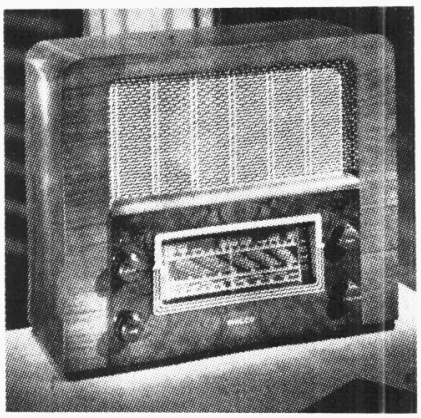
Supplement to The Wireless & Electrical Trader, Sept. 16, 1939

"TRADER" SERVICE SHEET

427

PHILCO A2

3-BAND AC SUPERHET



THE Philco A2 receiver is a 3-valve (plus rectifier) 3-band superhet suitable for operation from mains of 200-250 V, 40-100 C/S. The SW range is 16-50 m, calibrated in MC/S from 18-6 MC/S. Tone and switch positions are indicated on the scale, and there is provision for connection of both a gramophone pick-up and an external speaker.

Release date : July, 1939.

CIRCUIT DESCRIPTION

Aerial input is via IF rejector **L1, C25** and coupling coil **L3** (SW) or coupling components **L2, C1, C2** (MW and LW) to single-tuned circuits **L4, C28** (SW), **L5, C28** (MW) and **L6, C28** (LW) which precede heptode valve (**V1, Brimar 6A7**) operating as frequency changer with electronic coupling.

Oscillator grid coils **L7** (SW), **L8** (MW) and **L9** (LW) are tuned by **C30 ;** parallel trimming by **C31** (SW), **C32** (MW) and **C33** (LW) ; series tracking by **C5** (SW), **C34** (MW) and **C35** (LW). Reaction by direct coupling via **C6** on all bands, augmented on SW by reaction coil **L10.**

Second valve (**V2, Brimar 6F7B**) is a triode pentode. The variable-mu pentode section is employed as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C36, L11, L12, C37** and **C38, L13, L14, C39.** **Intermediate frequency 465KC/S.**

Diode second detector is part of double diode output pentode valve (**V3, Philco PenDD61**). Audio frequency component in rectified output is developed across load resistance **R9** and passed via AF coupling condenser **C12,** manual volume control **R8** and CG condenser **C10** to triode section of **V2,** which operates as AF amplifier. IF filtering by **C14, R10** and **C13.** Tone compensation by **C11.** Provision for connection of gramophone pick-up across **C12, R8** via switch **S14.**

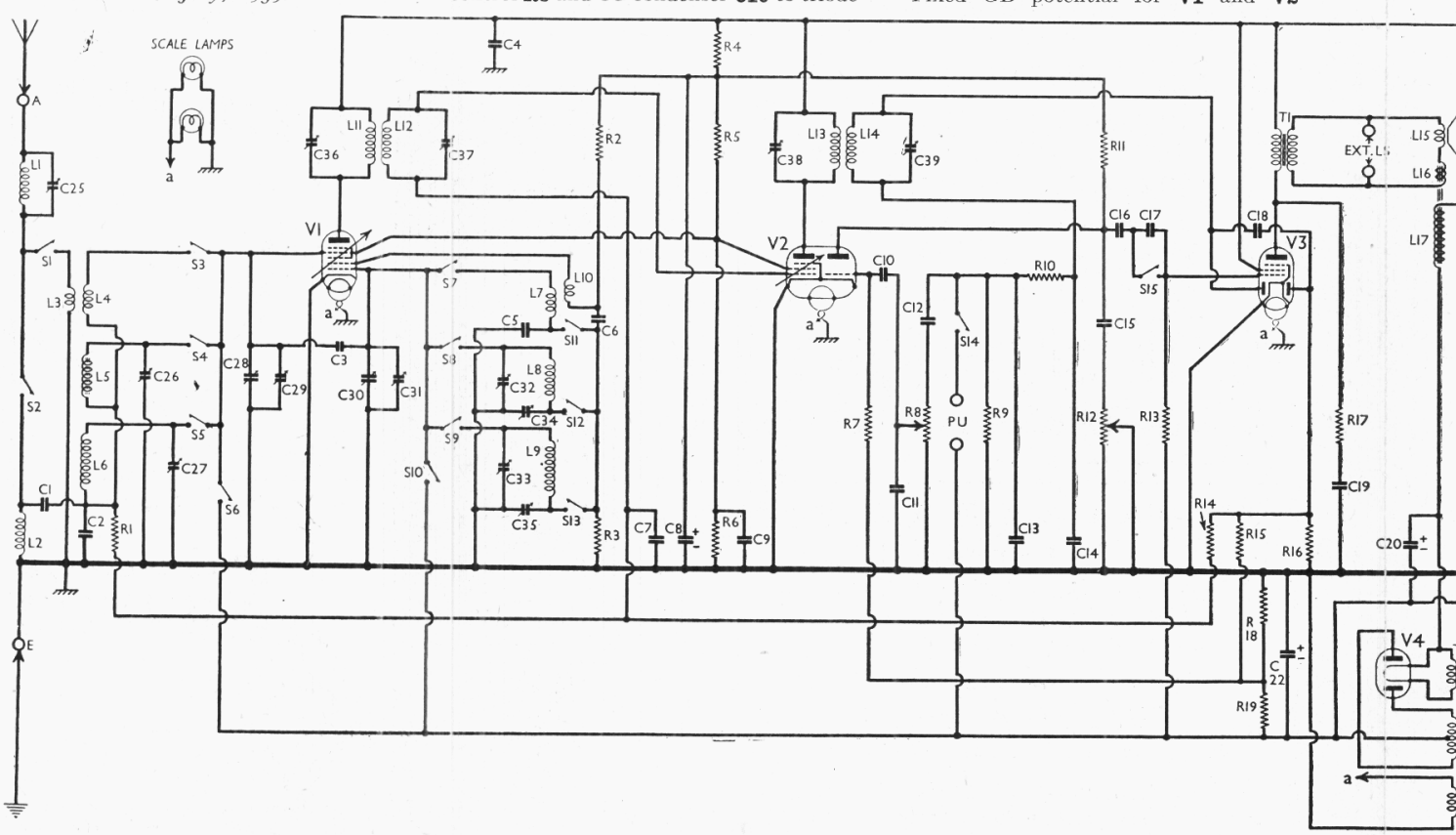
Resistance-capacity coupling by **R11, C16** and **R13,** via **S15,** between **V2** triode and **V3** pentode section. Variable tone control by **C15, R12.** When the control spindle of **R12** is turned fully anti-clockwise, **S15** opens and inserts **C17** in series with **V2** triode — **V3** pentode coupling, producing low note attenuation.

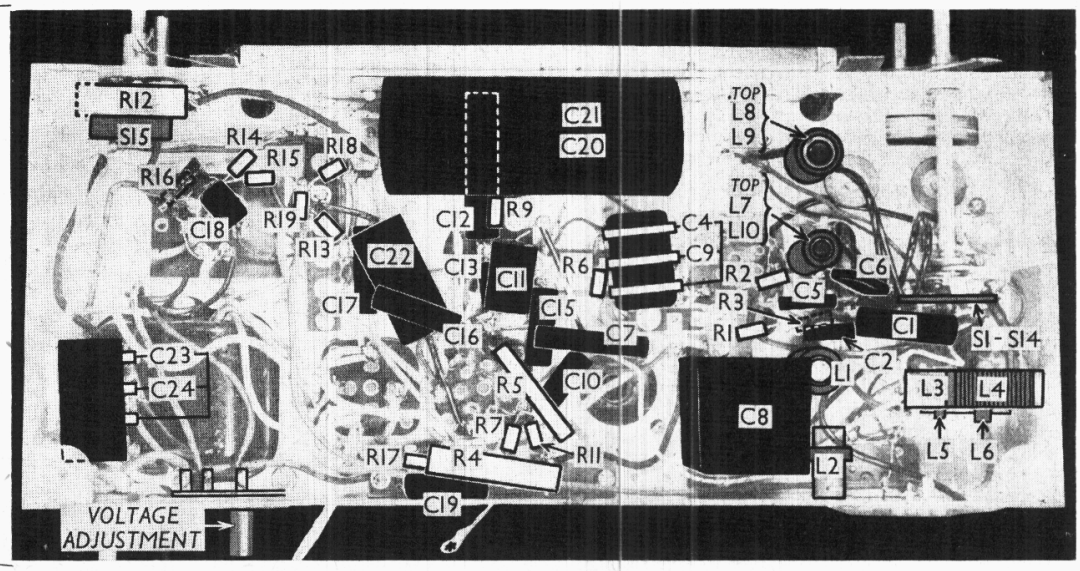
Fixed tone correction by **R17, C19** in **V3** pentode anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1.**

Second diode of **V3,** fed from **L14** via **C18,** provides DC potential which is developed across load resistances **R15, R16** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control.

HT current is supplied by full-wave rectifying valve (**V4, Brimar 80**). Smoothing by speaker field **L17** and dry electrolytic condensers **C20** and **C21.** Mains RF filtering by condensers **C23** and **C24.**

Fixed GB potential for **V1** and **V2**





Under - chassis view. A diagram of the **S1-S14** unit is in col. 3 overleaf. Note the two dual moulded condensers **C4, C9** and **C23, C24,** each pair having one common connection. The coils **L1-L10** are all to be seen in this view.

(pentode section), GB for **V2** (triode section) and **V3** (pentode section), and AVC delay, are obtained from potential divider **R18, R19** in negative HT lead to chassis.

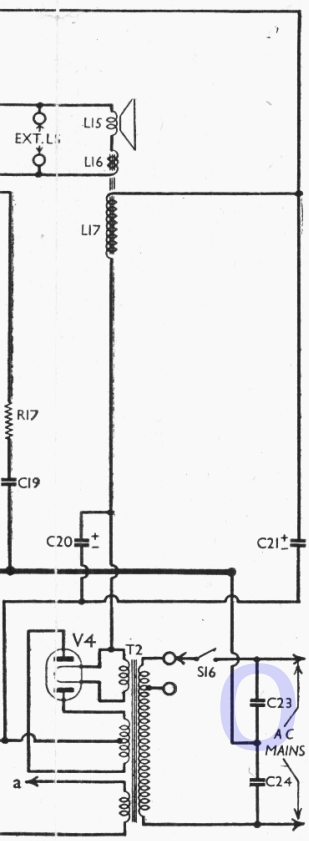
Looked at from **V3** AVC diode, **R15** and **R16** are in parallel, but from the viewpoint of **R18,** across which they are connected, these resistances are in series, and form a potential divider, from which the AVC delay and **V1, V2** fixed GB is obtained.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (recessed grub screws), the white earthing wire connected to the speaker frame, and the four bolts (with metal and rubber washers) holding the chassis to the bottom of the cabinet. 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 the speaker leads, and *when replacing,* connect them as follows, numbering the tags on the transformer from left to right: 1, green/white; 2, white; 3, green. Note that a rubber washer is fitted to each fixing bolt, between the chassis and the bottom of the cabinet, and do not forget to replace the white earthing wire on the bottom right-hand fixing bolt of the speaker.

Removing Speaker.—The speaker can be removed from the cabinet by unsoldering the leads and removing the nuts (with lock washers) from the four bolts holding it to the sub-baffle. *When replacing,* see that the transformer is at the top, and connect the leads as indicated above.



Circuit diagram of the Philco A2 3-band AC superhet. Note the unusual arrangement of the circuit, **V2** being a combined IF and 1st AF amplifier.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 tetrode CG decoupling	400,000
R2	V1 osc. anode HT feed	6,500
R3	V1 osc. CG resistance	99,000
R4	V1 osc. anode, V2 triode anode, and V1, V2 SG's HT feed potential divider resistances.	9,000
R5		5,000
R6		25,000
R7	V2 triode CG resistance	650,000
R8	Manual volume control	500,000
R9	V3 signal diode load	400,000
R10	IF stopper	51,000
R11	V2 triode anode load	65,000
R12	Variable tone control	100.000
R13	V3 pentode CG resistance	250,000
R14	AVC line decoupling	650,000
R15	V3 AVC diode load resistances	650,000
R16		1,500,000
R17	Part of fixed tone corrector	6,500
R18	V1 tet. and V2 pent. fixed GB; V2 triode and V3 pent. GB resistances	68
R19		68

	CONDENSERS	Values (μF)
C1	Aerial MW and LW coupling condensers	0·01
C2		0·0046
C3	Small coupling	Very low
C4	HT circuit RF bypass	0·09
C5	Osc. circuit SW tracker	0·00154
C6	V1 osc. anode coupling	0·00025
C7	V2 CG decoupling	0·025
C8*	V1 osc., and V2 triode anodes decoupling	16·0
C9	V1, V2 SG's decoupling	0·09
C10	V2 triode CG condenser	0·04
C11	Tone compensator	0·0004
C12	Coupling to V2 triode	0·065
C13	IF by-pass condensers	0·00011
C14		0·00011
C15	Part of variable tone control	0·04
C16	V2 triode to V3 pentode AF coupling	0·0065
C17	Treble boost coupling	0·001
C18	Coupling to V3 AVC diode	0·0001
C19	Part of fixed tone corrector	0·006
C20*	HT smoothing condensers	8·0
C21*		8·0
C22*	Auto GB circuit by-pass	50·0
C23	Mains RF by-pass	0·05
C24		0·05
C25‡	Aerial IF rejector tuning	—
C26‡	Aerial circuit MW trimmer	—
C27‡	Aerial circuit LW trimmer	—
C28†	Aerial circuit tuning	—
C29‡	Aerial circuit SW trimmer	—

Continued in next column.

	CONDENSERS (*Continued*)	Values (μF)
C30†	Oscillator circuit tuning	—
C31‡	Osc. circuit SW trimmer	—
C32‡	Osc. circuit MW trimmer	—
C33‡	Osc. circuit LW trimmer	—
C34‡	Osc. circuit MW tracker	—
C35‡	Osc. circuit LW tracker	—
C36‡	1st IF trans. pri. tuning	—
C37‡	1st IF trans. sec. tuning	—
C38‡	2nd IF trans. pri. tuning	—
C39‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡Preset.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil	2·0
L2	Aerial coupling choke	18·0
L3	Aerial SW coupling coil	0·2
L4	Aerial SW tuning coil	0·05
L5	Aerial MW tuning coil	3·0
L6	Aerial LW tuning coil	40·0
L7	Osc. circuit SW tuning coil	0·05
L8	Osc. circuit MW tuning coil	2·8
L9	Osc. circuit LW tuning coil	21·0
L10	Oscillator SW reaction	0·4
L11	1st IF trans. Pri.	8·0
L12	1st IF trans. Sec.	12·0
L13	2nd IF trans. Pri.	12·0
L14	2nd IF trans. Sec.	8·0
L15	Speaker speech coil	2·0
L16	Hum neutralising coil	0·15
L17	Speaker field coil	1,500·0
T1	Speaker input trans. Pri.	650·0
	Speaker input trans. Sec.	0·2
T2	Mains trans. Pri., total	20·0
	Mains trans. Heater sec.	0·2
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	480·0
S1-S13	Waveband switches	—
S14	Gram. pick-up switch	—
S15	Tone control switch	—
S16	Mains switch, ganged R8	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235 V, using the 200-229 V

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6A7	280	6·0	95	3·9
	Oscillator 125	2·6		
V2 6F7B	280	6·9	95	1·6
	Triode 65	1·3		
V3 PenDD61	265	26	280	5·6
V4 80	350†	—	—	—

† Each anode, A.C.

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

GENERAL NOTES

Switches.—**S1-S14** are the waveband and pick-up switches, in a single rotary unit. This is indicated in our under-chassis view and shown in detail in the diagram in col. 3 of this page as seen when viewed from the rear of the underside of the chassis. The table (col. 2) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates *open*, and **C**, *closed*.

S15 is a QMB switch associated with the variable tone control **R12.** It opens when **R12** spindle is turned fully anti-clockwise. Otherwise it remains closed and short-circuits **C17.**

When the waveband control is turned to "Gram," a switch, not shown in our diagrams, connects the junction of **L2, C1** to the common side of switches **S11, S12, S13.**

S16 is the QMB mains switch, ganged with the volume control **R8.**

Coils.—The IF rejector coil **L1,** the coupling coil **L2,** and the RF and oscillator tuning coils **L3, L4 ; L5, L6 ; L7, L10 ;** and **L8, L9** are in six unscreened tubular units beneath the chassis. They are indicated on the right of our under-chassis view.

The IF transformers **L11, L12** and **L13, L14** are in two screened units with their associated trimmers on the chassis deck. In the **L13, L14** unit are included certain other components.

Scale Lamps.—These are two Tung-sol lamps rated at 6·3 V, 0·35 A, and have small bayonet caps.

External Speaker.—Two sockets are provided on the speaker connecting strip, which is mounted on the speaker transformer, for connection of a low impedance (2-3 O) external speaker.

Pick-up Connections.—Two sockets are provided at the rear of the chassis for a magnetic type pick-up. The pick-up may be left permanently connected if desired.

Condensers C20, C21. These are two dry electrolytics in a single carton mounted on the front member of the chassis. The red lead is the positive of **C21** and the yellow the positive of **C20.** Each is 8μF, 475 V working, and they have a common negative black lead, which is connected to HT negative, not chassis.

Trackers C34, C35.—These are in a dual unit fitted beneath the chassis, but adjusted through a hole in the chassis deck. The screw adjusts **C34,** and the nut **C35.**

Condensers **C4, C9 ; C23, C24.**—These are made up as dual units in bakelite mouldings ; each unit contains two condensers which have one side common, connected to chassis via the fixing bolt. The "live" sides are brought out to two separate tags. These and the common tag are indicated in our under-chassis view.

Chassis Divergences.—The makers' diagram shows two alternative connections for **L1, C25.** In both cases, however, they form a filter across the aerial circuit instead of a rejector circuit in series with the aerial lead. Either **L1** or **C25** may be connected to chassis when connected as a filter ; when **C25** is connected to chassis a 0·00006 μF condenser may be shunted across it.

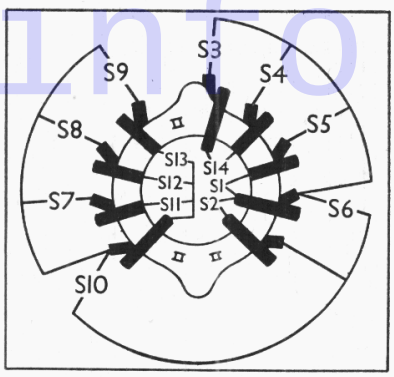
In several cases alternative values are given for resistances and condensers : **R3,** 100,000 O ; **R4,** 10,000 O ; and **C17,** 0·0008 ; are values given in the makers' diagram which were different in our chassis.

CIRCUIT ALIGNMENT

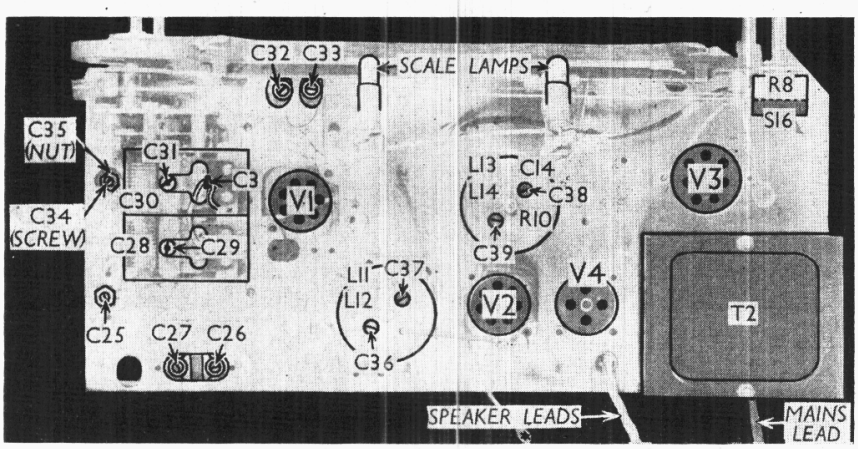
During alignment, the volume control should be kept at maximum, and the tone control should be turned as far anti-clockwise as it will go without opening **S15.**

TABLE AND DIAGRAM OF SWITCH UNIT

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



Above is the switch table, with (*right*) the switch diagram as seen looking from the rear of the underside of the chassis.



Plan view of the chassis. All the trimmers are clearly indicated.

IF Stages.—Switch set to MW and turn gang to minimum. Connect signal generator to control grid (top cap) of **V1** via a standard dummy aerial, leaving existing cap in position, and chassis. Feed in a 465 KC/S signal and adjust **C37, C36,** then **C38, C39** in that order for maximum output.

Transfer signal generator to **A** and **E** sockets, feed in a 465 KC/S signal, and adjust **C25** for *minimum* output.

RF and Oscillator Stages.—With the gang at maximum, the pointer should coincide with the third vertical line from the left-hand side of the scale. The signal generator should remain connected to **A** and **E** sockets.

SW.—Since the SW trimmers are connected directly across the tuning condensers, it is essential that this band is adjusted first. Subsequent alteration of the positions of these trimmers will upset the alignment of the other bands. Connect signal generator via a 400 O resistance (in place of dummy aerial).

Switch set to SW, tune to 18 MC/S on scale, feed in an 18 MC/S (16·65 m) signal, and adjust **C31** to the peak involving the *lesser* trimmer capacity for maximum output. Now adjust **C29** for maximum output, while rocking the gang for optimum results. Re-adjust **C31** with pointer set to 18 MC/S. Check that image is obtained at 17·1 MC/S and repeat the whole adjustment until no further improvement results.

Feed in a 6 MC/S (50 m) signal, tune it in, and check that pointer coincides with 6 MC/S calibration on scale. No variable tracking is provided.

MW.—Replace 400 O resistance with standard dummy aerial, switch set to MW, tune to 214 m (dot on scale), feed in a 214 m (1,400 KC/S) signal and adjust **C32,** then **C26,** for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C34** (screw) for maximum output, while rocking the gang for optimum results. Re-adjust **C32** at 214 m. Repeat the whole process until no improvement results.

LW.—Switch set to LW, tune to 1,034·5 m (dot on scale), feed in a 1,034·5 m (290 KC/S) signal, and adjust **C33,** then **C27,** for maximum output. Feed in a 1,875 m (160 KC/S) signal, tune it in (dot on scale) and adjust **C35** (nut) while rocking the gang for optimum results. Re-adjust **C33** at 1,034·5 m, then repeat the whole process until no further improvement results.

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