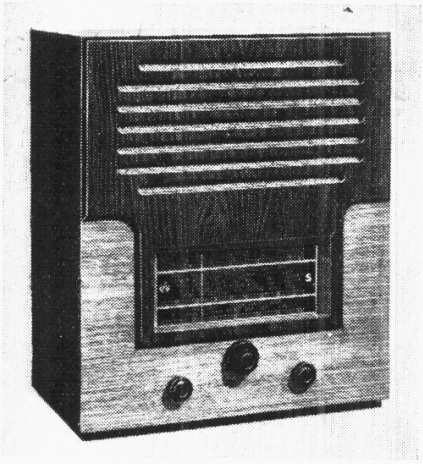
Supplement to The Wireless & Electrical Trader, January 25, 1941

"TRADER" SERVICE SHEET

503

PILOT 455

AC/DC SUPERHET



PROVISION by means of jack-type switched sockets for connection of an external speaker and a gramophone pick-up is made in the Pilot 455 superhet.

The receiver is a 4-valve (plus valve rectifier) 3-band table model, designed to operate from AC or DC mains of 200-250v, 25-100 C/S. SW range is 13.5-50 m.

Release date : *September*, 1940.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (SW), **L2** (MW) and **L3** (LW) to single tuned circuits **L4, C26** (SW), **L5, C26** (MW) and **L6, C26** (LW). The SW tuning coil is connected directly to **V1** control grid and **C26** at one end, while on SW the other (low potential) end is connected to chassis via the switch **S10.** On MW and LW, however, the tuning coils **L5** and **L6** are connected via switches **S8** and **S9** respectively and **L4,** which has a negligible impedance on these bands, to **V1** and **C26.**

First valve **(V1, Brimar 6K8G)** is a triode-hexode operating as frequency changer with internal coupling. Although it is not obvious in the diagram, the two sections of the valve are disposed on opposite sides of the cathode. The oscillator grid surrounds the cathode, so that it is included in each of the cathode streams so formed (i.e., one on either side of the cathode), and thus establishes the coupling between the two sections.

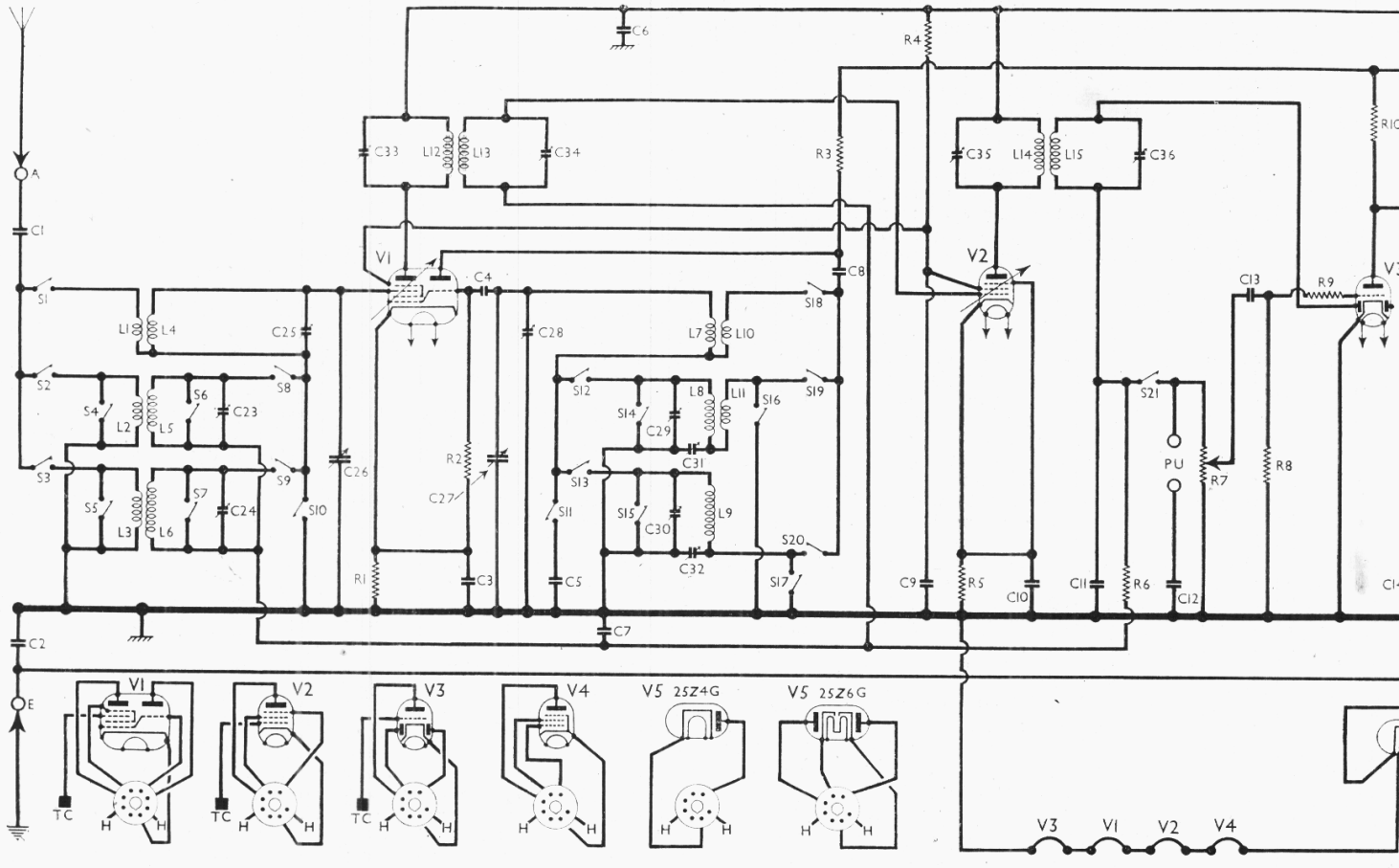
Oscillator grid coils **L7** (SW), **L8** (MW) and **L9** (LW) are tuned by **C27.** Parallel trimming by **C28** (SW), **C29** (MW) and **C30** (LW); series tracking by **C5** (SW), **C31** (MW) and **C32** (LW). Reaction coupling by **L10** (SW), **L11** (MW) and common impedance of trackers.

As will be seen from the diagram, the switching arrangement in the tuning circuit is similar to that employed in the aerial circuit, **L7** being connected to its tracker **C5** via switch **S11** on the SW band, and **L8** and **L9** respectively to the oscillator control grid and **C27** via **L7** on the MW and LW bands.

Second valve **(V2, Brimar 6U7G)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C33, L12, L13, C34** and **C35, L14, L15, C36.**

Intermediate frequency 451 KC/S.

Diode second detector is part of double diode triode valve **(V3, Brimar 6Q7G)** in which one diode only is used. Audio fre-



Circuit diagram of the Pilot 455 AC/DC superhet. Valve base diagrams are shown beneath the circuit diagram; the 25Z6

quency component in rectified output is developed across the manual volume control **R7,** which also operates as load resistance, and passed via AF coupling condenser **C13,** CG resistance **R8** and grid stopper **R9** to control grid of triode section, which operates as audio frequency amplifier. Grid bias potential for **V3** triode is developed across **R8,** which has a very high value, by the small grid current flowing through it.

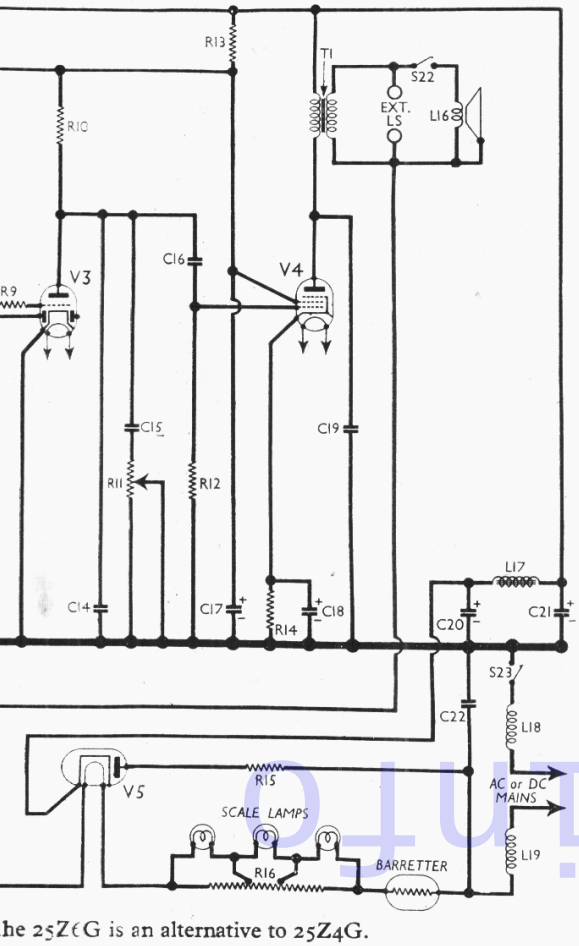
IF filtering by **C11** in the diode circuit, **R9** in triode CG circuit and **C14** in triode anode circuit. Variable tone control by **C15, R11** in triode anode circuit.

A jack-type socket incorporating switch **S21** makes provision for connection of a gramophone pick-up whose plug, when inserted and turned a little, causes **S21** to open and break the diode circuit, thus muting radio. The "Earthy" pick-up socket is returned to chassis via the condenser **C12,** which isolates it from the mains.

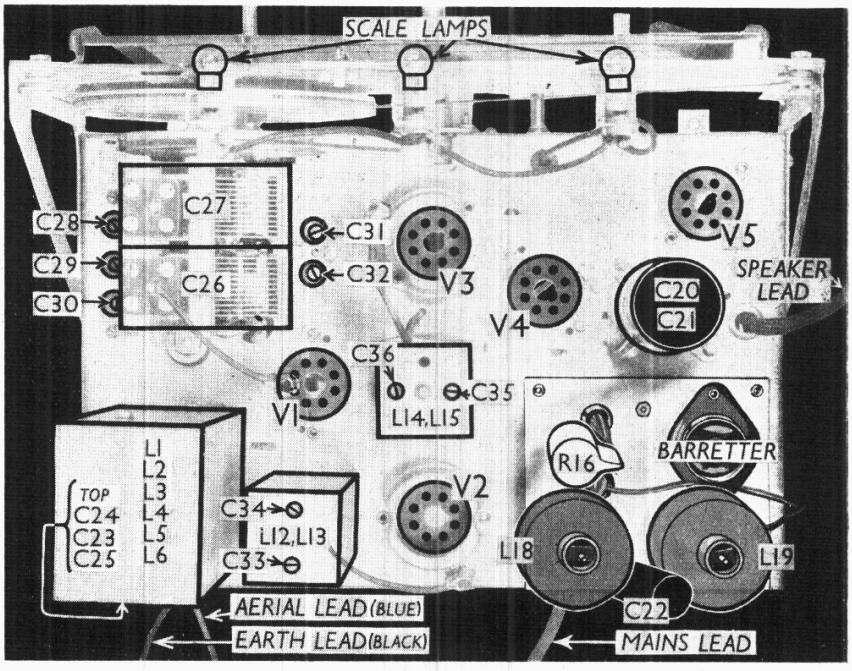
DC potential developed across **R7** is tapped off and fed back through decoupling circuit **R6, C7** as GB to frequency changer (except on SW) and IF amplifier valves, giving automatic volume control.

Resistance-capacity coupling by **R10, C16** and **R12** between **V3** triode and pentode output valve **(V4, Brimar 25A6G).**

Fixed tone correction by **C19** in **V4** anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1** by means of a second jack-type



The 25Z6G is an alternative to 25Z4G.



Plan view of the chassis. All the pre-set trimmer and tracker adjusting screws are indicated here, although some of these condensers appear again in the under-chassis view.

socket like that used for the pick-up. In this case, when the plug is turned, **S22** opens to mute the internal speaker.

The common junction of **T1** secondary, the speech coil **L16** and one of the external speaker sockets, is joined to the internal speaker frame and connected directly to the earth lead, so that the whole is isolated from chassis and the mains, and is as safe to handle as would be that in an AC receiver.

When the receiver is used with AC mains, HT current is supplied by the IHC rectifying valve **(V5, Brimar 25Z4G** or **25Z6G),** which with DC mains behaves as a low resistance. The holder is wired for the 25Z6G, which is of the voltage-doubler type, but the pin connections are such that either valve will operate in it as a half-wave rectifier. Smoothing is effected by the iron-cored choke **L17** in conjunction with the dry electrolytic condensers **C20, C21.**

Valve heaters, together with the scale lamps and their shunt resistance **R16,** and the current regulating barretter **(Barretter, Osram 304),** are connected in series across the mains input. Filter circuit, comprising air-cored chokes **L18, L19** and condenser **C22,** suppresses mains interference. HT circuit RF filtering by **C6.**

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on AC mains of 233 V.

The receiver was tuned to the lowest wavelength on the medium wave 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	6K8G	195	0·8	60	3·5
		Oscillator			
		63	2·6		
V2	6U7G	195	4·6	60	1·2
V3	6Q7G	46	0·35	—	—
V4	25A6G	182	36·0	148	7·1
V5	25Z4G	217†	—	—	—

† Cathode to chassis, DC.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial isolating condenser	0·0001
C2	Earth isolating condenser	0·025
C3	V1 cathode by-pass	0·05
C4	V1 osc. CG condenser	0·00006
C5	Osc. circuit SW tracker	0·006
C6	HT circuit RF by-pass	0·05
C7	AVC line decoupling	0·05
C8	V1 osc. anode coupling	0·00015
C9	V1, V2 SG's decoupling	0·05
C10	V2 cathode by-pass	0·05
C11	IF by-pass	0·00015
C12	PU isolating condenser	0·025
C13	AF coupling to V3 triode	0·001
C14	IF by-pass	0·0004
C15	Part of variable tone control	0·01
C16	V3 triode to V4 AF coupling	0·01
C17*	V1 osc. anode, V3 triode anode and V4 SG decoupling	8·0
C18*	V4 cathode by-pass	25·0
C19	Fixed tone corrector	0·002
C20*	HT smoothing condensers	8·0
C21*	HT smoothing condensers	16·0
C22	Mains RF by-pass	0·1
C23‡	Aerial circuit MW trimmer	0·00005
C24‡	Aerial circuit LW trimmer	0·00014
C25‡	Aerial circuit SW trimmer	0·00003
C26†	Aerial circuit tuning	—
C27†	Oscillator circuit tuning	—
C28‡	Osc. circuit SW trimmer	0·00004
C29‡	Osc. circuit MW trimmer	0·00005
C30‡	Osc. circuit LW trimmer	0·0002
C31‡	Osc. circuit MW tracker	0·0007
C32‡	Osc. circuit LW tracker	0·0003
C33‡	1st IF trans. pri. tuning	—
C34‡	1st IF trans. sec. tuning	—
C35‡	2nd IF trans. pri. tuning	—
C36‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 fixed GB resistance ...	220
R2	V1 osc. CG resistance ...	47,000
R3	V1 osc. anode HT feed ...	33,000
R4	V1, V2 SG's HT feed ...	33,000
R5	V2 fixed GB resistance ...	220
R6	AVC line decoupling ...	1,000,000
R7	Manual volume control; V3 signal diode load ...	1,000,000
R8	V3 triode CG resistance...	9,500,000
R9	V3 triode grid stopper ...	47,000
R10	V3 triode anode load ...	270,000
R11	Variable tone control ...	1,000,000
R12	V4 CG resistance... ...	270,000
R13	V1 osc. anode, V3 triode anode and V4 SG HT feed	4,700
R14	V4 GB resistance ...	470
R15	V5 anode surge limiter ...	100
R16	Scale lamps shunt resistance, total	120*

* Tapped at 40 Ω intervals.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil...	1·0
L2	Aerial MW coupling coil...	20·0
L3	Aerial LW coupling coil...	100·0
L4	Aerial SW tuning coil ...	Very low
L5	Aerial MW tuning coil ...	1·4
L6	Aerial LW tuning coil ...	16·0
L7	Osc. circuit SW tuning coil	Very low
L8	Osc. circuit MW tuning coil	6·0
L9	Osc. circuit LW tuning coil	16·0
L10	Osc. SW reaction coil ...	0·1
L11	Osc. MW reaction coil ...	0·8
L12	1st IF trans. Pri. ...	3·5
L13	1st IF trans. Sec. ...	3·5
L14	2nd IF trans. Pri. ...	11·0
L15	2nd IF trans. Sec. ...	11·0
L16	Speaker speech coil ...	1·4
L17	HT smoothing choke ...	390·0
L18	Mains filter chokes ...	5·5
L19	Mains filter chokes ...	5·5
T1	Speaker input trans. Pri. ...	330·0
	Speaker input trans. Sec. ...	0·3
S1-S20	Waveband switches ...	—
S21	Radio muting switch ...	—
S22	Speaker muting switch ...	—
S23	Mains switch, ganged R11	—

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off) from the front of the cabinet;

free the speaker lead from the wire staple on the side of the cabinet;

remove the four screws (with washers and lock-washers) holding the chassis to the bottom of the cabinet, having first removed the tacks holding down the insulated covering strips.

The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder from the speaker transformer the five leads, emerging from the braided cable, connecting it to the chassis.

When replacing, the leads should be connected as follows, numbering the tags on the speaker transformer from top to bottom :

1, green;
2, black;
3, red/blue;
4, blue;
5, red.

When replacing the fixing bolts, do not omit to fit to each one an insulating strip after the two washers, and to tack down the strips so that they cover the screw heads.

Note, also, that a felt washer should be fitted to each control spindle, between the knob and the cabinet.

Removing Speaker.—Unsolder the five connecting leads from the speaker transformer;

slacken the four clamp nuts (with lock-washers) until the clamps can be swivelled, remove two adjacent nuts and withdraw the speaker assembly.

When replacing, see that the transformer is on the right, and connect the leads as previously indicated.

GENERAL NOTES

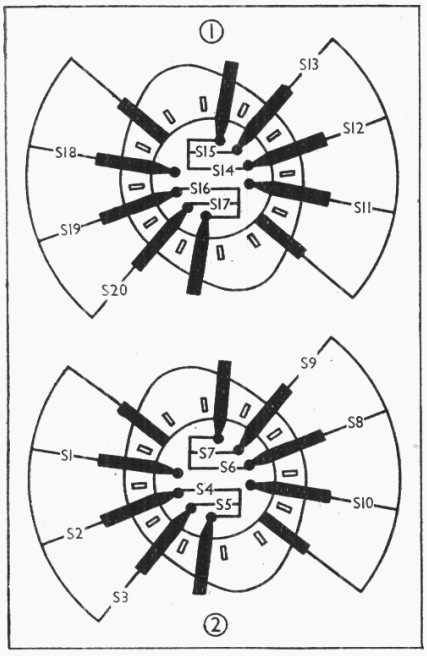
Switches.—**S1-S20** are the waveband switches, in two ganged rotary units beneath the chassis. They are indicated by arrows and numbered circles in our under-chassis view and shown in detail in the diagrams below, where they are viewed as seen from the rear of the underside of the chassis.

The table (col. 3) gives the switch positions for the three waveband settings starting from fully anti-clockwise. A dash indicates open, and **C,** closed.

S21.—This is the radio muting switch, of the rotary type, associated with the pick-up sockets at the rear of the chassis. **S21** is normally closed, but when the two-pin pick-up plug is inserted and rotated anti-clockwise, it opens **S21** and so mutes radio by breaking the diode circuit at the junction of **L15** and **R7.** When the pick-up plug is rotated clockwise or withdrawn **S21** closes for radio operation, although unless the plug is actually withdrawn the pick-up winding will remain connected across **R7.**

S22.—This switch is another of the same type as **S21,** but this time it is associated with the external speaker sockets. When the external speaker plug is inserted in the sockets and turned anti-clockwise, **S22** opens and mutes the internal speaker by breaking the connection between **T1** secondary and the internal speaker speech coil **L16.** When the plug is turned clockwise, however, **S22** closes, and both speakers operate together.

S23.—This is the QMB mains switch, ganged with the variable tone control **R11.**



Diagrams of the two switch units, viewed in the direction of the arrows in the under-chassis view.

Coils.—All the aerial coupling and tuning coils, **L1, L2, L3, L4, L5** and **L6,** are contained in a single screening can, with their associated trimmers, mounted on the chassis deck. This is indicated in our plan view, where the positions of the trimmers are indicated by an arrow.

Switch Table

Switch	SW	MW	LW
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	C	—	—
S5	C	C	—
S6	C	—	—
S7	C	C	—
S8	—	C	—
S9	—	—	C
S10	C	—	—
S11	C	—	—
S12	—	C	—
S13	—	—	C
S14	C	—	—
S15	C	C	—
S16	C	—	—
S17	C	C	—
S18	C	—	—
S19	—	C	—
S20	—	—	C

The IF transformers **L12, L13** and **L14, L15** form two further screened units on the chassis deck with their associated trimmers.

The oscillator coils **L7, L10; L8, L11;** and **L9** are in three unscreened units beneath the chassis. They are mounted horizontally on the front chassis member and are shown in our under-chassis view, where they are seen grouped round the front switch unit.

L17 is the iron-cored HT smoothing choke seen in the under-chassis view.

The air-cored chokes **L18, L19** form part of the mains input filter. They are mounted unscreened on vertical formers and are shown in our plan view.

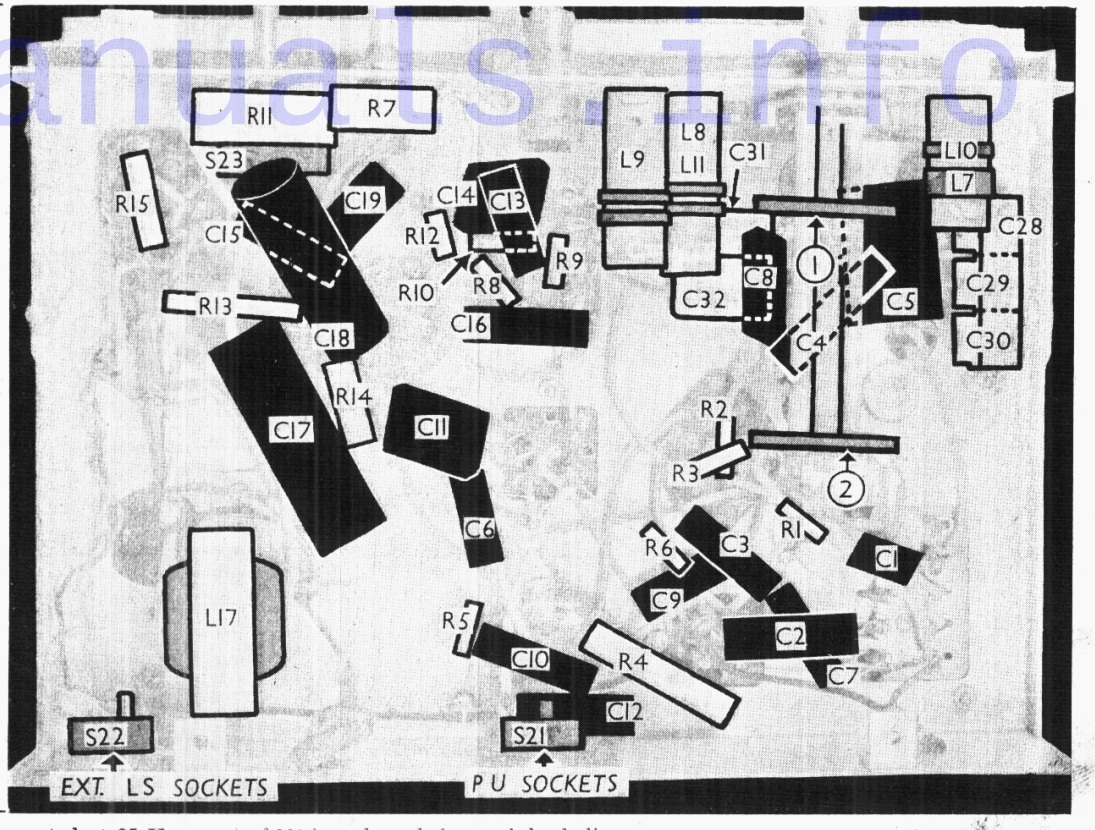
Scale Lamps.—These are three Ever-Ready MES types with spherical bulbs, rated at 6.2v, 0.3A. They are wired in series with the heater circuit, and are shunted by the tapped resistance **R16,** each section of which shunts a single lamp. The lamp holders are insulated from chassis.

External Speaker.—Sockets incorporating a switching device are provided at the rear of the chassis for a low impedance (about 4 Ω) external speaker. Since **T1** secondary circuit is isolated from chassis and connected directly to earth, normal extension leads may safely be used. See also under "Switches."

Gramophone Pick-up.—Another pair of sockets incorporating a switching device are fitted at the rear of the chassis for connection of a gramophone pick-up, which should be of the high-impedance type. See also under "Switches."

Condenser C17.—This is a Hunt's dry electrolytic condenser in a tubular cardboard container, mounted on its connecting leads. It is rated at 8 μF, 175 peak volts.

Condenser C18.—This is also a dry electrolytic in a tubular cardboard container, mounted on its connecting leads. It is



Under - chassis view. The two waveband switch units are indicated here, and shown in detail in the diagrams in column 2 opposite. The pick-up and external speaker sockets, with their associated switches **S21** and **S22**, and the oscillator pre-set trimmers and trackers are also indicated. The adjusting screws of the pre-set condensers are shown in the plan view.

a 25 μF Plessey condenser, rated at 25 V working and 35 V surge.

Condensers C20, C21.—These are two dry electrolytics in a single tubular metal container, mounted vertically on the chassis deck and shown in our plan view. They are rated at 450 V working, and the can is the common negative connection.

The positive tag of **C20** (8 μF) is marked with a red spot, and is connected to pin **4** of **V5** holder. The positive tag of **C21** (16 μF) is plain, and is connected to pin 6 of **V5.**

Resistance R16.—This is a tapped wire-wound vitreous type resistance, mounted on the chassis deck near the barretter resistance, and shown in our plan view. It has four tappings, including the two ends, splitting it up into three sections, each of which is 40 O, giving a total of 120 O overall.

Chassis Divergencies.—A note on the makers' diagram explains that, owing to transient difficulties, substitute values of condensers and resistances may be used. These, they say, are invariably of the nearest value, and do not detract from the efficiency of the receiver. When fitting replacements, however, it is advisable to adhere to the values quoted in our component tables.

In the makers' diagram, **R2** and **R9** were both given as 47,000 O, whereas in our chassis they were actually 40,000 O, but in order that replacements shall be correct we have quoted the makers' values in our tables.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to MW, and turn gang to maximum. Connect signal generator leads via a 0.1 μF non-inductive condenser to the control grid (top cap) of **V1** hexode and the earth lead clip.

Feed in a 451 KC/S (665.2 m) signal, and adjust **C36, C35, C34** and **C33** in that order for maximum output. Repeat these adjustments until no further improvement can be obtained.

If a whistle appears as the circuits are brought into tune, alter the position of the gang slightly, until the whistle disappears.

RF and Oscillator Stages.—With the gang at minimum, the pointer should coincide with the short vertical lines at the extreme left-hand ends of the three scales. Connect the signal generator to the **A** and **E** leads via a suitable dummy aerial.

SW.—Switch set to SW, and tune to 16.8 m on scale. Feed in a 16.8 m (17.8 MC/S) signal, and adjust **C28,** then **C25,** for maximum output. Repeat these adjustments very carefully. There is no variable tracking on this band, but the setting should be checked at 49 m.

MW.—Switch set to MW, and tune to 214 m on scale. Feed in a 214 m (1,400 KC/S) signal, and adjust **C29,** then **C23,** for maximum output.

Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C31** for maximum output while rocking the gang for optimum results. Repeat the 214 m adjustments.

LW.—Switch set to LW, and tune to 1,100 m on scale. Feed in a 1,100 m (272.5 KC/S) signal, and adjust **C30,** then **C24,** for maximum output.

Feed in a 1,900 m (158 KC/S) signal, tune it in, and adjust **C32** for maximum output while rocking the gang for optimum results. Repeat the 1,100 m adjustments.

VALVE BASES

A Service Sheet Innovation

AS in the past, the laboratory staff still strives to improve the value of the service sheet supplement to the service engineer. All suggestions by dealers and their staffs for improvements receive careful consideration, and where they are considered practicable (and this includes our ability to accommodate them) they are incorporated.

One suggestion that has been made by several dealers is that we should publish with each service sheet the base connections of each valve in the receiver with which it deals, and it has now been decided to incorporate this innovation. The first example of these diagrams will be found with this issue, which deals with the Pilot 455 receiver.

The method adopted is to show the valve diagram and base separately, with the leads between the electrodes and the base pins connecting the two.

The base is shown as it appears when viewed from the free ends of the pins, and the connections to the pins radiate from the periphery of the base.

Where a pin is fitted to the base but is not connected to an electrode, that pin is left unconnected in the diagram; when a pin is omitted from the base altogether, then it is omitted from our base. External connections such as grid or anode top caps are taken to a square block marked "TC" at the side of the base, while heaters, when their connections are obvious, are left unconnected for the sake of clarity. Their positions on the base are, however, indicated.

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