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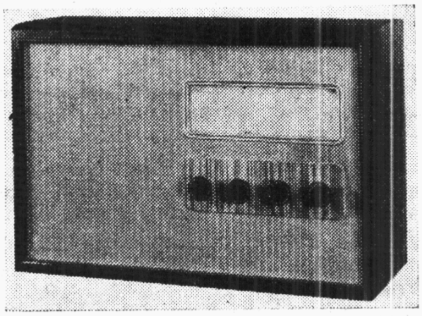
"TRADER" SERVICE SHEET

548

MURPHY B89S

AND B89 SUPERHETS



TWO wavebands, SW and MW, are provided in the Murphy B89S. The receiver is a 4-valve battery superhet, and the SW band is 16.7-50 m.

An IF rejector is provided in the aerial circuit, and sockets connected by a brass link are fitted for the ready insertion of local station rejectors where necessary.

The B89 employs a chassis which, apart from the wavebands, is similar to that in the B89S. The wavebands, however, are MW and LW.

This *Service Sheet* was prepared from a B89S chassis, but the B89 is dealt with separately at the end of the *Service Sheet*, the differences being fully explained there.

Release date: 1940.

CIRCUIT DESCRIPTION

Aerial input via rejector link, IF rejector circuit **L1**, **C1** and coupling coils **L2** (SW) and **L3** (MW) to single tuned circuits **L4**, **C23** (SW) and **L5**, **C23** (MW), which precede first valve **(V1, Mazda metallised TP25)**, a triode-pentode operating as frequency changer with internal coupling.

The rejector link connects together two sockets which are wired in series with the aerial lead. In districts served by powerful local transmitters, a rejector circuit (or two rejectors for twin transmitters) can be plugged into the sockets, after the link has been cut, to prevent interference from the local station.

V1 oscillator anode coils **L8** (SW) and **L9** (MW) are tuned by variable condenser **C26**. Parallel trimming by **C27** (SW) and **C25** (MW); series tracking by **C7** (SW), and **C10** (MW) in high-potential end of circuit. The tracking condensers are fixed, and tracking adjustments are made by positioning movable iron-dust cores on both bands. Reaction coupling by grid coils **L6** (SW) via stabilising resistance **R3**, and **L7** (MW) via stabilising resistance **R4**. Additional coupling on SW is obtained by returning the grid circuit, via **S6** and **C6**, and the anode circuit, to chassis through **C7**.

The HT feed to the oscillator anode is via **R5**, which has a very low value, on SW, and via **R6** on MW, and the change over is effected automatically by the wave-band switching, and results in the application of a comparatively high anode voltage on SW.

Second valve **(V2, Mazda metallised VP23)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-dust cored transformer couplings **C4**, **L10**, **L11**, **C5** and **C12**, **L12**, **L13**, **C13**. The tuning condensers are fixed, and alignment trimming is carried out by adjusting the movable iron-dust cores.

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mazda metallised HL23DD)**, of which one diode only is used, the second diode anode being strapped to chassis. Audio frequency component in rectified output is developed across load resistance **R11** and passed via AF coupling condenser **C16** and manual volume control **R12** to CG of triode section, which operates as AF amplifier. IF filtering by **C14**, **R8** and **C15**.

DC potential developed across **R11** appears also across resistances **R9**, **R10**, which are connected in series across the load, and is tapped off at their junction and fed back as GB to FC and IF valves, giving automatic volume control.

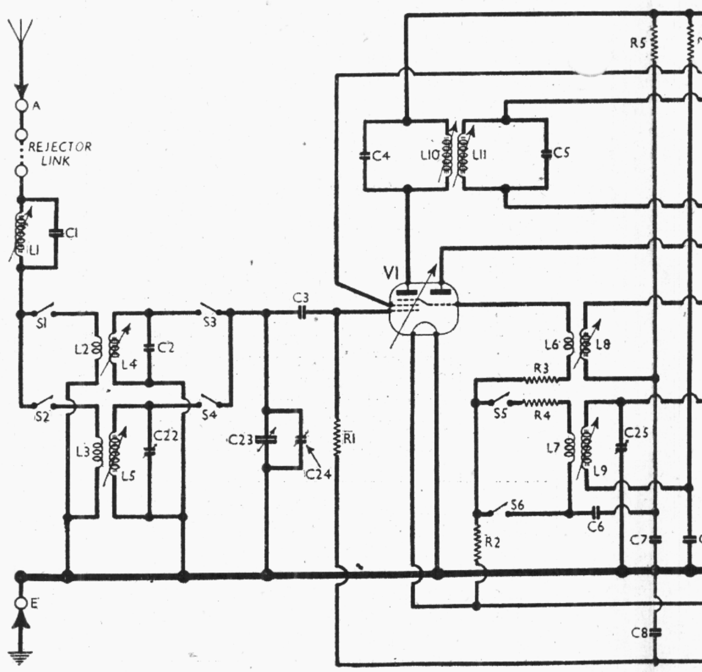
Resistance-capacity coupling by **R13**, **C17** and **R14**, via grid stopper **R15**, between **V3** triode and pentode output valve **(V4, Mazda Pen 25)**. Fixed tone correction by **C19** in anode circuit, and variable tone control by **C18**, **R16**, also in anode circuit. Provision for connection of low impedance external speaker, via **S11**, across output transformer **T1** secondary winding. **S11**, **S12** form a three-position switch unit, which is so arranged that either or both speakers may be operated at a given time.

GB potential for **V4** is obtained automatically from drop across **R17** in the negative HT lead to chassis. The same bias point is connected to the bottom of **R10**, and thus via this resistance to the AVC line to provide a fixed GB voltage for **V1** and **V2**; but **R10**, **R9** and **R11** are connected in series between HT negative and LT positive, so that the potential of the AVC line is thus modified, since it is tapped off the potential divider so formed. Similarly, as **R8** is joined to a point near the positive end of the potential divider, the diode receives a bias voltage which is a little positive with respect to chassis.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 pentode CG resistance	470,000
R2	V1 osc. CG resistance ...	22,000
R3	Osc. SW reaction damping	27
R4	Osc. MW reaction damping	330
R5	V1 osc. anode SW HT feed	27
R6	V1 osc. anode MW HT feed	47,000
R7	V1, V2 SG's HT feed ...	39,000
R8	IF stopper	47,000
R9	AVC feed potential	2,200,000
R10	divider resistances ...	3,900,000
R11	V3 signal diode load ...	1,000,000
R12	Manual volume control ...	2,000,000
R13	V3 triode anode load ...	68,000
R14	V4 CG resistance... ...	2,200,000
R15	V4 grid stopper	270,000
R16	Variable tone control ...	100,000
R17	Auto GB and AVC delay resistance	330

Circuit diagram of the Murphy B89S battery superhet. The two wavebands are SW and MW. On the MW band, C6, C7 serve as V1 oscillator CG condensers, and return L7 to chassis; on SW they operate as reaction coupling and tracking condensers as well. Separate HT feed resistances R5 and R6 are used in V1 oscillator anode circuit on the two bands. The differences in the B89 (MW and LW) model are described overleaf, and the circuit diagram there can be folded over and applied to the input circuit of V2 in this diagram.



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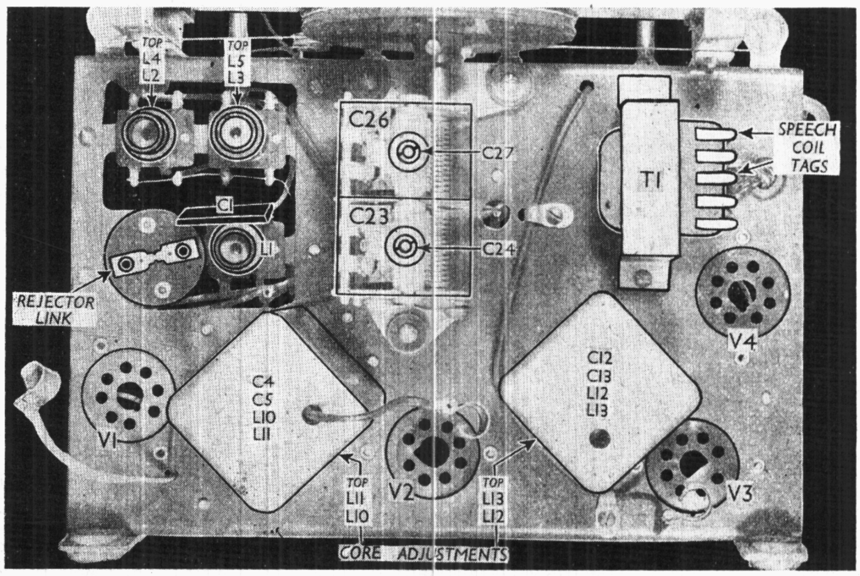
	CONDENSERS	Values (μF)
C1	Aerial IF rejector tuning	0·0005
C2	Aerial SW fixed trimmer	0·00002
C3	V1 pentode CG condenser	0·0005
C4	1st IF transformer tuning condensers	0·000092
C5		0·000092
C6	Osc. SW reaction coupling; V1 osc. CG condenser ...	0·0002
C7	Osc. circ. SW tracker ...	0·006
C8	AVC line decoupling	0·025
C9	V1 osc. anode MW decoupling	0·05
C10	Osc. circ. MW tracker ...	0·0007
C11	V1, V2 SG's, decoupling...	0·05
C12	2nd IF transformer tuning condensers	0·000092
C13		0·000092
C14	IF by-pass condensers ...	0·0001
C15		0·0001
C16	AF coupling to V3 ...	0·002
C17	V3 triode to V4 coupling	0·003
C18	Part variable tone control	0·01
C19	Fixed tone corrector ...	0·003
C20*	Auto GB by-pass	50·0
C21*	HT reservoir condenser ...	8·0
C22‡	Aerial circ. MW trimmer	—
C23†	Aerial circuit tuning	—
C24‡	Aerial circuit SW trimmer	—
C25‡	Osc. circuit MW trimmer	—
C26†	Oscillator circuit tuning...	—
C27‡	Osc. circuit SW trimmer...	—

* Electrolytic. † Variable. ‡ Pre-set.



Plan view of the chassis. The IF core adjustments are indicated.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil ...	3·3
L2	Aerial SW coupling ...	0.15
L3	Aerial MW coupling ...	0.8
L4	Aerial circ. SW tuning ...	Very low
L5	Aerial circ. MW tuning ...	2·0
L6	Oscillator SW reaction ...	Very low
L7	Oscillator MW reaction ...	1·4
L8	Osc. circ. SW tuning coil...	Very low
L9	Osc. circ. MW tuning coil...	0·8
L10	1st IF trans. Pri. ...	8·0
L11	1st IF trans. Sec. ...	8·0
L12	2nd IF trans. Pri. ...	8·0
L13	2nd IF trans. Sec. ...	8·0
L14	Speaker speech coil ...	4·0
T1	Output trans. Pri. ...	0·4
	Output trans. Sec. ...	700·0
S1-S10	Waveband switches ...	—
S11	External speaker switch ...	—
S12	Internal speaker switch ...	—
S13	HT circuit switch	—
S14	LT circuit switch	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with an HT battery reading 106 V on load.

The receiver was tuned to the lowest wavelength on the MW 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 the negative connection.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TP25	103	0·6	56	0·5
	Oscillator 30	1·2		
V2 VP23	103	1·8	56	0·6
V3 HL23DD	46	0·7	—	—
V4 Pen 25	101	3·0	103	0·8

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (recessed grub screws);

remove the two round-head set screws holding the front member of the chassis to the metal supports at the front of the cabinet, and two further similar screws holding the rear member to the metal brackets at the rear of the cabinet.

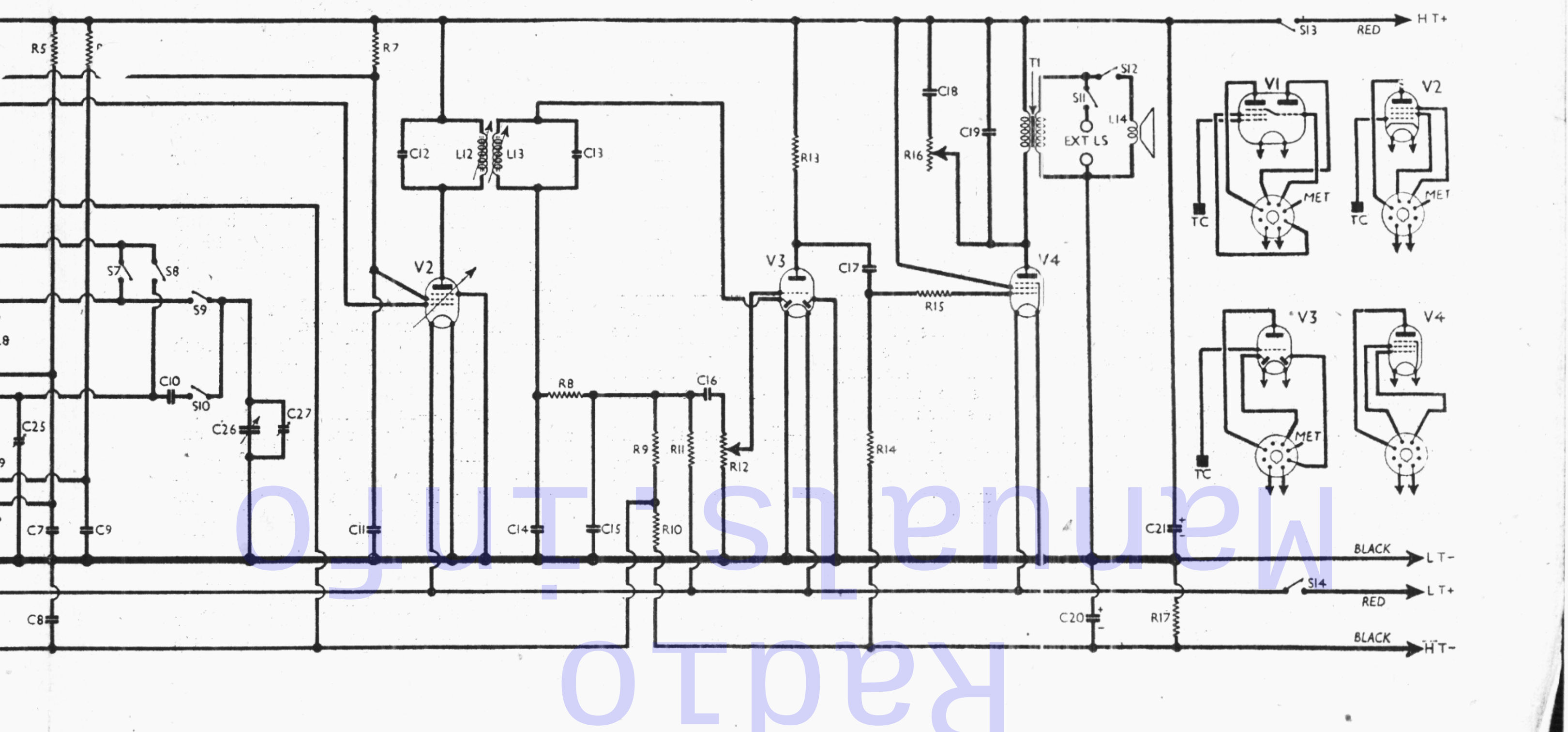
The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free chassis entirely, unsolder from the output transformer on the chassis deck the two leads connecting it to the speaker.

When replacing, connect the red speaker lead to the tag on the transformer nearest the front of the chassis, and the black lead to the middle tag.

See that each chassis fixing hold is fitted with a rubber grommet and metal sleeve, and that a large metal washer is fitted between each fixing screw head and grommet.

Removing Speaker.—Unsolder the two leads as described above, and free them from the clip on the wooden upright at the rear;



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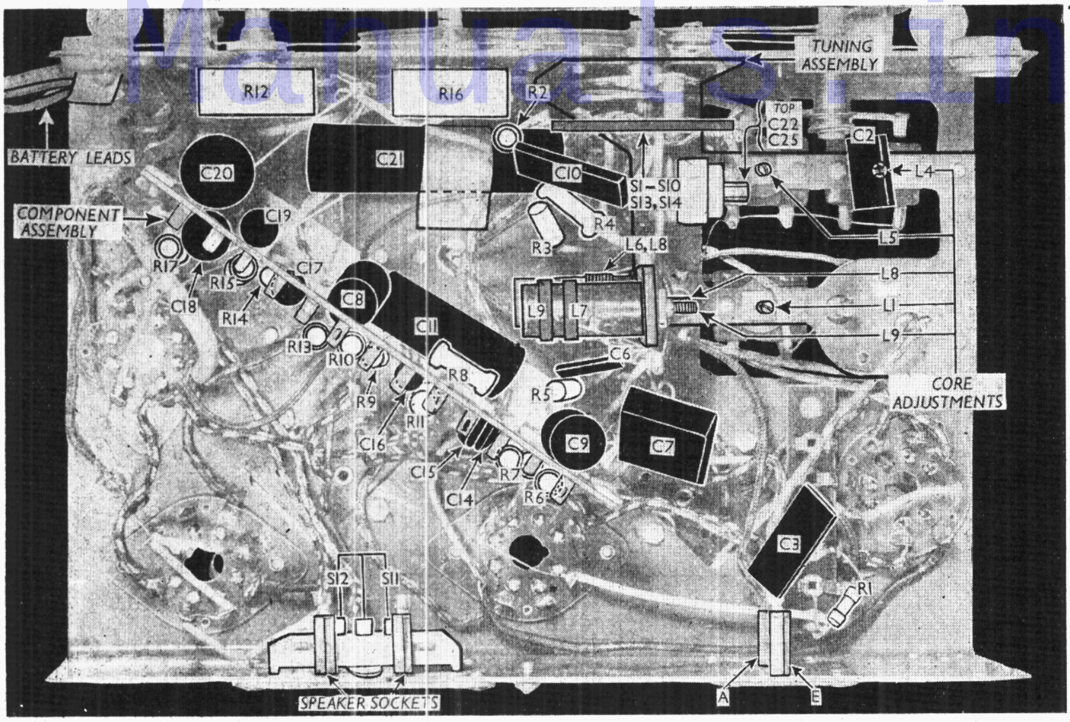

Under - chassis view. The component assembly is indicated in the left half of the illustration, while the detachable tuning assembly is seen on the right. All the RF and oscillator core adjustments are indicated here. The switch unit is indicated, and the arrow indicates the direction in which it is viewed in the diagram in col. 3 (below).

slacken the four fixing nuts holding the two clamp plates to the rim of the speaker; then remove the top nuts and plate.

When replacing, the connecting leads should emerge from the top.

Removing Tuning Assembly.—Unsolder from two tags on the diagonal component assembly the two leads connecting it to the tuning assembly. These tags are the ninth and eleventh in the upper row of tags, as seen with the chassis inverted; that is, the row farther from the chassis deck; and numbering the tags from left to right when viewed from the rear, as seen in our under-chassis view;

unsolder the two leads from pins 4 and 5 of **V1**, and the brown/green lead from pin 7 of **V4**;

unsolder from the chassis tag on the tuning assembly the brown/black lead from the forked earthing tag on the gang;

unsolder the leads from the **A** and **E** sockets;

unsolder **C7** and **R5** leads from the tag on **L8**; and from the tag on **L9** the yellow-sleeved lead connecting **L9** to **R6** and **C9** at tag 13 on the lower row of the component assembly;

unsolder from the common tags of **S3, S4**; and **S9, S10**; the two leads from **C23** and **C26**;

unsolder the red rubber HT+ lead from **S13** tag;

remove five round-head fixing screws holding the sub-chassis framework to the main chassis; and lift out the assembly.

When replacing, connect the leads attached to the assembly as follows:

green/brown lead from **R2** on the switch unit to tag 9 on the component assembly;

brown/pink lead to tag 11 on the component assembly;

brown/green lead from **S14** tag on the switch unit to pin 7 on **V4** holder;

black/mauve lead from the common of **S7, S8** to pin 4 on **V1** holder; and the black/yellow lead from **L6** to pin 5 of **V1** holder;

brown/white lead from rejector link socket to the aerial socket;

brown/black lead from chassis tag to the earth socket.

Finally, connect to the tuning assembly the leads attached to the chassis proper:

three leads, which enter the underside of the chassis through holes in the deck, from the gang: brown/black to chassis tag on sub-chassis; brown/blue lead from **C23** to common tag of **S3, S4** on switch unit; and a brown/blue lead from **C26** to common tag of **S9, S10**;

connect the free ends of **C7** and **R5** to **L8** (second tag up from chassis deck) and the yellow-sleeved lead from tag 13 (lower row) on the component assembly to **L9** (third tag up from chassis deck).

Replace the fixing screws, and, in view of the disturbance caused to the wiring, it is advisable to run over the RF and oscillator circuit alignment, particularly in the case of SW.

GENERAL NOTES

Switches.—**S1-S10** are the waveband switches, and **S13, S14** the battery switches, in a single double-sided unit mounted on the front member of the chassis, where it is indicated in our under-chassis view. **S1-S10** are on the rear side of the unit, and **S13, S14** on the front side, facing the chassis member.

The diagram in col. 3 shows the unit in detail, viewed from the rear of the underside of the chassis. The table below gives the switch positions, starting from the fully anti-clockwise position of the control. A dash indicates open and **C**, closed.

Switch Table

Switch	Off	MW	SW
S1	C	—	C
S2	—	C	—
S3	C	—	C
S4	—	C	—
S5	—	C	—
S6	—	—	C
S7	C	—	C
S8	—	C	—
S9	C	—	C
S10	—	C	—
S13	—	C	C
S14	—	C	C

S11, S12 are the speaker circuit switches, in a three-position unit at the rear of the chassis. The abbreviations "INT" and "EXT" are engraved on the control slide to indicate the position in which the switch is left.

Tuning Assembly.—The aerial and oscillator coils **L1-L9**, with the switch unit, rejector link and several associated components, but excluding the tuning condensers in the gang, are mounted on a sub-framework forming a tuning assembly, which can be detached from the chassis proper after the interconnecting leads and fixing screws have been removed as described under "Dismantling the Set." This operation may be necessary in some cases, such as for attention to the switch unit.

All the core adjustments are reached from beneath the chassis, and are indicated in our under-chassis view.

External Speaker.—Two sockets are provided at the rear of the chassis for a

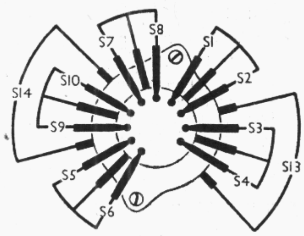

Diagram of the B89S switch unit.

low impedance (about 4 O) external speaker. Switches **S11** and **S12** are associated with the output circuit, and are arranged to operate as described under "Switches."

Batteries and Leads.—The makers state that any HT battery of 120 V, having physical dimensions not exceeding 10 × $7\frac{3}{8}$ × 4 inches, and any 2 V accumulator rated to supply 0.5 A or more, having dimensions not greater than $4\frac{1}{2}$ × $5\frac{1}{2}$ × $8\frac{1}{2}$ inches high, may be used.

There are only two leads for each supply, and grid bias is automatic.

CIRCUIT ALIGNMENT

IF Stages.—In their manual, the makers say that the usual damping of one circuit while another, coupled to it, is being tuned to resonance, may be omitted, provided that a fairly large input, sufficient to bring the AVC into action, is applied from the signal generator. The volume control of the receiver should be adjusted so as to maintain an output signal lower than 0.5 V.

Switch set to MW, and tune to 500 m on scale. Connect signal generator via a

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0.1 μF condenser to control grid (top cap) of **V2** and chassis, feed in a 465 KC/S (645.16 m) signal, and adjust the cores of **L13** and **L12** in turn for maximum output, adjusting the volume control as the circuits come into line so that the output is less than 0.5 V.

Transfer signal generator lead to control grid (top cap) of **V1**, and adjust **L11** and **L10** in turn for maximum output, again resetting the volume control as required.

RF and Oscillator Stages.—With the gang at maximum, the pointer should coincide with the vertical lines at the high-wavelength ends of the scales. If it does not, the pointer carrier can, with care, be eased along the drive cord.

Transfer signal generator leads to **A** and **E** sockets, and turn volume control to maximum. AVC action should now be avoided.

SW.—Switch set to SW, tune to 20 m on scale, and, using a 400 ohm resistance as a dummy aerial, feed in a 20 m (15 MC/S) signal, and adjust **C27** for maximum output. Two peaks should be observed, and that requiring the lesser trimmer capacity should be selected. Now adjust **C24** for maximum output.

Tune to 49 m on scale, feed in a 49 m (6.125 MC/S) signal, and adjust the cores of **L8** and **L4** in that order for maximum output. If the movement is large, repeat the whole of the SW alignment.

MW.—Switch set to MW, tune to 220 m on scale, and, using the usual dummy aerial, feed in a 220 m (1,360 KC/S) signal and adjust **C25**, then **C22**, for maximum output. Tune to 500 m on scale, feed in a 500 m (600 KC/S) signal and adjust the cores of **L9** and **L5**, in that order, for maximum output. If the movement is large, repeat the whole of the MW alignment.

IF Rejector.—Feed in a *strong* 465 KC/S (645.16 m) signal, and adjust the core of **L1** for *minimum* output.

MURPHY B89 (MW & LW)

The Murphy B89, like the B89S, is a two-band battery receiver, but its wavebands are MW and LW, instead of SW and MW as in the case of the B89S.

The difference between the two versions of the 89 series, therefore, is limited to the aerial and oscillator circuits, but in these circuits it is considerable. It is too involved to describe verbally, but will become clear from a study of the diagram below and the following explanation.

L2, L3 and **L6, L8** are now MW coils, and **L4, L5** and **L7, L9** are LW coils; their numbers, therefore, bear no reference to the B89S diagram overleaf. **L1** and **L10, L11,** however, are the same as those in the diagram overleaf.

Of the other components, **C2** becomes the LW aerial trimmer instead of SW, and its value becomes 0.0008 μF. **C22, R3** and **R5** in the original diagram are omitted altogether in the B89, while **C7** becomes the LW tracker with a capacity of 0.000414 μF, in the high-potential end of the circuit, instead of the SW tracker. The feed resistance **R6** to **V1** oscillator anode now operates on both wavebands.

Some components, such as **C6** and **C7,** are to be found in a different position in the circuit although they still perform the same kinds of work. In the case of **C6,** of course, the condenser operates now only as **V1** oscillator CG condenser, whereas previously it also formed part of the SW reaction coupling.

C10, in the same position as before, now has a different value : 0.000662 μF.

The waveband switching is considerably modified : not only because **S1** is omitted, but also because the sequence and the oscillator reaction circuit switching are reversed. A diagram showing the B89 switch, therefore, is given in col. 5, where it is viewed in the same position as in the B89S diagram in col. 3.

The remainder of the circuit, from **V2** onwards, is identical with that of the B89S, but the foregoing modifications entail some physical changes. All the core adjustments are to be found in the same positions as in our chassis illustrations, but those which are shown as SW adjustments will, in the B89, become LW. Since **C22** is omitted, there is only one pre-set trimmer **(C25)** beneath the chassis, and it is adjusted for LW alignment, instead of MW as before. Similarly, **C24** and **C27** on the gang occupy the same positions as before, but they are now adjusted for MW alignment, instead of SW. A few of the small components, also, occupy positions different from those shown in our illustrations, but there should be no difficulty in locating them.

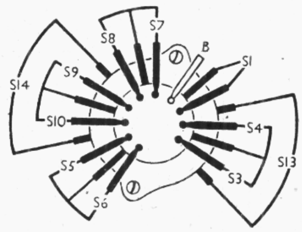


Diagram of the B89 switch unit.

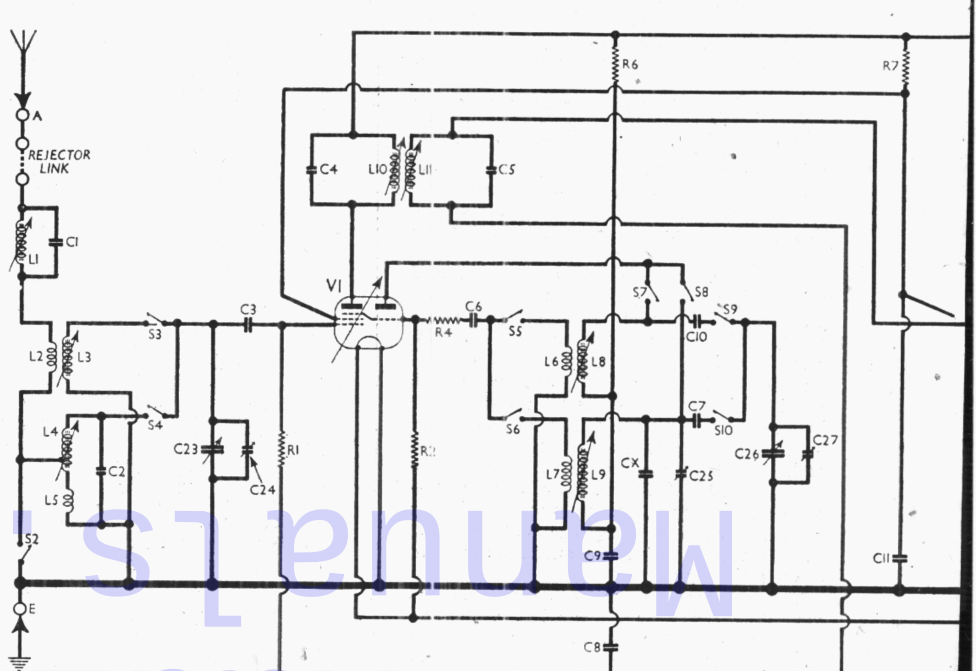
B89 CIRCUIT ALIGNMENT

IF Stages.—The procedure here is exactly the same as for the B89S. The adjustment of the IF rejector circuit is also similar, except that in the B89 the receiver should first be switched to LW.

RF and Oscillator Stages.—Adjust calibration as for B89S, connect signal generator to **A** and **E** sockets via the usual dummy aerial, and turn the volume control to maximum.

MW.—Switch set to MW, tune to 220 m on scale, feed in a 220 m (1,360 KC/S) signal, and adjust **C27,** then **C24,** for maximum output. Tune to 500 m on scale, feed in a 500 m (600 KC/S) signal, and adjust the cores of **L8** and **L3** for maximum output. If the movement is large, repeat the MW alignment.

LW.—Switch set to LW, tune to 1,000 m on scale, feed in a 1,000 m (300 KC/S) signal, and adjust **C25** for maximum output. Tune to 1,900 m on scale, feed in a 1,900 m (158 KC/S) signal, and adjust the cores of **L9** and **L4** for maximum output. If the movement is large, repeat the LW alignment.



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Circuit diagram of the aerial and oscillator circuits of the B89. **Cx** is 0.0002 μF. If the sheet is folded over as indicated by the dotted line, this diagram will overlap the B89S diagram overleaf and give the complete diagram of the B89.

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