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"TRADER" SERVICE SHEET

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FERGUSON 503

503C, 503RG, 503T, 503CT, 503RGT

TWO short-wave bands are employed in the Ferguson 503, an eight-valve (plus rect.), four-band superhet designed for AC mains of 200-250 V, 56-60 c/s. The two SW bands cover 12-35 m (designated SW1) and 25-70 m (designated SW2).

An identical chassis is employed in the 503C console and 503RG radiogram models, and the range is repeated with small modifications in the 503T table, 503CT console and 503RGT radiogram models, but the "T" models cover short-wave ranges of 16-50 m (SW1) and 75-175 m (SW2). The differences in these models are explained under "503T, 503CT, 503RGT Modifications," overleaf. Both of the radiograms are fitted with record changers.

Release date, all models: August, 1937.

Original prices: 503 *and* 503*T*, £16 16s.; 503*C* and 503*CT*, £21; 503*RG and* 503*RGT*, £42.

CIRCUIT DESCRIPTION

Aerial input on SW is via series condensers **C1, C2, C3** and switch **S2** to single-tuned circuits **L2, C37** (SW1) and **L3, C37** (SW2); **S1** and **S3** are then open.

On MW, **S2** opens and **S3** closes, and input is then developed across **C1, C2** and **C4,** which form a potential divider across the aerial circuit, and bottom coupling is derived from **C4** and thus passed on to the single-tuned circuit **L4, C37.** On LW, **S2** and **S3** open, and **S1** closes to connect **C2** in parallel with the aerial circuit, where it constitutes a high impedance. Input is then via coupling coil **L1** to single-tuned circuit **L5, C37.**

First valve **(V1, National Union 6D6)** is a variable-mu RF pentode operating as signal frequency amplifier, with choke-fed tuned-grid coupling to a heptode valve **(V2, National Union 6A7),** which operates as frequency changer.

The RF coupling circuits are **L7, C42** (SW1), **L8, C42** (SW2), **L9, C42** (MW) and **L10, C42** (LW), and they are coupled via **C6, S13** on **SW1** and **SW2, S14** being open, and by the potential divider formed by **C6, S14, C8** on MW and LW, again using bottom coupling.

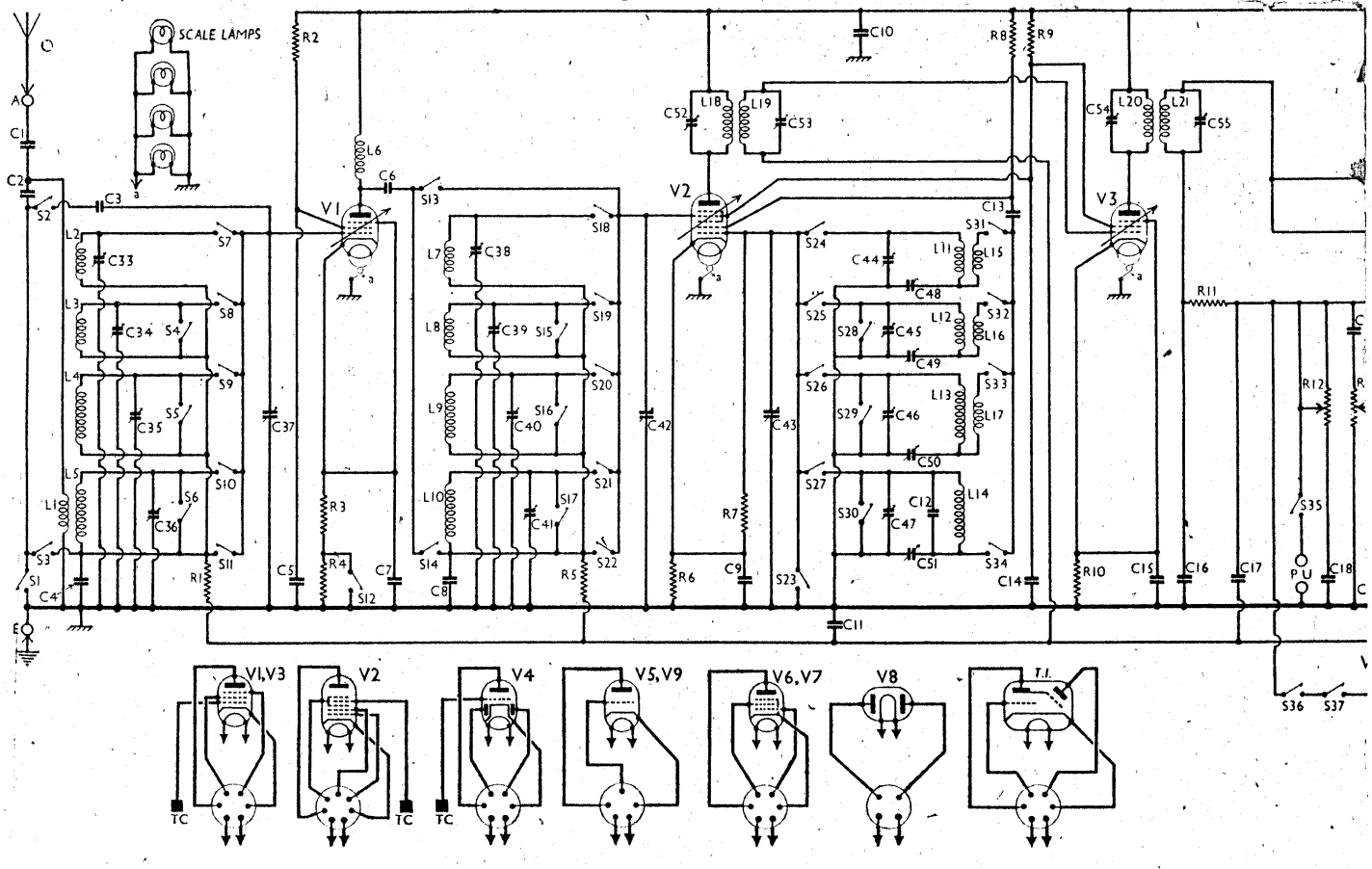
V2 oscillator grid coils **L11** (SW1), **L12** (SW2), **L13** (MW) and **L14** (LW) are tuned by **C43;** parallel trimming by **C44** (SW1), **C45** (SW2), **C46** (MW) and **C12, C47** (LW); series tracking by **C48** (SW1), **C49** (SW2), **C50** (MW) and **C51** (LW).

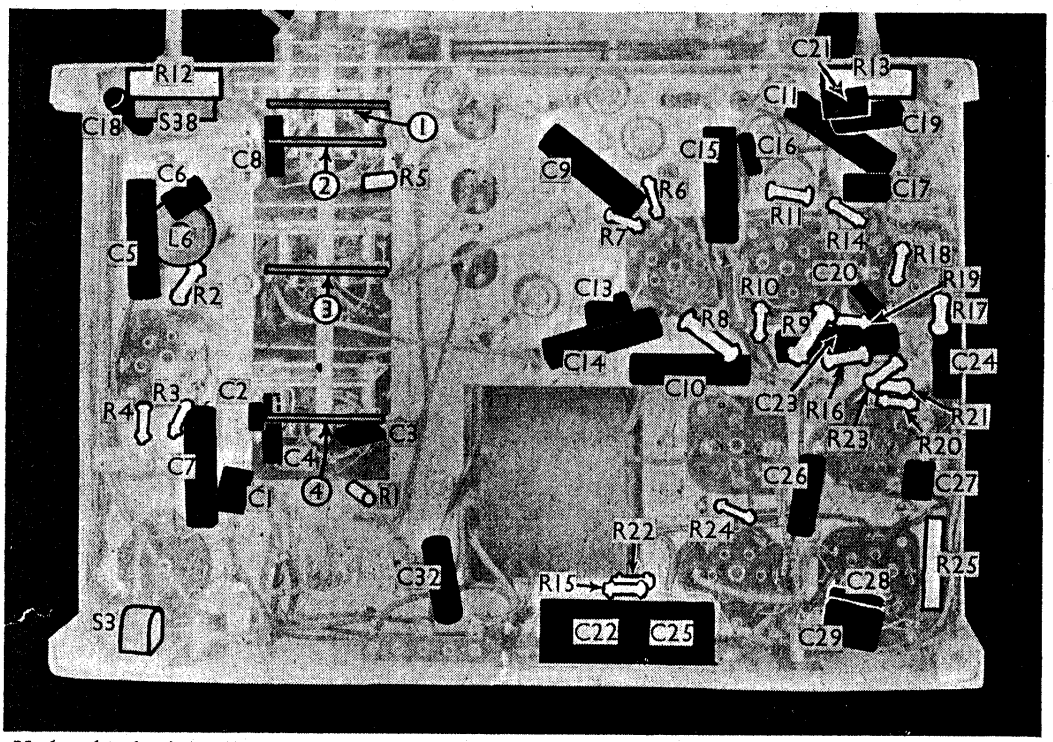
Reaction coupling from anode, via **C13,** is by coils **L15** (SW), **L16** (SW2) and **L17** (MW), with additional bottom coupling by including the impedance of the trackers in grid and anode circuits. On LW, bottom coupling only is employed.

Third valve **(V3, National Union 6D6)** is a second variable-mu RF pentode, operating this time as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings. **C52, L18, L19, C53** and **C54, L20, L21, C55.**

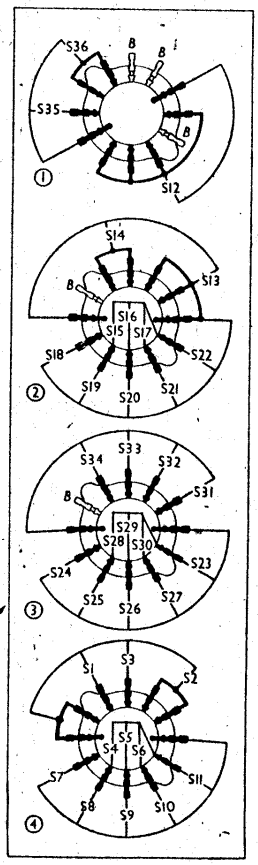
Intermediate frequency 465 kc/s.

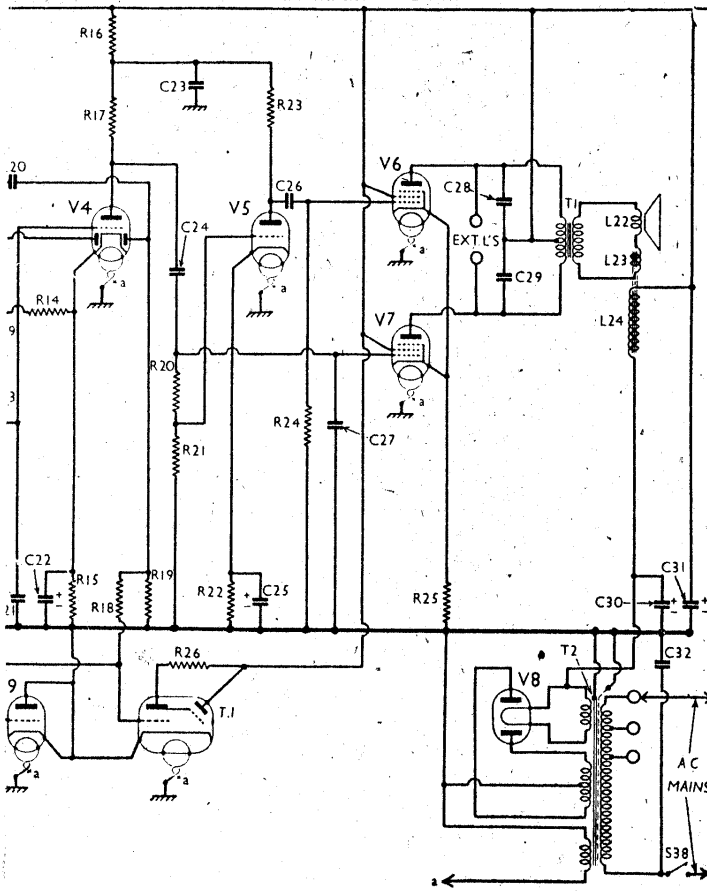
Diode second detector is part of double diode triode valve **(V4, National Union 75).** Audio frequency component in rectified output is developed across load resistor **R14** and passed via AF coupling condenser **C19** and manual volume control **R13** to CG of triode section, which operates as AF amplifier. Variable tone control by RC filter **R12, C18,** and provision for connection of gramophone





Under-chassis view. The four waveband switch units are indicated by arrows and numbers in circles, showing the direction in which they are viewed in the diagrams on the right.





Circuit diagram of the Ferguson 503 4-band AC superhet. **T.I.** is the tuning indicator, and beside it is **V9**, connected to operate as a diode. When **S36** is closed, **S37** acts with **V9** as a local/distant device. The push-pull output stage **V6, V7** is resistance-capacity coupled via a phase-reversing valve **V5**. The circuit applies directly to all three versions of the 503, and also to the three 503T Trawler versions.

pick-up across **C19, R13.** IF filtering by **R11, C16, C17.**

Second diode of **V4,** fed via **C20** from **L21,** provides DC potential which is developed across load resistor **R19** and fed back through decoupling circuits as GB to RF, FC and IF valves, giving automatic volume control. Delay voltage, together with grid bias for triode section, is obtained from drop along resistor **R15** in **V4** cathode lead to chassis.

On MW and LW only, noise suppressor valve **(V9, National Union 76),** operating as a diode with anode and cathode strapped, may be connected across **V4** signal diode output by closing the local-distant switch **S37,** thus damping the AF circuit. On both SW bands **S36** is open.

Control voltage for the cathode ray tuning indicator **(T.I., National Union 6G5)** is taken from the AVC line, the **T.I.** cathode being returned to chassis.

Resistance-capacity coupling by **R17, C24** and **R20, R21, C27,** between **V4** triode and one section **(V7)** of push-pull output stage comprising two pentodes **(V6, V7, National Union 42's).** Second section **(V6)** is fed by phase reversing valve **(V5, National Union 76),** which obtains its input voltage from the junction of **R20, R21,** which give a step-down coupling to compensate for the gain of **V5.** Fixed tone correction in output stage by **C28, C29.** Provision for connection of high impedance external speaker across primary of **T1.**

HT current is supplied by full-wave rectifying valve **(V8, National Union 80).** Smoothing by speaker field **L24** and electrolytic condensers **C30, C31.**

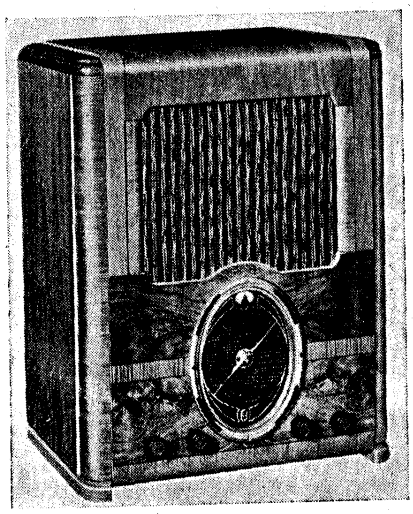
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial series condenser ...	0·00025
C2	Aerial coupling condenser	0·00025
C3	Aerial SW coupling ...	0·00002
C4	Aerial MW coupling ...	0·002
C5	V1 SG decoupling ...	0·1
C6	V1 to V2 RF coupling ...	0·00005
C7	V1 cathode by-pass ...	0·1
C8	V1 to V2 coupling ...	0·002
C9	V2 cathode by-pass ...	0·1
C10	HT circuit RF by-pass ...	0·1
C11	AVC line decoupling ...	0·1
C12	Osc. circuit LW trimmer	0·00007
C13	V2 osc. anode coupling ...	0·00025
C14	V2, V3 SG's decoupling ...	0·1
C15	V3 cathode by-pass ...	0·1
C16	IF by-pass condensers ...	0·00025
C17		0·00025
C18	Part variable tone control	0·004
C19	AF coupling to V4 triode	0·01
C20	V4 AVC diode coupling ...	0·00025
C21	IF by-pass	0·00025
C22*	V4 cathode by-pass ...	25·0
C23	V4, V5 anodes' decoupling	0·1
C24	V4 triode to V5 and V7 AF coupling	0·01
C25*	V5 cathode by-pass ...	5·0
C26	V5 to V6 AF coupling ...	0·01
C27	Fixed tone correctors ...	0·001
C28		0·002
C29		0·002
C30*	HT smoothing condensers	8·0
C31*		16·0
C32	Mains RF by-pass ...	0·01
C33‡	Aerial SW1 trimmer ...	—
C34‡	Aerial SW2 trimmer ...	—
C35‡	Aerial MW trimmer ...	—
C36‡	Aerial LW trimmer ...	—
C37†	Aerial circuit tuning ...	—
C38‡	V2 CG SW1 trimmer ...	—
C39‡	V2 CG SW2 trimmer ...	—
C40‡	V2 CG MW trimmer ...	—
C41‡	V2 CG LW trimmer ...	—
C42†	V2 CG circuit tuning ...	—
C43†	Oscillator circuit tuning ...	—
C44‡	Osc. circ. SW1 trimmer ...	—
C45‡	Osc. circ. SW2 trimmer ...	—
C46‡	Osc. circ. MW trimmer ...	—
C47‡	Osc. circ. LW trimmer ...	—
C48‡	Osc. circ. SW1 tracker ...	—
C49‡	Osc. circ. SW2 tracker ...	—
C50‡	Osc. circ. MW tracker ...	—
C51‡	Osc. circ. LW tracker ...	—
C52‡	1st IF trans. pri. tuning ...	—
C53‡	1st IF trans. sec. tuning ...	—
C54‡	2nd IF trans. pri. tuning	—
C55‡	2nd IF trans. sec. tuning	—

* Electrolytic. †Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	V1 CG decoupling ...	500,000
R2	V1 SG HT feed	100,000
R3	V1 fixed GB resistors ...	300
R4		5,000
R5	V2 tetrode CG decoupling	500,000
R6	V2 fixed GB resistor ...	200
R7	V2 osc. CG resistor ...	25,000
R8	V2 osc. anode HT feed ...	25,000
R9	V2, V3 SG's HT feed ...	50,000
R10	V3 fixed GB resistor ...	300
R11	IF stopper	25,000
R12	Variable tone control	500,000
R13	Manual volume control ...	500,000
R14	V4 signal diode load ...	500,000
R15	V4 GB resistor	10,000
R16	V4 triode and V5 anodes' decoupling	100,000
R17	V4 triode anode load ...	250,000
R18	AVC line decoupling ...	500,000
R19	V4 AVC diode load ...	500,000
R20	V5, V7 CG resistors ...	500,000
R21		50,000
R22	V5 GB resistor	10,000
R23	V5 Anode load resistor ...	250,000
R24	V6 CG resistor	500,000
R25	V6, V7 GB resistor ...	300
R26	T.I. anode HT feed ...	250,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial LW coupling coil ...	125.0
L2	Aerial SW1 tuning coil ...	Very low
L3	Aerial SW2 tuning coil ...	0·05
L4	Aerial MW tuning coil ...	3·2
L5	Aerial LW tuning coil ...	18.0
L6	V1 anode RF choke ...	117·0
L7	V2 CG SW1 tuning coil ...	Very low
L8	V2 CG SW2 tuning coil ...	0·05
L9	V2 CG MW tuning coil ...	3·2
L10	V2 CG LW tuning coil ...	17·5
L11	Osc. SW1 tuning coil ...	Very low
L12	Osc. SW2 tuning coil ...	Very low
L13	Osc. MW tuning coil ...	2·2
L14	Osc. LW tuning coil ...	4·0
L15	Oscillator SW1 reaction ...	0·4
L16	Oscillator SW2 reaction ...	1·0
L17	Oscillator MW reaction ...	0·7
L18	1st IF trans. Pri. ...	9·0
L19	1st IF trans. Sec. ...	13·0
L20	2nd IF trans. Pri. ...	13·0
L21	2nd IF trans. Sec. ...	9·0
L22	Speaker speech coil ...	1·8
L23	Hum neutralising coil ...	0·1
L24	Speaker field coil	1,000·0
T1	Speaker input trans. Pri., total	725·0
	Sec. ...	0·3
T2	Mains trans. Pri., total ...	17·0
	Heater, sec. ...	0·05
	Rect. heat. sec.	0·1
	HT sec., total	220·0
S1-S34	Waveband switches ...	—
S35	Gram. PU switch	—
S36	V9 control switch	—
S37	Local-distant switch ...	—
S38	Mains switch, ganged R12	—



The Ferguson 503 and 503T.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off) from the front of the cabinet, taking care not to lose the felt backing washers;

remove the four bolts (with flat washers and spring washers) holding the chassis to the bottom of the cabinet.

The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes. If it is desired to free the chassis entirely, unsolder from the connecting panel on the speaker transformer the leads connecting to the chassis.

When replacing, connect the speaker leads as follows, using the markings beside the tags to identify the connections: F and 2 (joined together), red; 3, blue; 1, blue; F, red/white.

If the valves have been removed, the screening covers should be replaced on **V1, V2, V3, V4** and **V5.**

Removing Speaker.—Unsolder from the input transformer the leads connecting it to chassis;

remove the nuts from the four bolts holding the speaker to the sub-baffle.

When replacing, the transformer should be on the left.

If the leads have been unsoldered, they should be connected as previously described.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6D6	255	5·6	72	1·5
V2 6A7	255	2·1	62	2·7
	Oscillator			
	133	4·4		
V3 6D6	255	4·5	62	1·2
V4 75	61	0·2	—	—
V5 76	45	0·4	—	—
V6 42	245	24·0	255	5·2
V7 42	242	31·0	255	6·2
V8 80	343†	—	—	—
V9 76	—	—	—	—
T.I. 6G5	43	0·9	—	—
	Target			
	255	0·7		

† Each anode, AC.

Valve voltages and currents given in the table above are those measured in our receiver when it was operating on mains of 226 V, using the 220-230 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume and local-distant controls were at maximum (the latter down), but there was no signal input.

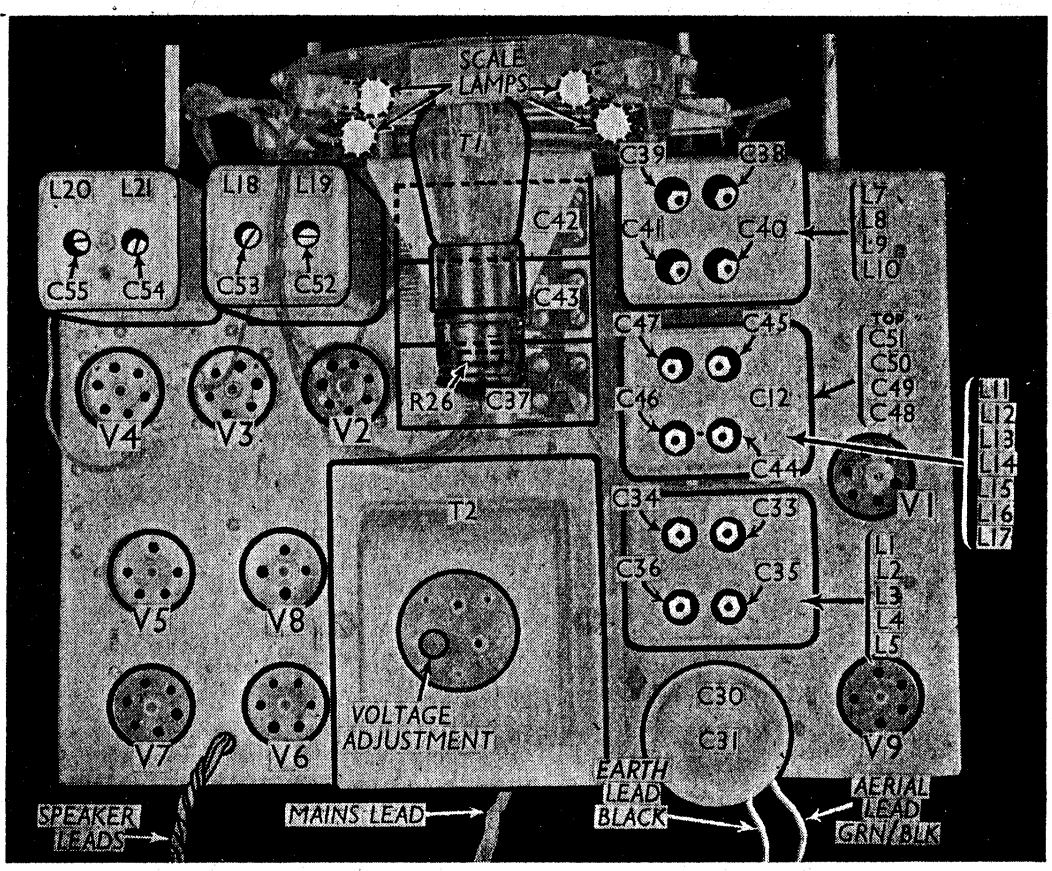
Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

GENERAL NOTES

Switches.—**S1-S34** are the waveband switches, **S35** the gram pick-up switch and **S36** the **V9** CG switch, ganged in four rotary units beneath the chassis. These units are indicated in our under-chassis view, and shown in detail in diagrams overleaf. The table below gives the

Switch Table

Switch	SW1	SW2	MW	LW	Gram
S1	—	—	—	C	—
S2	C	C	—	—	—
S3	—	—	C	—	—
S4	C	—	—	—	—
S5	C	C	—	—	—
S6	C	C	C	—	—
S7	C	—	—	—	—
S8	—	C	—	—	—
S9	—	—	C	—	—
S10	—	—	—	C	—
S11	—	—	—	—	C
S12	C	C	C	—	C
S13	C	C	—	—	—
S14	—	—	C	C	—
S15	C	—	—	—	—
S16	C	C	—	—	—
S17	C	C	C	—	—
S18	C	—	—	—	—
S19	—	C	—	—	—
S20	—	—	C	—	—
S21	—	—	—	C	—
S22	—	—	—	—	C
S23	—	—	—	—	C
S24	C	—	—	—	—
S25	—	C	—	—	—
S26	—	—	C	—	—
S27	—	—	—	C	—
S28	C	—	—	—	—
S29	C	C	—	—	—
S30	C	C	C	—	—
S31	C	—	—	—	—
S32	—	C	—	—	—
S33	—	—	C	—	—
S34	—	—	—	C	—
S35	—	—	—	—	C
S36	—	—	C	C	—



Plan view of the chassis. **R26**, the tuning indicator anode feed resistor, is located inside the **T.I.** valve holder. All the trimming adjustments are indicated here, and the trackers are identified in sequence from top to bottom at the side of the oscillator unit.

positions for the four control settings, starting from the fully anti-clockwise position of the control spindle. A dash indicates open, and **C**, closed.

S37 is the QMB local-distant switch, at the rear of the chassis. It is closed when the lever is up (local).

S38 is the QMB mains switch, ganged with the tone control **R12.**

Coils.—**L1-L5, L7-L10, L11-L17** and the IF transformers **L18, L19** and **L20, L21** are in five screened units on the chassis deck, with their associated trimmers. **L6** is an RF choke, beneath the chassis.

Scale Lamps.—These are four 6V National Union N51 types, fitted with miniature centre contact bayonet caps.

External Speaker.—Two sockets are provided at the rear of the chassis for a high impedance (14,000 Ω) external speaker, although if it is preferred, one of low impedance (about 3-6 Ω) could be connected to the speech coil connections on the internal speaker.

Condensers C30, C31.—These are two dry electrolytics in a single tubular metal can on the chassis deck, the can being the common negative connection. The red lead is the positive of **C30** (8 μF) and the yellow the positive of **C31** (16 μF).

Condensers C22, C25.—These are two dry electrolytics in a single carton beneath the chassis. Viewed as seen in our underchassis view, the tag on the left of the unit is the common negative connection, the upper tag on the right is the positive of **C22** (25 μF), and the lower tag on the right is the positive of **C25** (5 μF).

Chassis Divergencies. — Our chassis differs in a number of minor points from the makers' original circuit diagram. Our diagram is based entirely on our chassis.

Models 503T, 503CT and 503RGT.—These are Trawler models. The only difference from the standard 503 chassis in these models is in the two SW bands. SW1 covers 16-50 m (instead of 12-35 m), and SW2 covers 75-175 m (instead of 25-70 m), thus including the trawler band.

The circuit in each case is the same, but **L2** and **L7** each have a resistance of 0.2 Ω, and **L11,** 0.15 Ω, while **L3** and **L8** each have a resistance of 0.4 Ω, and **L12,** 0.3 Ω. The alignment frequencies are also different for these bands in the 503T chassis.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator to control grid (top cap) of **V3** and chassis. Feed in a 465 kc/s (645.16 m) signal, and adjust **C54** and **C55** roughly for maximum output. Switch set to MW, and turn gang to maximum. Transfer signal generator to control grid (top cap) of **V2** and adjust **C52** and **C53** for maximum output, keeping input low. Set the local/distant switch **S37** to "distant" (toggle down), and readjust **C52, C53, C54** and **C55** accurately for maximum output.

RF and Oscillator Stages.—Transfer signal generator leads to **A** and **E** leads via a 50 μμF (0.00005 μF) condenser. For tracking adjustments the makers recommend coupling to the aerial circuit the output from a high-frequency buzzer.

LW.—Switch set to LW, tune to 1,300 m on scale, feed in a 1,300 m (230 kc/s) signal, and adjust **C47, C41** and **C36** for maximum output. Tune to 2,000 m on scale, and feed in the output from the high-frequency buzzer. Adjust **C51** for maximum output. Return to 1,300 m and re-check settings.

MW.—Switch to MW, tune to 300 m on scale, feed in a 300 m (1,000 kc/s) signal, and adjust **C46, C40** and **C35** for maximum output. Tune to 550 m on scale, feed in the buzzer signal, and adjust **C50** for maximum output. Return to 300 m and re-check.

SW2.—Switch to SW2, and tune to 30 m on scale (pointer directly over the O in Melbourne on the 31 m band). Feed in a 30 m (10 Mc/s) signal, and adjust **C45, C39** and **C34** for maximum output. Tune to middle of 67 m band, feed in the buzzer signal, and adjust **C49** for maximum output. Return to 30 m and re-check.

SW1.—Switch to SW1, and tune to 15 m on scale (pointer directly over 1,000 mark on LW scale). Feed in a 15 m (20Mc/s) signal and adjust **C44, C38** and **C33** for maximum output. (When adjusting **C44,** two peaks should be found, and the one requiring the lesser trimmer capacity should be selected.) Tune so that pointer is over the 2,000 m mark on the LW band, feed in the buzzer signal, and adjust **C48** for maximum output. Return to 15 m and re-check.

503T Chassis.—With these models the SW2 band should be adjusted at 100 m (3 Mc/s) and 161 m (1,860 kc/s), while the SW1 band should be adjusted at 20 m (15 Mc/s) and 50 m (6 Mc/s).

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