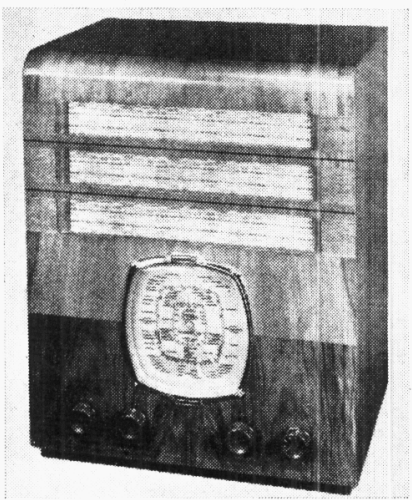
Supplement to The Wireless & Electrical Trader, October 12, 1940

"TRADER" SERVICE SHEET

488

LISSEN 8503

8480, 8481, 8529, 8533, 8539



The Lissen 8503 receiver.

THE Lissen model 8503 is a 4-valve (plus valve rectifier) 3-band AC superhet, with provision for a gramophone pick-up (with switching) and for an external speaker. The SW range is 16.3-52m, and the receiver is suitable for use on 200-250 V, 40-100 C/S mains.

This *Service Sheet* also covers the chassis of a number of radiograms, the 8480, the 8529 and the 8533. These only differ as to their cabinet. It also covers the 8481 auto-radiogram (10in. or 12in. records) and the 8539 auto-radiogram (10in. and 12in. records mixed).

Release dates: 8503, 8529, 8533, 8539, *Sept.*, 1939; 8480, 8481, *Feb.*, 1940.

CIRCUIT DESCRIPTION

Aerial input on MW and LW via coupling coils **L1** (MW) and **L2** (LW) to inductively coupled band-pass filter. Primary coils **L3** (MW) and **L4** (LW) are tuned by **C31;** secondaries **L7** (MW) and **L8** (LW) by **C35.** Mutual coupling by juxtaposition of appropriate coils.

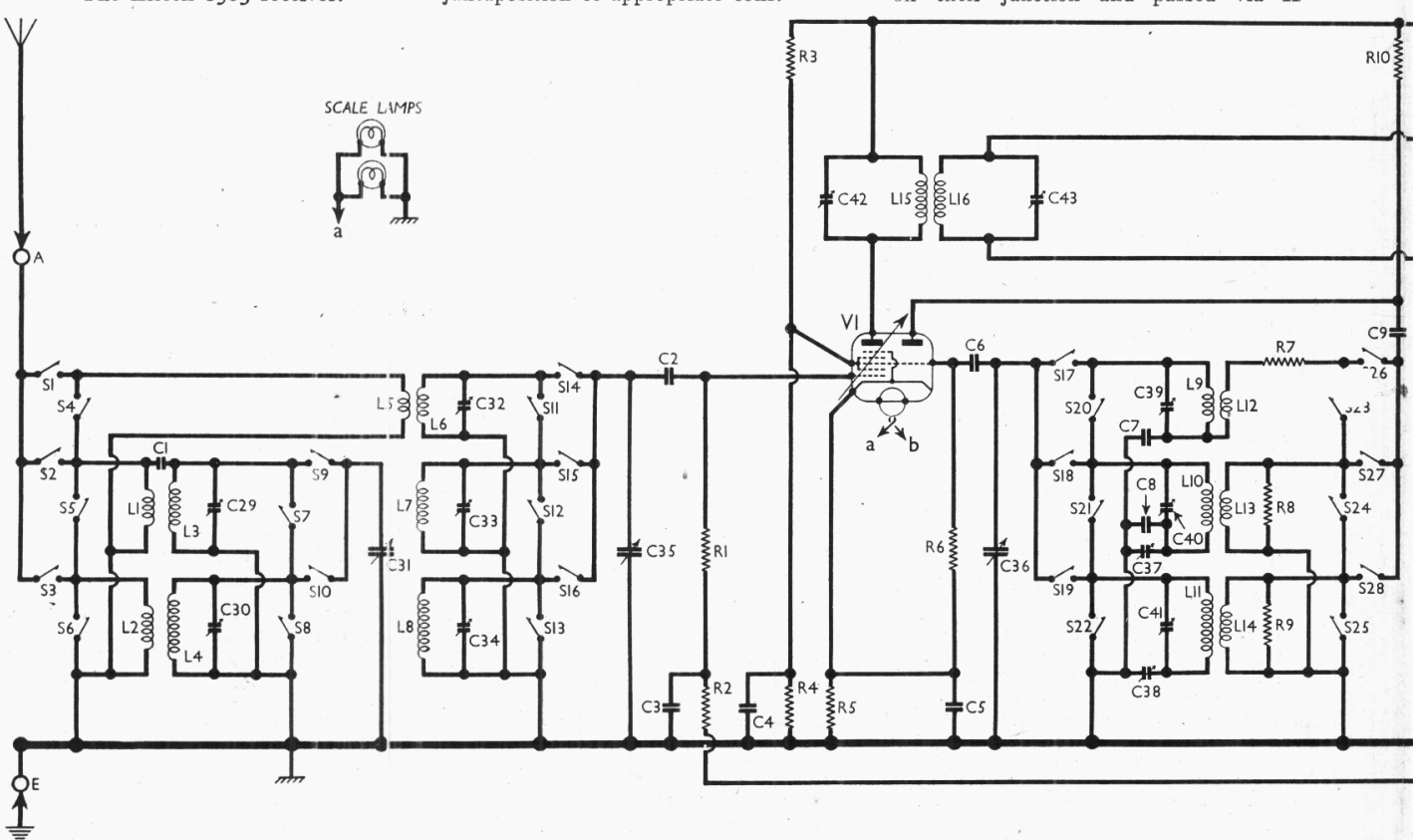
On SW, input is via coupling coil **L5** to single-tuned circuit **L6, C35.**

First valve **(V1, Mullard ECH3)** is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator grid coils **L9** (SW), **L10** (MW) and **L11** (LW) are tuned by **C36.** Parallel trimming by **C39** (SW), **C40** (MW) and **C41** (LW); series tracking by **C7** (SW), **C8, C37** (MW) and **C38** (LW). Reaction coupling from anode by coils **L12** (SW), **L13** (MW) and **L14** (LW).

Second valve **(V2, Mullard EF9)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C42, L15, L16, C43** and **C44, L17, L18, C45.**

Intermediate frequency, 452 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mullard EBC3).** Audio frequency component in rectified output is developed across load resistances **R14, R15;** that across **R15** is tapped off their junction and passed via IF



Circuit diagram of the Lissen 8503 3-band AC superhet. It is identical with that of the 8480, 8481, 8529, 8533 and 85 pick-up and mute radio respectively. Note the feed-back circuits **R24, C21** and **R26** which provide variable tone control and is provided on each waveband, and in the case of SW is carried out by adjusting the end turn of **L9.** Current limiting by-pass condensers **C26** and **C27,** are included in **V5** anodes feed circuit.

stopper **R16,** AF coupling condenser **C17** and manual volume control **R17** to CG of triode section, which operates as AF amplifier. IF filtering by **C16, R16** and **C14.** Provision for connection of gramophone pick-up across **C17, R17,** via switch **S30,** which closes when the waveband control knob is turned to the gram position.

Radio is muted during gramophone operation by **S29,** which opens as **S30** closes and cuts off the HT to **V1** and **V2.**

Second diode of **V3,** fed from **V2** anode via **C15,** provides DC potential which is developed across load resistance **R22** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained from drop along resistances **R18** and **R19** which form a potential divider in the cathode lead to chassis.

Resistance-capacity coupling by **R21, C22** and **R25,** via grid stopper **R27,** between **V3** triode and pentode output valve **(V4, Mullard EL3).** Fixed tone correction by negative feed-back coupling resistance **R26,** connected between **V4** and **V3** anodes. Variable tone control by **C21, R24,** connected across **R26.**

HT current is supplied by full-wave rectifying valve **(V5, Mullard AZ1).** Smoothing is effected by iron-cored choke **L20** in conjunction with electrolytic condensers **C24** and **C25.**

Mains input circuit RF filtering by **C28.** RF filtering in rectifier circuit by by-pass condensers **C26** and **C27.** Surge limiting by resistances **R29** and **R30** in **V5** anodes circuit.

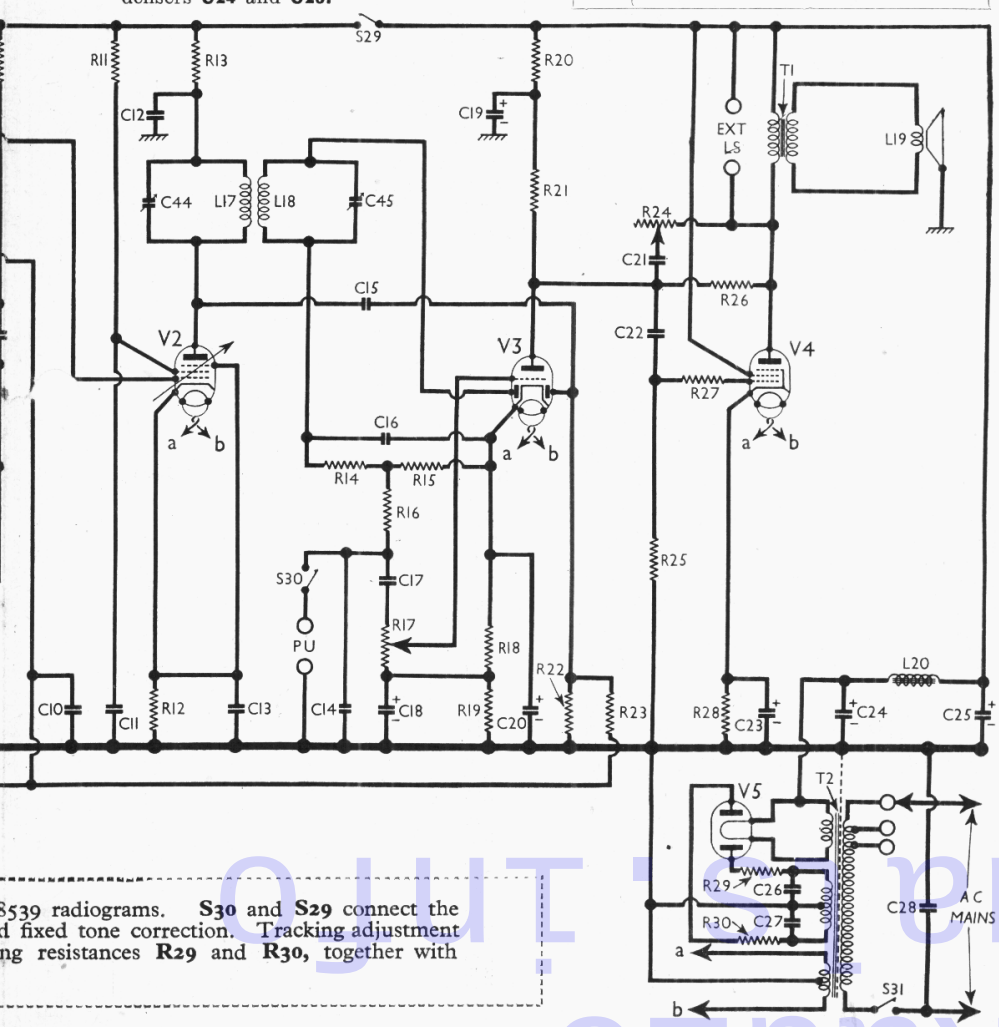
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 heptode CG resistance	1,100,000
R2	V1 heptode CG decoupling	220,000
R3	V1 SG HT potential divider resistances	25,000
R4		30,000
R5	V1 fixed GB resistance	200
R6	V1 osc. CG resistance	50,000
R7	Osc. SW reaction damping	150
R8	Osc. MW reaction damping	1,500
R9	Osc. LW reaction damping	5,100
R10	V1 osc. anode HT feed	30,000
R11	V2 SG HT feed	80,000
R12	V2 fixed GB resistance	250
R13	V2 anode HT feed	2,100
R14	V3 signal diode load resistances	250,000
R15		250,000
R16	IF stopper	110,000
R17	Manual volume control	500,000
R18	V3 triode GB and AVC delay resistances	1,600
R19		3,100
R20	V3 triode anode decoupling	10,000
R21	V3 triode anode load	50,000
R22	V3 AVC diode load	1,100,000
R23	AVC line decoupling	250,000
R24	Variable tone control	2,000,000
R25	V4 CG resistance	510,000
R26	Fixed tone corrector	250,000
R27	V4 grid stopper	50,000
R28	V4 GB resistance	150
R29	V5 anode current limiting resistances	75
R30		75

	CONDENSERS	Values (μF)
C1	Aerial MW "top" coupling	0·000005
C2	V1 heptode CG condenser	0·0005
C3	V1 heptode CG decoupling	0·05
C4	V1 SG decoupling	0·1
C5	V1 cathode by-pass	0·1
C6	V1 osc. CG condenser	0·0001
C7	Osc. circuit SW tracker	0·0057
C8	Osc. circ. MW fixed tracker	0·0003
C9	V1 osc. anode coupling	0·0003
C10	V2 CG decoupling	0·1
C11	V2 SG decoupling	0·1
C12	V2 anode decoupling	0·1
C13	V2 cathode by-pass	0·1
C14	IF by-pass	0·00005
C15	Coupling to V3 AVC diode	0·00001
C16	IF by-pass	0·00005
C17	AF coupling to V3 triode	0·05
C18*	V3 triode CG decoupling	50·0
C19*	V3 triode anode decoupling	2·0
C20*	V3 cathode by-pass	50·0
C21	Part of variable tone control	0·0005
C22	V3 triode to V4 AF coupling	0·05
C23*	V4 cathode by-pass	50·0
C24*	HT smoothing condensers	16·0
C25*		24·0
C26	V5 anode RF by-pass condensers	0·005
C27		0·005
C28	Mains RF by-pass	0·01
C29‡	Band-pass pri. MW trimmer	0·0001
C30‡	Band-pass pri. LW trimmer	0·0001
C31†	Band-pass pri. tuning	—
C32‡	Aerial circuit SW trimmer	0·00002
C33‡	Band-pass sec. MW trimmer	0·0001
C34‡	Band-pass sec. LW trimmer	0·0001
C35†	Band-pass sec. and SW aerial tuning	—
C36†	Osc. circuit tuning	—
C37‡	Osc. circuit MW tracker	0·0003
C38‡	Osc. circuit LW tracker	0·0003
C39‡	Osc. circuit SW trimmer	0·00002
C40‡	Osc. circuit MW trimmer	0·0001
C41‡	Osc. circuit LW trimmer	0·0001
C42‡	1st IF trans. pri. tuning	0·0001
C43‡	1st IF trans. sec. tuning	0·0001
C44‡	2nd IF trans. pri. tuning	0·0001
C45‡	2nd IF trans. sec. tuning	0·0001

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial MW coupling coil	17·0
L2	Aerial LW coupling coil	140·0
L3	Band-pass primary coils	2·5
L4		45·0
L5	Aerial SW coupling coil	2·2
L6	Aerial SW tuning coil	Very low
L7	Band-pass secondary coils	2·5
L8		48·0
L9	Osc. circuit SW tuning coil	Very low
L10	Osc. circuit MW tuning coil	1·7
L11	Osc. circuit LW tuning coil	4·5
L12	Oscillator SW reaction	0·2
L13	Oscillator MW reaction	3·0
L14	Oscillator LW reaction	10·0
L15	1st IF trans. Pri.	26·0
L16	1st IF trans. Sec.	26·0
L17	2nd IF trans. Pri.	26·0
L18	2nd IF trans. Sec.	26·0
L19	Speaker speech coil	2·0
L20	HT smoothing choke	260·0
T1	Speaker input trans. Pri.	600·0
	Speaker input trans. Sec.	0·4
T2	Mains trans. Pri., total	20·0
	Mains trans. Heater sec.	0·1
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	400·0
S1-S28	Waveband switches	—
S29, S30	Radio/gram change switches	—
S31	Mains switch, ganged R17	—



8539 radiograms. **S30** and **S29** connect the d fixed tone correction. Tracking adjustment ng resistances **R29** and **R30,** together with

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off). These knobs are fitted with spring fixing clips, which

frequently stick tight. If difficulty is experienced in removing a knob, twist a thick piece of string round its neck and pull the string steadily.

Free the speaker leads from the cleat on the sub-baffle;

remove the four bolts (with metal washers) holding the chassis to the bottom of the cabinet, when the chassis may be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free chassis entirely, unsolder the two leads from the speaker transformer and a third (earthing) lead from the tag at the foot of the transformer.

When replacing, connect the speaker leads as follows, numbering the tags on the speaker transformer from top to bottom:

1, brown;
2 and 3, no external connection;
4, red.

The black lead goes to the earthing tag on the lower transformer fixing bolt.

Removing Speaker.—Disconnect the three leads as indicated above; remove the four fixing nuts (with washers) holding the speaker to the sub-baffle.

When replacing, the transformer should be on the right and the leads should be connected as outlined previously.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235 V, using the 216-235 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium wave 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 ECH3	239 (Oscillator) 102	2.2 4·2	92	3·0
V2 EF9	222	6·2	88	1·8
V3 EBC3	133	1·9	—	—
V4 EL3	215	31·9	239	4·8
V5 AZ1	249†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S28** are the waveband switches, and **S29, S30** the radio/gram switches, ganged in four rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams in col. 3, where they are drawn as seen looking from the front of the underside of the chassis.

The table (col. 3) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C,** closed.

S31 is the QMB mains switch, ganged with the volume control **R17.**

Coils.—**L1, L3, L7; L2, L4, L8; L10, L11, L13, L14** and the IF transformers **L15, L16,** and **L17, L18** are in five screened units on the chassis deck. Each unit contains two trimmers, and in addition the first unit contains **C1** and the third unit contains **R8, R9.**

L5, L6 and **L9, L12** are in two tubular unscreened units beneath the chassis, near the switch unit. The thick wire windings are **L6** and **L9** respectively. Each unit has a trimmer mounted above it.

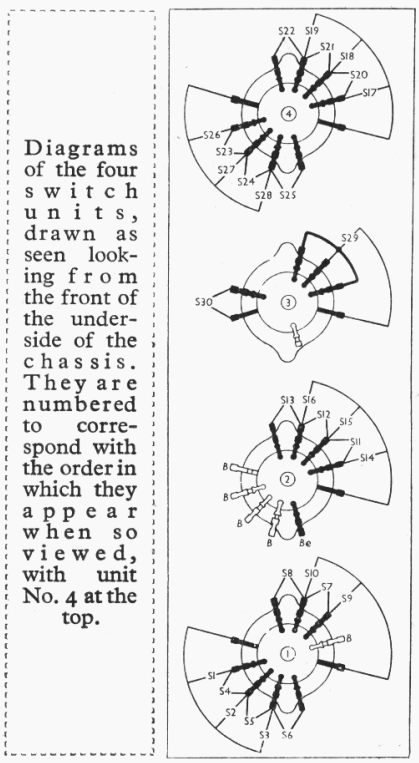
L20 is the iron-cored smoothing choke, mounted on the chassis deck.

External Speaker.—Two sockets are provided at the rear of the chassis for a high impedance (not less than 10,000 Ω) external speaker.

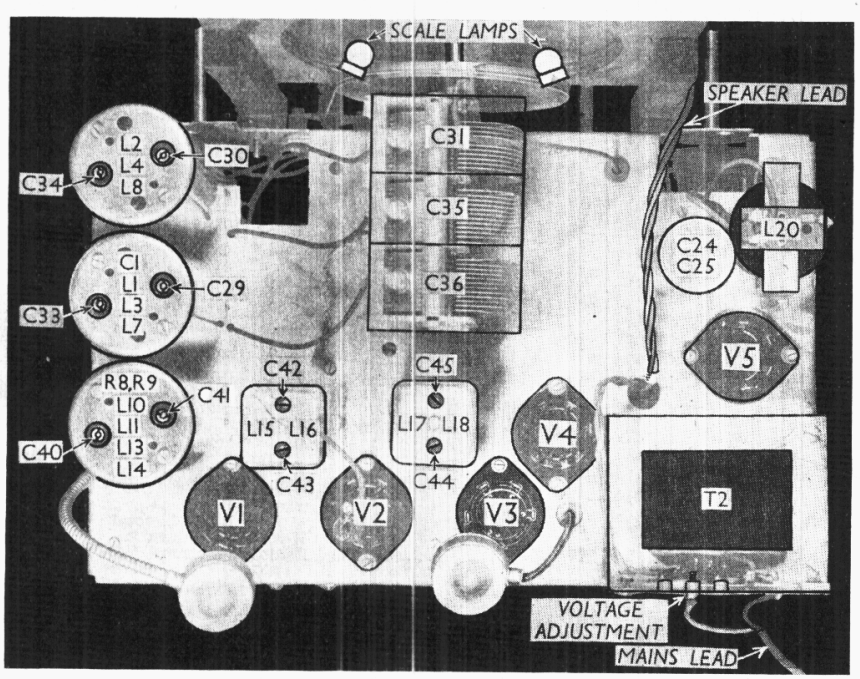
Scale Lamps.—These are two Ever Ready MES types, rated at 4.5 V, 0.3 A. They are run from one half of the heater secondary of **T2.**

Condensers C24, C25.—These are two 350 V peak working dry electrolytics in a single tubular metal can, mounted on the chassis deck. The connections emerge from beneath the chassis, the black lead being the common negative. The red lead is the positive of **C24** (16 μF) while the yellow lead is the positive of **C25** (24 μF).

Trimmers. — Apart from the ten trimmers (two in each of the five screened coil units) there are two more beneath the chassis (one at the top of each SW coil unit), and two trackers mounted on



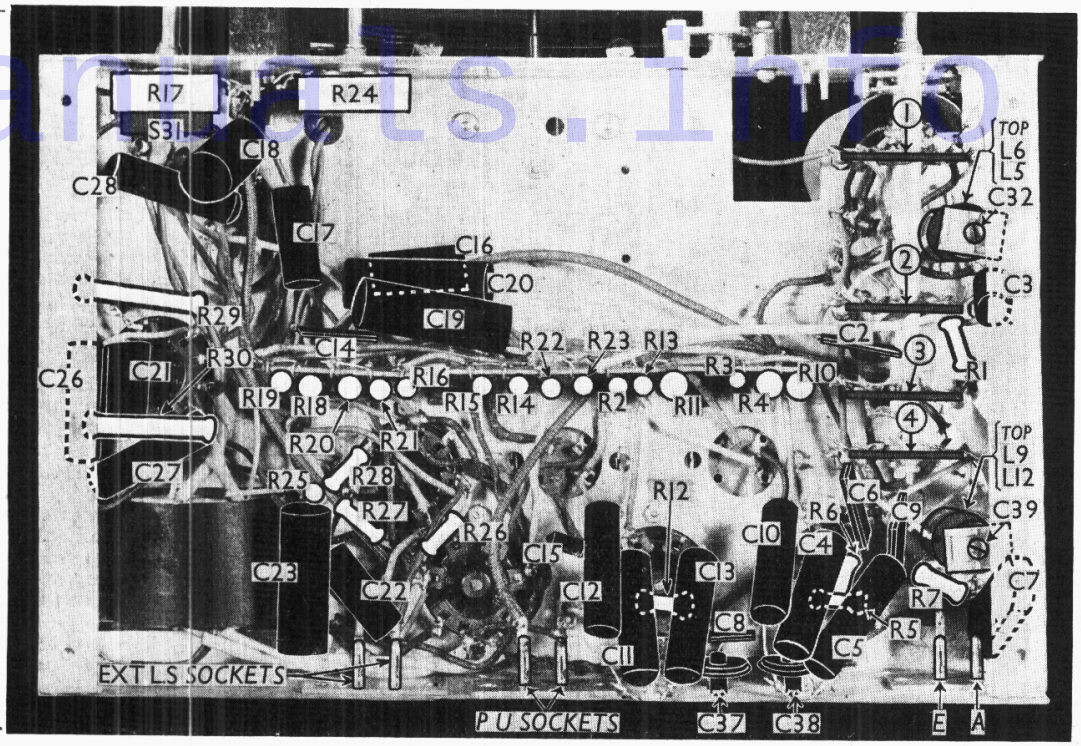
Diagrams of the four switch units, drawn as seen looking from the front of the underside of the chassis. They are numbered to correspond with the order in which they appear when so viewed, with unit No. 4 at the top.



Plan view of the chassis. **L20, C24** and **C25** form the smoothing circuit. All the variable trimmers except **C32** and **C39** are shown.

Switch Table

Switch	LW	MW	SW	Gram
S1	—	—	C	—
S2	—	C	—	—
S3	C	—	—	—
S4	—	—	—	C
S5	—	—	C	C
S6	—	C	C	—
S7	—	—	C	C
S8	—	C	C	—
S9	—	C	—	—
S10	C	—	—	—
S11	—	—	—	C
S12	—	—	C	—
S13	—	C	C	—
S14	—	—	C	—
S15	—	C	—	—
S16	C	—	—	—
S17	—	C	—	—
S18	—	C	—	—
S19	C	—	—	—
S20	—	—	—	C
S21	—	—	C	C
S22	—	C	C	—
S23	—	—	C	C
S24	—	—	C	—
S25	—	C	C	—
S26	—	—	C	—
S27	—	C	—	—
S28	C	—	—	—
S29	C	C	—	—
S30	—	—	—	C



Under-chassis view. Diagrams of the four switch units, viewed in the direction indicated by the arrows, are shown in Col. 3. The trackers **C37** and **C38** are adjustable through holes in the rear chassis member. The trimmers **C32** and **C39** are mounted on the SW coil units.

the rear chassis member, and adjustable from the back of the chassis.

Chassis Divergencies.—Slight divergencies in certain resistors were noted in our chassis, compared with the makers' values. **R2** was 220,000 O (not 260,000 O); **R14, R15** and **R23** were all 250,000 O (not 260,000 O); **R6** and **R27** were both 50,000 O (not 51,000 O); **R20** was 10,000 O (not 11,000 O). In our chassis **R16** was 110,000 O, though the makers' component table gives it as 11,000 O. This appears to be a misprint, however. The makers also show **C28** connected to the side of **S31** opposite to that indicated in our diagram.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator, via a 0.1 μF condenser, to control grid (top cap) of **V1,** and to chassis. Short circuit **C36** and switch set to MW. Feed in a 452 KC/S signal, and adjust **C45, C44, C43** and **C42** in turn for maximum output. Check these settings, then remove the short circuit from **C36.**

RF and Oscillator Stages.—With gang at maximum, pointer should be horizontal. Connect signal generator via a suitable dummy aerial to the **A** and **E** sockets.

LW.—Switch set to LW, and adjust **C38** to about two-thirds its maximum setting. Tune to 1,000 m on scale, feed in a 1,000 m (300 KC/S) signal, and adjust **C41,** then **C34** and **C30,** for maximum output. Feed in a 1,700 m (176.3 KC/S) signal, tune it in, and adjust **C38** for maximum output, while rocking the gang for optimum results. Repeat the 1,000 m adjustments.

MW.—Switch set to MW, and adjust **C37** to about three-quarters its maximum setting. Tune to 214 m on scale, feed in a 214 m (1,400 KC/S) signal, and adjust **C40,** then **C33** and **C29,** for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C37** for maximum output, while rocking the gang for optimum results. Repeat the 214 m adjustments.

SW.—Switch set to SW, and tune to 15 MC/S on scale. Feed in a 15 MC/S (20 m) signal, unscrew **C39** fully, then screw it up to the first peak encountered, and adjust accurately for maximum output. Then adjust **C32** for maximum output. Feed in a 6 MC/S (50 m) signal and tune it in, then adjust the top turn of **L9** for maximum output, while rocking the gang slightly for optimum results. Repeat the 15 MC/S adjustments.

Stocking Replacement Condensers

STOCKS of replacement condensers of all types likely to be required in general radio service work should always be kept. There should be no excuse for holding up a repair job because a suitable replacement is not to hand, particularly at the present time when supplies and deliveries may be uncertain.

In mica types, values from 0.00001μF to 0.01μF should be available; paper types from 0.05μF to 1.0μF, with plenty of 0.1μF values, are often required.

Electrolytics from 2μF to 32μF with a peak voltage of 450 to 550 V are necessary. For general work, separate condensers, as distinct from multiple blocks, are probably best. Even if their bulk is greater, room can usually be found for them in the receiver chassis. Nevertheless, it is useful to have a few 8+8μF, 8+16μF and 16+16μF types in stock, with a common negative connection.

In addition, low voltage electrolytic condensers should be kept in stock. The most commonly required ratings are: 12μF, 50 V; 25μF, 25 V, and 50μF, 15 V.

It is useful to remember that if the exact replacement is not available, it is often safe to fit an alternative value, if this will enable the repair to be completed without delay. A certain amount of discretion must be used, however, in order not to upset the working of the receiver.

As a general rule it is fairly safe to fit a larger size in the case of decoupling and by-pass condensers. For instance, in place of a 0.05μF decoupling condenser, a 0.1μF or 0.2μF type could be used. Coupling condensers, tone compensation and control condensers, and naturally any condensers associated with the tuning circuits, should usually not be changed in value. If any doubt exists, the different size should be fitted and the receiver carefully checked over under working conditions.

In certain parts of some receivers special silver-mica and ceramic condensers may be used in order to secure a high degree of frequency stability and freedom from temperature drift. In these cases, while the set will work well with ordinary mica types as replacements, the stability will generally be impaired, and such replacements are not recommended except as temporary ones for urgent cases.

Printed in Great Britain by The Cornwall Press Ltd., Paris Garden, London, S.E.1.

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