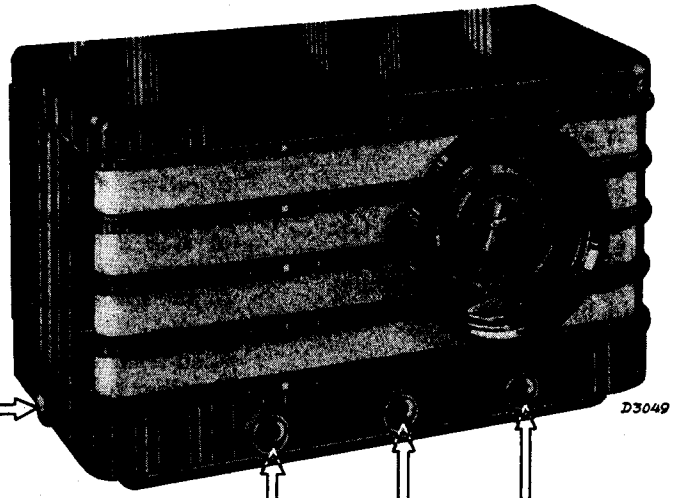
PHILIPS

SERVICE DOCUMENTATION

FOR THE RECEIVER

TYPE 284 A



FOR A.C. SUPPLY

GENERAL DATA.

This superhet receiver is equipped with:
Seven tuned circuits;
Automatic volume control;
Continuously variable tone filter;
A „local-foreign" switch in the medium wave band;
Special noise-reducing H.F.-penthode (EF 8);
Permanently magnetised moving coil speaker (type 9636);
Voltage adjustment with automatic voltage indication for voltages of 110—245 V;
Safety contact, making the set "dead" when the rear panel is removed;
Coarse and vernier control by one single knob.

Waveranges

1st shortwave band: 13·5—45 m (22·1—6.67 Mc/s)
2nd shortwave band: 45—160 m (6·67—1·87 Mc/s)
Medium wave band: 160—570 m (1875—527 kc/s)

Knob-arrangement

On the front panel, from left to right:
Waveband switch and local-foreign switch.
Tuning knob.
Volume control and mains switch.
On the left-hand side panel:
Tone control.

Positions of the waveband switch

From left to right:
A. Medium wave band, local
B. Medium wave band, foreign
C. 2nd shortwave band
D. 1st shortwave band.

Weight: 11·5 kg (valves included).

Dimensions: height 29 cm
breadth 50 cm (knob included)
depth 24 cm (knobs included).

ADJUSTING THE RECEIVER

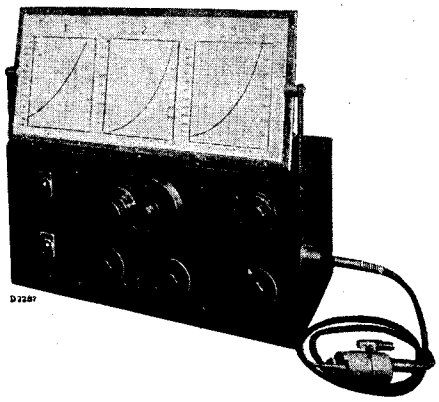


Fig. 1

For trimming, the set must be taken out of its cabinet (see G-sheets).

Newly regulating is necessary:

1. After changing coils or condensers in the I.F.- or H.F.-parts.
2. When the set is not sufficiently sensitive or selective.

When regulating make use of:

1. Service oscillator GM 2880 (fig. 1).
2. Output indicator: Universal measuring apparatus 4256 or 7629.
3. Auxiliary receiver or aperiodic amplifier GM 2404.
4. Measuring pin for connecting the auxiliary receiver.
5. A 15° gauge for establishing the relation between condenser position and dial.
6. Insulated trimming plug-in key 6 mm.
7. Sealing-wax for fixing the trimmers.
8. A tuning-tester.
9. A trimming transformer.
10. A small fork for scale-adjustment.

For the artificial aerial use:

1. For I.F.: a condenser of 32000 $\mu\mu$F.
2. For medium waves a standard artificial aerial.
3. For short waves: a shortwave artificial aerial = red spot on standard artificial aerial.

When trimming, always use the customer's valves. If during trimming the converter valve becomes defective trimming must be repeated (Pre-heat the new valve).

During trimming the volume control of the receiver must always be at maximum position. The strength of the signal is regulated on the service oscillator.

Before proceeding to trim, the wax on the trimmers must be removed and the trimmers turned to and fro a few times for cleaning the screw thread.

Tuning-tester

When trimming use a tuning-tester. This instrument consists of a rubber tube, in the one end of which is a piece of so-called H.F. iron and in the other end a piece of copper. The two ends are successively put into the hole at the bottom of the coil. If the outputindicator falls back in both cases, the concerning circuit is tuned exactly, otherwise the circuit is to be adjusted.

Wire trimmers

Some of the trimmers in this receiver are of a different type to the usual, being constructed of a tube of insulating material with a sprayed layer of metal on the inside and covered on the outside with a winding of copper wire. The capacity is adjusted by removing turns of wire.

When trimming, turns are removed until the output indicator which has reached maximum value, drops back slightly. A couple of turns are then replaced and the surplus wire clipped off. The winding is held in place with wax.

The oscillator frequency is in all bands higher than the tuning frequency of the H.F.-circuits.

The I.F. is 452 kc/s.

A. **I.F.-circuits**

1. Connect the output indicator via a trimming transformer to the speaker.
2. Set waveband switch in position for medium waves.

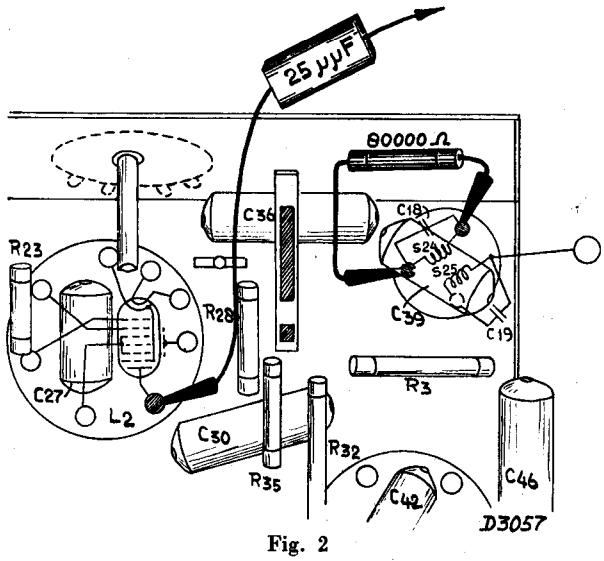


Fig. 2

3. Short circuit the oscillator by short-circuiting C7 with a short flex. (See fig. 4).

13. Tune the auxiliary set and the set to be trimmed.
14. Remove the auxiliary set and the short circuit of C7. Connect the output indicator to the speaker of the set to be trimmed via a trimming transformer. **Do not turn the variable condenser.**
15. Trim C17 to maximum output (see fig. 11).
16. Connect the auxiliary receiver via a condenser of 25 μμF to the anode of L2. Connect the output indicator to the set to be trimmed.
17. Short circuit C7.
18. Apply a modulated signal of 1700 kc/s to the aerial socket of the set to be trimmed via a normal artificial aerial.
19. Tune the auxiliary receiver and the set to be trimmed.
20. Remove the auxiliary set and the short-circuit of C7. Connect the output indicator to the speaker of the set to be trimmed via a trimming transformer.
21. Re-trim C16 to maximum output.
22. Seal the trimmers.

Adjusting the dial

1. Connect the output indicator to the speaker of the set via a trimming transformer.
2. Apply a modulated signal of 938 kc/s to the aerial socket.
3. Accurately tune the receiver.
4. With the aid of the small screw at the little drum and the small fork mentioned at pag. 01. set the pointer at 320 m without turning the variable condenser.

TRACING FAULTS

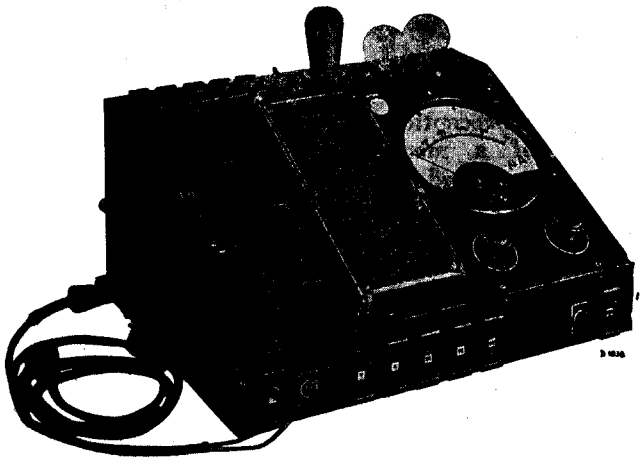


Fig. 5

For properly establishing defects a good measuring instrument is necessary; therefore always use the Universal Measuring Apparatus type 4256 (fig. 5) or 7629. To locate a fault it is necessary to take the set out of its cabinet (see G-sheets). Do not unsolder a single connection before the defect has been located by measurement. The normal values of currents and voltages are mentioned between brackets. These values are measured with the measuring apparatus type 7629 or 4256.

I. Connect the set at the correct voltage and test its valves on the outdoor aerial or service-oscillator.
   a. If the set works normally leave it in operation and keep it in observation.
   b. If the set does not work at all, or badly, then:

II. Place a set of good valves from a properly functioning receiver in the set to be examined and if need be try another speaker.
Faults in valves or speaker are thus eliminated or located.

III. Measure the tension across C2 (Normal 225 V).

A. **Tension across C2 abnormal**

1. Mains-voltage adapter in wrong position.
2. Mains-switch, safety contact or mains-voltage adapter defective.
3. R3, R8, R19 defective.
4. C1, C2 or C36 short-circuited.
5. C26 short-circuited.
6. S1, S2, S3 defective.
7. Short-circuit of the primary of the loud-speaker transformer against the secundary or against the chassis.
8. Short-circuit of S24, S26, S32 against the chassis.

B. **Tension on C2 normal, but no reproduction of a modulated signal of 452 kc/s applied to the grid of L3 via a condenser of 32000 μμF.**

a. L4 has abnormal currents and tensions (V_a = 250 V; V_{g2} = 225 V; I_a = 33 mA; I_{g2} = 4·7 mA).
   1. No anode-current: S28 interrupted.
   2. Anode-current to high: C46, C45, C40 short-circuited.
   3. R20, R21, R4 interrupted.

b. L3 has abnormal currents and tensions (V_a = 225 V; V_{g2} = 95 V; V_{cath} = 1·9 V; I_a = 5·5 mA; I_{g2} = 1·6 mA).
   1. No anode-current: S32, R33 interrupted.
   2. Anode-current to high: C42 short-circuited.
   3. S25, R31, R34, R17, R28 interrupted; C43 short-circuited.

c. L3 and L4 have normal currents and voltages, but no reproduction of a modulated signal of 452 kc/s applied to the grid of L3 via a condenser of 32000 μμF.
   1. S26, S32, C20, S27, S31, C21 interrupted or short-circuited.
   2. R17, R22, C40, R20, C38 interrupted.
   3. C38 short-circuited.
   4. C4 short-circuited.
   5. S29, S30 interrupted.
   6. Loudspeakertransformer defectuous.

C. **Reproduction of a modulated signal of 452 kc/s applied to the grid of L3 via a condenser of 32 000 μμF, but no radio-reception.**

a. L2 has abnormal currents and tensions (V_a = 220 V; V_{g2} = 200 V; $V_{g3.5}$ = 60 V; V_{cath} = 3 V; I_a = 2·5 mA; I_{g2} = 3·8 mA; $I_{g3.5}$ = 1·4 mA).
   1. No anode-current: S24, R5, R23 interrupted.
   2. Anode-current to high: C27 short-circuited.
   3. No $I_{g3.5}$: R9, R10 interrupted; C30, C3 short-circuited.
   4. R7, S13, S15, S17, R18 interrupted.
   5. S18, S20 interrupted.
   6. R11, R6 interrupted.

b. L1 has abnormal currents and tensions (V_a = 205 V; V_{g3} = 205 V; V_{cath} = 0·5 V; I_a = 5·5 mA; I_{g3} = 0·2 mA).

TRACING FAULTS BY THE „POINT-TO-POINT" SYSTEM

If a universal measuring apparatus type 4256 or 7629 is available the tracing of faults is greatly simplified by applying the "point-to-point" system. At the beginning this method is the same as that indicated in the E-sheets under points I and II. After this follows:

III. General examination according to the "point-to-point" system, i.e. measuring of resistance and capacity between valve holder contacts and connection sockets, both with respect to each other and with respect to the chassis. In this way a fault and, with the aid of the circuit diagram, the defective part can be traced. If need be compare with the E-sheets.

a. Remove the mains flex from the plug socket.

b. Remove all valves and place in the valve holder of the rectifier lamp a valve base with the contacts of filament and anodes interconnected. In this way, furthermore, the meter is protected against possible overloads on the smoothing condensers.

c. Connect the universal measuring apparatus type 4256 or 7629 and set at resistance measurement (position 12). Lengthen the + pin of the measuring flex so that the contacts of the valve holder, etc. can easily be touched. Insert the other pin in the earth socket of the receiver.

d. Measure the resistance between the points indicated in the point-to-point table and the chassis by touching the indicated contact by the + pin. Compare the meter deflection with the value in the table.

Note. P signifies: measure between the gramophone pick-up socket and earth, etc. 11/12 signifies: measure between points 11 and 12. 4 × 29 signifies: Measure at 4 positions of the waveband switch.

e. Switch the measuring apparatus in succession on position 11, 10 and 9 and compare the readings.

f. Set the universal measuring apparatus for capacity measurement (in succession on position 12, 11, 10 and 9). Compare the meter deflection with the value in the table.

g. Remove the short-circuiting valve-base when measuring at the valve holder of the rectifier.

Important

1. The values measured can vary about 10% with those given in the table, without this necessarily pointing to a defective part.
2. During resistance measurements of electrolytic condensers the leak current and with it the meter deflection drops during measurement. Now it may happen that the value found is much too high owing to a defective condenser; however, such a deviation also occurs when the set has not been in operation for a long time. Be careful therefore when judging electrolytic condensers!

Number code for valve-holder contacts.

The first numeral indicates the valve holder in accordance with the circuit diagram, the second one has the undermentioned significance:

1 and 2 = filament
3 = control grid
4 = contact for metallisation
5 = cathode
6 = extra grid (for instance 1st grid of octode, suppressor grid of pentode)
7 = screen grid
8 = anode
9 = extra grid (for instance 2nd grid octode).

REPAIR AND CHANGING OF PARTS

General instructions.

1. After repair the course of the wiring and the position of the screening partitions must be brought into the original position.
2. Make sure at the same time that the wires are sufficiently far apart (at least 3 mm) from each other.
3. After repair replace in their original position spring washers, insulating material, etc.
4. As a rule rivets can be replaced by screws and nuts.
5. Moving parts may be slightly greased by means of a little pure vaseline.
6. Where necessary and possible, give contacts some mechanical pre-tension.
7. Solder as quickly as possible so that the parts themselves heat up as little as possible.
8. Condensers immersed in compound must be soldered at a distance of at least 1 cm from the compound, to prevent melting away of the compound and bad contact in the condensers. These condensers must be suspended free from the other wiring.
9. In view of the heat development of resistances, the latter must be mounted in such a manner that they do not touch any other parts.

Changing coils

The coils are fixed to the chassis by means of tags which form part of the chassis. After the connections have been unsoldered and the tags have been bent back, the coil must be pulled carefully from the chassis. A new coil can be mounted with the aid of a pair of pliers.
If the tags have been broken, the part must be fixed by means of a clamping plate.

Decription of the wave-band switch.

The waveband switch consists of one or more units, an arresting plate for establishing the number of positions, spindles, springs, etc.

System for drawing the diagram of the switch.

In order to give a clear idea of the wavelength switch in the circuit diagram we are giving below a short explanation.
The switches are drawn as seen from the control end with the receiver in a vertical position and the switch units are numbered starting at the control end. The position of the stop-ball is given in the first unit. The outer edge of the stator is also shown in the various units, 90° from the stop-ball. The rotors are drawn in their extreme left hand position; this is further indicated by the right hand arrow drawn round the hole in the stator.
The contact springs on the stator side facing the arresting plate are indicated as open circles in the outer circle. Where there is no contact spring a black dot has been drawn. In all, therefore, 12 circles can be drawn in the outer circle.
In the inner circle 12 circles can also been drawn which indicate the contact spring on the other side of the stator. The interconnecting strips on the rotor side facing the arresting plate are indicated by continuous lines close to the outer circle; those on the other side of the rotor as a dotted line close to the inner circle, whilst contact pieces are shown as a short line between the inner and the outer circle.
The rotor contacts cover one or more holes and on one side all form part of a circle.
The switches are replaced as complete units only, see O-sheets.

To remove the chassis from the cabinet

1. Loosen the rear panel
2. Remove the knobs.
3. Remove six screws with which the speaker board is fixed to the cabinet.
4. Slide the chassis with speaker board out of the cabinet.

To remove the chassis from the speaker board

1. Take the set out of the cabinet (vide above).
2. Unhook the string for the pointer drive from the drum on the condenser spindle (for this purpose turn the condenser to maximum).
3. Unsolder the connections to the tone control and speaker.
4. The small pointer of the waveband indicator is connected to the speaker board by a spring. Unhook this spring from the pointer.
5. Take the lighting lamp out of the brace at the screen.
6. Unscrew the chassis from the speaker board (4 square screws and 2 wood-screws).
7. Mounting is effected in the reverse order. The string for the pointer drive is hooked on in the following way:
   a. Turn the little drum two turns in a clockwise direction, but do not yet wind the string on this drum.
   b. Turn the variable condenser to maximum; hook the end of the string to the drum on the condenser spindle.
   c. Let the drum behind the pointer run back, during which the string is wound on the drum.
   d. After mounting check the pointer setting (see C-sheets).

Changing the station name dial

1. Take the set out of the cabinet (see above).
2. Take the chassis off the speaker board (see above).
3. Unscrew the reflection screen behind the station name dial from the speaker board.
4. Unscrew the station name dial from the speaker board.
5. Mounting is effected in the reverse order.

Note

The new dial must be cemented to a new glass mask by applying a drop of necol cement to the corners. The 4 small circles on the dial must thereby coincide with the small circles on the mask. The combination mask and dial must be fixed on the

LIST OF PARTS AND TOOLS

When ordering parts or tools, always mention:
1. Codenumber. 2. Tpenumber of the receiver. 3. Description.

Fig.	Pos.	Description	Codenumber	Price
8	1	Cabinet (colour 041)	23.660.671	
8	2	Speaker silk	06.601.140	
8	3	Stationname dial	A1.890.002	
8	4	Glass plate (mask)	28.340.635	
8	5	Metal plate behind the stationname dial	28.875.090	
8	6	Rubber bloc	28.096.321	
8	7	Pointer	28.896.841	
8	8	Knob (colour 041)	23.611.230	
8	9	Spindle for volume control	28.004.693	
8	10	Spindle for waverangeswitch	28.615.960	
8	11	Knob (colour 041)	23.610.654	
8	12	Marking disc	28.713.271	
9	13	Safety contact	28.837.830	
9	14	Backplate	28.404.101	
9	15	Spring in little drum	28.760.271	
9	16	Lighting valve holder	08.515.271	
9	17	Notched screw	07.743.040	
9	18	Pin for screening plate	28.622.020	
9	19	Spring on screening plate	28.753.200	
9	20	Brace (toggle)	28.071.970	
9	21	Rubber ring	28.454.260	
9	22	Rubber tulle	28.725.520	
9	23	Plug socket plate	28.875.611	
9	24	Plug pin plate	28.869.190	
9	25	Plate with pins	28.871.702	
9	26	Tulle	28.725.470	
		Strip of felt before the scale	28.683.970	
		Tulle for fixing the chassis to the loudspeaker board	25.655.951	
		Mains switch	08.529.570	
		Rivet for fixing the mains-switch	07.066.410	
		Vernier unit	28.882.880	
		Spring for vernier unit	28.751.811	
		Spring on pointer for wave-bandindication	28.740.731	
		Spring on great drum	28.740.662	
		Valve cap	28.838.741	
		Tulle 4·5 × 1 mm	25.655.420	
		Tulle 5·5 × 1 mm	25.655.440	
		Stator + rotor no. 1, 2 and 3[1])	25.873.590	
		LOUDSPEAKER.		
		Screen cap (chassis)	28.256.170	
		Ring with incissions	25.871.810	
		Paper ring	28.451.540	
		TOOLS.		
1		Service oscillator	GM2880	
5		Universal Measuring Apparatus	GM 4256	
		Universal Valve and Measuring Apparatus	GM 7629	
		15°-gauge	09.992.440	
		Insulated plug-in key 6 mm	M646.565	
		Centring gauge for loudspeaker	09.991.530	
		Trimming transformer	09.992.220	
		Lever for fixing coils	09.991.560	
		Clamping plate for fixing coils	28.080.870	
		Small fork for scale-adjustment	09.992.450	
		Sealing-wax	02.851.360	
		STATION-NAME DIALS.		
		When a station-name dial has to be replaced, always use one with the same codenumber (mentioned in the corner of the dial).		

[1]) For the number of the switch-elements see the principle-diagram.

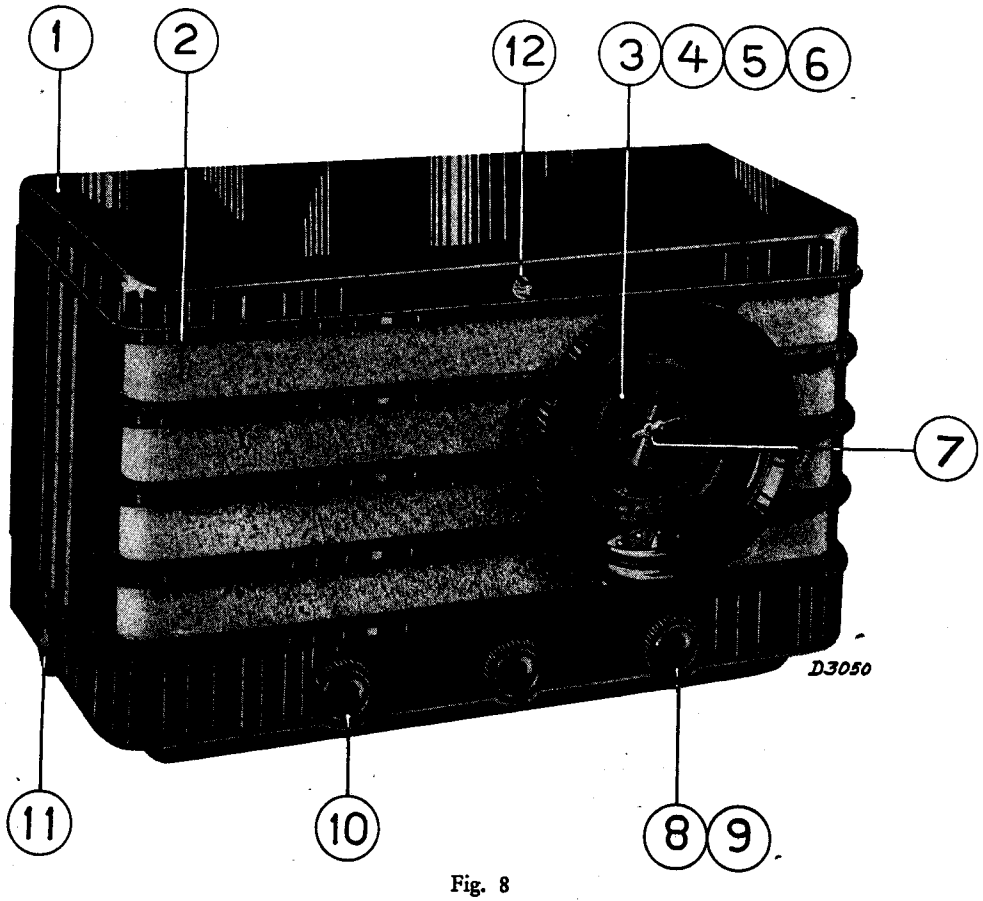
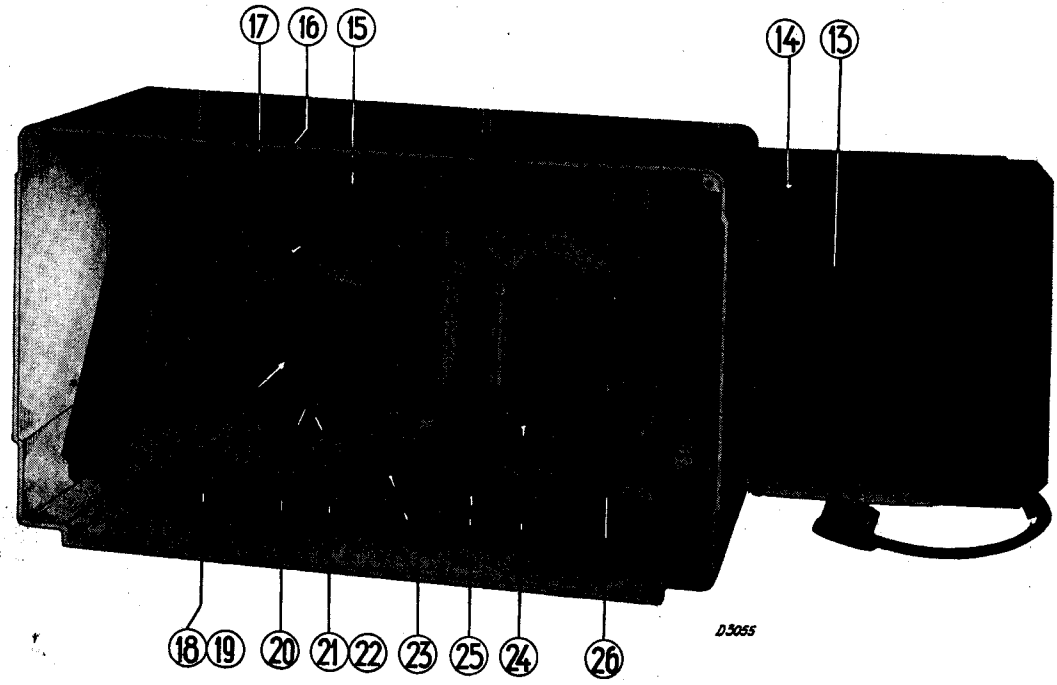

1
2
12
3
4
5
6
7
D3050
11
10
8
9

Fig. 8


17
16
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14
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D3055
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21
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23
25
24
26

Fig. 9

speaker board in such a way that the circles on the dial are concentric with the round opening in the cabinet. For this purpose the speaker board is fixed temporarily to the cabinet.
After this the reflection screen must be mounted in such a way behind the dial that the four round openings in this screen coincide with the corresponding transparent places on the glass mask. In this way the dial is in the middle behind the dial.

Changing the pointer

1. Take the set out of the cabinet (see above).
2. Remove the chassis from the speaker board (see above).
3. Unscrew from the speaker board the reflection screen behind the station name dial.
4. Loosen the set screw on the drum behind the pointer, after which the pointer can be removed.

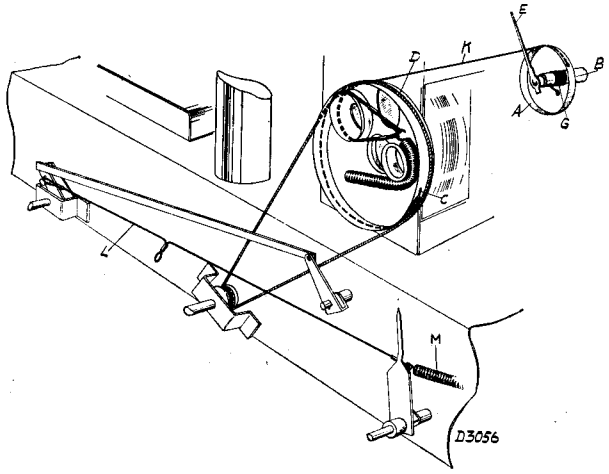


Fig. 6

Driving strings

The course of the driving strings is given in fig. 6.
The length of the cord is 49.6 cm.
The length of the string K is 18·8 cm.
The length of the string L is 25.0 cm.
These dimensions have been measured between the fixing points, so there must be added some cm. for the loops.

LOUDSPEAKER TYPE 9636.

Defects.

1. No reproduction: short-circuit or interruption in voice-coil.
2. Reproduction too weak and distorted: coil jammed.
3. Rustling: dirt in the air-gap, distorted coil, injured cone or too close connections.

Important.

1. When repairing take care for dust and iron-parts.
2. The front and rear plates may not under any circumstances be pulled of from the magnet.
3. Replace dust-cover after repair.

Centring the cone.

This can be done with 4 pertinax calibers which can be inserted between the coil and the core. A new cone can be centreed with 4 calibers and fixed with a clamping ring with incisions.

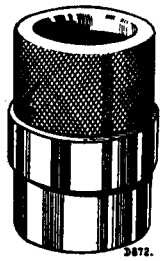
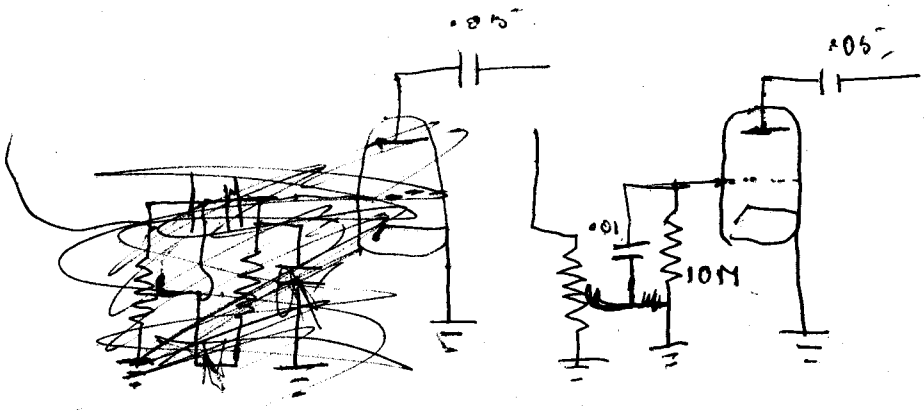
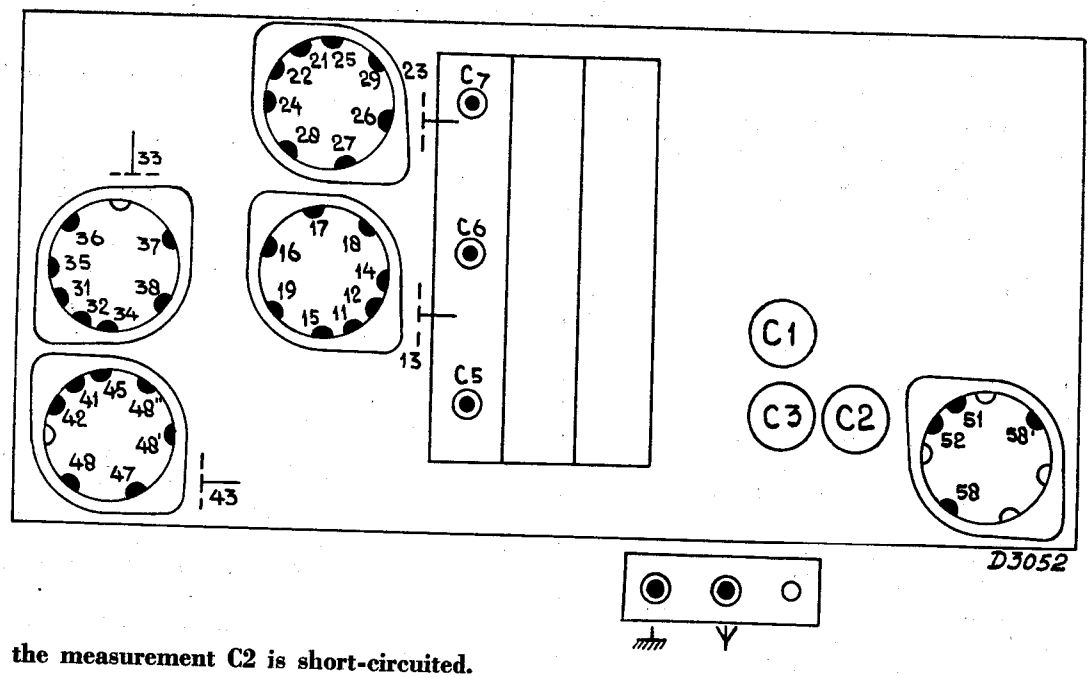


Fig. 7

For renewing the cone-carrier a special gauge is required which is placed in the airgap before loosening the three nuts (fig. 7).





During the measurement C2 is short-circuited.

RESISTANCE

12	11/ /12	21/ /22	31/ /32	41/ /42	51/ /52	14	24	34	4×Y				4×C5				16			
									SWI	SWII	MW For.	MW Loc.	SWI	SWII	MW For.	MW Loc.				
	5	5	5	5	5	5	5	5	125	225	370	215	5	30	155	155	5			
12	4×C6				28	4×29 a)					28	33/ /48''	38	45	47					
	SWI	SWII	MW For.	MW Loc.		SWI	SWII	MW For.	MW Loc.											
	10	50	155	155	215	35	75	120	120		215	210	200	5	5					
11	15	4×18				23	25	35	36		48	47/ /51	58/ /58'	58						
		SWI	SWII	MW For.	MW Loc.															
	125	90	10	275	275	85	330	280	280		335	455	275	265						
10	17	26	27 a)	37																
	155	250	85	100																
9	13	43	48'																	
	70	165	225																	

CAPACITY

12	4×C7								10											
	SWI	SWII	MW For.	MW Loc.																
	170	60	25	25																
11	17	27	37	48''					9	29	41									
	170	145	145	140						465	370									

a) C3 short-circuited.

1. No anode-current: R27, S12, S14, S16, R13, R26 interrupted; C35 short-circuited.
2. R1, R31, R34, R17 interrupted.

c. L1 and L2 have normal currents and tensions, but no radio-reception.
1. No reproduction of a modulated signal of 452 kc/s applied to the fourth grid of L2 via a condenser of 32000 μμF. S24, C18, S25, C19 interrupted or short-circuited.

2. Reproduction of an I.F.-signal applied to the fourth grid of L2, but no reproduction of a H.F.-signal applied to that grid. The oscillator is not functioning.
In none of the wavebands: C28, C7 interrupted or short-circuited; R11, R6 interrupted.
In one of the wavebands: Coils or condensers of the oscillator part in the concerning waveband defectuous.

3. Reproduction of a H.F.-signal applied to the fourth grid of L2 but no reproduction of the same signal applied to the first grid of L1.
In none of the wavebands: C6, C34, C11 interrupted or short-circuited; R7 interrupted.
In one of the wavebands: Coils or condensers between L1 and L2 in the concerning waveband defectuous.

4. Reproduction of a H.F.-signal applied to the first grid of L1 but no radio-reception.
In none of the wavebands: C5, C23 interrupted or short-circuited.
In one of the wavebands: Coils or condensers of the preselection in the concerning waveband short-circuited or interrupted.

IV. Radio and gramophone reproduction — quality bad.

A. Weak reproduction.
1. Set out of adjustment — trim.
2. Fault in the speaker or speaker transformer.
3. Abnormal voltages or currents.
4. C12, C34, C11 interrupted.

B. Distorted reproduction
1. Defective valve.
2. Fault in speaker.
3. Abnormal voltages or currents.
4. C40, C45, R40, C54, R41 interrupted or short-circuited.

C. A.V.C. not working
1. R34, R32, R31, R35, C39 interrupted.
2. C39 short-circuited.

D. Insufficient selectivity
1. Set out of adjustment — trim.
2. C18, C19, C20, C21 short-circuited or interrupted.
3. S24, S25, S26, S32, S27, S31 short-circuited or interrupted.

E. Microphonic effect
1. The chassis touches the cabinet otherwise as via the rubber tulles, for example with the knobs or with the spindles.
2. The variable condenser touches the chassis otherwise as via the rubber tulles.
3. Fault in a valve.
4. Fault in the variable condenser.

F. Hum.
1. Screenings make no contact with the chassis.
2. C1, C2 interrupted.

G. Crackling

Bad contact at a soldering place, in a switch or in a valve base.

H. The set oscillates

C36, C46, C35, C30, C43, C38 interrupted.

K. Resonances

These may be caused by loose parts, such as valve hoods, springs, terminals, etc. When the resonating part has been traced it can be fixed by means of a piece of felt.

4. Apply an I.F.-signal of 452 kc/s to the 4th grid of L2 via a condenser of 32,000 μμF.
5. Damp the second circuit by connecting a resistance of 80,000 ohms in parallel with S25. (See fig. 3).
6. Adjust successively to maximum output (S27, S31), (S26, S32) and S24. (See fig. 4).
7. Remove the damping resistance of the 2nd circuit and damp the 1st circuit by placing a resistance of 80,000 ohms in parallel with S24 (See fig. 2).
8. Adjust S25 to maximum output. (See fig. 4).
9. Seal the coil cores; remove the damping resistance.

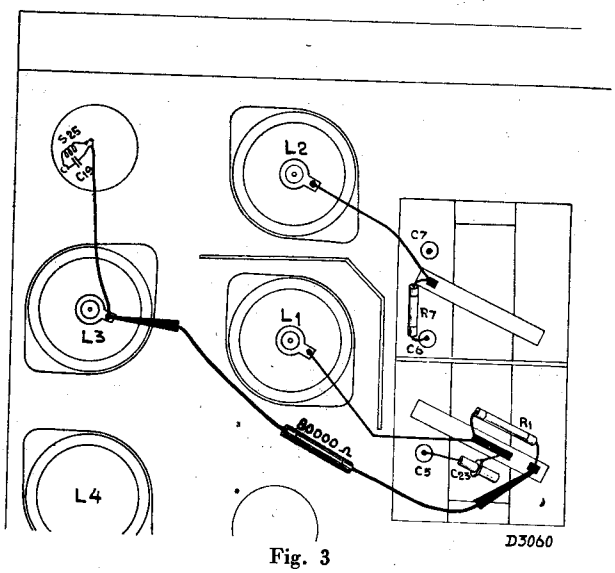


Fig. 3

B. **H.F.- and oscillator-circuits**

First short-wave Band (13.5—45 m).

1. Fit the 15° gauge. Turn the variable condenser right against the gauge. (Smallest capacity).
2. Connect the auxiliary set via a condenser of 25 μμF to the anode of L2. Connect the output indicator after the auxiliary set.
3. Short circuit C7 (see fig. 4).
4. Apply a modulated signal of 20·5 Mc/s (14·6 m) to the aerial socket of the set to be trimmed via a shortwave aerial (= red point on normal artificial aerial).
5. Tune the auxiliary receiver.
6. Trim C8 and C11 to maximum output (see fig. 4).
7. Remove the auxiliary receiver and the short-circuit of C7. Connect the output indicator via a trimming transformer to the speaker of the set to be trimmed.
8. Trim C14 to maximum output (see fig. 4). (The first maximum starting from minimum capacity is the right one).
9. Seal the trimmers; remove the 15° gauge.

Second short-wave band (45—160 m).

1. Connect the auxiliary set via a condenser of 25 μμF to the anode of L2. Connect

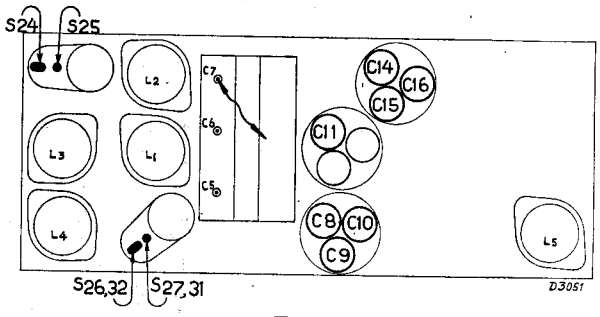


Fig. 4

the output indicator after the auxiliary receiver.
2. Short circuit C7 (see fig. 4).
3. Apply a modulated signal of 6 Mc/s (50 m) to the first grid of L1 via a short-wave aerial.
4. Tune the auxiliary set.
5. Tune the set to be trimmed with the variable condenser. (The first maximum starting from minimum condenser setting is the right one).
6. Apply the modulated signal of 6 Mc/s to the aerial socket of the set to be trimmed via a shortwave aerial. **Do not turn the variable condenser.**
7. Trim C9 to maximum output (see fig. 4).
8. Remove the auxiliary set and the short-circuit of C7. Connect the output indicator to the speaker of the set to be trimmed via a trimming transformer.
9. Trim C15 to maximum output (see fig. 4).
10. Seal the trimmers.

Medium-wave Band (160—570 m).

1. Connect the auxiliary set via a condenser of 25 μμF to the anode of L2. Connect the output indicator after the set to be trimmed.
2. Short circuit C7 (see fig. 4).
3. Turn C10 to minimum capacity (see fig. 4).
4. Apply a modulated signal of 1700 kc/s (1765 m) to the aerial socket of the set via a normal artificial aerial.
5. Tune the auxiliary set.
6. With the variable condenser of the set to be trimmed look for the first tuning, starting from the minimum condenser setting.
7. Trim C10 to maximum output.
8. Remove the auxiliary receiver and the short circuit of C7. Connect the output indicator to the speaker of the set to be trimmed via a trimming transformer.
9. Trim C16 to maximum output (see fig. 4).
10. Connect the auxiliary receiver via a condenser of 25 μμF to the anode of L2. Connect the output indicator after the auxiliary set.
11. Short-circuit C7.
12. Apply a modulated signal of 600 kc/s (500 m) to the aerial socket of the set to be trimmed.

DESCRIPTION OF CIRCUIT DIAGRAM

I. **H.F.-section**

A. **Medium wave band** (local)
Aerial circuit: S10, C44, damping-resistance R14.
1st grid circuit of L1: S11, C10, C5. Coupling with aerial circuit through coupling between S10 and S11. Coupling with 1st grid of L1 via C23.
Anode circuit of L1: S16, C13.
4th grid circuit of L2: S17, damping-resistance R18, C11, C34, C6. Coupling with anode circuit of L1 through coupling between S16 and S17. R7 prevents parasitic oscillation on ultra short waves.
1st grid circuit of L2: S23, C16, C33, C17, C7. Coupling with the first grid via C28. R11 prevents parasitic oscillation of L2.
2nd grid circuit of L2: S22, R42. Coupling with the 1st grid circuit of L2 through coupling between S22 and S23.

B. **Medium wave band** (foreign)
As medium wave band (local), but R14 no longer in parallel with S10 and R18 no longer in series with S17.

C. **2nd short wave band**
Aerial circuit: S8.
1st grid circuit of L1: S9, C9, C29, C5. Coupling with the aerial circuit through coupling between S8 and S9: Coupling with the 1st grid of L1 via C23.
Anode circuit of L1: S14.
4th grid circuit of L2: S15, C11, C34, C6. Coupling with the anode circuit of L1 through coupling between S14 and S15.
1st grid circuit of L2: S21, C15, C32, C7. Coupling with the 1st grid of L2 via C28.
2nd grid circuit of L2: S20. Coupling with the 1st grid circuit of L2 through coupling between S20 and S21.

D. **1st shortwave band**
Aerial circuit: S6.
1st grid circuit of L1: S7, C8, C5. Coupling with aerial circuit, capacitively through C12, inductively through coupling between S6 and S7. Coupling with 1st grid of L1 via C23.
Anode circuit of L1: S12, R27.
4th grid circuit of L2: S13, C11, C34, C6. Coupling with anode circuit of L1 through coupling between S12 and S13.
1ste grid circuit of L2: S19, C14, C31, C7. Coupling with 1st grid of L2 via C28.
2nd grid circuit of L2: S18. Coupling with the 1st grid circuit of L2, through coupling between S18 and S19.

II **I.F.-part**
1st I.F.-transformer: S24, C18, S25, C19.
I.F.-amplifier valve: L3.
2nd I.F.-transformer: S26, S32, C20, S31, S27, C21.

III. **Detector**
Detector circuit for I.F.: 1st diode-anode of L4, S31, (S27, C21), C38, cathode of L4.
Detector circuit for L.F. and D.C.: 1st diode-anode of L4, S31, R17, cathode L4.

IV. **L.F.-amplifier**
The L.F.-voltage on the volume control R17 is applied via R22, C40, R20 to the grid of L4. The amplified voltage reaches the speaker S30 via the speaker transformer S28, S29.
The variable tonefilter is formed by R40, C54, R41.

V. **Automatic volume control.**
The voltage at the 2nd diode-anode of L4 (this is the voltage across C39) is fed to the first grid of L3 via S25 and to the first grid of L1 via R1.
Without signal this anode is positive (via R35, R32).
With a small signal this positive voltage is reduced via R34 by a portion of the voltage across R17, that exists as a result of the detection of the I.F.-signal by the first diode of L4. The reduction of the tension on C39 is only a small one as the resistance cathode-anode (of the 2nd diode of L4) is small compared with that of R34 when the anode is positive.
With a larger signal this reduction is so great that the 2nd diode-anode of L4 becomes negative in respect of its cathode. Now the resistance cathode-anode is great in respect of R34 and therefore practically the whole voltage across R17 is applied to C39 and so to the grids of L1 and L3.

VI. **Feeding**
Feed transformer: S1, S2, S3, S4
Rectifier tube: L5
Smoothing filter: C1, R19, R8, R3, C2.
The positive voltages are tapped from condenser C2.

Voltages for L1
V_a : via R13 and S16, S14 or S12, R27; decoupled by C35.
V_{g3} : via R13; decoupled by C35.
V_{g1} : voltage drop across R26. Vide also under V (automatic volume control).

Voltages for L2
V_a : Via S24; decoupled by C2 and C36.
$V_{g3.5}$: from C1; via R9, R10; decoupled by C30.
V_{g2} : from C1; via R10; decoupled by C3.
V_{g4} : voltage drop produced by the cathode current of L2 across R5 + R23; decoupled by C27.
V_{g1} : voltage drop produced by the cathode current of L2 across R23.

Voltages for L3
V_a : via S32; decoupled by C2 and C36.
V_{g2} : via R28; decoupled by C43.
V_{g1} : voltage drop across R33; decoupled by C42. See also under V. (Automatic volume control).

Voltages for L4
V_a : via S28; decoupled by C1.
V_{g2} : from C2.
V_{g1} : voltage drop across R8, R3; decoupled by R4, C46.