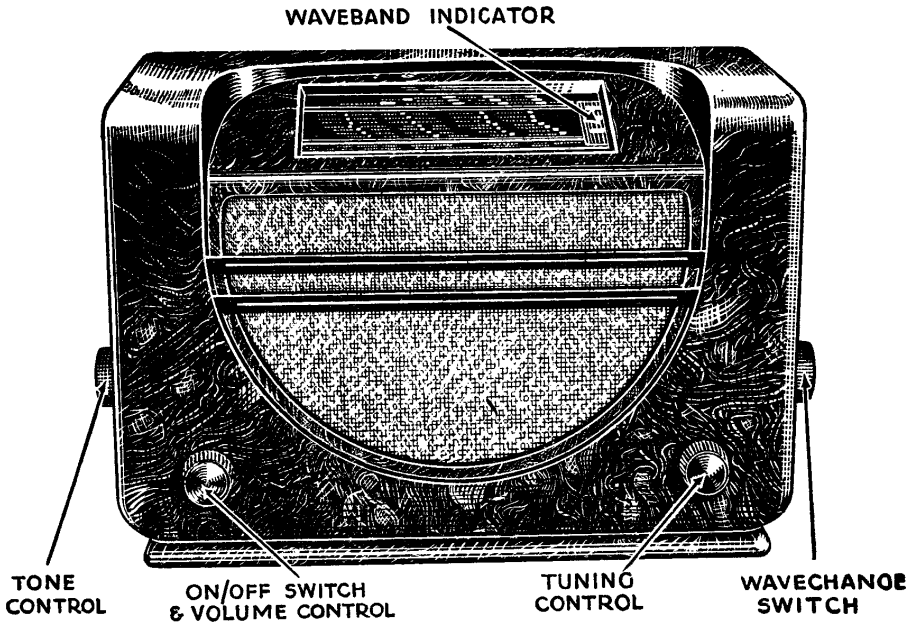
THE Mullard Wireless Service Company LTD.

SERVICE MAS6 MANUAL

GENERAL DESCRIPTION

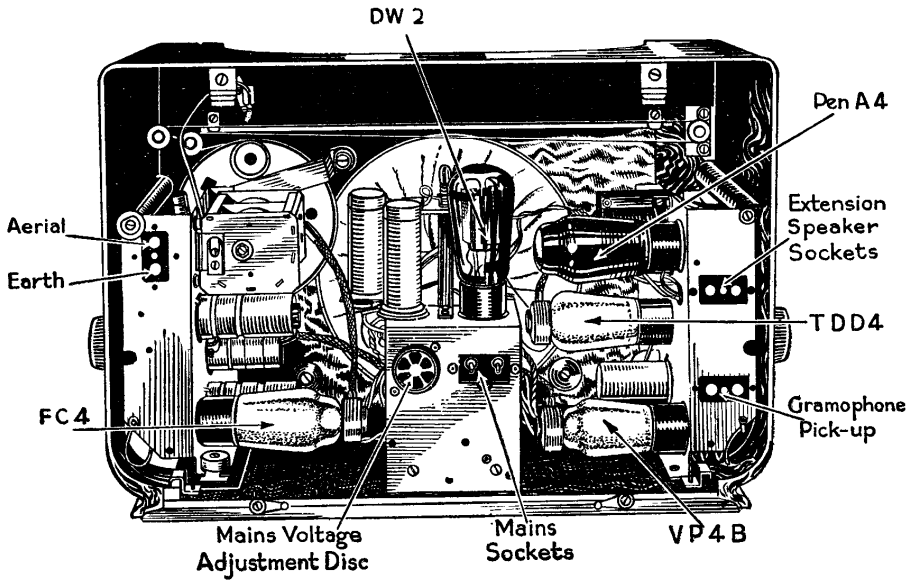
Model M.A.S.6 is a four-valve (plus rectifier) superheterodyne receiver for A.C. mains, incorporating a long, medium and short (16·7 to 51 metres) waveband. The valve combination comprises Type FC4 octode frequency changer ; Type VP4B variable-mu screened pentode I.F. amplifier (intermediate frequency 128 kcs.) ; Type TDD4 double-diode triode L.F. amplifier, A.V.C. rectifier and speech detector ; Type PENA4 output pentode ; and Type DW2 half-wave H.T. rectifier. The receiver incorporates delayed A.V.C., a modified form of L.F. feed back, continuously variable tone control, provision for connecting a gramophone pick-up and an extension speaker circuit of low impedance (5-10 ohms). The location of the controls and valves can be seen from Figs. 1 and 2.

Fig. 1



Front view

Fig. 2



Rear view

MAINS VOLTAGE ADJUSTMENT

Remove the back panel ; inspect the cover-plate marked with various mains voltages (see Fig. 2), and rotate it if necessary until the correct voltage is uppermost ; push the cover-plate carefully back into position.

DESCRIPTION OF CIRCUIT

The following description will be better understood by reference to the circuit diagram at the end of this manual. A description of the method of indicating the switching connections is given under the heading " Wave-change Switch " on page 9.

Input Circuit.

Medium Wave. This consists of the aperiodic winding S6, coupled inductively and also by C10 and S27, to

the first tuned circuit of the band-pass filter comprising the coil S8, tuning condenser C4 and trimmer C7. This circuit is coupled by S28 and C15 to the second tuned circuit of the filter, comprising S10 tuned by C5 and the trimmer C8.

Long Wave. The same circuit is used with the addition of the long wave coils S7 (aperiodic), S9 (first band-pass circuit) and S11 (second band-pass circuit) and the additional coupling condenser C14.

Short Wave. For short wave reception signals are fed from the aerial to the coil S12, coupled to the single tuned circuit comprising the coil S13 tuned by C5 and the trimmer C46. The resistance R2 in the grid circuit of L1 is included for preventing parasitic oscillation on short waves.

Oscillator Circuit.

Medium Wave. The oscillator grid circuit of the frequency changer comprises S14 tuned by C6 and the parallel padding condenser C12, and the series padding condenser C18. S15 is the reaction coil in the oscillator anode circuit (Grid No. 2). R4 is the oscillator grid leak, the grid condenser C41 being short circuited.

Long Wave. The same circuit is used with the addition of the long wave grid coil S16, the additional parallel padding condenser C9, the series padding condenser C19, and the long wave reaction coil S17. C41 is short circuited.

Short Wave. For short wave reception the oscillator grid circuit comprises the coil S18 tuned by C6, coupled to S19 in the anode circuit, with the grid condenser C41 and the grid leak R4.

Aerial Filter and Image Suppressor. S5 with C13 and the trimmer C37 forms an acceptor circuit tuned to the intermediate frequency (128 kcs.), while C11 suppresses signals differing from the signal frequency by twice the intermediate frequency.

I.F. Amplifier. Coupling between the frequency changer and the I.F. amplifier L2 is by means of the band-pass filter comprising S20 tuned by C33 and the trimmer C21, and S21 tuned by C34 and the trimmer C22. The second I.F. transformer comprises S22 tuned by C35 and the trimmer C25, and S23, S23a tuned by C36 and the trimmer C26, the connection to the speech detector diode anode being taken from the junction of S23 and S23a in order to reduce the circuit damping.

Speech Detector. This circuit comprises the speech diode anode, cathode, R9 and R21, R8 and S23a, R9 being the manual volume control. Signals are transferred from the slider of R9 to the control grid of L3 via C30.

Low Frequency Amplifier. The audio-frequency output of L3 is transferred to the grid circuit of the output valve L4 by a resistance-capacity coupling, R17 being the anode resistance of L3 and C32 the coupling condenser. R19 in the grid circuit of L4 is an H.F. oscillation stopper. C38 serves to by-pass any I.F. component in the output of L3.

Output Circuit. S24 is the output transformer primary and S25 the secondary.

Tone Control and Correctors. C39, R22 and R24 in parallel with the output transformer primary form the tone control.
Additional tone control is provided by C40, and the omission of a by-pass condenser across the bias resistor R20 gives a modified form of L.F. feed back which increases bass response and minimises the distortion from overloading.

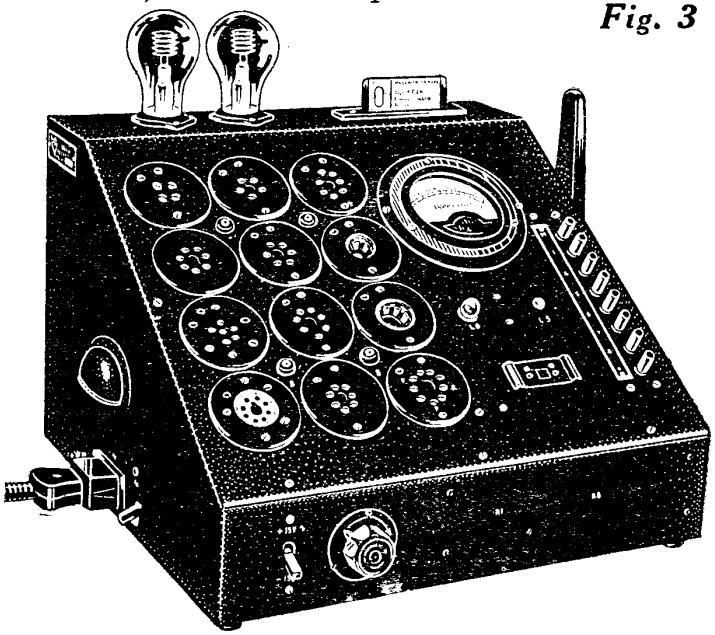
A.V.C. Circuit. The anode of the A.V.C. diode is coupled to the primary of the second I.F. transformer by C28, and the diode circuit comprises the diode load R16, the diode anode, cathode and the bias resistances R13 and R15, which apply the required delay voltage. The voltage developed across the load R16 is transferred as A.V.C. bias to the control grid of L2 via R14 by-passed by C23, and also to the control grid of L1 via R1.

Gramophone Reproduction. Disconnect the aerial and insert the pick-up leads in the appropriate sockets. When the pick-up is connected the voltage drop across R10 biases back the speech diode of L3, and so helps to prevent the break through of radio signals. When it is desired to revert to radio reception, the aerial plug must be replaced in the aerial socket, and the pick-up leads must be withdrawn from the pick-up sockets.

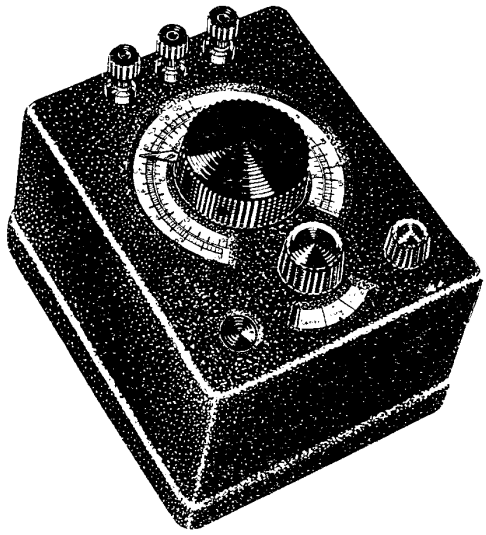
FAULT FINDING

Faults can only be quickly located by systematic measurements in different parts of the circuit. Two methods of fault finding are given, one dependent on the measurement of current and voltage, the other dependent on the measurement of resistance and capacity. The success of both these methods depends on the accuracy with which the various values are determined; in this connection we would draw special attention to the Mullard Master Test Board (Fig. 3), which enables all these measurements to be made with speed and accuracy. In addition the Board can be used for the complete testing of any type of valve, as output meter, and for a variety of other purposes normally necessitating the use of separate instruments. For the complete and rapid testing of resistances and condensers, the Mullard Measuring Bridge will be found particularly suitable (see Fig. 3). Full details can be obtained from the Mullard Wireless Service Co., Valve Sales Department.

Fig. 3



Mullard Master Test Board.



Mullard Measuring Bridge.

PRELIMINARY EXAMINATION.

When checking a receiver for alleged faults, first be certain that :

The receiver is adjusted for the correct mains voltage.
Valves are making good contact in their holders.
Loudspeaker is in good condition. (Try a speaker known to be satisfactory.)
Valves are in good condition. (Test the valves or substitute valves known to be good.)
The tuned circuits are correctly trimmed. (Follow procedure for trimming—see page 10.)

QUICK CIRCUIT TESTS.

The nature and approximate location of many faults can often be ascertained by measuring the voltages and currents at various points in the circuit or the resistances of various circuits. The following table gives the approximate values which should be obtained at the points indicated. It should be noted, however, that actual readings may vary somewhat from these values without necessarily indicating a fault.

	L1 (FC4)	L2 (VP4B)	L3 (TDD4)	L4 (Pen 4DD)
Va	200	200	100	210
Vg1	2*	1.5*	9.5*	4.0*
Vg2	70	140		200
Vg3+5	70			
Ia (mA)	1.8	5	1.0	32
Ig2 (mA)	1.2	0.8		3
Ig3+5(mA)	3.2			

*Measured from cathode to earth.

Total Consumption—55 watts. Voltage across C2—200 volts.

Note.—All readings in the above table are actual values. Allowance must be made when the resistance of the circuit in which a particular measurement is made is comparable with that of the measuring instrument.

METHODS OF SYSTEMATIC TESTING

The following method of tracing faults by the successive elimination of the various valve stages, commencing at the output end of the receiver, should enable most faults to be speedily located. It must be remembered, however, that it is not practicable to indicate every possible fault, and the possibility of more than one defect occurring must also be kept in mind. Methods of dealing with various mechanical faults are given on page 8.

Note.—For test purposes modulated signals should be applied to the various valves via a 0·1μF condenser. The grid connecting cap of the valve under test should be removed, but this cap must be replaced before proceeding to apply a test signal to a proceeding valve. If the receiver operates, but results are unsatisfactory, it may be possible to ascertain the cause by reference to Test 3. When testing examine screened leads carefully to see that the lead is not shorting to the screening, and also make sure that the fault does not lie in the wave-change switch.

1. Test with Gramophone Pick-up. If results are satisfactory, assume low frequency circuits are in order and proceed to Test 2. (See Table.)
If receiver is inoperative on gramophone, test in succession the H.T. and L.T. supplies and the circuits of L4 and L3 as follows :—

(a) **Check H.T. voltage across C2** (200 volt).
If reading is abnormal, suspect :
Faulty voltage adjustment of receiver.
Faulty mains on-off switch. (Check voltage across S1.)
Faulty winding in mains transformer. (Check voltage across S2 (H.T. secondary) and S3 with L5 removed.)
Short circuit in C1, C2, C27, C38 or C42.
Open circuit in R1 or R10. (No voltage across C2.)
Short circuit in one of the I.F. transformer circuits.
Short circuit in heater circuit.
Short circuit between primary or secondary of output transformer and earth.
Faulty contact in valve-holder.

(b) **Measure the anode currents of L4, L3, L2 and L1 in that order.** When a reading is found to be abnormal, reference to the table below will indicate the appropriate components to test :

If measurement shows :	Suspect :	**Test 1.** If gramophone inoperative, measure currents of : L4 (Pen A4) (Ia=32mA)	L3 (TDD4) (Ia=1.0mA)	**Test 2.** If L.F. circuits in order, measure currents of : L2 (VP4B) (Ia=5mA)	L1 (FC4) (Ia=1.8mA)
No anode current.	Short circuit in ...	—	C38	C27	C42
	Open circuit in ...	S24, R20	R13, R15, R17	S22, R6, R7	S20, R12, R23
Excessive anode current.	Short circuit in ...	C32	C3, C31	C24	C16
	Open circuit in ...	—	—	—	—
Abnormal anode current.	Short circuit in ...	—	—	—	—
	Open circuit in ...	R18, R19	R11	R5, R14, R16	R2, R3, R4
Normal anode current.	Short circuit in ...	C28, C29, R9		—	
	Open circuit in ...	C30, C32, R8, R9		—	

(c) **Apply modulated signal of 128 kcs. to the control grid of L2.**
If the signal is not reproduced, suspect :
Short circuit in C25, C26, C35, C36.
Open or short circuit in S22, S23, S23a.

(d) **Apply a modulated signal of 128 kcs. to the control grid of L1.**
If the signal is not reproduced, suspect :
Short circuit in C21, C22, C33 or C34.
Open or short circuit in S20 or S21.
Faulty wave-change switch. (Check the voltages for all three wavebands.)

(e) **Apply a modulated R.F. signal to the control of L1 and tune the receiver to this frequency.**
If the R.F. signal is not reproduced, although a modulated I.F. signal applied to this grid is reproduced, suspect :
Open circuit or short circuit in one of the coils, condensers or resistances in the oscillator circuit.

(f) **Apply a modulated R.F. signal to the aerial socket.**
If an R.F. signal is reproduced when applied to the control grid of L1, but not when applied to the aerial socket, suspect :
Open or short circuit in one of the coils, condensers, or resistances in the aerial or input circuits of the receiver.

3. Radio signals heard but weak, distorted or accompanied by noise.

Weak reception. Suspect :
Mains voltage low or receiver adjusted for incorrect mains voltage.
Receiver need retrimming. (See pages 10 and 11.)
Open circuit or short circuit in one of the coils or condensers in the R.F. circuits.
Open circuit in C10, S27, or S28.

Unsatisfactory A.V.C. Suspect :
Open circuit in R3, R14 or C28.
Short circuit in C23.

The receiver oscillates. Suspect :
Open circuit in one of the decoupling condensers, e.g., C20, C27, C42.
Open circuit in earthing connection between wire screening and chassis.

Hum. Suspect :
Open circuit in C1 or C2.
Short circuit in R1 or R10.
Screening making poor contact with the chassis.

Image frequency inadequately suppressed. Suspect :
Open circuit in C11.

High background noise.
Receiver may need retrimming.

The Receiver appears unselective. Suspect :
Set needs retrimming.
Fault in one of the coils or trimmers of the I.F. circuits.

No oscillation at the lower end of the short waveband.
Renew C20.

Resonance.
The cause of resonance is most easily found by applying a signal modulated with a varying L.F. frequency. Tune in the signal and adjust the L.F. modulation until the resonance is most marked.

Then examine cabinet and speaker to discover loose parts. It may be found that a screw has become loose, or that it is necessary to pack a loose part with a thickness of felt. Methods for dealing with various mechanical faults are given on page 8.

POINT TO POINT METHOD OF RESISTANCE AND CAPACITY MEASUREMENT.

4. Tests 1, 2 and 3 will show in which part of the circuit the trouble lies, even if the particular part cannot be found; by using the point to point method in conjunction with the Mullard Master Test Board, the faulty component may be quickly located. When a measurement is found to be abnormal, reference to the circuit diagram will show which part is defective, or if any particular component is suspected, reference to the circuit diagram will indicate the most suitable points for testing.

Testing is carried out by referring to Fig. 4, below, and to the Resistance and Capacity tables opposite. In Fig. 4 the various testing points are marked; of the two figures against each valve socket, the first indicates the number of the valve holder and the second the valve electrode, as follows :—

1 and 2.	Heater.
3	Control grid.
4	Metallising.
5	Cathode.
6	Suppressor grid.
7	Auxiliary grid.
8	Anode.
9	Additional grid in frequency changer.

When making measurements, proceed as follows :—

(1) Remove the backplate and the valves.
(2) Set the volume control at maximum.
(3) The anode socket of L5 must be shorted to the cathode; this is essential to enable the measurements to be made and also discharges the smoothing condensers, which might otherwise become charged during testing, and damage the test meter. This short circuit must be removed when testing the rectifier valve holder.
Care must be taken in measuring electrolytic condensers; initially the leak current may be large, but this should fall quickly to a low value. A high final reading is sometimes obtained if the receiver has not been used for some time.

In the table the first vertical column indicates the appropriate card for insertion in the Mullard Master Test Board to make the necessary measurements, and the first horizontal column indicates the point across which a particular measurement is made. It will be seen that the majority of measurements are made to earth (E). The second horizontal column gives the reading which should be obtained. Where a measurement is to be made with the wave-change switch in a particular position, this is indicated as S (Short), M (Medium), or L (Long).
Note that variations up to 10 per cent. in the values given do not necessarily indicate a fault.

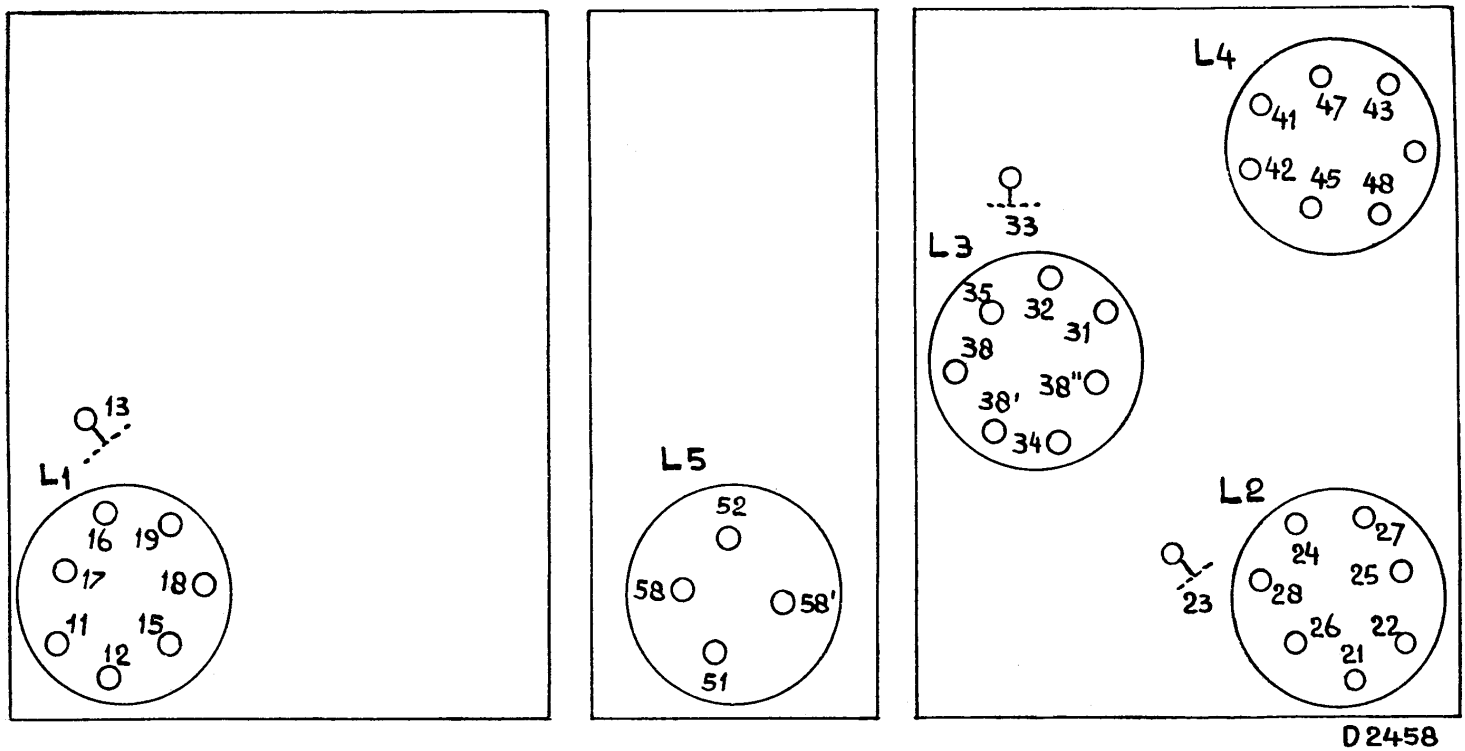


Fig. 4

RESISTANCES

12	Aer. E	Aer. E	Aer. E	11 12	21 22	31 32	41 42	24 34	L E	S E	P E					
	S 95	M 380	L 480	5	5	5	5	5	5	30	315					
11	15 E	13 E	25 E	28 E	26 E	45 E	48 E	47 E								
	310	S 100	285	455	285	190	400	455								
10	18 E	19 E	16 E	17 E	35 E	27 E										
	420	240	140	230	390	320										
9	13 E	13 E	23 E	33 E	38 E	38″ E	38′ E	43 E	U E							
	L 75	M 75	80	80	400	200	225	170	370							

CAPACITIES.

12	13 E	13 E	13 E	38 E	38″ E	43 E										
	S 500	M 450	L 370	350	125	250										
11	17 E	23 E	27 E													
	280	290	365													
10	48 E															
	330															
9	35 E	45 E	52 E													
	470	390	465													

DISMANTLING AND REPAIRING THE RECEIVER

Should it be necessary to withdraw the chassis from the cabinet, the following hints will be found of service.

To Remove Knobs and Chassis.

(1) Removal of Knobs.—The screws securing the knobs at the side are accessible from the back through slots in the chassis on the same level as knobs. The screws securing the two front knobs can be reached through two holes in the baseboard.

(2) To remove the three unit assembly speaker, and baseboard complete :—
   (a) Remove the backplate, valves and knobs.
   (b) Turn the tuning condenser to its maximum capacity position, and loosen the screws holding the right-hand drive pulley bracket.
   (c) Remove the driving wire carefully from the left-hand pulley, noticing its position on the condenser drum.
   (d) Release the four screws on the underside of the cabinet which clamp the wooden baseboard to the cabinet.
   (e) Unsolder the earth wires on the left and right hand chassis and undo the screws holding the chassis to the cabinet.
   (f) The chassis assembly and speaker can now be removed from the cabinet.
   When refixing the chassis the calibration must be carefully checked. (See page 12.)

(3) To remove the left-hand (H.F.) unit :—
   (a) Proceed as in (a) to (c) above.
   (b) Release the screw holding the fixing bracket to the power unit.
   (c) Release the screw holding the drum bracket to the speaker baffle.
   (d) Remove the leads from the clip on the baseboard. These leads need not be unsoldered ; they are sufficiently long to enable the unit to be fully accessible when removed from the cabinet.
   (e) Undo the two screws holding the unit to the baseboard.
   (f) Unhook the Bowden cable to the wave-change indicator.
   (g) Unsolder the earth wire.
   (h) The unit can now be removed.
   When refixing the chassis the calibration must be carefully checked. (See page 12.)

(4) To remove the right-hand (I.F. and L.F.) unit :—
   (a) Remove the leads from the clip on the baseboard ; they are sufficiently long to enable the unit to be removed from the cabinet.
   (b) Unsolder the earth wire and undo the screw securing the unit to the cabinet.
   (c) Undo the two screws securing the unit to the baseboard.
   (d) The unit can now be removed.

General Hints. The efficiency of the M.A.S.6, as of all Mullard receivers, is due largely to careful design and accurate manufacture and assembly. In carrying out repairs, therefore, nothing should be done which will materially alter the values of components or the lay-out of the wiring. For example, when re-making connections, even connections to the chassis, they should be re-connected to the original points and screening partitions should be reinstated in their former positions. Adequate insulation is provided where necessary in the wiring, and no additional insulating material should be used such as, for example, on the H.F. wires, which are bare when they leave the factory. Care must be taken that none of the wiring is displaced so that bare wires touch the insulation of other wires, as this may introduce serious losses. Where bare wires approach each other there must be a clearance of at least $\frac{1}{8}$ in. between them.

Great care must be taken to reinstate wiring in its original position and the wiring diagram at the end of this manual should be followed exactly.

Resistances and Fixed Condensers. Soldered connections should be made rapidly, with the joints at least half-an-inch from the component, to avoid overheating. These components should be suspended clear of the other wiring.

Changing Coils. Coils are secured to the chassis by lugs formed on the chassis. The coil connections must be unsoldered, the fixing lugs bent up slightly and then the coil can be withdrawn. Should the holding lugs break off when securing a new coil, a special repair bracket, Code No. M.2808087, obtainable from the Mullard Receiver Service Department, can be used to fix the coil. A special lever, Code No. 0999156, is available for bending down the coil lugs.

Condenser and Pointer Drive. The method of securing the cord and wire to the drum should be carefully noted so that they can be replaced as originally fitted. New driving cord should be stretched for one minute by attaching a 4-lb. weight to it. The length of the cord must be so adjusted that the tension spring is completely compressed. The cord can be shortened by tying a knot in it. Adjust the drive so that the condenser reaches the limits of its travel before the station pointer in order to avoid the risk of the wire becoming slack and running off the drum.

Mains On-Off Switch and Volume Control. These are mounted on the front of the L.F. unit and can be reached by removing this unit from the cabinet. (See page 8.)

Bowden Wires. Two sizes are used—the thinner for the condenser drive and the thicker for the waveband indicator. The wire must be carefully handled, as a kink will cause irregular drive and backlash. When fitting new wires, the outside cable may be cut with pliers and the ends trimmed smooth with a fine file. The inner cable should be tinned after being cut to length, using a non-greasy flux.

To Fit a New Scale. It is not necessary to remove the chassis from the cabinet. Release the screw holding the pointer to the wire drive and the two screws securing the pointer guide rod. Undo the four screws securing the scale assembly to the cabinet and this will release the scale. Take care not to kink the control cable. When fitting a new scale take care that the rubber bands are properly fitted and check the calibration.

Wave-change Switch. This is built up of units, together with a ratchet plate, spindle, clips, etc. Each unit comprises a stator, a rotor, contact springs attached to the stator, springs to maintain correct alignment between rotor and stator, and the necessary contacts and connections. The stator has 24 holes, so that it can accommodate a maximum of 12 contact springs on each side. In the circuit diagram the stator contacts are shown as open dots, the contacts fixed to the side of the stator nearer the ratchet plate being shown in the outer circle, and those fixed to the other side of the stator in the inner circle. A black dot indicates that the hole carries no contact. The rotor carries connection strips the ends of which pass through the holes in the rotor and are then bent over on the other side with smooth pliers. The flattened portion not only keeps the connection strip in position, but is also used as a contact. In the circuit diagram the contact pieces (carried on the rotor), are indicated as small lines between the two circles and the connection strips are shown as full lines near the outer circle for those strips which are fixed on the side nearer the ratchet plate, and as dotted lines near the inner circle for those on the other side. The flat portion of the strips acting as contacts are indicated in the same way as the contact pieces. In view of the different arrangements of contacts in the different units, the following code is used to describe the connections in the list of spare parts. The first figure indicates the number of holes covered by the strip, while the other figures indicate in which hole a projection is located. Thus " 5.2.3.5 " indicates that five holes are covered, and that there are projections in holes 2, 3 and 5. The stator springs can be fitted by using a small pair of pliers in the same way as the rotor contacts.

Speaker. Faults which appear to be in the speaker, such as rattling or resonance, may be due to components or wiring in the receiver, and it is therefore always advisable to test the set with a speaker which is known to be satisfactory.

The speaker can be removed by taking the three-unit assembly out of the cabinet, unsoldering the speaker connector plate and releasing the brass clamp.

Repairs should be carried out on a bench free from dust and not made of iron.

The front and back plates must **never** be removed from the magnet ; the fabric dust-cover should be replaced as soon as repairs are completed.

To centre the speech coil, remove the dust-cover and loosen the screws securing the spider. Centre the coil with a set of small feelers (Code No. 0999084), tighten up the screws holding the spider, and then remove the feelers.

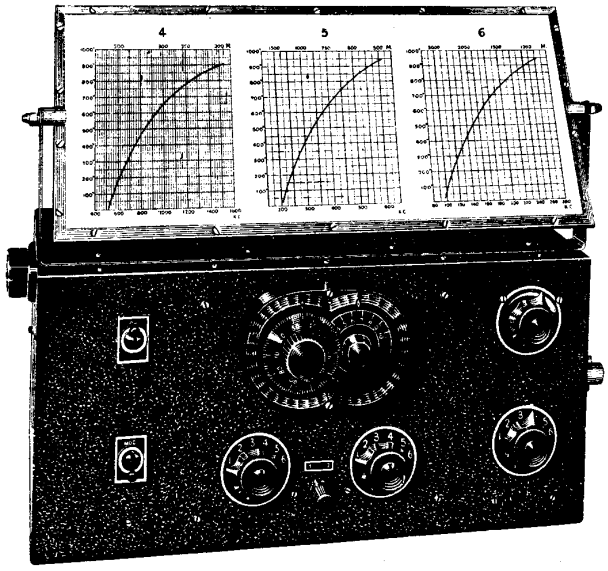
To remove the coil and cone, unsolder the coil leads and remove the ring holding the cone by cutting across the ring with a pair of pliers. When replacing the cone, this ring should be replaced by a clamping ring (Code No. M.2587181), which can be secured with a pair of flat pliers. The air gap may be cleaned by passing through it a piece of wadding wound on a flat stick and moistened with methylated spirit.

PROCEDURE FOR TRIMMING THE TUNED CIRCUITS

Equipment. Accurate trimming is essential if the maximum sensitivity and selectivity of the receiver is to be maintained and the Mullard Master Signal Generator (Fig. 5) will be found particularly suitable for quick and precise alignment of the various circuits. The following equipment will be necessary :—

(1) An oscillator with short, medium and long wave artificial aerials, similar to the Mullard Master Signal Generator. This is supplied complete with the necessary aerials ; full details can be obtained from the Mullard Wireless Service Co., Valve Sales Department.

Fig. 5



Mullard Master Signal Generator.

(2) An output meter. A suitable type is incorporated in the Mullard Master Test Board.

(3) A transformer for matching the output meter to the low impedance (5–10 ohms) extension speaker sockets.

(4) A 15-degree jig (Code No. M.09991741) for adjusting the tuning condenser to the standard trimming position.

(5) A box spanner for trimming (Code No. M.0999221).

General Notes. The I.F. trimmers, C21, C22, C25, C26, and the trimmers C9 and C37, are wire trimmers consisting of a tube of insulating material sprayed on the inside with a layer of metal and carrying a spiral of wire on the outside. When trimming, melt the wax with a warm soldering iron, undo the wire spiral until the output meter just passes its maximum reading (minimum in the case of C37). Replace one or two turns to give maximum deflection and cut off the surplus wire. Seal the spiral in position with wax. Should it be found that the wire is not long enough to enable a maximum reading to be obtained, replace the trimmer with a new one.

Note that all the trimmers are located in the left-hand (H.F.) unit, except C25 and C26, which are in the right-hand unit (see the wiring diagrams at the end of this manual).

The trimmers located on top of the coils (C7, C8, C12) are sealed with wax, which should be softened with a warm soldering iron, taking care not to melt it as this may damage the trimmers. The I.F. circuits should be trimmed first and afterwards the radio-frequency and oscillator circuits in the following order—medium wave, long wave. No trimming on short waves is provided.

When applying signals to the control grid of a valve for the purpose of trimming, its normal grid circuit must remain connected. When applying signals to the anode of L1 or L2, care must be taken that these are not accidentally shorted to earth, as this will damage the I.F. transformer primary winding. Throughout the process of trimming the volume control must be at maximum, and if the reading on the output meter becomes too great, the signal must be reduced by means of the attenuator on the service oscillator.

When the various trimmers have been correctly adjusted, they should be sealed in position with wax. Care should be taken that the output meter reading does not alter while this is done. Note that for the medium and long wave ranges the oscillator frequency is 128 kcs. higher than the signal frequency, but for the short wave range it is 128 kcs. lower than the signal frequency.

The receiver must be retrimmed if the frequency changer valve, Type FC4, is replaced. The new FC4 must be allowed to heat up for 5 or 10 minutes before trimming is commenced.

Intermediate Frequency Trimming.

(1) Remove the three unit assembly from the cabinet. (See page 8.)
(2) Shunt the output meter with a 0·1μF condenser and connect it to the extension loudspeaker sockets via the matching transformer and earth the chassis.
(3) Adjust the tuning condenser and volume control to maximum.
(4) Short circuit R4 and C23. This facilitates trimming by putting the local oscillator and A.V.C. circuits out of action.
(5) Apply a modulated signal of 128 kcs. to the control grid of L2 via a condenser of 32,000$\mu\mu$F.
(6) Trim C26 and then C25 for maximum output.
(7) Apply a signal of 128 kcs. to the control grid G4 of L1 via a condenser of 32,000$\mu\mu$F.
(8) Trim C21 and then C22 for maximum output.
(9) Lock the trimmers with wax.
(10) Remove the short circuits across R4 and C23.

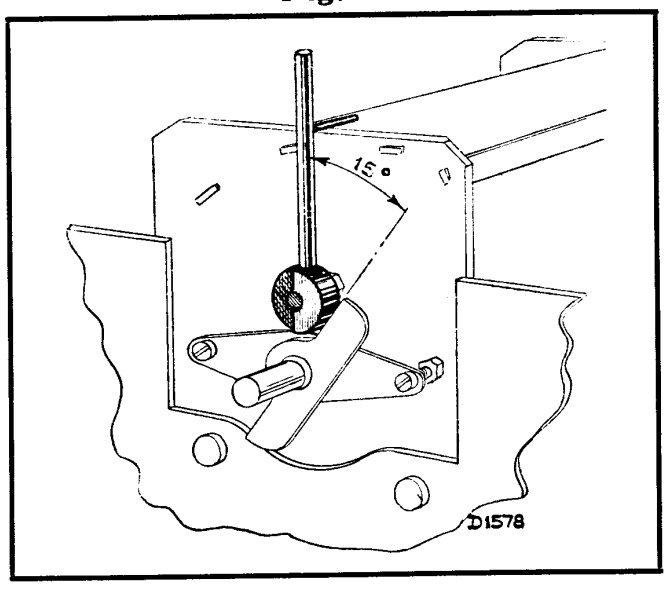
Radio Frequency and Oscillator Trimming.

Preliminary. Earth the chassis and set the volume to maximum. Fit the 15-degree jig by slipping the boss over the locating pin just above the condenser spindle, as indicated in Fig. 6. This jig ensures that when the condenser is turned so that it bears upon it the vanes are advanced exactly 15 degrees, which is the standard trimming position.

Medium Wave Trimming.

(1) Switch to the medium waveband and turn the condenser until it bears on the jig.
(2) Apply a weak modulated signal of 1,442 kcs. (208 metres) to the aerial socket via a standard artificial aerial.
(3) Trim C12, C7 and C8 for maximum output in that order.
(4) Repeat (3).

Fig. 6



Long Wave Trimming.

(1) Switch to the long waveband and set the tuning condenser to the jig.
(2) Apply a modulated signal of 395 kcs. (760 metres) to the aerial socket via a standard artificial aerial.
(3) Trim C9 for maximum output.

Trimming the I.F. Aerial Filter.

(1) Switch the receiver to long waves and set the tuning condenser to maximum position (2,000 metres).
(2) Apply a strong modulated signal of 128 kcs. and trim C37 for minimum output.

CALIBRATION OF SCALE

(1) Apply a signal of 810 kcs. (310 metres) to the aerial socket via a standard artificial aerial, and tune the receiver for maximum output.

(2) Adjust the position of the pointer to 310 metres on the scale by means of the screw and washer securing the pointer to the Bowden wire drive.

RECEIVER SERVICE DEPARTMENT

Receivers for service and orders for spare parts should be addressed to :—

The Mullard Receiver Service Dept.,

Waddon Factory Estate,

Purley Way,

Croydon, Surrey.

Spare parts should be ordered by stating the Code Number as given on the Parts Lists on pages 13 to 16, quoting at the same time the type and serial number of the receiver and the description of the part required.

Owners in Scotland should return their receivers to :—

The Mullard Wireless Service Co., Ltd.,

168, Buchanan Street,

Glasgow.

COMPONENT AND SPARE PARTS LISTS

In the following tables the various components and parts of the Mullard M.A.S.6 are listed, together with their purpose, electrical values and the code number under which spares should be ordered. The references in the first column of each table permit the identification of any component on the circuit and wiring diagrams at the end of this manual.

Important Note.—Those code numbers which are marked with an asterisk are for a coil assembly and trimmer complete. The component numbers of the coils and trimmers in particular assemblies can be ascertained from the wiring diagrams.

CONDENSERS.

Reference	Purpose	Capacity	Code No.
C1	H.T. Smoothing	32 μF	M.2818240
C2	H.T. Smoothing	32 μF	M.2818240
C3	Bias Decoupling L3	25 μF	M.2818224
C4, C5, C6	Tuning Condenser	11–490μμF	M.2821219
C7	Trimmer	2·5–30μμF	M.2857159*
C8	Trimmer	2·5–30μμF	M.2857179*
C9	Wire Trimmer	8μμF	M.2821205
C10	Band-pass Coupling	20μμF	M.2820637
C11	Image Suppressor	50μμF	M.2820624
C12	Trimmer	2·5–30μμF	M.2857254*
C13	I.F. Aerial Filter	64μμF	M.2819241
C14	Band-pass Coupling	16,000μμF	M.2820110
C15	Band-pass Coupling	25,000μμF	M.2820112
C16	Bias Decoupling L1	50,000μμF	M.2820115
C17	Oscillator Coupling	2μμF	M.2820588
C18	Padding	1,400μμF	M.2819187
C19	Padding	670μμF	M.2819535
C20	H.T. Feed Decoupling	0·1 μF	M.2819909
C21	I.F. Wire Trimmer	30μμF	M.2821206
C22	I.F. Wire Trimmer	30μμF	M.2821206
C23	A.V.C. Decoupling	0·1 μF	M.2820118
C24	Bias Decoupling L2	0·1 μF	M.2820118
C25	I.F. Wire Trimmer	30μμF	M.2821206
C26	I.F. Wire Trimmer	30μμF	M.2821206
C27	Decoupling L2 Anode	50,000μμF	M.2819906
C28	A.V.C. Diode Coupling	20μμF	M.2820637
C29	I.F. By-pass	100μμF	M.2820627
C30	L.F. Coupling L3	10,000μμF	M.2820106
C31	I.F. By-pass	0·1 μF	M.2820118
C32	L.F. Coupling L4	10,000μμF	M.2819899
C33	I.F. Trimmer	50μμF	M.2819240
C34	I.F. Trimmer	50μμF	M.2819240
C35	I.F. Trimmer	50μμF	M.2819240
C36	I.F. Trimmer	64μμF	M.2819241
C37	I.F. Aerial Filter Wire Trimmer...	30μμF	M.2821206
C38	I.F. By-pass	250μμF	M.2819247
C39	Tone Control	50,000μμF	M.2820164
C40	Tone Control	2,000μμF	M.2820148
C41	Oscillator Grid Coupling	100μμF	M.2820627
C42	Anode Decoupling L1	0·1 μF	M.2819909
C46	Trimmer	10μμF	M.2820634

RESISTANCES.

Reference	Purpose	Resistance	Code No.
R1	H.T. Smoothing	2,000 ohms	M.2880266
R2	H.F. Stopper	50 ohms	M.2877357
R3	A.V.C. Decoupling L1	0·1 megohm	M.2877390
R4	Oscillator Grid Leak	50,000 ohms	M.2877387
R5	H.T. Feed	12,300 ohms	M.2877103
R6	H.T. Feed	8,000 ohms	M.2877099
R7	Bias L2	250 ohms	M.2877364
R8	Speech Diode Load	0·4 megohm	M.2877396
R9	Manual Volume Control	0·5 megohm	M.2881455
R10	H.T. Smoothing	16 ohms.	M.2877352
R11	Grid Decoupling L3	1·6 megohm	M.2877057
R12	H.T. Feed L1 Anode	2,000 ohms	M.2877373
R13	Resistor for L3 Delay Voltage ...	2,500 ohms	M.2877374
R14	A.V.C. Decoupling	1·6 megohm	M.2877057
R15	Bias L3	6,400 ohms	M.2877378
R16	A.V.C. Diode Load	0·5 megohm	M.2877397
R17	H.T. Feed L3	0·1 megohm	M.2877390
R18	Grid Leak L4	0·8 megohm	M.2877399
R19	H.F. Stopper	1,000 ohms	M.2877370
R20	Bias L4	125 ohms	M.2877016
R21	Speech Diode Load	0·16 megohm	M.2877392
R22	Manual Tone Control	50,000 ohms	M.2881250
R23	Bias L1	320 ohms	M.2877365
R24	Tone Control	100 ohms	M.2877360

COILS.

Reference	Purpose	Resistance (Ohms)	Code No.
S1, S2, S3, S4	Mains Transformer		MK.51014
S5	I.F. Aerial Filter	120	M.2858788
S6, S7	Aerial Coils (M.W. and L.W.)	35 100	M.2857159*
S8, S9	Band-pass Filter (M.W. and L.W.) ...	4.5 48	
S10, S11		4.5 48	M.2857179*
S12, S13	Aerial Coils (S.W.)	2.2 0.05	
S14, S15, S16, S17	Oscillator Coils (M.W. and L.W.) ...	10 3.3 40 7	M.2857254*
S18, S19	Oscillator Coils (S.W.)	0.05 40	
S20, S21	1st I.F. Transformer	130 130	M.2857206
S22, S23, S23a	2nd I.F. Transformer	130 30 100	M.2857178
S24, S25	Output Transformer	600 0.8	M.2853372
S26	Loudspeaker Speech Coil	3.6	
S27, S28	Band-pass Coupling	1.0 1.0	M.2858769

SPARE PARTS.

Description of Part	Code No.
Cabinet	M.23660334
Station Scale	M.2871066
Front Control Knob	M.236108
Side Control Knob	M.2361079
Backplate	M.2841034
Mains On–Off Switch and Volume Control	M.2881455
Main Safety Connector on Backplate	M.257420
Mains Input Plate on Chassis	M.2886919
Valve Cap	M.2883874
Stator without Contacts	M.2893458
Rotor without Contacts	M.2847721
Rotor Contact 1·1	M.28904161
Rotor Contact 2·2	M.2890439
Rotor Contact 3·2	M.28904211
Stator Contact	M.2875097
Clip for Stator Contact	M.2807739
Connection Strip	M.2807738
7-Pin Valve Holder	M.2822542
4-Pin Valve Holder	M.2883885
Loudspeaker Silk	M.0660101
Pilot Lampholder	M.0851523
Pilot Lamp	Type 8042-07
Rubber Chassis Bush	M.2889024
Rubber for securing Scale	M.2845114
Plug for Aerial or Earth Plug	M.0828172
Speaker	M.288604
Clamping Ring for Speaker	M.2587181
Paper Ring for Speaker	M.2845154
Loudspeaker Cone and Speech Coil	M.2822051

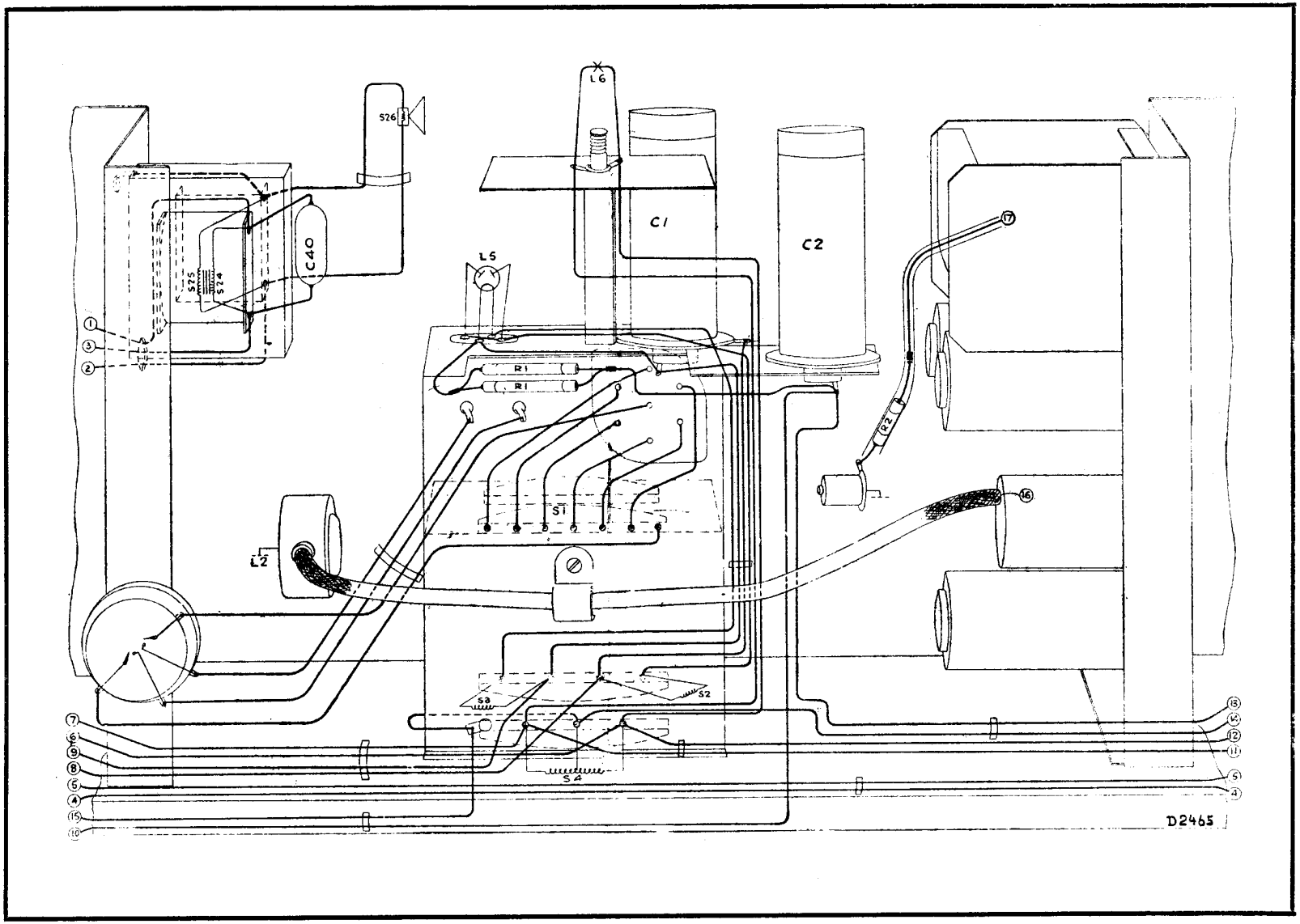
TEST APPARATUS AND TOOLS.

Master Test Board Master Signal Generator Measuring Bridge	Full particulars on application.
Chassis Holder	M.0999138
Box Spanner for Trimming	M.0999221
15-degree Trimming Jig	M.09991741
Air Gap Feelers	M.0999084
Lever for securing Coils	M.0999156
Bracket to replace Coil Lugs	M.2808087

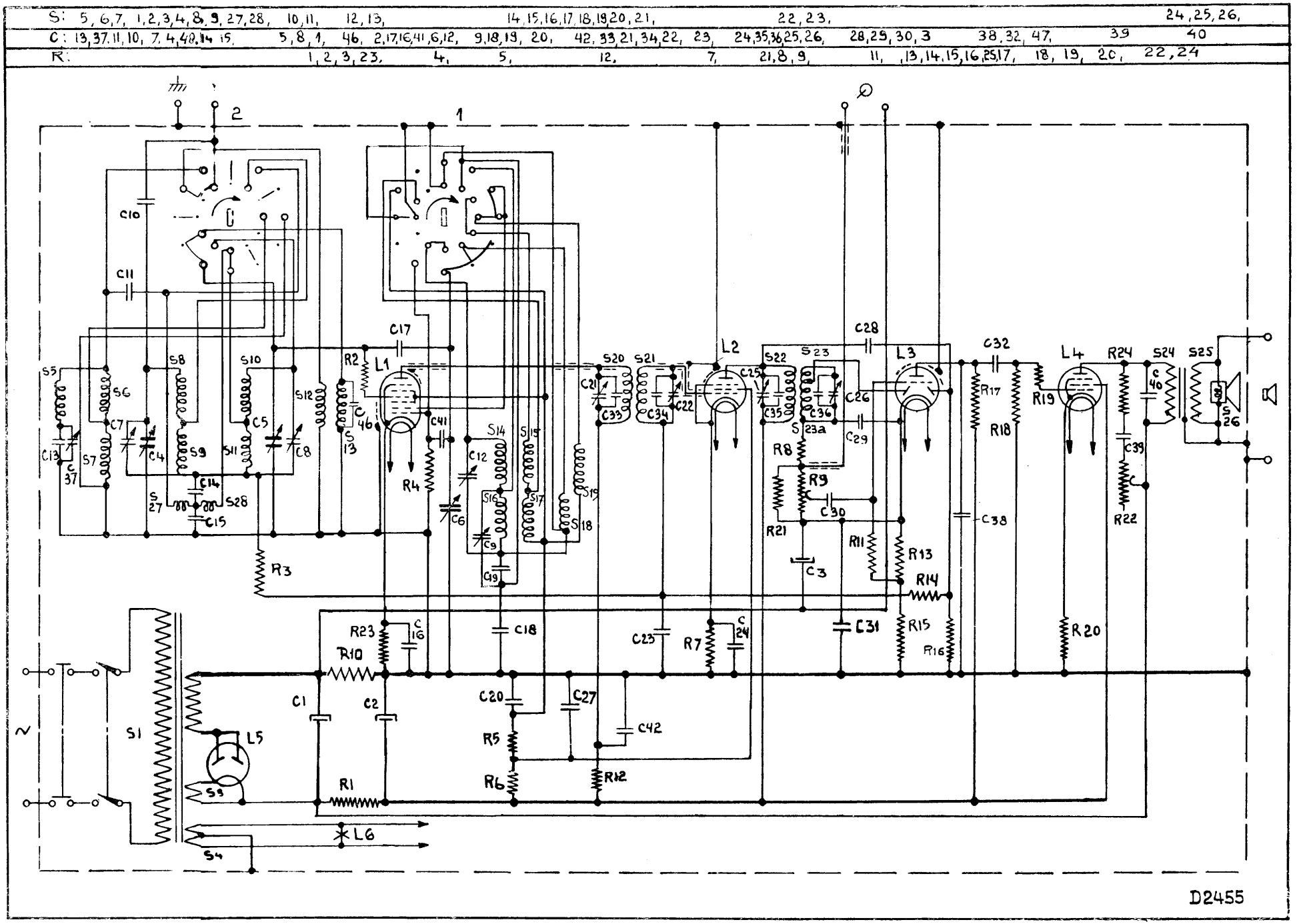
WIRING DIAGRAM OF MULLARD M A S 6 RECEIVER

INTER UNIT CONNECTIONS, AND WIRING OF CENTRE (H.T.) UNIT

(viewed from front of cabinet)

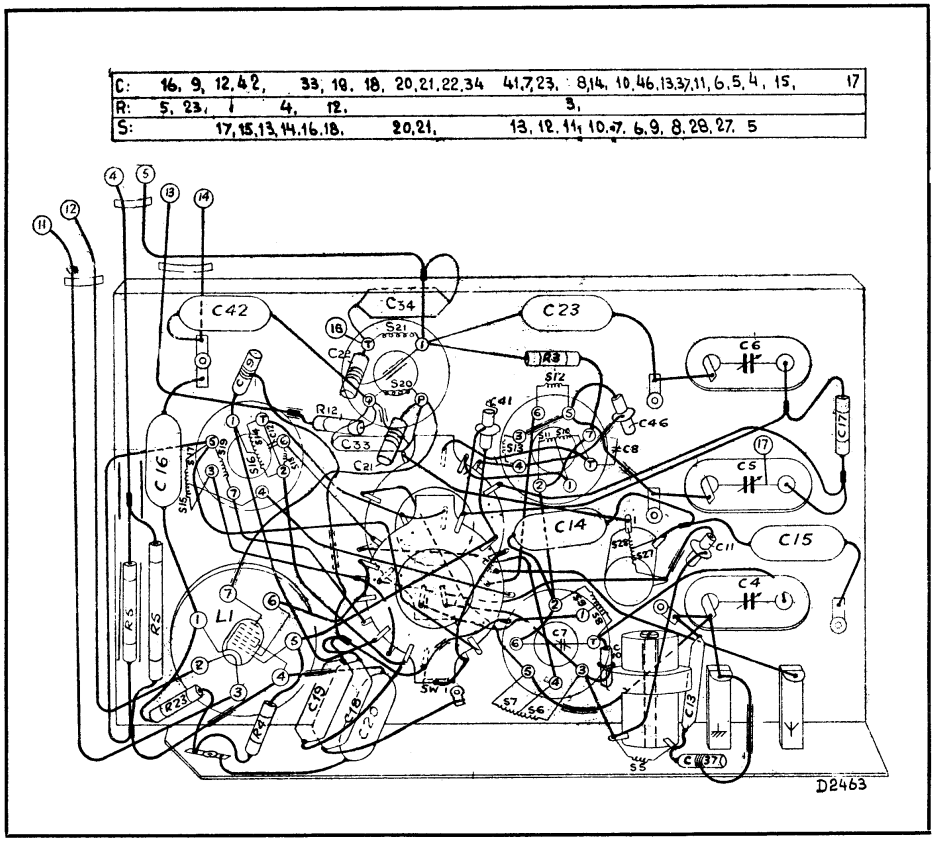


CIRCUIT DIAGRAM OF MULLARD M A S 6 RECEIVER



WIRING DIAGRAMS OF MULLARD M A S 6 RECEIVER

UNDERNEATH OF CHASSIS.



Left Hand (H.F.) Unit ⟵

Right Hand (I.F. and L.F.) Unit ⟶