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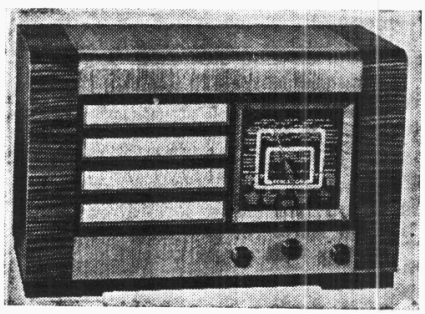
"TRADER" SERVICE SHEET

442

FERGUSON 901, 901U

TABLE, CONSOLE AND RADIOGRAM MODELS



The Ferguson 901 and 901 U table model.

THE Ferguson 901 series of models includes table, console and radiogram versions, all using the same 3-band 4-valve (plus valve rectifier) AC superhet chassis. The 901U series is similar, but for AC/DC mains.

The main chassis in each case is almost identical, except for the heater and scale lamp wiring. A separate power and output chassis is used, and this differs in the two series.

The speaker in the AC models is an energised type, while in the AC/DC models it is a permanent magnet type.

In this *Service Sheet* both series are included, with separate diagrams and chassis illustrations for the AC/DC versions. Six models are therefore covered, and their divergencies fully explained.

Release date: All models, Aug., 1939.

CIRCUIT DESCRIPTION

With the exception of three modifications, the receiver chassis in the AC/DC model is similar to that used in the AC model. The modifications are: the valve heaters and scale lamps are wired in series instead of in parallel; a resistance **R19** is shunted across the scale lamps; and a condenser **C37** is inserted in the earth lead (shown dotted in circuit diagram) to isolate the mains.

Descriptions of the AC and AC/DC power and output units follow that of the receiver chassis.

Receiver Chassis.—Aerial input on SW is via series condenser **C1** and coupling condenser **C3** to single tuned circuit **L3, C25.**

When the receiver is switched to LW, **S3** closes, but **S2** and **S4** are open, and input is via aerial circuit choke, LW coupling circuit **L2, C2** and **S3** to single tuned circuit **L5, C25.**

On MW, when **S3** opens and **S2** and **S4** close, input is via **S2, L5** and **S4** to single tuned circuit **L4, C25.** Coil **L5** operates as MW coupling coil. The aerial circuit choke **L1** is permanently connected across the aerial circuit.

First valve **(V1, Mullard ECH3)** is a triode heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L7** (SW), **L8** (MW) and **L9** (LW) are tuned by **C32**; parallel trimming by **C29** (SW), **C30** (MW) and **C31** (LW); series tracking by **C8, C26** (SW), **C27** (MW) and **C28** (LW). Reaction coupling by impedance of trackers, which are common to grid and anode circuits, supplemented on SW band by reaction coil **L6.**

Second valve **(V2, Mullard EF9)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C33, L10, L11, C34** and **C35, L12, L13, C36.**

Intermediate frequency 470 KC/S.

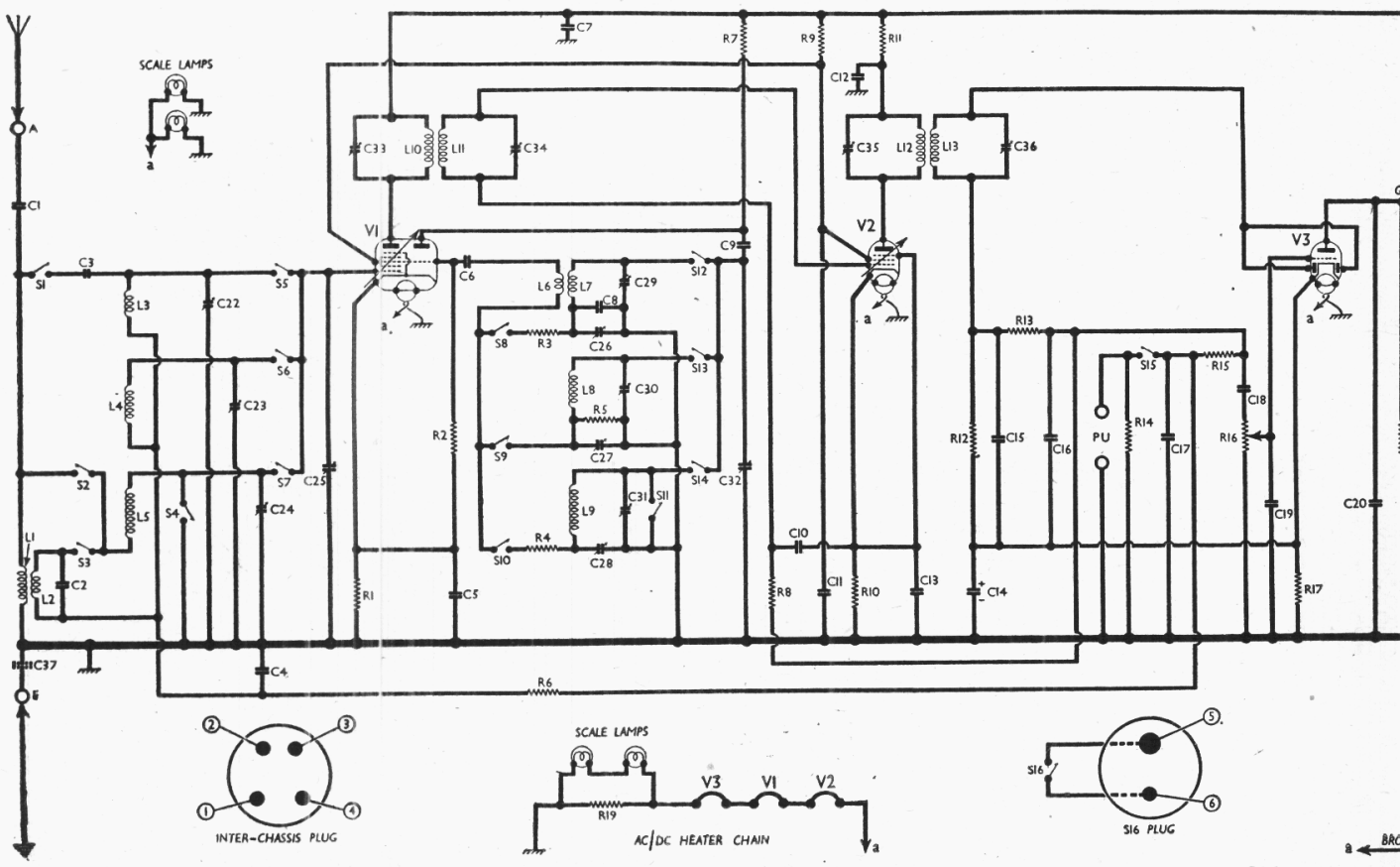


Diagram of the main chassis of all 901 models. The AC/DC heater chain for the 901 U is inset beneath the circuit. **C37** and **R19** occur in the 901 U models only.

Diode second detector is part of double diode triode valve **(V3, Mullard EBC3)** in which the two diode anodes are strapped together. Audio frequency component in rectified output is developed across load resistance **R12** and passed via **R13,** AF coupling condenser **C18** and manual volume control **R16** to CG of triode section, which operates as AF amplifier.

IF filtering by **C15, R13** and **C16** in diode circuit, **C19** in triode grid circuit, and **C20** in triode anode circuit. Variable tone control by **R18** and **C21** in triode anode circuit.

Provision for connection of gramophone pick-up via **S15, R15** and **C18** across **R16.**

DC potential developed across **R12** is fed back via **R13** and **R15** as GB to FC and IF valves, giving AVC.

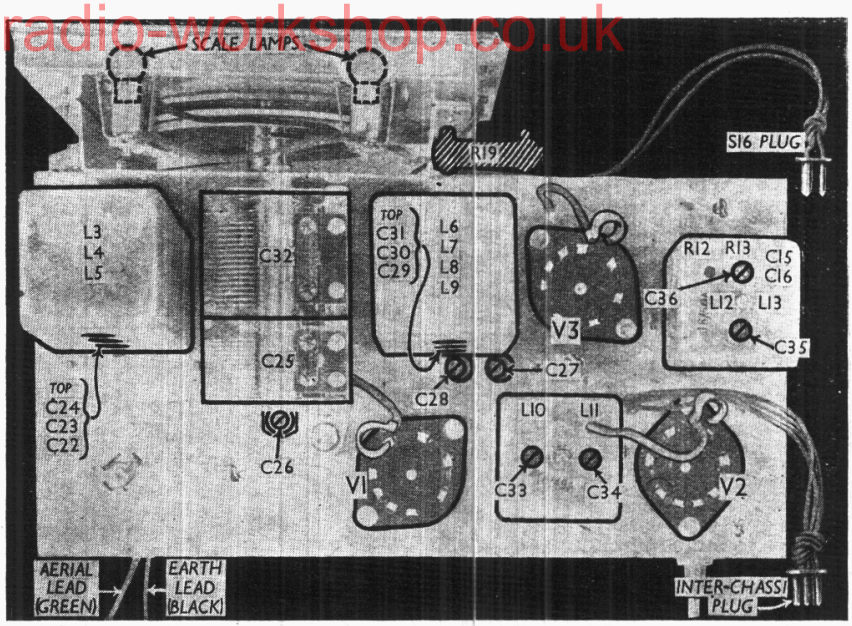
Power and Output Unit (AC).—Resistance-capacity coupling by **R101, C101** and **R102** between **V3** triode and beam tetrode output valve **(V101, Mullard 6V6G).** Fixed tone correction by **C102** in anode circuit. Provision for high impedance external speaker.

HT current is supplied by full-wave rectifying valve **(V102, Mullard 5Y3G).** Smoothing by speaker field **L103** and electrolytic condensers **C104** and **C105.**

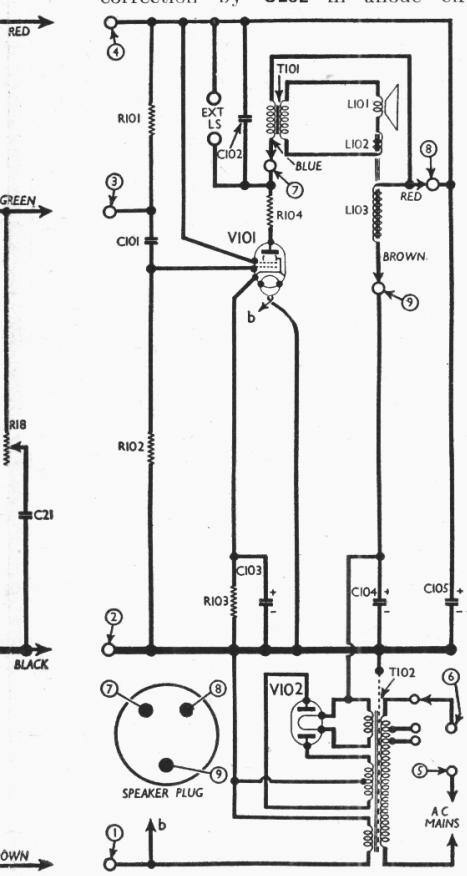
Power and Output Unit (AC/DC).—Resistance-capacity coupling by **R201, C201** and potential divider **R202, R203** between **V3** triode and pentode output valve **(V201, Mullard CL4).** Fixed tone correction by **C202** in anode circuit. Provision for connection of high impedance external speaker.

When the receiver is used with AC mains, HT current is supplied by IHC half-wave rectifying valve **(V202, Mullard CY1),** which with DC mains behaves as a low resistance. Smoothing is effected by iron-cored choke **L202** and dry electrolytic condensers **C204** and **C205.**

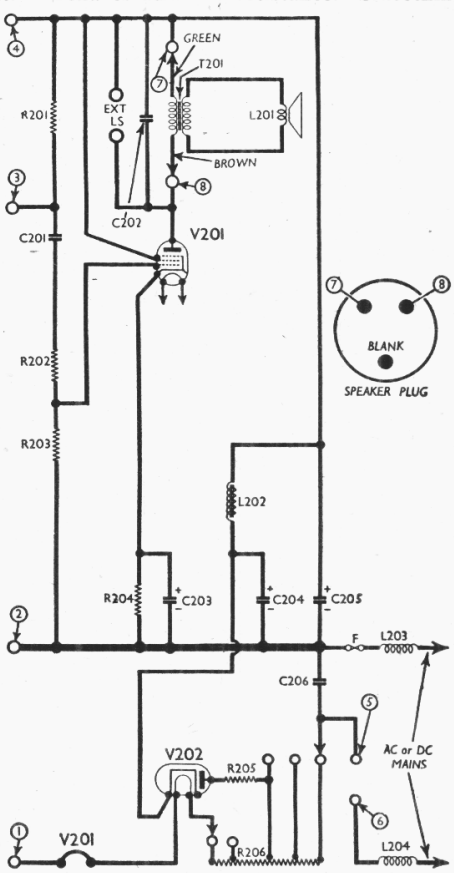
Valve heaters of both the power and output unit and the receiver chassis, together with the scale lamps and ballast resistance **R206,** are connected in series across mains input. Filter circuit comprising air-cored chokes **L203** and **L204** and condenser **C206** suppresses mains borne interference, while fuse **F** affords protection against accidental short-circuit.



Plan view of the main chassis of both models.



The AC power and output unit diagram.



The AC/DC power and output unit diagram.

DISMANTLING THE SET

The receiver consists of two units: the receiver chassis, and the power and output unit. The two units and the speaker are interconnected by plugs and sockets which are not interchangeable.

Removing Receiver Chassis.—Remove the three control knobs (pull-off) and the four bolts (with claw washers and lock washers) holding the chassis to the bottom of the cabinet. Then withdraw from the power and output unit the two plugs connecting it to the receiver chassis, when the latter may be withdrawn.

When replacing, place a felt washer on each control spindle between the knob and the cabinet.

Removing Power and Output Unit.—Withdraw the two plugs referred to above and a third connecting the speaker to the unit, then remove the two bolts (with washers and lock washers) holding the unit to the bottom of the cabinet, when the unit may be withdrawn.

When replacing, note that the square claw washer goes on to the front fixing bolt, and the round one on the rear bolt, where a recess is made in the cabinet to accommodate it.

Removing Speaker.—Withdraw the speaker plug from the power and output unit, and remove the four nuts holding the speaker to the sub-baffle, and, *when replacing,* place the speaker so that the transformer is at the top.

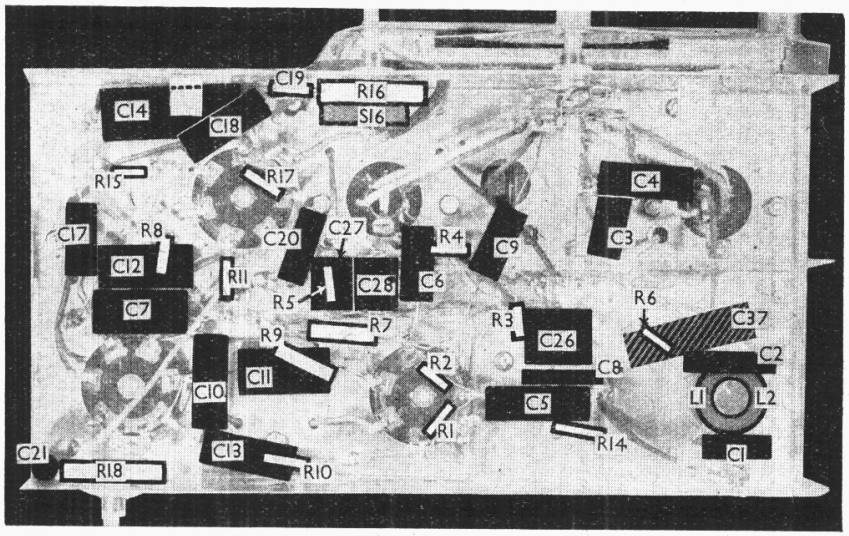
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 fixed GB resistance ...	500
R2	V1 osc. CG resistance ...	50,000
R3	Osc. SW reaction damping	22
R4	Osc. circuit MW damping...	5,000
R5	Osc. LW reaction damping	5,000
R6	V1 heptode CG decoupling	500,000
R7	V1 osc. anode HT feed ...	25,000
R8	V2 CG decoupling	500,000
R9	V1, V2 SG'S HT feed ...	50,000
R10	V2 fixed GB resistance ...	500
R11	V2 anode HT feed	1,000
R12	V3 signal diode load ...	500,000
R13	IF stopper	25,000
R14	PU shunt	50,000
R15	AVC line decoupling ...	100,000
R16	Manual volume control ...	500,000
R17	V3 triode GB resistance ...	2,500
R18	Variable tone control ...	100,000
R19	Scale lamps shunt (AC/DC model only)...	200
	AC MODEL	
R101	V3 triode anode load ...	250,000
R102	V101 CG resistance	500,000
R103	V101 GB resistance	300
R104	V101 anode stabiliser ...	100
	AC/DC MODEL	
R201	V3 triode anode load ...	250,000
R202	V201 CG input potential divider	100,000
R203		250,000
R204	V201 GB resistance	300
R205	V202 anode surge limiter ...	100
R206	Heater circuit ballast, total	830*

*Tapped at 30 O, 630 O, 730 O and 830 O from V202 heater end.

	CONDENSERS	Values (μF)
C1	Aerial series condenser ...	0·0001
C2	Part LW aerial coupling ...	0·002
C3	Aerial SW coupling condenser	0·00001
C4	V1 heptode CG decoupling...	0·1
C5	V1 cathode by-pass	0·1
C6	V1 osc. CG condenser ...	0·0001
C7	HT circuit RF by-pass ...	0·1
C8	Osc. circuit SW fixed tracker	0·002
C9	V1 osc. anode coupling ...	0·0001
C10	V2 CG decoupling	0·1
C11	V1, V2 SG's decoupling ...	0·1
C12	V2 anode decoupling... ...	0·1
C13	V2 cathode by-pass	0·1
C14*	V3 cathode by-pass	25·0
C15	IF by-pass condensers ...	0·0001
C16		0·0001
C17		0·0002
C18	AF coupling to V3 triode ..	0·01
C19	IF by-pass condensers ...	0·0001
C20		0·0002
C21	Part of variable tone control	0·01
C22‡	Aerial circuit SW trimmer..	—
C23‡	Aerial circuit MW trimmer..	—
C24‡	Aerial circuit LW trimmer..	—
C25†	Aerial circuit tuning	—
C26‡	Osc. circuit SW tracker ...	—
C27‡	Osc. circuit MW tracker ...	—
C28‡	Osc. circuit LW tracker ...	—
C29‡	Osc. circuit SW trimmer ...	—
C30‡	Osc. circuit MW trimmer ...	—
C31‡	Osc. circuit LW trimmer ...	—
C32†	Oscillator circuit tuning ...	—
C33‡	1st IF trans. pri. tuning ...	—
C34‡	1st IF trans. sec. tuning ...	—
C35‡	2nd IF trans. pri. tuning ...	—
C36‡	2nd IF trans. sec. tuning ...	—
C37	Earth isolating condenser (AC/DC model only) ...	0·1
	AC MODEL	
C101	V3 triode to V101 AF coupling	0·01
C102	Fixed tone corrector... ...	0·001
C103*	V101 cathode by-pass ..	25·0
C104*	HT smoothing condensers ...	16·0
C105*		8·0
	AC/DC MODEL	
C201	V3 triode to V201 AF coupling	0·01
C202	Fixed tone corrector... ...	0·001
C203*	V201 cathode by-pass ...	25·0
C204*	HT smoothing condensers ...	16·0
C205*		16·0
C206	Mains RF by-pass	0·1

* Electrolytic. † Variable. ‡ Pre-set.



Underneath view of the main chassis of AC and AC/DC models. The two switch units are controlled by the centre spindle. The unit nearest the front of the chassis is numbered 1, and that nearest the rear of the chassis is numbered 2, in the diagrams in column 4.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial circuit choke... ...	224·0
L2	Aerial LW coupling coil ...	13·0
L3	Aerial SW tuning coil ...	Very low
L4	Aerial MW tuning coil ...	4·2
L5	Aerial LW tuning coil ...	26·5
L6	Oscillator SW reaction ...	0·5
L7	Osc. circuit SW tuning coil	Very low
L8	Osc. circuit MW tuning coil	4·7
L9	Osc. circuit LW tuning coil	19·3
L10	1st IF trans. Pri.	16·5
L11	Sec.	16·5
L12	2nd IF trans. Pri.	16·5
L13	Sec.	16·5
S1–S14	Waveband switches... ...	—
S15	Gram PU switch	—
S16	Mains switch ganged R16	—
	AC MODEL	
L101	Speaker speech coil... ...	2·2
L102	Hum neutralising coil ...	0·15
L103	Speaker field coil	1,500·0
T101	Speaker input trans. Pri ...	620·0
	Sec	0·3
T102	Mains trans. Pri., total...	38·0
	Heater sec. ...	0·2
	Rect. heat. sec. ...	0·2
	H.T. sec., total ...	410·0
	AC/DC MODEL	
L201	Speaker speech coil	2·2
L202	HT smoothing choke ...	300·0
L203	Mains filter chokes ...	3·5
L204		3·5
T201	Speaker input trans. Pri.... ...	620·0
	Sec	0·3
F	Mains circuit fuse, 5A ...	—

Valve		Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
		AC MODEL			
V1	ECH3	258 Oscillator 130	2·2 Oscillator 4·8	95	1·0
V2	EF9	252	5·7	95	1·8
V3	EBC3	53	1·0	—	—
V101	6V6G	226	41·0	258	3·3
V102	5Y3G	335*	—	—	—
		AC/DC MODEL			
V1	ECH3	202 Oscillator 109	2·0 Oscillator 3·0	77	0·8
V2	EF9	198	4·3	77	1·3
V3	EBC3	45	0·6	—	—
V201	CL4	186	26·0	202	4·5
V202	CY1†	—	—	—	—

* Each anode, AC.
† Cathode to chassis 215 V, DC.

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 3) are those measured in our receiver when it was operating on AC mains of 233 V, using the 220-230 V tapping on the mains transformer in the case of the AC model and the 230 V tapping on the mains resistance in the case of the AC/DC model. 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 negative.

GENERAL NOTES

In the preparation of this *Service Sheet* the main chassis, which is almost identical in both AC and AC/DC models, has been dealt with separately, while the AC and AC/DC power and output units are also separately treated.

Note that components in the main chassis are numbered normally; those in the AC unit are numbered from 101 upwards; and those in the AC/DC unit are numbered from 201 upwards.

Switches.—S1—S14 are the waveband switches, and **S15** the gram. switch, in two rotary units beneath the chassis. They are shown in detail in the diagrams in col. 4, where they are drawn as seen looking from the rear of the underside of the chassis. The table (col. 5) gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S16 is the QMB mains switch, ganged with the volume control **R16.** Its leads terminate in a 2-pin plug, fitting into a socket in the power and output chassis.

Coils.—L1, L2 are in an unscreened unit beneath the chassis. **L3-L5,**

L6-L9; L10, L11 and **L12, L13** are in four screened units on the chassis deck.

Scale Lamps.—These are two National Union type N51 bulbs, with miniature bayonet cap bases. They are in parallel in the AC model, and in series, shunted by **R19,** in the AC/DC model.

External Speaker.—Two sockets are provided on the deck of the power and output unit for a high impedance (5,000O) external speaker.

Smoothing Condensers.—In the case of the AC model, **C104** and **C105** are two dry electrolytics in a single metal can mounted on the deck of the power and output unit. The can is the common negative; the red spotted tag is the positive of **C104** (16μF) and the plain tag is the positive of **C105** (8μF).

In the AC/DC model, the condensers **C204** and **C205** are in a single unit mounted horizontally beneath the deck of the power and output unit. Both condensers are rated at 16μF in this case. The can is negative; the red tag is the positive of **C204** and the plain tag the positive of **C205.**

Chassis and Speaker Connections.—The inter-connections between the two chassis, and the speaker, are carried out by various plugs and sockets.

The main chassis is connected to the power and output unit by a 4-pin plug and socket. A diagram of the plug, viewed from the free ends of the pins, is beneath the circuit diagram. The pins are numbered 1 to 4, and the connection points indicated in the circuit.

The mains switch **S16** is in the main chassis, but is connected to the other chassis by a 2-pin plug and socket. This plug is also shown beneath the main circuit diagram; the pins being numbered 5 and 6.

The speaker is connected to the power and output unit by a 3-pin plug and socket. This is shown associated with the separate circuit diagrams of the power and output units. In the AC model, all three pins are used (7-9), while in the AC/DC model only two pins are used (7 and 8), the third being blank.

Heater Wiring.—This differs in the two models. The main circuit diagram indicates the AC (parallel) wiring. Inset beneath it is a diagram of the series heater chain for the first three valves of the AC/DC model (the remaining two heaters being shown in the separate diagram of the AC/DC power and output unit).

Resistance R206.—This ballast resistance is in the AC/DC power and output unit only. It is of the vitreous enamelled wire-wound type. At the upper end it has three mains voltage tappings; at the lower end there are two tappings, of which the bottom one is always used in the 901 (5-valve) models. The other tapping is for use with 904 (7-valve) chassis only.

Chassis Divergencies.—A large number of minor differences in component values, etc., were found in our models, compared with the makers' information. None of them are serious, and they will not be mentioned in detail here. The values we give are those found in our models.

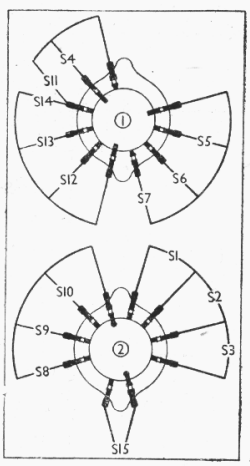


Diagram of the **S1-S15** switch units, as seen from the rear of the underside of the chassis.

SWITCH TABLE

SWITCH	GRAM.	LW	MW	SW
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	—	—	—

Condensers C15, C16, C36.—These are inside the second IF transformer, and are all contained in a multiple unit built up with **C36,** the trimmer, as a basis. Four connection tags emerge from the unit. One is the top end of **C36,** the next the junction of **C36** and **C15,** the next the junction of **C15** and **C16,** and the last the top end of **C16.**

Resistance R19.—This is the scale lamp shunt, which is only used in the AC/DC model. It is shown dotted in the plan view of the main chassis.

Condenser C37.—The earth isolating condenser is only used in the AC/DC model. It is shown dotted in the circuit.

CIRCUIT ALIGNMENT

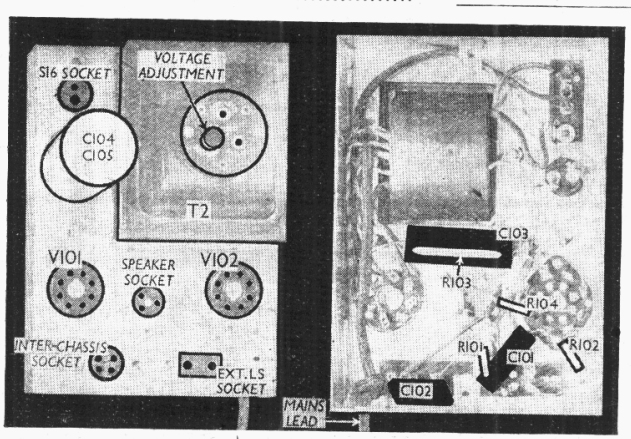
IF Stages.—Switch set to MW and turn gang to maximum. Remove top cap connector of **V1** and connect a 500,000O resistance between the connector and the top cap of the valve. Connect signal generator, via a 0.00025μF condenser, between top cap of **V1** and earth lead. Feed in a 470 KC/S signal, and adjust **C36, C35, C34** and **C33** in turn for maximum output. Repeat these adjustments.

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

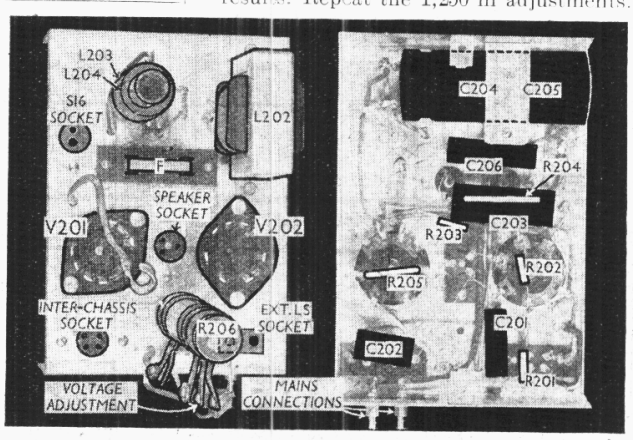
SW.—Switch set to SW, tune to 16 MC/S on scale, feed in a 16 MC/S (18.75 m) signal, and adjust **C29** for maximum output, using the peak involving the lesser trimmer capacity. Then adjust **C22** for maximum output. Feed in a 6 MC/S (50 m) signal, tune it in, and adjust **C26** for maximum output, while rocking the gang for optimum results. Repeat the 16 MC/S adjustments.

MW.—Switch set to MW, tune to 214 m on scale, feed in a 214 m (1,400 KC/S) signal, and adjust **C30,** then **C23,** for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C27** for maximum output, while rocking the gang for optimum results. Repeat the 214 m adjustments.

LW.—Switch set to LW, tune to 1,250 m on scale, feed in a 1,250 m (240 KC/S) signal, and adjust **C31,** then **C24,** for maximum output. Feed in a 2,000 m (150 KC/S) signal, tune it in, and adjust **C28** for maximum output, while rocking the gang for optimum results. Repeat the 1,250 m adjustments.



Plan and under views of the AC unit.



Plan and under views of the AC/DC unit.

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