'TRADER' SERVICE SHEET 192

MULLARD MAS4

3-BAND A.C. SUPERHET

ADJUSTABLE for mains of 100-150 and 200-250 V, the Mullard MAS4 receiver is a 4-valve (plus rectifier) A.C. 3-band superhet with a short-wave range of 16·7-51 metres. It is provided with variable selectivity and sockets for a gramophone pick-up and an extension speaker, a switch allowing the internal speaker to be cut out of circuit.

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 **L4, L5,** is tuned by **C35**; secondary **L7, L8** is tuned by **C37**; coupling by **C4, C5.** I.F. filter **L1, C32** shunts aerial-earth circuit. Image suppression by **C1** and **C33.** On S.W. band aerial input is via **C2** to single-tuned circuit comprising **L6** and **C37.**

First valve (**V1, Mullard metallised FC4**) is an octode operating as electron-coupled frequency changer. Oscillator grid coils **L9** (S.W.), **L11, L12** (M.W. and L.W.) are tuned by **C38**; parallel trimming by **C39** (S.W.); **C40** (M.W.), **C41** (L.W.); series tracking by **C10, C42** (L.W.), **C11, C43** (M.W.); oscillator anode reaction coils **L10** (S.W.), **L13, L14** (M.W. and L.W.).

Second valve (**V2, Mullard metallised VP4B**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C44, L15, L16, C45** and **C46, L17, L18, C47.** Provision is made for varying the coupling between primary and secondary windings of the first transformer in order to give variable selectivity.

Intermediate frequency 128 KC/S.

Moving iron meter tuning indicator **T.I.** in **V2** anode H.T. feed circuit.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD4**). Audio frequency component in rectified output is developed across manual volume **R12** and passed via **C18** and **R13** to C.G. of triode amplifier section. Condenser **C19** is connected in series with **C18** in order to provide a degree of bass attenuation in conjunction with switches **S28, S30, S31.** Provision for connection of gramophone pick-up across volume control by switches **S26** and **S27.**

Second diode of **V3,** fed from **V2** anode via **C22** provides D.C. potential which is developed across **R21** and fed back through decoupling circuits as G.B. to F.C. valve giving automatic volume control. D.C. potential developed across signal diode load **R12** controls I.F. valve.

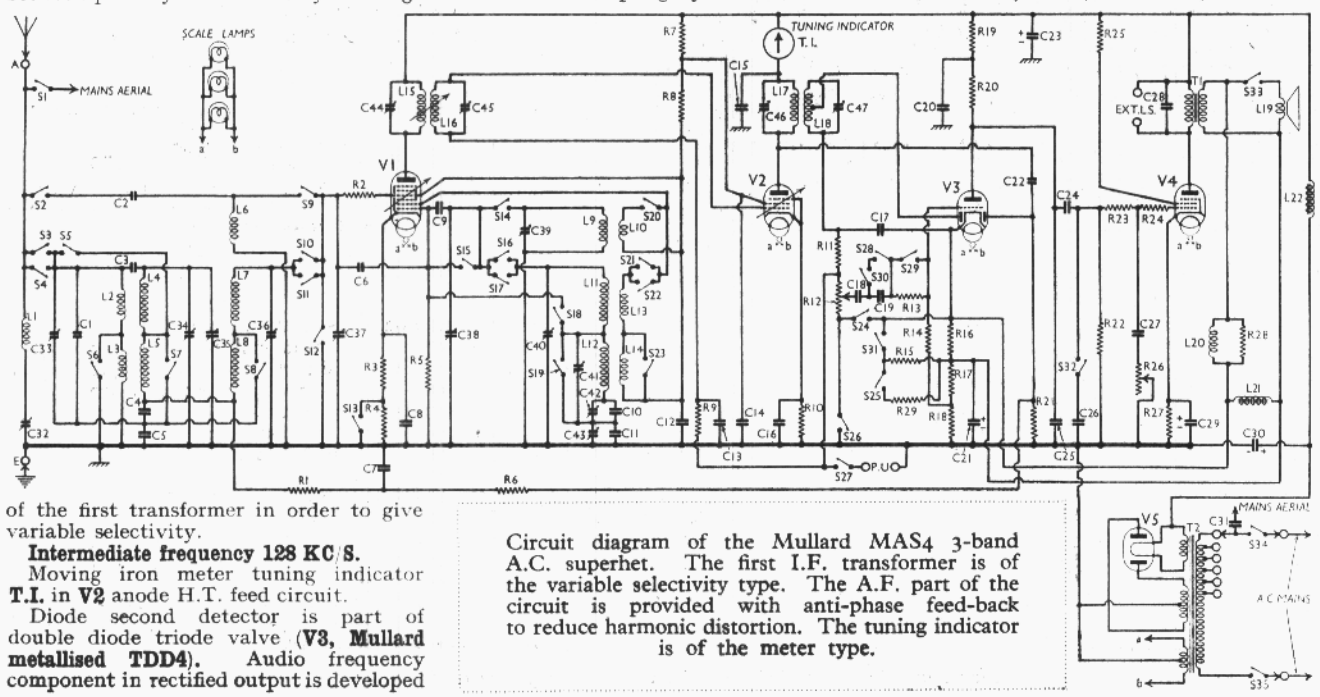
Resistance-capacity coupling by **R20, C24** and **R22** between **V3** triode and pentode output valve (**V4, Mullard PenA4.**) Variable tone control by R.C. filter **R26, C27** in C.G. circuit; fixed tone correction in anode circuit by **C28.** Condenser **C26** shunts C.G. circuit when switch **S32** is closed, thus muting the receiver. Provision for connection of high-impedance external speaker across primary of **T1.** Switch **S33** breaks internal speaker speech coil circuit. Components **L20, R28, L21, R16** and **R29** are used in an inverse feed-back circuit to inject into the cathode circuit of **V3,** in anti-phase, any harmonics developed in the A.F. portion of the receiver, thus reducng distortion.

H.T. current is supplied by full-wave rectifying valve (**V5, Mullard DW2**). Smoothing by iron-cored choke **L22** and electrolytic condensers **C23, C30.** Mains aerial coupling by **C31.**

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Image suppressor	0·00002
C2	Aerial S.W. coupling	0·000016
C3	Aerial M.W., L.W. coupling	0·00001
C4	Band-pass couplings	0·016
C5	Band-pass couplings	0·025
C6	Neutralising condenser	0·000002
C7	V1 A.V.C. line decoupling	0·1
C8	V1 cathode by-pass	0·05
C9	V1 osc. C.G. condenser	0·0001
C10	Osc. fixed L.W. tracker	0·00065
C11	Osc. fixed M.W. tracker	0·001375
C12	V1 S.G.'s and osc. A decoupling	0·1
C13	V2 C.G. decoupling	0·1
C14	V2 S.G. by-pass	0·1
C15	V2 anode decoupling	0·1
C16	V2 cathode by-pass	0·1
C17	I.F. by-pass	0·0001
C18	A.F. coupling to V3 triode	0·002
C19	Bass control condenser	0·00025
C20	V3 anode decoupling	0·5
C21*	V3 cathode by-pass	25·0
C22	V3 A.V.C. diode feed	0·00001
C23*	H.T. smoothing	32·0
C24	V3 to V4 A.F. coupling	0·02
C25	V3 anode I.F. by-pass	0·0004
C26	Muting condenser	0·1
C27	Tone control condenser	0·008
C28	Fixed tone corrector	0·004
C29*	V4 cathode by-pass	25·0
C30*	H.T. smoothing	32·0
C31	Mains aerial coupling	0·0005
C32‡	Aerial I.F. filter tuning	0·00017
C33‡	Image suppressor	0·00003
C34‡	Band-pass pri. trimmer	0·00003
C35†	Band-pass pri. tuning	0·00047
C36‡	Band-pass sec. trimmer	0·00003
C37†	Band-pass sec. and S.W. tuning	0·00047
C38†	Osc. circuit tuning	0·00047
C39‡	Osc. circuit S.W. trimmer	0·00003
C40‡	Osc. circuit M.W. trimmer	0·00003
C41‡	Osc. circuit L.W. trimmer	0·00003
C42‡	Osc. circuit L.W. tracker	0·00017
C43‡	Osc. circuit M.W. tracker	0·00017
C44‡	1st I.F. trans. pri. tuning	0·00017
C45‡	1st I.F. trans. sec. tuning	0·00017
C46‡	2nd I.F. trans. pri. tuning	0·00017
C47‡	2nd I.F. trans. sec. tuning	0·00017

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Mullard MAS4 3-band A.C. superhet. The first I.F. transformer is of the variable selectivity type. The A.F. part of the circuit is provided with anti-phase feed-back to reduce harmonic distortion. The tuning indicator is of the meter type.

	RESISTANCES	Values (ohms)
R1	V1 pentode C.G. decoupling	100,000
R2	V1 pentode C.G. stabiliser	50
R3	V1 fixed G.B. resistance	250
R4	V1 G.B. resistance (gram.)	2,500
R5	V1 osc. C.G. resistance	50,000
R6	V1 A.V.C. line decoupling	1,000,000
R7	V1, V2, S.G.'s and osc. anode H.T. feed resistances	16,000* 25,000†
R9	V2 C.G. decoupling	1,600,000
R10	V2 fixed G.B. resistance	1,250
R11	I.F. stopper	100,000
R12	Manual volume control	500,000
R13	I.F. stopper	1,600,000
R14	V3 triode C.G. resistance	1,600,000
R15	Bass control resistance	32
R16	Inverse feed-back circuit	32
R17	V3 G.B. and A.V.C. delay voltage resistances	3,200 4,000
R19	V3 triode anode decoupling	50,000
R20	V3 triode anode load	100,000
R21	V3 A.V.C. diode load	500,000
R22	V4 C.G. resistance	800,000
R23	V4 C.G. I.F. stoppers	100,000
R24		1,000
R25	V4 aux. grid stabiliser	32
R26	Variable tone control	2,580,000
R27	V4 G.B. resistance	160
R28	Inverse feed-back circuit	500
R29	Bass control resistance	10

* Two 32,000 Ω in parallel. † 12,500 and 10,000 Ω in series; may be 20,000 Ω.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial I.F. filter coil	140·0
L2	Aerial M.W. and L.W. coupling coils	25·0 95·0
L3		
L4	Band-pass primary coils	4·0
L5		40·0
L6	Aerial S.W. tuning coil	0·05
L7	Band-pass secondary coils	4·0
L8		37·0
L9	Osc. S.W. tuning coil	0·05
L10	Osc. S.W. reaction coil	30·0
L11	Osc. M.W. and L.W. tuning coils	10·0 25·0
L12		
L13	Osc. M.W. and L.W. reaction coils	4·0 8·0
L14		
L15	1st I.F. trans. Primary	140·0
L16	1st I.F. trans. Secondary	140·0
L17	2nd I.F. trans. Primary	140·0
L18	2nd I.F. trans. Secondary	135·0
L19	Speaker speech coil	5·0
L20	Parts of inverse feed-back circuit	150·0 7·0
L21		

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
L22	H.T. smoothing choke	385·0
T1	Output trans. Pri.	310·0
	Output trans. Sec.	0·4
T2	Mains trans. Pri. total	35·0
	Mains trans. Heater sec.	0·04
	Mains trans. Rect. fil. sec.	0·17
	Mains trans. H.T. sec. total	360·0
T1	Tuning indicator meter	2000·0
S1	Mains aerial switch	—
S2-23	Waveband and muting switches	—
S24-27	Radio-gram. change switches	—
S29		
S28	Bass control switches	—
S30-31		
S32	Muting switch	—
S33	Internal speaker switch	—
S34-35	Mains circuit switches	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four screws and washers) gives access to most of the under-chassis components.

Removing Chassis and Speaker.—If it is desired to remove the chassis from the cabinet, it will be found most convenient to remove both the chassis and speaker at the same time. Care should be taken to handle the Bowden cables gently as otherwise kinks may develop in the wire.

First remove the four control knobs at the front of the cabinet (recessed grub screws) and unclip the four pilot lamps. Now free the cables from the wave-change and variable selectivity controls, loosen the lock nuts at the other ends and withdraw the cables. Next free the two cleats on the speaker fixing bolts.

Then release the scale pointer by loosening the small screw holding it to the Bowden wire and free the pointer drive bridge (two nuts). Unsolder the earthing lead from the screen at the bottom of the cabinet, remove the tuning indicator (two nuts) and the speaker switch assembly (two round-head wood screws). Free the speaker by slackening the three clamps holding it to the sub-baffle. The chassis and speaker can now be removed from the cabinet.

Removing Speaker.—If it is desired to remove the speaker alone, unsolder the leads and slacken the three clamps holding it to the sub-baffle. *When replacing*, see that the terminal strip is pointing to the top right-hand corner of the cabinet and connect the leads as follows, numbering them from left to right: Bottom row: 1, screened lead in insulating sleeving; 2, lead to H.T. smoothing choke; 3 and 4, white leads to mains transformer; 5 and 6, leads to output transformer; 7, speech coil.

Top row: 1, screened lead to tuning indicator; 2, other lead to T.I.; 3, white lead to screening on two other leads; 4 and 5, scale lamps; 6 and 8, speaker switch; 7, speech coil. Do not forget to bond together the screening on the two screened leads.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 230 V, using the 245 V tapping on the mains transformer. 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 1,200 V scale of an Avometer, with chassis as negative.

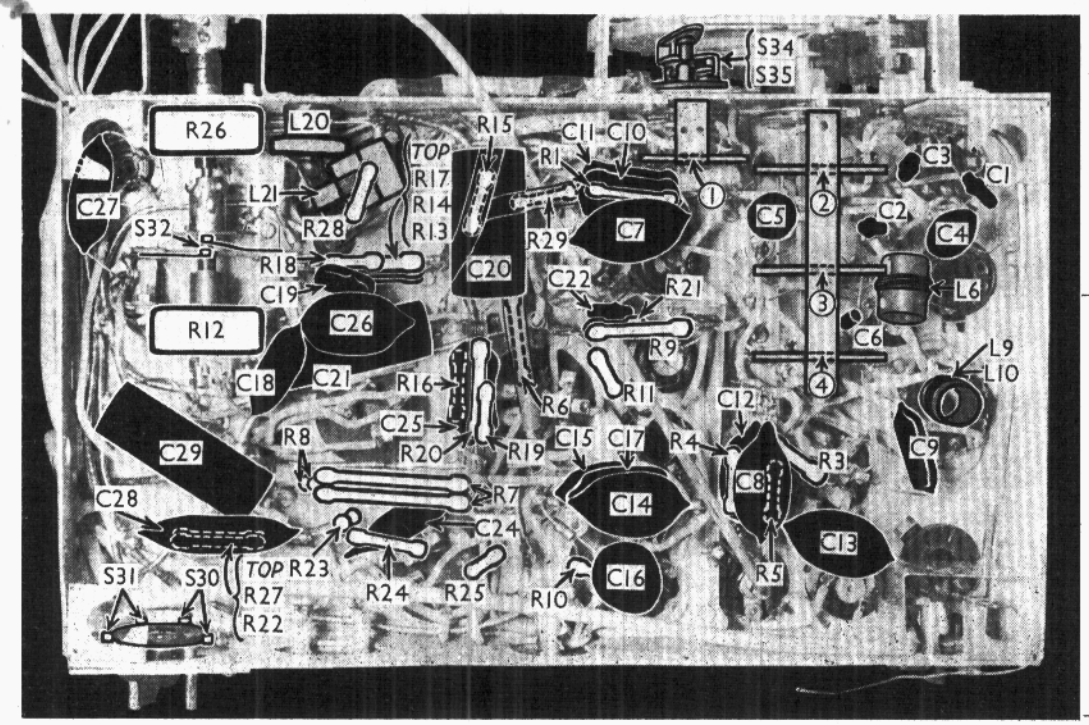
Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4*	245	1·6	65	2·6
V2 VP4B	230	4·9	150	1·8
V3 TDD4	80	0·9	—	—
V4 PenA4	230	32·0	245	4·1
V5 DW2	240†	—	—	—

* Oscillator anode (G2) 55V, 1·4 mA.
† Each anode A.C.

GENERAL NOTES

Switches.—S2-S29 are the wavechange, gramophone and tone control switches, in four ganged units beneath the chassis, arranged in one group of three, with the fourth at one side, link-operated from the main spindle. Diagrams of these switch units, looking in the direction of

Continued overleaf



Under-chassis view. **R6, R15, R29** are enclosed in sleeving. The last may not occur in some chassis. **R7** consists of two resistances in parallel, and **R8** of two in series. A diagram of the four main switch units is given on page VIII. The other switches are indicated in this view.

MULLARD MAS4—*Continued*

the arrows in the under-chassis view, are on this page. The table below gives the switch positions for the various control settings, starting from the fully anti-clockwise position. O indicates open, and C closed.

Switch	S.W.	M.W.	L.W.	Gram.
S2	C	O	O	O
S3	O	C	O	O
S4	O	O	O	C
S5	O	O	C	O
S6	O	C	O	O
S7	C	C	O	C
S8	O	C	O	C
S9	C	O	O	O
S10	O	C	O	O
S11	O	O	C	O
S12	O	O	O	C
S13	C	C	C	O
S14	C	O	O	O
S15	O	C	C	O
S16	O	C	O	O
S17	O	O	C	O
S18	O	O	O	C
S19	O	C	O	O
S20	C	O	O	O
S21	O	C	O	O
S22	O	O	C	O
S23	O	C	O	O
S24	C	C	C	O
S25	O	C	C	C
S26	O	O	O	C
S27	O	O	O	C
S28	O	C	C	C
S29	O	O	O	C

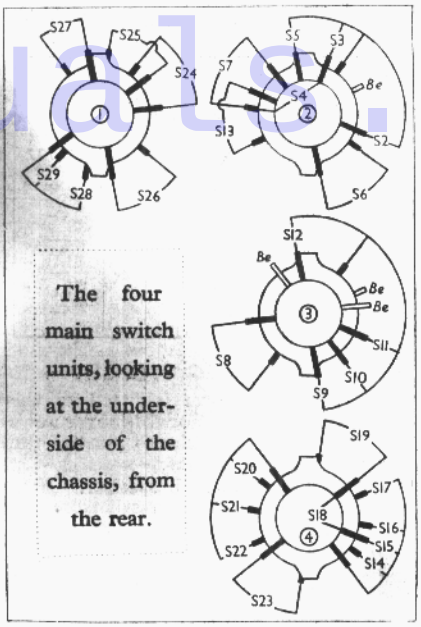
S34 and **S35** are the Q.M.B. mains switches, in a rotary unit fitted to the front of the chassis, and ganged with the **S2-S29** units.

S1 is the Q.M.B. mains aerial switch mounted on a bracket at the back of the chassis. The unit contains two switches, but only one is used.

S30 and **S31** are the bass control switches, in a single unit at the rear of the chassis. They are each indicated in the under-chassis view.

S32 is the muting switch, mounted between **R12** and **R26**, and operated by pushing in the volume control knob.

S33 is the internal speaker switch, mounted on a bracket fitted at the back of the cabinet.



The four main switch units, looking at the underside of the chassis, from the rear.

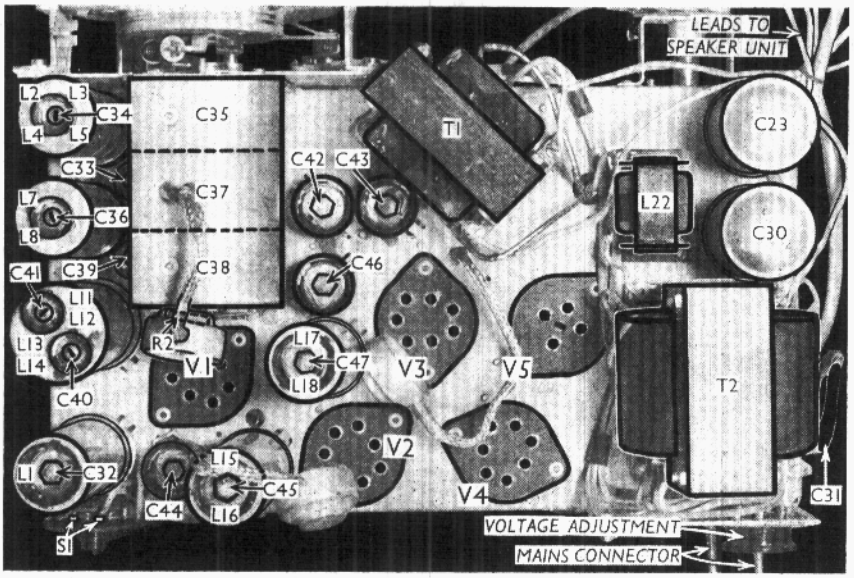
Coils.—**L1**; **L2-L5**; **L7, L8**; **L11-L14**; **L15, L16** and **L17, L18** are in six tubular screened units on the chassis deck, the last two being I.F. transformers. All the units, except **L11-L14**, have single trimmers at the tops of their cans; the **L11-L14** unit has two trimmers.

The first I.F. transformer, **L15, L16**, is of the variable selectivity type, the coupling between primary and secondary being adjustable by the Bowden-type cable fitted.

L6 and **L9, L10** are two small unscreened tubular units beneath the chassis.

L19 is the speaker speech coil; **L20, L21** are beneath the chassis, and **L22** is on the chassis deck.

Scale Lamps.—These are Philips 8042 M.E.S., frosted bulb types wired in parallel.



Plan view of the chassis. Note the new large type of trimmers employed. **R2** is in the top cap of **V1**.

External Speaker.—Two sockets are provided at the rear of the chassis for a high impedance (8,000 O) external speaker. The internal speaker can be cut out of circuit by means of **S33** if desired.

Resistances R7, R8.—In our chassis, **R7** consists of two 32,000 O resistors in parallel, and **R8** of a 10,000 O and a 12,500 O resistor in series. It may, however, be a single 20,000 O resistor.

Condensers C1, C2, C3.—These are special low capacity tubular types.

Resistance R29.—This is not in the makers' diagram, but is included in our chassis, with the extra switch **S25**. The tone compensation circuit arrangements may be a little different in early chassis.

CIRCUIT ALIGNMENT

NOTE.—Apart from the usual equipment, a special 15 deg. jig (Code No. M.0999174) will be necessary for adjusting the gang to the standard checking point, and an auxiliary radio receiver or aperiodic amplifier will be required to determine when a signal on the control grid of **V1** reaches a maximum.

When adjusting one winding of an I.F. transformer, damping must be applied to the other winding by a shunt resistance. If the two ends of the winding to be damped are not accessible, the damping must be connected between the anode or grid side of the winding and chassis, but with a 0·1 μF condenser in series with the resistance and on the chassis side of it.

When applying signals to the control grid of a valve its normal grid circuit must remain connected, that is, the top cap must not be removed.

I.F. Stages.—Connect output meter to external speaker sockets. Turn volume control to maximum, selectivity control to minimum selectivity position (max. band width), and switch set to L.W., short-circuit **R5**, and apply a 128 KC/S signal to control grid (top cap) of **V1**, leaving existing connection undisturbed.

Shunt **C46** with a 25,000 O resistance, and adjust **C47** for maximum output. Remove shunt. Shunt **C45** with a 10,000 O resistance and 0·1 μF condenser in series. Adjust **C44** for maximum output. Remove shunt. Shunt **C47** with a 25,000 O resistance and adjust **C48** for maximum output. Remove shunt. Shunt **C44** with a 10,000 O resistance and 0·1 μF condenser in series. Adjust **C45** for maximum output. Remove shunt, and also the short circuit across **R5**.

R.F. and Oscillator Stages.—Shunt **L15** with a 25,000 O resistance. Earth the chassis, and turn **C32** so that it is almost at maximum. Fit the 15 deg. jig by slipping the boss over the locating pin just above the condenser spindle. The jig ensures that when the condenser is turned so that it bears upon it, the vanes are advanced exactly 15 degrees, which is the standard trimming position.

M.W.—Switch to M.W. and set selectivity control to maximum selectivity position (minimum band width). Turn condenser until it bears on jig. Apply a 1,442 KC/S (208 m.) signal to the aerial socket via a standard artificial aerial. Adjust **C40, C36** and **C34** for maximum output.

Short circuit **R5**. Connect anode of **V1** via a 25 $\mu\mu$F condenser to aerial socket of auxiliary receiver, and connect output meter to this receiver.

Feed in a 550 KC/S (545 m.) signal to the MAS4, and tune to maximum output on aux. receiver. Disconnect aux. receiver, remove short from **R5**, and re-connect output meter to MAS4. Keeping input at 550 KC/S, adjust **C43** for maximum output. Re-trim at 442 KC/S, as above.

L.W.—Switch to L.W., feed in a 395 KC/S (760 m.) signal, short **R5**, connect aux. receiver and output meter as for M.W., and tune MAS4 for maximum output. Disconnect aux. receiver, remove short from **R5**, and re-connect output meter to MAS4. Adjust **C41** for maximum output.

Apply a 160 KC/S (1,875 m.) signal, short **R5**, connect aux. receiver and output meter as before, and tune MAS4 for maximum output. Disconnect aux. receiver, remove short from **R5** and re-connect output meter to MAS4. Adjust **C42** for maximum output.

S.W.—Switch to S.W. Turn gang until it bears on jig. Apply a 17 MC/S (17·6 m.) signal to aerial socket via a S.W. artificial aerial, and adjust **C39** for maximum output. The peak obtained with the greater trimmer capacity is correct.

I.F. Filter.—Switch set to L.W. and set tuning consenser to maximum (2,000 m.). Apply a 128 KC/S signal, and adjust **C32** for *minimum* output.

Image Freq. Filter.—Switch set to M.W. Apply a 774 KC/S (403 m.) signal to the aerial socket and, tune it in. Without altering the tuning, apply a strong 1,000 KC/S (300 m.) signal, and adjust **C33** for *minimum* output.

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