"TRADER" SERVICE SHEET

805

PHILCO A535

Covering All Models in the 535 Series

THERE are three versions of the Philco A535 on the English market, and they may all be housed in wooden or plastic cabinets. Our illustration shows the plastic type. The differences between these versions, and other modifications, are explained under "Chassis Divergencies" overleaf.

In addition there are three export versions, which are not sold on the English market. No attempt is made to cover these, but their general arrangement is described also.

The A535 is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-250v, 40-100 c/s. Provision is made for the connection of a gramophone pick-up and Ext. L.S.

This *Service Sheet* was prepared from a sample A535B MKII receiver with resistance smoothing.

Release date and original prices: November, 1945. *With wooden cabinet*, £17 5*s*, *plus* £3 14*s* 2*d purchase tax; with plastic cabinet*, £16, *plus* £3 8*s* 10*d purchase tax.*

CIRCUIT DESCRIPTION

Aerial input is developed across **C1, L1,** and **C2,** which form a potential divider, shunted by **R1.** On S.W., where the impedance of **C2** is negligible, signal is developed across **L1** and passed to single-tuned circuit **L2, C30.**

On M.W. and L.W., where the impedance of **L1** is negligible, **C1** and **C2** form a potential divider to provide "bottom" coupling from **C2,** which is common to aerial and tuning circuits, to single-tuned circuits **L3, C30** (M.W.) and **L4, C30** (L.W.).

First valve **(V1, Brimar 6K8G)** 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 **C31.** Parallel trimming by **C32** (S.W.), **C33** (M.W.) and **C9, C34** (L.W.); series tracking by capacitors **C35** (M.W.) and **C36** (L.W.).

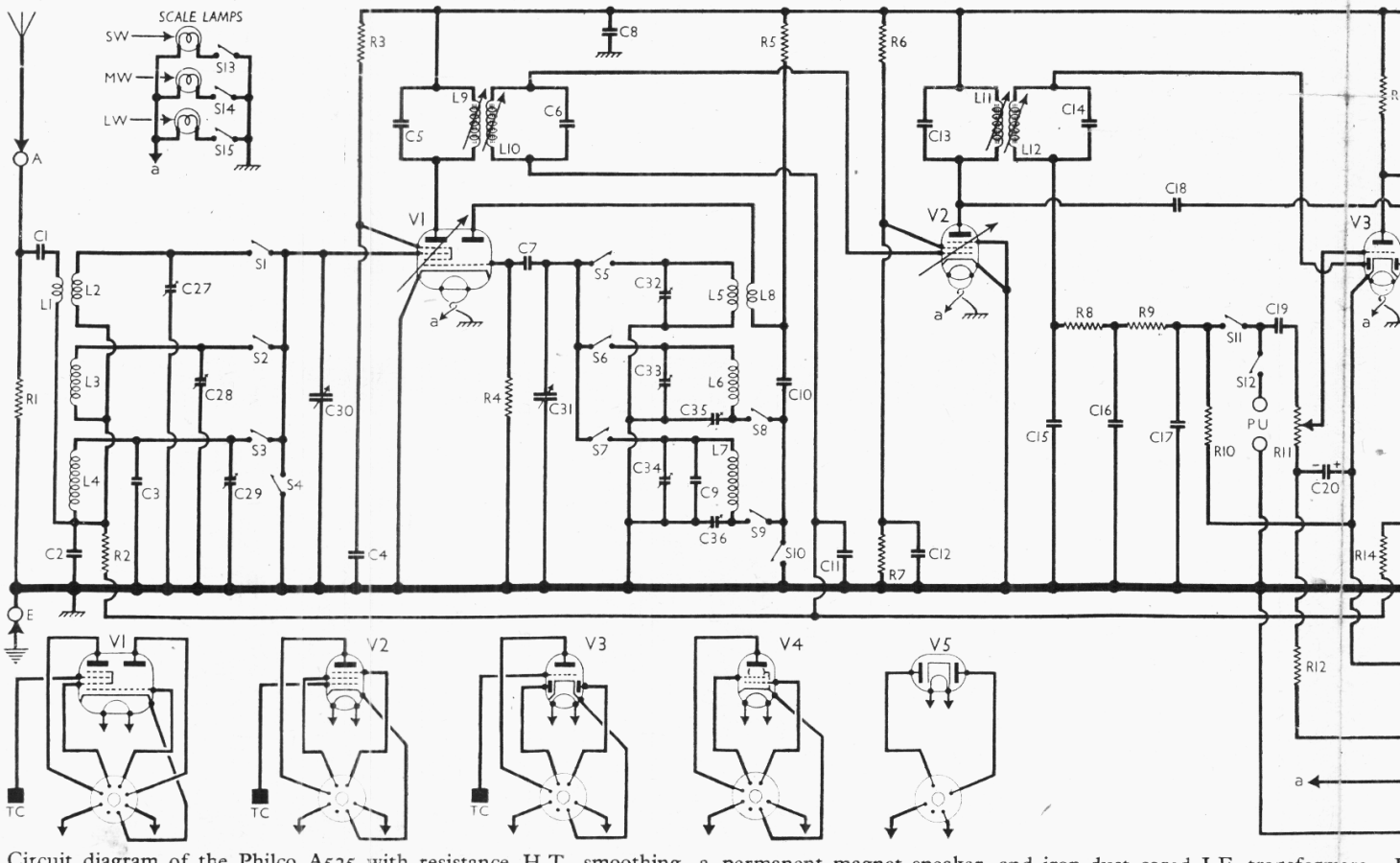
Reaction coupling from anode, via coupling capacitor **C10,** is effected by **L8** on S.W., and by the common impedance of the trackers, via switches **S8** (M.W.) and **S9** (L.W.). **S10** closes on S.W.

Second valve **(V2, Brimar 6K7G)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C5, L9, L10, C6** and **C13, L11, L12, C14,** in which the tuning capacitors are fixed and alignment adjustments are carried out by varying the positions of the iron-dust cores.

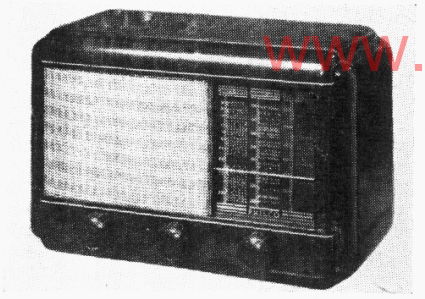
Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V3, Brimar 6Q7G).** Audio frequency component in rectified output is developed across load resistor **R10** and passed via switch **S11,** coupling capacitor **C19,** and manual volume control **R11** to control grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C15, R8, C16, R9** and **C17** in diode circuit. Sockets are provided for the connection of a gramophone pick-up, which is isolated on radio by **S12.**

Second diode of **V3,** fed from **V2** anode via **C18,** provides D.C. potential which is developed across load resistor **R17** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving A.V.C.



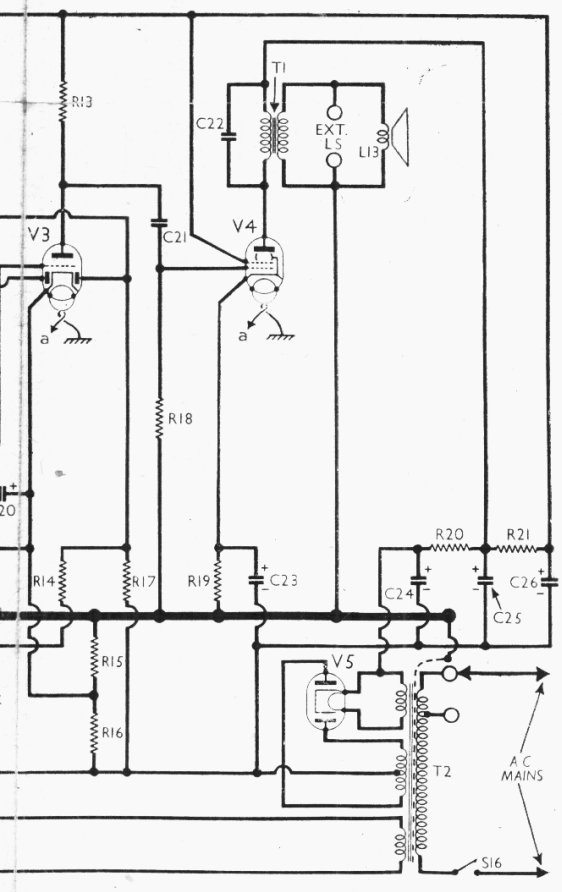
Circuit diagram of the Philco A535 with resistance H.T. smoothing, a permanent magnet speaker, and iron-dust cored I.F. transformers. I items in the circuit are described under "Chassis Divergencies" overleaf.



Resistance-capacitance coupling by **R13, C21** and **R18,** between **V3** triode and beam tetrode output valve **(V4, Brimar 6V6G).** Fixed tone correction in anode circuit by **C22,** and provision for the connection of a low impedance external speaker across the secondary winding of **T1.**

H.T. current is supplied by a full-wave rectifying valve **(V5, Brimar 5Z4G).** Smoothing by resistors **R20, R21,** and capacitors **C24, C25** and **C26.** H.T. circuit R.F. filtering by **C8.**

Potential divider comprising resistors **R15, R16** in the negative H.T. lead to chassis provides a voltage drop which is applied via **R17** and the A.V.C. line as fixed G.B. for **V1** and **V2.** **V3** G.B. and A.V.C. delay are derived from the drop along **R16** only, **V3** cathode being returned to the junction of **R15** and **R16.**



mers. Differences in respect to these and other

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	Aerial circuit shunt ...	10,000
R2	V1 hex. C.G. decoupling	470,000
R3	V1 S.G. H.T. feed ...	33,000
R4	V1 osc. C.G. resistor ...	47,000
R5	V1 osc. anode H.T. feed...	39,000
R6	V2 S.G. H.T. potential	47,000
R7	divider ...	47,000
R8	I.F. stoppers	47,000
R9		47,000
R10	V3 signal diode load ...	330,000
R11	Manual volume control ...	1,000,000
R12	V3 triode C.G. decoupling	100,000
R13	V3 triode anode load ...	220,000
R14	A.V.C. line decoupling ...	1,000,000
R15	V1, V2, V3 fixed G.B. and	15
R16	A.V.C. delay resistors ...	33
R17	V3 A.V.C. diode load ...	1,000,000
R18	V4 C.G. resistor	470,000
R19	V4 G.B. resistor	220
R20	H.T. smoothing resistors	1,000
R21		2,000

	CAPACITORS	Values (μF)
C1	Aerial M.W. and L.W.	0.01
C2	coupling capacitors ...	0·0025
C3	Aerial L.W. fixed trimmer	0·000035
C4	V1 S.G. decoupling ...	0·1
C5	1st I.F. transformer fixed	0·0001
C6	tuning capacitors ...	0·0001
C7	V1 osc. C.G. capacitor ...	0·0003
C8	H.T. circuit R.F. by-pass	0·1
C9	Osc. L.W. fixed trimmer...	0·000035
C10	V1 osc. anode coupling ...	0·0003
C11	A.V.C. line decoupling ...	0·1
C12	V2 S.G. decoupling ...	0·01
C13	2nd I.F. transformer fixed	0·0001
C14	tuning capacitors... ...	0·0001
C15	I.F. by-pass capacitors ...	0·0001
C16		0·0001
C17		0·0003
C18	V3 A.V.C. diode coupling	0·0001
C19	A.F. coupling to V3 triode	0·01
C20*	V3 triode G.B. decoupling	50·0
C21	A.F. coupling to V4 C.G....	0·01
C22	Fixed tone corrector ...	0·01
C23*	V4 cathode by-pass ...	25·0
C24*	H.T. smoothing capacitors	8·0
C25*		8·0
C26*		16·0
C27‡	Aerial circ. S.W. trimmer	0·00003
C28‡	Aerial circ. M.W. trimmer	0·00003
C29‡	Aerial circ. L.W. trimmer	0·00003
C30†	Aerial circuit tuning ...	0·0004
C31†	Oscillator circuit tuning...	0·0004
C32‡	Osc. circ. S.W. trimmer...	0·00003
C33‡	Osc. circ. M.W. trimmer...	0·00003
C34‡	Osc. circ. L.W. trimmer...	0·00003
C35‡	Osc. circ. M.W. tracker...	0·00047
C36‡	Osc. circ. L.W. tracker ...	0·00015

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial S.W. coupling coil	0·1
L2	Aerial S.W. tuning coil ...	Very low
L3	Aerial M.W. tuning coil ...	2.75
L4	Aerial L.W. tuning coil ...	36·0
L5	Osc. S.W. tuning coil ...	0.1
L6	Osc. M.W. tuning coil ...	2·5
L7	Osc. L.W. tuning coil ...	20·0
L8	Osc. S.W. reaction coil ...	0·3
L9	1st I.F. trans. Pri. ...	7·2
L10	Sec. ...	7·2
L11	2nd I.F. trans Pri. ...	7·2
L12	Sec. ...	7·2
L13	Speaker speech coil ...	3·0
T1	Output trans. Pri.	500·0
	Sec.	0·5
T2	Mains trans. Pri., total ...	28·0
	Heater sec. ...	0·2
	Rect. heat. sec....	0·1
	H.T. sec., total	420·0
S1–S15	Waveband switches ...	—
S16	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 217V, using the 200-229V 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 400V 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	222	1·82	90	3·9
	Oscillator			
	88	3·35		
V2 6K7G	222	4·0	73	1·25
V3 6Q7G	98	0·48	—	—
V4 6V6G	238	39·0	222	2·2
V5 5Z4G	277†	—	—	—

† Each anode, A.C.

Switch Diagram and Table

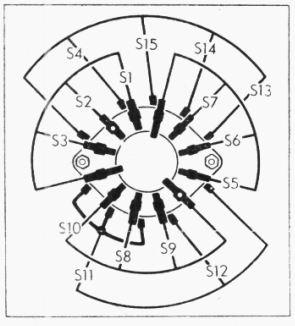


Diagram of the waveband switch unit, drawn as seen from the rear of an inverted chassis. Below is the associated table.

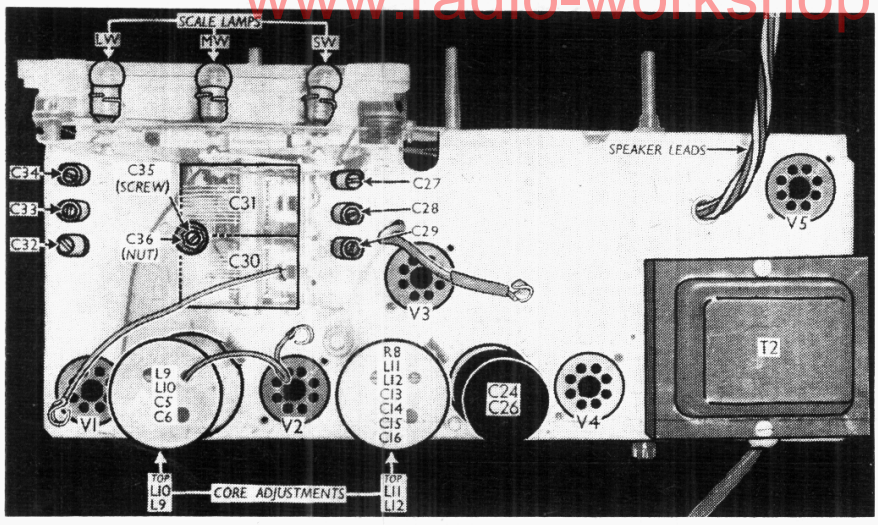
Switch	S.W.	M.W.	L.W.	Gram.
S1	C	—	—	—
S2	—	C	—	—
S3	—	—	C	—
S4	—	—	—	C
S5	C	—	—	—
S6	—	C	—	—
S7	—	—	C	—
S8	—	C	—	—
S9	—	—	C	—
S10	C	—	—	—
S11	C	C	C	—
S12	—	—	—	C
S13	C	—	—	—
S14	—	C	—	—
S15	—	—	C	—

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (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



Plan view of the chassis. **C35** and **C36** have concentric screw and nut adjustments. In some chassis, the I.F. core adjustments are replaced by pre-set capacitor trimmers at the tops of the cans.

speaker input transformer the four leads connecting it to the chassis.

When replacing, reconnect the four speaker leads as follows, numbering the tags on the speaker transformer from left to right : 1, black; 2, blue; 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 point to the right-hand top corner of the cabinet.

GENERAL NOTES

Switches.—S1-S10 are the waveband switches, **S11, S12** are the radio/gram changeover switches, and **S13-S15** are the scale lamp switches, all 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.

S16 is the Q.M.B. mains switch, ganged with the manual volume control **R11.**

Coils.—The R.F. and oscillator coils are in four units : **L1, L2; L3, L4; L5, L8;** and **L6, 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 three Ever-Ready M.E.S. types, with small clear spherical bulbs, rated at 6.5 V, 0.3 A. They are mounted on a detachable strip held to the top of the scale assembly by a single captive thumb-screw, and can quickly be withdrawn for replacement purposes.

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.

Capacitors C24, C26.—These form a pair of dry electrolytics in a tubular metal container mounted vertically on the chassis deck. The red tag is the positive connection of **C24** (8 μF) and the plain tag is that of **C26;** the black tag is the common negative connection. The unit is rated at 450 V D.C. working.

Trackers C35, C36.—These are the M.W. and L.W. trackers, mounted on opposite sides of a ceramic base and adjusted from one side by a concentric screw and nut arrangement. Like all the other pre-set adjustments in this receiver, they are accessible from above the chassis deck. The screw **(C35)** and nut **(C36)** are identified in our plan view of the chassis.

Chassis Divergencies. — In the Philco A535 series there are altogether three versions that are sold in the English market : A535, A535MK.II, and A535 BM, and these may be housed in either a wooden or a Bakelite cabinet, this being signified by the suffix " W " or " B," viz. : A535W or A535B.

There are also three export versions : AE535, which is designed for sale in the European market; and the ATS535 and AT535, which are designed for sale in tropical and semi-tropical markets.

Each of these has a 100 V tapping on the mains transformer, and the AE535 is otherwise in general like the English models. The principal difference in the ATS535 and the AT535 is that their waveband ranges are S.W., S.W. and M.W. Although this *Service Sheet* may be of some use in connection with the export models, however, no attempt is made to cover them.

Our sample receiver was an A535 MK.II, and this *Service Sheet* is therefore based on that model. The following differences will be found in the other two English versions as compared with the information given from our sample.

In the A535, **V1** hexode anode is fed via an H.T. decoupling circuit consisting of a 4,700 Ω resistor and a 2 μF tubular electrolytic which are mounted on the tuning sub-assembly beneath the chassis.

R5 becomes 10,000 Ω and is fed from **V1** screen instead of the H.T. positive line, the screen feed resistor **R3** being 15,000 Ω instead of 33,000 Ω. Also, a 330,000 Ω resistor is connected in parallel with **L11,** and **R15** and **R16** are transposed.

The A535 BM is fitted with a transformer whose primary winding is tapped for 100 V mains, but otherwise it is like an A535 or A535 MK.II.

In all three versions, the following differences might be found as compared with our sample : The I.F. transformers, which we show as having adjustable iron-dust cores, may instead be fitted with air-cored coils and capacitative pre-set trimmers. As the " Q " is the same in either type, the performance will be unaffected, but the D.C. resistance of the coils will be different from that quoted in our tables, and the adjustments will not be as shown in our plan view.

Secondly, instead of the permanent magnet speaker and resistance-capacitance H.T. smoothing shown in our circuit diagram, an energized type of speaker may be used, its field winding replacing **R20** and **R21** in our diagram, and **C25** being omitted. As the field winding has a resistance of only 1,000 Ω, allowance must be made for this when measuring H.T. voltages.

DRIVE CORD REPLACEMENT

Two separate cords of differing texture are used for the complete drive. For the primary, or gang, drive 21in of Finlayson Python No. 40 or Russell and Chappell No. 3 twine is required, while for the secondary, or cursor, drive 45in of Finlayson Python No. 20 or Hayes Thread, Black No. 18, is used.

Suitable cords can be obtained from the makers, their part numbers being 13/0667 and 13/0163 for the gang and cursor cords respectively.

To obtain access to the drive drum, the glass scale panel and its backing-plate must be removed. The scale panel is held by a springy clip at the bottom, and by a springy bar at the top which can be removed if the latching stub at either end is sprung inwards to clear the retaining slot. When the bar is removed, the scale may be lifted out.

To remove the scale backing-plate, insert a thin blade between the plate and the scale assembly, and lift out the plate. If the cursor is still on its cord, it should be run to the bottom of its travel (gang at maximum) to permit withdrawal of the plate. If it is desired, the complete scale assembly, together with both drive systems and the gang, may be dismounted in one unit upon removal of three hexagonal self-tapping screws and unsoldering three leads beneath the gang.

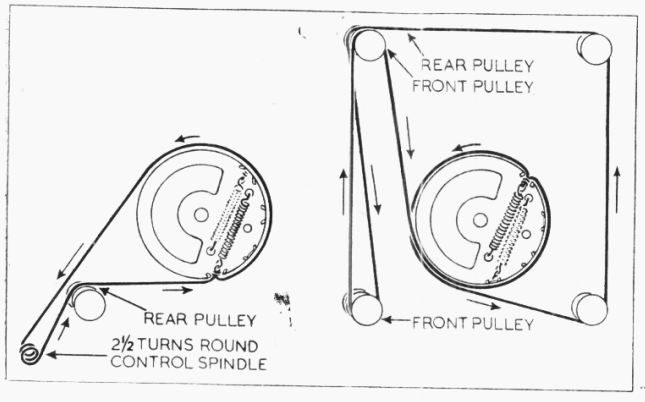
Gang Drive.—As the gang drive cord is behind the cursor drive, it should be fitted first. If the cursor drive is intact, it is advisable to slip it off its pulleys to fit the gang drive cord.

To fit the gang drive cord, tie one end of it to its spring, turn the gang to maximum, when the drum should be in the position shown in the left-hand diagram below, pass the free end of the cord through the appropriate slot in the drum groove, from inside to out, and run the cord as shown in the diagram, taking it 2½ turns round the control spindle, and finally tieing it off to the end of the spring, where it started. Then extend the spring and hook its free end to the hole provided, imposing tension on the cord. Cut off surplus cord.

When tieing off, the cord should be pulled fairly tight, as the spring provides an even pull rather than simply taking up slack. Extra tension can be obtained by slipping the cord from the groove in its pulley, allowing it to run instead over the pulley spindle, and forcing it back into its groove after tieing off.

Cursor Drive.—To fit the cursor drive cord, tie one end to its spring, turn the gang to maximum, when the drum should be in the position shown in the diagrams above, pass the free end of the cord through the appropriate slot in the drum groove, from inside to out, and run the cord as shown in the right-hand diagram, round the five pulleys in the direction of the arrows, and back to the starting point, finally tieing off while pulling at the cord to maintain tension, which may be increased by the same expedient as was suggested for the gang drive. Then hook the spring into the hole provided, and cut off surplus cord.

The cursor may now be fitted, its end claws being opened slightly so that it may be pushed on to the cord. This should be done with the gang still at maximum, the cursor bar being below its fixing claws, and the whole near the bottom of the scale assembly.



Sketches showing the courses followed by the gang drive cord (left) and cursor drive cord (right) as seen from the front of the receiver when the gang is at maximum.

Replacing Scale.—Turn the scale backing-plate so that the sprayed surface is at the front and the small hole is at the top right-hand corner. Slip its lower edge behind the cursor bar, and fit the locating tags into the holes provided for them, and press lightly home.

Take the glass scale panel, turn it to face correctly, and slip its bottom edge into the spring clip provided, and fit the springy retaining bar across the top of the scale.

Finally, to set the cursor, check that the gang is still at maximum, then slide the cursor along the cord until it is level with the two arrow-heads on each side near the bottom of the scale. Then tighten up the two cursor claws on the cord.

CIRCUIT ALIGNMENT

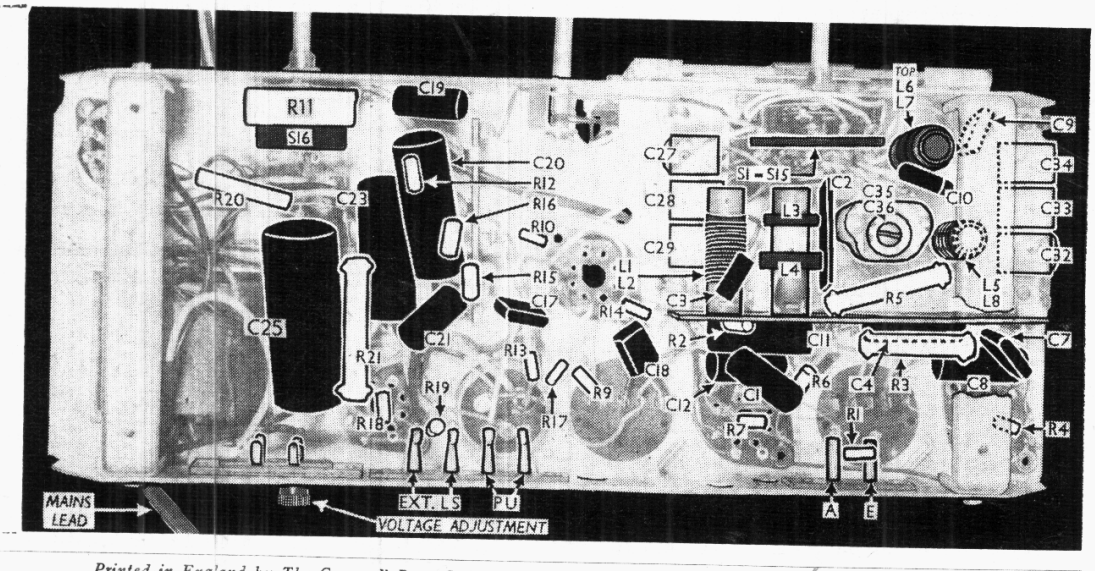
I.F. Stages.—Connect signal generator leads via a 0.1 μF capacitor to control grid (top cap) of **V1,** leaving the normal connector in position. Turn the volume control to maximum, feed in a 465 kc/s (645.16 m) signal, and adjust the cores of **L12, L11, L10** and **L9** in that order for maximum output, keeping input low to avoid A.V.C. action. Repeat these adjustments.

R.F. and Oscillator Stages.—With the gang at maximum, the cursor should be level with the two arrows at the edges of the scale glass, near the bottom of the scale, visible only when the chassis is removed from the cabinet. If the fixing claws are eased open, the cursor may be slid up or down the drive cord. Transfer signal generator leads to **A** and **E** sockets, using a suitable dummy aerial.

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 **C32** for maximum output, using the peak involving the lesser trimmer capacitance; then check that no image appears at 17 Mc/s. Return to 18 Mc/s on scale, and adjust **C27** for maximum output while rocking the gang.

M.W.—Switch set to M.W., tighten up **C35** (screw) lightly, but fully, then unscrew it one-third of a turn. Tune to 214 m (spot on scale), feed in a 214 m (1,400 kc/s) signal, and adjust **C33,** then **C28,** for maximum output. Feed in a 500 m (600 kc/s) signal, tune it in, and adjust **C35** for maximum output while rocking the gang for optimum results. Repeat the 214 m and 500 m adjustments until no improvement can be obtained.

L.W.—Switch set to L.W., tighten up **C36** (nut) lightly, but fully, then unscrew it one-third of a turn. Tune to 1,034 m (spot on scale), feed in a 1,034 m (290 kc/s) signal, and adjust **C34,** then **C29,** for maximum output. Feed in a 1,875 m (160 kc/s) signal, tune it in (about spot on scale), and adjust **C36** for maximum output while rocking the gang for optimum results. Repeat the 1,034 m and 1,875 m adjustments until no improvement can be obtained.



Under-chassis view. The waveband switch unit **S1-S15** forms the nucleus of the tuning assembly, which may be removed as a whole if the wiring is suitably coded and unsoldered. A diagram of the switch unit appears in col. 6 overleaf.

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