PRICE

HEATH COMPANY • BENTON HARBOR, MICHIGAN

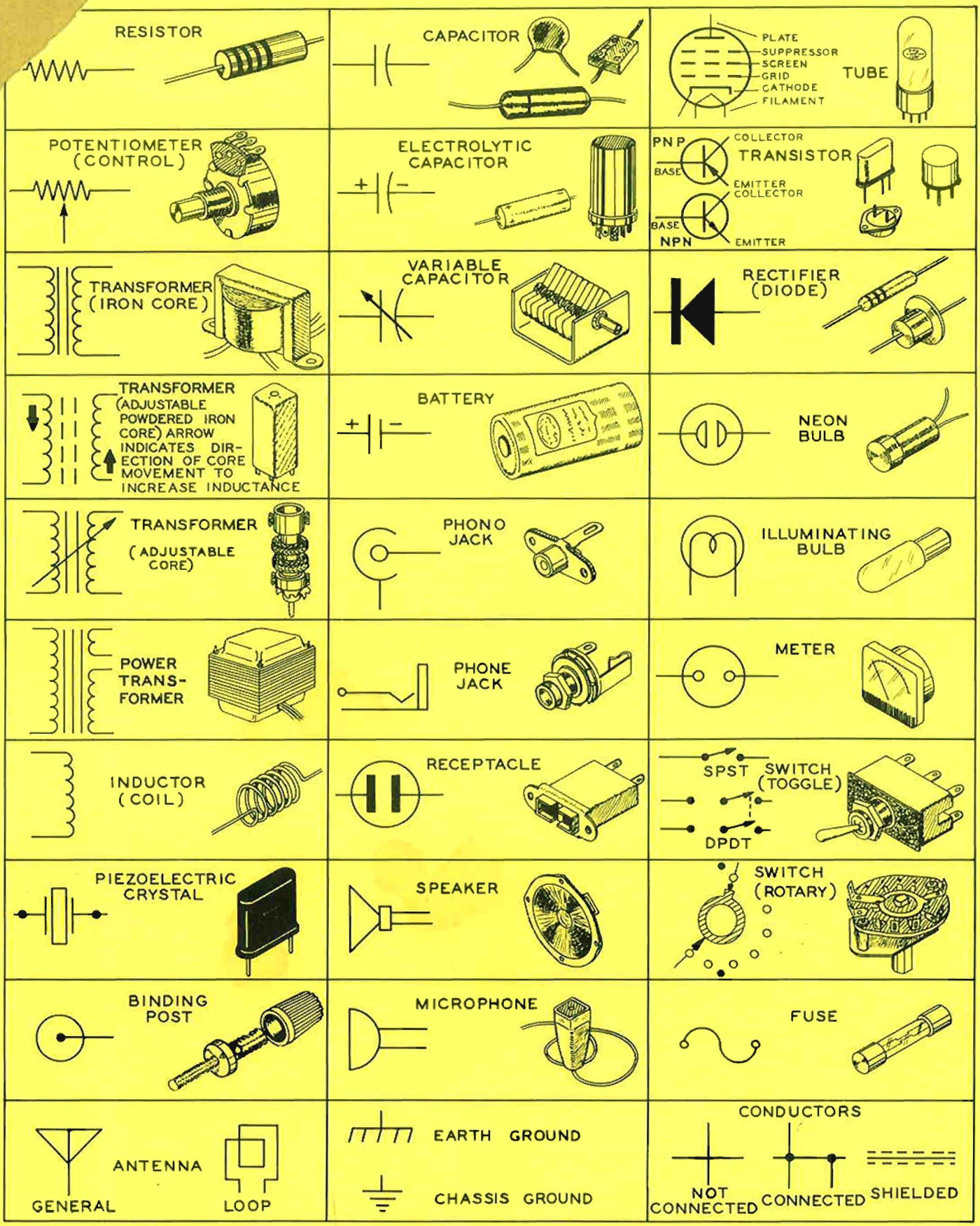
HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT

ALL-TRANSISTOR STEREO TUNER
MODEL AJ-43D

TYPICAL COMPONENT TYPES

a guide to commonly used types of elec-
nents. The symbols and related illustra-
tions should prove helpful in identifying most parts and reading the schematic diagrams.



Assembly

and

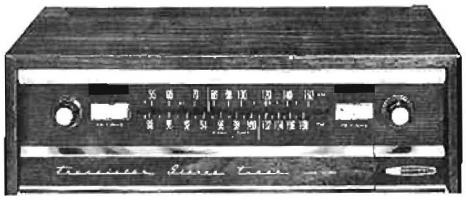
Operation

of the

HEATHKIT

ALL-TRANSISTOR STEREO TUNER

MODEL AJ-43D



NOTE: TUNER IS SHOWN INSTALLED IN AE-11 WALNUT CABINET ACCESSORY.

HEATH COMPANY
BENTON HARBOR,
MICHIGAN

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8/12/66

SPECIFICATIONS

AM SECTION

Tuning Range	535 to 1620 kilocycles.
Intermediate Frequency	455 kilocycles.
Sensitivity (for 10 db signal-to-noise: measured at antenna terminals through standard 200 $\mu\mu$f dummy antenna)	7 microvolts at 600 kilocycles. 4 microvolts at 1000 kilocycles. 3 microvolts at 1400 kilocycles.
Antenna	Built-in rod antenna with provisions for external antenna and ground.
Image Rejection	50 db at 600 kilocycles. 70 db at 1400 kilocycles.
IF Rejection	55 db at 600 kilocycles. 65 db at 1400 kilocycles.
10 Kilocycles Rejection	40 db below rated output voltage.
Harmonic Distortion	Less than 2% with 1000 microvolts input, 400 cps with 90% modulation.
Hum And Noise (complete tuner)	30 db.*
Output Voltage	1 volt with 1000 microvolts input, 400 cps with 90% modulation.
Output Impedance	
Normal	Variable to 3000 ohms.
Auxiliary	Variable to 4000 ohms.

FM SECTION

Tuning Range	88 to 108 megacycles.
Intermediate Frequency	10.7 megacycles.
Quieting Sensitivity	1-1/2 microvolts for 20 db of quieting.* 2 microvolts for 30 db of quieting.* 3 microvolts for full quieting, 40 db.
Bandwidth (complete tuner)	300 kilocycles at 6 db down with 1000 microvolt input.
Detector Bandwidth (peak-to-peak)	600 kilocycles.
Antenna	Balanced input for external 300 ohm antenna, internal line antenna provided.
Image Rejection	35 db.*

*Rated IHF (Institute of High Fidelity) Standards.

IF Rejection	75 db.*
Capture Ratio	3 db. *
AM Suppression	40 db. *
Harmonic Distortion	Less than 1%.*
Hum And Noise (complete tuner)	50 db.*
Output Voltage	1 volt with 1000 microvolts input, 400 cps with 100% modulation.
Output Impedance	Variable to 3000 ohms, each channel.
Audio Frequency Response	±3 db from 20 to 15,000 cps.*

FM STEREO SECTION

	SCA FILTER OFF	SCA FILTER ON
Converter Bandpass, 50 cps to 53,000 cps	±1/4 db	±1 db
Channel Separation: 50 cps to 2,000 cps	40 db	30 db
10,000 cps	30 db	20 db
15,000 cps	20 db	12 db

SCA (Subsidiary Communications Authorization) is a commercial music channel transmitted on some FM carriers.

19 KC And 38 KC Suppression	45 db below rated output voltage.
SCA Rejection	30 db minimum.
Harmonic Distortion	Less than 1% at 1000 cps.
Output Voltage (filters off)	0.5 volt with 1000 microvolts input, 400 cps with 100% modulation.
Output Impedance	Variable to 3000 ohms each channel.

GENERAL

Transistor Complement

1 - 2N2495 FM RF amplifier.
1 - 2N2671 FM oscillator.
1 - 2N2654 FM mixer.
4 - 2N2654 3-FM IF amplifiers and FM limiter.
1 - 35070 AM RF amplifier.
2 - TI 364 AM oscillator-mixer and IF amplifier.
1 - 2N408 FM squelch amplifier.
14- 2N2712 Multiplex amplifier, 19 kc amplifier and emitter follower, 19 kc amplifier, stereo indicator amplifier, automatic B+ switch, 38 kc oscillator, emitter follower, AM audio amplifier, switching detectors, left and right post detector and audio amplifier, and left and right output emitter follower.

*Rated IHF Standards.

Front Panel Controls.	Left Level control. Right Level control. AM Level control. Stereo Converter Balance control. Stereo Converter Separation control. FM Squelch control. Stereo Phase control and switch. Stereo Noise Filter switch. Stereo SCA Filter switch. AM-FM Selector. FM Signal strength switch. Stereo Converter defeat switch. AFC defeat switch. Push Panel On-Off switch. AM Tuning. FM Tuning. Stereo Tuner, indicator lamp. AM and FM Tuning Meters.
Rear Panel Controls.	AM Meter Zero control. FM Meter Zero control. 38 KC Oscillator adjustment switch.
Power Supply.	Transformer operated with silicon diode rectifiers.
Power Requirements.	105-125 volts AC, 50/60 cps, 7.5 watts at 120 volts.
Dimensions.	15" wide x 5-1/2" high x 14-3/4" deep.
Net Weight.	14-1/2 lbs.

The foregoing specifications are representative of the performance of the average production unit. Minor variations from the specifications are to be expected. However, such variations are held to a minimum through the use of printed circuit boards and high quality components. Due to these factors, plus conservative design, these normal variations may be disregarded from a performance standpoint.

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

INTRODUCTION

The new Heathkit Model AJ-43D All-Transistor Stereo Tuner was designed to provide the finest in AM, FM, and stereo FM listening. It incorporates such features as a preassembled, prealigned FM tuning unit and FM IF section, and prealigned transformers and coils for the AM and multiplex circuit boards. These features greatly simplify assembly and alignment of the Tuner.

Transistors generate practically no heat and require no warmup time; the tuner is ready to operate as soon as it is turned on. Flywheels are used to provide smooth tuning action for quick easy station tuning.

Some of the circuit features are an FM squelch circuit to eliminate between-station noise when tuning across the FM band; a lamp to indicate when an FM stereo signal is being received; individual meters that monitor AM and FM tuning; and emitter follower output stages that provide a low output impedance to avoid hum and high frequency losses in the interconnecting audio cables.

With an FM stereo output, the emitter followers perform separately as left and right channel output stages; on monophonic AM or FM, these two output stages are tied together and supply the same signal to both the left and right channel outputs of the Tuner.

Control versatility is essential to good performance in a high quality tuner. All controls are arranged to offer maximum versatility. The AM and FM Tuning controls are located at the ends of the highly-lighted dial and tuning meters. The remaining controls are conveniently located under the front trim panel, except for the meter zero controls and the 38 kc adjustment switch which are located on the rear of the chassis.

Completely separate circuits are used for the AM and FM portions of the Tuner to avoid compromising the performance. The multiplex circuit is used only in the FM position of the AM-FM Selector switch. Silicon diode rectifiers are used in the power supply because of their long life, dependability, and the fact that they generate essentially no heat. The electrostatically shielded power transformer isolates the Tuner circuitry from the power line.

INTRODUCTION TO TRANSISTORS

Transistors are one of the most important developments in the field of electronics. Although they have been available for comparatively few years, they have already found application in every branch of the art.

Because of their small size, transistors possess very little mass or inertia. As a result they are not subject to the shock, vibration and microphonic faults of tubes. Transistors do not contain a heater or filament, and they require no warmup. Because little heat is generated, longer life can be expected from other circuit components that deteriorate from heat. Transistors operate on very low voltage, measured in volts instead of hundreds of volts as with tubes.

Transistors have an extremely long life expectancy. The average life of transistors has not yet been definitely established simply due to lack of time to arrive at representative figures. Transistors have been in continuous operation for years without failure. Most failures are caused by improper use rather than by deficiencies in the basic design.

Semi-conductor materials are used in the fabrication of transistors. Germanium and silicon are two basic materials in common use today. Stated simply, a transistor consists of a "sandwich" of various germanium or silicon alloys. Three layers of alloys form this sandwich. A connecting lead is attached to each of the layers and brought out for external connections.

It might be of interest to note here some of the production problems connected with the making of a transistor. The germanium or silicon must first be refined to an extremely high degree of purity. The rigid requirements would compare to allowing no more than one kernel of corn in several carloads of wheat. The pure germanium is then "doped" with precisely controlled amounts of other elements to obtain the proper alloy necessary for transistor action. More will be said about the doping process later.

The center layer or "meat" of the sandwich may be only 1/1000 inch thick. This layer must be precisely located, and a wire attached. The entire

process must be performed under "operating-room" clean conditions. Any contamination of the layers may be cause for failure. The assembly is then hermetically sealed in a protective case, often with an inert compound to assist in conducting heat away from the assembly. Figure 1 shows two typical transistor assemblies.

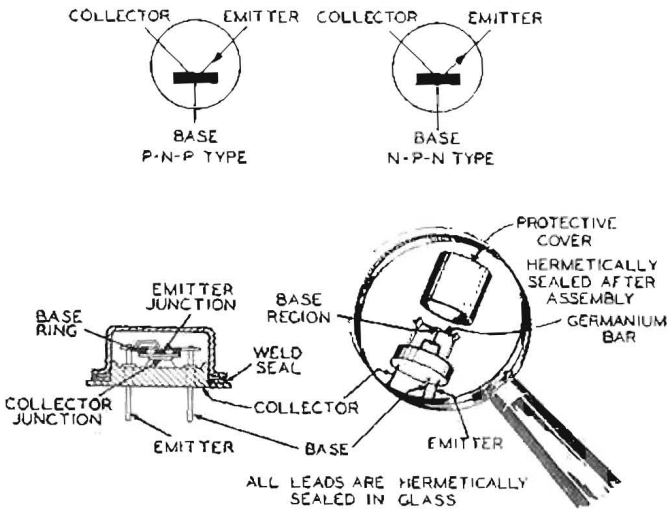


Figure 1

As mentioned before, the germanium must be doped to obtain the characteristics needed for transistor action. Different materials are used to produce a "P" or an "N" type germanium. "P" type germanium means that the pure metal has been modified so that there is an electron deficiency (often referred to as a "hole") in the natural crystal structure. "N" type germanium means that an electron excess is created in the germanium crystal. Transistors are produced in both NPN and PNP configurations; the letters indicate the type of germanium in each of the layers. The schematic representation for the transistor identifies the types as shown in the two diagrams (Figure 1).

The middle layer of the sandwich is called the base. One outside layer is called the emitter and the other one the collector. The junctions formed between the emitter and base and between the collector and base have a characteristic similar to that of a diode rectifier, in that the junction will conduct current much more readily in one direction than the other.

When voltage is applied across a junction, with a positive voltage applied to the "P" type region and negative voltage to the "N" type region, a current consisting of two components will flow.

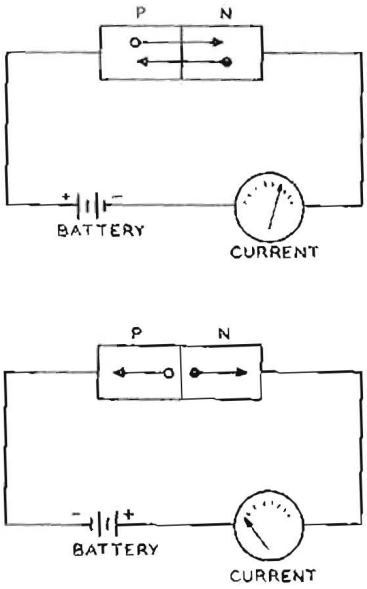


Figure 2

Electrons will flow from the "N" region across the junction to the "P" region and holes will flow or migrate from the "P" region across the junction to the "N" region. If the polarity of the applied voltage is reversed, the electrons and holes move away from the junction and for practical purposes, no current will flow. Figure 2 illustrates this effect.

In most applications, transistors have operating voltages applied so that the base-emitter junction is "biased" in the forward or conducting direction and the base-collector junction is "biased" in the reverse or non-conducting direction. When connected in this manner, most of the current carriers flowing in the emitter circuit will diffuse across the base region and appear as a current in the collector circuit. Since the emitter bias is usually a very low voltage (being in the forward direction), and the collector bias is relatively high (being in the reverse direction), the transistor is able to produce a power gain. This can be seen when you consider that power is the product of voltage and current. Because the current flow is across a junction of a very small area, the power handling capabilities of a transistor are limited due to heating caused by the current flowing through the junction resistance.

CIRCUIT DESCRIPTION

Each section of the AJ-43D Tuner will be described separately in this Circuit Description.

Refer to the Schematic Diagram (fold-out from Page 75) as well as to the Block Diagram (fold-out from Page 15) while reading the Circuit Description. The circuit part numbers (R7, C210, R315, etc.) for all resistors and capacitors have been put into the following groups to make them easier to locate on the chassis and Schematic.

1-99	Parts in the FM tuning unit.
100-199	Parts in the FM circuit.
200-299	Parts in the AM circuit.
300-399	Parts in the multiplex circuit.
400-499	Parts in the power supply.

FM TUNING UNIT

The received FM signal is coupled from the FM antenna through the FM Signal switch to 300 Ω balanced input transformer T1 in the FM tuning unit. The secondary of transformer T1 forms a tuned circuit with tuning capacitor C1A and trimmer capacitor C1. Capacitor C1A is the antenna section of the main tuning capacitor. The signal selected by this tuned circuit is coupled through capacitor C4 to the emitter of RF amplifier Q1.

The supply voltage (+9 volts DC) is applied to Q1 and to the rest of the FM tuning unit through feedthrough capacitor C11 from the AM-FM Selector switch. All parts of this switch are shown in the FM position on the Schematic.

Transistor Q1, which is connected as a grounded-base amplifier, amplifies the signal and couples it to an output tuned circuit that consists of coil L1, tuning capacitor C2A, and trimmer capacitor C2. C2A is the RF portion of the tuning capacitor. An AGC signal is coupled from first IF amplifier Q4 to the base of RF amplifier Q1. This AGC signal decreases the gain of Q1 when a strong input signal is received.

The signal selected by the tuned circuit at the collector of Q1 is connected through capacitor C6 to the base of mixer transistor Q2. Coil L2, which acts as a 10.7 mc trap, shorts out any 10.7 mc signal that is present at this point. Resistors R3 and R4 supply bias to the base of the mixer.

Transistor Q3 is used in a grounded-base oscillator circuit. The frequency of oscillation is determined by a tuned circuit that consists of tuning capacitor C3 (the oscillator portion of the tuning capacitor), trimmer capacitor C16, and coil L3. Capacitor C15 is the feedback capacitor for the oscillator. Resistors R7 and R8 supply bias to the base of Q3.

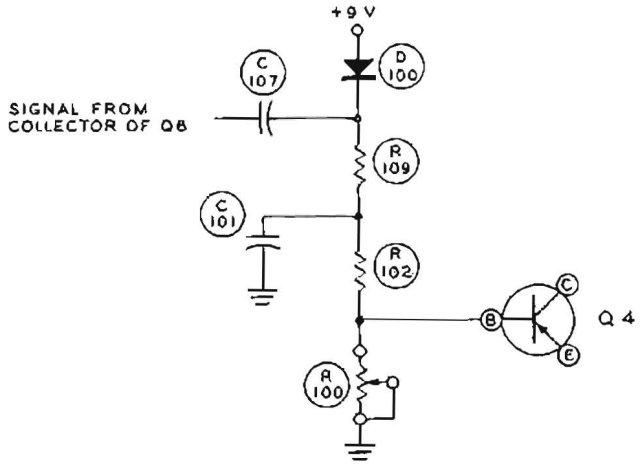
A small DC voltage is coupled from the ratio detector circuit through resistor R6 to AFC diode D1. This DC voltage, which changes when the frequency of the tuner begins to drift, is used as an AFC (automatic frequency control) voltage.

The frequency of the oscillator is corrected by the AFC voltage in the following manner: The capacitance between the elements of diode D1, changes when the DC voltage that is applied to it changes. D1 is connected in series with capacitor C13 and C14. These three series connected capacitances are connected in parallel with tuning capacitor C3. Thus, when the capacitance of diode D1 is changed by a change in the AFC voltage, the total capacitance in parallel with C3 is changed. This change in the total capacitance across the tuned circuit changes the frequency of the oscillator in such a way as to correct for the frequency drift.

The oscillator signal is coupled through capacitor C7 to the base of mixer transistor Q2. The frequency of the oscillator is adjusted to produce a signal that is 10.7 mc higher than the input signal from the FM station. The input signal and the oscillator signal beat together in mixer stage Q2; as a result of this mixing, a difference frequency of 10.7 mc is produced and coupled from the collector of Q2 through resistor R10 to transformer T2. This 10.7 mc IF signal contains the modulation that is present on the input signal. Transformers T2 through T6 are resonant at 10.7 megacycles, and will only pass a band of frequencies near that frequency. The original incoming signal and the oscillator signals are blocked out by these transformers.

FM-IF CIRCUIT

From the FM tuning unit, the 10.7 mc IF signal is coupled through capacitor C100 to the base of transistor Q4, the first FM IF amplifier. Diode D100 and resistors R109, R102, and variable



FM AGC CIRCUIT

Figure 3

resistor R100 form a base bias voltage divider network for transistor Q4, as shown in Figure 3.

A small amount of signal voltage from the collector of transistor Q6 is coupled through capacitor C107 to the junction of diode D100 and resistor R109. This signal voltage is rectified by diode D100 to produce a DC control voltage proportional to the strength of the incoming signal. This DC control voltage either adds to, or subtracts from the base bias voltage of transistor Q4. This changing bias controls the amount that Q4 amplifies the incoming signal. On a weak station, Q4 amplifies the incoming signal more than on a strong station. Capacitor C101 removes any remaining signal voltage from the DC control voltage. This operation is called AGC (automatic gain control).

Since this AGC voltage is directly coupled to the base of Q4, an amplified AGC voltage appears across emitter resistor R103. This amplified AGC voltage is coupled through resistors R101 and R2 to the base of transistor Q1, thus, providing automatic control of the RF gain. Amplified AGC voltage is also fed to the base of squelch amplifier Q12, which will be discussed later.

Variable resistor R100 allows the bias voltage at the base of Q4 to be adjusted to its optimum value.

From the collector of Q4, this amplified IF signal is coupled through IF transformer T3 to the base of second IF amplifier Q5.

Bias for the base of Q5 is supplied by a voltage divider that consists of resistors R104 and R105.

From the collector of Q5, this amplified IF signal is coupled through damping resistor R107 to the primary of IF transformer T4. From the secondary of T4, the FM IF signal is coupled to the base of Q6. Base bias for Q6 is provided by resistors R108 and R110. From the collector of Q6, the IF signal is coupled through resistor R112 and IF transformer T5 to the base of limiter transistor Q7. A high bias voltage at its base and a low collector voltage causes this transistor to clip, or limit. This action eliminates any amplitude modulation that may be superimposed on the FM signal.

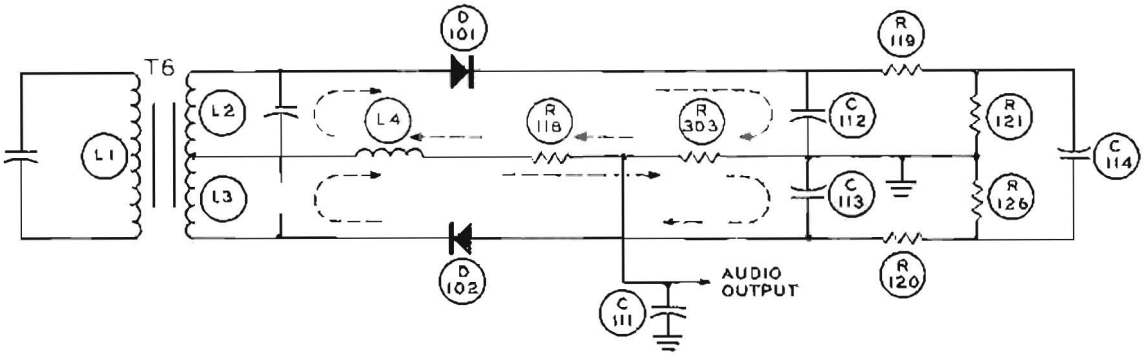
Base bias for Q7 is supplied by a voltage divider, consisting of resistors R113 and R114. Capacitors C102, C103, C104, C105, C106, C108, and C110 keep the emitters and the cold sides of the IF transformers at RF ground potential.

A portion of the limiter voltage developed across emitter resistor R116 is fed to the meter circuit.

RATIO DETECTOR

From the collector circuit of Q7, the IF signal is coupled through resistor R117 and ratio detector transformer T6 to the ratio detector circuit. This circuit, which separates the audio signal from the 10.7 mc IF signal, is shown redrawn for greater clarity in Figure 4. Transformer T6 is represented in this figure by primary coil L1, a center tapped secondary composed of coils L2 and L3, and a third or tertiary winding, L4. L4 is just a few turns of wire tightly wrapped around the bottom of primary L1.

Consider a separate voltage to be induced by the primary into each of the windings, L2, L3, and L4. L4, which is closely coupled to the primary, introduces a voltage that is in series with both L2 and L3. This voltage across L4 is relatively constant in amplitude as long as the voltage across L1 does not change. (Remember, the voltage across L1 will stay relatively constant due to the limiting action of Q7.)



RATIO DETECTOR CIRCUIT

Figure 4

Notice that each diode has its own separate loop through which its current flows (indicated by the arrows). Current flowing in diode D101 is controlled by the voltage induced in L2 and L4 which charges capacitor C112. The current flowing in diode D102 is controlled by the voltage induced in coils L3 and L4 which charges capacitor C113. Current flows through L4 in both directions, since this coil is common to both current loops.

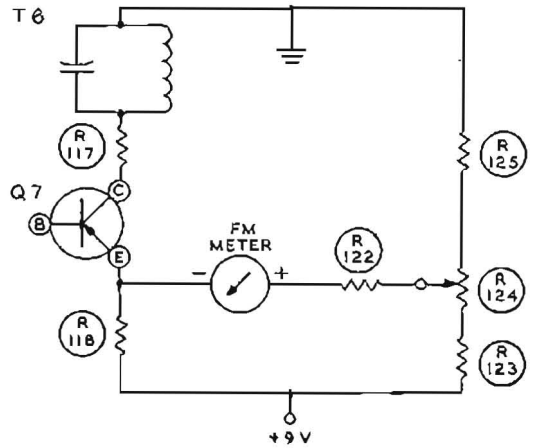
The two currents flow through capacitors C112 and C113 in the same direction. Electrolytic capacitor C114 is connected across both of these capacitors through resistors R119 and R120. This large capacitor keeps the total voltage across these two capacitors from changing, thus, any amplitude changes on the IF signal are damped out by this capacitor.

The audio output signal from the ratio detector circuit is taken across resistor R303 to ground. Note that the two loop currents are flowing in opposite directions through resistors R118, R303 and coil L4. At the FM IF center frequency of 10.7 mc, the diode currents are equal, thus they cancel each other out and no voltage appears across resistor R303. In the actual circuit, as shown on the large Schematic, R303 is located on the multiplex circuit board.

When the IF frequency deviates from 10.7 mc due to FM modulation (audio signal), the current in one diode loop increases while the current in the other loop decreases. These changes are caused by a change in phase relationship in the signal across coils L2 and L4, and L3 and L4. Now current flows through resistor R303 in the direction of the larger signal and an output voltage is developed across resistor R303. The amplitude of this output voltage is determined by how far the IF frequency deviates from the center frequency of 10.7 mc. The frequency of this audio output voltage is determined by how often the frequency deviates from 10.7 mc.

The slug in the secondary of coil L6 is used to balance the ratio detector circuit. Capacitor C111 removes any remaining 10.7 mc IF signal from the audio signal. R121 and R126 are load resistors for diodes D101 and D102.

The DC component from the ratio detector (AFC voltage) is coupled to the AFC diode D1 through a decoupling network consisting of resistor R115 and capacitor C109. This decoupling network is essentially a low-pass filter which removes the audio from this DC voltage. When properly tuned to an FM station, the DC component at the ratio detector will be 0 volts. As the tuner is detuned (oscillator drift) in either direction, the DC voltage will vary proportionally plus or minus with respect to ground, depending on which way the tuning changed.



FM METER CIRCUIT

Figure 5

The FM meter circuit is basically a balanced bridge circuit. See Figure 5. The meter is connected between the emitter of Q7 and the arm of control R124. Under no-signal conditions (between stations), the emitter of Q7 draws current through resistor R116. In this condition, the meter control is adjusted, so the bridge is balanced (no current through the meter) so the meter indicates zero (no signal). When a signal is tuned in, limiter voltage is developed across R116. This increase in emitter voltage unbalances the bridge and causes the meter to deflect upscale. FM stations are tuned for maximum deflection of the meter.

MULTIPLEX CIRCUIT

Figures 6A and 6B show two sample signals that might appear from the left (L) and right (R) channel microphones of a radio station that is broadcasting a stereo FM signal. The transmitting circuits then combine these signals to produce the L+R signal shown in Figure 7A and the L-R subcarrier signal shown in Figure 7B. The L-R subcarrier signal is a suppressed carrier amplitude modulated signal on a 38 kc subcarrier, and is called the subcarrier channel. These two signals, L+R and L-R, are then combined with the 19 kc pilot signal shown in Figure 7C. This whole complex signal is then radiated from the broadcasting antenna on the FM (carrier) signal.

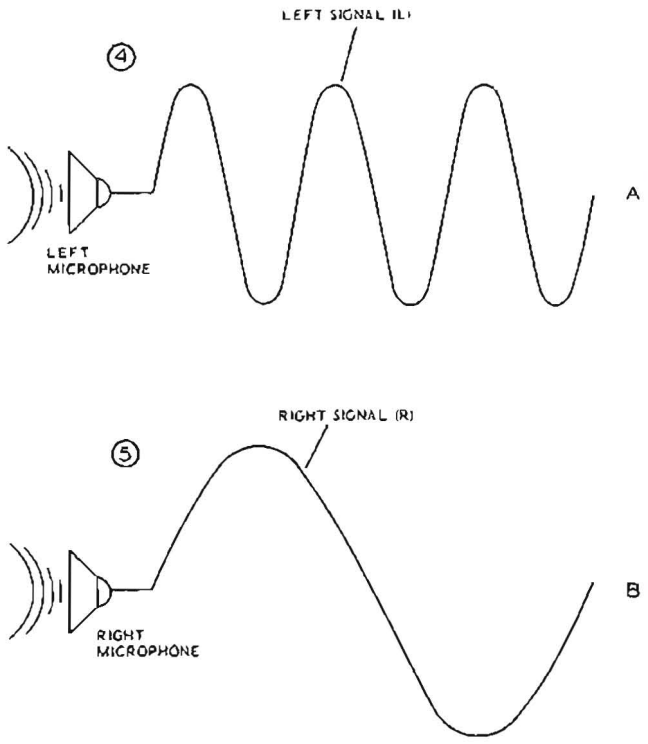


Figure 6

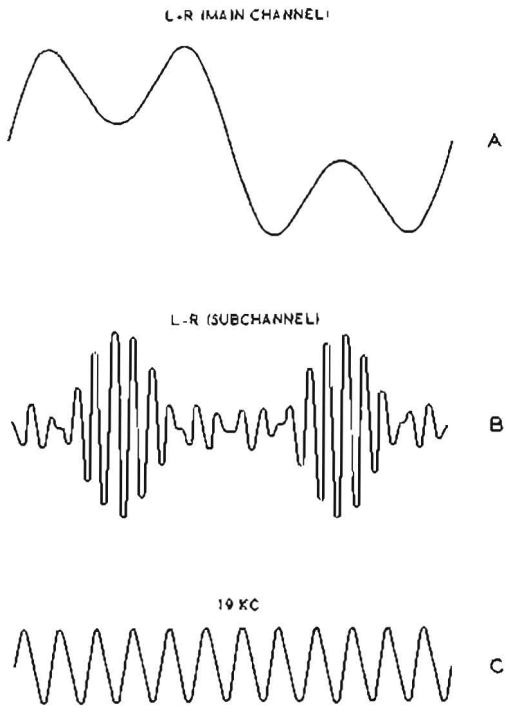


Figure 7

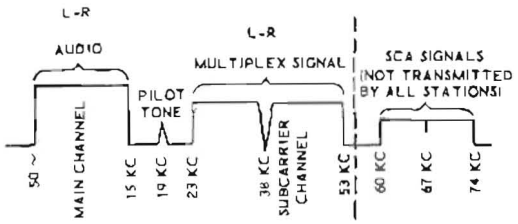


Figure 8

Figure 8 shows where these different components are to be found in a stereo FM modulating signal. The L+R signal, which is in the audio spectrum (50 cps to 15 kc), is called the "main channel." Monophonic FM tuners use only this part of the signal, and the remaining signal components are attenuated by the tuner de-emphasis network.

A second subcarrier signal is transmitted by some stations on a subcarrier frequency of 67 kc. This channel, which transmits a commercial music signal, is called the SCA (Subsidiary Communications Authorization) channel.

The ratio detector signal that appears across resistor R303 is coupled through capacitor C301 to the base of amplifier transistor Q13. Between stations, this amplifier can be cut off by a controlling current from squelch amplifier Q12.

When a station is tuned in, a large positive AGC voltage is applied to the base of squelch amplifier Q12 from the emitter circuit of transistor Q4. This AGC voltage keeps Q12 cut off (no current flow) allowing Q13 to amplify normally.

When tuned between FM stations, the AGC voltage becomes less positive and Q12 begins to conduct. When Q12 conducts, its collector current flows through resistor R307, the emitter resistor of transistor Q13. The added current increases the voltage drop across R307, cutting off transistor amplifier Q13 so that between-station noise can no longer pass through it. The voltage divider consisting of variable resistor R301 and resistor R302 determines the operating range of Q12, and is adjusted so Q13 is cut off when tuned off station.

Study Figure 9 (fold-out from Page 15) carefully while reading the following paragraphs. In this figure, waveforms have been added to the multiplex converter to help you to understand how it operates.

From Q13, the FM signal is coupled through capacitor C302 to the base of transistor Q14. This stage performs two operations: a 19 kc resonant circuit in the collector (T12 and C303) causes it to act as a 19 kc amplifier; an output connection at the emitter causes it to act as an emitter follower.

The 19 kc pilot signal is amplified by Q14 and is coupled from the tuned circuit to the base of 19 kc amplifier Q23 through isolation resistor R349 and coupling capacitor C335. Capacitor C336 and coil T13 form a resonant circuit that acts as the collector load for transistor Q23. Capacitor C337 and Stereo Phase control R351 are connected across a portion of coil T13 so the phase of the 19 kc output signal can be adjusted.

The Phase Adjust control enables the operator to correct for possible phase errors between the 19 kc pilot and 38 kc subcarrier signals which may occur between different stereo stations. This control is necessary to achieve maximum separation on all stereo stations.

Two outputs are taken from 19 kc amplifier Q23. One of the outputs connects the amplified 19 kc pilot signal to the base of stereo indicator amplifier Q24 through capacitor C338.

With no 19 kc signal input (as with monophonic FM) only a small current flows in the collector circuit of Q24, and the indicator lamp does not light. When a 19 kc input signal is received, transistor Q24 begins to conduct on the positive peak of each cycle of the amplified 19 kc pilot signal. Q24 then conducts for only a short period of time, until the time constant of C338 and resistor R353 allows the stage to return to its cut-off condition. The resulting pulses of current are shown beside the stereo indicator in Figure 9. These pulses of current raise the average voltage across the indicator lamp to the 2 volt level, causing the lamp to light.

These current pulses are also coupled through capacitor C341 and detected by diode D300. The resulting DC voltage is coupled to the base of transistor Q25 through resistor R356. Capacitor C342 filters this DC voltage. With the Stereo Converter switch in the Automatic position, Q25 conducts and forms a B+ return for 38 kc oscillator transistor Q15. In the absence of the 19 kc pilot signal, resistor R358 keeps

Q25 cut off. Q25 acts as a switch in the B+ return of 38 kc oscillator transistor Q15. With Q15 cut off by Q25, the stereo converter operates in a monophonic mode, resulting in the same signal being present at both the left and right outputs.

With the Stereo Converter switch in the Off position, the converter will remain in the monophonic mode all the time.

The other output signal of 19 kc amplifier Q23 is from the junction of phase control R351 and capacitor C337. This signal is coupled through the 38 kc oscillator switch, capacitor C340, and resistor R355 to the base of 38 kc oscillator transistor Q15. When the free-running frequency of the 38 kc oscillator is being adjusted, capacitor C340 is switched from the 19 kc amplifier circuit and connected instead to capacitor C339. This disconnects the 19 kc pilot signal (which synchronizes the frequency of the 38 kc oscillator to the received 38 kc subcarrier frequency) and maintains the same impedance at the base of Q15.

Transistor Q15 is connected as a grounded base 38 kc oscillator. The primary of transformer T14 and capacitor C306 forms a tuned circuit in the collector circuit of Q15. This tuned circuit is adjusted to resonate at 38 kc. The 38 kc oscillation is synchronized (or locked) to the same frequency and phase as the received 38 kc subcarrier by the 19 kc pilot signal from Q23.

Refer back to the emitter follower portion of transistor Q14. The complete FM signal is coupled from the emitter of transistor Q14 to the SCA and subchannel filter circuits. This circuit acts both as an SCA filter and also as a subchannel filter. When the SCA Filter switch is On, SCA signals are removed as the complete stereo signal passes through a 67 kc parallel tuned circuit (coil L6 and capacitor C308). Any remaining SCA signals are shorted to ground by a 67 kc series resonant circuit (capacitor C311, coil L5, and capacitor C309) at the output side of the 67 kc parallel tuned circuit.

When the SCA Filter switch is Off and the Stereo Phase switch is in the In position, all filters are bypassed and all signals are connected directly to the next stage, Q16. The Stereo Phase switch is only placed in the Out position when the phase of the 19 kc pilot signal is to be adjusted. In this Out position a 38 kc series resonant circuit (capacitor C311 and coil L5) is inserted and allows only the 38 kc subcarrier channel to pass through to the next stage. The Stereo Phase control is adjusted for maximum output. The presence of main channel sound at the output would make this adjustment impossible.

The stereo signal from the SCA filter circuit is coupled through capacitor C312 and resistor R320 to the base of emitter follower stage Q16. The signal is coupled from the emitter of Q16 to a switching detector stage, containing transistors Q17 and Q18.

The switching detector circuit performs several operations simultaneously. The stereo signal (waveform 1, see Figure 9) is coupled to the emitters of transistors Q17 and Q18 from emitter follower Q16. The 38 kc oscillator signal (waveform 2) is coupled to the bases of these transistors through transformer T14. When these signals are combined in this circuit, the 38 kc carrier, which was removed at the transmitter (suppressed carrier transmission) is reinserted back into the stereo signal (waveform 3). The left channel (4) and right channel (5) signals are then detected and coupled to separate output amplifiers Q19 and Q20.

Figure 10 (fold-out from Page 15) shows the various waveforms that are present in the switching detector circuit. Waveform (1) is the suppressed carrier stereo signal that comes from transistor Q16. Waveform (2) is the 38 kc oscillator signal that is reinserted in the stereo signal at the same phase and frequency as the original 38 kc carrier. Remember, this 38 kc oscillation was locked at the correct frequency and phase by the 19 kc pilot signal from Q23.

The actual detection process takes place in the following manner: When waveform (3) is applied to the switching detector transistors, Q18 only conducts on that part of the waveform that carries the L waveform. Thus, only the L waveform (4) appears at its output. Transistor Q17 only conducts on the R portion of the 38 kc waveform, thus only the R waveform (5) appears at its output. These are the left and right signals originating at the broadcasting station (see Figure 6).

In Figure 11, the 38 kc signal is shown superimposed on the stereo signal. At each 38 kc peak on the L waveform, Q18 conducts and Q17

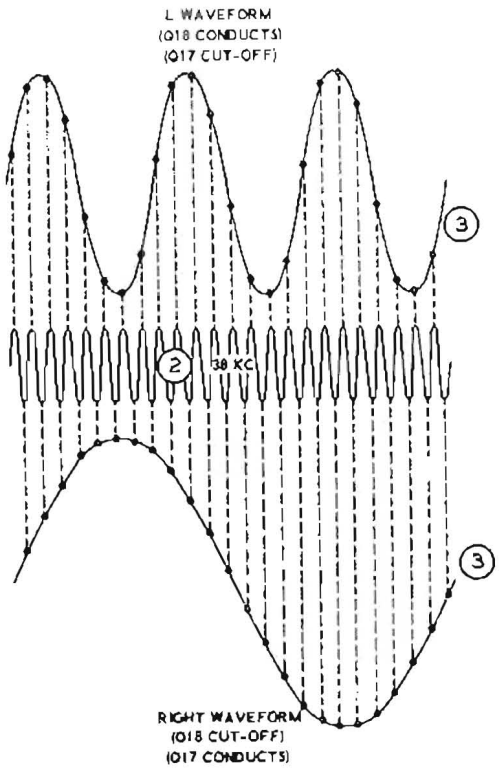


Figure 11

is cut off. At each 38 kc peak on the R waveform Q18 is cut off and Q17 conducts. The L signal from Q18 charges capacitor C313 and is coupled through capacitor C316 to the base of transistor Q19. The R signal charges capacitor C314 and is coupled through capacitor C315 to the base of transistor Q20.

Transistor Q19 is the left channel audio amplifier and post-detector circuit. Transistor Q20 is the right channel audio amplifier and post-detector. Any small amount of left channel signal that appears at the base of transistor Q20 (right post-detector and audio amplifier) is cancelled out by an opposing signal at the emitter of Q20. This opposing signal is coupled to Q20 from the emitter of Q19 through resistors R334 and R335, the Stereo Separation control.

In a like manner, any right channel information that remains in the signal at the base of transistor Q19 (left post-detector and audio amplifier) is also cancelled out. This process is called post-detection.

Stereo Converter Balance control R331 is adjusted so that the amplification of transistors Q19 and Q20 are equal.

After transistors Q19 and Q20, the left channel and the right channel circuits are identical. For this reason, only the left channel output circuits will be explained.

From the collector of Q19, the left channel audio signal is coupled through two filters, a de-emphasis network, a section of the Selector switch and through a coupling capacitor to the base of output emitter follower transistor Q21. Coil L7 and capacitor C321 trap out any of the 19 kc pilot signal that passes through to this point. R336 and capacitor C323 are part of a PEC (packaged electronic circuit) notch filter circuit that traps out any remaining 38 kc signal. Resistor R336 and capacitor C325 are the de-emphasis network. This low-pass filter circuit reduces the higher audio frequencies to their proper amplitude with relation to the lower audio frequencies. (The higher audio frequencies are transmitted more strongly from FM stations to make them more noise free at your receiver.)

From the de-emphasis network, the signal is coupled through the Selector switch, and through resistor R338 and coupling capacitor C329 to the base of output emitter follower Q21. The signal is then applied across the Left channel Level control R346, which is located in the emitter circuit of transistor Q21. From the arm of this level control, the signal is coupled through capacitor C333 to the Left channel output socket.

MONOPHONIC FM OPERATION

The Monophonic signal is coupled from the ratio detector circuit to the base of amplifier Q13 on the multiplex circuit board. Q13 amplifies the signal and couples it to the base of Q14. Since no 19 kc signal is present, Q14 acts only as an emitter follower. The monophonic signal is then coupled through the SCA filter to emitter follower Q16, and from Q16 to Q17 and Q18.

In the absence of the 19 kc pilot signal, Q25 appears as an open circuit (cutoff), making 38 kc oscillator Q15 inoperative.

Transistors Q17 and Q18, with no 38 kc signal applied to them from T14 have no base leak bias developed across resistor R317 and capacitor C310. Under this condition, resistor R316 biases both transistors Q17 and Q18 to where they conduct all the time. This produces the same monophonic signal at the collectors of both Q17 and Q18.

The monophonic signal from Q17 and Q18 is then coupled through the audio amplifiers, the de-emphasis networks, and output emitter followers to the two output sockets.

AM TUNER

The received signal is picked up in the ferrite rod antenna, T7, and coupled by the secondary winding to the base of RF amplifier Q8. The primary of the rod antenna forms a tuned circuit with C200A, the antenna section of the tuning capacitor, and trimmer capacitor C200. External antenna signals are connected directly to the base of Q8 through capacitor C201.

The amplified signal from the collector of RF amplifier Q8 is connected to a tuned circuit that consists of the primary of transformer T8 and capacitor C204A, the RF section of the tuning capacitor, and trimmer capacitor C204. From the secondary of transformer T8, the signal is coupled directly to the base of oscillator mixer transistor Q9. Bias for transistor Q9 is coupled from the voltage divider, consisting of resistors R202 and R203, through the secondary winding of T8 to the base of Q9.

The frequency of oscillation of Q9 is determined by a tuned circuit that consists of tuning capacitor C209A, the oscillator section of the tuning capacitor, trimmer capacitor C209, and coil T9. Feedback from the collector of Q9 is supplied through IF transformer T10 to a small separate winding of T9. Oscillator voltage is coupled from T9 through resistor R204 and capacitor C207 to the emitter of Q9.

The frequency of the oscillator is always 455 kc higher than the received signal. The received signal and the oscillator signal are mixed together in Q9. A difference frequency of 455 kc is produced and coupled from its collector to transformer T10. This 455 kc IF signal contains the modulation that is present on the received signal. From the secondary of T10, this IF signal is directly coupled to the base of IF amplifier Q10.

The 455 kc IF signal from the collector of Q1 is coupled through transformer T11 and detecte by diode D200 and capacitor C213.

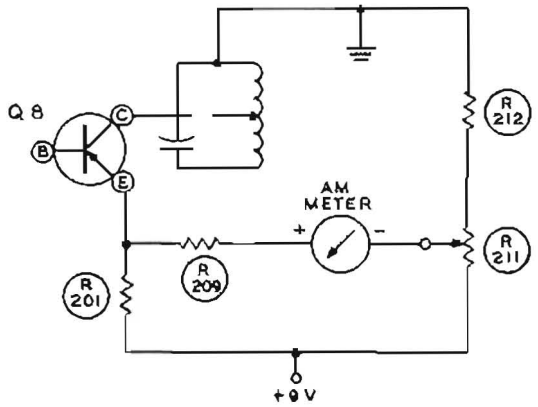
The audio output signal from the AM detecto is coupled to output audio amplifier Q11 throug the 10 kc whistle filter, consisting of capacito C214, coil L4, and resistor R215. The ampli fied audio signal from the collector of Q11 i applied across AM Level control R220. Fro the arm of this control, the audio signal i coupled through capacitor C218 to the Aux iliary AM output socket and to the Selecto switch.

This audio signal is present at the Auxiliary AM output socket, regardless of the setting o the Selector switch. With the Selector switch i the AM position, this audio signal is fed through emitter followers Q21 and Q22 and to both the Left and Right Normal output sockets.

A DC voltage is also produced at detector D200. This voltage is proportional to the received signal strength. This AVC (automatic volume control) voltage is coupled to the base of Q8 through resistor R213 and the secondary of the rod antenna. AVC voltage either adds to, or subtracts from the bias voltage of transistor Q8. This changing bias voltage controls the amount that Q8 amplifies the received signal. On a weak station Q8 amplifies the received signal more than on a strong station. Capacitor C202 removes any remaining audio signal voltage from the AVC voltage.

Since the AVC voltage is directly coupled to the base of Q8, an amplified AVC voltage appears across its emitter resistor R201. This amplified AVC voltage is coupled through resistor R208 and the secondary of transformer T10 to the base of transistor Q10, thus providing automatic control of the IF gain.

The AM meter circuit is basically a balanced bridge circuit. See Figure 12. The meter is connected between the emitter of Q8 and the arm of control R211 through resistor R209. Under no-signal conditions, the emitter of Q8 draws current through resistor R201. In this condition, the meter control is adjusted so the bridge is balanced (no current through meter) so the meter indicates zero (no signal). When a signal is tuned in, amplified AVC voltage is developed across R201. This decrease in emitter voltage



AM METER CIRCUIT

Figure 12

unbalances the bridge and causes the meter to deflect upscale. AM stations are tuned for maximum deflection of the meter.

Coil L4, capacitor C214, and resistor R215 constitute a narrowband rejection filter (whistle filter), which eliminates the 10 kc beat signal between two adjacent broadcast signals; this beat is normally present in wideband AM tuners.

POWER SUPPLY

AC power is applied through the on-off switch, the primary of the FM line antenna T15, and the fuse to the primary of power transformer T16. Diodes D400 and D401 are connected in a full-wave power supply circuit in the secondary of transformer T16.

Rectified voltage from the two diodes is coupled through two pi-section filters and applied to zener diode D402. The two filter sections consist of resistors R400 and R401, and capacitors C401, C402, and C403. A +13 volts is supplied to the stereo indicator circuit from the junction of R400 and R401. Regulated +9.1 volts is coupled from the zener diode to all other circuits. A 6.3 volt winding on transformer T16 supplies power to the four pilot lamps.

CONSTRUCTION NOTES

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

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the Replacements section and supply the information called for therein.

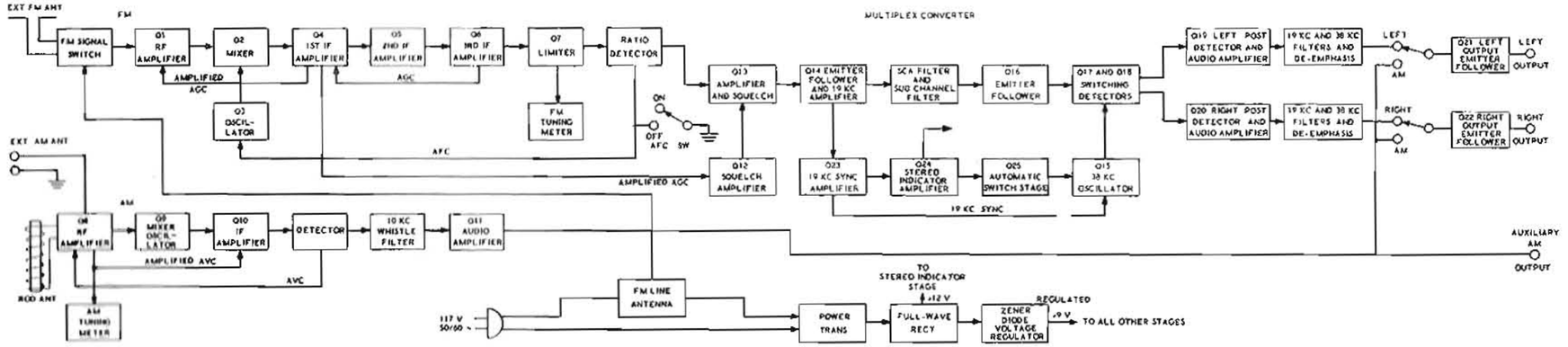
Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.

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

1. Lay out all parts so that they are readily available.

2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a penknife or a tool for stripping insulation from wires; and a soldering iron (or gun). A set of nut drivers, while not necessary, will aid extensively in construction of the kit.

BLOCK DIAGRAM



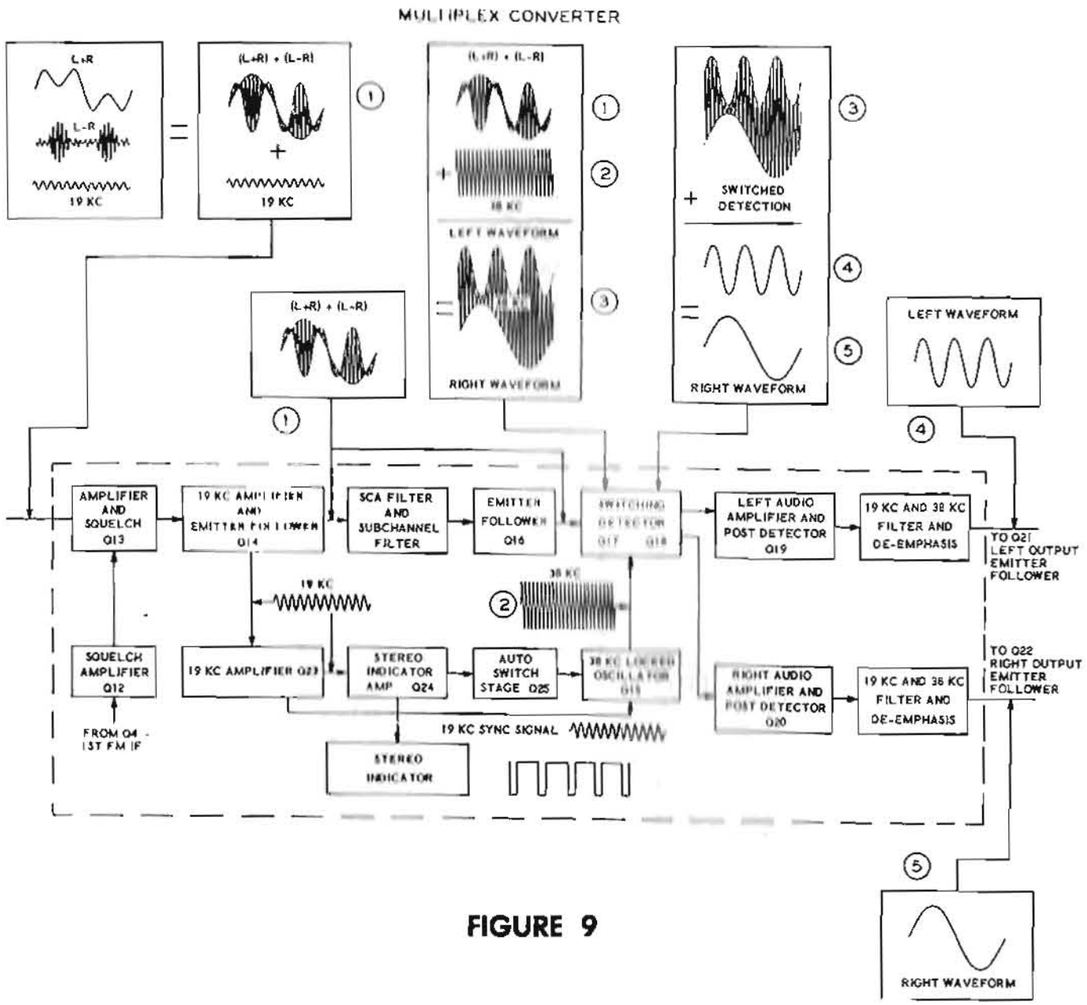
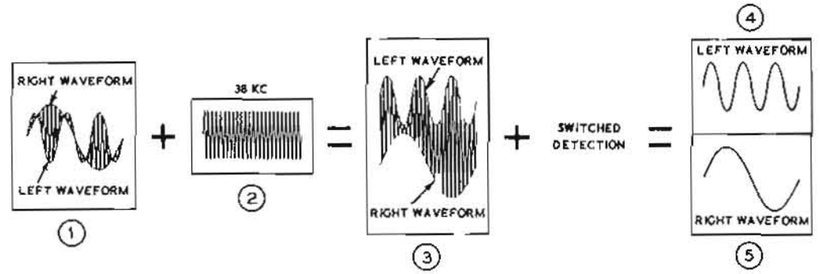


FIGURE 9



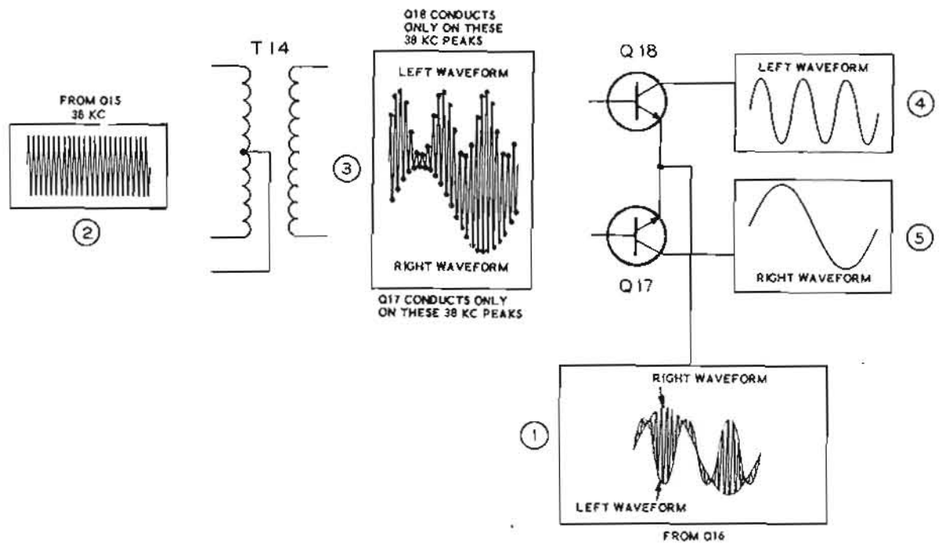


FIGURE 10

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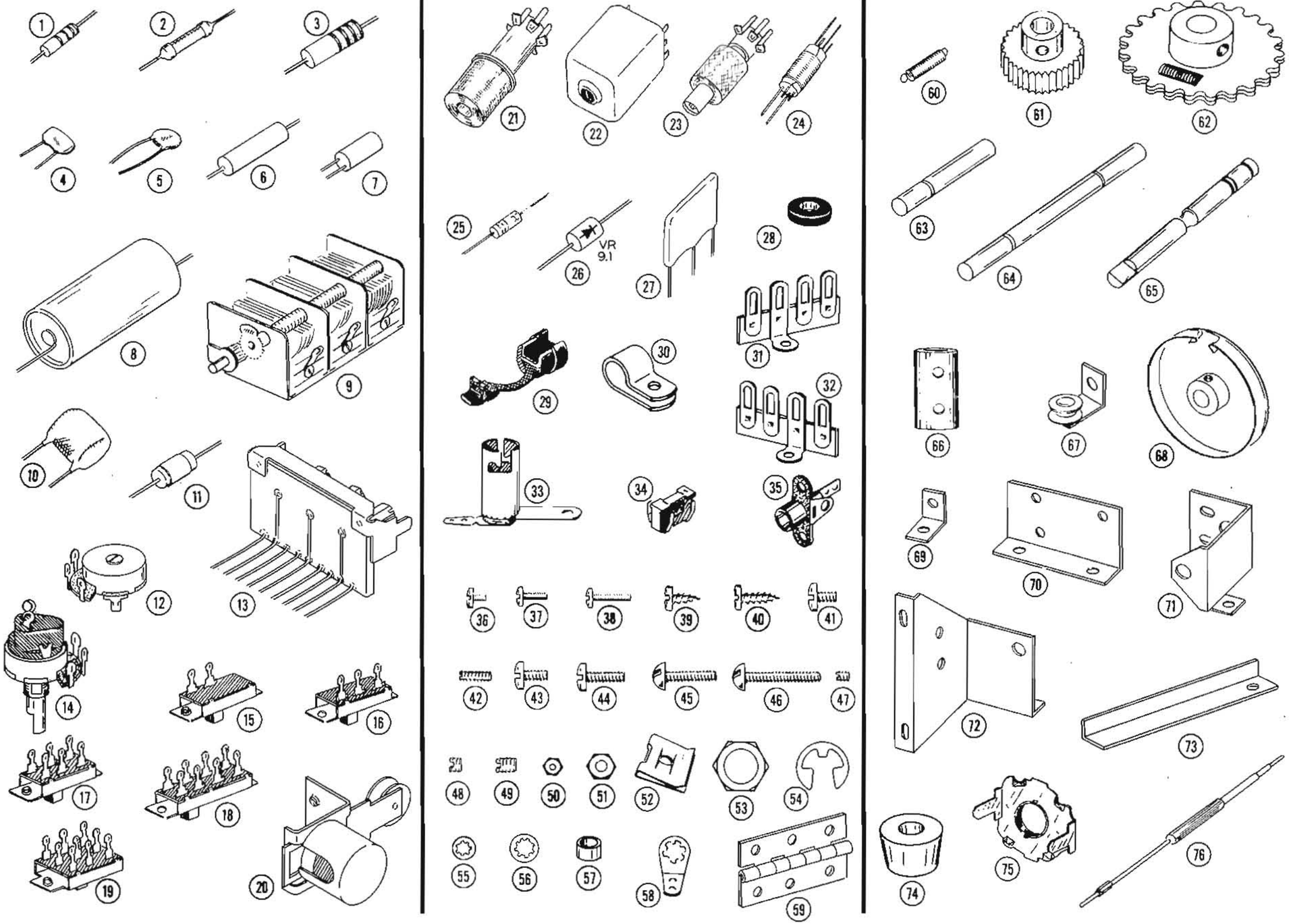
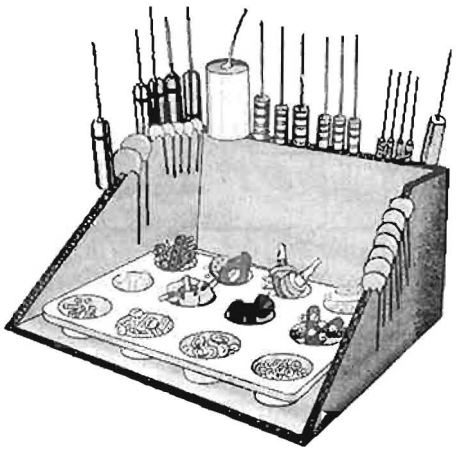
PARTS PICTORIAL



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



PARTS LIST

The numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial to aid in parts identification.

	PART No.	PARTS Per Kit	DESCRIPTION
	Resistors (1/2 Watt)		
(1)	1-49	2	22 Ω (red-red-black)
	1-3	4	100 Ω (brown-black-brown)
	1-66	1	150 Ω (brown-green-brown)
	1-45	1	220 Ω (red-red-brown)
	1-42	2	270 Ω (red-violet-brown)
	1-4	3	330 Ω (orange-orange-brown)
	1-6	4	470 Ω (yellow-violet-brown)
	1-7	2	680 Ω (blue-gray-brown)
	1-9	5	1000 Ω (brown-black-red)
	1-11	1	1500 Ω (brown-green-red)
	1-93	1	1800 Ω (brown-gray-red)
	1-44	3	2200 Ω (red-red-red)
	1-14	3	3300 Ω (orange-orange-red)
	1-46	1	3900 Ω (orange-white-red)
	1-16	5	4700 Ω (yellow-violet-red)
	1-19	2	6800 Ω (blue-gray-red)
	1-20	13	10 KΩ (brown-black-orange)
	1-21	1	15 KΩ (brown-green-orange)
	1-69	1	18 KΩ (brown-gray-orange)
	1-22	4	22 KΩ (red-red-orange)
	1-67	3	39 KΩ (orange-white-orange)
	1-25	9	47 KΩ (yellow-violet-orange)
	1-60	1	68 KΩ (blue-gray-orange)
	1-27	2	150 KΩ (brown-green-yellow)
	1-34	1	680 KΩ (blue-gray-yellow)
(2)	2-11	1	100 KΩ precision
	Resistors (1 Watt)		
(3)	1A-14	2	33 Ω (orange-orange-black)

	PART No.	PARTS Per Kit	DESCRIPTION
	Capacitors		
(4)	20-103	1	150 μμf mica
	20-107	1	680 μμf mica
	20-122	3	1000 μμf mica
(5)	21-17	2	270 μμf disc
	21-13	1	500 μμf disc
	21-14	2	.001 μfd disc
	21-36	2	.002 μfd disc
	21-26	2	.003 μfd disc
	21-46	2	.005 μfd disc 50 V
	21-35	1	.005 μfd disc 1.6 kv
	21-47	1	.01 μfd disc
	21-31	3	.02 μfd disc
	21-48	4	.05 μfd disc
	21-81	2	.1 μfd disc
(6)	25-123	1	2 μfd tubular electrolytic
	25-54	3	10 μfd tubular electrolytic
(7)	25-115	16	10 μfd electrolytic
	25-116	1	50 μfd electrolytic
	25-117	2	100 μfd electrolytic
	25-131	1	250 μfd tubular electrolytic
(8)	25-121	1	500 μfd electrolytic
	25-78	1	1000 μfd electrolytic
(9)	26-90	1	3-section variable
(10)	27-28	3	.1 μfd Mylar* (polyester film)
(11)	29-4	1	1800 μμf tubular
	29-3	2	2700 μμf tubular
	29-2	4	10,000 μμf tubular

*DuPont Registered Trademark

PART No.	PARTS Per Kit	DESCRIPTION
Controls-Switches		
(12) 10-61	1	200 Ω tab-mount control
10-75	1	500 Ω tab-mount control
(13) 13-6	1	5 KΩ 3-section side-by-side control
13-7	1	1 KΩ, 50 KΩ, 100 Ω - 3-section side-by-side control
(14) 19-84	1	10 KΩ control with SPST push-pull switch
(15) 60-1	1	SPST slide switch
(16) 60-11	2	SPDT slide switch
(17) 60-2	2	DPDT slide switch
(18) 60-22	1	DPTT slide switch
(19) 60-20	1	TPDT slide switch
(20) 100-M419	1	SPST push-push switch with shield
Coils-Transformers		
(21) 40-453	1	Whistle filter coil
(22) 40-540	1	AM oscillator coil
40-541	1	AM mixer coil
(23) 40-542	2	19 kc trap coil
40-543	2	19 kc tuning coil
40-545	1	38 kc oscillator coil
40-556	1	38 kc trap coil
40-557	1	67 kc trap coil
(24) 40-149	1	FM line antenna coil
40-554	1	AM rod antenna
45-7	2	90 μh choke
52-68	1	AM input IF transformer
52-49	1	AM output IF transformer
54-145	1	Power transformer
Diodes-P.E.C. (Printed Electronic Circuit)-Transistors-Fuse		
(25) 56-26	2	Crystal diode (brown-white-brown)
(26) 56-19	1	Zener diode VR9.1
57-29	2	Silicon diode
(27) 84-36	2	38 kc filter P.E.C.
417-18	1	2N408 transistor
417-53	2	TI 364 transistor
417-67	13	2N2712 transistor (orange-dot)
417-77	1	2N2712 transistor (blue dot)
417-68	1	35070 transistor
421-26	1	1/8 ampere slow-blow fuse
Transistors in FM Tuner		
417-70	1	2N2671
417-71	1	2N2654
417-72	1	2N2495

PART No.	PARTS Per Kit	DESCRIPTION
Transistors on FM IF Circuit Board		
417-71	4	2N2654
Grommets-Insulator-Clamps-Fuseholder-Terminal Strips-Sockets		
(28) 73-4	5	5/16" rubber grommet
73-1	2	3/8" rubber grommet
(29) 75-24	1	Line cord strain insulator
(30) 207-22	2	Plastic clamp
423-1	1	Fuseholder
431-2	1	2-lug terminal strip
431-10	2	3-lug terminal strip
(31) 431-12	1	4-lug terminal strip
(32) 431-40	1	4-lug terminal strip
431-13	1	4-screw terminal strip
431-35	1	7-lug terminal strip
(33) 434-83	4	Pilot lamp socket
434-88	1	Pilot lamp socket with bent bracket
(34) 434-103	3	Transistor socket
(35) 434-42	1	Single phono socket
434-76	1	Triple phono socket
Hardware		
(36) 250-256	7	3-48 x 1/8" screw
(37) 250-49	7	3-48 x 1/4" screw
(38) 250-172	14	3-48 x 3/8" screw
(39) 250-170	10	#6 x 1/4" sheet metal screw
(40) 250-8	6	#6 x 3/8" sheet metal screw
(41) 250-138	8	6-32 x 3/16" screw
(42) 250-100	4	6-32 x 5/16" setscrew
(43) 250-56	56	6-32 x 1/4" screw
(44) 250-89	10	6-32 x 3/8" screw
(45) 250-48	6	6-32 x 1/2" screw
(46) 250-29	3	6-32 x 3/4" screw
(47) 250-33	2	6-32 x 1/8" setscrew
(48) 250-15	1	8-32 x 1/8" setscrew
(49) 250-16	3	8-32 x 3/16" setscrew
(50) 252-1	21	3-48 nut
(51) 252-3	49	6-32 nut
(52) 252-22	2	6-32 speednut
(53) 252-7	1	Control nut
(54) 253-11	6	E washer
(55) 254-7	39	#3 lockwasher
(56) 254-1	72	#6 lockwasher
(57) 255-1	2	1/8" long spacer
255-3	3	3/8" long spacer
255-49	2	5/16" long spacer
255-42	2	3/4" long spacer (phenolic)
255-11	5	1" long spacer
(58) 259-1	7	Solder lug
(59) 265-7	1	Large hinge
265-8	2	Small hinge

PART No.	PARTS Per Kit	DESCRIPTION
Line Cord-Cable Assembly-Wire-Cable-Sleeving		
89-1	1	Line cord
134-93	1	Cable assembly
344-59	1	White hookup wire
343-7	1	Shielded cable
134-36	2	Audio cable assembly
347-2	1	Twin lead
346-1	1	Small sleeving
346-2	1	Clear plastic sleeving
346-6	1	Large sleeving
Dial Spring-Dial Cord-Gears-Shafts-Flywheels-Knobs-Pointers-Pulleys		
(60) 258-1	2	Dial spring
349-1	1	Dial cord
(61) 451-15	1	Drive gear
(62) 451-16	1	Anti-backlash gear
(63) 453-124	1	1-13/16" drive shaft
(64) 453-37	1	3-7/32" extension shaft
(65) 453-120	2	Dial cord drive shaft
(66) 456-7	1	Shaft coupling
454-2	2	Flywheel
462-171	1	Small knob
462-120	2	Large knob
463-39	2	Dial pointer
(67) 100-M302	4	Dial pulley assembly
(68) 100-M452	1	Small dial pulley
100-M365	1	Large dial pulley
Metal Parts		
100-M552	1	Long decorative panel
100-M427	1	Short decorative panel
200-M447F951F952	1	Chassis
203-M363F435	1	Front panel

PART No.	PARTS Per Kit	DESCRIPTION
Metal Parts (cont'd.)		
(69) 204-M102	1	Angle bracket
(70) 204-M550	1	Tuner mounting bracket
204-M552	1	Large L bracket
(71) 204-M563	1	FM shaft mounting bracket
204-M561F	1	Dial pointer bracket
(72) 204-M555	1	Left front panel mounting bracket
204-M556	1	Right front panel mounting bracket
(73) 204-M592	1	Corner bracket
205-M490F	1	Chassis bottom plate
206-M269F	1	Shield
206-M270P95	1	Shield cover
Miscellaneous		
110-15	1	FM tuner
100-M521	1	FM IF circuit board assembly
(74) 261-17	4	Plastic feet
(75) 266-82	1	Control tab mounting adapter
391-17	1	Nameplate
1407-98	2	Meter
412-16	1	#49 pilot lamp
412-20	4	#47 frosted pilot lamp
85-73F953	1	AM circuit board
85-74F954	1	Multiplex circuit board
85-75F955	1	Input circuit board
446-23F957	1	Dial window
(76) 490-1	1	Plastic alignment tool
490-5	1	Nut starter
331-6		Solder
595-761	1	Manual

PROPER SOLDERING TECHNIQUES

Only a small percentage of customers find it necessary to return equipment for factory service. By far the largest portion of malfunctions in this equipment are due to poor or improper soldering.

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

For most wiring, a 25 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly. Keep the iron tip clean by wiping it from time to time with a cloth.

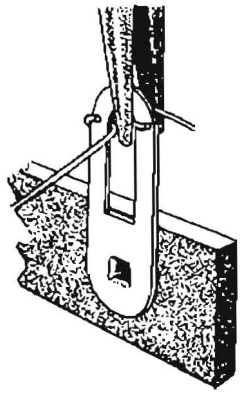
CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with colored insulation (hookup wire). In preparing a length of hookup wire, 1/4" of insulation should be removed from each end unless directed otherwise in the assembly step.

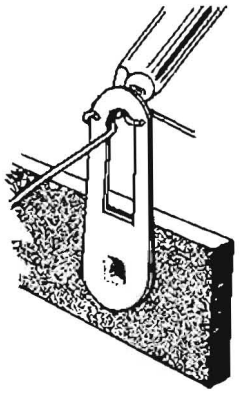
2. To avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, care should be taken not to pull directly on the lead. Instead, hold the lead with pliers while it is being stripped.

3. Leads on resistors, capacitors, and similar components are generally much longer than need be to make the required connections. In these cases, the leads should be cut to proper length before the part is installed. In general, the leads should be just long enough to reach their terminating points.

4. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving. Where the use of sleeving is specifically intended, the phrase "use sleeving" is included in the associated assembly step. In any case where there is the possibility of an unintentional short circuit, sleeving should be used. Extra sleeving is provided for this purpose.



5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the lead is too large to allow bending or if the step states that it is not to be crimped, position it so that a good solder connection can still be made.

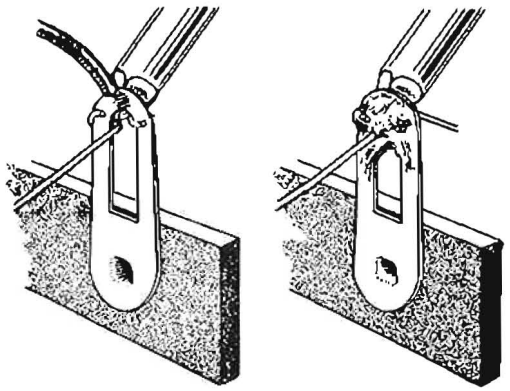


6. Position the work, if possible, so that gravity will help to keep the solder where you want it.

7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

8. Then place the solder against the connection and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.

9. Remove the solder and then the iron from the completed joint. Use care not to move the leads until the solder is solidified.



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

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE (60:40 or 50:50 TIN-LEAD CONTENT) RADIO TYPE SOLDER.

CIRCUIT BOARD WIRING AND SOLDERING

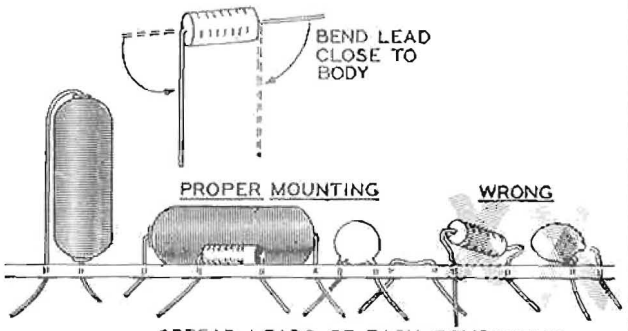
Before attempting any work on the circuit board, read the following instructions carefully and study the Figures. It is only necessary to observe the following basic precautions to insure proper operation of the unit the first time it is turned on.

Proper mounting of components on the board is essential for good performance. A good general rule to follow is that all components on the board should be mounted tightly to the board, unless instructions state otherwise. All leads should be kept as short as possible to minimize the effects of stray capacity in the wiring. Proper and improper methods of mounting are illustrated in the accompanying Figures.

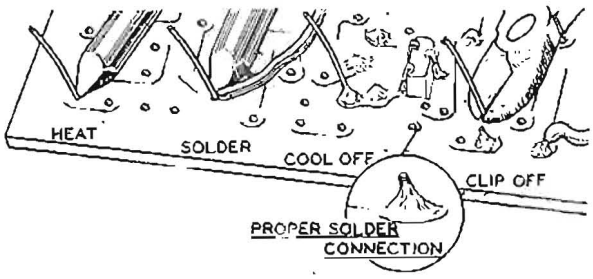
NOTE: Exercise care not to damage resistors or capacitors when bending the leads as shown.

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

Parts should be inserted as instructed, and the leads bent outward, as illustrated, to lock them in place. When a group of parts have been installed on a circuit board, solder each lead to the foil pattern and clip off the excess wire.



The actual technique of soldering leads to a circuit board is quite simple. Position the tip of the soldering iron so that it firmly contacts both the circuit board foil and the wire or lug to be soldered, as shown. The iron should be held so that solder is not likely to flow to adjacent foil conductors or connections. The solder should immediately be placed between the iron and the joint to be soldered. Remove the length of solder as soon as its end begins to melt and flow onto the lead and foil. Hold the tip of the iron in place only until the solder begins to flow outward over the foil; then remove the iron quickly.



Avoid overheating the connection. A soldering pencil or small iron (approximately 25 watts) is ideal for use in circuit board work. If only a high wattage iron or soldering gun is available, precautions must be taken to avoid circuit board damage due to overheating and excess solder.

IMPROPER SOLDER CONNECTIONS

The use of excessive amounts of solder will increase the possibility of bridging between foil conductors or plugging holes which are to be left open for wires which may be added later on. If solder is accidentally bridged across insulating areas between conductors, it can be cleaned off by heating the connection carefully and quickly wiping or brushing the solder away with a soft cloth or clean brush. Holes which become plugged can be cleared by heating the area immediately over the hole while gently pushing the lead of a resistor through the hole from the opposite side, and withdrawing the lead before the solder rehardens. Do not force the lead through; too much pressure before the solder has time to soften may separate the foil from the board.

STEP-BY-STEP PROCEDURE

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

ILLUSTRATIONS

The fold-out diagrams in this manual may be removed and attached to the wall above your working area; but because they are an integral part of the instructions, they should be returned to the manual after the kit is completed.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate clearly showing all of the parts.

SOLDERING

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a wire to lug 1 (S-2)," it will be understood that there will be two wires connected to the terminal at the time it is soldered. (In cases where a wire passes through a terminal or lug and then connects to another point, it will count as two wires, one entering and one leaving the terminal.)

GENERAL

The steps directing the installation of resistors include color codes to help identify the parts.

STEP-BY-STEP ASSEMBLY

CIRCUIT BOARD ASSEMBLY

Refer to Pictorial 1 for the following steps.

( ) Place the AM circuit board (#85-73F953) on your work surface as shown, with the lettered side up.

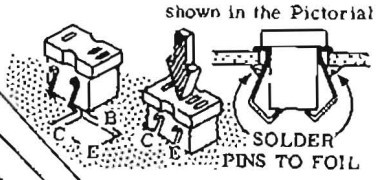
( ) Referring to Detail 1A on Pictorial 1, install transistor sockets at locations Q8, Q9, and Q10. Position the holes of each socket as shown in Pictorial 1. Solder all three pins of each socket to the foil of the circuit board.

NOTE: Be careful not to cover any of the unuse holes when soldering to the circuit boar SOLDERING TO THE CIRCUIT BOARDS WI BE EASIER IF YOU SOLDER AND CLIP OF EXCESS LEADS AFTER EVERY SIX OR EIGH COMPONENTS ARE INSTALLED. All resistor are 1/2 watt unless specified otherwise. Re sistors will be called out only by resistanc value and color code in the circuit boar wiring steps. Be sure to read the Circuit Boar Wiring And Soldering instructions on Page 2 before assembling the circuit boards. Positio the components as shown.

( ) Perform the steps on Pictorial 1.

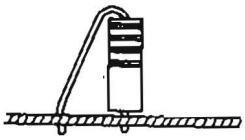
Detail 1A

Position the holes of the socket as shown in the Pictorial

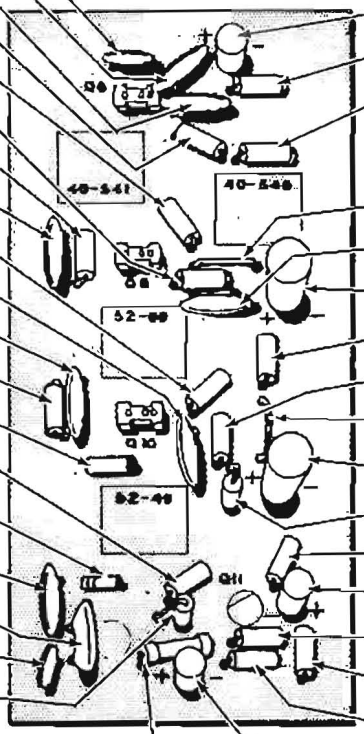


START

( ) 500 µµf disc capacitor.
( ) .02 µfd disc capacitor.
( ) .05 µfd disc capacitor.
( ) 270 Ω (red-violet-brown).
( ) 3900 Ω (orange-white-red).
( ) 1800 Ω (brown-gray-red).
( ) 18 KΩ (brown-gray-orange).
( ) .05 µfd disc capacitor.
( ) 270 Ω (red-violet-brown).
( ) .05 µfd disc capacitor.
( ) .05 µfd disc capacitor.
( ) 47 KΩ (yellow-violet-orange).
( ) 1000 Ω (brown-black-red).
( ) 4700 Ω (yellow-violet-red).
( ) Crystal diode. Position the banded end as shown.
( ) .02 µfd disc capacitor.
( ) 1000 µµf mica capacitor.
( ) 270 µµf disc capacitor.
( ) 10 KΩ (brown-black-orange).



VERTICAL MOUNTING



PICTORIAL 1

CONTINUE

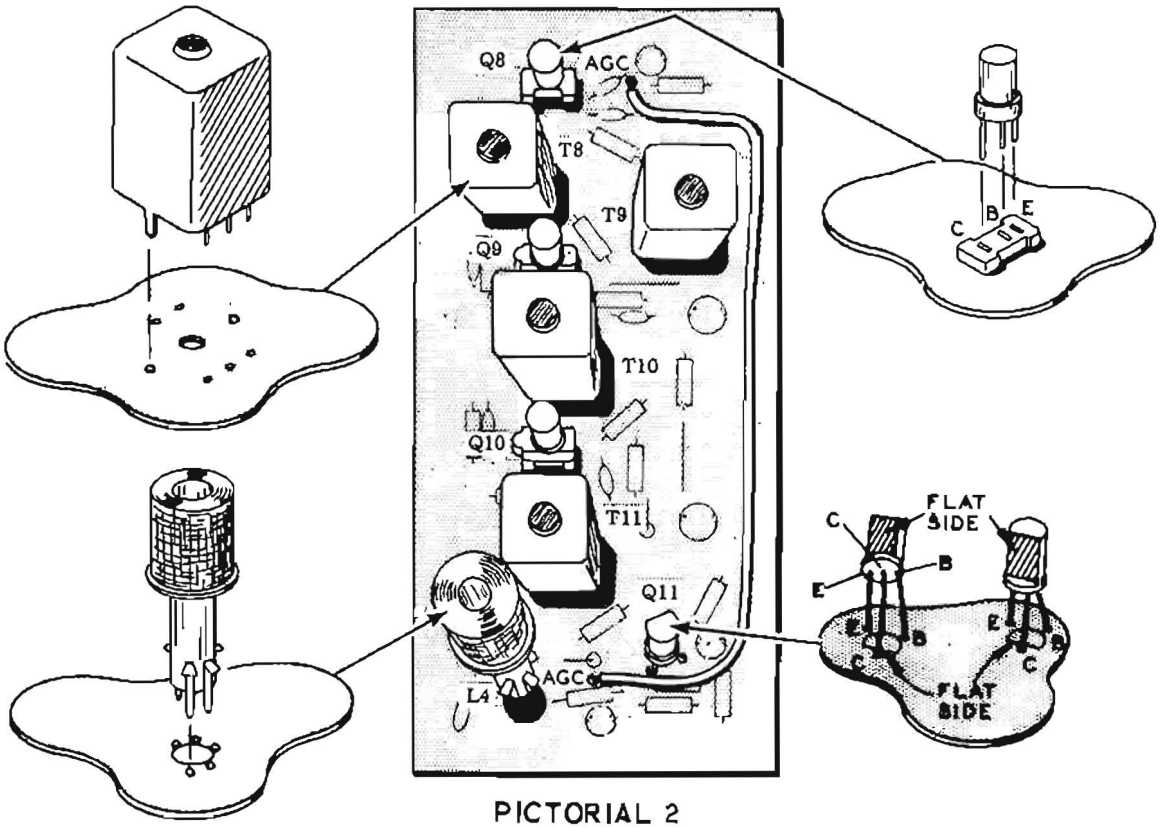
NOTE: Position the electrolytic capacitors so the positive (+) lead goes into the positive (+) hole in the circuit board. If the (+) lettering on the circuit boards is not clear, observe the lettering on the Pictorials.

( ) 10 µfd electrolytic capacitor.
( ) 150 KΩ (brown-green-yellow).
( ) 680 KΩ (blue-gray-yellow).

NOTE: When bare wire is called for in a step, use a cut off resistor lead.

( ) Bare wire.
( ) .02 µfd disc capacitor.
( ) 100 µfd electrolytic capacitor.
( ) 100 Ω (brown-black-brown).
( ) 1500 Ω (brown-green-red).
( ) Bare wire.
( ) 100 µfd electrolytic capacitor.
( ) 2200 Ω (red-red-red).
( ) 1000 Ω (brown-black-red).
( ) 10 µfd electrolytic capacitor.
( ) 10 KΩ (brown-black-orange).
( ) 10 KΩ (brown-black-orange).
( ) 47 KΩ (yellow-violet-orange).
( ) 10 µfd electrolytic capacitor.
( ) 100 KΩ precision.
( ) Check to see that all connections are soldered and cut off excess leads.

FINISH



PICTORIAL 2

Refer to Pictorial 2 for the following steps.

( ) Strip 1/4" insulation from each end of a 7" wire. Connect this wire between the two AGC holes. Position the wire as shown. Solder both connections and cut off the excess wire.

( ) Locate a 2N2712 orange dot transistor and bend the collector (center) lead toward the flat side on the transistor as shown in the drawing on Pictorial 2.

( ) Install this 2N2712 orange dot transistor at Q11, with the flat of the transistor aligned with the flat side shown on the circuit board. Position the transistor about 1/4" above the board. Solder and cut off the excess leads.

CAUTION: When installing the following transistors, carefully align the transistor pins with the holes in the sockets. Push the transistor pins straight down into the socket, being careful not to bend the pins over or together.

( ) Install TI 364 transistors in sockets Q9 and Q10.

( ) Install a 35070 transistor in socket Q8.

NOTE: When installing coils and transformers on the circuit boards, solder all the connections, except the ones that do not have foil, as each part is installed. It is not necessary to cut off the pins of the coils or transformers after soldering.

( ) Install coil #40-453 at location L4.

( ) Install transformer #52-49 at location T11. Carefully align the pins of the transformer with the holes of the circuit board before mounting. Straighten the pins if necessary.

( ) In a similar manner, install transformer #40-541 at location T8, and transformer #40-540 at location T9.

( ) Install transformer #52-68 at location T10. Note that the pins are spaced further apart on one side of the transformer than on the other. Be sure to install the transformer properly.

This completes the assembly of the AM circuit board. Check to see that all connections are soldered, and that no solder bridges exist between foils. One pin of T11 and two pins of T10 have no foil and are not soldered.

Set the AM circuit board aside temporarily.

Refer to Pictorial 3 for the following steps.

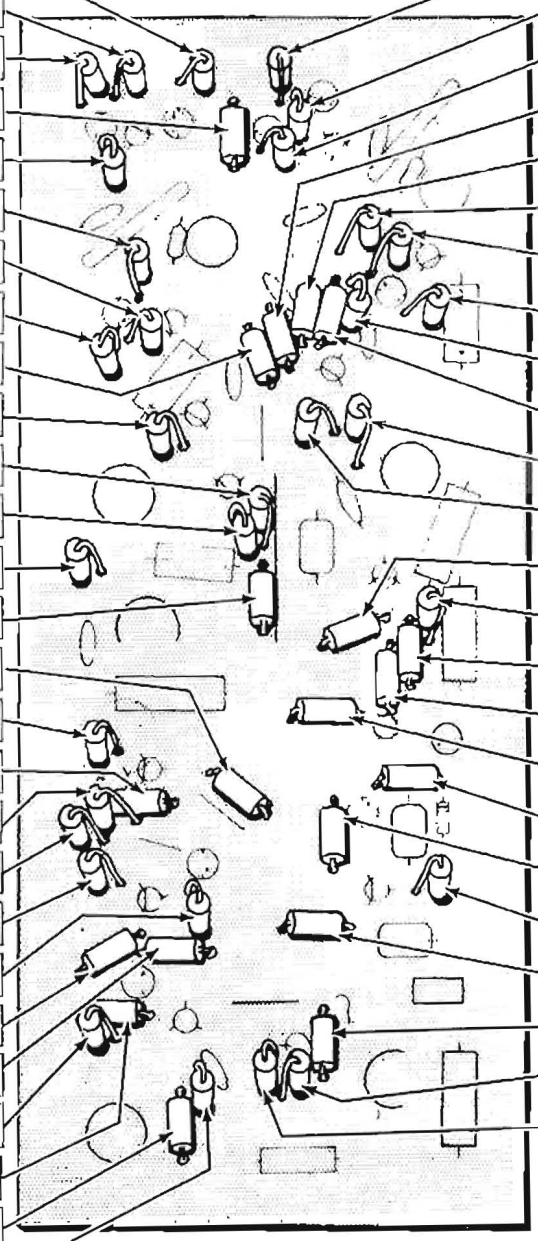
( ) Place the multiplex circuit board (#85-74-F954) on your work surface as shown, with the lettered side up.

NOTE: Some resistors and capacitors are mou
ed vertically; position each component as show

( ) Perform the steps on Pictorials 3 and

START

( ) 22 KΩ (red-red-orange).
( ) 47 KΩ (yellow-violet-orange).
( ) 47 KΩ (yellow-violet-orange).
( ) 22 KΩ (red-red-orange).
( ) 100 Ω (brown-black-brown).
( ) 470 Ω (yellow-violet-brown).
( ) 10 KΩ (brown-black-orange).
( ) 10 KΩ (brown-black-orange).
( ) 39 KΩ (orange-white-orange).
( ) 330 Ω (orange-orange-brown).
( ) 47 KΩ (yellow-violet-orange).
( ) 100 Ω (brown-black-brown).
( ) 1000 Ω (brown-black-red).
( ) 39 KΩ (orange-white-orange).
( ) 470 Ω (yellow-violet-brown).
( ) 330 Ω (orange-orange-brown).
( ) 10 KΩ (brown-black-orange).
( ) 10 KΩ (brown-black-orange).
( ) 10 KΩ (brown-black-orange).
( ) 220 Ω (red-red-brown).
( ) 680 Ω (blue-gray-brown).
( ) 10 KΩ (brown-black-orange).
( ) 47 KΩ (yellow-violet-orange).
( ) 470 Ω (yellow-violet-brown).
( ) 22 KΩ (red-red-orange).
( ) 6800 Ω (blue-gray-red).
( ) 4700 Ω (yellow-violet-red).



CONTINUE

( ) 47 KΩ (yellow-violet-orang
( ) 47 KΩ (yellow-violet-orang
( ) 100 Ω (brown-black-brown).
( ) 3300 Ω (orange-orange-red).
( ) 3300 Ω (orange-orange-red
( ) 2200 Ω (red-red-red).
( ) 10 KΩ (brown-black-orang
( ) 470 Ω (yellow-violet-brown
( ) 10 KΩ (brown-black-orang
( ) 39 KΩ (orange-white-orang
( ) 15 KΩ (brown-green-orang
( ) 4700 Ω (yellow-violet-red).
( ) 47 KΩ (yellow-violet-orange
( ) 3300 Ω (orange-orange-red).
( ) 6800 Ω (blue-gray-red).
( ) 2200 Ω (red-red-red).
( ) 10 KΩ (brown-black-orange
( ) 4700 Ω (yellow-violet-red).
( ) 10 KΩ (brown-black-orange
( ) 22 Ω (red-red-black).
( ) 1000 Ω (brown-black-red).
( ) 150 KΩ (brown-green-yellow
( ) 22 KΩ (red-red-orange).
( ) 330 Ω (orange-orange-brown
( ) Check to see that all connectio
are soldered and cut off exce
leads.

FINISH

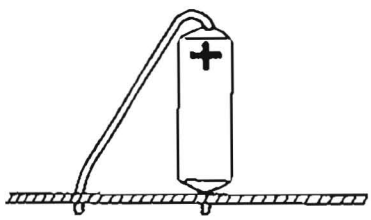
PERFORM THE STEPS ON PICTORIAL 4.

PICTORIAL 3

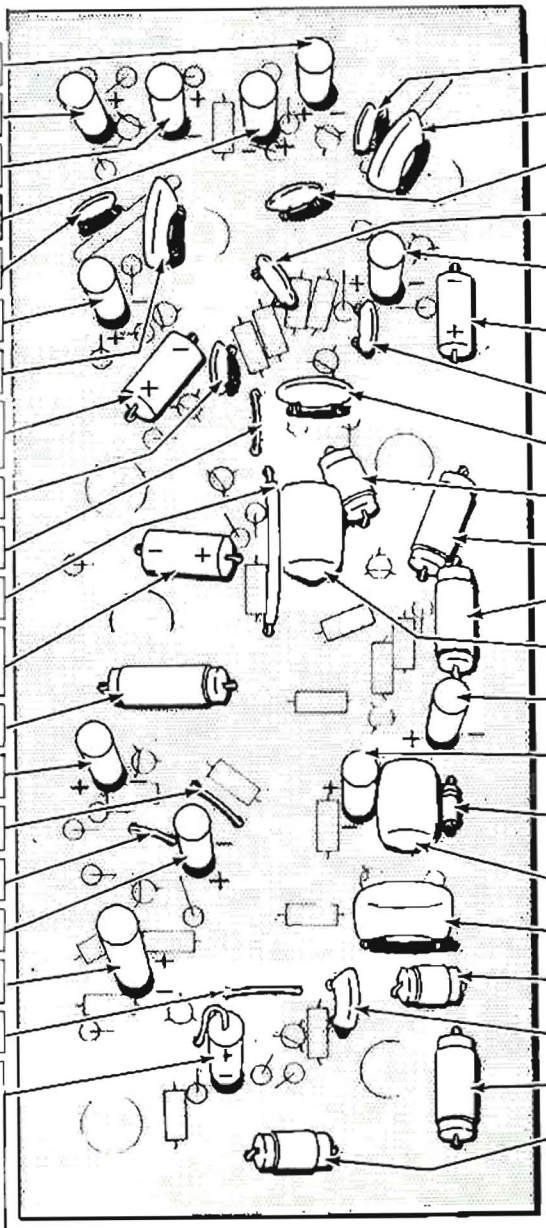
START

NOTE: Position the electrolytic capacitors so the positive (+) lead goes into the positive (+) hole on the circuit board. The lead from the marked (banded) end of Mylar capacitors, and from the colored end of tubular capacitors can be placed in either hole for these components.

- (√) 10 µfd electrolytic capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) .001 µfd disc capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) 1000 µµf mica capacitor.
- (√) 10 µfd tubular electrolytic capacitor.
- (√) .005 µfd disc 50 volt capacitor.
- (√) Bare wire.
- (√) 1-3/4" hookup wire.
- (√) 10 µfd tubular electrolytic capacitor.
- (√) 10,000 µµf tubular capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) Bare wire.
- (√) Bare wire.
- (√) 10 µfd electrolytic capacitor.
- (√) 50 µfd electrolytic capacitor.
- (√) Bare wire.
- (√) 2 µfd tubular electrolytic capacitor.



VERTICAL MOUNTING



PICTORIAL 4

CONTINUE

- (√) .001 µfd disc capacitor.
- (√) 1000 µµf mica capacitor.
- (√) .002 µfd disc capacitor.
- (√) .002 µfd disc capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) 10 µfd tubular electrolytic capacitor.
- (√) .005 µfd disc 50 volt capacitor.
- (√) .01 µfd disc capacitor.
- (√) 2700 tubular capacitor.
- (√) 10,000 µµf tubular capacitor.
- (√) 10,000 µµf tubular capacitor.
- (√) .1 µfd Mylar capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) 10 µfd electrolytic capacitor.
- (√) Crystal diode. Position color band end as shown.
- (√) .1 µfd Mylar capacitor.
- (√) .1 µfd Mylar capacitor.
- (√) 1800 µµf tubular capacitor.
- (√) 680 µµf mica capacitor.
- (√) 10,000 µµf tubular capacitor.
- (√) 2700 µµf tubular capacitor.
- (√) Check to see that all connections are soldered and cut off excess leads.

FINISH

Refer to Pictorial 5 for the following steps.

NOTE: When installing coils, transformers, and transistors on the circuit board, solder all connections, except the ones that do not have foil, as each part is installed. It is not necessary to cut off the pins of coils and transformers after soldering.

(√) Install a 2N408 transistor at location Q12. After soldering, cut off the excess leads. Position the transistor 1/4" above the circuit board. Be sure to observe the red dot on the transistor and the red dot reference on the circuit board.

(√) Install the 2N2712 blue dot transistor at Q24. Position the transistor 1/4" above the circuit board. Note that the (C) collector lead is bent away from the flat side of the transistor.

(√) Similarly, install twelve 2N2712 orange d transistors at locations Q13 through Q2 and Q25.

(√) Install #40-543 coils at locations T13 an T12.

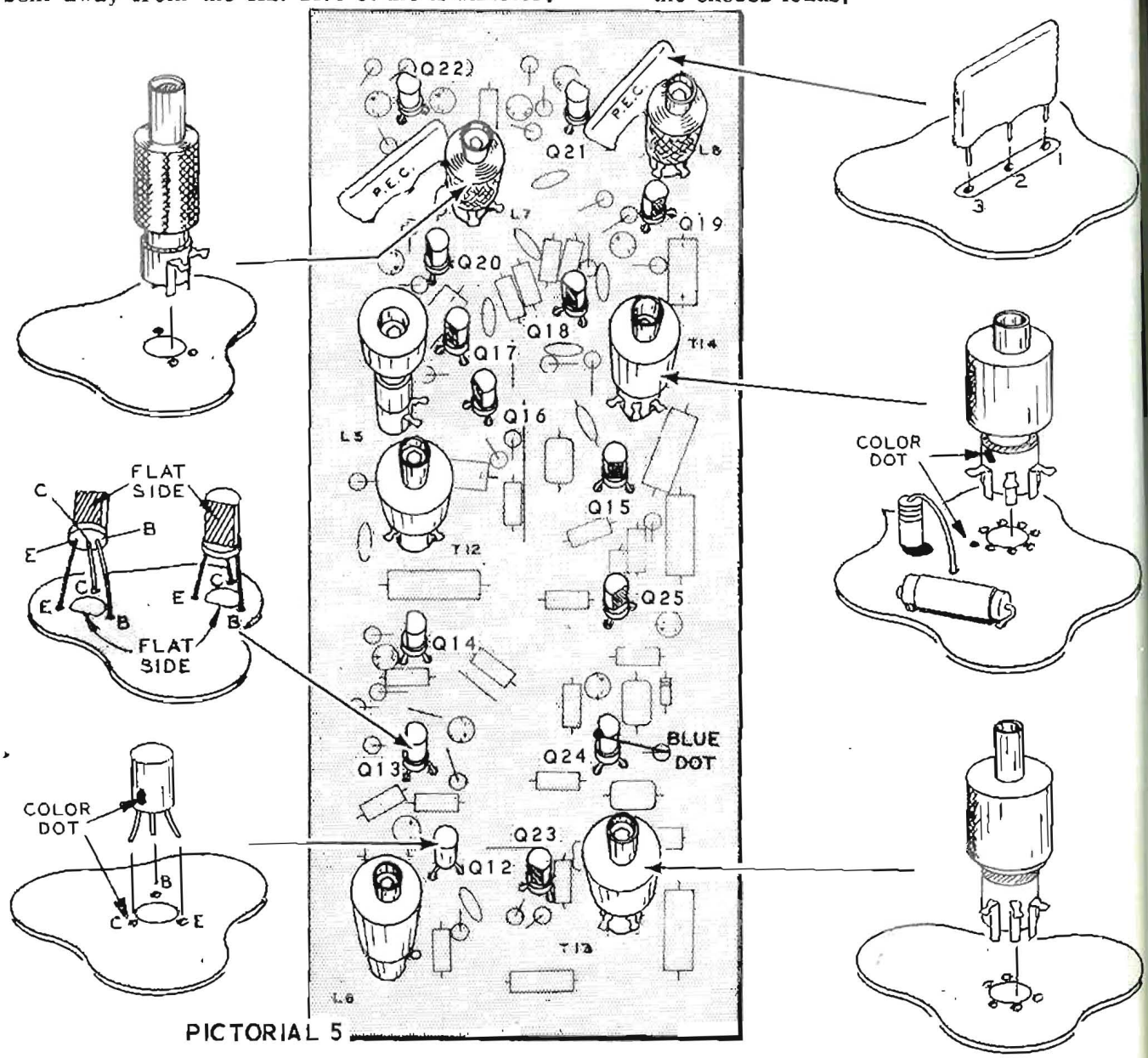
(√) Install #40-542 coils at locations L7 and L8

(√) Install the #40-545 coil at location T14 Align the color dot of the coil with the colo dot on the circuit board.

(√) Install coil #40-556 at location L5.

(√) Install coil #40-557 at location L6.

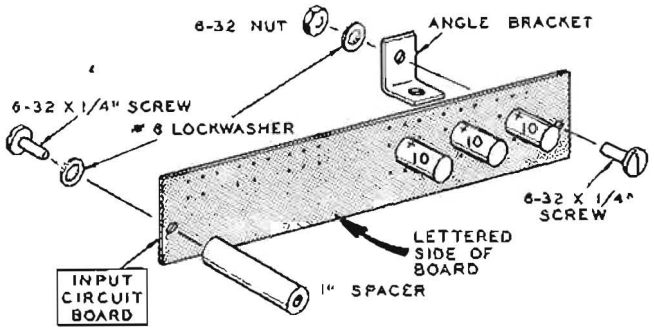
(√) Install a #84-36 P.E.C. (printed electroni circuit) at each of the two locations shown Align the numbered leads of the P.E.C with the corresponding numbered holes o the circuit board. After soldering, cut of the excess leads.



PICTORIAL 5

This completes the assembly of the multiplex circuit board. Check to see that all connections are soldered and that no solder bridges exist between foils.

Set the multiplex circuit board aside temporarily.



PICTORIAL 6

Refer to Pictorial 6 for the following steps.

( ) Place the input circuit board (#85-75F955) on your work surface as shown, with the lettered side up.

( ) Install three 10 µfd electrolytic capacitors on the circuit board. Solder all six connections and cut off the excess leads. Position the positive (+) lead as shown.

( ) Install the angle bracket on the circuit board, using a 6-32 x 1/4" screw, #6 lockwasher, and a 6-32 nut. Position the bracket as shown.

( ) Install a 1" spacer on the circuit board, using a 6-32 x 1/4" screw and a #6 lockwasher.

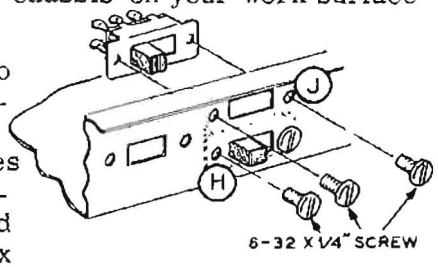
( ) Set the input circuit board aside temporarily.

PARTS MOUNTING-CHASSIS BOTTOM

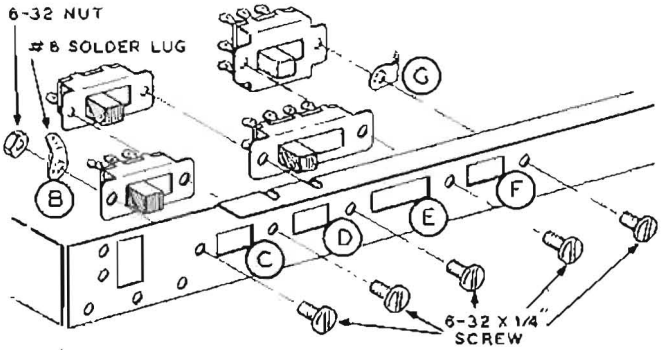
Refer to Pictorial 7 (fold-out from Page 31) for the following steps.

( ) Position the chassis on your work surface as shown.

( ) Referring to Detail 7A, install DPDT slide switches (#60-2) at locations H and J. Use 6-32 x 1/4" screws.



Detail 7A

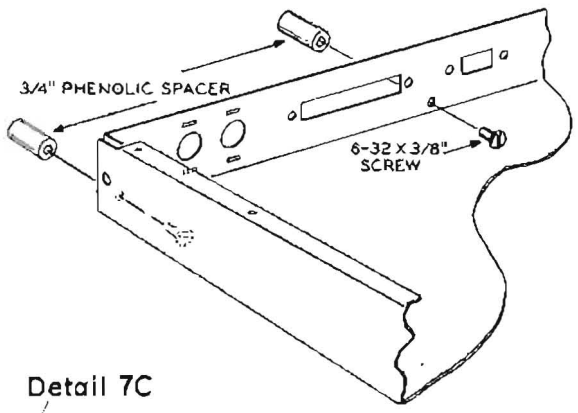


Detail 7B

( ) Referring to Detail 7B, install a SPDT slide switch (#60-11) at location C, and a #6 solder lug at B. Use a 6-32 x 1/4" screw and a 6-32 nut. Install the hardware in the one hole only, and do not tighten.

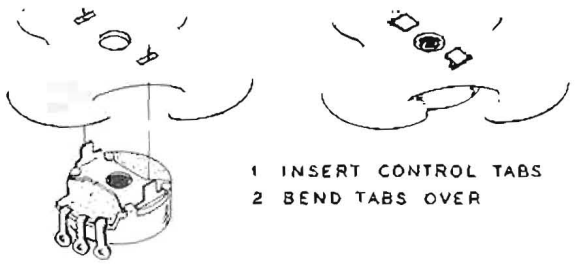
( ) While holding the DPTT slide switch (#60-22) in place at location E, install a SPST slide switch (#60-1) at location D using two 6-32 x 1/4" screws. Do not tighten the screws. Position the switch lugs as shown in Pictorial 7.

( ) Install the TPDT slide switch (#60-20) at location F and a #6 solder lug at G, using two 6-32 x 1/4" screws. Bend the solder lug up as shown. Now tighten the screws that secure the slide switches to the chassis. Position solder lugs B and G as shown.



Detail 7C

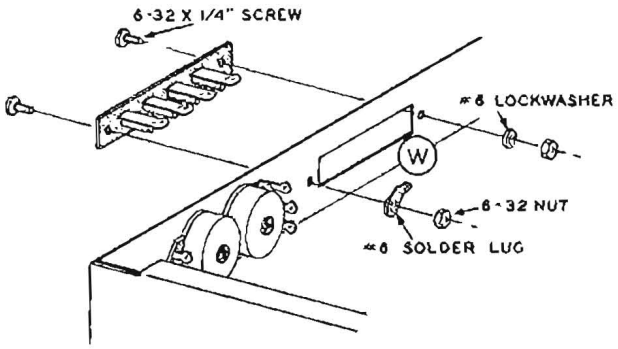
( ) Referring to Detail 7C, install 3/4" phenolic spacers on the rear chassis apron, using 6-32 x 3/8" screws. Do not overtighten the screws as the threads in the spacers can easily be damaged.



Detail 7D

( ) Referring to Detail 7D, install a 500 Ω control (#10-75) at location T. Position the control lugs as shown. Bend the mounting tabs over against the chassis.

( ) In a like manner, install a 200 Ω control (#10-61) at location U.

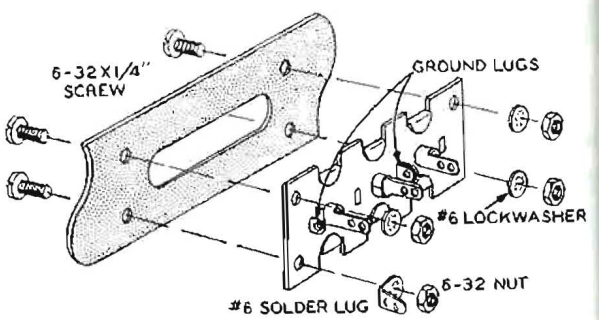


Detail 7E

( ) Referring to Detail 7E, install the 4-screw terminal strip at location W, using 6-32 x 1/4" screws, a #6 solder lug, a #6 lockwasher, and 6-32 nuts. Mount the terminal strip on the outside of the chassis with the lugs positioned as shown. Be sure the solder lug is against the first lug of the terminal strip as shown.

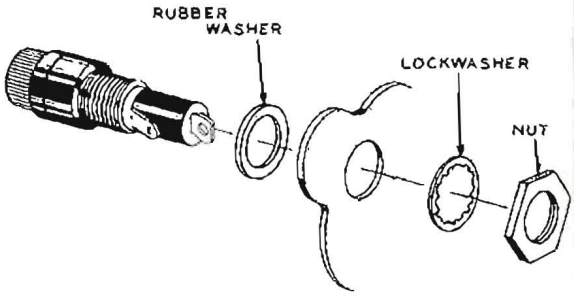
( ) Install the SPDT slide switch (#60-11) at location X, using 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts.

( ) Referring to Detail 7F, install the trip phono socket at location Y, using 6-32 1/4" screws, #6 lockwashers, a #6 sold lug, and 6-32 nuts. Mount the phono sock from inside the chassis. Position the grou lugs as shown.



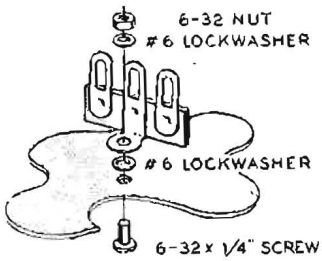
Detail 7F

( ) Referring to Detail 7G, install the fus holder at location Z, using the hardwa supplied with the fuseholder. Position t lugs as shown in Pictorial 7.



Detail 7G

( ) Referring to Detail 7H, install a 3-lu terminal strip at S, using a 6-32 x 1/4 screw, two #6 lockwashers, and a 6-3 nut. Position the terminal strip as shown

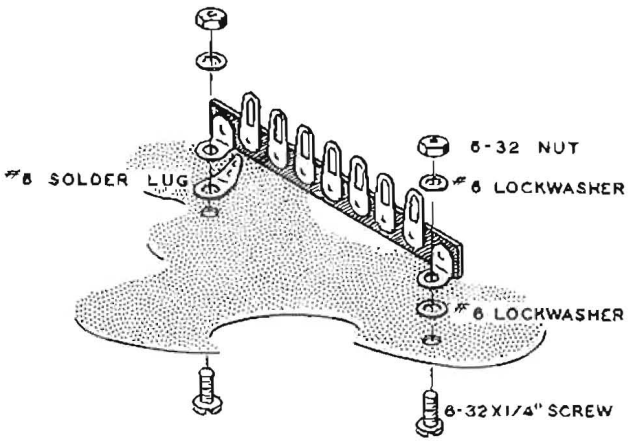


Detail 7H

( ) In a like manner install a 4-lug terminal strip (#431-12) at location N, using a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut.

( ) Install the remaining 4-lug terminal strip at location P, using a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut.

( ) Referring to Detail 7J, install a 7-lug terminal strip at location Q, using 6-32 x1/4" screws, a #6 solder lug, three #6 lockwashers, and 6-32 nuts.

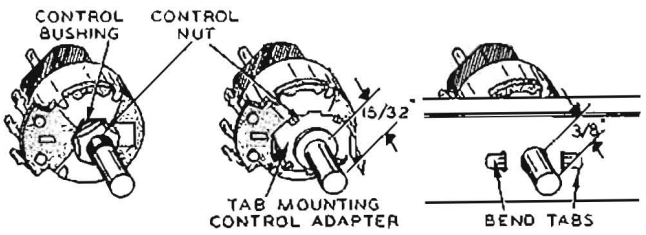


Detail 7J

Refer to Detail 7K for the following steps.

( ) Install a control nut all-the-way onto the bushing of the 10 KΩ control with SPST push-pull switch (#19-84). Do not tighten the nut yet.

( ) Install the tab mounting control adapter onto the bushing of this control. Position the adapter so it is flush with the end of the bushing.



Detail 7K

( ) Turn the adapter counterclockwise until it is positioned as shown with respect to the control lugs. Then, tighten the control nut against the rear of the adapter.

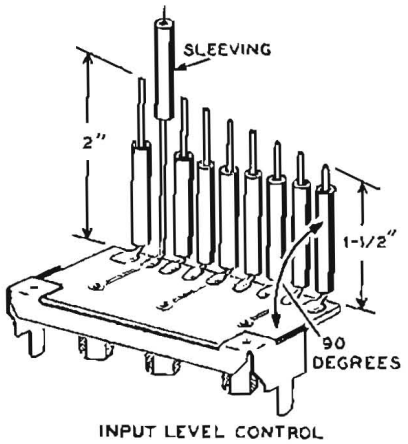
( ) Install this control at R by fitting the tabs of the adapter into the slots in the chassis. Check to see that the shaft extends only 3/8" from the chassis; be sure the control shaft is in the pushed-in position. If not, make the necessary adjustment by repositioning the tab mounting control adapter. Bend the tabs against the chassis away from the control shaft.

Refer to Pictorial 7 for the following steps.

( ) Install 5/16" rubber grommets in holes HA, HG, HH, and HJ.

( ) Install 3/8" rubber grommets in holes HL and HK.

( ) Cut all nine leads of triple control #13-7 to the indicated lengths, and place a 3/4" length of small sleeving on each lead, as shown in Detail 7L.

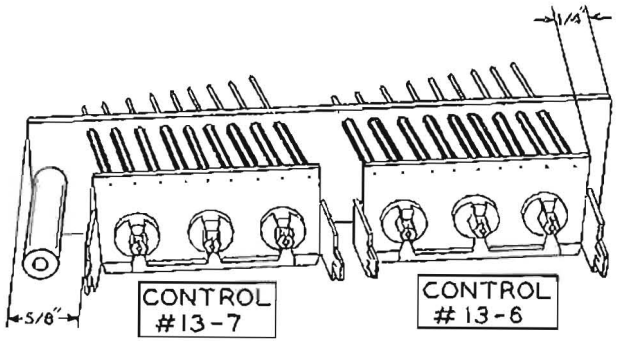


Detail 7L

( ) Bend the leads of each triple control so they extend away from the control body at a 90 degree angle, as shown in Detail 7L.

( ) Locate triple control #13-6 and repeat the preceding step, except place a 5/8" length of small sleeving on all nine leads of the control.

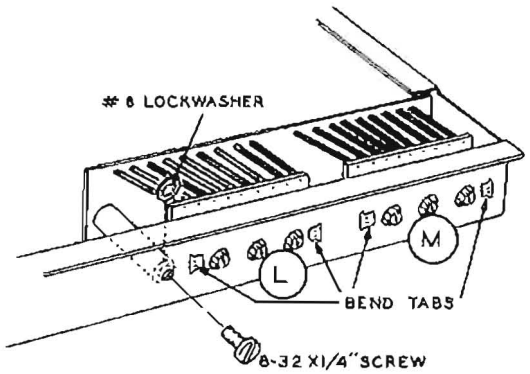
( ) Referring to Detail 7M, pass the leads of triple control #13-6 into holes 10 through 18 of the input circuit board from the lettered side. Move the control to the right bending the control leads so the right end of the control is 1/4" from the right end of the circuit board. Keep the control parallel to the circuit board while bending the leads. Do not solder the control leads to the input circuit board until instructed to do so later.



Detail 7M

( ) In a like manner, place the leads of triple control #13-7 into holes 1 through 9 of the input circuit board from the lettered side. Move the control to the right, bending the leads so the left end of the control is 5/8" to the right of the left end of the circuit board. Keep the control parallel to the board while bending the leads. Do not solder the control leads to the input circuit board until instructed to do so later.

( ) Referring to Detail 7N, install the triple control assembly in the chassis with control #13-7 at location L and control #13-6 at location M. Fit the control mounting tabs into the slots in the front apron of the chassis. Do not bend the control tabs until instructed to do so later.



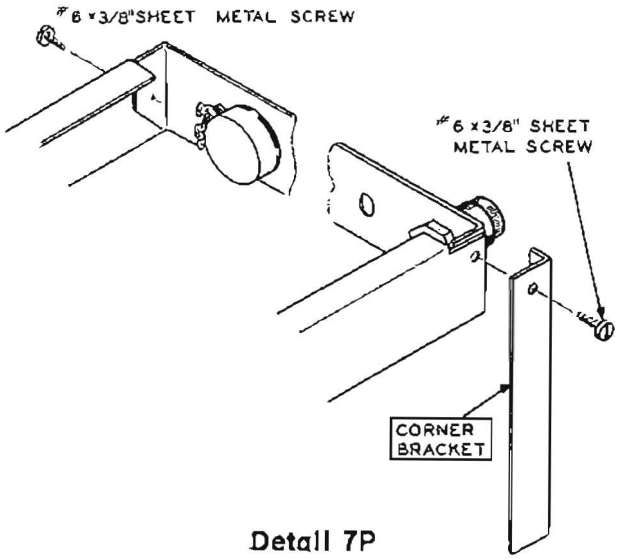
Detail 7N

( ) Secure the input circuit board to the front chassis apron, using a 6-32 x 1/4" screw and #6 lockwasher at the spacer. The angle bracket will be mounted to the chassis later. Position the lockwasher between the spacer and the inside of the chassis.

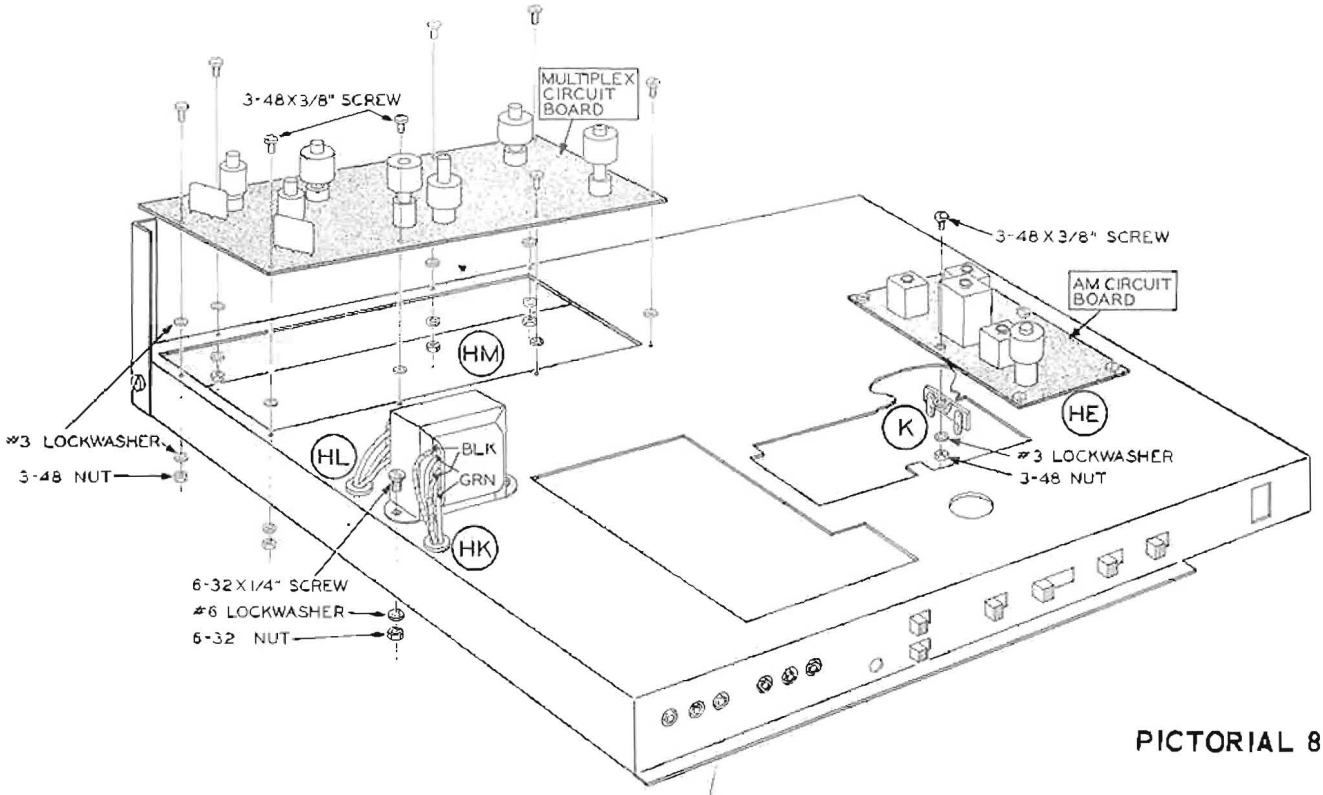
( ) Center the triple control shafts in the chassis holes, and while supporting the controls with your finger, bend the tabs over as shown in Detail 7N.

( ) Referring to Detail 7P, install the corner bracket at the rear corner of the chassis near the fuseholder. Use a #6 x 3/8" sheet metal screw. This bracket is used to protect the circuit board components during assembly.

( ) Install a #6 x 3/8" sheet metal screw in the opposite rear corner of the chassis.



Detail 7P



PICTORIAL 8

PARTS MOUNTING-CHASSIS TOP

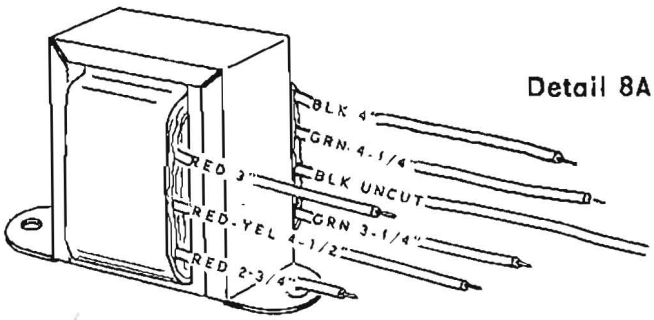
Refer to Pictorial 8 for the following steps.

NOTE: Mounting the AM and multiplex circuit boards in the following steps will be easier if the chassis is positioned right-side-up on your work surface. Place the lockwashers over the chassis holes and carefully set the circuit board being mounted on the lockwashers. Place a screw in each mounting hole of the circuit board. Make sure the screws pass through the circuit board, lockwasher, and the chassis. A piece of cellophane or masking tape to hold the screws in place will aid in mounting the circuit boards. While holding the circuit board in place, lift the chassis just enough to place lockwashers and nuts on the bottom ends of the screws.

( ) Install the multiplex circuit board at cutout HM, using 3-48 x 3/8" screws, #3 lockwashers, and 3-48 nuts.

( ) Install the AM circuit board and 2-lug terminal strip K at cutout HE of the chassis. Use 3-48 x 3/8" screws, #3 lockwashers, and 3-48 nuts. Position the terminal strip as shown.

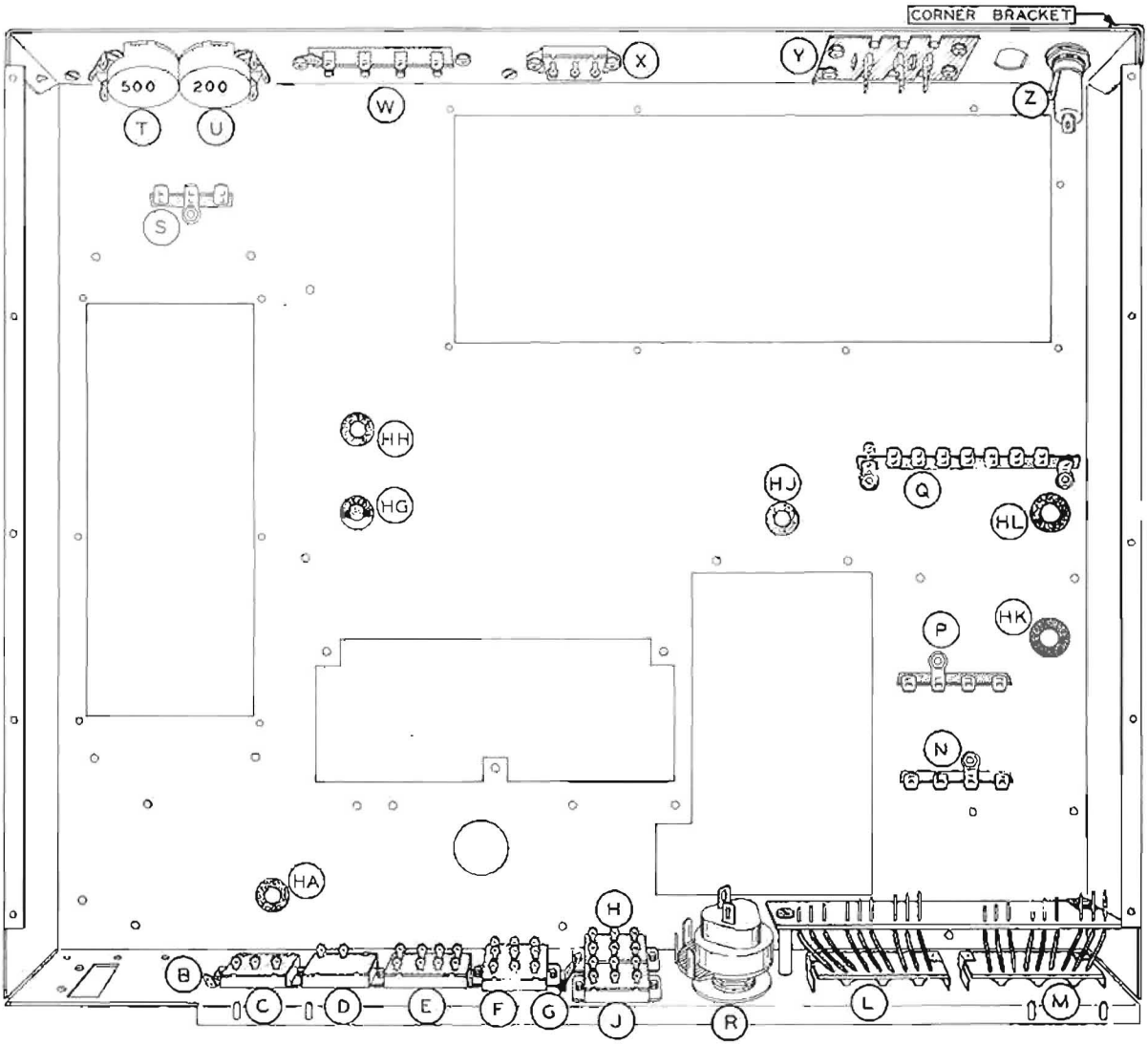
( ) Referring to Detail 8A, cut the leads of the power transformer (#54-145) as shown. Measure the leads from where they come out of the transformer.



Detail 8A

( ) Strip 1/4" of insulation from the ends of the transformer leads. Twist the end strands together and melt a small amount of solder on the exposed lead ends.

( ) Install the power transformer to the chassis, using 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Pass the two black and two green leads down through grommet HK, and pass the remaining leads down through grommet HL.


CORNER BRACKET
500
200
T
U
W
X
Y
Z
S
HH
HG
HJ
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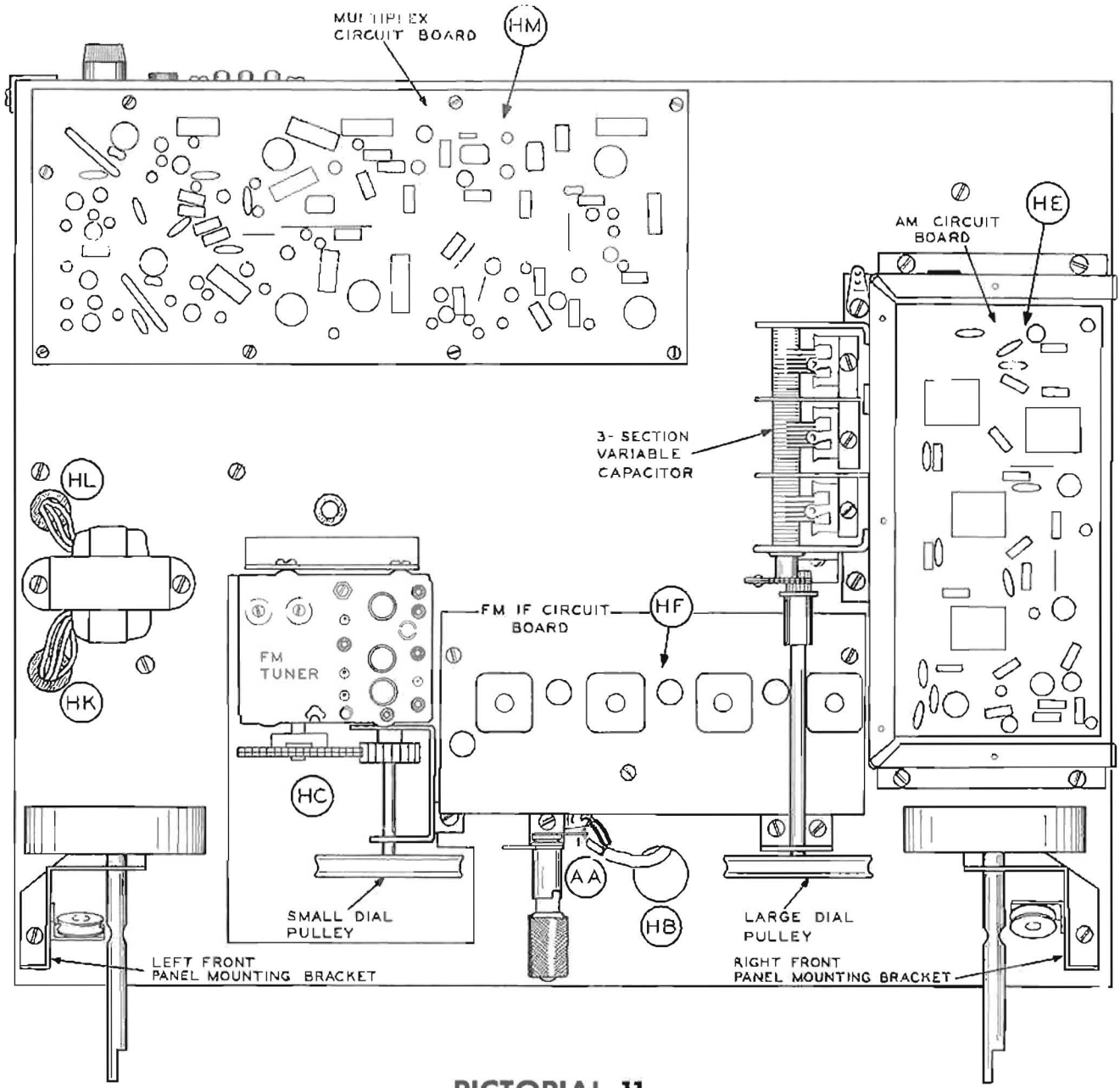
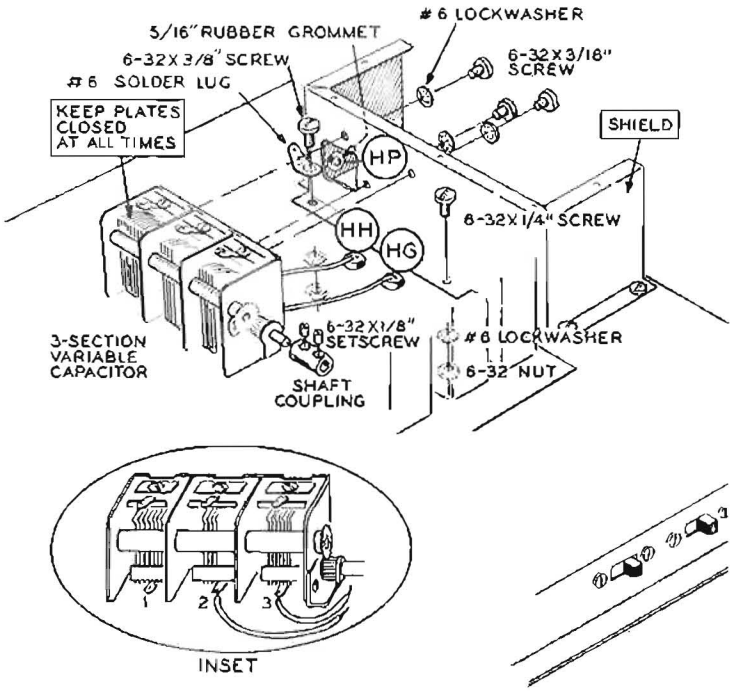
PICTORIAL 7



PICTORIAL 11



PICTORIAL 9

Refer to Pictorial 9 for the following steps.

CAUTION: Be sure to keep the plates of the 3-section variable capacitor closed to prevent damage to the plates.

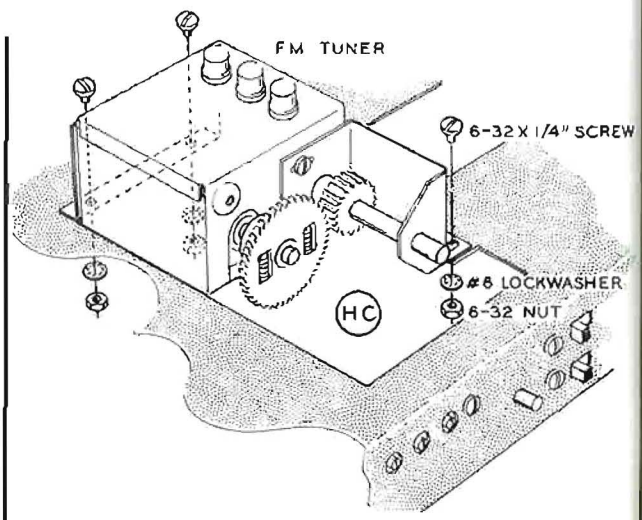
( ) Connect one end of a 4-3/4" wire to lug 2 of the 3-section variable capacitor (S-1).

( ) Connect one end of a 4" wire to lug 3 of the 3-section variable capacitor (S-1).

( ) Install a 5/16" rubber grommet in hole HP of the shield.

( ) Install the 3-section variable capacitor on the shield, using 6-32 x 3/16" screws and #6 lockwashers.

( ) Install the shield over the AM circuit board using five 6-32 x 1/4" screws, a 6-32 x 3/8" screw, #6 lockwashers, a #6 solder lug, and 6-32 nuts. Use the 6-32 x 3/8" screw when mounting the solder lug. Pass the wire from lug 2 through grommet HH and the wire from lug 3 through grommet HG. These wires will be connected later.



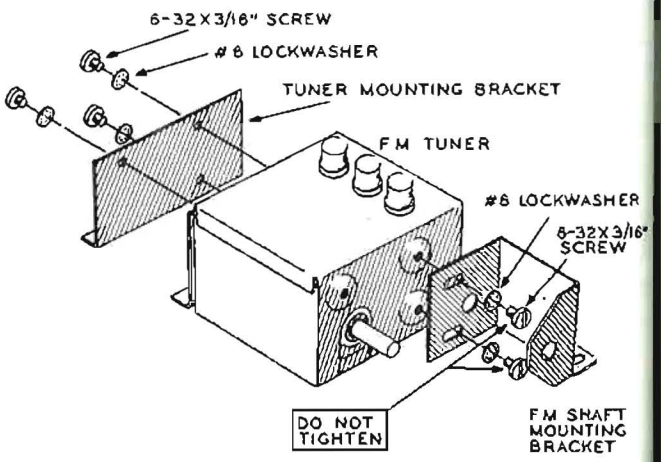
PICTORIAL 10

( ) Start two 6-32 x 1/8" setscrews into the threaded holes of the shaft coupling.

( ) Install the shaft coupling halfway on the shaft of the 3-gang variable capacitor and tighten the proper setscrew.

Refer to Pictorial 10 for the following steps.

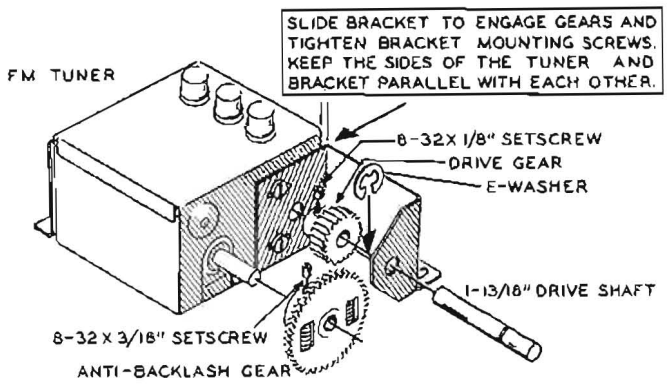
( ) Referring to Detail 10A, install the tuner mounting bracket on the rear of the FM tuner, using 6-32 x 3/16" screws and #6 lockwashers.



Detail 10A

( ) Install the FM shaft mounting bracket to the front of the FM tuner, using 6-32 x 3/16" screws and #6 lockwashers. Do not tighten the screws.

( ) Referring to Detail 10B, start the end furthest from the groove of the 1-13/16" drive shaft into the front hole of the FM shaft mounting bracket.



Detail 10B

( ) Start an 8-32 x 1/8" setscrew into the hole of the drive gear.

( ) Place the drive gear on the drive shaft as shown.

( ) Position the end of the drive shaft into the rear hole of the FM shaft mounting bracket and install an E washer into the groove of the drive shaft, inside the FM shaft mounting bracket.

( ) Pull the shaft forward until the E washer is against the inside of the FM shaft mounting bracket. Slide the drive gear back against the rear inside surface of the FM shaft mounting bracket and tighten the setscrew of the drive gear. Be sure the shaft turns freely.

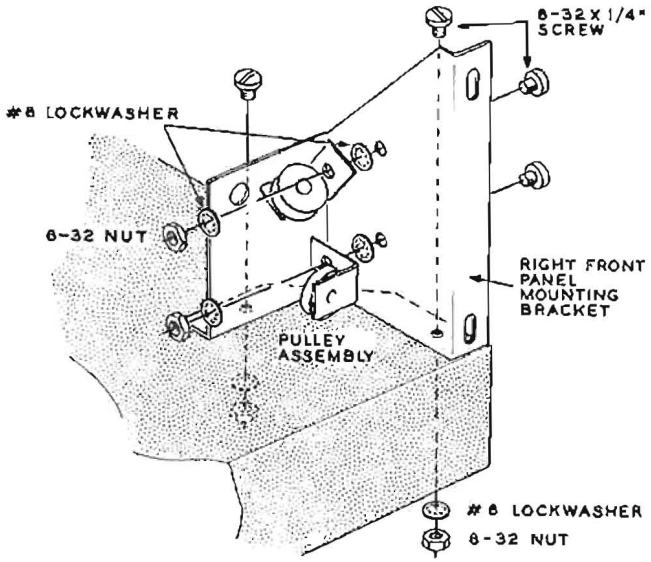
( ) Start an 8-32 x 3/16" setscrew into the hole of the anti-backlash gear.

( ) Position the anti-backlash gear on the shaft of the FM tuner until its teeth are centered with the teeth of the drive gear, then tighten the setscrew of the anti-backlash gear.

( ) Place tension on the anti-backlash gear by rotating the inside half of the gear past the front half for a distance of one tooth. Hold the tension with a screwdriver or your fingers; engage the two gears by slipping the FM support bracket toward the anti-backlash gear, and tighten the screws that secure the bracket to the FM tuner.

( ) The gear mechanism should work smoothly when the drive shaft is rotated; if it does not, loosen the bracket screws, move the bracket out slightly, and retighten the screws. Refer to Detail 10B.

( ) Install the FM tuner at cutout HC, using 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Align the shaft of the FM tuner as squarely as possible in the cutout. See Pictorials 10 and 11.



Detail 11A

Refer to Pictorial 11 (fold-out from Page 32) for the following steps.

( ) Referring to Detail 11A, install the right front panel mounting bracket to the chassis, using 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts.

( ) Install two pulley assemblies on the right front panel mounting bracket, using a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut on each pulley. Position the pulleys as shown in Detail 11B.

( ) Referring to Detail 11B, start two 6-32 x 5/16" setscrews in the holes of one of the flywheels.

( ) Pass the end opposite the flat of a dial cord shaft through the hole in the right front panel mounting bracket into the flywheel. Place a small amount of grease or vaseline on the dial drive shaft between the two front E washer grooves. Do not get any grease in the dial cord grooves.

( ) Install E washers in the two grooves of the dial cord shaft, one on each side of the right front panel mounting bracket.

( ) Slide the flywheel forward until the rear of the flywheel is flush with the end of the shaft, and tighten the setscrews.

( ) Referring to Detail 11B, install the large L bracket to the top of the chassis and 3-lug terminal strip V to the bottom of the chassis. Use 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts. Position the terminal strip as shown.

( ) Referring to Detail 11B, install the pilot lamp socket with the bent bracket at location AA, using a 6-32 x 1/4" screw, a #6 solder lug, a #6 lockwasher, and a 6-32 nut. Position the solder lug as shown.

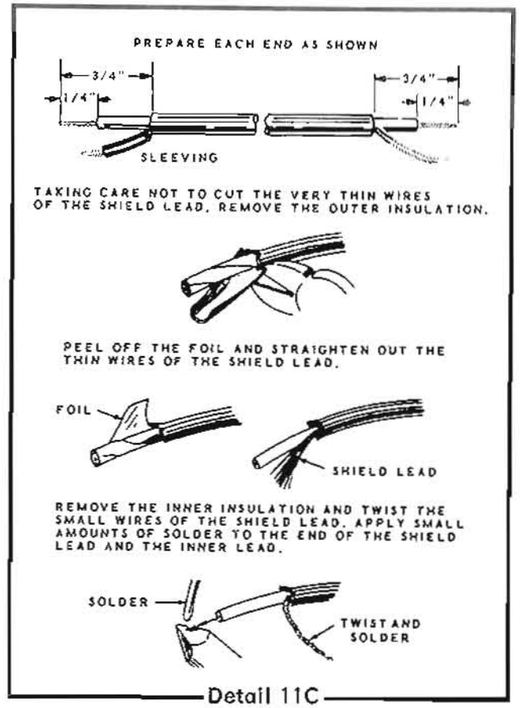
( ) Install the #49 pilot lamp in pilot lamp socket AA.

( ) Install a 3/4" length of large sleeving over the #49 pilot lamp.

CAUTION: The inner insulation of the shielded cable melts easily. Therefore, to prevent shorting the cable, the connections should be soldered quickly. It is helpful to hold the shield lead of the cable with a pair of long-nose pliers, between the cable and the connection, to act as a heat sink.

( ) Referring to Detail 11C, prepare the ends of a 12-1/2" length of shielded cable as shown.

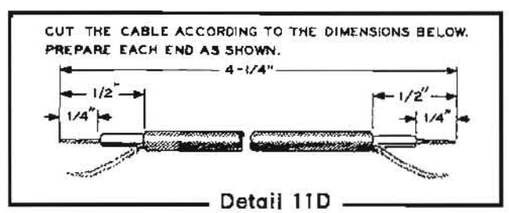
( ) Place a 1/2" length of sleeving on the shield lead at one end of this cable. Connect the inner lead to lug 1 of pilot lamp socket AA (S-1) and the shield to the solder lug mounted at AA (S-1). Pass the other end of the cable through hole HB for connection later.



Detail 11C

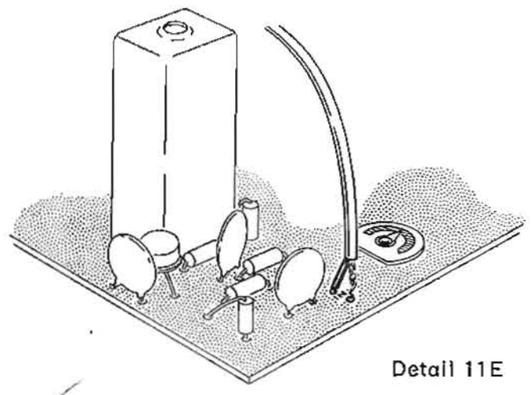
( ) Referring to Detail 11D, prepare the ends of a 4-1/4" length of shielded cable as shown.

( ) Locate the preassembled FM IF circuit board.



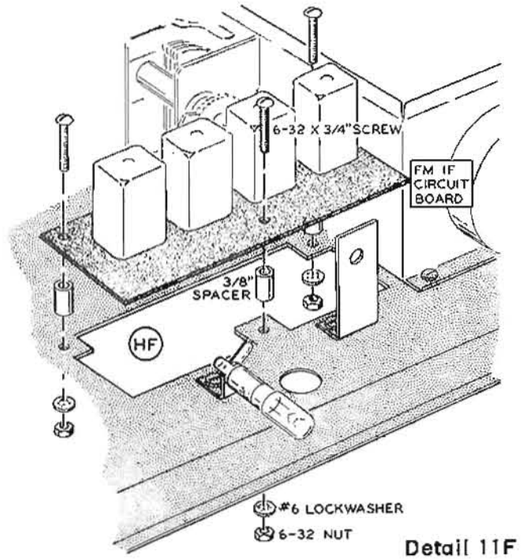
Detail 11D

( ) At either end of the cable, connect the inner lead to hole IN (S-1) and the shield to the adjacent hole (S-1) in the FM IF circuit board. Identify the hole locations in Detail 11E.

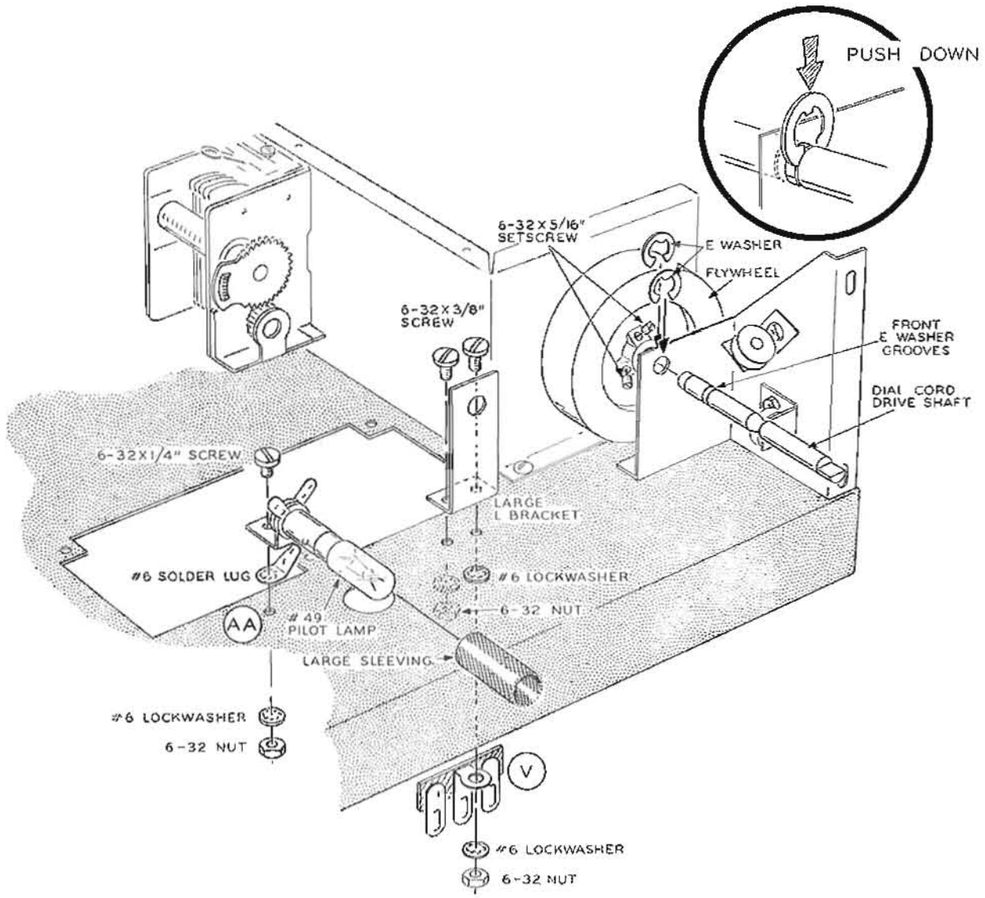


Detail 11E

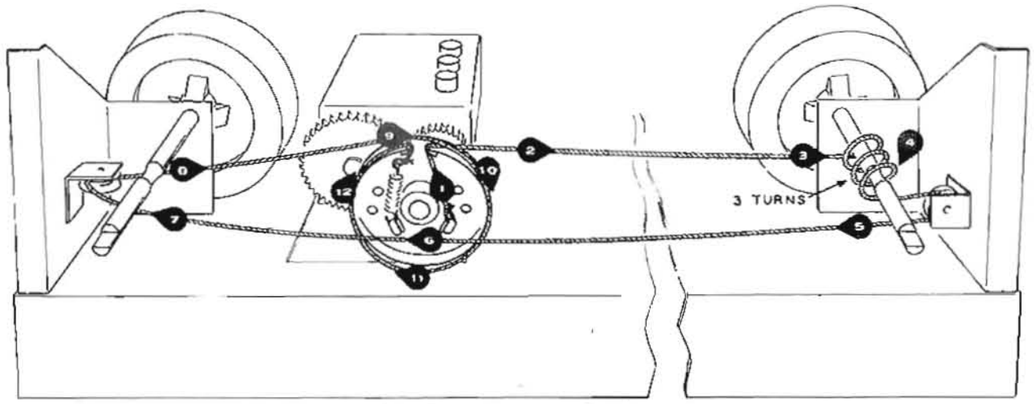
( ) Referring to Detail 11F, install the FM IF circuit board at cutout HF, using 6-32 x 3/4" screws, 3/8" spacers, #6 lockwashers, and 6-32 nuts. Do not overtighten the screws as the circuit board may be damaged.



Detail 11F

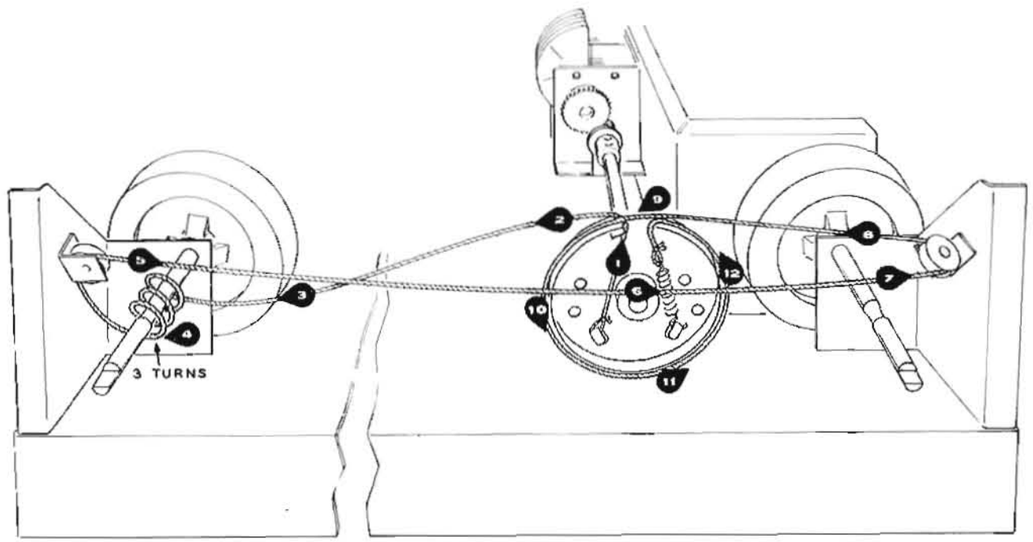


DETAIL 11B



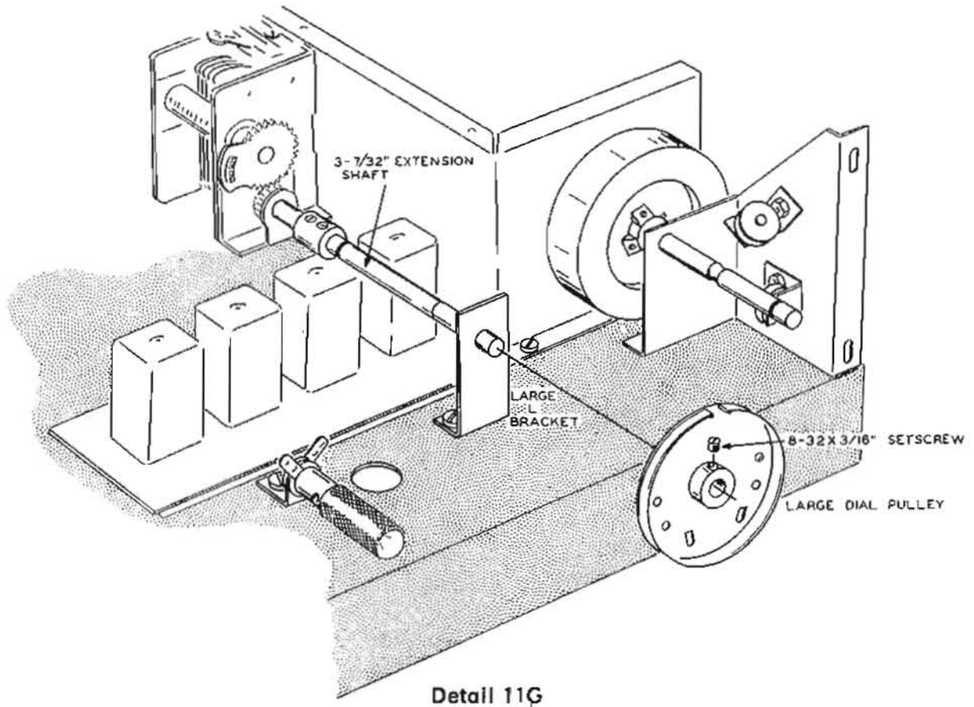
FM DIAL CORD STRINGING

PICTORIAL 12



AM DIAL CORD STRINGING

PICTORIAL 13



Detail 11G

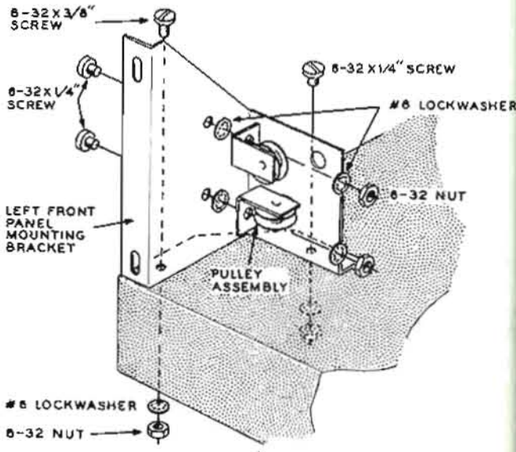
Referring to Detail 11G, pass one end of the 3-7/32" extension shaft through the large L bracket and into the shaft coupling on the 3-section variable capacitor. Tighten the setscrew in the shaft coupling. (Disregard the grooves in this shaft.)

Start an 8-32 x 3/16" setscrew in the hole of the large dial pulley.

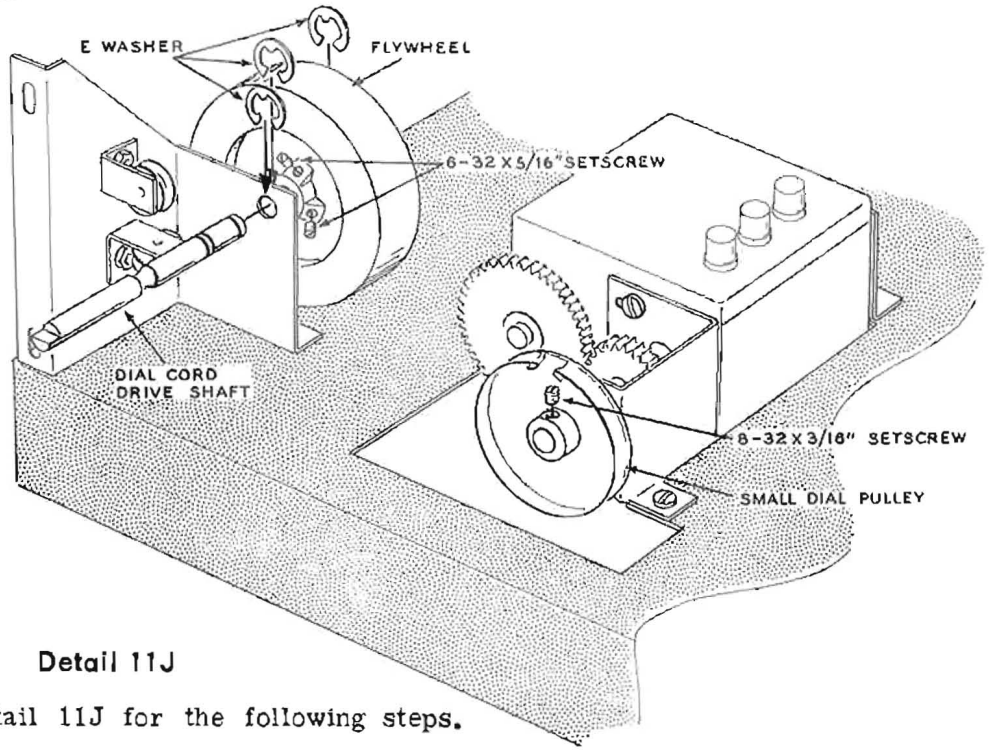
With the 3-section variable capacitor plates fully closed, place the large dial pulley on the 3-7/32" extension shaft. Position the edge of the bushing of the dial pulley flush with the end of the shaft and tighten the setscrew. Position the opening in the pulley, up as shown.

Referring to Detail 11H, install the left front panel mounting bracket, using a 6-32 x 1/4" screw, a #6 lockwasher, and a 6-32 nut in the rear hole, and a 6-32 x 3/8" screw, a #6 lockwasher, and a 6-32 nut in the side hole. The screw in the side hole must be through the angle bracket on the input circuit board.

Referring to Detail 11H, install two pulley assemblies on the left front panel mounting bracket. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut on each pulley. Position the pulleys as shown.



Detail 11H



Detail 11J

Refer to Detail 11J for the following steps.

( ) Start two 6-32 x 5/16" setscrews in the remaining flywheel.

( ) Pass the end opposite the flat of a dial cord shaft through the hole in the left front panel mounting bracket. Place grease on the dial drive shaft as before.

( ) Install E washers in the grooves of the dial cord shaft. One on each side of the left front panel mounting bracket.

( ) Slide the flywheel on the rear of the dial cord shaft as far as possible. Do not tighten the setscrews.

( ) Install an E washer in the groove of the shaft just behind the flywheel.

( ) Push the flywheel back against the rear E washer and tighten the setscrews.

( ) Start an 8-32 x 3/16" setscrew into the hole of the small dial pulley.

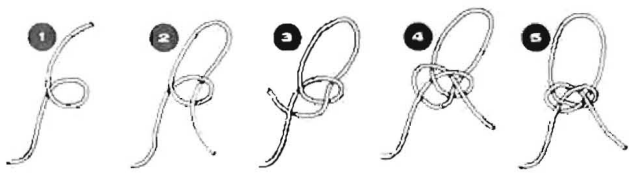
( ) Turn the drive shaft on the FM tuner fully clockwise.

( ) Slide the small dial pulley onto the FM tuner drive shaft until its bushing is flush with the end of the shaft, then tighten the setscrew. Position the opening in the pulley as shown.

FM DIAL CORD STRINGING

Refer to Pictorial 12 for the following steps.

( ) Referring to Detail 12A, tie a knot in one end of the dial cord string.



Detail 12A

( ) Start with arrow #1 and string the FM dial cord as shown by the consecutive arrow heads.

( ) Pull the dial cord tight and tie the dial cord to a dial cord spring (using simple overhand knots) just inside the dial pulley. Open the end of the spring so that it fits over the tab. The spring must have some tension to provide smooth operation.

( ) Cut off the free end of the dial cord near the spring.

AM DIAL CORD STRINGING

Refer to Pictorial 13 (fold-out from page 36) for the following steps.

( ) Rotate the shaft of the 3-section variable capacitor until the plates of the capacitor are fully open.

( ) Tie a knot in one end of the dial cord, as before for FM.

( ) String the AM dial cord by following the consecutive arrows.

( ) Pull the dial cord tight and tie the dial cord to the dial cord spring (using simple overhand knots) just inside the dial pulley. Open the end of the spring so that it fits over the tab. The spring must have some tension to provide smooth operation.

( ) Cut off the free end of the dial cord near the spring.

( ) Rotate the dial cord shaft until the plates of the 3-section variable capacitor are fully closed.

( ) Carefully check the operation of both dials. Temporarily install a large knob on each of the dial cord shafts. Rotate each knob to operate each tuning unit through its entire range. See that each of the units operate smoothly without appreciable drag. If drag is encountered, a small amount of light oil may be applied to the pulleys, shafts, and gears. Be careful not to get oil on the dial cord. A slight readjustment of the pulley assemblies or loosening the dial cord string by moving the spring to one of the dial pulley holes, may also be helpful. Remove the knobs. Extra care taken in dial stringing at this time will insure smooth tuning when the Tuner is completed.

FRONT PANEL ASSEMBLY

Refer to Pictorial 14 for the following steps.

( ) Place a soft cloth on your work surface to protect the front panel from being scratched in the following steps.

( ) Install four 1" spacers on the front panel, using 6-32 x 1/4" screws and #6 lockwashers.

( ) Install a #47 pilot lamp in each of the four pilot lamp sockets.

( ) Install the four pilot lamp sockets on the spacers mounted on the front panel, using 6-32 x 1/4" screws and #6 lockwashers. Position the pilot lamps in the holes of the front panel.

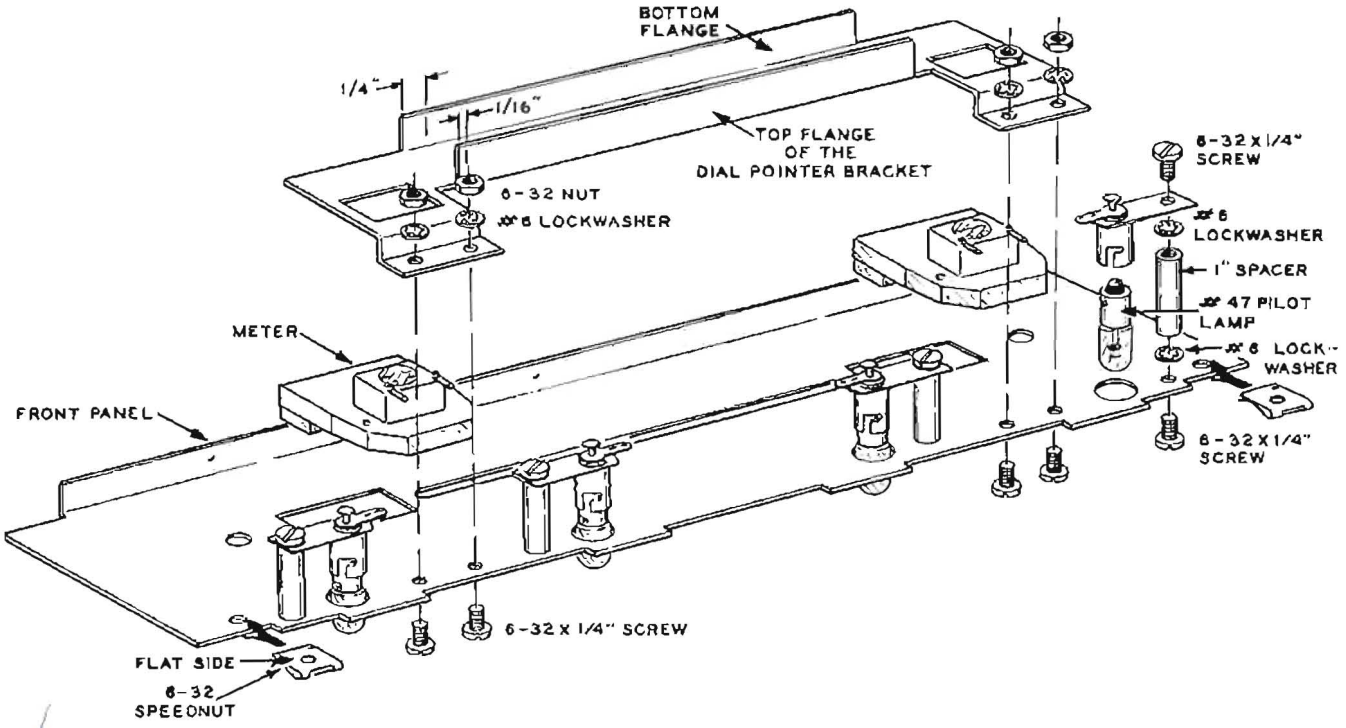
( ) Install a 6-32 speednut on each end of the front panel. Position the flat side of the speednut to the rear as shown.

( ) Position a meter in each large cutout of the front panel as shown. The screw supplied with the meters will not be used.

( ) Install the dial pointer bracket to the front panel, using 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts.

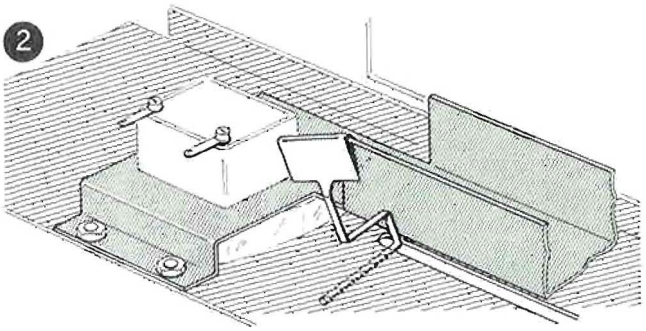
( ) Make a mark 1/16" from the right end of the top flange of the dial pointer bracket. Mark the top and inside of the flange.

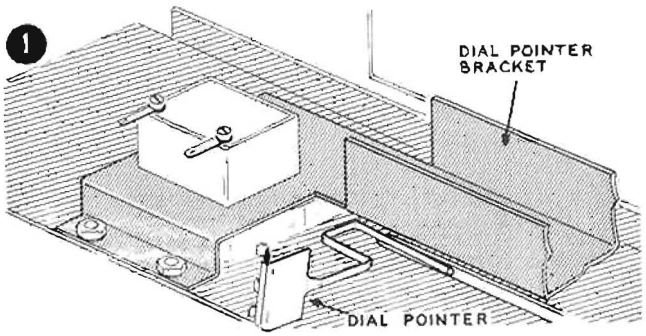
( ) In a like manner, make a mark 1/4" from the right end of the bottom flange of the dial pointer bracket. Mark the bottom and inside of the flange.

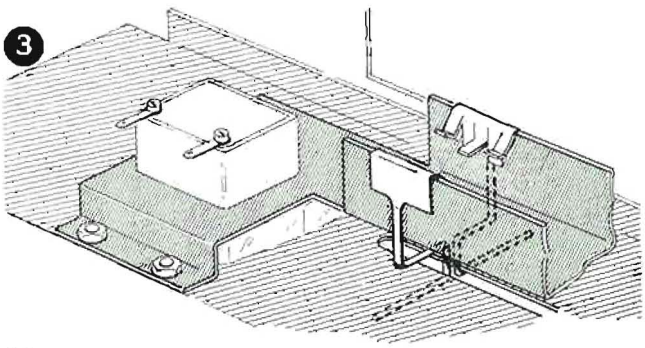


PICTORIAL 14

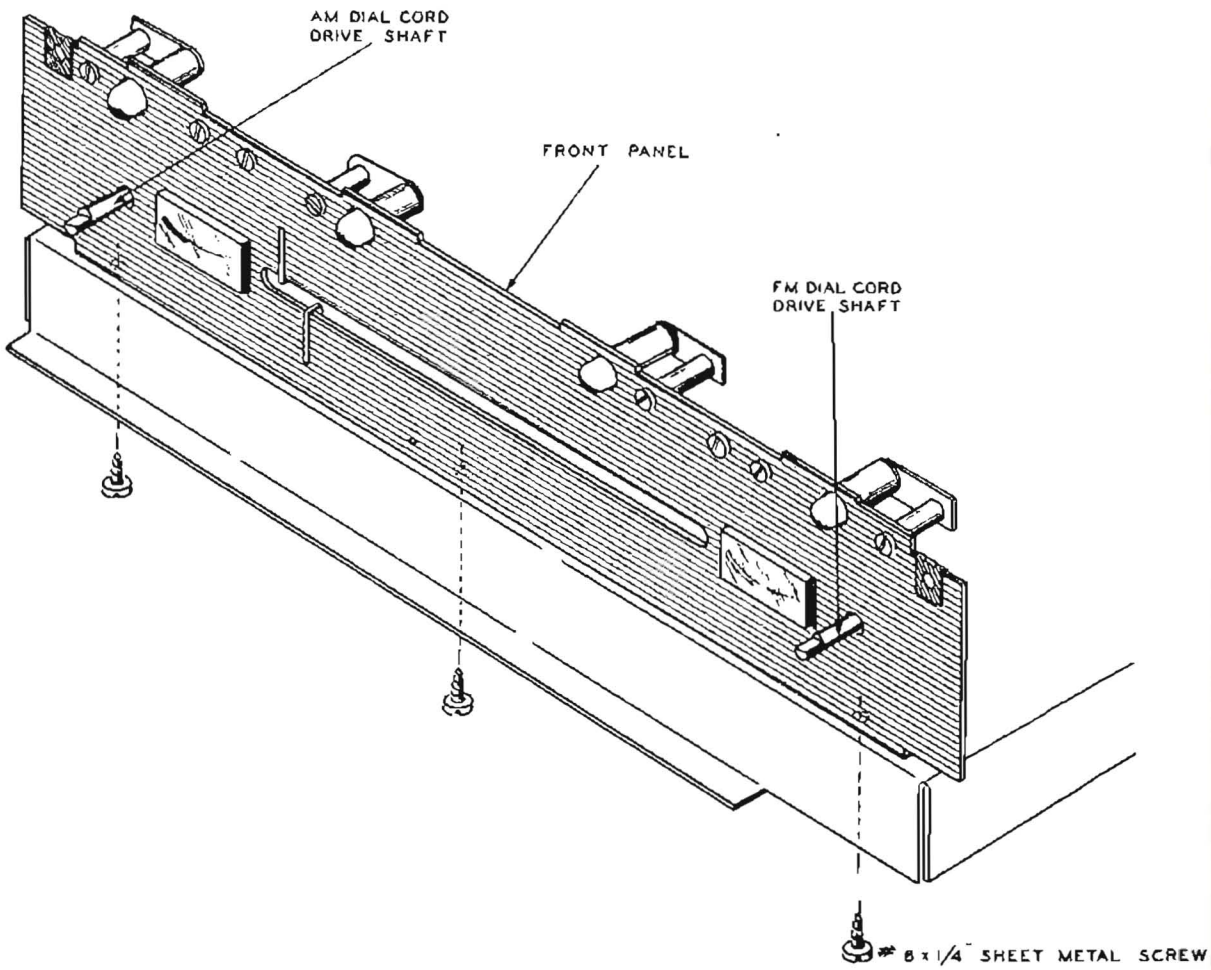
(1) Referring to Detail 14A, install the two dial pointers on the dial pointer bracket. Tape each pointer to the bracket to keep them in place. Be sure the dial pointer slides freely on the dial pointer bracket.







Detail 14A



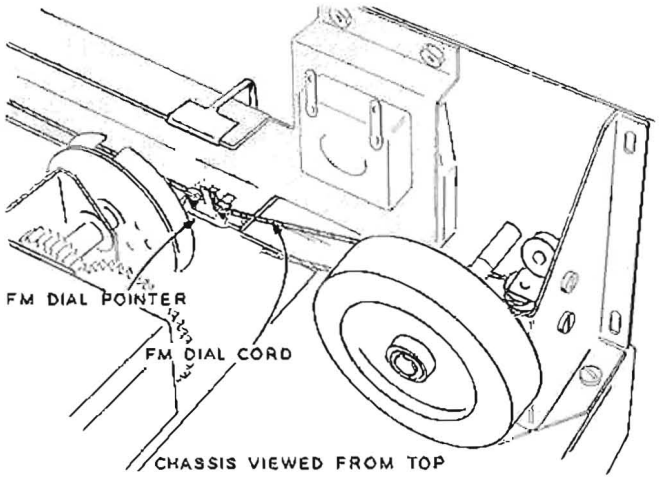
PICTORIAL 15

( ) Referring to Pictorial 15, install the front panel to the chassis, using three #6 x 1/4" sheet metal screws. Be sure the sleeving is still on the #49 pilot lamp.

( ) Remove the fine shorting wires found between the meter lugs.

( ) Referring to Detail 15A, remove the tape and position the FM dial pointer 1/4" from the right end (viewed from the rear of tuner) of the dial pointer bracket.

( ) With the FM dial cord drive shaft rotated fully counterclockwise, place the FM dial cord between the fingers of the dial pointer.



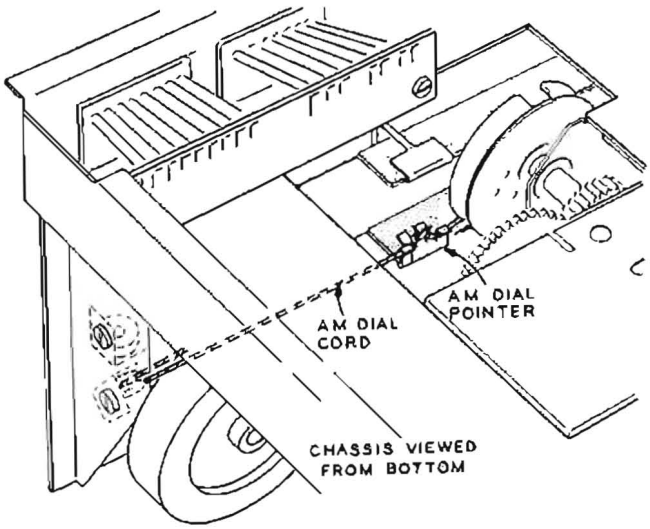
Detail 15A

( ) Referring to Detail 15B, turn the chassis over. Remove the tape and position the AM pointer 1/16" from the same end of the dial pointer bracket as the FM pointer.

( ) With the AM dial cord drive shaft rotated fully counterclockwise, place the AM dial cord between the fingers of the dial pointer.

( ) Temporarily install a large knob on each of the dial cord drive shafts. Rotate the dial cord drive shafts, moving the pointers over the entire length of travel to see that the pointers operate smoothly. Any burrs or excess paint on the dial pointer bracket should be removed.

( ) Be sure the pointers are straight up and down and parallel to the front panel. If not, bend them as required with your fingers.



Detail 15B

PRELIMINARY WIRING-CHASSIS BOTTOM

Refer to Pictorial 16 for the following steps.

NOTE: It will be easier to perform the next step if the chassis is propped up so it is standing on the front panel.

( ) Solder the leads of triple controls L and M to the input circuit board and cut off the excess leads.

Connect the free end of the power transformer leads extending from grommets HL and HK as follows:

( ) Short red to lug 7 of terminal strip Q (NS).

( ) Long red to lug 5 of terminal strip Q (NS).

( ) Red-yellow to lug 2 of terminal strip P (NS).

( ) Long black to lug 1 of fuseholder Z (S-1).

( ) Short black to lug 3 of terminal strip P (NS).

( ) Short green to lug 3 of terminal strip N (S-1).

( ) Long green to lug 2 of terminal strip N (NS).

NOTE: Where wire is called for in the following steps, standard hookup wire should be used.

If desired, the following lengths of hookup wire may be precut. Strip 1/4" insulation from the ends of each wire. The wire lengths are listed in the order in which they will be used.

( ) Prepare the following lengths of hookup wire:

21"	7-1/2"
21"	1-3/4"
1-1/4"	14-1/2"
9-1/2"	15"
3"	16-1/2"
2-1/4"	12"
5"	11"

( ) Twist two 21" wires together with about two turns per inch.

( ) At one end of the twisted pair, connect either wire to lug 1 (NS) and the other wire to lug 3 (NS) of terminal strip P.

( ) Position the twisted pair as shown and pass the other end through hole A to be connected later.

( ) Pass one end of a 1-1/4" bare wire (stripped hookup wire) through lug 1 (S-2) to lug 2 (S-1) of switch C. Connect the other end of the wire to solder lug B (S-1).

( ) Connect one end of a 9-1/2" wire to lug 3 of switch C (S-1). Pass the other end of the wire through hole HB for connection later.

( ) Connect a 3" wire from lug 4 of switch F (NS) to lug 1 of switch J (S-1).

( ) Connect a 2-1/4" wire from lug 7 of switch F (NS) to lug 4 of switch J (S-1).

( ) Connect a 5" wire from lug 2 of switch F (NS) to hole N of the input circuit board (S-1).

( ) Strip an extra 1/4" insulation from one end of a 7-1/2" wire. Pass this end of the wire through lug 6 (S-2) to lug 9 (S-1) of switch F. Connect the other end of the wire to hole G of the input circuit board (S-1).

( ) Strip an extra 1/4" insulation from one end of a 1-3/4" wire. Pass this end of the wire through lug 3 (NS) to lug 6 (NS) of switch J. Connect the other end of the wire to the bottom hole of solder lug G (NS). Bend the solder lug up as shown.

( ) Connect a 14-1/2" wire from A of the input circuit board (S-1) to lug 2 of triple phono socket Y (S-1). Position the wire as shown.

( ) Connect a 15" wire from hole C of the input circuit board (S-1) to lug 3 of triple phono socket Y (S-1).

( ) Connect a 16-1/2" wire from hole F of the input circuit board (S-1) to lug 1 of triple phono socket Y (S-1).

( ) Connect a 12" wire from hole B of the input circuit board (S-1) to hole K of the multiplex circuit board (S-1).

( ) Connect an 11" wire from hole D of the input circuit board (S-1) to hole N of the multiplex circuit board (S-1).

( ) Prepare the following lengths of hookup wire.

8"	2-1/2"	9-1/2"
4-1/2"	3-1/2"	11-1/2"
3"	2-1/2"	12"
1-1/2"	1-3/4"	12"
1-1/2"	9-1/2"	4-1/2"

( ) Connect one end of an 8" wire to lug 2 of terminal strip N (S-2). Pass the other end of the wire through hole HD for connection later.

( ) Strip an extra 1/2" of insulation from one end of a 4-1/2" wire. Pass this end of the wire through lug 3 (NS) to lug 2 (NS) of terminal strip Q. Connect the other end of the wire to hole M of the multiplex circuit board (S-1).

( ) Connect a 3" wire from lug 2 of switch X (NS) to hole G of the multiplex circuit board (S-1).

( ) Connect a 1-1/2" wire from lug 3 of switch X (S-1) to hole A of the multiplex circuit board (S-1).

( ) Connect a 1-1/2" wire from lug 1 of switch X (NS) to hole B of the multiplex circuit board (S-1).

( ) Strip an extra 1/2" of insulation from one end of a 2-1/2" wire. Pass this end of the wire through lug 4 of phono socket Y (S-2) to the adjacent solder lug (S-1). Connect the other end of the wire to lug 5 (both lugs) of phono socket Y (S-1).

( ) Connect a 3-1/2" wire from hole C (S-1) to hole F (S-1) of the AM circuit board.

( ) Connect a 2-1/2" wire from hole E of the AM circuit board (S-1) to lug 1 of terminal strip K (NS).

( ) Connect a 1-3/4" wire from hole 3 of the FM IF circuit board (S-1) to lug 3 of terminal strip V (NS).

( ) Connect a 9-1/2" wire from lug 4 of control R (S-1) to hole X of the multiplex circuit board (S-1).

( ) Connect a 9-1/2" wire from lug 5 of control R (NS) to hole AA of the multiplex circuit board (S-1).

( ) Connect a 11-1/2" wire from lug 5 of control R (S-2) to hole DD of the multiplex circuit board (S-1).

( ) Strip an extra 1/4" insulation from one end of a 12" wire. Pass this end of the wire through lug 1 (S-2) to lug 2 (S-1) of control R. Connect the other end of this wire to hole C of the multiplex circuit board (S-1).

( ) Connect a 12" wire from lug 3 of control R (S-1) to lug 1 of switch X (NS).

( ) Connect a 4-1/2" wire from lug 2 of 4-screw terminal strip W (S-1) to hole A of the AM circuit board (S-1).

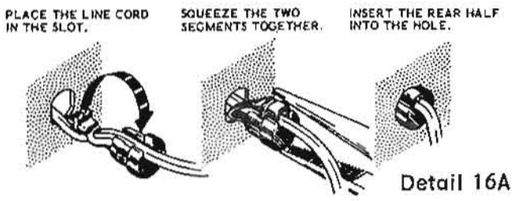
( ) Connect the free end of the wire extending from grommet HH to hole D on the AM circuit board (S-1).

( ) Connect the free end of the wire extending from grommet HG to hole B of the AM circuit board (S-1).

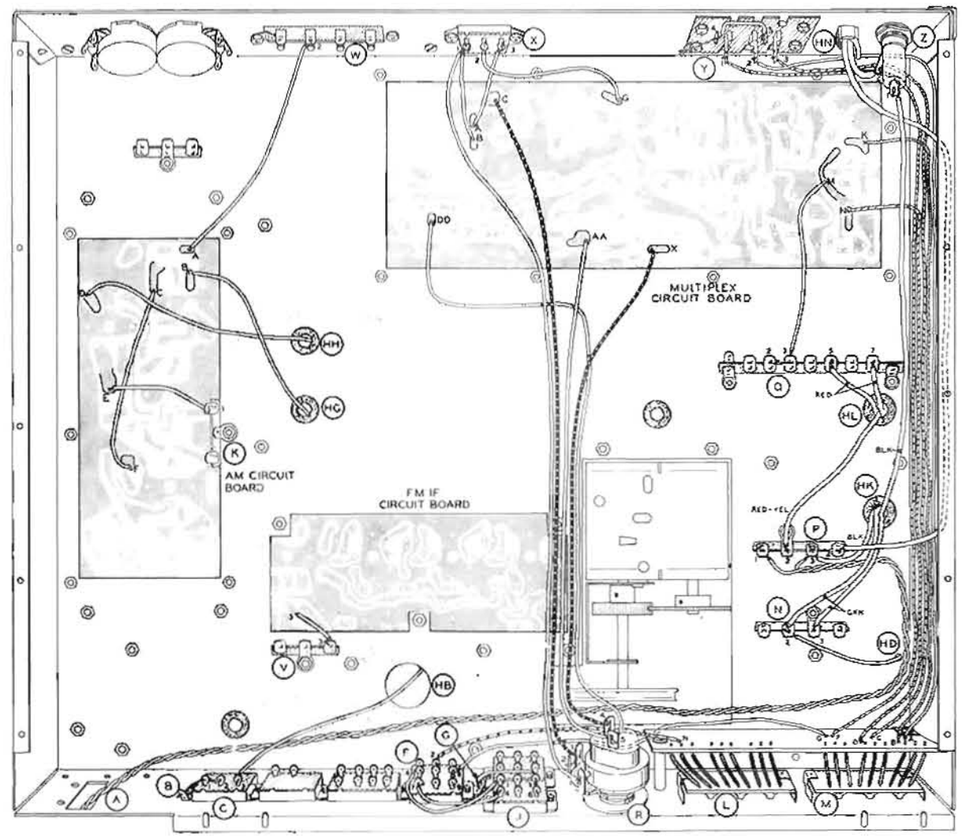
( ) Locate the line cord and separate the two leads for a length of 8" from the stripped end. Cut a 6" length from one of the leads. Strip 1/4" insulation from this end and apply a small amount of solder to the exposed lead ends.

( ) Pass the line cord through hole HN. Connect the long lead to lug 4 of terminal strip P (NS) and the short lead to lug 2 of fuseholder Z (S-1). Bend the lug of the fuseholder as shown.

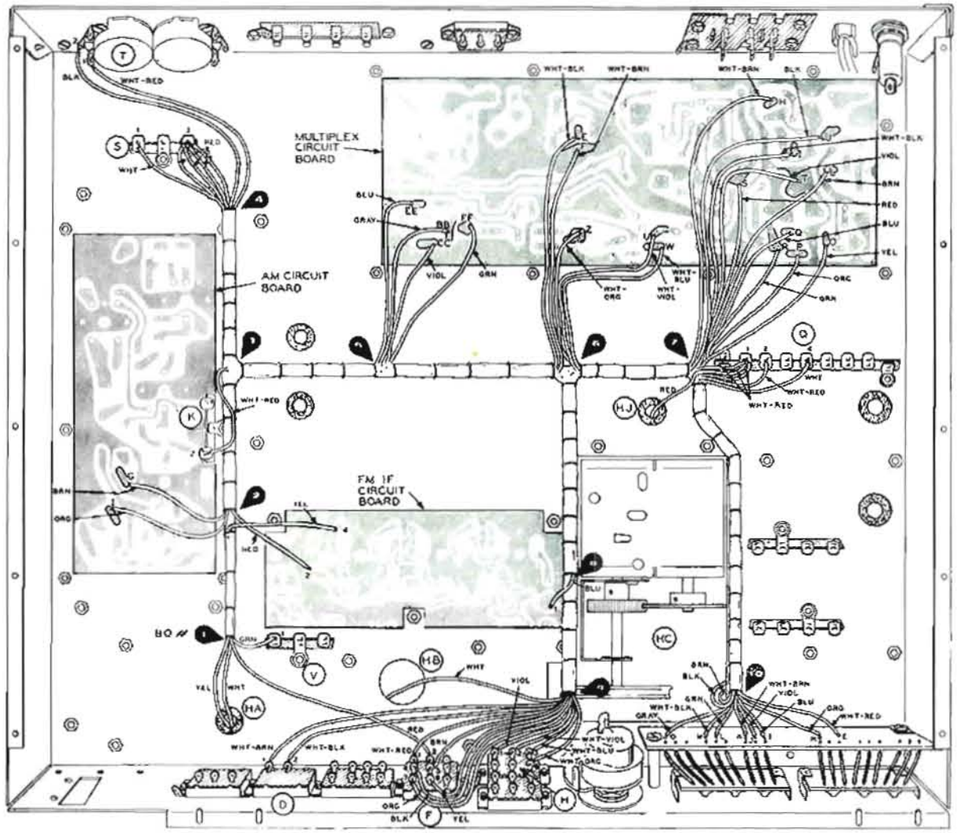
( ) Referring to Detail 16A, install the line cord strain relief in hole HN.



Detail 16A



PICTORIAL 16



PICTORIAL 17

CABLE ASSEMBLY WIRING

Refer to Pictorial 17 for the following steps.

( ) Locate the cable assembly and position it on the chassis as shown.

Connect the wires from BO#1 (breakout #1) as follows:

( ) Yellow and white through grommet HA for connection later.

( ) Red to lug 2 of switch F (S-2).

( ) Green to lug 1 of terminal strip V (NS).

( ) Connect the yellow wire from BO#2 to hole 4 of the FM IF circuit board (S-1). Push this wire only a short distance into the board. If it is pushed through the board, it will short the capacitor on the opposite side of the board.

( ) Connect the red wire from BO#2 to hole 2 of the FM IF circuit board (S-1).

Connect the remaining wires from BO#2 to the AM circuit board as follows:

( ) Orange to hole I (S-1).

( ) Brown to hole G (S-1).

( ) Connect the white-red wire from BO#3 to lug 2 of terminal strip K (NS).

Connect the wires from BO#4 as follows:

( ) White to lug 1 of terminal strip S (NS).

( ) All four red to lug 3 of terminal strip S (NS).

( ) White-red to lug 1 of control T (S-1).

( ) Black to lug 2 of control T (S-1).

Connect the wires from BO#5 to the multiplex circuit board as follows:

( ) Blue to hole EE (S-1).

( ) Violet to hole CC (S-1).

( ) Gray to hole BB (S-1).

( ) Green to hole FF (S-1).

Connect the wires from BO#6 to the multiplex circuit board as follows:

( ) White-blue to hole W (S-1).

( ) White-violet to hole U (S-1).

( ) White-orange to hole Z (S-1).

( ) White-black to hole E (S-1).

( ) White-brown to hole F (S-1).

Connect the wires from BO#7 to the multiplex circuit board as follows:

( ) Orange to hole P (S-1).

( ) Green to hole R (S-1).

( ) Yellow to hole O (S-1).

( ) Blue to hole Q (S-1).

( ) Short red to hole S (S-1).

( ) Violet to hole T (S-1).

( ) Brown to hole L (S-1).

( ) Black to hole J (S-1).

( ) White-black to hole I (S-1).

( ) White-brown to hole H (S-1).

Connect the remaining wires from BO#7 as follows:

( ) The long white-red wire to lug 2 of terminal strip Q (NS).

( ) The three remaining white-red wires to lug 1 of terminal strip Q (NS).

( ) White to lug 4 of terminal strip Q (NS).

( ) Pass the remaining red wire through grommet HJ for connection later.

( ) Connect the blue wire from BO#8 to hole 1 on the FM IF circuit board (S-1).

Connect the wires from BO#9 as follows:

( ) White-blue to lug 3 of switch H (S-1).

( ) White-violet to lug 2 of switch H (S-1).

( ) Violet to lug 1 of switch H (S-1).

( ) White-orange to lug 6 of switch H (S-1).

( ) White-red to lug 1 of switch F (S-1).

( ) Brown to lug 5 of switch F (S-1).

( ) Black to lug 4 of switch F (S-2). Position as shown.

( ) Orange to lug 7 of switch F (S-2).

( ) Yellow to lug 8 of switch F (S-1).

( ) White-black to lug 2 of switch D (S-1).

( ) White-brown to lug 1 of switch D (S-1).

( ) Pass the white wire through hole HB for connection later.

( ) Prop the Tuner on its face to prevent solder from running down and shorting other foils of the circuit board in the following steps.

Connect the wires from BO#10 to the input circuit board as follows:

( ) Gray to hole O (S-1).

( ) White-black to hole M (S-1).

( ) Green to hole L (S-1).

( ) White-brown to hole K (S-1).

( ) Violet to hole J (S-1).

( ) Blue to hole I (S-1).

( ) Orange to hole H (S-1).

( ) White-red to hole E (S-1).

( ) Pass the black and brown wires through cutout HC for connection later.

FINAL WIRING-CHASSIS BOTTOM

Refer to Pictorial 18 (fold-out from Page 49) for the following steps.

( ) Connect a 270 $\mu\mu$f disc capacitor between lugs 1 (NS) and 2 (S-1) of terminal strip V.

( ) Connect a 90 μh choke (#45-7) between lugs 1 (S-3) and 3 (S-2) of terminal strip V.

( ) Connect a 68 KΩ (blue-gray-orange) 1/2 watt resistor from lug 1 (S-3) to lug 2 (S-2) of switch X.

( ) Connect a 150 Ω (brown-green-brown) 1/2 watt resistor from lug 1 of control U (S-1) to lug 3 of terminal strip S (S-5).

( ) Connect a 680 Ω (blue-gray-brown) 1/2 watt resistor from lug 2 of control U (S-1) to lug 1 of terminal strip S (S-2).

( ) Connect a 1000 Ω (brown-black-red) 1/2 watt resistor from lug 3 of control U (S-1) to lug 2 of terminal strip S (NS).

( ) Connect a 4700 Ω (yellow-violet-red) 1/2 watt resistor from lug 3 of control T (S-1) to lug 2 of terminal strip S (S-2). Use sleeving on the lead to the terminal strip.

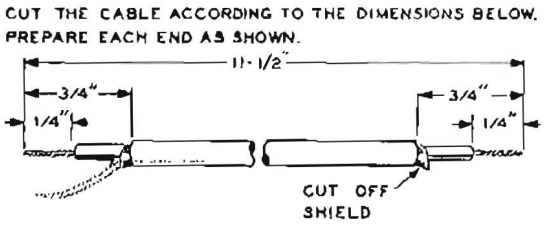
( ) Connect a 90 μh choke (#45-7) between lugs 1 (S-2) and 2 (S-2) of terminal strip K.

( ) Solder lug 1 of 4-screw terminal strip W to the solder lug (S-1).

( ) Connect a 150 $\mu\mu$f mica capacitor from lug 4 of switch H (S-1) to solder lug G (NS).

( ) At the free end of the shielded cable extending from hole HB, connect the inner lead to hole D (S-1) and the shield in the large hole (S-1) next to hole D of the multiplex circuit board.

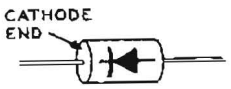
( ) Referring to Detail 18A, prepare the ends of an 11-1/2" length of shielded cable as shown.



Detail 18A

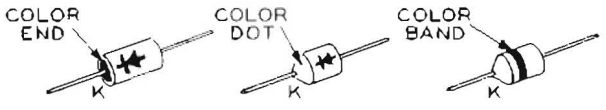
( ) At the end of the cable with the shield removed, connect the inner lead to hole V of the multiplex circuit board (S-1). At the other end of the cable, connect the inner lead to lug 5 of switch H (S-1) and the shield to the top hole of solder lug G (S-3). Use sleeving on the shield.

( ) Referring to Detail 18B, connect the VR 9.1 volt zener diode from lug 1 of terminal strip Q (NS) to the adjacent solder lug (S-1). The cathode end goes to the terminal strip.



Detail 18B

NOTE WHEN INSTALLING SILICON DIODES, THE CATHODE END SHOULD BE PLACED AS DIRECTED THE CATHODE END IS MARKED WITH EITHER A COLOR END, COLOR DOT OR COLOR BAND. IN THE ILLUSTRATION, THE SYMBOL K INDICATES THE CATHODE END



Detail 18C

( ) Referring to Detail 18C, connect a silicon diode between lugs 5 (S-2) and 6 (NS) of terminal strip Q. The cathode end goes to lug 6.

( ) Connect a silicon diode between lugs 6 (NS) and 7 (S-2) of terminal strip Q. The cathode end goes to lug 6.

( ) Pass one lead of a 33 Ω (orange-orange-black) 1 watt resistor through lug 2 (S-4) and 1 (S-5) of terminal strip Q. Connect the other lead of this resistor to lug 4 of terminal strip Q (NS).

( ) Connect a 33 Ω (orange-orange-black) 1 watt resistor between lugs 4 (NS) and 6 (NS) of terminal strip Q.

( ) Connect a 500 μfd electrolytic capacitor from lug 6 of terminal strip Q (S-4) to lug 2 of terminal strip P (NS). The positive (+) lead goes to terminal strip Q. Use sleeving on the lead to terminal strip P.

( ) Connect a 1000 μfd electrolytic capacitor from lug 4 of terminal strip Q (S-4) to lug 2 of terminal strip P (NS). The positive (+) lead goes to terminal strip Q.

( ) Connect a 250 μfd electrolytic capacitor from lug 3 of terminal strip Q (S-3) to lug 2 of terminal strip P (S-4). The positive (+) end goes to terminal strip Q. Use sleeving on both leads.

( ) Connect a .005 μfd 1.6 kv disc capacitor between lugs 1 (NS) and 3 (S-3) of terminal strip P.

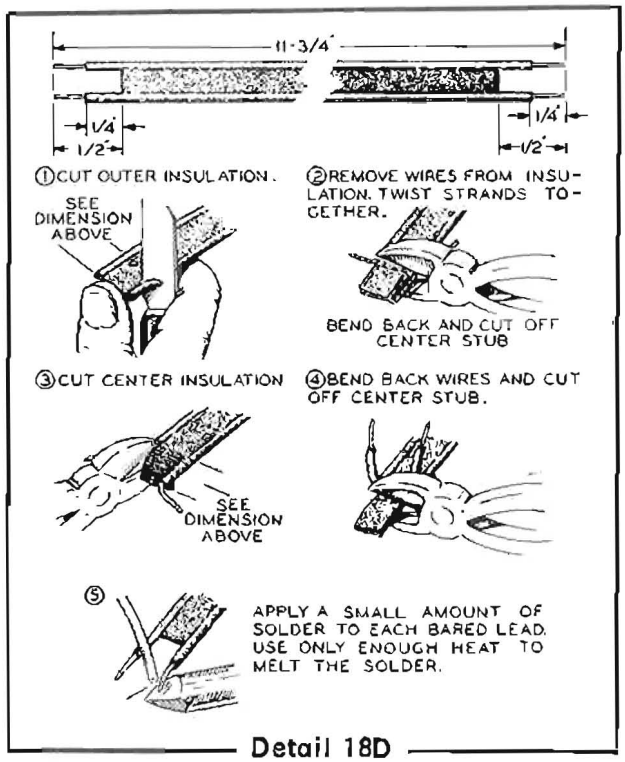
( ) Bend the leads of the FM line antenna coil (#40-149) as shown. At one end of the coil, connect one lead to lug 1 of terminal strip P (S-3) and the other lead to lug 1 of terminal strip N (NS).

( ) At the other end of the coil, connect one lead to lug 4 of terminal strip P (S-2) and the other lead to lug 4 of terminal strip N (NS).

( ) Connect a .003 μfd disc capacitor between lugs 2 (S-1) and 3 (S-3) of switch J.

( ) Connect a .003 μfd disc capacitor between lugs 5 (S-1) and 6 (S-2) of switch J.

( ) Referring to Detail 18D, prepare the ends of an 11-3/4" length of twin lead as shown.

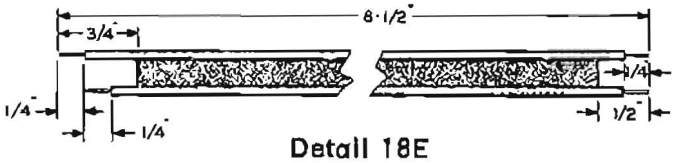


Detail 18D

( ) At one end of the prepared twin lead, connect one wire to lug 1 (S-1) and the other wire to lug 5 (S-1) of switch E.

( ) At the other end of the twin lead, connect one wire to lug 3 (S-1) and the other wire to lug 4 (S-1) of 4-screw terminal strip W.

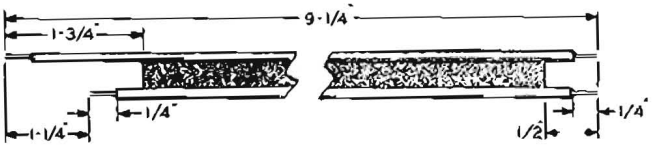
( ) Referring to Detail 18E, prepare the ends of a 6-1/2" length of twin lead as shown.



Detail 18E

( ) Referring to the inset drawing on Pictorial 18, connect the leads at the uneven end of the twin lead as follows: short lead to lug 1 (S-1) and the long lead to lug 2 (S-1) of the FM tuner on top of the chassis. Pass the free end of the twin lead through hole HB.

( ) At the free end of the twin lead extending from hole HB, connect one wire to lug 2 (S-1) and the other wire to lug 6 (S-1) of switch E.



Detail 18F

( ) Referring to Detail 18F prepare the ends of a 9-1/4" length of twin lead as shown. At the uneven end of the twin lead, connect the short wire to lug 1 (S-2) and the long wire to lug 4 (S-2) of terminal strip N.

( ) At the other end of the twin lead, connect one wire to lug 3 (S-1) and the other wire to lug 7 (S-1) of switch E.

Refer to Pictorial 19 for the following steps.

( ) Remove the twisted wires extending through hole A.

( ) Install the large hinge to the front chassis apron, using 3-48 x 1/4" screws, #3 lockwashers, and 3-48 nuts. Push the hinge up as far as possible (see arrow) before tightening the screws.

( ) Install the SPST push-push switch at location A, using 6-32 x 1/2" screws and 5/16" spacers.

( ) Remove the shield from the switch and place it over the free ends of the twisted wire coming from terminal strip P.

( ) Connect either wire of the twisted pair to lug 1 (S-1) and the other wire to lug 2 (S-1) of switch A.

( ) Replace the shield on the switch.

( ) Install the two small hinges on the front apron of the chassis, using 3-48 x 1/4" screws, #3 lockwashers, and 3-48 nuts. Do not tighten the screws at this time. Be sure to position the hinges as shown in the inset drawing on Pictorial 19.

Refer to Pictorial 20 for the following steps.

( ) Remove the pin from the large hinge. It may be necessary to drive the pin from the hinge, using a small nail and hammer.

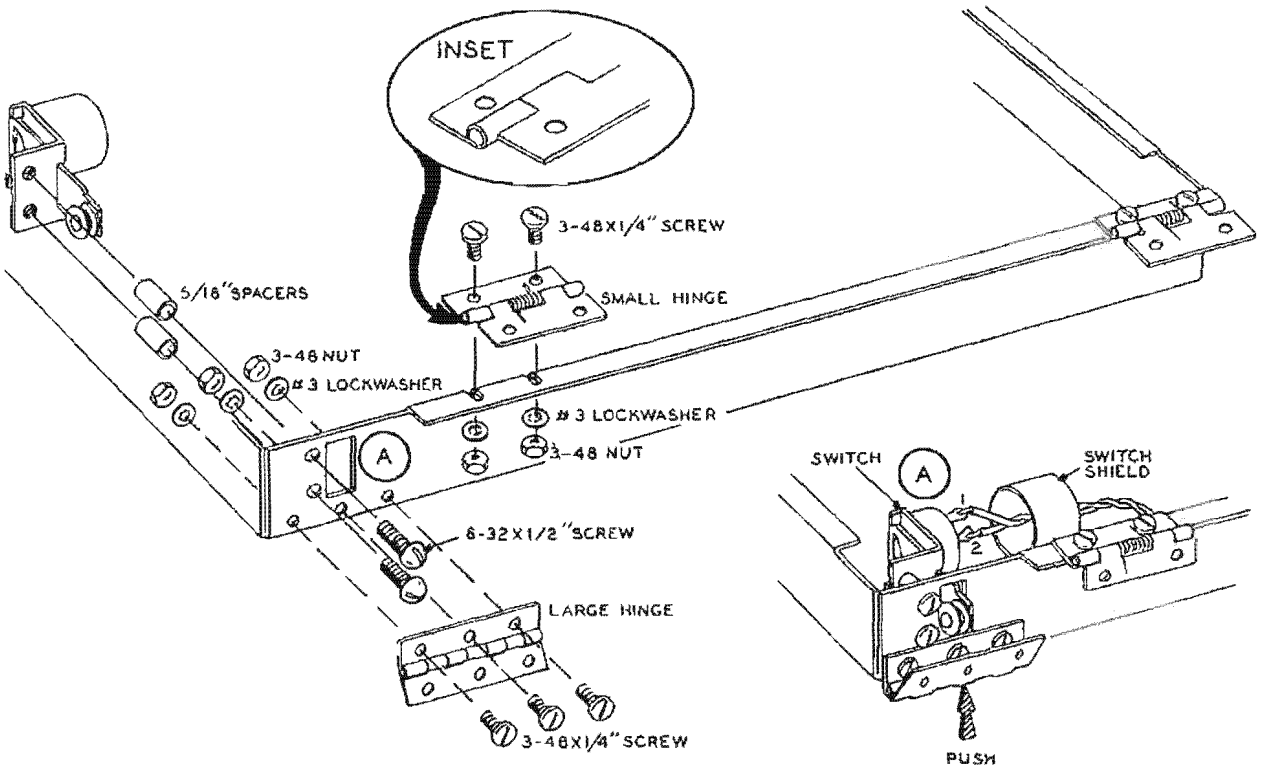
( ) Install the free half of the large hinge to the short decorative panel. Use 3-48 x 1/8" screws and #3 lockwashers. Push the hinge as far as possible, as shown by the arrow, and tighten the screws.

( ) Install the short decorative trim panel by aligning the two halves of the hinge and replacing the pin.

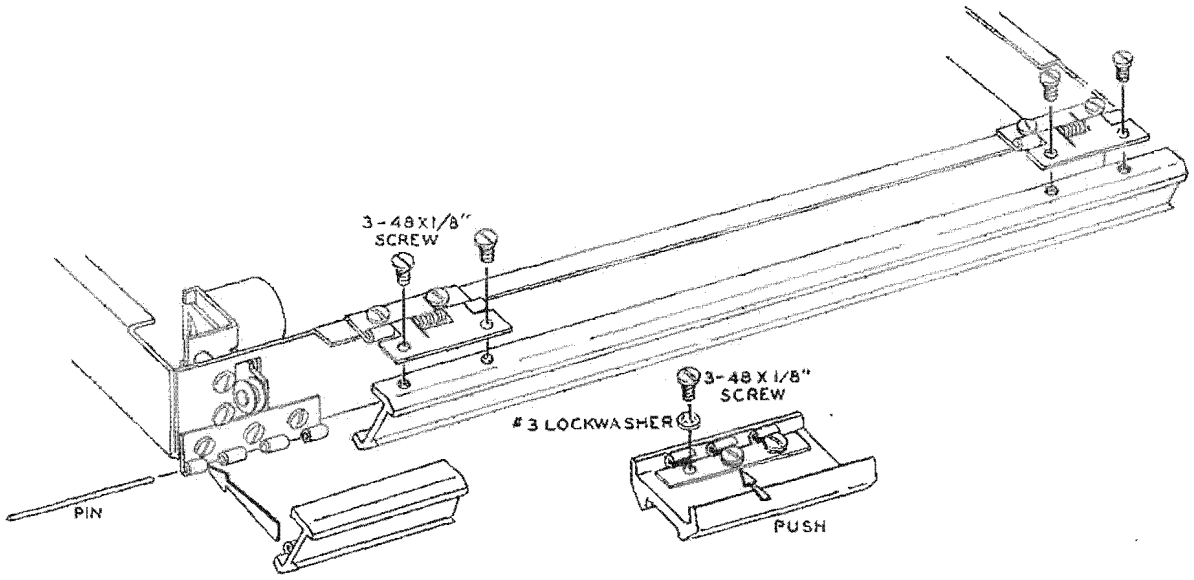
( ) Install the long decorative panel on the two small hinges, using 3-48 x 1/8" screws.

( ) Align the end of the long and short decorative panels, with the short decorative panel in against the roller of switch A, and tighten the screws securing the small hinges to the chassis.

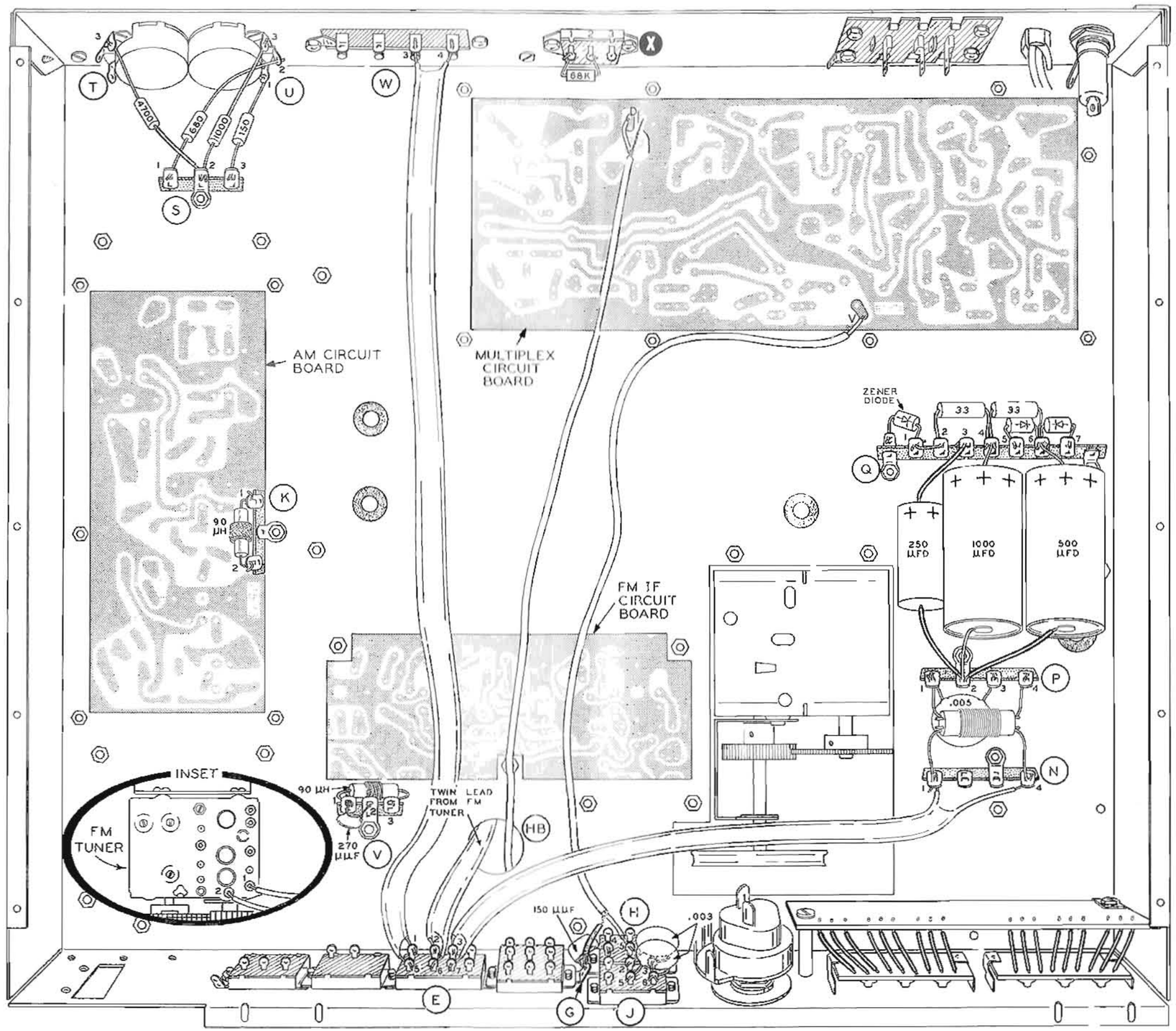
A slight adjustment of the hinges may be required to provide proper alignment of the long and short decorative trim panels.



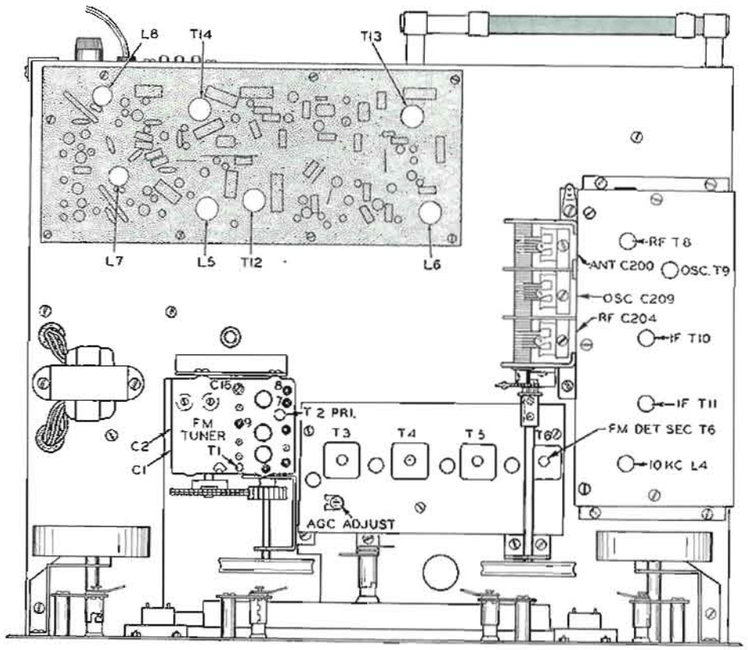
PICTORIAL 19



PICTORIAL 20



PICTORIAL 18



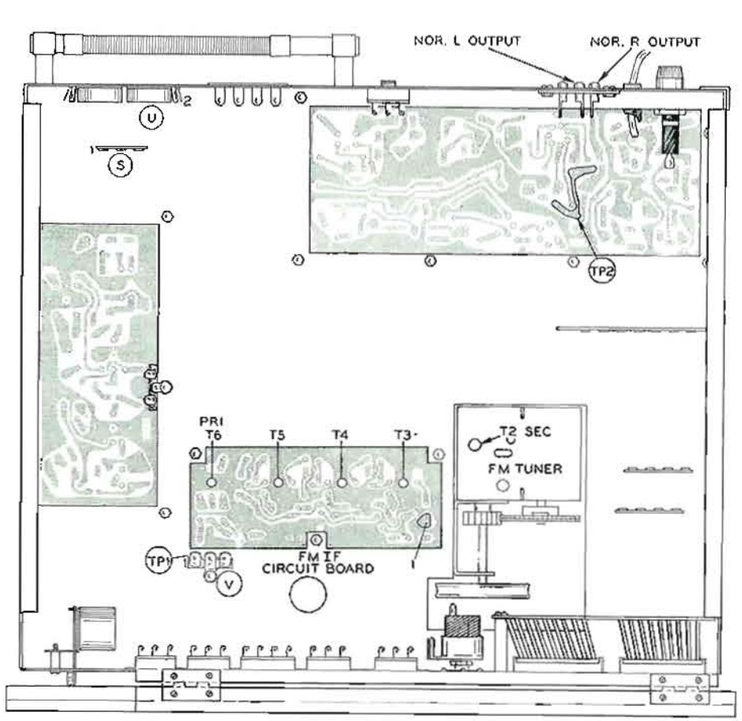


FIGURE 13

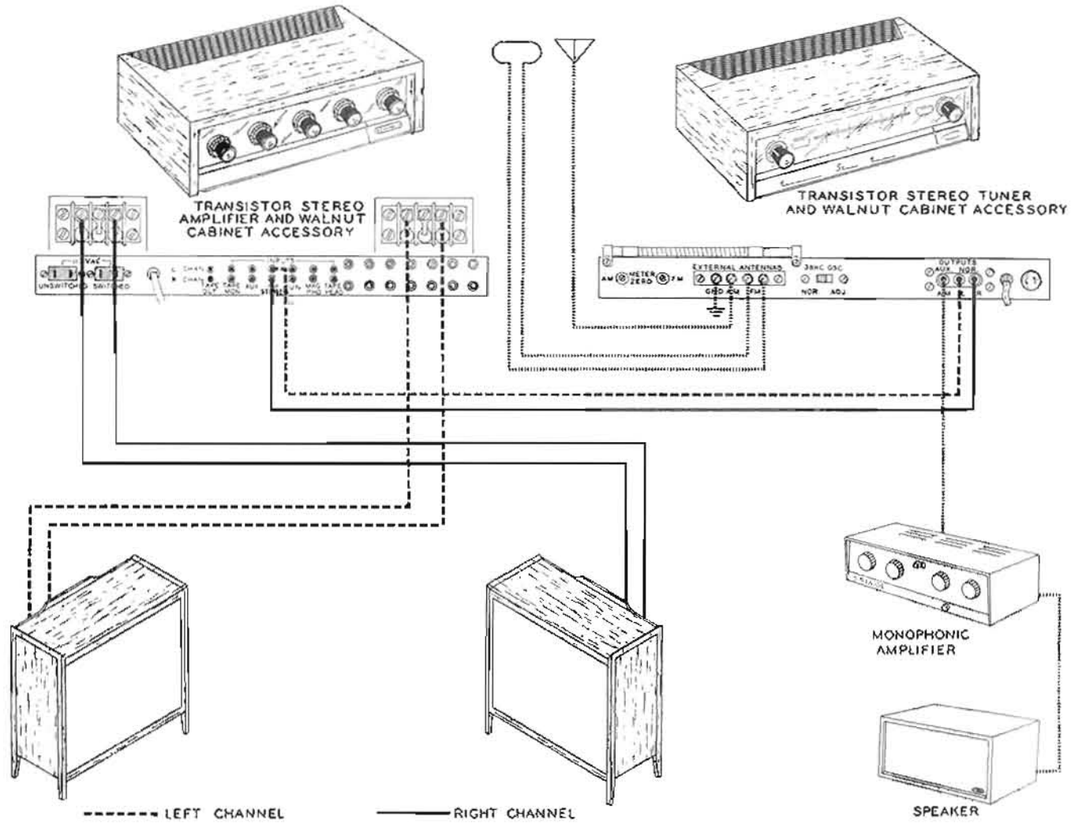


FIGURE 16

WIRING-CHASSIS TOP

Refer to Pictorial 21 for the following steps.

CAUTION: Be very careful in the following steps not to get solder or the soldering iron on or near the dial cords, as the dial cord will burn easily.

NOTE: In the following four steps position the wires against the front panel, away from the dial cords and solder the meter connections as quickly as possible, being careful not to overheat the meter lugs.

Connect the wires extending from grommet HA to the FM tuning meter as follows:

( ) Yellow to lug 1 (S-1).

( ) White to lug 2 (S-1).

Connect the wires extending from cutout HC to the AM tuning meter as follows:

( ) Black to lug 1 (S-1).

( ) Brown to lug 2 (S-1).

Position the wires against the front panel.

( ) Connect the wire extending from hole HD to pilot lamp socket PL4 (NS).

( ) Connect a 6" wire from pilot lamp socket PL4 (S-2) to pilot lamp socket PL3 (NS).

( ) Connect a 5-1/2" wire from pilot lamp socket PL3 (S-2) to pilot lamp socket PL2 (NS).

( ) Connect a 6" wire from pilot lamp socket PL2 (S-2) to pilot lamp socket PL1 (S-1).

Connect the wires extending from hole HB as follows:

( ) White to lug 2 of pilot lamp socket AA (S-1).

( ) Wire coming from lug 3 of switch C to lug 4 of FM tuner (NS).

( ) Connect a 7-1/2" wire from hole AFC of the FM IF circuit board (S-1) to lug 4 of the FM tuner (NS). Position both wires connected to lug 4, along the front of the FM tuner and down against the chassis.

( ) Connect a .1 µfd disc capacitor between lugs 3 (NS) and 4 (S-3) of the FM tuner. Position the capacitor flat against the top of the tuner.

( ) Connect a .1 µfd disc capacitor between lugs 3 (S-2) and 5 (NS) of the FM tuner. Position the capacitor flat against the top of the tuner.

( ) Connect one lead of a 22 Ω (red-red-black) 1/2 watt resistor to lug 5 of the FM tuner (S-2). Keep the resistor leads as short as possible.

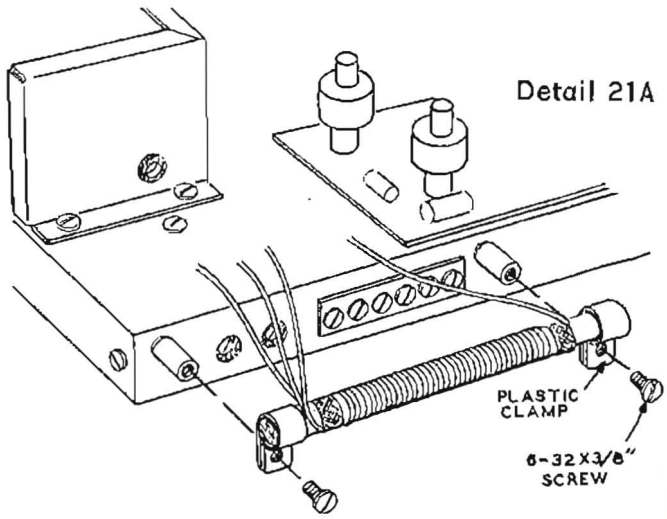
( ) Place a 1" length of clear plastic sleeving on the red wire extending from grommet HJ.

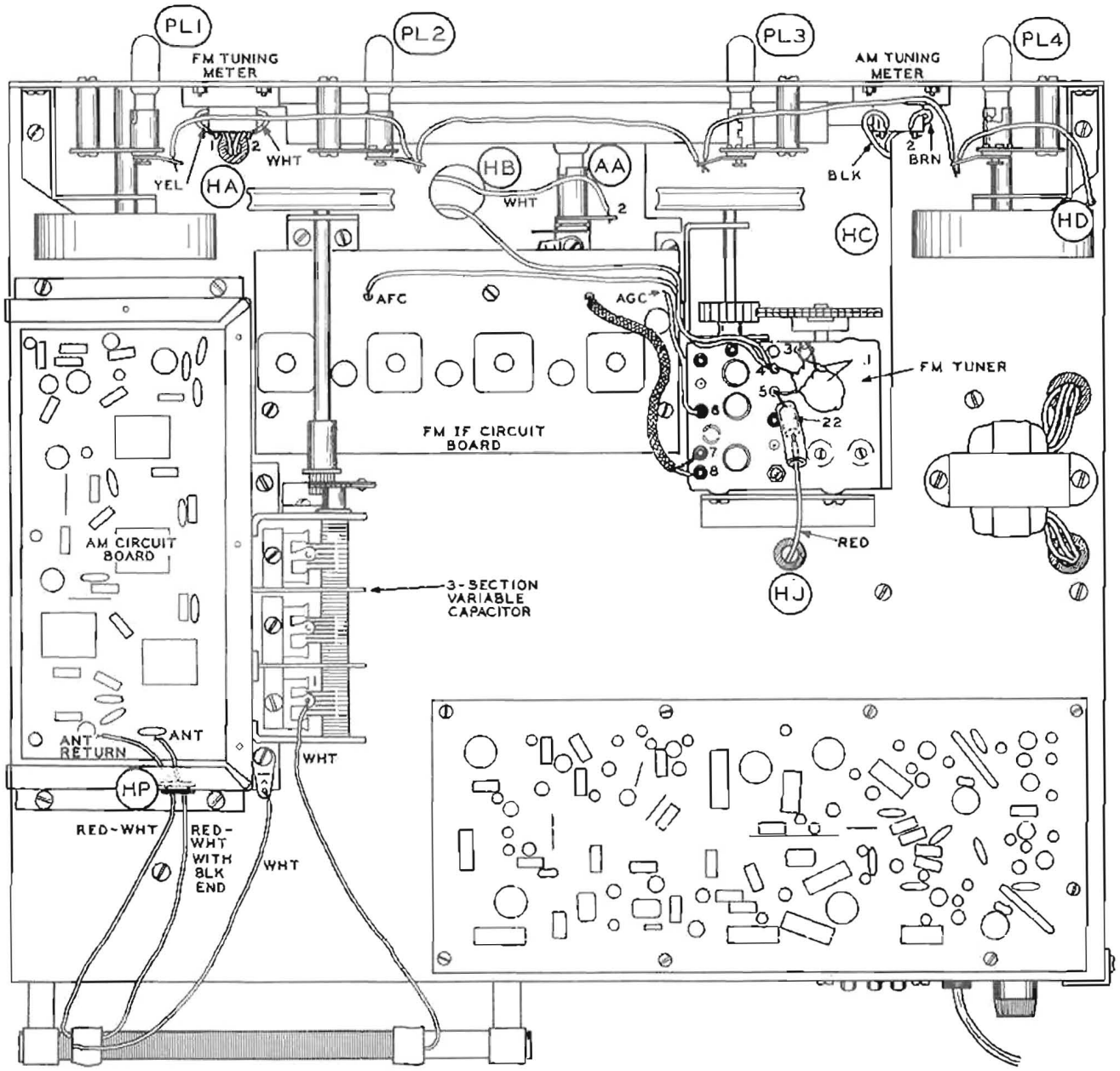
( ) Connect the red wire extending from grommet HJ to the free lead of the 22 Ω resistor (S-1). Keep the resistor leads as short as possible. Push the sleeving over the connection and the resistor.

( ) Connect a 3" wire from hole AGC on the FM IF circuit board (S-1) to lug 6 of the FM tuner (S-1). Position the wire against the side of the FM tuner.

( ) Connect the inner lead of the shielded cable extending from the FM IF circuit board to lug 8 (S-1) and the shield to lug 7 (S-1) of the FM tuner.

( ) Referring to Detail 21A, install the AM rod antenna to the spacers on the rear chassis apron. Use plastic clamps and 6-32 x 3/8" screws. Position the antenna leads as shown.





PICTORIAL 21

At the end of the AM rod antenna having three leads, connect the leads as follows: (See Pictorial 21).

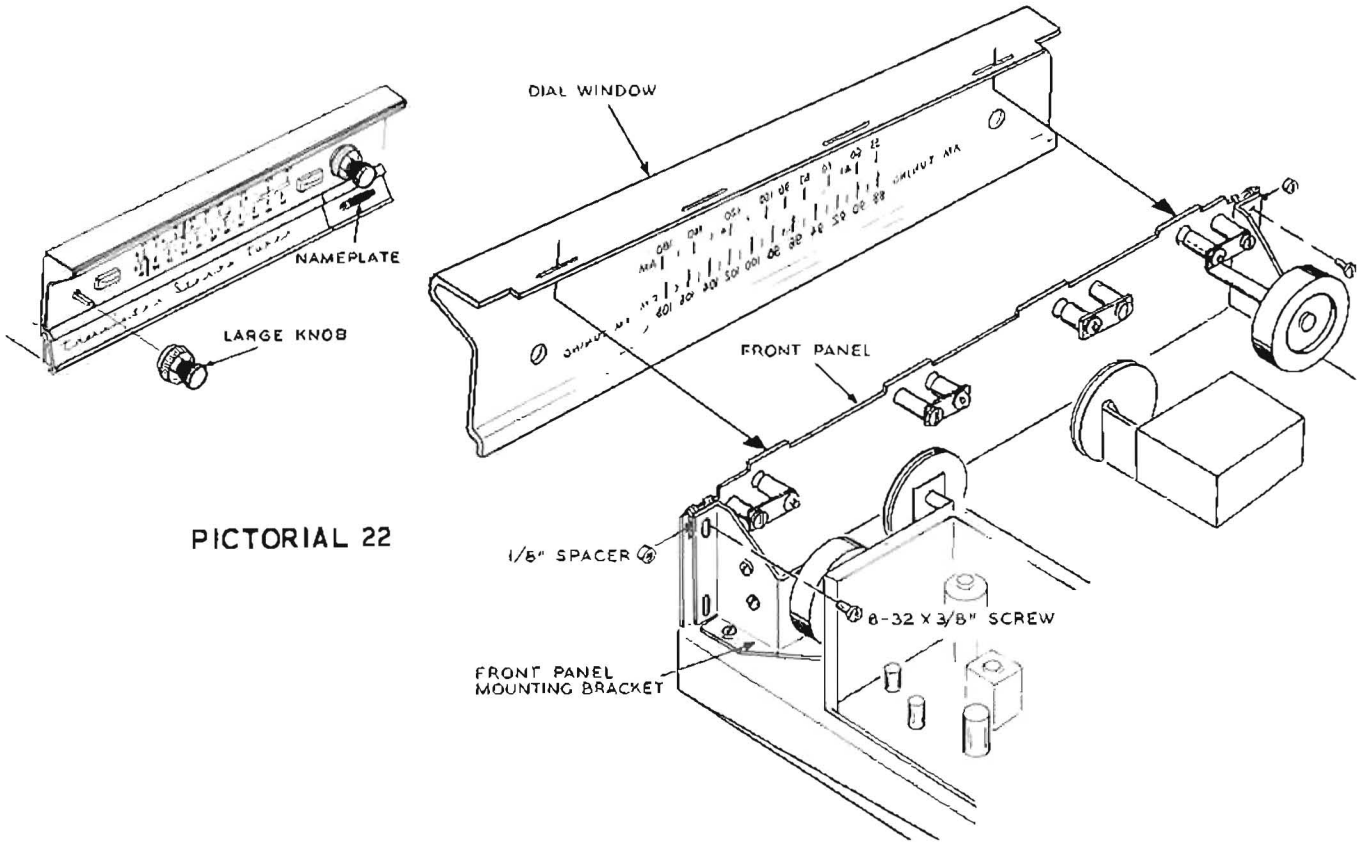
( ) Red-white with black end through grommet HP to ANT hole in the AM circuit board (S-1).

( ) Remaining red-white through grommet HP to ANT RETURN hole in the AM circuit board (S-1).

( ) White to the solder lug mounted with the shield (S-1).

( ) Connect the white lead from the other end of the AM rod antenna to lug 1 of the variable capacitor (S-1). Set the tuner on edge to prevent solder dropping into the variable capacitor plates when soldering.

This completes the wiring of your Tuner. Carefully inspect the wiring for any obvious short circuits, loose wire clippings, or solder splashes; especially recheck the silicon and zener diode rectifiers to make sure they are installed properly. Position any wires extending from the top of the circuit board so they do not touch the component leads or the metal transformer covers.

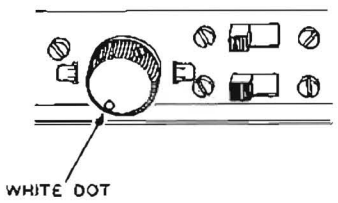


PICTORIAL 22

DIAL WINDOW AND KNOB INSTALLATION

Refer to Pictorial 22 for the following steps.

( ) Referring to Detail 22A, rotate the shaft of control R fully counterclockwise. With the shaft pushed in, install the small knob on the shaft. Position the white dot as shown, and tighten the setscrew of the knob.



Detail 22A

( ) Install 1/8" long spacers between the front panel and front panel mounting brackets. Use 6-32 x 3/8" screws. Install the spacers at the top holes of the front panel mounting brackets.

( ) Install the plastic dial window on the front panel. Be sure the slots of the dial window fit over the tabs of the front panel.

( ) Install a large knob on the AM and FM dial shafts.

( ) Install the nameplate on the short decorative panel. Peel off the protective backing and press the nameplate firmly in place.

( ) Install the fuse in the fuseholder.

INITIAL TEST AND ADJUSTMENT

Refer to Figure 13 (fold-out from Page 50) for the locations of the coils and transformers referred to in the following instructions.

( ) Referring to Figure 14, cut off the tip of the short end of the plastic alignment tool. This end of the alignment tool can be used for the adjustment of the Level, Stereo BAL and SEP, and FM Squelch controls.

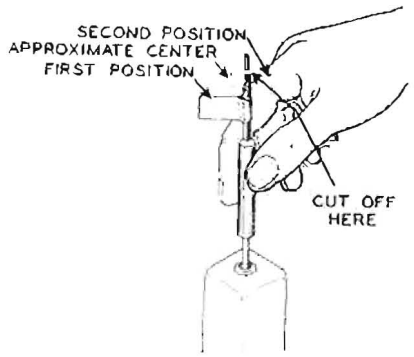


Figure 14

( ) Place the controls and switches in the following positions:

LEVEL controls - fully clockwise.
STEREO CONVERTER BAL control - 3 o'clock position.
STEREO CONVERTER SEP control - center of rotation.
FM SQUELCH control - fully counterclockwise.
STEREO PHASE - pushed in, and center of rotation.
STEREO FILTERS: SCA-OFF
NOISE-OFF.
SELECTOR - AM.
FM SIGNAL - MED.
STEREO CONVERTER switch - OFF.
AFC - OFF.
38 KC OSCillator switch - NOR.
AM METER ZERO control: - center of rotation.
FM METER ZERO control: - center of rotation.

( ) Connect one of the assembled audio cables from the NOR. L OUTPUT socket of the Tuner to the left channel tuner input of a stereo amplifier.

( ) Connect the other assembled audio cable from the NOR. R OUTPUT socket of the Tuner to the right channel tuner input of a stereo amplifier.

( ) Plug the line cord of the Tuner into a standard 117 V AC outlet. If the pilot lamps do not light, actuate the on-off switch by pushing the short decorative strip panel. The pilot lamps should now light. If difficulty is encountered, turn the Tuner off and refer to the In Case Of Difficulty section on Page 67 of the manual.

( ) If no difficulty is experienced in the preceding step, turn up the volume of the amplifier until background noise can be heard.

AM TUNING METER ADJUSTMENT

( ) Adjust the AM METER ZERO control so the AM TUNING meter reads zero. This should be done with no station being received. If a station is heard, rotate the AM TUNING control to a position where no station is present before making the meter adjustment.

( ) Rotate the AM TUNING control over its entire range. Strong local stations should be heard, even though they might appear to be off frequency according to the dial markings.

FM TUNING METER ADJUSTMENT

( ) Change the SELECTOR switch to FM.

( ) Adjust the FM METER ZERO control so the FM TUNING meter reads zero. This should be done with no station being received. If a station is heard, rotate the FM TUNING control to a position where no station is present before making the meter adjustment.

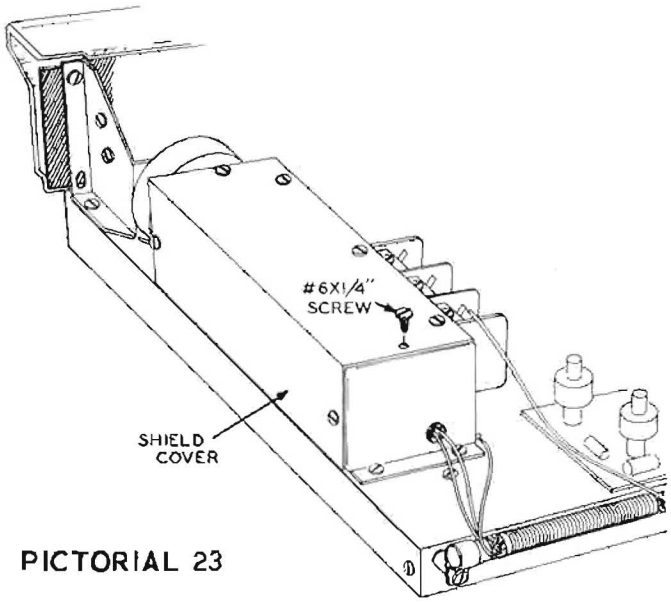
( ) If there is an FM station in your area, leave the FM SIGNAL switch in the MED position. If only distant stations are available, place the FM SIGNAL switch in the DIST position, and connect a 300 Ω FM or TV antenna to the FM EXTERNAL ANTENNA screws. If an external FM or TV antenna is not available, see Figure 17 on Page 60 for information on the construction of a simple FM folded dipole antenna.

( ) Rotate the FM TUNING control and tune in a station by tuning for maximum meter deflection. Find the correct frequency of this station in the radio listing of your local newspaper, then slide the FM dial pointer to indicate the correct frequency on the Tuner dial. It may be necessary to loosen the center finger of the dial pointer to make this adjustment. After making this adjustment, bend the center finger of the dial pointer against the dial cord, being careful not to cut the cord.

LEFT AND RIGHT LEVEL CONTROL ADJUSTMENT

( ) Tune in any monophonic AM or FM station and adjust the LEFT and RIGHT LEVEL controls for equal output levels from both speaker systems. These controls should be set at a level that will not overdrive the input stage of the amplifier and cause distortion.

( ) Referring to Pictorial 23, install the shield cover on the shield, using #6 x 1/4" sheet metal screws.



PICTORIAL 23

ALIGNING THE AM TUNING SECTION

If you have encountered no difficulty, you may assume that the Tuner is wired correctly and that the components are operating properly. The FM section as well as the AM coils and transformers of the Tuner are prealigned. However, it is impossible to prealign the AM tuning capacitor.

Alignment of the AM tuning section may be accomplished quite easily. There are two general methods; one requires instruments and the other does not. Instrument alignment may show some improvement over alignment without instruments; satisfactory results, however, should be obtained with either procedure. The alignment procedure without instruments is given in the following paragraphs. If you wish to align the AM tuning section with instruments, refer to the Alignment section on Page 63.

AM ALIGNMENT WITHOUT INSTRUMENTS

Refer to Figure 13 (fold-out from Page 50).

Turn the Tuner on and place the SELECTOR switch in the AM position. Be sure the dial pointer is aligned with the diamond at the left end of the dial window when the AM tuning knob is rotated fully counterclockwise.

( ) Tune in a station of known frequency near 1400 kc on the dial.

( ) If the correct station frequency is lower than the dial pointer now indicates, turn OSC trimmer C209 counterclockwise slowly; at the same time, turn the AM TUNING control counterclockwise to keep up with the station as it moves down the dial. Continue this adjustment until the station is received at the correct dial marking, resulting in the highest indication on the AM TUNING meter.

( ) If the correct frequency of the known station is higher than the dial pointer now indicates, turn OSC trimmer C209 clockwise slowly; at the same time turn the AM TUNING control clockwise to keep up with the station as it moves up the dial. Continue this adjustment until the station is received at the correct dial marking, resulting in the highest indication on the AM TUNING meter.

( ) Adjust RF trimmer C204 and ANT trimmer C200 for maximum meter indication.

( ) Repeat the preceding alignment in the same order. Observe the AM TUNING meter and peak each trimmer for maximum meter indication.

( ) Now detune the station by turning the AM TUNING control, and without looking at the dial pointer, retune the station for maximum meter indication. Check the dial pointer setting. If it has retuned to the proper frequency setting, continue with the rest of the alignment procedure; if not, repeat the adjustments of trimmers C209, C204, and C200 until the dial pointer falls at the correct known frequency of the station with maximum AM TUNING meter indication.

( ) Turn on a source of "noise" such as a fluorescent lamp, electric shaver or a mixer. Place the Tuner near the noise source so that the static will be heard. Tune the dial to approximately 600 kc but not to a station. Adjust oscillator coil T9 to obtain maximum noise volume. If a station should appear during this adjustment, slightly retune the dial so that only the noise will be heard. Make the adjustment with the dial as close to 600 kc as possible without interference from a station.

( ) Tune in a station of known frequency near 600 kc. The station and dial frequency should agree. Unless there is a large difference between the station frequency and the dial pointer indication (more than the width of the dial pointer), no adjustment should be made. If some adjustment is necessary, slip the dial pointer to the proper station frequency marking on the dial window.

( ) Next, adjust the slug of RF transformer T8 for maximum tuning meter indication.

( ) Recheck the station near 1400 kc to make sure that the setting has not changed. If it has changed, repeat the entire alignment procedure until there is no difference between the dial point settings and the correct station frequencies at both ends of the dial.

NOTE: In the adjustment of the bottom slug of IF transformer T10 in the following step, it is necessary to pass the long end of the plastic alignment tool down through the top slug. Care must be taken when passing the alignment tool through the top slug to not disturb the setting of the top slug.

( ) The AM IF transformers may be adjusted using the signal from a station. First, tune in a station with a weak, interference-free signal at, or near, the low end of the band. Use the plastic alignment tool to adjust the top and bottom slugs of IF transformer T10 and the slug of IF transformer T11 for maximum indication on the AM TUNING meter.

This completes the alignment of the AM portion of the Tuner, except for coil L4, the 10 kc whistle filter, which can only be adjusted using instruments. The preadjusted position of coil L4 will give good performance in most cases.

FM RATIO DETECTOR ADJUSTMENT FOR PROPER AFC ACTION

NOTE: In the following steps it is very important that the slug of the transformer not be turned too far, otherwise, instrument alignment may be required to obtain proper operation of the Tuner. To guard against this condition, a flag (piece of tape) should be placed on the alignment tool as shown in Figure 14 for use in the following alignment procedure.

A simple test for proper AFC action and ratio detector adjustment can be made as follows.

( ) Place the SELECTOR switch in the FM position and the AFC switch to the OFF position.

( ) Carefully tune in a station for maximum meter deflection.

( ) Now place the AFC switch in the ON position while watching the FM TUNING meter. If the meter indication does not change, the ratio detector adjustment is correct. If there is a change of one quarter meter division or more, adjust FM DET SEC of transformer T6 as follows:

( ) With the AFC switch in the OFF position, tune in a station for maximum meter deflection. Now turn the AFC switch on and carefully insert the alignment tool in the top slug of FM DET SEC T6. Rotate the slug slightly (not more than one-quarter turn) in either direction while watching the tuning meter. If this causes the reading of the meter to increase, continue rotation in this direction to a point where maximum meter deflection is achieved. If the meter indication decreases,

rotate the slug in the reverse direction and adjust for maximum deflection of the meter. Normally, only 1/8 to 1/4 turn of the slug is all that will be required.

FM STEREO MULTIPLEX ADJUSTMENTS

( ) Unplug the Tuner from the AC outlet, and disconnect the audio cables from the Tuner.

( ) Referring to Figure 15, temporarily solder the lugs of the single phono socket between lugs 2 and 3 of triple phono socket Y. Be sure the socket does not touch the chassis or multiplex circuit board.

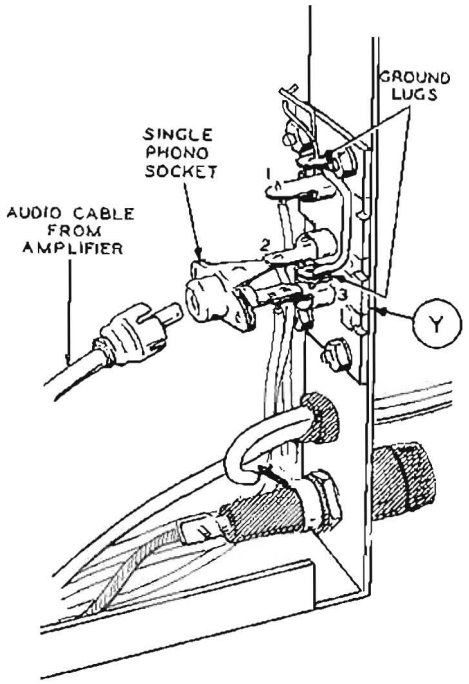


Figure 15

( ) Plug either of the audio cables from the amplifier into the single phono socket.

( ) Place the Tuner switches and controls in the following positions:

STEREO CONVERTER BAL control - fully counterclockwise.
STEREO CONVERTER SEP control - 3 o'clock position.
FM SQUELCH - fully counterclockwise.
STEREO PHASE - pushed in, and center of rotation.
STEREO FILTERS - SCA-OFF.
- NOISE-OFF.
SELECTOR - FM.
STEREO CONVERTER switch - OFF.
38 KC OSCillator switch - NOR.

( ) Turn the amplifier volume fully counterclockwise (no sound output).

( ) Plug the line cord of the Tuner into an AC outlet.

( ) Tune in an FM station.

( ) Turn up the amplifier volume just enough to hear the station.

( ) Adjust the STEREO CONVERTER BAL control for minimum output. Place a pencil mark on the Tuner in line with the slot of the control, so the control can be returned to its proper setting if it is turned accidentally.

( ) Unplug the Tuner from the AC outlet.

( ) Remove the audio cable from the single phono socket and remove the single phono from triple phono socket Y.

( ) Plug the left and right audio cables from the amplifier into the L and R NOR OUTPUTS of the Tuner.

( ) Plug the line cord of the Tuner into an AC outlet.

( ) Place the STEREO CONVERTER switch in the AUTO position, and the STEREO CONVERTER SEP control to the 3 o'clock position.

( ) Tune in an FM station that is known to be broadcasting a stereo multiplex signal. Using the plastic alignment tool, adjust coils T12 and T13 for maximum brightness of the STEREO TUNER indicator lamp. NOTE: Because the FM SQUELCH control is in its minimum position at this time, between-station noise may cause the STEREO TUNER indicator lamp to flicker.

( ) Align the STEREO TUNER indicator lamp with the hole in the front panel. It may be necessary to bend the bracket up slightly. Align the lamp for the brightest light as seen from the front of the Tuner. Use a non-metallic tool to position the socket.

( ) Detune coil T13 counterclockwise until the STEREO TUNER indicator lamp almost goes out.

( ) Adjust coil T12 for maximum brightness of the STEREO TUNER indicator lamp.

( ) Turn the slug of coil T13 clockwise for maximum brightness of the STEREO TUNER indicator lamp. This adjustment covers a wide range of slug rotation without much effect on the brightness of the lamp. The most accurate adjustment can be obtained by observing the flag on the alignment tool while turning the slug in one direction until the lamp goes out. Then reverse the direction of rotating the slug until the lamp goes out again. Set the flag to the center of this rotation.

( ) Place the switches in the following positions.

STEREO FILTER - SCA-OFF.
NOISE-OFF.
STEREO PHASE - out and fully clockwise.
38 KC OSCillator - ADJ.

( ) Turn up the amplifier volume control to the desired level.

NOTE: In the next step, the 38 kc oscillator of the Tuner will be adjusted to the 38 kc subcarrier frequency of the incoming signal. The process by which these two signals are compared is called zero-beating. When these two signals beat together, a third signal (audible tone) is created. Thus, if the oscillator signal is not at the same frequency as the incoming subcarrier signal, a beating can be heard. At this point the music or program material will be garbled. As the oscillator frequency gets closer to the subcarrier frequency, the third signal frequency becomes lower and lower in pitch, until it can no longer be heard. This indicates that both signals are of the same frequency. Also, the music or program material should become clear and listenable.

( ) Adjust coil T14 for a zero beat. This should require no more than one turn of the slug in either direction. This adjustment is very critical, turn the slug very slowly. This adjustment can be made easier on some program material than on other program material. If difficulty is encountered, wait for another selection.

( ) Place the 38 KC OSC switch in NOR position.

( ) Adjust coil T13 for minimum sound output (null) and maximum brightness of the STEREO TUNER indicator lamp.

( ) Adjust the STEREO PHASE control for maximum output (position of the white dot should be about 2 o'clock).

( ) Push the STEREO PHASE knob in, being careful not to disturb the setting of the control.

( ) If the signal is noisy, place one or both FILTER switches (SCA and NOISE) to the ON position. See the Operation section of the manual for the purpose of these and other controls.

This completes the multiplex alignment without instruments, except for the fine adjustment of the STEREO CONVERTER SEP control. This adjustment can be made as follows if desired, however, satisfactory operation should be obtained with the present setting of the control.

FINE ADJUSTMENT OF THE STEREO CONVERTER SEPARATION CONTROL

This adjustment can be made only when a stereo station is broadcasting on one channel (left only or right only). Some stations operate in this manner for stereo checks or during news broadcasts. This adjustment can be made later if such a broadcast is not available at this time. For the time being, you can set the control to the 3 o'clock position.

( ) Tune in an FM stereo station operating on one channel.

( ) Turn off the channel that has the sound, either by turning down the amplifier volume control for that channel or by changing the amplifier mode switch setting.

( ) It will probably be necessary to turn up the volume on the remaining (quiet) channel in order to hear the program material.

( ) Adjust the STEREO CONVERTER SEP control for minimum sound output. This will normally be near the center of rotation.

( ) Make a pencil mark on the chassis in line with the slot in the STEREO CONVERTER SEP control. This control need not be re-adjusted, thus, the pencil line will permit proper resetting if the control is turned accidentally.

This completes Initial Test and Adjustment. Proceed to Final Assembly, unless instrument alignment is needed.

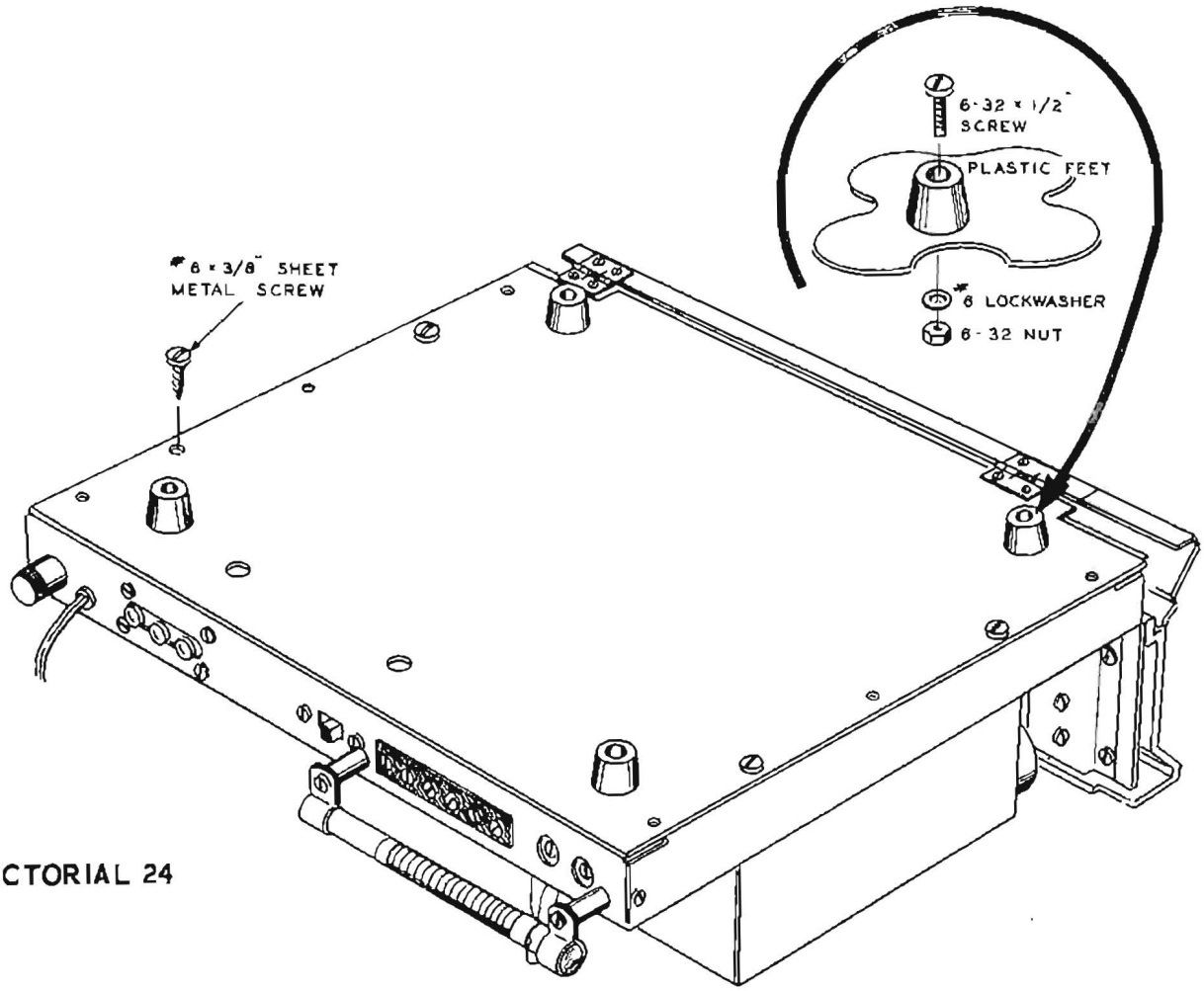
FINAL ASSEMBLY

Refer to Pictorial 24 for the following steps.

( ) Install the plastic feet on the bottom plate, using 6-32 x 1/2" screws, #6 lockwashers, and 6-32 nuts. Be sure to install the feet on the proper side of the bottom plate.

NOTE: Omit the following step if the Heathkit Model AE-11 Walnut Cabinet is to be installed.

( ) Install the bottom plate on the chassis, using four #6 x 3/8" sheet metal screws along the sides in the indicated holes.



PICTORIAL 24

( ) Remove the corner bracket from the chassis and replace the screw.

NOTE: The blue and white identification label shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

( ) Install the identification label in the following manner:

1. Select a location for the label where it can easily be seen when needed, but will not show when the unit is in operation. This location might be on the rear panel or the top of the chassis.

2. Carefully peel away the backing paper. Then press the label into position.

This completes the assembly of your Stereo Tuner. We suggest that you read the following information concerning its installation and operation.

INSTALLATION

Refer to Figure 16 (fold-out from Page 50) for information on installing the Tuner in your system.

MOUNTING THE TUNER

The Tuner can be installed in one of the Heathkit Accessory Cabinets; the Model AE-11 Walnut Cabinet (a short and a long walnut grained decorative strip is included with this Cabinet) or the Model AE-15 Vinyl Clad Steel Cabinet or if desired, the Tuner may be panel mounted by providing an appropriate cutout.

Do not place the Tuner directly above an amplifier or other equipment producing large amounts of heat.

AUDIO CONNECTIONS

Connect one of the audio cables from the NOR L OUTPUT socket of the Tuner to the left channel tuner input of your amplifier. Connect the other audio cable from the NOR R OUTPUT socket of the Tuner to the right channel tuner input of your amplifier.

The AUX AM OUTPUT socket can be connected to a monophonic amplifier to supply AM to a monophonic sound system, such as a home music distribution or intercom system.

INSIDE ANTENNAS

Both the AM and FM sections of the Tuner contain built-in antennas. The AM section has a rod antenna mounted on the rear of the Tuner. The signal response of this rod antenna is directional.

For best AM operation, the Tuner should be positioned to keep the rod antenna well away from large metallic objects and house wiring.

The FM section contains a coil that picks up the FM signals present on the power lines. This "line cord antenna" may be placed in operation by placing the FM SIGNAL switch in the MED position.

OUTSIDE ANTENNAS

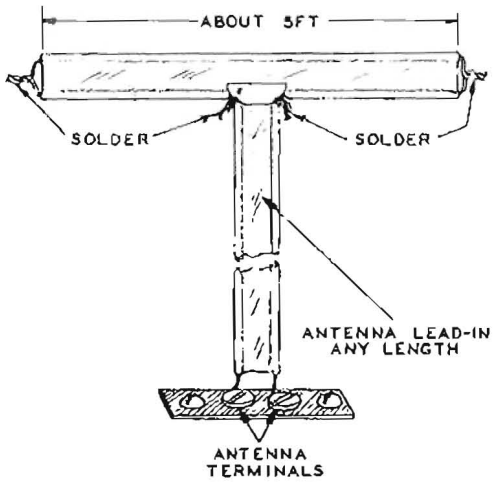
To receive weaker stations, or in weak signal areas, an external antenna will be necessary, especially on FM.

An AM antenna, consisting of a long wire placed as high above the ground as possible, connected to the AM antenna terminal at the rear of the Tuner, should improve AM reception. A ground connection should then be made by connecting a wire from the GND terminal to a ground rod or cold water pipe.

Best reception especially for stereo FM would be from a commercial FM outside antenna with a 300 Ω impedance to match the antenna input of the Tuner.

A TV antenna can be used as an FM antenna since the FM stations are actually tuned in between TV channels 6 and 7. Do not hook a TV antenna to both the TV set and the FM Tuner at the same time unless a TV antenna coupler is used. If the two units are both connected to the antenna without a TV coupler to separate them, a weak and distorted signal may result in both units.

A simple folded dipole antenna can be made of standard 300 Ω twin lead as shown in Figure 17. This antenna can be placed on the rear of a large cabinet or nailed or stapled to a piece of wood to reinforce it. Keep the antenna broadside to the stations you wish to receive for best reception.



FOLDED DIPOLE ANTENNA MADE FROM 300 OHM TWIN LEAD TRANSMISSION LINE

Figure 17

It is also advisable to use approved TV lead-in lightning arrestors with an outside antenna.

OPERATION

FRONT PANEL CONTROLS

AM AND FM TUNING

By turning the TUNING controls you can change the dial setting to select the station you desire. AM TUNING selects AM stations, and FM TUNING selects FM stations.

AM TUNING METER

The AM TUNING meter indicates how strong the signal is that is being received from the tuned-in AM station. Each AM station should be tuned for maximum indication (strongest signal) on the meter.

FM TUNING METER

The FM TUNING meter indicates the signal strength of the tuned-in FM station. Each FM station should be tuned for maximum indication on the meter.

LEVEL CONTROLS

The LEFT and RIGHT LEVEL controls are adjusted for equal and undistorted output levels from both speaker systems with the Tuner tuned to a monophonic AM or FM station.

When the AM OUTPUT of the Tuner is connected to a monophonic amplifier and speaker system, the AM LEVEL control should be adjusted to a level that will result in a clear undistorted output from the speaker system when the Tuner is tuned to an AM station.

STEREO CONVERTER BALANCE CONTROL

The STEREO CONVERTER BALance control must be adjusted to give proper balance of the post detector section (see the Circuit Description) of the multiplex circuit. See the Multiplex Adjustment section on Page 56 for proper adjustment.

STEREO CONVERTER SEPARATION CONTROL

The STEREO CONVERTER SEParation control should be adjusted to provide maximum channel separation. Satisfactory results can usually be obtained by setting this control to the center of its rotation. For a more accurate adjustment, see the FM Stereo Multiplex Adjustment section.

FM SQUELCH

The FM SQUELCH control is used to adjust the squelch circuit to eliminate the noise that is heard between FM stations. This control should be adjusted in a clockwise direction only far enough to eliminate the noise between stations. If it is turned fully clockwise, only the very strong stations will be heard. To receive a very weak station, it may be necessary to turn this control completely counterclockwise.

STEREO PHASE CONTROL AND SWITCH

This control and switch are used only when tuned to an FM stereo station. To set this control, the knob should be pulled out, to activate the switch. In this position, only the subchannel information will be heard (see the Circuit Description).

NOTE: The SCA FILTER switch must be in the OFF position before the STEREO PHASE control can be adjusted.

The STEREO PHASE control is adjusted, first in one direction and then in the other, for the loudest output from the speaker systems. This will normally be set at or near the 2 o'clock position.

Push the knob back in without disturbing the setting of the control. This control allows the user to obtain maximum separation.

NOTE: If this adjustment cannot be made, return to the FM Stereo Multiplex Adjustment section. This control enables the user to enjoy maximum stereo separation from any station by allowing him to correct for transmitted phase errors between different stereo stations.

SCA FILTER

SCA (Subsidiary Communications Authorization) is a commercial music channel, transmitted on some FM carriers along with a regular FM program. When this occurs on a station broadcasting a stereo program, an audible beat can be heard. Placing the SCA FILTER switch in the ON position will eliminate this beat from the output signal.

NOISE FILTER

On a weak stereo station, there is usually more noise than is present on a strong stereo or monophonic station. Placing the NOISE FILTER in the ON position will help to eliminate this unwanted noise.

SELECTOR SWITCH

The SELECTOR switch selects the desired signals and connects them to the OUTPUT sockets at the rear of the Tuner.

In the AM position, the same monophonic AM signal is present at the NOR L and R OUTPUT sockets as well as the AUX AM socket.

In the FM position, one channel signal is at the NOR L OUTPUT socket, and the other channel signal is at the NOR R OUTPUT socket when tuned to a stereo station. When a monophonic FM station is tuned in, the same monophonic signal is present at both the NOR L and R OUTPUT sockets.

FM SIGNAL SWITCH

Normally, with the use of an external antenna, this switch would be placed in the DIST position. If no external antenna is used, this switch should be placed in the MED position. On extremely strong stations when distortion occurs, the switch should be placed in the LOCAL position.

STEREO CONVERTER SWITCH

Normally the STEREO CONVERTER switch should be left in the AUTO position. With the switch in this position, the converter is automatically switched off when the Tuner receives a monophonic FM signal, applying the same signal to both the NOR L and R OUTPUT sockets. When a stereo FM signal is received the converter is automatically turned on, applying the left channel signal to the NOR L OUTPUT, and the right channel signal to the NOR R OUTPUT. Placing the switch in the OFF position turns the converter off, resulting in monophonic operation, even on stereo signals. This may be desired on a very weak and noisy stereo station.

AFC SWITCH

This switch is used to either turn OFF or ON the AFC (Automatic frequency control) voltage.

It may be difficult with the AFC ON, to tune in a weak station that is near a strong station. This is because the AFC tries to lock-in on the strong station. Turning the AFC switch to OFF makes possible the sharper, more careful tuning that is needed for weak stations. Turning the AFC switch to ON again should lock-in the weak station.

POWER SWITCH

The push-push off-on switch is located behind the short decorative trim panel. Pushing the trim panel will turn the Tuner either off or on.

REAR PANEL CONTROLS

METER ZERO CONTROLS

These controls determine the operating range of the tuning meters. They should be adjusted according to the AM and FM Tuning Meter Adjustment instructions.

38 KC OSCILLATOR SWITCH

The 38 KC OSC switch should be placed in the ADJ position when adjusting oscillator coil T14. (See the FM Stereo Multiplex Adjustment section). At all other times, this switch must be in the NOR position.

HOW TO USE AND GET THE MOST OUT OF YOUR TUNER

The following procedure is presented to help the new user realize the most enjoyment that this high quality Stereo Tuner is capable of providing. The Tuner should be connected, as illustrated, to a good quality stereo amplifier or two separate monophonic amplifiers. The speakers should be placed far enough apart to provide good stereo separation; approximately four to eight feet.

1. Set the Tuner controls as follows:

   Power switch pushed to on.
   AFC switch to OFF.
   STEREO PHASE control pushed in and set at about 2 o'clock.
   FM SQUELCH control fully counterclockwise.
   SELECTOR switch to FM.
   STEREO CONVERTER switch to OFF.

2. Tune in a station broadcasting stereo as indicated by a steady glow of the STEREO TUNER indicator and maximum deflection of the FM TUNING meter.

   NOTE: In order to reduce the inherent noise in a multiplex system, the selected station signal must be strong enough to produce at least a deflection of 2 on the FM TUNING meter scale.

3. Adjust the level controls of the amplifier to produce equal volume from each speaker at the desired listening level.

4. Make sure the speakers are in phase. This can be accomplished by standing between the speakers and switching the polarity of the leads on one of the speakers. The connections that give the indication that the sound comes from between the speakers is correct. Most Heathkit stereo amplifiers have a phase switch to reverse the leads to one of the speakers.

5. Place the STEREO CONVERTER switch to the AUTO position.

6. Pull out the STEREO PHASE knob and carefully adjust it, first in one direction and then in the other, until you hear the loudest and clearest reproduction from the speaker systems; a 2 o'clock position of the control is usually about right. Now push the knob in without disturbing the setting of the control. NOTE: This control adjusts the phase of the 38 kc reinserted carrier. On some stereo stations it may be necessary to readjust this control to correct for transmitted phase differences and thus achieve maximum separation.

7. The STEREO CONVERTER SEP control should be left in the 12 o'clock position unless there is program material on one channel only, such as commercials or announcements that are switched from one channel to the other; thus the sound will come from only one speaker. If the station you are listening to broadcasts in this manner, this control should be adjusted for minimum output on the channel not being used. It may be necessary to turn off the channel that has the sound, either by turning down the amplifier volume control for that channel or by changing the amplifier mode switch setting. Once this adjustment is made, the control should always be left in that position.

8. Place the AFC switch in the ON position. This switch should always be in this position unless you want to tune in a weak station adjacent to a strong station.

9. Turn the FM TUNING control off station so only a loud hiss is heard. Now adjust the FM SQUELCH control clockwise until the loud hiss is no longer heard. This control should be left in this position unless you want to receive a very weak station. This adjustment is best made with the AFC switch in the OFF position.

10. There is a possibility of more noise on a stereo broadcast. To eliminate these noises, place one or both of the STEREO FILTER switches in the ON position.

11. To listen to the program material from a weak and noisy stereo station, the STEREO CONVERTER switch can be placed in the OFF position. This turns the stereo converter off, resulting in monophonic operation, thus eliminating unwanted noise.

12. Normally, with the use of an external antenna, the FM SIGNAL switch would be placed in the DIST position. If no external antenna is used, this switch should be placed in the MED position; if distortion occurs on extremely strong stations, the switch should be placed in the LOCAL position.

13. To receive AM programs turn the SELECTOR switch to the AM position and adjust the AM TUNING control for maximum AM TUNING meter deflection on each station.

14. FM stereo reception normally requires a higher signal strength than necessary for FM monophonic reception. If distortion or fading is encountered when receiving an FM stereo station, an outdoor TV or FM antenna should be used to provide good strong reception.

ALIGNMENT WITH INSTRUMENTS

It is recommended that only persons familiar with instrument alignment perform the following alignment procedure, and then only if poor operation is encountered after Alignment Without Instruments has been performed.

NOTE: Before alignment is started, make sure that when the AM and FM TUNING controls are turned fully counterclockwise the dial pointers line up with their respective diamonds on the dial window.

AM ALIGNMENT

Refer to Figure 13 (fold-out from Page 50) for transformer and coil locations.

Equipment needed: AM signal generator.
AC VTVM.
Audio Generator.

( ) Set the SELECTOR switch to the AM position.

		Connect AM signal generator to:	Set frequency of AM generator modulated at 400 cycles to:	Set AM Dial of Tuner to:	Adjust for maximum deflection of tuning meter.
Keep generator output attenuator so that tuning meter deflects approximately two divisions.	1	AM antenna terminal.	455 kc	Diamond on dial window.	Slug of T11 and top and bottom slugs of T10.
	2	Loosely coupled to rod antenna (lay hot lead of generator close to rod).	600 kc	600 kc	1. Rock dial back and forth; adjust T9 for max. meter indication. 2. Peak T8. 3. Slip dial pointer to 600 kc.
	3	Loosely coupled to rod antenna.	1400 kc	1400 kc	C200, C209, and C204.
	4	Repeat steps 2 and 3 until no change is noticed.			

Whistle Filter Adjustment

( ) Connect the AC VTVM to the AM OUTPUT socket.

( ) Connect the audio generator through a .01 µfd capacitor to pin 1 of coil L4 (whistle filter). The AM Circuit Board X-Ray View, Figure 20 on Page 74, shows the pin numbers of coil L4.

( ) Set the generator frequency to 10 kc.

( ) Set the generator output signal level to approximately .1 volt.

( ) Set the AM dial of the Tuner between stations.

( ) Adjust coil L4 for a minimum reading on the AC VTVM.

This completes the adjustment of the whistle filter coil.

FM ALIGNMENT

Refer to Figure 13 (fold-out from Page 50) for coil, transformer, and test point TP locations.

Equipment needed: FM RF generator and DC voltmeter.

( ) Set the controls as follows:

SELECTOR switch - FM.
AFC switch - OFF.
FM SQUELCH control - fully counterclockwise.
FM SIGNAL - LOCAL with no antenna connected.

( ) Connect the DC voltmeter between location 1 on the FM IF circuit board and the chassis.

( ) Adjust the AGC ADJ control (on FM IF circuit board) for a +7.5 volt reading on the meter.

( ) Disconnect the meter from the Tuner.

( ) 1. Temporarily connect a jumper wire from lug 1 of terminal strip S, to lug 2 of control U.

( ) 2. Connect the FM RF generator through a 10 KΩ resistor to lug 9 on the FM tuner.

( ) 3. Set the generator to 10.7 megacycles (with or without modulation). Adjust the generator output for a reading of approximately 1 on the FM TUNING meter of the Tuner.

( ) 4. Adjust the primary (bottom slug) of transformer T6 for a minimum (dip) on the FM TUNING meter.

( ) 5. First, adjust the top and then the bottom slugs of transformers T5, T4, and T3 for a maximum indication on the FM TUNING meter.

( ) 6. Readjust the output of the generator as often as necessary to maintain a reading of 1 on the FM TUNING meter.

( ) 7. Repeat steps 5 and 6 until no further improvement is obtained.

( ) 8. Adjust the top and bottom slugs of T2 (located on the FM tuner) for a maximum indication on the FM TUNING meter.

( ) 9. Remove the jumper wire from between lug 1 of terminal strip S and lug 2 of control U.

( ) 10. Adjust the DC voltmeter to a zero center setting and connect it between lug 1 of terminal strip V (TP1) and the chassis.

( ) 11. If the DC voltmeter deflects in either direction from zero center, adjust the secondary (top slug) of transformer T6 to return the meter to its original zero center position.

( ) 12. Disconnect the generator and voltmeter from the Tuner.

FM FRONT END ALIGNMENT

Tuner Tuned To:		Connect Generator To:	Generator Frequency.	Adjust For Maximum Deflection of Tuning Meter.
90 MC	1	Antenna terminal matched to 300 Ω.	90 MC	T1
106 MC	2	"	106 MC	C1, C2 and C18.
	3	Repeat steps 1 and 2 until no further improvement can be obtained.		

FM STEREO MULTIPLEX ALIGNMENT

Equipment needed: Audio VTVM, audio generator, and an oscilloscope.

( ) Place the switches in the following positions.

FM SQUELCH - full counterclockwise.
SELECTOR switch - FM.
SCA FILTER switch - OFF.
STEREO PHASE control - out.

( ) Disconnect the green wire from lug 1 of terminal strip V (TP1).

( ) Connect the generator to the free end of the green wire just disconnected from TP1. Set the generator to 38 kc ±200 cps and to 0.1 volt rms output.

( ) Connect the VTVM and oscilloscope to test point 2 with short unshielded leads.

( ) Adjust coil L5 for maximum output on the meter. The VTVM should read approximately 0.25 volt rms.

( ) Push the STEREO PHASE control in, and adjust the control to about a 2 o'clock position.

( ) Place the SCA FILTER switch to the ON position.

( ) Set the generator to 65 kc and to 0.1 volt rms output.

( ) Adjust coil L6 for minimum output.

( ) Set the generator to 19 kc ±100 cps and to 0.03 volt rms output.

( ) Connect the VTVM and oscilloscope to the NOR L OUTPUT socket.

( ) Adjust L8 for minimum output.

( ) Connect the VTVM and oscilloscope to the NOR R OUTPUT socket.

( ) Adjust coil L7 for minimum output.

NOTE: Be sure the Tuner chassis is not touching any of the test instruments in the following adjustment.

( ) Connect the ground lead of the VTVM to the NOR R lug, and the hot lead of the VTVM to the NOR L lug of the output sockets.

( ) Set the generator to 1000 cps and 0.1 volt rms output.

( ) Adjust the STEREO CONVERTER BAL control for a minimum output.

NOTE: Coils T12, T13, and T14 can most accurately be adjusted by using signals from an FM stereo station as described in the FM Stereo Multiplex Adjustment section on Page 56.

( ) Reconnect the green wire to lug 1 of terminal strip V (TP1).

This completes the multiplex alignment.

FM STEREO GENERATOR MULTIPLEX TESTS

If a stereo generator is available, you can use it to adjust T12, T13, and T14, and to check channel separation, as directed in the following steps.

( ) Disconnect the green wire from lug 1 of terminal strip V (TP1).

( ) Connect an AC or audio VTVM and an audio amplifier (and an oscilloscope if desired) to the L NOR OUTPUT of the Tuner.

( ) Using the 19 kc pilot signal with a 1 kc multiplex signal from the stereo generator, adjust coils T12, T13 and T14 as described; start with the last two steps on Page 56.

Stereo channel separation can be checked as directed in the next six steps.

( ) 1. Pull out the STEREO PHASE control and set it for maximum output (about the 2 o'clock position) on the VTVM.

( ) 2. Push in the STEREO PHASE control without disturbing the control setting.

( ) 3. With the stereo generator set for right channel output, adjust the STEREO SEP control for minimum output on the VTVM.

( ) 4. Turn the channel switch of the stereo generator to the right channel position and then to the left channel position. Note the L NOR OUTPUT reading on the VTVM for each position. Your left channel separation figure is the difference between these two readings; usually it is expressed in decibels (db).

( ) 5. Disconnect the VTVM, amplifier (and oscilloscope if used) from the L NOR OUTPUT and connect them to the R NOR OUTPUT of the Tuner. Repeat step 4 to obtain the right channel output separation reading.

( ) 6. Disconnect the stereo generator, VTVM, amplifier and oscilloscope (if used) from the Tuner.

( ) Reconnect the green wire to TP1 (lug 1 of terminal strip V) and solder the connection.

This completes the instrument alignment of your Tuner. Refer to the Final Assembly section of the manual on Page 58.

IN CASE OF DIFFICULTY

UNIT FAILS TO OPERATE

Refer to Figures 18 through 22 (Pages 74 and 75) for the location of components on the circuit boards.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques and Circuit Board Wiring And Soldering sections of this manual.

3. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

5. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10%.

6. Check transistors with a transistor tester or by substitution of transistors of the same types, known to be good.

7. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
Dead tuner, pilot lamps not lit.	1. Open AC line cord or fuse. 2. Faulty AC switch. 3. Open FM line cord antenna coil or power transformer.
Dead tuner, pilot lamps on but no output.	1. Open or shorted output cable. 2. Level controls turned counterclockwise. 3. No B-. 4. Faulty silicon rectifiers. 5. Open R400 or R401. 6. Faulty filter capacitors. 7. Emitter follower stages Q21 and Q22 inoperative.
Noise but no sound, AM or FM.	1. Check antennas and Selector switch. 2. Emitter follower stages Q21 and Q22 inoperative.
FM all right, AM dead.	1. Check setting of AM Level control and Selector switch. 2. Capacitors C216 and C218 open or shorted. 3. Faulty Q8, Q9, Q10, Q11, or diode D200.
AM all right, FM dead.	1. Need EXT FM ANT. 2. Check position FM signal switch, AM-FM Selector switch, and FM Squelch control. 3. Stages Q1 through Q7, Q12 through Q14, and Q16 through Q20 inoperative. 4. Faulty R316 or open RFC100.
One channel dead, both AM and FM.	1. Open or shorted output cable. 2. Check Level control circuitry. 3. Check emitter follower circuitry (Q21 or Q22). 4. Check AM-FM Selector switch circuitry.
One channel dead, FM only.	1. Check AM-FM Selector switch circuitry. 2. Check stages Q18 and Q19 or Q17 and Q20. 3. Faulty PEC (#84-36).
One channel weak, FM only.	1. Open coil L7 or L8.
Low level AM audio.	1. Open coil L4. 2. Antenna open. 3. Check alignment of T7.
Distorted output, both AM and FM.	1. Shorted capacitor C329, C330, C333, C331, C332, or C334. 2. Faulty transistor Q21 or Q22.

DIFFICULTY	POSSIBLE CAUSE
Distorted output, AM only.	1. Faulty crystal diode D200. 2. Shorted capacitors C216, C217, or C218. 3. Check AM alignment. 4. Open coil L4.
Distorted output, FM only.	1. Squelch control set too high. 2. Check alignment of T6. 3. Diodes D101 or D102 faulty. 4. Shorted capacitors C301, C302, C304, C312, C315, C316, C317, or C318. 5. Check FM alignment.
Whistles on AM.	1. Open emitter or base bias bypass capacitor. 2. Check alignment of 10 kc whistle filter L4. 3. Open capacitor C214, or coil L4. 4. Caused by radiation from TV set operating nearby.
Hum.	1. Faulty filter capacitors C401, C402 or C403. 2. Open zener diode D402. 3. Reverse AC line plug in outlet.
FM AFC inoperative.	1. Check position of AFC switch. 2. Check alignment of ratio detector transformer T6. 3. Shorted AFC lead. 4. Open or shorted diode D1.
Nonlinear AFC action.	1. Check alignment of T6 secondary. 2. Diode D1 defective.
No FM squelch.	1. Shorted capacitor C300. 2. Faulty Squelch control R301. 3. Check resistors R300 and R302. 4. Defective transistor Q12.
Unable to zero AM or FM meter.	1. Open meter or leads. 2. Check meter zero control circuits.
AM or FM tuning meter does not indicate signal (swing upscale).	1. AM: check AVC circuit. 2. FM: check AGC circuit. 3. See previous step.
FM all right, no FM stereo. Stereo indicator fails to light.	1. Program is not stereo. 2. Open or shorted coil T12 or T13. 3. Check stages Q23 and Q24. 4. Stereo indicator lamp open. 5. Check alignment of T12 and T13.

DIFFICULTY	POSSIBLE CAUSE
FM all right, stereo indicator lights, but no stereo.	1. Check adjustment of Stereo Phase control. 2. Check adjustment of coil T14. 3. Shorted AM-FM Selector switch. 4. Shorted capacitor C310 or C305. 5. Faulty diode D300. 6. Check stages Q25 and Q15. 7. Open or shorted oscillator coil T14.
FM stereo signal garbled or whistles.	1. 38 kc switch in ADJ position. 2. Check adjustment of oscillator coil T14. 3. Shorted or open capacitor C340. 4. Open capacitor C305.
Unable to adjust Stereo Phase control.	1. SCA Filter switch in ON position. 2. Open or shorted coil L5. 3. Check Stereo Phase control and switch circuitry. 4. Shorted or open capacitor C340.
Little or no FM stereo separation.	1. Signal is not stereo (see above). 2. Misadjustment of coil T14 and/or Stereo Phase control R351. 3. Stereo Phase switch is in the "out" position. 4. Separation control R335 misadjusted. 5. Check capacitors C310, C313, and C314. 6. Check stages Q19 and Q20.
High background noise, even with SCA and Noise Filters in On position.	1. FM signal too weak, need better external FM antenna. 2. Check adjustment of coils L5 and L6. 3. Check capacitors C308, C309, C311, C326 and C327. 4. Check SCA and Noise filter switch circuitry.

MECHANICAL TROUBLESHOOTING

DIFFICULTY	POSSIBLE CAUSE
No flywheel action of tuning knobs.	1. Setscrews not tight in flywheel. 2. Tuning shafts binding. 3. Improper dial cord stringing.
Tuning shafts bind.	1. Shaft not in line. 2. Mounting plates bent.
Dial cords slip.	1. Check dial cord tension and stringing. 2. Oil on dial cord. 3. Dial pointer binding.

SERVICE INFORMATION

SERVICE

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

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

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

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit Model Number and Series Number, and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)
5. Print or type your name and address, preferably in two places on the letter.

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

report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

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

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service. HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from the Heath Company; however, it will be necessary that you verify the purchase date of your kit.

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

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

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

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

REPLACEMENTS

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

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the kit Model Number and Series Number.

C. Mention date of purchase.

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

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as

this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

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

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Michigan 49022

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

WARRANTY

The Heath Company warrants that the parts supplied in its kits (except batteries) shall be free of defects in materials and workmanship under normal conditions of use and service. The obligation of Heath under this warranty is limited to replacing or repairing any such part upon verification that it is defective in this manner. This obligation is further limited to such defective parts for which Heath is notified of the defect within a period of ninety (90) days from the original date of shipment of the kit.

The obligation of Heath under this warranty does not include either the furnishing or the expense of any labor in connection with the installation of such repaired or replacement parts. The obligation of Heath with respect to transportation expenses is limited to the cost of shipping the repaired or replacement parts to the buyer, provided such repair or replacement comes within the terms of this warranty.

The foregoing warranty extends only to the original buyer and is expressly in lieu of all other warranties, expressed or implied. The foregoing warranty is further in lieu of all other obligations or liabilities on the part of Heath and in no event shall the Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or use of the kit product or components thereof.

The foregoing warranty shall be deemed completely void if acid core solder or paste flux or other corrosive solders or fluxes have been used in assembling or repairing the kit product. Heath will not replace or repair any parts of any kit products in which such corrosive solders or fluxes have been used.

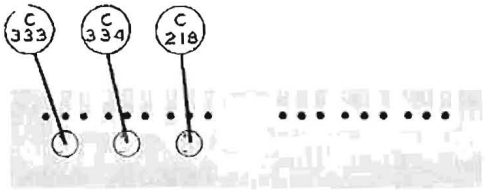
This warranty applies only to Heath products sold and shipped to points within the continental United States and to APO and FPO shipments. Warranty replacement for Heath products sold or shipped outside the United States is on an f.o.b. factory basis. Contact the Heath authorized distributor in your country or write: Heath Company, International Division, Benton Harbor, Michigan, U.S.A.

HEATH COMPANY

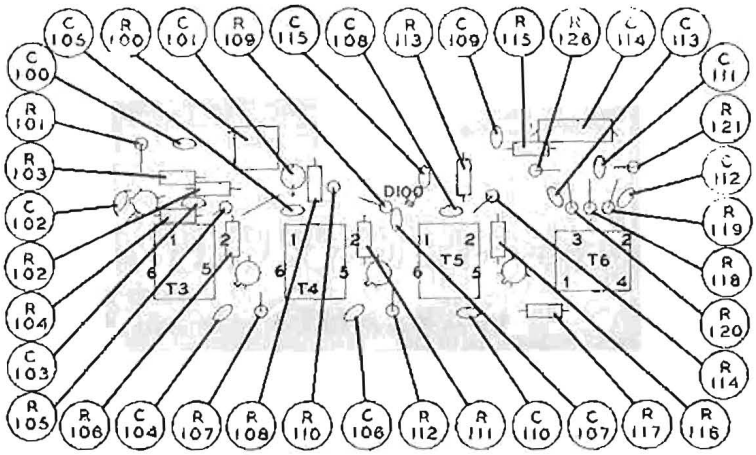
CIRCUIT BOARD X-RAY VIEWS

THE X-RAY VIEWS OF THE CIRCUIT BOARDS ARE PROVIDED TO AID IN TROUBLESHOOTING

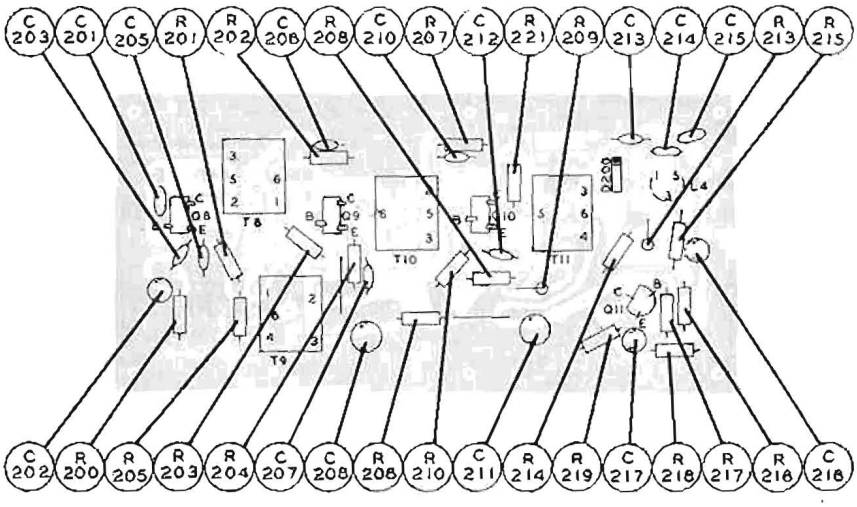
(VIEWED FROM FOIL SIDE)



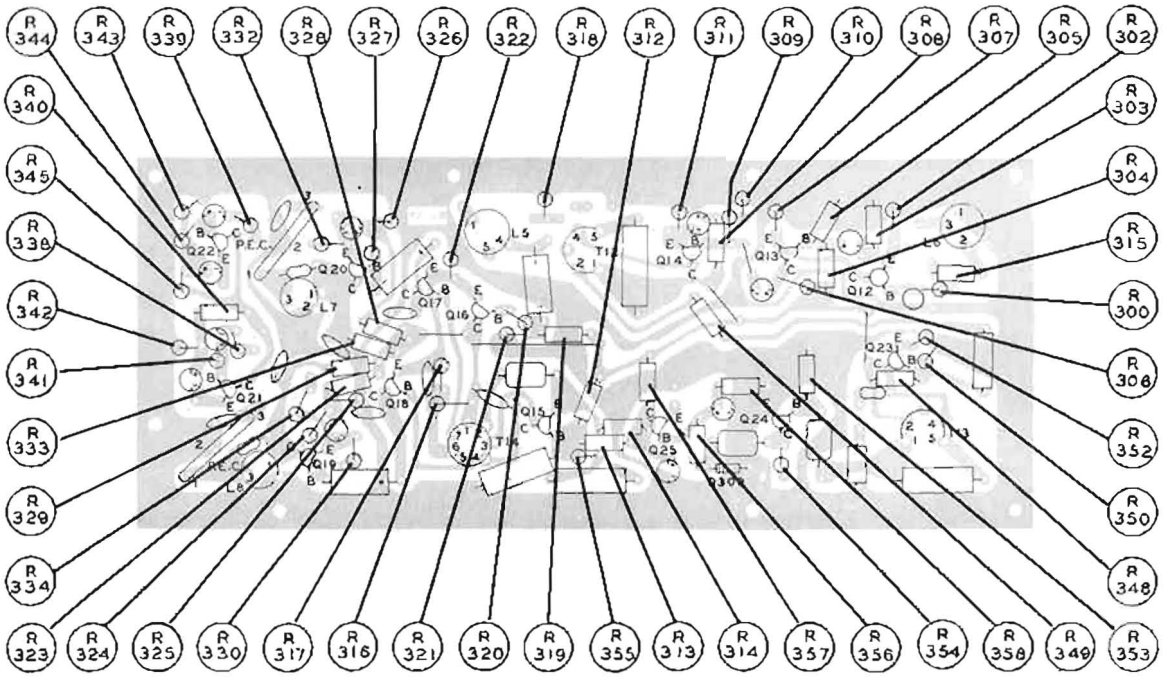
X-RAY VIEW
INPUT CIRCUIT BOARD
Figure 18



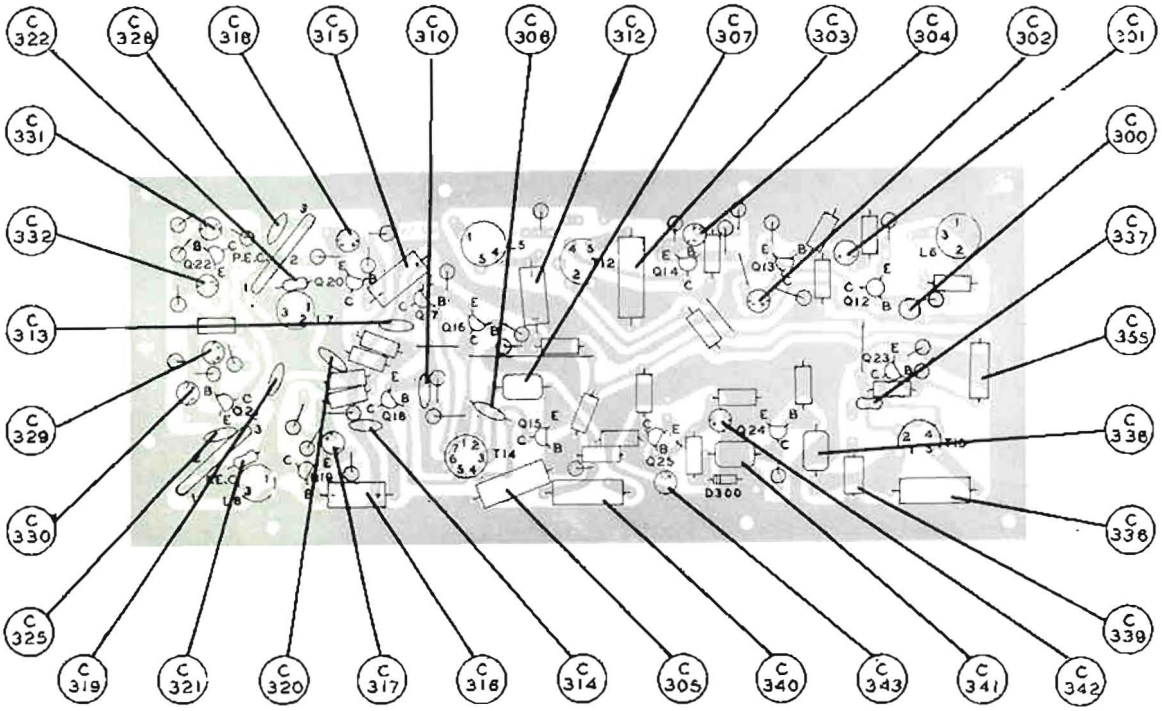
X-RAY VIEW
I.F. CIRCUIT BOARD
Figure 19



X-RAY VIEW
AM CIRCUIT BOARD
Figure 20



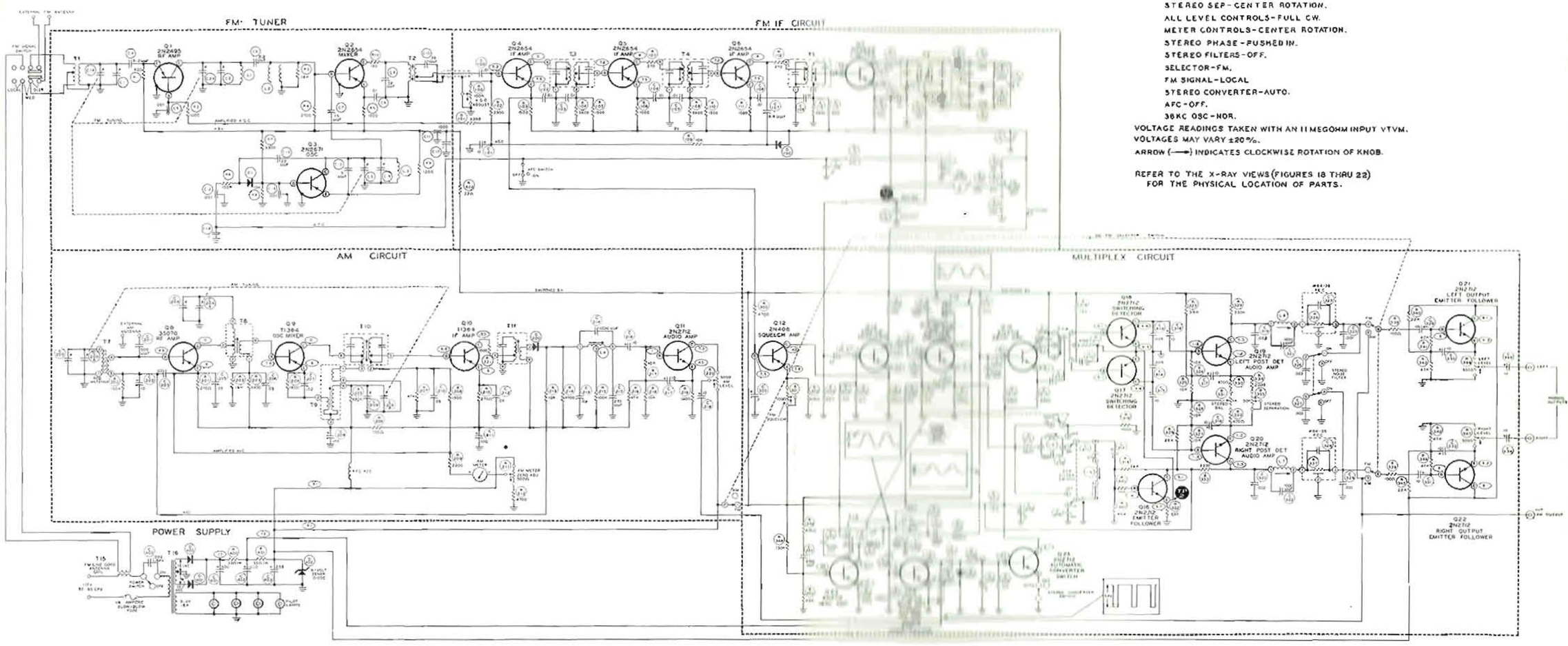
X-RAY VIEW
RESISTORS
MULTIPLEX CIRCUIT BOARD
Figure 21



X-RAY VIEW
CAPACITORS
MULTIPLEX CIRCUIT BOARD
Figure 22

NOTES:
ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE
ALL RESISTOR VALUES ARE IN OHMS (K=1000).
ALL CAPACITOR VALUES ARE IN µFD UNLESS MARKED OTHERWISE.
<⊃ INDICATES VOLTAGE READING.
ALL VOLTAGES ARE DC POSITIVE UNLESS MARKED OTHERWISE.
ALL VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND,
EXCEPT AC VOLTAGES ON POWER TRANSFORMER WINDINGS.
TUNER TUNED OFF STATION WITH CONTROLS AND SWITCHES SET AS FOLLOWS:
FM SQUELCH - FULL C.C.W.
STEREO BAL - CENTER ROTATION.
STEREO SEP - CENTER ROTATION.
ALL LEVEL CONTROLS - FULL C.W.
METER CONTROLS - CENTER ROTATION.
STEREO PHASE - PUSHED IN.
STEREO FILTERS - OFF.
SELECTOR - FM.
FM SIGNAL - LOCAL
STEREO CONVERTER - AUTO.
AFC - OFF.
38KC OSC - NOR.
VOLTAGE READINGS TAKEN WITH AN 11 MEGOHM INPUT VTVM.
VOLTAGES MAY VARY ±20%.
ARROW (⟶) INDICATES CLOCKWISE ROTATION OF KNOB.

REFER TO THE X-RAY VIEWS (FIGURES 18 THRU 22)
FOR THE PHYSICAL LOCATION OF PARTS.



SCHEMATIC OF THE
HEATHKIT®
TRANSISTOR STEREO TUNER
MODEL AJ-43U

HEATH COMPANY

BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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