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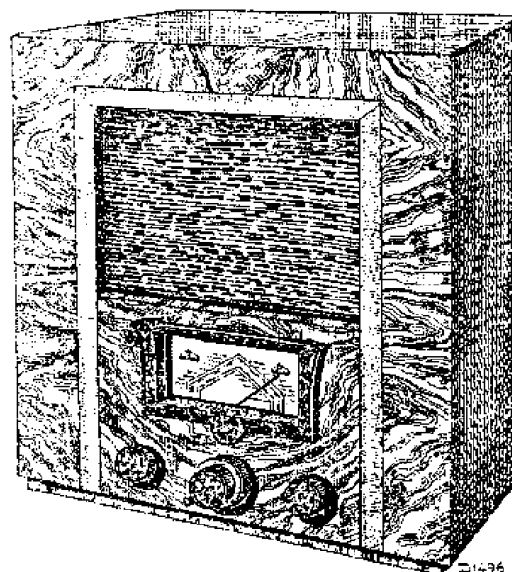
PHILIPS

SERVICE MANUAL

BATTERY RECEIVER

3 VALVES.

Type 821B



GENERAL REMARKS.

This receiver is a straight two-circuit, three-valve instrument for use with batteries, and has two wavebands, 1,500—545 K.C. (200—500 metres) and 275—158 K.C. (800—1,900 metres).

Four controls are provided. The left-hand knob controls the volume and the right-hand knob controls the sensitivity and selectivity. A dual control is fitted in the centre. The small round knob operates the tuning, whilst the larger knob controls the wavelength band and the on/off battery switch. In the position to the extreme right, the switch is in the "off" position; in the next position it is adjusted for the medium waveband (200—550 metres) and in both the third and fourth position long waves (800—1,900 metres) can be obtained. The fourth position, however, switches in a filter for the Droitwich (1,500 metres) wavelength. Provision is also made for a gramophone pick-up and an extra loudspeaker of high impedance. The control grid of the valve L1 (VP2) is connected via C22 to the tuned circuit S3, S4, C3 and trimmer C5 which is coupled to S1, S2, C21 by the small condenser C8. This tuned aerial circuit is connected to the aerial sockets 1 and 2 by the series condensers C19 and R12 respectively. Aerial No. 1 is for distant stations and No. 2 is for local stations. The Droitwich filter consisting of S13, S14, C18 is only switched into circuit at position 4 of the waveband switch.

The resistances R1, R2, R10, R11 are connected across the 9 volt grid bias tapping; R1 applies a variable negative grid potential to L1 and consequently forms the volume control. The fixed resistances R10, R11 are tapped off at their centre to provide a grid bias of approximately 2.5 volts for the output pentode valve PM22D.

The resistance R14 ensures that the drain from the grid bias section is substantially the same as the current drawn from the H.T. section of the H.T. battery.

The screened grid voltage is directly applied to L1 through the switch by the H.T.+2 battery tapping, whilst that for L2 is applied through the resistance R5 which is decoupled by C12.

The auxiliary grid voltage for the output pentode valve is applied through the switch from the H.T.+1 tapping.

The H.F. coupling between L1 and L2 consists of the tuned circuit S7 (S8), C4, and the trimmer C6, with the coupling condensers C20, C11 and the grid leak R4. The selectivity and sensitivity can be varied by the circuit comprising S5, S6 and the variable condenser C7. L2 and L3 are coupled by the filter circuit S9, C13, C14 and the resistance capacity circuit R6, C15, R7, R8. Finally the output of the pentode valve is coupled via an output transformer S10, S11 to the permanent magnet loudspeaker S12. Extra speaker sockets are connected

A 2

across S10 suitable for high impedance speakers. The condenser C16 is for tone correction and the condensers C17, C2, C9, C10 are decoupling condensers.

A pilot lamp, Type 8057, is connected across the filament circuit. Note that the PM22D is graded into two classes: A & B. When the valve is

marked A the tapping for the auxiliary grid voltage is 135 volts, when marked B the tapping should be reduced to 123 volts.

Gramophone pick-up sockets are provided, but it is necessary to make sure that the tapping G.B.— $1\frac{1}{2}$ volts is connected to its appropriate socket.

TRIMMING THE TUNED CIRCUITS.

If any part of the tuned circuits, i.e., coils, variable condenser or trimming condensers, are repaired or replaced, it will be necessary to re-trim that part of the circuit or circuits affected.

The same will apply if the sensitivity or selectivity has diminished in any way.

The apparatus required for these adjustments is as follows :—

1. A service oscillator having wavebands covering the receiver, similar to Philips Service Signal Generator GM.2880 (see Fig. 1). Prices and particulars upon application from the Service Department.

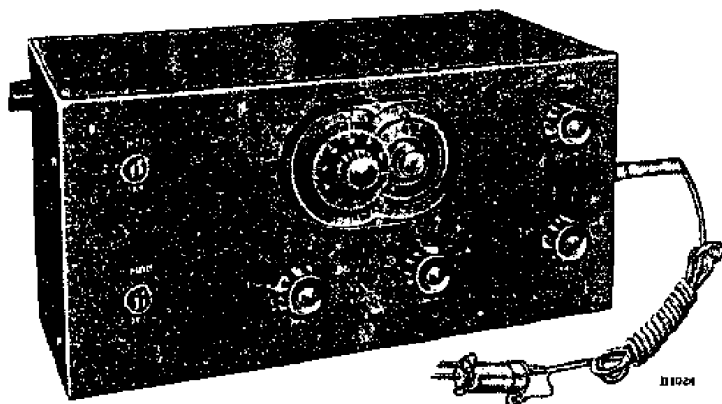


Fig. 1.

2. An artificial aerial (200-3,000 metres).
3. An output indicator, i.e., triode voltmeter connected in parallel with the loudspeaker. The output indicator in the testing apparatus, Type 4256 (Fig. 2) is, of course, quite suitable. An adaptation box for connecting between moving coil milliammeters (GM.2295) can also be supplied.
4. A trimming tool (see list of tools).
5. An auxiliary dial (see Sketch opposite page 10).

- I. Connect the receiver to the following supplies :—
H.T.+1 = 135 volts; H.T.— and G.B.+ to their appropriate sockets; G.B.—1 to —1½ volts; G.B.—2 to —9 volts; H.T.+2 according to the grade of valve. The L.T.+ and L.T.— to their respective connections. Connect the oscillator to aerial socket No. 1 and switch to medium waves. Turn condenser drive until the 150° mark on the scale is coincident with 225 metres.

Adjust the volume control to give 1½ volts grid bias to the grid of L1.

This may be conveniently measured with a high resistance voltmeter at the potentiometer R1. Turn the reaction condenser to approximately 10° from minimum capacity. C6 should be approximately flush with the insulating tube and C5 approximately 9 mm. below.

Now trim for maximum output at 225 metres. Turn the reaction control until the receiver is on the verge of oscillation. Re-trim keeping the receiver in this critical state. If it is found that during trimming, two peaks are observed, the reaction control should be turned back. It is advantageous to trim with a low input.

Check up to make sure that the receiver tunes to 200 metres and also that the calibration lies within the limits marked on the driving disc at 225 metres, 300 metres, 500 metres, 1,000 metres and 1,500 metres.

II. Trimming the Droitwich Filter.

If the coil S13, S14 or the trimmer C18 is changed, it will be necessary to re-trim this part of the circuit. It should be done as follows :—

Place the volume control to maximum. Switch the receiver to long-waves and tune very carefully to 1,500 metres (200 K.C. \pm 1 K.C.). Switch to filter position of the waveband switch and adjust C18 for minimum output.

The output must rise when C18 is turned either way from the position of minimum output. It is essential to use a small screwdriver having a small amount of metal.

THE TRACING OF FAULTS.

1. The following data is as complete as possible, but some of the cases may not occur in practice.
2. Always carry out, first of all, test measurements to ascertain the cause of the fault, (See point to point tests, pages 5 & 6.)
In this connection fault finding will be considerably simplified by using the Universal Test-board shown at Fig. 2.

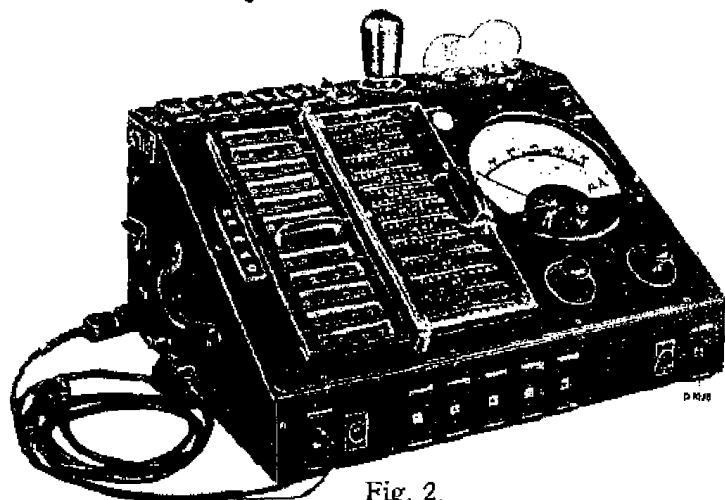


Fig. 2.

It covers all voltage, current, resistance, and capacity measurements. Full particulars and prices can be obtained from the Service Department. The method of testing should preferably be as follows:—

- I. Check all batteries before switching on and then check all anode and grid voltages together with the voltage across the filament sockets of the valve holders with the switch placed at "ON." If they are satisfactory in the first instance but no grid bias voltage in the second case, check C2 and C9. If no H.T. voltage then check C10, C12, C17.
- II. Equip the receiver with a known good set of valves (or a set of valves from a receiver which functions satisfactorily) and if necessary try another loudspeaker.
- III. Try whether gramophone reproduction is possible, if it is not test as follows:—
- IV. All voltages and valves are normal, but no gramophone reproduction.
 - A. L3 has abnormal voltages and currents.
 1. Switch defective.
 2. S10 open-circuited.
 3. R8, R7, R10, R11 open-circuited.
 4. C15 short-circuited.
 5. Fault in valve holder.
 7. Pilot lamp holder short-circuited.
 - B. L3 has normal voltages and currents.
 1. S10 short-circuited.
 2. C16 short-circuited.
 3. C15 open-circuited.
 4. Fault in loudspeaker or loudspeaker transformer.
 - C. L2 has abnormal voltages and currents.
 1. C12 short-circuited.
 2. Fault in switch contacts.
 3. R6 open-circuited.

4. S9 open-circuited.
 5. Anode screening or cap shorted to wiring.
 6. R4 open-circuited.
 7. R5 open-circuited.
 8. C13, C14 short-circuited.
- D. L2 has normal voltages and currents.
1. R4 short-circuited.
 2. Fault in loudspeaker or loudspeaker transformer.

V. Gramophone reproduction but no radio reception.

1. L1 has abnormal voltages and currents.
 1. Fault in switch contacts.
 2. S7, S8 open-circuited.
 3. Anode screening or cap shorting to wiring.
 4. R11, R10, R2, R1, R13 open-circuited.
 5. C9 short-circuited.
 6. Screened wiring shorting to screen.
2. Currents and voltages normal but no reception.
 1. S1, S2, S3, S4 open-circuited.
 2. C19, C22, C11, C20 open-circuited.
 3. C3, C4, C5, C6 short-circuited.
 4. Bad contact in wavechange switch.

If no reception on aerial II, check R12.

If the Droitwich filter fails to operate, check S13, S14, C18 and switch.

VI. Reception obtained but quality not satisfactory.

Too weak.

1. Currents and voltages not correct.
2. Receiver out of balance.
3. One of the anode grid coupling condensers open-circuited.

Distorted reception.

1. One of the valves has an incorrect bias.
2. One of the grid resistances open-circuited.
3. Fault in loudspeaker or loudspeaker transformer.
4. Battery voltages incorrect.

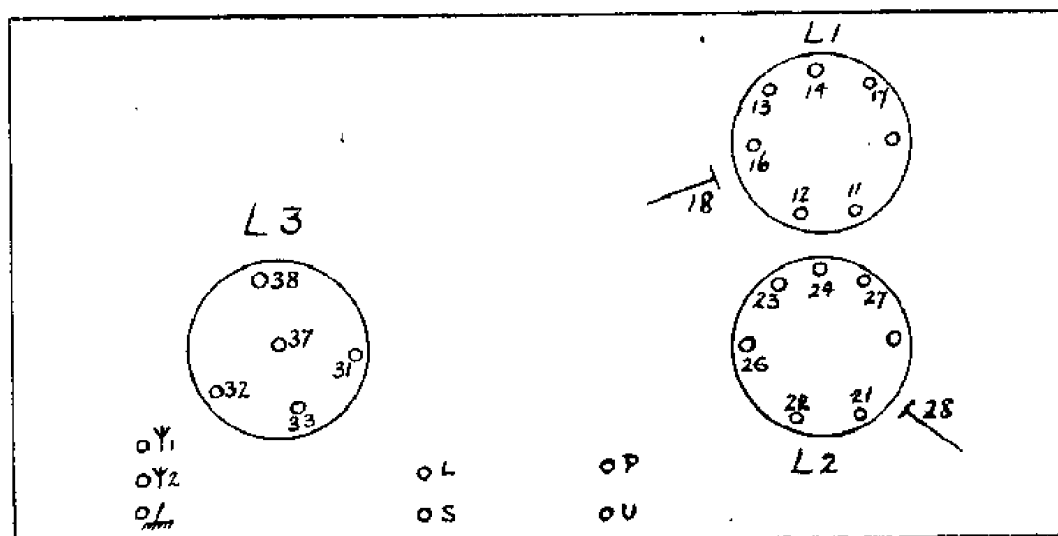
Receiver crackles.

1. Poor contact to aerial or earth sockets.
2. Intermittent short circuit in some part of the wiring.
3. Poor contact in one of the soldered joints.
4. Poor contact in one of the switches, valve holders or variable resistances.

Receiver oscillates or motor-boats.

1. One of the screening connections broken.
2. Metallised coating of valves not in contact with cathode.
3. One of the earth connections open-circuited.
4. One of the decoupling condensers open-circuited.
5. Wiring disarranged.

Cabinet resonances may be caused by loose parts of the cabinet, chassis or speaker. The resonating part should be firmly fixed by tightening screws, securing with a piece of felt, etc.



RESISTANCES.

12	14	16	17	18	24	26	37	U	11/12	21/22	31/32	L					
	5	5	5	415	5	5	5	5	5	5	5	5					
11	S																
	380																
10																	
9	13	23	27	28	33	P											
	100	85	315	410	180	85											

CAPACITIES.

12	28	Aerial 1	28/33														
	390	65	110/70														
11																	
10	27	38															
	300	180															
9	+HT2			-HT													
	-HT			-GB2													
	105			100													

Apparatus on long-wave, position 3.

Volume control at maximum.

REMOVING AND CHANGING OF PARTS.

The chassis can be removed as follows :—

1. Remove the rear panel.
2. Disconnect the batteries.
3. Take out the valves.
4. Unsolder the connections to the loudspeaker transformer.
5. Remove the knobs which are secured with grub screws.
6. Unscrew the four bottom screws.
7. Take the chassis out of the cabinet.

Important points to be observed when repairing.

1. The instrument is constructed as a precision instrument and should be treated as such.
2. It is desirable to carry out repairs on a support, preferably a universal type (Code No. 09.991.380) Fig. 3.

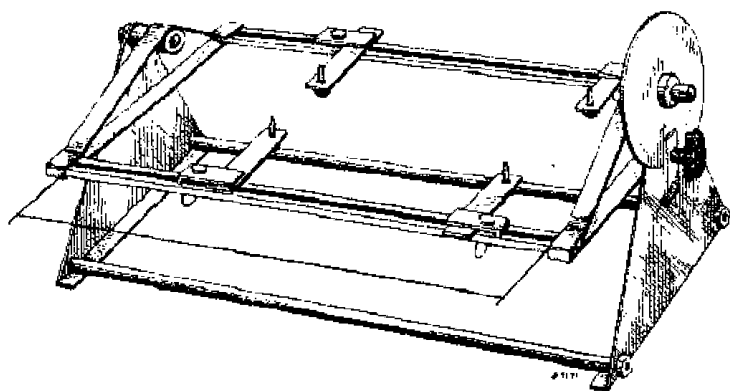


Fig. 3.

3. Do not alter the wiring or the position of the screening plates.
4. Always re-connect earth connections to the original points.
5. Do not place any insulating fabric round the bare wires of the H.F. circuits, and make sure these wires do not touch any insulating fabric of other conductors. In either of these cases the circuits may be impaired by "damping."
6. Make, if necessary, a sketch of the wiring or mark the wires with coloured wax.
7. See that bare wires are kept away from each other (there should be a clearance of at least 3 mm.).
8. After a repair, take care to replace all items such as spring washers, insulating material, etc. Screws and nuts may, as a rule, be substituted for rivets (e.g., when changing valve holders, etc.).
9. All moving parts, but not contacts, may be greased with a little pure vaseline.
10. Where necessary and possible, carefully give the contacts a little extra mechanical stress. We will now deal only with such repairs as may involve difficulty or require special attention.

Resistances.

Solder the connections to them as quickly as possible in order to avoid undue overheating.

H.F. Coils.

These coils which are situated side by side on the top of the chassis and clamped by a ring held by screws, may only be changed by dealers possessing the necessary apparatus and tools for adjusting, trimming and rebalancing the H.F. circuits. No difficulties

are likely to be experienced when changing the coils provided care is taken with their connections and the position of the coils. The "former" is colour-marked with paint, and this mark should point towards the screening plate in the middle of the chassis.

Condenser Box, C12, C17.

This condenser box is fitted on top of the chassis and is secured by a clamping ring held by two screws.

Volume Control.

This is fitted on the subsidiary chassis bracket. The spindle is held by two grub screws fitting into a brass collar. If the complete unit is required to be taken out it will be necessary to remove the three screws holding the unit. The leads can then be unsoldered and the volume control and spindle removed.

Reaction Condenser.

The spindle and collar are secured with a grub screw and set screw respectively.

The condenser is secured to the screen by a one-hole fixing, but it will be necessary to drill the small rivet under the earth tag when it is required to remove the condenser.

Fixed Condensers.

The fixed condensers should be kept clear of all other wiring and the ends should be soldered at least 1 cm. away from the component.

Wavechange Switch Mechanism.

It will be necessary to remove the subsidiary bracket if it is required to adjust or replace parts of the operating mechanism.

If it is necessary to repair one of the switch parts, the spindle will have to be withdrawn according to which switch requires attention. Further a right-angle screwdriver (Code No. 09.990.360) will be of great assistance in order to obtain access to the rear screws. New stators are supplied with 12 contact springs. The superfluous contacts can be taken away. Rotors are supplied with loose contacts and can be fitted with the pliers shown on page 10.

Variable Condenser.

Unsolder the wires leading through to the inside of the chassis, release the bracket holding the drive disc and coupling, and release the spring coupling device.

Loosen the rear plate and the condenser can then be withdrawn from the front.

When the new variable is fitted and rewired, the receiver must be rebalanced.

REMOVING AND REPAIRING THE LOUD-SPEAKER.

Method of removal.

The loudspeaker can be removed by merely loosening the three eccentric clamps and unsoldering the leads to the transformer.

Important points to be considered when repairing.

1. See that the repair is carried out with good tools on a table or bench (not an iron one) free from dust or filings.

2. Under no circumstances should the front and rear plates be removed from the magnet as this would impair its magnetism (as also would be the case when working on an iron bench).
3. Replace the cover of the loudspeaker immediately after the repair has been carried out.

Centring the Cone.

Loosen the centring screw, place four feelers of .008-inch thickness (Code No. 09.990.840) through the perforations of the spider into the air-gap. Tighten up the centring screw and withdraw the feelers. No sound should be heard when the cone is carefully moved up and down (see Fig. 4).



Fig. 4.

Changing the Cone.

Unsolder the connections from the transformer, cut through the clamping ring and loosen the centre screw. The air-gap, if dirty, should be cleaned with a piece of strong material, namely, brass, pertinax, etc., wrapped in wadding that has been moistened with alcohol. Any iron particles should be moved from the air-gap by means of a steel plate spring. The new cone is to be centred as indicated above and can be fixed with a special service clamping ring (Code No. 28.445.821). Commence by bending the tags at four points positioned at angles of 90° from each other; the feelers are not to be removed from the air-gap until all the tags have been bent. The flexible leads of the transformer should be of the correct length. It will be found that if they are fitted too tight they will impede the movement of the cone, and if they are too loose they are likely to touch the cone and cause rustling.

Changing the Cone Holder.

If such an adjustment is necessary, a gauge will be required as shown in Fig. 5 (Code No. 09.991.022).

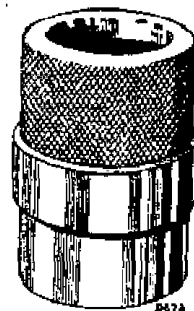


Fig. 5.

Remove the cone and place the gauge in the air-gap. Mark out the internal circumference of the cone-holder, unscrew the nuts of the three bolts and stand the loudspeaker on the back plate, bearing in mind paragraph 2. When remounting do not withdraw the gauge from the air-gap until the three bolts have been secured tightly. A gauge will also be found necessary for centring the pole pieces in the air-gap.

Faults.

Before commencing a repair, try a different loudspeaker and transformer in order to make sure that there is actually a defect in the loudspeaker assembly.

No sound.

This may be due to an open or short circuit in the speech coil or output transformer. Measure with an ohm-meter and check with the values given at the back of the manual.

Sound weak or distorted.

The coil may have become jammed in the air-gap or there may be a partial short circuit in the windings of the speech coil or transformer.

Rustling or resonance.

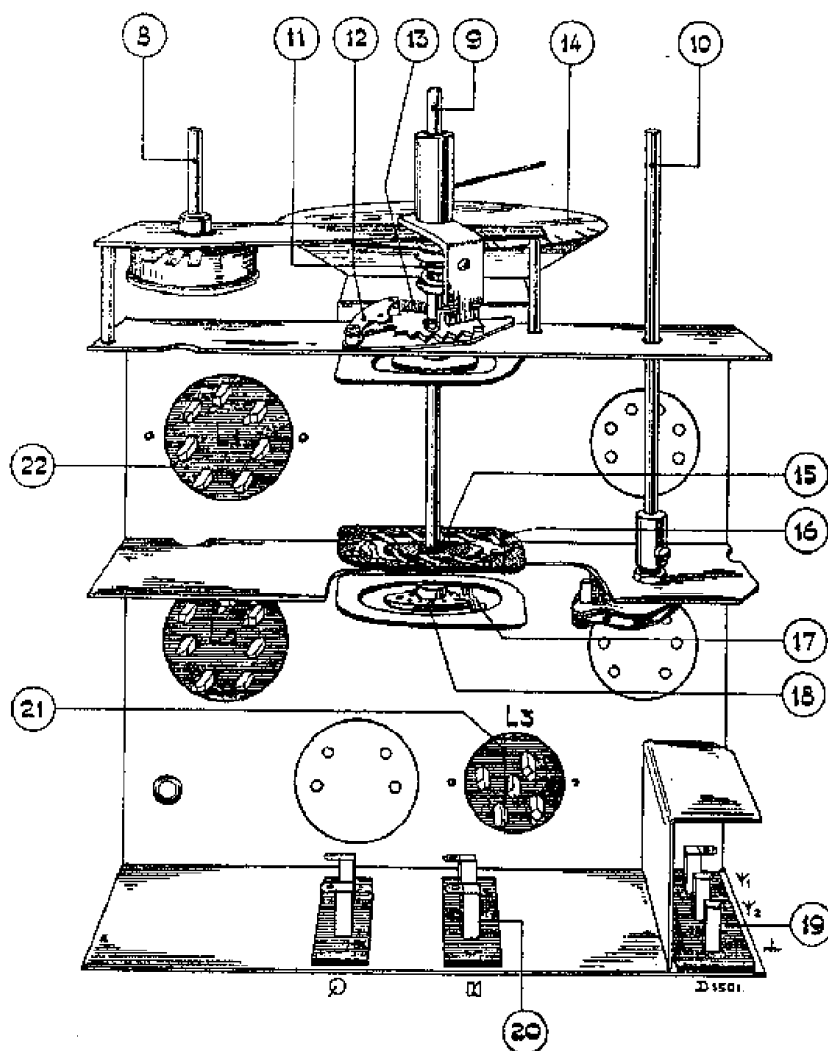
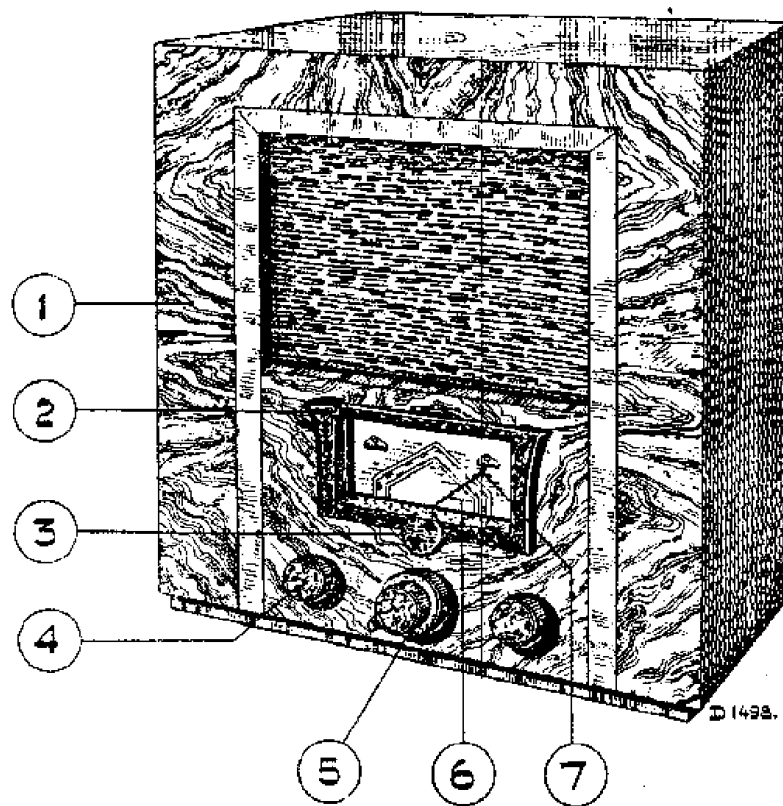
This fault may be caused by loose particles in the loudspeaker assembly or by loose parts attached to the cabinet or chassis. It may also be caused by some hindrance in the movement of the cone, namely, too tight or too slack, dirt in the air-gap or the speech coil may have become distorted.

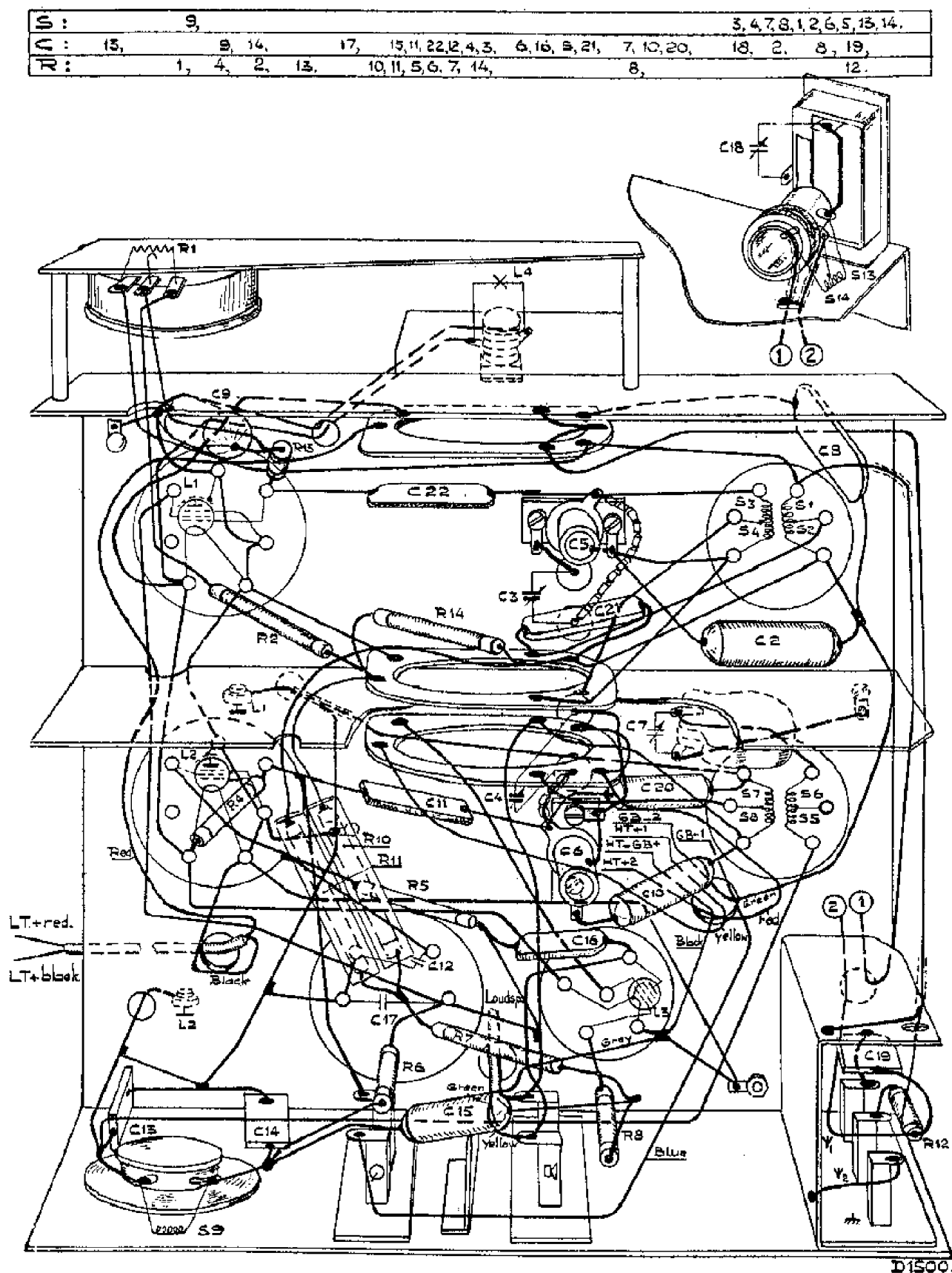
LIST OF SPARE PARTS, ETC.

When ordering any of these items please state:—

1. Code number.
2. Type and serial number of receiver.
3. Description of part.

Fig.	Item.	Description of Parts.	Code No.
	1	Cabinet	28.242.270
	2	Escutcheon... ..	23.999.380
	3	Trade mark button	25.988.610
	5	Knob for wavechange switch, colour 005	23.950.840
	4	Knob round, colour 005	23.995.590
	6	Station scale	28.701.170
	7	Pointer	28.944.480
	14	Celluloid plate	28.336.840
	25	Back for cabinet	28.397.700
	21	5-pin valve holder... ..	25.161.330
	22	7-pin valve holder... ..	28.225.010
	27	Top cap for valve	28.854.410
	20	Socket plate for extra loudspeaker	28.867.790
	19	Socket plate for aerial and earth	28.870.610
	20	Socket plate for gramophone pick-up	28.867.790
	26	Pilot lamp holder assembly	28.837.960
	28	Reflector	28.254.000
		Insulated disc for condenser drive	28.888.020
		Friction drive assembly	25.747.170
	9	Spindle for variable condenser drive	28.001.580
	8	Spindle for volume control	28.001.600
	10	Spindle for reaction condenser	28.001.610
	16	Stator with 12 contacts for wavechange switch	25.868.760
	18	Rotor without contacts for wavechange switch	25.439.481
	17	Contacts for rotor	25.046.590
	12	Lever for stop plate	25.292.030
	13	Tension spring for wavechange switch	25.668.710
		Variable condenser coupling assembly	MK.830.620
	11	Friction	28.824.620
	15	Rotor hub	25.104.180
	23	Spring for back	28.750.040
	24	Spring for back	25.673.860
		LOUDSPEAKER.	
		Service clamping ring	28.445.821
		Paper ring	28.445.390
		Clamp for holding loudspeaker to cabinet	25.012.210
		Cone and coil	28.220.200 or
			28.220.201
		Protecting cap for loudspeaker	28.253.260
		GAUGES AND TOOLS.	
		Air gap centring gauge	09.991.022
		Pertinax centring pieces	09.990.840
		Service oscillator wave range 14/3,000 metres	09.991.260
		Universal measuring test-board, type 4256	09.991.030
		Trimming tool	09.991.101
		Right angle screwdriver	09.990.360
		Pliers for rotor contacts	09.991.410
		Universal chassis holder	09.991.380



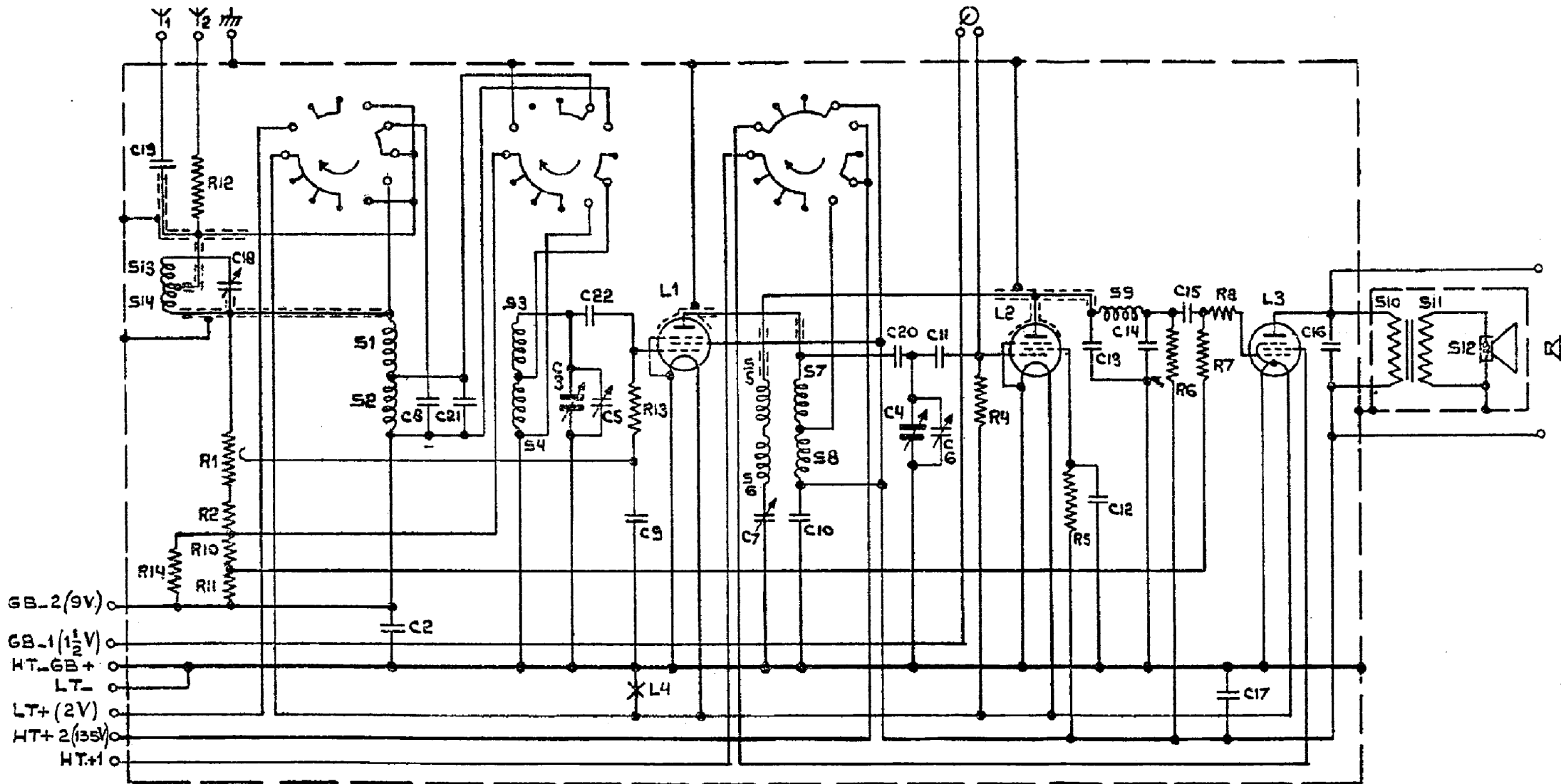


CONDENSERS.		
Designation.	Condensers.	Code No.
C2	0.1 μF	28.199.090
C3	11—450 $\mu\mu\text{F}$ }	28.210.510
C4		
C5	0—27 $\mu\mu\text{F}$	25.115.410
C6	0—27 $\mu\mu\text{F}$	25.115.410
C7	200 $\mu\mu\text{F}$	28.211.350
C8	80 $\mu\mu\text{F}$	28.190.120
C9	0.1 μF	28.199.090
C10	0.1 μF	28.199.090
C11	16 $\mu\mu\text{F}$	28.190.050
C12	0.5 μF }	28.160.630
C17		
C13	100 $\mu\mu\text{F}$	28.190.130
C14	1000 $\mu\mu\text{F}$	28.190.230
C15	3200 $\mu\mu\text{F}$	28.198.940
C16	1600 $\mu\mu\text{F}$	28.190.250
C18	60—160 $\mu\mu\text{F}$	28.210.720
C19	2000 $\mu\mu\text{F}$	28.190.260
C20	50000 $\mu\mu\text{F}$	28.199.060
C21	80 $\mu\mu\text{F}$	28.190.120
C22	100 $\mu\mu\text{F}$	28.190.130
RESISTANCES.		
R1	10000 Ohm	28.808.990
R2	500 Ohm	28.770.220
R4	2 M. Ohm	28.770.580
R5	0.25 M. Ohm	28.770.490
R6	0.1 M. Ohm	28.770.450
R7	2 M. Ohm	28.770.580
R8	0.2 M. Ohm	28.770.480
R10	25000 Ohm	28.774.370
R11	64000 Ohm	28.774.380
R12	0.25 M. Ohm	28.770.490
R13	2 M. Ohm	28.770.580
R14	1600 Ohm	28.770.270

OHMIC RESISTANCE OF COILS.

Coil.	Resistance in Ohms.	Code No.
S1 ; S2 ; S3 ; S4	25.0 ; 58.0 ; 2.5 ; 43.0	28.564.270
S5 ; S6 ; S7 ; S8	1.0 ; 7.5 ; 2.5 ; 43.0	28.565.850
S9	335—415	28.564.770
S10 ; S11	630 ; 0.2	28.529.120
S12	2.0	28.220.200
S13 ; S14	17.0 ; 17.0	28.587.040

S: 13,14,	1,2,	3,4,	5,6, 7,8,	9,	10, 11, 12.
C: 19, 18,	2, 8, 21,	3,22,5, 9,	7, 10,	20,4,11,6,	13,12, 14, 15, 17, 16.
R: 14, 12,1,2,10,11,	13,	4,	5,	6, 7, 8.	



H.T. Battery 135 volts.

Filament Battery 2 volts.

Valve.	VP2.	SP2.	22D.	
Va	135	125	132	Volts
Vg'	135	115	135*	Volts
—Vg	Variable 0.4—9	Nil	4.5	Volts
Ia	2.2—0	.7	4.5—5.0	mA
Ig'	0.15—0	.1	1.1	mA

Approximate total H.T. consumption = 7 mA in H.T. + lead.

„ „ L.T. „ = .75 amps.

* According to grade of valve.

The voltages are measured with voltmeters having a resistance of 2,000 Ohm per volt. The values given are the mean of several measurements, therefore some readings may differ appreciably, particularly as variations may arise due to the tolerances of the components as well as the valves. Before finally deciding that a valve is defective it is recommended that a replacement test with the same type of valve is made.

