INSTRUCTION BOOK

FOR

"SUPER-PRO" RADIO RECEIVER

(100 - 400 kc and 2.5 - 20 mc)

MANUFACTURED BY

HAMMARLUND MFG. CO., INC.

RADIO RECEIVER BC-779-A
POWER SUPPLY UNIT RA-84-A

MANUFACTURED FOR
HAMMARLUND MFG. CO.
BY
HOWARD RADIO CO

PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

ORDER NO. 2109-PHILA-42

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LITHO IN U. S. A.

CONTENTS

I

DESCRIPTION OF EQUIPMENT

1. GENERAL.—The Super-Pro receiving equipment consists of two units:

RECEIVER

POWER SUPPLY

a. The 18 tubes are in their respective sockets and 2 connector cables are packed separately.

2. TYPE OF EQUIPMENT.—The Super-Pro receiving equipment employs a superheterodyne circuit designed for reception of amplitude modulated signals. It is generally intended to be operated from a standard commercial power line under fixed conditions. Although the Super-Pro is of rugged construction, it should receive the care and treatment usually given precision technical apparatus.

3. MECHANICAL DESCRIPTION.—The Super-Pro receiving equipment is available for two types of mounting, having the following physical characteristics:

a. Rack model receiver weighs 55 lbs.

(*1*) Over-all width 19 inches.

(*2*) Depth behind panel, 15⅜ inches.

(*3*) Height, 10½ inches.

b. Rack model power unit weighs 45 lbs.

(*1*) Over-all width, 19 inches.

(*2*) Depth behind panel, 8⅜ inches.

(*3*) Height, 8¾ inches.

c. Table model receiver weighs 73 lbs.

(*1*) Over-all width, 23 inches.

(*2*) Depth, 16½ inches.

(*3*) Height, 12¼ inches.

d. Table model power unit weighs 39 lbs.

(*1*) Over-all width, 13 inches.

(*2*) Depth, 8⅜ inches.

(*3*) Height, 8¼ inches.

e. Rack model panels are 19 inches wide and equipped with notches to fit standard relay racks.

(*1*) Rack model receiver is equipped with a dust cover which is fastened to the front panel with knurled thumb nuts. Similar thumb screws fasten the cover to the rear edge of the chassis.

(*2*) Rack model power unit has a dust cover fastened to the panel with knurled nuts, the same as the receiver. Similar thumb screws fasten the dust cover to the chassis.

(*3*) Rack model equipment, both receiver and power unit, as well as the table mounting power unit have bottom plates for protection against dust and damage.

(4) All front panels are coated with a special baked black finish, unless otherwise specified.

f. All controls on the front panel are clearly identified by markings. These controls and their functions are explained under "OPERATION," page 7. On the rear skirt of the receiver chassis will be found terminal strips which serve to connect the power cable, output load, antenna and earphones (see page 28, fig. 9).

(1) Power supplies are also equipped with terminal strips for connecting the power cable (see page 28, fig. 9).

(2) The protective fuse is in a holder mounted on the rear skirt of the power supply chassis and can be replaced by unscrewing the fuse-holder cap.

g. Terminal strips on both receivers and power supplies are protected by small rectangular covers. These covers must be in place before equipment is put in operation (see page 18, fig. 5).

4. ELECTRICAL DESCRIPTION.—The Super-Pro receiver normally receives its power from a separate unit which in turn connects to a 105/125 volt, 50/60 cycle, single phase power line. The average power consumed is 180 watts. The Super-Pro will also operate from a storage battery to supply the heater power, and "B" batteries for the plate and C-Bias voltages (see page 28, fig. 10).

a. The total heater current required is 6.25 amperes at 6 volts.

b. The total plate voltage required is 225 volts applied in the following manner:

225 volts at .117 amperes
90 volts at .0045 amperes

c. The "C" bias voltage required is 45 volts at .010 amperes.

5. POWER OUTPUT.—The Super-Pro, unless otherwise specified, has two output impedances. Appropriately marked terminals are located along the rear edge of the chassis. The total output power available is approximately 8 watts. Undistorted output is in the neighborhood of 3 watts with distortion increasing as the power output is increased.

a. The 600 ohm output (marked "SPKR") is provided for use under all conditions requiring an appreciable amount of power, such as loudspeaker, recorder, or a 600 ohm audio transmission line. All power output measurements and all audio frequency fidelity readings should be taken at this output terminal.

b. An 8000 ohm output (marked "PHONES") is provided for monitoring purposes only, and no attempt should be made to take power measurements at this terminal.

6. FREQUENCY RANGE.—The frequency range of the Super-Pro receiver is divided into five separate bands. The selection of any one of these bands is determined by the position of the band-switch control. This control is clearly marked to indicate the band in use.

a. The coverage of the five bands is as follows:

100–200 kilocycles	2.5– 5.0 megacycles
200–400 kilocycles	5.0–10.0 megacycles
10.0–20.0 megacycles	

b. In addition to the markings on the band-switch control, a rotating mask, with appropriate windows, exposes a calibrated scale on the main tuning dial to correspond with the band selected by the band switch. This operation is automatic . . . the mask is controlled by the band switch through gears.

c. Band spread: For simplified tuning over a narrow range of frequency, a separate band spreading control is provided. This control has an arbitrary scale reading from 0 to 100 through approximately 170°. If set at 100, the frequency covered by moving the dial will extend from that indicated by the setting of the main dial, to some lower frequency, depending on how far the band spread dial is moved. The capacity of the band spread condenser increases as the scale approaches 0.

(*1*) To cover a specific range with the band spread dial, the main dial should be set to the high frequency end of the band which it is desired to spread.

7. DIAL CALIBRATION.—The main tuning dial is calibrated directly in frequency as follows:

BAND	CALIBRATION
10 mc–20 mc	100 kc per division
5 mc–10 mc	100 kc per division
100 kc–200 kc	2 kc per division
200 kc–400 kc	5 kc per division
2.5 mc–5.0 mc	50 kc per division

a. The above calibration holds true only with the band spread dial set at 100.

8. TUBE COMPLEMENT.—The following tubes are used in the receiver:

TYPE	FUNCTION	SYMBOL
6K7	1st RF Amplifier	V1A
6K7	2nd RF Amplifier	V2A
6L7	Mixer	V3A
6J7	HF Oscillator	V4A
6K7	1st IF Amplifier	V5A
6SK7	2nd IF Amplifier	V6A
6SK7	3rd IF Amplifier	V7A
6H6	Second Detector	V8A
6N7	Noise Limiter	V9A
6SJ7	BF Oscillator	V10A
6SK7	AVC Amplifier	V11A
6H6	AVC Diode	V12A
6C5	1st AF Amplifier	V13A
6F6	2nd AF Amplifier	V14A
2-6F6	3rd AF Amplifier	V15A-V16A

a. The following tubes are used in the power unit.

TYPE	FUNCTION	SYMBOL
5Z3	Plate Voltage Rectifier	V1B
80	C-Bias Rectifier	V2B

9. SENSITIVITY.—Normally, the Super-Pro has more sensitivity than can actually be used. The determining factor in practical operation is the background or external noise not generated in the receiver. Regardless of the capabilities of the receiver, when the background or external noise (generated by electrical apparatus or atmospheric conditions) reaches the level or intensity of the desired signal, it becomes very difficult to obtain satisfactory reception.

a. As a guide, fig. 13, page 31, illustrates sensitivity characteristics of the five bands covered by a typical receiver.

b. Full benefit of the excellent sensitivity of the Super-Pro can be obtained only when properly installed, with respect to the antenna and choice of location.

10. SELECTIVITY.—A wide range of selectivity is available in this receiver. Starting with the most selective point of the crystal filter, the selectivity range is approximately from 100 cycles to 16 kilocycles. This wide range of selectivity permits the receiver to be used for a great many services. Usually a degree of selectivity can be found which will provide the best possible fidelity with the least amount of interference. Typical selectivity curves are shown in fig. 12, page 30.

a. Radio Frequency selectivity (pre-selection) is sufficient to reduce images or repeat spots (removed from the main frequency by twice the intermediate frequency) to a minimum.

b. Intermediate frequency (465 kc) selectivity is variable over wide limits. With the crystal filter out of the circuit, the range is from 3 to 16 kilocycles. Some deviation from this figure takes place on the two low frequency bands where the Radio Frequency stages have some effect. Variation of the intermediate frequency band width is accomplished by varying the degree of coupling between the primary and secondary coils of the IF transformers. The control on the panel marked BAND WIDTH performs this operation.

c. The crystal filter employed in the Super-Pro has a distinct advantage over other types of filters. Besides the OFF position, there are five degrees of selectivity governed by different settings of the control knob on the panel.

(*1*) The first two settings of the crystal filter selectivity control are especially suited to radio telephone reception. In cases of extreme interference, the third position may be used, though a good portion of the intelligibility of the voice signal may be removed due to lack of the higher audio frequencies.

(*2*) The last two degrees of selectivity are for reception of radio telegraph signals where selectivity is more important than quality, though telegraph signals may be received on any degree of selectivity depending, of course, on the amount of interference from other signals or disturbances of the man-made variety.

11. AUDIO FIDELITY.—There are two factors controlling the quality of reproduction of the receiver.

a. During reception the overall selectivity of the receiver controls the quality of response. When adjusted to a high degree of selectivity, the quality will be deepened in tone due to the lack of high audio frequencies. As the selectivity is broadened, the higher frequencies become stronger.

b. The audio part of the receiver can pass only what has already gone through the IF amplifier. The Super-Pro audio amplifier is a relatively high quality system, capable of reproducing voice or music with a good degree of fidelity.

c. Fidelity curves taken with the entire receiver in operation are reproduced on page 31, fig. 14.

II

INSTRUCTIONS FOR INSTALLATION

1. CONNECTING EQUIPMENT.—In selecting the operating position for the Super-Pro receiving equipment, it should be borne in mind that evenness of temperature and humidity play an important part in obtaining uniform performance. Wide changes in temperature or humidity will have some effect on calibration. While the Super-Pro is of solid construction, vibration will have some effect on performance when the receiver is adjusted for a high degree of selectivity. In addition to the receiver power unit and tubes, there are two connector cables. One is for normal operation with the power unit, and the other cable is for use with batteries.

a. The vacuum tubes are in their respective sockets. These tubes were employed during final inspection and adjustment at the factory. Make sure all tubes are in their proper sockets in the receiver, and remove the cardboard packing around the two glass rectifier tubes in the power unit. Then connect the receiver and power supply together as follows:

(*1*) Remove the large terminal cover from the receiver and attach one end of the power supply cable. The cable having two terminal strips is the one referred to. After removing a similar terminal cover from the rear of the power unit, attach the other terminal strip of the cable to the terminal strip on the power unit. See page 28.

(*2*) It will be noted that the terminal strips on the cable correspond exactly in dimensions with the terminal boards on the receiver and power unit. These terminals can be installed without difficulty. DO NOT USE FORCE! If they do not go together properly, remove and examine to determine whether or not they are being applied properly. Be certain the screws are fully unscrewed. Terminal lugs should slip under the screws from the top. See page 28.

b. If the equipment is to be operated with batteries, connections should be made in accordance with the drawing in fig. 10, page 28. The cable used for battery operation is the one having only one terminal strip, the other end consists of free wires. All other operations will be the same as for normal operation with the power unit.

c. The antenna input has been designed to couple to either a balanced transmission line of approximately 115 ohms impedance, or to a conventional single wire antenna and ground. There is an electrostatic screen between primary and secondary of each antenna input transformer. This screening, together with a two-wire balanced lead-in, reduces noise pick-up to a minimum.

(*1*) In the case of the transmission line lead-in, the feeders should be connected to the terminals at the rear of the receiver marked "A". If a single wire type of antenna is used, its lead-in should be connected to one of the "A" terminals, and the othe "A" terminal should be connected to good ground.

(*2*) For reception over a relatively narrov band of high frequencies, a suitably de signed doublet or similar tuned antenn connected to the receiver through a high grade lead-in cable, will result in exceptiona efficiency.

(*3*) It is not essential to ground the receiver chassis but this may be readily accom plished by connecting a ground wire under one of the thumb screws securing the dust cover to the rear of the chassis.

d. Earphones should be connected with an ap propriate plug to the jack provided for them on the front panel (see fig. 2) for preliminary testing. Earphones may also be connected to a terminal strip on the rear skirt of the chassis

e. Next, connect the power cord (see fig. 5) to the AC power line. For further information, see "OPERATION."

III

ADJUSTMENT AND OPERATION

1. PLACING IN OPERATION.—After installation, the equipment should be checked thoroughly for possible mechanical defects caused by handling and shipping.

a. The tubes for this equipment are shipped already installed in their proper sockets—each socket being marked with the type number of the tube which belongs in that socket.

(*1*) It is necessary to remove the dust cover from the rack model of the Super-Pro, in order to make sure that all tubes are in their proper places. This is done by removing the knurled thumb nuts which fasten the dust cover to the front panel. Similar thumb screws on the rear edge of the chassis must also be removed. This dust cover may be left removed until the equipment is found to be operating satisfactorily. This will avoid an additional operation should further servicing be required.

(*2*) The dust cover must also be taken off the power unit to remove the cardboard jackets from the two rectifier tubes.

(3) Both dust covers should be replaced after the equipment has been found to be operating satisfactorily.

2. ADJUSTMENT.—This equipment has been completely adjusted at the factory and no further adjustment should be necessary prior to actual operation.

3. OPERATION.—Although the Super-Pro is a highly technical piece of apparatus with quite a large number of controls, it is relatively easy to operate. There are 14 controls on the panel. However, they are not all used at the same time. The number of controls necessary for operation will depend on the type of service for which the receiver is to be used. The major controls are:

a.

BAND SWITCH	AUDIO GAIN
MAIN TUNING	SENSITIVITY
BAND SPREAD	

(*1*) The remaining controls are brought into play as conditions demand their use.

b. Assuming that the earphones, power supply and antenna have been connected according to instructions, the various controls should be set in the following positions:

CRYSTAL SELECTIVITY	OFF
PHASING	On arrow
BAND WIDTH	3
LIMITER	OFF
AVC–MANUAL	AVC
SENSITIVITY	10
BAND SPREAD	100
MOD–CW	MOD
AUDIO GAIN	6
SEND–REC	REC
BEAT OSCILLATOR	0

(*1*) Then throw the power switch in the center of the panel (marked OFF-ON to the ON position. This puts the receiver in operation.

(*2*) The band switch should be adjusted to the band which the operator is likely to find most active. Receiving stations on this band will permit the operator to familiarize himself with the various adjustments. The band width control should be set at 3. If interference is not serious, it can be adjusted to a wider degree of selectivity, depending upon the amount of fidelity desired. In general, this control should be adjusted to the band width providing best tone quality with a minimum of interference.

(*3*) All tuning, with or without the meter, should be done with the band width control set at 3. Other settings provide a wider band making accurate tuning difficult. Band width adjustments should be made *after* the signal is tuned in properly.

(*4*) The beat-oscillator is turned on when the SIGNAL switch is in the CW position. The beat-oscillator control varies the pitch of the heterodyne or beat between the oscillator and the incoming signal. This feature is used for code reception and for locating weak modulated signals.

(*5*) The LIMITER control turns the noise limiter on and off. The noise limiter is most valuable on the higher frequencies where automobile ignition interference and other similar disturbances are serious.

c. So far, we have considered adjustments necessary for radiophone reception. For code reception, the AVC-MANUAL control should be set in the MANUAL position and the SENSITIVITY control turned down to provide proper sensitivity.

(*1*) On strong signals, this control should not be turned all the way on because it will cause overloading. If the AUDIO GAIN control is set at approximately 7, volume can be regulated with the SENSITIVITY adjustment only.

(*2*) Because of the type of AVC system used in the Super-Pro, code signals can be very effectively controlled with this system. The AVC action is slow enough not to have an effect upon individual charactertеrs of high speed code, but it is fast enough to control the overall level of the signal.

d. The crystal filter is very effective and easy to operate because of its excellent stability. The first three positions are generally used for radiophone reception and will serve for code reception where interference is not serious. The last two positions are for code reception exclusively.

(*1*) After the CRYSTAL SELECTIVITY control is adjusted for the desired degree of selectivity, the PHASING control may be used to reject heterodyne interference or "whistle."

e. The receiver can be silenced by turning the SEND-REC switch to the SEND position. This allows the receiver to remain ready for instant service during transmission periods when it is used for communication purposes.

f. All tuning can be done with the MAIN TUNING control. In this case, the band spread dial is left at 100. The band spread dial operates so as to spread out a narrow band of frequencies *below* the frequency to which the main dial is set.

(*1*) The band spread dial operates continuously throughout the three high frequency bands covered by the receiver, but is automatically disconnected by the band switch on the two low frequency bands. In this manner, high frequency bands can be spread out over the band spread dial f easy tuning.

g. For earphone operation, earphones are plugge into the jack provided for them on the fror panel. A set of terminals are also available o the rear of the chassis for connecting earphone These terminals are connected in parallel wit the jack on the front panel.

h. The S-meter operates only when the receiver i adjusted for AVC. This meter is used mainl as a tuning guide. Its reading will increase a the receiver approaches resonance with the in coming signal. Exact resonance is indicate by the greatest reading of the meter. The ban width control *must* be set at 3 for accurat tuning by means of the meter.

(*1*) The meter calibration in "S" numbers i more or less arbitrary. A screw drive adjustment at the rear of the chassis nea the second detector diode varies the re sistance in shunt with the meter. B means of this adjustment, an S9 readin may be obtained on any input betwee approximately 10 and 10,000 micro-volts The normal factory adjustment is mad on an input of 50 micro-volts, and wher so adjusted each "S" number represents a change in signal input of approximately 6 db.

IV

MAINTENANCE AND REPAIR

1. GENERAL.—The receiver has been carefully inspected and adjusted and servicing is not generally necessary over long periods of operation. Vacuum tubes should be tested at regular intervals and those indicating low sensitivity should be replaced. All adjustments were originally made with R.C.A. tubes and it is strongly recommended that the same type tubes be used for replacement purposes.

a. If the receiver becomes completely inoperative, it may be due to a shorted filter or by-pass condenser or an open resistor. By measuring socket voltages and comparing them with the tabulations in the chart (page 13), the defective part can be quickly discovered. We do not believe that detailed continuity tests should be described since most operators are familiar with the ordinary procedure for determining defective component parts. In both receiver and power supply units, (rack mounting) the bottom cover plates should be removed so that all parts are accessible. The table model receiver should be removed from its cabinet. Values of any resistor or capacitor may be obtained by locating the symbol number on the circuit diagram, and referring to the parts list.

b. The receiver has been accurately aligned at the factory and under normal operating conditions should retain this adjustment indefinitely. When either sensitivity or selectivity (or both) appear to be below normal, and all tubes have been checked, it may be desirable to check the alignment. Removing the dust cover and bottom cover plate of the receiver will make all adjustments accessible. If the following instructions are carefully carried out, no difficulty should be experienced in restoring the original performance of the receiver. CAUTION:—Any changes from original settings will be relatively small and extreme care should be exercised when checking adjustments. This is especially true of the HF Oscillator circuits (fig. 11) which should NOT be disturbed unless the main tuning dial is definitely known to be off calibration. *Do not* manipulate the insulated screw driver indiscriminately.

c. The Test Oscillator should be an accurately calibrated instrument producing modulated signals covering frequencies between 100 and 400 kc and 2.5 and 20 mc (also 465 kc). This oscillator should have an output of the order of 100 micro-volts and an output impedance of approximately 100 ohms for best results when aligning the RF and HF Oscillator circuits. For IF alignment these values are not critical. The frequency calibration of the test oscillator is extremely important, if the receiver dial calibration is to be correct.

d. The Output Meter should respond to the modulation frequency of the test oscillator, preferably 400 cps, and should provide at least half-scale deflection for 10 volts. Its resistance should be greater than 500 ohms.

e. An insulated screw driver 9/64" wide and .025" thick at bit, is required for aligning the receiver.

2. PRELIMINARY PROCEDURE.—Throw the OFF-ON switch to the ON position and allow the receiver to warm up approximately one hour before beginning adjustments. Connect the output meter to the SPKR terminals located at the rear of the receiver chassis.

3. IF-AVC-BEAT OSC. ALIGNMENT.—Adjust the test oscillator to approximately 465 kc and connect the output to the control grid cap of the 1st detector tube (6L7) through a fixed condenser. Front panel controls should be set as follows:

SENSITIVITY	0
AVC–MANUAL	MANUAL
MOD–CW	MOD
SEND–REC	REC
BAND SWITCH	2.5–5.0 mc
AUDIO GAIN	10
CRYSTAL SELECTIVITY	OFF
CRYSTAL PHASING	On arrow
BAND WIDTH	3
BAND SPREAD DIAL	100

a. IF ALIGNMENT CHECK.—The main tuning dial should be set near 2.5 mc, but care should be taken to avoid tuning in a powerful local signal. Now tune the test oscillator to the proper alignment frequency in the following manner. Set the CRYSTAL SELECTIVITY switch on 3, the AVC-MANUAL switch on AVC, and advance the SENSITIVITY to 10. Turn off the modulation of the test oscillator and adjust its frequency slightly until maximum deflection of the "S" meter is obtained. The adjustment of the test oscillator frequency in this manner is necessary in order to insure exact agreement with the natural period of the particular quartz crystal in the receiver being checked. After reducing SENSITIVITY to 0 the modulation may be switched on, but the tuning of the test oscillator *must not* be altered until the alignment check is completed. The CRYSTAL SELECTIVITY and AVC-

MANUAL controls may now be returned to their original settings of OFF and MANUAL respectively and SENSITIVITY advanced until a suitable output meter reading is secured. A half-scale reading in the neighborhood of 5 or 10 volts will be satisfactory.

b. Now check the alignment of both upper (grid) and lower (plate) air trimmer condensers in IF transformers T2A and T3A and the single trimmer in T4A for peak reading of the output meter. If one or more of these adjustments results in a material increase of output reduce SENSITIVITY sufficiently to bring meter reading back to half-scale. Alignment of the plate circuit of the crystal filter T1A can be tested in the same fashion by means of the *lower* adjusting screw on the side of the unit. This screw varies the position of the powdered iron core in coil L26A. *Do not* disturb the setting of the *upper* adjusting screw which tunes the grid coil L27A, as this circuit cannot be properly adjusted by the foregoing method. This circuit may, however, be correctly aligned by the "visual" method employing a frequency-modulated oscillator and cathode ray oscillograph.

c. AVC ALIGNMENT CHECK.—Leaving all other controls as above, and *without* disturbing the test oscillator frequency, reduce AUDIO GAIN to 0, switch to AVC, and increase SENSITIVITY to 10. Increase AUDIO GAIN to restore half-scale reading on output meter and adjust single trimmer condenser in T6A for *minimum* output meter reading. The "S" meter reading should "peak" at the same time the output meter reading "dips."

d. BF OSCILLATOR ALIGNMENT CHECK.—Continuing with controls as above (AVC Alignment) switch off modulation of test oscillator leaving it tuned to *same* frequency. Disconnect output meter and plug in a pair of headphones, or replace meter with suitable loud speaker. Throw SIGNAL switch to CW and see that BEAT OSCILLATOR knob is exactly on zero. If tone in headphones (or speaker) is not very low in pitch, readjust th trimmer condenser near the bottom of T5 until such is the case. In case the BFO is i perfect alignment when this test is made, n sound will be heard since the test oscillator an the BFO will be oscillating at the same fr quency and consequently there will be n audible difference or "beat" note to be heard This condition may be determined by turnin the BEAT OSCILLATOR control knob slightl off 0 toward one side or the other. If suc movement results in an audible tone rising i pitch as the pointer is turned away from 0 o either side, the BFO is perfectly aligned.

e. HF OSCILLATOR CALIBRATION CHECK —The accuracy of the main dial calibratio depends solely on the HF oscillator frequency which in the Super-Pro is 465 kc (the IF higher than the signal frequency. For exampl when the receiver is tuned to a 10.0 mc signa the frequency of the HF oscillator must b 10.465 mc. While the frequency of the H oscillator can be measured directly if accurat frequency measuring equipment is available, i is far simpler to check it by tuning in signal of *known* frequency and noting the main dia readings. *Be sure* the band spread dial is se at 100 when making this test in the three high frequency bands.

(*1*) When it has been determined that the dia calibration is sufficiently in error to requir correction, this may be accomplished a follows: Reference to the alignment char (fig. 11) will show the location of the HF oscillator adjustments as well as the signal frequencies at which the settings should b made. If the 2.5 to 5.0 mc band is to b corrected the test oscillator may be accurately set to 2.5 mc and its second harmonic (if strong enough) used for th 5.0 mc end of the band. The output o the test oscillator should be unmodulated and the SIGNAL switch on the receiver turned to CW. The BEAT OSCILLATOR control should be at 0, the AUDIO GAIN at 10, the AVC-MANUAL switch on MANUAL, and the BAND WIDTH at

16. The output meter should be disconnected and headphones or loud speaker used to make the necessary adjustments by the "zero beat" method. The test oscillator should be connected to the antenna terminals for this test.

(2) Tune in the second harmonic at the 5.0 mc end of the dial to zero beat, noting the approximate dial error. Then turn the main dial slightly toward the 5.0 mc calibration line until the beat note rises to a high pitch. Do not turn the dial far enough to raise the beat note beyond audibility. With the alignment screw driver adjust the trimmer condenser designated HF OSC-5.0 mc until the beat note is again reduced to zero. Turn the main dial still further toward the 5.0 mc line and make a further adjustment of the trimmer condenser to return to zero beat. Repeat this process as many times as necessary to bring the dial to exactly 5.0 mc. While it is obvious that the main dial could be set at once on exactly 5.0 mc and the trimmer turned enough at one time to produce zero beat without further ado, the step-by-step method described above is recommended. Then tune in the 2.5 mc fundamental at the low frequency end of the dial and correct the calibration step-by-step as before using the inductance trimming adjustment designated HF OSC-2.5 mc in fig. 11. When the second harmonic is again tuned in at the other end of the dial, it will be found that the adjustment of the inductance at 2.5 mc has disturbed the correction previously made at 5.0 mc. This is perfectly normal, as an adjustment at one end of the dial also affects the other end of the band. It is therefore necessary to go back and forth several times from 2.5 to 5.0 mc in order to bring both ends of the dial scale into exact agreement with the signal frequency.

(3) During the above process great care should be taken to properly adjust the SENSITIVITY control to avoid overloading or "freak" reception due to excessive signal input.

f. RF AND 1st DETECTOR ALIGNMENT.—Although the alignment of these three circuits (1st and 2nd RF and 1st Det) can be checked simultaneously with the HF oscillator, it is simpler to consider them as separate operations. Efficient weak signal reception with low receiver noise level and high image rejection ratios depends on the *relative* alignment of these three circuits with respect to the HF oscillator, *without* regard to calibration accuracy. As long as these circuits are adjusted to resonate at a frequency 465 kc lower than that of the HF oscillator, optimum results will be obtained.

(*1*) Accurate calibration of the test oscillator is not required to check these adjustments. Modulation of the oscillator, while convenient, is not strictly necessary. The input to the antenna terminals should be through 100 ohms (approximate) including the output resistance of the oscillator. If the test oscillator is modulated the receiver controls should be set as for IF alignment—if unmodulated, set BEAT OSCILLATOR knob to 2 (on either side) and throw SIGNAL switch to CW. SENSITIVITY should be adjusted to produce a half-scale reading on output meter when signals are exactly in tune.

(2) Starting with the 2.5 to 5.0 mc band, set the main dial at 5.0 mc (band spread dial at 100) and adjust the frequency of the test oscillator for peak deflection of the output meter. Then check the setting of the trimmer marked 1st DET and 5.0 mc in the center row of adjustments shown in fig. 11. Repeat this procedure on trimmers indicated as 2nd RF and 1st RF in the same row. If readjustment of one of these settings results in a material increase in output meter reading, the SENSITIVITY should be slightly altered to reduce the reading to half-scale. After each adjustment check the tuning of the receiver to make sure the test signal is still accurately

tuned (the band spread dial may be used as a vernier for this purpose in the three high frequency bands). This precaution is extremely important at the high end of the 10-20 mc band where there is some slight interaction between the 1st DET and HF OSC circuits. After checking the three trimmers at the high end of this band, turn the main dial to 2.5 mc and retune the test oscillator to suit. Then check the three inductance adjuster settings marked 2.5 mc in the same row. Since adjustments at one end of a band also affect the other end of the band, as described under HF OSC alignment, it will be necessary to repeat the above procedure until no further improvement can be secured. The number of repetitions necessary will depend on how much mistuning existed to start with. The remaining bands may be checked in the same manner.

(3) For maximum possible efficiency with a particular antenna arrangement, the 1st RF circuits may be adjusted without disconnecting it. This can be accomplished by loosely coupling the output of the test oscillator to the antenna system instead of directly to the antenna terminals through a 100 ohm resistor. Make sure that the signal from the test oscillator actually reaches the receiver via the antenna rather than by some form of direct coupling.

(4) In all the foregoing tests using output meter readings for circuit adjustment, it is recommended that headphones (or speaker) be used to monitor the signal. In this way false adjustments due to overloading, spurious responses, or other "freaks" may be avoided.

TUBE SOCKET VOLTAGES

Socket No.	Tube No.	VOLTS AT SOCKET TERMINAL NUMBER*					
		3	4	5	6	7	8
X1A	V1A	+250	+135		+135	6.3AC	0
X2A	V2A	+250	+135		+135	6.3AC	0
X3A	V3A	+250	+115			6.3AC	0
X4A	V4A	+150**	+150**	+150**		6.3AC	
X5A	V5A	+250	+135	0		6.3AC	0
X6A	V6A	0	−43	0	+135	6.3AC	+250
X7A	V7A	0	−1.5	0	+100	6.3AC	+240
X8A	V8A	−.2	+.4	−.2		6.3AC	+.4
X9A	V9A	+.4	0	0	+.4	4.0AC	−.2
X10A	V10A	0		0	+40	6.3AC	+155
X11A	V11A	0	−1.5	0	+110	6.3AC	+240
X12A	V12A	−3.2	−3.2	−3.2		6.3AC	−3.2
X13A	V13A	+110			−3.2	6.3AC	0
X14A	V14A	+240	+240		−20	6.3AC	0
X15A	V15A	+380	+380	0		6.3AC	+38
X16A	V16A	+380	+380	0		6.3AC	+38

* Terminals 1 and 2 of all sockets are at zero potential with respect to chassis.

** Varies widely with different tubes; also with dial setting.

The above voltage readings are based on an AC line voltage exactly equal to the primary tap on the power transformer—higher or lower line voltage should result in corresponding variations in these readings.

All DC readings are based on the use of a meter having a resistance of 1000 ohms per volt, and are taken between socket terminals and chassis.

SENSITIVITY and AUDIO GAIN should be set at 0.

MOD-CW switch should be on CW.

AVC-MANUAL switch should be on MANUAL.

SEND-REC switch should be on REC.

LIMITER switch should be ON.

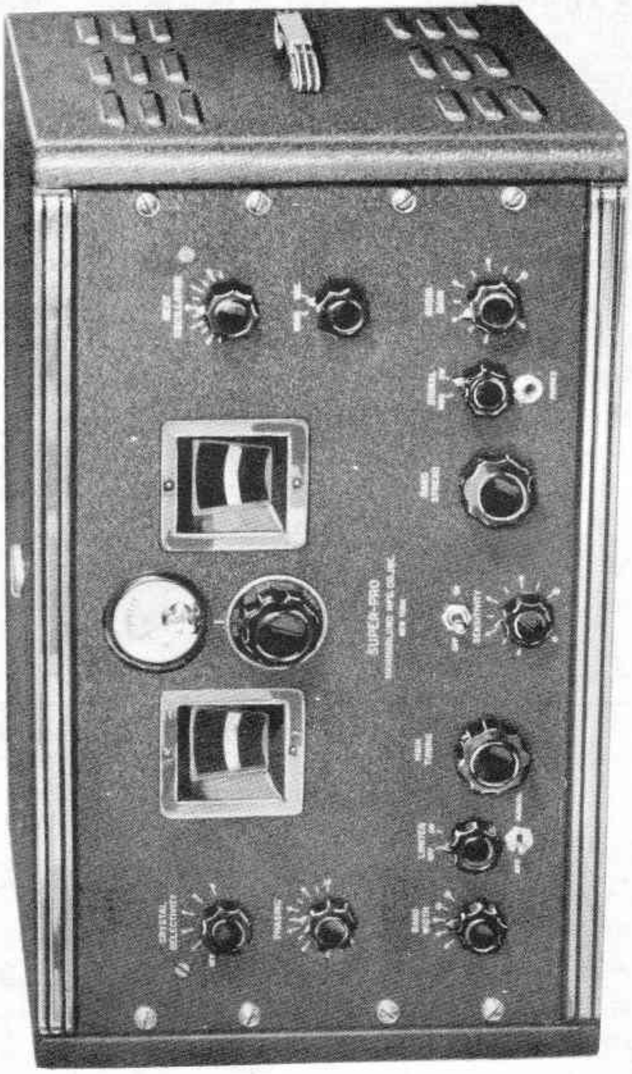


Fig. 1. Front view radio receiver table model

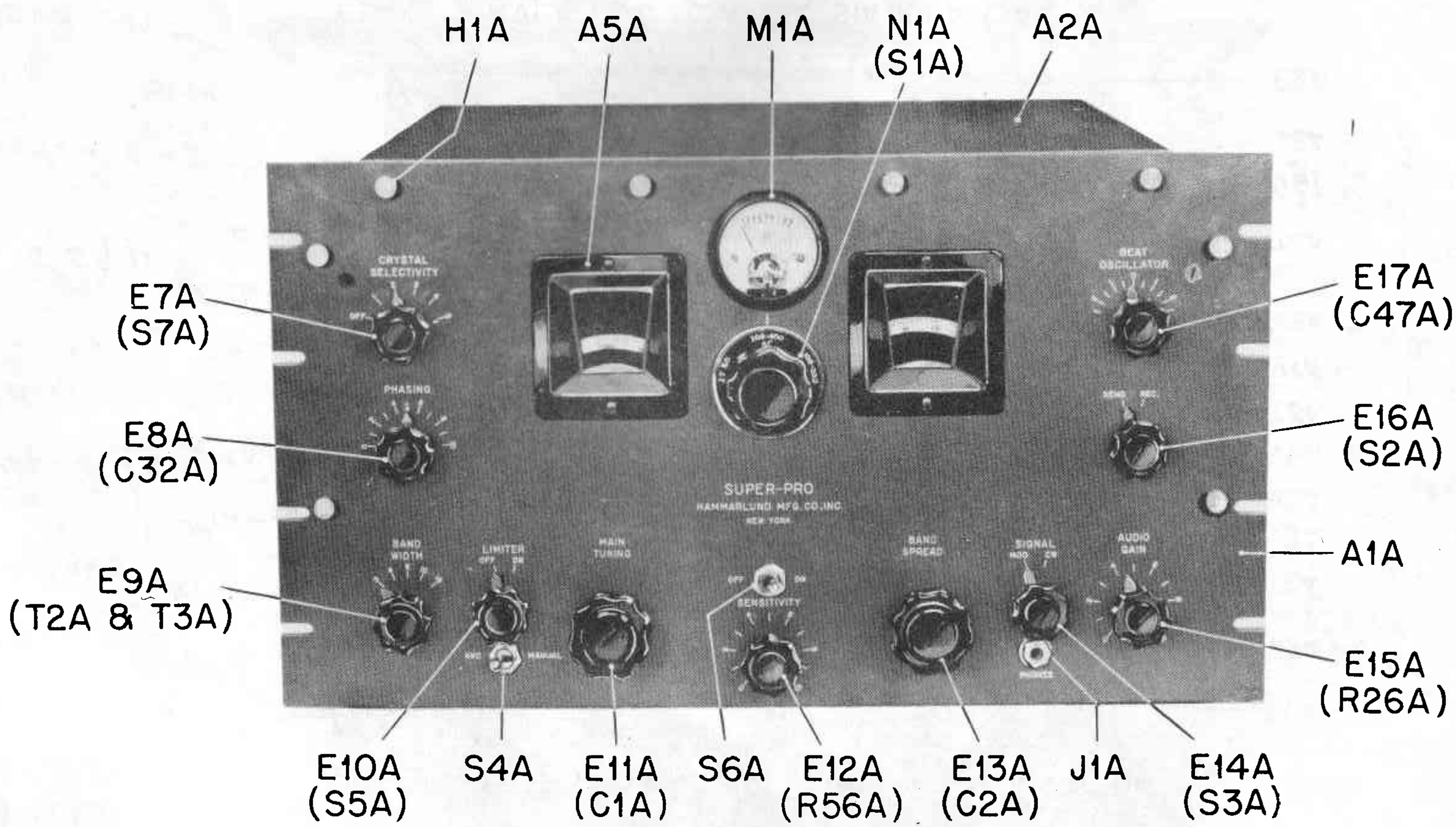


Fig. 2. Front view radio receiver rack model

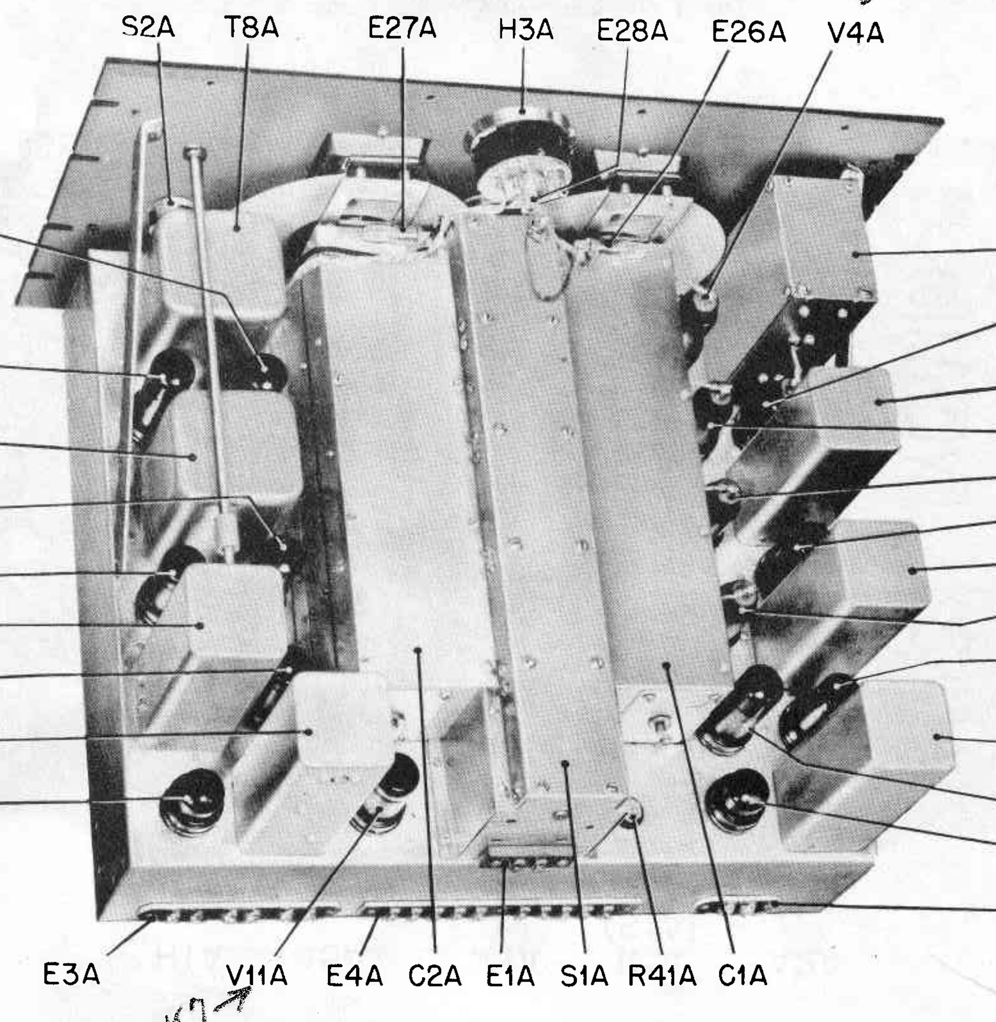


Fig. 3. Inside view radio receiver

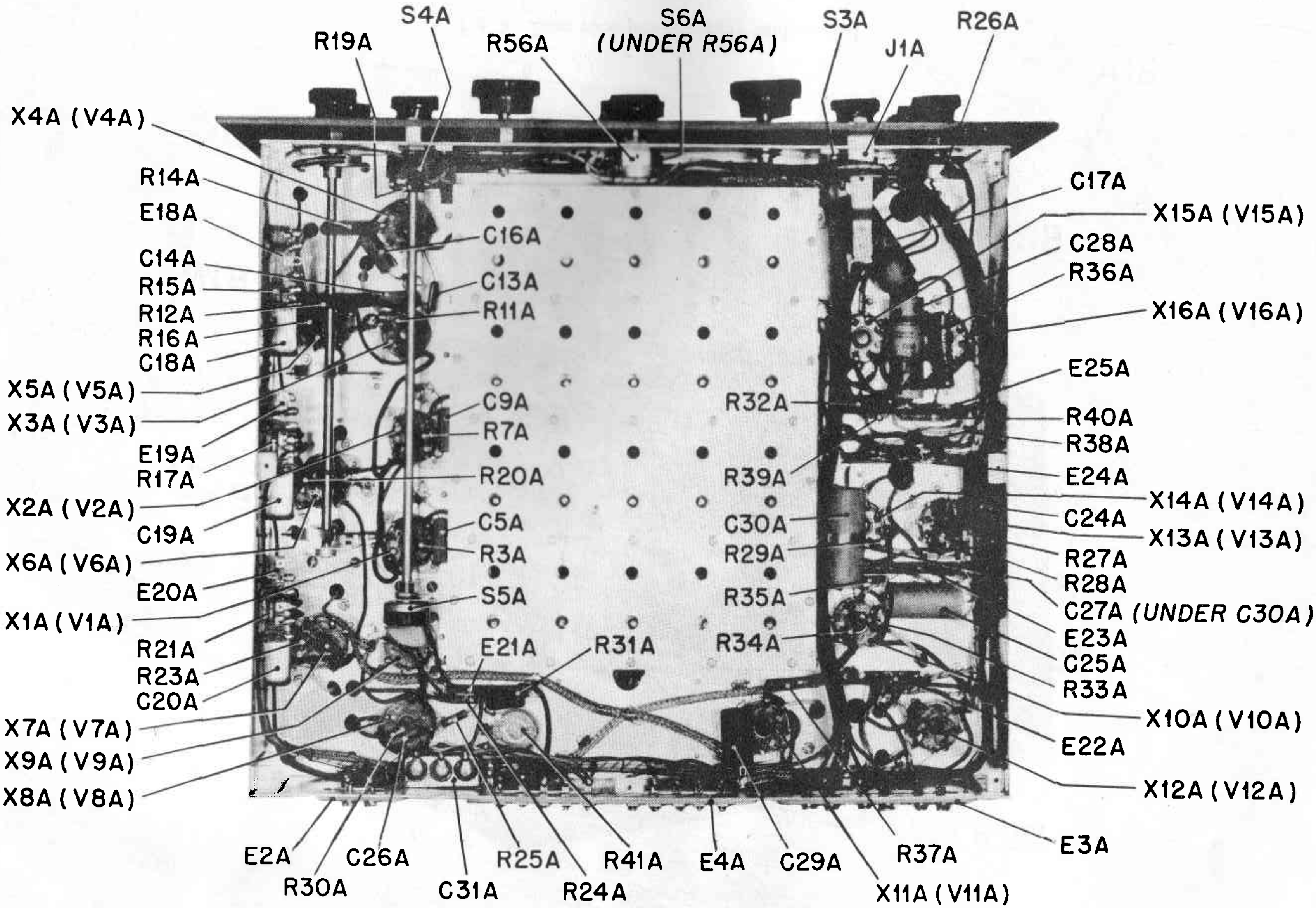


Fig. 4. Bottom view radio receiver

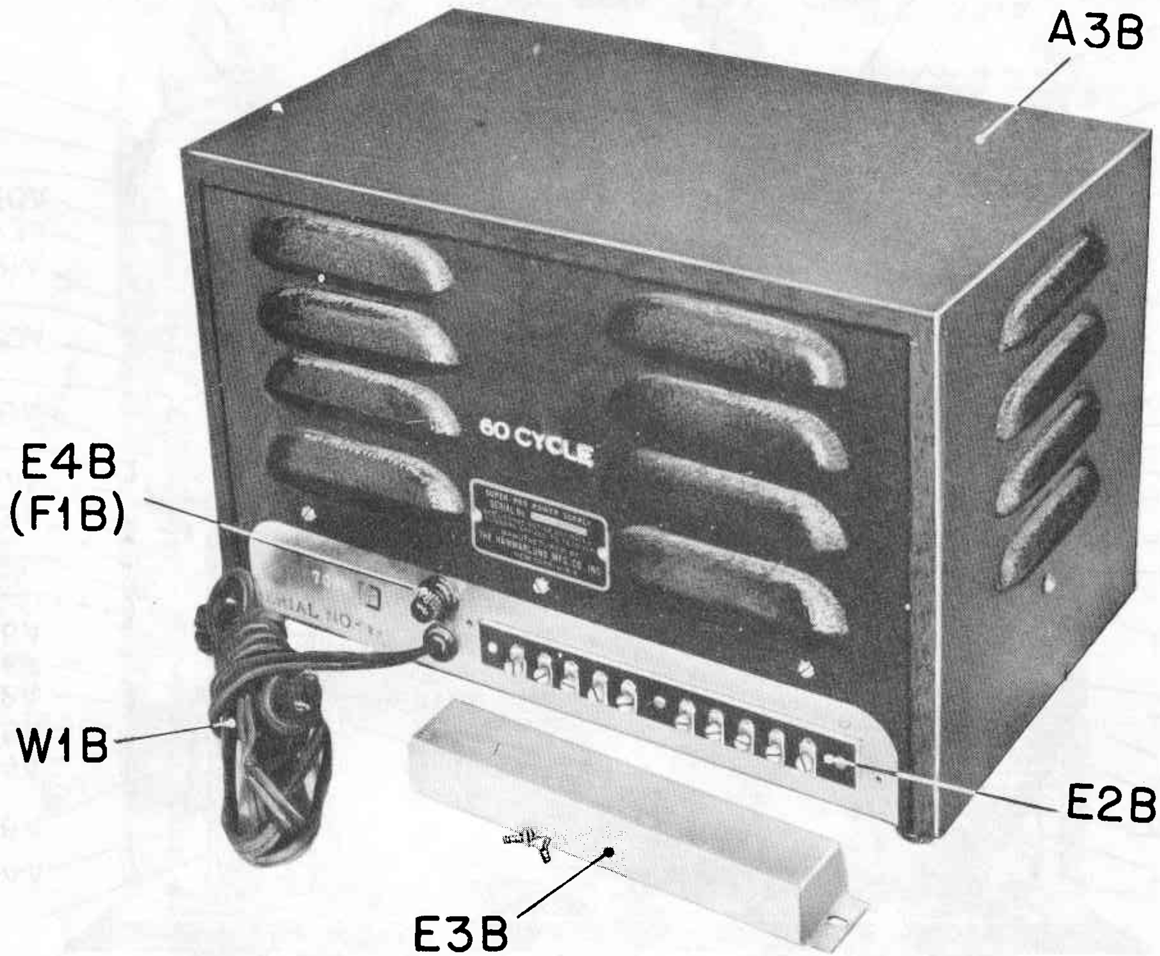


Fig. 5. Rear view power supply table model

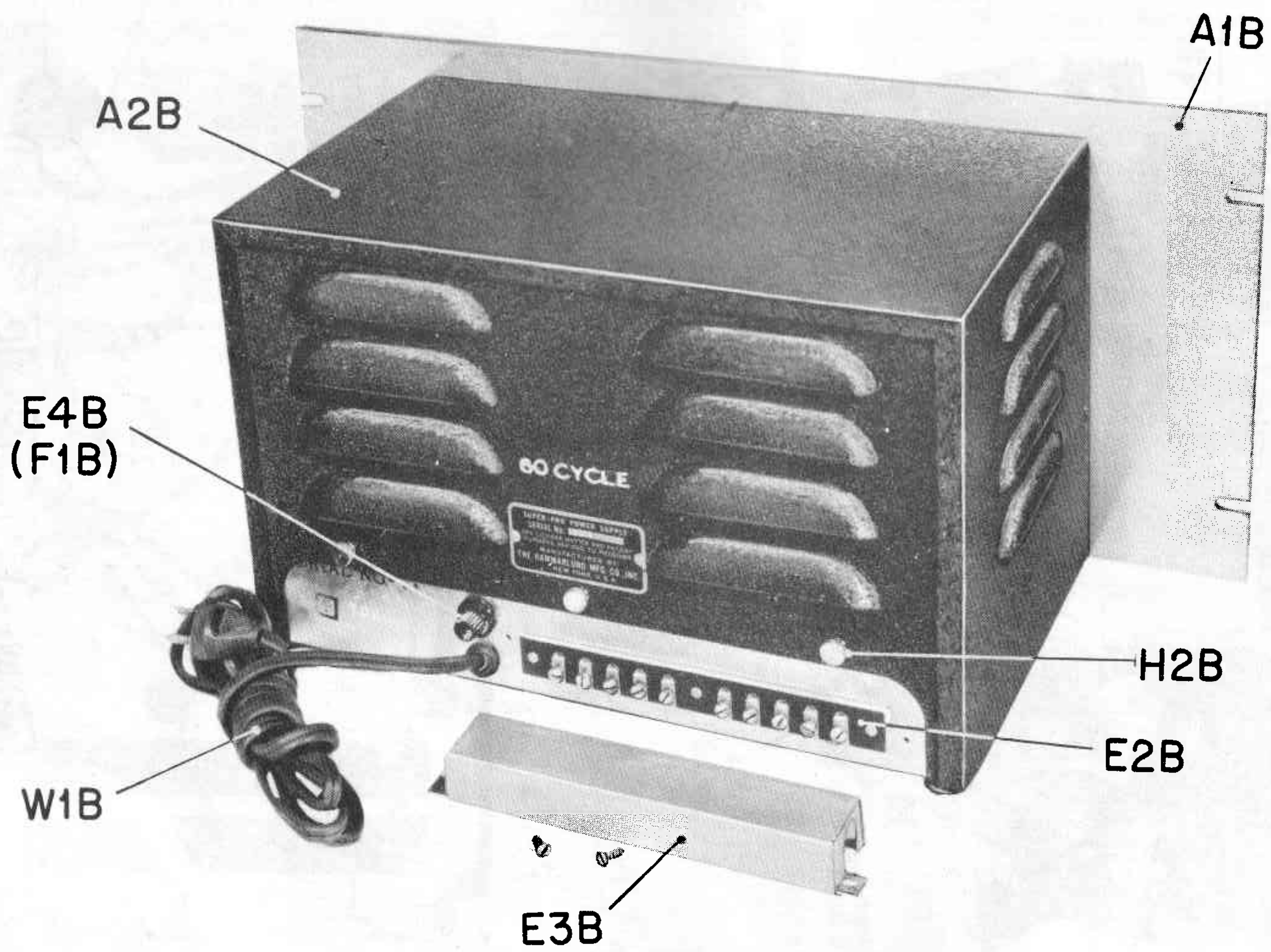


Fig. 6. Rear view power supply rack model

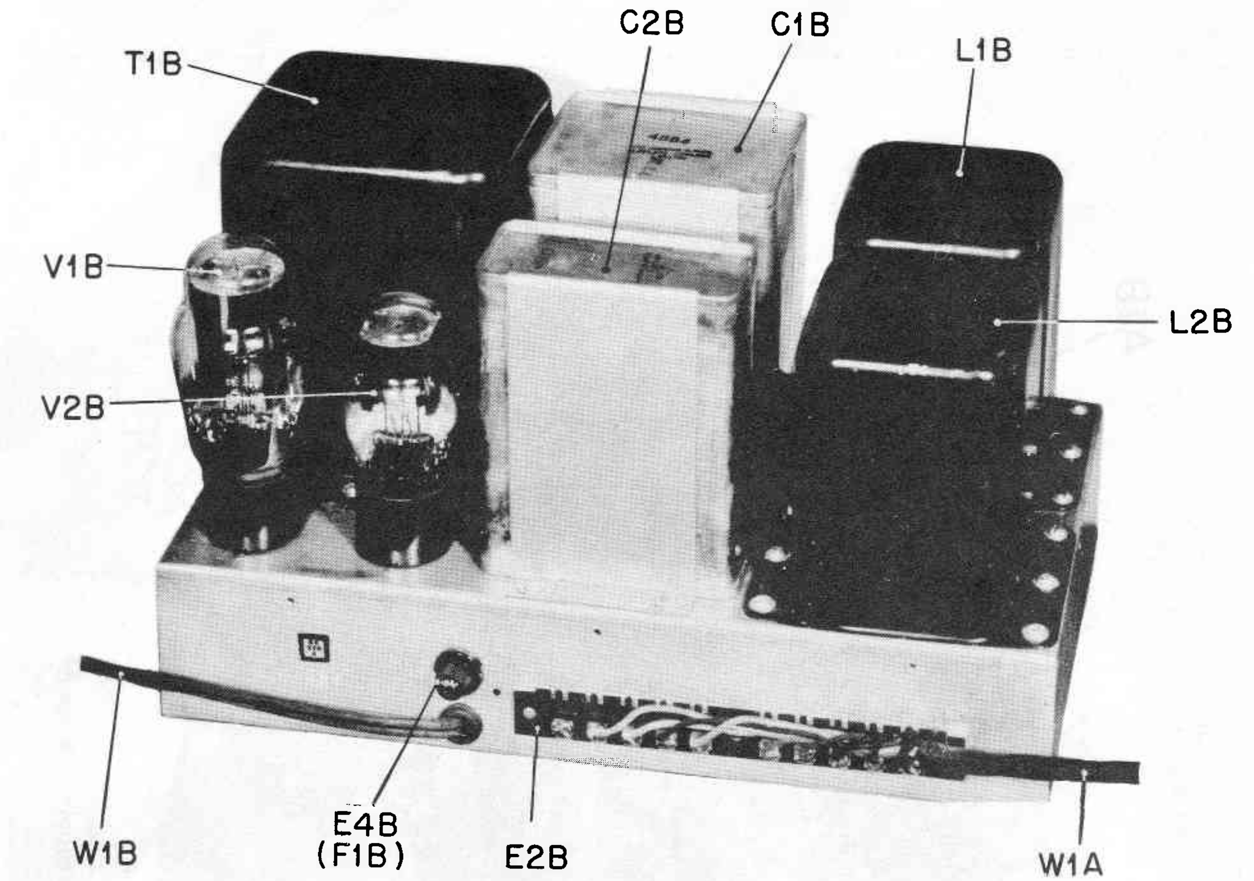


Fig. 7. Inside view power supply

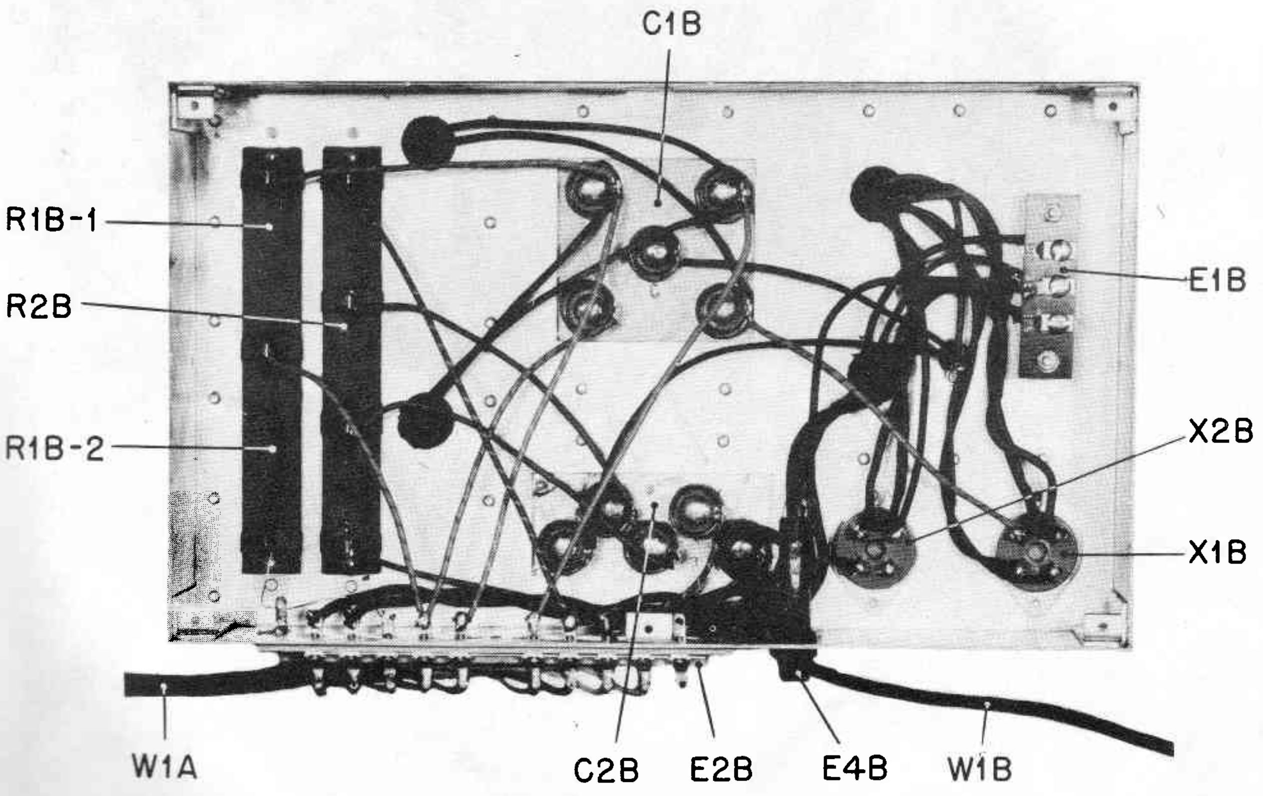


Fig. 8. Bottom view power supply

PARTS LIST—RECEIVER
(100–400 kc and 2.5–20 mc)

Symbol		NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
A1A		Front Panel, receiver	19″ wide, 10½″ high, ⅛″ thick	5063	9	5063	
A2A		Dust Cover, receiver (Rack Model only)	Black wrinkle-finished steel	2897	9	2897	
A3A		Cabinet, receiver (Table Model only)	Black wrinkle-finished steel, chromium trim	4902	25		
A4A		Handle, cabinet (Table Model only) 2 required	Black enameled steel, chromium trim	6032	19	X-2818-4¾″	
A5A		Dial escutcheon (Main and Band Spread) 2 required	Black enameled brass	2957	26		
		* * *	* * *				
C1A		Capacitor, Main Tuning (in Tuning Unit)	4 section (4 stators) variable condenser		9		
		1st R.F. grid tuning	(Integral part of Tuning Unit)				
		2nd R.F. grid tuning					
	1	1st Det. grid tuning					
	2	H.F. Osc. grid tuning					
C2A	3	Capacitor, Band Spread Tuning (in Tuning Unit)	4 section (12 stators) variable condenser		9		
	4	1st R.F. grid band spread	(Integral part of Tuning Unit)				
		2nd R.F. grid band spread					
	1	1st Det. grid band spread					
	2	H.F. Osc. grid band spread					
C3A	3	Capacitor, 1st R.F. grid coupling (in Tuning Unit)	600 mmf. molded mica	6073	6	5W	
C4A	4	Capacitor, 1st R.F. grid by-pass (in Tuning Unit)	.01 mfd. molded mica	4886	6	3WLS	
C5A		Capacitor, 1st R.F. screen by-pass	Same as C4A				
C6A		Capacitor, 1st R.F. plate by-pass (in Tuning Unit)	Same as C4A				
C7A		Capacitor, 2nd R.F. grid coupling (in Tuning Unit)	Same as C3A				
C8A		Capacitor, 2nd R.F. grid by-pass (in Tuning Unit)	Same as C4A				
C9A		Capacitor, 2nd R.F. screen by-pass	Same as C4A				
C10A		Capacitor, 2nd R.F. plate by-pass (in Tuning Unit)	Same as C4A				
C11A		Capacitor, 1st Det. signal grid coupling (in Tuning Unit)	Same as C3A				
C12A		Capacitor, 1st Det. grid by-pass (in Tuning Unit)	Same as C4A				
C13A		Capacitor, 1st Det. oscillator grid coupling	95 mmf. molded silvered mica	6195	6	5R	
C14A		Capacitor, 1st Det. screen by-pass	Same as C4A				
C15A		Capacitor, H.F. Osc. grid coupling (in Tuning Unit)	50 mmf. molded silvered mica	6074	6	5R	
C16A		Capacitor, H.F. Osc. plate by-pass	Same as C4A				
C17A		Capacitor, extra A.V.C. timing for C.W. reception	.25 mfd. paper in oil-filled metal can	4892	15	Type 689	
C18A		Capacitor,	3 x .05 mfd. paper in oil-filled metal can	4891	15	Type 630	
	1	1st Det. plate by-pass					
	2	Common grid return by-pass					
	3	1st I.F. screen by-pass					
C19A		Capacitor,	Same as C18A				
	1	1st I.F. plate by-pass					
	2	2nd I.F. grid by-pass					
	3	2nd I.F. screen by-pass					
C20A		Capacitor	Same as C18A				
	1	2nd I.F. plate by-pass					
	2	3rd I.F. grid by-pass					
	3	3rd I.F. screen by-pass					
C21A		Capacitor, Crystal filter plate coil tuning (in T1A)	120 mmf. molded silvered mica	6179	6	5R	
C22A		Capacitor, Crystal filter plate coil center tapping (in T1A)	100 mmf. molded mica	6172	6	5W	
C23A		Capacitor, Crystal filter plate coil center tapping (in T1A)	Same as C22A				
C24A		Capacitor, 1st A.F. grid coupling	.02 mfd. paper in oil-filled metal can	4894	15	Type 689	
C25A		Capacitor, 2nd A.F. grid coupling	.05 mfd. paper in oil-filled metal can	4893	15	Type 689	
C26A		Capacitor, 2nd Det. Cathode by-pass	50 mmf. molded mica	6199	6	5W	
C27A		Capacitor, Beat oscillator plate by-pass	Same as C25A				
C28A		Capacitor, 3rd A.F. cathode by-pass	40 mfd. 150V dry electrolytic	6171	15	Type PRS	

PARTS LIST—RECEIVER (Cont.)

(100–400 kc and 2.5–20 mc)

Symbol		NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
C29A		Capacitator, AVC amplifier screen by-pass	Same as C25A				
C30A		Capacitator, 3 Volt "C" bias by-pass	Same as C17A				
C31A		Capacitator,	2×.25 mfd. paper in oil-filled metal can	4890	6	DYR-6022	
	1	"B" plus 250V by-pass					
	2	"B" plus 100V by-pass					
C32A		Capacitor, Crystal filter phasing (in T1A)	Variable, opposed stator type	SA-179	9	SA-179	
C33A		Capacitor, Crystal Filter grid coil tuning (in T1A)	85 mmf. molded silvered mica	6180	6	5R	
C34A		Capacitor, 1st I.F. grid by-pass (in T1A)	Same as C4A				
C35A		Capacitor, Crystal filter phasing trimmer (in T1A)	Adjustable mica trimmer 1.5 to 5 mmf.	6189	9	6189	
C36A		Capacitor, 1st I.F. plate tuning (in T2A)	Air dielectric adjustable trimmer	SA-1	9	SA-1	
C37A		Capacitor, 2nd I.F. grid tuning (in T2A)	Same as C36A				
C38A		Capacitor, 2nd I.F. plate tuning (in T3A)	Same as C36A				
C39A		Capacitor, 3rd, I.F. grid tuning (in T3A)	Same as C36A				
C40A		Capacitor, 3rd I.F. plate tuning (in T4A)	Same as C36A				
C41A		Capacitor, Beat oscillator coupling (in T4A)	5½ mmf. molded silvered mica	6151	6	5R	
C42A		Capacitor, Noise limiter timing (in T4A)	Same as C25A				
C43A		Capacitor, 3rd I.F. plate by-pass (in T4A)	Same as C4A				
C44A		Capacitor, 2nd Det. R.F. by-pass (in T4A)	Same as C26A				
C45A		Capacitor, 2nd Det. R.F. by-pass (in T4A)	Same as C26A				
C46A		Capacitor, Beat oscillator tuning (in T5A)	Air dielectric adjustable trimmer	SA-197	9	SA-197	
C47A		Capacitor, Beat oscillator vernier tuning (in T5A)	Air dielectric variable	SA-170	9	SA-170	
C48A		Capacitor, Beat oscillator parallel padding (in T5A)	Same as C13A				
C49A		Capacitor, Beat oscillator plate blocking (in T5A)	Same as C3A				
C50A		Capacitor, Beat oscillator grid coupling (in T5A)	Same as C22A				
C51A		Capacitor, AVC amplifier plate tuning (in T6A)	Same as C36A				
C52A		Capacitor, AVC diode load R.F. by-pass (in T6A)	.005 mfd. molded mica	6194	6	1W	
C53A		Capacitor, AVC amplifier plate by-pass (in T6A)	Same as C4A				
C54A		Capacitor, AVC diode load filter (in T6A)	Same as C4A				
C55A		Capacitor, AVC diode load filter (in T6A)	Same as C4A				
C56A		Capacitor, AVC Timing (in T6A)	Same as C25A				
		* * *	* * *				
E1A		Terminal Strip, Antenna	Bakelite, two screw terminals	3842	12	No. 6 (Special)	
E2A		Terminal Strip, "Send-Receive" relay	Bakelite, two screw terminals	4904	12	No. 50	
E3A		Terminal Strip, "phono," "spkr," "phones"	Bakelite, six screw terminals	4905	12	No. 50	
E4A		Terminal Strip, power supply connector	Bakelite, ten screw terminals	3838	12	No. 6 (special)	
E5A		Cover, E2A terminal strip	.031″ sheet steel, cadmium plated	2829	9	2829	
E6A		Cover, E4A terminal strip	.031″ sheet steel, cadmium plated	2813	9	2813	
E7A		Control knob, Crystal filter selectivity	Black bakelite, with pointer, 1⅛″ dia.	SA-86	9	SA-86	
E8A		Control knob, Crystal filter phasing	Same as E7A				
E9A		Control knob, Variable coupling I.F. transformers	Same as E7A				
E10A		Control knob, Limiter switch	Same as E7A				
E11A		Control knob, Main tuning	Black bakelite, 1⅝″ dia.	3856	14	S-309-3	
E12A		Control knob, R.F. and I.F. sensitivity	Same as E7A				
E13A		Control knob Band Spread tuning	Same as E11A				
E14A		Control knob "Mod" "CW" switch	Same as E7A				
E15A		Control knob, A.F. gain	Same as E7A				
E16A		Control knob, "Send" "Receive" switch	Same as E7A				
E17A		Control knob, Beat oscillator pitch	Same as E7A				
E18A		Terminal Strip	Bakelite, metal base, 6 lugs	6153	12	No. 2006	
E19A		Terminal Strip	Same as E18A				
E20A		Terminal Strip	Same as E18A				

PARTS LIST—RECEIVER (Cont.)

(100–400 kc and 2.5–20 mc)

Symbol	NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
E21A	Terminal Strip	Same as E18A				
E22A	Terminal Strip	Bakelite, metal base, 4 lugs	6152	12	No. 2004	
E23A	Terminal Strip	Bakelite, metal base, 9 lugs	4885	12	No. 2009	
E24A	Terminal Strip	Same as E23A				
E25A	Terminal Strip	Same as E23A				
E26A	Dial lamp socket and bracket—Main tuning dial	Miniature socket on angle bracket	2978	16	VB-13762–SUB 0	
E27A	Dial lamp socket and bracket—Band spread dial	Same as E26A				
E28A	Tuning meter lamp socket	Special bayonet type		3		
	* * *	* * *				
H1A	Knurled Cap Nut, dust cover (8 required for Rack Model only)	Brass, nickel plated, tapped 8-32	2951	9	2951	
H2A	Knurled Cap Screw, dust cover (3 required for Rack Model only)	Brass, nickel plated, threaded 6-32	2952	9	2952	
H3A	Clamp, tuning meter	Brass, nickel plated, ring type	3926	17	D-54108	
	* * *	* * *				
I1A	Dial Lamp, Main tuning	6-8V, .15 amp. miniature screw base	3920	8	No. 40	
I2A	Dial Lamp, Band spread	Same as I1A				
I3A	Tuning Meter Lamp	6-8V, .15 amp. bayonet base	6036	8	No. 47	
	* * *	* * *				
J1A	Jack, headphone	Open circuit, long frame	3892	16	No. 1	
	* * *	* * *				
L1A	Antenna Primary Coil Assembly, 10.0–20.0 mc		SA-46	9	SA-46	
L2A	Antenna Primary Coil Assembly, 5.0–10.0 mc		SA-47	9	SA-47	
L3A	Antenna Primary Coil Assembly, 2.5– 5.0 mc		SA-48	9	SA-48	
L4A	Antenna Primary Coil Assembly, 200–400 kc		SA-161	9	SA-161	
L5A	Antenna Primary Coil Assembly, 100–200 kc		SA-162	9	SA-162	
L6A	1st R.F. Grid Coil Assembly, 10.0–20.0 mc		SA-110	9	SA-110	
L7A	1st R.F. Grid Coil Assembly, 5.0–10.0 mc		SA-113	9	SA-113	
L8A	1st R.F. Grid Coil Assembly, 2.5– 5.0 mc		SA-116	9	SA-116	
L9A	1st R.F. Grid Coil Assembly, 200–400 kc		SA-160	9	SA-160	
L10A	1st R.F. Grid Coil Assembly, 100–200 kc		SA-159	9	SA-159	
L11A	1st R.F. Transformer Assembly, 10.0–20.0 mc		SA-111	9	SA-111	
L12A	1st R.F. Transformer Assembly, 5.0–10.0 mc		SA-114	9	SA-114	
L13A	1st R.F. Transformer Assembly, 2.5– 5.0 mc		SA-117	9	SA-117	
L14A	1st R.F. Transformer Assembly, 200–400 kc		SA-157	9	SA-157	
L15A	1st R.F. Transformer Assembly, 100–200 kc		SA-158	9	SA-158	
L16A	2nd R.F. Transformer Assembly, 10.0–20.0 mc	Same as L11A				
L17A	2nd R.F. Transformer Assembly, 5.0–10.0 mc	Same as L12A				
L18A	2nd R.F. Transformer Assembly, 2.5– 5.0 mc	Same as L13A				
L19A	2nd R.F. Transformer Assembly, 200–400 kc	Same as L14A				
L20A	2nd R.F. Transformer Assembly, 100–200 kc	Same as L15A				
L21A	H.F. Oscillator Coil Assembly, 10.0–20.0 mc.		SA-112	9	SA-112	
L22A	H.F. Oscillator Coil Assembly, 5.0–10.0 mc		SA-115	9	SA-115	
L23A	H.F. Oscillator Coil Assembly, 2.5– 5.0 mc		SA-118	9	SA-118	
L24A	H.F. Oscillator Coil Assembly, 200–400 kc		SA-155	9	SA-155	
L25A	H.F. Oscillator Coil Assembly, 100–200 kc		SA-156	9	SA-156	
L26A	Coil, Crystal filter plate (in T1A)	Universal, 7/41 Litz., Iron dust core	6146	23		
L27A	Coil, Crystal filter grid (in T1A)	Universal, 7/41 Litz., Iron dust core	6147	23		
L28A	Coil, 1st I.F. plate tuning (in T2A)	3 pie universal on isolantite core, 7/41 Litz.	2903-A	9	2903-A	
L29A	Coil, 2nd I.F. grid tuning (in T2A)	3 pie universal, 7/41 Litz., tapped 30 turns from finish	3990	9	3990	

PARTS LIST—RECEIVER (Cont.)

(100–400 kc and 2.5–20 mc)

Symbol	NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
L30A	Coil, 2nd I.F. plate tuning (in T3A)	Same as L28A				
L31A	Coil, 3rd I.F. grid tuning (in T3A)	Same as L29A				
L32A	Coil, 2nd Det. input (in T4A)	Universal on isolantite core, 7/41 Litz.	4907	9	4907	
L33A	Coil, Beat oscillator tuning (in T5A)	3 pie universal, 7/41 Litz., tapped between 1st and 2nd pies	2931	9	2931	
L34A	Coil, AVC diode input (in T6A)	Universal on isolantite core, 7/41 Litz.	4906	9	4906	
	* * *	* * *				
M1A	Meter, tuning and "S"	2" flush mounting	4903	3		
	* * *	* * *				
N1A	Knob and dial, Band switch	Black bakelite knob with etched aluminum dial	SA-163	9	SA-163	
	* * *	* * *				
R1A	Resistor, 1st R.F. grid coupling (in Tuning Unit)	500,000 ohms, 1/3 watt, metallized	4959	10	F-1/3	
R2A	Resistor, 1st R.F. grid filter (in Tuning Unit)	10,000 ohms, 1/2 watt, metallized	6165	10	BT-1/2	
R3A	Resistor, 1st R.F. screen filter	2,000 ohms, 1/2 watt, metallized	6160	10	BT-1/2	
R4A	Resistor, 1st R.F. plate filter (in Tuning Unit)	Same as R3A				
R5A	Resistor, 2nd R.F. grid coupling (in Tuning Unit)	Same as R1A				
R6A	Resistor, 2nd R.F. grid filter (in Tuning Unit)	Same as R2A				
R7A	Resistor, 2nd R.F. screen filter	Same as R3A				
R8A	Resistor, 2nd R.F. plate filter (in Tuning Unit)	Same as R3A				
R9A	Resistor, 1st Det. grid coupling (in Tuning Unit)	Same as R1A				
R10A	Resistor, 1st Det. grid filter (in Tuning Unit)	Same as R2A				
R11A	Resistor, 1st Det. oscillator grid	50,000 ohms, 1/3 watt, metallized	4960	10	F-1/3	
R12A	Resistor, 1st Det. screen filter	25,000 ohms, 2 watt, metallized	3999	10	BT-2	
R13A	Resistor, H.F. oscillator grid (in Tuning Unit)	Same as R11A				
R14A	Resistor, H.F. oscillator plate filter	12,000 ohms, 2 watt, metallized	4840	10	BT-2	
R15A	Resistor, 1st Det. plate filter	Same as R3A				
R16A	Resistor, 1st I.F. screen filter	Same as R3A				
R17A	Resistor, 1st I.F. plate filter	Same as R3A				
R18A	Resistor, 2nd I.F. grid filter	Same as R2A				
R19A	Resistor, "AVC-MAN" shunt	2,000,000 ohms, 1/2 watt, metallized	4920	10	BT-1/2	
R20A	Resistor, 2nd I.F. screen filter	Same as R3A				
R21A	Resistor, 2nd I.F. plate filter	Same as R3A				
R22A	Resistor, 3rd I.F. grid filter	Same as R2A				
R23A	Resistor, 3rd I.F. screen filter	50,000 ohms, 1 watt, metallized	6166	10	BT-1	
R24A	Resistor, 2nd Det. diode load	75,000 ohms, 1/2 watt, metallized	4914	10	BT-1/2	
R25A	Resistor, 2nd Det. diode load	50,000 ohms, 1/2 watt, metallized	6075	10	BT-1/2	
R26A	Resistor, A.F. gain control	250,000 ohms, variable potentiometer, taper "B"	4919	10	9801-6452 SUB 1	
R27A	Resistor, 1st A.F. grid coupling	500,000 ohms, 1/2 watt, metallized	6076	10	BT-1/2	
R28A	Resistor, 1st A.F. plate coupling	Same as R23A				
R29A	Resistor, 2nd A.F. grid coupling	Same as R27A				
R30A	Resistor, 2nd Det. cathode bias	250,000 ohms, 1/2 watt, metallized	4912	10	BT-1/2	
R31A	Resistor, Noise limiter heater series dropping	4 ohms, 5 Watt, wire wound	4921	10	AA-3	
R32A	Resistor, Dial and meter lamps series dropping	Same as R31A				
R33A	Resistor, Beat Oscillator screen supply	Same as R27A				
R34A	Resistor, Beat Oscillator plate supply	Same as R25A				
R35A	Resistor, Beat Oscillator filter	5000 ohms, 1/2 watt, metallized	4814	10	BT1/2	
R36A	Resistor, 3rd A.F. cathode bias	750 ohms, 10 watts, wire wound	3836	18	10-V W Q	
R37A	Resistor, AVC amplifier screen filter	Same as R23A				

PARTS LIST—RECEIVER (Cont.)

(100–400 kc and 2.5–20 mc)

Symbol		NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
R38A		Resistor, "C" bias voltage divider (on E24A)	300 ohms, ½ watt, metallized	6169	10	BT-½	
R39A		Resistor, "C" bias voltage divider (on E25A)	1700 ohms, ½ Watt, metallized	4947	10	BT-½	
R40A		Resistor, "C" bias voltage divider (on E25A)	3000 ohms, 1 Watt, metallized	3809	10	BT-1	
R41A		Resistor, "S" meter shunt	1000 ohms, wire wound potentiometer	4932	11	MH-1000	
R42A		Resistor, Crystal filter selectivity controlling (in T1A)	25 ohms, ½ Watt, metallized	6155	10	BW-½	
R43A		Resistor, Crystal filter selectivity controlling (in T1A)	50 ohms, ½ Watt, metallized	6170	10	BW½	
R44A		Resistor, Crystal filter selectivity controlling (in T1A)	Same as R38A				
R45A		Resistor, Crystal filter selectivity controlling (in T1A)	Same as R3A				
R46A		Resistor, 1st I.F. grid filter (in T1A)	Same as R2A				
R47A		Resistor, 3rd I.F. plate filter (in T4A)	Same as R3A				
R48A		Resistor, 2nd Det. diode load (in T4A)	100,000 ohms, ½ Watt, metallized	6135	10	BT½	
R49A		Resistor, Noise limiter timing (in T4A)	1,000,000 ohms, ½ Watt, metallized	6167	10	BT½	
R50A		Resistor, Beat Oscillator grid (in T5A)	Same as R48A				
R51A		Resistor, AVC amplifier plate filter (in T6A)	Same as R3A				
R52A		Resistor, AVC timing (in T6A)	Same as R49A				
R53A		Resistor, AVC diode load (in T6A)	25,000 ohms, ½ Watt, metallized	6198	10	BT½	
R54A		Resistor, AVC diode load (in T6A)	Same as R35A				
R55A		Resistor, AVC diode load (in T6A)	Same as R35A				
R56A		Resistor, Sensitivity control	50,000 ohm potentiometer, taper "A"	5023	10	9801–12607	
		* * *	* * *				
S1A		Switch, Band change (in Tuning Unit)	10 pole, 5 position (5 sections)		9		
	1	Antenna section	(Integral part of Tuning Unit)				
	2	1st R.F. grid section					
	3	1st R.F. plate and 2nd R.F. grid section					
	4	2nd R.F. plate and 1st det. grid section					
	5	H.F. oscillator grid and cathode section					
S2A		Switch, "Send-Receive"	SPST rotary snap switch	4917	11		
S3A		Switch, "CW-Modulation"	DPST rotary snap switch	4915	11		
S4A		Switch, "AVC-Manual"	DPDT toggle	2990	13		
S5A		Switch, Noise limiter	SPST rotary snap switch	4916	11		
S6A		Switch, power "off-on"	DPST toggle	2983	13		
S7A		Switch, Crystal filter selectivity (in T1A)	Wafer type, 6 positions	4911	20		
		* * *	* * *				
T1A		Quartz Crystal filter assembly		SA-178-A	9	SA-178-A	
T2A		1st I.F. transformer assembly (variable coupling)		SA-166	9	SA-166	
T3A		2nd I.F. transformer assembly (variable coupling)	Same as T2A				
T4A		2nd Detector diode input transformer assembly		SA-167-A	9	SA-167-A	
T5A		Beat oscillator assembly		SA-169	9	SA-169	
T6A		AVC diode input transformer assembly		SA-168-A	9	SA-168-A	
T7A		Push-pull input A.F. transformer	Class AB_2 driver trans. for triode-connected 6F6's	4887	5	4212-A	
T8A		Push-pull output A.F. transformer	Plates to 600 ohm load (8000 ohm monitoring secondary)	4888	5	4962-B	
		* * *	* * *				
V1A		1st R.F. amplifier	R.F. pentode, remote cut-off		21	6K7	
V2A		2nd R.F. amplifier	Same as V1A				
V3A		1st Detector (mixer)	Pentagrid Mixer		21	6L7	
V4A		H.F. Oscillator	R.F. pentode, sharp cut-off		21	6J7	
V5A		1st I.F. amplifier	Same as V1A				

PARTS LIST—RECEIVER (Cont.)

(100–400 kc and 2.5–20 mc)

Symbol	NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
V6A	2nd I.F. amplifier	R.F. pentode, remote cut-off, single ended		21	6SK7	
V7A	3rd I.F. amplifier	Same as V6A				
V8A	2nd Detector	Twin diode		21	6H6	
V9A	Noise limiter	Twin triode, class "B"		21	6N7	
V10A	Beat oscillator	R.F. pentode, sharp cut-off, single ended		21	6SJ7	
V11A	AVC amplifier	Same as V6A				
V12A	AVC rectifier	Same as V8A				
V13A	1st A.F. amplifier	Triode amplifier, class "A"		21	6C5	
V14A	2nd A.F. amplifier (driver)	Power Pentode		21	6F6	
V15A	3rd A.F. amplifier (push-pull output)	Same as V14A				
V16A	3rd A.F. amplifier (push-pull output)	Same as V14A				
	* * *	* * *				
W1A	Power Supply Connector Cable	9 wire, with two 10 terminal connector strips	SA-35	2	EH-1469	
W2A	Battery Connector Cable	8 wire, with one 10 terminal connector strip	SA-67	2	EH-1786	
	* * *	* * *				
X1A	Socket for V1A	Molded low-loss bakelite octal marked 6K7	5000	1	MIP-8-T	
X2A	Socket for V2A	Same as X1A				
X3A	Socket for V3A	Molded low-loss bakelite octal marked 6L7	5001	1	MIP-8-T	
X4A	Socket for V4A	Molded low-loss bakelite octal marked 6J7	5002	1	MIP-8-T	
X5A	Socket for V5A	Same as X1A				
X6A	Socket for V6A	Molded low-loss bakelite octal marked 6SK7	5003	1	MIP-8-T	
X7A	Socket for V7A	Same as X6A				
X8A	Socket for V8A	Molded low-loss bakelite octal marked 6H6	5005	1	MIP-8-T	
X9A	Socket for V9A	Molded low-loss bakelite octal marked 6N7	5006	1	MIP-8-T	
X10A	Socket for V10A	Molded low-loss bakelite octal marked 6SJ7	5004	1	MIP-8-T	
X11A	Socket for V11A	Same as X6A				
X12A	Socket for V12A	Same as X8A				
X13A	Socket for V13A	Molded low-loss bakelite octal marked 6C5	5007	1	MIP-8-T	
X14A	Socket for V14A	Molded low-loss bakelite octal marked 6F6	5008	1	MIP-8-T	
X15A	Socket for V15A	Same as X14A				
X16A	Socket for V16A	Same as X14A				
	* * *	* * *				
Y1A	Quartz Crystal (in T1A)	Resonator type, ground for 465 kc	4944	22		

PARTS LIST—POWER SUPPLY

Symbol		NAME OR FUNCTION	DESCRIPTION	Hammarlund Part No.	Mfgr.	Identification	NOTES
A1B		Front Panel, Power Supply (Rack Model only)	On 50-60 cycle models—19" wide, 8¾" high, ⅛" thick	5064	9	5064	
			On 25-60 cycle models—19" wide, 10½" high, ⅛" thick	5065	9	5065	
A2B		Dust Cover, Power Supply (Rack Model only)	On 50-60 cycle models—Black wrinkle-finished steel	2976	9	2976	
			On 25-60 cycle models—Black wrinkle-finished steel	5019	9	5019	
A3B		Cabinet, Power Supply (Table Model only)	On 50-60 cycle models—Black wrinkle-finished steel	2975	9	2975	
			On 25-60 cycle models—Black wrinkle-finished steel	5021	9	5021	
		* * *	* * *				
C1B		Capacitor, "B" supply filter	4 x 8 mfd. Dykanol (or equal) 600V DC	4884	6	PC-1936	
C2B		Capacitor, "C" supply filter	4 x 3 mfd. Dykanol (or equal) 600V DC	4883	6	PC-1937	
		* * *	* * *				
E1B		Terminal Strip, primary tap	On 50-60 cycle models—105-115-125 Volts	3858	12	No. 6	
E2B		Terminal Strip, Power Supply connector	Bakelite, 10 terminals	3838	12	No. 6	
E3B		Cover for terminal strip E2B	.031" sheet steel, cadmium plated	2813	9	2813	
E4B		Fuse Holder	Molded Bakelite, screw-type	4996	7	1075-A	
		* * *	* * *				
F1B		Power line fuse	2 amp., glass enclosed	3921	4	3AG	
		* * *	* * *				
H1B		Knurled Cap Nut (Rack Model only)	Same as H1A				
H2B		Knurled Cap Screw (Rack Model only)	Same as H2A				
		* * *	* * *				
L1B		First Filter Choke	Potted, 350 ohms, 20h at .160 amp.	4994	5	SPEC. 7410	
L2B		Second Filter Choke	Potted, 1150 Ohms, 50h at .100 amp.	4999	5	SPEC. 7393	
		* * *	* * *				
R1B		Resistor, "B" supply voltage divider	18,000 ohms, tapped at 9,500	4946	24		
	1	Screen voltage dropping resistor—8500 ohms					
	2	Screen voltage bleeder resistor—9500 ohms					
R2B		Resistor, "C" supply filter	24,000 ohms, tapped at 8,000 and 16,000 ohms	4882	24		
		* * *	* * *				
T1B		Power Transformer	On 50-60 cycle models—105,115,125 V	4998	5	SPEC. 7397	
			On 50-60 cycle models—210-230-250 V	5012	5		
			On 25-60 cycle models—105-115-125-225-250 V	5015	5		
		* * *	* * *				
V1B		"B" Supply rectifier tube	Full Wave Rectifier		21	5Z3	
V2B		"C" Supply rectifier tube	Full Wave Rectifier		21	80	
		* * *	* * *				
W1B		Power line cord and plug	2 conductor with plug	6143	2	POS-J	
		* * *	* * *				
X1B		Socket for V1B	Molded Bakelite, four prong, marked 5Z3	5009	1	M1P-4	
X2B		Socket for V2B	Molded Bakelite, four prong, marked 80	5010	1	M1P-4	

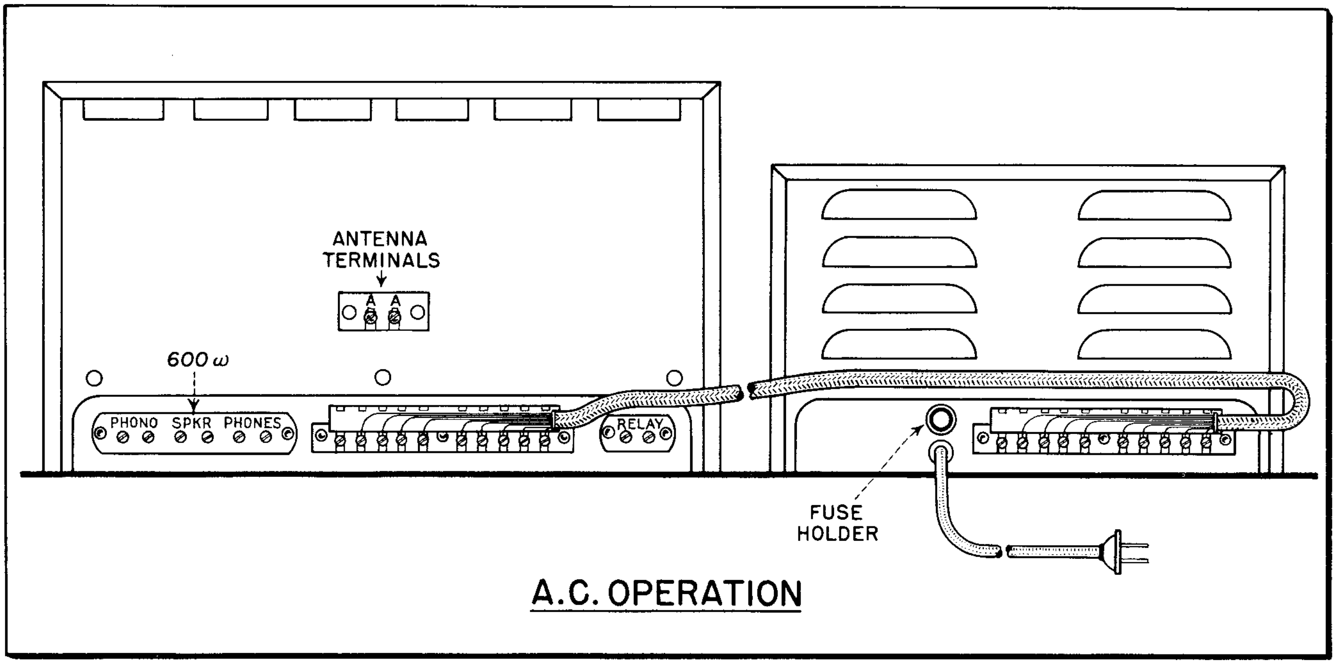


Fig. 9. Power connection for AC operation

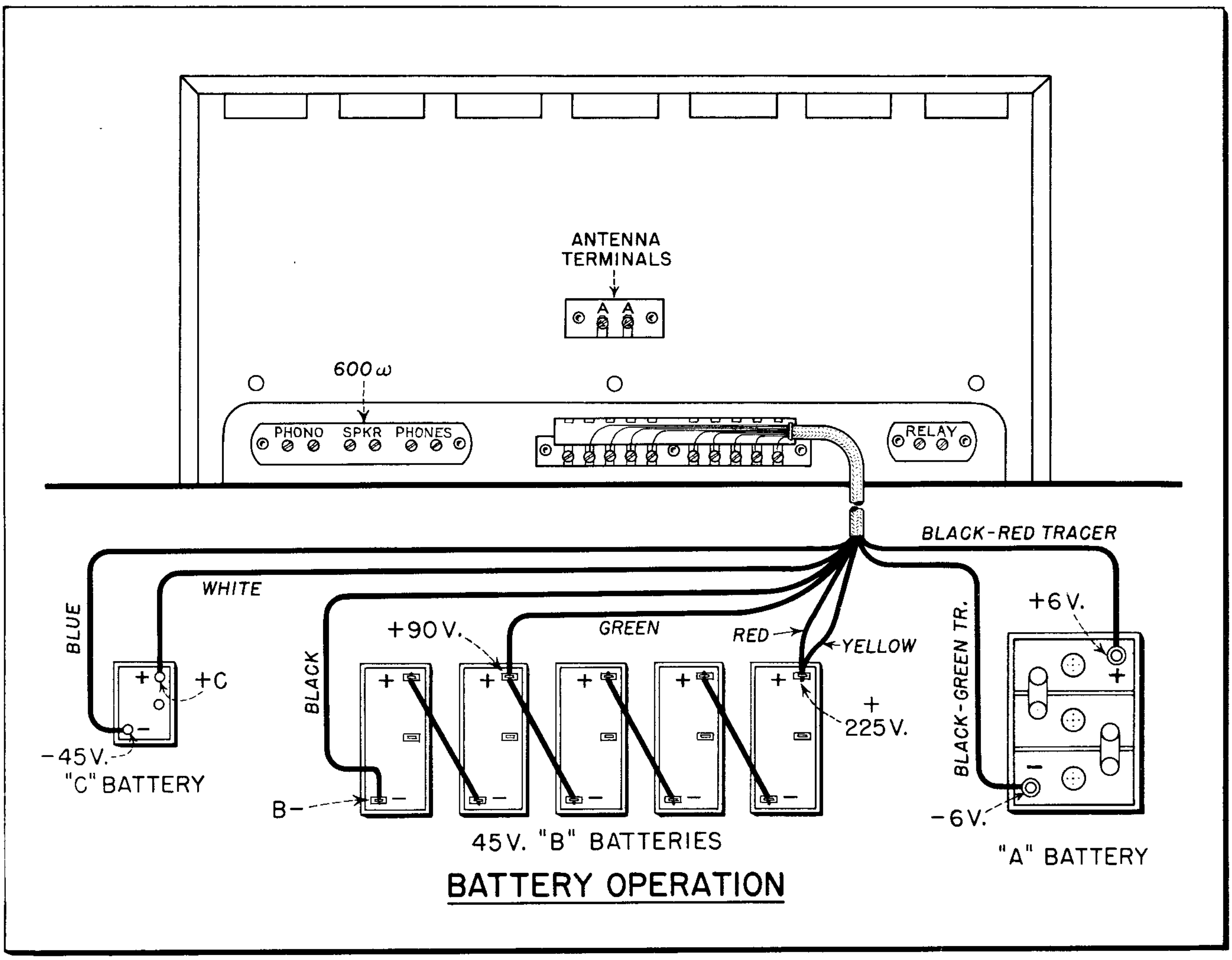


Fig. 10. Power connection for battery operation

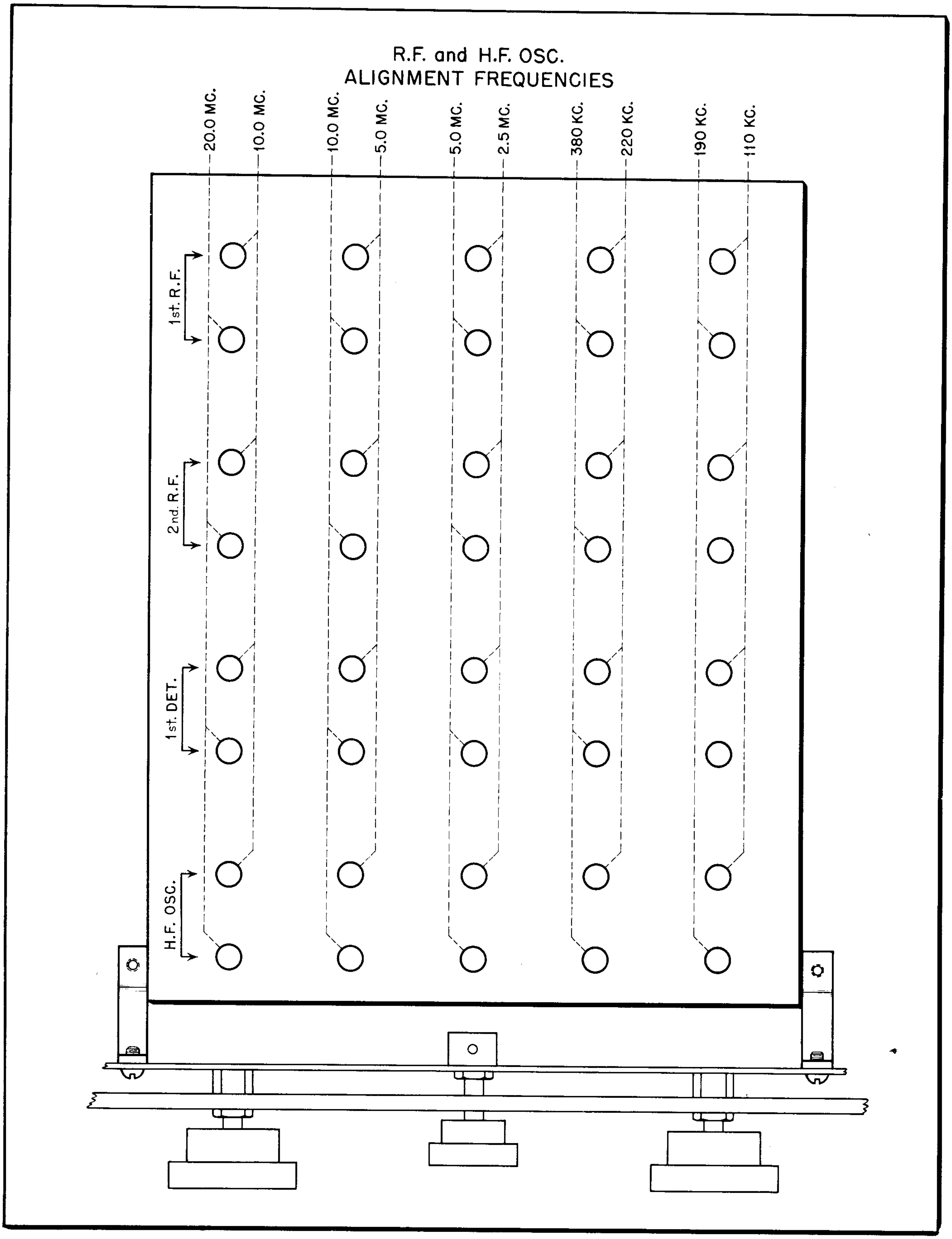


Fig. 11. R.F. and H.F. oscillator alignment chart

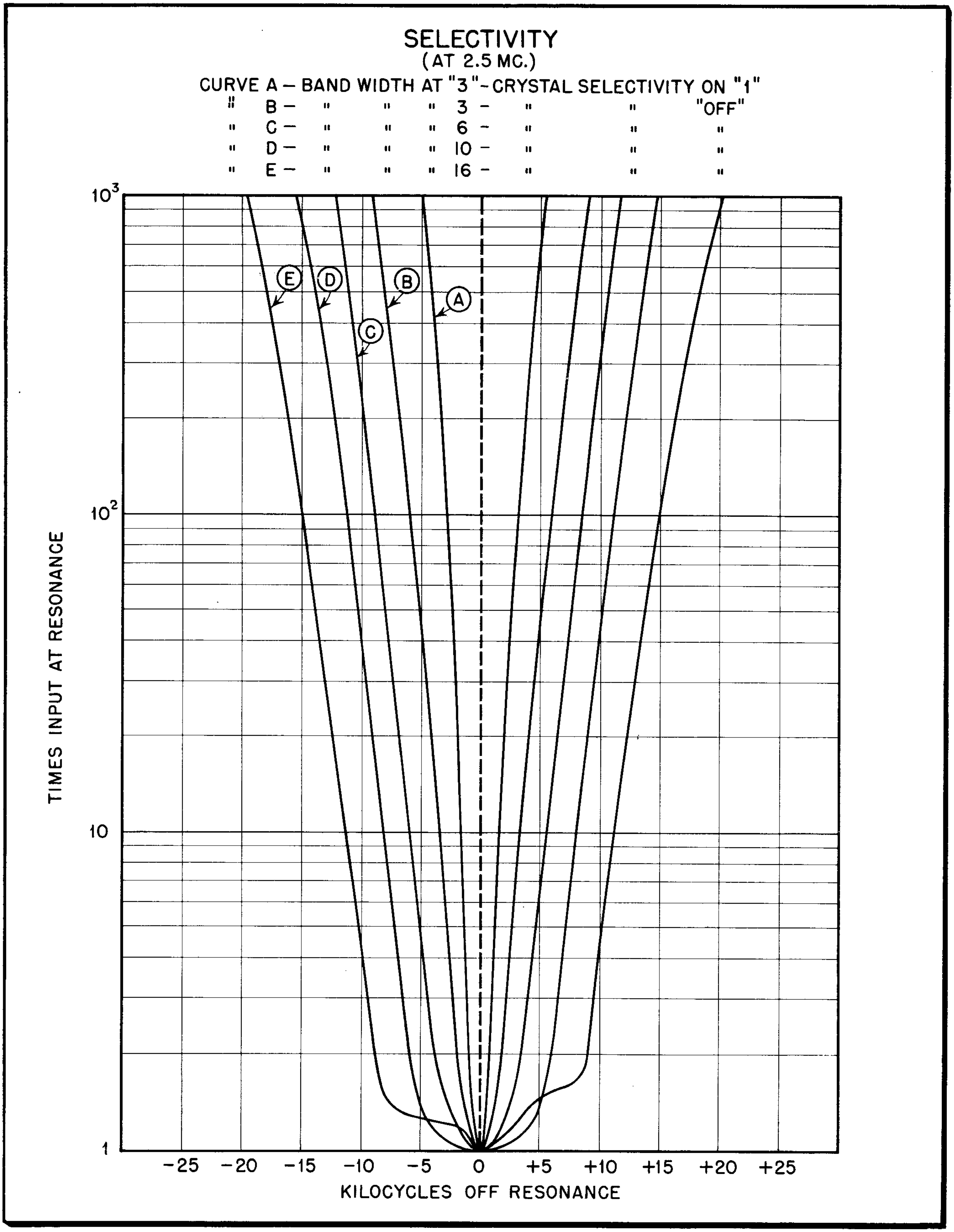


Fig. 12. Selectivity curves

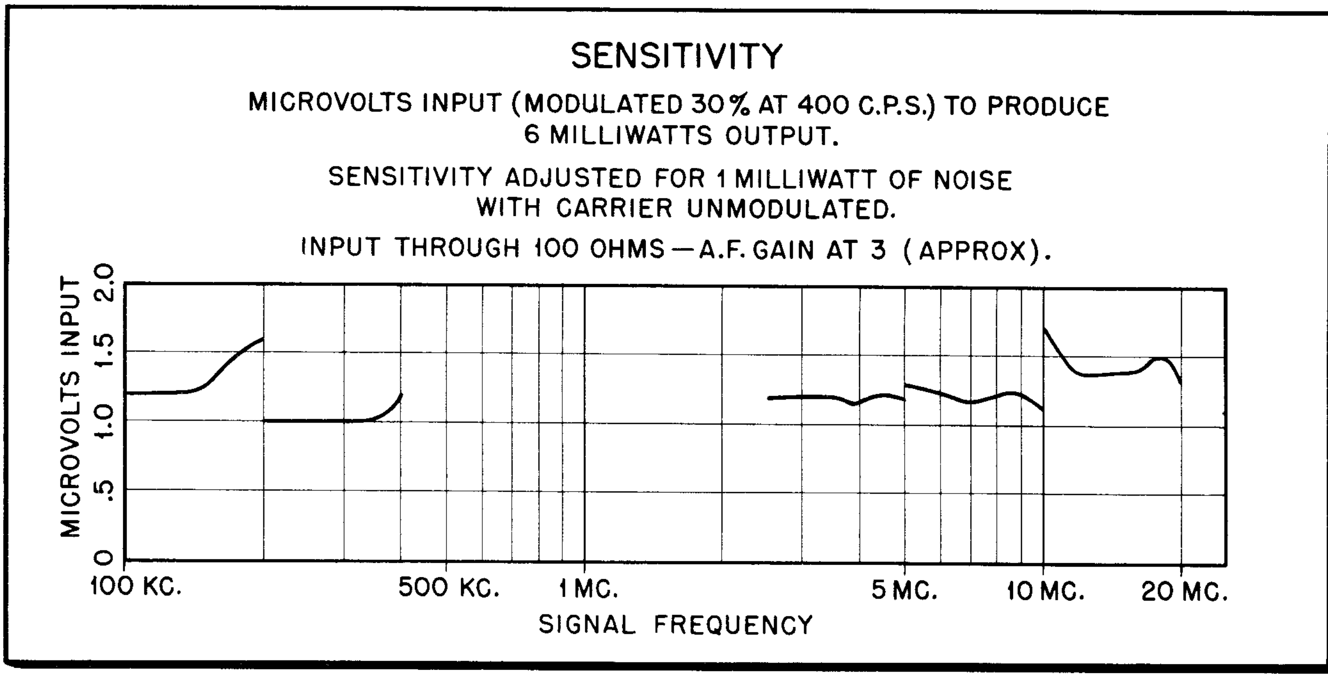


Fig. 13. Sensitivity curves

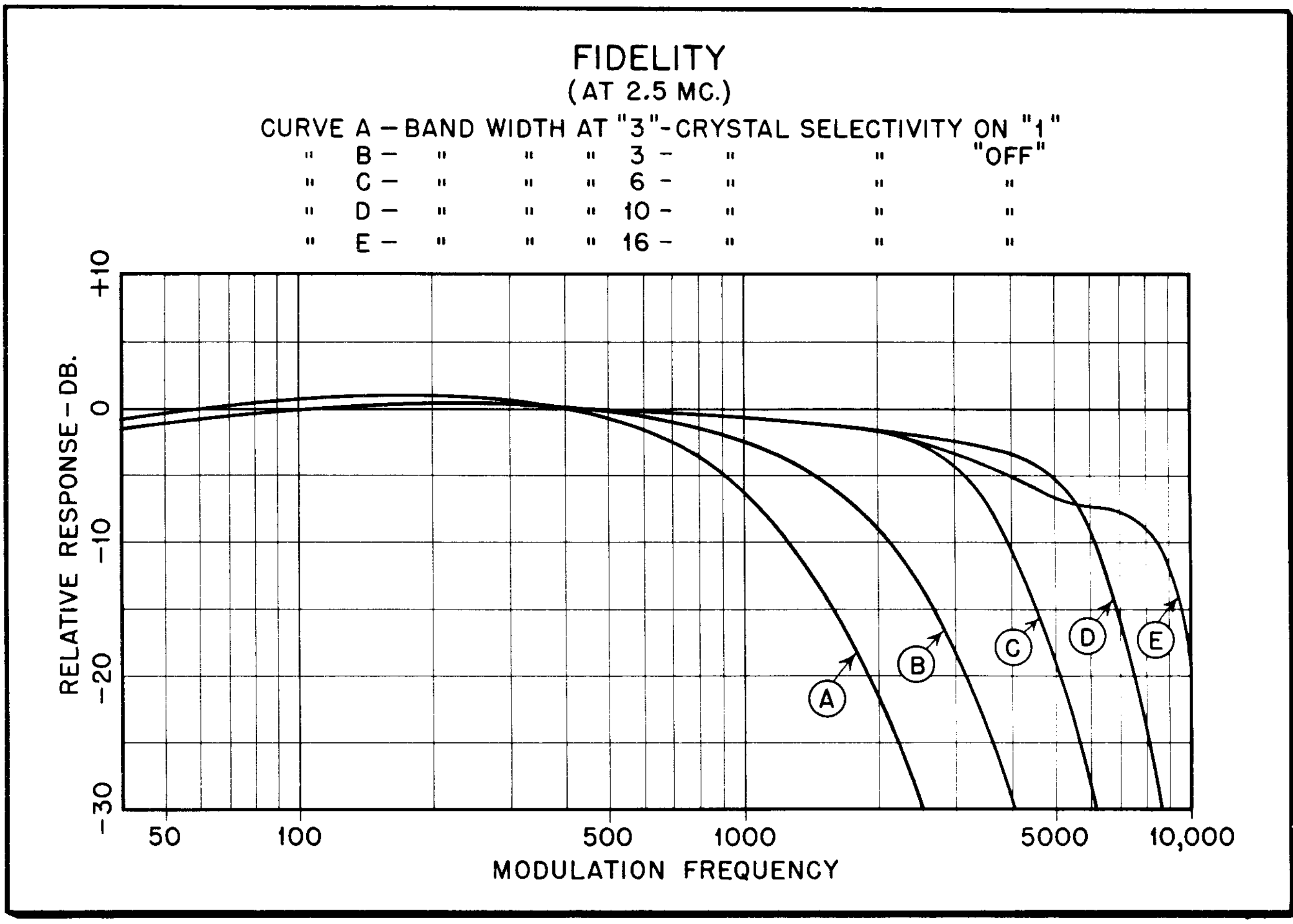


Fig. 14. Fidelity curves

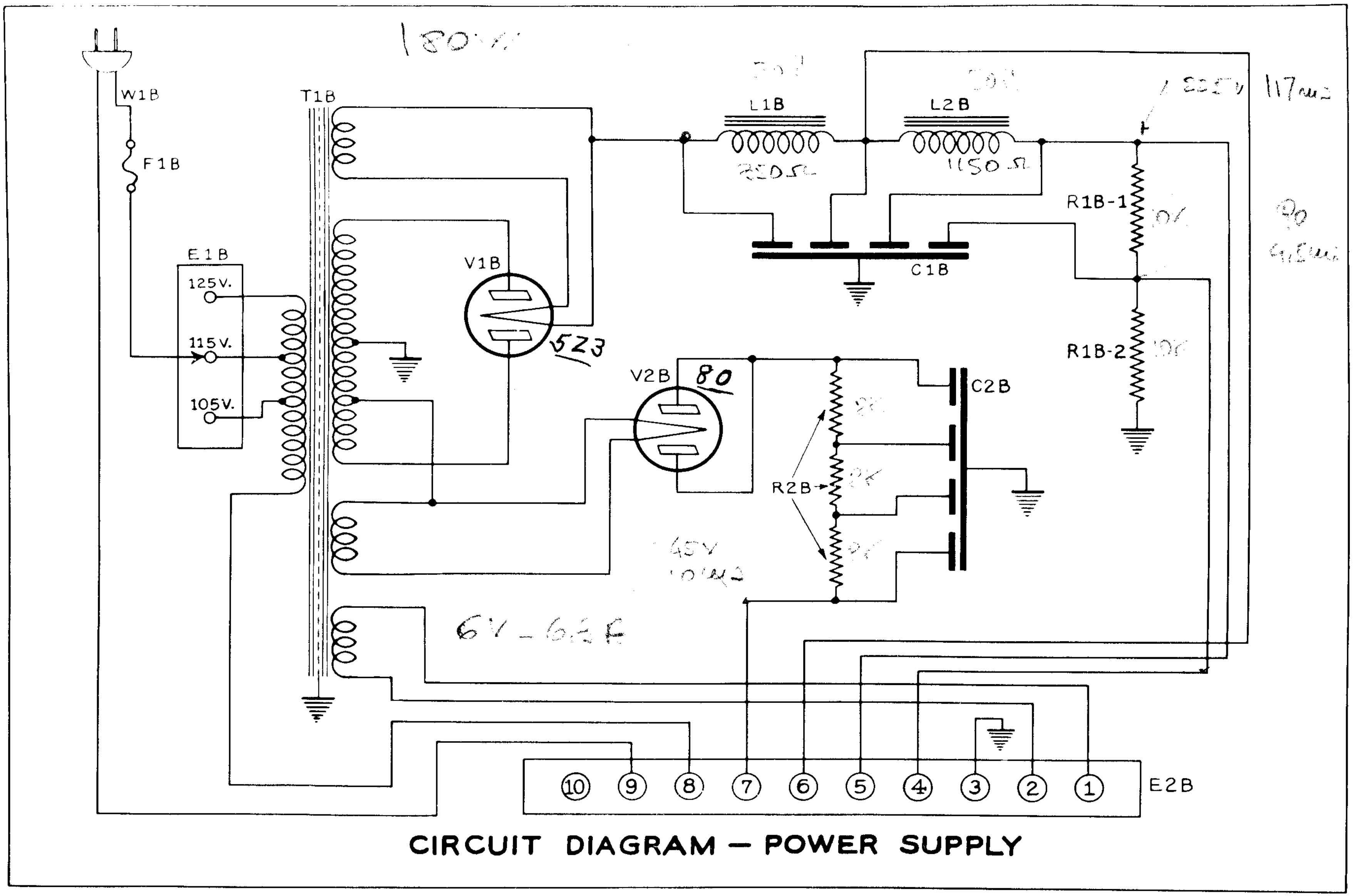
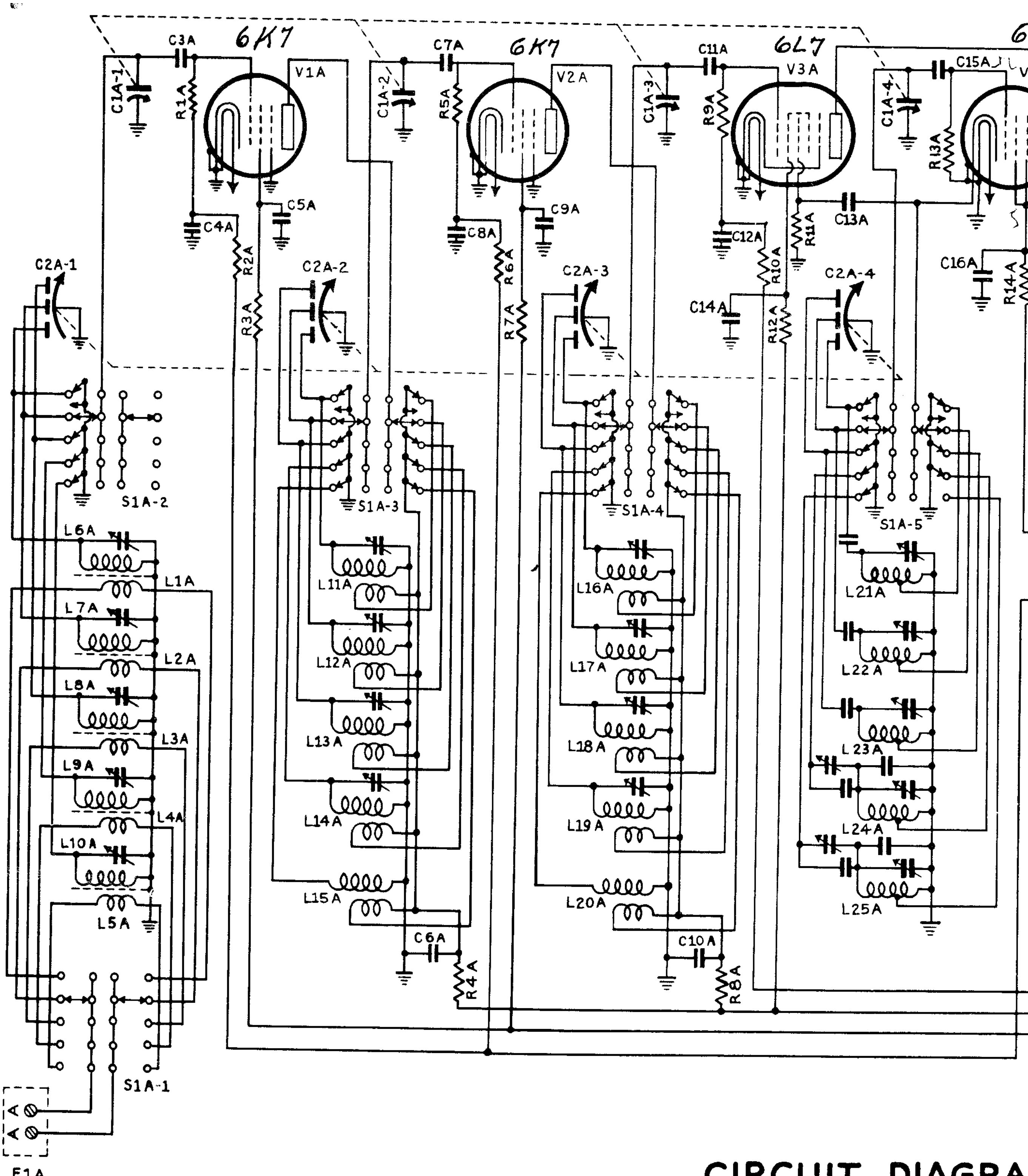
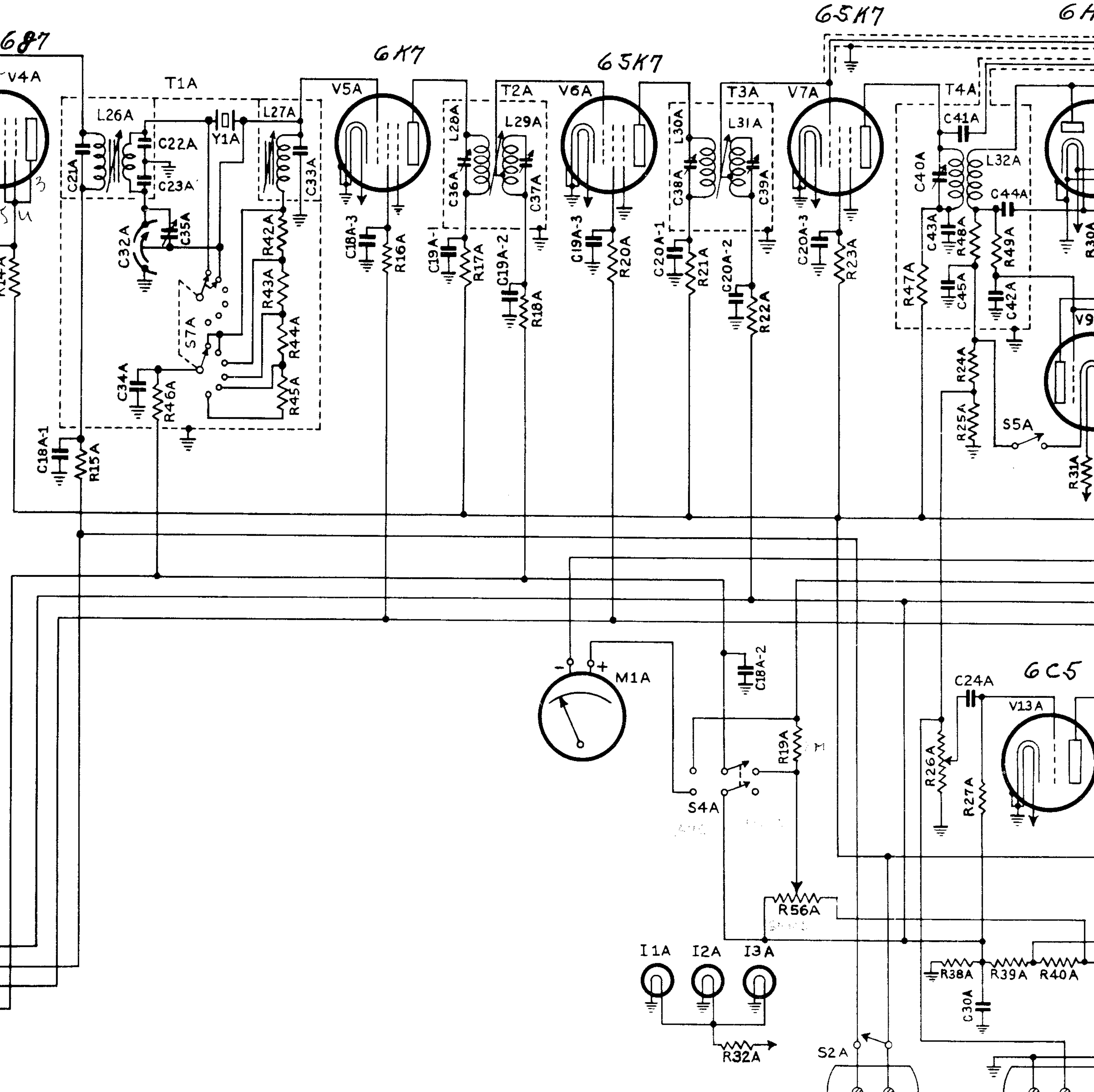


Fig. 15. Power supply wiring diagram



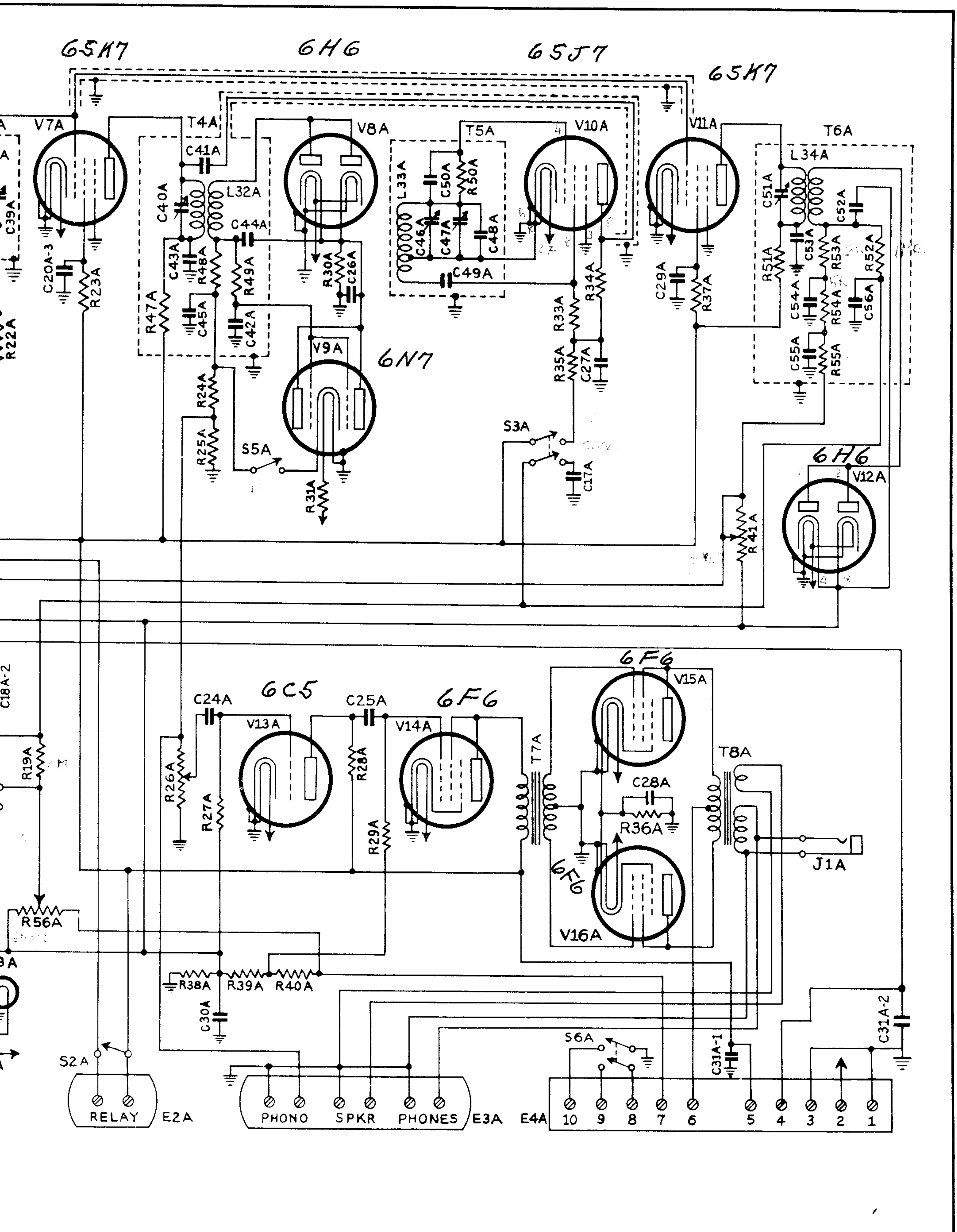
CIRCUIT DIAGRA

100 - 400 kc an



AM — RECEIVER

and 2.5 – 20 mc


6SK7
6H6
6SJ7
6SK7
V7A
T4A
V8A
T5A
V10A
V11A
T6A
C41A
L32A
C40A
C44A
C43A
R48A
R49A
R30A
C26A
R47A
C45A
C42A
V9A
6N7
R24A
R25A
S5A
R31A
L33A
C50A
R50A
C46A
C47A
C48A
C49A
R33A
R34A
R35A
C27A
S3A
C17A
C29A
R37A
L34A
C51A
C52A
R51A
C53A
R53A
R52A
C54A
R54A
C56A
C55A
R55A
6H6
V12A
R41A
C39A
C20A-3
R23A
R22A
C18A-2
R19A
C24A
6C5
V13A
C25A
6F6
V14A
R26A
R27A
R28A
R29A
T7A
6F6
V15A
C28A
R36A
6F6
V16A
T8A
J1A
R56A
R38A
R39A
R40A
C30A
S2A
RELAY
E2A
PHONO
SPKR
PHONES
E3A
S6A
C31A-1
C31A-2
E4A
10
9
8
7
6
5
4
3
2
1

LIST OF MANUFACTURERS

No.	Name	Address
1	American Phenolic Corp.	Chicago, Ill.
2	Belden Mfg. Co.	Chicago, Ill.
3	Beede Electrical Instrument Co.	Penacook, N. H.
4	Bussmann Mfg. Co.	New York, N. Y.
5	Chicago Transformer Corp.	Chicago, Ill.
6	Cornell-Dubilier Electric Corp.	South Plainfield, N. J.
7	Littlefuse Inc.	Chicago, Ill.
8	General Electric Co.	Cleveland, Ohio
9	Hammarlund Mfg. Co., Inc.	New York, N. Y.
10	International Resistance Co.	Philadelphia, Pa.
11	Clarostat Mfg. Co.	Brooklyn, N. Y.
12	Howard B. Jones Co.	Chicago, Ill.
13	Cutler-Hammer, Inc.	Milwaukee, Wisc.
14	Kurz-Kasch Co.	Dayton, Ohio
15	Aerovox Corp.	New Bedford, Mass.
16	P. R. Mallory & Co., Inc.	Indianapolis, Ind.
17	Weston Electrical Instrument Co.	Newark, N. J.
18	Utah Radio Products Co.	Chicago, Ill.
19	National Lock Co.	Rockford, Ill.
20	Oak Mfg. Co.	Chicago, Illinois
21	R.C.A. Mfg. Co.	Harrison, N. J.
22	R.C.A. Mfg. Co.	Camden, N. J.
23	F. W. Sickles Co.	Springfield, Mass.
24	Wirt Company	Philadelphia, Penna.
25	Par-Metal Products Corp.	Long Island City, N. Y.
26	American Emblem Company	Utica, N. Y.

CAUTION

When the Power Supply Unit must be operated continuously leave its dust cover off to avoid overheating. Use the highest primary voltage tap which will afford satisfactory operation of the receiver. For example: with a line voltage of 117, use the 125 volt tap rather than the 115 volt tap.

An extra heavy shock during shipment may cause the idler gear controlling the main dial mask to jump out of mesh. This may result in faulty operation of the dial mask, when the band switch knob is turned. With the dust cover removed from the receiver, this idler gear can be seen by looking down between the S-meter and the main dial escutcheon. With a long screw driver carefully spring this idler gear back into line while slightly rocking the band switch knob back and forth to permit the gear teeth to engage. If the dial mask then does not properly synchronize with the band switch dial, it can be turned by hand to the correct position while holding the idler gear out of mesh.

The front panel may be bent during shipment causing the main dial escutcheon to press heavily enough against the main dial guides to pinch them in on the dial mask. Since the mask is driven through gears by the band switch knob, any extra friction on the mask will make the band switch difficult to turn. This condition can be relieved by springing the dial guide assembly back a sufficient amount to permit the mask to rotate freely.

To correct faulty operation of a friction dial drive remove the bottom cover plate from the receiver and make sure the two friction discs are tightly squeezing the edge of the dial. These discs are held on the friction drive shaft by a hex nut which can be tightened with a wrench or pair of pliers. If a heavy shock has caused the dial to jump completely out from between the discs, the outer disc must be removed and replaced with the dial in its proper position. Make sure the several washers are replaced exactly as they were originally assembled.