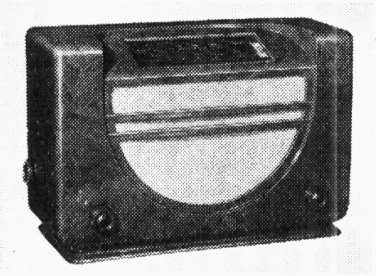
'TRADER' SERVICE SHEET 314

MULLARD MUS6

3-BAND AC/DC SUPERHET



CONSTRUCTIONALLY the Mullard MUS6 is of unusual form in that it is assembled in three separate units, which for convenience of reference in this *Service Sheet* are designated the RF, AF, and power supply units respectively. Actually the units do not divide up as distinctly as this.

The receiver is a 4-valve (plus rectifier) AC/DC 3-band superhet for mains of 200-250 V (40-100 C/S in the case of AC) and covers a short-wave range of 16·7-51 m.

CIRCUIT DESCRIPTION

Aerial input on MW and LW via isolating condenser **C1,** coupling coils **L2, L3** and condenser **C5** to mixed coupled band-pass filter. Primary coils **L4, L5** are tuned by **C37;** secondaries **L10, L11** by **C39.** Coupling by coils **L6, L7** and condensers **C6, C7.** IF filtering by **L1, C3, C35** across coupling coils. Image suppression by **C4.** On SW, coupling is via **C1** and coupling coil **L8** to single-tuned circuit **L9, C39.** Resistance **R1** across aerial circuit provides a DC path between socket **A** and earth so that **C1** cannot develop a charge.

First valve (**V1, Mullard metallised FC13C**) is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L12** (SW), **L13** (MW) and **L14** (LW) are tuned by **C40;** parallel trimming by **C41** (MW) and **C42** (LW); series tracking by **C16** (MW) and **C15** (LW). Reaction by coils **L15** (SW), **L16** (MW) and **L17** (LW).

Second valve (**V2, Mullard metallised VP13C**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C43, C10, L18, L19, C11, C44** and **C45, C20, L20, L21, C21, C46.**

Intermediate frequency 128 KC/S.

Diode second detector is part of double diode triode valve (**V3, Mullard metallised TDD13C**). Audio frequency component in rectified output is developed across load resistances **R10, R11** and passed via manual volume control **R12,** AF coupling condenser **C26** and CG resistance **R13** to CG of triode section, which operates as AF amplifier.

Second diode of **V3,** fed from **V2** anode via **C22,** provides DC potential which is developed across load resistance **R18** and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving automatic volume control.

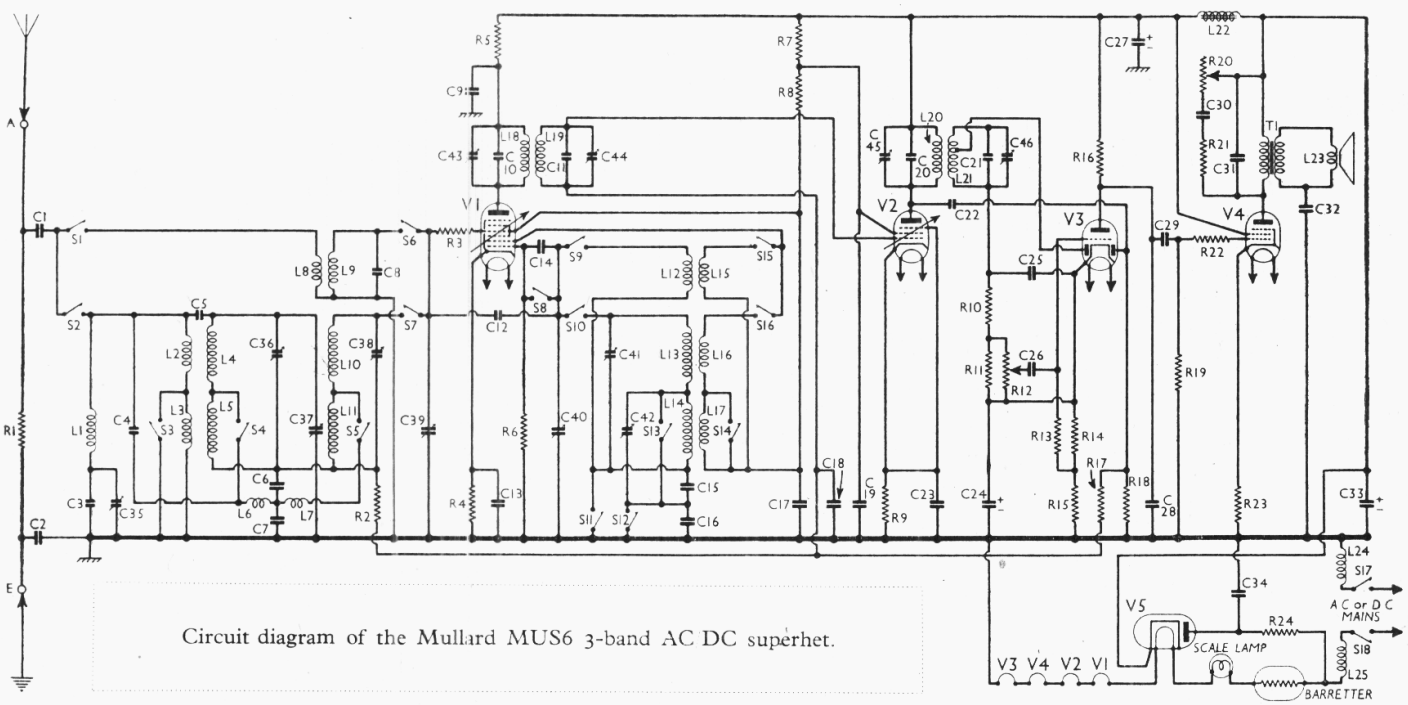
Resistance-capacity coupling by **R16, C29** and **R19,** via RF stopper **R22,** between **V3** triode and pentode output valve (**V4, Mullard Pen36C**). Fixed tone correction by **C31** and variable tone control by **R20, C30, R21,** in anode circuit. A measure of negative feed-back is introduced by the omission of the usual cathode by-pass condenser.

When the receiver is used with AC mains, HT current is supplied by half-wave rectifying valve (**V5, Mullard URIC**) which, with DC supplies, behaves as a low resistance. Smoothing is effected by iron-cored choke **L22** and electrolytic condensers **C27, C33.** RF filtering by **C34.**

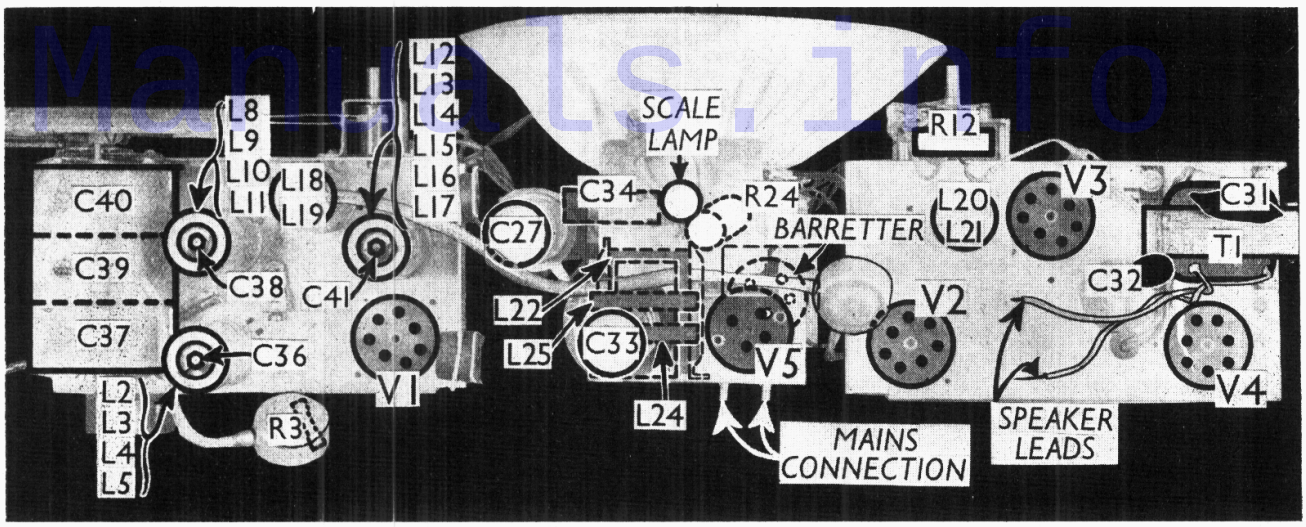
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial circuit safety shunt ..	100,000
R2	V1 pentode CG decoupling ..	100,000
R3	V1 pentode CG stabiliser ..	50
R4	V1 pent. fixed GB resistance	320
R5	V1 pent. anode HT feed ..	2,000
R6	V1 osc. CG resistance ..	50,000
R7	V1 SG and osc. anode and	8,000
R8	V2 SG HT feed ..	12,300*
R9	V2 fixed GB resistance ..	250
R10	V3 signal diode load	250,000
R11	resistances	160,000
R12	Manual volume control ..	500,000
R13	V3 triode CG resistance ..	1,600,000
R14	V3 triode GB and AVC	2,500
R15	delay resistances ..	5,000
R16	V3 triode anode load	100,000
R17	AVC line decoupling ..	1,600,000
R18	V3 AVC diode load	500,000
R19	V4 CG resistance	800,000
R20	Variable tone control	50,000
R21	Part of variable TC circuit ..	100
R22	V4 CG RF stopper	1,000
R23	V4 GB resistance	160
R24	V5 anode current limiter ..	130

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



Circuit diagram of the Mullard MUS6 3-band AC DC superhet.



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

	CONDENSERS	Values (μF)
C1	Aerial isolating condenser	0·005
C2	Earth isolating condenser	0·005
C3	Part aerial IF filter tuning	0·000064
C4	Image suppressor	0·00005
C5	MW and LW aerial coupling	0·00002
C6	Band-pass LW coupling	0·016
C7	Band-pass MW coupling	0·025
C8	Aerial SW trimmer	0·00001
C9	V1 pentode anode decoupling	0·1
C10	1st IF trans. pri. trimmer	0·00005
C11	1st IF trans. sec. trimmer	0·00005
C12	Small coupling	0·000002
C13	V1 cathode by-pass	0·05
C14	V1 osc. CG condenser	0·0001
C15	Osc. circuit LW tracker	0·00067
C16	Osc. circuit MW tracker	0·0014
C17	V1 SG and osc. anode decoupling	0·1
C18	V2 CG decoupling	0·1
C19	V2 SG decoupling	0·05
C20	2nd IF trans. pri. trimmer	0·00005
C21	2nd IF trans. sec. trimmer	0·000064
C22	Coupling to V3 AVC diode	0·000032
C23	V2 cathode by-pass	0·1
C24*	V3 cathode by-pass	25·0
C25	IF by-pass	0·0001
C26	AF coupling to V3 triode	0·01
C27*	Part HT smoothing	32·0
C28	IF by-pass	0·00025
C29	V3 triode to V4 AF coupling	0·01
C30	Part variable TC circuit	0·05
C31	Fixed tone corrector	0·002
C32	Speaker isolating condenser	0·004
C33*	Part HT smoothing	32·0
C34	V5 anode RF by-pass	0·1
C35‡	Part aerial IF filter tuning	0·00003
C36‡	Band-pass pri. MW trimmer	0·00003
C37†	Band-pass pri. tuning	0·00049
C38‡	Band-pass sec. MW trimmer	0·00003
C39†	Band-pass sec. and SW aerial tuning	0·00049
C40†	Oscillator circuit tuning	0·00049
C41‡	Osc. circuit MW trimmer	0·00003
C42‡	Osc. circuit LW trimmer	0·000008
C43‡	1st IF trans. pri. tuning	0·00003
C44‡	1st IF trans. sec. tuning	0·00003
C45‡	2nd IF trans. pri. tuning	0·00003
C46‡	2nd IF trans. sec. tuning	0·00003

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF filter coil	120·0
L2	Aerial MW coupling coil	35·0
L3	Aerial LW coupling coil	100·0
L4, L5	Band-pass primary coils	4·5, 48·0
L6, L7	Band-pass coupling coils	1·0, 1·0
L8	Aerial SW coupling coil	2·2
L9	Aerial SW tuning coil	0·05

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
L10, L11	Band-pass secondary coils	4·5, 48·0
L12	Osc. circuit SW tuning coil	0·05
L13	Osc. circuit MW tuning coil	10·0
L14	Osc. circuit LW tuning coil	40·0
L15	Oscillator SW reaction	40·0
L16	Oscillator MW reaction	3·3
L17	Oscillator LW reaction	7·0
L18	1st IF trans. Pri.	130·0
L19	1st IF trans. Sec.	130·0
L20	2nd IF trans. Pri.	130·0
L21	2nd IF trans. Sec., total	130·0
L22	HT smoothing choke	350·0
L23	Speaker speech coil	3·6
L24, L25	Mains filter chokes	4·5, 4·5
T1	Output trans. Pri.	600·0
	Output trans. Sec.	0·8
S1-S16	Waveband switches	—
S17,18	Mains switches, ganged R12	—

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 RF nor power supply units can be removed from the cabinet unless all three units are first withdrawn together, but the AF unit can and this is accordingly dealt with first.

Removing AF Unit.—First remove the knob from the tone control by loosening the recessed grub screws which are accessible through a slot in the back of the chassis and the volume control knob (hole in baseboard). Now unsolder the earthing lead and speaker leads, remove the barretter and **V2** top cap, free the leads from the cleat on the baseboard and remove the screw (with washer) holding the top of the unit to the cabinet.

Next remove the two paxolin panels covering the screws holding the unit to the baseboard (two round-head wood screws) and remove the screws (with washers), when the chassis can be withdrawn to the extent of the leads. *When replacing*, see that the earthing lead is brought out to the back of the cabinet, note that the two lower tags on the speaker terminal panel are joined, and note that the flat knob is for the tone control.

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

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

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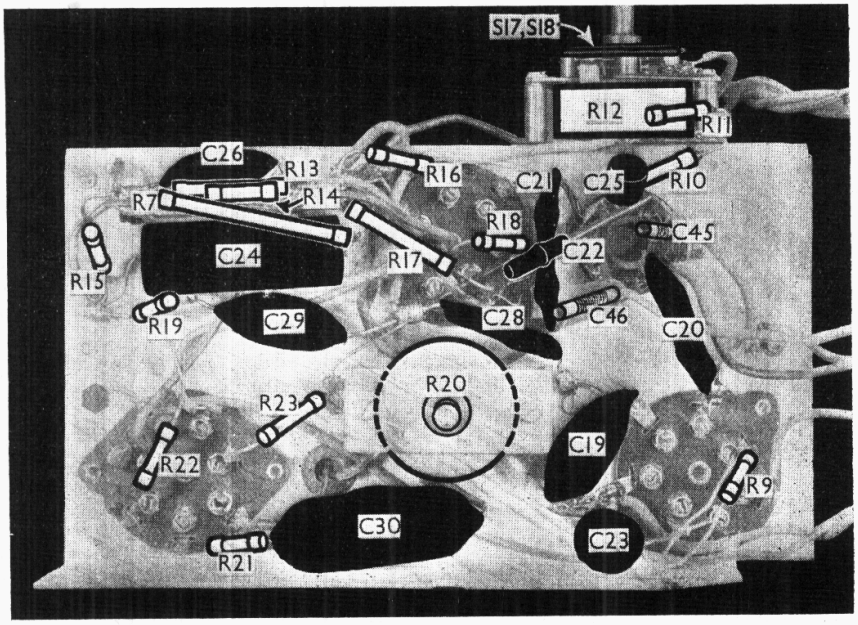


Underneath view of the AF chassis. **C45** and **C46** are IF trimmers.

MULLARD MUS6—*Continued*

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) holding the front of the baseboard to the cabinet, slacken the two 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 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 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 RF Unit.—Having removed all units together, it is now possible to remove the RF 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. Free the gang condenser strap from the power unit (screw and washer) and remove the two screws (with washers) holding the unit to the baseboard.

Removing Power Supply 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), removing the four paxolin panels covering the bolts holding the unit to the baseboard (eight round-head wood screws) and removing the bolts (with washers).

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on AC mains of 230 V. 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 FC13C..	203 (Oscillator)	1·3	75	4·1
	75	2·0		
V2 VP13C	207	6·2	145	2·2
V3 TDD13C	83	1·0	—	—
V4 Pen36C	188	49·0	207	11·0
V5 UR1C†	—	—	—	—

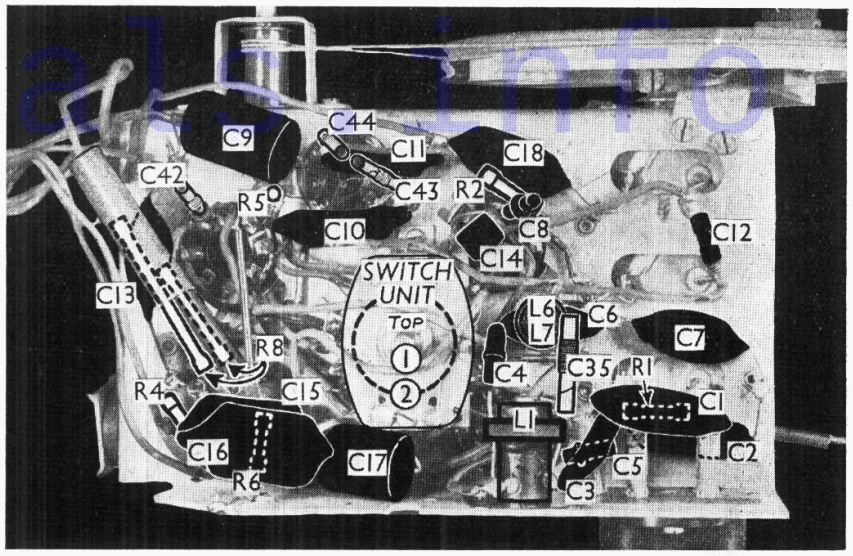
† Cathode to chassis (but not power unit chassis), 220 V, DC.

GENERAL NOTES

Switches.—**S1-S16** are the waveband switches, in two rotary units beneath the RF 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 RF chassis, are on this page.

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*.



Underneath view of the RF chassis. Note the special " wire-wound " trimmers used.

Switch	SW	MW	LW
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 QMB mains switches, ganged with the volume control **R12**, in front of the AF chassis.

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

L24 and **L25** are beneath the power supply chassis.

Scale Lamp.—This is a special Philips MES type, with a tubular frosted bulb, type number 8080-07.

External Speaker.—No provision is made for this, but a low impedance type could be connected across the internal speaker speech coil terminals.

Trimmers C35 and C42-C46.—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 R3.—This is inside the top cap connector of **V1.**

Resistance R8.—This consists of two resistors connected in parallel.

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 ouptut meter just passes its maximum reading (*minimum* in the case of **C35**). 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.

IF Stages.—Turn gang to maximum. Short circuit **R6** and **C18**. Connect signal generator via a 0·032 μF condenser to grid (top cap) of **V2** and chassis. Feed in a 128 KC/S signal and adjust **C45** and **C46** for maximum output. Transfer signal generator to grid (top cap) of **V1**, and adjust **C43** and **C44** for maximum output. Remove the short circuits from **R6** and **C18**.

RF and Oscillator Stages.—Turn volume control to maximum. Fit a 15 deg. jig (No. Mo9991741) 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.

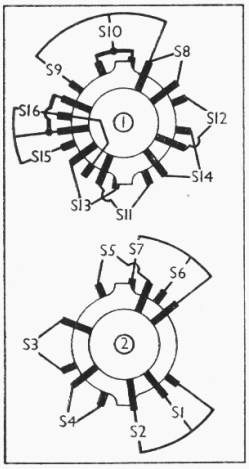
MW.—Switch set to MW, and turn gang until it bears on the jig. Connect signal generator to aerial socket (via a standard dummy aerial) and chassis. Feed in a 1,442 KC/S (208 m) signal, and adjust **C41, C36** and **C38,** in that order, for maximum output. Repeat these adjustments.

LW.—Switch set to LW, and advance gang to bear on jig. Feed in a 395 KC/S (760 m) signal, and adjust **C42** for maximum output.

There are no SW adjustments.

IF Filter.—Switch set to LW and turn gang to maximum (2,000 m). Feed in a strong 128 KC/S signal, and adjust **C35** 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 two switch units.

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