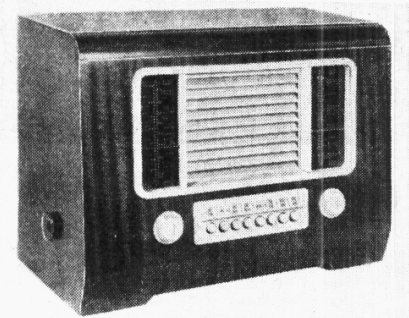


"TRADER" SERVICE SHEET
886

H.M.V. 1407

Press-button Battery Superhet



The appearance of the H.M.V. 1407 battery superhet. The knob on the side belongs to the tone control.

PRESS-BUTTON tuning for five stations and press-button waveband switching is provided on the H.M.V. 1407, a 4-valve, 3-band battery superhet. The waveband ranges are 16.3-51.7 m, 192-575 m and 850-2,000 m. Release date and original price: March, 1948; £26 5s, including batteries, plus purchase tax.

CIRCUIT DESCRIPTION

External aerial input is via coupling coils L2 (S.W.), L3 (M.W.) and L4 (L.W.) to L5 (S.W.), L6 (M.W.) and L7 (L.W.), tuned manually by C31 via S1a, b (S.W.), S1x, S2a, b (M.W.) and S1x, S3a, b (L.W.). For automatic tuning, C31 is replaced by pre-set trimmer type capacitors C35, C36, C37 (M.W.) and C38, C39 (L.W.), selection being achieved by switches S4a, b, x to S8a, b, x.

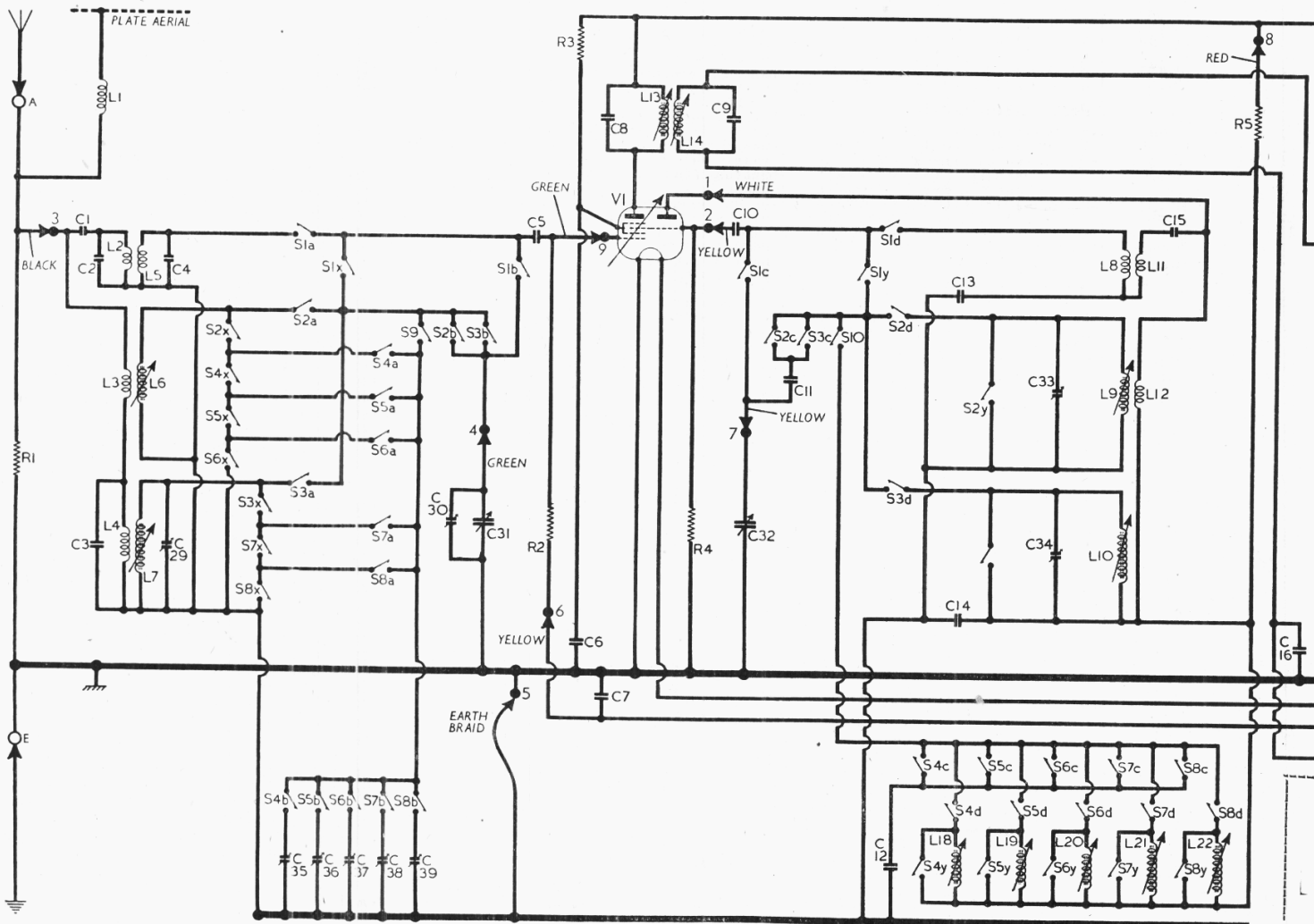
The press-button switches are coded with suffix letters to indicate their functions, and they are arranged in groups. Two groups are controlled by each button, one belonging to the aerial circuit and the other to the oscillator circuit.

All the switches in the two groups belonging

to a given press-button bear the same number, the individual switches in each group being identified by the suffix letter. If the suffix is a, b, c or d, the switch closes when its button is pressed; if the suffix is x or y, the switch opens. When a button is released (by pressing another button), its a, b, c, d switches open and its x and y switches close. When the manual tuning system is in operation the automatic tuning switches are disconnected, via master switches S9, S10.

First valve (V1, Marconi metallized X24M) is a triode-hexode operating as frequency changer with internal coupling. For manual operation triode oscillator grid coils L8 (S.W.), L9 (M.W.) and L10 (L.W.) are tuned by C32, via S1c, d to S1y, S3c, d. Parallel trimming by C33 (M.W.) and C34 (L.W.), and series tracking by C13 (S.W.), C11 (M.W.) and C14 (L.W.). Mixed reaction coupling from anode, via C15, L11 and the common impedance of C13 on S.W., inductive reaction coupling by L12 on M.W., and capacitive coupling across C14 on L.W.

For automatic tuning all the foregoing circuits are disconnected and replaced, via S1y



COMPONENTS AND VALUES

If the component numbers given in the following tables are used when ordering replacement parts, dealers are advised to mention the fact on the order, as these numbers may differ from those used in the manufacturers' diagram.

and **S10**, by one of the iron-dust cored pre-set coils **L18** to **L22**, which are tuned by fixed capacitors **C12**, **C14** in series, selection being determined by switches **S4c**, **d**, **y** to **S8c**, **d**, **y**, as explained previously.

Second valve (**V2**, Marconi metallized **Z21M**) is an R.F. tetrode operating as I.F. amplifier with tuned transformer couplings.

Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve (**V3**, Marconi metallized **HD24M**). Audio frequency component in rectified output is developed across manual volume control **R9**, which is the diode load resistor, and passed via **C21** and **R10** to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C20**, **R7** in diode circuit and **C23** in triode anode circuit.

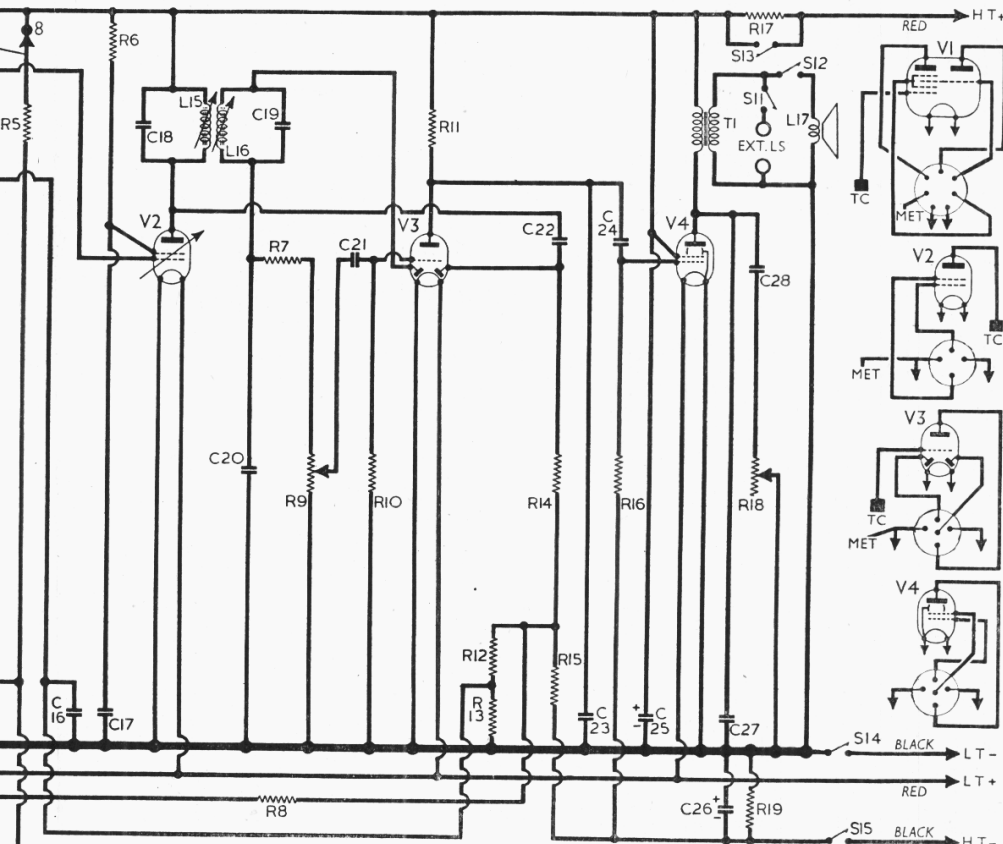
Second diode of **V3**, fed from **V2** anode via **C22**, provides D.C. potential which is developed across load resistors **R14**, **R15**, tapped off, and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic gain control. Delay voltage, together with fixed G.B. for **V1**, **V2** and **V4** is obtained from the drop across **R19** in the H.T. negative lead to chassis.

Resistance-capacitance coupling by **R11**, **C24** and **R16**, between **V3** triode and beam tetrode output valve (**V4**, Marconi **KT2**). Fixed tone correction by **C27** in anode circuit, and variable tone control by **C28**, **R18**. Provision for the connection of a low impedance external speaker across **T1** secondary winding, via **S11**. Resistor **R17** is included in series with the H.T.+ lead to reduce the H.T. battery consumption, and is short-circuited by **S13** when the battery economiser switch is in the "off" position.

RESISTORS		Values (ohms)	Locations
R1	Aerial shunt ...	10,000	J6
R2	V1 hex. C.G. ...	470,000	H4
R3	V1 S.G. feed ...	47,000	J5
R4	V1 osc. C.G. ...	100,000	J5
R5	Osc. anode load ...	10,000	L8
R6	V2 S.G. feed ...	68,000	J6
R7	I.F. stopper ...	220,000	H5
R8	A.G.C. decoupling	220,000	H5
R9	Volume control ...	500,000	E3
R10	V3 triode C.G. ...	2,200,000	E3
R11	V3 triode load ...	150,000	H5
R12	A.G.C. potential divider resistors	1,000,000	H5
R13	A.G.C. diode load resistors	220,000	H5
R14	A.G.C. diode load resistors	220,000	H6
R15	A.G.C. diode load resistors	1,000,000	H5
R16	V4 C.G. resistor	330,000	G5
R17	H.T. economiser ...	10,000	H6
R18	Tone control ...	200,000	E4
R19	G.B. resistor ...	360	E3

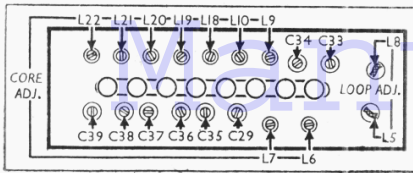
CAPACITORS		Values (μF)	Locations
C1	Aerial S.W. series	0.00005	J4
C2	Aerial S.W. shunt	0.000005	J4
C3	Aerial L.W. shunt	0.0005	G4
C4	Aerial S.W. trim...	0.000005	J3
C5	V1 hex. C.G. ...	0.0001	J4
C6	V1 S.G. decoupling	0.047	J5
C7	V1 A.G.C. decoup.	0.047	H5
C8	1st I.F. transformer tuning ...	0.0001	A2
C9		0.0001	A2
C10	V1 osc. C.G. ...	0.00005	L8
C11	Osc. M.W. tracker	0.0005	L8
C12	Osc. auto-tuning	0.00023	M8
C13	Osc. S.W. tracker	0.005	L7
C14	Osc. L.W. tracker	0.00035	M8
C15	Osc. anode coup.	0.00005	L7
C16	V2 C.G. decoup. ...	0.047	K5
C17	V2 S.G. decoup. ...	0.047	J5
C18	2nd I.F. transformer tuning ...	0.0001	B2
C19		0.0001	B2
C20	I.F. by-pass ...	0.0001	H5
C21	A.F. coupling ...	0.047	E4
C22	A.G.C. coupling ...	0.0001	H6
C23	I.F. by-pass ...	0.00023	G5
C24	A.F. coupling ...	0.047	G5
C25*	H.T. reservoir ...	8.0	H6
C26*	G.B. by-pass ...	50.0	F5
C27	Tone corrector ...	0.001	G5
C28	Part tone control...	0.01	E5
C29†	Aerial L.W. trim...	0.000135	G3
C30†	Aerial M.W. trim...	—	K4
C31†	Aerial tuning ...	—	K4
C32†	Oscillator tuning	—	K4
C33†	Osc. M.W. trim. ...	0.000045	L7
C34†	Osc. L.W. trim. ...	0.000135	L7
C35†	Osc. L.W. trim. ...	0.000135	G3
C36†	Aerial circuit press-button tuning trimmers	0.00045	G3
C37†		0.00045	F3
C38†		0.00045	F3
C39†		0.00045	F3

* Electrolytic † Variable ‡ Pre-set.



Circuit diagram of the H.M.V. 1407 battery superhet. The sections of the tuning circuits shown beneath the chassis line are associated solely with the pre-set station press-buttons. Fixed grid bias potentials for **V1** and **V2** are obtained from the potential divider formed by the A.G.C. diode load resistors **R13**, **R12**, **R15** which are connected in series across the G.B. resistor **R19**.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial choke ...	4.5	K6
L2	Aerial coup. coils ...	0.6	J3
L3		26.0	H3
L4		60.0	H3
L5	Aerial tuning coils	0.1	J3
L6		5.5	H3
L7		20.0	H3
L8	Osc. tuning coils ...	0.1	L7
L9		3.0	L7
L10	Osc. reaction coils	8.5	M7
L11		0.6	L7
L12		1.5	L7
L13	1st I.F. trans. { Pri. Sec.	7.0	A2
L14		7.0	A2
L15	2nd I.F. trans. { Pri. Sec.	7.0	B2
L16		7.0	B2
L17	Speech coil ...	3.5	—
L18	Osc. press-button tuning coils ...	2.0	M7
L19		4.5	M7
L20	Output trans. { Pri. Sec.	4.5	M7
L21		10.4	M7
L22		10.4	M7
T1	Aerial circuit wave-band switches	1,200.0	C1
S1a, b to S3a, b, x	Aerial circ. press-button tuning switches	0.1	C1
S4a, b to S8a, b, x	Osc. circuit wave-band switches	—	—
S1c, d to S3c, d, y	Osc. circuit press-button tuning switches	—	—
S4c, d to S8c, d, y	Press-button tuning master switches	—	G4
S9	Speaker switches	—	M8
S10	Economiser switch	—	G6
S11	L.T. circ. switch	—	G6
S12	H.T. circ. switch	—	J6
S13	—	—	E3
S14	—	—	E3
S15	—	—	E3



Drawing of the tuning assembly panel as seen from the front of the receiver after removing the moulded escutcheon. The pre-set tuning adjustments are on the left, and the manual tuning adjustments are on the right.

VALVE ANALYSIS

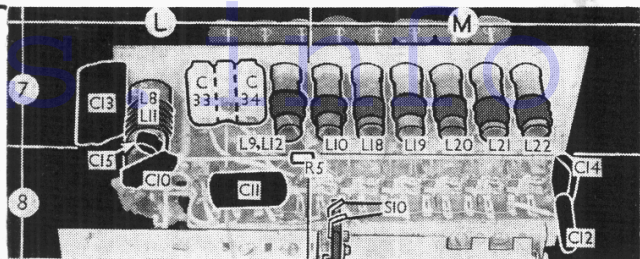
Valve voltages and currents given in the table below are those quoted by the manufacturers. With the economy switch closed and the receiver operating from a new H.T. battery they give the total H.T. current as 11.5 mA. Voltages were measured with a meter having an internal resistance of 500 ohms-per-volt.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X24M	115	0.95	60	1.05
	Oscillator	85		
V2 Z21M1	115	1.1	60	0.28
V3 HD24M	33	0.4	—	—
V4 KT2	110	4.0	115	1.0

GENERAL NOTES

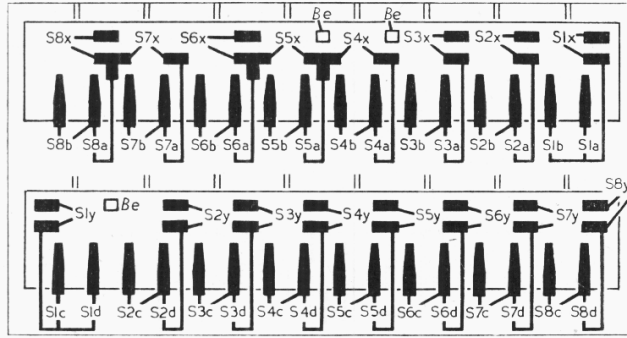
Switches.—The press-button switches are numbered S1 to S8, with suffix letters a, b, c, d, x, y, as explained under "Circuit Description" overleaf. The S1 switches are controlled by the S.W. manual button, the S2 switches by the M.W. manual button, and the S3 group by the L.W. manual button. S4, S5 and S6 groups are controlled by the three M.W. pre-set station buttons, and S7 and S8 by the two L.W. pre-set buttons. Both sides of the press-button switch unit are shown in detail in the diagrams in cols. 2 and 3.

Upper side of the tuning assembly, which faces the underside of the chassis deck, as seen from the rear. S9 is on the lower end of the appended switch unit carrying S10.



S9 and S10 form a separate unit mounted on the rear of the press-button unit, as seen in our photograph at the head of cols. 2, 3. They both open automatically when any waveband button is pressed, and close when any station button is pressed. S11, S12 are the speaker switches, in a three-position unit which permits either the internal or external speaker to be operated separately or both to operate together. Its connecting tags

toggle unit whose "dolly" is operated by a lever on the spindle of the volume control R9. **External Speaker.**—Two sockets are provided at the rear of the chassis for the connection of a low impedance (about 5Ω) external speaker. Either or both speakers can then be operated, according to the setting of the speaker circuit switch unit S11, S12. **Batteries and Leads.**—A thin pair of black and red leads with wander-plugs are provided for the



Diagrams of the two sides of the press-button switch unit. The upper diagram is actually the underside of the unit, as seen in our under-chassis view; the lower one is the side seen in the photograph above.

are identified in our under-chassis photograph, where the unit has been artificially tilted so as to show them. S13 is the battery economy switch, indicated on the rear chassis member. It closes to short-circuit R7 when its knob is turned clockwise. S14, S15 are the battery circuit switches in a

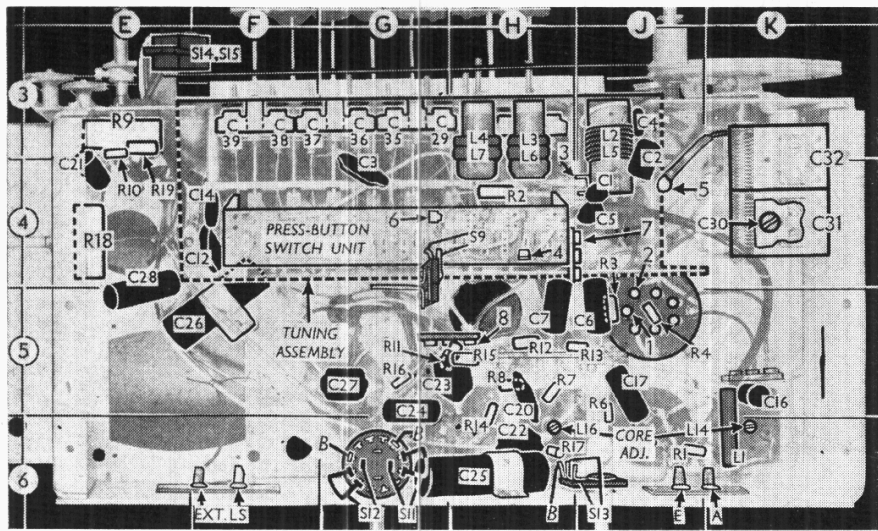
H.T. battery, and a thicker pair with spade tags for the accumulator. The accumulator is a 2v cell type GFAG. The H.T. battery is a Marconiphone type B498, 120 V overall. The positive plug goes to the +114 V socket, and the negative plug to the -6v socket. An alternative battery suggested by the makers is No. B600. **Chassis Divergencies.**—The plate aerial leading coil L1, which is covered with plastic sleeving, may be 2.3Ω in early versions instead of 4.5Ω as in our sample. Generally, with the exception of a few early chassis, the S.W. aerial fixed trimmer G4 is omitted.

DRIVE WIRE REPLACEMENT

When replacing the drive, it is important that only the correct type of wire be used for the tuning drive wire replacement. This can be obtained from E.M.I. Sales and Service, Ltd., Sheraton Works, Hayes, Middlesex. The overall length is about 88 ins. Make a 1/8 in. diameter loop at one end of the wire (which will solder quite easily), pass it through the groove slot in the drum and hook it on to the anchor pin as shown in the sketch (col. 4), where the gang is at maximum. Take the wire 1/4 of a turn clockwise round the drum, then follow the course shown in the sketch, finishing off with another loop like the first, twisting the wire and soldering. The loop is then passed through the second groove slot and hooked on to the spring, which is in turn hooked to the anchor peg. The length of the spring wire should be such that the coils of the spring open slightly.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator via an 0.05 μF capacitor in the "live" lead to control grid (top cap) of V2 and the E socket. Press the S.W. button, turn the gang to maximum capacitance and the volume control to maximum, feed in a 465 kc/s (645.16 m) signal, and adjust the cores of L16 and L15 (location references H6, B2) for maximum output, damping L15 with a 33,000 Ω resistor while adjusting L16 and vice versa. Transfer "live" signal generator lead to control grid (top cap) of V1, leaving existing connector in position, and adjust the cores of L14 (K6) and L13 (A2) for maximum output, damping the associated winding in each case, as previously explained.



Under-chassis view. The press-button switch unit is indicated here, but it is shown in detail in the diagrams in cols. 2 and 3 above, where both sides are drawn. A photograph of the upper side of the tuning assembly appears at the top of cols. 2 and 3. Interconnecting points between this assembly and the main chassis, referred to in "Dismantling The Set," are indicated here by numbers 1 to 8. No. 9 is on the top cap connector to V1. The speaker switch unit S11, S12 has been tilted artificially to show its face.

R.F. and Oscillator Stages.—The locations of all adjustments (except C30) in the following operations are indicated in our sketch of the tuning assembly front panel (col. 1). Since the calibrated glass scales are mounted on the cabinet and the alignment adjustments are carried out with the chassis on the bench, a substitute scale is fixed on the front chassis member. This is divided into inches and sixteenths of an inch, and linear measurements on this scale correspond to frequencies given in the alignment instructions, which are read against the left-hand edge of a red tab attached to the horizontal section of the drive wire.

With the gang at maximum capacitance the left-hand edge of the red tab should coincide with the 5½ in mark on the scale. If any adjustment is necessary, slacken the two screws securing the scale and slide it horizontally to correct the error. Tighten the fixing screws and connect "live" signal generator lead to A socket, via a suitable dummy aerial.

M.W.—Press M.W. button, set tab to 3½ in, feed in a 210 m (1,427 kc/s) signal, and adjust C33 and C30 (K4) for maximum output. Set tab to 4½ in, feed in a 510 m (588 kc/s) signal, and adjust the cores of L9 and L6 for maximum output. Repeat these adjustments.

L.W.—Press L.W. button, set tab to 1½ in, feed in a 1,000 m (300 kc/s) signal, and adjust C34 and C29 for maximum output. Set tab to 4½ in, feed in a 1,850 m (162 kc/s) signal, and adjust the cores of L10 and L7 for maximum output. Repeat these adjustments.

S.W.—Press the S.W. button and use S.W. dummy aerial. Set tab to 5½ in, feed in a 50 m (6.0 Mc/s) signal and adjust the positions of the internal loops in L8 and L5 for maximum output.

Finally, replace the chassis in the cabinet and turn the gang to maximum capacitance. The two cursors should be positioned so that they coincide with the horizontal lines at the tops of the scales and then clamped to the drive wires. Check the calibration on known stations at approximately mid-scale positions and adjust the cursors as necessary. On M.W. and L.W. it may be necessary to set the cursor to give the best compromise on both wavebands.

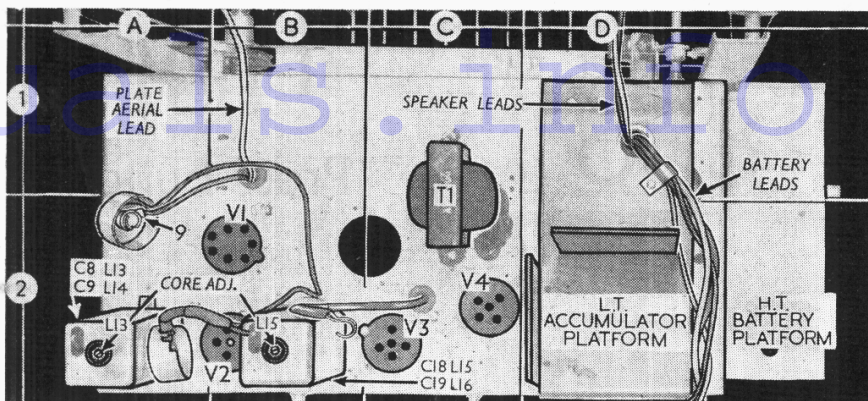
Press-button Setting

The press-button circuits should be reset after alignment. The process is simple, but should be carried out at the customer's address on actual stations if possible. The adjustment range of each oscillator coil core is shown on an associated label exposed when the escutcheon is lifted off the cabinet (press fit). Adjust the upper (oscillator) coil core first to the required station, and then peak the lower (aerial) trimmer.

DISMANTLING THE SET

Almost unimpeded access to the chassis underside may be obtained upon removal of the bottom cover (three round-head wood screws).

Removing Chassis.—Remove the two front control knobs (taking care not to lose their fixing screws) and the side control knob (pull off);



Plan view of the chassis, showing the battery platforms. V2 top cap, it should be noted, is the anode connection.

detach the plate aerial lead (one round-head wood screw and washer);

loosen each of the scale cursor clamping screws and lift out the associated drive wire; loosen the speaker lead cleat on the sub-baffle, lift out the leads, and remove the four hexagonal chassis retaining screws (with spring and claw washers) from the underside of the cabinet.

To free the chassis entirely, unsolder the two speaker leads at tags on the speaker connecting panel.

When replacing, resolder the yellow speaker lead to the tag marked + on the speaker connecting panel, and the black lead to the tag marked -, which is also joined to the right-hand scale backing plate.

Removing Speaker.—Remove the four round-head bolts (with washers) securing the speaker to the sub-baffle.

When replacing, the connecting panel should be at the top, and if the leads have been unsoldered they should be reconnected as previously described.

Removing Tuning Assembly.—Unsolder from the underside of the chassis, at points indicated in our circuit diagram and under-chassis view by the numbers 1 to 8 (location references J5, J4, H4, G4, H5), the eight leads connecting the assembly;

remove V1 top cap connector and unsolder the green plastic covered lead, number 9 (A2), and draw the lead back into the chassis through the grommet provided;

remove the two self-threading screws securing the toggle switch mounting bracket and the four screws securing the tuning assembly and substitute scale to the front chassis member; lift out the assembly, taking care not to foul the cursor drive wire.

When replacing, the eight leads should be re-

soldered to the numbered points indicated in our under-chassis picture as follows: 1, white lead from L12; 2, yellow lead from C10; 3, black screened aerial lead; 4, green lead from C31; 5, metal braided lead from tuning assembly; 6, yellow lead from C7, R8; 7, yellow lead from C11; 8, red lead from R5.

The long green lead from C5, R2 on the press-button switch should be threaded back, through the grommet provided, to the chassis deck where V1 top-cap connector (9) may be reconnected to it.

Service Short-cuts

Acc | A50

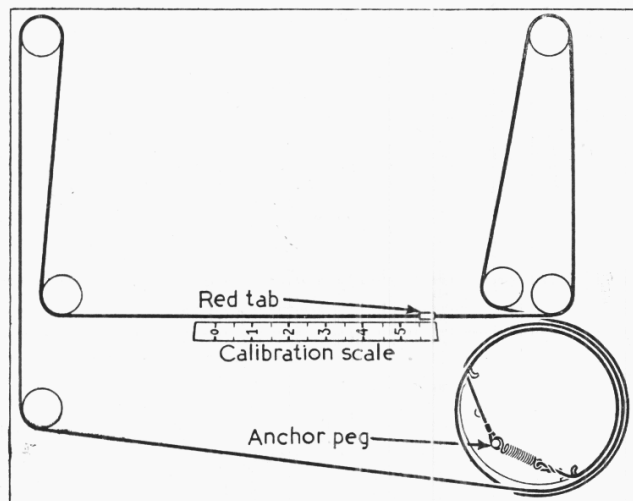
One of these sets was left with us recently with the complaint of very poor reception on all three wavebands. On test we found an audible signal on about 26 m, which was improved upon by transferring the aerial to the frequency changer grid. An A.F. signal to the P.U. sockets gave a normal output. Voltages on V1 and V2 were normal.

A close scrutiny revealed that two of the fixing nuts were missing from the main tuning gang mounting, while a third was so loose that the frame was not in firm contact with the chassis. For once we were able to find a couple of suitable nuts, and all three were pulled up firmly, when the set sprang to life, giving good reception on all three wavebands. To prevent a repetition of the trouble we sealed the tops of the nuts.—N. M., Bugle.

Philips 170A

Having traced a cabinet rattle which occurs only on L.W., I thought as even normal rattles are sometimes very elusive, other dealers would like to know the cause of this one, which was due to the wave-change indicator return spring touching scale assembly when it contracted in the L.W. position.

Another rattle in this receiver I have traced to a bracket on the mains transformer, which touches lightly against another bracket on the chassis. In *Service Sheet 770* (plan view), above the words "Voltage Adjustment," can be seen a small bracket projecting from the right of the transformer, but I found a second one, not visible in the illustration referred to, at the rear of the transformer. It is this second bracket that is liable to contact the one on the chassis, causing a buzz.—R. C. B., Amble-side.



Sketch showing the tuning system drive system, drawn as seen from the front of the chassis when the gang is at maximum. The cable consists of a special stranded steel wire. The position of the calibration scale is indicated.