PRIVATE AND CONFIDENTIAL

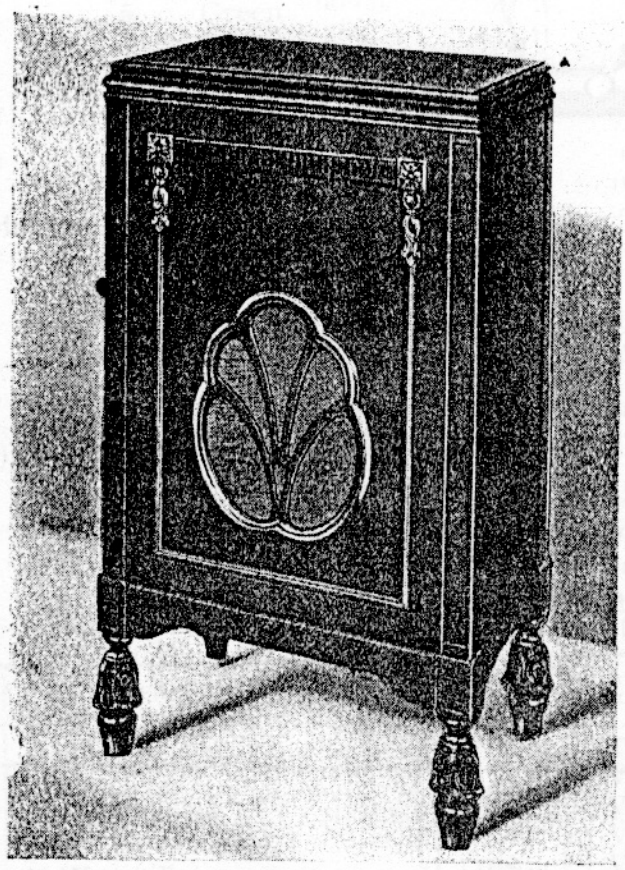
TO THE TRADE ONLY

SERVICE MANUAL

MODELS 470
A.C. MAINS 523

November, 1932

"His Master's Voice"

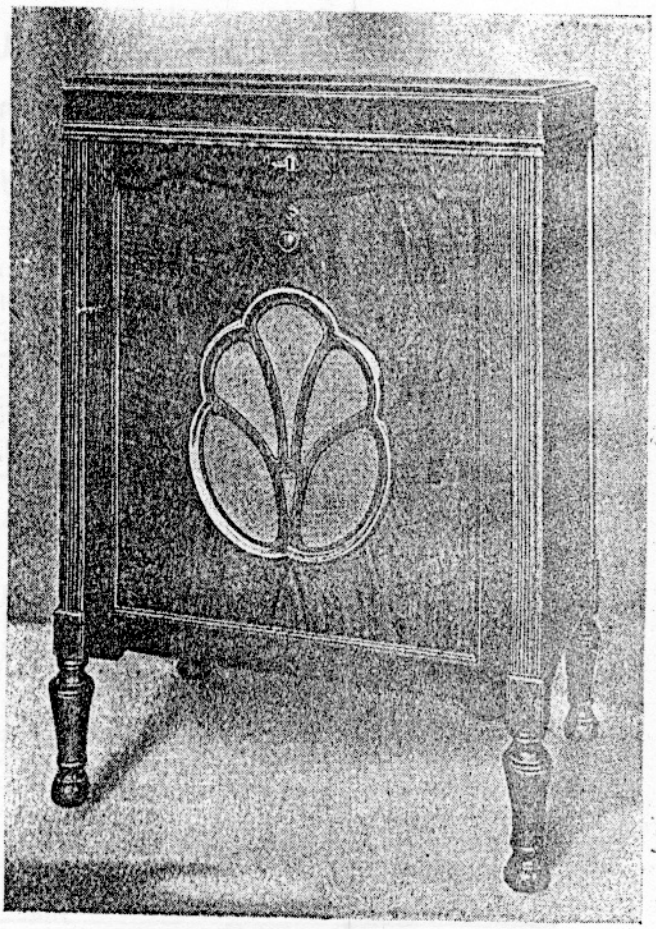


Superhet Lowboy Seven

MODEL 470

Superhet Radiogram Seven

MODEL 523



Part No. 14359

Issue 1.

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IMPORTANT.—With the exception of the details given on pages 20 to 23 the details given under "Superhet Lowboy Seven," pages 3 to 19, are applicable to both Models 470 and 523.

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Superhet Lowboy Seven

VOLTAGE RANGE.

200 to 250 volts (AC).
50 to 100 cycles (periodicity)

This instrument is designed to work only on the voltage for which it is adjusted. Should any variation be experienced the supply company must be notified immediately.

CURRENT CONSUMPTION.

Approximately 95 watts.

IMPORTANT.

This instrument must not be connected to a supply which is fused for more than 5 amperes working current.

SPEECH OUTPUT.

2¼ watts (undistorted).
15 watts (anode dissipation).

WAVELENGTH RANGE.

Medium waves, 200 to 550 metres.
Long waves, 900 to 2,000 metres.

DIMENSIONS.

Overall height, 33⅝ inches ; 85·4 cm.
Overall width, 21⅛ inches ; 53·6 cm.
Overall depth, 13⅜ inches ; 33·8 cm.

WEIGHT.

Net weight, 84 lb. 38·3 kg.
Weight packed, 140 lb. 63·5 kg.

LOUDSPEAKER.

Large Electro-magnet moving-coil type. (See separate Service Manual.)
(For connection of cable see page 6.)

CIRCUIT DESCRIPTION.

Model 470 is a superheterodyne receiver having three band-pass circuits and incorporating an electro-magnet moving-coil speaker (field is shunt fed).

AERIAL COUPLING.

Pre-set compensating condenser TC5 (to be set on installation) aligns the first tuned circuit (L1, L2, VC1) of a magnetically coupled band-pass filter, the secondary of which (L3, L4, VC2) tunes the grid of

FIRST HIGH FREQUENCY AMPLIFIER (Marconi VMS4).

A variable mu valve having bias control by VR1, which is choke, capacity coupled (L15, C4) to the

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FIRST DETECTOR VALVE (Mixer) (Marconi MS4).

An anode bend detector with tuned grid circuit (L5, L6, VC3) and biassed by a cathode resistance (R4) common to

OSCILLATOR (Marconi MH4).

Tuned grid (L7, L8, VC4) magnetically coupled to the grid circuit of the 1st detector valve, in the anode of which is the primary (L11, TC1) of the 1st band-pass IF transformer, the secondary (L12, TC2) being connected to the grid of

INTERMEDIATE FREQUENCY AMPLIFIER (Marconi VMS4).

A variable mu valve with bias control by VR1, coupled by second IF transformer to

SECOND DETECTOR (Marconi MH4).

An anode bend detector with cathode bias resistances (R10, R11), the bias being reduced for "gramophone" by the shorting out of R11. This valve is resistance capacity coupled (R12, C12) to the intervalve transformer (T1), the secondary of which is connected to

POWER OUTPUT (Marconi PX4).

Biassed by R15, connected to centre point of filament potentiometer (VR3), which also acts as a **hum control.** The output transformer T3 (which is mounted on the loudspeaker) is in the anode circuit of this valve.

RECTIFIER (Marconi U12).

This valve supplies the high tension current for all valves, and energising current for the loudspeaker field

WARNING.

Marconi valves have been selected for this instrument because of their high performance and special electrical characteristics. Inferior performance or actual damage may result if valves other than the specified Marconi valves are employed.

CONTROLS.

TUNING.

Four gang condenser tuning 1st band-pass filter, and 1st detector and oscillator grid circuits.

SWITCH.

Four position wave-range, gramophone and main "ON—OFF."

BRILLIANCE OR TONE.

Variable resistance VR4 in series with C19 connected to grid of output valve (V6).

VOLUME.

Radio and gramophone volume controls VR1 and VR2 are coupled together and operated by one knob. The 20,000 ohm potentiometer (VR1) in the cathode circuits of V1 and V4 controls the bias on these variable mu valves.

EXTRA LOUDSPEAKERS.

Up to two extra low resistance moving coil speakers may be connected to the extra loud speaker sockets without appreciable drop in volume. **High resistance speakers** may be connected across terminals 3 and 4 of the output transformer panel (on loudspeaker), but great care must be taken to thoroughly insulate the leads and terminal points, as terminals 3 and 4 are at 300 volts potential above earth.

PICK-UP.

A high resistance pick-up may be connected to the pick up sockets; the connecting lead must be metal-screened and the screening connected to earth. The volume control incorporated in the set will control the strength of record reproduction.

If, however, the pick-up is already fitted with a volume control, this should be used to control the strength of record reproductions, the control on Model 470 being set to maximum.

FAULT FINDING TABLE.

Symptom.	Possible Cause.	Tests.
NO RADIO OR GRAM—		
Valves and pilot lamp do not light	Defective mains transformer or mains lead	Continuity tests 22, 23, 24, 25 (page 18)
Pilot lamp and valves light ..	Damaged valves ..	See valves tables (page 15)
	Defective smoothing	Continuity test 30
	Disconnection in loudspeaker cable or output trans. T3 .	Continuity tests 26, 27, 28, 29 (page 19). See also page 11.
GOOD GRAM., NO RADIO ..	Faulty valves V1, 2, 3 or 4 ..	See valves tables (page 15).
	Faulty tuning circuits	Continuity tests (page 17). See also page 11.
GOOD RADIO, NO GRAM. ..	Faulty volume control VR2 or associated wiring	Test or substitute volume control.
	Damaged pickup.	
	Switch contacts J and K not opening	Examine.
OSCILLATION ON RADIO ..	Earth wiring disconnected or wrongly connected	See page 12.
WEAK RADIO	Set out of gang (flat tuning) ..	See page 13.
	Defective valves	See valves tables (page 15).
WEAK GRAM.	Switch contacts N and P not opening	Examine.
HUM	See page 12	—
CRACKLE OR BUZZ	See page 12	—

DISMANTLING.

REPLACEMENT OF PILOT LAMPS.

1. Disconnect instrument from mains and remove knobs.
2. Remove four screws fixing control board and lift board by two small lifting knobs.
3. Slacken screws holding, and withdraw lampholders from under scales.
4. Replacement lamps should be of the 6-volt screw in type.

Note :—The lamp illuminating the small "**gram**" window is accessible if the tuning knobs and escutcheon only are removed.

The three lamps on this model are controlled by a small switch which is ganged to the main switch spindle. The appropriate scale *only* should be illuminated when the switch is turned to the desired position.

REMOVAL OF CHASSIS.

1. Remove knobs, control board and back.
2. Disconnect lid stay from cabinet.
3. Remove four bolts from underside of chassis supporting bearers. If the four transit screws are in position these must also be removed.
4. Disconnect loudspeaker cable.
5. Withdraw unit upwards through top of cabinet.

REMOVAL OF LOUDSPEAKER.

1. Disconnect loudspeaker cable.
2. Remove four bolts holding loudspeaker supporting bracket to floor of cabinet, and withdraw speaker.

The loudspeaker cable should be connected as follows :—

On Chassis. Terminal	Wire Colour.	On Loudspeaker. Terminal
,, B	~~Green~~ Red	,, 3
,, A	~~White~~ Yellow	,, 4
,, 24	~~Yellow~~ Black	,, 5
,, 25	~~Black~~ White	,, 6
	~~Red~~ Green	

REPLACEMENT OF CONDENSER DRIVE.

(The numbers refer to Fig. 1.)

1. Remove pointers, slide scale drums off their spindles and remove scales.
3. Procure 50 inches of flax fishing line (breaking strain approx. 40 lbs.). This can be obtained from

The Service Dept.,
The Gramophone Co., Ltd.,
Sheraton Buildings,
Hayes, Middlesex.
Phone : Southall 2468.

Please quote Specification S.515.

4. Set the condenser vanes full open and the tuning spindle to minimum stop position.
5. Make a temporary loop in one end of the cord and hook it on to the stud (1), passing cord under the condenser drive drum in direction of arrows.

NOTE.—It is important that the vanes of the condenser be kept fully open whilst winding the cord.

6. Pass cord out through hole in plate and over small pulley (2).

7. Slip right hand scale drum (3) on to its spindle so that the slots cut in the periphery are at the top as shown.

8. Pass cord through slots as shown and round the drum in a clockwise direction one and a half turns.

9. Take cord down to tuning spindle (4) and wind on five complete turns in a clockwise direction, being sure to keep spindle at its minimum stop position.

10. Slip left hand scale drum (5) on spindle so that the slots are at the top.

11. Pass cord under drum and up in a clockwise direction (following the arrows), through the slots, and then round the drum one complete turn.

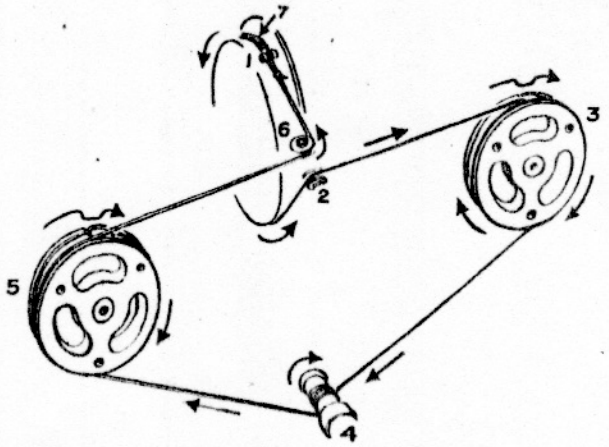

FIG. 1.

12. Take cord over small pulley (6) and through plate.

13. Make a loop in the end of the cord so that when it is assembled on to the stud (1) it will be kept as taut as possible. Assemble the loop on to the stud, first removing the temporary loop at other end of cord.

14. Now shorten the temporary loop so that the coil spring (7) will be correctly tensioned when it is assembled between stud and loop end of cord as shown.

15. Slide each scale drum off the spindle in turn, being careful to keep sufficient tension on cord to prevent it from unwinding, and refix scales in position (M.W. left hand, L.W. right hand). Replace scale drums and refix pointers.

16. Tune in a station of known wavelength and adjust scales to read correctly. If sufficient adjustment is not given by the elongated holes in scale the grub screw fixing the condenser drive drum may be slackened and drum repositioned.

WIRING COLOUR CODE.

(The circuit diagram is coded with the small letters.)

(a)	Black	Earth.
(b)	White	Cathode.
(c)	Red	HT positive.
(d)	Green	Grid.
(e)	Blue	Pick-up.
(f)	Brown	Heaters.
(g)	Pink	Loudspeaker.
(h)	Purple	Aerial.
(j)	Orange	Mains.
(k)	Yellow	Anode.
(l)	Yellow with red tracer ..	Screen of screen grid valve.
(p)	Green with black tracer ..	Bottom of grid circuit not direct to earth.
(r)	Green with white tracer ..	Mid position of tuning coil.

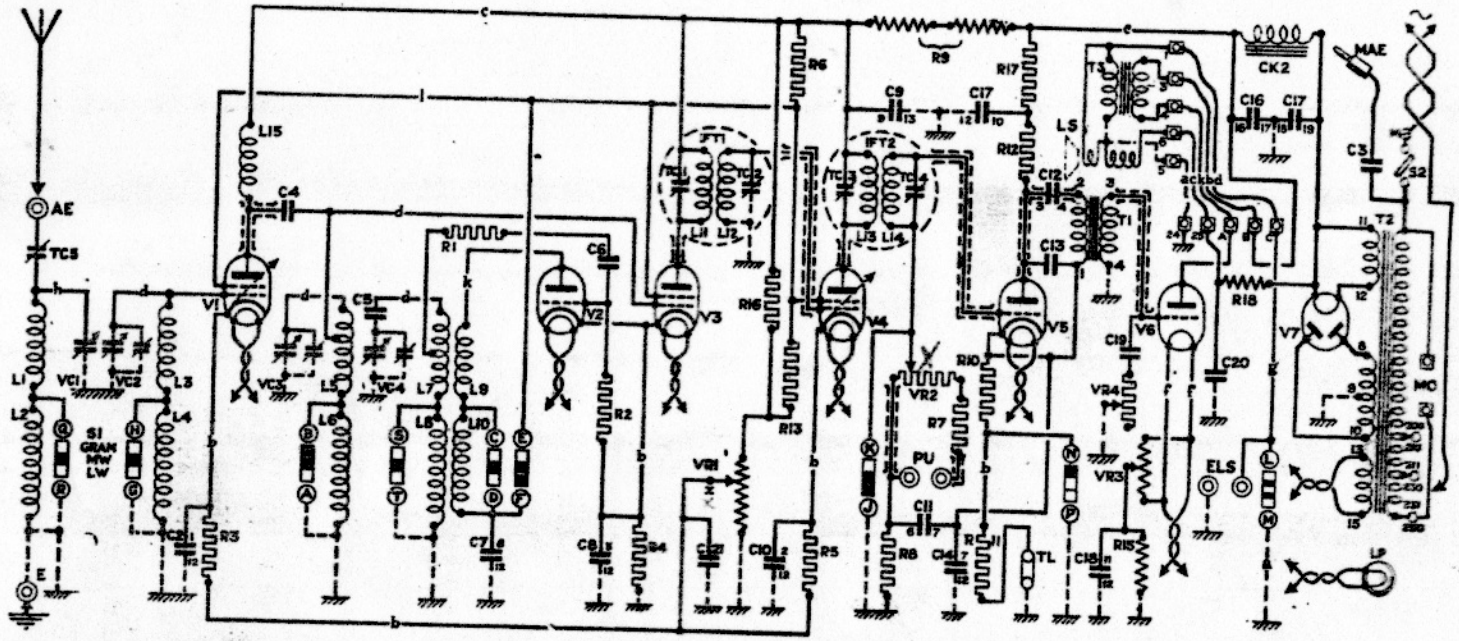

FIG. 2.

An additional resistance (R19—450 ohms) may be found in series with CK2. Its position in the above circuit will be between right hand end of CK2 and lug 19 of C15.

The lamp switch is not shown in this diagram. For information about same see under "Replacement of Pilot Lamps."

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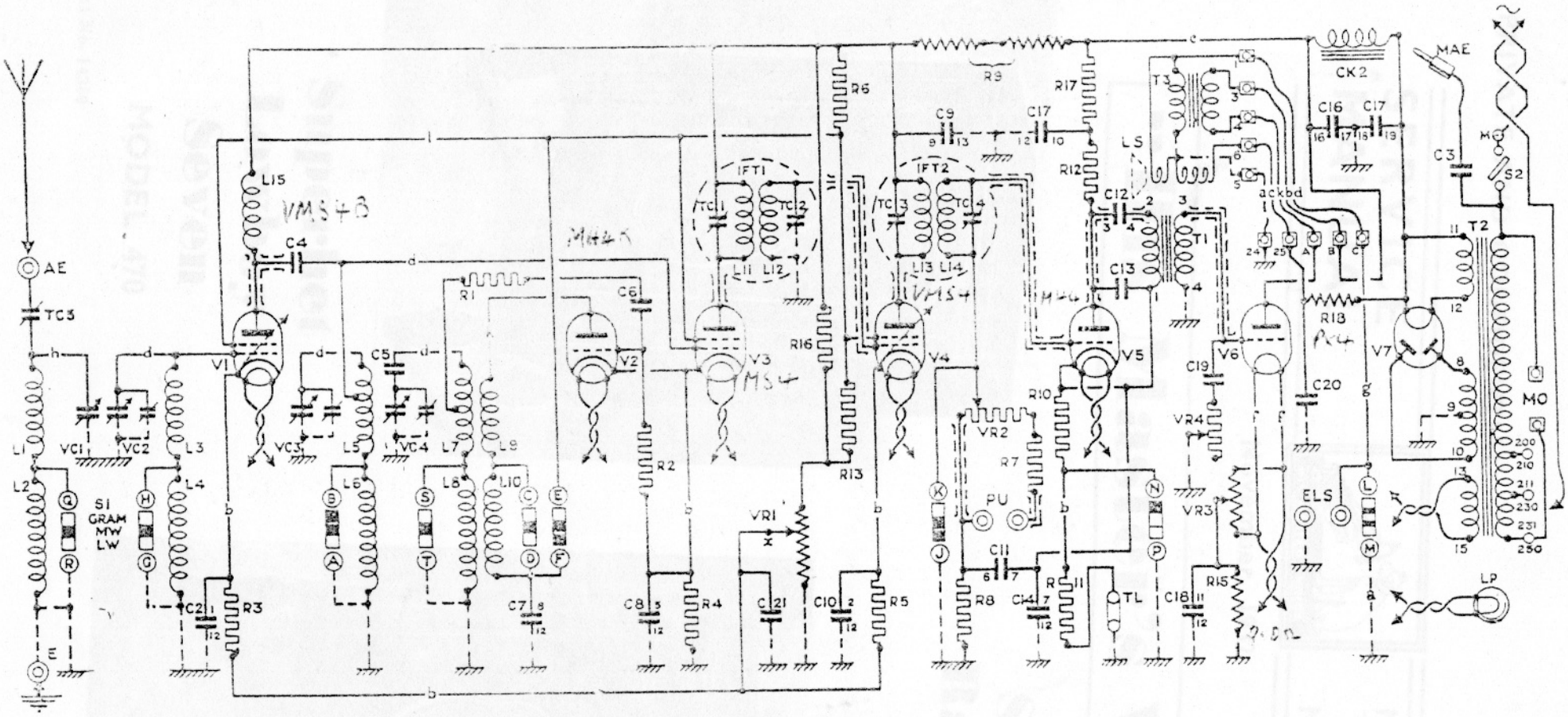

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The lamp switch is not shown in this diagram. For information about same see under "Replacement of Pilot Lamps."

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AVC)

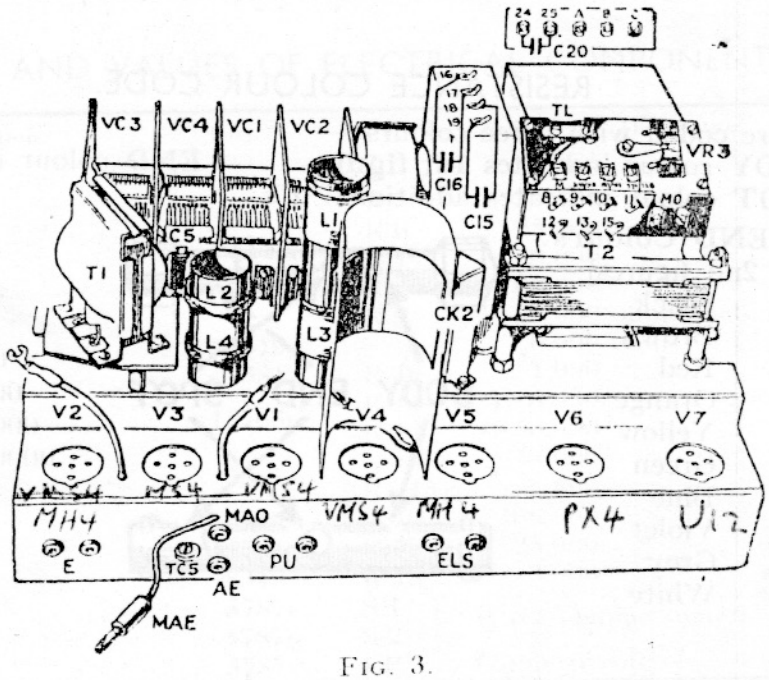

FIG. 3.

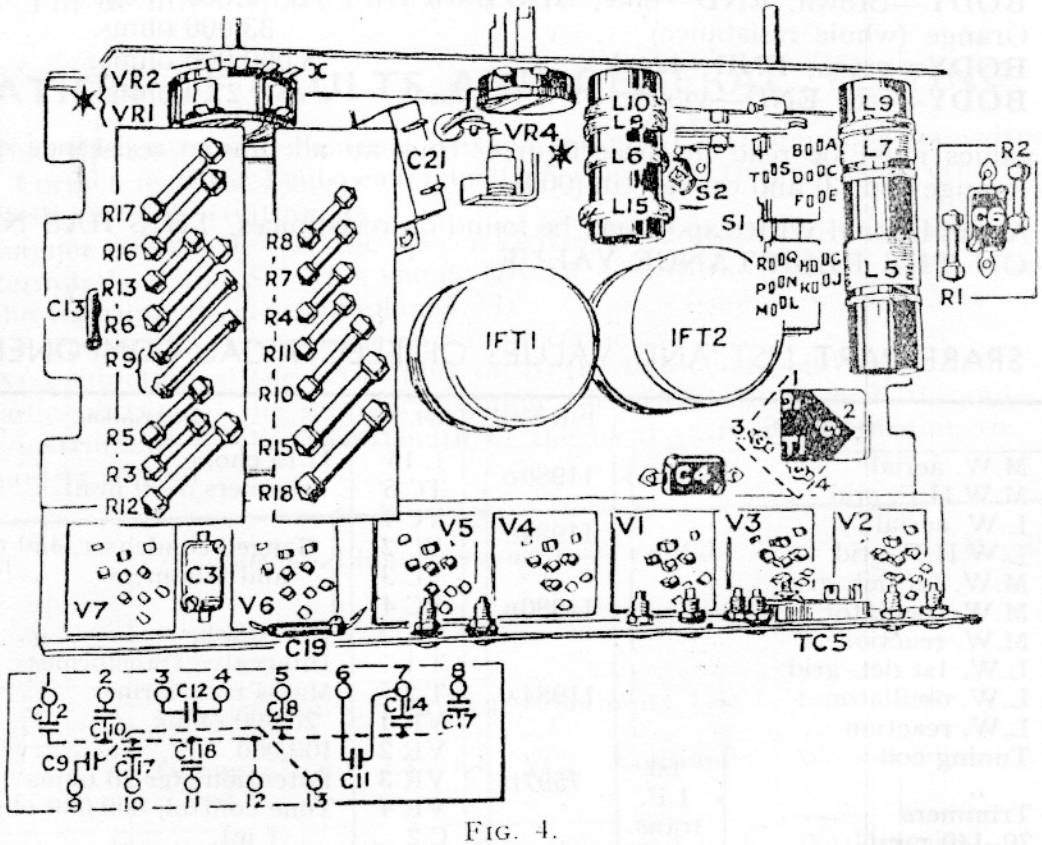

FIG. 4.

* NOTE.—In model 523 VR4 will be found mounted on a bracket near the ganged condenser. VR1 and 2 are mounted on the front of the cabinet.

The additional resistance R19 (see circuit diagram) will be between R18 and R15.

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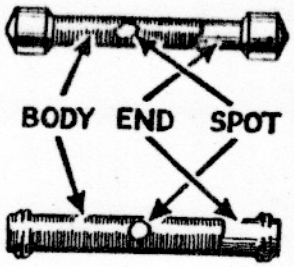
RESISTANCE COLOUR CODE.

Resistances are coded with three colours :—
BODY colour indicates **1st figure.** **END** colour indicates **2nd figure.**
SPOT colour indicates additional **0's.**

BODY and END Colours.
(1st and 2nd figures)

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White



SPOT Colours.
(additional 0's)

0	Black
0.	Brown
00.	Red
000.	Orange
0000.	Yellow
00000.	Green

Examples :

BODY—Brown, **END**—blue, **SPOT**—red	1,600 ohms.
Orange (whole resistance)	33,000 ohms.
BODY—green, **END**—black	5,000,000 ohms.
BODY red, **END** violet, **SPOT** black	27 0 ohms.

All values must be read in three figures: thus an all orange resistance equals orange Body (3), orange end (3) and orange tip (000).

Note : An additional **white** spot may be found on resistances, **THIS HAS NO BEARING ON THE RESISTANCE VALUE.**

SPARE PART LIST AND VALUES OF ELECTRICAL COMPONENTS.

Ref. No.	Description.	Part No.
L 1	M.W. aerial	11980D
L 3	M.W. H.F. grid	
L 2	L.W. aerial ..	11984C
L 4	L.W. H.F. grid ..	
L 5	M.W. 1st det. grid ..	11980B
L 7	M.W. oscillator ..	
L 9	M.W. reaction	
L 6	L.W. 1st det. grid ..	11984A
L 8	L.W. oscillator	
L 10	L.W. reaction	
L 11	Tuning coil ..	1st I.F. trans. 7597D
L 12	,, ..	
TC 1	Trimmers ..	
TC 2	70–140 mmf. ..	
L 13	Tuning coil ..	2nd I.F. trans. 7597E
L 14	,, ..	
TC 3	Trimmers ..	
TC 4	73–140 mmf. ..	

Ref. No.	Description.	Part No.
L 15	H.F. choke	11984A
TC 5	Trimmers 5–70 mmf.	11737C
VC 1	Ganged condenser, 450 mmf. and trimmers	10198A
VC 2		
VC 3		
VC 4		
CK 2.	L.F. Choke	12045C
T 1	Intervalve transformer ..	4518F
T 2	Mains transformer	7572A
VR 1	20,000 ohms	6000
VR 2	100,000 ,, ...	K or Q
VR 3	Potentiometer 20 ohms ..	10201B
VR 4	Tone control, 600,000 ohms ..	6000P
C 2	·1 mf.	7581A
C 3	300 mmf.	15719D
C 4	50 ,, ...	15719A
C 5	1,700 ,, ...	17195F
C 6	300 ,, ...	15719D

SPARE PART LIST AND VALUES OF ELECTRICAL COMPONENTS (continued)

Ref. No.	Description	Part No.	Ref. No.	Description	Part No.
C 7	1 mf.	7581A	R 4	2,000 ohms	5787A
C 8	·5 ,,		R 5	320 ,,	5787V
C 9	1 ,,		R 6	25,000 ,,	5786C
C 10	·1 ,,		R 7	200,000 ,,	5787D
C 11	·5 ,,		R 8	100,000 ,,	5786H
C 12	·1 ,,		R 9	2—(3,000 ohms each) 6,000 ohms	13525A
C 13	2,000 mmf.	15719G	R 10	1,000 ,,	5787K
C 14	·5 mf.	7581A	R 11	5,000 ,,	5787F
C 15	4 ,,	15763B	R 12	50,000 ,,	5786A
C 16	6 ,,		R 13	50,000 ,,	5787P
C 17	1 mf.	7581A	R 15	800 ,,	13525B
C 18	4 ,,		R 16	100,000 ,,	5787Q
C 19	2,000 mmf.	15719G	R 17	25,000 ,,	5786C
C 20	4 mf.	15764B	R 18	3,000 ,,	13525C
C 21	1 ,,	8349A	S 1, S 2	Wave change switch	12540C
R 1	5,000 ohms	5787F	LP	Lamp, 6-volt	1575A
R 2	25,000 ,,	5787B			
R 3	320 ,,	5787V			

For detailed Spare Part List see separate publication.

LOCATION OF FAULTS AND GENERAL TESTING.

Make sure that the loudspeaker magnet is being energised by applying a screwdriver near the pole-piece. Correct feed for loudspeaker field 25 ma. See that all connecting leads are securely connected and are continuous.

With the magnet energised, test the speech circuit by momentarily contacting a **small** battery across terminals 1 and 5. This should give a definite noise from the loudspeaker.

First test the instrument on gramophone. If "Gram" results are good but not radio, the fault will be found in that part of the circuit preceding V5.

A progressive contacting of the aerial plug on to the following points may help to locate a fault in the radio portion of the receiver. Follow these tests through in the order given, first setting the instrument to the wave-length of the local station and turning the volume control three-quarters full on.

Test Point.	Components Eliminated and Tests to Make.	Correct Results.
Fixed vanes VC1	TC5	Normal results.
Fixed vanes VC2	Tuning circuit L1, L2, VC1. Continuity Test 1	Loud results.
Anode V1	Tuning circuit L3, L4, VC2. Continuity Test 2	Weak results.
Fixed vanes VC3	L15, C4, also V1 and all its associated feed, bias, &c., components. Continuity Tests 13 and 14. See also Valve Tables	Weak results.

HUM.

If the hum is very bad examine grid V5 for disconnection. (See Test 9.)

Test CK2 for short circuited turns (Test 20) and C15 and C16 for complete or partial breakdown. See that hum control (VR3) is correctly set.

Filament wiring "earthing"—Test anode current V6 and try continuity test No. 23.

CRACKLE OR BUZZ.

This may be due to :—

(a) Condenser breaking down (see further on).
(b) Bad connection (dry joint).
(c) Faulty non-inductive resistance. (Try continuity tests.)
(d) Speech coil rubbing on pole pieces. (See Speaker Manual.)
(e) Mechanical rattle. (Loose components.)
(f) Bad contact at valve legs or inter-electrode contact in valves. (Clean valve legs or try new valves.)

BREAKDOWN OF CONDENSERS.

To ascertain if any condensers (smoothing or anode by-pass) are broken down, remove all valves except rectifier (U12) and disconnect loudspeaker field (red or black wire). Remove black wire from terminal 9 on mains transformer (T2) and insert milliammeter between the end of wire and terminal 9. The reading here should be 7* milliamps. This is the current which flows through the screen grid potentiometer network R6, R13, R16, VR1.

Should this value be considerably exceeded, suspect broken down smoothing or anode by-pass condensers (such as C15, C16, C17, C9, &c.) or an "earth" somewhere in the HT+ feed wiring.

If the reading is low, suspect R6, R13 or R16, and if there is no reading VR1 is at fault.

***Note :** This value is considerably higher than the **actual** value. The voltage rises to approximately 500 volts (main HT test point) due to the valves being out.

"HF" TESTS AND ADJUSTMENTS.

INSTABILITY.

If instability is encountered, *i.e.*, the set oscillates and causes a whistle in the loudspeaker similar to a straight set, carefully examine all earth leads for disconnection. See also that the screening of all HF leads is connected to chassis (earth).

Where new coils have been fitted, the earth wiring **MUST BE REPLACED EXACTLY AS IT WAS**, otherwise instability may result. (See Fig. 6.)

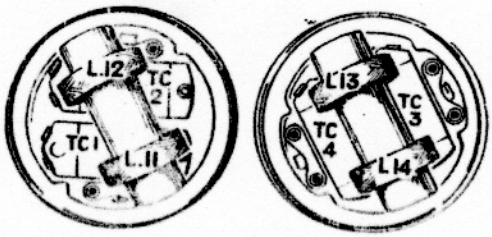


FIG. 5.

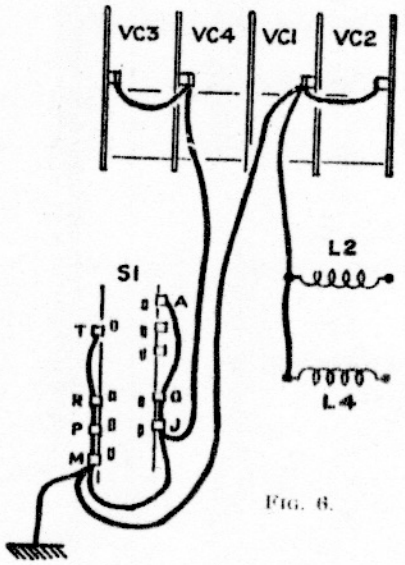


FIG. 6.

Unless adequate test equipment is available it is suggested that replacement of coil units 1.6, 8, 10 and 15 should not be attempted, as this work entails considerable knowledge of the instrument.

TRIMMING OF "IF" TRANSFORMERS.

If a new unit is fitted to an IF transformer, such as L11 and L12, the circuits should be retrimmed. A local modulated oscillator is most useful for this work, as it supplies a signal of constant power, frequency and note.

Note : Care should be taken when making adjustments to trimming condensers that the screwdriver has an insulated handle and that the blade does not touch the chassis. A piece of insulating tape wrapped round the blade will prevent this. *Make all adjustments cautiously and gradually.*

To trim "IF" Transformers with an Oscillator :

Remove V2 and put switch to MW position. Set the oscillator to 125 Kc. and loosely couple to set by a coupling coil lying on bench or anywhere adjacent to 1.5, 7 and 9. Measurement of output is best made with an output meter which may be a 0-5 milliammeter connected in place of the test link TL. Alternatively, an AC milliammeter (0-25 m/a scale) may be connected across the extra loudspeaker sockets. Output can, however, be judged by the ear but not as well as by a meter. Adjust the trimmers for maximum response in the following order :—

1. TC3 Top left screw.
2. TC4 Bottom left screw.
3. TC1 Bottom right screw.
4. TC2 Top right screw.

Positions given viewing chassis from back.

Now set the oscillator to 128 Kc. and retrim No. 3 (TC1). Reset oscillator to 125 Kc. and retrim No. 4 (TC2). Go over TC3 and 4 again in the same order to verify the setting, **but do not touch No. 3 (TC1) setting.**

Trimming "IF" transformers on signals (in the absence of an oscillator):—

Tune in a weak station of between 250 and 350 metres, preferably in daylight so that there is no possibility of fading. Where only one IF transformer has been renewed or repaired, adjust the trimmers on the new IF transformer for maximum, but do not touch the trimmers on the other IF transformer. If it is IF T2 which has been renewed or repaired, the trimming should now be left, but if it is IF T1, TC1 must be unscrewed **one half turn,** and TC2 screwed up a fraction of a turn. An AC milliammeter connected to the loudspeaker sockets **cannot be used to measure broadcast signals.** To ascertain that the intermediate frequency is approximately correct (125 Kc.), tune in to Northern Regional (480 metres). Now advance the volume control until past overloading point and a strong whistle should be heard when the tuning control is moved this way and that.

TRIMMING GANGED VARIABLE CONDENSERS.

Where any tuning coils such as L1 and L3 have been replaced or new wiring inserted, the trimmers on the ganged condenser must be adjusted. A local modulated oscillator and an output meter, or an ordinary signal may be used (see Trimming IF transformers). Unscrew all trimmers to minimum. It is best to gang roughly first on the local station (or a powerful signal from the oscillator) at approximately 250 metres. Adjust trimmer on VC4 first, then on VC2, and lastly on VC3. Now tune to a faint signal of not more than 220 metres and adjust trimmer of VC4 more carefully.

Note : Maximum signals may be obtained at two distinct settings of this trimmer, but the setting where the trimmer is nearest to minimum (unscrewed) must **be used.**

Now tune to a faint signal of between 250 and 300 metres and carefully adjust trimmers on VC2 and VC3 for maximum response. **Never attempt to gang on long waves.**

Notes : Remember that when the signal **overloads** the set the sound output **falls.**

Be very careful not to bend or disarrange the wires just under the end of the chassis and adjacent to L5, 7 and 9, or the set may be thrown out of gang.

VALVE TESTING.

Before taking any other readings it is advisable to test all valves for filament continuity and inter-electrode contacts, with AVO meter, ohmeter or battery and head-phones.

QUICK VALVE TESTING.

Bias values (and consequently a check on emission values) may be quickly obtained on V1, V2, V3, V4 or V5 by measuring with a voltmeter between the metallised coating of the valve and chassis. (For values, see valve table.)

VALVE READINGS.

Always test for HT voltage at main test point before taking valve readings. **Main HT test point**—terminal 3 on loudspeaker panel (white wire) not less than 290 volts to chassis (all valves in).

If the voltage is lower than this, suspect rectifier valve or smoothing condensers C15, C16 or C20, and check total HT feed. (See note 3.)

If the instrument is fitted with the new resistance R19 (see circuit diagram) all voltages will be slightly lower than values given.

If the voltage is high test CK2 (Test No. 20), or emissions of valves. (See Table.)

All readings taken with Valves in position, and on Avometer Scale indicated.
(Readings given are ± 10 per cent.)

TABLE.

Valves.	Location.	Appearance.	Temperature.	Function.	Anode Feed D.C. M/A.	Avo Scale	Anode / Frame volts. D.C.	Avo Scale.	Screen Feed Milli-amps. D.C.	Avo Scale.	Screen Frame volts. D.C.	Avo Scale	G.B. volts	Avo Scale.	Fil. or Heater volts.	NOTES.
U 12 (V.7)	Extreme right	Faint glow	Hot	Rectifier	45 each anode	0·12	—	—	—	—	—	—	—	—	4 volts A.C.	Do not attempt to measure filament or anode voltages.
PX 4 (V.6)	2nd from right	No glow	Hot	Output	50	1·12	300*	1,200	—	—	—	—	37	120	4 volts A.C.	Grid bias measured between filament and grid.
MH 4 (V.5)	3rd from right	No glow	Warm	2nd Detector	Radio 0·9 Gram. 2·2	0·012	195	1,200	—	—	—	—	Radio 3·5 Gram. 2·0	12	4 volts A.C.	Grid bias measured between metallised coating and earth.
VMS 4 (V.4)	Centre (Shielded)	No glow	Warm	IF Amplifier	Radio 5·5 to zero† Gram. 7·0 to zero†	0·012	190 to 270*	1,200	Radio 1·7 to zero† Gram. 2·0 to zero*	0·012	Radio 53 to 87* Gram. 60 to 105*	120	Radio 2·0 to 45* Gram. 2·5 to 60*	120	4 volts A.C.	Grid bias measured between metallised coating and earth.
MS 4 (V.3)	2nd from left	No glow	Warm	1st Detector	Radio 0·15 to 0·3* Gram. 1·0 to 4·0*	0·012	190 to 270*	1,200	0·1	0·012	Radio 53 to 87* Gram. 60 to 105*	120	Radio 4·0 to 7·5* Gram. 3·0 to 6·5*	12	4 volts A.C.	Grid bias measured between metallised coating and earth.
MH 4 (V.2)	Extreme left	No glow	Warm	Oscillator	Radio 2·0 to 6·0* Gram. —	0·012	Radio 50 to 75* Gram. —	120	—	—	—	—	Radio 4·0 to 7·5* Gram. 3·0 to 6·5	12	4 volts A.C.	Grid bias measured between metallised coating and earth.
VMS 4 (V.1)	3rd from left	No glow	Warm	H.F. Amplifier	Radio 5·5 to zero† Gram. 7·0 to zero†	0·012	190 to 270*	1,200	Radio 1·7 to zero† Gram. 2·0 to zero†	0·012	Radio 53 to 87* Gram. 60 to 105*	120	Radio 2·0 to 45* Gram. 2·5 to 60*	120	4 volts A.C.	Grid bias measured between metallised coating and earth.

* Reading increases when volume control is retarded. † Reading decreases when volume control is retarded.

NOTE.—(1) Feed of V.5 may be obtained by opening testing link TN and inserting M.A. meter.
(2) Bias of V.6 can be obtained by measuring between centre point of VR 3 and earth.
(3) Total H.T. feed (90 M.A.) can be obtained by detaching wire from terminal 9 (T 2) and inserting M.A. meter between black wire and terminal 9.
25 M.A. of the total feed is used to energise the loudspeaker field.

VALVE FAULT TABLE.

Valve.	Symptom.	Condition.	Components to suspect.	Test Nos.
V7 ..	No anode feed ..	No signals ..	Valve or T2 (mains transformer) windings	22, 23, 24 and 25
V6 ..	No anode volts ..	No signals ..	Primary T3 (terminals 3 and 4) or connecting cable	26.
	Anode volts but no anode feed	No signals ..	VR3 (bad contact at slider ?) R15	18 and 30.
V5 ..	No anode volts ..	No signals ..	R12, R17, C12	16.
	Anode volts but no anode feed	No signals ..	R10, R11	15.
	Anode volts but low anode feed on Gram.	Faint Gram. ..	Contacts N and P of S1 not closing	15
V4 ..	No anode volts ..	No signals ..	L13, R9, C9	8 and 14.
	Anode volts but no anode or screen feed	No signals ..	R5, VR1	12.
V3 ..	No anode volts ..	No signals ..	L11, R9, C9	6 and 14.
	Anode volts but no anode or screen feed	No signals ..	R4	11.
V2 ..	No anode volts ..	No signals ..	L9, L10, R6, R9, C7	5, 13, 14.
	Anode volts but no feed	No signals ..	R4	11.
	Anode volts, high anode feed	No signals (valve not oscillating)	L7, L8, R1, R2, C6 or valve ..	4.
V1 ..	No anode volts ..	Faint signals ..	L15, R9, C9	6 and 14.
	Anode volts but no screen or anode feeds	Faint signals ..	R3, VR1	10.
V1, 3 and 4	No screen volts ..	No signals ..	R6, C7, R9	13 and 14.
	High screen volts ..	Weak signals ..	R13, R16, VR1	17.
V1, 2, 3, 4, 5, 6	High anode feed on any valve	Weak or distorted signals	Bias resistance by-pass condensers C2, 8, 21, 10, 14 or 18	
		No signals ..	Disconnection in grid circuits or components	2, 3, 7, 9, 21.
V1, 2, 3, 4, 5, 6 or 7	Low anode feed on any valve	Faint distorted signals	Valve may have lost emission (try new valve)	
V1, 2, 3, 4, 5 or 6	Low anode voltage on any valve	Faint distorted signals	Complete or partial breakdown of anode by-pass condensers C7, 9 or 17	

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CONTINUITY TESTS WITH CHASSIS IN POSITION.

(Valves out and mains disconnected).

No.	Components.	Test between.	Resistance Valves ± 10 per cent.
	TUNING COILS.		
1	L1 and L2	Fixed vanes VC1 and chassis..	Switch MW 3·0 ohms. LW 23·0 ohms.
2	L3 and L4	Fixed vanes VC2 and chassis..	Switch MW 3·0 ohms. LW 23·0 ohms.
3	L5 and L6	Fixed vanes VC3 and chassis..	Switch MW 4·0 ohms. LW 23·0 ohms.
4	L7 and L8	Condenser C5 and chassis ..	Switch MW 3·5 ohms. LW 14·0 ohms.
5	L9 and 10	Anode socket V2 and screen socket V1, 3 or 4	Switch MW 2·0 ohms. LW 6·0 ohms. Gram. infinity. To chassis, 50,000 ohms.
6	L11 and L15	Anode lead V1 and anode lead V3	97·0 ohms. To chassis, 20,000 ohms.
7	L12	Grid V6 and chassis	51·0 ohms
8	L11 and L13	Anode lead V3 and anode lead V4	95·0 ohms. To chassis, 20,000 ohms
9	L14	Grid socket V5 and chassis ..	51·0 ohms (switch MW or LW).
	RESISTANCES.		
10	R3 and VR1	Cathode V1 and chassis ..	Volume minimum, 20,000 ohms. Volume maximum, 330 ohms.
11	R4	Cathode socket V2 or 3 and chassis	2,000 ohms.
12	R5 and VR1	Cathode V4 and chassis ..	Volume minimum, 20,000 ohms. Volume maximum, 330 ohms.
13	R6 and L15	Anode tag V1 and screen socket V1 Anode tag, V1 and chassis ..	25,000 ohms (slight indication on avometer 10,000 ohm scale). 20,000 ohms.
14	R9 and L15	Anode tag V1 and white wire in loudspeaker cable (terminal 3) Terminal 3 and chassis ..	6,000 ohms. 14,000 ohms.

No.	Components.	Test between.	Resistance Valves ± 10 per cent.
15	R10 and R11	Cathode V5 and chassis ..	Switch MW or LW, 6,000 ohms. Switch "Gram.," 1,000 ohms.
16	R12 and R17	Anode socket V5 and white wire in loudspeaker cable (terminal 3)	75,000 ohms (very slight indication on avometer, 10,000 ohms scale).
		Anode socket, V5 and chassis	90,000 ohms.
17	R13 and VR1	Screen socket V1, 3 or 4 and chassis	70,000 ohms (very slight indication on avometer, 10,000 ohm scale).
18	R15	Centre point of VR3 (hum control) and chassis	800 ohms
19	R18	Filament socket V7 and red wire in loudspeaker cable terminal 6)	3,000 ohms.
		Terminal 6 and chassis ..	10,600 ohms (loudspeaker field).
	TRANSFORMERS AND CHOKES.		
20	CK2 (and R19)	Lug 19 and Lug 16 on condenser block	750 ohms (or 1,200 ohms if R19 is fitted).
21	T1 (secondary)	Grid socket V6 and chassis ..	6,000 ohms.
22	T2 (mains) rectifier filament winding	Across filament sockets V7 ..	0·1 ohms. To chassis 13,000 ohms.
23	T2 (filament winding) ..	Across filament sockets V1, 2, 3, 4, 5 or 6	0·1 ohms (test to chassis, 1,000 ohms).
24	T2 (HT windings) ..	Each anode socket V7 to chassis	180 ohms one side. 230 ohms the other side. Across anode sockets, 410 ohms.
25	T2 (primary)	Across MO terminals	19 ohms (whole winding).
		"M" terminal to 200–210 tapping	15 ohms.
		"M" terminal to 211–230 tapping	17 ohms.
			Test to chassis infinity.
26	T3 (primary)	Terminals 3 and 4 on loudspeaker panel	150 ohms. To chassis, 14,000 ohms.
27	T3 (secondary)	Terminals 1 and 5	2 ohms. The speech coil leads must be disconnected from tags to obtain reading on speech coil.

No.	Components.	Test between	Resistance values ± 10 per cent
	LOUDSPEAKER.		
28	Field	Terminals 5 and 6 on panel ..	10,000 ohms.
29	Speech coil	Across ends	11 ohms.
	HUM CONTROL.		
30	VR3	Across ends	20 ohms (one brown lead must be disconnected).

NET RESISTANCE VALUES OF COMPONENTS ± 10 PER CENT.

L1 —MW	3.0 ohms.
L2 —LW	20.0 ,,
L3 —MW	3.0 ,,
L4 —LW	20.0 ,,
L5 —MW	3.5 ,,
L6 —LW	20.0 ,,
L7 —MW	3.5 ,,
L8 —LW	11.0 ,,
L9 —MW	2.0 ,,
L10—LW	4.0 ,,
L11—IFT1	47.0 ,,
L12—IFT1	51.0 ,,
L13—IFT2	47.0 ,,
L14—IFT2	51.0 ,,
L15—HF choke	50.0 ,,
CK2—	750.0 ,,

T1

Lugs 1 and 2 (Prim.)	1,700.0 ,,
Lugs 3 and 4 (Sec.) ..	6,000.0 ,,

T2

PRIMARY.

M to 200/210	15.0 ohms.
200/210 to 211/230	2.0 ,,
211/230 to 231/250	2.0 ,,

SECONDARIES.

8 and 9	180.0 ,,
9 and 10	230.0 ,,
11 and 12	0.1 ,,
13 and 15	0.1 ,,

T3 (on loudspeaker)

Primary 3 and 4	150.0 ,,
Secondary 5 and 6	2.0 ,,

Superhet Radiogram Seven

Except for the following particulars the information given for Model 470 is applicable.

VOLTAGE RANGE.

200 to 250 volts (AC).
50 to 60 cycles (periodicity).

CURRENT CONSUMPTION.

Radio, 95 watts (approximately).
Gramophone, 125 watts (approximately).

IMPORTANT.

This instrument must not be connected to a supply point which is fused for more than 5 amperes working current.

SPEECH OUTPUT.

2¼ watts undistorted.
15 watts (anode dissipation).

WAVELENGTH RANGE.

200 to 550 metres (medium waves).
900 to 2,000 metres (long waves).

DIMENSIONS.

Overall height, 36¼ inches ; 92.1 cm.
Overall width, 25¼ inches ; 64.2 cm.
Overall depth, 17½ inches ; 44.5 cm.

WEIGHT.

Net weight, 113 lb. ; 50·3 kg.
Weight packed, 181 lb. ; 80·5 kg.

LOUDSPEAKER.

Large electro-magnet moving coil. (See separate Service Manual.)

MOTOR.

Disc induction type 24. (See separate Service Manual.)

IMPORTANT.

The voltage adjusting links on this motor must not be altered.

PICK-UP.

Type 15. 6,000 ohms, D.C resistance.

THE AUTOMATIC BRAKE.

WHAT THE BRAKE WILL DO.

This brake will automatically stop the turntable revolving and switch off the motor at the end of all 8-inch, 10-inch or 12-inch Records having a quick run-in groove.

TO PLAY OTHER TYPES OF RECORDS.

The auto brake lever must be set to the " OFF " position and the motor stopped by the handbrake (HB, Fig. 7).

HOW THE AUTO BRAKE WORKS.

The pickup arm travels across record until the point is reached when lever L1 commences to slowly push lever L2 (rubber covered arm). This slight pressure is transmitted to the brake lever L3 by the friction bearing BR.

So long as the needle progresses over the record at the normal rate (obtained only by the actual playing of the record), the movement of the pickup arm is not enough to move L3 sufficiently for the pawl CW to fully engage with the tooth D on the friction collar round the turntable bush.

The tooth engages with face A thus pushing the pawl away at each revolution.

When, however, the end of the record is reached and the spiral " run-in " groove gives the pickup arm a more rapid movement, the increase is sufficient to cause the pawl CW to move far enough towards the turntable spindle for the tooth D to strike face B thus actuating the brake and switching off the motor.

Note.—A faint regular click is normal with this type of brake.

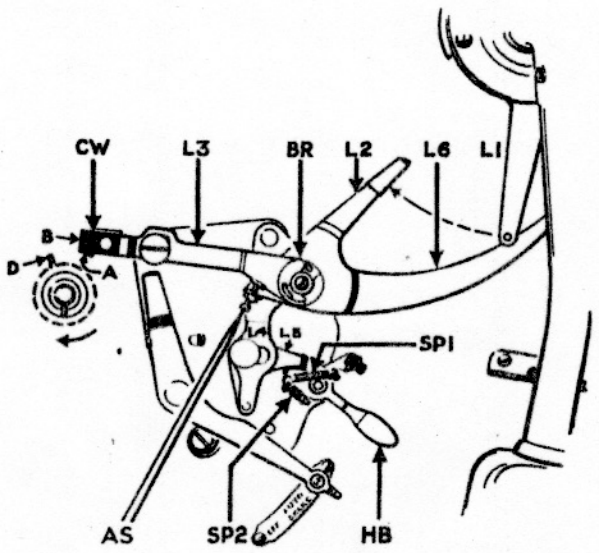

FIG. 7.

ADJUSTMENT OF BRAKE.

Screw AS is provided to exert a positive movement to lever L3 and to transmit via L4 and L5 the necessary movement to actuate the " ON-OFF " switch.

To set screw refer to Fig. 1 and proceed as follows :—

1. Slack off locking nut of screw AS, retard the screw and set the switch to the " OFF " position and the " auto brake " lever to the " ON " position.
2. With the pick-up on the rest as shown in Fig. 7 adjust screw AS so that there is just a little clearance (about 1/32-inch) between lever L6 and the pin on lever L1.
3. Tighten up the lock nut, being careful not to alter the adjustment of AS.

IMPORTANT NOTE.

If at any time the spring SP1 on the hand brake is renewed or replaced, make sure that the axis of the spring lies as far as possible distant from the centre of the pivot of the HB lever, otherwise the friction brake may fail to operate in conjunction with the automatic stop.

SERVICE TABLE.

Symptom.	Suggested Action.
Auto brake will not switch on the motor.	Adjust screw AS as directed.
Auto brake will not function at end of record.	See that auto brake lever is set to " ON " position. Increase friction at BR. To do this slide the flat disc from the groove in boss. A special spring washer will be disclosed, the arms of which should be SLIGHTLY bent down to increase effective thickness.
Brake fails to operate but gives a series of clicks.	Increase friction at bearing BR by bending arms of spring washer. *Note.*—Excessive friction at BR will cause undue record wear.
Friction brake does not operate with the auto brake.	*See* that the springs SP1 and SP2 are in position (*see* also " IMPORTANT NOTE ").

DISMANTLING.

REPLACEMENT OF PILOT LAMPS.

The pilot lamp holders are fitted on a pivoted bracket which may be swung towards front of cabinet.

If difficulty is experienced in inserting a new lamp or in adjusting its position, the motor board should be removed when the two lamps and fitting will be freely accessible. Replace with 6-volt screw in type lamps.

The two lamps on this model are controlled by a small switch which is ganged to the main switch spindle. In the MW position the medium wave scale only should be illuminated, in the LW position the long wave scale, and in the GRAM position both scales.

TO REMOVE MOTOR BOARD.

1. Take out the four wood screws (2 at front, and 2 at back).
2. Disconnect motor leads from transformer terminal panel and remove 2 pick up (blue) plugs and single earth (black) plug from chassis.
3. Grasp lifting knob and pick up rest and lift motor board carefully, making sure that the motor and pick-up leads are not caught in the radio chassis.

TO REMOVE CHASSIS.

1. Remove motor board as above.
2. Disconnect ends of multiple cable attached to loudspeaker terminal panel.
3. Procure an "O" BA or 7/32 inch BSF tubular box spanner and remove the four bolts holding the chassis cradles to bottom of cabinet.

The special transit screws must also be removed if this has not already been done.

4. Remove volume control from inside front of cabinet.
5. Remove two bolts securing top end of chassis bracket to bearers on cabinet.

Note the position of the rubber washers which serve to prevent shocks and vibration being transmitted to the valves—THESE WASHERS MUST BE REPLACED.

REMOVAL OF LOUDSPEAKER.

1. Disconnect cable from loudspeaker terminal panel (if it is not already disconnected).
2. Remove four bolts fixing loudspeaker supporting bracket to bottom of cabinet.
3. Withdraw loudspeaker complete with supporting bracket.

For reconnection of loudspeaker cable, see page 6.

CONDENSER DRIVE.

BAND DRIVE ADJUSTMENT.

If the band drive is slack there will be back lash and sluggishness in the scale movement. To tighten band proceed as follows :—

1. Loosen nut fixing scale spindle.
2. The hole for the scale fixing bolt is elongated. Tension band by applying pressure to scale spindle.
3. Tighten nut fixing scale spindle.

See adjustment of calibration.

REPLACING BAND.

Should the band break it may be replaced as follows (Driving Band part No. 12824) :—

1. Remove scale (complete with spindle) by removing fixing nut.
2. Fix centre of band to scale by screw on periphery of drum.
3. Fix ends of band (long end under short) by screw on friction drive plate.
4. Replace scale drum and tension as above.

See adjustment of calibration.

FRICTION DRIVE ADJUSTMENTS.

Should the friction drive slip it may be due to a worn friction drive plate (on condenser spindle) or friction washers on tuning spindle.

To remove friction plate proceed as follows :—

1. Remove driving band from plate.
2. Pull tuning spindle out of its bearing, thus releasing it from the edge of the drive plate.
3. Undo screws and remove plate.

   Note.—When replacing plate see that it is pushed on to the spindle *almost* tight up to the bearing plate, otherwise the tuning spindle may slip out of its bearing when the drive is being operated.
4. Replace tuning spindle by prising open friction washers with a screwdriver and sliding edge of friction plate in position. The tuning spindle should then locate in its end bearing correctly.

See adjustment of calibration.

TO REPLACE TUNING SPINDLE.

Should the friction washers on the tuning spindle become worn the complete tuning spindle assembly should be replaced (Part No. 12815A).

To remove tuning spindle :—

1. Remove four screws fixing bracket, when tuning spindle can be withdrawn.
2. Replace spindle as described above.

ADJUSTMENT OF CALIBRATION.

After making any of the adjustments described above it is advisable to check over the correctness of the scale readings. Tune in to a medium wave station of known wavelength, and if the pointer does not register correctly, slacken nut fixing pointers and adjust to obtain correct reading.

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ELECTRICAL INTERFERENCE.

Attention is drawn to the activities of H.M. Post Office and the British Broadcasting Corporation in investigating the sources of interference in the reception of broadcast programmes from electrical sources exterior to radio receivers, such as tramways, electric signs, motors, &c., X-ray apparatus and similar installations.

WHAT TO DO.

1. Make absolutely certain that the interference is not within the instrument by disconnecting the aerial to see whether the interference continues or not after testing.

2. As this instrument is a superheterodyne, connect a piece of wire across the aerial and E terminals while testing.

3. Apply to the B.B.C. for a copy of the special questionnaire form issued by them. DO NOT communicate direct with H.M. Post Office.

4. Fill in the form accurately, giving, in addition to the answers required—

(*a*) Name of manufacturer of the receiver.

(*b*) The manufacturer's Cat. No. of the receiver.

5. Send the questionnaire back to the B.B.C., together with BRIEF notes as to possible source of interference which your local knowledge may suggest.

6. DO NOT assure your customer that a cure will be effected.

7. The B.B.C./P.O. organisation is one for investigating the CAUSE of complaint with a view to ascertaining whether or not a cure can be effected. Such investigations may be both delicate and lengthy and require both goodwill and tact to bring to a successful conclusion. DO NOT suggest to the owner (if known) of the interfering apparatus that your application to the B.B.C. is in any way a measure of retaliation.

8. It is of the utmost importance that this valuable channel of co-operation with H.M. Post Office and the B.B.C. should not be employed until every possible test has been made to ensure that the interference complained of comes definitely from a source EXTERIOR to the instrument.

Please address all **service** communications respecting His Master's Voice Models 470 and 523 and all orders for Spare Parts to:—

THE SERVICE DEPARTMENT,
THE GRAMOPHONE COMPANY, LTD.,
SHERATON BUILDINGS,
HAYES, MIDDLESEX.

Telephone: Southall 2468.

(For Detailed Spare Part Lists see separate publication.)

Always quote the type and serial number of the instrument.

h.45 11.32 H & S.