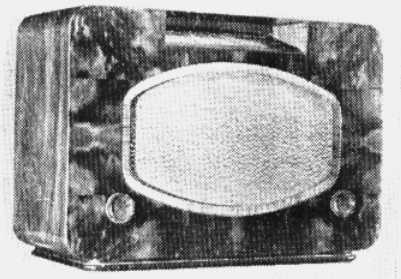
'TRADER' SERVICE SHEET

294

PHILIPS 716B

3-BAND BATTERY SUPERHET



A TWO-VALVE frequency changer is employed in the Philips 716B 5-valve battery 3-band superhet, another feature being that it is constructed in two units—one for the the frequency changer, and the other for the I.F., second detector and output stages. The short-wave range covered is 19-51 m.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and small condenser **C3** to capacity coupled band-pass filter. Primary coils **L4, L5** are tuned by **C28**; secondaries **L7, L8** by **C30**; coupling by **C4, C5.** I.F. filter **L1, C25** is connected across **L2, L3.** Image suppression by **C1, C26.** On S.W. input is via coupling condenser **C2** to aperiodic coil **L6.**

First valve (**V1, Mullard metallised VP2B**) is a variable-mu hexode operating as frequency changer with suppressor grid injection in conjunction with separate oscillator valve (**V2, Mullard metallised PM2HL**). Oscillator anode coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.) are tuned by **C31**; parallel trimming by **C32** (M.W.) and **C33** (L.W.); series tracking by **C12** (M.W.) and **C11** (L.W.). Reaction by grid coils **L12** (S.W.), **L13** (M.W.) and **L14** (L.W.).

Third valve (**V3, Mullard metallised VP2B**) is a variable-mu hexode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C34, L15, L16, C35** and **C36, L17, L18, C37.**

Intermediate frequency 128 KC/S.

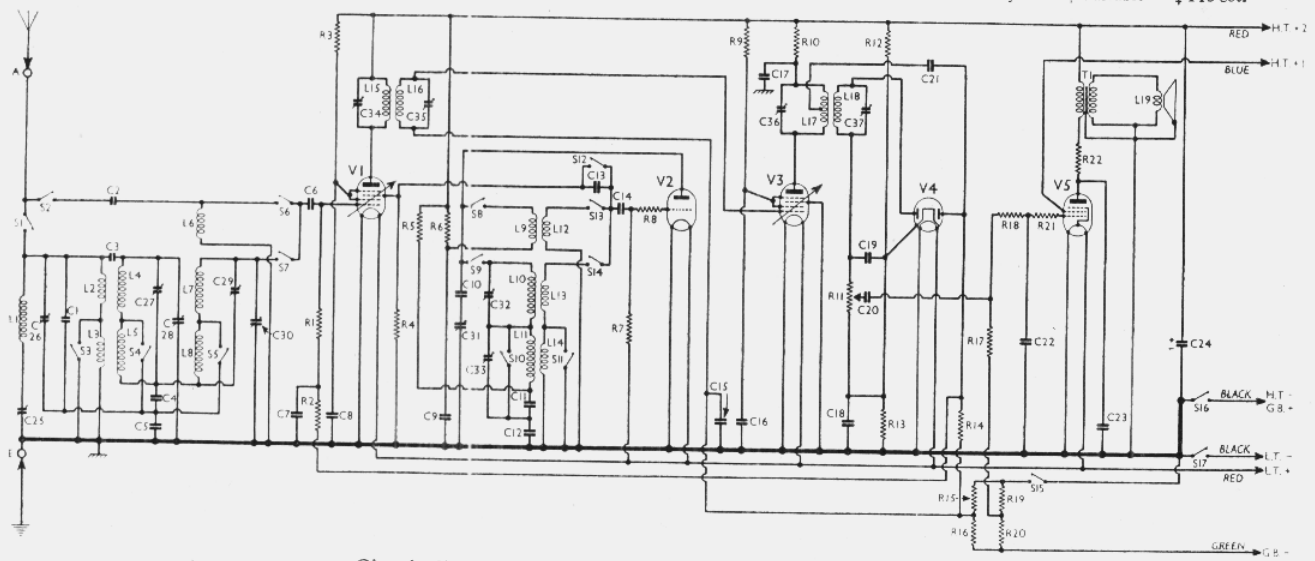
Diode second detector is part of separate double diode valve (**V4, Mullard metallised 2D2**). Audio frequency component in rectified output is developed across manual volume control **R11,** which also operates as load resistance, and passed via A.F. coupling condenser **C20,** C.G. resistance **R17** and I.F. filter **R18, C22, R21** to pentode output valve (**V5, Mullard PM22D**). Fixed tone correction in anode circuit by **C23.** G.B. potential is obtained from potential divider **R19, R20** across G.B. section of H.T. battery.

Second diode of **V4,** fed from tapping on **L17** via **C21,** provides D.C. potentials which are developed across load resistances **R14, R15** and fed back through decoupling circuits to F.C. (except on S.W.) and I.F. valves, giving automatic volume control. Delay voltage and minimum G.B. for **V3** is obtained from potential divider **R15, R16,** also connected across G.B. section of H.T. battery, whilst additional delay voltage is obtained from potential divider **R12, R13** across H.T. circuit.

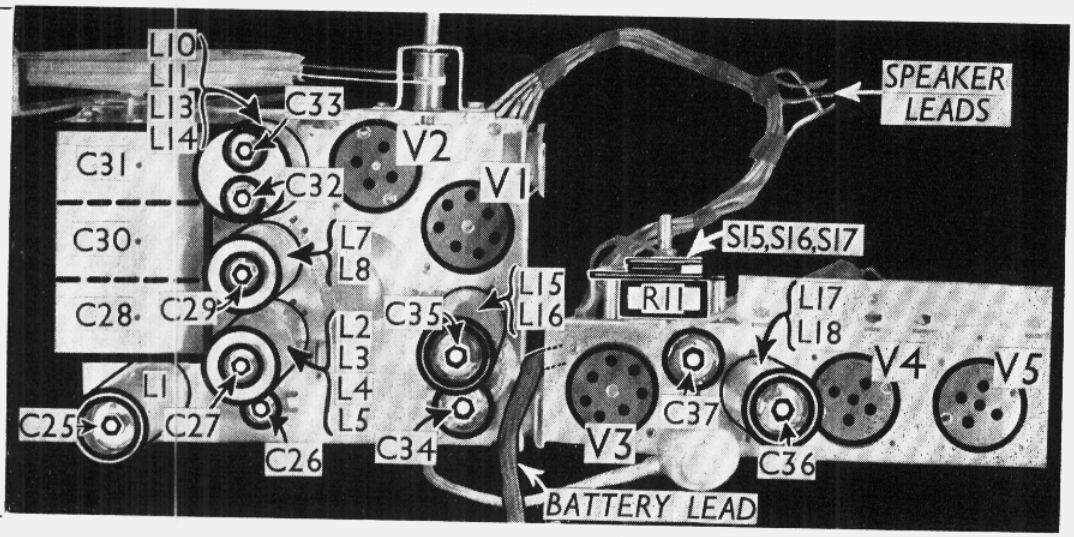
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Image suppressor (fixed) ..	0·000025
C2	Aerial S.W. series condenser..	0·00005
C3	M.W. and L.W. aerial coupling	0·00002
C4	Band-pass bottom coupling condensers	0·016
C5		0·025
C6	V1 C.G. condenser	0·0001
C7	V1 C.G. decoupling	0·05
C8	V1 S.G. decoupling	0·1
C9	V2 anode S.W. decoupling ..	0·02
C10	H.T. blocking condenser ..	0·02
C11	Osc. circuit L.W. tracker ..	0·000764
C12	Osc. circuit M.W. tracker ..	0·001615
C13	V2 to V1 S.W. osc. coupling..	0·0005
C14	V2 C.G. condenser	0·0001
C15	V3 C.G. decoupling	0·1
C16	V3 S.G. decoupling	0·01
C17	V3 anode decoupling	0·01
C18	V4 cathode by-pass	0·5
C19	I.F. by-pass	0·0001
C20	A.F. coupling to V5	0·01
C21	Coupling to V4 A.V.C. diode..	0·0001
C22	Part of I.F. filter	0·0001
C23	I.F. by-pass	0·002
C24*	H.T. reservoir condenser ..	8·0
C25‡	Aerial I.F. filter tuning ..	0·00017
C26‡	Image suppressor tuning ..	0·00003
C27‡	Band-pass pri. M.W. trimmer	0·00003
C28†	Band-pass primary tuning ..	0·00049
C29‡	Band-pass sec. M.W. trimmer	0·00003
C30‡	Band-pass secondary tuning..	0·00049
C31†	Oscillator circuit tuning ..	0·00049
C32‡	Osc. circuit M.W. trimmer ..	0·00003
C33‡	Osc. circuit L.W. trimmer ..	0·00003
C34‡	1st I.F. trans. pri. tuning ..	0·00017
C35‡	1st I.F. trans. sec. tuning ..	0·00017
C36‡	2nd I.F. trans. pri. tuning ..	0·00017
C37‡	2nd I.F. trans. sec. tuning ..	0·00017

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Philips 716B 3-band battery superhet.



Plan view of the two chassis, showing all the trimmers. The frequency-changer chassis is on the left. **S15-S17** are the battery circuit switches, ganged with **R11**. The wavechange switches are beneath the F.C. chassis.

	RESISTANCES	Values (ohms)
R1	V1 C.G. resistance	1,000,000
R2	V1 C.G. decoupling	1,000,000
R3	V1 S.G. H.T. feed	200,000
R4	V1 mixing grid resistance	100,000
R5	V2 anode M.W. and L.W. H.T. feed	64,000
R6	V2 anode S.W. H.T. feed	32,000
R7	V2 C.G. resistance	16,000
R8	V2 C.G. anti-parasitic resistance	40
R9	V3 S.G. H.T. feed	160,000
R10	V3 anode H.T. feed	5,000
R11	V4 signal diode load and manual volume control	500,000
R12	V4 A.V.C. delay voltage potential divider	500,000
R13		80,000
R14	V4 A.V.C. diode load	1,000,000
R15	V4 A.V.C. delay and V3 fixed G.B. potential dividers	10,000
R16		100,000
R17	V5 C.G. resistance	500,000
R18	Part of I.F. filter	100,000
R19	V5 G.B. potential divider resistances	25,000
R20		50,000
R21	Part of I.F. filter	100,000
R22	Anti-parasitic resistance	250

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial I.F. filter coil	130·0
L2	Aerial M.W. and L.W. coupling coils	25·0
L3		100·0
L4	Band-pass primary coils	4·5
L5		50·0
L6	Aperiodic S.W. aerial coil	0·5
L7	Band-pass secondary coils	4·5
L8		45·0
L9	Osc. circuit S.W. tuning coil	0·01
L10	Osc. circuit M.W. tuning coil	10·0
L11	Osc. circuit L.W. tuning coil	35·0
L12	Oscillator S.W. reaction	1·0
L13	Oscillator M.W. reaction	4·5
L14	Oscillator L.W. reaction	9·0
L15	1st I.F. trans. Pri.	130·0
L16	1st I.F. trans. Sec.	130·0
L17	2nd I.F. trans. Pri., total	130·0
L18	2nd I.F. trans. Sec.	130·0
L19	Speaker speech coil	3·0

	OTHER COMPONENTS (*Continued*)		Approx. Values (ohms)
T1	Output trans.	Pri.	2,000·0
		Sec.	0·2
S1-S14	Waveband switches		—
S15	G.B. circuit switch	ganged R11	—
S16	H.T. circuit switch		—
S17	L.T. circuit switch		—

DISMANTLING THE SET

NOTE.—In the following paragraphs the term " F.C. unit " is used to describe the left-hand unit in the cabinet (viewed from the back), while " I.F. and A.F unit " means the right-hand unit. It is not advisable to remove either of the units separately, and it will be better to remove both together.

Removing Both Units.—Remove the tuning and volume control knobs (two recessed grub screws in each, accessible through holes in the bottom of the cabinet) and the wave-change switch knob (two recessed grub screws, accessible through a slot in the back of the F.C. unit). Now remove the four round-head wood screws (with washers) holding the baseboard to the bottom of the cabinet, the two long round-head wood screws (with washers) holding the backs of the units to the wooden fillets in the cabinet, and the shorter round-head wood screw (with washer) holding the bracket on the F.C. unit to the sub-baffle.

Next unsolder the speaker leads and the earthing lead from each of the units, and free the bowden cable from the wave-change switch indicator. Free the drive wire from the scale pointer, loosen the two round-head wood screws holding the right-hand pulley and free the drive wire from the other pullies.

The baseboard and the two units can now be withdrawn from the cabinet. *When replacing*, do not forget to bring out the earthing lead from each unit and connect the speaker leads as follows, numbering the tags from left to right :— 1 and 2 joined together, lead from top contact stud on transformer; 3, lead from bottom stud.

Removing Speaker.—To remove the speaker from the cabinet, remove **V3** and **V4**, unsolder the leads and slacken the three clamps holding the speaker to the sub-baffle (nuts and lock nuts). *When replacing*, see that the terminal panel is pointing to the top right-hand corner of the cabinet and connect the speaker leads as above.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with an H.T. battery reading 142·5 V overall, on load. 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.

In our receiver **V5** was Grade A.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 VP2B	135	0·4	35	0·4
V2 PM2HL	49	1·1	—	—
V3 VP2B	123	1·6	38	0·6
V4 2D2	—	—	—	—
V5 PM22D	124	5·5	135	0·9

GENERAL NOTES

Switches.—S1-S14 are the waveband switches, in two rotary units beneath the frequency changer chassis. They are placed close together and screened, and cannot be easily reached without partial dismantling. The nearer unit, looking at the underside of the chassis is number 1, and the further, number 2. Diagrams of the units, as seen from the underside of the chassis, are on page VIII.

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

S15-S17 are the battery circuit switches, ganged in a rotary unit with the volume control **R11.** Their position is indicated

Continued overleaf

PHILIPS 716B—*Continued*

in the plan view of the two chassis. One side of each switch is common, and is connected to chassis.

Coils.—**L1**; **L2-L5**; **L7, L8**; **L10, L11, L13, L14** and the first I.F. unit, **L15, L16**, are in five screened units on the F.C. chassis deck, while the **L17, L18** unit is on the deck of the other chassis. **L6** and **L9, L12** are in two unscreened units beneath the F.C. chassis.

External Speaker.—No provision is made for this, but a low resistance type could be connected across **T1** secondary in parallel with **L19.**

Condenser C18.—This is 0·5 μF in our chassis, not 0·1 μF as given in the makers' diagram.

Batteries.—L.T., 2 V 20 AH accumulator cell; H.T. and G.B., 135 V plus 9 V combined H.T. and G.B. dry battery.

Battery Leads and Voltages.—Black lead, spade tag, L.T. negative; red lead, spade tag, L.T. positive 2 V; black lead and plug, H.T. negative and G.B. positive; green lead and plug, G.B. negative —7·5 V; red lead and plug, H.T. positive 2, +135 V; blue lead and plug, H.T. positive 1, +135 V (in socket in red plug) if **V5** is coded "A," and +120 V or 123 V if **V5** is coded "B."

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to L.W., turn gang to minimum and volume control to maximum. Connect signal generator to control grid (top cap) of **V3** (via a 0·032 μF condenser) and chassis, and feed in a 128 KC/S signal. Adjust **C36** and **C37** for maximum output.

Connect a 25,000 O resistor and 0·1 μF condenser in series between anode of **V1** and chassis, and connect signal generator, via the 0·032 μF condenser to control grid (top cap) of **V1** and chassis. Feed in a 128 KC/S signal, and adjust **C35** for maximum output. Transfer series resistance and condenser from anode circuit of **V1,** and connect them from control grid of **V3** to chassis. Adjust **C34** for maximum output, then remove damping circuit.

R.F. and Oscillator Stages.—A Philips 15 degree jig must be used to obtain the correct gang setting for trimming at the lower ends of the wavebands. The volume control should be at maximum, and the signal generator must be connected via a standard dummy aerial to **A** and **E** sockets.

M.W.—Fit 15 deg. jig, switch set to M.W., and turn gang until it bears on jig. Connect a 25,000 O resistor and 0·1 μF condenser in series between anode of **V1** and chassis. Feed in a 1,442 KC/S (208 m.) signal, and adjust **C32, C29, C27,** then **C29** and **C32** again, for maximum output.

L.W.—Switch set to L.W., and set gang to jig. Keep the damping circuit connected to **V1,** feed in a 395 KC/S (760 m.) signal, and adjust **C33** for maximum output. Remove damping circuit.

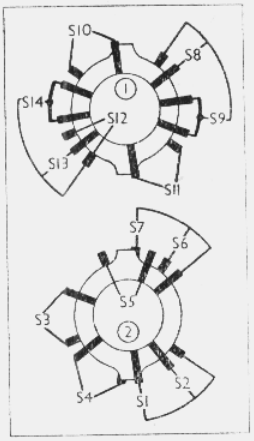
I.F. Filter.—Switch set to L.W., turn gang and volume control to maximum feed in a strong 128 KC/S signal, and adjust **C25** for *minimum* output.

Image Suppressor.—Switch set to M.W., turn volume control to maximum, and feed in a strong 300 m. (1,000 KC/S) signal. Tune set to the image (about 403 m.), and adjust **C26** for *minimum* output.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

Switch	S.W.	M.W.	L.W.
S1	—	C	C
S2	C	—	—
S3	—	C	—
S4	—	C	—
S5	C	C	—
S6	C	—	—
S7	—	C	C
S8	C	—	—
S9	—	C	C
S10	—	C	—
S11	—	C	—
S12	—	C	C
S13	C	—	—
S14	—	C	C

Switch diagrams, showing the two units as seen from the underside of the chassis, when the assembly is partially dismantled.



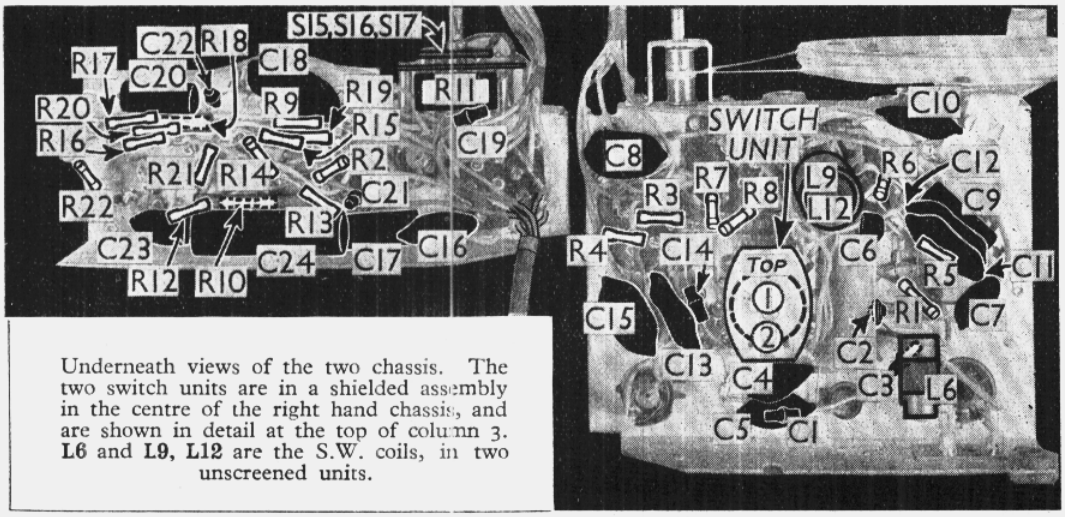
MAINTENANCE PROBLEM

Unusual Cause of Noise

A PYE T17 came in with the complaint that bad noises were spoiling reception; this set had been serviced before for the same fault and had been sent to the makers for their attention soon after sale. At that time we had suspected the first intermediate frequency transformer and the makers had replaced it and given a protracted test to prove the replacement. About a month after the set had been re-installed the noises again developed.

It was found that the end of the flex to the top cap of the FC4 had only one strand connected to the inside clip going to the valve thimble, while all the others were cut off short to the rubber. After correcting this, further trouble was found to be due to some faulty insulation inside the screened cover of this lead near the valve cap. A new lead and screened cover was fitted and further tests made. The most important point now follows.

Severe noises could still be produced by pulling one of the leads going to the coil can at the front of the chassis. This was opened up but no fault existed inside. However, it was noticed that there was a steady pin protruding up through the top of this can and bolted to the top paxolin disc carrying the two trimming condensers, and obviously in a strong R.F. field; this pin was making intermittent contact with the earthed can, and not being a tight fit in its hole it had been fixed with Chatterton's compound to secure it. This cement had not provided an insulating skin, neither had it forced the pin into certain contact with the can. After bonding it to earth all further attempts to provoke noises entirely failed. —F. SHUTER, EASTBOURNE.



Underneath views of the two chassis. The two switch units are in a shielded assembly in the centre of the right hand chassis, and are shown in detail at the top of column 3. **L6** and **L9, L12** are the S.W. coils, in two unscreened units.

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