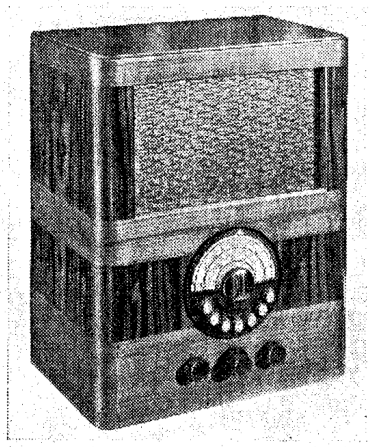
FERGUSON D531W, DR31B, D531RG



The Philco D531 W.

A MECHANICAL type of pre-set tuning is included in the Philco D531W, using a dial with seven buttons. The receiver is a 4-valve (plus rectifier) AC 3-band superhet for 200-250 V, 50-100 C/S mains.

An identical chassis is fitted in the D531B, but this has a moulded cabinet, and the chassis of the D531RG radiogram is very similar, the differences being explained under "D531RG Modifications." This *Service Sheet* was prepared on a D531W.

Release date : July, 1938, for all models.

CIRCUIT DESCRIPTION

Aerial input is via series condenser **C1** to SW coupling coil **L2**, and MW and LW coupling condenser **C2**, and thus to single-tuned circuits **L3, C32** (SW), **L4, C32** (MW) and **L5, C32** (LW). **L1** is connected across aerial circuit to suppress modulation hum.

First valve (**V1, Philco 6A7E**) is a heptode operating as frequency changer with internal coupling. Oscillator grid coils **L6** (SW), **L7** (MW) and **L8** (LW) are tuned by **C33**; parallel trimming by **C34** (SW), **C9, C35** (MW) and **C36** (LW); series tracking by **C7** (SW), **C8, C37** (MW) and **C38** (LW). Reaction by anode coil **L9** (SW only) and, via coupling condenser **C10,** direct coupling to coils **L6** (SW), **L7** (MW) and **L8** (LW).

Second valve (**V2, Philco 78E**) is a variable-mu RF pentode, employed here with a fixed mean grid potential, operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C39, C4, L10, L11, C5, C40** and **C41, L12, L13, C42.**

Intermediate frequency 475KC/S.

Diode second detector is part of double diode triode valve (**V3, Philco 75**). Audio frequency component in rectified output is developed across load resistances **R8, R9** and passed via AF coupling condenser **C15** and manual volume control **R7** to CG of triode section, which operates as AF amplifier. IF filtering by **C13, R6, C14.** Provision for connection of gramophone pick-up across **C15, R7** via **S11** and **R8.**

The resistances **R10, R11** and **R12** in **V3** cathode circuit, though necessarily interdependent, perform three separate functions. **R10** is included to provide a common impedance in the valve circuit and the negative feed-back circuit and contributes a negligible addition to the DC potential of the cathode. **R11,** by-passed to AF by **C16,** develops between its ends a DC potential difference which is employed as triode section GB. **R12** is employed to provide an additional potential difference which, together with that across **R11,** is part of the AVC delay voltage.

Second diode of **V3,** fed from **L13** via **C18,** provides DC potential which is developed across load resistance **R16** and fed back through a decoupling circuit as GB to frequency changer valve to give AVC.

Resistance-capacity coupling by **R14, C20** and **R17** between **V3** triode and pentode output valve (**V4, Philco 42E**). IF filtering in grid circuit by **C21.** Tone control by **R19, S12, C23** in anode circuit and negative feed back from potentiometer **R18** across speech coil circuit, via **C19** to cathode circuit of **V3.** These two controls are ganged so that when the control knob is turned fully anti-clockwise **S12** is opened and the slider of **R18** is at its low potential position and no feed-back occurs. When the knob is turned clockwise **S12** closes, short-circuiting **R19** between **V4** anode and **C23,** and increasing the high-note attenuation, and **R18** slider begins to obtain a potential above chassis, which is applied to **V3** cathode, this portion of the speech coil voltage being progressively increased as the control is rotated further clockwise.

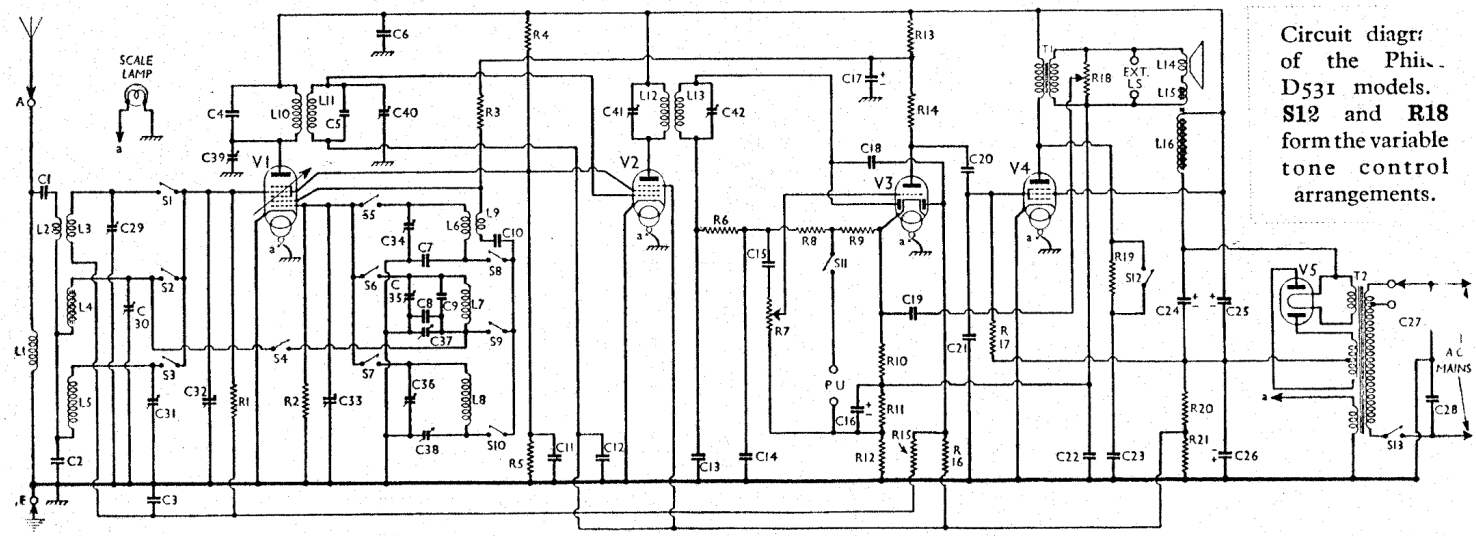
HT current is supplied by full-wave rectifying valve (**V5, Philco 80**). Smoothing is effected by speaker field **L16** and electrolytic condensers **C24, C25.**

Fixed GB for **V1** and **V2,** which also forms part of the AVC delay voltage in addition to that developed in **V3** cathode circuit, and GB for **V4** is automatically obtained from drop along resistances **R20, R21** forming a potential divider in negative HT lead to chassis.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)*
R1	V1 tetrode CG resistance ..	1,500,000
R2	V1 osc. CG resistance	70,000
R3	V1 osc. anode HT feed	25,000
R4	V1, V2 SG's HT feed potential divider	51,000
R5		150,000
R6	IF stopper	51,000
R7	Manual volume control	500,000
R8	V3 signal diode load and PU feed resistances	200,000
R9		40,000
R10	Negative feed-back coupling ..	120
R11	V3 triode GB and AVC delay resistances	4,000
R12		20,000
R13	V3 triode and V1 osc. anodes decoupling	6,000
R14	V3 triode anode load	250,000
R15	AVC line decoupling	1,000,000
R16	V3 AVC diode load	1,000,000
R17	V4 CG resistance	1,000,000
R18	Variable negative feed-back control	1,000
R19	Part of tone control filter ..	15,000
R20	V1 fixed GB; V2, V3 triode and V4 GB and AVC delay resistances	200
R21		70

* See "General Notes" for divergencies.



Circuit diagram of the Philco D531 models. **S12** and **R18** form the variable tone control arrangements.

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	CONDENSERS	Values (μF)
C1	Aerial series condenser	0·006
C2	Aerial MW and LW coupling ..	0·00225
C3	V1 tetrode CG decoupling ..	0·04
C4	1st IF trans. pri. timmer.. ..	0·000115
C5	1st IF trans. sec. trimmer ..	0·00005
C6	HT circuit RF by-pass	0·25
C7	Osc. circuit SW tracker	0·0025
C8	Osc. circuit MW tracker	0·00025
C9	Osc. circuit MW fixed trimmer ..	0·000012
C10	V1 osc. anode coupling	0·0008
C11	V1, V2 SG's decoupling	0·05
C12	V2 CG decoupling	0·015
C13, C14	IF by-pass condensers ..	0·00011, 0·00011
C15	AF coupling to V3 triode.. ..	0·1
C16*	V3 cathode AF by-pass	60·0
C17*	V1 osc. and V3 triode anodes decoupling	16·0§
C18	Coupling to V3 AVC diode ..	0·00011
C19	Negative feed-back coupling ..	0·25
C20	V3 triode to V4 AF coupling ..	0·01
C21	V4 CG IF by-pass	0·00025
C22	V3 cathode RF by-pass	0·05
C23	Part of tone control filter.. ..	0·01
C24*, C25*	HT smoothing	8·0, 8·0
C26*	Auto GB circuit by-pass	35·0
C27, C28	Mains circuit RF by-pass condensers	0·015, 0·015
C29‡	Aerial circuit SW trimmer ..	0·00003
C30‡	Aerial circuit MW trimmer ..	0·00003
C31‡	Aerial circuit LW trimmer ..	0·00011
C32†	Aerial circuit tuning	—
C33†	Oscillator circuit tuning	—
C34‡	Osc. circuit SW trimmer	0·00003
C35‡	Osc. circuit MW trimmer.. ..	0·00003
C36‡	Osc. circuit LW trimmer	0·00011
C37‡	Osc. circuit MW tracker	0·0001
C38‡	Osc. circuit LW tracker	0·0001
C39‡	1st IF trans. pri. tuning	—
C40‡	1st IF trans. sec. tuning	—
C41‡	2nd IF trans. pri. tuning.. ..	—
C42‡	2nd IF trans. sec. tuning.. ..	—

* Electrolytic. † Variable. ‡ Pre-set. § 8 μF+8 μF.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Modulation hum suppressor ..	25·0
L2	Aerial SW coupling coil	0·15
L3	Aerial circuit SW tuning coil ..	Very low
L4	Aerial circuit MW tuning coil ..	3·5
L5	Aerial circuit LW tuning coil ..	45·0
L6	Osc. circuit SW tuning coil ..	0·05
L7	Osc. circuit MW tuning coil ..	5·0
L8	Osc. circuit LW tuning coil ..	25·0
L9	Oscillator SW reaction	0·5
L10	1st IF trans. Pri.	8·0
L11	1st IF trans. Sec.	12·0
L12	2nd IF trans. Pri.	12·0
L13	2nd IF trans. Sec.	8·0
L14	Speaker speech coil	2·0
L15	Hum neutralising coil	0·15
L16	Speaker field coil	1,140·0
T1	Speaker input trans. Pri. ..	500·0
	Speaker input trans. Sec. ..	0·2
T2	Mains trans. Pri., total ..	20·0
	Mains trans. Heater sec. ..	0·2
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	480·0
S1–S10	Waveband switches	—
S11	Gram. pick-up switch	—
S12	Tone control switch, ganged R18	—
S13	Mains switch, ganged R7	—

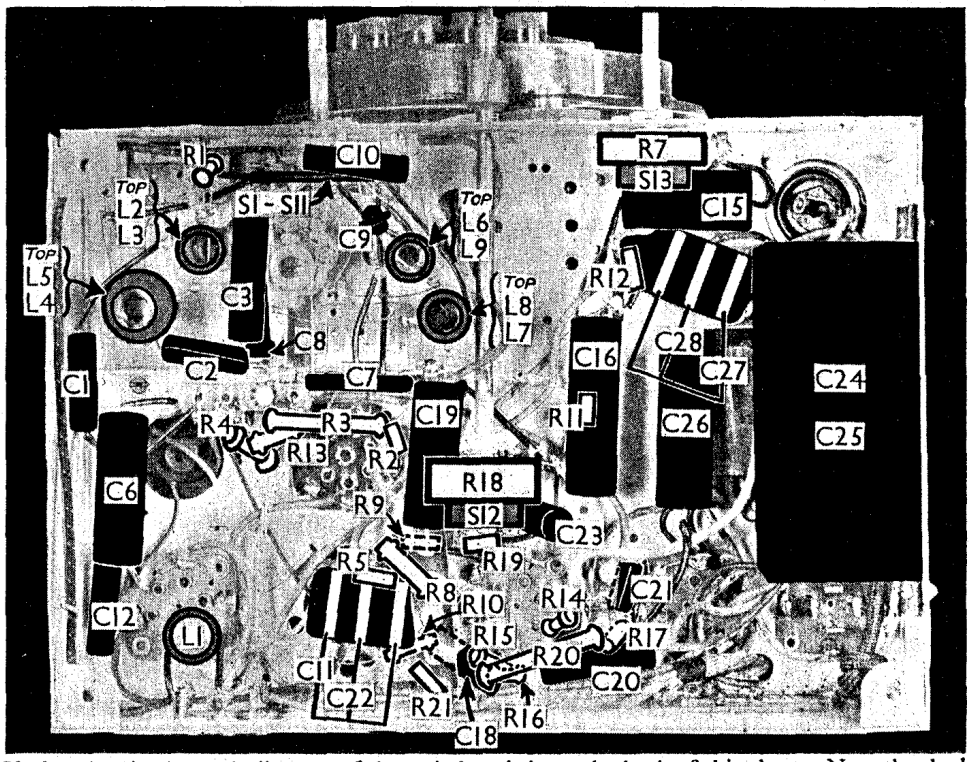
DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the four knobs (pull off) and the four self-tapping bolts (with washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, make sure that there is a rubber washer on each of the fixing bolts, between the chassis and the bottom of the cabinet.

To free the chassis entirely, unsolder the speaker leads and *when replacing*, connect them as follows, numbering the terminals from left to right:—1 (socket), red; 2 (socket), black; 3 (tag), white; 4 (tag), green; 5 (tag), green/white.

Removing Speaker.—If it is necessary to remove the speaker from the cabinet, remove the nuts and spring washers from the four screws holding the speaker to the sub-baffle. *When replacing*, see that the transformer is at the bottom.



Under-chassis view. A diagram of the switch unit is on the back of this sheet. Note the dual condensers **C11, C22** and **C27, C28.**

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 232 V, using the 231-260 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6A7E ..	247	1·9	78	2·1
	Oscillator 117	3·5		
V2 78E ..	247	3·3	78	0·8
V3 75 ..	80	0·3	—	—
V4 42E ..	220	36·0	247	7·6
V5 80 ..	312†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches. — S1-S10 are the waveband switches, and **S11** the gramophone pick-up switch, ganged in a single rotary unit beneath the chassis. This is indicated in the under-chassis view, and shown in detail in the diagram on the back of this sheet, where it is drawn as seen looking from the rear of the underside of the chassis. Note that the contacts of **S4** and **S11** are on the back of the unit, when looking in the direction indicated.

The table on the back of this sheet gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C,** closed.

S12 is the QMB tone control switch, ganged with **R18.** At the minimum (anti-clockwise) position of the control **S12** opens, and puts **R19** in circuit.

S13 is the QMB mains switch, ganged with the volume control **R7.**

Coils.—L1; L2, L3; L4, L5; L6, L9 and **L7, L8** are in five unscreened units beneath the chassis. **L1** is across the **A** and **E** sockets, while the other units are near the wave-change switch unit.

The IF transformers **L10, L11** and **L12, L13** are in two screened units on the chassis deck, with their associated trimmers and certain other components.

Scale Lamp.—This is a Tung-Sol miniature bayonet-cap type, with a tubular bulb. It is rated at 6·3 V, 0·35 A (Philco part number 34-2141).

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-3 Ω) external speaker.

Condensers C24, C25.—These are two 8μF (475 V DC working) dry electrolytics, in a single carton beneath the chassis, having a common negative (black) lead. The red lead is the positive of **C24** and the yellow lead the positive of **C25.**

Condenser C17.—In our chassis, this consists of two 8 μF electrolytics in a tubular metal unit on the chassis deck, the two sections being connected in parallel to give 16 μF. The can is negative. In some chassis a single 16 μF condenser may be employed.

Condensers C11, C22, C27, C28.—These are in two black moulded dual units, each unit having one tag common to its two condensers.

Chassis Divergencies.—These are mainly in the types and values of components.

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C17 may be one 16 μF unit, instead of two 8μF units in parallel.

C12 has alternative values of 0·01, 0·015, 0·03 and 0·05 μF.

C8 in our chassis was a 0·00025 μF tubular ceramic condenser, but it may consist of a 0·00022 μF and a 0·000025 μF in parallel.

C18 has alternative values of 0·0001, 0·00011, 0·00012 or 0·00014 μF.

C20 may be 0·008 μF, not 0·01 μF as in our chassis. **C21** may be 0·00024 μF, not 0·00025 μF. **C27** and **C28** may be 0·05 μF each, not 0·015 μF.

Alternative values for certain resistors are: **R2,** 65,000, 70,000 or 75,000 O; **R5,** 150,000 or 160,000 O; **R8,** 200,000, 240,000 or 250,000 O; **R12,** 20,000 or 25,000 O; **R13,** 5,000, 6,000 or 6,500 O; **R15** and **R16,** 1,000,000 or 1,500,000 O; **R21,** 63, 65 or 70 O.

D531B AND D531W MODIFICATIONS

The only difference between the D531B (bakelite cabinet) and D531W (wooden cabinet) is that the former has a 6-in. speaker, while the latter has an 8-in. speaker.

D531RG MODIFICATIONS

This is fitted with an 8-in. speaker, a gramophone motor and a pick-up (2,000 O resistance). The voltage range is the same as for the table models, but the frequency range is 50-60 C/S, not 50-100 C/S.

CIRCUIT ALIGNMENT

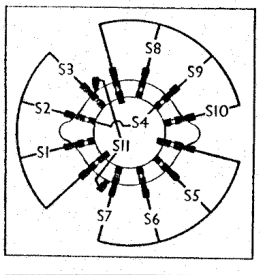
IF Stages.—Switch set to MW, turn volume control to maximum and tone control fully anti-clockwise. Connect signal generator to control grid (top cap) of **V1** and chassis, leaving existing top cap connection in place. Feed in a 475 KC/S signal, and adjust **C42, C41, C40** and **C39** for maximum output.

RF and Oscillator Stages.—See that the light slot and pilot light are so disposed that the line of light on the scale coincides at one end with the letter "D" in Daventry (SW scale, about 16·5 MC/S) and at the other end with the letters "OR" in R. Normandie. Two dots mark the position on the scale.

Open the gang to its fullest extent, insert a 0·006-in. feeler gauge under the heel of the moving vanes, and close the gang on to the gauge. With gang in this position, check that indicator covers the "E" in R. Normandie. Remove feeler gauge.

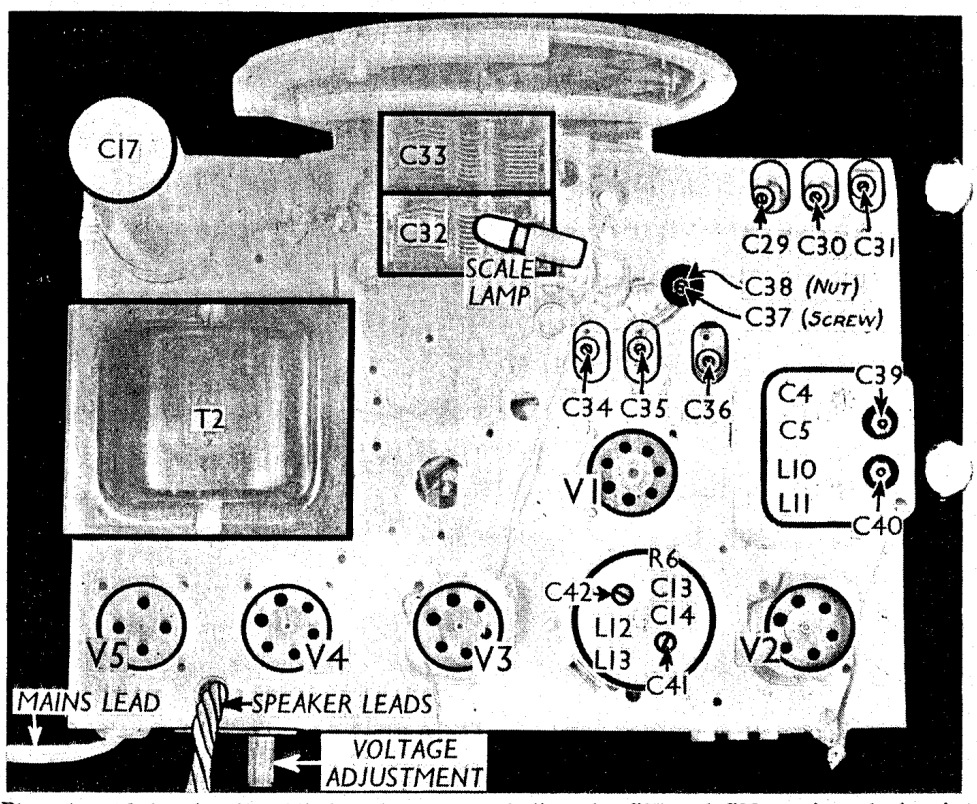
Connect signal generator via standard dummy aerial to **A** and **E** sockets. Keep volume control at maximum and tone control fully anti-clockwise.

SWITCH DIAGRAM AND TABLE



Switch diagram, looking from the rear of the underside of the chassis.

Switch	LW	MW	SW	Gram
S1	—	—	C	—
S2	—	C	—	—
S3	C	—	—	—
S4	C	—	—	—
S5	—	—	C	—
S6	—	C	—	—
S7	C	—	—	—
S8	—	—	C	—
S9	—	C	—	—
S10	C	—	—	—
S11	—	—	—	C



Plan view of the chassis. All the trimmers are indicated. **C37** and **C38** are in a dual unit.

MW.—Switch set to MW, and turn gang to 214 m (dot on scale under "R. Normandie.") Feed in a 214 m (1,400 KC/S) signal and adjust **C35,** then **C30,** for maximum output.

Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C37** (screw) for maximum output, while rocking the gang for optimum results. Re-adjust **C35** at 214 m and **C37** at 500 m until no further improvement results.

LW.—(a) With set switched to MW, feed in a 285·7 m (1,050 KC/S) signal (corresponding to West of England Regional) and tune it in. Keep gang in this position, and switch set to LW.

(b) Feed in a 1,293 m (232 KC/S) signal (corresponding to Luxembourg) and adjust **C36,** then **C31,** for maximum output.

(c) Feed in a 1,875 m (160 KC/S) signal, tune it in, and adjust **C38** (nut) for maximum output, rocking the gang for optimum results.

Repeat (a) and (b), then repeat (c), (a) and (b) in that order until no further improvement results. This method of LW alignment is necessary to ensure the accurate coincidence of MW and LW stations on certain of the press-buttons.

SW.—Switch set to SW, and use a 400 O resistor as a dummy aerial. Tune to 18MC/S on scale, feed in a 16·7 m (18 MC/S) signal, and adjust **C34** for maximum output on the higher frequency peak (the second one encountered on unscrewing **C34** from its maximum position). The adjustment of **C29** may be affected by "pulling" of the circuits, so proceed as follows: shunt a 0·00035 μF variable condenser across **C33,** and tune it so that the second harmonic instead of the fundamental beats with the 18 MC/S signal, then adjust **C29** for maximum output. Disconnect shunt condenser, and re-adjust **C34.** Check that the 18 MC/S image is obtained at about 17·1 MC/S. Check sensitivity and calibration also at 6 MC/S.

AUTOMATIC DIAL

A special tool is supplied for adjusting the buttons, for which operation both hands must be used. In the event of any difficulty being experienced at any stage of the procedure described below, tighten the button and start again.

First turn the wave-change switch to the appropriate band, tune in the required station and prise out the station name-tab from the button nearest to the bottom by inserting a pin in the hole in the centre of the tab.

Then insert the prongs of the tool in the two holes in the button, press the button, rotate the dial until a click is heard and give the tool one turn in an anti-clockwise direction to loosen the button, but do unscrew beyond this point.

Next, holding the button depressed with the finger and thumb of the free hand, insert the blade of the tool in the screw head in the centre of the button, turn the screw (and thus the dial) until the required station is properly tuned in and keeping the blade of the tool pressed in and steady, tighten the button itself by clockwise rotation with the finger and thumb of the other hand.

Now complete the tightening of the button by inserting the prongs of the tool in two holes and giving a final twist, check setting by turning the dial, pressing the button and swinging the button towards the bottom until a click is heard and, if satisfactory, insert the appropriate name-tab, a selection of which is supplied with the set.

For a detailed description of the construction of the dial reference should be made to the *Radio Maintenance Supplement*, dated May 14, 1938.