INSTRUCTION BOOK NO. 13500R

INSTALLATION, OPERATION AND MAINTENANCE

U.S. SIGNAL CORPS

A.M.R. - 100 RECEIVER

(A.W.A. TYPE C13500)

Amalgamated Wireless (A'sia) Limited

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SYDNEY

11043

INSTRUCTIONS FOR

INSTALLING, OPERATING AND MAINTAINING

MODEL AMR-100 RECEIVER U.S. SIGNAL CORPS.

CHAPTER 1

GENERAL DESCRIPTION

1.1. Introduction

The AMR-100 Communication Receiver is a nine valve high gain superheterodyne with a frequency coverage of 0.48 to 26 megacycles in six bands employing plug-in coil units. It may be mains-operated from 110 or 240 volts A.C., 40-60 c/s or, alternatively, battery-operated from a 12 volt accumulator.

Designed primarily for service conditions the AMR-100 is impregnated throughout to render it impervious to tropical conditions and incorporates stabilised circuits to ensure permanency of adjustment under conditions of extreme changes in temperature and humidity as well as unusual mechanical vibration.

Other features in the design of the receiver are - Single Signal Unit with a front panel variable selectivity control with sufficient range for phone reception and a phasing control for heterodyne elimination; Separate Universal Power Unit for silent operation; Micrometer dial giving direct reading to one part in 500; Beat frequency Oscillator for C.W. reception; Automatic volume control which may be switched off when desired; Separate R.F. and Audio gain controls; Aerial trimmer for aerial matching; Signal strength meter; Twin phone jacks; H.T. voltage switching, providing a stand-by condition.

1.2 Schedule of Equipment (Essentials for operation and not including spares)

1 - Communication Receiver Type AMR-100, complete with valves and six coil units.
Dimensions - 17¼ inches long x 9 inches high x 11¾ inches deep.

1- Universal Power Unit, Type H13501, complete with valves and vibrator.
Dimensions - 11⅞ inches long x 8½ inches high x 9⅝ inches deep.

1- Loudspeaker Unit, Type 013503.
Dimensions - 8⅛ inches long x 8⅛ inches high x 4¾ inches deep.
Diameter of loudspeaker - 6½ inches.

2- Pairs of Headphones, 2000 ohms impedance.

1- Battery Cable No. 13222

1- A.C. Mains Cable No. 13225

1- Battery Link Cable No. 4021 B2/31

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CHAPTER 1.

GENERAL DESCRIPTION

CHAPTER 11.

INSTALLATION AND OPERATION

Band	A	14.3	-	26 Mc/s
"	B	7.0	-	14.6 "
"	C	3.6	-	7.3 "
"	D	1.85	-	3.9 "
"	E	0.9	-	1.9 "
"	F	0.48	-	1.0 "

R.F. Alignment Frequencies

Band	A	24	-	14.8 Mc/s
"	B	14.2	-	7.3 "
"	C	7.1	-	3.7 "
"	D	3.8	-	1.9 "
"	E	1.85	-	0.94 "
"	F	0.98	-	0.5 "

Intermediate Frequency - 455 Kc/s.

Valves

1 - 6U7G 1st R.F. Amplifier
1 - 6U7G 2nd R.F. Amplifier
1 - 6J8G Converter
1 - 6J5GT Local Oscillator
1 - 6U7G 1st I.F. Amplifier
1 - 6U7G 2nd I.F. Amplifier
1 - 6G8G Detector, A.V.C. and A.F. Amplifier
1 - 6J5GT Beat Frequency Oscillator
1 - 6V6G Output

Universal Power Unit

A.C. Operation

Input Voltage and Frequency- 110/240 volts, 50-60 C/s

Power Consumption - 70 watts

Battery Operation

Input Voltage - 12 volts, D.C.
Current Consumption - 5.5 Amps.

Valves

2 - 6X5GT Full Wave Rectifiers.

Vibrator

12V. Non-Synchronous, Oak Type V5123

Loudspeaker Unit (Permanent Magnet)

Voice Coil Impedance - 3.7 ohms at 400 C/s.

Aerial and Earth

Provision is made in the design of the receiver for the use of either a doublet or single wire type of aerial. There are two input terminals, one marked "A1" and the other "A2" and adjacent to these a third terminal marked "EARTH". When using a single wire it should be connected to the terminal "A1" and the terminal "A2" should be connected to the chassis using the pigtail lead provided. Doublet aerial feeders should be connected to terminals "A1" [illegible]

Connected, otherwise the output valve will be damaged.

2.1.3 Aerial and Earth Connections.

Connect the aerial and earth leads as described in Chapter 1, section 1.4.

.2 Operation

2.2.1 Controls (See Plate 2)

i. Tuning Dial and Calibration Curve

The tuning dial is located in the centre of the front panel. As the dial is turned a number will be seen in a window opposite the pointer at each 1/5 of a full revolution. These numbers are from 0-500 in tens and the dial is also calibrated between each window in units so that readings may be made on the scale to one part in 500.

A curve located on each coil unit shows dial readings plotted against frequency; dial readings on the horizontal axis and frequencies on the vertical axis. Stations may be logged on the tablet on the coil unit.

ii Selectivity Control

The uppermost knob at the right-hand side of the panel is the variable selectivity control of the single signal crystal filter. With the crystal filter in use, minimum selectivity is obtained with the pointer at "MIN". Turning the knob clockwise from this point will increase the selectivity.

iii Crystal switch

Below and slightly to the left of the selectivity control is the crystal filter switch. This switch is designated "IN" (Crystal in) or "OUT" (Crystal out).

iv Phasing Control

This control is located directly below the selectivity control. When the pointer is set at the point indicated by a square dot the crystal filter is centrally phased. For the elimination of heterodynes, etc. the control is adjusted to a suitable position on either side of this setting. The control is calibrated for record purposes.

v. Facility Switch

The four position switch at the bottom right-hand corner. Reading clockwise the positions are "H.T OFF", "A.V.C. ON", "A.V.C. OFF" and "B.F.O. ON". With the switch set at the first position ("H.T. OFF") the H.T. is disconnected but the valve heaters are still in circuit. This position is used when "standing by" with the power on during periods of transmission, or when changing coils and from it the receiver will begin operating immediately the switch is turned to any of the remaining three positions. The function of positions marked "A.V.C. ON" and "A.V.C. OFF" are self-explanatory, being an abbreviation of Automatic Volume Control on and off, and the fourth position

The B.F.O. control is located at the left-hand bottom of the front panel and adjusts the heterodyne tone between zero (indicated by bar on panel) and 2000 cycles/second clockwise and anti-clockwise when the facility switch is at "B.F.O. ON" as explained in sub-section v. above. The control is calibrated for record purposes.

vii R.F. Gain Control

This control, which is located to the right of the dial, governs the cathode bias applied to the 2nd R.F. and I.F. valves and thus controls the R.F. sensitivity. The control is calibrated for record purposes.

viii A.F. Gain Control

The audio frequency gain control which is located directly above the B.F.O. control regulates the audio input to the grid of the 1st A.F. valve and thus controls the audio volume when using either the loud-speaker or headphones. The control is calibrated for record purposes.

ix Aerial Trimmer

An aerial trimmer located to the left of the dial is provided for matching the aerial to the input circuit. The trimmer should be adjusted for maximum sensitivity after tuning with the main dial. The trimmer turns continuously and it will be found that it has two peaks. Either peak will do. The trimmer is calibrated for record purposes.

iii

x "S" Meter and Switch

The "S" meter indicates signal strength and is located in the upper left-hand corner. A switch on the right of the meter connects it in or out as required. "IN"- down, "OUT"- up.

.2.2 Tuning

Changing Coils- When changing coils it is essential to first switch to "H.T. OFF". This will eliminate the possibility of an H.T. short-circuit during the operation.

i Phone Reception without Crystal Filter

iv

First set the "CRYSTAL" switch at "OUT", the "SELECTIVITY" control at "MIN" and the "B.F.O. CONTROL" at the centre of the bar marked on the panel.

Set the facility switch at "A.V.C. ON" or "A.V.C. OFF" as desired. If A.V.C. is used the "R.F. GAIN" control may be advanced fully clockwise to 0 and the volume will then be controlled by the "A.F. GAIN" control. If A.V.C. is not used it is suggested that the "A.F. GAIN" control be set at about the mid-positio i.e. 5 to 6, and the sensitivity controlled by the "R.F. GAIN" control. The setting of the two gain controls is largely a matter of preference to be determined by the operator and by the receiving conditions prevailing.

The B.F.O. may be used for locating carriers

but the facility switch must be returned to its former position when the receiver is tuned to zero beat. Having tuned the station with the main tuning dial, rotate the "AERIAL TRIMMER" for maximum sensitivity then, if necessary, re-adjust the gain control (s).

ii Phone Reception with Crystal Filter

The use of the crystal filter for the reception of phone stations is recommended when adverse conditions prevail, such as interference, static, heterodynes, etc..

First switch the "CRYSTAL" switch to "IN", set the "SELECTIVITY" control at "MIN", the "PHASING" control to the square dot and the "B.F.O. CONTROL" at the centre of the bar marked on the panel. The description on the use of the gain controls, the "BFO.CONTROL" and the "AERIAL TRIMMER" given in sub-section i. applies.

The principal advantage of the crystal filter is its ability to eliminate heterodynes. Suppose for instance, a signal has been carefully tuned and during transmission an interfering station causes a bad heterodyne, inverted speech etc; ordinarily the desired signal would be made unintelligable but careful adjustment of the "SELECTIVITY" and/or "PHASING" controls will eliminate the heterodyne and the interfering station, in most cases, completely. The "PHASING" control will eliminate one signal only. If another interfering station comes on, however, only one heterodyne will be present, instead of the several resulting from three station carriers beating together.

iii C.W. Reception without Crystal Filter

Set the "CRYSTAL" switch at "OUT", the facility switch at "B.F.O. ON" and the "B.F.O. CONTROL" at the centre of the bar marked on the panel.

Best signal-to-noise ratio will usually be obtained by retarding the "A.F. GAIN" control considerably and controlling sensitivity with the "R.F. GAIN" control. Tune for zero beat. A beat note produced between the received signal and the B.F.O. may be obtained by means of the "B.F.O. CONTROL" which will give a variation from 0 - 2000 c/s on either side of the bar indicated on the panel.

iv C.W. Reception with Crystal Filter

Set the "CRYSTAL" switch at "IN", the "SELECTIVITY" control at "MIN", the "PHASING" control to the square dot, the "B.F.O CONTROL" at the centre of the bar marked on the panel and the facility switch at "B.F.O. ON".

Tune the receiver as shown in sub-section iii. above, then set the "SELECTIVITY" control at "MAX". Now as the receiver is tuned slowly across the carrier the beat note will be sharply peaked at one point. All other parts of the beat note will be weak and furthermore this peak will be found to occur on only one side of the carrier. Should a heterodyne be present from an interfering station it can be elim-

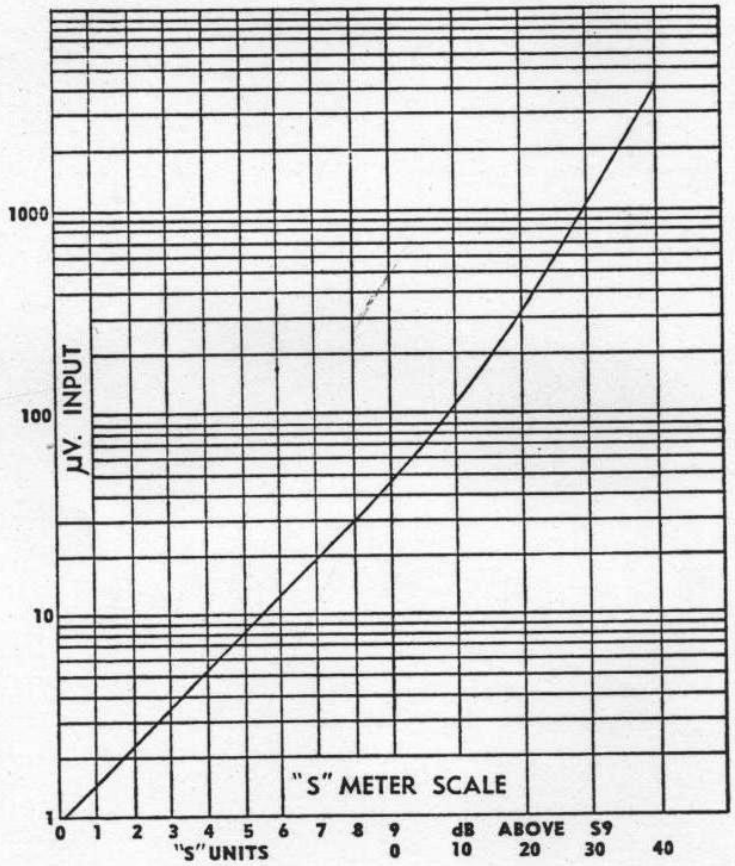


TABLE I — "S" METER CURVE.

v. The "S" Meter

The "S" meter serves to indicate the strength of a received signal. It is calibrated from 1 to 9 in arbitrary units which correspond, roughly, to the definition of the nine points of the "S" scale of the R.S.T. system of signal reports.

The accompanying curve (Table 1.) shows the relation between average meter readings and the actual signal input to the receiver in microvolts and from this curve it will be noted that each "S" unit is equal to a change of approximately 4 dB. The 40 dB range above the S.9 level is used for comparative checks on extremely strong signals.

Fig. 3 shows the "S" meter network connected in the anode circuits of the I.F. stages. Actually the meter is the indicator of a bridge circuit, two legs of which are fixed resistors, the third leg being a balancing control and the fourth leg (variable) the anode circuits of the A.V.C. controlled I.F. valves. The bridge is balanced by means of the manual "R.F. GAIN" control which, through its action of indirectly changing the anode resistance of the valves, automatically adjusts the R.F. and I.F. gain to a predetermined level at the same time that the meter is brought to zero. The strength of the incoming signal is, therefore, accurately indicated by the action of the A.V.C. circuits in controlling high frequency gain.

Before making a measurement on a signal, certain adjustments must be made. Since the meter is actuated by the amount of signal reaching the second detector, it is obviously necessary that the receiver be adjusted to have a predetermined amount of amplification between the aerial and second detector. To adjust the amplification to the proper value, the facility switch must be at "A.V.C. OFF" and the "SELECTIVITY" control at "MIN". Now switch the meter in and advance the "R.F. GAIN" control fully clockwise (0). The meter should then read zero. The receiver is now adjusted and the strength of any signal may be measured by switching to "A.V.C. ON" and tuning for maximum meter deflection. The "A.F. GAIN" control does not have any effect on the R.F. adjustments or upon the meter reading, so that it may be retarded as much as necessary to prevent audio overload when making the preliminary adjustments.

If the signal being measured is extremely strong, however, or if local noise is exceptionally high, it may be impossible to bring the meter to 0. In this case it is necessary to detune the receiver from the signal or to disconnect the aerial.

If it should happen that the "S" meter network gets out of balance and meter does not read zero with R.F. gain control at 0 the alignment procedure is as follows:-

Disconnect the aerial and switch to "A.V.C. OFF", set the "R.F. GAIN" control at 0, then by means of a screwdriver, adjust the control which is located in the chassis near the aerial terminals (see Fig. 1) until the meter reads zero.

TECHNICAL DESCRIPTION

1 Introduction

The receiver is of the superheterodyne type using an intermediate frequency of 455 Kc/s, the frequency of the local oscillator being higher than the signal frequency. Two R.F. stages and two I.F. stages of amplification are employed, these being followed by detector, audio amplifier and output stages. A second local oscillator is employed for use as a heterodyne for reception of C.W. signals.

An I.F. crystal filter is also used to increase the selectivity of the intermediate frequency amplifiers.

The frequency range is from 0.48 - 26 Mc/s covered in six bands namely:-

Band A -	14.3	- 26	Mc/s
Band B -	7.0	- 14.6	"
Band C -	3.6	- 7.3	"
Band D -	1.85	- 3.9	"
Band E -	0.9	- 1.9	"
Band F -	0.48	- 1.0	"

2 R.F. Amplifiers

The input circuit comprises two inductances L1 and L2. L1 is an aerial coil inductively coupled to the grid inductan L2, which is associated with valve V1A. The grid inductance is tuned by means of the tuning condenser C18, which forms part of the 4 gang tuning condenser. This circuit is trimmed by the "AERIAL TRIMMER" condenser C18A to enable various types of aerial to be used with the set.

The output from V1A is applied to the grid of valve V1B via the inductance L3 & L4. L3 is a high impedance inductance resonant outside the low frequency end of the band and is inductively coupled to the grid inductance L4. Top capacity coupling is also employed by means of the 4 uuF condenser C2. The grid inductance is tuned by means of the variable condenser C23, which forms part of the 4 gang tuning condenser, and is trimmed by adjustable condenser C4 and fixed condenser C4A.

The same method of coupling is employed between valves V1B and V2A, using inductance L5 and L6; C26 is used for tuning and C7 and C7A for trimming the grid circuit of valve V2A.

In band A a series padding condenser (C1, C3, C6) is employed in all the R.F. circuits to give a slight bandspread effect to facilitate tuning at these higher frequencies. Resistors (R2 and R3) are connected across the anode inductan of the R.F. stages in bands C and D to improve signal to nois ratio, and also to give comparable sensitivity with the highe frequency bands. Similar results are obtained in bands E and F by use of a low impedance inductance in the plate circuit of the 2nd R.F. valve V1B.

These two R.F. valves are self-biased by resistors R6 an R9, respectively and receive A.V.C. bias through resistors R5 and R8, which together with condensers C20 and C24 provide individual decoupling. In addition to the self bias obtained by resistor R9, on valve V1B, a variable bias is provided by the "R.F. GAIN" control R10.

The screen grid voltage is obtained from the junction of resistors R20 and R21 which form a potential divider

The oscillator valve V5A operates in a tuned anode feed-back circuit, at a frequency of 455 Kc/s higher than signal frequency. The tuned circuit comprises inductance L7, condenser C33 (part of the four gang assembly) and conden C10, the padder condenser. The tuned circuit is trimmed by adjustable condenser C9 and fixed condenser C33A. C33A is a temperature compensating condenser used to minimise frequen drift due to temperature variations. Resistor R1, and conden C8 provide decoupling for the anode circuit. Bias is obtaine by means of the grid resistor R18 and condenser C34.

3.4 Frequency Converter

The frequency converter valve (V2A) is a triode-heptode. The output from the oscillator is applied to the triode grid via condenser C31, which is connected internally to the injec grid of the heptode section which acts as the mixer. The tri anode is connected to cathode. The heptode anode is coupled the control grid of the I.F. amplifier valve V1C through the crystal filter circuit, which is tuned to a frequency of 455

Decoupling of the anode circuit is accomplished by means of R19 and C35.

Self-bias is obtained by resistor R15 and the screen grid voltage is obtained through the dropping resistor R17.

3.5 Crystal Filter

The load impedance for the heptode anode of V2A is formed by the high impedance primary L17 of the filter input transformer, which is tuned by the condenser C36 and adjustable magnetic core. The secondary L18 is of relatively low impedance and is centre-tapped to earth to provide a neutralizing voltage 180° out of phase with the voltage fed to the crystal. C39 is the "PHASING" control and is employed to neutralize the capacity of the crystal holder. In parallel with this control is a trimmer condenser C38 to enable exact neutralization to be obtained with the control set at 0 on the dial.

The output of the crystal is fed to the grid of the first I.F. amplifier valve V1C via C40 and I.F. inductance L19 The grid circuit is tuned by means of fixed condenser C41, variable condenser C43 ("SELECTIVITY" control) and adjustable magnetite core. The function of the "SELECTIVITY" control is to enable various degrees of selectivity to be obtained whe using the crystal. For broad bandwidth or minimum selectivity the control is set in the minimum capacity position which tune the circuit to exactly the same frequency as the crystal. As the capacity is increased so the selectivity is also increased The adjustable magnetite core is provided to enable the circui to be tuned to exact crystal frequency with the "SELECTIVITY" control set at the appropriate position ("MIN") on the dial.

3.6 I.F. Amplifiers

The first I.F. amplifier V1C is an R.F. pentode valve. The input circuit has already been described in section 3.5. The output from this valve is fed to the grid of the 2nd I.F. amplifier valve via the I.F. transformer L20 and L21 both primary and secondary of which are tuned by fixed condensers, C45 and C47 respectively, adjustment being effected by adjustable magnetite cores. The input to valve V1D is taken from a tap on the secondary of the I.F. transformer to reduce signal to noise ratio, and also to minimise change in alignment when valves are replaced.

The same method of coupling is employed between valve V1D and the diodes on V3A using I.F. transformer L22 and L23 tuned by condensers C50 and C54.

These two I.F. valves are self biased by resistors R23 and R25, respectively. In addition to the self bias obtained by resistors R23 and R25 a variable bias is provided by the "R.F. GAIN" control R10. Valve V1C receives A.V.C. bias through resistor R22 which together with C42 also provides decoupling. V1D receives A.V.C. bias through resistor R35, only half the available A.V.C. bias being supplied to this valve.

Decoupling of the anode circuits is accomplished by R24 and C46 and R26 and C51 respectively. Screen grid voltage is obtained from the same potential divider as for V1A & V1B.

Detector, A.V.C. and A.F. Stage.

V3A is a duo-diode pentode. One diode acts as the signal detector, the other as the A.V.C. detector, and the pentode section as the A.F. amplifier.

3.7.1 Signal Detector

The signal detector is directly connected to the "hot" side of the second I.F. transformer secondary L23. The diode load is provided by R27 and R28. R27, as well as forming part of the diode load, acts as an I.F. filter in conjunction with filter condensers C55 and C52.

The A.F. component developed across R28 also appears across resistor R31 ("A.F. GAIN" control), which is in parallel with the diode load through the coupling condenser C56. The control grid of the pentode section is connected to the moving arm of this control, thus the voltage applied to the grid is dependent upon its setting.

3.7.2 A.V.C. Detector.

The A.V.C. diode is connected through C57 to the signal detector diode. The rectified voltage is developed across the diode load potentiometer formed by resistors R33 and R34. This voltage is proportionate to the strength of the received carrier and is used to provide negative bias to the A.V.C. system. The full voltage is applied to the control grid of valves V1A, V1B and V1C through decoupling resistors R36, R5, R8 and R22. Valve V1D obtains portion of this voltage by connecting the control grid to the junction of resistors R33 and R34 through decoupling resistor R35. The diode load potentiometer being connected to earth provides a delay voltage equal to the D.C. volts developed across the cathode resistor R29 by cathode current of V3A. Therefore, no rectification takes place in this diode until the strength of the incoming carrier is sufficient to overcome this bias, thus delaying the A.V.C.

3.7.3 A.F. Amplifier

The pentode section of V3A operates as an A.F. amplifier. Resistor R37 forms the output impedance across which the A.F. component is developed and applied to the control grid of the output valve V4A. Decoupling of the anode circuit is accomplished by means of resistor R38 and condenser C64.

Screen grid voltage is obtained from the junction of resistors R30 and R32, which form a potential divider

3.8 Output Stage

V4A is a beam power tetrode output valve. The anode is coupled by the transformer T1 to the loud-speaker, head-phones or 600 ohms line. Self bias is obtained by resistor R40. The screen grid is connected directly to H.T.

Inverse feedback is provided by means of resistor R39

NOTE: Either headphones, line, or loudspeaker must be connected before switching on the set otherwise damage to the output valve will result due to it operating in an unloaded condition.

3.9 Beat Frequency Oscillator

V5B is a triode and operates as a beat frequency oscillator in a circuit comprising C68, L24 and L25 tuned to a frequency of 455 Kc/s. Coupling to the I.F. channel is obtained by connecting the anode of the oscillator to the A.V.C. diode through condenser C61.

The inductance L25 is closely coupled to the tuning inductance L24. Variable resistor R44 ("B.F.O. CONTROL") is connected across this inductance and a variation of pitch in the beat note may be affected by varying this resistor.

For reception of a signal with the B.F.O. on, the "B.F.O. CONTROL" should be set at the centre of the bar or null point marked on the panel. This setting ensures that when a carrier is tuned to zero beat the receiver is tuned to the centre of the carrier. The pitch of the beat note may now be adjusted up to a frequency of 2000 cycles by moving the control either side of the null point.

Anode decoupling is accomplished by resistor R43 and condenser C70. Bias is obtained by the grid resistor R45 and condenser C69.

3.10 "S" Meter

The "S" Meter is calibrated in "S" units from 1 - 9, and dB above S9. It is connected in the H.T. supply circuit to the anodes of the I.F. stages V1C & V1D. It is actually an indicator in a bridge circuit, two legs of which are fixed resistors, R11 & R13, the third an adjustable balancing resistor R12 and the fourth leg the plate circuits of the A.V.C. controlled I.F. valves. The bridge is balanced with no signal input and the "R.F. GAIN" control set at a predetermined position by means of the resistor R12. When a signal is received the A.V.C. functions applying bias to the I.F. amplifier valves thus changing their anode resistance, upsetting the balance of the bridge circuit and giving a reading on the meter.

3.11 Universal Power Unit - Type H13501

All components in the universal power unit are mounted on a chassis which is insulated from the case. Full-wave rectification is employed using two 6X5GT type valves (V6A and V6B) each having their anodes bridged. The valve heaters are connected in series and the cathodes in parallel. The H.T. secondary of T2 has its centre tap connected through a filter circuit comprising choke L30 and condenser C79 to contact 3 on the output socket. In the receiver this circuit is connected to chassis by the facility switch S2 in all positions excepting "H.T. OFF" when the circuit is opened by section 3 of this switch thus removing H.T. from the receiver. H.T. is taken from the cathodes of the rectifiers

and is fed through a filter circuit comprising chokes L26, L27 and condensers C28, C71, C72, C73 and C75 to contact 2 on the output socket. The ON-OFF switch S4 switches both input leads on A.C. operation and the positive input lead only for battery operation. Condensers C87 and C85 filter the A.C. primary circuit.

3.11.1 A.C. Operation

For 240 volt A.C. operation the primary windings A and B of transformer T2 are connected in series; A being a 130 volt winding and B a 110 volt winding. For 110 volts A.C. operation connection is made to a 110 volt tap on winding A and the winding is connected in parallel with winding B. A 3 amp fuse inserted in one primary lead protects the unit. A 12 volt secondary winding E on T2 feeds the valve heaters and the pilot lamp. However, as the lamp is of 6 volts rating the voltage is dropped by resistor R50.

3.11.2 Battery Operation.

The negative pole of the battery is connected to chassis inside the unit. The input voltage is filtered by choke L34 and condensers C87 and C86, then passed through switch S4 and fuse F1,

(a) to the centre tap of primary winding C on transformer T2 ;

(b) through a filter circuit comprising choke L33 and condensers C83 and C82 to the driving contact of the non-synchronous vibrator,

(c) to the heater of V6A and V6B and

(d) via the filter circuit comprising choke L29 and condensers C74 and C76 to contact 1 on the output plug to provide heater voltage for the receiver. Resistors R48 and R49 and condensers C77 and C78 form a buffer circuit for vibration operation.

The primary winding C of transformer T2 is connected to the primary contacts of the vibrator through filter circuits comprising choke L31, and L32 condensers C80 and C81.

3.12 Universal Power Unit Type 1H13501

This power unit is identical with H13501 except for a minor circuit alteration involving the rewiring of L29 and C74 (see plate 6) and the addition of two 100 uF electrolytic condensers C88 & C89 - see circuit diagram for 1H13501 - Fig. 4.

The modification is found necessary to suppress vibrator "hash" on the low frequency end of G band or any further bands which may be used down to 50 Kc/s.

NOTE: The H13501 power unit is supplied with receivers bearing Serial Nos. 400 to 751, whilst the 1H13501 power unit is supplied with receivers bearing serial Nos. 752 onwards.

If it is required to modify an H13501 to 1H13501 the following instructions will be found helpful.

Referring to Plate 6 -

(1) Disconnect 4 leads from L29. Join together, solder and wrap with insulation tape.

(2) Remove C74 and clamp.

(3) Connect .5 mfd. paper condenser C74 in Fig. 4 from junction of L30 and black lead from transformer centre tap to sub chassis.

(4) Connect two 100 uF 40 P.V. electrolytic condensers, C88 & C89 shown in Fig. 4, one on each side of L29 to sub-chassis, mounted in the space from which C74 was removed.

(5) Disconnect lead, which joins L33 to lug on S3, from the lug on S3 and remove the lead which joins F1 to same lug.

(6) Join lead from L33 mentioned in (5) to one side of L29.

(7) Connect that same point in L29 to the lug on F1 from which lead was removed in (5).

(8) Connect the other side of L29 to the lug on S3 identified in (5).

CHAPTER 1V

ALIGNMENT PROCEDURE AND SERVICE DATA

4.1 General

4.1.1 Manufacturer's Setting of Adjustments

The Receiver is tested by the manufacturer with precision instruments and all adjustments locked and sealed. Re-alignment should be necessary only when components in certain circuits have required replacement or repair. However, it should not be assumed that re-alignment is required because a component, except in a tuned circuit, has been replaced. First, check the performance of the receiver and if it is below normal, re-alignment will be necessary.

It is especially important that the adjustments should not be interfered with in any way unless in association with the correct testing instruments listed below.

If adjustment is necessary, the seal covering the adjusting screws must be broken and the locking nuts loosened, using the tool supplied for the purpose.

Under no circumstances should the plates of the variable condenser C18, C23, C28 and C33 be interfered with. This condenser is aligned by the manufacturer and cannot be re-adjusted without precision instruments.

4.1.2 Setting of Controls

In all operations in this chapter the receiver controls should be in the following positions, unless otherwise stated.

Facility Switch	"A.V.C. OFF"
"A.F. GAIN"	Maximum clockwise
"R.F. GAIN"	Maximum clockwise
"CRYSTAL" switch	"OUT"
"SELECTIVITY" control	"MIN"
"PHASING" control	At mid position.
"B.F.O. CONTROL"	At null point or bar.
"AERIAL TRIMMER"	Adjusted for maximum output of each test frequency.

4.2 Testing Instruments

Recommended instruments for use in the alignment of the Receiver are as follows:-

4.2.1 Standard Signal Generator

Frequency Range	- 400 Kc/s to 36 Mc/s
Output Range	- 1 microvolt to 1 volt.
Internal Modulation	- 30 per cent at 400 C/s.

4.2.2 Dummy Aerial

I.R.E. Standard in series with output termination of Standard Signal Generator.

4.2.3 Output Meter

This instrument should have impedances of 3.7,600 and 5,000 ohms, and a range of 5-1000 milliwatts.

4.2.4 D.C. Micro-ammeter

This instrument should have a range of 0-50 or 0-100 micro-amps.

4.2.5 Aligning Tools

Tools designed to facilitate alignment are supplied with the equipment and these are:-

i. Insulated Screwdriver - Part No. 13776

This tool is used for adjusting I.F. transformer cores and "PHASING" control trimmer.

ii. Locking Tool - Part No. 13779

Locking nuts are fitted to all I.F. transformer and trimmer condenser adjustments. The locking tool supplied is especially constructed for the purpose.

4.3 I.F. Alignment

(a) Connect loudspeaker to socket SO1 or headphones to jacks J1 or J2. Plug in band "E" or band "F" coil unit and set dial at 0.

(b) Disconnect the grid clip connected to the Control Grid of valve V2A and connect the active lead of the Standard Signal Generator in its place and the earth lead to the receiver chassis.

(c) Remove the crystal from the receiver and plug in to an external oscillator. Loosely couple the output from the oscillator to the Control Grid of valve V2A. Increase the unmodulated input from the Standard Signal Generator and tune until beat note is heard in receiver headphones or loudspeaker. When the Standard Signal Generator is tuned to zero beat with the crystal oscillator, it is tuned to the same frequency as the crystal supplied.

The use of an external oscillator will only be necessary when the I.F. transformers are badly out of alignment. If the adjustments are not far out the following procedure may be adopted.

Switch facility switch to "B.F.O. ON". Set "SELECTIVITY" switch to "MAX" and "CRYSTAL" switch to "IN". Switch modulation on the Standard Signal Generator off and as the generator is tuned, a peak in the audio beat note will be heard on one side of resonance. The frequency at which this note is heard will be crystal frequency.

(d) Replace crystal in receiver, and remove coupling from the crystal oscillator. Switch H.T. off; remove loudspeaker or headphones, and connect output meter to either of the following:-

Phone or Line Jack J1 or J2 - 600 ohm impedance
Loudspeaker Socket SO1 - 3.7 ohm impedance

to one of these positions and set at the correct impedance before switching H.T. on, otherwise damage to the Output Valve may result.

(e) Switch on modulation, 30% at 400 C/s. of Standard Signal Generator and adjust input to give an Output Meter reading of approximately 50 milliwatts.

(f) Using the insulated screwdriver supplied, adjust the magnetite cores L23 and L21 for maximum peak output.

(g) Reverse the chassis and adjust cores L22, L20 and L17 for maximum peak output.

(h) Repeat adjustments (f) and (g).

(i) Switch facility switch to "B.F.O. ON" and modulation of the Standard Signal Generator off. Adjust magnetite core in B.F.O coil L24 until zero beat is obtained.

4.4 Crystal Filter Alignment

(a) Disconnect end of resistor R28, which is connected to V3A cathode, from panel and connect D.C. micro-ammeter between this resistor and the lug on the panel from which it was disconnected. Switch crystal switch to "IN".

(b) With the modulation switched off set the Standard Signal Generator at a frequency of approx. 445 or 465 Kc/s and adjust input until a reading of approx. 10 or 20 micro-amps is obtained on micro-ammeter.

(c) Using the insulated screwdriver supplied, adjust trimmer condenser C38 until a minimum reading on the micro-ammeter is obtained. As the condition for minimum output is approached it may be necessary to increase the input from the Standard Signal Generator, or change the frequency slightly towards 455 Kc/s.

(d) Reset the Standard Signal Generator to 455 Kc/s and adjust the input until a reading of approximately 20 micro-amps is obtained on micro-ammeter.

(e) With the insulated screwdriver, adjust magnetite core L19; while rotating the Standard Signal Generator tuning back and forth, through a frequency of approximately 454 to 456 Kc/s, until a minimum reading is obtained on the micro-ammeter. At this minimum reading point it will be found that the output remains substantially constant between these frequencies.

(f) Repeat adjustments (b) to (e).

(g) To ensure that this alignment is correct a check should be made on the bandwidth at 6.0 dB. This should be approximately 4 Kc/s. and symmetrical to within 1 Kc/s.. Set "SELECTIVITY" control to "MIN" and check bandwidth at 6.0 dB.. It should be approximately 400 C/s..

(h) Disconnect Standard Signal Generator from V2A grid, replace grid connector; remove the micro-ammeter from the diode circuit and reconnect resistor R29 in place.

4.5 R.F. Alignment

(a) Connect active lead from Standard Dummy Aerial to

other side of Standard Dummy Aerial to Receiver Chassis. Connect terminal "A2" to earth.

(b) Plug in Band A tuning coils. Set Standard Signal Generator, modulated 30% at 400 C/s, at 25 Mc/s.. Tune receiver to give maximum output at this frequency. If calibration is not correct adjust trimmer C9, which is located at right hand end of coil unit on top of chassis, until the frequency corresponds to the dial readings as shown on the curve on coil unit.

(c) Adjust trimmers C7 and C4 second and third trimmers from right hand end, in turn for maximum output while rocking tuning condenser back and forth through the Signal.

Care must be taken in alignment at this frequency to ensure that the receiver is aligned to the correct frequency and not to the image frequency.

(d) Set the Standard Signal Generator at 14.8 Mc/s. and tune the receiver for maximum output at this frequency.

If calibration is incorrect it may be corrected by the magnetite core in the oscillator coil L7 which is located underneath the chassis at the right-hand rear of the coil unit.

(e) If adjustment was necessary at 14.8 Mc/s. repeat adjustment (b) and (c).

(f) Align bands B.C.D.E. and F. in the same manner at the following frequencies.

Band "B"	14.2 - 7.3	Mc/s.
Band "C"	7.1 - 3.7	Mc/s.
Band "D"	3.8 - 1.9	Mc/s.
Band "E"	1.85 - 0.94	Mc/s.
Band "F"	0.98 - 0.5	Mc/s.

When the receiver has been satisfactorily aligned, lock all adjustments using the tool provided.

4.6 Removal of Crystal

The crystal is mounted in sockets on top of the Crystal Filter Unit. To remove the crystal, loosen screw "A" shown in Plate 3. and slide off cover towards rear of chassis. The crystal will now be fully revealed and may be withdrawn towards the front panel.

NOTE:

In receivers having serial numbers of 500 and onwards, magnetite cores are fitted to the R.F. coil assemblies in Band "A".

The Alignment Procedure is the same as described above, excepting that after making calibration adjustment given in section 4.5 (d) adjust cores in R.F. coils L4 and L6 for maximum output. The adjusting screws project from the rear of the coil unit housing - see Plate 4, references F4 and G4, respectively.

TABLE 2. - SENSITIVITY MEASUREMENTS

Measurements taken with controls set in position described in Chapter IV, Section 4.1.3

Description of Test	Connect Input to	Input Voltage	Band	Frequency	Output	Remarks
A.F. Gain	Grid V3A (6G8G)	5 mV		400 C/s.	50 mW	
I.F. Gain	" V1D (6U7G)	4000 uV		455 Kc/s.	50 "	
"	" V1C (6U7G)	120 "		455 "	50 "	
"	" V2A (6J8G)	30 "	E	455 "	50 "	Sensitivity taken w Band 'E' coil unit and dial set at 0
R.F. Gain	" V2A (6J8G)	40 "	A	24.0 Mc/s	50 "	
"	" " "	45 "	A	14.8 "	50 "	
"	" " "	40 "	B	14.2 "	50 "	
"	" " "	40 "	B	7.3 "	50 "	
"	" " "	40 "	C	7.1 "	50 "	
"	" " "	40 "	C	3.7 "	50 "	
"	" " "	40 "	D	3.8 "	50 "	
"	" " "	40 "	D	1.9 "	50 "	
"	" " "	40 "	E	1.85 "	50 "	
"	" " "	40 "	E	0.94 "	50 "	
"	" " "	40 "	F	0.98 "	50 "	
"	" " "	40 "	F	0.5 "	50 "	
"	" V1B (6U7G)	15 "	A	24.0 "	50 "	
"	" " "	10 "	A	14.8 "	50 "	
"	" " "	9 "	B	14.2 "	50 "	
"	" " "	5 "	B	7.3 "	50 "	
"	" " "	5 "	C	7.1 "	50 "	
"	" " "	5 "	C	3.7 "	50 "	
"	" " "	5 "	D	3.8 "	50 "	
"	" " "	5 "	D	1.9 "	50 "	
"	" " "	40 "	E	1.85 "	50 "	
"	" " "	40 "	E	0.94 "	50 "	
"	" " "	40 "	F	0.98 "	50 "	
"	" " "	40 "	F	0.5 "	50 "	

Table 2. - Sensitivity Measurements (Contd.)

Description of Test	Connect Input to	Input Voltage	Band	Frequency	Output	Remarks
R.F. Gain	Grid V1A (6U7G)	3 uV	A	24.0 Mc/s	50 mW	
"	" " "	3 "	A	14.8 "	50 "	
"	" " "	3 "	B	14.2 "	50 "	
"	" " "	3 "	B	7.3 "	50 "	
"	" " "	3 "	C	7.1 "	50 "	
"	" " "	3 "	C	3.7 "	50 "	Sensitivity for 2
"	" " "	3 "	D	3.8 "	50 "	signal to noise ra
"	" " "	3 "	D	1.9 "	50 "	
"	" " "	3 "	E	1.85 "	50 "	
"	" " "	3 "	E	0.94 "	50 "	
"	" " "	3 "	F	0.98 "	50 "	
"	" " "	3 "	F	1.0 "	50 "	

Output measurements taken with a resistive load of 5000 ohms across primary of output transformer or 600 ohms across phone jacks.

TABLE 3. - SOCKET VOLTAGES AND CURRENTS

Tube Type	Function	Anode to Chassis Volts	Screen Grid to Shassis Volts	Cathode to Chassis Volts	Anode Current mA	Screen Current mA.	Remarks
6U7G	1st R.F. Amp.	255	95	2.7	7.0	1.5	
6U7G	2nd R.F. Amp.	255	95	2.7	7.0	1.5	
6J8G	Converter	260	85	1.5	1.5	2.7	
6J5GT	Oscillator	140	-	-	A-6.0 B-6.0 C-4.0 D-4.0 E-3.0 F-3.0	-	
6U7G	1st I.F. Amp.	255	95	3.5	5.0	1.3	
6U7G	2nd I.F. Amp.	255	95	3.5	5.0	1.3	
6G8G	Detector A.V.C. and A.F. Amp.	85	30	1.8	0.6	0.16	Screen & Anode Votlag as measured with 1000 ohm per volt met 1000V range
6V6G	Output	255	280	13.0	45.0	4.0	
6J5GT	B.F.O.	110	-	-	3.0	-	Facility Switch at "B.F.O. ON".

Measurements taken with receiver operating on 240V A.C. with no signal input and controls set in the following positions:- "A.F. GAIN" control at 0; "R.F. GAIN" control at 0; Tuning Dial at 0; Facility switch at "A.V.C. OFF".

TABLE 4. - SCHEDULE OF EQUIPMENT FOR COMPLETE STATION

Item No.	Equipment	Essential Items	Spares	Total
1.	Communication Receiver, Type C13500	1		1
2.	Coil Units (5 in box, 1 in set)			
2.1	Band A	1		1
2.2	Band B	1		1
2.3	Band C	1		1
2.4	Band D	1		1
2.5	Band E	1		1
2.6	Band F	1		1
3.	Valves -			
3.1	6U7G Radiotron	4	12	16
3.2	6J8G Radiotron	1	3	4
3.3	6J5GT Radiotron	2	6	8
3.4	6G8G Radiotron	1	3	4
3.5	6V6G Radiotron	1	3	4
4.	Instruction Book	1		1
5.	Universal Power Unit, Type H13501	1		1
6.	Valves - 6X5GT Radiotron	2	6	8
7.	Vibrator - 12 volt, non-synchronous, Oak Type V5123	1	1	2
8.	Loudspeaker Unit Type D13503	1		1
9.	Headphones (complete with plugs)	2		2

Table 4. - Schedule of Equipment for Complete Station - Contd.

Item No.	Equipment	Essential Items	Spares
10.	Cables		
10.1	Battery, No. 13222	1	
10.2	A.C. Mains, No. 13225	1	
10.3	Battery Link, No. 4021B2/31	1	
11.	Screwdriver, insulated, No. 13776	1	
12.	Locking Tool (aligning) No. 13779	1	
13.	Lamp, pilot, 6.3V., 0.25 amp.		6
14.	Fuses, 10 amp.		6
15.	Fuses, 3 amp.		6

The equipment is packed in two cartons; one containing items 1-4, the other containing the remainder. Items 9, 11, 12 and all spares are carried in a spare parts case.

APPENDIX 1 - CIRCUIT COMP

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remarks
	CONDENSERS				
C1	Series padder	V1A	-	Band A Aerial coil unit	480 uuF silvered mica, ± 2½%
C2	Capacity coupling	V1B	-	Band A 1st R.F. coil unit	4 uuF mica
C3	Series padder	V1B	-	Band A 1st R.F. coil unit	460 uuF silvered mica, ± 2½%
C4	Trimmer	V1B	-	Band A 1st R.F. coil unit	3-25 uuF air variable
C4A	Trimmer shunt	V1B	-	Band A 1st R.F. coil unit	14 uuF mica
C5	Capacity coupling	V2A	-	Band A 2nd R.F. coil unit	4 uuF mica
C6	Series padder	V2A	-	Band A 2nd R.F. coil unit	480 uuF silvered mica, ± 2½%
C7	Trimmer	V2A	-	Band A 2nd R.F. coil unit	3-25 uuF air variable
C7A	Trimmer shunt	V2A	-	Band A 2nd R.F. coil unit	14 uuF mica
C8	Anode decoupling	V5A	-	Band A Osc. coil unit	0.01 uF mica
C9	Trimmer	V5A	-	Band A Osc. coil unit	3-25 uuF air variable
C10	Series padder	V5A	-	Band A Osc. coil unit	400 uuF silvered mica, ± 2½%
					1 - 200 uuF silvered mica
					1 - 200 uuF N680 silver
C11	Capacity coupling	V1B	-	Bands B-F 1st R.F. coil unit	4 uuF mica
C12	Trimmer	V1B	-	Bands B-F 1st R.F. coil unit	3-25 uuF air variable
C12A	Trimmer shunt	V1B	-	Bands B-F 1st R.F. coil unit	9 uuF mica
C13	Capacity coupling	V2A	-	Bands B-D 2nd R.F. coil unit	4 uuF mica
C14	Trimmer	V2A	-	Bands B-F 2nd R.F. coil unit	3-25 uuF air variable
C14A	Trimmer shunt	V2A	-	Bands B-F 2nd R.F. coil unit	9 uuF mica
C15	Anode decoupling	V5A	-	Bands B-F Osc. coil unit	0.01 uF mica
C16	Trimmer	V5A	-	Bands B-F Osc. coil unit	3-25 uuF air variable
C16A	Trimmer shunt	V5A	-	Band F Osc. coil unit	14 uuF mica
C17	Series padder	V5A	-	Band B Osc. coil unit	3000 uuF mica ± 2½%
	"	"	-	Band C Osc. coil unit	2000 uuF mica ± 2½%
	"	"	-	Band D Osc. coil unit	1200 uuF mica ± 2½%
	"	"	-	Band E Osc. coil unit	600 uuF mica ± 2½%
	"	"	-	Band F Osc. coil unit	400 uuF mica ± 2½%
C18	Input tuning	V1A	3	K3	19-250 uuF section of 4 gan
C18A	Aerial Trimmer	V1A	3	K2	4-40 uuF air variable
C19	Grid decoupling	V1A	4	D4	0.05 uF paper, 350V working
C20	Cathode by-pass	V1A	4	D6	0.1 uF paper, 350V working
C21	Screen by-pass	V1A	4	E6	0.1 uF paper, 350V working
C22	Anode decoupling	V1A	4	G5	0.1 uF paper, 350V working

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remarks
C51	Anode decoupling	V1D	4	H3	0.1 uF paper, 350V working
C52	Signal diode filter	V3A	4	H7	100 uuF mica
C53	Cathode by-pass	V3A	4	F6	25 uF 40V. Electro. type E.T.
C54	2nd I.F. trans. secondary tuning	V3A	3	F7	250 uuF silvered mica
C55	Signal diode filter	V3A	4	H7	100 uuF mica
C56	Signal diode coupling	V3A	4	G8	0.01 uF paper, 350V working
C57	A.V.C. diode coupling	V3A	4	F7	50 uuF mica
C58	Screen grid by-pass	V3A	4	J8	0.1 uF paper, 350V working
C59	Grid decoupling	V1D	4	L7	0.05 uF paper, 350V working
C60	Anode by-pass	V3A	4	F7	500 uuF mica
C61	B.F.O. coupling	V5B	4	B7	2 uuF mica (2-4 uuF in serie
C62	A.V.C. decoupling	-	4	G8	0.05 uF paper, 350V working
C63	Output coupling	V3A	4	E8	0.01 uF paper, 350V working
C64	Anode decoupling	V3A	4	E8	0.1 uF paper, 350V working
C65	Anode by-pass	V4A	4	C7	0.02 uF paper, 350V working
C66	Cathode by-pass	V4A	4	C6	25 uF 40V Electro. type E.T.
C67	H.T. by-pass	-	4	A7	0.1 uF paper, 350V working
C68	B.F.O. tuning	V5B	4	B6	750 uuF silvered mica
C69	Grid	V5B	4	B3	250 uuF silvered mica
C70	Anode decoupling	V5B	4	A7	0.1 uF paper, 350V working
C71	Filter	-	5		24 uF 600 P.V. Electro. EE1(
C72	H.T. + R.F. by-pass	-	6		0.1 uF paper 350V working
C73	Filter	-	5		24 uF 600 P.V. Electro. typ
C74	Heater Supply R.F. by-pass	-	6		0.5 uF paper 350V working
C75	Filter	-	5		24 uF 600 P.V. Electro. typ
C76	Heater Supply R.F. by-pass	-	6		0.1 uF paper, 350V working
C77	Buffer	-	6		0.03 uF paper, 700V working
C78	Buffer	-	6		0.03 uF paper, 700V working
C79	H.T. - R.F. by-pass	-	6		5000 uuF mica
C80	Vib. Prim. R.F. by-pass	-	6		0.1 uF paper, 350V working
C81	Vib. Prim. R.F. by-pass	-	6		0.1 uF paper, 350V working
C82	Vib. Coil R.F. by-pass	-	6		0.5 uF paper, 350V working
C83	Vib. Coil R.F. by-pass	-	6		0.1 uF paper, 350V working

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remarks
C84	Mains filter	-	6		0.02 uF paper, 700V working
C85	Mains filter	-	6		0.02 uF paper, 700V working
C86	L.T. Supply R.F. by-pass	-	6		0.1 uF paper, 350V working
C87	L.T. Supply R.F. by-pass	-	6		0.5 uF paper, 350V working
	RESISTORS				
R1	Anode decoupling	V5A	7	Band A, Osc. coil unit	20,000 ohms, 1 watt
R2	Anode inductance shunt	V1A	7	Band C, 1st R.F. coil unit	16,000 ohms, 1 watt
		V1A		Band D, 1st R.F. coil unit	8,000 ohms, 1 watt
R3	Anode inductance shunt	V1B	7	Band C, 2nd R.F. coil unit	16,000 ohms, 1 watt
		V1B		Band D, 2nd R.F. coil unit	8,000 ohms, 1 watt
R4	Anode decoupling	V5A	7	Band B, Osc. coil unit	20,000 ohms, 1 watt
		V5A		Bands C-D Osc. coil unit	32,000 ohms, 1 watt
		V5A		Bands E-F Osc. coil unit	40,000 ohms, 1 watt
R5	Grid decoupling	V1A	4	E4	0.1 megohm, ½ watt
R6	Cathode bias	V1A	4	D5	320 ohms, 1 watt
R7	Anode decoupling	V1A	4	G5	2000 ohms, 1 watt
R8	Grid decoupling	V1B	4	E4	0.1 megohms, ½ watt
R9	Cathode bias	V1B	4	F5	320 ohms, 1 watt
R10	"R.F. GAIN" control	-	3	D2	3000 ohms, w.w. variable
R11	"S" Meter Bridge Arm		4	M4	80,000 ohms, 2 watt (2-0.16 megohm, 1 watt in pa
R12	"S" Meter adjusting		4	B2	3,000 ohms, w.w. variable
R13	"S" Meter bridge arm		4	M4	400 ohms, 1 watt
R14	Anode decoupling	V1B	4	G5	2,000 ohms, 1 watt
R15	Cathode bias	V2A	4	H5	320 ohms, 1 watt
R16	Triode grid leak	V2A	4	G5	50,000 ohms, 1 watt
R17	Screen feed	V2A	4	G5	63,000 ohms, 1 watt
R18	Grid leak	V5A	4	J5	32,000 ohms, 1 watt
R19	Anode decoupling	V2A	4	M4	2000 ohms, 1 watt
R20	Screen potentiometer	V1A-D	4	K8	20,000 ohms, 2 watt (2-40,000 ohms, 1 watt in pa

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remarks
R21	Screen potentiometer	V1A-D	4	K8	17,000 ohms, 3 watt (3-50,000 ohms, 1 watt in p
R22	Grid decoupling	V1C	3	J5	0.1 megohm, ½ watt
R23	Cathode bias	V1C	4	M4	630 ohms, 1 watt
R24	Anode decoupling	V1C	4	K8	2,000 ohms, 1 watt
R25	Cathode bias	V1D	4	J7	630 ohms, 1 watt
R26	Anode decoupling	V1D	4	J8	2000 ohms, 1 watt
R27	Signal Diode Filter	V3A	4	G7	0.1 megohm, ½ watt
R28	Signal Diode Load	V3A	4	J8	0.25 megohm, 1 watt
R29	Cathode bias	V3A	4	F6	3200 ohms, 1 watt
R30	Screen potentiometer	V3A	4	J8	1 megohm, 1 watt
R31	"A.F. GAIN" control	V3A	3	M2	1 megohm, variable potentio
R32	Screen potentiometer	V3A	4	J8	0.5 megohm, 1 watt
R33	A.V.C. Diode load pot.	V3A	4	G8	1 megohm, 1 watt
R34	A.V.C. Diode load pot.	V3A	4	G8	1 megohm, 1 watt
R35	A.V.C. decoupling	-	4	G8	1 megohm, 1 watt
R36	A.V.C. decoupling	-	4	G8	1 megohm, 1 watt
R37	Anode load	V3A	4	E8	0.2 megohm, 1 watt
R38	Anode decoupling	V3A	4	E8	50,000 ohms, 1 watt
R39	Inverse feedback	V4A	4	E8	3.2 megohm, 1 watt
R40	Cathode bias	V4A	4	D7	250 ohms, 3 watt w.w. type A A coat C
R41	Grid suppressor	V4A	4	D7	50,000 ohms, ½ watt
R42	Grid leak	V4A	4	D7	0.5 megohm, ½ watt
R43	Anode decoupling	V5B	4	A7	50,000 ohms, 1 watt
R44	"B.F.O CONTROL"	V5B	4	B5	250 ohms, w.w. variable
R45	Grid leak	V5B	4	B6	50,000 ohms, 1 watt
R46	Heater series	V5B	4	E7	40 ohms, 3 watt, w.w. type AA coat C
R47	Pilot lamp series		4	C5	32 ohms, 3 watt w.w. type AA coat C
R48	Buffer		6		100 ohms, 3 watt w.w. type AA coat C
R49	Buffer		6		100 ohms 3 watt w.w. type AA coat C
R50	Pilot lamp series		6		32 ohms, 3 watt w.w. type AA coat C.

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remarks
	INDUCTANCES				
L1	Aerial coupling	-	7	Band A, aerial coil unit	
L2	Input tuning	V1A	7	Band A, aerial coil unit	
L3	Anode coupling	V1A	7	Band A, 1st R.F. coil unit	
L4	Input tuning	V1B	7	Band A, 1st R.F. coil unit	
L5	Anode coupling	V1B	7	Band A, 2nd R.F. coil unit	
L6	Input tuning	V2A	7	Band A, 2nd R.F. coil unit	
L7	Anode tuning	V5A	7	Band A, Osc. coil unit	
L8	Grid coupling	V5A	7	Band A, Osc. coil unit	
L9	Aerial coupling	-	7	Bands B-F Aerial coil unit	
L10	Input tuning	V1A	7	Bands B-F Aerial coil unit	
L11	Anode coupling	V1A	7	Bands B-F 1st R.F. coil unit	
L12	Input tuning	V1B	7	Bands B-F 1st R.F. coil unit	
L13	Anode coupling	V1B	7	Bands B-F, 2nd R.F. coil unit	
L14	Input tuning	V2A	7	Bands B-F 2nd R.F. coil unit	
L15	Anode tuning	V5A	7	Bands B-F Osc. coil unit	
L16	Grid coupling	V5A	7	Bands B-F Osc. coil unit	
L17	I.F. Crystal filter input trans. prim.	V2A	3 and 4	B3 and L3	
L18	I.F. Crystal filter input trans. sec.	V2A	3	B3	
L19	I.F. Crystal filter output	V1C	3	B4	
L20	1st I.F. trans. prim.	V1C	3 and 4	B7 and L7	
L21	1st I.F. trans. sec.	V1D	3	B7	
L22	2nd I.F. trans. prim.	V1D	3 and 4	F7 and G7	
L23	2nd I.F. trans. sec.	V3A	3	F7	
L24	B.F.O. tuning	V5B	4	B5	
L25	"B.F.O CONTROL" coupling	V5B	4	B5	
L26	R.F. choke, H.T. +		6		
L27	A.F. choke,		5		
L28	A.F. choke,		5		
L29	R.F. choke, heater supply		6		

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Remar
L30	R.F. choke, H.T. -		6		
L31	R.F. choke, Vib. Prim.		6		
L32	R.F. choke, Vib. Prim.		6		
L33	R.F. choke, Vib. coil		6		
L34	R.F. choke, L.T. supply		6		
	TRANSFORMERS				
T1	Receiver output	V4A	3	M5	
T2	Power transformer	-	5		
	SWITCHES				
S1	"S" meter "IN" - "OUT"		3	K1	
S2	Facility switch 4 pole 4 posn. (H.T. OFF" "A.V.C. ON" - "A.V.C. OFF" - "B.F.O. ON")		4	L1-2	
S3	Power Selector switch		4		
S4	ON-OFF switch		5		
S5	"CRYSTAL" "IN" - "OUT".		3	B2	
	JACKS				
J1	Headphone or Line		3	L3	
J2	Headphone or Line		3	L3	
	SOCKETS				
SO1	Loudspeaker, 4 point		3	K8	
SO2	Power unit, 4 point		6		

Symbol	Description	Assoc. with valve	Plate	Location	Type, Rating and Rema
	PLUGS				
PL1	Receiver Power Unit, 4 point				
PL2	Battery connection, 3 point		6		
PL3	A.C. Mains input				
	FUSES				
F1	Vibrator prim.		6		Cartridge 10 amps.
F2	A.C. Mains		6		Cartridge 3 amps.
	LAMPS				
P1	Receiver ON-OFF indicator		3	J1	6-8V, .25A, E.S. Miniatu
P2	Power Supply ON-OFF indicator		5		Bas
	VALVES				
V1A	6U7G 1st R.F. amplifier		3	K5	
V1B	6U7G 2nd R.F. amplifier		3	H5	
V1C	6U7G 1st I.F. amplifier		3	B5	
V1D	6U7G 2nd I.F. amplifier		3	D7	
V2A	6J8G Frequency converter		3	F5	
V3A	6G8G Detector A.V.C. and A.F. amp.		3	H7	
V4A	6V6G Output		3	K7	
V5A	6J5GT Local oscillator		3	L5	
V5B	6J5GT Beat Frequency Oscillator		3	M7	
V6A	6X5GT Rectifier		5		
V6B	6X5GT Rectifier		5		
	METERS				
M1	"S" Meter		5	M1	
	CRYSTALS				
X1	455 Kc/s resonator		3	B2	A.W.A. Type R5587

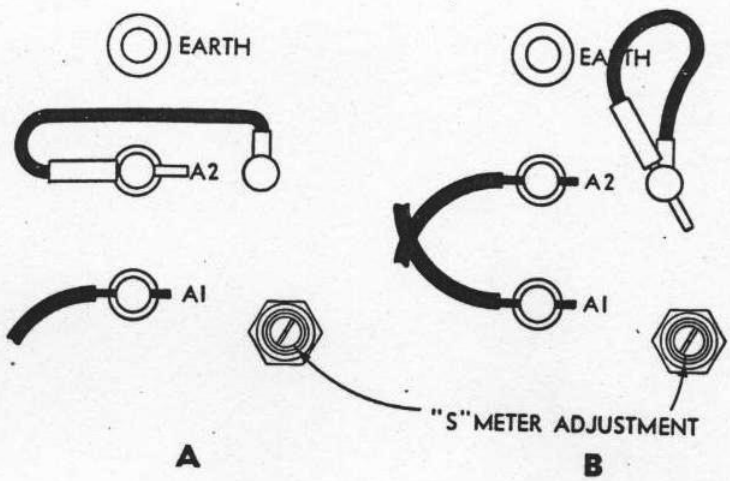


FIG. 1 — AERIAL CONNECTIONS.

A — Connections for single wire aerial.

B — Connections for doublet aerial.

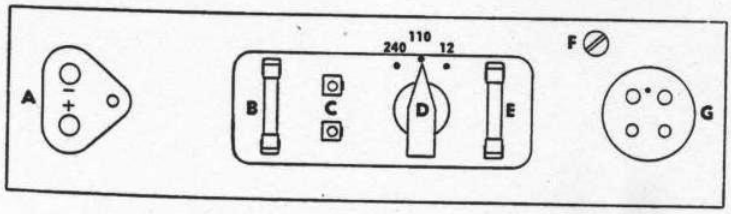
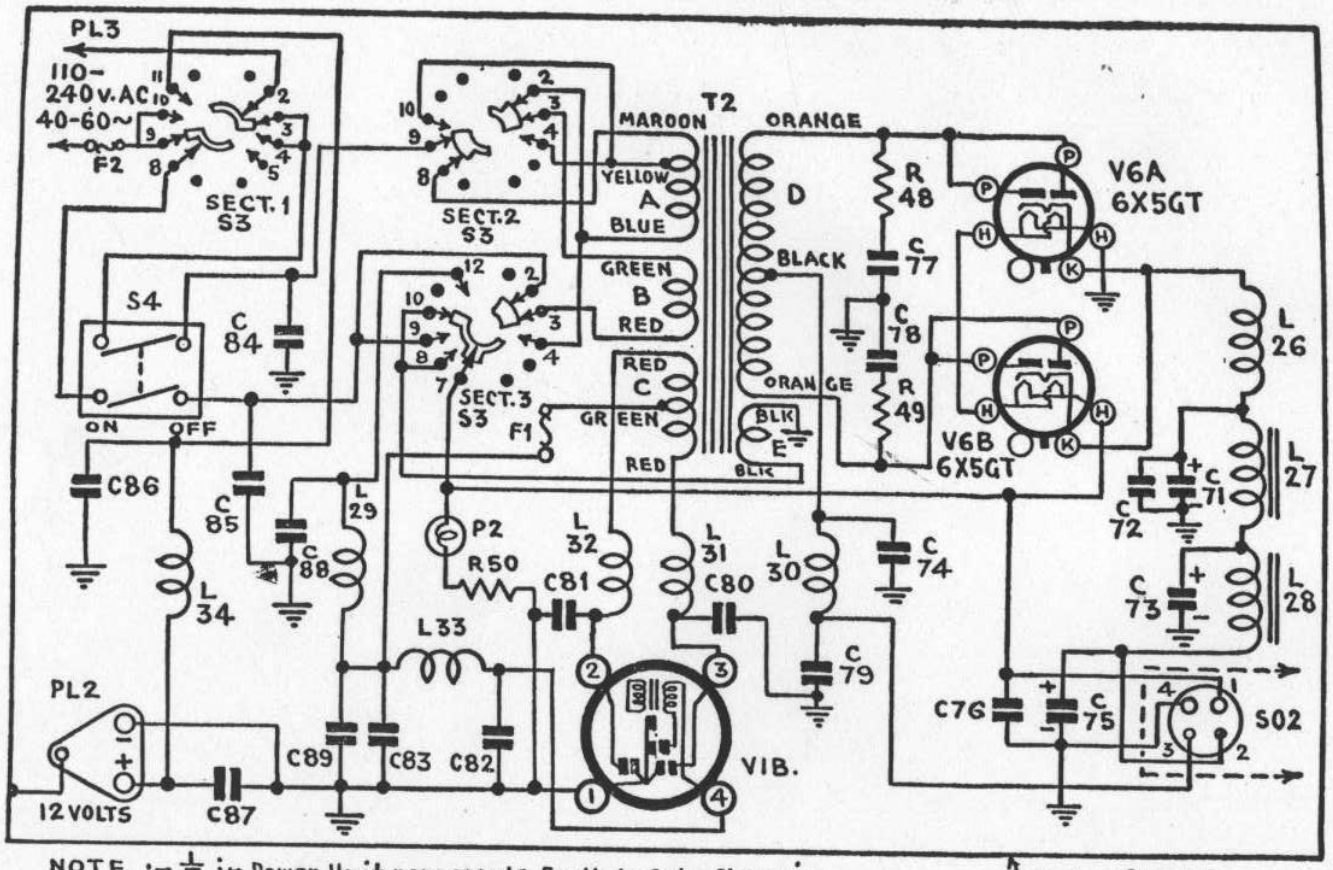


FIG. 2 — UNIVERSAL POWER UNIT CONNECTIONS.

A—Battery input plug; B—A.C. mains fuse—3 amp.; C—A.C. mains input plug; D—Selector switch; E—Battery fuse—10 amp.; F—Screw for connecting metal braiding on Receiver cable to Power Unit chassis; G—Socket for Receiver cable.



NOTE :- ⏚ in Power Unit represents Earth to Sub-Chassis

:- All Rotary Switches viewed from Spindle End & in extreme Anti-Clockwise Position

Outer Shield

FIG. 4 — CIRCUIT DIAGRAM OF 1H13501 UNIVERSAL POWER UNIT.

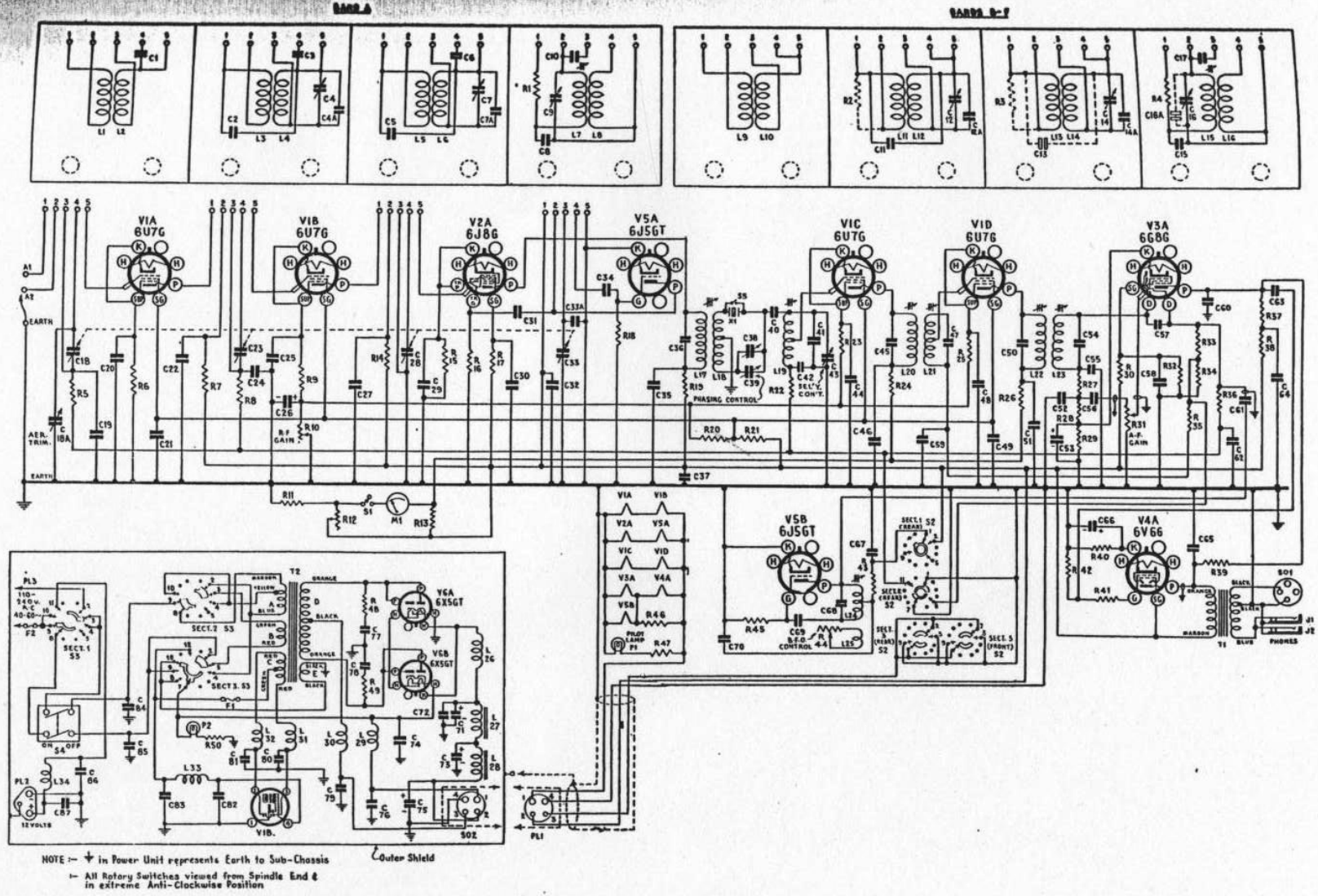


FIG. 3 — CIRCUIT DIAGRAM.

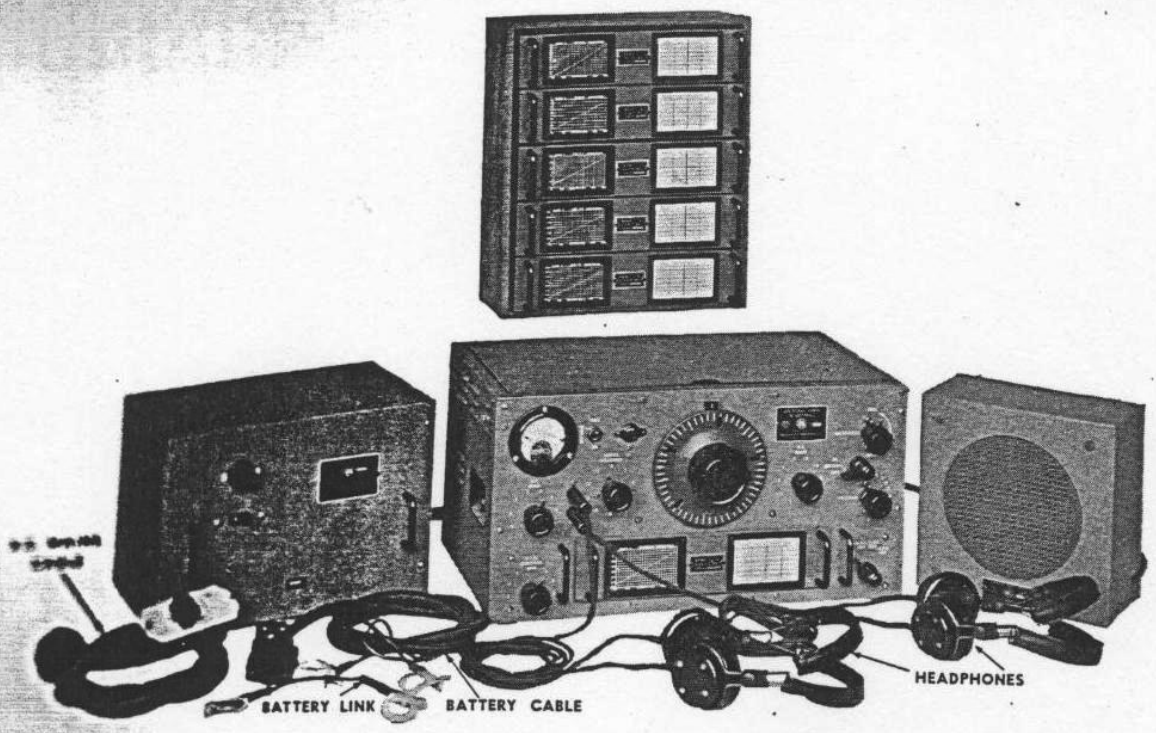


PLATE 1 — INSTALLATION.

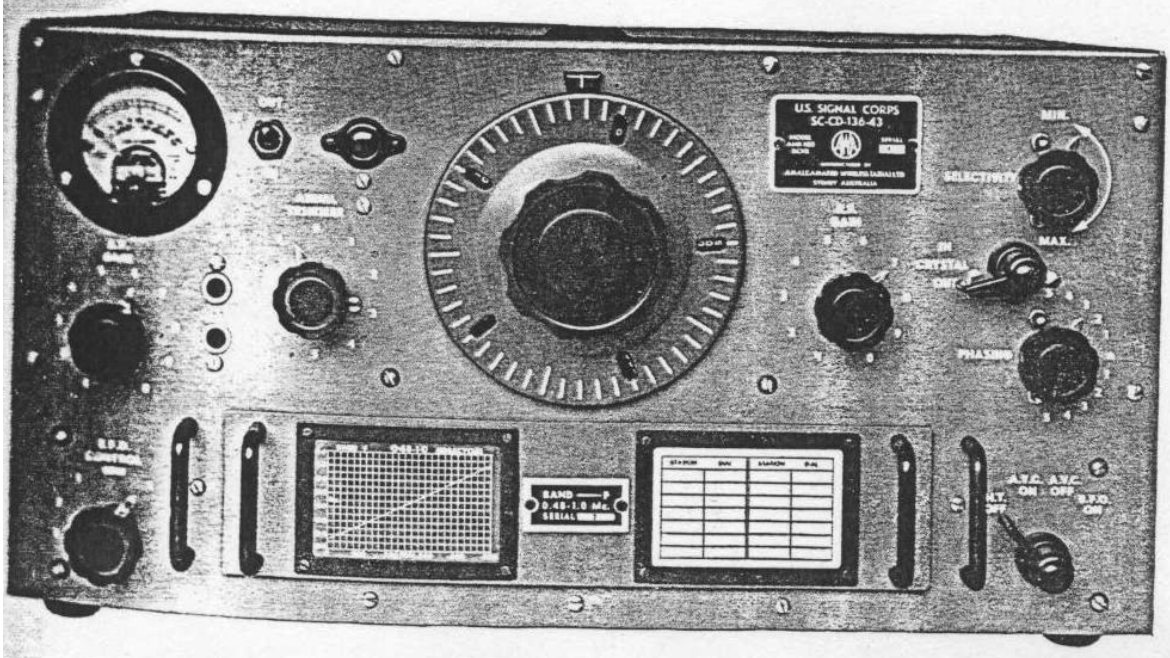


PLATE 2 — RECEIVER FRONT PANEL.

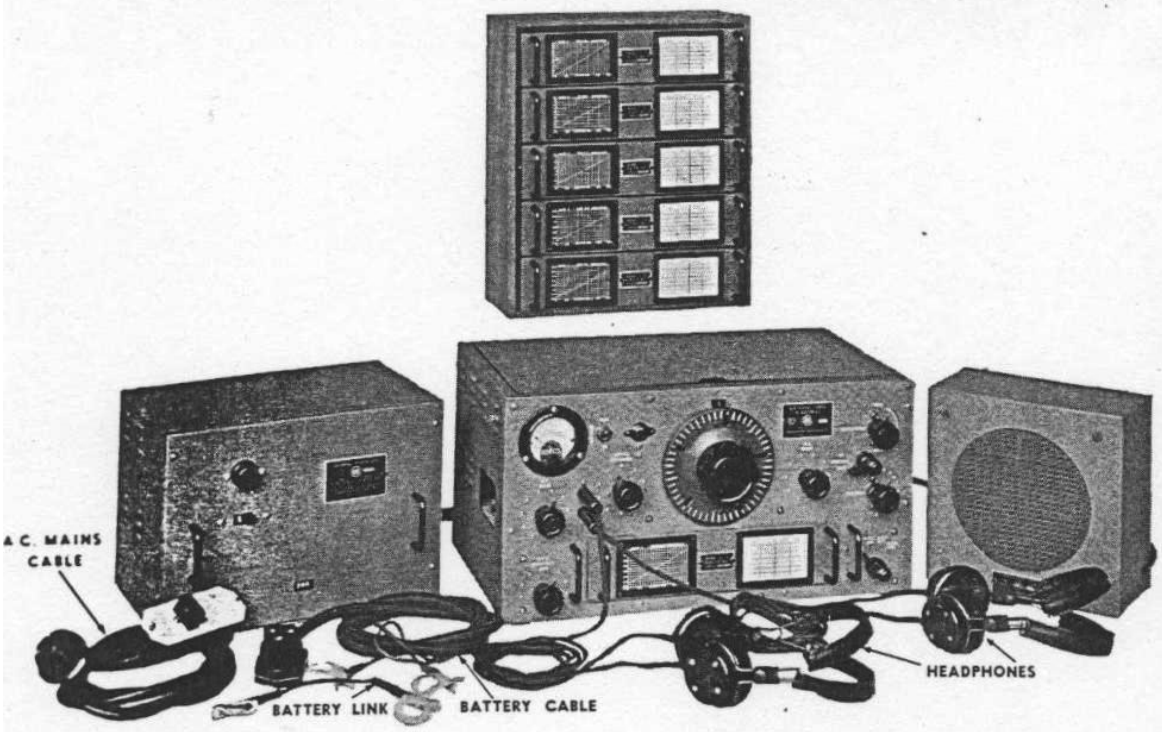


PLATE 1 — INSTALLATION.

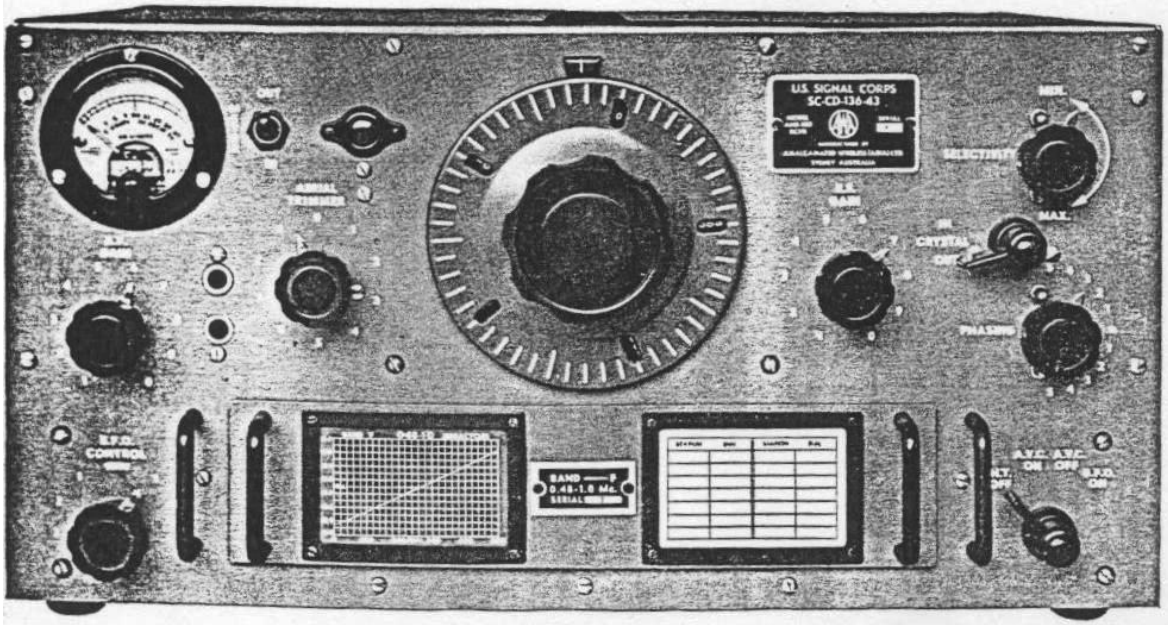


PLATE 2 — RECEIVER FRONT PANEL.

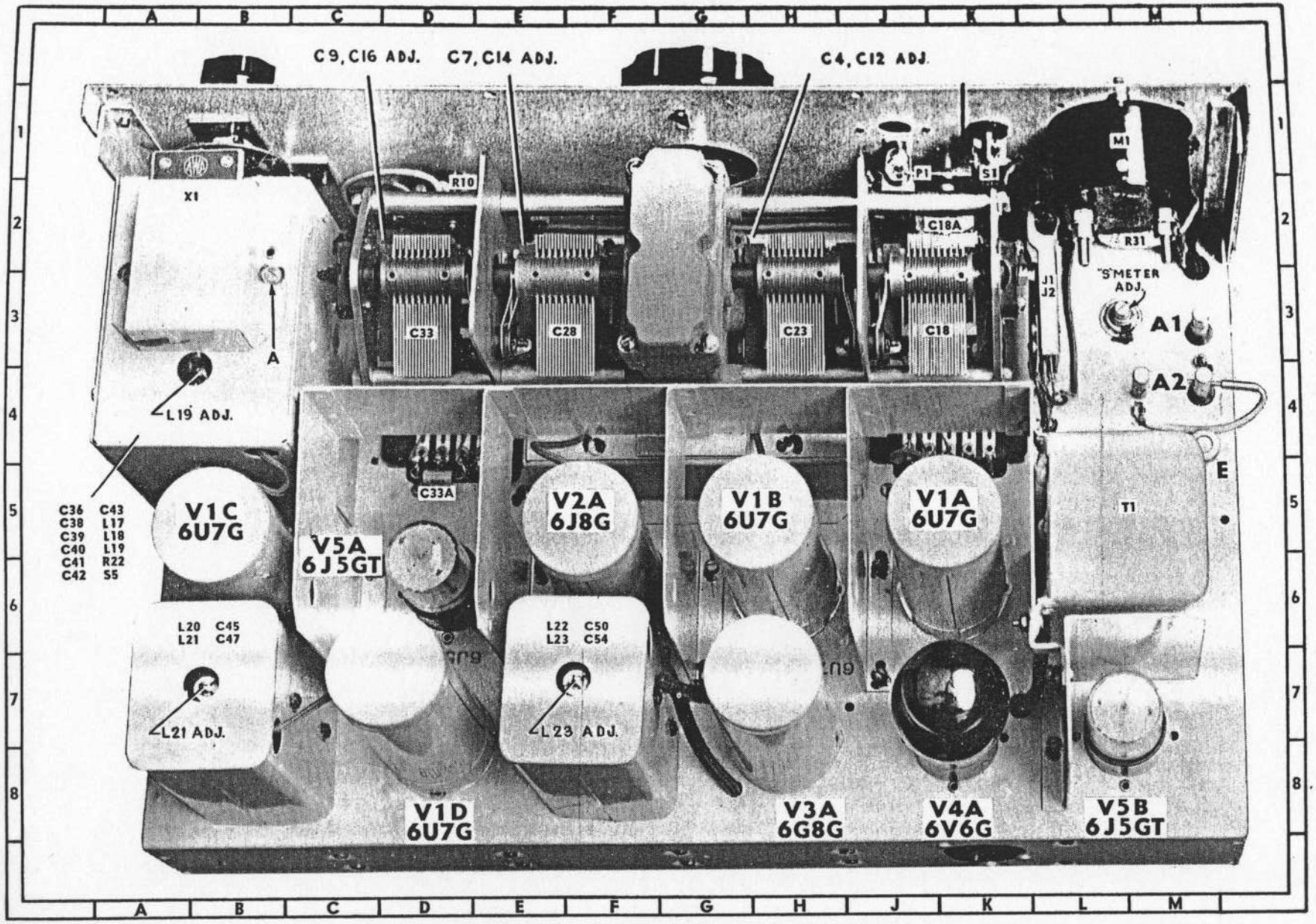


PLATE 3 — RECEIVER CHASSIS—TOP VIEW.

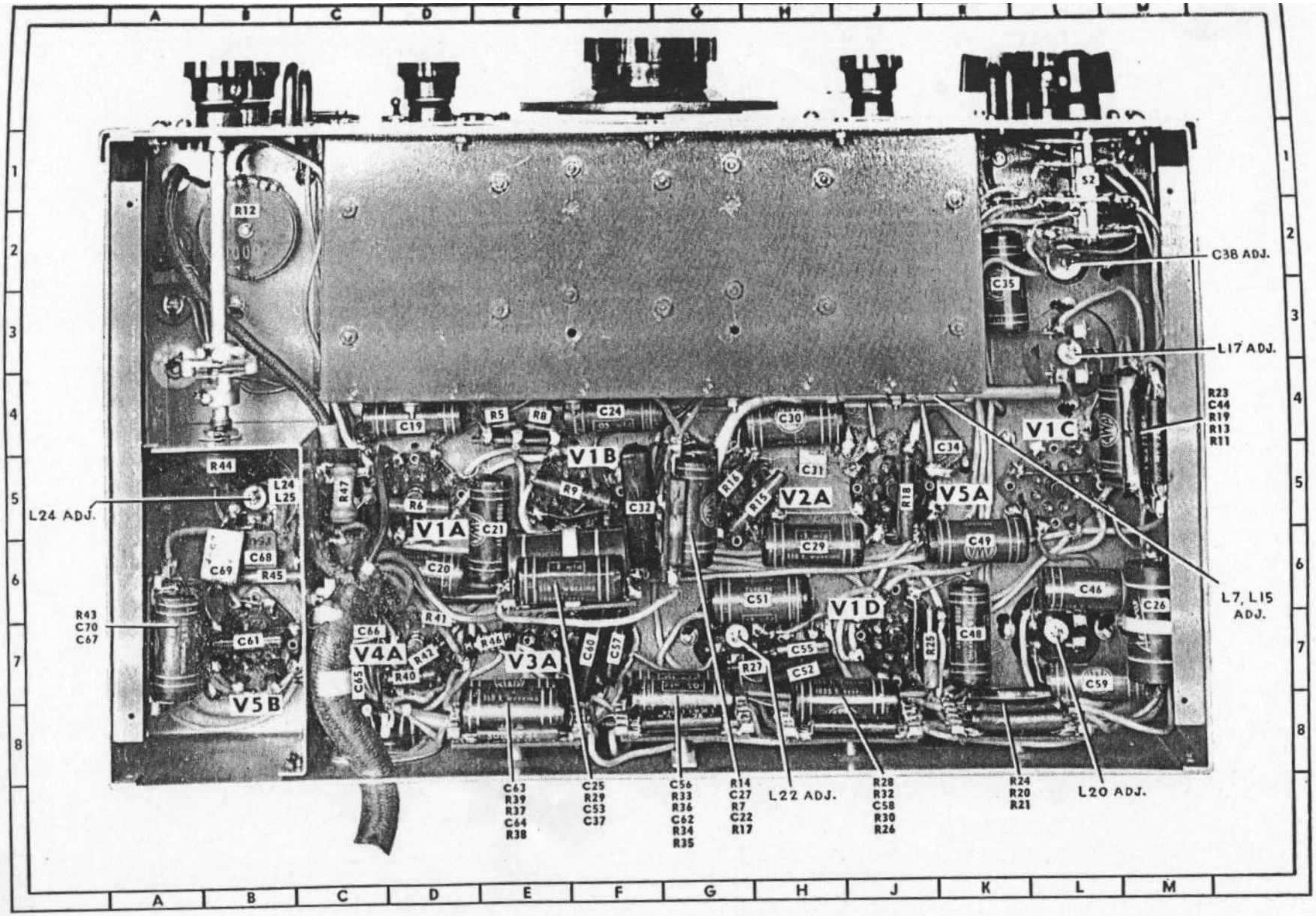


PLATE 4 — RECEIVER CHASSIS—UNDERNEATH VIEW.

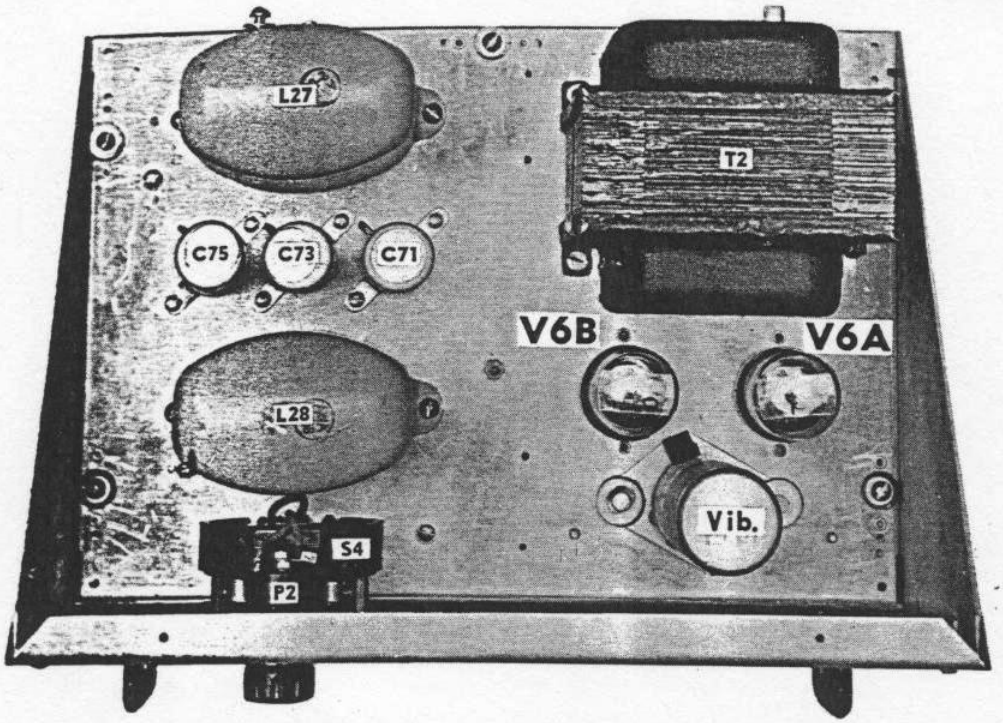


PLATE 5 — POWER UNIT CHASSIS—TOP VIEW.

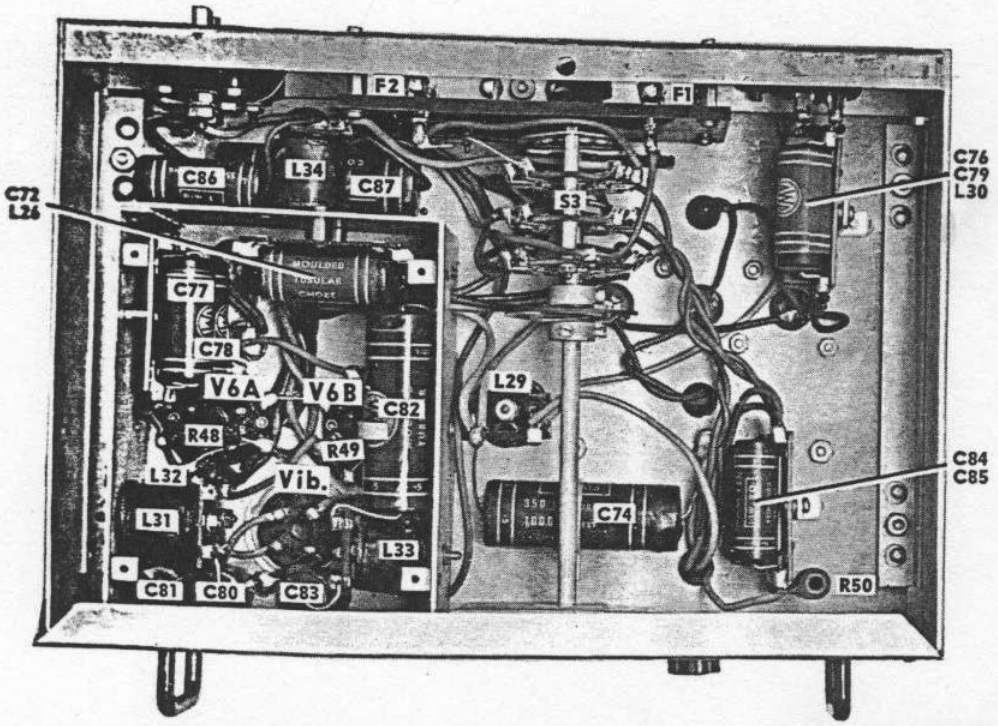


PLATE 6 — POWER UNIT CHASSIS—UNDERNEATH VIEW.

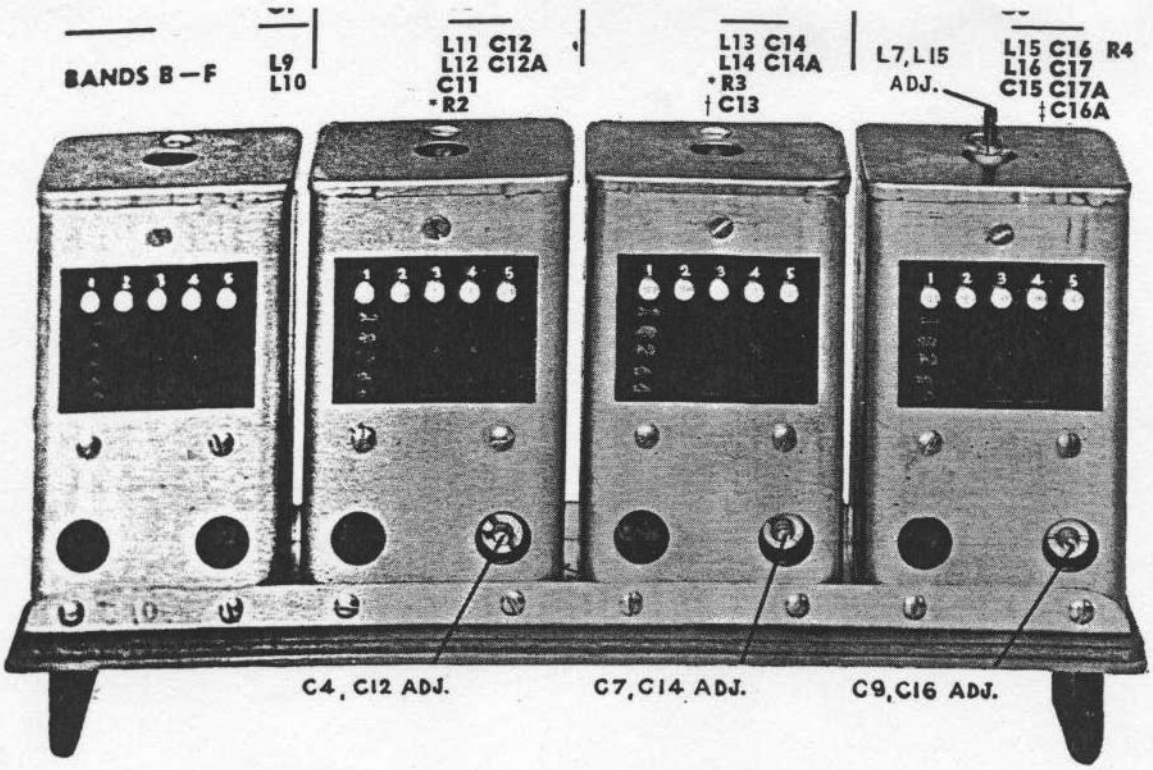


PLATE 7—COIL UNIT, SHOWING ADJUSTMENTS.

* Bands C and D only.
† Bands B and D only.
‡ Band F only.

NOTE: In receivers having serial numbers of 500 and onwards magnetite cores are fitted to the R.F. coils L4 and L6 in Band "A" (two centre assemblies).