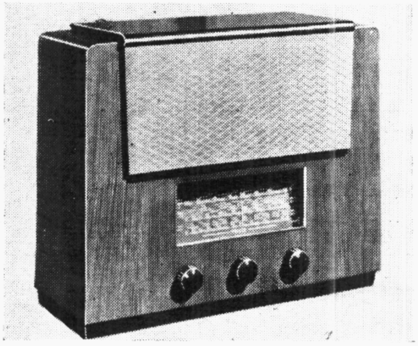
Supplement to The Wireless & Electrical Trader, August 9, 1947

"TRADER" SERVICE SHEET

823

PHILCO A536W

THREE-BAND A.C. SUPERHET



The Philco A536W superhet.

THE Philco A536W is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-250 V, 40-100 c/s. The S.W. range is 16.7-50 m, which is marked on the scale as 18-6 Mc/s. Provision is made for the connection of a gramophone pick-up and for the connection of a low-impedance external speaker.

Modifications which have been made during production are explained under "General Notes" overleaf, and full instructions are given for the replacement of the tuning drive cord.

Release date and original price: December, 1946. £19 9s, plus £4 6s 5d purchase tax.

CIRCUIT DESCRIPTION

On M.W. and L.W., aerial input is developed across **C1, C2** in series, which form a capacitative potential divider (**S2** being closed). "Bottom" coupling is provided from **C2,** which is common to aerial and tuning circuits, to single-tuned circuits **L3, C32** (M.W.) and **L4, C32** (L.W.).

On S.W., where the impedance of **C1** is negligible, input is developed across **L1** and passed to single-tuned circuit **L2, C32.**

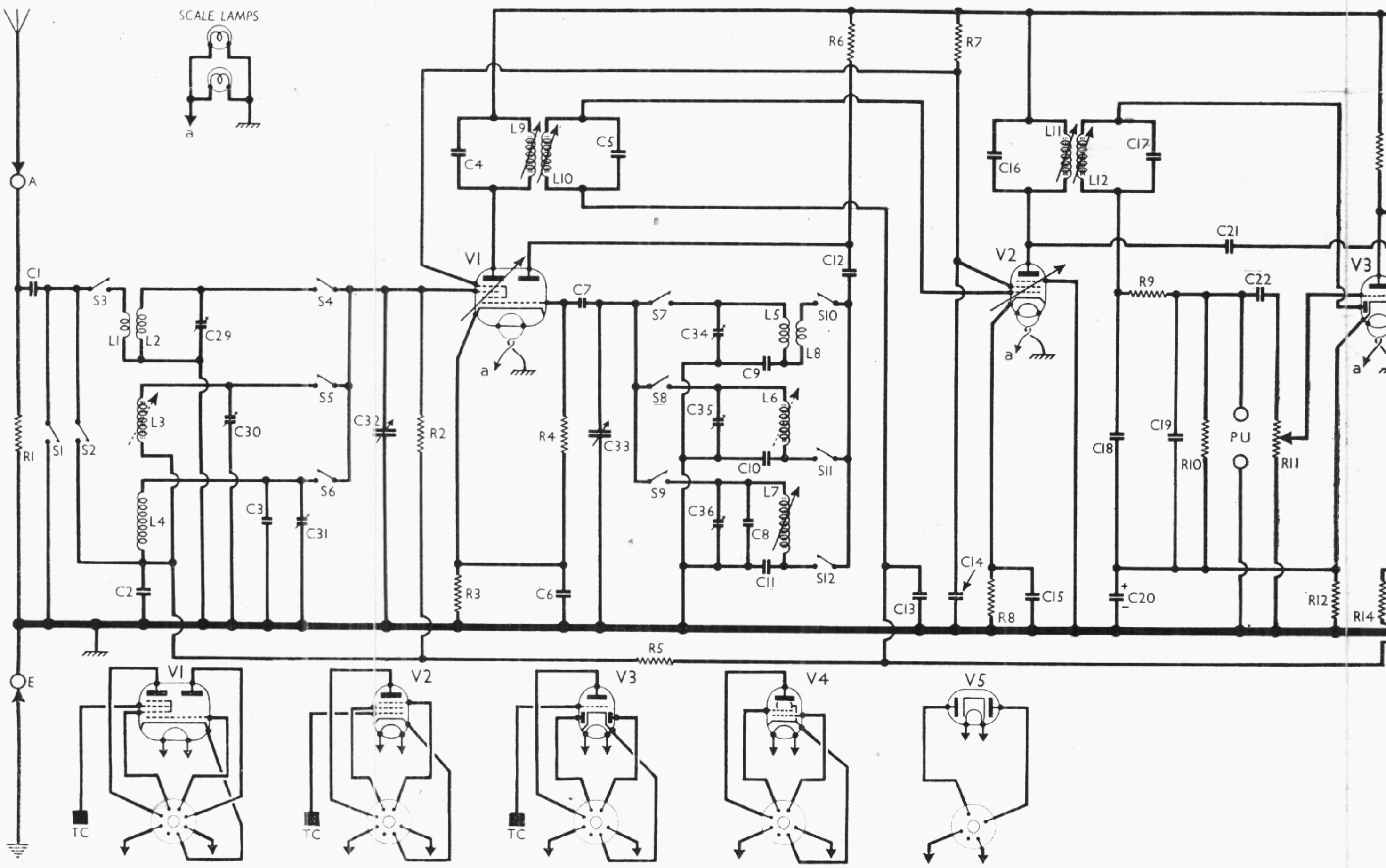
First valve **(V1, Ferranti 6K8G** or **GT)** is a triode hexode operating as frequency changer with electron coupling. Triode oscillator grid coils **L5** (S.W.), **L6** (M.W.) and **L7** (L.W.) are tuned by **C33.** Parallel trimming by **C34** (S.W.), **C35** (M.W.) and **C8, C36** (L.W.); series tracking by capacitors **C9** (S.W.), **C10** (M.W.) and **C11** (L.W.).

Reaction coupling from anode, via capacitor **C12,** is effected by the common impedance of the trackers on all bands, with additional inductive coupling by **L8** on S.W.

Second valve **(V2, Ferranti 6K7G** or **GT)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C4, L9, L10, C5** and **C16, L11, L12, C17,** in which the tuning capacitors are fixed and alignment adjustments are carried out by varying the positions of the iron-dust cores.

Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V3, Ferranti 6Q7G** or



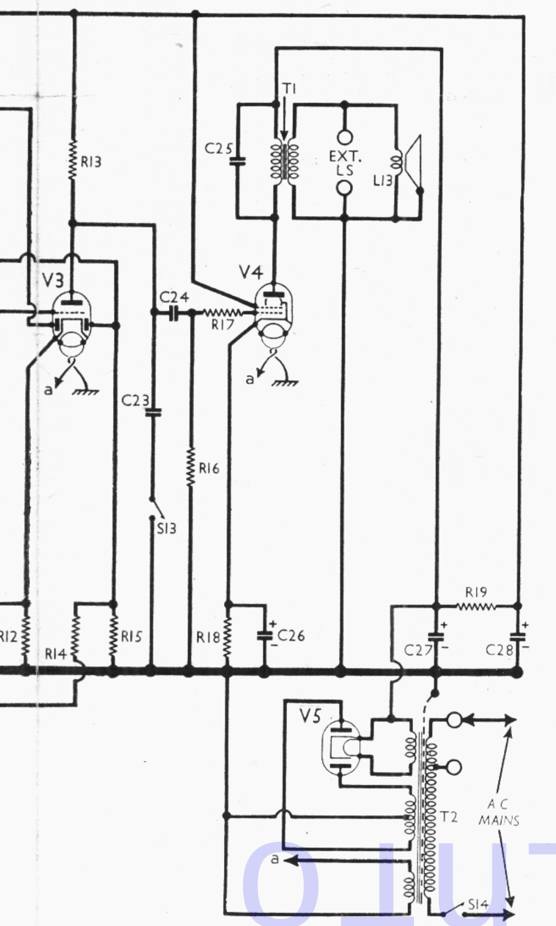
Circuit diagram of the Philco A536W 3-band A.C. superhet. The iron-dust cores of the I.F. transformers and the L.W. oscillator coil **L7** are r
s through them. The cores of **L3** and **L6** should not be altered unless this is necessary to obtain proper calibration. For this re

GT). Audio frequency component in rectified output is developed across load resistor **R10** and passed via A.F. coupling capacitor **C22** and manual volume control **R11** to C.G. of triode section, which operates as A.F. amplifier. I.F. filtering by **C18, R9, C19** in diode circuit. Sockets are provided for the connection of a gramophone pick-up across **C22, R11.**

Second diode of **V3,** fed from **V2** anode via **C21,** provides D.C. potential which is developed across load resistor **R15** and fed back through decoupling circuits as G.B. to F.C. (except on S.W.) and I.F. valves, giving automatic volume control. Delay voltage, together with fixed G.B. for triode section, is obtained from the drop along **R12** in **V3** cathode lead to chassis.

Resistance-capacitance coupling by **R13, C24** and **R16,** via grid stopper **R17,** between **V3** triode and beam tetrode output valve **(V4, Ferranti 6V6G).** Fixed tone correction by **C25** in anode circuit, and provision for the connection of a low impedance external speaker across the secondary winding of **T1.** Two position tone control by **C23** and **S13** in **V3** triode anode circuit.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Ferranti R52).** Smoothing by resistor **R19** and electrolytic capacitors **C27, C28,** but the H.T. supply for **V4** anode is obtained direct from the rectifier cathode.



...7 are normal alignment adjustments, is indicated by ...r this reason the arrows through them are broken.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	Aerial circuit shunt ...	10,000
R2	V1 hex. C.G. resistor ...	1,000,000
R3	V1 fixed G.B. resistor ...	270
R4	V1 osc. C.G. resistor ...	47,000
R5	V1 hex. C.G. decoupling	33,000
R6	V1 osc. anode H.T. feed...	39,000
R7	V1, V2 S.G.'s H.T. feed ...	15,000
R8	V2 fixed G.B. resistor ...	270
R9	I.F. stopper	47,000
R10	V3 signal diode load ...	330,000
R11	Manual volume control ...	1,000,000
R12	V3 G.B. ; A.V.C. delay ...	3,300
R13	V3 triode anode load ...	220,000
R14	A.V.C. line decoupling ...	1,000,000
R15	V3 A.V.C. diode load ...	1,000,000
R16	V4 C.G. resistor ...	470,000
R17	V4 grid stopper	4,700
R18	V4 G.B. resistor	390
R19	H.T. smoothing resistor...	4,300

	CAPACITORS	Values (μF)
C1	Aerial M.W. and L.W. coupling capacitors ...	0.001
C2		0.0025
C3	Aerial L.W. fixed trimmer	0.00001
C4	1st I.F. transformer fixed tuning capacitors ...	0.0001
C5		0·0001
C6	V1 cathode by-pass ...	0·01
C7	V1 osc. C.G. capacitor ...	0·000075
C8	Osc. L.W. fixed trimmer	0·000068
C9	Osc. circ. S.W. tracker ...	0·004
C10	Osc. circ. M.W. tracker ...	0·000374
C11	Osc. circ. L.W. tracker ...	0·000145
C12	V1 osc. anode coupling ...	0·0003
C13	A.V.C. line decoupling ...	0·1
C14	V1, V2 S.G.'s decoupling	0·1
C15	V2 cathode by-pass ...	0·01
C16	2nd I.F. transformer fixed tuning capacitors ...	0·0001
C17		0·0001
C18	I.F. by-pass capacitors ...	0·0001
C19		0·0001
C20*	V3 cathode by-pass ...	50·0
C21	V3 A.V.C. diode coupling	0·0001
C22	A.F. coupling to V3 triode	0·01
C23	Tone control capacitor ...	0·005
C24	A.F. coupling to V4 C.G.	0·001
C25	Fixed tone corrector ...	0·01
C26*	V4 cathode by-pass ...	25·0
C27*	H.T. smoothing capacitors	32·0
C28*		32·0
C29‡	Aerial circ. S.W. trimmer	0·00003
C30‡	Aerial circ. M.W. trimmer	0·00003
C31‡	Aerial circ. L.W. trimmer	0·00003
C32†	Aerial circuit tuning ...	0·000458
C33†	Oscillator circuit tuning...	0·000461
C34‡	Osc. circ. S.W. trimmer ...	0·00003
C35‡	Osc. circ. M.W. trimmer...	0·00003
C36‡	Osc. circ. L.W. trimmer...	0·00003

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms.)
L1	Aerial S.W. coupling coil	0·2
L2	Aerial, S.W. tuning coil...	Very low
L3	Aerial M.W. tuning coil ...	6·5
L4	Aerial L.W. tuning coil ...	45·0
L5	Osc. S.W. tuning coil ...	Very low
L6	Osc. M.W. tuning coil ...	5·0
L7	Osc. L.W. tuning coil ...	11·5
L8	Osc. S.W. reaction coil ...	Very low
L9	1st I.F. trans. Pri. ...	7·0
L10	1st I.F. trans. Sec. ...	7·0
L11	2nd I.F. trans. Pri. ...	7·0
L12	2nd I.F. trans. Sec. ...	7·0
L13	Speaker speech coil ...	2·5
T1	Speaker input trans. Pri.	650·0
	Speaker input trans. Sec.	0·3
T2	Mains trans. Pri., total ...	32·0
	Heater sec. ...	0·1
	Rect. heat. sec.	0·1
	H.T. sec., total	350·0
S1–S12	Waveband switches ...	—
S13	Tone control switch ...	—
S14	Mains switch, ganged R11	—

VALVE ANALYSIS

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

The receiver was tuned to the lowest wavelength on the M.W. 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 Avometer, chassis being the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6K8G	208	2.8	96	5.0
	Oscillator			
	82	3.1		
V2 6K7G	208	10.0	96	2.3
V3 6Q7G	64	0.45	—	—
V4 6V6G	300	28.0	208	1.5
V5 R52	276†	—	—	—

† Each anode, A.C.

Switch Diagram and Table

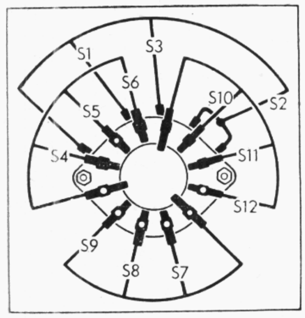


Diagram of the waveband switch unit S1-S12, drawn as seen when viewed from the rear of an inverted chassis. Below is the associated switch table.

Switch	L.W.	M.W.	S.W.	Gram.
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	—	—	—

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs and felt washers (pull off);

remove the four cheese-head fixing bolts (with washers) securing the chassis to the base of the cabinet, when the chassis may be withdrawn to the extent of the speaker leads.

To free the chassis entirely, unsolder from the connecting panel on the speaker input transformer the four leads connecting it to chassis.

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When replacing, reconnect the four speaker leads as follows, numbering the tags on the input transformer from left to right: 1, black; 2, red/yellow; 3, yellow; 4, white.

Removing Speaker.—Unsolder the four leads as described above;

remove the four cheese-head bolts (with plain and spring washers) securing the speaker to the sub-baffle.

When replacing, the transformer should be at the top.

DRIVE CORD REPLACEMENT

Sixty-four inches of a special Nylon twine, Finlayson "Python" No. 40, is required for the tuning drive system, which is completed in one single length.

Commence by turning the gang to minimum, place the chassis on the bench with the control spindles away from you, and check that the slot in the drive drum groove is then at 6 o'clock when viewed from the rear, as indicated in our sketch in cols. 2 and 3.

Tie one end of the cord securely to the spring, and hook the spring as shown in the sketch. Take the cord out through the groove slot, and one turn anti-clockwise round the drum; then round the right-hand pulley, round the left-hand pulley, over the *front* centre pulley, and down to the left of the control spindle.

Take 1½ turns anti-clockwise round the control (still viewed from the rear), winding *forwards* as shown, then up to the top of the drive drum, missing the rear centre-pulley for the time being, and anti-clockwise round the drum, keeping it in *front* (that is the *further* side) of the turn already there, to the slot.

Holding the cord thus, turn the gang to maximum, then tie off the end of the cord securely to the spring, beside the other end of the cord, applying sufficient tension to the spring to extend it fairly well. Then strain the cord between the control spindle and the drum to draw it over the rear centre pulley, as shown in the sketch.

Finally, slip the cursor carriage on to the cord. With the gang at maximum, the cursor should be in line with the two setting arrows at top and bottom edges of the scale.

GENERAL NOTES

Switches.—S1-S12 are the waveband and pick-up switches, ganged in a single double-sided rotary unit beneath the chassis. The unit is indicated in our under-chassis view, and shown in detail in the diagram in col. 6 overleaf, where it is drawn as seen from the rear of an inverted chassis.

The table below it gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S13 is the Q.M.B. tone control toggle switch mounted on the rear edge of the chassis.

S14 is the Q.M.B. mains switch, ganged with the manual volume control **R11**.

Coils.—The R.F. and oscillator coils are in six unscreened units: **L1, L12; L3; L4; L5, L8; L6;** and **L7.** These, together with their associated trimmers, trackers, the waveband switch unit and several other small components, are mounted on a sub-assembly which can be removed as a single unit, a slot in the chassis pressing permitting the switch spindle to pass.

The connections between the assembly and the rest of the chassis are so numerous, however, and so broadly distributed, that no purpose would be served in attempting to describe them for the benefit of those who may have to remove and replace one, as it is simpler to make the connections from a study of the circuit diagram, the chassis illustrations and the switch diagram.

Scale Lamps.—These are two Ever-Ready M.E.S. types, with small clear spherical bulbs, rated at 6.5 V, 0.3 A.

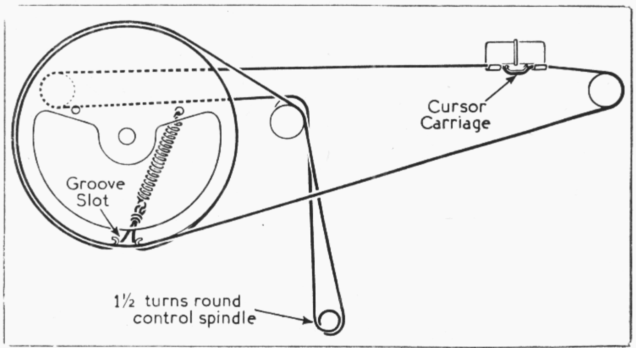
External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 2-3 Ω) external speaker.

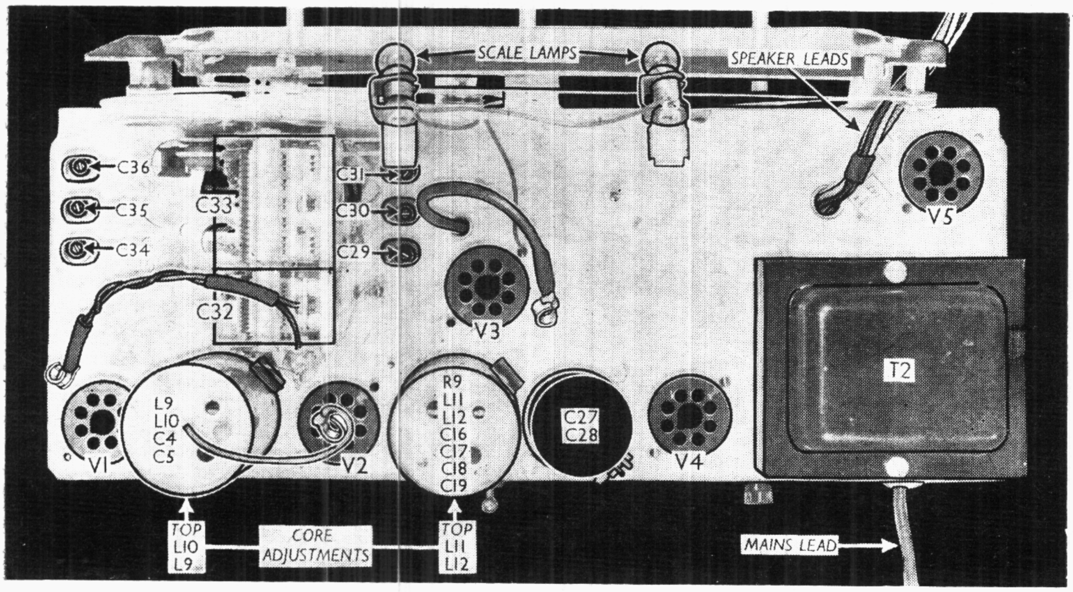
Gramophone Pick-up.—A second pair of sockets, to the left of those for the external speaker when viewed from the rear, is provided for the connection of a gramophone pick-up.

These sockets are not switched, and it will therefore be necessary to remove the "live" pick-up plug when reverting to radio reception. The "Gram" position on the waveband switch merely serves to prevent radio break-through by disconnecting the R.F. and oscillator tuned circuits and earthing the aerial.

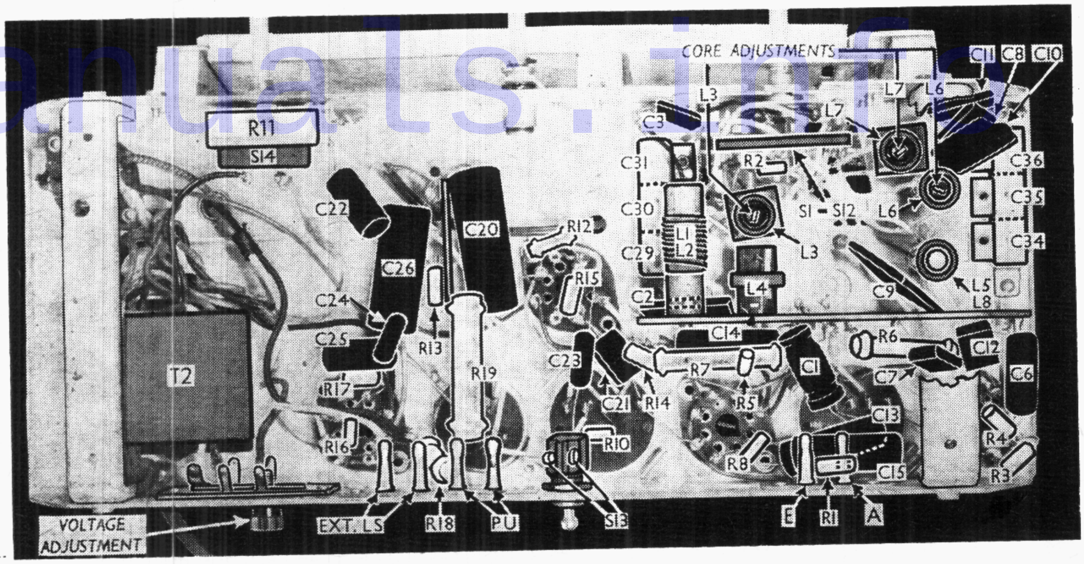
Capacitors C27, C28.—These form a pair of dry electrolytics in a tubular metal container mounted vertically on the

Sketch showing the cord driven tuning system. It is drawn as seen from the rear of the chassis when the gang is at minimum capacitance. The hollow side of the gang drum faces the front of the receiver.





Plan view of the chassis. The core adjustments of the I.F. transformers are indicated approximately. The second (earthed) lead spiralled round the top cap lead to V1 is a screening wire.



Under-chassis view. The tuning assembly in the top right-hand corner is grouped around the wave-band switch unit **S1-S12** and may be removed with it if the leads to be unsoldered are first suitably coded. A diagram of the switch unit appears in col. 6 overleaf.

chassis deck. The red tag is the positive connection of **C27,** and the plain tag is that of **C28;** the black tag is the common negative connection. The unit is rated at 350 V D.C. working.

Chassis Divergencies.—Some chassis are fitted with a 0.005 μF capacitor for **C24,** but in others it may be 0.001 μF. A change to the smaller value should be made if microphony is troublesome on S.W. Also, until mains transformers with a screened primary were available, a capacitor of 0.01 μF was connected as an R.F. filter from one side of the mains to chassis.

In some early chassis, **C1** was 0.01 μF, and **R5** was 470,000 Ω; **C13** was 0.01 μF, and was returned to **V2** cathode instead of to chassis. The makers are modifying all such models that come into their service department, substituting the values quoted in our tables and returning **C13** to chassis as shown in our circuit diagram. Dealers are advised to do the same thing, particularly if modulation hum is apparent.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator leads via a 0.1 μF capacitor to control grid (top cap) of **V1,** leaving existing connector in position. Switch set to M.W., turn gang to minimum capacitance, and volume control to maximum. Feed in a 465 kc/s (645.16m) signal, and adjust the cores of **L12, L11, L10** and **L9,** in that order, for maximum output. Repeat these adjustments.

R.F. and Oscillator Stages.—With the gang at maximum capacitance, the cursor should coincide with the arrow printed on the lower edge of the scale, near the right-hand corner. It may be adjusted in position if the drive drum fixing screws are slackened. Transfer signal generator leads to **A** and **E** sockets, via a 0.1 μF capacitor.

S.W.—Switch set to S.W., tune to 18 Mc/s on scale, feed in an 18 Mc/s (16.67 m) signal, and adjust **C34** for maximum output, using the peak involving the lesser trimmer capacitance; then tune to 17.07 Mc/s on scale and check that image appears. Return to 18 Mc/s on scale, and adjust **C29** for maximum output while rocking the gang.

M.W.—Switch set to M.W., tune to 214 m (spot on scale), feed in a 214 m (1,400 kc/s) signal and adjust **C35,** then **C30,** for maximum output.

The cores of **L3** and **L6** are pre-set in production to give a definite value of coil inductance, and they should only be adjusted if correct calibration cannot be obtained. The following procedure must then be adopted: Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust the cores of **L6** and **L3** for maximum output. Repeat the 214 m and 500 m adjustments until no improvement can be obtained.

L.W.—Switch set to L.W., tune to 1,875 m on scale, feed in a 1,875 m (160 kc/s) signal, and adjust the core of **L7** for maximum output. Tune to 1,034 m (spot on scale), feed in a 1,034 m (290 kc/s) signal, and adjust **C36,** then **C31,** for maximum output. Repeat the 1,875 m and 1,034 m adjustments until no improvement can be obtained.

Service Short-cuts

Philips 680A and 599A

We spent a considerable time tracing an intermittent hum of varying intensity in this model. It was found that when applying the usual tests for hum, etc., the hum would clear itself and could not be made to return for several days, and sometimes as much as two weeks. It was eventually traced to an intermittent open circuit in one half of the tertiary winding of the output transformer, and a new transformer completely cured the trouble.—**G. A.,** Birmingham.

Marconiphone 878

One of these sets came in for service with the complaint that it would usually behave normally, but at times would go faint, with background of whistles, finally going off altogether. It was found by making the usual tests that no H.T. was getting to the anode of V3, and on replacing R20 (*Trader Service Sheet 417*) the receiver worked, but the slightest vibration would make the output normal or faint with whistles in the background. This was eventually traced to the screening can of V2 not making good contact with the chassis, both rivets being loose. Replacing these by two small nuts and bolts cured the trouble.—**J. T. T.,** Crewe.

K.B. 880

This receiver was found to have a hum but no signals coming through. It was found to work normally by placing a finger on the grid cap of V2. After testing most of the components associated with this valve it was found that the trouble was an O.C. electrolytic H.T. smoothing capacitor. When this was replaced the set was O.K.—**J. T. T.,** Crewe.

Bush BA71

This receiver was brought in with the complaint of very muffled and distorted output, the owner suggesting that the speaker was faulty. The speaker was tested by replacement, with no better results, so the tone control fixed capacitor was tested, but proved O.K. After various other tests it was found that the volume control had increased in resistance from ½ meg to over 10 meg. Replacing this cured the trouble.—**J. T. T.,** Crewe.

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