Fig. 8. Connect a 3.3 meg resistor, R3, from J2 (C) to J3 (C).
- () Fig. 8. Connect a 4" green lead to J2 (S). Leave the other end free.
- () Fig. 8. Connect the ground lug on S1 (S) to the grounded jack, J3 (S).
- () Fig. 8. Mount the trimmer assembly to the side bracket as shown. Use two #6-32 X 1/4 screws, two #6 hex nuts, and two #6 lockwashers.
- () Fig. 8. Connect the six bare leads from S1 to C2, C3, and C4, as follows:
 - () S1-2B to C2-1 (S)
 - () S1-1B to C3-1 (S)
 - () S1-12B to C4-1 (S)
 - () S1-2C to C2-2 (S)
 - () S1-1C to C3-2 (S)
 - () S1-12C to C4-2 (S) (See Fig. 4)

30
1
0
12

FINAL ASSEMBLY AND WIRING

() Fig. 9. Assemble the front panel to the main chassis. Use four #6-32 X 1/4 screws, four #6 lockwashers, and four #6 hex nuts. Join the four holes on the side lips of the main chassis to the four corresponding holes on the side brackets.

() Fig. 9. Assemble the rear chassis to the main chassis. Use the same hardware as above. Join the four holes on the rear chassis supports to the four corresponding holes on the top of the main chassis.

() Fig. 9. Assemble the two struts to the rear chassis supports as shown. Use one #6-32 X 1/4 screw, one #6 lockwasher, and one #6 hex nut per strut.

() Fig. 9. Join the struts to the front panel by means of the Intensity control, R72 (250K), and the Focus control, R75 (2 meg), as shown. Use one 3/8" hex nut, one 3/8" lockwasher and one 3/8" flat washer per control.

() Fig. 9. Mount TB18 and TB19 as shown. Use one #6-32 X 1/4 screw, one #6 lockwasher, and one #6 hex nut per strip.

() Fig. 10. Connect a .1 mfd 10% capacitor, C17, from S3-7 (S) to ground "B" (C).

() Fig. 10. Connect a .01 mfd 10% capacitor, C18, from S3-6 (S) to ground "B" (C).

() Fig. 10. Connect a .001 mfd 10% capacitor, C19, from S3-5 (S) to ground "B" (C).

() Fig. 10. Connect a 68mmf 10% capacitor, C20, from S3-4 (S) to ground "B" (C). Allow the grounded lead to pass thru the ground lug — do not clip off the excess.

() Fig. 10. Connect a 270mmf capacitor, C21, from S3-2 (C) to ground "B". (C) Again, do not clip off the excess lead at the ground lug.

() Fig. 10. Connect a mica trimmer capacitor, C22, to ground "B" (S) by means of the two leads remaining on C20 & C21. Connect the other end of the trimmer to S3-2 (S) by means of a small piece of bare wire. Before soldering, make certain that the adjusting screw is accessible from the right side of the scope and that the plate of the trimmer just under the adjusting screw is used as the ground side.

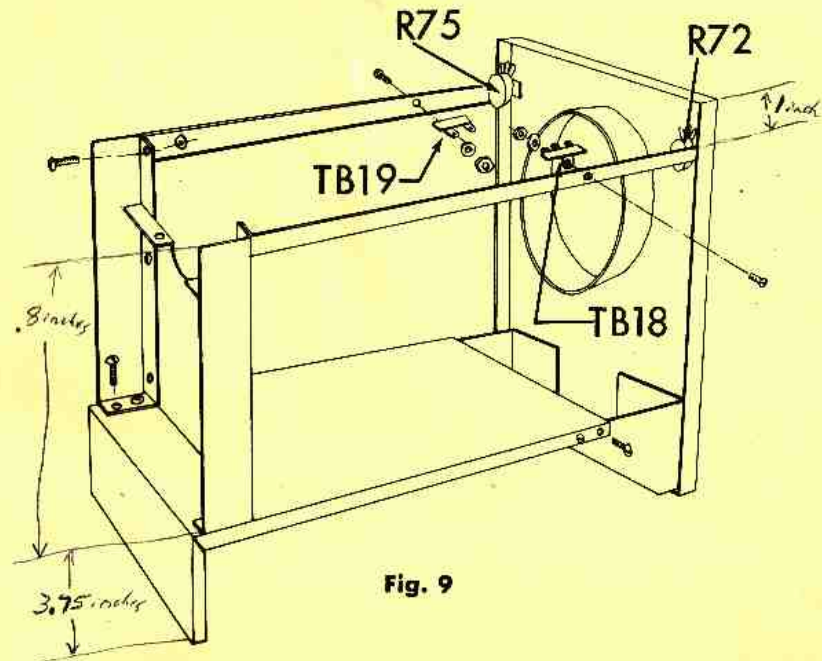


Fig. 9

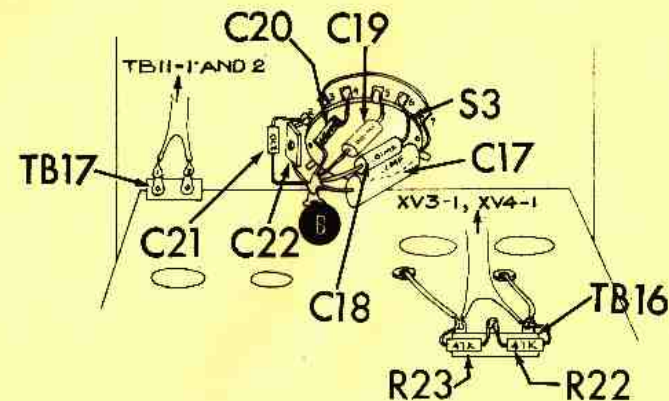


Fig. 10

() Fig. 3. Connect the yellow twisted pair from TB2-1 & 2 to XI2-1 & 2 (S) (Fig. 8).

() Fig. 8. Connect the green lead from J2 to TB1-1 (S) (Fig. 3).

() Fig. 3. Connect a .01 mfd disc capacitor, C8 and 220K resistor, R10, from XV1-7 (S) to S1-6C (S) (Fig. 8).

() Fig. 3. Connect an 820 Ω 5% resistor, R5, from R6-1 (S) to S1-11C (S) (Fig. 8).

() Fig. 3. Connect the black twisted pair (from the power transformer and the fuse post) to S4-1 & 2 (S) (Fig. 8).

() Fig. 8. Connect a piece of bare wire from R60-3 (S) to TB3-2 (S). (Fig. 3).

() Fig. 8. Connect the positive lead of C14 to XV5-3 (S) (Fig. 3).

() Fig. 8. Connect a green lead from S2-9 (S) to TB2-3 (S) (Fig. 3).

() Fig. 8. Connect a .1 mfd 400V capacitor, C29, from S2-7 (S) to TB3-1 (S) (Fig. 3). Use spaghetti.

() Fig. 8. Connect a .25 mfd 400V capacitor, C13 from S2-8 (S) to TB3-3 (S) (Fig. 3).

() Fig. 11. Strip both ends of 10" length of twin lead as shown. Connect one end to TB16-1 & 3 (S). Without twisting the lead, pass the two leads of the other end thru the two 1/4" grommets nearest XV3-1 and XV4-1, respectively. Connect and solder the leads to these points.

() Fig. 11. Connect one end of a 15" length of twin lead ^{connect 1/4 2} to R24-2 & 3 (S). Without twisting, pass the two leads of the other end thru the two 1/4" grommets nearest XV3-2 and XV4-2, respectively. Connect and solder the leads to these points.

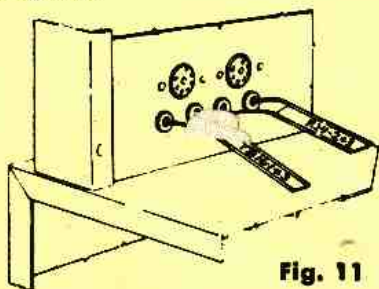


Fig. 11



NOTE

WHEN LEADS ARE CONNECTED TO TERMINAL BOARD, DIMENSION "A" SHOULD BE 1/2 INCH.

WHEN LEADS PASS THRU REAR PANEL CHASSIS, DIMENSION "A" SHOULD BE 1 1/2 INCH.

() Fig. 8. Connect a blue lead from S2-4 (S) to TB17-1 (C) (Fig. 10).

() Fig. 8. Connect a brown lead from S2-3 (S) to TB17-2 (C) (Fig. 10).

() Fig. 10. Connect one end of a 19" length of twin lead to TB17-1 & 2 (S). Without twisting the lead, connect the other end to TB11 (Fig. 6) so that the lead connects TB17-1 to TB11-2 (S) and TB17-2 to TB11-1 (S).

() Fig. 8. Solder the grounding lug under R42-2 (S) and connect one end of a 15" length of twin lead to R42-1 & 3 (S). Without twisting the lead, pass the two leads of the other end thru the 1/4" grommets above TB13 (Fig. 6). Connect the leads to TB13-2 & 3 (S).

() Fig. 3. Connect a red lead from TB5-3 (S) to R64-3 (S). (Fig. 8)

() Fig. 3. Connect a brown lead from TB5-2 (S) to R64-1 (S) (Fig. 8).

() Fig. 3. Connect the red lead from TB9-2 going up thru the 5/8" grommet to TB12 (S) (Fig. 6).

() Fig. 3. Connect the brown lead from TB9-3 going up thru the 5/8" grommet to TB15-1 (S) (Fig. 6).

() Fig. 12. Connect a grey lead from TB19-2 (C) to R72-3 (C).

() Fig. 12. Connect a 470K 1W resistor, R74, from R75-3 (S) to TB19-2 (S).

() Fig. 12. Connect a 2.2 meg 1W, resistor, R76, from R75-1 (S) to TB19-1 (S).

() Fig. 12. Connect a 2.2 meg 1/2W resistor, R70, from TB18-2 (S) to TB18-3 (C).

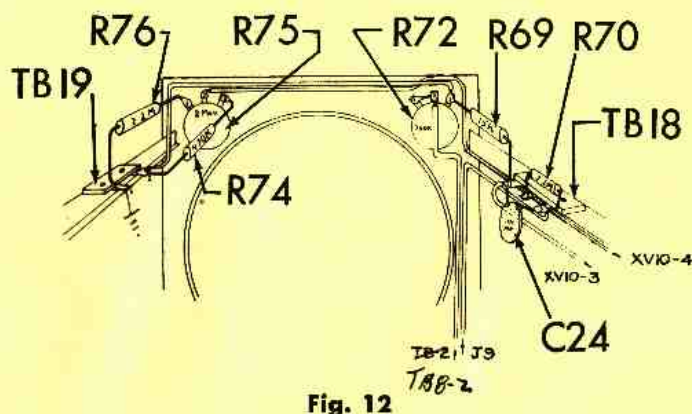


Fig. 12

- () Fig. 12. Connect a .01 mfd disc capacitor, C24, from TB18-1 (C) to TB18-3 (C).
- () Fig. 12. Connect a 15K 1/2W resistor, R69, from R72-3 (S) to TB18-1 (C).
- () Fig. 6. Connect a brown lead from TB15-3 (S) to R64-2 (S), passing the lead along the strut as shown (Fig. 8).
- () Fig. 6. Connect a green lead from TB15-2 (S) to J7 (S), passing the lead along the strut as shown (Fig. 8).
- () Fig. 7. Insert the large felt in the rear bezel. (A few drops of glue will hold the felt to the rear bezel securely.)
- () Fig. 7. CAREFULLY remove the 5UP1 from its carton and insert in the felt-lined rear bezel. Clamp in place with the two CRT clamps. Use the small felt, two #6-32 X 3/4 screws, two #6 hex nuts, and two #6 lockwashers. Be sure the clamps are on the tube base — NOT on the glass. Insert the CRT under the twin lead from TB17 to TB11.
- () Fig. 6. Mount the CRT socket on the tube base. The locating pin should point up.
- () Fig. 6. Connect the green twisted pair from the transformer to the CRT socket, XV10-1 (C) & 12 (S). Leave at least 1" of slack in all CRT connections.
- () Fig. 3. Connect a grey lead from TB8-2 (C) to XV10-1 (S) (Fig. 6).
- () Fig. 3. Connect the green lead from TB8-3 to XV10-2 (S) (Fig. 6).
- () Fig. 12. Run a brown lead along the strut from TB18-1 (S) to XV10-3 (S) (Fig. 6).
- () Fig. 12. Run a blue lead from R75-2 (S) over the rear bezel, past R72, and along the strut. Connect the other end to XV10-4 (S) (Fig. 6).
- () Fig. 6. Connect the blue lead from XV7-2 to XV10-10 (S).
- () Fig. 6. Connect the blue lead from XV7-1 to XV10-9 (S).
- () Fig. 6. Connect the green lead from TB13-1 to XV10-6 (S).
- () Fig. 6. Connect the green lead from TB13-4 to XV10-7 (S).
- () Fig. 3. Connect the grey lead from R81-2 to XV10-8 (S) (Fig. 6). (SHIELD)
- () Fig. 3. Connect the red lead from TB4-1 to S2-2 (S) (Fig. 8).
- () Fig. 3. Connect the yellow twisted pair from XV9-2 & 7 to XV7-3 & 4 (S). (Fig. 6)
- () Fig. 12. Connect a green lead from TB18-3 (S) to J9 (S) (Fig. 8).
- () Fig. 12. Connect a red lead from R72-1 & 2 (S) to TB8-2 (S) (Fig. 3) (SHIELD)

Mount the knobs on the front panel. Intensity, Focus, V. and H. Positioning controls should be set to their most counter-clockwise position. Then set the (small) knobs on so that the pointers point down and about 30 degrees left of the vertical. The knobs on the other controls should be positioned so that the pointers agree with the markings on the front panel.

() Fig. 3. Insert the line cord thru the 3/8" grommet in the rear apron. Make a knot in the cord 4" from the free end (inside the chassis) and connect to XF1-1 (S) and TB10-2 (S).

() Fig. 2. Insert the shield under the main chassis. Use two #6 hex nuts and two #6 lockwashers.

Insert V1 thru V9 in the correct sockets.

Insert the two #47 bulbs in the pilot lamp sockets.

Insert the binding post link between J2 and J3.

Insert F1 in the fusepost. A quarter-turn of the knob will lock the fuse in place.

The construction of the scope is now complete.

You have now completed the assembly and wiring of your instrument. When you have completed the following steps your instrument will be ready for use.

1) To catch any wiring errors, it is suggested that the entire wiring be checked point-by-point against the wiring instructions (and preferably also against the schematic wiring diagram in order to become more familiar with the component layout and circuitry). While doing so, check for rosin joints, loose lumps of solder, poor lead dress, and accidental shorts or leakage paths arising from the flow of rosin between contacts (remove with a stiff brush dipped in carbon tetrachloride, being careful not to spring contacts when cleaning switches).

2) IMPORTANT: BE SURE TO MAKE THE FOLLOWING RESISTANCE CHECKS BEFORE CONNECTING TO THE AC LINE: Check for a cold dc resistance of $5\Omega \pm 10\%$ across the AC plug with AC power switch turned on (SCALE LIGHT control turned clockwise from AC OFF), for $350\Omega \pm 10\%$ between plate pins 3 and 5 of the 6AX5 rectifier tube (V9) socket, for $850\Omega \pm 10\%$ between pin 4 of the 1V2 rectifier tube (V8) socket and chassis ground, for a minimum of $70K\Omega$ between the positive terminal of each section of triple electrolytic capacitor C27 to chassis ground, and for a resistance of 5 meg $\pm 20\%$ between cathode pin 9 of the V8 rectifier tube and chassis ground. Allow sufficient time for electrolytic capacitors to be charged by the ohmmeter battery when

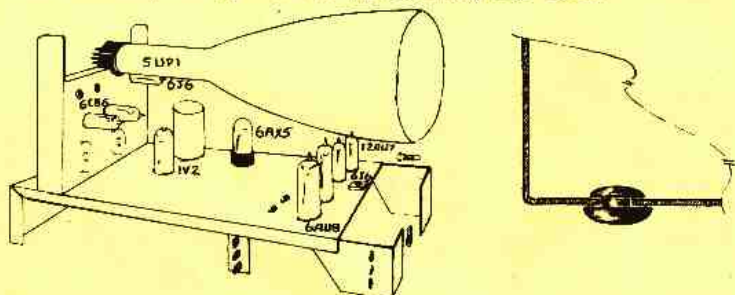
they are involved in the measurement. These measurements constitute a reasonable check of the power supply components and wiring before applying power. If you fail to obtain these resistance values, do not connect the instrument to the a-c line until the cause is discovered and the condition remedied.

3) INITIAL CHECKS ON COMPLETED KITS AFTER CONNECTING TO AC LINE:

Insert the AC plug in the 115 volt AC line and turn the power on by rotating the SCALE LIGHT control clockwise from the AC OFF. Turn the intensity control maximum counter-clockwise. Allow a 1 minute warmup and then check for a B+ voltage of approximately 380 volts on the cathode (pin 8) of the 6AX5 rectifier tube (V8) to ground and a high negative voltage of approximately -950 volts on plate (pin 9) of the 1V2 high voltage rectifier (V8). Check to see that all tube filaments are lit. (V8 does not have a visible glow).

WARNING: The voltages in this instrument are dangerous. Take caution to avoid personal contact with these voltages when the instrument is being operated outside of its cabinet.

4) Before the scope will operate as intended, certain initial adjustments must be made. These adjustments are described in detail in the MAINTENANCE sub-section of the INSTRUCTION section of the book. Proceed to these instructions now and carry them out in the order given. When the initial adjustments are completed, proceed to the remaining steps below.



5) Install the rubber feet in the openings provided in the cabinet as shown. The method is to work the rounded portion of each foot into the interior of the cabinet from the outside, using a small screwdriver. The flat portion should be the actual resting or contact surface.

6) Lay the handle on the cabinet top so that the slots rest over the center of each set of three. Place a U-shaped bracket over each slot, passing the prong through the slot and the hole beneath. Fasten the brackets to the cabinet with 4 #6-32 X 3/8 screws, 4 #6 hex nuts and 4 #6 lockwashers. Also insert a snap-in plug in each of the three holes in the cabinet side.

7) Run the ac line cord through the rear cabinet opening and insert the completed unit in the cabinet, fitting the cabinet edges inside the flange around the panel. Use the line cord to position the chassis so that the two #6 holes

in the rear chassis apron line up with the corresponding holes in the cabinet rear and insert two #6 P.K. screws. After the screws are tightened, chassis installation is completed.

NOTES

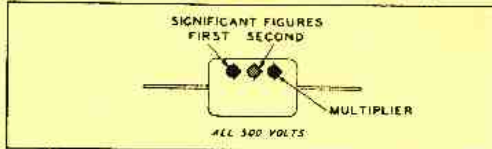
If the instrument fails to operate properly, recheck the wiring for errors or reversed connections, test for continuity, and check individual components for breakdown. With the instrument disconnected from the AC line and capacitors discharged, check all resistances listed in the resistance chart (Fig. 11). Keep in mind that where capacitor leakage resistance is involved in a measurement, the values given are only indicative of the order of magnitude of the reading and wide variation will be normal. Also keep in mind that many measurements involve RC circuits with long time constants and the meter reading will reach a final value only after the charging process by the ohmmeter battery is completed. Chart values in these cases are very roughly two-thirds of the nominal final values to permit faster checking. An abnormal reading should be followed by point-to-point resistance checks in the circuit involved. If resistance checks fail to disclose the source of trouble, connect the scope to the ac line, and proceed to check all dc and ac operating voltages, keeping in mind that all voltages may vary from the values shown by as much as 15% due to component tolerance, line voltage variations, and type of measuring instrument used (schematic voltages were measured with VTVM). In addition check the panel binding posts for possible mounting error (all ground posts should be shorted to the panel, all other posts should be insulated from the panel).

SERVICE

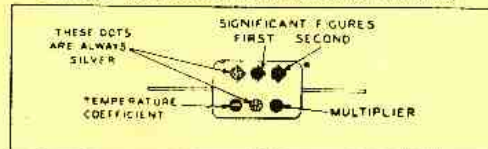
If you are still having difficulty, write to our service department listing all possible indications that might be helpful. If desired, you may return the instrument to our factory where it will be placed in operating condition for \$12.50 plus the cost of parts replaced due to their being damaged in the course of construction. This service policy applies only to completed instruments constructed in accordance with the instructions as stated in the manual. Instruments that are not completed or instruments that are modified will not be accepted for repair. Instruments that show evidence of acid core solder or paste fluxes will be returned not repaired. **NOTE:** Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material is inserted to keep the instrument immovable. Ship by prepaid Railway Express, if possible, to the Electronic Instrument Co., Inc. 33-00 Northern Blvd., L.I.C. 1, New York. Return shipment will be made by express collect. Note that the carrier cannot be held liable for damages in transit if packing, IN HIS OPINION, is insufficient.

CAPACITOR COLOR CODES

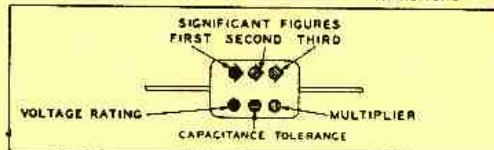
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



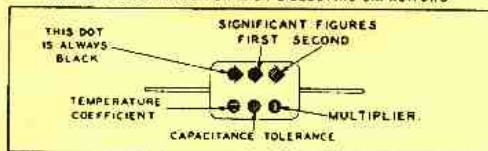
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



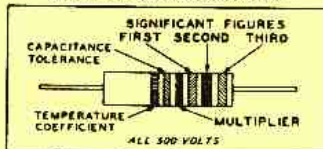
RMA 8-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



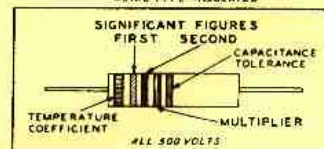
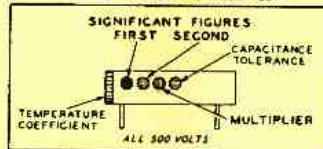
JAN 8-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

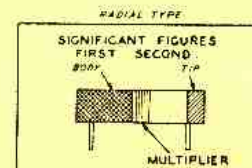
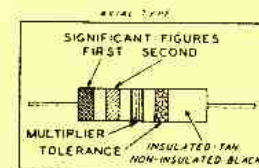


RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS				CAPACITORS				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	MULTIPLIER			VOLTAGE RATING	TEMPERATURE COEFFICIENT
				RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC		
	1	0	BLACK	1	1	1	100	A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1000	3	ORANGE	1000	1000	1000	300	D
	10000	4	YELLOW	10000			400	E
	100000	5	GREEN	100000			500	F
	1000000	6	BLUE	1000000			600	G
	10000000	7	VIOLET	10000000			700	
	100000000	8	GRAY	100000000		0.01	800	
	1000000000	9	WHITE	1000000000		0.1	900	
3	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

