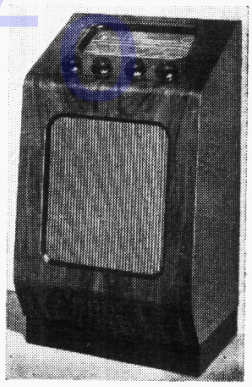
Supplement to The Wireless & Electrical Trader, July 26, 1947

"TRADER" SERVICE SHEET

821

FERGUSON

201C & 201RG



The 201C console.

SIX valves, including an R.F. amplifier and push-pull output, plus rectifier and cathode ray tuning indicator are used in the Ferguson 201C console, a 3-band superhet designed to operate from A.C. mains of 200-250v, 50-100 c/s.

The 201 RG is a radiogram employing a modified 201C chassis, the slight differences being explained overleaf.

Release date and original prices: 201C, May, 1947; £39 18*s*, *plus* £8 11*s* 7*d p.t.; 201RG, September,* 1947, £94 10*s*, *plus* £20 6*s* 4*d p.t.*

CIRCUIT DESCRIPTION

On L.W., aerial input is via the R.F. transformer **L1, L2, C2,** the primary of which is permanently connected across the aerial-earth circuit. The low impedance secondary winding **L2** is connected via switch **S1** to the low potential end of the L.W. aerial tuning circuit **L5, C38,** and thus injects signals into the circuit. **S2, S3** are then open.

On M.W., **S1** opens, while **S2** and **S4** close, so that the "top" of **L5** is connected to chassis, and the "bottom" of it is joined via **S2** and **C1** to the aerial, "inverting" the coil. Since **L4** and **L5** are wound on the same former they are magnetically coupled, and thus **L5** transfers signals to the M.W. aerial tuning circuit **L4, C38.**

On S.W., **S1, S2** and **S4** are open, and **S3** is closed, providing capacitative coupling via **C1, C3** to the S.W. aerial tuning circuit **L3, C38.** On M.W. and S.W., **L1** remains in circuit, but behaves as a high impedance choke shunt.

First valve **(V1, Mullard metallized EF39)** is a variable-mu R.F. pentode operating as signal frequency amplifier with choke-capacitance coupling to single-tuned circuits **L7, C42** (S.W.), **L8, C42** (M.W.) and **L9, C42** (L.W.).

Second valve **(V2, Mullard metallized ECH35)** is a triode hexode operating as frequency changer with internal coupling. Triode oscillator anode coils **L12** (S.W.), **L13** (M.W.) and **L14** (L.W.) are tuned by **C48.** Parallel trimming by **C45** (S.W.), **C46** (M.W.) and **C16, C47** (L.W.); series tracking by **C14** (S.W.), **C15, C43** (M.W.) and **C44** (L.W.).

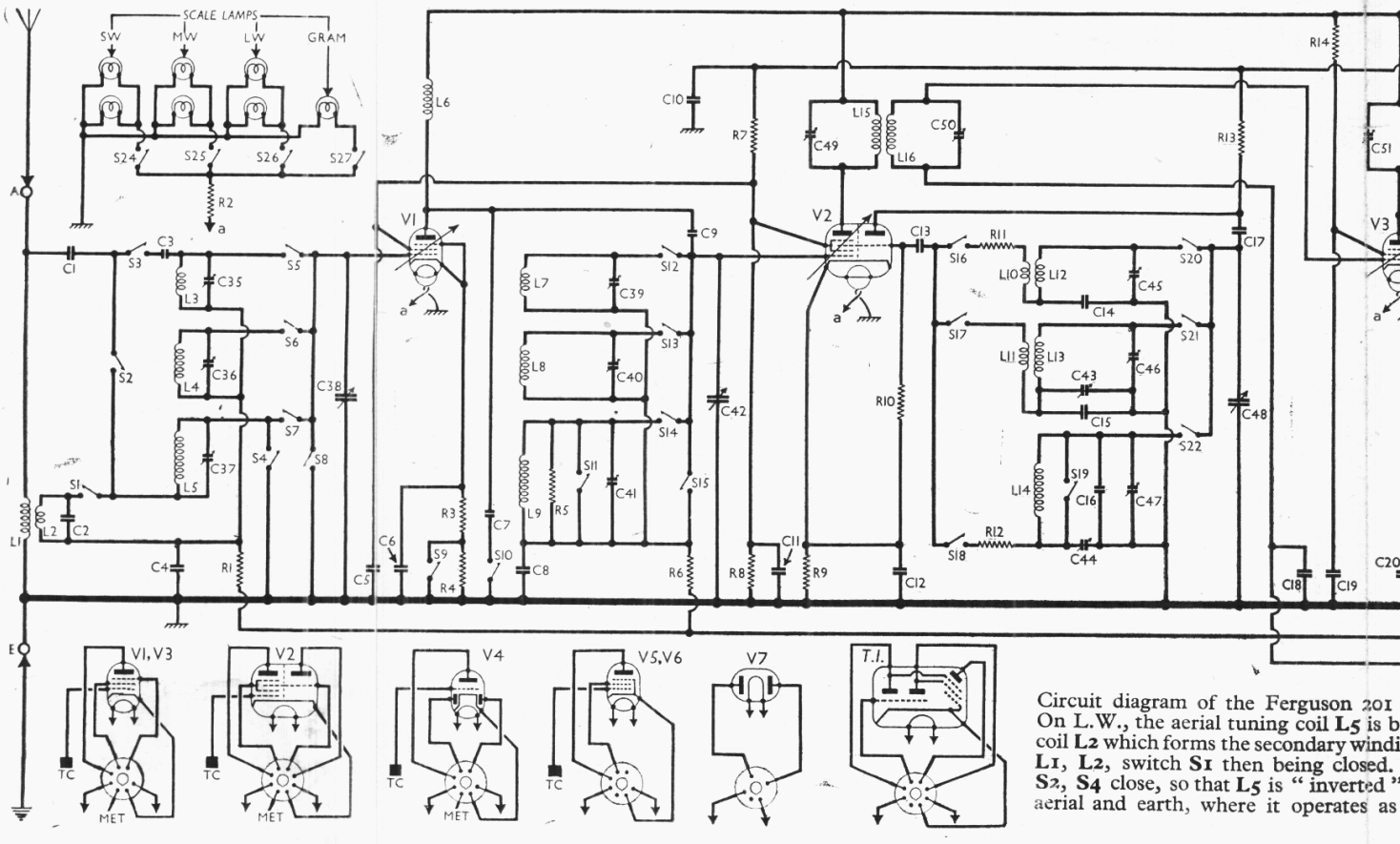
Reaction coupling to grid circuit is obtained from common impedance of trackers on all bands, with additional inductive coupling by **L10** (S.W.) and **L11** (M.W.).

Third valve **(V3, Mullard metallized EF39)** is a second R.F. pentode, operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C49, L15, L16, C50** and **C51, L17, L18, C52.**

Intermediate frequency 470 kc/s.

Diode second detector is part of double diode triode valve **(V4, Mullard metallized EBC33).** Audio frequency component in rectified output is developed across manual volume control **R17,** which also acts as diode load resistor, and passed via coupling capacitor **C25** and C.G. resistor **R18** to C.G. of triode section, which operates as A.F. amplifier. I.F. filtering by **C22, R16** and **C23** in diode circuit.

Sockets are provided for the connection of a gramophone pick-up across **R17,** via **S23.** In the "gram" position of the waveband switch, **S8** and **S15** close to



Circuit diagram of the Ferguson 201
On L.W., the aerial tuning coil **L5** is b
coil **L2** which forms the secondary windi
L1, L2, switch **S1** then being closed.
S2, S4 close, so that **L5** is "inverted"
aerial and earth, where it operates as

mute radio, while **S23** closes to connect the pick-up.

Second diode of **V4,** fed from **V3** anode via **C24,** provides D.C. potentials which are developed across load resistors **R24, R25** and fed back through decoupling circuits as G.B. to R.F., F.C. and I.F. stages, giving automatic volume control. This potential is also applied as control voltage to cathode ray tuning indicator **(T.I., Mullard EM34).** Delay voltage, together with G.B. for triode section of **V4,** is obtained from the drop along resistor **R21** in **V4** cathode lead to chassis.

Parallel-fed transformer coupling by **R20, C29** and **T1** between **V4** triode and push-pull output stage comprising two pentodes **(V5, V6, Mullard EL32's).** Variable tone control in anode circuit by **R29, C31.** Provision for the connection of a low impedance external speaker across **T2** secondary winding.

H.T. current is supplied by a full-wave rectifying valve **(V7, Mullard AZ31).** Smoothing by **L21** and **C32, C33.**

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (recessed grub screws) and felt washers;
loosen the mains lead cleat (round head wood screw) and release the lead;
remove the left-hand connecting panel (two self-threading screws) from its brackets at the bottom of the cabinet;
lay the cabinet front downward on a felt pad, and remove the two round head screws (with washers) securing the upper left and right corners of the scale assembly to plywood blocks inside the top of the cabinet;
remove the two brackets (cheese head screw, large square metal washer and hexagon nut each) supporting the chassis rear edge, and lift out the chassis to the extent of the speaker leads, which is sufficient for most purposes.
To free the chassis entirely, unsolder the four leads from their connecting strip on the speaker input transformer and the earthing lead from its tag on the speaker frame.
When replacing, connect the speaker leads as follows, numbering the tags on the connecting panel from top to bottom: 1, orange; 2, blue; 3, no external connection; 4, blue; 5, red. The black earthing lead should be soldered to a tag on the bottom right-hand speaker fixing clamp.
Removing Speaker.—Remove the right-hand connecting panel (two self-threading screws) from its brackets at the bottom of the cabinet;
remove the locking and fixing nuts from the bottom right-hand speaker fixing bolt, and lift off the earthing lead;
loosen the two nuts on each of the other fixing bolts, support the speaker with one hand, and swivel the clamps away with the other.
When replacing, the input transformer should be on the right, and if the leads have been unsoldered they should be reconnected as previously described.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 230 V, using the 220-230 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the M.W. 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 Avometer, chassis being the negative connection.

Valve		Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1	EF39	285	1·2	71	0·32
V2	ECH35	285	1·0	71	1·6
		Oscillator			
		122	4·1		
V3	EF39	285	5·6	90	1·8
V4	EBC32	113	2·4	—	—
V5	EL32	269	31·0	285	4·7
V6	EL32	271	30·0	285	4·8
V7	AZ31	374§	—	—	—
		42	0·19	(Pin 3)	—
		35	0·28	(Pin 6)	—
T.I.	EM34	Target			
		285	0·13	(Pin 5)	—

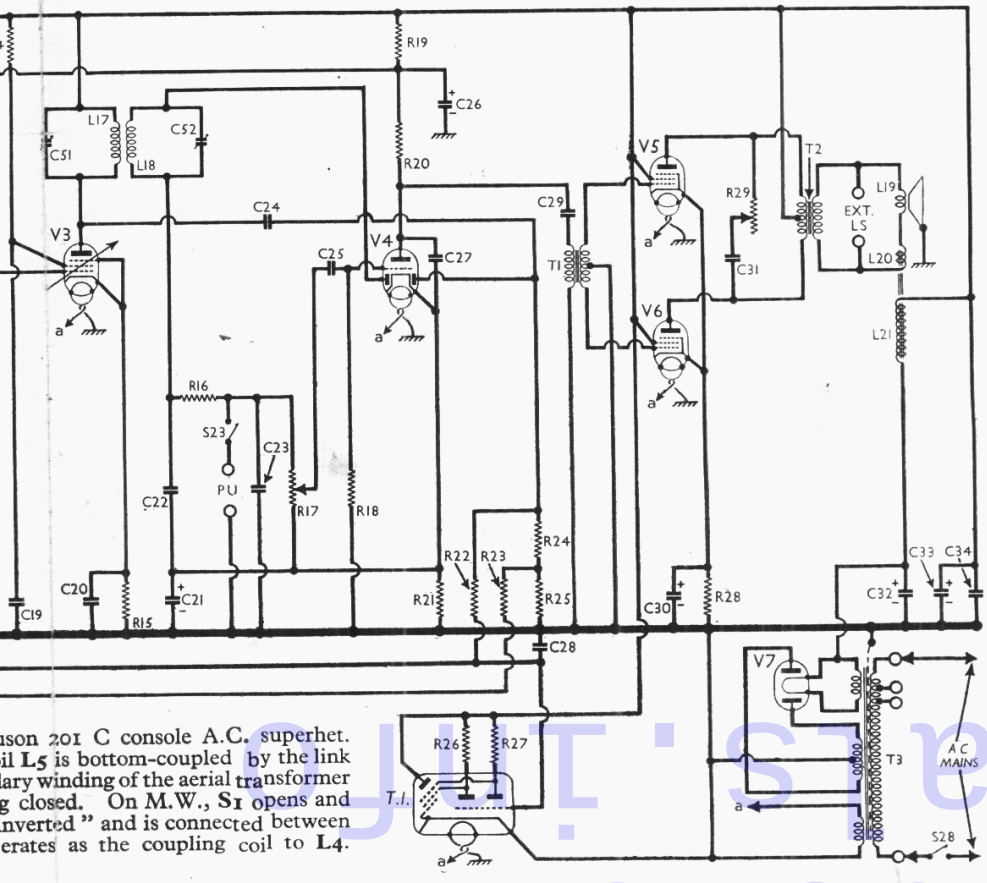
§ Each anode, A.C.

COMPONENTS AND VALUES

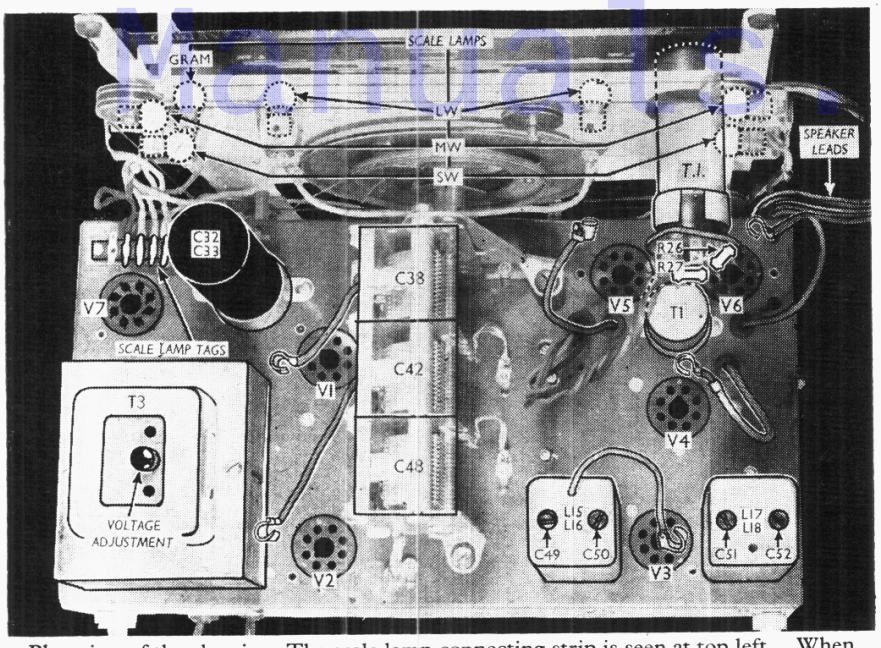
	RESISTORS	Values (ohms)
R1	V1 C.G. decoupling ...	220,000
R2	Scale lamp ballast ...	2
R3	V1 fixed G.B. resistors ...	470
R4		2,200
R5	R.F. L.W. damping ...	100,000
R6	V2 hex. C.G. decoupling ...	220,000
R7	V1, V2 SG's H.T. po-	50,000
R8	tential divider	50,000
R9	V2 fixed G.B. resistor ...	330
R10	V2 osc. C.G. resistor ...	50,000
R11	Osc. S.W. stabiliser ...	20
R12	Osc. L.W. stabiliser ...	8,200
R13	V2 osc. anode H.T. feed ...	25,000
R14	V3 S.G. H.T. feed ...	100,000
R15	V3 fixed G.B. resistor ...	330
R16	I.F. stopper	100,000
R17	Manual volume control ...	500,000
R18	V4 triode C.G. resistor ...	2,000,000
R19	H.T. line decoupling ...	4,700
R20	V4 triode anode load ...	50,000
R21	V4 G.B.; A.V.C. delay ...	1,000
R22	A.V.C. line decoupling ...	470,000
R23	V3 C.G. decoupling ...	470,000
R24	V4 A.V.C. diode load	470,000
R25	resistors	470,000
R26	T.I. triode anode load	1,000,000
R27	resistors	1,000,000
R28	V5, V6 G.B. resistor ...	300
R29	Variable tone control ...	100,000

	CAPACITORS	Values (μF)
C1	Aerial M.W. coupling ...	0·0005
C2	Part L.W. aerial coupling	0·002
C3	Aerial S.W. coupling ...	0·00001
C4	V1 C.G. decoupling ...	0·1
C5	V1 S.G. decoupling ...	0·1
C6	V1 cathode by-pass ...	0·1
C7	V1 anode L.W. shunt ...	0·00003
C8	V2 hex. C.G. decoupling ...	0·1
C9	R.F. coupling capacitor ...	0·00001
C10	H.T. line R.F. by-pass ...	0·0001
C11	V2 S.G. decoupling ...	0·1
C12	V2 cathode by-pass ...	0·1
C13	V2 osc. C.G. capacitor ...	0·0001
C14	Osc. circ. S.W. tracker ...	0·005
C15	Osc. M.W. fixed tracker ...	0·00025
C16	Osc. L.W. fixed trimmer ...	0·00005
C17	V2 osc. anode coupling ...	0·0001
C18	V3 C.G. decoupling ...	0·1
C19	V3 S.G. decoupling ...	0·1
C20	V3 cathode by-pass ...	0·1
C21*	V4 cathode by-pass ...	25·0
C22	I.F. by-pass capacitors ...	0·0001
C23		0·0001
C24	V4 A.V.C. diode coupling	0·0001
C25	A.F. coupling to V4 C.G. ...	0·001
C26*	H.T. line decoupling ...	4·0
C27	V4 anode I.F. by-pass ...	0·0001
C28	A.V.C. line decoupling ...	0·1
C29	A.F. coupling to T1 ...	0·5
C30*	V5, V6 cathode by-pass ...	25·0
C31	Part variable tone control	0·01
C32*	H.T. smoothing capaci-	16·0
C33*	tors	16·0
C34	H.T. circuit R.F. by-pass	0·1
C35†	Aerial circ. S.W. trimmer	0·00003
C36†	Aerial circ. M.W. trimmer	0·00003
C37†	Aerial circ. L.W. trimmer	0·00008
C38†	Aerial circuit tuning ...	0·000483
C39†	R.F. circ. S.W. trimmer ...	0·00003
C40†	R.F. circ. M.W. trimmer ...	0·00003
C41†	R.F. circ. L.W. trimmer ...	0·00008
C42†	R.F. circuit tuning ...	0·000483
C43†	Osc. circ. M.W. tracker ...	0·0003
C44†	Osc. circ. L.W. tracker ...	0·0003
C45†	Osc. circ. S.W. trimmer ...	0·00003
C46†	Osc. circ. M.W. trimmer ...	0·00003
C47†	Osc. circ. L.W. trimmer ...	0·00008
C48†	Oscillator circuit tuning ...	0·000483
C49†	1st I.F. trans. pri. tuning	0·00018
C50†	1st I.F. trans. sec. tuning	0·00018
C51†	2nd I.F. trans. pri. tuning	0·00018
C52†	2nd I.F. trans. sec. tuning	0·00018

* Electrolytic. † Variable. ‡ Preset



...ison 201 C console A.C. superhet. ...oil L5 is bottom-coupled by the link ...dary winding of the aerial transformer ...g closed. On M.W., S1 opens and ...nverted" and is connected between ...erates as the coupling coil to L4.



Plan view of the chassis. The scale lamp connecting strip is seen at top left. When connecting leads to it from the lamps, the tags can be identified by the lead colours at the rear ends of the tags.

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial L.W. coupling trans-former		280·0
L2			14·0
L3	Aerial S.W. tuning coil		Very low
L4	Aerial M.W. tuning coil		3·5
L5	Aerial L.W. tuning coil		28·0
L6	V1 anode R.F. choke		550·0
L7	R.F. S.W. tuning coil		Very low
L8	R.F. M.W. tuning coil		3·6
L9	R.F. L.W. tuning coil		28·0
L10	Osc. S.W. reaction coil		0·2
L11	Osc. M.W. reaction coil		1·2
L12	Osc. S.W. tuning coil		Very low
L13	Osc. M.W. tuning coil		2·1
L14	Osc. L.W. tuning coil		5·0
L15	1st I.F. trans.	Pri.	8·5
L16		Sec.	8·5
L17	2nd I.F. trans.	Pri.	8·5
L18		Sec.	8·5
L19	Speaker speech coil		2·0
L20	Hum neutralising coil		0·5
L21	Speaker field coil		1,000·0
T1	Intervalve trans.	Pri.	1,000·0
		Sec., total	5,000·0
T2	Speaker input trans.	Pri., total	800·0
		Sec.	0·5
T3	Mains trans.	Pri., total	16·0
		Heater sec.	0·2
		Rect. heat. sec.	0·25
		H.T. sec., total	260·0
S1-S22	Waveband switches		—
S23	Gram P.U. switch		—
S24-S27	Scale lamp switches		—
S28	Mains switch, ganged R17		—

RADIOGRAM MODIFICATIONS

Except for minor modifications, the chassis in the radiogram version 201 RG is the same as that in the Console 201 C.

The volume control **R17,** with switch **S28,** is detached from the chassis and mounted on a panel which is fitted to the front of the cabinet. The place it occupied on the chassis is taken by a bass attenuating control, consisting of a 2,000,000 Ω variable resistor, which is connected between the bottom of **R18** and chassis. **R18** is changed to 250,000 Ω, and **C25** is changed to 0.002 μF. A 22,000 Ω resistor is shunted across the P.U. sockets.

GENERAL NOTES

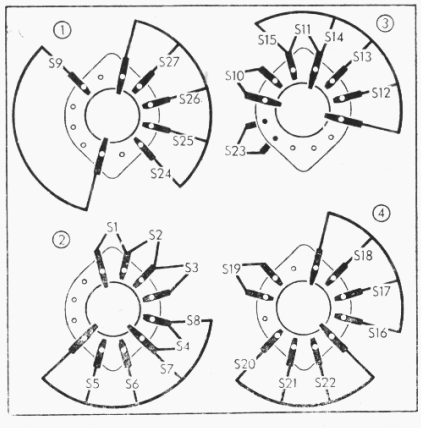
Switches.—**S1-S22** are the waveband switches, **S23** the P.U. switch, and **S24-S27** the scale lamp switches, ganged in four rotary units beneath the chassis. These units are indicated in our under-chassis view, and shown in detail in the diagrams below, where they are drawn as seen from the rear of an inverted chassis.

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

Scale Lamps.—These are seven Osram M.E.S. types, with small, clear, spherical bulbs, rated at 6.5 V, 0.3 A.

The scale lamp leads are colour coded as follows : S.W., green; M.W., yellow; L.W., orange; Gram, red.

External Speaker.—Two spring clips are provided on a panel at the rear of the cabinet for the connection of a low impedance (about 3-4 Ω) external speaker. They are connected to the speaker unit by a flexible lead.



Diagrams of the waveband switch units, seen from the rear. On the right is the associated switch table.

Switch	S.W.	M.W.	L.W.	Gram.
S1	—	—	C	—
S2	—	C	—	—
S3	C	—	—	—
S4	—	C	—	—
S5	C	—	—	—
S6	—	C	—	—
S7	—	—	C	—
S8	—	—	—	C
S9	C	—	—	—
S10	—	—	C	—
S11	—	C	—	—
S12	C	—	—	—
S13	—	C	—	—
S14	—	—	C	—
S15	—	—	—	C
S16	C	—	—	—
S17	—	C	—	—
S18	—	—	C	—
S19	—	C	—	—
S20	C	—	—	—
S21	—	C	—	—
S22	—	—	C	—
S23	—	—	—	C
S24	C	—	—	—
S25	—	C	—	—
S26	—	—	C	—
S27	—	—	—	C

Chassis Divergencies.—Although we have quoted the makers' figure for the value of **C16** (50 μμF), in our chassis it actually consisted of a 30 μμF and 10 μμF connected in parallel. **R2,** the scale lamp ballast, was made up of two 4 Ω resistors connected in parallel.

Our sample chassis had a shrouded mains transformer, but in some cases it is unshrouded, when the H.T. line voltage will be lower than in our case by about 20 V.

DRIVE CORD REPLACEMENT

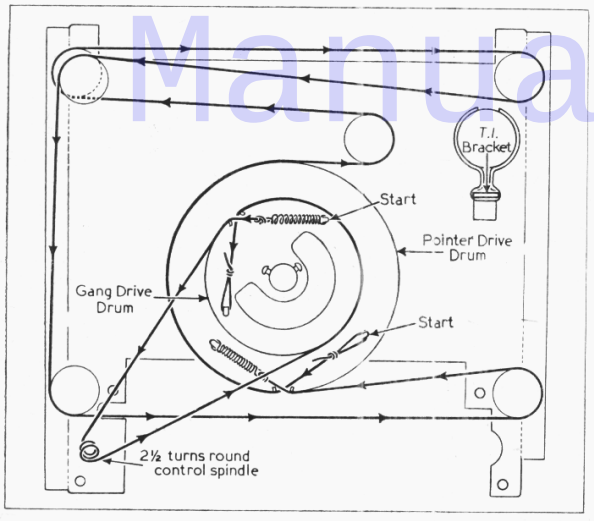
Separate drive cords are used for the gang and the cursor, and for the replacement of either the scale assembly, which carries both systems, is removed.

To do this, first remove the tuning indicator by sliding its clamp off the bracket, after slackening the fixing screw, and unsolder from their connecting-panel the six coloured scale lamp leads. Then slacken the two fixing screws on the drive drum boss, freeing it from the gang spindle, and remove the four round-head set-screws (with lock-washers) holding the scale assembly to the front chassis member, when the complete assembly can be withdrawn.

It is possible to remove it after unclipping the seven scale lamps from their receptacles, instead of unsoldering the leads, but the leads to the two lamps on the left side of the assembly are threaded through holes at the bottoms of the two vertical members, and this limits the freedom of movement of the assembly. In our case the length of lead was ample, but care had to be taken to avoid damage to the bulbs.

Suitable cords of adequate length can be obtained from T.E.I. Service, Great Cambridge Road, Enfield, Middlesex. The requirements of the gang drive cord are not very critical, but in the case of the pointer drive the gauge is of very great importance. The makers have it prepared especially for them, and no other type of cord should be used.

Gang Drive.—Lay the scale assembly face-down on the bench, and turn the drum to the position shown in the sketch



Sketch showing the two cord drive systems. The smaller drum is used for the primary, or gang, drive and the larger one for the pointer drive. The whole scale assembly is shown, as seen from the rear after removal when gang is at maximum.

(above). Tie one end of gang drive cord to its tension spring, pass the free end of the cord through the slot in the groove of the smaller drum, and hook the spring to the anchor provided on the smaller drum plate. This is the upper spring in our sketch.

Run the cord 2½ turns anti-clockwise round the control spindle, then finish off round the drum groove, re-entering the slot and finally tieing a loop to slip over the second anchor tag. When completed, all the coils of the spring should open.

Pointer Drive.—Lay the scale assembly face-down on the bench, and turn the drum to the position shown in the sketch. Pass one end of the cord through the slot in the groove of the larger drum, tie a loop on the end inside the drum, and hook it to the "Start" anchor tag.

Now run the free cord clockwise round the drum for half a turn, and follow the course indicated in the sketch, first going round the further (front) pulley of the two in the top left-hand corner, and round the nearer (rear) one on the return journey. Finally, return through the same slot to the inside of the drum, and tie off securely to the tension spring. When this is hooked to its anchor, the coils should open slightly, but the tension on the spring should be slight.

Replace the scale assembly on the chassis, with the drum still as shown in the sketch, turn the gang to maximum, and tighten up the drum boss screws. Then fit the cursor to the two horizontal runs of cord above and below the scale, taking care that it is truly vertical and that it covers the high wavelength ends of the S.W. and M.W. scales. Insert a pad of empire tape in the clamps to avoid chafing the cord, and squeeze up the clamps, fixing the cursor.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W., turn the gang to minimum capacitance and the volume control to maximum. Remove existing control grid (top cap) connector of **V2** and connect signal generator leads, with a 100,000 Ω parallel resistor, to top cap and chassis. Feed in a 470 kcs (638.3 m) signal and adjust **C49, C50, C51** and **C52,** in that order, for maximum output.

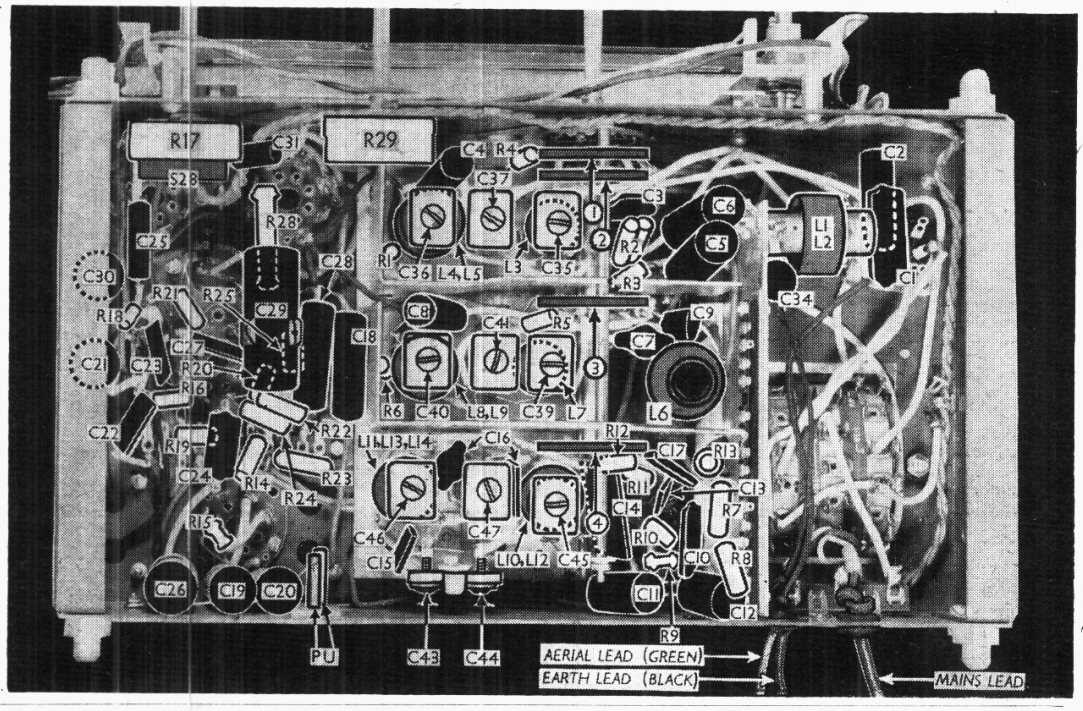
R.F. and Oscillator Stages.—With the gang at maximum capacitance the cursor should be vertical and coincident with the ends of the S.W. and M.W. scales. Small errors may be corrected by loosening the clamps and repositioning the scale. Connect signal generator leads to **A** and **E** sockets via a suitable dummy aerial.

S.W.—Switch set to S.W., tune to 18 Mc/s on scale, feed in an 18 Mc/s (16.67 m) signal, and adjust **C45, C35** and **C39** for maximum output. Tune to 6 Mc/s on scale, feed in a 6 Mc/s (50 m) signal, and check calibration. Small errors may be corrected by adjusting the position of the end turn of **L12.**

M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C46, C36** and **C40** for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust **C43** for maximum output, while rocking the gang for optimum results. Repeat these adjustments until no improvement can be obtained.

L.W.—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C47, C37** and **C41** for maximum output. Tune to 1,850 m on scale, feed in a 1,850 m (162 kc/s) signal, and adjust **C44** for maximum output. Repeat these adjustments until no improvement can be obtained.

Under - chassis view. The aerial, R.F. and oscillator tuning components are in the three central compartments, running front to rear respectively. The waveband switch units, indicated in the appropriate compartments, are shown in detail in the diagrams in col. 2.



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