'TRADER' SERVICE SHEET 272

MULLARD MAS6

3-BAND A.C. SUPERHET

AN unusual form of construction is adopted in the Mullard MAS6 3-band superhet in that it is assembled as three separate units. The receiver is a 4-valve (plus rectifier) A.C. model, suitable for mains of 100-250V, 50-100 C/S, and the short-wave range covered is 16·7-51 m.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling coils **L2, L3** and condenser **C3** to mixed coupled band-pass filter. Primary coils **L4** (M.W.) plus **L5** (L.W.) are tuned by **C34**; secondaries **L10** (M.W.) plus **L11** (L.W.) by **C36.** Coupling by coils **L6, L7** and condensers **C4, C5.** I.F. filtering by **L1, C1, C32** across coupling coils. Image suppression by **C2.** On S.W. input is via coupling coil **L8** to single tuned circuit **L9, C36.**

First valve (**V1, Mullard metallised FC4**) is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L12** (S.W.), **L13** (M.W.) plus **L14** (L.W.), are tuned by **C37**; parallel trimming by **C38** (M.W.) and **C39** (L.W.); series tracking by fixed condensers **C14** (M.W.) and **C13** (L.W.). Reaction by coils **L15** (S.W.), **L16** (M.W.) plus **L17** (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 **C9, C40, L18, L19, C10, C41,** and **C18, C42, L20, L21, C19, C43.**

Intermediate frequency 128KC/S.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD4**). Audio frequency component in rectified output is developed across load resistances **R9, R10** and from their junction is passed via manual volume control **R11** and A.F. coupling condenser **C25** to C.G. of triode section, which operates as A.F. amplifier. Provision for connection of gramophone pick-up between junction of **R9** and **R10** and H.T. negative lead, thus obtaining from drop along smoothing resistance **R24** a biasing potential on **V3** signal diode, which tends to prevent break-through of radio signals.

Second diode of **V3,** fed from **V2** anode via **C20,** provides D.C. potential which is developed across load resistance **R17** and fed back through decoupling circuits as G.B. to F.C. (except on S.W.) and I.F. valves, giving automtaic volume control. Delay voltage is obtained from drop along **R13, R14** in **V3** cathode circuit.

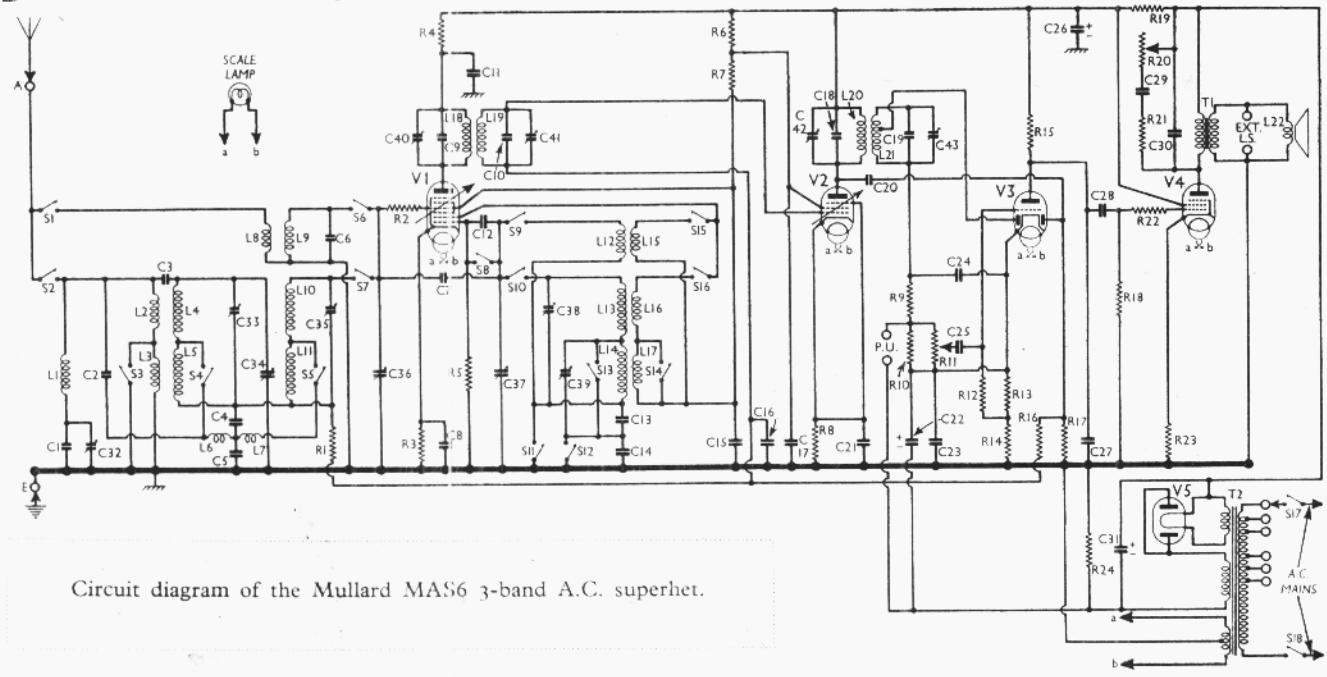
Resistance-capacity coupling by **R15, C28, R18** via stopper **R22,** between **V3** triode and pentode output valve (**V4, Mullard PenA4**). Tone correction by **C30** and variable tone control **R20, R21, C29** in anode circuit. Negative feedback by omission of cathode by-pass condenser. Provision for external speaker across secondary of **T1.**

H.T. current is provided by directly-heated rectifying valve (**V5, Mullard DW2**) operating as half-wave rectifier with the anodes strapped together. Smoothing by resistances **R19, R24** and electrolytic condensers **C26, C31.**

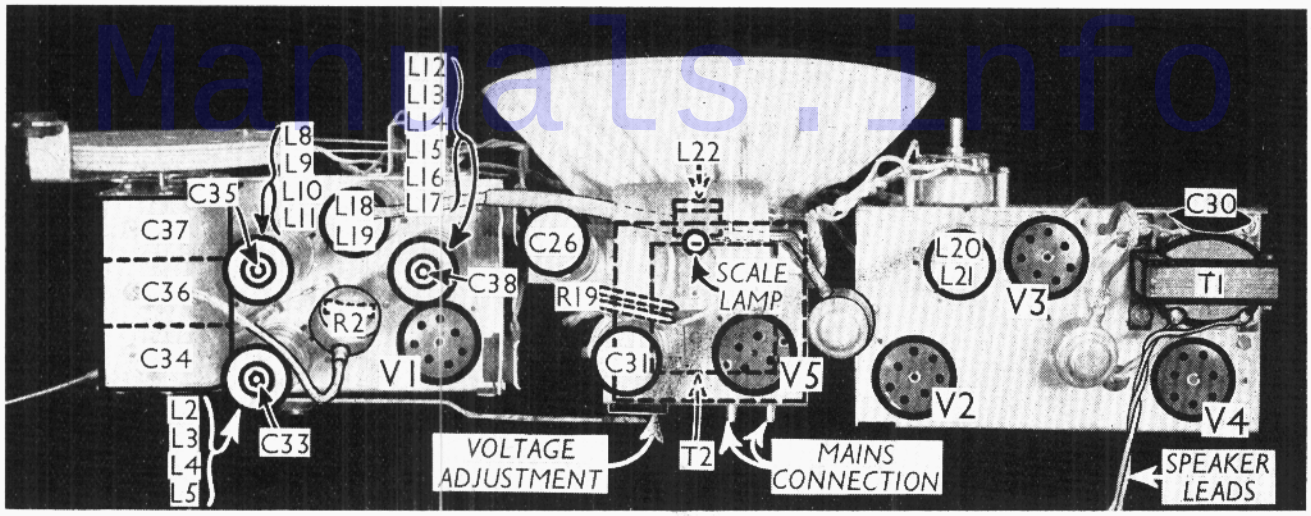
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Part aerial I.F. filter tuning	0·000064
C2	Image suppressor. ..	0·00005
C3	M.W. and L.W. aerial coupling	0·00002
C4	Band-pass L.W. coupling ..	0·016
C5	Band-pass M.W. coupling ..	0·025
C6	Aerial S.W. trimmer	0·00001
C7	Small coupling	0·000002
C8	V1 cathode by-pass	0·05
C9	1st I.F. trans. pri. trimmer ..	0·00005
C10	1st I.F. trans. sec. trimmer ..	0·00005
C11	V1 pentode anode decoupling	0·1
C12	V1 osc. C.G. condenser ..	0·0001
C13	Osc. circuit L.W. tracker ..	0·00067
C14	Osc. circuit M.W. tracker ..	0·0014
C15	V1 S.G. and osc. anode decoupling	0·1
C16	V2 C.G. decoupling	0·1
C17	V2 S.G. decoupling	0·05
C18	2nd I.F. trans. pri. trimmer ..	0·00005
C19	2nd I.F. trans. sec. trimmer ..	0·000064
C20	Coupling to V3 A.V.C. diode..	0·00002
C21	V2 cathode by-pass	0·1
C22*	V3 cathode by-pass	25·0
C23	V3 cathode I.F. by-pass ..	0·1
C24	I.F. by-pass	0·001
C25	A.F. coupling to V3 triode ..	0·01
C26*	Part H.T. smoothing	32·0
C27	I.F. by-pass	0·00025
C28	V3 triode to V4 A.F. coupling	0·01
C29	Part variable T.C. circuit ..	0·05
C30	Fixed tone corrector	0·002
C31*	Part H.T. smoothing	32·0
C32‡	Part aerial I.F. filter tuning ..	0·00003
C33‡	Band-pass pri. M.W. trimmer	0·00003
C34†	Band-pass pri. tuning.. ..	0·00049
C35‡	Band-pass sec. M.W. trimmer	0·00003
C36†	Band-pass sec. and S.W. aerial tuning	0·00049
C37†	Oscillator circuit tuning ..	0·00049
C38‡	Osc. circuit M.W. trimmer ..	0·00003
C39‡	Osc. circuit L.W. trimmer ..	0·000008
C40‡	1st I.F. trans. pri. tuning ..	0·00003
C41‡	1st I.F. trans. sec. tuning ..	0·00003
C42‡	2nd I.F. trans. pri. tuning ..	0·00003
C43‡	2nd I.F. trans. sec. tuning ..	0·00003

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Mullard MAS6 3-band A.C. superhet.



Plan view of the three chassis, R.F. on the left, power unit in the centre and A.F. on the right. The outer ones have been rotated 90 degrees from their positions in the cabinet.

	RESISTANCES	Values (ohms)
R1	V1 pentode C.G. decoupling	100,000
R2	V1 pentode C.G. stabiliser	50
R3	V1 pent. fixed G.B. resistance	320
R4	V1 pent. anode H.T. feed	2,000
R5	V1 osc. C.G. resistance	50,000
R6	V1 S.G. and osc. anode and	8,000
R7	V2 S.G. H.T. feed	12,300*
R8	V2 fixed G.B. resistance	250
R9	V3 signal diode load resis-	400,000
R10	tances	160,000
R11	Manual volume control	500,000
R12	V3 triode C.G. decoupling	160,000
R13	V3 triode G.B. and A.V.C.	2,500
R14	delay resistances	6,400
R15	V3 triode anode load	100,000
R16	A.V.C. line decoupling	160,000
R17	V3 A.V.C. diode load	500,000
R18	V4 C.G. resistance	800,000
R19	Part H.T. smoothing	2,000†
R20	Variable tone control	50,000
R21	Part of variable T.C. circuit	100
R22	V4 C.G. R.F. stopper	1,000
R23	V4 G.B. resistance	125
R24	Part H.T. smoothing	16

*20,000 Ω and 32,000 Ω resistances connected in parallel.
† Two 4,000 Ω resistances connected in parallel.

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial I.F. filter coil		120·0
L2	Aerial M.W. coupling coil		35·0
L3	Aerial L.W. coupling coil		100·0
L4	Band-pass primary coils		4·5
L5			48·0
L6	Band-pass coupling coils		1·0
L7			1·0
L8	Aerial S.W. coupling coil		2·2
L9	Aerial S.W. tuning coil		0·05
L10	Band-pass secondary coils		4·5
L11			48·0
L12	Osc. circuit S.W. tuning coil		0·05
L13	Osc. circuit M.W. tuning coil		10·0
L14	Osc. circuit L.W. tuning coil		40·0
L15	Oscillator S.W. reaction		40·0
L16	Oscillator M.W. reaction		3·3
L17	Oscillator L.W. reaction		7·0
L18	1st I.F. trans.	Pri.	130·0
L19		Sec.	130·0
L20	2nd I.F. trans.	Pri.	130·0
L21		Sec., total	130·0
L22	Speaker speech coil		3·6
T1	Output trans.	Pri.	600·0
		Sec.	0·8
T2	Mains trans.	Pri., total	47·0
		Heater sec.	0·1
		Rect. heat. sec.	0·25
		H.T. sec.	100·0
S1-S16	Waveband switches		—
S17,18	Mains switches, ganged R11.		—

DISMANTLING THE SET

NOTE.—In the following notes the term "cabinet" is used to indicate the moulded part and "baseboard" to indicate the wooden bottom. Neither the R.F. nor the power unit can be removed from the cabinet unless all three units are first withdrawn together, but the A.F. unit (right-hand) can.

Removing A.F. Unit.—First remove the knob from the tone control by loosening the recessed grub screw which is accessible through a slot in the back of the chassis. Now unsolder the earthing lead and the speaker leads, and remove the screw (with washer) holding the top of the chassis to the cabinet and the two screws (with washers) holding the unit to the baseboard. The unit can now be withdrawn to the extent of the leads, and *when replacing*, see that the earthing lead is brought out to the back of the cabinet and note that the two lower tags on the speaker terminal panel are joined.

Removing All Three Units.—All three units can be removed complete on the baseboard, and this must be done before either the R.F. or power units can be withdrawn.

To do this turn the gang condenser to maximum, remove the two control knobs at the front of the cabinet by loosening the recessed grub screws accessible through holes in the baseboard, and remove the two knobs at the sides of the cabinet (recessed grub screws accessible through slots in the backs of the chassis).

Now remove the two screws (with nuts and washers) holding the front of the baseboard to the cabinet, slacken the two screws securing the clamps holding the back of the baseboard to the cabinet, unsolder the earthing leads from each of the side units, and remove the screw (with washer) holding the top of the right-hand unit to the cabinet. Next

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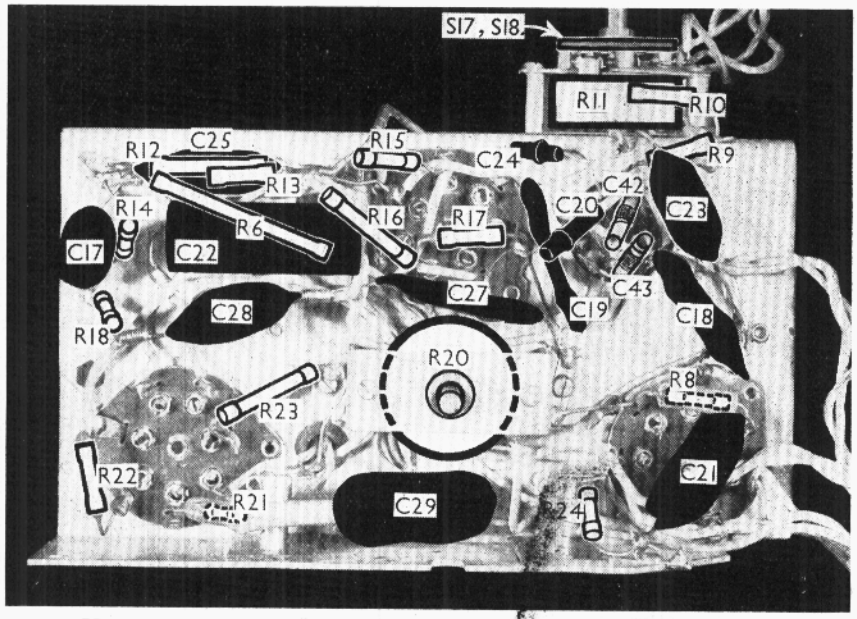


Underneath view of the A.F. chassis. **C42** and **C43** are I.F. trimmers.

MULLARD MAS6—*Continued*

remove the wood screw (with washer) holding the bracket on the gang condenser to the sub-baffle and slacken the two clamps (wood screws) holding the speaker to the sub-baffle.

Then remove the bowden cable from the switch indicator, loosen the two screws holding the plate carrying the right-hand pointer drive wire pulley, and remove the wire from the left-hand pulleys and the drum on the condenser, taking a careful note of its position.

The three units can now be withdrawn complete on the baseboard. *When replacing*, make sure that the earthing leads are brought out to the back of the cabinet and note that the larger control knobs go to the front of the cabinet.

Removing R.F. Unit.—Having removed the three units together, it is now possible to remove the R.F. unit. Free the leads to it from the cleat on the baseboard, remove the speaker by slackening the two screws holding the brass strap and remove the cleat thus exposed which holds the lead to **V2** top cap. Now remove the two screws (with washers) holding the unit to the baseboard.

Removing Power Unit.—When the three units have been removed complete, as described above, it is possible to remove the power and speaker unit by removing the two other units as previously described (or, alternatively, unsoldering and carefully coding the wires going to the other units), and removing the four screws (with washers) holding it.

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 220 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 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC4	214 Oscillator 75	1·7 1·9	75	2·7
V2 VP4B	218	7·8	150	2·7
V3 TDD4	48	1·6	—	—
V4 PenA4	250	38·0	218	5·0
V5 DW2	280	—	—	—

GENERAL NOTES

The receiver comprises three main chassis, which for convenience of reference below we shall designate as R.F., A.F. and power supply. The three chassis do not divide up so simply, but the reference will be near enough.

Switches.—**S1-S16** are the waveband switches, in two rotary units beneath the R.F. chassis. They are placed close together and screened, and cannot be easily reached without partial dismantling.

After this dismantling, the nearer unit is number 1 and the further, number 2 (close to the chassis deck). Diagrams of the units, as seen from the underside of the R.F. chassis, are in column 3.

The table (col. 2) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C** closed.

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	—	C	C
S3	—	C	—
S4	—	C	—
S5	C	C	—
S6	C	—	—
S7	—	C	C
S8	—	C	C
S9	C	—	—
S10	—	C	C
S11	C	—	—
S12	C	—	—
S13	—	C	—
S14	—	C	—
S15	C	—	—
S16	—	C	C

S17 and **S18** are the Q.M.B. mains switches, ganged with the volume control **R11**, in front of the A.F. chassis.

Coils.—**L1** and **L6, L7** are beneath the R.F. chassis, and are unscreened. **L2-L5, L8-L11**; **L12-L17**; and the first I.F. transformer **L18, L19** are in four screened units on the R.F. chassis deck, the first three each having a trimmer at the top of the can. The second I.F. transformer, **L20, L21,** is in a further screened unit, on the A.F. chassis deck.

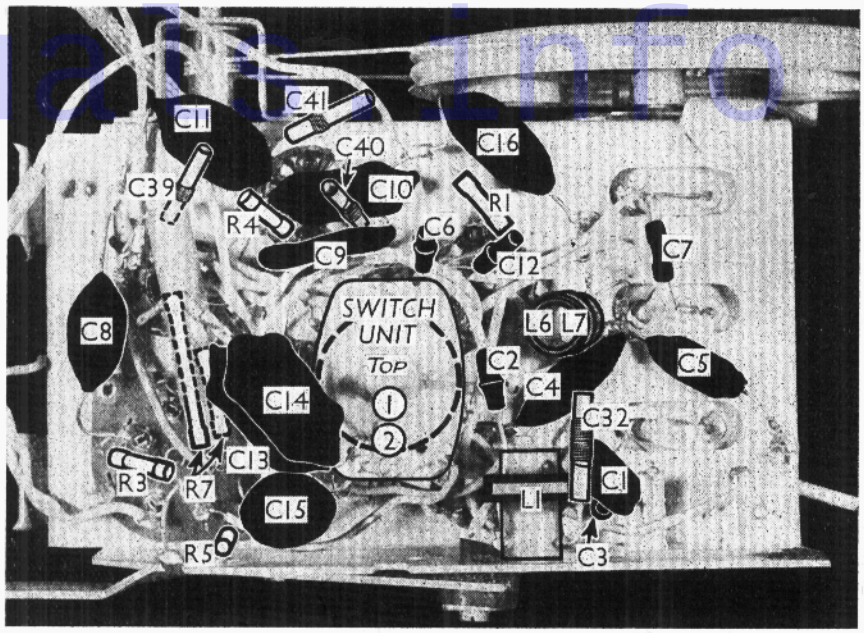
Scale Lamp.—This is a special Philips M.E.S. type, with a tubular frosted bulb, type number 8042-07.

External Speaker.—Two sockets are provided at the rear of the A.F. chassis for a low impedance (5-10 Ω) external speaker.

Trimmers C32 and C39-C43.—These six trimmers are formed of a spiral winding of tinned copper wire on a small tubular ceramic former, the inside of which is sprayed with a metal coating, which forms the other electrode. Adjustment is performed by winding or unwinding turns of the tinned copper wire.

Resistance R2.—This is inside the top cap connector of **V1.**

Resistances R7, R19.—These each consist of two resistors in parallel. The **R19** resistors are in the power supply unit.



Underneath view of the R.F. chassis.

CIRCUIT ALIGNMENT

When adjusting the special tubular trimmers, proceed as follows: Melt the wax with a warm soldering iron, undo the wire spiral until the output meter just passes its maximum reading (*minimum* in the case of **C32**). Replace one or two turns to give maximum deflection, and cut off the surplus wire. Seal the spiral in position with wax. If the wire is not long enough, replace the trimmer with a new one.

When applying signals to the control grid of a valve, its normal grid connection must remain. The volume control must be at maximum. The receiver must be re-aligned if **V1** is replaced.

I.F. Stages.—Turn gang to maximum. Short circuit **R5** and **C16**. Connect signal generator via a .32 mF condenser to grid (top cap) of **V2** and chassis. Feed in a 128 KC/S signal and adjust **C42** and **C43** for maximum output. Transfer signal generator to grid (top cap) of **V1**, and adjust **C41** and **C40** for maximum output. Remove the short circuits from **R5** and **C16**.

R.F. and Oscillator Stages.—Earth the chassis, and turn volume control to maximum. Fit a 15 deg. jig (No. M.09991741) by slipping the boss over the locating pin just above the condenser spindle. When the gang is turned so that it bears upon the jig the vanes are advanced exactly 15 degrees, which is the standard alignment position.

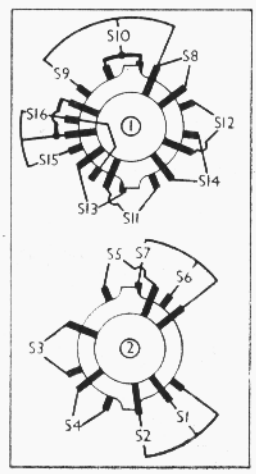
M.W.—Switch set to M.W., and turn gang until it bears on the jig. Connect signal generator to aerial socket (via a standard dummy aerial) and chassis. Feed in a 1,442 KC/S (208 m.) signal, and adjust **C38, C33** and **C35,** in that order, for maximum output. Repeat these adjustments.

L.W.—Switch set to L.W., and advance gang to bear on jig. Feed in a 395 KC/S (760 m.) signal, and adjust **C39** for maximum output.

There are no S.W. adjustments.

I.F. Filter.—Switch set to L.W., and turn gang to maximum (2,000 m.). Feed in a strong 128 KC/S signal, and adjust **C32** for *minimum* output.

Scale Calibration.—Apply an 810 KC/S (370 m.) signal, tune receiver for maximum output, and adjust position of the pointer to 370 m. on the scale by means of the screw and washer securing the pointer to the Bowden wire drive.



Diagrams of the switch units.

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