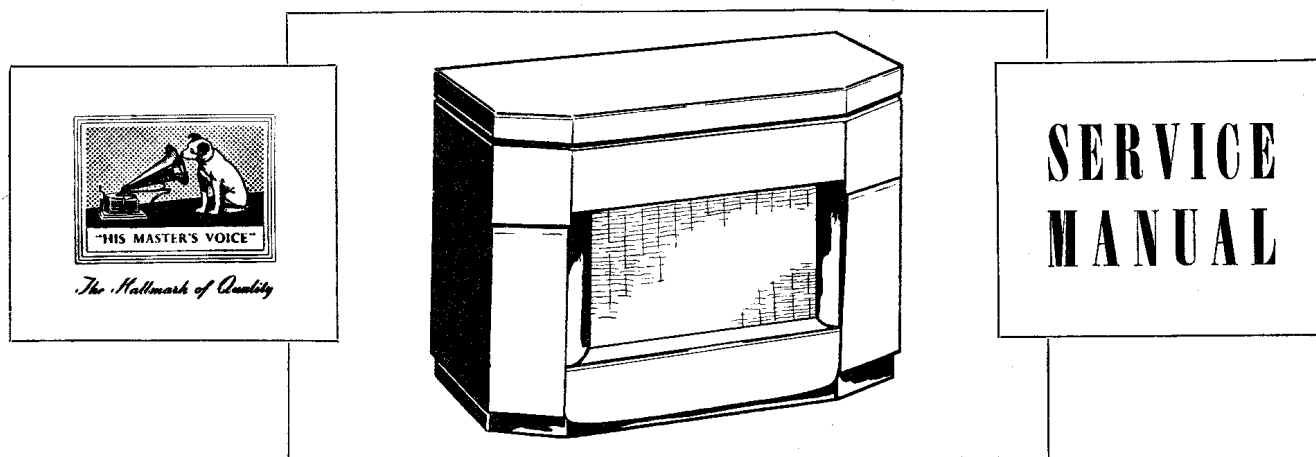


"HIS MASTER'S VOICE"



MODEL 1609 FOR A.C. MAINS 5-VALVE CONSOLE AUTO-RADIOGRAM

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MODEL 1609

SPECIFICATION

Physical.

Height	30 $\frac{1}{4}$ inches	} Overall.
Width	34 $\frac{3}{4}$ inches	
Depth	17 $\frac{1}{2}$ inches	
Weight	106 lbs.	

Mains Supply.

195—255 volts, 50 cycles A.C. only.

Consumption.

50 watts on Radio.

69 watts on Gram.

Scale Lamps.

Two 6·8 volt, 0·3 amp.

Rated Output.

4 watts.

Intermediate Frequency.

465 kc/s.

Valves.

V1	X81	Frequency Changer.
V2	W81	I.F. Amplifier.
V3	DH81 or DH149	Detector A.G.C. and A.F. Amplifier.
V4	KT81	Output.
V5	U84	Rectifier.

Wave Ranges.

S.W.3	..	15·5—20·9 metres (19·35—14·36 Mc/s).
S.W.2	..	20·5—33·0 metres (14·62—9·086 Mc/s).

S.W.1	..	33·0—100 metres (9·086—2·998 Mc/s).
M.W.	..	187—570 metres (1,604—526 kc/s).
L.W.	..	720—2,000 metres (416·5—150 kc/s).

Loudspeaker.

A 10 $\frac{1}{2}$ -inch elliptical permanent magnet moving coil loudspeaker. The speech coil has a D.C. resistance of 3 ohms and an impedance of 5 ohms at 1,000 cycles. The flux density is 8,000 lines per sq. cm.

External Loudspeaker.

An additional low resistance loudspeaker may be connected to the "EXT L.S." sockets at the rear of the receiver. The loudspeaker should have an impedance of approximately 5 ohms. With the Loudspeaker Switch turned to position "INT" only the internal loudspeaker is connected, turning to "EXT" connects the external loudspeaker, whilst in the centre position both are connected.

Pick-Up.

No. 13. D.C. resistance of coil, 1·3 ohms.

Motor.

Hysteresis, Type 26200P or Type U48.

Auto-Mechanism.

New type auto-mechanism, plays ten unmixed 10-inch or 12-inch records.

Type 45000AS using type 26200P motor.

Type 45000Q using type U48 motor.

CIRCUIT DESCRIPTION

Frequency Changer.

The aerial is switched on each waveband to high impedance coils, which are coupled to tuned coils in the grid circuit of the triode hexode frequency changer V1 (X81); these grid coils are adjusted by means of iron-dust cores and parallel trimmer condensers.

The local oscillator circuit also has tuned coils, adjusted by means of iron-dust cores and parallel trimmer condensers, the tuned windings being in the oscillator anode circuit to give greater stability on the short wave bands. The frequency coverage on the short wave bands is obtained by means of condensers in series with the gang condenser, thus giving ease of tuning on all bands.

The first iron-dust cored I.F. transformer (IFT1) couples this valve to the I.F. amplifier.

I.F. Amplifier.

The I.F. amplifier V2 (W81) is a high slope valve and amplifies at the I.F. of 465 kc/s. The second I.F. transformer (IFT2) couples this valve to the detector.

Detector A.G.C. and A.F. Amplifier.

The double-diode-triode V3 (DH81) is used as a detector and A.G.C. rectifier. The volume control (VR1) forms the signal diode load. A.G.C. voltage is taken from the D.C. component of the rectified voltage across R12, and is applied to control the bias of the grid circuits of V1 and V2, which are decoupled by R9 and C28.

A.F. signals from VR1 are applied to the grid of the triode section of V3, this section is resistance capacity coupled to the grid of the output valve.

Output.

The tetrode output valve V4 (KT81) has its cathode biased by R17. Tone correction is effected by C35, and variable control by VR2; C36 eliminates heterodyne and sideband whistles. The valve supplies the loudspeaker via an output transformer (T1).

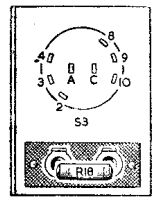
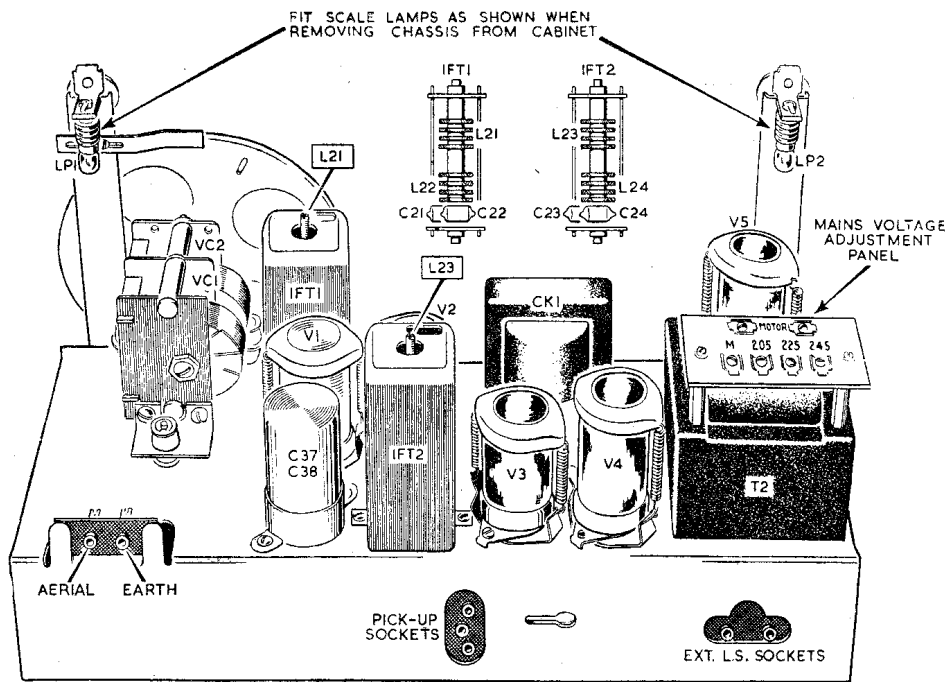
H.T. and Heater Supplies.

H.T. is supplied from the mains transformer (T2) and the full-wave rectifier valve V5 (U84). Smoothing is obtained by the choke (CK1) and electrolytic condensers C38 and C37. The L.T. supply is taken from a separate winding on the mains transformer. Two scale lamps LP1 and LP2 are connected across this winding.

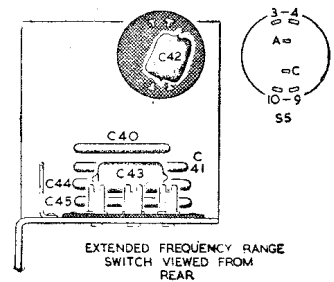
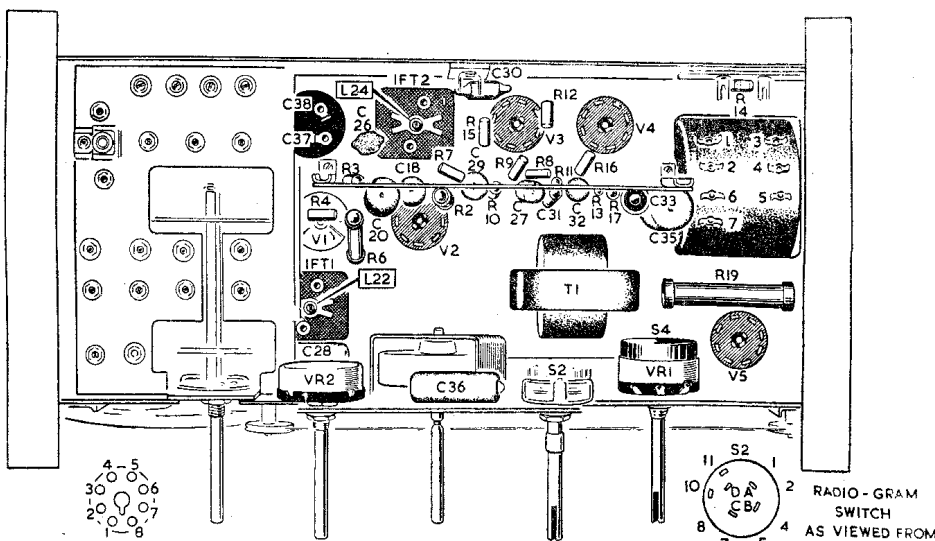
Gramophone.

For gramophone operation, S2 switches the output from the pick-up, via the matching transformers (T3 and T4) and the volume control (VR1), to the grid of the triode section of the A.F. Amplifier, V3. Filtering is effected by CK2, C39 and R20.

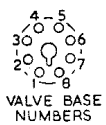
In the "NORMAL" position of S5, top cut is applied to the pick-up circuit. When S5 is switched to the "EXTENDED" position, the top cut is removed, thus giving the pick-up an extended frequency range.



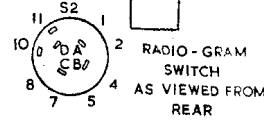
EXTERNAL LOUDSPEAKER
SWITCH VIEWED FROM
REAR



EXTENDED FREQUENCY RANGE
SWITCH VIEWED FROM
REAR

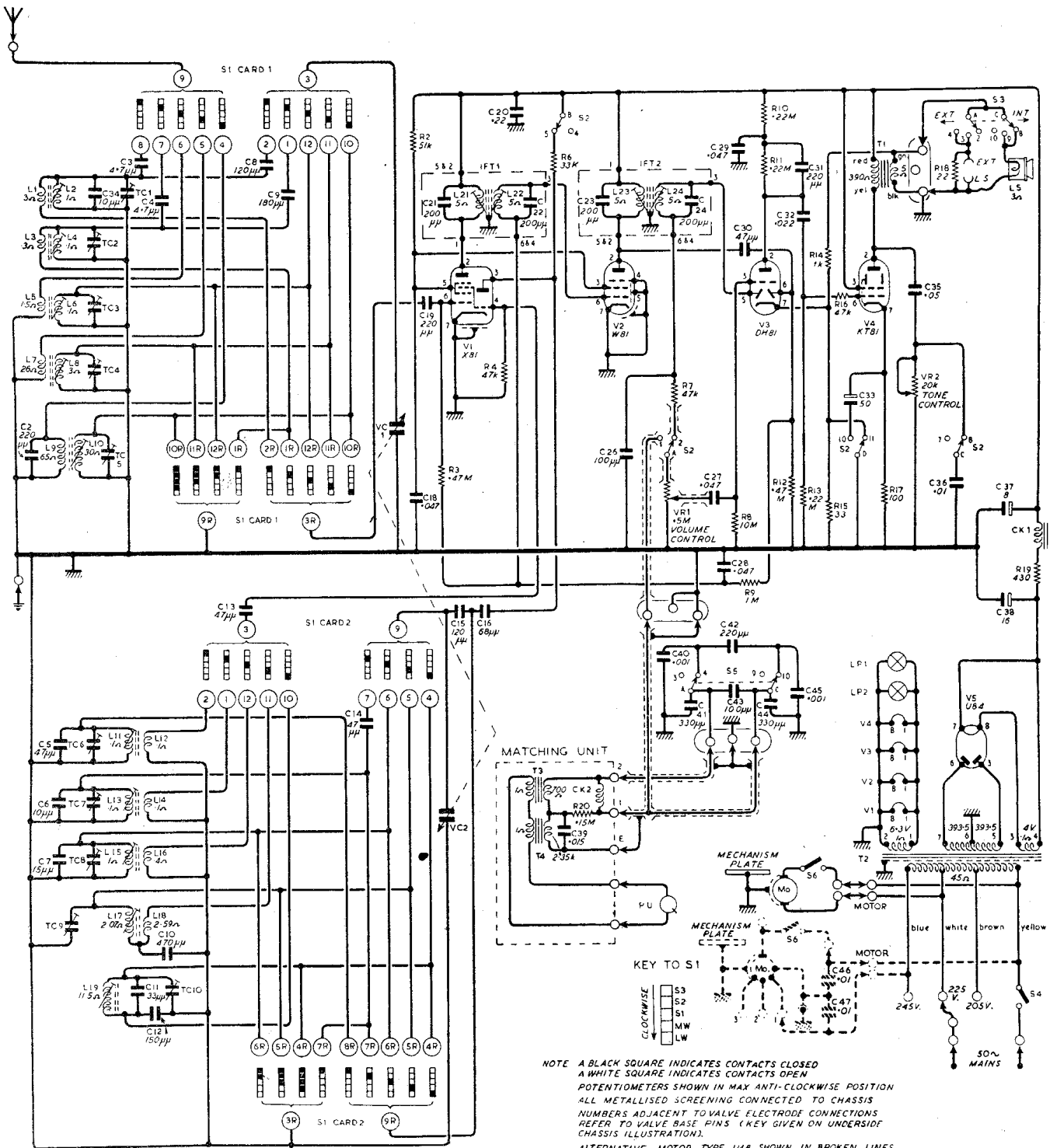


VALVE BASE
NUMBERS



RADIO-GRAM
SWITCH
AS VIEWED FROM
REAR

C	2	5,6,7	34	3	4	11,12,10	13	8	9	14	19,18,21	20	22	23	26	24	27	29	28,30	32,31	33	35	3A	37	C											
R	1 to 10		11 to 19								21	22	23	24		7	8	9,10,11,12	14,13	16,15	17	18		38	R											
L																									L											
MISC	TC ₁	TC ₂	TC ₃	TC ₄	TC ₅	TC ₆	TC ₇	TC ₈	TC ₉	TC ₁₀	S ₁	S ₁	VC ₁	VC ₂	V ₁	IFT ₁	T ₃ T ₄	CK ₂	S ₂	V ₂	PU	IFT ₂	S ₂	V ₃	M ₀	S ₆	S ₂	T ₂	V ₄	T ₁	VR ₂	V ₅	S ₂	S ₁	S ₄	CK ₁



NOTE—In certain models a Condenser C1 is in parallel with L7, and/or a DH149 is fitted in place of the DH81.

INSTALLATION

The Aerial and Earth.

This receiver has been designed to give a high standard of reception on all wavebands. Unless it is connected to an adequate aerial and earth installation, however, the advantages of the design will be minimised or lost, and although the receiver will work on an inside aerial, a high outside aerial is essential for the best reception.

Erect a high outside aerial 60 to 80 feet total length, as far as possible from buildings and trees. Point the aerial towards any potential source of interference, such as overhead power or trolley lines, or any roadway carrying heavy motor traffic. A lightning arrester or switch should be fitted and the aerial must be well insulated from all grounded objects.

A copper plate or rod buried about three feet deep in moist ground provides the best earth. Alternatively, connection can be made to a rising main water pipe. Do not use a telephone earth or a hot water or gas pipe as an earth. The aerial and earth should be fitted with the two plugs provided.

Transit Packing.

Before operating the instrument all transit packing must be removed.

1. Ensure that the instrument is completely disconnected from the mains and remove the back panel (screw-fixing).
2. Remove the two "spade" bolts securing the radio chassis to the cabinet.
3. Remove the four screws and washers from the corners of the mechanism plate and replace with those contained in the linen bag.
4. Untie the tapes securing the pick-up and record retaining arm.

Before attempting any dismantling, ensure that the instrument is completely disconnected from the mains supply.

Removal of Chassis.

1. Take out the aerial and earth plugs, pull off the "EXT. L.S." switch knob and remove the back panel (six screws).
2. Disconnect the motor leads from the mains voltage adjustment panel.
3. Disconnect from the chassis the Aerial and Earth plugs, the "EXT L.S." plugs and the three pin plug from the Pick-Up Matching Unit.
4. Disconnect the motor earth tag from the chassis, and unclean the mains lead from the cabinet.
5. Remove the scale lamp holders from their supports and secure the holders to the cord drive supports as shown in the illustration. Disengage the pointer from the cord drive.
6. Open the lid and remove the control knobs (5 screw fixing and 1 spring fixing).
7. Remove the four screws securing the control panel and lift out panel.
8. Remove the four chassis fixing bolts and withdraw the chassis.

Mains Supply.

This instrument may be operated on A.C. mains supplies of 195—255 volts, 50 cycles only. Make sure that the instrument is completely disconnected from the supply and attach the Mains Voltage Adjustment Lead to the appropriate terminal; voltages covered by the terminals are :—

Terminal	Voltage
205	195-215
225	216-235
245	236-255

IMPORTANT.—The mains supply point to which the instrument is connected must be fused for not more than 2 amps. If the mains point is normally fused at a higher rating than this, a 2 amp. fuse plug may be satisfactorily employed.

Do not connect the mains supply until the remaining adjustments are completed.

Valves.

Make certain that the valves are firmly inserted in their correct positions. Do not remove cradles securing valves (see illustration).

WARNING.—When removing or refitting a valve, always use a vertical movement and on no account use force. As these valves have glass bases, any excessive sideways movement or rough handling may fracture the glass surrounding the pins and the valve will fail.

Final Connections.

Ensure that all plugs at the rear of the instrument are firmly and correctly inserted. Replace the back panel, plug the aerial and earth into their appropriate sockets and connect mains supply.

DISMANTLING

Removal of H.F. Unit.

Repeat operations 1 to 8 above, and proceed as follows :—

1. Unsolder the lead from the aerial tag and the two leads from the gang condenser.
2. Unsolder from the tag panel on the H.F. Unit
 - (a) The braided lead from Tag 1 to the spigot of V1.
 - (b) The red lead from Tag 2 to pin 3 V1.
 - (c) The yellow lead from Tag 4 to pin 4 V1.
 - (d) The green lead from Tag 5 to pin 6 V1.
3. Remove the four P.K. screws and withdraw the unit.

Removal of Auto-Mechanism.

1. Tie the pick-up arm to its rest.
2. Disconnect the pick-up leads from the Matching Unit.
3. Disconnect the motor leads from the Mains Voltage Adjustment panel, unclean leads from cabinet.
4. Remove the motor earth lead from the chassis.
5. Remove the four screws from the corners of the mechanism plate, and withdraw mechanism.
6. Remove earth lead from mechanism plate.

I.F. AND R.F. ALIGNMENT

General.

If the I.F. circuits have been disturbed, complete I.F. and R.F. alignment must follow. Either S.W., M.W., or L.W. bands can be reganged without affecting the other bands. The S.W. bands can also be reganged independently.

The oscillator tracks at a higher frequency on all wavebands.

Whilst ganging, the input to the receiver must be progressively reduced, as the circuits are brought into line so that the output does not exceed 500 mW (1.58 v. across the speech coil).

An A.C. voltmeter (rectifier type) connected across the loudspeaker speech coil may be used as an output meter.

Intermediate Frequency.

Set the Waveband switch to M.W.; the Volume control to maximum; the Tone control fully clockwise. Turn the gang condenser to minimum capacity (plates fully open).

1. Inject a modulated signal at 465 kc/s, via a 0.05 mfd. condenser into the grid of V2 and chassis, leaving the grid connection made. Adjust cores of L24 and L23 in that order for maximum output.

2. Inject a modulated signal at 465 kc/s, via a 0.05 mfd. condenser into the grid of V1 and chassis, leaving the grid connection made. Adjust cores of L22 and L21 in that order for maximum output.

3. Repeat operations 1 and 2.

Short Waves.

Set the Volume control to maximum; the Tone control fully clockwise and the Waveband switch as required. Inject test signal into aerial and earth sockets via a S.W. dummy aerial.

Waveband Switch Position.	Op. No.	Calibration Scale Setting.	Tune Test Oscillator to		Operation.
			m.	Mc/s.	
S.W.3	1	$7\frac{11}{16}$	20.68	14.5	Adjust L11 for Maximum Output. Adjust L2 for Maximum Output. Adjust L11 for Maximum Output. Adjust TC6 for Maximum Output. Adjust TC1 for Maximum Output. Adjust TC6 for Maximum Output. Repeat Operations 1 to 6.
	2	Rock Gang	20.68	14.5	
	3	$7\frac{11}{16}$	20.68	14.5	
	4	$1\frac{1}{8}$	16.21	18.5	
	5	Rock Gang	16.21	18.5	
	6	$1\frac{1}{8}$	16.21	18.5	
	7	—	—	—	

Waveband Switch Position.	Op. No.	Calibration Scale Setting.	Tune Test Oscillator to		Operation.
			m.	Mc/s.	
S.W.2	1	$7\frac{3}{16}$	31.9	9.4	Adjust L13 for Maximum Output. Adjust L4 for Maximum Output. Adjust L13 for Maximum Output. Adjust TC7 for Maximum Output. Adjust TC2 for Maximum Output. Adjust TC7 for Maximum Output. Repeat Operations 1 to 6.
	2	Rock Gang	31.9	9.4	
	3	$7\frac{3}{16}$	31.9	9.4	
	4	$1\frac{1}{8}$	22.2	13.5	
	5	Rock Gang	22.2	13.5	
	6	$1\frac{1}{8}$	22.2	13.5	
	7	—	—	—	

Radio Frequency—Setting Up Calibration Scale.

As the wavescale is not assembled to the chassis, a calibration scale is printed on the back of the condenser drum. This scale is calibrated in inches and sixteenths of an inch, which correspond to the frequencies given in the ganging tables, and is read against the red datum line on the bracket mounted above the condenser drum.

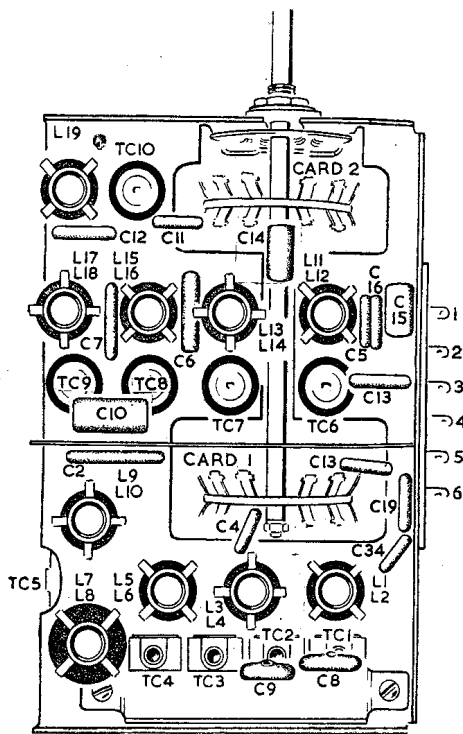
Before commencing R.F. ganging operations, it is essential to check the position of the red datum line in relation to the calibration scale as follows:—

1. Turn gang condenser to maximum capacity.
2. See that the red datum line coincides with 9 inches on the calibration scale.
3. If adjustment is necessary, slacken the two screws securing the bracket and adjust, then tighten the screws securely.

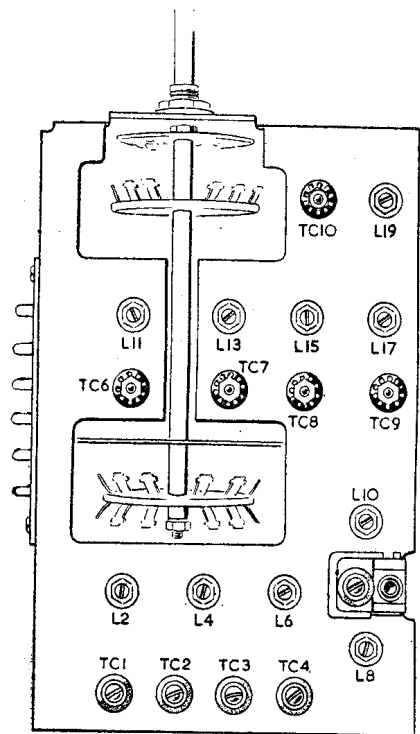
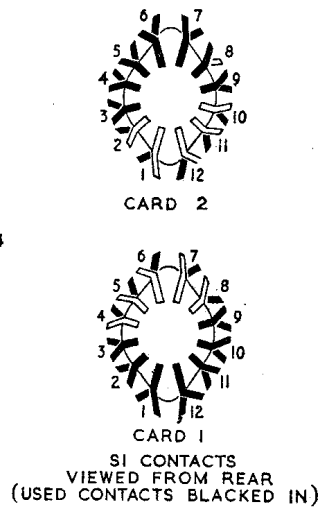
Bandspread.

Unless the signal generator to be used for alignment is known to have an extremely high order of accuracy, it is essential to check the calibration of these ranges on a transmission of known frequency, either during or after ganging. The oscillator circuit inductances may be re-adjusted to bring the tuning to the correct pointer reading on the scale. The receiver should have been switched on for at least a quarter of an hour before making adjustments.

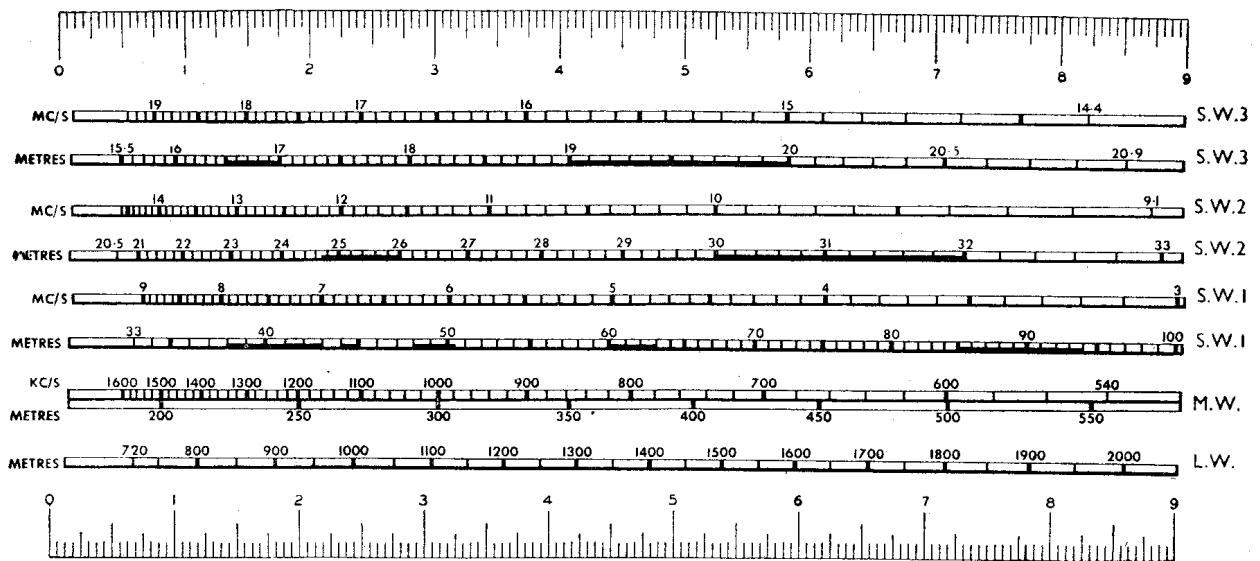
A reproduction of the scales relative to the inch calibrating scale is given so that the wavelength can be interpreted as calibration scale readings for this purpose.



UNDER VIEW OF
H.F. UNIT



TOP VIEW OF
H.F. UNIT



RELATIONSHIP BETWEEN WAVESCALE AND CALIBRATION SCALE

Waveband Switch Position.	Op. No.	Calibration Scale Setting.	Tune Test Oscillator to		Operation.
			m.	Mc/s.	
S.W.1	1	$7\frac{5}{16}$	85.66	3.5	Adjust L15 for Maximum Output. Adjust L6 for Maximum Output. Adjust L15 for Maximum Output. Adjust TC8 for Maximum Output. Adjust TC3 for Maximum Output. Adjust TC8 for Maximum Output. Repeat Operations 1 to 6.
	2	Rock Gang	85.66	3.5	
	3	$7\frac{1}{16}$	85.66	3.5	
	4	$1\frac{1}{8}$	36.12	8.3	
	5	Rock Gang	36.12	8.3	
	6	$1\frac{1}{8}$	36.12	8.3	
	7	—	—	—	

Medium Waves.

Controls as before, but with waveband switch set to M.W. M.W. dummy aerial to be used.

Waveband Switch Position.	Op. No.	Calibration Scale Setting.	Tune Test Oscillator to		Operation.
			m.	kc/s.	
M.W.	1	$7\frac{3}{8}$	510	588	Adjust L17 for Maximum Output. Adjust L8 for Maximum Output. Adjust L17 for Maximum Output. Adjust TC9 for Maximum Output. Adjust TC4 for Maximum Output. Adjust TC9 for Maximum Output. Repeat Operations 1 to 6.
	2	Rock Gang	510	588	
	3	$7\frac{3}{8}$	510	588	
	4	$\frac{9}{16}$	186.9	1,605	
	5	Rock Gang	186.9	1,605	
	6	$\frac{9}{16}$	186.9	1,605	
	7	—	—	—	

Long Waves.

Controls as before, but with waveband switch set to L.W. L.W. dummy aerial to be used.

Waveband Switch Position.	Op. No.	Calibration Scale Setting.	Tune Test Oscillator to		Operation.
			m.	kc/s.	
L.W.	1	$7\frac{1}{2}$	1,850	162	Adjust L19 for Maximum Output. Adjust L10 for Maximum Output. Adjust L19 for Maximum Output. Adjust TC10 for Maximum Output. Adjust TC5 for Maximum Output. Adjust TC10 for Maximum Output. Repeat Operations 1 to 6.
	2	Rock Gang	1,850	162	
	3	$7\frac{1}{2}$	1,850	162	
	4	$1\frac{1}{2}$	850	353	
	5	Rock Gang	850	353	
	6	$1\frac{1}{2}$	850	353	
	7	—	—	—	

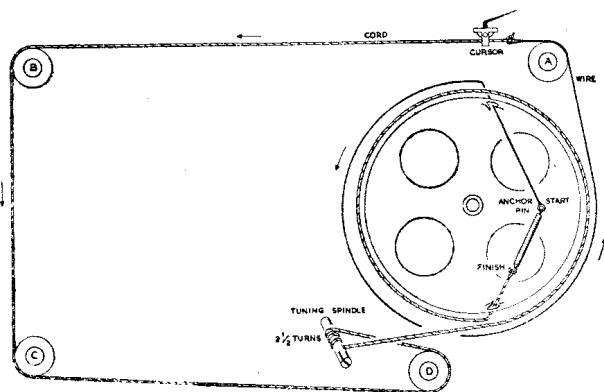
CALIBRATION

Replace chassis in cabinet and check calibration at about the middle of the tuning scale on a station of known

wavelength. Adjust pointer to give best compromise on all wavebands, if necessary.

CONDENSER AND POINTER DRIVE

Use only correct wire (4851 × 9033) and high grade fishing line (6301 × 0335). Approximately 22 inches of wire and 48 inches of cord are used.



1. Form a loop with an opening of about $\frac{1}{8}$ -inch in diameter at one end of the wire. It will be found that the twisted part of the wire can readily be soldered.
2. Pass loop end of wire through hole in periphery of drum and assemble on anchor pin as shown in diagram.
3. Wind wire nearly a complete turn round drum and take it over pulley "A". Arrows show direction.
4. Attach one end of cord to loose end of wire; form a loop in end of wire and solder, tie a knot in end of cord and fix with shellac.
5. Take cord around pulleys marked "B", "C" and "D".
6. Wind two and a half turns round tuning spindle.
7. Take cord round drum and in through hole in periphery of drum. Assemble tension spring as shown. Tie a knot and shellac end of cord.

VALVE TABLE

The following table indicates the approximate voltage readings obtained on each valve when the receiver is connected to a 220 volts 50 cycle mains supply, and operating with the Volume Control at maximum, at a point of no reception on the M.W. band. Variations of ± 15 per cent. may be anticipated between models. Higher or lower mains voltage will naturally produce a corresponding variation in meter readings in approximate proportion to the change in mains supply.

A high resistance voltmeter should be used to measure voltages. Values stated below were obtained using a meter with a resistance of 500 ohms per volt.

VALVE.	ANODE.		SCREEN.	CATHODE.
	Volts to Chassis.			
V1 (X81)	Mx. 280	Osc. 110	45	—
V2 (W81)	280		45	—
V3 (DH81)		60	—	—
V4 (KT81)		260	280	4.6
V5 (U84)		320 A.C.	—	340

Total H.T. current, 70 mA (D.C.).

Total A.C. current, 220 mA.

Total H.T. voltage (smoothed), 280 volts.

HYSTERESIS MOTOR

Electrical Data.

Frequency Range 50 cycles only.
 Current, maximum 0.07 amp. at 200 volts.
 Wattage, maximum 14 watts at 200 volts.
 Resistance of Coils 555 ohms.
 Condensers 1.15 mfd. each section.

Insulation not less than 50 megohms at 500 v. D.C. On 50 cycle mains, the speed of the motor is constantly maintained giving a turntable speed of 78 r.p.m.

Principle of Operation.

The hysteresis motor is an induction type operating by virtue of the rotating magnetic field produced by the four-pole stator in conjunction with condensers. The rotor consists of a plain ring of magnet steel which, during starting, is magnetised by the eddy currents produced by the rotating field in such a way that torque is developed between the stator and the rotor field. As the motor reaches synchronous speed, the rotor becomes polarized in a simple two-pole manner and consequently follows the rotating field set up by the stator.

To Remove Motor from Mechanism Plate.

1. Remove the turntable (3 screws).
2. Detach external connections from motor.
3. Slacken the two grub screws securing the motor pulley.
4. Take out the 3 screws on top of the mechanism plate, at the same time supporting the bottom of the motor to prevent it from dropping.
5. Withdraw the motor.

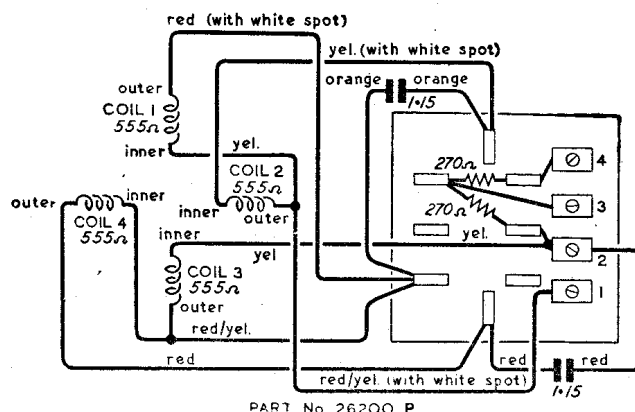
To Remove Stator.

1. Remove large bronze rotor bearing, and withdraw rotor carefully.
2. Unsolder leads from condenser block.
3. Remove stator assembly by unscrewing the four securing screws.

Electrical Data.

Voltage—200—250 v. A.C., 40—60 c.p.s.
 Current—0.12 amps at 250 v., 50 c.p.s.
 Wattage—19 watts at 250 v., 50 c.p.s.

When re-assembling, care must be exercised to ensure that the end of the rotor spindle is located in the spring-loaded bearing (at the worm end) before pushing the large bronze bearing home. Before finally tightening the stator securing screws, assemble the rotor in position and ensure that an equal gap is obtained all round the magnet steel ring. A diagram of the coil connections is given.



To Remove the Main Spindle.

Remove three screws securing the bottom plate of the motor. The spindle can now be withdrawn.

Adjustments.

End play is catered for by the spring-loaded bearing. Ball thrust bearings should be present at both ends of the rotor and at the lower end of the main spindle.

Lubrication.

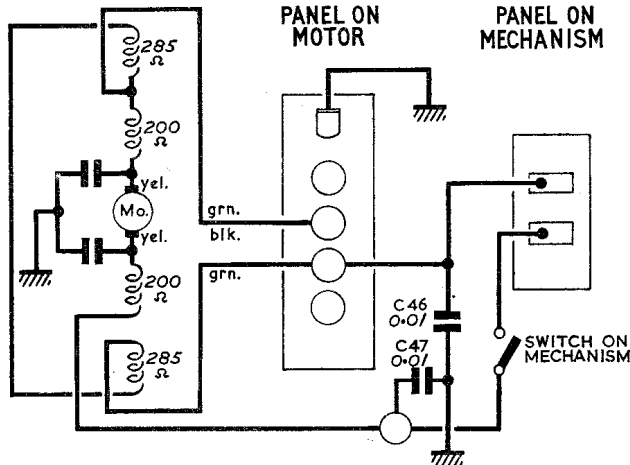
The motor should be oiled periodically with "His Master's Voice" oil. There are three lubrication points—two holes at extreme ends of motor, and the spindle bearing.

MOTOR TYPE U48

Resistance of Armature between adjacent segments of Commutator—30 ohms.
 Resistance of Armature across diameter of Commutator—200 ohms.

Description.

The motor is a series wound commutator type, and has a two pole field and a twenty-four pole armature. Two suppressor condensers are fitted across the motor brushes. The armature shaft, to which is attached the governor, drives the motor spindle worm and wheel reduction gearing.



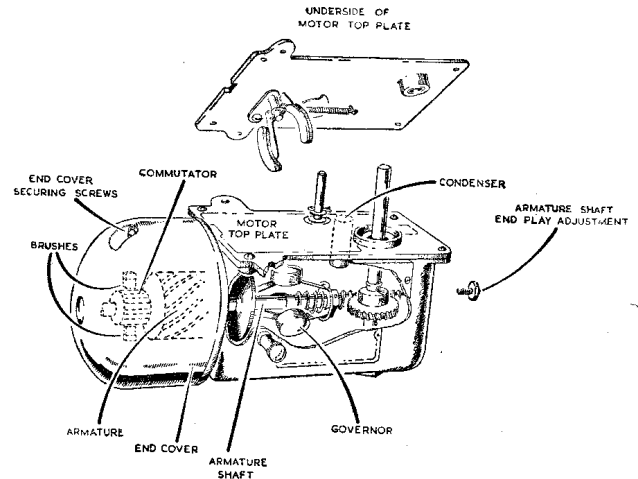
To Remove Motor from Mechanism Plate.

1. Remove the turntable (3 screws).
2. Disconnect external connections from motor panel.
3. Slacken the two grub screws securing Motor Pulley and remove the pulley.
4. Remove the three screws securing the motor sub-plate to the mechanism plate and withdraw motor.

To Remove Motor Spindle and Armature.

1. Remove the Speed Regulator arm (grub screw).
2. Remove the motor sub-plate.
3. Remove the motor top plate (4 screws) and withdraw the motor spindle.

4. Remove the end cover (2 screws).
5. Unhook the brush arms from the pivot pins.
6. Unscrew the two circular brass nuts.
7. Loosen screw securing Governor.
8. Withdraw the armature.



General Hints.

Electrical noise may develop after considerable use, this is usually due to worn brushes. If the brushes are badly worn, they should be replaced with new ones; if they are not badly worn the surface which bears on the commutator should be lightly scraped with a pen knife. In extreme cases of noise, it may be necessary to remove the armature from the motor and clean or skim the commutator. The armature spindle should have no appreciable end-play; this should be adjusted by means of the armature shaft end-play adjustment (see illustration), and the lock-nut securely tightened.

PICK-UP

IMPORTANT.—Dealers should appreciate, and advise owners that the lightweight pick-up is a component of precision which should be handled accordingly. No other needles but the H.M.V. Permanent Sapphire or Silent Stylus types must be used, and it is normal for these to feel loose when correctly inserted. Damage will result if force is used or a larger needle inserted. The needle should not be disturbed until it has to be changed.

Normal Maintenance Adjustments.

To carry out normal maintenance adjustments, it is not necessary to remove the pick-up from the mechanism plate, although it may be found more convenient to do so.

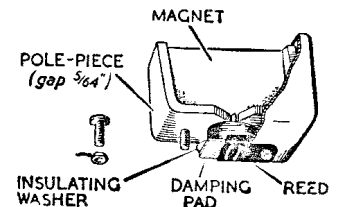
1. Unscrew the two nuts securing the reed plate. The reed plate may now be removed, and the coil may be lifted clear of the pole pieces. Note carefully the arrangement of paper washer(s).
2. Insert a small screwdriver through the aperture revealed, when the reed plate is removed, and push out the top. The top is stuck in position with cellulose cement.
3. Examine the armature and air gap for dust, grit and iron filings, but do not dismantle further unless absolutely necessary. A small piece of plasticine will be found very effective for clearing out iron filings.
4. Ascertain whether the damping pad has perished. Make sure that the armature is attached firmly to the reed plate and is not bent or damaged in any way. If any one of the above parts is faulty, reject and fit a complete new assembly.
5. Check continuity of the coil. (Resistance 1.3 ohms).
6. If it is necessary to remove the coil, the leads may be unsoldered from the tags, just behind the pick-up head.

These tags are protected by an insulator which is fixed by means of a screw.

NOTE.—Do not remove the magnet and pole-pieces unless this is absolutely necessary.

To Replace the Coil.

1. Insert the coil and paper washer in the hole provided with the inner lead lying on the side of the coil nearest the pole pieces; care should be taken to see that this lead does not lie in the air gap.
2. Cut the leads to the correct length and clean the ends. Solder to the connecting tags.
3. Replace the insulator over the tags, and fix in position.



To Re-Assemble the Pick-Up Head.

1. Replace the coil as above.
2. Place the paper washer(s) on the coil and replace the reed plate. Care must be taken to see that the paint spot on the slot side of the reed plate is at the back of the Pick-up head, i.e., towards the arm.

3. Place the fixing nuts on the reed plate and adjust the plate until the armature lies centrally in the air gap. Tighten the fixing nuts until the damping pad is compressed slightly.
4. Replace the top and secure with cellulose cement.

To Remove the Pick-Up.

1. Unsolder the pick-up leads from the tag panel under the mechanism plate.
2. Remove the knurled pin and withdraw pick-up.

AUTOMATIC RECORD CHANGER

Although the mechanism is robust and non-critical in adjustment, it must be handled with care. The record changer must be installed in such a manner that the turntable is level (test on turntable). Force is not necessary when operating the mechanism, and warped or damaged records should not be used. The operating instructions below are in sequence and should be performed in the order given.

Any salient points are shown in heavy type and the most important of these, which should be emphasised to the customer when the instrument is installed, are listed separately.

OPERATING INSTRUCTIONS

To Play a Programme of Records.

The automatic record changer will play one side of each of up to ten 10-inch or 12-inch records, incorporating a quick run-in concentric or eccentric finishing groove; the finishing groove must not be more than $3\frac{5}{8}$ inches diameter. Non-standard (6-inch or 8-inch) records cannot be played. Only records of one size, 10-inch or 12-inch, may be played at one loading. Not more than ten records may be loaded at a time.

If less than ten records have been loaded, others may be added whilst a record is being played; the total of ten records must not be exceeded.

The speed of the turntable should be adjusted to 78 r.p.m. (where a regulator is fitted). The procedure for playing one or more records is as follows :—

1. Lift the record retaining arm. Adjust the position of the 10-inch record support plate to suit the size of records, i.e., for 10-inch records the record support plate must be down, for the 12-inch records this support plate must be fully raised. The support plate must not be lowered whilst 12-inch records are being played.
2. Fit cranked spindle in top of pusher tube, then rotate until it locates and drops into position.
3. Place the records on the spindle so that they will be supported by the "Shelf" in the cranked spindle and by the appropriate record support plate.
4. Lower the record retaining arm on to the top record.
5. Lift the pick-up arm to an almost vertical position, and insert a "His Master's Voice" Silent Stylus or Permanent Sapphire needle, pushing the needle fully home (see Important Note above).
6. Return the pick-up arm to its rest.
7. Turn "Start Reject" control as far as it will go in a clockwise direction and then release it; the control will automatically return to its normal position.
8. The mechanism will now play the full programme of records and then come to rest, the motor will be switched "off" when the pick-up arm returns to its rest.

To Reject a Record.

A record can only be rejected after it has started to be played. To reject, simply turn "Start-Reject" control

in a clockwise direction and release. The pick-up will automatically lift from the record and move aside while the next record is dropped.

To Play a Single Record.

Place a record on the turntable. **Lower the record retaining arm, lift the pick-up and gently feed needle into the record groove.**

At the end of the record, the pick-up is returned to its rest and the mechanism stops.

To Unload the Mechanism.

1. Lift the record retaining arm, and remove the cranked spindle.
2. Lift the records straight off the turntable.
3. Replace the cranked spindle. Rotate until it locates and drops into position.
4. Lower the record retaining arm.

To Stop Mechanism.

To stop the mechanism before a programme of records has been completed, proceed as follows :—

1. Lift record retaining arm.
2. Remove unplayed records from cranked spindle.
3. Lower record retaining arm.
4. Turn "Start Reject" control clockwise.

The pick-up arm will then lift from the record being played and the mechanism will automatically switch "off" when the pick-up arm is returned to its rest.

Important Operating Points.

All movements of the pick-up arm during record changing are entirely automatic and must not be interfered with.

The 10-inch record support plate must not be down when playing 12-inch records.

Ensure that the cranked spindle is in position before loading records.

See that needle is in position before starting mechanism.

Do not rotate turntable by hand.

For further information regarding the auto-mechanism, see separate Service Manual.

SPARE PARTS LIST

Part No.	Description	No. per Inst.	Fin.	Part No.	Description	No. per Inst.	Fin.
INDUCTANCES							
27389CS	L1 } 15.5-21 metres Aerial Coil	1	—	38150A	C37—8 mfd., 450 v. ..	1	—
	L2 }			See C37	C38—16 mfd., 450 v. ..	1	—
27389CT	L3 } 21-33 metres Aerial Coil	1	—	See MU	C39—0.015 mfd. ..	1	—
	L4 }			38002N	C40—0.001 mfd., ± 5% ..	1	—
27389CU	L5 } 33-100 metres Aerial Coil	1	—	38001K	C41—330 mmfd., ± 5% ..	1	—
	L6 }			38001J	C42—220 mmfd., ± 5% ..	1	—
27389DU	L7 } M.W. Aerial Coil ..	1	—	38004G	C43—100 mmfd., ± 5% ..	1	—
	L8 }			38001K	C44—330 mmfd., ± 5% ..	1	—
27389DT	L9 } L.W. Aerial Coil ..	1	—	38002N	C45—0.001 mfd., ± 5% ..	1	—
	L10 }			38214F	*C46—0.01 mfd., 1,000 v. ..	1	—
27389CW	L11 } 15.5-21 metres Oscilla-	1	—	38214F	*C47—0.01 mfd., 1,000 v. ..	1	—
	L12 } tor Coil ..			37101C	VC1—Gang Condenser ..	1	—
27389CX	L13 } 21-33 metres Oscillator	1	—		VC2—Gang Condenser ..	1	—
	L14 } Coil ..			31759A	TC1—4-30 mmfd. ..	1	—
27389DG	L15 } 33-100 metres Oscillator	1	—		TC2—4-30 mmfd. ..	1	—
	L16 } Coil ..				TC3—4-30 mmfd. ..	1	—
27389BX	L17 } M.W. Oscillator Coil ..	1	—	39650A	TC4—4-30 mmfd. ..	1	—
	L18 }			35480B	TC5—4-30 mmfd. ..	1	—
27389BW	L19—L.W. Oscillator Coil ..	1	—	35480B	TC6—3-30 mmfd. ..	1	—
See IFT1	L21—IFT1 Primary Coil ..	1	—	35480B	TC7—3-30 mmfd. ..	1	—
	L22—IFT1 Secondary Coil ..	1	—	35480B	TC8—3-30 mmfd. ..	1	—
See IFT2	L23—IFT2 Primary Coil ..	1	—	35480B	TC9—3-30 mmfd. ..	1	—
	L24—IFT2 Secondary Coil ..	1	—		TC10—3-30 mmfd. ..	1	—
CONDENSERS							
38051DL	C1—470 mmfd. ..	1	—	33373NV	R2—51,000 ohms, ± 5% ..	1	—
38000J	C2—220 mmfd. ± 5% ..	1	—	33360EE	R3—0.47 megohms ..	1	—
38050NL	C3—4.7 mmfd. ..	1	—	33360DY	R4—47,000 ohms ..	1	—
38050NL	C4—4.7 mmfd. ..	1	—	33373X	R6—33,000 ohms, ± 5% ..	1	—
38000ZJ	C5—47 mmfd. ± 2% ..	1	—	33360DY	R7—47,000 ohms ..	1	—
38003BA	C6—10 mmfd. ± 10% ..	1	—	33360EN	R8—10 megohms ..	1	—
38003B	C7—15 mmfd. ± 5% ..	1	—	33360EG	R9—1 megohm ..	1	—
38000TH	C8—120 mmfd. ± 2% ..	1	—	33360EC	R10—0.22 megohms ..	1	—
38000VE	C9—130 mmfd., 3% ..	1	—	33360EC	R11—0.22 megohms ..	1	—
38001VQ	C10—510 mmfd., 3% ..	1	—	33360EE	R12—0.47 megohms ..	1	—
38000ZE	C11—33 mmfd., 3% ..	1	—	33360EC	R13—0.22 megohms ..	1	—
38000TJ	C12—150 mmfd., 3% ..	1	—	33360N	R14—1,000 ohms, ± 5% ..	1	—
38000E	C13—47 mmfd., 5% ..	1	—	33360D	R15—33 ohms, ± 5% ..	1	—
38003ZS	C14—47 mmfd., 2% ..	1	—	33360DY	R16—47,000 ohms ..	1	—
38003TH	C15—120 mmfd., 2% ..	1	—	33334G	R17—100 ohms, ± 5% ..	1	—
38003F	C16—68 mmfd., 5% ..	1	—	33363DC	R18—22 ohms ..	1	—
38211DY	C18—0.047 mfd., 350 v. ..	1	—	33381RV	R19—430 ohms, ± 5% ..	1	—
38000J	C19—220 mmfd., ± 5% ..	1	—	See MU	R20—0.15 megohm, ± 5%; ..	1	—
38211EC	C20—0.022 mfd., 350 v. ..	1	—	37900ER	VR1—0.5 megohms, Volume Control ..	1	—
See IFT1	C21—200 mmfd., ± 2% ..	1	—		VR2—20,000 ohms, Tone Control ..	1	—
	C22—200 mmfd., ± 2% ..	1	—	37900GR			
See IFT2	C23—200 mmfd., ± 2% ..	1	—				
	C24—200 mmfd., ± 2% ..	1	—				
38050DG	C26—100 mmfd., 350 v. ..	1	—				
38210DY	C27—0.047 mfd., 150 v. ..	1	—				
38210DY	C28—0.047 mfd., 150 v. ..	1	—				
38211DY	C29—0.047 mfd., 350 v. ..	1	—				
38051DE	C30—47 mmfd., 500 v. ..	1	—				
38051DJ	C31—220 mmfd., 500 v. ..	1	—				
38211DW	C32—0.022 mfd., 350 v. ..	1	—				
38151F	C33—50 mfd., 12 v., Electrolytic ..	1	—				
38003BA	C34—10 mmfd., 10% ..	1	—	39000B	IFT1—First I.F. Transformer ..	1	—
31840W	C35—0.05 mfd., 1,000 v. ..	1	—	39000B	IFT2—2nd I.F. Transformer ..	1	—
31840N	C36—0.01 mfd., 1,000 v. ..	1	—	35527H	T1—Output Transformer ..	1	—
RESISTANCES							
VALVES							
				V1—X81	Frequency Changer ..	1	—
				V2—W81	I.F. Amplifier ..	1	—
				V3—DH81 or DH149	Detector, A.G.C. and A.F. Amplifier ..	1	—
				V4—KT81	Output ..	1	—
				V5—U84	Rectifier ..	1	—
TRANSFORMERS AND CHOKES							

* Only used with U48 motor.

Part No.	Description	No. per Inst.	Fin.	Part No.	Description	No. per Inst.	Fin.
44390G	T2—Mains Transformer	1	—	36653B	Rotor Assembly	1	—
See MU	T3—Pick-up Transformer	1	—	26204	End Bearing	1	03
	T4—Pick-up Transformer	1	—	200040H	Screw	} securing End Bearing	} 2 03
22628AL	CK1—Choke	1	—	201804	S.P. Washer		
See MU	CK2—Choke	1	—	20850	Bush (Oilite)	} for Large End Bearing	} 1 —
				36000	Plug		
				3540	Ball	} 1 —	}
				36001	Bush (Oilite)		
				36002	Plug	} for Small End Bearing	} 1 —
				26206	Spring		
				249	Ball	} 1 —	}
				32780D	Coil Lamination Assembly		
				35471B	Coil	4	358
				35473	Ring	1	—
				39350	Packing	8	—
				200040T	Screw	} securing Lamination Assembly	} 4 03
				201804	S.P. Washer		
				36003	Washer	} 4 —	}
				20703	Rubber Grommet for Leads		
				20710F	Condenser Block and Bracket, 2 × 1.5 mfd., ± 10 per cent.	1	—
				11805	P.K. Screw	} securing Condenser to Motor	} 2 —
				210306	Washer		
				36260B	Tag Panel (4 tags)	1	—
				200068F	Terminal Screw	4	03
				14512	Tag	4	454
				14511	Nut	4	288
				17378	Tag	8	454
				12619	P.K. Screw securing Panel	4	—
				15159	Tag	1	454
				33379CX	Resistance, 270 ohms, 2 watt	2	—
				200025N	Screw	} securing Motor to Motor Sub-Plate	} 3 689
				201302	Washer		
				34987	Spacer	} 3 689	}
				34859	Grommet		
				34863A	Motor Sub-Plate	1	689
				200028Q	Screw	} securing Motor Sub-Plate	} 2 689
				200028Q	Screw		
				201802	S.P. Washer	} 3 —	}
				34861	Spacer		
				36489	Tag for Earth Lead	1	104

MISCELLANEOUS			
43815A	S1—Waveband Switch	1	—
32498F	S2—Radiogram Switch	1	—
35419B	S3—EXT. L.S. Switch	1	—
See VR1	S4—Mains ON/OFF Switch	1	—
32498H	S5—Extended Range Switch	1	—
See Auto-mech	S6—Motor Switch	1	—
35421D	LP1, LP2—Scale Lamps	2	—
24460AN	LS1—Loudspeaker	1	—
34720Z	MU—Matching Unit with T3, T4, C39, R20 and CK2	1	—
45000AS	Auto-mech. complete with No. 13 P.U. and Hysteresis Motor	1	—
45000Q	Auto-mech. complete with No. 13 P.U. and U48 Motor	1	—

PICK-UP			
35218D	Pick-Up Head and Arm Assembly with Leads	1	—
35218C	Pick-Up Arm Moulding Only	1	820
35215	Pole Piece, R.H.	1	312
35216	Pole Piece, L.H.	1	312
34778	Magnet	1	—
35361	Insulation	1	—
28811B	Coil	1	—
35364	Washer	1	—
28808	Damper (Vinylite)	1	—
35217B	Reed Plate Assembly	1	—
41109	Screw	} securing Pole Piece	} 2 689
123994	Washer		
35356	Nut	} Coil and Reed Plate Assembly	} 2 256
35219A	Cover Moulding (plain)		
35358	Lead Clamp	1	—
200060F	Screw	} securing Clamp to Arm Moulding	} 1 312
201306	Washer		
35214B	Lead and Contact Pin Assembly	2	—
4120 × 1309	Lead only	25"	—
41991	Pin Cover	1	—
200860D	Screw	} securing Cover	} 1 689
201306	Washer		

HYSTERESIS MOTOR			
26200P	Hysteresis Motor, complete	1	—
26200S	Body Casting, complete	1	—
26202A	Base Plate	1	—
26203	Screw	} securing Base Plate	} 3 03
201803	S.P. Washer		
34988B	Drive Spindle Assembly	1	—
26212	Circlip	1	03
26214	Thrust Plate	1	03
200048G	Screw	} securing Thrust Plate	} 3 03
201804	S.P. Washer		

U48 MOTOR			
28980C	Motor Complete	1	—
48/1	Main Frame	1	—
48/25	Condenser	1	—
48/32	Stator Assembly	1	—
48/1805	Armature Assembly Wound	1	—
48/1912	Resistance Coil Assembly	1	—
48/84	Governor Assembly	1	—
48/92	Carbon Brush	2	—
48/94	Carbon Brush Spring	2	—
48/1859	Field Coil Assembly	1	—

Part No.	Description	No. per Inst.	Fin.	Part No.	Description	No. per Inst.
48/62	Domed End Cap	1	—	48/114	Governor Spring	3
48/66	Top Cover	1	—	48/1271	Shoe Pivot Assembly	1
48/15	Terminal	5	—	48/540	Speed Regulator Spindle	1
48/19	Terminal Plate Assembly	1	—	48/1403	Main Spindle and Gear	1

In order to expedite delivery of spare part orders, please quote:—

1. Model number and serial number.
2. Spare part number and description, as given above.
3. Quantity required.

Unless full particulars are quoted delay in execution of orders must inevitably result.

Order spare parts from:—

E.M.I. SALES AND SERVICE, LTD.,
SPARE PARTS DIVISION,
SHERATON WORKS,
WADSWORTH ROAD,
GREENFORD, MIDDLESEX.

Telephone : PERivale 6666.

Telegraphic Address : Emiservice, Greenford, Middlesex.

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