AM-FM TUNER

MODEL

# HFT-92


# INSTRUCTION MANUAL

HFT 92-1

ELECTRONIC INSTRUMENT CO. INC.
3300 NORTHERN BLVD., L. I. CITY 1, N. Y.

# MODEL HF-92 *AM & FM TUNER*

## GENERAL

The new Model HFT-92 FM/AM tuner incorporates the justly famous HFT-90 High Fidelity FM tuner together with excellent AM tuning facilities. This is not a "stereo" type FM/AM tuner since both types of reception cannot be obtained at the same time.

The FM section includes an entirely pre-wired and pre-aligned "front end" housed and completely shielded in a solid aluminum-zinc casting. This "front-end" not only provides fabulous sensitivity and low noise, but is also entirely stable and guaranteed drift free by virtue of the most advanced circuitry and temperature-compensated components. Just as in the costliest and finest FM tuners available, no AFC is used because none is needed. Other FM performance features include stabilized low limiting threshold for excellent performance from weaker signals and a broad-band ratio detector for improved capture ratio and easier tuning.

Precision "eye-tronic" tuner is employed on both FM and AM using the DM-70 traveling eye indicator that contracts into an "exclamation point" at the exact center of each broadcast channel. A stage of audio amplification and a cathode follower output stage provide high output with low output impedance. An FM multiplex output is provided also. The full-wave rectifier and heavy filtering provide a stable dependable power supply.

Additional important features include: slide-rule dial, effortless flywheel tuning, low inter-station noise, and front-panel volume control and on-off switch.

The FM "front end" is supplied completely pre-aligned and all IF coils in both FM and AM sections are supplied pre-aligned so that an instrument alignment should not be a necessity for operation of the completed kit. The superbly convenient and extremely rugged mechanical construction features a single horizontal chassis to permit proper layout and component separation necessary for long component life and stability. Important construction aids include simplified dial cord arrangement and pre-wired tuning eye assembly. Extremely flexible design permits easy console installation with different thicknesses of panel.

## SPECIFICATIONS

| | FM | AM |
|---|---|---|
| Sensitivity | 1.5uv for 20 db quieting 2.5uv for 30 db quieting. Full limiting from 25 uv | 20uv for 0.8v output with 15 db S/N |
| Selectivity (IF Bandwidth) | 240 kc at 6 db | 8 kc at 6 db |
| Antenna Input | 30 ohms balanced | Ferrite Rod: terminals for external antenna provided |
| Stability | Max. drift of 20 kc (2 parts in 10,000) from cold start | Excellent |
| Frequency Response | 20-20,000 cps ±1 db | 20-5000 cps ±3 db |
| Hum | 60 db below 1 volt | 60 db below 1 volt |
| Output | Min. output of 1 volt with 10 uv input, 30% deviation | Min. output of 0.8 volt with 20v input, 30% modulation |
| Image Rejection | 30 db | 40 db |
| Tuning Range | 88 - 108mc | 540 - 1650 kc |
| Total Harmonic Distortion | 1.5% | Below 2% up to 70% modulation |
| Ratio Detector Peak Separation | 600 kc | |

Controls: Tuning, volume/power on-off, FM-AM Selector
Size: (HWD): 3 5/8" x 12" x 8 1/4"
Shipping Weight: 12 lbs.

## mechanical installation

a) HEAT DISSIPATION (VENTILATION): In common with other electronic equipment, the HFT-92 produces considerable heat in normal operation. Unless continuous and adequate air flow is obtained around the heat producing elements, these elements will over-heat and their useful life will be greatly reduced.

Adequate ventilation will be provided if the tuner is installed in an open-back console provided that the top of the tuner is spaced at least two inches below any shelf mounted above it. If the cabinet is enclosed at the rear, provide several large holes or slots as low down and as high up in the cabinet back as possible. As an alternative, holes may be provided in the sides, bottom, or top of the cabinet. The important thing to remember is that effective ventilation requires provision for cool air to enter at the bottom and hot air to leave at the top.

If the tuner is not installed in a console, it may be situated on an open surface or on a shelf of a bookcase. Four rubber feet are also provided so that the tuner will not mar the surface of furniture on which it is placed.

If it is considered essential, because of space limitations to "stack" a matching amplifier such as the HF-12 with the tuner (not recommended for reasons described above), place the amplifier above the tuner since the amplifier produces substantially more heat and requires more ventilation.

b) POSITION: The specified absence of tuning drift can be fully assured only if the tuner is placed in an approximately horizontal position, which is therefore strongly recommended.

c) EASY ACCESS TO CONTROLS: Mount the tuner at a height which will permit easy manipulation of the controls. Amplifier controls should be located nearby.

d) ACCESSABILITY TO PARTS: Tubes are the most frequently replaced items in electronic equipment. If the tuner is installed in a console, sufficient space should be allotted to reach and remove any tube in the tuner. Furthemore, antenna and output terminals of the tuner should be accessible to permit easy interchanging of system components for comparison. If antennas are strung around the back of the console in which the tuner is installed, arrange them so they will not interfere with access to the tuner.

e) ACOUSTICAL ISOLATION: If tuner and speaker are installed in the same cabinet (not recommended), provide sufficient separation to minimize mechanical speaker vibration reaching the tuner which may result in microphonics and howling. The minimum separation is about one foot. A baffle, usually the tuner mounting base, should be present between tuner and speaker. In extreme cases, it may be necessary to mount the tuner on sponge rubber pads.

CONSOLE MOUNTING

NOTE: The tuner may be installed in a console with the slide-out perforated cover in place. We recommend the use of the cover even in console mounting for the additional shielding and protection it provides. The thickness of the console panel may be up to 3/8".

a) Operations on console front panel preliminary to the tuner mounting: (1) Tape the panel template provided to the face of the console so that the top of the mounting surface line on the template is level with the top of the tuner mounting shelf. (2) Use an awl or a nail to pierce the centers of the two 3/8" diameter holes for the controls, and the two small holes for mounting the control plate, to transfer their locations to the console panel beneath. (3) Use an awl or nail to mark the four corners of the rectangular tuning dial cut-out. (4) Remove the panel template and draw the dial cut-out with a pencil. (5) Drill only the holes for the panel controls (the two small holes which have been marked are for wood screws). (6) Now make the dial cut-out, which must be done accurately. It is recommended that the rough cut-out be made slightly undersize and then finished accurately and smoothly with a file. Then use the file to make a smoothly finished 45 degrees bevel on the lower edge of the cut-out sloping downward from the outside surface to the inside surface. The beveled surface must be smooth so that the wire going to the tuning eye socket will not catch or otherwise be obstructed when the tuning eye is moved along the dial.

b) Tuner mounting in console: (1) Pull off the control knobs. (2) Remove the four screws that fasten the bezel to the side pieces and remove the bezel, which is not used in console mounting. (3) Remove the control plate, which is attached to the bezel by two screws and nuts. (These may be discarded since they are unsuitable for attaching the control plate to the console panel and two 4 x 3/8 wood screws have been supplied for this purpose.) (4) Fasten the control plate to the console panel with the two #4 x 3/8 wood screws. (5) If the rubber feet have been inserted in the bottom plate, remove them. (They may be pried out with a thin screwdriver.) (6) Place the unit on the mounting shelf and slide it forward until the front surface of the tuning dial rests against the turned-in edge of the dial cut-out in the control plate and the control shafts are centered in the holes. (7) With a sharp pencil, draw the outline of the side and rear bottom edges on the chassis shelf. As the bottom plate falls short of the full width by 3/16" on each side, draw new side edge lines 3/16" inside the original side edge lines. (8) Now take the chassis off the shelf. (9) Remove the 6 screws which fasten the bottom plate to the side pieces. (10) Place

the bottom plate exactly in the outline drawn on the shelf and mark the position of the center hole on the left side and the center hole on the right side. (11) Remove the bottom plate and drill each of the marked holes on the shelf to a diameter of 1/4". (2) Refasten the bottom plate to the side pieces, with four of the six #8 x 3/8 screws previously removed, using the front and rear holes on the side pieces which are fitted with speed nuts. (13) Replace the chassis on the shelf, positioning it exactly in the outline previously drawn, and push on the knobs.

The inner knob of the left-hand concentric is for VOLUME/OFF and the outer knob is the SELECTOR for either FM or AM reception. Make sure that the indicator dots on both knobs agree with the control positions. (14) From the bottom side of the shelf insert a #8 x 1" screw, with a 1/2" flat washer against the head, through both the left and right side center holes. These screws engage speed nuts on the side piece center holes and when tightened secure the chassis to the shelf.

## electrical installation

### FM ANTENNA

Any VHF 300 ohm TV antenna will serve very well as an antenna for the tuner. If the antenna is also being used with a tv set, it is advisable to use an inexpensive two-set coupler. If an antenna is to be installed for FM reception only, a 300 ohm FM antenna composed of a folded dipole and reflector is recommended. The best reception in extreme fringe areas will be achieved with an FM yagi antenna properly oriented for maximum sensitivity in the direction of the broadcasting station. The antenna in all cases is connected to the ANT. INPUT terminals on the rear chassis apron. Good results may be obtained inexpensively with an indoor dipole antenna fashioned from 300 ohm twin lead as shown below. Note that the length of the lead to the ANT. INPUT terminals is not critical. Any convenient length may be used.

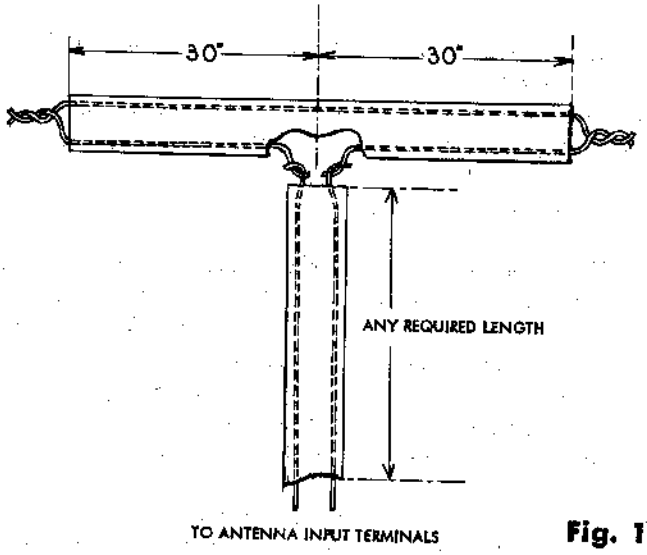



Fig. 1

### AM ANTENNA

AM signals are picked up by a ferrite-rod antenna at the chassis rear. As the ferrite-rod is directional, it may be found valuable in a particular installation to swing the rod out in a direction that provides best reception. This can be done by removing the screw and washer that holds the rod to the stand-off nearest the power transformer.

If reception is marginal on a desired station or stations, a straight wire type of antenna may be used. For strong station reception a wire two to eight feet long inside the room and connecting to the ANTENNA terminal will suffice. In difficult locations, a long wire outside antenna is used. Be sure to use an insulator between each end of the antenna and the object from which the antenna end is suspended as well as a lightning arrestor at the outside point where the lead-in enters the home (one terminal of the lightning arrestor must be connected to the earth-ground). The GND. terminal on the AM tuner chassis is connected to the ground terminal on your amplifier, which in turn should be connected to true earth ground such as a ground rod or a water pipe.

DO NOT CONNECT THE TUNER TO ANY AC-DC EQUIPMENT: Connecting the tuner to AC-DC equipment will make tuner chassis "hot" to one side of the AC line, except where the input of the AC-DC amplifier is isolated from the AC line. In general, this is very dangerous practice and strictly disallowed because fatal shock may result.

### POWER

Plug the line cord into any outlet supplying 117 volts, 60 cycle AC power. Variation of the line voltage from 105 to 125 volts is not critical, but it must be 50 or 60 cycles AC. This outlet may be a switched convenience outlet on an amplifier having controls and switching facilities if the convenience of having power to the tuner controlled by the ON-OFF switch on the amplifier is desired. On the other hand, if the tuner is being operated with a power amplifier having no controls itself, plug the line cord of the power amplifier into the convenience outlet at the back of the tuner (so that the amplifier will be turned on and off with the tuner) and plug the tuner line cord into a wall outlet.

### AUDIO OUTPUT

A jack marked "AUDIO OUTPUT" will be found on the rear chassis apron. A low-capacity shielded cable of the shortest practical length possible should be used to connect

this jack to the TUNER input jack of the amplifier. Such a cable with connectors may be purchased at an electrical supply store or made up from the desired length of cable and two RCA male phono connectors.

MULTIPLEX OUTPUT

A jack marked "MULTIPLEX OUTPUT" will be found on the rear chassis apron. At this output, the audio signal before de-emphasis is obtainable. This jack is provided for use if and when multiplex FM transmission for stereophonic FM broadcasting becomes a fact. At such time, EICO and other manufacturers will make available multiplex reception equipment which will make use of this output.

## operation

The HFT-92 has three controls. The TUNING control at the right selects the station. The VOLUME/OFF control at the left turns the tuner on and off and controls the audio output level. The SELECTOR switch concentric with it chooses either FM or AM operation.

To turn the tuner on, rotate the VOLUME control clockwise from the OFF position. Allow a one minute warm-up for completely stable operation. Then set the SELECTOR switch to the desired type of broadcast reception, FM or AM, and use the TUNING control to set the tuner to the desired station. Read the uppermost scale when set to FM and the middle scale when set to AM. The lowest scale, 0-100, is a logging scale used to facilitate accurate re-setting to a particular station. The tuning position is shown by the traveling eye-tube indicator. Correct tuning of each broadcast channel, FM or AM, is indicated by maximum contraction of the luminous "exclamation point".

A moderate difference in average volume when switching from FM to AM or visa-versa is to be expected and is easily adjusted with the tuner VOLUME control. Also, bear in mind the different character of AM and FM reception. AM is not interference-free, the noise level is higher, and the frequency range is generally restricted as compared to FM.

## maintenance

OPERATING NOTES

Your tuner should require little service except for normal tube replacement. No substitutions for tube types used in this tuner is permissible. All tube types used are distributed nationally, but replacements can be obtained directly from EICO if desired.

If dial calibration seems to be in error, it can always be corrected by re-setting the position of the tuning-eye indicator carriage on the dial cord.

When connected properly, the hum originating in your HFT-92 tuner is inaudible. If the hum level is high due to defective components, alignment or installation, please check the following.

1. Check tubes V1 through V8 for excessive heater-cathode leakage or grid-cathode short.
2. Check C25 for value of capacity and leakage.
3. Check the dress of all leads connected to the grids of all the tubes. Dress away from AC filament and power lines. Exercise special precautions with leads to pin 2 and pin 6 of V2.
4. Check alignment of T2 through T6.
5. Reverse AC plug in receptacle to determine position for minimum hum.
6. Run wire from tuner to amplifier chassis. Connect chassis of amplifier to ground (water or steam pipe).

ALIGNMENT PROCEDURE

1. Plug line cord into 117VAC, 60 cycle outlet. Rotate VOLUME control clockwise from AC OFF to turn tuner on and set at maximum clockwise position for full volume. Allow full 5 minutes warm-up time before alignment. All instruments including sweep generators, signal generators and VTVM, should be allowed to warm up for 15 minutes before use to insure against drift during alignment.

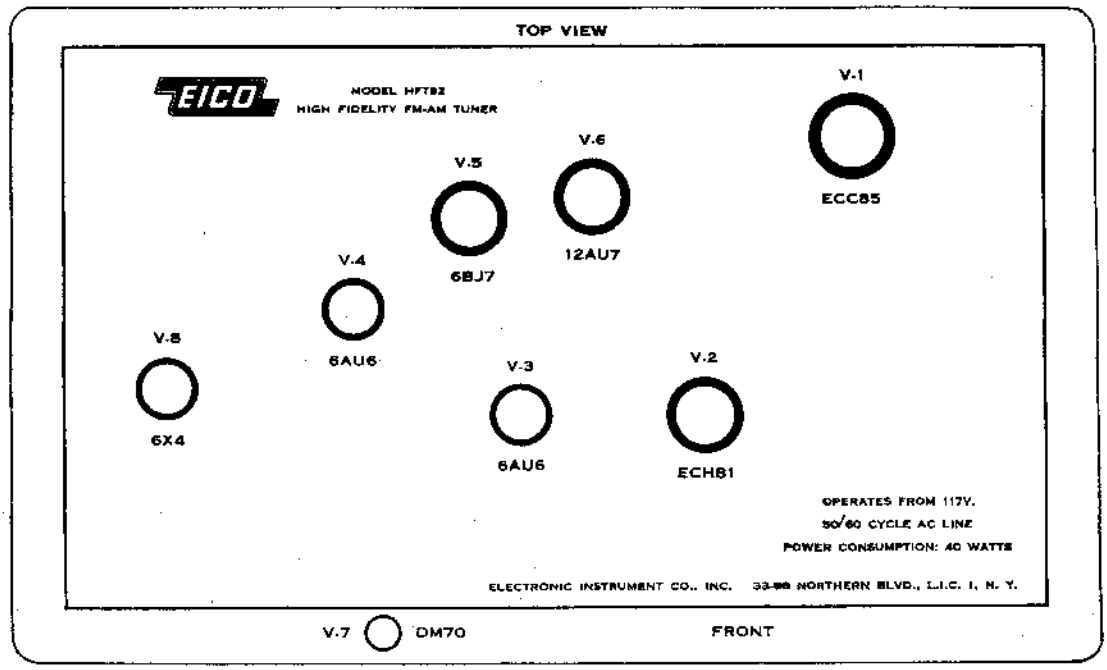
2. Check the voltages as given in the voltage chart using either a VTVM or a 20,000 ohms/volt VOM. All voltages are checked with a line voltage of 117VAC. If line voltage is actually 117VAC, all voltages should measure as stated within ±15%. If line voltage is about or below 117VAC, then the discrepancy must be considered in interpreting the permissible variation in measured voltages. Note that voltages are measured under no-signal conditions. If voltages check out as given, proceed with alignment.

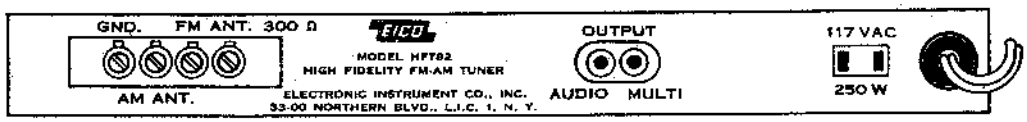
3. Set SELECTOR switch to AM and proceed to alignment instructions for "AM ALIGNMENT USING SIGNAL GENERATOR AND SCOPE OR VTVM".

4. Set SELECTOR switch to FM and proceed to alignment instructions either for "FM IF ALIGNMENT USING AM SIGNAL GENERATOR" or "FM IF ALIGNMENT USING SWEEP GENERATOR & MARKER OSCILLATOR, VTVM or SCOPE". NOTE: FM IF alignment method, requiring a sweep generator and an oscilloscope, is of course preferred. If this equipment is not available however, good results will normally be obtained by the simple signal generator method described also. Please read the whole procedure through very carefully before starting, including the IMPORTANT NOTE regarding the FM "front-end" (RF Tuning Assembly). Under no condition tamper with the setting of the RF SENSITIVITY TRIMMER or the OSCILLATOR TRACKING TRIMMER in the FM "front-end". Do not tamper with a seemingly defective FM "front-end" unit. Return it to Electronic Instrument Co., Inc., 33-00 Northern Blvd., L.I.C. 1, N.Y. for repair or replacement.

## SERVICE

If trouble develops in your instrument which you can not remedy yourself, 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 $9.00 plus the cost of parts replaced due to their being damaged in the course of construction. 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 inserted to keep the instrument immovable. Ship by prepaid Railway Express, if possible, to the Service Dept., Electronic Instrument Co., 33-00 Northern Blvd., Long Island City 1, New York. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.



## HFT-92 ALIGNMENT INSTRUCTIONS: READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

NOTES: 1. Allow 15 minutes warm-up time for Tuner and Test Equipment.
2. Set Volume Control to maximum - fully clockwise.
3. Output of Signal Generator should be set no higher than necessary to obtain a usable indication on VTVM or scope.
4. Use an insulated alignment tool for adjusting slugs and trimmers.

### A. M. ALIGNMENT USING SIGNAL GENERATOR AND SCOPE OR VTVM

| STEP NO. | DUMMY ANTENNA OR COUPLING THROUGH | CONNECT SIG. GEN. "HOT" LEAD TO: | SIGNAL GEN. FREQ. | SELECTOR SW. POS. | TUNER DIAL SETTING | CONNECT SCOPE OR VTVM TO: | ADJUST | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1. | .01uf cap. | pt. (A) pin No. 2 of Tube V2 ECH81<br>ground lead to chassis | 455kc<br>400 cps mod. | A. M. | At low freq. (left) end or nearby point free of interference | pt. (X) (J2 Audio Output)<br>see schematic | A1 top lug of T5<br>A2 bottom slug of T5<br>A3 top slug of T3<br>A4 bottom slug of T3 | Adjust in given order for max. output |
| 2. | Standard dummy ant. or 200 uuf capacitor | pt. (B) AM Ant. terminal lug<br>ground lead to chassis | 700kc<br>400 cps mod. | A. M. | 700kc<br>(70 on Dial) | pt. (X) (J2)<br>see schematic | A5 of L2 oscillator coil | Adjust for maximum output while rocking tuning cap. |
| 3. | Standard dummy ant. or 200uuf capacitor | pt. (B) AM Ant. terminal lug<br>ground lead to chassis | 1300kc<br>400 cps mod. | A. M. | 1300kc<br>(130 on Dial) | pt. (X) (J2) | A6 oscillator trimmer<br>A7 AM ant. trimmer | Adjust carefully for max. output (very critical).<br>Adjust for max. output |

**Repeat steps 2 and 3 until proper RF tracking is obtained.**

REMARKS: Should it be desired to perform a sensitivity test, it may only be performed properly after alignment exactly as described above. Use a standard dummy antenna for sensitivity measurements.

### FM IF ALIGNMENT USING SWEEP GENERATOR & MARKER OSCILLATOR, SCOPE AND VTVM

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4. | .01 uf cap.<br>or direct | pt. (C) pin No. 1 of Tube V4 6AU6<br>ground lead to chassis close to V4 pin 1 | 10.7Mc<br>600kc sweep | F. M. | 108Mc | pt. (Z) (J3 Multi output)<br>see schematic | A8 top slug of T6 so that 10.7Mc marker occurs at center of crossover line<br>A9 bottom slug of T6 for max. amplitude and symmetry of "S" curve | Set sweep generator output to obtain about 0.3 RMS AC volt from pt. Z to chassis ground. |
| 5. | .01uf cap.<br>or direct | pt. (A) pin No. 2 of Tube V2 ECH81<br>ground lead to chassis close to V2 pin #2 | 10.7Mc<br>250kc sweep | F. M. | 108Mc | pt. (Y) (Junction R13, C15)<br>see schematic | A10 top slug of T4*<br>A11 bottom slug of T4*<br>A12 top slug of T2*<br>A13 bottom slug of T2* | Set sweep generator output to obtain about 0.4 RMS AC volt from pt. Y to chassis ground. Sacrifice additional output if it entails loss of symmetry. |

*Adjust in given order for symmetry and maximum deflection of IF response curve with 10.7Mc marker at center

IMPORTANT NOTE: The FM "FRONT END" is factory pre-set and no adjustment facility thereon should be tampered with. If there is definite indication that the "front end" is misaligned, check the positions of the cores in IF transformer T7 located inside the "front-end". The T7 primary core can be seen on the bottom chassis surface of the "front-end" and the secondary core on the top chassis surface of the "front-end" (see Fig. 2 & 3 page 7). The T7 primary bottom core should protrude approximately 1/32" from the coil form; the T7 secondary top core should be neither "in" nor "out" of the coil form but flush with it. If these conditions do not exist closely as described, then it is permissible to adjust one or both of the cores to the described condition. Please note that the T7 core adjustments will normally have already been made at the factory. If a highly skilled, properly equipped person feels it necessary to make an absolutely exact adjustment of the T7 cores, he may do so on his own responsibility as described below.(EICO does not feel such an adjustment is normally necessary and takes no responsibility for any damage done to the "front-end" if this method of adjustment is undertaken.)

## FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM OR 20,000Ω/V VOM

NOTES: Allow 15 minutes warm-up time for tuner and test equipment.
If signal generator is inexpensive type and frequency calibration is doubtful shift frequency setting above and below 10.7Mc marking on the dial to find setting at which highest output reading across C13 is obtained with the T6 (bottom) slug adjustment. The signal generator frequency setting found in this manner should be taken as 10.7Mc throughout the entire alignment procedure. Note that if a small error in the intermediate frequency used for alignment is maintained constantly throughout the entire alignment procedure, performance will not be greatly affected except for a small shift in the dial calibration. If, however, there is any drift or change in the signal generator frequency setting from the time of the Ratio Detector Transformer alignment, some distortion and loss of sensitivity will be noticeable.

| STEP NO. | DUMMY ANTENNA OR COUPLING THROUGH | CONNECT SIG. GEN. "HOT" LEAD TO: | SIGNAL GEN. FREQ. | SELECTOR SW. POS. | TUNER DIAL SETTING | CONNECT VTVM OR VOM LEADS | ADJUST | REMARKS |
|---|---|---|---|---|---|---|---|---|
| 1. | .01uf cap. | pt. C pin #1 of Tube V4 6AU6 ground lead to chassis close to V4 pin 1 | 10.7Mc unmod. | FM | 108Mc | across cap. C21 (observe polarity) see schematic | A9 bottom slug of T6 for max. DC voltage output | |
| 2. | .01uf cap. | as above | 10.7Mc unmod. | FM | 108Mc | pt. Z and ground see schematic | A8 top slug of T6 for a zero indication | (a) Set Signal Gen. output to max. 50-100mV<br>(b) If VTVM is used, set it to zero center on the 10 to 15 volts DC range.<br>(c) If 20,000Ω/V VOM is used set the range selector at 10 or 15 volts DC range and use the meter movement zero adjust screw to set the pointer off zero to the first major scale marking. The purpose of this is to permit observation of a negative indication on the meter. Reset the meter needle to the zero mark on the scale after this alignment step is completed. |
| 3. | .01uf cap. | pt. A pin #2 of Tube V2 ECH81 | 10.7Mc unmod. | FM | 108Mc | across cap. C21 | A10 top slug of T4*<br>A11 bottom slug of T4*<br>A12 top slug of T2*<br>A13 bottom slug of T2* | Maintain this output all through the alignment by reducing the output from the signal generator as alignment proceeds. |

*Adjust in given order for maximum DC voltage output

IMPORTANT NOTE: The FM "FRONT END" is factory pre-aligned and no adjustment facility thereon should be tampered with. If there is definite indication that the "front-end" is misaligned, check the positions of the cores in IF transformer T7 located inside the "front-end". The T7 primary core can be seen on the bottom chassis surface of the "front-end" and the secondary core on the top chassis surface of the "front-end" (see figs. 2 & 3). The T7 primary bottom core should protrude approximately 1/32" from the coil form; but T7 secondary top core should be neither "in" nor "out" of the coil form but flush with it. If these conditions do not exist closely as described, then it is permissible to adjust one or both of the cores to the described condition. Please note that the T7 core adjustments will normally have already been made at the factory.

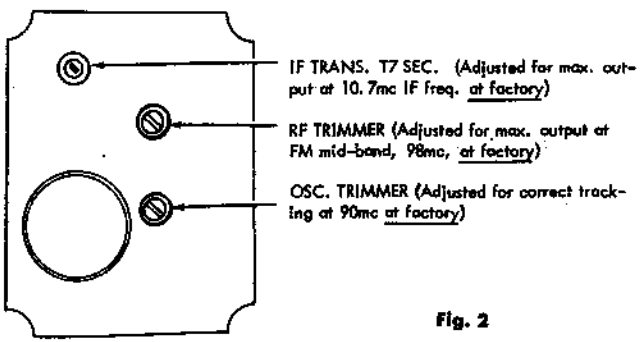



Fig. 2

TOP VIEW OF "FRONT-END"

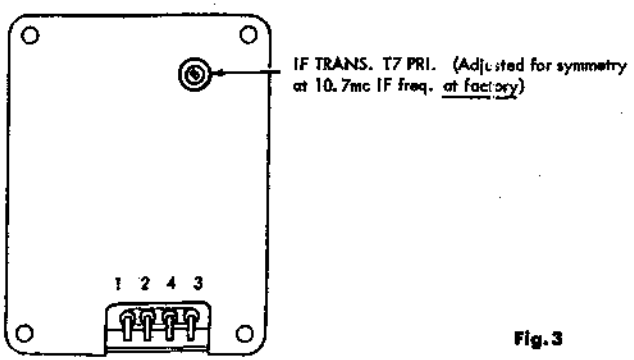



Fig. 3

BOTTOM VIEW OF "FRONT-END"

## VOLTAGE CHART

| Tube Sym. # | Type | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| V1 | ECC85 | Not accessible — DO NOT attempt to measure. See note below voltages at "FRONT END" solder lugs. | | | | | | | | |
| V2 | ECH81 | +80VDC | -0.7VDC | GND | GND | 6.3VAC | +170VDC | -0.6VDC | | -0.6VDC |
| | | Set switch S2 to AM oscillator section readings: | | | | | | *-6.0VDC | *+80VDC | *-6.0VDC |
| | | Set switch S2 to FM | | | | | | | | |
| V3 | 6AU6 | | GND | GND | 6.3VAC | +140VDC | +140VDC | +1.2VDC | — | — |
| V4 | 6AU6 | -0.5VDC | GND | GND | 6.3VAC | +50VDC | +50VDC | GND | — | — |
| V5 | 6BJ7 | GND | -0.6VDC | GND | 6.3VAC | GND | -0.4VDC | -0.5 to -3.0VDC | +0.5V to +3.0VDC | +0.4VDC |
| V6 | 12AU7 | +150VDC | +45VDC** | +75VDC | 6.3VAC | 6.3VAC | +30VDC | — | +1.2VDC | GND |
| V7 | DM70 | -0.4VDC | — | — | 1.2VAC | GND | — | — | +140VDC | — |
| V8 | 6X4 | 195VAC | — | GND | 6.3VAC | — | 195VAC | 215VDC | — | — |

| "FRONT END" solder lugs see fig. 3 for lug numbering. | lug 1 | lug 2 | lug 3 | lug 4 |
|---|---|---|---|---|
| | 6.3VAC | +90VDC | GND | +140VDC |

NOTES: a) All measurements made with selector switch set to FM position except where noted.
b) Voltages are measured at line voltage of 117VAC, 60cps
c) All voltages may normally vary by ±15%
d) Measurments made with VTVM or 20,000Ω/V VOM
e) All measurements made to chassis ground and under no signal condition - tuning indicator at extreme right 108Mc

*AM position readings
**VTVM or at least 250V scale of VOM only

## RESISTANCE CHART (Unit disconnected from line, Selector Switch set to FM position)

| Tube Sym. # | Type | Pin 1 | Pin 2 | Pin 3 | Pin 4 | Pin 5 | Pin 6 | Pin 7 | Pin 8 | Pin 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| V1 | ECC85 | Not accessible — DO NOT attempt to measure. See note below resistances at "FRONT END" solder lugs. | | | | | | | | |
| V2 | ECH81 | 22K | 1.5M | 0 | 0 | 0.1 | 4K | 47K | 33K* | 47K |
| V3 | 6AU6 | 15 | 0 | 0 | 0.1 | 1K | 1K | 100 | — | — |
| V4 | 6AU6 | 100K | 0 | 0 | 0.1 | 7.5K | 7.5K | 0 | — | — |
| V5 | 6BJ7 | 0 | 250K | 0 | 0.1 | 0 | 8K | — | — | 8K |
| V6 | 12AU7 | 0 | 1M | 50K | 0.1 | 0.1 | 220K | 500K | 2.2K | 0 |
| V7 | DM70 | 7K | — | — | 38 | 0 | — | — | 1K | — |
| V8 | 6X4 | 190 | — | — | 0.1 | — | 190 | 25K | — | — |

| "FRONT END" solder lugs see fig. 3 for lug numbering | lug 1 | lug 2 | lug 3 | lug 4 |
|---|---|---|---|---|
| | 0.1 | 10K | 0 | 10K |

CAUTION: Be certain to disconnect unit from AC line before making measurments.

NOTES: a) All measurements made with volume control set for maximum clockwise and SELECTOR switch to FM position except where noted.
b) All measurements made with VTVM or 20,000Ω/V VOM.
c) All resistances may normally vary by ±20%.
d) All measurements made with respect to chassis ground.
e) For plates and screens resistance test short B+ to ground on joint of R29 and C25c, for all tubes except V8 Rectifier.

*Reading on AM position

# GENERAL INSTRUCTIONS

The EICO kit you are about to assemble and wire has been designed to meet the highest standards of performance. It is a high quality instrument, to be constructed from the finest components available anywhere.

The following Construction Manual has been written to carefully guide you through the construction of your kit. If you follow all the instructions implicitly and work carefully without haste, you will be rewarded with many years of fine performance from the instrument and a personal inner satisfaction from a job well done.

Your Construction Book: Beginning with the number on this page, and throughout the rest of your Construction Manual, the page numbers are followed by a "C" (1C, 2C, etc.). The Instruction Manual detailing the installation, operation, and maintenance of your instrument are identified by numerals only, without any letters following these numerals.

Observe that the Instruction Manual section precedes this page and follows the last page of your Construction Book section. After you are certain that you have successfully completed the wiring of your kit, you no longer need the Construction Book. You may remove these centrally located Construction pages, leaving the Instruction section intact for future reference. Keep the Instruction Manual for reference as to the installation and operation, as well as for any maintenance that may be necessary in the future.



Choosing a Workbench and Tools: To avoid the accidental loss or misplacement of components, choose a convenient workbench before unpacking your new kit. You will find it most advantageous to choose a working place that will not be used for any other purpose until you have completed the construction of your kit. Proper precautions should be observed to prevent damage to any table top from a soldering iron or any heavy tools.

When you check the component parts against the Parts List later on, it will be convenient to group the various parts by component type and hardware sizes. It will be convenient to keep these sorted parts separated in the compartments of specially made trays. Small cartons, egg trays or a refrigerator ice tray with dividers will all serve equally well.

Several basic tools are required in constructing this kit. They are:

1. Screwdriver - 3/16" to 1/4" blade
2. Screwdriver - 1/8" blade
3. Longnose pliers - 5" or 6"
4. Diagonal wire cutters
5. Soldering iron (100 watts), solder gun or pencil iron (35 watts).
6. Gas Pliers
7. High quality rosin core radio solder. DO NOT use Acid Core solder or Paste fluxes under any circumstances.

The following tools are useful, but are not absolutely necessary to construct this kit:

1. Socket wrench set
2. Open end wrench set
3. Wire Stripper

Unpacking the kit: This procedure serves two purposes. First, you become acquainted with the various types of components. Second, you are able to ascertain if you received all the parts required to build the kit. This is your opportunity to have any packing errors corrected.

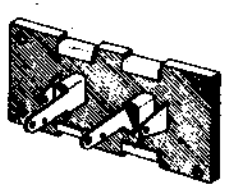
When unpacking, handle all parts carefully so that you will not damage any fragile components. Do not throw any packing material away until after having checked all components. Check each part off against the "Parts List" which you will find in your Instruction Book. Check the packing for any small parts.

From time to time, due to modernization or possible error, corrections may be necessary to your Parts List. If there are any changes to be made, they will be listed on the loose "addenda sheets" included with this book. Make these corrections, if any, before checking your components. If no corrections to your Parts List are noted on the addenda sheets, or there are no addenda sheets, assume your Parts List is correct, and proceed to checking all components against this list.

To enable rapid identification of electronic parts, each part has been assigned one or two letters of the alphabet called a reference designation. These reference designations are nothing more than an initial letter or two representint the name of the part. For example, a vacuum tube has been assigned the reference designation letter V, and a transformer the letter T. Thus, if you have eight vacuum tubes and six transformers in your kit, these parts would be identified by the designation V1 through V8 and T1 through T6, respectively.

The reference designation assigned to receptacles (often referred to as jacks) is the letter J. The different types of jacks and plugs used in this kit are illustrated. In some cases, two jacks are mounted on one bakelite strip and are so noted.

CONVENIENCE OUTLET



DUAL PHONO JACK

In some cases, these jacks are insulated from the chassis. A bakelite insulator used between the chassis and the jack is supplied for this purpose.

The reference designation assigned to capacitors is C.

Some capacitors, such as electrolytics, are marked plus (+) and minus (-). These are the only capacitors that must be mounted in a specific direction. Follow the direction for mounting described in the appropriate steps below. When no direction is mentioned, mount the capacitor either way. Some molded or paper capacitors have a black line near one end. Although these can be mounted without any concern for direction, it is preferable that you follow the direction for the black line shown on the drawing. If there is no black line on the drawing or on the capacitor, just mount the capacitor in either direction.

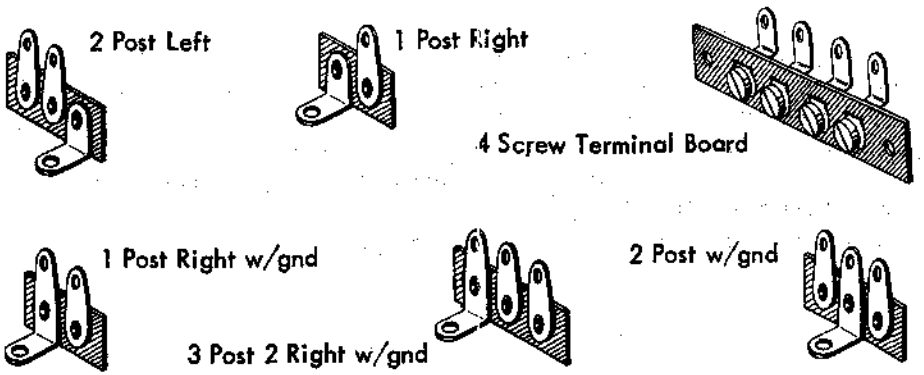
Ceramic capacitor tolerance may be noted by a letter rather than a number. "K" is 10%. "M" is 20%, "P" or "GMV" means guaranteed minimum value.

Resistors are denoted by the symbol letter R.

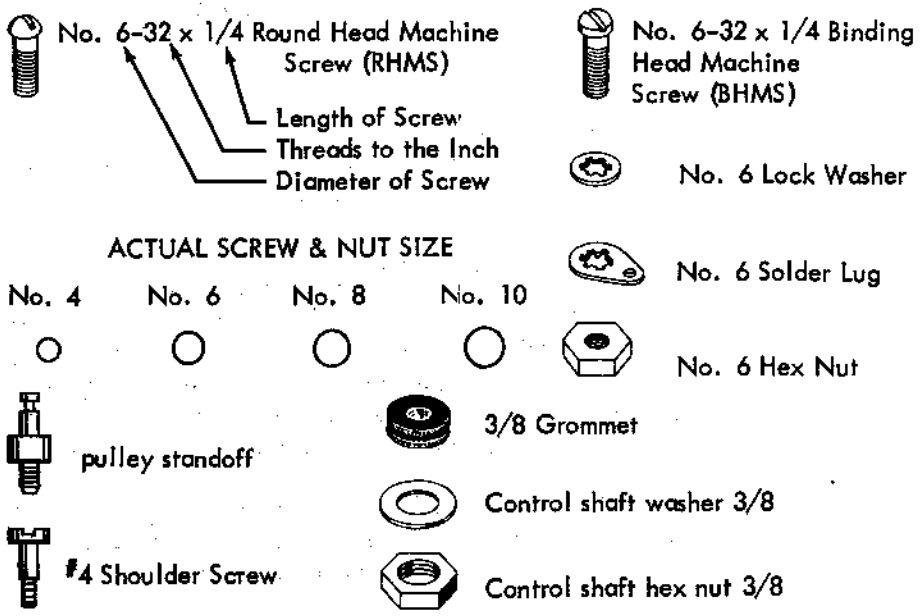
Some resistors have their resistance value stamped on the surface of the resistor body. However, other fixed resistors are coded with color marking which indicate their value. The actual color code of these resistors is noted in the parts list. In some instances, even when the color code is noted, in the book, the actual resistor value may be stamped on the body, rather than the color code.

The tolerance of a resistor is the amount the resistance value can vary around its marked value. Thus, if a 1K (1000Ω) resistor has a ±10% tolerance, its actual value can be between 900 ohms and 1.1K ohms. If the same resistor and a ±5% tolerance, its actual value can be between 950 ohms and 1.05K ohms. The fourth color band from the end of the resistor, indicates the tolerance. The gold band indicates a 5% tolerance, the silver band a 10% tolerance and the absence of a band a 20% tolerance. This tolerance value is always stated or given as part of the color code when the resistor is listed. If the resistor is marked with a number rather than a color code, the tolerance, is stamped on the body. In your kit, 5% resistors may be substituted for 10% and 10% resistors substituted for 20%. However, be certain that you do not use a 10% resistor when a 5% resistor is required or a 20% resistor when a 10% or 5% resistor is specified.

The various types of terminal strips are assigned the reference designation TB. The type used in this kit are illustrated and denoted in this figure.




Hardware is a general term for mechanical parts used in the assembly of EICO kits. Such items are usually screws, nuts and washers. Machine screws are sized in accordance with the diameters of the threaded portion (#2, #4, #6) with the smaller number denoting the smaller diameter. The second number indicates the number of threads to an inch. Thus a #6-32 screw has a #6 diameter with 32 threads per inch. The final number indicates the length of the threaded portion. A #6-32 x 3/8 has a 3/8" long threaded portion. The diameters are shown in the figure.




The figure also shows the various head types in which these screws are supplied. Use the type specified in the particular step.

Washers and nuts are sized in accordance with the diameter of the screws they are used with.

Various types of washers are supplied. A lockwasher has internal or external teeth. A flat washer is made out of thin metal. Fiber and bakelite washers are used for insulating devices. They generally separate two metallic pieces of hardware. Tinnerman speed nuts are generally used to mount a chassis cover or bottom plate.

Self tapping screws are used where it is not desirable to hold the screw to the chassis by a nut. The screw actually taps the threads in the metal into which it is screwed. The sizes are designated by numbers similar to those used for machine screws, with the smaller number indicating a smaller diameter screw.

Grommets are rubber devices used for insulating wire from the metal chassis.

Most of the other component parts used with the kit are self evident and require little further explanation or description.

If after having checked all your components against the parts list, you find a shortage, please write us at

Customer Service
Electronic Instrument Co., Inc.
33-00 Northern Blvd.
Long Island City 1, N.Y.

Include the inspection slip with your letter describing the shortage. If there is any slight hardware shortage, you can expedite matters by purchasing these pieces at your local jobber or hardware store.

Soldering Techniques: To get a good, clean connection, use the soldering techniques described below. USE THE BEST GRADE OF ROSIN CORE RADIO SOLDER ONLY. UNDER NO CIRCUMSTANCES SHOULD ACID CORE SOLDER OR FLUX BE USED. The use of acid core solder or paste fluxes can cause serious corrosion and will void all the repair and service guarantees.

The soldering and wiring techniques described below should be practiced several times by the novice before he attempts to wire or solder components in the actual kit. Practice several connections with a spare piece of wire and a socket or terminal strip you can purchase at your local jobber.

First make a good mechanical connection. Remove 1/4" of insulation from the end of the wire. Feed the wire through the solder lug opening so that the wire insulation just touches the lug. With the long-nose pliers, bend the wire lead around the lug and crimp the wire lead to the lug. Now solder this wire. Place the tip of the hot soldering iron on the lug or terminal at a point close to the wire being soldered. Apply the solder to the junction of the lug, wire and soldering iron. When the lug and wire have been heated to the correct temperature, the solder will flow into and over the joint. Remove the iron when the solder starts to flow and remove the solder immediately after. Use only enough solder to cover the wire at the connection point.

A poor solder connection is obvious by its appearance. A grainy or pitted joint is a poor connection due to insufficient heat. Blobs of solder on the wire or solder lug is also due to insufficient heat. Solder should flow as a result of the heated lug and wire. Do not solder by applying solder to the iron tip and then wiping the hot solder onto the joint. A well soldered joint is indicated by a smooth bright finish on the soldered connection.



Construction Hints: The various lengths of wire to be used in the kit are specified in the construction steps. After cutting the wire to the length specified, strip the insulation off 1/4" from each end. The exposed wire will be used to make the actual connection to the solder lug.

Shield wire sizes are also indicated in the specific construction step. In the particular step you will be told just how much of the outer insulation must be removed and just how long the shield strands and inner conductor (s) must be.

Components, such as resistors, capacitors, transformers, etc., may have longer leads than specified. Cut the leads to the length indicated in the particular construction step. This length is to be measured from the body of the component. In the case of insulated leads, strip 1/4" of insulation off from the ends and twist the strands (if any) of the wire together.

As an example, one step may specify that each lead on a resistor be cut to 1/2". 1/4" of each lead is used to make a mechanical connection to the solder lug. The other 1/4" is between the socket and the component so that the component will not be overheated when soldering.

When a connection is indicated, a (C) or an (S) will appear next to the lug involved. The (C) indicates that the connection should be made mechanically, but is not to be soldered yet, since other leads are to be connected to this same lug. The (S) indicates that the connection should be made and soldered immediately. However, the (S) is always followed by a number, such as (S1), (S2), (S3), etc. This number indicates the number of connections made to the lug. It is a check on the accuracy of your work.

As an example, if it says (S3), you should count three leads going to the lug to be soldered. If there are less than three leads at this particular lug, you will know that you have forgotten one or more leads, or connected them to the wrong lugs. If there are more than three leads, you can be certain you have connected an extra wire to this lug, which should probably go elsewhere.

When you assemble the components in your unit, mark the symbol number of each socket and terminal strip near the part with a crayon. This will facilitate your wiring operation.

When wiring, lay the component in, close to the chassis, dressed as shown in the drawing. Be careful to avoid shorts at the lugs. The book is written so that the wiring closest to the chassis usually gets wired in first. The next layer of wires are to be soldered in next. In each case, dress the leads and components as close to the chassis as possible.

Next to each step number you will find a parenthesis ( ). After you have completed each step, make a check mark in the parenthesis so that you will have a record of your work. Follow the steps in the sequence written in the book. Do not skip steps or pages.

If any addendas are included in your book to modernize your instrument or make corrections or part substitutions, be sure to correct the Construction Book first before you start to wire or assemble your kit.

You are now ready to construct your fine tuner.

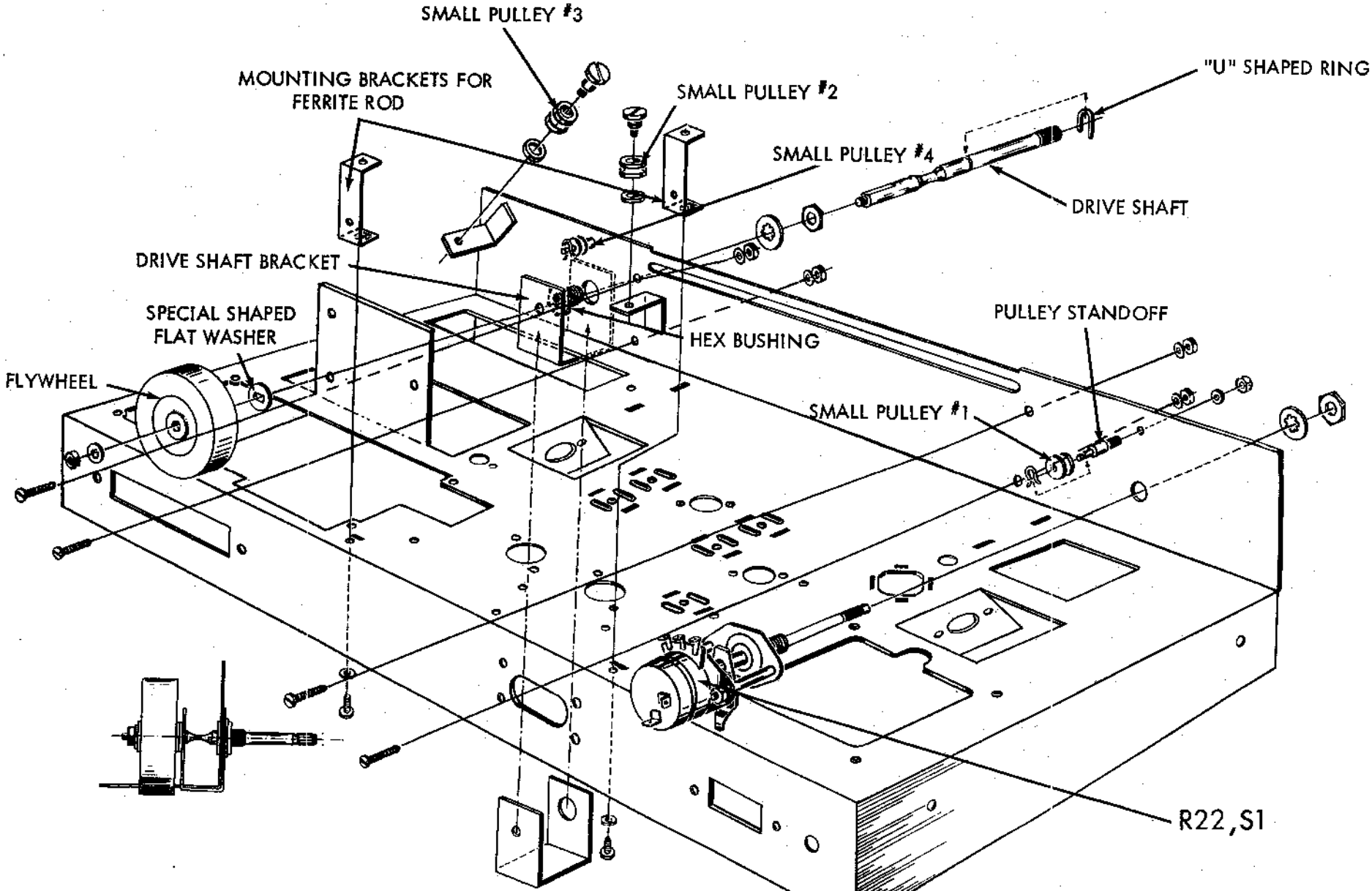

SMALL PULLEY #3
MOUNTING BRACKETS FOR FERRITE ROD
SMALL PULLEY #2
"U" SHAPED RING
SMALL PULLEY #4
DRIVE SHAFT
DRIVE SHAFT BRACKET
SPECIAL SHAPED FLAT WASHER
HEX BUSHING
PULLEY STANDOFF
FLYWHEEL
SMALL PULLEY #1
R22,S1

**Fig. 1**

## TOP OF CHASSIS ASSEMBLY

1. Fig. 1. Mount the drive shaft bracket from below the chassis as shown. Set the bracket in position so that the leg with the large hole rests against the front side of the chassis apron. Secure the 3/8 hex bushing (and the drive shaft bracket) in position with a 3/8 lockwasher and a 3/8 hex nut. Note that the leg with the larger hole against the front apron is mounted from the outside of the chassis. The bottom part of the bracket is below the chassis. Only the leg with the smaller round hole sticks out inside above the chassis and comes through the rectangular hole in the chassis.

2. Fig. 1. Mount the potentiometer and switch combination, R22, S1, as shown. Note the lever from the shaft of the potentiometer extends through the rectangular hole underneath the component. Secure to the front chassis apron using one #3/8 lockwasher and one 3/8 hex nut.

3. Fig. 1. Just above the potentiometer switch combination, R22, S1, mount the pulley standoff to the chassis. Use one #6 lockwasher and one #6-32 hex nut.

4. Fig. 1. On the thin shaft of the standoff, mount the small pulley #1. Use a cotter pin to secure the pulley to the shaft.

5. Fig. 1. Similar to steps numbers 3 and 4, mount the Small Pulley #4 on the front apron of the chassis, as shown.

6. Fig. 1. Mount the small pulleys #2 and #3 to the angle brackets welded to the front apron on the chassis. Use one special #4 shoulder screw (upper shank unthreaded) and a #4 flatwasher on each. Place one pulley on top of each washer. Do not tighten the screws too much or the pulleys will bind and the threads will be damaged.

7. Fig. 1. Mount the two ferrite rod mounting brackets to the top of the chassis near the rear edge. The small tab in one leg of each bracket fits through the rectangular slit in the chassis. Secure each bracket with a #6-32 x 1/4 screw and a #6 lockwasher.

8. Fig. 1. Mount four #6-32 x 1 1/8 screws to the front apron. Use a #6 flatwasher and a #6-32 hex nut for each screw. The black backing plate and dial scale will be mounted later to these screws.

9. Fig. 1. Close the "U" shaped ring around the anular groove on the drive shaft.

10. Fig. 1. From the front of the chassis, pass the threaded end of the cord drive shaft through the 3/8 bushing and the small hole in the drive shaft bracket. The threaded end of the cord drive shaft is now protruding at the rear from the small hole in the drive shaft bracket. Over this threaded end, pass the specially shaped flat washer, the flywheel, a #10 lockwasher and a #10-24 hex nut, in the order given. The flywheel will fit on the shaft only if the side of the flywheel having the three small circular indentations is facing toward the front of the chassis. Tighten the whole assembly. Note that the drive shaft must rotate freely. A position of the 3/8 hex nut can always be found which will permit free rotation of the drive shaft. Adjust the 3/8 hex nut a little bit at a time until you find a position at which the drive shaft does turn freely. Note that it is quite normal to find that the drive shaft will not turn freely if the 3/8 hex nut is either tightened or loosened slightly from a position at which the drive shaft does turn freely DO NOT thread the dial cord until free rotation of the shaft is assured. Check the three pulleys mounted in steps 4 and 5 above to be sure that they will rotate freely.

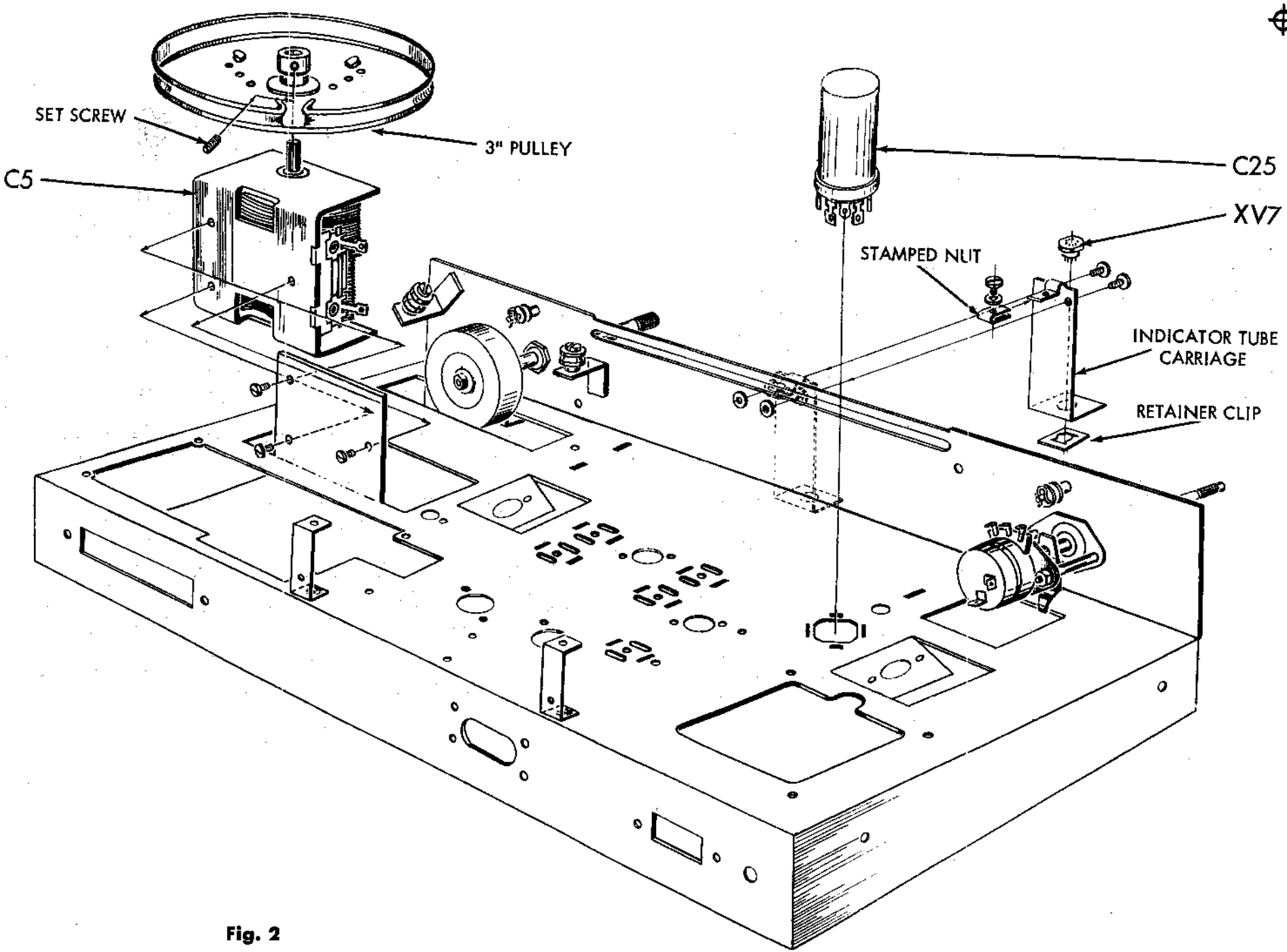

SET SCREW
3" PULLEY
C5
C25
XV7
STAMPED NUT
INDICATOR TUBE CARRIAGE
RETAINER CLIP

**Fig. 2**

(✓) 1. Fig. 2. Snap the small stamped nut in position on the indicator tube carriage. Screw a #4-40 screw and a #4 flat washer into the nut. Do not tighten screw.

(✓) 2. Fig. 2. Pass the leads pre-wired to socket XV7 through the "D" shaped hole in the indicator tube bracket. Note that the flat on the socket automatically positions the socket. Pass the leads through the retainer clip and firmly press it over the socket to secure the socket to the tube carriage.

(✓) 3. Fig. 2. Mount the indicator tube carriage to the chassis as follows: Lay the carriage in place against the chassis front, as shown. Insert the shoulder of one of the special round brass tapped eyelets into the chassis slot from the rear and line it up behind one of the holes in the carriage. Insert a brass screw through one of the holes in the carriage into the threaded hole in the round brass tapped eyelet and then tighten the screw. Do the same with the second round brass tapped eyelet and brass screw using the second hole in the carriage. The carriage should slide freely along the full length of the slot when you are finished.

(✓) 4. Fig. 2. Mount the 40-20-20 mfd electrolytic can capacitor, C25, as shown. Note the orientation (direction of half moon, square and triangle) in figure 5. Twist all four tabs about 1/4 turn. Do not twist too much or the tabs will shear off. Solder the tab without the hole to the chassis to assure a good ground contact.

(✓) 5. Fig. 2. Turn the shaft on the variable capacitor C5, so that the plates are fully in mesh - closed (maximum capacity). This will prevent damage to the rotor plates. Mount the capacitor to the chassis bracket bent at a right angle with the rest of the chassis. The capacitor is to be mounted with the trimmer screws facing and closest to the edge of the chassis. Secure the capacitor to the bracket using three #6-32 x 1/8 screws.

(✓) 6. Fig. 2. Mount the set screw into the hole in the bushing of the 3" pulley. Rotate this screw three times in the hole so that it will not come loose.

(✓) 7. Fig. 2. Slide the 3" pulley over the capacitor shaft. Rotate the pulley and note if it is parallel to the frame of the capacitor. It is parallel if the pulley does not wobble when rotated. If it is not parallel, bend the pulley slightly. Push the pulley towards the frame. There should be about 1/32" clearance between the pulley bushing and the frame. Turn the pulley clockwise on the shaft until the opening in the side of the pulley is towards the side of the chassis, away from the center. Tighten the set screw when the pulley is in this direction, and the tuning capacitor is fully closed.

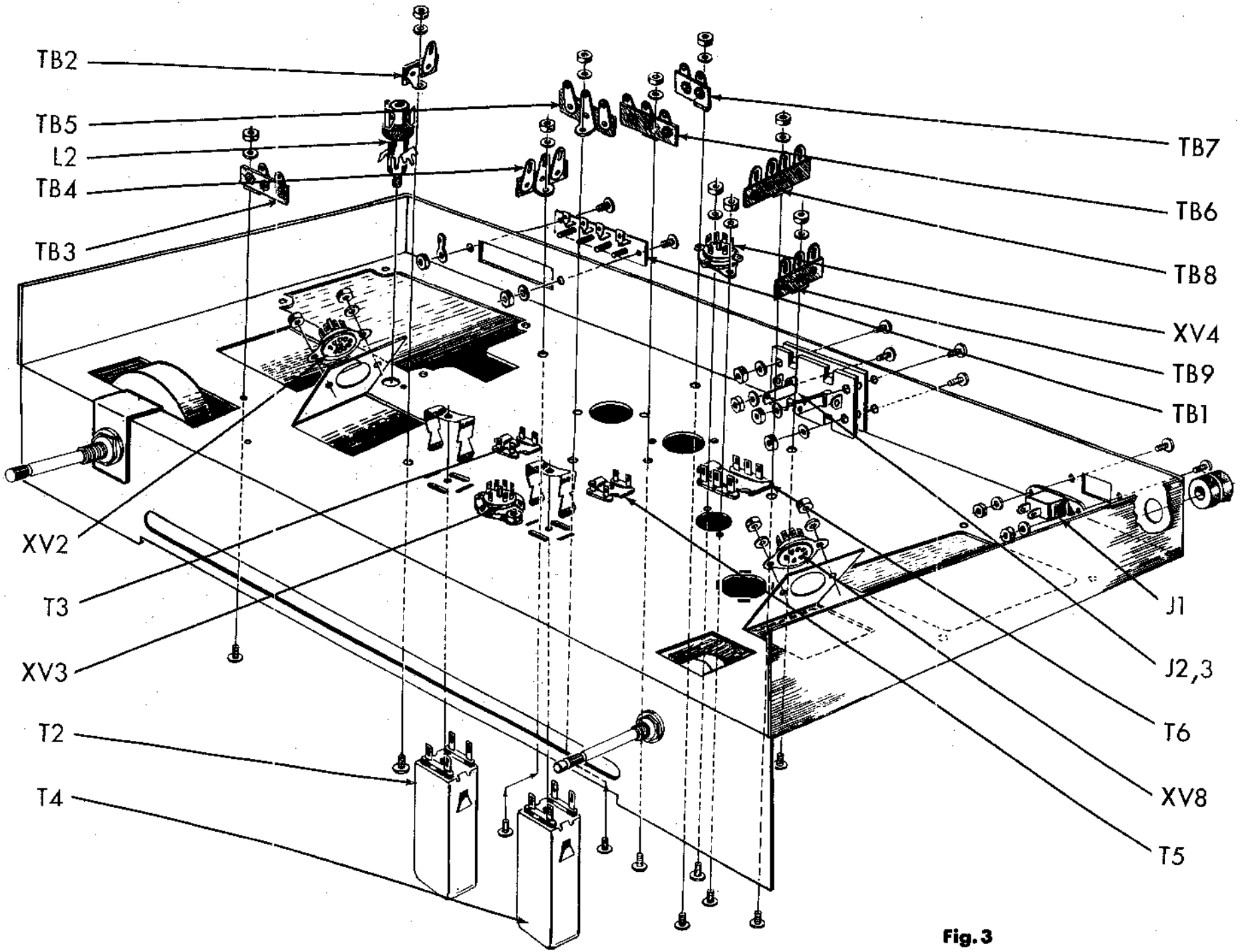

TB2
TB5
L2
TB4
TB3
XV2
T3
XV3
T2
T4
TB7
TB6
TB8
XV4
TB9
TB1
J1
J2,3
T6
XV8
T5

Fig. 3

## BELOW CHASSIS ASSEMBLY

( ) 1. Fig. 3. Mount the convenience outlet J1, in the rear apron of the chassis. Use two #6-32 x 1/4 screws, two #6 lockwashers and two #6-32 hex nuts.

( ) 2. Fig. 3. In the hole next to the convenience outlet, mount a 3/8" rubber grommet.

( ) 3. Fig. 3. Mount dual jack J2, 3, as shown. Use four #4-40 x 3/8 screws, four #4 lockwashers and four #4-40 hex nuts. Use a bakelite insulator between the chassis and the jack.

( ) 4. Fig. 3. On four screw antenna terminal board TB1, bend up all lugs as shown in the drawing. From the outside of the chassis, mount the board using two #6-32 x 1/4 screws and two #6-32 hex nuts. Under one hex nut, mount a #6 ground lug and under the second hex nut mount a #6 lockwasher. Check that the lugs are bent parallel to the rear apron of the chassis and are about 3/16" away from the rear apron so that they will not short against the chassis or the component to be mounted near the lugs.

( ) 5. Fig. 3. Mount the seven pin miniature socket, without the center shield lug, XV8, as shown. Use two #4-40 screws, two #4 lockwashers and two #4-40 hex nuts. Note orientation in figure 5.

( ) 6. Fig. 3. Mount the seven pin miniature sockets, with the center shield lugs, XV3 and XV4, as shown. Use two #4-40 screws, two #4 lockwashers and two #4-40 hex nuts on each. Note orientation in figure 5.

( ) 7. Fig. 3. Mount the tan nine pin miniature socket, XV2, as shown. Use two #4-40 screws, two #4 lockwashers and two #4-40 hex nuts. Note orientation in figure 5.

( ) 8. Fig. 3. Mount the one post right terminal strip TB2, the two post left terminal strip TB3, the four-two post with ground terminal strip TB4, TB5, TB6 and TB9, the one post right with ground terminal strip TB7, and the three post two right with ground terminal strip TB8, as shown. Use one #6-32 screw, one #6 lockwasher and one #6-32 hex nut on each. See Fig. 5 for the orientation of the terminal strips.

( ) 9. Fig. 3. Mount the rectangular cans, T2, T3, T4, T5 and T6, as shown. Use the special brass clip provided to hold each can. Each can may be identified by the stock number stamped on the can. The stock number for T2 is 34613, for T3 is 34603, for T4 is 34614, for T5 is 34605 and for T6 is 34602. T2 through T5 are IF cans and T6 is the ratio detector can. Orient each can so that the color dot, identifying one of the terminals, is as shown in figure 5. Push the plastic at the bottom of the can (in which the solder lugs are mounted) through the longer two of the four elongated slots (which surround the round hole). When this is done, the can stands on the top of the chassis. From the bottom of the chassis, insert the brass spring clip through the two remaining elongated slots, by spreading the clip apart slightly. Next, push one side of the clip up far enough so that it will catch in the "Y" shaped hole at the side of the can. Hold the can firmly against the top of the chassis with one hand. With the index finger of the other hand, working from the bottom of the chassis, push the clip up until it clicks into the remaining "Y" shaped hole in the other side of the can. Repeat this for each of the five cans.

( ) 10. Fig. 3. Insert the oscillator coil, L2, into the hole near the variable capacitor and FM Front End Assembly, from the bottom of the chassis. Note the orientation in figure 5. The small locating pin on the mounting clip should fit into the small hole adjacent to the mounting hole. Push down toward the chassis until two soft clicks are heard and the coil form is held firmly to the chassis by the spring action of the two legs.

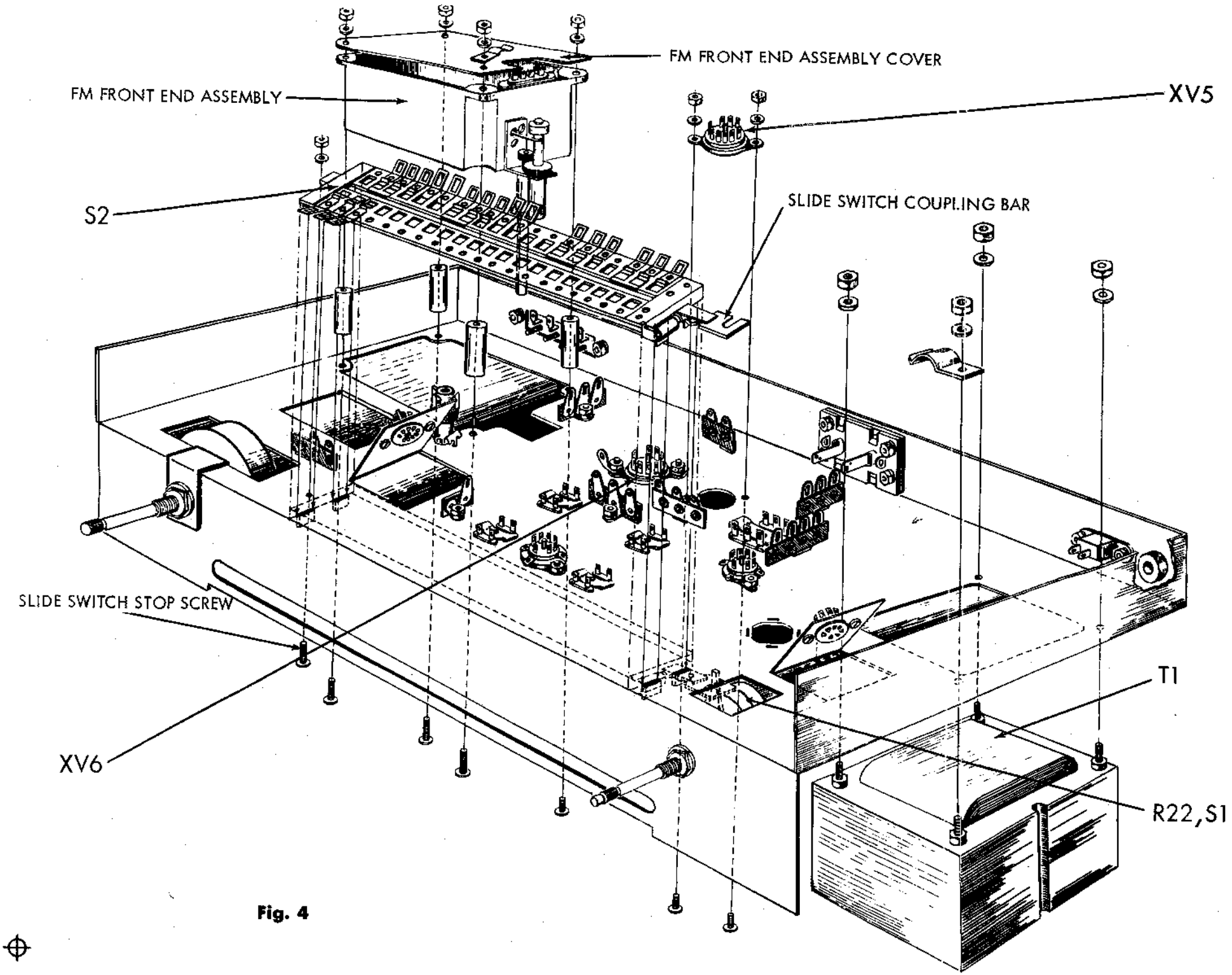

FM FRONT END ASSEMBLY COVER
FM FRONT END ASSEMBLY
XV5
S2
SLIDE SWITCH COUPLING BAR
SLIDE SWITCH STOP SCREW
XV6
T1
R22,S1

**Fig. 4**

1. Fig. 4. Mount the two nine pin miniature tube sockets, XV5 and XV6, as shown. Use two #4-40 screws and two #4-40 hex nuts. On XV5, use two #4 lockwashers under the hex nuts. On XV6, use one #4 lockwasher under one hex nut and one #4 ground lug under the second hex nut. Note orientation in figure 5.

2. Fig. 4. On power transformer T1, cut both green leads, one red lead and the white leads to 4". Cut the red-white and the second red lead to 5". Cut both black leads to 2". Strip 1/4" of insulation off from the ends of each of these leads. Mount the power transformer as shown, with the red leads close to the side of the chassis, away from the center. Use four #8 lockwashers and four #8-32 hex nuts. Under one of the lockwashers, mount a cable clamp. The two green leads, the two red leads, the red white lead and the white lead are to be run under this cable clamp.

3. Fig. 4. Mount the FM Front End Assembly as shown. Use four #6-32 x 1 1/8" screws, four 11/16" aluminum spacers, four #6 lockwashers and four #6-32 hex nuts. The screws are passed through the four holes through the top of the chassis. The spacers are placed over these screws from the bottom of the chassis. The FM Front End Assembly is placed over these spacers with the FM Front End Assembly cover over this. Each screw and the FM Front End Assembly is secured to the chassis with the four lockwashers and four hex nuts. Note that the shielded lead from the FM Front End Assembly must pass through the notch in the FM Front End Assembly cover. Under one of the lockwashers, mount a cable clamp. Pass the shielded lead under the cable clamp as shown in figure 5.

Above the chassis, looking from the rear, you will see two solder lugs mounted on the FM Front End Assembly. Bend these lugs so that they are straight up and down.

4. Fig. 4. Mount the 6-32 x 3/8" slide switch stop screw as shown from above the chassis. Use a #6 lockwasher and a #6-32 hex nut to secure the screw to the chassis.

5. Fig. 4. Mount the large slide switch, S2, as shown. Slip the slide switch coupling bar over the actuating lever protruding from the rectangular hole under the potentiometer-switch combination, R22, S1. It may be necessary to move the slide switch lever when doing his. Insert the four tabs on the slide switch through the four small slits near the front of the chassis. Twist all four tabs about 1/4 turn. Do not twist too much or the tabs will shear off.

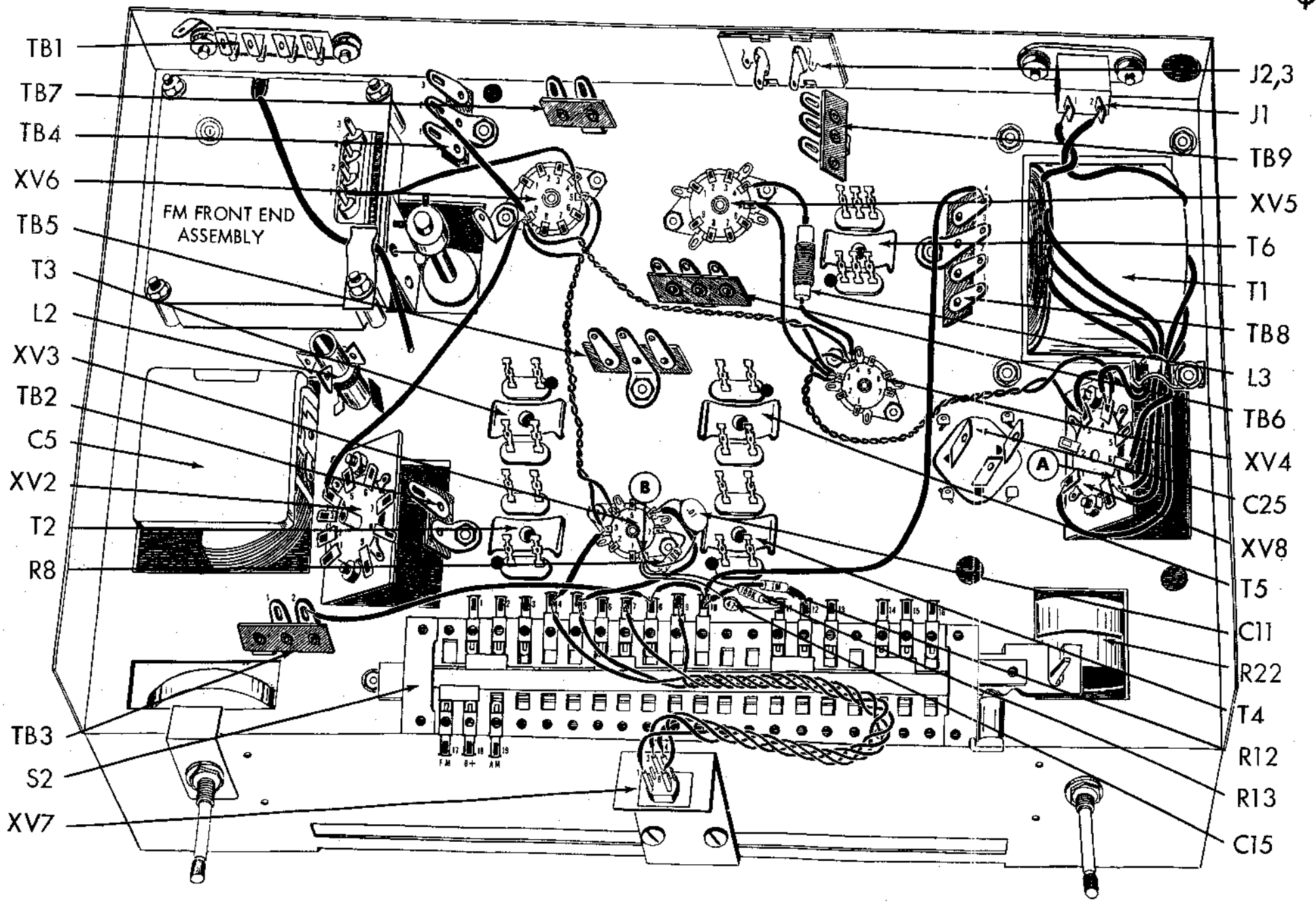

TB1
TB7
TB4
XV6
TB5
T3
L2
XV3
TB2
C5
XV2
T2
R8
TB3
S2
XV7
FM FRONT END ASSEMBLY
J2,3
J1
TB9
XV5
T6
T1
TB8
L3
TB6
XV4
C25
XV8
T5
C11
R22
T4
R12
R13
C15
A
B
FM
B+
AM

Fig. 5

## BELOW CHASSIS WIRING

1. Fig. 5. From power transformer T1, twist the two black leads as shown. Connect one lead to J1-1 (C) and the second lead to J1-2 (C).

2. Fig. 5. From power transformer T1, connect the red-yellow and white leads to ground lug "A" (S2) at XV8; connect one red lead to XV8-1 (S1) and the second red lead to XV8-6 (S1); connect one green lead to XV8-3 (C) and the second green lead to XV8-4 (C).

3. Fig. 5. Connect one end of a 5" piece of yellow wire to XV8-4 (S2) and one end of a 5" piece of brown wire to XV8-3 (S2). Twist both leads together. Run the leads along the chassis, as shown. Connect the other end of the yellow lead to XV4-4 (C) and the other end of the brown lead to XV4-3 (C).

4. Fig. 5. Connect one end of a 5" piece of yellow wire to XV4-4 (C) and one end of a 5" piece of brown wire to XV4-3 (C). Twist the two leads together. Run the leads along the chassis, as shown. Connect the other end of the yellow wire to XV6-5 (C) and the other end of the brown wire to XV6-9 (C).

5. Fig. 5. Connect a 2 1/2" piece of brown wire from XV4-3 (S3) to XV5-5 (S1).

6. Fig. 5. Cut both leads on RF choke, L3, to 7/8". Cover each lead with a 5/8" piece of spaghetti. Connect from XV4-4 (C) to XV5-4 (S1). Dress the choke close to the chassis.

7. Fig. 5. Connect a 3/4" piece of bare wire from XV6-4 (C) to XV6-5 (C).

8. Fig. 5. Connect a 4" piece of yellow wire from XV6-4 (C) to terminal 1 (S1) on the FM Front End Assembly. Apply a minimum of heat to the terminal to prevent damage.

9. Fig. 5. Connect one end of a 4" piece of yellow wire to XV6-5 (C) and one end of a 4" piece of brown wire to XV6-9 (C). Twist both wires together and run them along the chassis, as shown. Connect the other end of the yellow wire to XV3-4 (C) and the other end of the brown wire to XV3-3 (C).

10. Fig. 5. Connect a 4" piece of brown wire from XV6-9 (C) to XV2-4 (S1).

11. Fig. 5. Connect a 3" piece of brown wire from XV6-9 (S4) to TB4-2 (C).

12. Fig. 5. Connect a 2" piece of brown wire from XV3-3 (S2) to S2-4 (C).

13. Fig. 5. From the tuning indicator socket, XV7, cut all leads to 5 1/2". Twist the leads as shown. Connect the black lead to S2-4 (S2), the red lead to S2-5 (C), the yellow lead to S2-7 (S1) and the brown lead to S2-9 (C).

14. Fig. 5. Connect a 4" piece of red wire from XV3-6 (C) to S2-5 (S2).

15. Fig. 5. Connect a 4" piece of violet wire from TB3-2 (C) to S2-8 (C).

16. Fig. 5. Connect a 1" piece of violet wire from S2-8 (S2) to S2-10 (C).

17. Fig. 5. Connect a 7" piece of violet wire from TB8-4 (C) to S2-10 (C).

18. Fig. 5. Cut both leads on a 1 Meg (brown, black, green, silver) resistor, R12, to 3/4". Cover each lead with a 1/2" piece of spaghetti. Connect from S2-10 (S3) to S2-12 (C).

19. Fig. 5. Cut both leads on a 100Ω (brown, black, brown, silver) resistor, R8, to 1/2". Connect from XV3-7 (S1) to ground lug "B" (C) at XV3.

20. Fig. 5. Connect a 3/4" piece of bare wire from the center post (S1) on XV3 to ground lug "B" (C) at XV3.

21. Fig. 5. Cut both leads on a 100K (brown, black, yellow, silver) resistor, R13, to 5/8". Connect from S2-11 (C) to ground lug "B" (C) at XV3.

22. Fig. 5. Cut both leads on a 47 mmf disc capacitor, C15, to 3/4". Connect from S2-11 (S2) to ground lug "B" (C) on XV3.

23. Fig. 5. Cut both leads on a .01 mfd (10K or 10,000 mmf), 10% disc capacitor, C11, to 1/2". Connect from XV3-6 (C) to ground lug "B" (S5) on XV3.

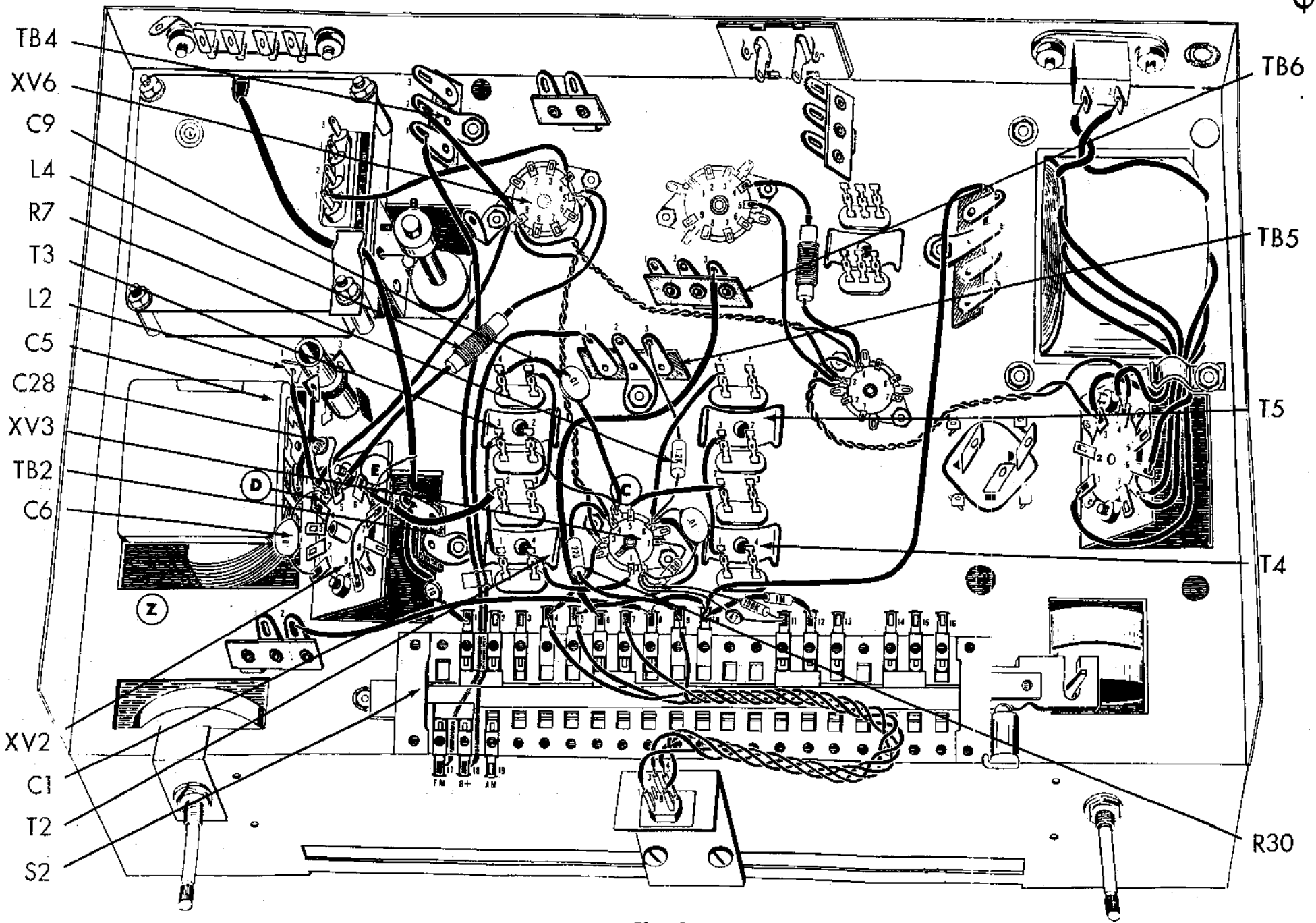

TB4
XV6
C9
L4
R7
T3
L2
C5
C28
XV3
TB2
C6
XV2
C1
T2
S2
TB6
TB5
T5
T4
R30
FM
B+
AM

Fig. 6

(  ) 1. Fig. 6. Connect a 1 3/4" piece of red wire from XV3-6 (C) to T5-4 (S1).

(  ) 2. Fig. 6. Connect a 5" piece of violet wire from S2-6 (S1) to TB6-3 (C). Run the wire along chassis as shown.

(  ) 3. Fig. 6. Cut both leads on a 1.2K (brown, red, red, silver) 1 watt resistor, R7, to 3/4". Connect from XV3-6 (S4) to TB5-3 (C). Dress the resistor close to the chassis.

(  ) 4. Fig. 6. Connect a 1 1/2" piece of red wire from T4-1 (S1) to T5-3 (S1).

(  ) 5. Fig. 6. Connect a 1 1/2" piece of red wire from XV3-5 (S1) to T4-2 (S1).

(  ) 6. Fig. 6. Connect a 1 1/2" piece of white wire from XV3-1 (S1) to T2-4 (S1).

(  ) 7. Fig. 6. Bend XV3-2 down to the center post on socket XV3 and solder this pin to the center post.

(  ) 8. Fig. 6. Cut both leads on a 220Ω (red, red, brown, gold) 1 watt 5% resistor, R30, to 3/4". Cover each lead with a 1/2" piece of spaghetti. Connect from XV3-4 (S2) to S2-9 (S2). Dress the resistor close to the chassis.

(  ) 9. Fig. 6. Connect one end of a 6 1/2" piece of red wire to TB4-1 (C). Run this lead along the chassis, and under switch S2, as shown. Connect the other end of this wire to S2-17 (S1).

(  ) 10. Fig. 6. Connect one end of a 6 1/2" piece of red wire to TB5-1 (C). Run the lead along the chassis and under the switch S2, as shown. Connect the other end of this wire to S2-18 (C). Tape the two pieces of wire (connected in step 9 and 10) to the chassis, as shown, with a small piece of scotch or masking tape.

(  ) 11. Fig. 6. Connect a 1 1/4" piece of bare wire from ground lug "C" (C) at XV3 to T3-2 (S1).

(  ) 12. Fig. 6. Connect a 1 1/2" piece of white wire from T3-1 (S1) to T2-3 (S1).

(  ) 13. Fig. 6. Cut one lead on a .01 mfd (10K or 10,000 mmf) disc capacitor, C9 to 1 1/4". Cover this lead with a 1" piece of spaghetti and connect to ground lug "C" (S2) at XV3. Cut the second lead to 1/2" and cover with a 1/4" piece of spaghetti. Connect the lead to T3-4 (C).

(  ) 14. Fig. 6. Connect a 1 1/2" piece of red wire from T2-1 (S1) to T3-3 (S1).

(  ) 15. Fig. 6. Cover each lead on RF choke L4 with a 1 1/4" piece of spaghetti. Connect from XV6-5 (S4) to XV2-5 (C). Dress the choke close to the chassis.

(  ) 16. Fig. 6. Cut both leads on a .005mfd (5K or 5000 mmf) 10% disc capacitor, C28, to 1/2". Connect from XV2-5 (S2) to ground lug "D" (C) on XV2.

(  ) 17. Fig. 6. Connect one end of a 1 3/4" piece of white wire to L2-2 (C). Run the other end of the lead through the rectangular cutout "Z" near the variable capacitor C5. Connect the other end of the wire to C5-1 (S1).

(  ) 18. Fig. 6. Connect the outer metal shield of the shielded lead coming from the FM Front End Assembly to ground lug "E" (C) at XV2 and the inner conductor to TB2 (C).

(  ) 19. Fig. 6. Cut both leads on a 10 mmf disc capacitor, C1, to 3/4". Cover each lead with a 1/2" piece of spaghetti. Connect from TB2 (S2) to S2-1 (S1).

(  ) 20. Fig. 6. On the short piece of shielded cable supplied, one end has two leads (the inner conductor and the shield) and the second end has one lead (only the inner conductor). From the end with the two leads, twist the outer shield strands together. Connect the shield strands to ground lug "E" (S2) at XV2 and the inner conductor to XV2-6 (S1). From the other end of this cable, connect the inner conductor to T2-2 (S1).

Do not use too much heat when soldering the center conductor on outer shield to their respective terminals. Excessive heat will cause the insulation to melt resulting in a short circuit.

(  ) 21. Fig. 6. Cut both leads on a .01 mfd (10K or 10,000 mmf) disc capacitor, C6 to 1/2". Connect from XV2-1 (C) to ground lug "D" (C) on XV2.

(  ) 22. Fig. 6. Connect a 1 1/2" piece of black wire from L2-1 (S1) to ground lug "D" (C) on XV2.

(  ) 23. Fig. 6. Connect a 3/4" piece of bare wire from XV2-7 (C) to XV2-9 (S1).

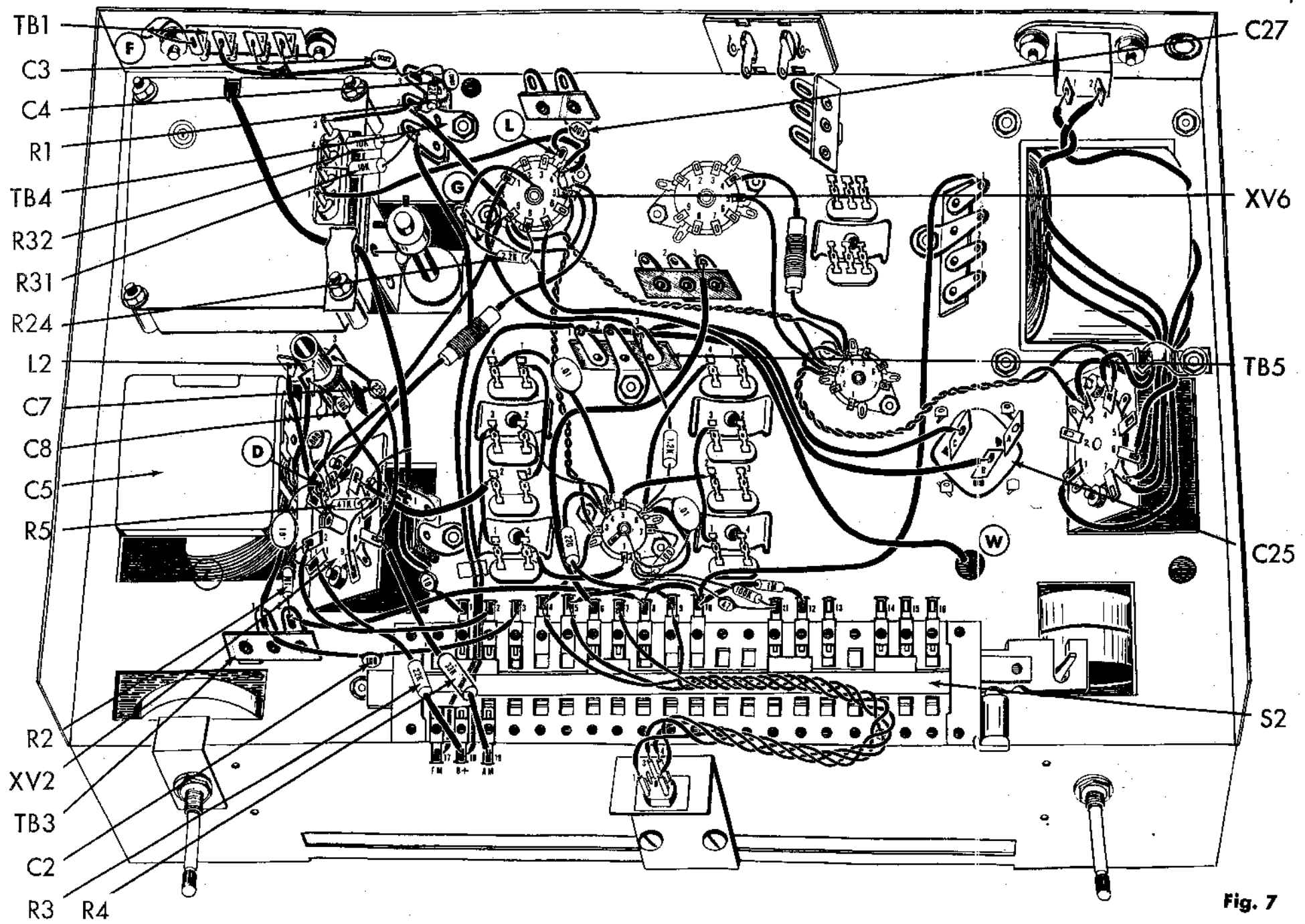

TB1
C3
C4
R1
TB4
R32
R31
R24
L2
C7
C8
C5
R5
R2
XV2
TB3
C2
R3
R4
C27
XV6
TB5
C25
S2
F
L
G
D
W

Fig. 7

(✓) 1. Fig. 7. Bend XV2-3 to the center lug on XV2.

( ) 2. Fig. 7. Cut both leads on a 47K (yellow, violet, orange, silver) resistor, R5, to 1/2". Connect from XV2-7 (C) to the center lug C on XV2.

(✓) 3. Fig. 7. Connect a 3/4" piece of bare wire from the center lug (S3) on XV2 to ground lug "D" (S4) on XV2.

( ) 4. Fig. 7. Cut both leads on a 100 mmf disc capacitor, C8, to 3/4". Cover each lead with a 1/2" piece of spaghetti. Connect from L2-2 (S2) to XV2-7 (S3).

( ) 5. Fig. 7. Cut both leads on a 225 mmf disc capacitor, C7, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from L2-3 (S1) to XV2-8 (C).

( ) 6. Fig. 7. Cut both leads on a 1M (brown, black, green, silver) resistor, R2, to 1/2". Connect from XV2-2 (C) to TB3-2 (S2).

(✓) 7. Fig. 7. Cut both leads on a 100 mmf disc capacitor, C2, to 1 1/4". Cover each lead with a 1" piece of spaghetti. Connect from TB3-1 (C) to S2-3 (S1).

(✓) 8. Fig. 7. Cut both leads on a 22K (red, red, orange, silver) 1 watt resistor, R3, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from XV2-1 (S2) to S2-18 (S2).

(✓) 9. Fig. 7. Cut both leads on a 33K (orange, orange, orange, silver) 1 watt resistor, R4, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from XV2-8 (S2) to S2-19 (S1).

(✓) 10. Fig. 7. Connect one end of a 3" piece of grey wire to TB3-1 (S2). Push the other end through rectangular hole "Z" next to the variable capacitor C5 to the top of the chassis.

(✓) 11. Fig. 7. Connect a 3" piece of white wire from XV2-2 (S2) to S2-2 (S1).

(✓) 12. Fig. 7. Cut all leads on two 10K (brown, black, orange, silver) 1 watt resistors, R31 and R32, to 1/2". Connect R31 from TB4-1 (C) to lug #2 (S1) on the FM Front End Assembly. Connect R32 from TB4-1 (S3) to lug #4 (S1) on the FM Front End Assembly. Do not use too much heat or it will melt the insulation on the FM Front End Assembly.

(✓) 13. Fig. 7. Connect a 1 3/4" piece of brown wire from TB4-2 (C) to lug #3 (S1) on the FM Front End Assembly. Do not use too much heat or it will melt the insulation on the FM Front End Assembly.

(✓) 14. Fig. 7. Connect a 3/4" piece of bare wire from TB1-1 (S1) to ground lug "F" (S1).

( ) 15. Fig. 7. Strip back 1/2" from both ends of a 2" piece of 300Ω twin lead. Connect one lead from one end to TB1-3 (S1) and the other lead from the same end to TB1-4 (S1). Without twisting the lead, push the remainder of the lead through hole "Y".

( ) 16. Fig. 7. On a .0022mfd (2.2K or 2000mmf) disc capacitor, C3, cut one lead to 1 1/2" and the second lead to 1". Cover the 1 1/2" lead with a 1 1/4" piece of spaghetti and connect to TB1-2 (S1). Connect the second lead to TB4-3 (C). Note that capacitor leads do not touch any metal component or screw.

(✓) 17. Fig. 7. Cut both leads on a 22K (red, red, orange, silver) resistor, R1, to 1/2". Connect from TB4-2 (C) to TB4-3 (C).

(✓) 18. Fig. 7. Cut both leads on a .0022mfd (2.2K or 2200mmf) disc capacitor, C4, to 1/2". Connect from TB4-2 (S4) to TB4-3 (C).

(✓) 19. Fig. 7. Connect a 4" piece of red wire from XV6-1 (S1) to TB5-3 (C).

(✓) 20. Fig. 7. Connect a 5" piece of red wire from TB5-1 (C) to C25-B (C).

(✓) 21. Fig. 7. Connect a 4" piece of red wire from TB5-3 (C) to C25-C (C).

(✓) 22. Fig. 7. Cut both leads on a 2.2K (red, red, red, silver) resistor, R24, to 1/2". Connect from XV6-8 (S1) to ground lug "G" (C) at XV6.

( ) 23. Fig. 7. Connect a 1 1/4" piece of black wire from the center post on XV6 (S1) to ground lug "G" (C) on XV6.

(✓) 24. Fig. 7. Cut both leads on a .005 mfd (5K or 5000 mmf) disc capacitor, C27, to 1/2". Connect from XV6-4 (S3) to ground lug "L" (S1) on XV6.

(✓) 25. Fig. 7. On one end of a 9" piece of shielded cable, strip the outer insulation back 3/4". Twist the shield strands together. Strip off 1/4" of the insulation from the inner conductor. Connect the inner conductor to XV6-7 (S1) and the outer shield to ground lug "G" (S3).

On the other end of the same piece of cable, strip the outer insulation back 1/2". Twist the shield strands together. Strip off 1/4" of the insulation from the inner conductor. Run the lead along the chassis as shown and push the unsoldered end through the rectangular hole "W", to the top of the chassis.

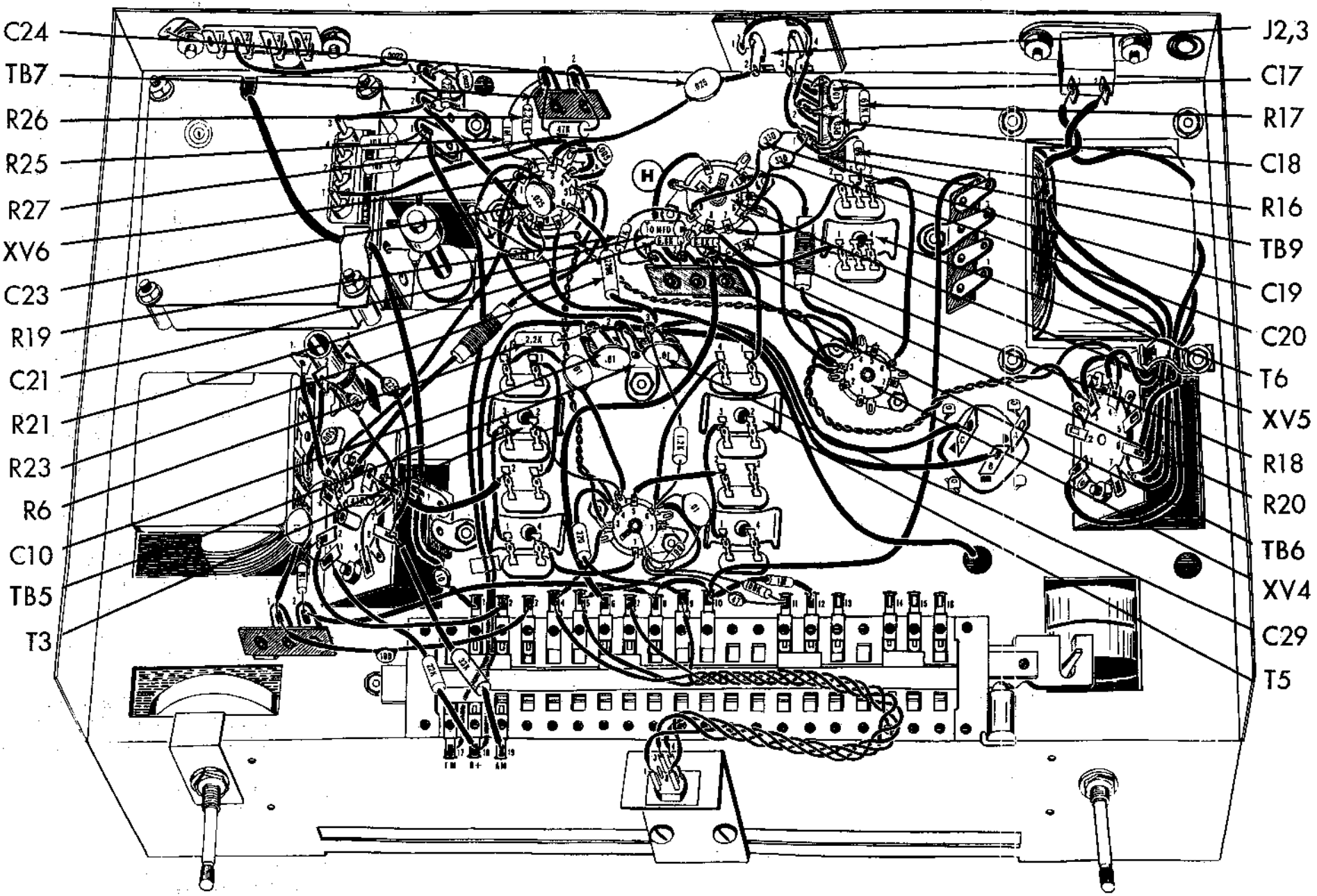

C24
TB7
R26
R25
R27
XV6
C23
R19
C21
R21
R23
R6
C10
TB5
T3
J2,3
C17
R17
C18
R16
TB9
C19
C20
T6
XV5
R18
R20
TB6
XV4
C29
T5
H

**Fig. 8**

( ) 1. Fig. 8. Cut both leads on a 47K (yellow, violet, orange, silver) 1 watt resistor, R27, to 3/4". Connect fromTB7-1 (C) to TB7-2 (S1). Dress the resistor close to the chassis.

( ) 2. Fig. 8. Cut both leads on a 2.2K (red, red, red, silver) resistor, R26, to 1/2". Connect from XV6-3 (C) to TB7-1 (C).

( ) 3. Fig. 8. Cut both leads on a 1M (brown, black, green, silver) resistor, R25, to 1/2". Connect from XV6-2 (C) to TB7-1 (S3).

( ) 4. Fig. 8. Cut both leads on a .025 mfd (25K or 25,000 mmf) disc capacitor, C24, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from XV6-3 (S2) to J2, 3-2 (S1).

( ) 5. Fig. 8. On the 220K (red, red, yellow, silver) 1 watt resistor, R23, cut one lead to 1/2" and the second lead to 1 1/4". Cover the longer lead with a 1" piece of spaghetti and connect to TB5-3 (C). Connect the remaining lead to XV6-6 (C). Dress the resistor close to the chassis.

( ) 6. Fig. 8. Cut both leads on a .025 mfd (25K or 25,000 mmf) disc capacitor, C23, to 1/2". Connect from XV6-2 (S2) to XV6-6 (S2).

( ) 7. Fig. 8. Cut both leads on a 2.2K (red, red, red, silver) 1 watt resistor, R6, to 1/2". Connect from T3-4 (S2) to TB5-1 (C). Dress the resistor close to the chassis.

( ) 8. Fig. 8. Cut all leads on two .01 mfd (10K or 10,000 mmfd) disc capacitors, C10 and C29, to 1/2". Connect C10 from TB5-1 (S4) to TB5-2 (C). Connect C29 from TB5-2 (S2) to TB5-3 (S5).

( ) 9. Fig. 8. Connect a 1 1/2" piece of black wire from J2, 3-1 (S1) to J2, 3-4 (C).

( ) 10. Fig. 8. Connect a 1 1/2" piece of black wire from J2, 3-4 (S2) to TB9-2 (C).

( ) 11. Fig. 8. Connect a 1 1/2" piece of white wire from J2, 3-3 (S1) to TB9-1 (C).

( ) 12. Fig. 8. Connect a 1" piece of bare wire from the center lug on XV5 to ground lug "H" (S1) at XV5.

( ) 13. Fig. 8. Push lugs XV5-1 and XV5-3 down to the center lug on XV5. Solder lugs XV5-1 and XV5-3 as well as the bare wire to the center lug on XV5.

( ) 14. Fig. 8. Cut both leads on a 10mfd electrolytic capacitor, C21, to 3/4". Connect the positive (+) lead to TB6-1 (C) and the negative (-) lead to TB6-3 (C). Dress the capacitor close to the chassis.

( ) 15. Fig. 8. Cut all leads on two 6.8K (blue, grey, red, silver) resistors, R20 and R21, to 1/2". Connect R20 from TB6-2 (C) to TB6-3 (C). Connect R21 from TB6-2 (S2) to TB6-1 (C).

( ) 16. Fig. 8. Connect a 3 1/2" piece of white wire from XV5-2 (S1) to T5-1 (S1).

( ) 17. Fig. 8. Cut both leads on a 1K (brown, black, red, silver) resistor, R19, to 1/2". Connect from XV5-9 (C) to TB6-1 (S3).

( ) 18. Fig. 8. Cut both leads on a 1.5K (brown, green, red, silver) resistor, R18, to 1/2". Connect from XV5-6 (C) to TB6-3 (S4).

( ) 19. Fig. 8. Connect a 1 3/4" piece of white wire from XV5-7 (S1) to T6-2 (S1).

( ) 20. Fig. 8. Connect a 1 1/2" piece of white wire from XV5-8 (S1) to T6-1 (S1).

( ) 21. Fig. 8. Cut one lead on the 330 mmf disc capacitor, C19, to 1 1/2" and the second lead to 1/2". Cover the longer lead with a 1 1/4" piece of spaghetti and connect to XV5-9 (S2). Connect the remaining lead to TB9-1 (C).

( ) 22. Fig. 8. Cut one lead on the 330 mmf disc capacitor, C20, to 1" and the second lead to 1/2". Cover the longer lead with a 3/4" piece of spaghetti and connect to XV5-6 (S2). Connect the remaining lead to TB9-1 (C).

( ) 23. Fig. 8. Cut both leads on a 68K (blue, grey, orange, silver) resistor, R17, to 3/4". Connect from TB9-1 (C) to TB9-3 (C).

( ) 24. Fig. 8. Cut both leads on a 68Ω (blue, grey, black, silver) resistor, R16, to 1/2". Connect from TB9-1 (C) to T6-5 (S1).

( ) 25. Fig. 8. Cut both leads on a 330 mmf disc capacitor, C18, to 1/2". Connect from TB9-1 (S6) to TB9-2 (C).

( ) 26. Fig. 8. Cut both leads on a .001 mfd (1K or 1000 mmf) disc capacitor, C17, to 1/2". Connect from TB9-2 (C) to TB9-3 (C).

( ) 27. Fig. 8. Connect a 2" piece of green wire from T6-3 (C) to XV4-6 (C).

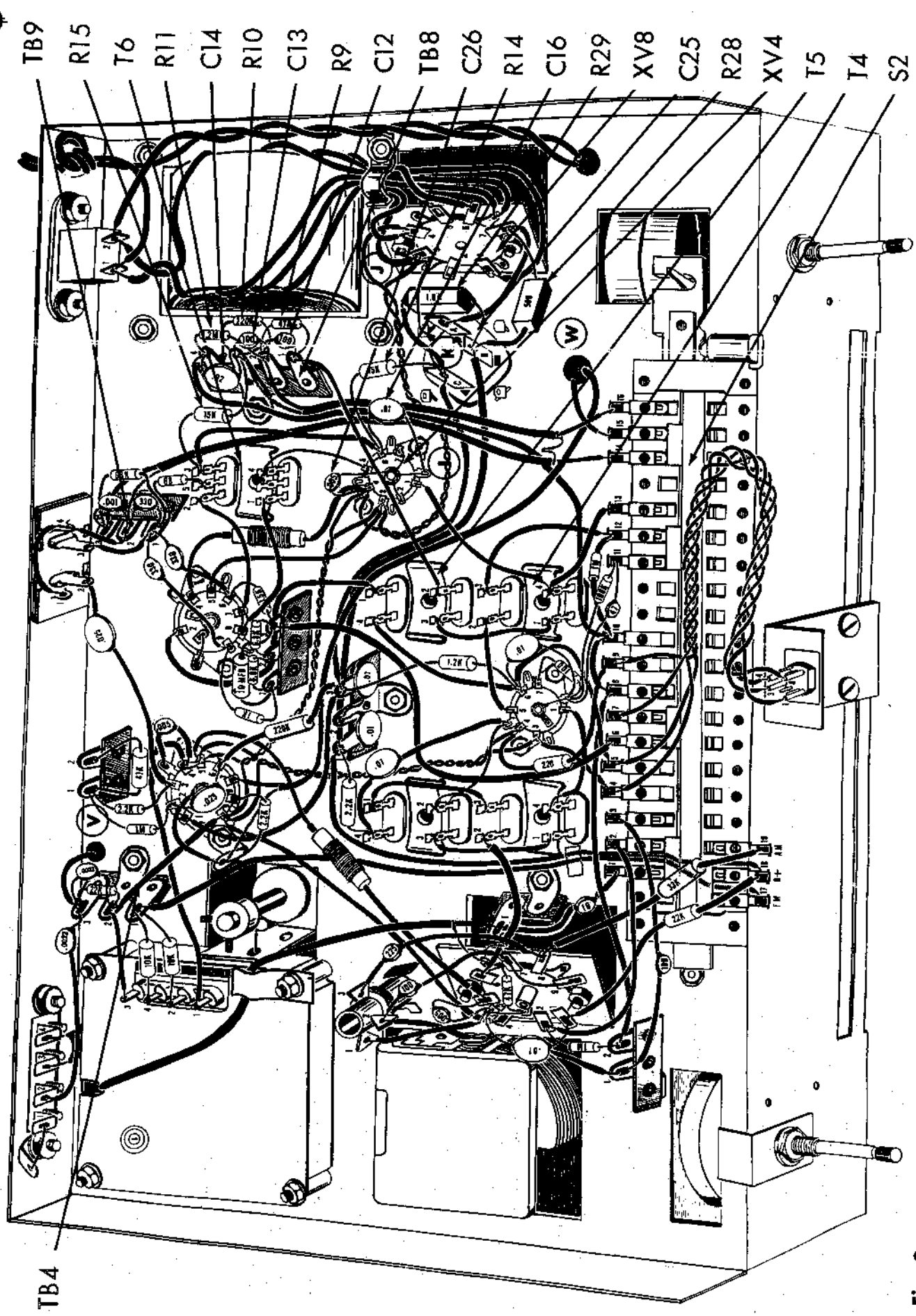

TB9
R15
T6
R11
C14
R10
C13
R9
C12
TB8
C26
R14
C16
R29
XV8
C25
R28
XV4
T5
T4
S2
TB4

Fig. 9

( ) 1. Fig. 9. Cut both leads on a 2.2M (red, red, green, silver) resistor, R11, to 3/4". Connect from TB8-2 (C) to TB8-4 (C).

( ) 2. Fig. 9. Cut both leads on a 15K (brown, green, orange, silver) 1 watt resistor, R15, to 3/4". Connect from T6-3 (S2) to TB8-3 (C).

( ) 3. Fig. 9. Cut both leads on a 220K (red, red, yellow, silver) resistor, R10, to 1/2". Connect from TB8-2 (C) to TB8-3 (C).

( ) 4. Fig. 9. Cut both leads on a 47K (yellow, violet, orange, silver) resistor, R9, to 1/2". Connect from TB8-1 (C) to TB8-2 (C).

( ) 5. Fig. 9. Cut both leads on a 100 mmf disc capacitor, C13, to 1/2". Connect from TB8-2 (C) to TB8-3 (C).

( ) 6. Fig. 9. Cut both leads on a 100 mmf disc capacitor, C12, to 3/4". Connect from TB8-1 (C) to TB8-3 (C).

( ) 7. Fig. 9. Cut both leads on a .02 mfd (20K or 20,000 mmf) disc capacitor, C14 to 1/2". Connect from TB8-3 (C) to TB8-4 (S3).

( ) 8. Fig. 9. Cut both leads on a .047 mfd (yellow, violet, orange, white, blue) molded capacitor C22, to 1 1/4". This capacitor is mounted on the top of the chassis, as may be seen in figure 10. Cover one lead with a 1" piece of spaghetti. Push this lead from the top of the chassis, through hole "W" to the bottom of the chassis. Connect this lead to S2-15 (S1).

( ) 9. Fig. 9. Connect a 3/4" piece of bare wire to center lug (C) on XV4 and connect to ground lug "I" (C) on XV4.

( ) 10. Fig. 9. Connect one 3/4" piece of bare wire from XV4-2 (S1) to the center lug (C) on XV4. Connect a second 3/4" piece of bare wire from XV4-7 (S1) to the center lug (C) on XV4.

( ) 11. Fig. 9. Cut both leads on a .005 mfd (5K or 5000 mmf) disc capacitor, C26, to 1/2". Connect from XV4-4 (S4) to the center lug on XV4. Solder the lead to the center lug (S4).

( ) 12. Fig. 9. Cut both leads on a .01 mfd (10K or 10,000 mmf) disc capacitor, C16, to 1/2". Connect from XV4-6 (C) to ground lug "I" (S2) at XV4.

( ) 13. Fig. 9. Connect a 1" piece of bare wire from T6-4 (S1) to XV4-5 (S1).

( ) 14. Fig. 9. On both ends of a 4" piece of shielded cable, strip the outer insulation back 1/2". Twist the shield strands together. On both ends, strip the insulation off 1/4" from the end of the inner conductor. On one end of the wire, connect the shield strands to TB8-3 (S6) and the inner conductor to TB8-2 (S5). Run the cable along the chassis, as shown. Connect the inner conductor on the other end to S2-16 (S1).

( ) 15. Fig. 9. On both ends of a 6" piece of shielded cable, strip the outer insulation back 1/2". Twist the shield strands together. On both ends, strip the insulation off 1/4" from the end of the inner conductor. On one end of the wire, connect the shield strands to TB9-2 (S4) and the inner conductor to TB9-3 (S3). Run the cable along the chassis, as shown. Connect the inner conductor on the other end to S2-14 (S1). Connect the outer shield at this end of the cable to the outer shield of the cable connected to the switch in the previous step. Solder these two groups of shield strands together. Dress away from the chassis so that the shield strands will not touch the chassis at any point.

( ) 16. Fig. 9. Cut both leads of a 15K (brown, green, orange, silver), 1 watt resistor, R14, to 3/4". Connect from XV4-6 (S3) to C25-C (C). Dress resistor close to the chassis.

( ) 17. Fig. 9. Connect a 2 1/2" piece of white wire from T5-2 (S1) to TB8-1 (S3).

( ) 18. Fig. 9. Connect a 1 1/2" piece of white wire from T4-3 (S1) to S2-12 (S2).

( ) 19. Fig. 9. Connect a 1" piece of white wire from T4-4 (C) to S2-13 (S1).

( ) 20. Fig. 9. Connect a 2" piece of white wire from T4-4 (S2) to XV4-1 (S1).

( ) 21. Fig. 9. Connect a 1" piece of bare wire from ground lug "J" (S1) at XV8 to ground lug "K" (S1) at C25.

( ) 22. Fig. 9. Connect a 1 3/4" piece of red wire from XV8-7 (C) to C25-A (S1).

( ) 23. Fig. 9. Cut both leads on a 500Ω, 5 watt resistor, R28, to 3/4". Cover one lead with a 1/2" piece of spaghetti and connect to C25-B (C). Connect the second lead to XV8-7 (S2).

( ) 24. Fig. 9. Cut both leads on a 1800Ω, 5 watt resistor, R29, to 1 1/4". Cover each lead with a 1" piece of spaghetti. Connect from C25-B (S3) to C25-C (S3).

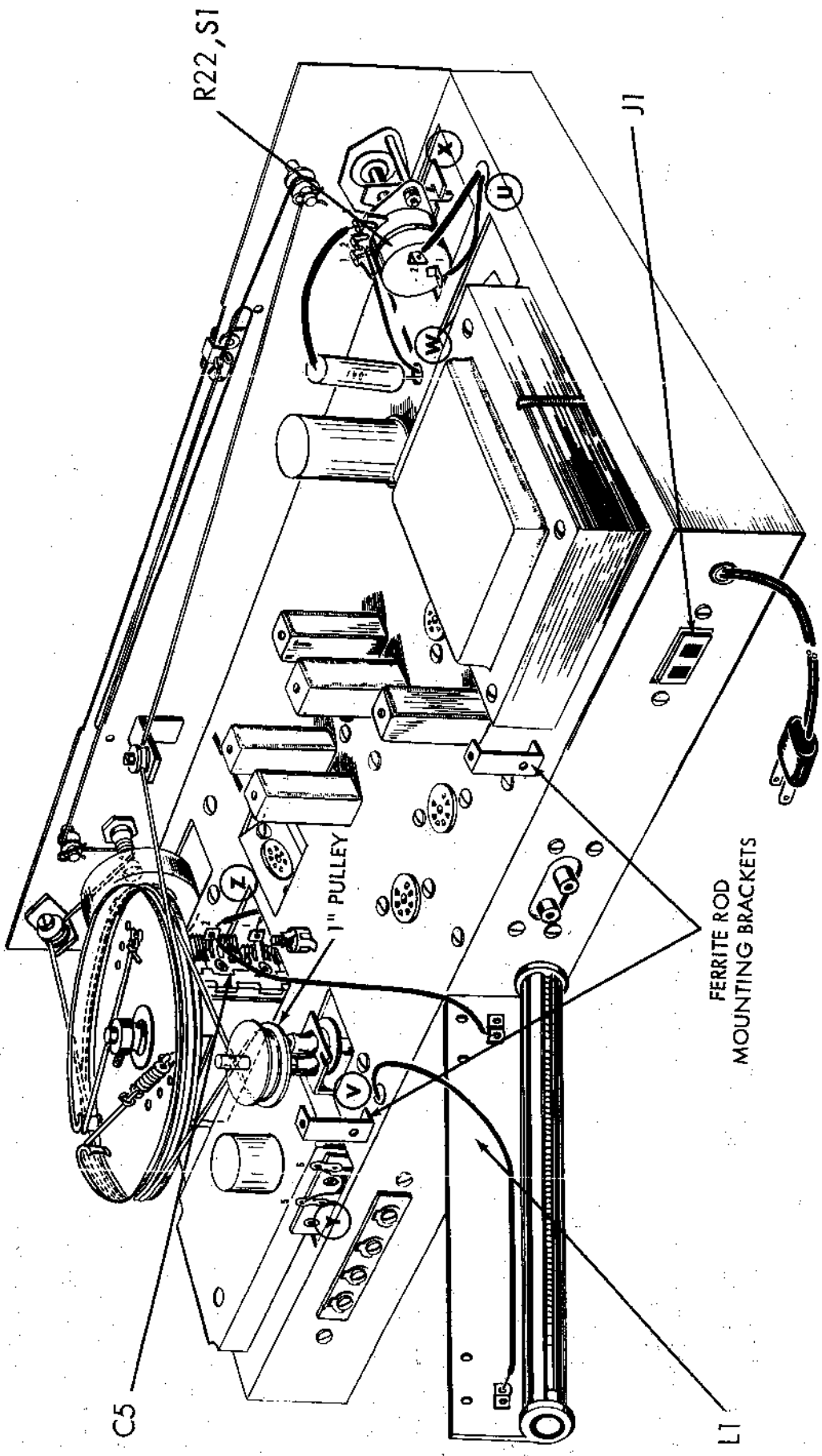



Fig. 10

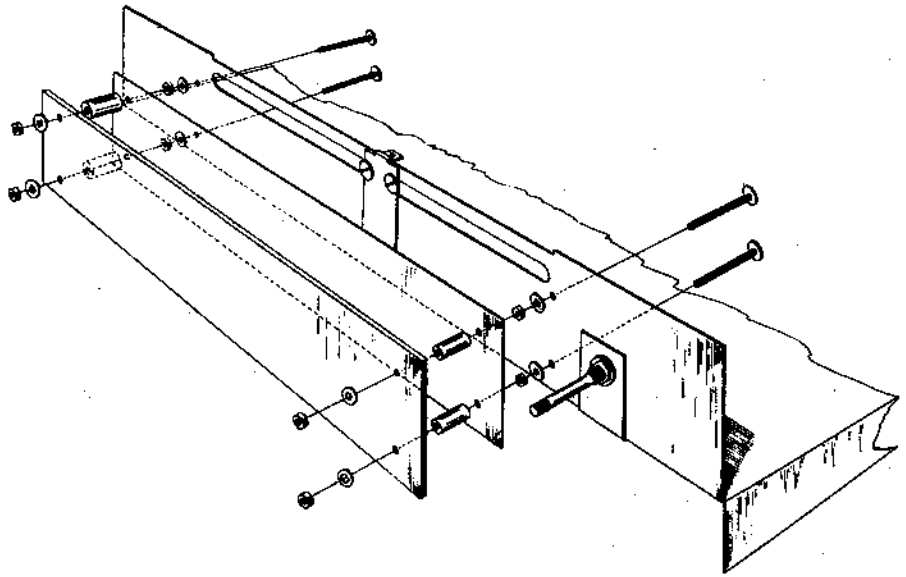


Fig. 11

## TOP OF CHASSIS WIRING

1. Fig. 10. From hole "W" connect the inner conductor of the shielded lead to R22-2 (S1) and the twisted shield strands to R22-1 (S1).

2. Fig. 10. A .047 mfd capacitor has been previously mounted with one lead passing to the bottom of the chassis through hole "W". Cover the remaining lead of this capacitor with a 1" piece of spaghetti and connect to R22-3 (S1).

3. Fig. 10. Connect the grey lead from hole "Z" near the variable capacitor, C5, to C5-2 (C). Dress the lead away from the rotor on the capacitor towards the front of the chassis.

4. Fig. 10. From the ferrite rod assembly, L1 push the black lead through hole "V" to the bottom of the chassis. Connect the white lead to C5-2 (S2). Connect the black lead to TB4-3 (S4). See Fig. 9.

5. Fig. 10. From hole "Y", connect one lead from the flat cable to terminal 5 (S1) on the FM Front End Assembly and the second lead to terminal 6 (S1).

6. Fig. 10. In the 1" pulley, insert a #8-32 set screw. Mount the pulley on to the RF Assembly shaft. Push the pulley down on the shaft so that 5/16" of the shaft protrudes about the top of the pulley. Tighten the pulley to the shaft with the set screw on the pulley.

7. Fig. 10. Mount the ferrite rod assembly, L1, on the ferrite rod mounting brackets, as shown in Figure 12. Turn the ferrite rod so that the flat part of the mounting bracket is facing up.

8. Fig. 10. From the rear, at the outside of the chassis, push the tinned leads of the line cord through the grommet. Inside the chassis, tie a knot in the line cord, 8" from the solder leads, so that the line cord cannot pull out through the grommet. Separate the two wires in the line cord by pulling the leads apart until the knot. Cut one wire to 2". As shown in figure 9, connect this wire to J1-1 (S2).

9. Fig. 10. Connect one end of an 8" piece of black wire to J1-2 (S2). As shown in figure 9, twist this lead with the remaining lead from the line cord mounted in the previous step. Run these leads along the chassis, as shown, and push these through hole "U" to the top of the chassis. On the top of the chassis, as shown in this figure, connect one of the leads from hole "U" to S1-1 (S1) and the second of these leads to S1-2 (S1).

10. Fig. 11. Place the black metal background plate on the four #6-32 x 1 1/8" screws previously mounted to the chassis front apron. If the background plate does not fit easily over the screws, loosen the 1 1/8" screws temporarily, slide the plate over the screws and then retighten the screws to the front panel apron. Insert the DM71 tube, V7, into socket XV7 on indicator tube carriage. If the DM70 (direct replacement) is supplied it is necessary to cut the leads to 1/4". Place a black spacer on each screw and mount the dial scale with four #6 lockwashers and four #6-32 hex nuts. Be sure to remove the protective paper from the dial scale.

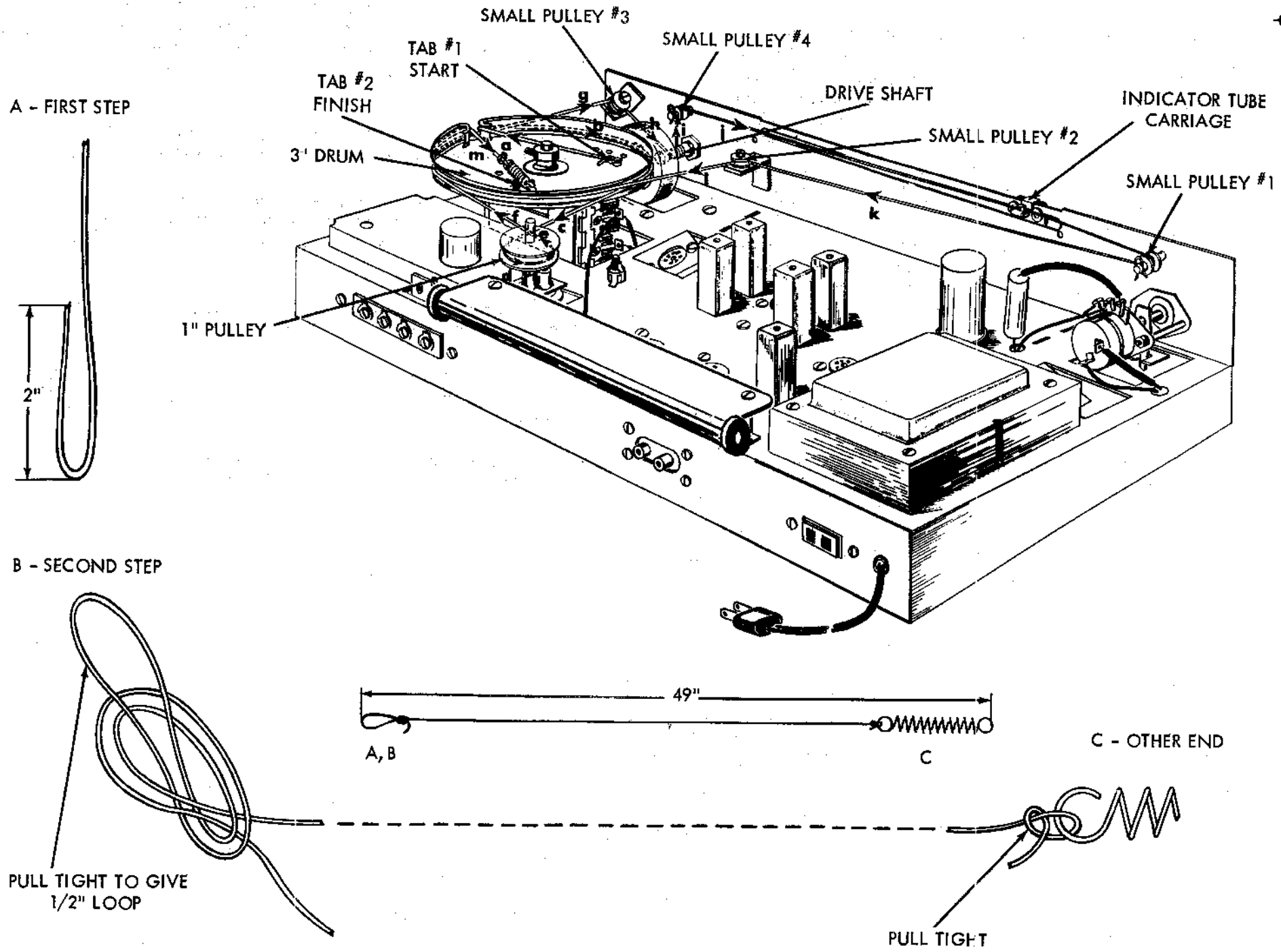

A - FIRST STEP
2"
SMALL PULLEY #3
SMALL PULLEY #4
TAB #1
START
TAB #2
FINISH
DRIVE SHAFT
INDICATOR TUBE
CARRIAGE
SMALL PULLEY #2
3" DRUM
SMALL PULLEY #1
1" PULLEY
B - SECOND STEP
49"
A, B
C
C - OTHER END
PULL TIGHT TO GIVE
1/2" LOOP
PULL TIGHT

**Fig. 12**

# DIAL CORD STRINGING

Figure 12 shows the appearance of the unit with the dial cord properly threaded. In the illustration, the tuning capacitor is seen fully meshed (closed) corresponding to a tuning position near the low-frequency end of the dial. Details are shown in the insert on the figure.

The stringing of the dial cord requires that the directions be followed exactly. Long-nose pliers and a thin screwdriver or soldering aid are essential tools. Proceed as follows:

( ) 1. Fig. 12. Prepare the dial cord-and-spring as shown in the insert in figure 12. Make the knot at the loop end exactly as shown in inserts A and B. Make a single knot at the spring end exactly as shown in insert C. Do not cut away any part of the loose ends that remain at this time. Now measure the overall length of the cord-and-spring as shown in the drawing. Move the knot on the spring end until a 49" overall length is obtained. A second and final knot will be made later when a check shows the spring tension to be correct.

( ) 2. Fig. 12. Turn the drum on the tuning capacitor shaft clockwise until the plates are fully meshed (closed). When the rear of the chassis faces you, the break-out slot on the rim of the drum should be facing the left hand side of the chassis. If it does not face the left hand side of the chassis, loosen the set screw that secures the drum to the shaft and set the drum to this position. In any case, check that the drum is on tight and can turn freely without rubbing.

( ) 3. Fig. 12. The shaft on the FM Front End Assembly should not be turned to either extreme of its range. It should be left at the approximate center position of its rotation. This will prevent any possible damage to the stop on the gear assembly when threading.

( ) 4. Fig. 12. Slip the loop in the cord over tab #1, as shown.

( ) 5. Fig. 12. String the cord exactly as shown, following the arrows and instructions implicitly. Run the cord (just attached to tab #1) through the break out slot, clockwise, half-way around the rim of the 3" drum. Next, run the cable around the rim of the 1" pulley in a counterclockwise direction. The cord is then run back to the 3" drum and continues in a clockwise direction around this 3" drum. (Note: the cord returning from the 1" pulley crosses the cord coming from the 3" drum at some point between these two pulleys. The cord returning from the 1" pulley is to be placed over the cord coming from the 3" drum). After running about 1/4 turn around the rim of the 3" drum, run the cord to small pulley #3, and around 1/4 turn in the direction shown. For convenience secure cord to 3" drum with tape. From small pulley #3, run the cord beneath and then around the drive shaft. The end of the cord with the spring is to be run 4 times around and under the drive shaft. A long-nose pliers and a thin screwdriver (or soldering aid) will help with the winding of the dial cord around the drive shaft. Wind the stipulated turns without crossing. The turns are wound towards the front apron of the chassis. While winding the cord around the drive shaft, the turns already wound should be held taut with one hand.

( ) 6. Fig. 12. Emerging from underneath the drive shaft, the cord is then run over small pulley #4, over to and around small pulley #1, and back to and around small pulley #2. From small pulley #2 it is run back to and clockwise around the 3" drum to the break out slot. Note that this cord is run around the 3" drum next to and above a cord that has been previously wound around this pulley. Run the end of the cord with the spring through the break out slot and attach the extreme end of the spring to tab #2. If the tension on the spring is proper, the spring loops will be open slightly and will turn both the 3" drum and the 1" pulley. In this case make a second knot where the cord attaches to the spring. If the tension is too great or too little, loosen the knot holding the spring and readjust so that the spring has sufficient tension. When the proper tension is found, tie the second knot at the dial cord-to-spring attachment, and trim both loose ends of the dial cord to 1 1/2". Apply lacquer or dope to the trimmed dial cord ends to avoid unraveling.

( ) 7. Fig. 12. With the capacitor fully meshed (maximum capacity), turn the shaft on the FM front End Assembly by hand in a counter-clockwise direction, observing when the stop tab on the brass drive gear of the FM Front End Assembly just touches the stop tab formed at the notch on the shaft bracket. Do not force these components as the gears on the FM Front End Assembly may be damaged. It should turn fairly easily, although the cord around the 1" pulley impedes its motion.

( ) 8. Fig. 12. Push the carriage to the right (rear view) towards the potentiometer so that approximately 1/8" of slit is visible between the edge of the carriage and the edge of the slit in which the carriage rides. Loosen the screw and washer on the carriage and slip the dial cord under the washer, as shown. Retighten the screw to fasten the tuning eye carriage to the dial cord.

( ) 9. Fig. 12. Now turn the drive shaft clockwise. If the movement is smooth from the position that the capacitor is fully meshed or fully open, and the pulley on the FM Front End Assembly turns through the complete action, the job has been properly completed.

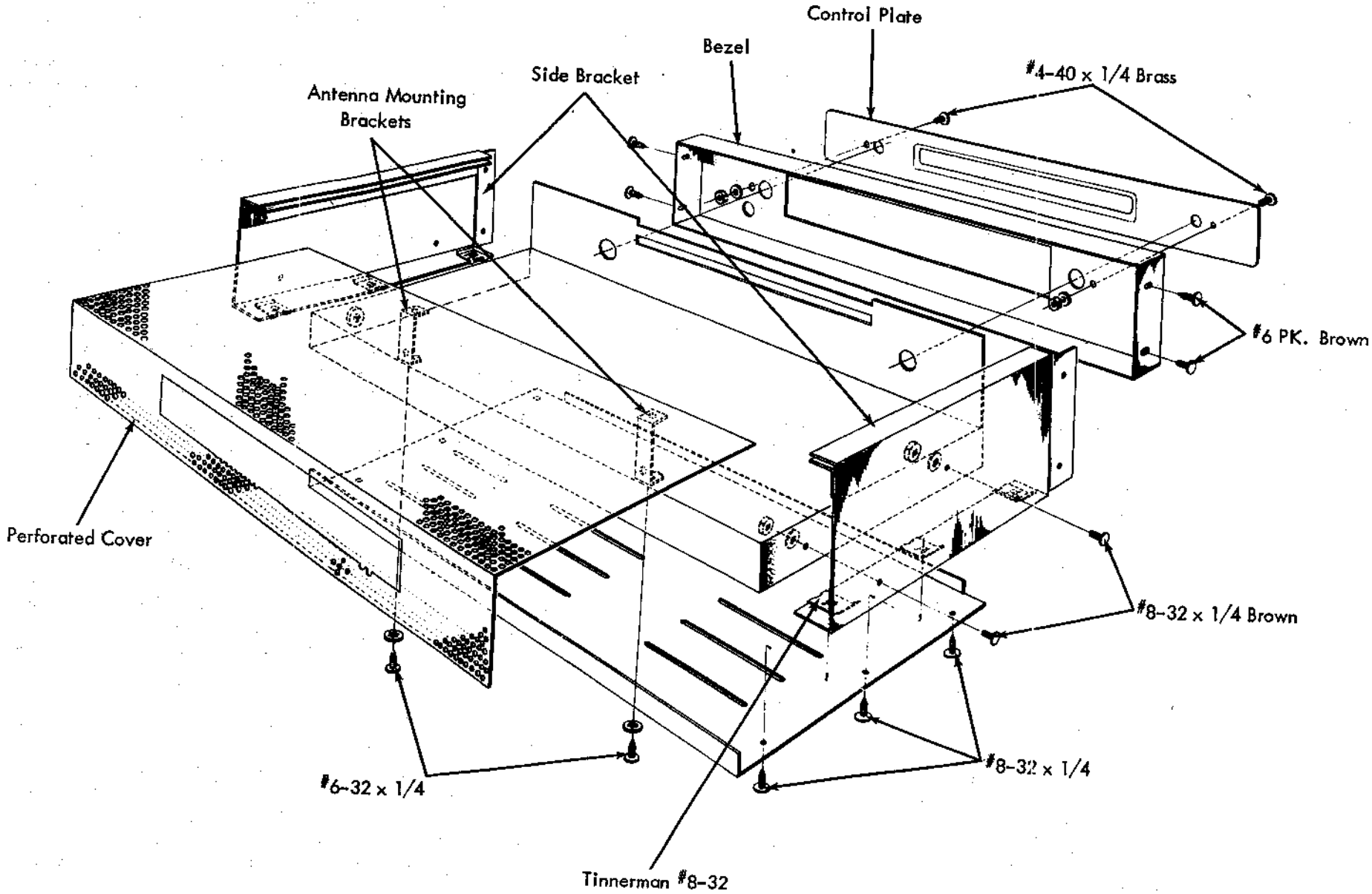

Control Plate
Bezel
Side Bracket
Antenna Mounting Brackets
#4-40 x 1/4 Brass
#6 PK. Brown
Perforated Cover
#8-32 x 1/4 Brown
#6-32 x 1/4
#8-32 x 1/4
Tinnerman #8-32

**Fig. 13**

## FINAL STEPS

You have now completed the assembly and wiring of your tuner. When you have completed the following steps your tuner 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).

2) Insert all the remaining tubes in their proper sockets noting the tube layout in the instruction manual.

3) If you have a VTVM or VOM, make the following resistance checks before connecting to the a-c line: Turn ON-OFF switch to on. Check for a cold d-c resistance of approximately 12 ohms across the a-c line plug; check for a resistance of approximately 200 ohms from XV8 pin 1 to ground and XV8 pin 6 to ground; check for a resistance of at least 20KΩ from XV8 pin 7 and ground. Allow sufficient time for the electrolytic capacitors to be charged by the ohmmeter battery in this last measurement. These measurements constitute a reasonable test of the power supply components and wiring before applying power. If you do not obtain the minimum resistance values indicated, do not proceed to the next step until the cause is discovered and the condition remedied.

4) ( ) Fig. 13. Assemble left side mounting bracket (with front of the chassis facing you) using two #8-32 x 1/4 brown colored screws, two #8-32 hex nuts, and two #8 lockwashers. Assemble right side mounting bracket using two #8-32 x 1/4 brown colored screws, one #8-32 hex nut, and one #8 lockwasher. Please note that one #8-32 nut is spot welded to the chassis.

5) ( ) Fig. 13. On the bottom flange of each side piece, press a Tinnerman #8-32 – Type J speed nut in place over each of these holes. Note that the short leg of the nut faces up towards you.

6) ( ) Fig. 13. Mount the control plate on the bezel using two each #4-40 x 1/4 brass screws, #4 lockwashers, and #4 hex nuts to fasten it to the bezel.

7) ( ) Fig. 13. Fit the bezel and control plate over the projecting control shafts, onto the ends of the side brackets. Assemble the bezel to the side brackets with four #6 x 1/4 brown colored P. K. screws.

8) Set VOLUME/OFF control to extreme counter-clockwise position (actuating switch. Place large concentric knob on the outer shaft of SELECTOR SWITCH with marking upwards. Place small concentric knob on the inner shaft with indicator dot so that the dot is at the OFF marking on the control plate. Place the dual concentric knob (without marking) on the Tuning Control.

9) OPERATIONAL CHECKS ON COMPLETED KITS: In the INSTRUCTION part of this manual you will find a section titled "Electrical Installation". Read this carefully and connect your amplifier to the tuner in accordance with the instructions given. Then read the section titled "Operating Instructions" and operate the controls, checking aurally for the results described. If the tuner does not operate at all or operates incorrectly, use the VOLTAGE & RESISTANCE chart to discover and remedy the difficulty.

10) The kit is supplied with all tuned circuits pre-aligned for the particular layout and lead dress as shown in the pictorial diagrams. Therefore, if the kit is wired as instructed, i.e. all leads and components are dressed as shown in the pictorial diagrams, the tuner will operate satisfactory with no alignment on the part of the constructor. In general, improved sensitivity and lower distortion can be obtained by a careful touch-up alignment of the IF and Ratio Detector transformers, particularly if the lead dress differs from the pictorial diagrams. Two methods of alignment are given; one is a visual alignment method employing sweep generator and oscilloscope; the other is a simple AM signal generator and VTVM or 20,000Ω/V VOM method which the average kit constructor is more usually equipped to perform. The visual alignment is certainly preferable, but the signal generator and VTVM/VOM method will give excellent results if carefully performed. The FM "front-end" (RF Tuning Assembly) adjustments should not be touched at all normally, and in no case should any repair work on the "front-end" be attempted. Any defective FM "front-end" should be returned to the factory for service. EICO reserves the right not to service any "front-end" that has been tampered with internally. For AM alignment it is necessary to remove right side mounting bracket to reach trimmers on tuning capacitor.

11) ( ) Fig. 13. Install the rubber feet in the openings provided in the bottom plate. 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.

12) ( ) Fig. 13. Insert the perforated cover into the "rails" on the side piece and slide it forward fully. The antenna loopstick will slide through the cutout in the rear of the perforated cover. If the perforated cover does not slide fully forward, temporarily loosen the screws holding the side brackets, slide the cover fully forward and retighten the screws.

13) ( ) Fig. 13. Fasten the perforated cover to the two antenna mounting brackets at the rear of the chassis. These brackets have previously been used in the mounting of the antenna loopstick. Use two #6-32 x 1/4 screws.

14) ( ) Fig. 13. Mount the bottom plate on the bottom flanges of the side pieces, using six #8-32 x 1/4 uncolored screws. Note that the rear flange on the bottom plate fits over the outside of the rear chassis apron.

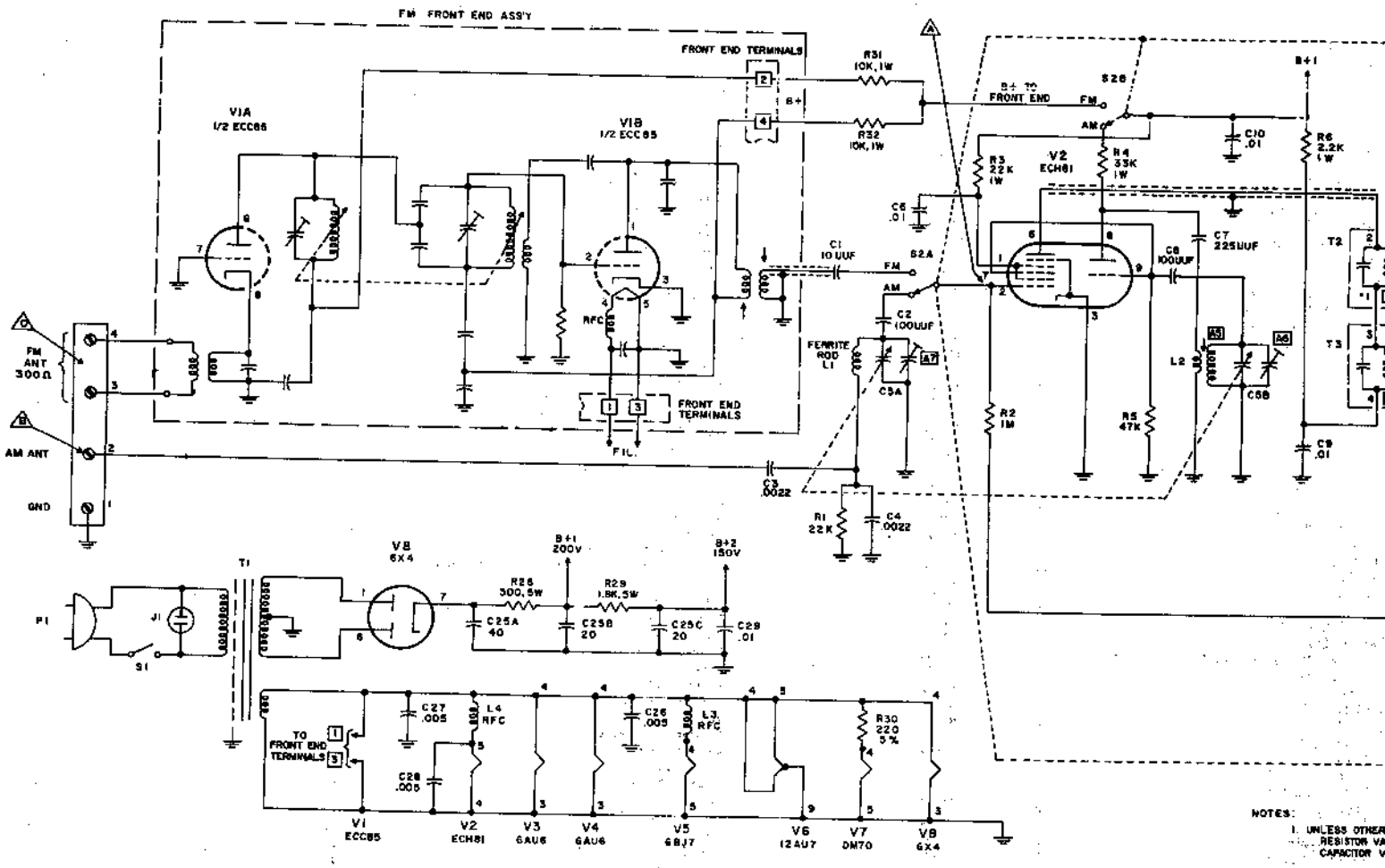
15) ( ) Fig. 13. Remove the backings from the two labels supplied and place them on the outside surface of the bottom plate.

16) If the tuner is to be mounted in a console, read carefully the "Mechanical Installation" section in the INSTRUCTION part of this manual and follow the procedures outlined.

17) Information as to the choice and connection of antenna, connection to amplifier input, and a-c line plug connections is given in the "Electrical Installation" section in the INSTRUCTION part of this manual.

## 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 $9.00 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 Service Dept., 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.



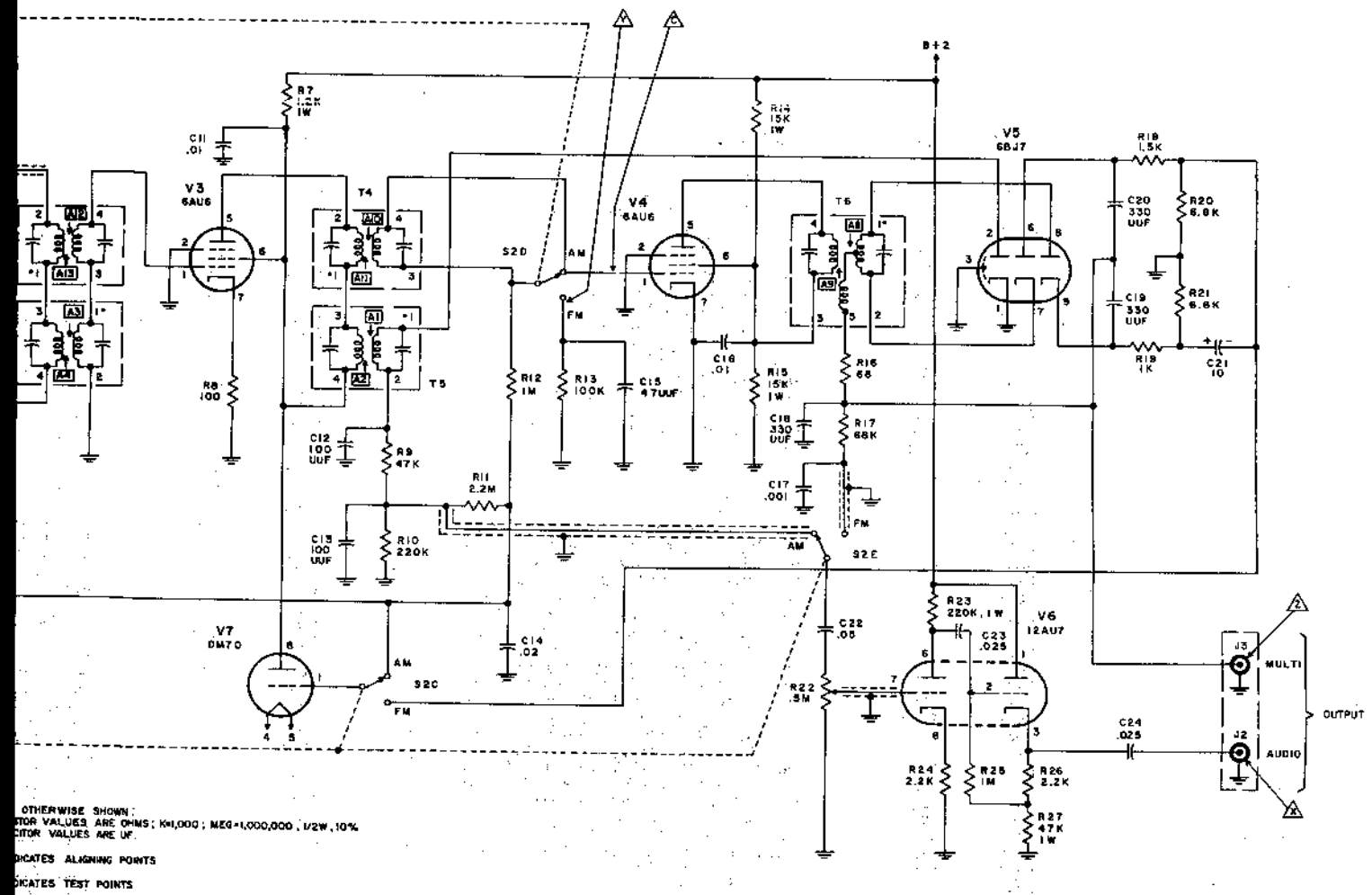

NOTES:

1. UNLESS OTHER
RESISTOR VA
CAPACITOR V

2. ☐ INDICATES
△ INDICATES

EICO

**MODEL HF-92 AM & FM TU**




OTHERWISE SHOWN:
STOR VALUES ARE OHMS; K=1,000; MEG=1,000,000, 1/2W, 10%
CITOR VALUES ARE UF.

DICATES ALIGNING POINTS

DICATES TEST POINTS