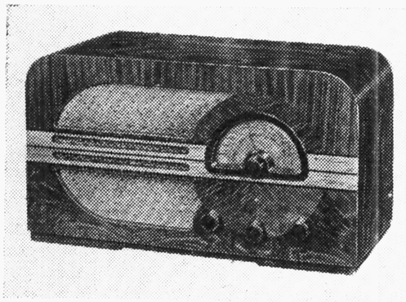
'TRADER' SERVICE SHEET

341

DECCA AW4

3-BAND AC/DC SUPERHET



A SHORT-WAVE range of 19-49 m is covered by the Decca AW4 4-valve (plus rectifier) AC/DC 3-band superhet, which is suitable for mains of 190-250 V (50-60 C/S in the case of AC). Provision is made for the connection of both a gramophone pick-up and an extension speaker.

CIRCUIT DESCRIPTION

Aerial input via series condenser **C1** and coupling coils **L2** (SW), **L4** (MW) and (via 342 metre rejector circuit **L1, C3**) **L6** (LW) to single-tuned circuits **L3, C31** (SW), **L5, C31** (MW) and **L7, C31** (LW).

First valve (**V1, Mazda metallised TH2320**) is a triode-hexode operating as frequency changer with internal coupling. Oscillator anode coils **L9** (SW), **L11** (MW) and **L13** (LW) are tuned by **C37**; parallel trimming by **C32** (SW), **C33** (MW) and **C34, C11** (LW); series tracking by **C9** (SW), **C10, C35** (MW) and **C36** (LW). Oscillator grid reaction coils **L8** (SW), **L10** (MW) and **L12** (LW).

Second valve, a variable-mu RF pentode (**V2, Mullard metallised VP13C**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C38, L14, L15, C39** and **C40, L16, L17, C41.**

Intermediate frequency 465 KC/S.

Diode second detector is part of separate double diode valve (**V3, Brimar 10D1**). Audio frequency component in rectified output is developed across load resistance **R11** and passed via stopper resistance **R10,** AF coupling condenser **C16** and manual volume control **R12** to CG of pentode output valve (**V4, Mullard Pen36C** or **Brimar 7D6**). Fixed tone correction in anode circuit by **C22.** Variable tone control by **C41** across **R12.** Provision for connection of high impedance external speaker across primary of internal speaker input transformer **T1.** Provision for connection of gramophone pick-up across **R12,** via isolating condenser **C17.**

Second diode of **V3,** fed from tapping on **L17** via **C18,** provides DC potential which is developed across load resistance **R13** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage is obtained from drop across **V4** cathode resistances **R14, R15.**

When the receiver is used with AC mains HT current is supplied by a half-wave rectifier (**V5, Brimar 1D5** or **Mullard URIC**) which, with DC supplies, behaves as a low resistance. Smoothing is effected by iron-cored choke **L19** and dry electrolytic condensers **C23, C24.**

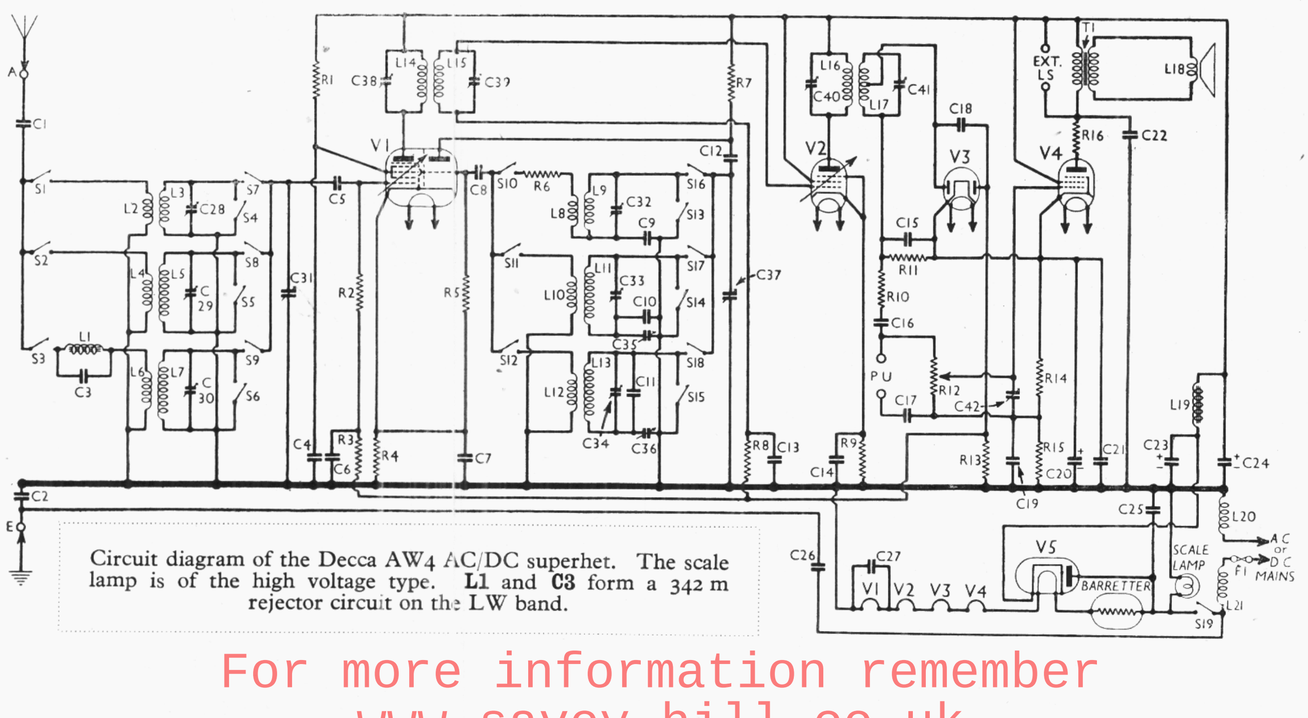
Valve heaters are connected in series together with current regulating barretter (**Type 150A**), across mains input. Scale lamp, which floodlights the tuning scale, is connected directly across the mains input.

Filter comprising **C26,** chokes **L20, L21** and condensers **C25, C26,** suppresses mains-borne interference.

COMPONENTS AND VALUES

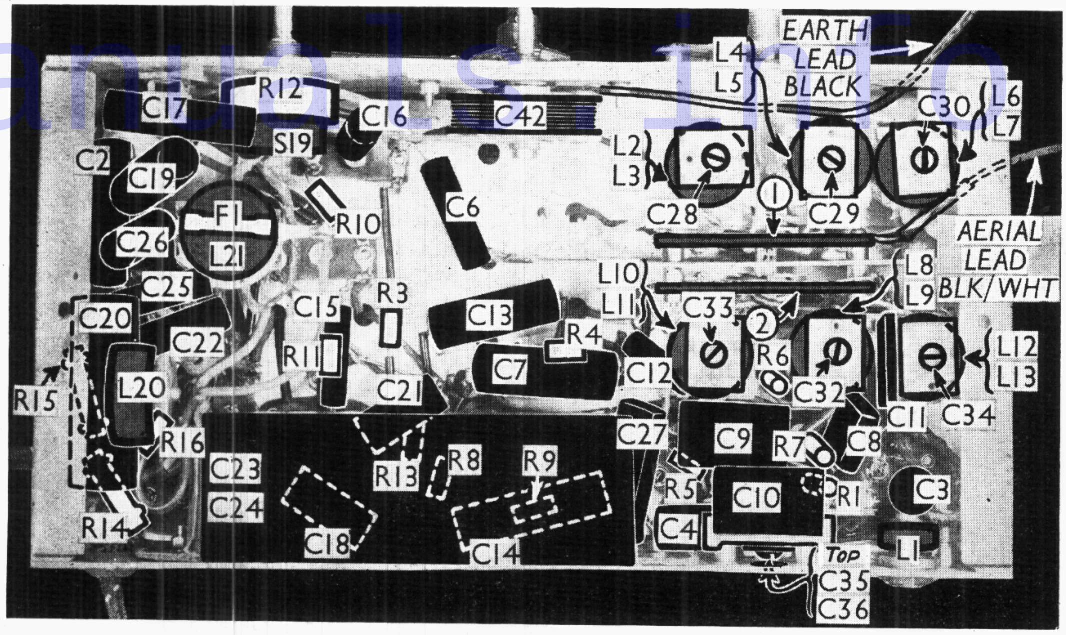
	RESISTANCES	Values (ohms)
R1	V1 SG HT feed	25,000
R2	V1 hexode CG resistance ..	500,000
R3	V1 hexode CG decoupling resistance	500,000
R4	V1 fixed GB resistance ..	200
R5	V1 osc. CG resistance ..	50,000
R6	Osc. circuit SW stabiliser ..	75
R7	V1 osc. anode HT feed ..	40,000
R8	V2 CG decoupling resistance ..	500,000
R9	V2 fixed GB resistance ..	200
R10	IF stopper	70,000
R11	V3 signal diode load	300,000
R12	Manual volume control ..	500,000
R13	V3 AVC diode load	500.000
R14	AVC delay voltage and V4 GB resistances ..	140
R15		160
R16	V4 anode circuit stabiliser ..	150

	CONDENSERS	Values (μF)
C1	Aerial series condenser ..	0·0004
C2	Earth blocking condenser ..	0·02
C3	Aerial circuit 342 m rejector tuning	0·000012
C4	V1 SG decoupling	0·1
C5	V1 hexode CG condenser ..	0·0001
C6	V1 hexode CG decoupling ..	0·02
C7	V1 cathode by-pass	0·1
C8	V1 osc. CG condenser	0·0002
C9	Osc. circuit SW fixed tracker	0·003
C10	Osc. circuit MW fixed tracker	0·0003
C11	Osc. circuit LW fixed trimmer	0·00006
C12	V1 osc. anode coupling ..	0·0001
C13	V2 CG decoupling	0·02
C14	V2 cathode by-pass	0·1



Circuit diagram of the Decca AW4 AC/DC superhet. The scale lamp is of the high voltage type. L1 and C3 form a 342 m rejector circuit on the LW band.

Under-chassis view. Diagrams of the two switch units, as seen in the directions of the arrows, are on page IV. Note the six coil units with one trimmer above each. **F1** is mounted above **L21.**



CONDENSERS (*Continued*)		Values (μF)
C15	IF by-pass	0·0001
C16	AF coupling to V4	0·02
C17	PU isolating condenser	0·02
C18	Coupling to V3 AVC diode	0·0001
C19	V4 CG decoupling	0·1
C20*	V4 cathode by-pass	50·0
C21	V3, V4 cathodes RF by-pass	0·0001
C22	V4 anode tone corrector	0·006
C23*	HT smoothing	8·0
C24*	HT smoothing	16·0
C25	Mains RF filter condensers	0·006
C26	Mains RF filter condensers	0·02
C27	V1 heater RF by-pass	0·01
C28‡	Aerial circuit SW trimmer	—
C29‡	Aerial circuit MW trimmer	—
C30‡	Aerial circuit LW trimmer	—
C31†	Aerial circuit tuning	—
C32‡	Osc. circuit SW trimmer	—
C33‡	Osc. circuit MW trimmer	—
C34‡	Osc. circuit LW trimmer	—
C35‡	Osc. circuit MW tracker	0·00022
C36‡	Osc. circuit LW tracker	0·00022
C37†	Osc. circuit tuning	—
C38‡	1st IF trans. pri. tuning	—
C39‡	1st IF trans. sec. tuning	—
C40‡	2nd IF trans. pri. tuning	—
C41‡	2nd IF trans. sec. tuning	—
C42†	Variable tone control	0·0005

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial circuit 342 m rejector coil	6·0
L2	Aerial circuit SW coupling coil	0·3
L3	Aerial circuit SW tuning coil	0·05
L4	Aerial circuit MW coupling coil	14·5
L5	Aerial circuit MW tuning coil	3·5
L6	Aerial circuit LW coupling coil	75·0
L7	Aerial circuit LW tuning coil	16·5
L8	Osc. circuit SW grid reaction	0·5
L9	Osc. circuit SW tuning coil	0·05
L10	Osc. circuit MW grid reaction	5·25
L11	Osc. circuit MW tuning coil	2·0
L12	Osc. circuit LW grid reaction	5·75
L13	Osc. circuit LW tuning coil	5·0
L14	1st IF trans. Pri.	8·0
L15	1st IF trans. Sec.	8·0
L16	2nd IF trans. Pri.	8·0
L17	2nd IF trans. Sec., total	8·0
L18	Speaker speech coil	1·7
L19	HT smoothing choke	400·0
L20	Mains filter chokes	2·0
L21	Mains filter chokes	2·0
T1	Speaker input trans. Pri.	650·0
	Speaker input trans. Sec.	0·03
S1-S18	Waveband switches	—
S19	Mains switch, ganged R12	—
F1	Mains circuit fuse	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (six countersunk-head wood screws) gives access to most of the components beneath the chassis.

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, remove the four control knobs (recessed grub screws) and the two bolts (with lock and claw washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the leads, which should be just sufficient for normal purposes.

To free the chassis entirely, remove the socket strip for the aerial, earth and pick-up (three round-head wood screws) and the scale lamp holder (two round-head wood screws), and unsolder the speaker leads.

Removing Speaker.—Should it be desired to remove the speaker from the cabinet, unsolder the leads and remove the nuts and lock washers from the four screws holding it to the sub-baffle. *When replacing*, see that the transformer is at the top

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 232 V. 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 TH2320	210	3·0	75	5·4
	Oscillator 75	Oscillator 3·1		
V2 VP13C	210	8·9	210	3·4
V3 10D1	—	—	—	—
V4 Pen36C	180	41·0	210	6·4
V5 1D5†	—	—	—	—

† Cathode to chassis, 240 V DC.

GENERAL NOTES

Switches.—**S1-S18** are the waveband switches, ganged in two rotary units beneath the chassis. The units are indicated in our under-chassis view and are shown in detail in the diagrams on p. IV, as seen looking in the directions of the arrows in the under-chassis view.

The table (p. IV) gives the switch positions for the three control settings, starting from fully clockwise. A dash indicates *open* and **C** *closed*.

S19 is the QMB mains switch, ganged with the volume control **R12.**

Coils.—All the RF and oscillator coils are in pairs on six tubular or wood formers in two screened compartments beneath the chassis, with their parallel pre-set trimmers mounted above them. There is one trimmer to each pair of coils, which are indicated in our under-chassis view. In the case of the SW band the two coils on each former are interwound but in each case the tuned coil is of thick bare copper wire.

The rejector circuit coil **L1** is iron-cored and, tuned by **C3,** is included to prevent break-through on LW from the London Regional transmitter.

L1 is provided with a core adjustment for accurate setting, which is indicated in our plan chassis view.

L20 and **L21** are on separate formers beneath the chassis.

The IF transformers, **L14, L15** and **L16, L17,** are in two screened units on the chassis deck with their associated trimmers.

Scale Lamp.—The tuning scale is flood-lit by a high voltage lamp with a large bulb and an MES base which is fixed to the inside of the front of the cabinet. It is rated at 200-250 V 15 W, and is connected across the mains input.

Fuse F1.—This is held in clips mounted on the **L21** former, beneath the chassis. It is a 1 in. glass tubular type, rated at 1·0 A.

External Speaker.—Two sockets are provided on a panel at the rear of the

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DECCA AW4—*Continued*

cabinet for a high impedance (7,000-10,000 O) external speaker. The sockets are not isolated.

Condensers C23, C24.—These are two dry electrolytics in a single carton beneath the chassis, having a common negative (black) lead. The yellow lead is the positive of **C23** (8μF) and the red the positive of **C24** (16μF).

Condenser C9.—This consists actually of two moulded bakelite condensers connected in parallel. The capacity (0·003 μF) is the total capacity of the pair and is marked only on one of them.

CIRCUIT ALIGNMENT

IF Stages.—Connect across **C37** a 0·01 μF swamp condenser and turn volume control to maximum. Remove top cap from **V1** and connect one lead of the signal generator in its place, the other lead being connected to chassis.

Feed in a 465KC/S signal and adjust **C41, C40, C39** and **C38** in that order for maximum output, keeping the generator output as low as possible consistent with an adequate reading on the meter. Repeat the process until the maximum peak is obtained on the meter. Remove swamp condenser and replace cap on **V1.**

RF and Oscillator Stages.—Tune to 220 m on the scale, feed in a 220 m signal to **A** and **E** sockets *via* a 0·0002 μF condenser, with the receiver switched to MW, and adjust **C33** and **C29** for maximum output. Next tune to 500 m on the scale, feeding in a 500 m signal and adjust MW tracker **C35** for maximum output whilst rocking the gang. Return to 220 m and adjust **C33** and **C29** accurately.

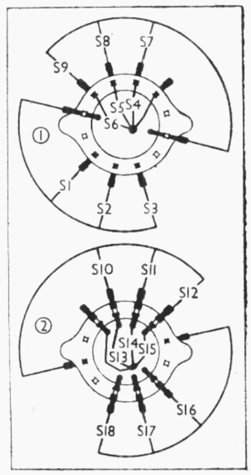
Switch receiver to LW, tune to 1,200 m on scale, feed in a 1,200 m signal and adjust **C34** and **C30** for maximum output. Tune to 1,875 m and adjust LW tracker **C36** whilst rocking the gang, finally returning to 1,200 m and accurately adjusting **C34** and **C30**

Switch on SW, tune to 19 m on scale, feed in a 19 m signal and accurately adjust **C32** and **C28.**

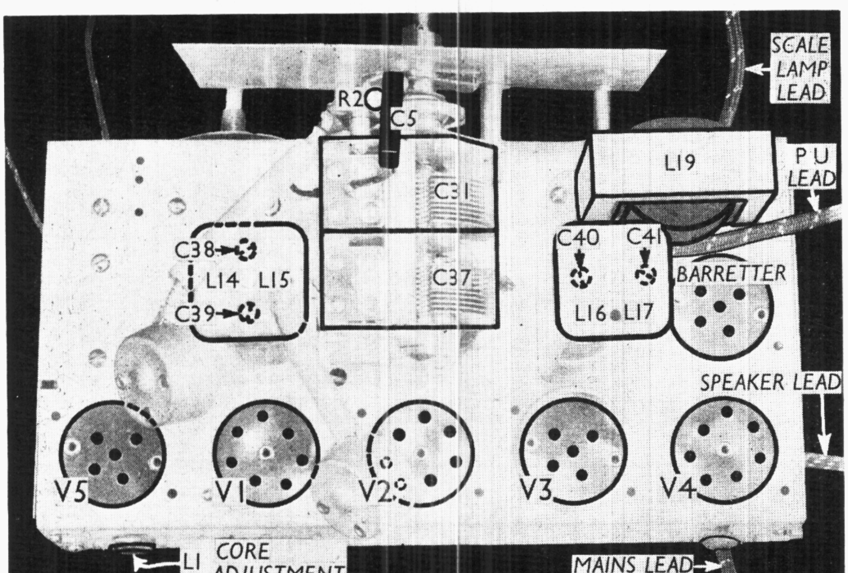
Whilst alignment of any stage is carried out the volume control must be kept at maximum and the input from the signal generator progressively reduced as the circuits come into line, so that the output is no greater than is necessary to give an adequate reading on the meter, in order to avoid overloading in the receiver.

SWITCH DIAGRAMS AND TABLE

Diagrams of the two switch units, looking in the directions of the arrows in the under-chassis view.



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



Plan view of the chassis. A core adjustment for **L1** tunes the 342 m rejector.

AUTOMATIC TUNING—15

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various voltages in the circuit) enables a control voltage to be produced across the load resistance which is positive if the incoming frequency is too high, and negative if it is too low (or *vice-versa*). If the incoming frequency happens to be dead accurate, no control voltage is produced.

The control voltage is now passed to the oscillator control stage. Various methods have been used to cause the positive or negative DC control voltage to alter the tuning of the oscillator stage to the correct value, and it is not possible to go into them in detail here. For the most part, the final circuits are quite simple, but the design and calculation of their constants is very tricky.

Methods of Control

As one example of a control stage, that used by Ekco may be quoted. The valve used for oscillator correction is a triode. An inductance is mutually coupled to the normal oscillator tuning circuit, and forms the anode load of the corrector triode, this valve being biased to give a standing condition of impedance when the AFC voltage, received from the discriminator, is zero, that is, when the set is accurately in tune.

When the set is off tune, the grid of the corrector triode is made more, or less, negative according to the direction in which the tuning error lies. This alters the impedance of the triode, and this, being virtually shunted across the oscillator circuit, alters the effective inductance of this circuit, and therefore its tuning. The oscillator frequency thus shifts until the AFC voltage is reduced to zero, that is, until the IF is corrected, and the set therefore comes into exact tune.

In other circuits the control valve itself is made to behave as a variable inductance, and is shunted across the oscillator tuning circuit, thus varying the tuning.

Alternatively, the corrector valve may have its gain controlled by the output from the discriminator stage, which varies its input capacity to a slight extent. If the valve is connected so that its input capacity is shunted across the tuned circuit of the oscillator, this capacity change is sufficient to correct the oscillator tuning in accordance with requirements.

The foregoing is, of course, only a very simplified explanation of AFC, but should give readers a grasp of the principles underlying its operation.

* * *

This brings us to the end of the present series of articles on automatic tuning, and it is hoped that readers who have followed the descriptions and explanations will be in a good position to assess the points of the various automatic receivers which are being produced for the 1938-9 season.

W.E.M.