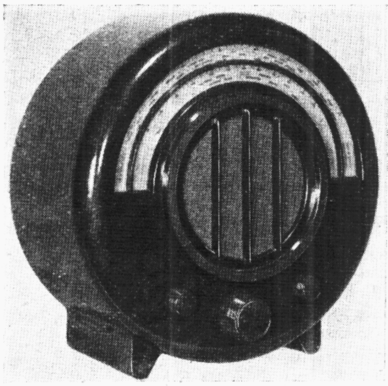
Supplement to The Wireless & Electrical Trader, December 4, 1943

"TRADER" SERVICE SHEET

649

EKCO AD65

AC/DC SUPERHET



The Ekco AD65 in the walnut finish cabinet.

HOUSED in a circular moulded cabinet, the Ekco AD65 is, in the original models, a 3-valve (plus rectifier) 2-band superhet, designed to operate from AC or DC mains of 200-250 V, 40-100 c/s in the case of AC. The standard model is finished in walnut or black and chromium, but special models have a coloured finish.

As the chassis is "live" to the mains, no provision is made for the connection of a gramophone pick-up or an external speaker. These can be attached, if required, but care must then be exercised to isolate them adequately.

In subsequent versions, considerable modifications occur, necessitated by valve changes. These are fully explained, however, under "Modified Chassis" overleaf.

Release date: 1934; *Original prices: Walnut,* £11 0s. 6*d.; black and chromium,* £11 11*s.; coloured models,* £13 2*s.* 6*d.*

CIRCUIT DESCRIPTION

Aerial input via mains isolating condenser **C1** to tapping on primary windings of band-pass filter circuit. Primary coils **L1** (MW) and **L2** (LW) are tuned by **C22**; secondary coils **L3, L4** are tuned by **C24.** Inductive coupling by mutual inductance between primary and secondary windings. Image suppression by pre-set condenser **C21.**

First valve **(V1, Mullard metallised FC13)** is an octode operating as frequency changer with electron coupling. Oscillator control grid coils **L5** (MW) and **L6** (LW) are tuned by **C26.** Parallel trimming by **C27** (MW); tracking by specially shaped vanes of **C26,** with addition of series tracking condensers **C5, C28** (LW). Reaction coupling from anode by coil **L7** on both bands.

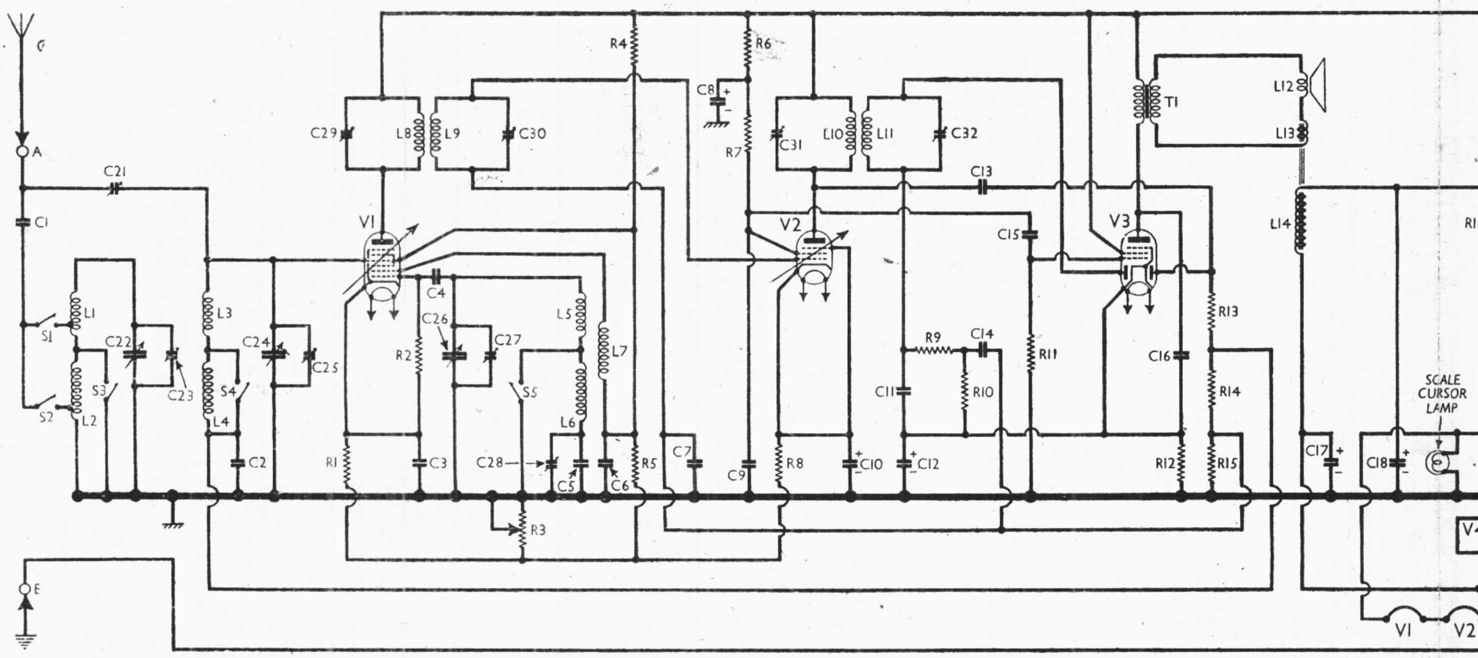
Second valve **(V2, Mazda metallised VP1321)** is a variable-mu RF pentode operating first as pentode IF amplifier, and then, by reflex action, as a triode AF amplifier. As an IF amplifier it has tuned-primary, tuned-secondary input and output transformer couplings **C29, L8, L9, C30** and **C31, L10, L11, C32,** which are connected in the conventional manner.

Intermediate frequency 110 kc/s.

Manual gain control for the receiver is provided in the form of a variable resistor **R3** which, with **R4, R5,** forms part of a potential divider across the HT circuit. **V1** and **V2** cathodes are returned via their respective fixed GB resistors **R1** and **R8** through **R3** to chassis, and as **R3** is adjusted, the bias applied to the valves is varied.

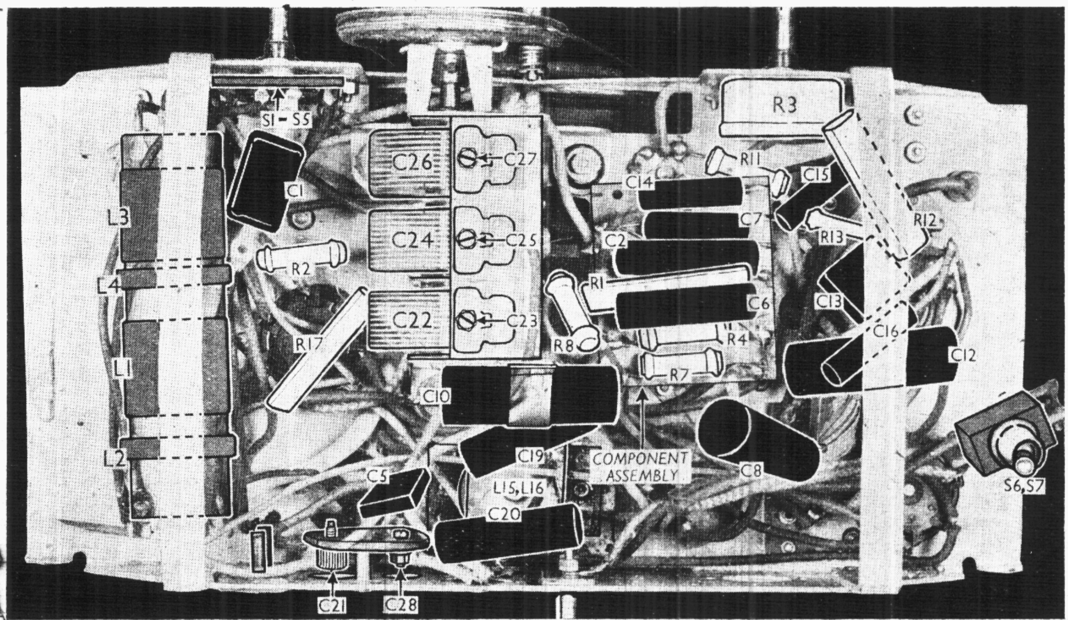
The IF output developed across **L11** is applied to diode second detector, which is part of double diode output pentode valve **(V3, Mazda PenDD4020).** Audio frequency component in rectified output is developed across load resistor **R10** and passed via AF coupling condenser **C14** back to **V2** control grid via **L9, C7,** the latter offering a high impedance at audio frequency but effectively by-passing the intermediate frequency, and forming, with **R9** and **C11** an IF filter circuit.

AF output from **V2** is developed in amplified form across the SG load resistor **R7,** the by-pass condenser **C9** shunting away signals at intermediate frequency while offering a high impedance to audio frequency signals, and passed via AF coupling condenser **C15** to control grid of pentode section of **V3.** Fixed tone correction in pentode anode circuit by **C16.**



Circuit diagram of the Ecko AD65 AC/DC superhet. **R3**, below the chassis line, is the manual volume control. AF signals are fed back [...] then amplifies them as a triode and passes them on from its screen load **R7** to **V3** pentode. One half of **V4** is shown dotted as this va[...] rectifier. Valve base connection diagrams are shown on the right for the alternative types for **V4**, as they are [...]

Under-chassis view. Several components mounted on the other side of the component assembly, and thus hidden in this view, are shown in a sketch in col. 4 overleaf. In col. 2 overleaf appears a diagram showing in detail the waveband switch unit. **C8** may be contained in the block with **C17, C18** on the chassis deck.

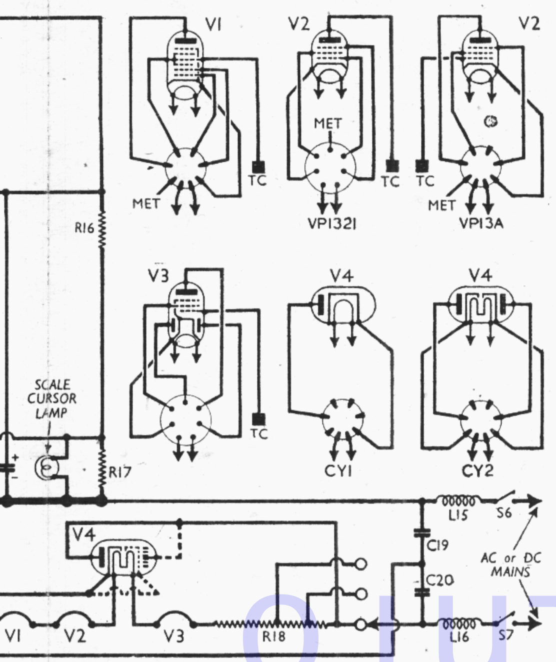


Second diode of **V3**, fed from **V2** anode via **C13**, provides DC potentials which are developed across load resistors **R13**, **R14** and **R15** and fed back through decoupled circuits as GB to FC and IF valves, giving automatic volume control. Since **V2** operates as a post-detector AF amplifier and is AVC controlled, AVC action should maintain a condition of practically constant gain, the degree of gain being determined by the setting of **R3**.

AVC delay voltage, together with GB for pentode section, is obtained from the drop along resistor **R12** in **V3** cathode lead to chassis.

When the receiver is operating from AC mains, HT current is supplied by IHC half-wave rectifying valve **(V4, Mullard UR1** or **CY1)** which, with DC mains, behaves as a resistor of low value; or a valve of the voltage-doubler type **(Mullard UR2** or **CY2)** may be used with the two halves strapped in parallel to operate as a half-wave rectifier, as shown by the dotted lines in the circuit diagram. Smoothing by speaker field **L14** and electrolytic condensers **C17, C18.** It should be noted that, in addition to the valve currents, an additional current somewhere in the neighbourhood of 40 mA of HT current will flow through the "bleeder," or shunt resistor **R16,** while the potential divider **R4, R5, R3** also shunts the HT circuit.

Valve heaters, together with the scale cursor lamp and ballast resistor **R18,** are connected in series across the mains input circuit. The cursor lamp is shunted by **R17,** the two being connected in series with both the heater circuit and **R16.** A filter circuit comprising air-cored chokes **L15, L16** and condensers **C19, C20** suppresses mains-borne interference. The earth socket **E** is taken from the junction of **C19** and **C20.**



ed back from **R10** in the diode circuit to **V2**, which this valve may be a single or double channel they are also for **V2**.

COMPONENTS AND VALUES

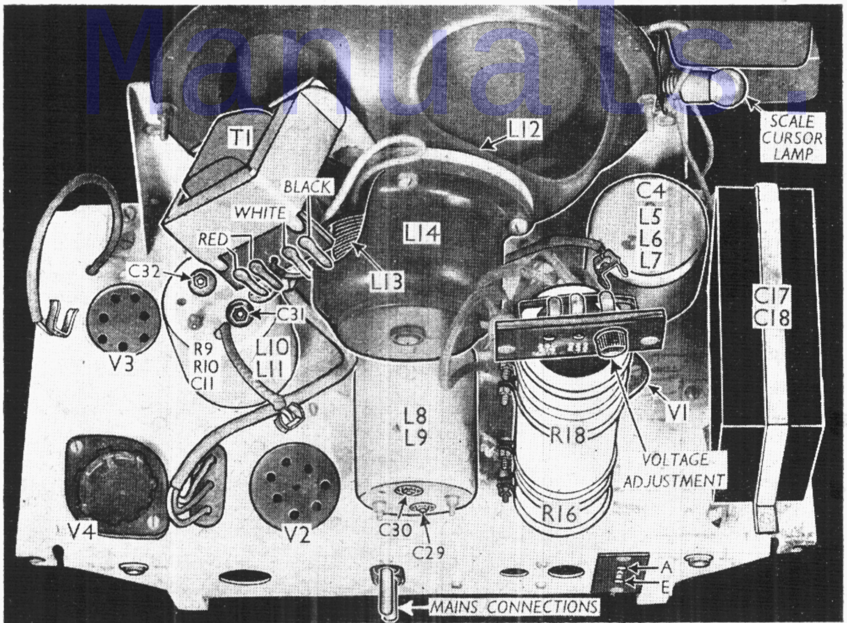
	RESISTORS	Values (ohms)
R1	V1 fixed GB resistor ...	200
R2	V1 osc. CG resistor ...	60,000
R3	Manual gain control ...	2,000
R4	} V1 SG and osc. anode HT feed potential divider...	15,000
R5		60,000
R6	V2 SG AF decoupling ...	15,000
R7	V2 SG AF load	50,000
R8	V2 fixed GB resistor ...	2,000
R9	1F stopper	30,000
R10	V3 signal diode load ...	250,000
R11	V3 pent. CG resistor ...	500,000
R12	V3 pent. GB and AVC delay resistor	165
R13	} V3 AVC diode load resistors	1,000,000
R14		250,000
R15		250,000
R16	HT circuit shunt ...	5,000
R17	Scale cursor lamp shunt...	100
R18	Heater circuit ballast ...	760*

* Tapped at 560Ω + 100Ω + 100Ω from V3 heater end.

	CONDENSERS	Values (μF)
C1	Aerial isolator	0·001
C2	V1 hex. CG decoupling	0·1
C3	V1 cathode by-pass ...	0·1
C4	V1 osc. CG condenser ...	0·001
C5	Osc. LW fixed tracker ...	0·0008
C6	V1 HT decoupling ...	0·1
C7	V2 CG RF by-pass ...	0·002
C8*	V2 SG AF decoupling ...	2·0
C9	V2 SG RF by-pass ...	0·0005
C10*	V2 cathode by-pass ...	25·0
C11	1F by-pass	0·0003
C12*	V3 cathode by-pass ...	25·0
C13	Coupling to V3 AVC diode	0·0001
C14	AF coupling to V2 ...	0·005
C15	V2 SG to V3 pentode AF coupling	0·005
C16	Fixed tone corrector ...	0·005
C17*	} HT smoothing condensers	8·0
C18*		24·0
C19	} Mains RF by-pass condensers	0·1
C20		0·1
C21‡	Image suppressor ...	—
C22†	Band-pass pri. tuning ...	—
C23‡	B-P pri. MW trimmer ...	—
C24†	Band-pass sec. tuning ...	—
C25‡	B-P sec. MW trimmer ...	—
C26†	Oscillator circuit tuning	—
C27‡	Osc. circ. MW trimmer	—
C28‡	Osc. circ. LW tracker ...	—
C29‡	1st IF trans. pri. tuning	—
C30‡	1st IF trans. sec. tuning	—
C31‡	2nd IF trans. pri. tuning	—
C32‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	} Band-pass primary coils...	4·0
L2		13·0
L3	} Band-pass secondary coils	4·0
L4		13·0
L5	Osc. MW tuning coil ...	5·0
L6	Osc. LW tuning coil ...	10·0
L7	Oscillator reaction coil ...	5·5
L8	1st IF trans. Pri. ...	100·0
L9	1st IF trans. Sec. ...	100·0
L10	2nd IF trans. Pri. ...	100·0
L11	2nd IF trans. Sec. ...	100·0
L12	Speaker speech coil ...	2·0
L13	Hum neutralising coil ...	0·1
L14	Speaker field coil ...	400·0
L15	} Mains RF filter chokes ...	3.0
L16		3·0
T1	Speaker input trans. Pri. ...	625·0
	Sec. ...	0·5
S1–S5	Waveband switches ...	—
S6, S7	Mains circuit switches ...	—



Plan view of the chassis. **C8** may be included in the block with **C17, C18. V1** holder is almost completely obscured by the heater ballast resistor **R18**. The speaker connections are indicated at their tags **T1**.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted in the makers' manual. They represent conditions to be expected in the average chassis when it is operating on AC mains of 230 V, using the 220/230 V tapping on the heater ballast resistor. Voltages were measured on the 1,200 V scale of a standard Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC13	200	1·6	90	6·0
	Oscillator			
	90	2·1		
V2 VP1321	200	4·5	145	0·8
V3 Pen DD4020	180	29·0	200	10·0
V4 UR1	245*	—	—	—

* Cathode to chassis, DC.

DISMANTLING THE SET

Removing Chassis.—Withdraw mains connecting plug and remove six (or in some cases seven) screws holding back cover to the rear of the cabinet, lifting off cover so that the heat vent cowl attached to it clears the voltage adjustment panel;

remove the three control knobs (recessed grub screws) from front of cabinet;

remove fixing nut from mains switch at side of cabinet, and push the switch into the cabinet;

remove the two cheese-head screws (with washers) holding the lugs at rear of chassis to ribs moulded in the cabinet;

remove two nuts (with washers) holding speaker mounting bracket to the front of the cabinet.

The chassis and speaker may now be withdrawn as a single unit.

When replacing, do not omit to rewax the heads of the grub screws in the control knobs.

Removing Speaker.—First remove the chassis as described above;

unsolder from the tags on the input transformer the three leads connecting it to the chassis;

remove the four nuts and bolts (with washers) holding the speaker to its mounting bracket.

When replacing, the transformer should be at top left (viewed from rear), and the leads should be connected as follows, numbering the tags from left to right: 1 and 2, joined together, red; 3, white; 4, black.

GENERAL NOTES

Switches.—S1-S5 are the waveband switches, ganged in a single rotary unit beneath the chassis. The unit is indicated in our under-chassis view, and shown in detail in the diagram below, where it is drawn as seen from the rear of the underside of the chassis. **S1, S3, S4** and **S5** close on MW, and open on LW; **S2** opens on MW, and is closed on LW. The control has two positions: anti-clockwise, MW; clockwise, LW.

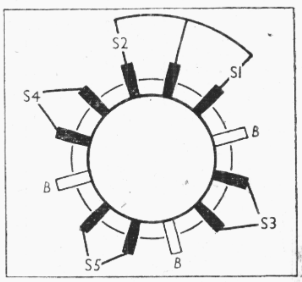


Diagram of the switch unit, as seen from the rear of the underside of the chassis.

S6, S7 are the QMB mains switches, in a double-pole toggle switch unit. The unit is not mounted on the chassis, although it is attached to it by its leads, but is mounted by a single-hole fixing on the cabinet.

Coils.—L1, L2 and **L3, L4** are the band-pass filter coils, wound in a single unscreened unit beneath the chassis. The oscillator coils **L5-L7** are in a screened unit on the chassis deck, the unit also containing **C4.**

The IF transformers **L8, L9** and **L10, L11** are in two further units on the chassis deck, the first being mounted horizontally beneath the speaker, and the second vertically mounted beside it. Both units contain their associated pre-set condensers, and the second unit also contains **R9, R10** and **C11.**

The mains RF filter chokes **L15, L16** are wound on a single bobbin near the rear of the underside of the chassis, with their associated condensers **C19, C20** mounted directly to tags on the assembly.

Scale Cursor Lamp.—This has an MES cap, with a spherical bulb, and is rated at 6.2 V, 0.3 A. It is mounted on the cursor carrier, so that it illuminates a small section of the scale from the rear, a cursor line in the carrier aperture throwing a shadow on the scale.

The lamp is shunted by **R17,** and is connected in series with the heater circuits. The surge of current when first switching on with cold heaters will not damage the lamp, but the lamp will become dim with the fall of current as the heaters warm up. Some small compensation for this will be obtained from an increase in HT current through **R16,** however, as **V4** cathode warms up and HT current flows, increasing the current again through the lamp and **R17.**

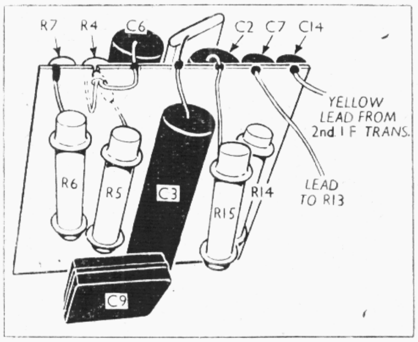
Gramophone Pick-up.—No provision is made for the connection of a gramophone pick-up, but one could be used if it were connected via isolating condensers or a double-wound transformer of adequate insulation across **R10,** so as to isolate it from the mains. An external volume control would also be required.

External Speaker.—Although for the same reason that pick-up sockets are omitted there is no provision for connecting an external speaker, one of low impedance (about 4 Ω) could be connected across the secondary winding of the internal speaker input transformer **T1,** provided that fairly well insulated connecting leads were used and their terminations were protected from external contact.

Alternatively, a high impedance speaker (about 6,000 Ω) could be connected via isolating condensers of about 1 μF each upwards across **T1** primary, but the condensers should then be housed inside the cabinet.

Condensers C8, C17, C18.—In our chassis, **C17** and **C18** were in a single container mounted on the chassis deck, while **C8** was a separate tubular unit beneath the chassis. The makers' instructions, however, indicate that all three condensers were originally contained in the large container.

Component Assembly.—Seven resistors and six condensers are mounted on a double-sided insulating panel lying horizontally beneath the chassis. The assembly is indicated in our under-chassis view, where the components on the underside



Sketch showing the components mounted out of view on the component assembly beneath the chassis. The method of reaching them is described in this column.

of it are indicated; those on the upper side, however, are not visible there, and are shown in a separate sketch above, where the assembly is drawn as seen when viewed from **V3** valve holder after raising one end of it.

This can be done when the lead from **R13** and the yellow lead from the second IF transformer have been unsoldered from their tags on the panel. The tags concerned are indicated in the sketch.

Heater Circuit Ballast.—This is a wire-wound unit, mounted vertically on the chassis deck, consisting altogether of four sections. The first three of these, counting from top downwards, are the two 100 Ω voltage adjustment sections, followed by the main ballast section of 560 Ω, the whole comprising **R18.** The fourth (bottom) section is **R16,** isolated from those above it and shunting the smoothed HT circuit. Its value is 5,000 Ω.

Alternative Rectifying Valves.—**V4** is quoted in the makers' manual as Mullard UR2 or UR1, but these valves have since been superseded by CY2 and CY1 respectively, which are direct replacements. The CY2 is of the voltage-doubler type, with two pairs of anodes and cathodes, and the CY1 is of the half-wave type.

As will be seen from the valve base connection diagrams on the right of the circuit diagram, where diagrams of both types are given, pins 4 and 8 are cathode and anode respectively in either type, and in the chassis, pins 4 and 1 are joined together, as are also pins 5 and 8, so that either valve may be inserted and will function correctly without alteration to the wiring.

Chassis Divergencies.—Apart from the alternative rectifiers, divergencies from the component values quoted in our tables occur in two instances: **R14** may be 500,000 Ω, and **C14** may be 0.01 μF.

CIRCUIT ALIGNMENT

The makers recommend that the output meter should be connected between **V3** pentode anode and chassis, via a condenser of about 2 μF if one is not already contained in the meter unit. It should be borne in mind that the meter will be live to the mains, although the chassis could be isolated from the mains for the whole of the alignment procedure if it were connected via a double-wound mains transformer.

IF Stages.—Connect signal generator leads to **A** and **E** sockets, switch set to LW, and turn the gang to maximum. If the output is then too weak, transfer lead from socket **A** via a 0.1 μF condenser to **V1** control grid (top cap).

Feed in a 110 kc/s (2,728 m) signal, and adjust **C29, C31, C30,** then **C32,** in that order, adjusting **C29, C30** and **C32** for maximum output, and **C31** for minimum output.

RF and Oscillator Stages.—Connect signal generator leads, via a suitable dummy aerial, to **A** and **E** sockets.

MW.—Switch set to MW, tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C27** for maximum output. Tune to 250 m on scale, feed in a 250 m (1,200 kc/s) signal, and adjust **C25** and **C23** for maximum output.

Feed in a 500 m (600 kc/s) signal, and tune it in. If calibration reads high, slacken off **C27** slightly, feed in a 250 m (1,200 kc/s) signal, tune it in, and adjust cursor carrier for correct calibration, re-adjusting **C25** and **C23.** If the calibration at 500 m is low, screw up **C27** slightly, then proceed as before.

LW.—Switch set to LW, tune to 1,700 m on scale, feed in a 1,700 m (176.3 kc/s) signal, and adjust **C28** for maximum output. Check calibration at 1,200 m (250 kc/s), and if incorrect, re-adjust **C28** to divide the error between the two settings.

Image Suppressor.—This was arranged to operate originally at 479 m, but owing to changed conditions the original adjustment may not now be effective.

If image interference is experienced, therefore, it may be minimised by tuning the receiver to a frequency at which the interference is found, and adjusting **C21** for minimum interference, using the speaker as an indicator.

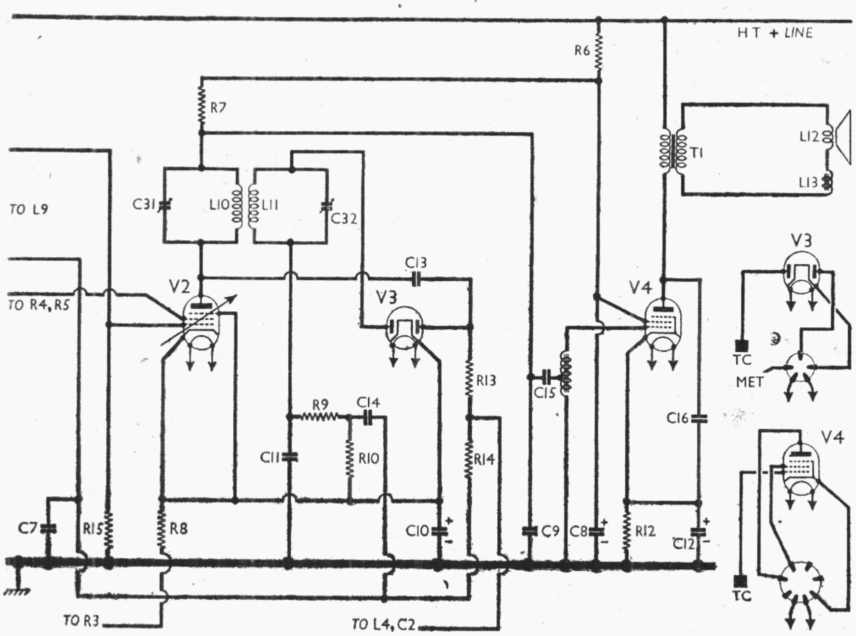
MODIFIED CHASSIS

There are two distinct modified versions of the AD65 chassis. In the first case, some of the original types, otherwise like the sample on which this Service Sheet is based, use a Mullard VP13A valve as **V2,** instead of a Mazda VP1321. This means that the top cap is the control grid connection instead of anode. Fortunately the two valves have different bases, so that confusion between them is unlikely. The top cap lead then comes from the **L8, L9** IF unit, instead of from the **L10, L11** unit.

Still greater changes occur in the second case. **V3** is replaced by two separate Mullard valves: a 2D13 and a Pen26. The affected section of the circuit is redrawn and shown in the diagram below.

Reflex amplification is retained. **V2** operates as a pentode IF and AF amplifier, **R7** still acting as the AF load, but in the anode instead of the screen circuit. The AF output is passed to **V4** via a parallel-fed auto transformer with **C15.**

The remainder of the circuit behaves very much as in the original model, although several circuit changes will be noticed. **R15,** for instance, is connected at its upper end to the opposite side of **L9,** so that AVC diode current flows through **L9;** and **V2** SG is now connected to **V1** SG. Component values do not alter considerably, except in the case of **R12,** which becomes 450 Ω. **V2** will usually be a VP13A; and **V3** heater comes between those of **V4** and **V5** (the HT rectifier).



Circuit diagram, showing the affected section in the second modified version of the original model. **V2** is a VP13A, and the original **V3** is now split into two separate valves, **V3** and **V4**. A step-up auto-transformer coupling is used between **V2** anode (instead of the screen) and the output valve **V4**. The rectifier thus becomes **V5**.

Printed in Great Britain by The Cornwall Press Ltd., Paris Garden, London, S.E.1