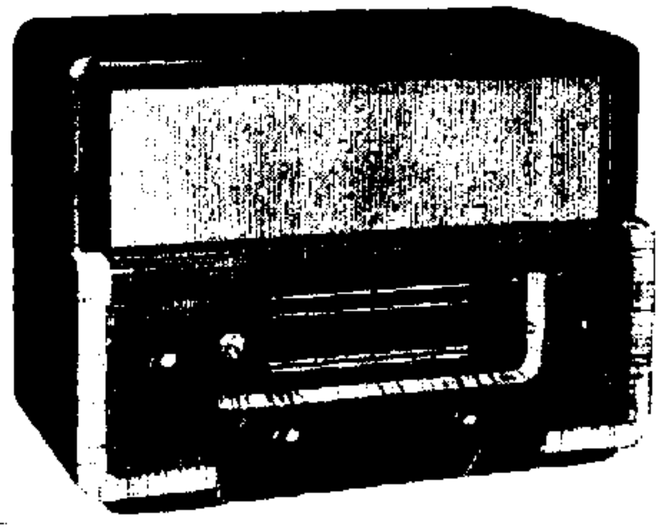
PILOT BLUE PETER"

Four-band A.C. Superhet



THE inclusion of the "Trawler" band in the Pilot "Blue Peter" provides a very good reason for its title. The receiver is a 4-valve (plus rectifier) 4-band superhet designed to operate from A.C. mains of 110 V and 200-250 V, 40-100 c/s. The waveband ranges are: 13-50 m (S.W.1); 60-180 m (S.W.2); 200-550 m (M.W.); and 1,000-2,000 m (L.W.).

The design includes optional negative feed-back (on M.W. and L.W. only), and there is provision for the connection of a gramophone pick-up (which may be left permanently connected) and an external speaker. An unusual feature is the "swinging choke" or inductive input filter for H.T. smoothing, although in later models this is not used.

Release date and original price: January 1949; £22 1*s. plus purchase tax.*

CIRCUIT DESCRIPTION

Aerial input, via series capacitor **C1,** is inductively coupled by **L1** (S.W.1), **L2** (S.W.2), **L3** (M.W.) and **L4** (L.W.) to single-tuned circuits **L5, C33** (S.W.1), **L6, C33** (S.W.2), **L7, C33** (M.W.) and **L8, C33** (L.W.), which precede a triode-hexode frequency changer **(V1, Brimar 6K8GT).**

Triode oscillator grid coils **L9** (S.W.1), **L10** (S.W.2), **L11** (M.W.), **L12** (L.W.) are tuned by **C34,** with parallel trimming by **C35** (S.W.1), **C36** (S.W.2), **C37** (M.W.), and **C10, C38** (L.W.). Series tracking is provided by **C8** (S.W.1), **C9, C39** (S.W.2), **C40** (M.W.) and **C41** (L.W.), and reaction coupling is obtained from the common impedance of trackers in grid and anode circuits on all bands except S.W.2, where the coupling is inductive, due to **L14.** Anode coil **L13** provides additional coupling on S.W.1.

Second Valve **(V2, Brimar 7H7)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-transformer couplings **C4, L15, L16, C5** and **C14, L17, L18, C15,** in which the tuning capacitors are fixed and alignment

Circuit diagram of the Pilot "
and L.W. connecting **R20, R13** ac
feed-back is applied via **R13** to
however, the NFB link may be
sockets are shown permanently
plug isolates itself from the circu

is effected by varying the positions of the iron-dust cores.

Intermediate frequency 451 Kc/s.

Diode second detector is part of double diode triode valve **(V3, Brimar 6Q7GT)**, in which the diode sections are wired in parallel. Audio frequency component in rectified output is developed across the volume control **R11**, which is also the diode load resistor, and passed, via A.F. coupling capacitor **C20** and grid resistor **R12**, to C.G. of triode section, which operates as A.F. amplifier. I.F. filtering by **C17, R9, C18, R10, C19** in diode circuit, and provision for the connection of a gramophone pick-up across **R11** by means of the special socket, with which is associated the radio muting switch **S28.**

The D.C. potential developed across **R9, R10, R11** in series is tapped off and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving A.G.C.

Resistance-capacitance coupling by **R14, C22, C23** and **R15**, via grid stopper **R16**, between **V3** triode and beam tetrode output valve **(V4, Brimar 6V6GT).** Bass cut in the A.F. amplifier response on S.W.1 is obtained by the introduction of **C23**, which is short-circuited on the other wavebands by **S26.** Fixed tone correction in **V4** anode circuit by **C25**, and variable tone control by **C27, R19.**

Provision is made for the connection of an external speaker across T1 secondary winding, and the A.F. voltage appearing across this winding is applied to a potential divider **R20, R13**, from which it is applied to **V3** cathode, giving negative feed-back. This feature is optional, since it may be removed by the connection of a short-circuiting link across **R13** and it is disconnected on the two S.W. bands by the opening of **S27** to obtain increased gain.

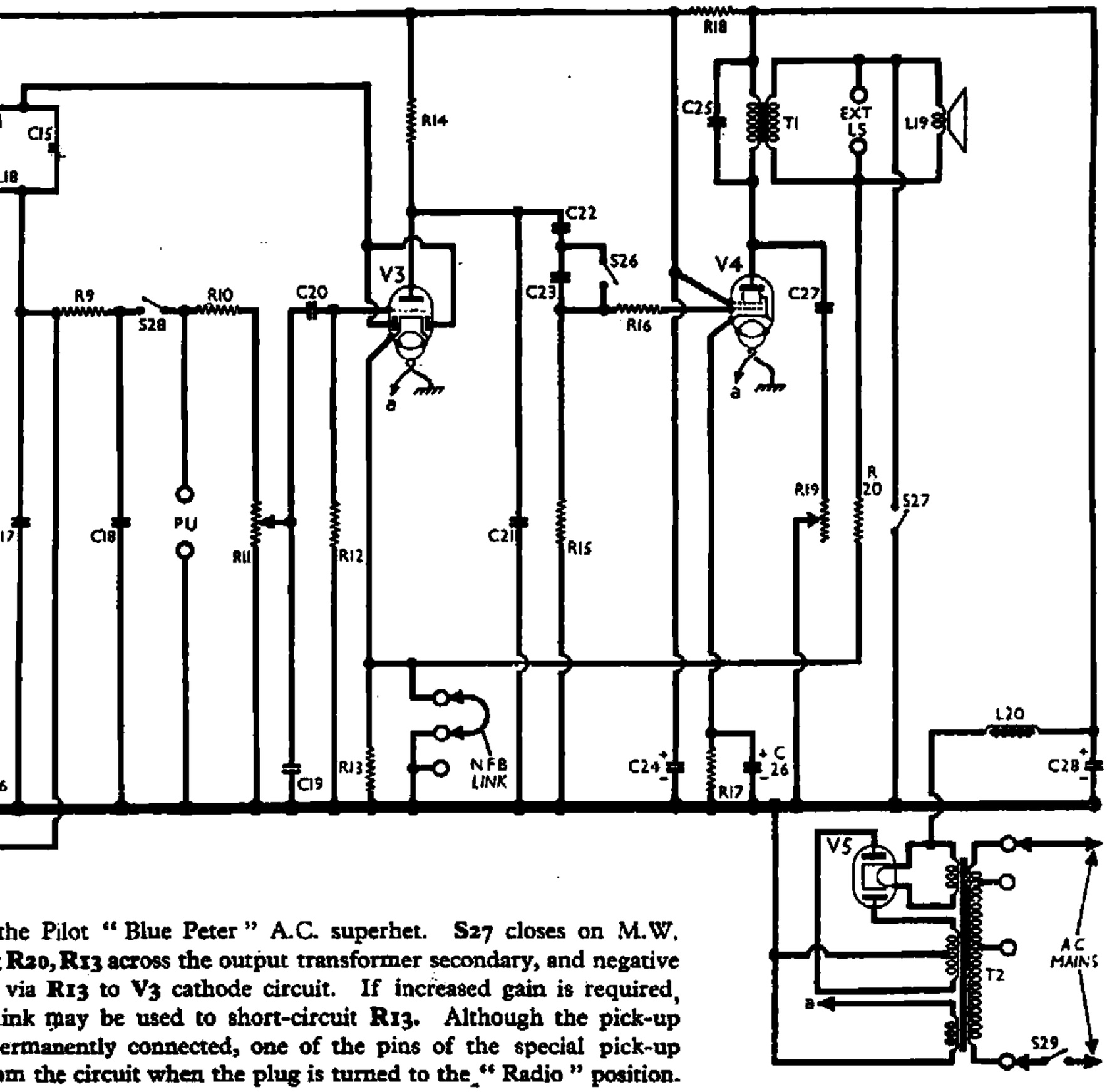
H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Brimar 5Z4G)**, with smoothing by iron-cored choke **L20**, resistor **R18**, and electrolytic capacitors **C24, C28.**

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)	Locations
R1	V1 hex. C.G. decoup.	1,000,000	H6
R2	V1 S.G. H.T. feed...	22,000	J6
R3	V1 fixed G.B. ...	220	K5
R4	V1 osc. C.G. ...	47,000	K5
R5	V1 osc. anode load	47,000	K5
R6	V2 S.G. H.T. feed...	33,000	J6
R7	V2 cath. by-pass ...	220	J6
R8	A.G.C. decoupling	1,000,000	H6
R9	I.F. stoppers ...	47,000	H6
R10		47,000	H6
R11	Volume control ...	500,000	D1
R12	V3 C.G. resistor ...	10,000,000	G6
R13	F.-B. coupling ...	220	F6
R14	V3 triode load ...	220,000	F5
R15	V4 C.G. resistor ...	470,000	F6
R16	V4 C.G. stopper ...	4,700	F6
R17	V4 G.B. resistor ...	270	F6
R18	H.T. smoothing ...	1,000	F5
R19	Tone control ...	25,000	F3
R20	F.-B. coupling ...	220	F6

	CAPACITORS	Values (μF)	Locations
C1	Aerial series ...	0·0005	K6
C2	V1 C.G. decoupling	0·1	K3
C3	V1 S.G. decoupling	0·1	K5
C4	1st I.F. transformer tuning	0·00011	A2
C5		0·00011	A2
C6	V1 cath. by-pass ...	0·1	K5
C7	V1 osc. C.G. ...	0·00006	J5
C8	Osc. S.W.1 tracker	0·006	H4
C9	Osc. S.W.2 tracker	0·00057	G3
C10	Osc. L.W. trimmer	0·00002	H3
C11	Osc. anode coup. ...	0·0001	K5
C12	V2 C.G. decoupling	0·1	J6
C13	V2 S.G. decoupling	0·1	J6
C14	2nd I.F. transformer tuning ...	0·00011	B2
C15		0·00011	B2
C16	V2 cath. by-pass ...	0·1	J6
C17	I.F. by-passes ...	0·0001	H6
C18		0·0001	G6
C19		0·0001	D1
C20	A.F. coupling ...	0·002	H6
C21	I.F. by-pass ...	0·0003	G5
C22	A.F. coupling ...	0·01	G5
C23	Bass cut	0·0003	G6
C24*	H.T. smoothing ...	16·0	D2
C25	Tone corrector ...	0·002	F5
C26*	V4 cath. by-pass ...	25·0	E5
C27	Part tone control...	0·05	F6
C28*	H.T. smoothing ...	16·0	D2
C29†	Aerial S.W.2 trim.	0·00007	J4
C30†	Aerial M.W. trim....	0·00007	J4
C31†	Aerial L.W. trim....	0·00007	J4
C32†	Aerial S.W.1 trim.	0·00003	J3
C33†	Aerial tuning ...	0·000532	B1
C34†	Oscillator tuning ...	0·000532	B1
C35†	Osc. S.W.1 trim. ...	—	B1
C36†	Osc. S.W.2 trim. ...	0·00007	H5
C37†	Osc. M.W. trim. ...	0·00007	H5
C38†	Osc. L.W. trim. ...	0·00007	H5
C39†	Osc. S.W.2 track....	0·00115	G3
C40†	Osc. M.W. track....	0·0007	H3
C41†	Osc. L.W. track. ...	0·0003	H3

* Electrolytic. † Variable. ‡ Pre-set.

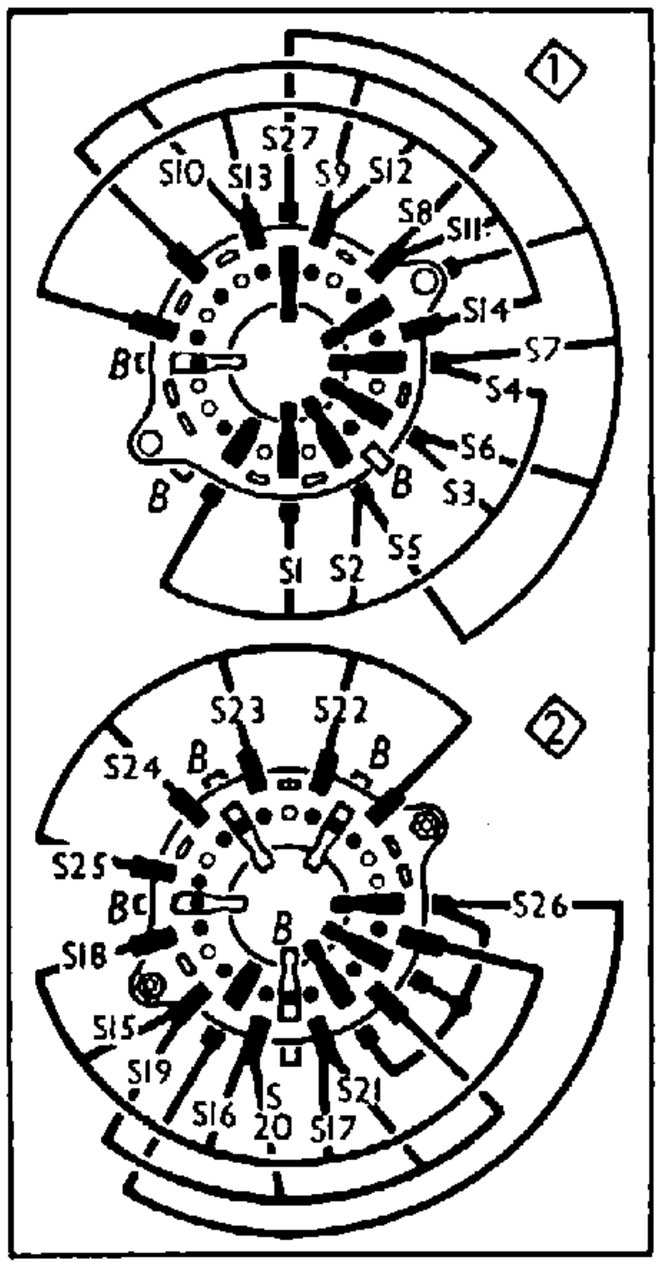


	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	Aerial coupling coils	1·8	A1
L2		12·5	K3
L3		17·0	K4
L4		123·0	A1
L5	Aerial tuning coils	Very low	A1
L6		0·3	K3
L7		6·5	K4
L8		12·5	A1
L9	Oscillator tuning coils	Very low	J5
L10		0·2	H4
L11		3·4	H4
L12		6·7	H4
L13	Oscillator reaction coils	0·2	J5
L14		1·4	H4
L15	1st I.F. trans. Pri.	7·5	A2
L16	1st I.F. trans. Sec.	7·5	A2
L17	2nd I.F. trans. Pri.	7·5	B2
L18	2nd I.F. trans. Sec.	7·5	B2
L19	Speech coil ...	2·0	—
L20	Smoothing choke...	240·0	E4
T1	Speaker trans. Pri.	400·0	—
	Speaker trans. Sec.	0·4	—
T2	Mains trans. Pri., total	19·5	C1
	Mains trans. Heat sec.,	Very low	
	Mains trans. Rect. heat sec.,	Very low	
	Mains trans. H.T. sec., total	430·0	
S1-S27	W/band switches...	—	J3
S28	Radio muting sw.	—	G6
S29	Mains sw., g'd R19	—	F3

...the Pilot "Blue Peter" A.C. superhet. **S27** closes on M.W. ...**R20, R13** across the output transformer secondary, and negative ... via **R13** to **V3** cathode circuit. If increased gain is required, ...ink may be used to short-circuit **R13.** Although the pick-up ...ermanently connected, one of the pins of the special pick-up ...m the circuit when the plug is turned to the "Radio" position.

Waveband Switch Table and Diagrams

Switch	S.W.1	S.W.2	M.W.	L.W.
S1	C	—	—	—
S2	—	C	—	—
S3	—	—	C	—
S4	—	—	—	C
S5	C	—	—	—
S6	C	C	—	—
S7	C	C	C	—
S8	C	—	—	—
S9	C	C	—	—
S10	C	C	C	—
S11	—	C	—	—
S12	—	—	C	—
S13	—	—	—	C
S14	C	—	—	—
S15	—	C	—	—
S16	—	—	C	—
S17	—	—	—	C
S18	C	—	—	—
S19	C	—	—	—
S20	C	C	—	—
S21	C	C	C	—
S22	C	—	—	—
S23	—	C	—	—
S24	—	—	C	—
S25	—	—	—	C
S26	—	C	C	C
S27	—	—	C	C



Diagrams of the waveband switch units, drawn as seen when viewed from the rear of an inverted chassis.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs and felt washers (pull off), and the four cheese-head screws (with metal washers) securing the chassis: the chassis may now be slid from the cabinet to the extent of the speaker leads, which are sufficiently long for most purposes.

Removing Speaker.—Loosen the nuts of the four speaker retaining cleats, swivel the cleats aside, and lift the speaker from the sub-baffle.

When replacing, the transformer should be on the right, when viewing the speaker from the rear, and if the four leads have been unsoldered they should be connected as follows, numbering the tags on the connecting panel from top to bottom: 1, yellow; 2, red; 3, black; 4, brown.

GENERAL NOTES

Switches.—S1-S27 are the waveband switches, ganged in two rotary units beneath the chassis. These are indicated in our under-chassis illustration, where they are identified by the numbers **1** and **2** in diamond-shaped enclosures, and they are shown in detail in the diagrams above, where they are drawn as seen from the rear of an inverted chassis.

The table (col. 1) gives the switch positions for the four control settings, starting at the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S28 is the radio muting switch, associated with a special plug and socket by which the pick-up leads are connected. When the plug is inserted and turned a few degrees anti-clockwise, **S28** opens to mute radio. When the plug is turned clockwise again, the lower prong of the plug detaches itself from the switch blade, disconnecting the pick-up from the diode load circuit.

S29 is the Q.M.B. mains switch, ganged with the tone control **R19.**

Scale Lamps.—These are two Ever Ready lamps, with M.E.S. bases and small clear 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 3-4 Ω) external speaker.

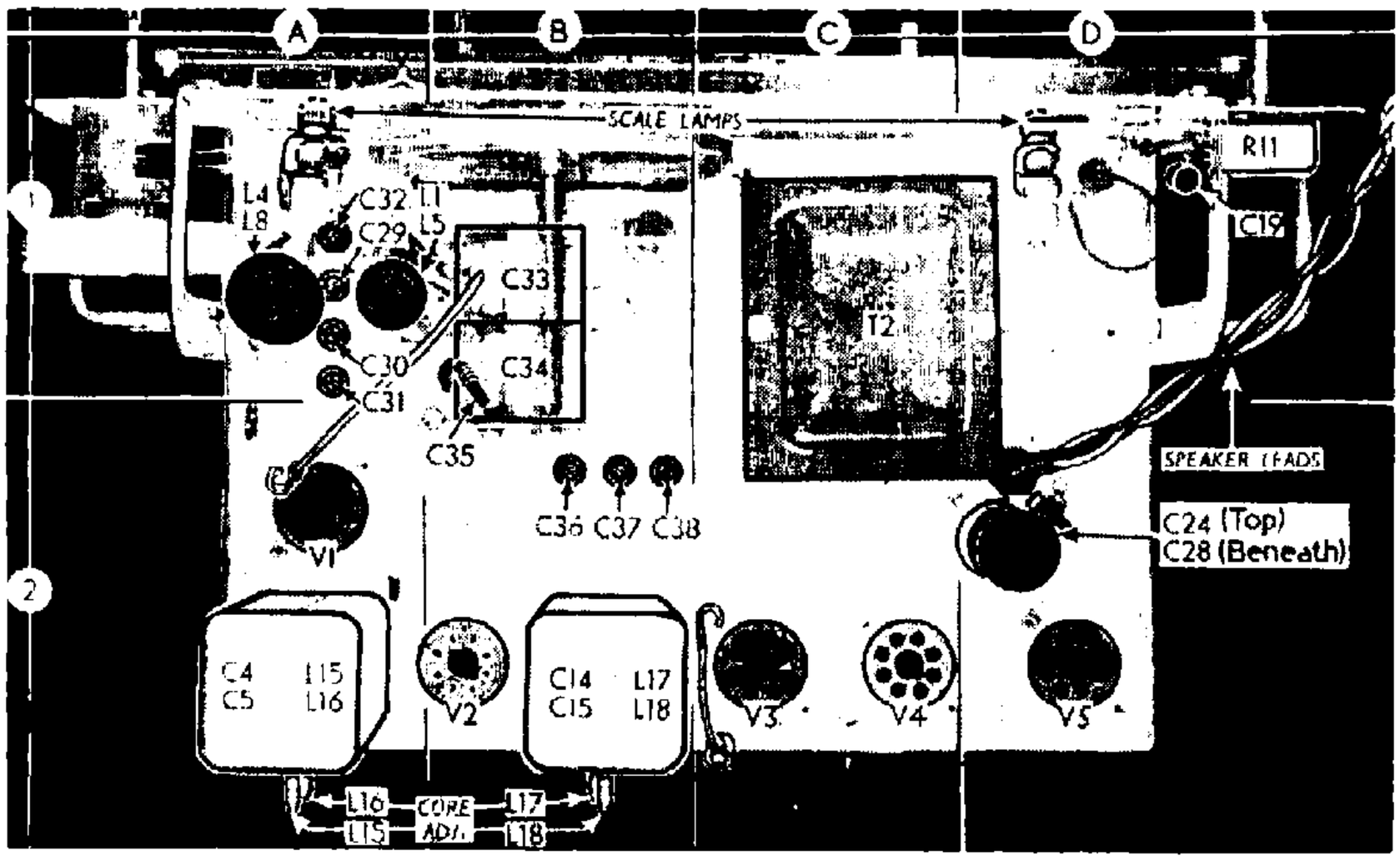
Negative Feed-back Strap. — Three sockets are provided on a panel at the rear of the chassis marked "NFB" in a vertical column for a shorting link or "strap." The strap may be connected to the centre socket and either of the outer sockets. In the upper position, the negative feed-back system is permitted to operate. In the lower position, **R13** in **V3** cathode circuit is short-circuited, and there is no feed-back coupling. The negative feed-back system operates only on M.W. and L.W. in any case, as **S27** opens when the waveband control is turned to the S.W.1 or S.W.2 position.

CHASSIS DIVERGENCIES

In later chassis than our sample a different kind of mains transformer was fitted. This has only two secondary windings, rated at 265+265 V and 6 V, and the 110 V tapping is omitted from the primary winding.

When this transformer is used, a 6X5GT valve is used as the rectifier, and its heater is connected to the single 6 V secondary winding with the rest of the valves in the receiver.

R18 is omitted altogether, and **L20** is replaced by a 680 Ω resistor, which is wire-wound and rated at 6 W. **C24** and **C28** are increased in value to 32 μF each, and they are connected either side of the new smoothing resistor, in the manner of the normal capacitative-input type of smoothing filter.



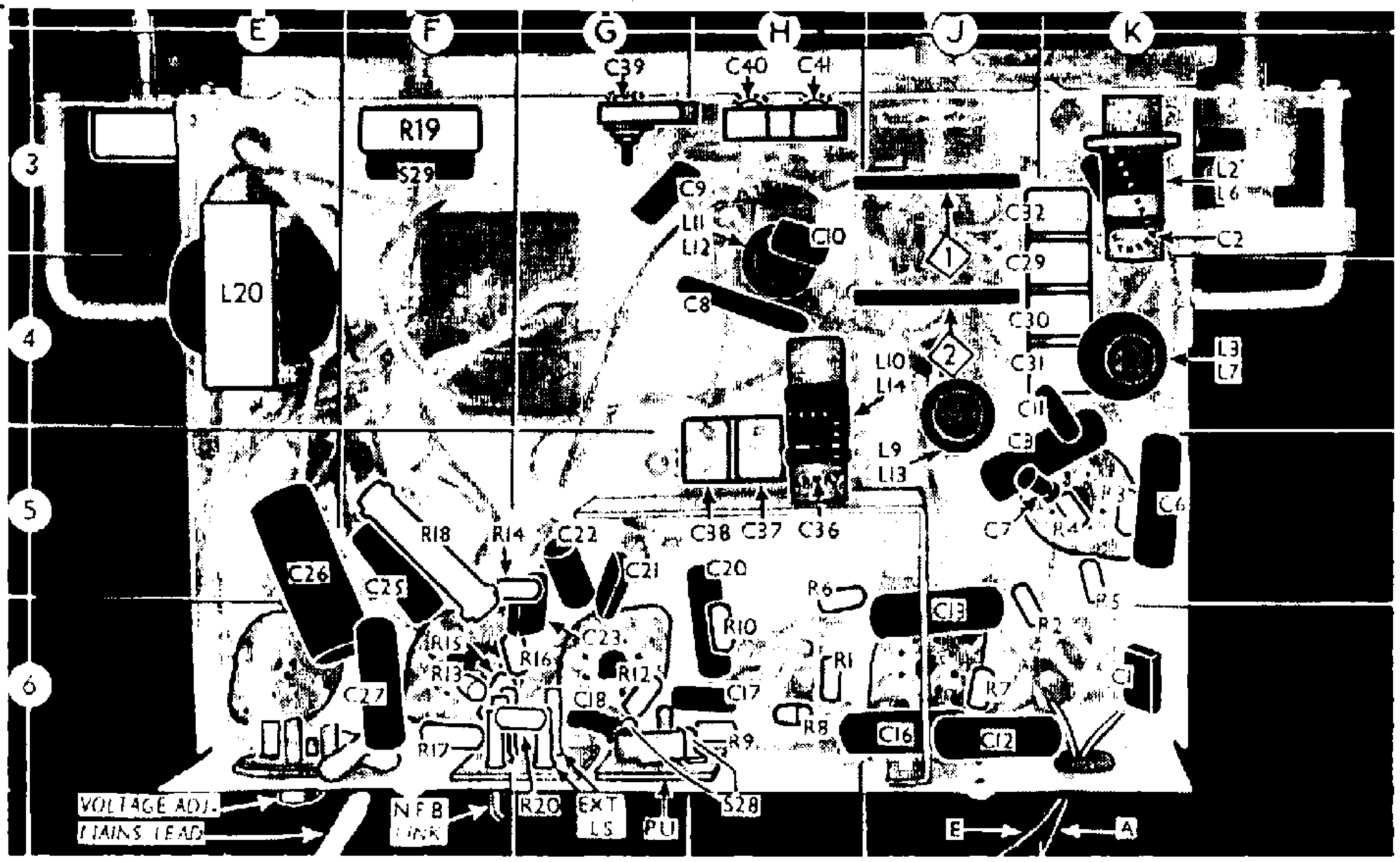
Plan view of the chassis. Several of the trimmers indicated here are reached through holes in the chassis deck, and the I.F. transformer core adjustments are identified.

DRIVE CORD REPLACEMENT

There are two tuning drive cords in this receiver: the main gang drive cord, and the cursor drive cord. They are both shown in our sketch (col. 4), where the complete system is drawn as seen from the front with the gang at maximum, neglecting such obstructions as hide the cord in places. To distinguish one cord from the other, the gang drive cord is drawn in broken line.

The gang drive is simple, and can be replaced without disturbing the scale, but to replace the cursor drive, the scale assembly must be dismantled.

Gang Drive.—About two feet of Nylon braided glass yarn is required. Thread one end into the rear side of the drum through the hole in the rear groove, thread a thimble on to it and tie a knot to secure it. Take the outer length of



Under - chassis view. The waveband switch units are indicated here by the numbers 1 and 2 in diamond surrounds, with arrows to show the direction in which they are viewed in the diagrams in col. 2 opposite. The adjustments of the pre-set capacitors C29 - C32 and C36 - C38, are reached through holes in the chassis deck.

cord anti-clockwise round the rear groove, 2½ turns round the control spindle, and back to the drum, where it is tied off to the tension spring.

Cursor Drive.—About four feet of Nylon braided glass yarn is required. Remove the glass scale panel (four nuts and bolts, with lock-washers), and the scale backing-plate (four bolts, with lock-washers), with the waveband indicator slide which comes away with it, to gain access to the front inside of the drum.

Thread one end of the cord into the front side of the drum through the hole in the front grove, thread a thimble on to it and tie a knot to secure it. Take the outer length of cord clockwise away from the drum and complete the circuit shown by the solid line in the sketch, finally threading the free end back into the hole in the groove and tying off to the spring.

When replacing the scale backing plate, the tuning indicator slide should be fitted under the heads of the two bolts that hold the right-hand end of the plate.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., tune to 550 m on scale, turn volume control to maximum, and connect signal generator via an 0.1 μF capacitor in the "live" lead, to control grid (top cap) of **V1** and the **E** socket. Feed in a 451 kc/s (665.1 m) signal, and adjust the cores of **L15, L17, L16** and **L15** (location references B2, A2) for maximum output, progressively attenuating the signal generator output as the circuits are aligned, to avoid automatic gain control action.

R.F. and Oscillator Stages.—With the gang at maximum capacitance the cursor should coincide with the vertical lines at the high wavelength ends of the four scales. It may be adjusted in position by sliding the cursor carriage along the drive cord. Transfer "live" signal generator lead to **A** socket, via a suitable dummy aerial.

S.W.1.—Switch set to S.W.1, tune to 20 m on scale, feed in a 20 m (15 Mc/s) signal, and adjust **C35** (B1) (if fitted) and **C32** (A1) for maximum output.

S.W.2.—Switch set to S.W.2, tune to 65 m on scale, feed in a 65 m (4.61 Mc/s) signal, and adjust **C36** (B2) and **C29** (A1) for maximum output. Tune to 165 m on scale, feed in a 165 m (1.81 Mc/s) signal, and adjust **C39** (G3) for maximum output. Repeat these operations until no improvement results.

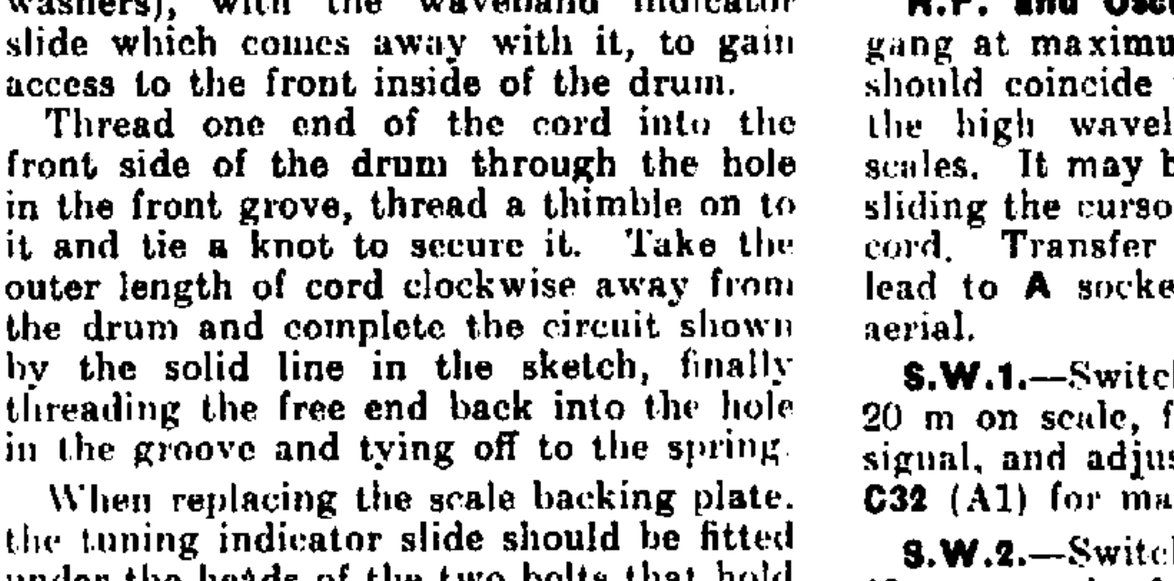
M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C37** (B2) and **C30** (A1) for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust **C40** (H3) for maximum output. Repeat these operations until no improvement results.

L.W.—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C38** (B2) and **C31** (A1) for maximum output. Tune to 1,800 m on scale, feed in a 1,800 m (166.7 kc/s) signal, and adjust **C41** (H3) for maximum outpnt. Repeat these operations until no improvement results.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 213 V, using the 200-225 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the M.W. band, the volume control was at maximum, and the optional negative feedback was not in circuit.

Voltages were measured on the 400 V scale, except where otherwise indicated, of a model 7 Avometer, chassis being the negative connection.



Sketch showing the drive cord system as seen from the front. The main (gang) drive is shown in broken line to distinguish it from the cursor cord. The drum is double sided.

Valves	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)	Cathode Voltage (V)
V1 6K8GT	222	2·9	91	6·4	2·5*
	Oscillator				
	53	3·9			
V2 7H7	222	7·2	123	2·5	2·0*
V3 6Q7GT	65	0·75	—	—	—
V4 6V6GT	233	40·0	222	2·4	11·0*
V5 5Z4G	312†	—	—	—	270

† Each anode, A.C. * 100 V meter range.

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