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"TRADER" SERVICE SHEET

457

ROBERTS M5A

PORTABLE AC SUPERHET

THE Roberts M5A is a 4-valve (plus valve rectifier) mains superhet portable receiver. It is fitted in a leatherette-covered carrying case with handle, and a turntable is provided. The receiver covers the MW and LW bands, and there is provision for use of a pick-up.

The construction is such that the complete assembly (with the exception of the speaker) can be removed in one unit for servicing.

Release date: July, 1939.

CIRCUIT DESCRIPTION

Tuned frame aerial input **L1, L2, C22** to triode heptode valve **(V1, Mullard ECH3)** which operates as frequency changer with internal coupling.

Triode oscillator grid coils **L3** (MW) and **L4** (LW) are tuned by **C24**; parallel trimming by **C26** (MW), **C27** (LW) and **C25** across **C24**; series tracking by **C5**, **C28** (MW) and **C29** (LW). Reaction by coils **L5** and **L6** connected in series between triode oscillator anode and HT feed resistance **R4.**

Second valve **(V2, Mullard EF9)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C30, L7, L8, C31** and **C32, L9, L10, C33.**

Intermediate frequency 430KC/S.

Diode second detector is part of double diode triode valve **(V3, Mullard EBC3)** in which the two diode anodes are strapped together to operate as a single diode.

Audio frequency component in rectified output is developed across load resistance **R9** and passed via radio muting switch **S5,** AF coupling condenser **C11,** grid stopper **R10** and CG resistance **R11** to control grid of triode section, which operates as AF amplifier.

IF filtering by **C9** and **R8** in diode circuit, and by **C12** in triode anode circuit. Provision for connection of gramophone pick-up via two sockets and a special plug, upon insertion of which switch **S5** opens to mute radio.

Resistance-capacity coupling by **R12, C13** and manual volume control **R14,** via grid stopper **R15,** between **V3** triode section and pentode valve **(V4, Mullard EL3).** Fixed tone correction in anode circuit by **C15.** Variable tone control by **C16, R18** also in anode circuit.

HT current is supplied by rectifying valve **(V5, Mullard AZ1 or AZ2).** Smoothing by iron-cored choke **L12** and electrolytic condenser **C17** and **C18.**

The mains transformer **T2** has only three windings: primary, heater secondary and rectifier heater secondary. The primary is connected at one end to chassis, and at the other end is tapped in the usual way for mains voltage adjustment.

When the highest voltage tapping is used, the mains are connected directly between **V5** anodes resistance **R19** and chassis, but when a lower voltage tapping is used the primary acts as an auto transformer, and the input voltage between **R19** and chassis is stepped up to 250V.

The heater secondary is centre-tapped, and the tap is connected to chassis. The scale lamps are connected in series across this winding, and the junction between the lamps is connected to chassis, so that each lamp is actually connected across one half of the winding.

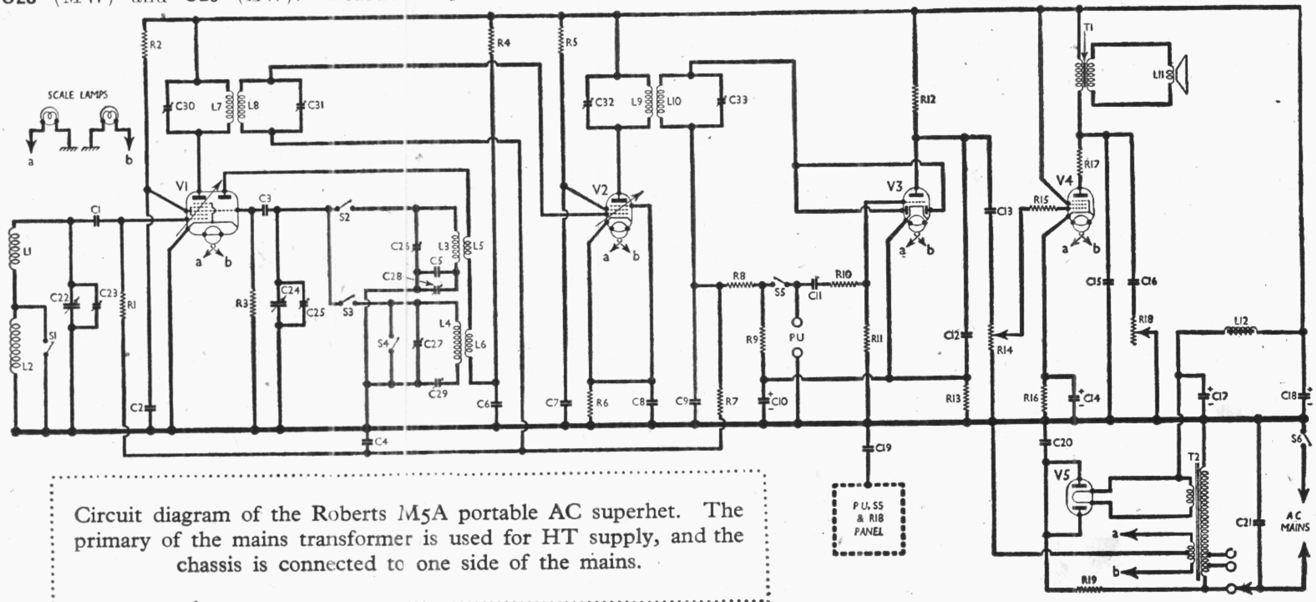
An RF filter comprising **C21, R19** and **C20** suppresses mains borne interference.

The small metal panel carrying the pick-up sockets, the jack switch **S5** and the variable tone control, is isolated from the chassis of the receiver by the condenser **C19.** It should be borne in mind, however, that one of the pick-up sockets is connected directly to chassis and therefore to one side of the mains.

DISMANTLING THE SET

Removing Chassis.—Remove the two round head wood screws holding the wooden framework to the bottom of the carrying case, and the remaining two holding it to the top, when the whole receiver assembly, with the exception of the speaker but including the frame aerial windings, can be withdrawn as a single unit to the extent of the speaker leads.

This single operation gives access to every part of the chassis, while the receiver remains in working order.



Circuit diagram of the Roberts M5A portable AC superhet. The primary of the mains transformer is used for HT supply, and the chassis is connected to one side of the mains.

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

When replacing, connect the red lead to the top tag on the speaker transformer and the black lead to the bottom tag.

Removing Speaker.—Remove the receiver assembly as outlined above; now remove the round head wood screw (with washer) holding the bottom edge of the speaker rim to the front of the carrying case, when the speaker can be withdrawn by easing it from the two clamps holding the top of the rim to the front of the case.

When replacing, see that the transformer is on the left; connect the leads as indicated above.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235V, using the 225V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the MW band and the volume control was at maximum, but a 0·1μF condenser was connected between the top cap of **V1** and chassis to ensure that there should be no signal input.

Voltages were measured on the 400V scale of a model 7 Universal Avometer, chassis being negative.

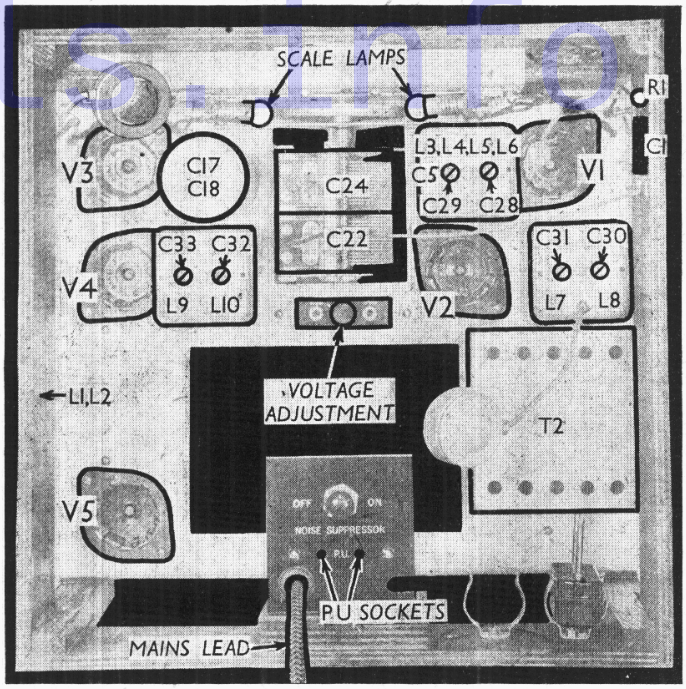
Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH3	218	0·9	54	2·3
	Oscil-	lator		
	72	4·8		
V2 EF9	218	8·3	90	2·5
V3 EBC3	96	2·4	—	—
V4 EL3	200	30·0	218	3·7
V5 AZ1	246†	—	—	—

† Anodes to chassis, AC.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	V1 heptode CG condenser	0·001
C2	V1 SG decoupling	0·1
C3	V1 osc. CG condenser ...	0·00011
C4	AVC line decoupling ...	0·1
C5	Osc. circ. MW fixed tracker	0·0006
C6	V1 osc. anode decoupling ...	0·1
C7	V2 SG decoupling	0·1
C8	V2 cathode by-pass	0·1
C9	IF by-pass	0·00025
C10*	V3 cathode by-pass	50·0
C11	AF coupling to V3 triode ...	0·01
C12	IF by-pass	0·001
C13	V3 triode to V4 AF coupling	0·01
C14*	V4 cathode by-pass	50·0
C15	Fixed tone corrector ...	0·001
C16	Part of variable tone control	0·1
C17*	HT smoothing condensers	16·0
C18*	HT smoothing condensers	16·0
C19	PU panel isolating condenser	0·01
C20	Mains RF filter condensers	0·01
C21	Mains RF filter condensers	0·01
C22†	Frame aerial tuning	—
C23‡	Frame aerial MW trimmer	—
C24†	Oscillator circuit tuning ...	—
C25‡	Oscillator circuit trimmer	—
C26‡	Osc. circuit MW trimmer ...	—
C27‡	Osc. circuit LW trimmer ...	—
C28‡	Osc. circuit MW tracker ...	—
C29‡	Osc. circuit LW tracker ...	—
C30‡	1st IF trans. pri. tuning ...	—
C31‡	1st IF trans. sec. tuning ...	—
C32‡	2nd IF trans. pri. tuning ...	—
C33‡	2nd IF trans. sec. tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.



Rear view of the complete assembly, showing the screened coil units and their trimmers. The small panel is isolated from chassis by a fixed condenser. **C5** is inside the **L3-L5** coil unit

	RESISTANCES	Values (ohms)
R1	VI heptode CG resistance...	2,000,000
R2	V1 SG HT feed	*70,000
R3	V1 osc. CG resistance ...	50,000
R4	V1 osc. anode HT feed ...	20,000
R5	V2 SG HT feed	50,000
R6	V2 fixed GB resistance ...	200
R7	AVC line decoupling ...	1,000,000
R8	IF stopper	100,000
R9	V3 diodes load resistance ...	500,000
R10	IF stopper	100,000
R11	V3 triode CG resistance ...	2,000,000
R12	V3 triode anode load ...	50,000
R13	V3 triode GB resistance ...	1,000
R14	Manual volume control ...	250,000
R15	V4 grid stopper	50,000
R16	V4 GB resistance	160
R17	V4 anode stopper	100
R18	Variable tone control ...	50,000
R19	Part of mains RF filter ...	100

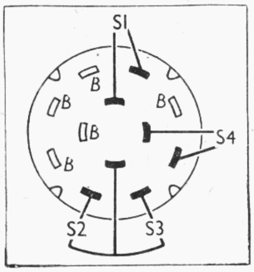
* 50,000O + 20,000O in series.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Frame aerial windings ...	1·7
L2	Frame aerial windings ...	15·0
L3	Osc. circuit MW tuning coil	3·0
L4	Osc. circuit LW tuning coil	8·5
L5, L6	Oscillator reaction coils, tot'l	5·0
L7	1st IF trans. Pri.	11·0
L8	1st IF trans. Sec.	11·0
L9	2nd IF trans. Pri.	11·0
L10	2nd IF trans. Sec.	11·0
L11	Speaker speech coil... ...	3·0
L12	HT smoothing choke ...	550·0
T1	Speaker input trans. Pri	450·0
	Speaker input trans. Sec.... ...	0·25
T2	Mains trans. Pri., total... ...	58·0
	Mains trans. Heater sec. ...	0·1
	Mains trans. Rect. heat. sec. ...	0·1
S1–S4	Waveband switches... ...	—
S5	Radio muting switch ...	—
S6	Mains switch, ganged R14...	—

GENERAL NOTES

Switches.—S1-S4 are the waveband switches, in a single rotary unit indicated in our front view of the chassis. The diagram (col. 6), drawn as seen looking in the direction of the arrow in the front chassis view, shows the switches in detail. The table below gives the switch positions for the two control settings, starting from anti-clockwise. A dash indicates open, and **C**, closed.

The **S1-S4** unit, as seen looking in the direction of the arrow in the front view of the chassis



SWITCH TABLE

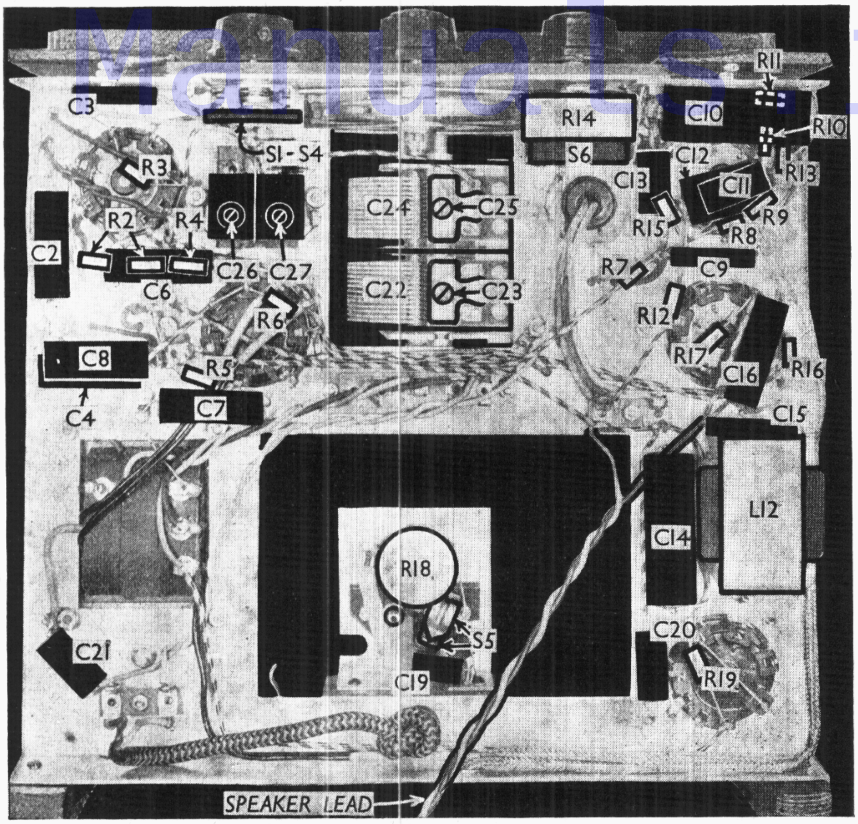
SWITCH	MW	LW
S1	C	—
S2	C	—
S3	—	C
S4	C	—

S5 is the radio muting jack switch, associated with the pick-up sockets on the small panel at the rear of the set. When the pick-up plug is inserted, **S5** opens, and mutes radio.

S6 is the QMB mains switch, ganged with the volume control **R14.**

Coils.—L1, L2 are the frame aerial windings. **L3-L6** and the IF transformers **L7, L8** and **L9, L10** are in three screened units on the rear side of the chassis. These units contain their associated trimmers, and in addition the first of them also contains **C5.** **L12** is the iron-cored smoothing choke, indicated in our front chassis view.

Scale Lamps.—These are two MES types, rated at 3.5V, 0.3A. Each is connected across one half of the heater secondary of **T2.**



Front view of the unit when removed from the cabinet. A diagram of the **S1-S4** unit is on the preceding page. **R2** consists of two resistors in series. **S5, R18, C19** and the pick-up sockets are on a separate small panel.

Condensers C17, C18.—These are two 16μF dry electrolytics in a single tubular unit mounted on the chassis. The case is the common negative connection, the yellow lead is the positive of **C17** and the red lead is the positive of **C18**. Both condensers are for 300V peak working, 350V surge.

Noise Suppressor.—The control knob marked "Noise Suppressor," on the panel at the rear of the chassis, operates **R18**, and is really a tone control, since it merely affects the response to high audio frequencies.

Pick-up Sockets.—Although the panel on which the sockets are mounted is insulated from chassis, and the sockets themselves are shrouded by a panel of insulating material, it should be noted that one of the sockets is connected direct to chassis, and may be live. Care should be taken to use or recommend only an insulated pick-up, and to see that its leads are also well insulated. Better still, the pick-up should be connected via a double-wound transformer or via a fixed condenser in each lead at the set end.

Chassis Divergencies.—R2 in our chassis consisted of a 20,000Ω and a 50,000Ω resistance in series (70,000Ω total). It is shown as 75,000Ω in the makers' diagram. **C21** is connected directly to one mains input lead, but the makers show it connected to the mains side of **R19**. **S4, C5, C23, C25** and **C26** are not shown in the makers' diagram.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator to control grid (top cap) of **V2** and (via a 0·1μF condenser) to chassis. Feed in a 430 KC/S signal, and adjust **C32** and **C33** for maximum output. Transfer signal generator to top cap of **V1,** and adjust **C30** and **C31** for maximum output. Re-check these settings.

RF and Oscillator Stages.—With gang at maximum, pointer should cover red horizontal line at upper wavelength end of scale. Couple signal generator via a turn or two of wire round the frame aerial former.

MW.—Switch set to MW, tune to 220m on scale, feed in a 220m (1,362 KC/S) signal, and adjust **C26,** then **C23,** for maximum output.

Feed in a 500m (600 KC/S) signal, tune it in, and adjust **C28** for maximum output, while rocking the gang for optimum results.

LW.—Switch set to LW, tune to 1,200m on scale, feed in a 1,200m (250 KC/S) signal, and adjust **C27** for maximum output. No aerial trimmer is provided for this band.

Feed in a 1,900m (158 KC/S) signal, tune it in, and adjust **C29** for maximum output, while rocking the gang for optimum results.

Note.—If either **C26** or **C27** will not tune to the required point, **C25** may be used as an auxiliary, reducing or increasing its capacity as required. In this case, both **C26** and **C27** must be re-adjusted afterwards.

DRY SOLDERED JOINTS

FAULTY soldered joints in the wiring of radio receivers still account for a large proportion of the failures which have to be dealt with by service engineers.

It has become the fashion to call such faulty connections "dry joints," but they may be of different types, giving rise to various faults. The symptoms of some of these faults are such that the wiring is about the last thing to be suspected, and the result is that the service engineer is apt to waste much time in checking up valves and components before the real cause of the trouble is found.

It is convenient to group "dry" joints into two classes, those in which a layer of flux exists between the two surfaces which should be in good electrical contact, and those in which the surfaces are in contact, but are not properly amalgamated.

Joints in the first class are the least common, because they usually introduce faults which are discovered before the receiver leaves the factory, and are rectified. Occasionally they are met with, however, probably due to the fact that initially the two surfaces were just touching.

These faults are usually fairly easy to find, as they are quite definite ones. An ohmmeter applied across the suspected joint will indicate the open circuit, provided nothing else is shunted across it, while if the trouble is intermittent it is usually best to clip the ohmmeter leads one on each side of the joint, and pull the suspected wires in various directions with pliers, watching the ohmmeter needle for signs of intermittent connection.

Sometimes the layer of flux in this type of joint, together with the metal surfaces which should be joined, form a very small condenser, and in certain parts of the circuit (e.g., the aerial input circuit) this may merely result in poor signal strength, with no other signs of a fault. This is a particularly difficult thing to spot.

The second class of "dry" joint, in which the two metal surfaces are touching, but are not properly bonded, is productive of many and varied faults which are often very hard to trace. The joint may behave as an intermittent open circuit, a high resistance (steady or intermittent) or a variable resistance. The result is that intermittent faults are common. Sometimes these result in complete absence of signals, while instability is often introduced. Another form of fault is the production of fading signals.

The identification of this type of faulty joint is rather more difficult than the first type, but it will often yield to the same treatment with an ohmmeter and/or pliers. It will often be found that a direct pull on the wires leading to the joint will not break the joint, but by twisting and rotating the wires the fault is often revealed.

Finally, never be satisfied with the surface appearance of a soldered joint, particularly if it has a large blob of solder on it. Sometimes the best-looking joints are the worst offenders.

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