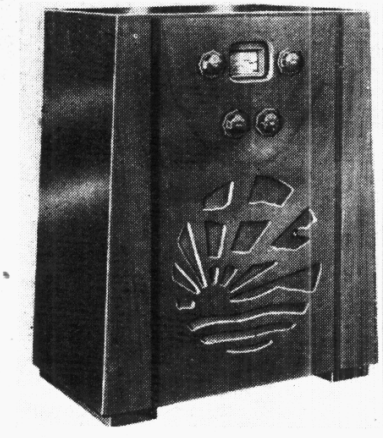
Supplement to The Wireless & Electrical Trader, November 18, 1944

"TRADER" SERVICE SHEET

698

PYE E/AC AND E/RG/AC RADIOGRAMS



The Pye E/AC superhet.

DELAYED and amplified AVC is used in the Pye E/AC receiver, a 5-valve (plus metal rectifier) 2-band superhet designed for AC mains of 200-250 V, 40-100 c/s. Special models cater for AC mains of 100-110 V. A practically identical chassis is employed in the radiograms.

Release date and original prices: 1933; *E/AC (table)*, £15 15*s*. *E/RG/AC, in oak*, £27 6*s*.; *in walnut*, £29 8*s*. *E/RG/AC/Auto, in oak*, £37 16*s*.; *in walnut*, £39 18*s*.

CIRCUIT DESCRIPTION

Aerial input via equalising coils and switches **L1, S1** (MW) and **L2, S2** (LW) to tappings on aerial coils **L3, L4,** which are tuned by **C29.** This tuned circuit precedes first valve **(V1, Mazda metallised ACSGVM),** a variable-mu RF tetrode operating as signal frequency amplifier.

Choke-capacitance coupling by **L5, C4** to frequency changer **(V2, Mazda metallised ACS2Pen),** and RF pentode whose control grid circuit is tuned by **L6, L7** and **C32.** The anode is coupled via **C8** to the tuned oscillator circuit **L9** (MW), **L10** (LW) and **C35.** Parallel trimming by **C33** (MW) and **C34** (LW); tracking by specially shaped vanes of **C35.** Reaction coupling by cathode coil **L8.**

Third valve **(V3, Mazda metallised ACS1VM)** is a variable-mu RF tetrode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C36, L11, L12, C37** and **C38, L13, L14, C39.**

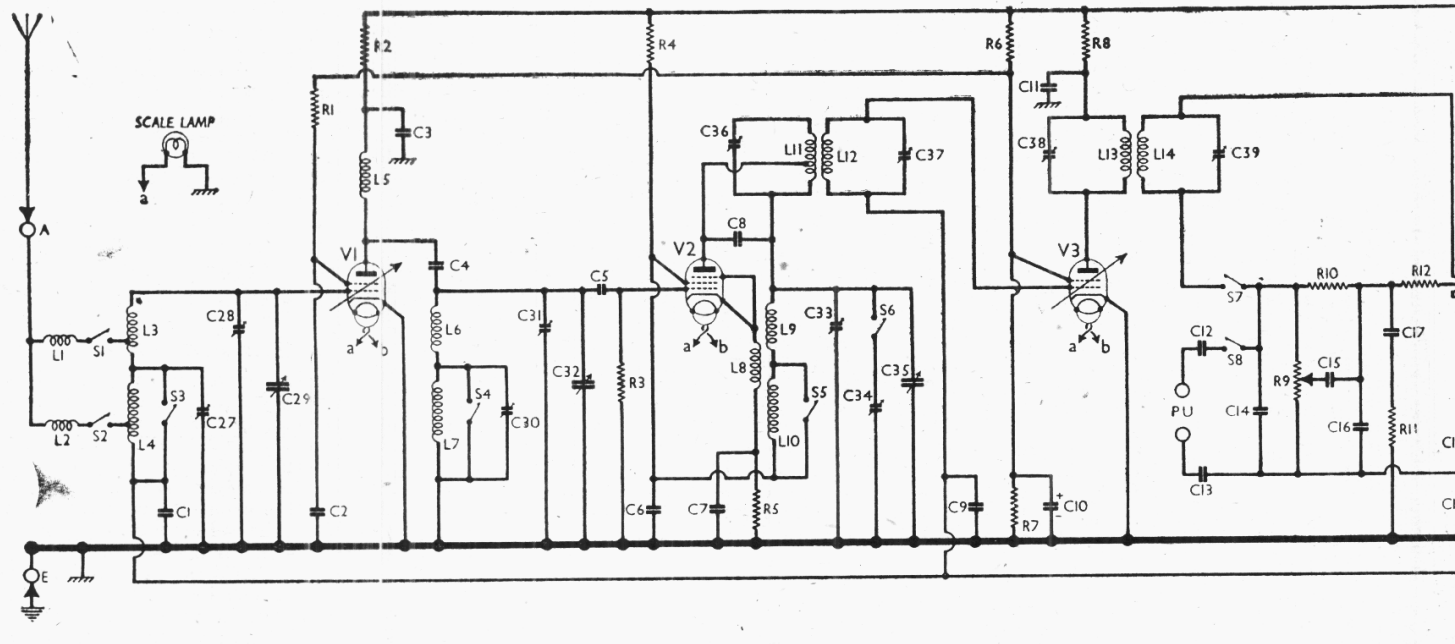
Intermediate frequency 114 kc/s.

Diode second detector is part of double diode triode valve **(V4, Mazda metallised ACHLDD).** Audio frequency component in rectified output is developed across load resistor **R9,** which also operates as manual volume control, and passed via AF coupling capacitor **C15,** tone corrector **C17, R11,** and grid stopper **R12** to control grid of triode section, which operates as AF amplifier.

IF filtering by **C14, C16.** Provision for connection of gramophone pick-up across **R9** via isolating capacitors **C12, C13** and switch **S8,** which closes on gram, while **S7** and **S9** open. On radio, **S9** closes and short-circuits **R14,** and GB is obtained from the DC potential developed across **R9** and applied to the control grid via **R10, R12,** so that GB varies in sympathy with signal strength, providing post-detector AVC and controlling the AVC system as a whole, as described later.

Parallel-fed AF transformer coupling by **R13, C20** and **T1** between **V4** triode and directly heated triode output valve **(V5, Mazda PP3/250).** Variable tone control by variable capacitor **C40** across **T1** secondary. Socketed plugs used to connect the internal speaker permit a low impedance external speaker to be connected with or without the internal one.

HT current is supplied by Westinghouse metal rectifier **MR1** connected to operate as a voltage doubler with electrolytic capacitors **C24, C25.** Smoothing by speaker field **L17** (connected in the negative HT lead to chassis with **R21**) and electrolytic capacitors **C22, C23.** Mains RF filtering by **C26.** GB potential for **V4** is obtained from the potential divider **R19, R20** across **L17, R21.**



Circuit diagram of the Pye E/AC superhet. The speaker field winding **L17,** and **R21,** are in the negative HT lead to chassis, and **R19 R20** are in parallel with them. The cathode of **V4** is returned via **R15** to HT negative, but the cathode potential relative to chassis varies between positive and negative values with change of signal strength according to the signal diode output, whose DC potential is applied as GB to the triode control grid. Note that the positive sides of **C19** and **C21** are connected to chassis.

The AVC System

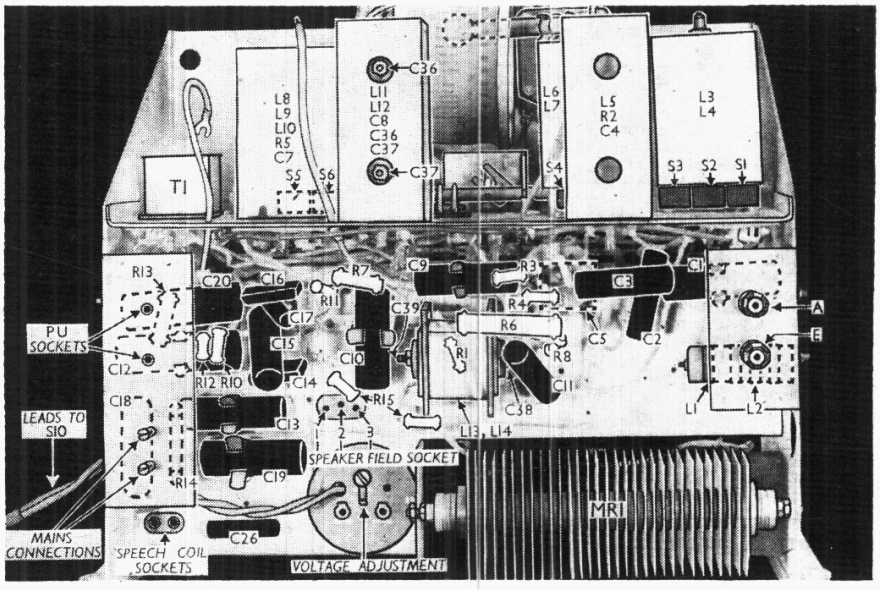
An amplified and delayed system of automatic volume control is obtained by biasing **V4** triode control grid from the signal diode load resistor **R9,** as mentioned earlier. The immediate effect of this is that the triode anode current, and consequently the cathode current, varies inversely as the strength of the received carrier at the signal diode, because the stronger the signal, the more negative does the control grid become relative to the cathode.

L17 and **R21** form a potential divider in the negative HT lead to chassis, and their junction provides a tapping point about 2 V negative with respect to chassis. To this point the AVC diode load resistor **R17** is returned, and from it is derived, via the AVC line, a fixed GB potential for **V1** and **V3,** whose cathodes are connected directly to chassis.

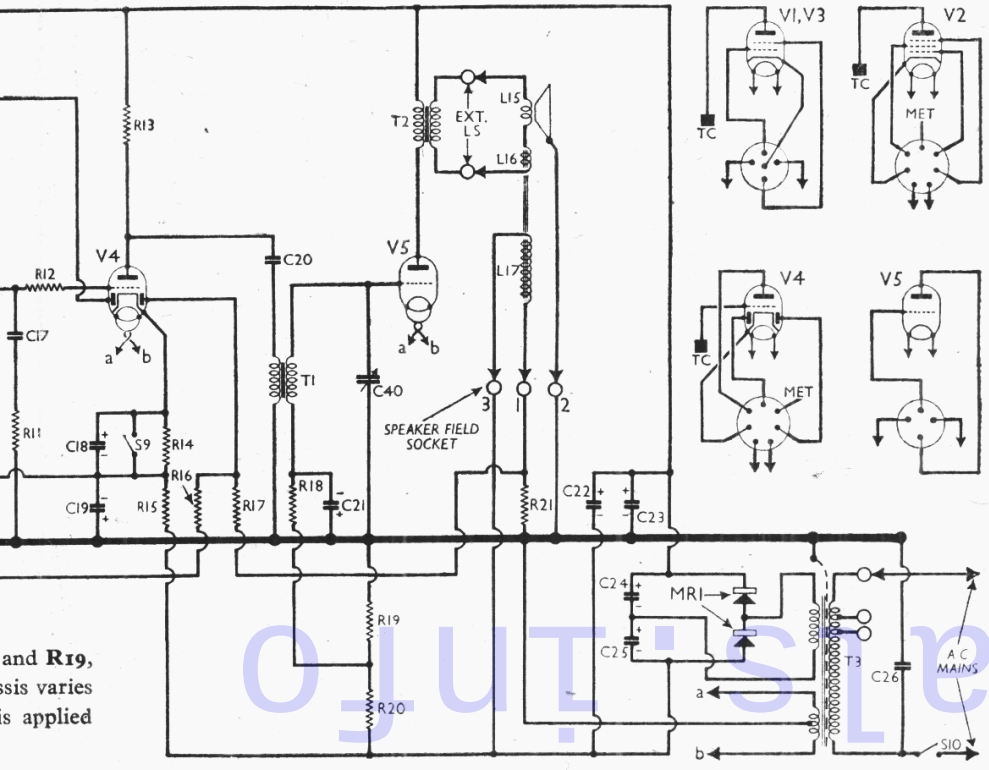
The cathode of **V4** is returned via **R15** (**R14** is short-circuited on radio by **S9**) to HT negative, which is some 75 V negative with respect to chassis. Under no-signal conditions, when **V4** control grid is at cathode potential, HT current through **V4** is at a maximum, and something like 100 V will be dropped along **R15.** This puts **V4** cathode at about 25 V positive with respect to chassis. The figures quoted are hypothetical, but they illustrate the case.

As the AVC diode is 2 V negative with respect to chassis, the cathode is now about 27 V positive with respect to the AVC diode anode, and no diode current will flow. Upon the arrival of a signal, however, **V4** control grid potential moves in a negative direction, causing a fall in HT current through **R15** and thus reducing the positive potential of the cathode, which begins to approach chassis potential.

No appreciable change occurs in the AVC line potential until the strength of the signal is such that the cathode potential falls below that of the AVC diode anode; that is, when the diode anode is more positive than the cathode. At this point diode current begins to flow, and as the DC resistance of the diode is then low compared with that of **R17,** the diode anode, and with it the AVC line, follows the potential of the cathode, becoming more and more negative as the signal strength increases and taking the AVC line potential with it.



Rear elevation of chassis. Most of the small components are indicated here beneath the chassis deck, although some are obscured by the panels either side. Separate sockets are provided for connecting the speaker field and speech coil. The **L5, R2, C4** unit (above the deck) is similar in appearance to the first IF unit. The 2nd IF unit in actually in the centre of the under-chassis compartment.



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COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	V1 CG decoupling ...	0·25
C2	V1 SG decoupling ...	0·1
C3	V1 anode decoupling ...	0·1
C4	V1–V2 RF coupling ...	0·0002
C5	V2 CG capacitor ...	0·00002
C6	V2 HT decoupling ...	0·1
C7	V2 cathode by-pass ...	0·01
C8	Oscillator coupling ...	0·001
C9	V3 CG decoupling ...	0·25
C10*	V3 SG decoupling ...	4·0
C11	V3 anode decoupling ...	0·1
C12	PU isolating capacitors ...	0·25
C13	PU isolating capacitors ...	0·25
C14	IF by-pass	0·0002
C15	AF coupling	0·25
C16	IF by-pass	0·001
C17	Part of tone corrector ...	0·01
C18*	V4 cathode by-pass capacitors	25·0
C19*	V4 cathode by-pass capacitors	4·0
C20	AF coupling to T1 ...	0·25
C21*	V5 CG decoupling ...	4·0
C22*	HT smoothing capacitors	16·0
C23*	HT smoothing capacitors	8·0
C24*	Voltage doubler capacitors	4·0
C25*	Voltage doubler capacitors	4·0
C26	Mains RF by-pass ...	0·01
C27‡	Aerial LW trimmer ...	—
C28‡	Aerial MW trimmer ...	—
C29†	Aerial circuit tuning ...	—
C30‡	V2 CG LW trimmer ...	—
C31‡	V2 CG MW trimmer ...	—
C32†	V2 CG circuit tuning ...	—
C33‡	Osc. circ. MW trimmer ...	—
C34‡	Osc. circ. LW trimmer ...	—
C35†	Oscillator circuit tuning	—
C36‡	1st IF trans. pri. tuning	—
C37‡	1st IF trans. sec. tuning	—
C38‡	2nd IF trans. pri. tuning	—
C39‡	2nd IF trans. sec. tuning	—
C40†	Variable tone control ...	—

* Electrolytic. † Variable. ‡ Pre-set.

RESISTORS		Values (ohms)
R1	V1 SG HT feed	8,500
R2	V1 anode HT feed ...	20,000
R3	V2 CG resistor	50,000
R4	V2 HT feed resistor ...	20,000
R5	V2 GB resistor	2,000
R6	V1, V3 SG's HT feed	25,000
R7	potential divider ...	12,500
R8	V3 anode HT feed ...	15,000
R9	Manual volume control; V4 signal diode load ...	40,000
R10	V4 triode CG resistor ...	2,000,000
R11	Part tone corrector ...	2,000,000
R12	V4 triode grid stopper ...	5,000
R13	V4 triode anode load ...	15,000
R14	GB resistor (gram) ...	500
R15	AVC delay resistor ...	25,000
R16	AVC line decoupling	250,000
R17	V4 AVC diode load ...	500,000
R18	V5 CG decoupling ...	100,000
R19	V5 GB potential divider	28,000
R20		40,000
R21	V1, V3 fixed GB resistor	64

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial equalising coils ...	3·6
L2		23·0
L3	Aerial tuning coils ...	4·0
L4		33·0
L5	V1 anode RF choke ...	230·0
L6	V2 CG tuning coils ...	4·0
L7		33·0
L8	Oscillator reaction coil ...	0·2
L9	Osc. MW tuning coil ...	2·25
L10	Osc. LW tuning coil ...	9·0
L11	1st IF trans. Pri., total	160·0
L12	Sec. ...	122·0
L13	2nd IF trans. Pri. ...	122·0
L14	Sec. ...	122·0
L15	Speaker speech coil ...	1·23
L16	Hum neutralising coil ...	0·1
L17	Speaker field coil ...	1,650·0
T1	Intervalve trans. Pri. ...	550·0
	Sec. ...	2,350·0
T2	Output trans. Pri. ...	380·0
	Sec. ...	0·25
T3	Mains trans. Pri., total	28·0
	Heater sec.	0·1
	HT sec. ...	32·0
S1–S6	Waveband switches ...	—
S7–S9	Radio/gram. change switches	—
S10	Mains switch	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the makers. With the exception of **V4** anode voltage, all voltages were measured with the negative meter lead connected to chassis, but in the case of **V4** it was connected to the cathode. There was no signal input.

The voltage between chassis and the positive end of the metal rectifier **MR1** should be about 290 V (chassis negative) and from chassis to the negative end about 90 V (chassis positive).

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 AC SGVM	145	6·65	45	1·95
V2 ACS2 Pen	185	3·0	186	1·8
V3 AC S1VM	200	5·3	63	2·0
V4 AC HLDD	146	7·7	—	—
V5 PP3/250	275	24·7	—	—

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off) from the front of the cabinet, and the back cover from the rear;

lay the chassis face down, and remove from the two top front corners of the chassis the wood screws (with metal collars and rubber grommets) holding the chassis to the front of the cabinet, taking care not to lose the collars if they are loose;

inserting a screwdriver through holes provided in the base of the cabinet, remove the four cheese-head screws (with washers) holding the bottom flanges of the chassis to the wooden fillets on the sides of the cabinet;

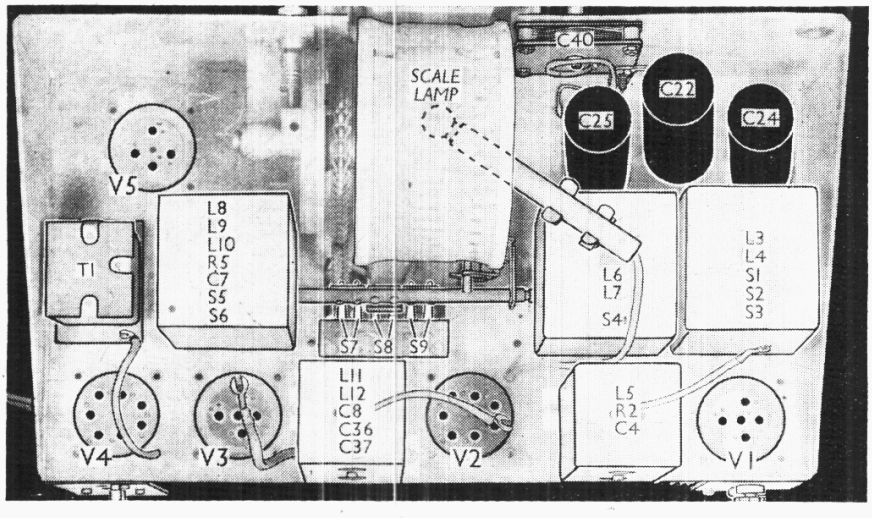
remove the two wood screws holding the mains switch to the side of the cabinet, and free its leads from the cleat below;

withdraw from their sockets in the lower rear compartment of the chassis the speech coil and speaker field plugs;

remove the two upper rear cover fixing brackets (two countersunk head wood screws each) from the sides of the cabinet, stand the cabinet upright, and withdraw the chassis.

When replacing, do not omit to replace the two spacing blocks between the bottom of the chassis and the supporting fillets.

Removing Speaker.—First remove the chassis, then remove the nuts from the two studs holding the speaker to its mounting bracket.



Plan view of the chassis. The radio/gram switches **S7–S9** are indicated here. The positions of the waveband switches are indicated in the rear view overleaf. Inductance adjustments in the tops of the **L3, L4** and **L6, L7** cans are not intended to be disturbed.

GENERAL NOTES

Switches.—**S1-S6** are the waveband switches, and **S7-S9** the radio/gram change-over switches, operated by a spindle which runs nearly the whole length of the chassis, above the deck, at a right-angle to the switch control spindle. **S1-S6** are located inside or just beneath their respective coil assemblies, while **S7-S9** occupy a position beneath the scale drum.

The positions of these switches are indicated in our chassis views, although some of them cannot be seen. Their action is indicated in the table below for the three control settings, starting from the fully anti-clockwise position of the control. A dash indicates open, and **C**, closed.

S10 is the QMB mains switch in a moulded case fitted to one side of the cabinet.

Switch Table

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

Coils.—The RF and oscillator coils **L3, L4; L6, L7;** and **L8-L10** are in three screened units on the chassis deck along the line of the switch spindle. The series coils **L1, L2** are in the unscreened unit beneath the chassis deck. The first IF transformer **L11, L12** is in a fourth unit on the chassis deck with its trimmers and **C8,** while the second IF transformer **L13, L14** is in another screened unit beneath the deck, seen in our rear view of the chassis, with a trimmer on each end face. A fifth screened unit on the chassis deck with an appearance similar to the first IF transformer contains **V1** anode RF choke **L5** and **R2, C4.**

Scale Lamp.—This has an MES base and a clear spherical bulb, and is rated at about 4 V 0.3 A. It is connected across one half of the heater secondary winding on the mains transformer **T3,** between the centre-tap and one end.

For replacement purposes, the lamp-holder can be eased from the two spring clips which hold it to the top of the **L6, L7** unit. The flexible lead then permits convenient handling.

External Speaker.—Two sockets are provided at the rear of the chassis for connecting the internal speaker, whose plugs also carry sockets. The chassis sockets are connected to the output transformer **T1** secondary, so that a low impedance (about 3-5 Ω) external speaker may be connected to them, or to the socketed plug if both speakers are required.

Capacitors C18, C19.—These are two electrolytics which by-pass **V4** cathode circuit. **C18** is a TCC moulded type, rated at 25 μF, 25 V DC maximum working, by-passing only the gram GB resistor **R14.** **C18** is in a tubular carton, and is rated at 4 μF, 200 V DC working. In our chassis it was a TCC type A, and it should be noted that its **positive** end is connected to **chassis.**

Capacitors C22, C23.—These are two wet electrolytics for the HT smoothing circuit. **C22** is mounted on an insulated platform fitted over a hole in the chassis deck with **C24, C25.** It is rated at 16 μF, 440 V DC working. **C23** is mounted at the foot of the chassis, seen in our front chassis view, and is rated at 8 μF, 440 V DC working. In both units, the case is the negative connection.

Capacitors C24, C25.—These are two wet electrolytics, in tubular metal containers, associated with the voltage doubler HT rectifier circuit. They are mounted on the insulated platform with **C22** as mentioned earlier, and are both rated at 4 μF, 425 V DC working. The can is the negative connection in each case, and the two units are connected in series.

The makers state that while 4 μF replacements are not available other values should not be substituted, and recommend replacing the whole rectifier with one of the thermionic valve type.

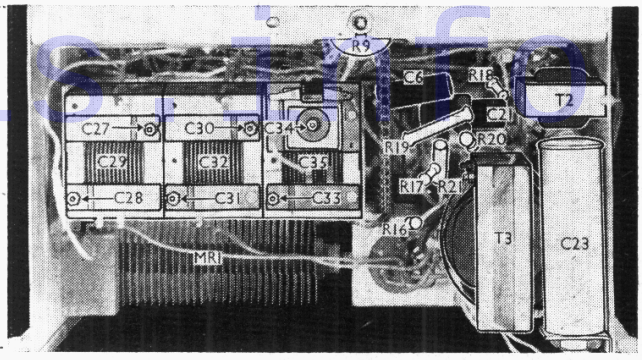
Resistor R15.—This is shown in our circuit diagram and tables as a single 25,000 Ω unit, but it actually consists of two 12,500 Ω units connected in series, as shown in our rear chassis illustration.

Chassis Divergencies.—After the first 3,000 E/AC chassis had been made, the design was slightly modified to include certain improvements, so that there are actually two distinct versions. Our sample was of the later type, and represents the majority by far. The differences in the earlier type are as follows :

C17 and **R11** were omitted, but a 0.00005 μF was connected between **V4** triode control grid and chassis. **R13** was then 10,000 Ω, instead of 15,000 Ω, and between it as HT positive was inserted a decoupling circuit comprising a 5,000 Ω resistor and a 2 μF capacitor.

Some components, although their position was unchanged, suffered a change in value. **R10** (now 2,000,000 Ω) was then 1,000,000 Ω; **C15** (now 0.25 μF) was 0.01 μF; and **C19** (now 4 μF) was 8 μF.

In early chassis, too, **C21** was a moulded TCC 4 μF electrolytic, mounted on the bottom flange outside the chassis, near the front, on the left as seen from the front, instead of a tubular type mounted beneath the deck as seen in our front view. In some cases, **C26** may be mounted in this compartment, instead of in the rear one as shown in our illustration.



Front view of the lower portion of the chassis, showing further components including the gang, beneath the chassis deck. Part of the volume control **R9** is seen at the top.

Alternative Rectifier.—Where difficulty is experienced in obtaining or replacing the electrolytic voltage doubler capacitors **C24, C25** with the correct capacitance of 4 μF each, either several 2 μF paper insulated capacitors of suitable working voltage may be used, if they can be accommodated, or a thermionic valve rectifier must be substituted for the metal one.

The second alternative involves the replacement of the mains transformer by one with suitable windings for the conventional valve, which the makers suggest should be a Mazda UU4 or its equivalent. They make a suitable mains transformer (part No. 77001) which is available only to Pye dealers.

CIRCUIT ALIGNMENT

IF Stages.—The IF adjustments can be carried out without removing the chassis from the cabinet, although usually, if the IF circuits are readjusted, the RF and oscillator circuits will also require readjustment.

Connect the signal generator leads via a 0.002 μF non-inductive capacitor to control grid of **V2** and chassis. The most convenient point at which to connect the control grid clip is the soldering tag of that socket on the valve holder. This is the rearmost tag, and is almost level with the rear edge of the chassis deck.

Short-circuit **L8** to stop the oscillator from working. The most convenient way to do this is to make up a piece of flexible cable with a crocodile clip at each end and clip one end to **V2** cathode, on the valve holder, and the other end to chassis.

Feed in a 114 kc/s (2,631.5 m) signal, and adjust **C36, C37, C38** and **C39** for maximum output, reducing input as circuits come into line to avoid AVC action. Now remove the short-circuit from **V2** cathode.

RF and Oscillator Stages.—For this operation the chassis must be removed from the cabinet, and it will be necessary to extend the speech coil and field coil leads from the speaker in order to connect up the two units.

To set the drum, turn the gang to maximum, slacken the fixing screw in the boss on the chain wheel on the gang spindle, and turn the tuning control until the scale drum reaches its stop at the low wavelength end of the scale. Now slacken the two screws holding the scale escutcheon to the front of the chassis, and adjust it so that the two pointers cover the red line across the scale, then tighten up the escutcheon screws.

Turn the gang to maximum again, and then back a little; with the flat end of a metal bar press the edges of the rotor vanes of the gang level with those of the stators, and while holding the vanes steady, adjust the drum so that the pointers are level with the 560 m mark on the MW scale and the black dot at the end of the LW scale. Then tighten up the chain wheel boss screw. A slot in the boss permits adjustment over quite a wide range.

Finally, transfer signal generator leads to **A** and **E** sockets, via a suitable dummy aerial.

MW.—Switch set to MW, slacken **C28** adjustment to minimum capacitance and **C31** to maximum. Turn the scale to minimum (red line), feed in a weak 196 m (1,530 kc/s) signal, and adjust **C33** for maximum output. If two peaks are found, select that involving the lesser trimmer capacitance. Then adjust **C28** and **C31** for maximum output, reducing input if necessary to avoid AVC action. Finally, readjust **C33** for maximum output.

LW.—Switch set to LW, and leave tuning control as already set at minimum wavelength. Set **C27** to minimum capacitance, and screw up **C30** almost to maximum. Feed in a 775 m (387.1 kc/s) signal, and adjust **C34** for maximum output; but if two peaks are found here, that involving the **greater** trimmer capacitance must be used. Now adjust **C27** and **C30** for maximum output, again reducing input if necessary. Feed in a strong 775 m signal, and readjust **C34** for maximum output. Do not disturb **C27** and **C30.**

Radiogram Models

The radiogramophone versions of the E/AC employ a chassis which is almost identical with that in the table model.

Model E/RG/AC is fitted with a Collaro combined gramophone motor and pick-up unit, and is housed in a pedestal cabinet. The cabinet is available in oak or walnut, the walnut model being two guineas dearer than the oak.

The E/RG/AC/Auto is similar to the ordinary RG model except that it is fitted with an automatic record changer which handles eight 10in. or eight 12in. records at one loading. It is made in the same two finishes at 10 guineas extra in each case.

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