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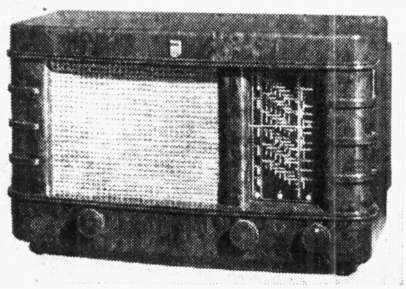
PHILIPS 206A

3-BAND AC SUPERHET



THE Philips 206A is a 3-valve (plus valve rectifier) 3-band AC superhet, suitable for use on 100-260V, 50-100 C/S mains. The SW range is 16.7-51m. The receiver is fitted into a compact moulded cabinet, the inside of the top of which is covered with metal foil, which is used as a plate aerial for the reception of the more powerful stations if desired.

Release date: May, 1940.

CIRCUIT DESCRIPTION

Aerial input, via coupling coils **L1** (SW), plus **L2** (MW), plus **L3** (LW) to single tuned circuits **L4** (SW), plus **L5** (MW), tuned by **C31** or **L6** (LW) tuned by **C31**. Condensers **C1** and **C2** shunt MW and LW coupling coils respectively, while unwanted coils are short-circuited to chassis both in coupling and tuning circuits.

A metallic foil stuck inside the roof of the cabinet is permanently connected via a contact strip to the aerial socket of the receiver to permit the receiver to operate without an external aerial if desired.

First valve (**V1, Mullard ECH3**) is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L11** (SW), plus **L12** (MW), plus **L13** (LW) are tuned by **C35**; parallel trimming by **C13** (SW), **C33** (MW) and **C34** (LW); series tracking by **C12** (MW) and **C32** (LW). Reaction coupling by **L8** (SW), plus **L9** (MW), plus **L10** (LW) via damping resistance **R7.**

IF suppression by tuned filter rejector circuit **L7, C5** in **V1** heptode control grid circuit.

Second valve (**V2, Mullard EF9**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-dust cored transformer couplings **C8, L14, L15, C9** and **C18, L16, L17, C19.** Tuning adjustments are made by suitably positioning the threaded cores in the coils.

Intermediate frequency 470 KC/S.

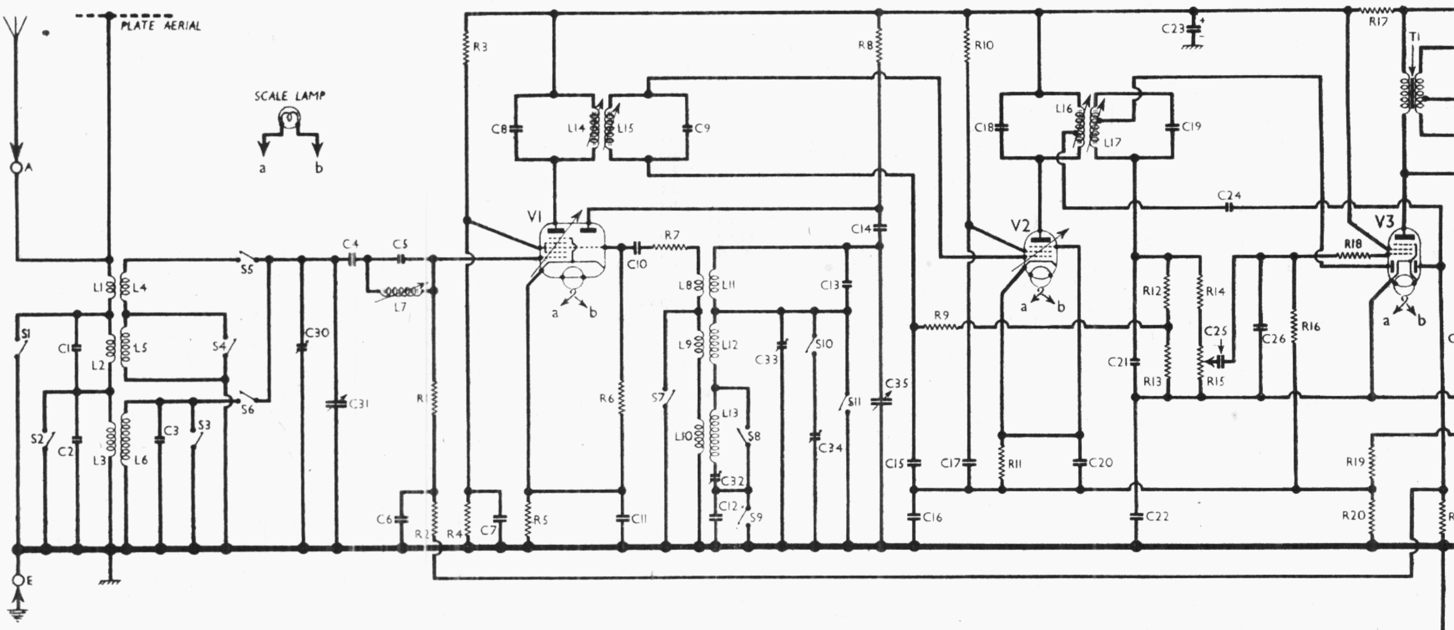
Diode second detector is part of double diode output pentode valve (**V3, Mullard EBL1**). Audio frequency component in rectified output is developed across manual volume control **R15** and its limiting resistance, **R14,** which operate as load resistance, and passed via the AF coupling condenser **C25,** CG resistance **R16** and grid stopper **R18** to CG of pentode section. IF filtering by **C21** and **C26.**

DC potential developed across **R14** and **R15** appears also across **R12, R13,** which are connected in parallel with them to form a potential divider, from which the AVC line for **V2** is tapped off and fed back via decoupling circuit to the valve grid circuit, giving undelayed automatic volume control.

Second diode of **V3,** fed from tapping on **L16,** via small coupling condenser **C24,** provides a second DC potential which is developed across load resistance **R21** and fed back through decoupling circuit to CG of frequency changer, giving delayed automatic volume control in this case. The delay voltage, together with GB for pentode section, is obtained from drop along resistances **R19** and **R20,** which form a potential divider in cathode lead to chassis.

Fixed tone correction in **V3** pentode anode circuit by **C27.**

Part of the output voltage, as it appears across the secondary winding of the output transformer **T1,** is tapped off and fed back to the cathode circuit of **V3,** where it is interposed between



Circuit diagram of the Philips 206A 3-band AC superhet. Note the plate aerial and the IF rejector in the heptode control grid circuit of **V1.** No smoothing choke is fitted, smoothing being carried out by **C23, R17** and **C29.** Slight modifications in **T1,** and in the heater secondary of **T2** may be present (See "Chassis Divergencies").

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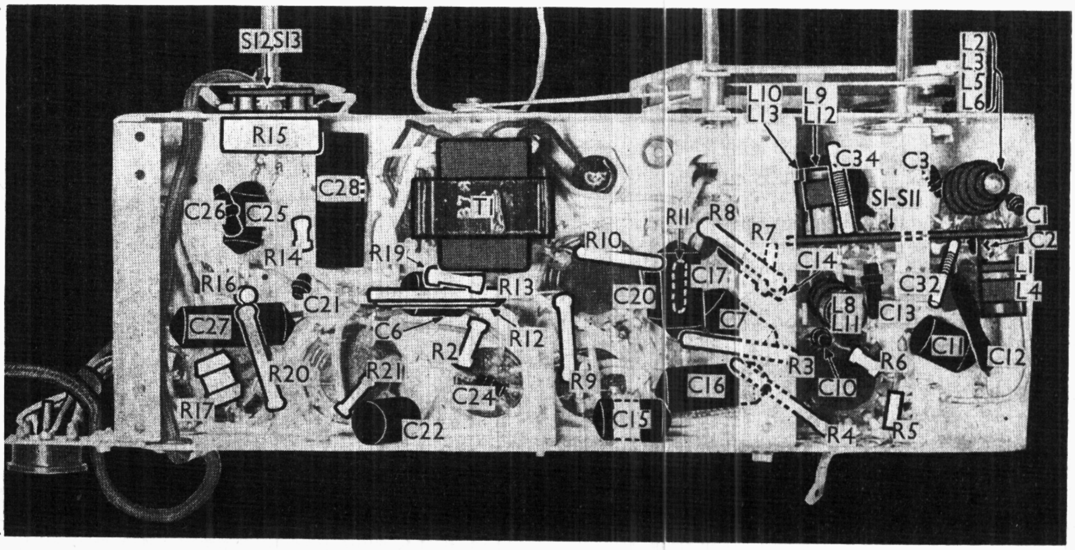
Under-chassis view. The **S1-S11** unit is built on to a paxolin plate which supports the five coil units. A diagram, looking at it in the direction of the arrow, is in column 1 overleaf. **C32** and **C34** are small wire-wound adjustable condensers. **R17** is a wire-wound resistor.



the cathode and the biasing circuit to introduce negative feed-back.

HT current is supplied by full-wave rectifying valve **(V4, Mullard AZ1).** Smoothing is effected by electrolytic condensers **C23** and **C29** in conjunction with the HT feed resistance **R17.**

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (recessed grub screws) from the front of the cabinet;

remove the screw holding the plate aerial lead, with its contact strip and small sub-baffle clamping bracket to the moulded projection on the inside front of the cabinet;

remove the clip (round-head wood-screw) holding the mains lead to the floor of the cabinet.

remove the two set-screws (with washers) holding the scale assembly to the front of the cabinet;

unsolder the three leads from the speaker connecting strip;

remove the four bolts (with washers) holding the chassis to the bottom of the cabinet.

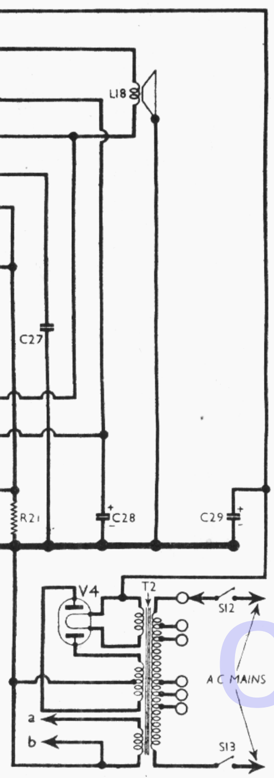
When replacing, the baseboard should be so placed that the totally screened side faces downwards; the end at which the screen overlaps on to the upper side should be on the right when viewed from the rear of the cabinet.

Connect the plain yellow speaker lead to the left-hand tag on the speaker connecting strip, as viewed from the rear of the receiver, and the second yellow lead (with a green splash near the end) to the middle tag.

The black (earthing) lead goes to the right-hand tag, which is clamped under the top fixing nut.

Removing Speaker.—Remove the three nuts (with washers and lock-nuts) holding the speaker to the sub-baffle.

When replacing, a lock-washer should be placed under the first nut on the top bolt, and the speaker connecting strip, with the earthing tag directly beneath it, should be fitted between the two nuts.



COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial MW shunt	0·000039
C2	Aerial LW shunt	0·000039
C3	Aerial circuit LW trimmer...	0·0000039
C4	V1 heptode CG condenser ...	0·00033
C5	IF rejector tuning condenser	0·000047
C6	V1 heptode CG decoupling...	0·047
C7	V1 SG decoupling	0·047
C8	1st IF transformer tuning condensers	0·000103
C9		0·000097
C10	V1 osc. CG condenser ...	0·0001
C11	V1 cathode by-pass	0·047
C12	Osc. circuit MW tracker ...	0·0004355
C13	Osc. circuit SW trimmer ...	0·000022
C14	V1 osc. anode coupling ...	0·00047
C15	V2 CG decoupling	0·047
C16	GB circuit by-pass	0·1
C17	V2 SG decoupling	0·047
C18	2nd IF transformer tuning condensers	0·000103
C19		0·000103
C20	V2 cathode by-pass	0·047
C21	IF by-pass	0·000056
C22	Part of negative feed-back coupling	0·047
C23*	HT smoothing condenser ...	15·0
C24	Coupling to V3 AVC diode ...	0·0000039
C25	AF coupling to V3 pentode...	0·022
C26	IF by-pass	0·0001
C27	Fixed tone corrector... ...	0·0047
C28*	V3 cathode by-pass	25·0
C29*	HT smoothing condenser ...	50·0
C30‡	Aerial circuit MW trimmer...	0·00003
C31†	Aerial circuit tuning	0·00049
C32‡	Osc. circuit LW tracker ...	0·0002
C33‡	Osc. circuit MW trimmer ...	0·00003
C34‡	Osc. circuit LW trimmer ...	0·000032
C35†	Oscillator circuit tuning ...	0·00049

*Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 heptode CG resistance ...	470,000
R2	V1 heptode CG decoupling...	1,500,000
R3	V1 SG HT potential divider resistances	33,000
R4		39,000
R5	V1 fixed GB resistance ...	270
R6	V1 osc. CG resistance ...	47,000
R7	Oscillator reaction damping	150
R8	V1 osc. anode HT feed ...	27,000
R9	V2 CG decoupling	1,800,000
R10	V2 SG HT feed resistance ...	68,000
R11	V2 fixed GB resistance ...	1,200
R12	V2 AVC feed potential divider resistances	2,700,000
R13		2,700,000
R14	Volume control limiter ...	47,000
R15	Manual volume control and V3 signal diode load ...	500,000
R16	V3 pentode CG resistance ...	1,000,000
R17	HT feed resistance	1,800
R18	V3 pentode grid stopper ...	1,000
R19	V3 pentode GB; AVC delay resistances	220
R20		470
R21	V3 AVC diode load	1,000,000

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial SW coupling coil ...		2·0
L2	Aerial MW coupling coil ...		23·0
L3	Aerial LW coupling coil ...		170·0
L4	Aerial SW tuning coil ...		0·1
L5	Aerial MW tuning coil ...		4·0
L6	Aerial LW tuning coil ...		45·0
L7	IF rejector coil		10·0
L8	Oscillator SW reaction coil		1·0
L9	Oscillator MW reaction coil		2·0
L10	Oscillator LW reaction coil		250·0
L11	Osc. circuit SW tuning coil		0·1
L12	Osc. circuit MW tuning coil		7·0
L13	Osc. circuit LW tuning coil		16·0
L14	1st IF trans.	Pri.	7·0
L15		Sec.... ...	7·0
L16	2nd IF trans.	Pri., total...	7·0
L17		Sec., total...	7·0
L18	Speaker speech coil		3·0
T1	Output trans.	Pri.	700·0
		Sec., total ...	3·2
T2	Mains trans.	Pri., total ...	60·0
		Heater sec. ...	Very low
		Rect. heat. sec.	Very low
		HT sec., total	480·0
S1-S11	Waveband switches... ...		—
S12,S13	Mains switches, ganged R15		—

VALVE ANALYSIS

Valve voltages and currents given in the table overleaf are those measured in our receiver when it was operating on mains of 230V, using the 220V tapping on

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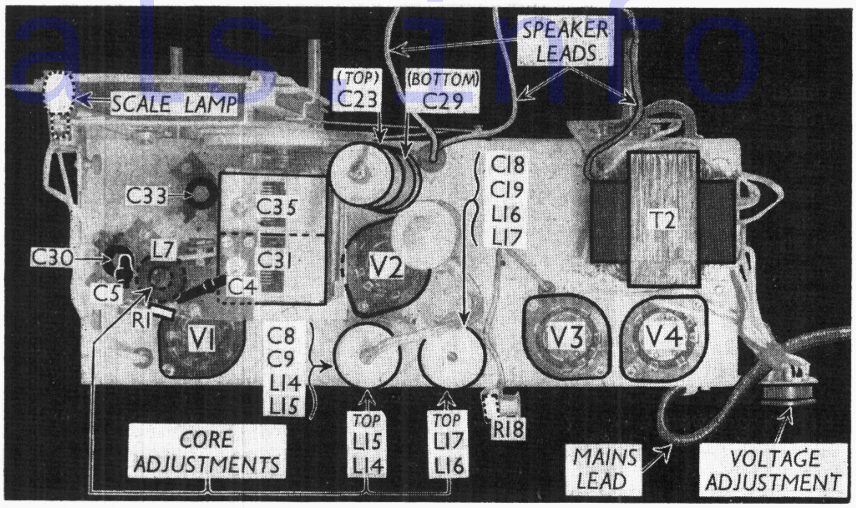

Plan view of the chassis. Note the dual condenser **C23, C29.**

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 400V scale of a model 7 Universal Avometer, chassis being negative.

If the receiver should become unstable, as it did in our case, when the anode and screen currents of **V1** are being measured, it can be stabilised by connecting a non-inductive condenser of about 0.1 μF between the top cap of **V1** and chassis.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH3	230 Oscil 112	1·8 lator 3·4	88	2·2
V2 EF9	230	7·2	98	1·6
V3 EBL1	240	23·0	225	2·8
V4 AZ1	250†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1-11 are the waveband switches, in a single rotary unit built on to a large paxolin plate beneath the chassis, which also carries five coil units. The unit is indicated in our under-chassis view, and shown in detail in the diagram below, where it is drawn as seen looking from the front of the underside of the chassis. The table (col. 2) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C** closed.

S12, S13 are the QMB mains switches, in a unit in front of the chassis, ganged with the volume control **R15.**

Coils.—L1, L4; L2, L3, L5, L6; L8, L11; L9, L12 and **L10, L13** are in five unscreened tubular units mounted on the paxolin plate carrying the wavechange switch. **L7** is an adjustable iron-cored unit on a panel attached to the gang condenser above the chassis. The IF transformers **L14, L15** and **L16, L17** are in two screened units on the chassis deck. Each unit contains its two associated fixed trimmers, while the core adjustments are reached through holes at the rear of the cans, indicated in our plan chassis view.

External Speaker.—No provision is made for this, but a low resistance (3—5O) type could be connected across the internal speaker speech coil tags.

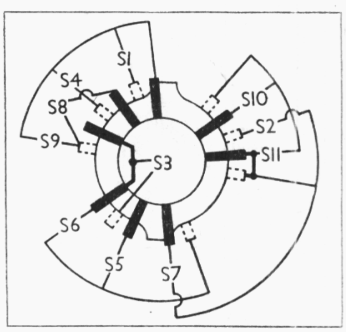

Diagram of the **S1-S11** switch unit, as seen from the front of the underside of the chassis. The tags at the rear are dotted.

Scale Lamp.—This is a Philips MES type, part No. 8045 D.

Condensers C23, C29.—These are two dry electrolytics in a single tubular metal container mounted vertically on the chassis deck. The can is the common negative connection; the tag emerging from the top of the can is the positive of **C23** (15μF), while the tag emerging beneath the chassis is the positive of **C29** (50μF).

Pre-set Condensers.—There are two trimmers on the chassis deck **(C30, C33)** and two adjustable condensers of the wire-wound type **(C32, C34)** beneath the chassis in the coil and switch assembly.

Resistance R18.—This is associated with the top cap connector of **V3.**

Chassis Divergencies.—Our model had a speaker type 9676, and output transformer with connections as shown in our circuit diagram. Other models may have a speaker of lower resistance which will be connected from the bottom to the tapping on **T1** secondary. Actually the secondary is formed of two windings in series, their common connection forming the tapping.

In some models a tapping is provided on the heater secondary of **T2** to enable a 4V scale lamp to be employed. The 4V scale lamp is the 8042D, while the 6.3V scale lamp is the 8045D, as in our model.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator, via a 0.032μF condenser, to control grid (top cap) of **V1** and chassis. Switch set to MW, turn gang to minimum and volume control to maximum. Feed in a 470 KC/S signal, connect an 80$\mu\mu$F condenser across **L16** for detuning, then adjust core of **L17** for maximum output. Transfer 80$\mu\mu$F condenser to **L17,** and adjust core of **L16** for maximum output. Connect 80$\mu\mu$F condenser across **L14,** and adjust core of **L15** for maximum output. Transfer 80$\mu\mu$F condenser to **L15,** and adjust core of **L14** for maximum output. Finally, remove the detuning condenser.

SWITCH TABLE

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

RF and Oscillator Stages.—Connect signal generator via a suitable dummy aerial, to **A** and **E** sockets. A Philips 15 degree jig will be required for setting the gang at the lower wavelength ends of the scales. (Code No. 09.992.440.) No SW adjustments are provided.

MW.—Switch set to MW, fit the 15 deg. jig, and set the gang to it. Feed in a 1,550 KC/S (193.5m) signal and adjust **C33,** then **C30,** for maximum output. Re-check **C33,** then seal the trimmers.

LW.—Switch set to LW, set the gang to the 15 deg. jig, feed in a 408 KC/S (734m) signal and adjust **C34** (by varying the turns of wire) for maximum output. Connect an aperiodic amplifier (type GM2404) to mixer anode of **V1,** and short circuit the **C35** section of the gang. Feed in a 160 KC/S (1,875m) signal, tune it in on the set for maximum output from the aperiodic amplifier. Without altering the tuning of the set, remove the amplifier, and the short circuit from **C35,** and adjust **C32** (by adding or removing turns) for maximum output. Finally, repeat the 408 KC/S adjustment.

If a new tracker is fitted, remove one-quarter of the wire winding before commencing alignment.

Where no aperiodic amplifier is available, **C32** must be adjusted while rocking the gang for optimum output.

IF Rejector.—Switch set to MW, turn gang to maximum, feed in a 470 KC/S signal, and adjust core of **L7** for *minimum* output.

Calibration.—After alignment is complete, tune to several known stations and adjust the pointer on the cord until the stations are indicated as accurately as possible.

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