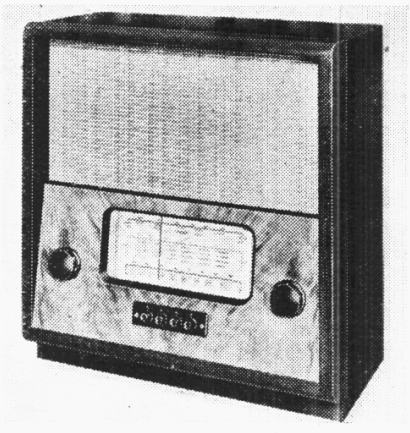
Supplement to The Wireless & Electrical Trader, March 14, 1942

"TRADER" SERVICE SHEET

560

ULTRA 330

AC SUPERHET



The appearance of the Ultra 330 receiver. The order of the press-buttons, reading from left to right, is : Gram, LW, MW, SW.

PRESS-BUTTONS are provided for waveband and gramophone switching in the Ultra 330, a 4-valve, plus rectifier, 3-waveband superhet, designed for operation from AC mains of 200-260 V, 40-100 C/S. The SW range is 16.5-50 m.

Mazda valves, with Mazda octal bases, are used throughout the receiver, and diagrams showing their base connections are given beneath the circuit diagram.

An unusual feature is the provision of a separate secondary winding on the mains transformer for the scale lamps. There is a variable tone control, and gramophone pick-up and external speaker sockets are fitted at the rear of the chassis, while a plug and socket device permits the internal speaker to be muted.

Release date: September, 1941.

CIRCUIT DESCRIPTION

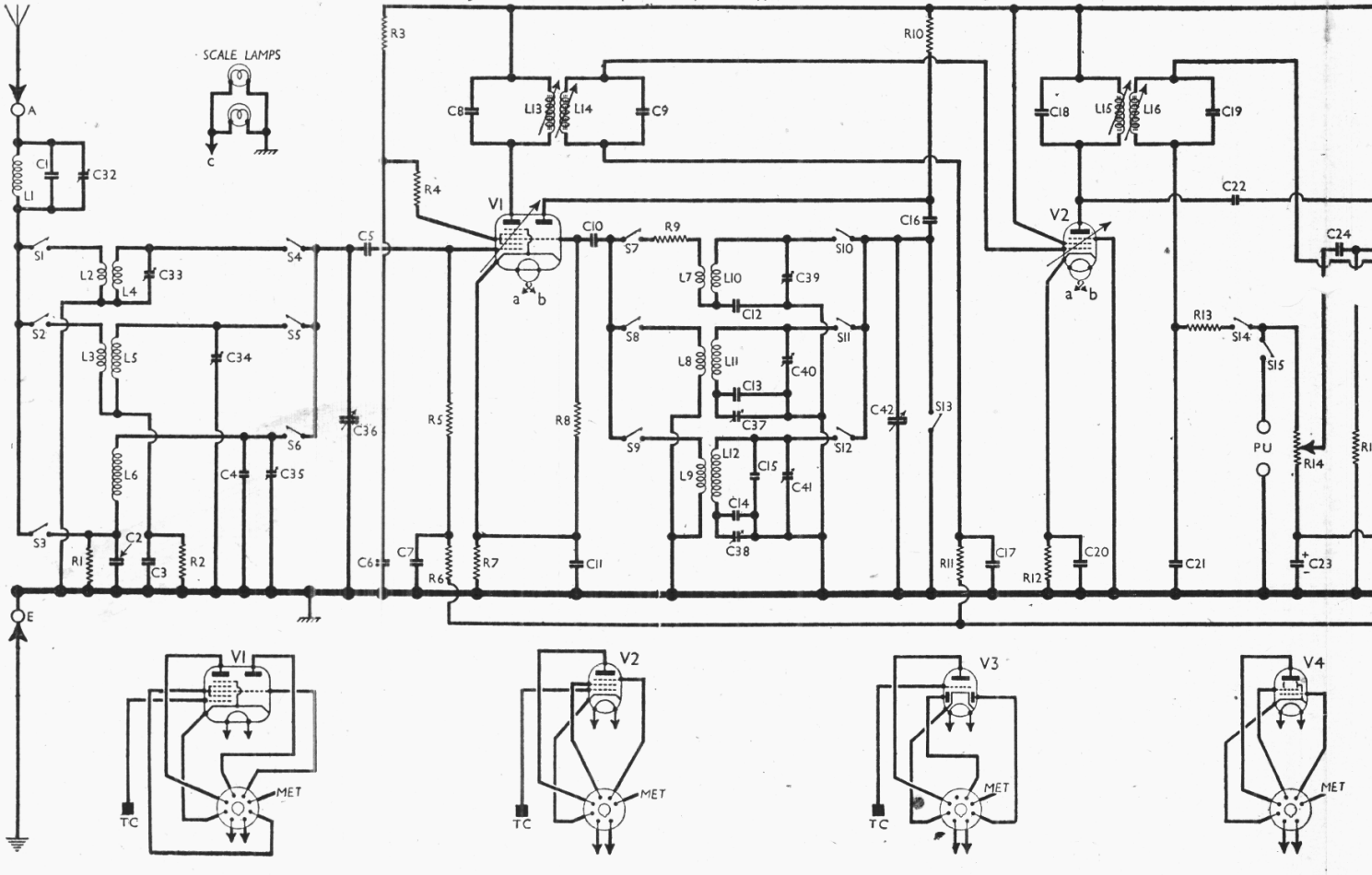
Aerial input via IF rejector circuit **L1, C1, C32** and coupling circuits **L2** (SW), **L3, C3, R2** (MW) and **R1, C2** (LW) to single tuned circuits **L4, C36** (SW), **L5, C36** (MW) and **L6, C36** (LW).

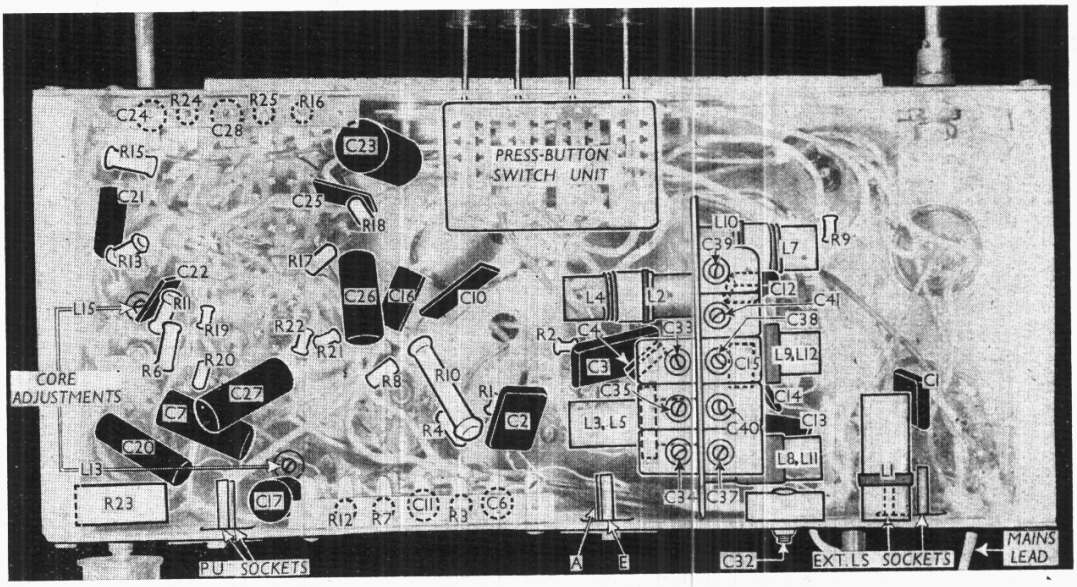
First valve **(V1, Mazda metallised TH41)** is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L10** (SW), **L11** (MW) and **L12** (LW) are tuned by **C42.** Parallel trimming by **C39** (SW), **C40** (MW) and **C15, C41** (LW); series tracking by **C12** (SW), **C13, C37** (MW) and **C14, C38** (LW). Reaction coupling from control grid via coils **L7** (SW) via damping resistance **R9, L8** (MW) and **L9** (LW). Additional coupling is obtained on SW by returning **L7** to chassis via **C12,** which thus forms a common impedance in grid and anode circuits.

Second valve **(V2, Mazda metallised VP41)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-dust cored transformer couplings **C8, L13, L14, C9** and **C18, L15, L16, C19.** The tuning condensers are fixed, and tuning adjustments are carried out by positioning the threaded iron-dust cores.

Intermediate frequency 470 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mazda metallised HL41DD).** Audio frequency component in rectified output is developed across





Under-chassis view. The press-button switch unit is indicated here, and shown in detail in the diagrams in cols. 5 and 6 overleaf, where the two sides of the unit are drawn separately. All the RF and oscillator coils, with the exception of **L6,** and pre-set condensers, are mounted on their respective sides of a vertical metal screen.

manual volume control **R14,** which also operates as load resistance, and passed via AF coupling condenser **C24** and CG resistance **R15** to control grid of triode section, which operates as AF amplifier. IF filtering by **C21, R13** in diode circuit, and **C25** in triode anode circuit.

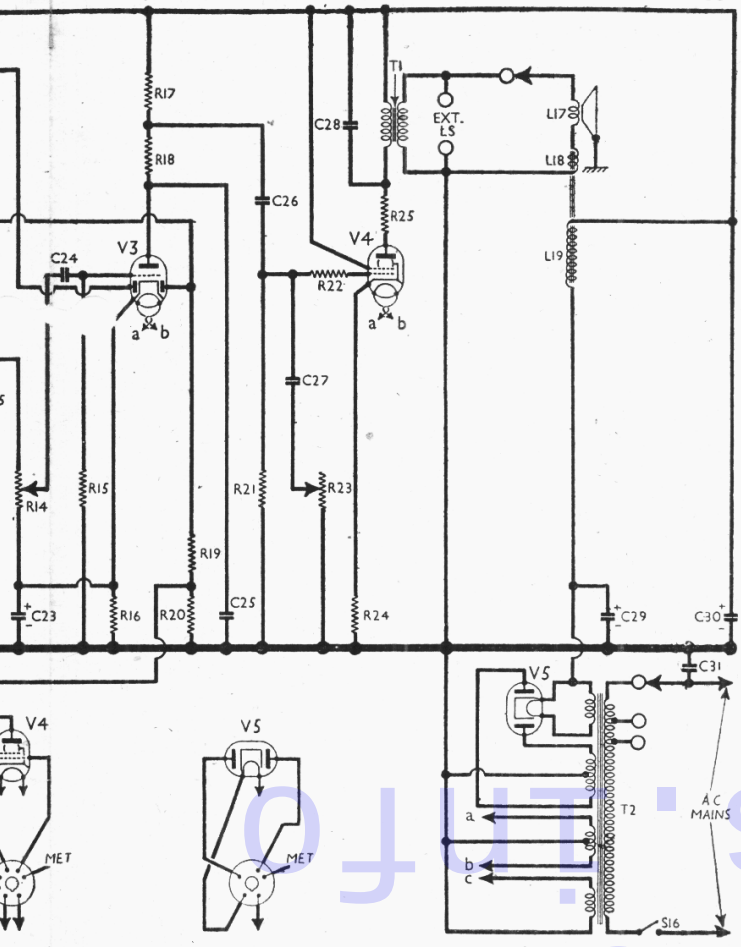
Provision for connection of gramophone pick-up via **S15** across **R14.** When the "Gram" press-button is depressed, **S15** closes, and **S14** opens, interrupting the diode circuit and muting radio. At the same time, **S13** closes and stops the oscillator circuit from oscillating.

Second diode of **V3,** fed from **V2** anode via **C22,** provides DC potential which is developed across load resistances **R19, R20** and tapped off at their junction 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 resistance **R16** in cathode lead to chassis.

Resistance-capacity coupling by **R17, R18, C26** and **R21,** via grid stopper **R22,** between **V3** triode and pentode output valve **(V4, Mazda Pen45). R17, R18** form a two-to-one step down coupling device, only that part of the output from **V3** triode which appears across **R17** being passed on to **V4.** Variable tone control is provided by connecting **C27, R23** across the control grid circuit of **V4.** Fixed tone correction by **C28** in anode circuit. Stopper resistances **R22** and **R25** in grid and anode circuits respectively prevent parasitic oscillation. Provision for connection of low-impedance external speaker by sockets across the secondary winding of the internal speaker input transformer **T1,** while a plug and socket device permits the internal speaker speech coil to be disconnected if desired. A measure of negative feed-back is introduced by the omission of the usual cathode by-pass condenser.

HT current is supplied by IHC full-wave rectifying valve **(V5, Mazda metallised UU6).** Smoothing by speaker field **L19** and dry electrolytic condensers **C29, C30.** Mains circuit RF filtering by **C31.**

The two scale lamps are energised from a separate low-voltage secondary winding, marked **c** in our circuit diagram, on the mains transformer **T2,** instead of being fed from the heater winding, marked **a, b,** as usual. One side of the scale-lamp circuit is returned to chassis.



Circuit diagram of the Ultra 330 AC superhet. **L1, C1, C32** is an IF rejector circuit. Aerial coupling on MW is partly inductive (via **L3**) and partly capacitative (via common impedance of **C3**). On LW, aerial coupling is wholly capacitative, via **C2,** except for the presence of **R1.** Note that the scale lamps are energised from a separate mains transformer secondary winding, one end of which is marked **C** in the diagram. The return circuit is via the chassis. The IF transformers have adjustable iron-dust cores, the adjusting screws of which are indicated in the two chassis illustrations.

VALVE ANALYSIS

Valve voltages and currents given in the table overleaf are those measured in our receiver when it was operating on mains of 230 V, using the 220-240 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.

If the receiver should become unstable when **V2** anode or screen current is being measured it can be stabilised by connecting a condenser of about 0.1 μF between the top cap of the valve and chassis.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH41	242 Oscillator 75	2·0 3·0	82	7·0
V2 VP41	242	13·0	242	3·1
V3 HL41DD	104	2·0	—	—
V4 Pen45	222	37·5	242	8·0
V5 UU6	305†	—	—	—

† Each anode, AC.

DISMANTLING THE SET

The cabinet of this receiver is fitted with a detachable bottom, upon removal of which (four round-head wood screws) access may be gained to most of the components beneath the chassis.

Removing Chassis.—Remove the two rotary control knobs from the front of the cabinet;

remove the four cheese-head screws (with claw washers and lock-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.

To free chassis entirely, unsolder from the connecting strip on the speaker the six leads connecting it to chassis; and from the earthing tag on the base of the magnet unsolder a seventh (earthing) lead.

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

1, green lead with pink tracer;
2, yellow lead;
3, mauve lead with pink tracer;
4, brown lead with pink tracer;
5, short black lead with pink tracer;
6, red lead;
7, no external connection.

The long black lead with pink tracer goes to the earthing tag on the magnet.

Removing Speaker.—Unsolder the connecting leads as already described; slacken the nuts (with lock-washers) holding the three clamps to the rim of the speaker, and remove one nut and clamp, when the speaker may be lifted out.

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

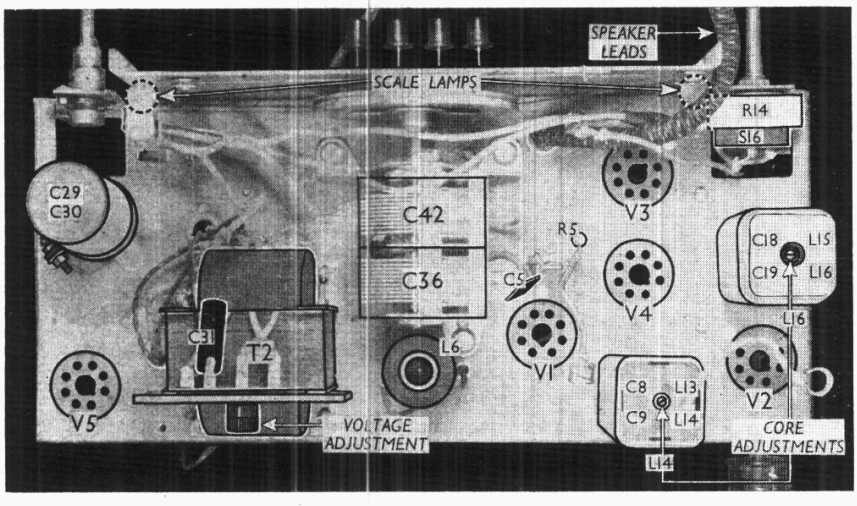
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	IF rejector fixed tuning...	0·002
C2	Aerial LW coupling impedance...	0·002
C3	Aerial MW coupling impedance...	0·004
C4	Aerial LW fixed trimmer	0·00003
C5	V1 heptode CG condenser	0·0001
C6	V1 SG decoupling	0·1
C7	V1 heptode CG decoupling	0·02
C8	1st IF transformer tuning condensers	0·0001
C9		0·0001
C10	V1 osc. CG condenser	0·0005
C11	V1 cathode by-pass	0·1
C12	Osc. circuit SW tracker...	0·004
C13	Osc. circ. MW fixed tracker	0·00033
C14	Osc. circ. LW fixed tracker	0·00008
C15	Osc. circ. LW fixed trimmer	0·00006
C16	V1 osc. anode coupling	0·0001
C17	V2 CG decoupling	0·02
C18	2nd IF transformer tuning condensers	0·0001
C19		0·0001
C20	V2 cathode by-pass	0·1
C21	IF by-pass	0·0002
C22	Coupling to V3 AVC diode	0·00001
C23*	V3 cathode by-pass	50·0
C24	V3 triode CG condenser...	0·004
C25	IF by-pass	0·0005
C26	V4 CG condenser...	0·02
C27	Part variable tone control	0·02
C28	Fixed tone corrector	0·004
C29*	HT smoothing condensers	8·0
C30*		16·0
C31	Mains RF by-pass	0·004
C32‡	Aerial IF rejector trimmer	—
C33‡	Aerial circuit SW trimmer	—
C34‡	Aerial circuit MW trimmer	—
C35‡	Aerial circuit LW trimmer	—
C36†	Aerial circuit tuning	—
C37‡	Osc. circuit MW tracker...	—
C38‡	Osc. circuit LW tracker...	—
C39‡	Osc. circuit SW trimmer...	—
C40‡	Osc. circuit MW trimmer	—
C41‡	Osc. circuit LW trimmer	—
C42†	Oscillator circuit tuning...	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	Aerial circuit damping resistances	10,000
R2		1,000
R3	V1 SG HT feed	25,000
R4	V1 SG stabiliser	60
R5	V1 heptode CG resistance	1,000,000
R6	V1 heptode CG decoupling	1,000,000
R7	V1 fixed GB resistance	200
R8	V1 osc. CG resistance	50,000
R9	Osc. circ. SW stabiliser	10
R10	V1 osc. anode HT feed	50,000
R11	V2 CG decoupling	1,000,000
R12	V2 fixed GB resistance	200
R13	IF stopper	100,000
R14	Manual volume control; V3 signal diode load	500,000
R15	V3 triode CG resistance...	1,000,000
R16	V3 triode GB; AVC delay	1,500
R17	V3 triode anode load resistances	30,000
R18		30,000
R19	V3 AVC diode load resistances	250,000
R20		750,000
R21	V4 CG resistance...	500,000
R22	V4 grid stopper	1,000
R23	Variable tone control	500,000
R24	V4 GB resistance...	175
R25	V4 anode stopper	60

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF rejector coil	3·7
L2	Aerial SW coupling coil	0·2
L3	Aerial MW coupling coil	0·3
L4	Aerial SW tuning coil	Very low
L5	Aerial MW tuning coil	3·0
L6	Aerial LW tuning coil	24·0
L7	Oscillator SW reaction...	6·2
L8	Oscillator MW reaction...	0·6
L9	Oscillator LW reaction...	1·3
L10	Osc. circuit SW tuning...	Very low
L11	Osc. circuit MW tuning...	5·7
L12	Osc. circuit LW tuning...	14·0
L13	1st IF trans. Pri.	4·5
L14	1st IF trans. Sec.	4·5
L15	2nd IF trans. Pri.	4·5
L16	2nd IF trans. Sec.	4·5
L17	Speaker speech coil	2·0
L18	Hum neutralising coil	0·1
L19	Speaker field coil	1,000·0
T1	Speaker input trans. Pri.	420·0
	Speaker input trans. Sec.	0·6
T2	Mains trans. Pri., total	39·0
	Mains trans. Heater sec.	0·1
	Mains trans. Rect. heat. sec.	0·075
	Mains trans. Scale lamp sec.	0·2
	Mains trans. HT sec., total	430·0
S1-S12	Waveband switches	—
S13-S15	Radio/gram change switches	—
S16	Mains switch, ganged R14	—



Plan view of the chassis. The secondary adjustments of the IF transformer cores are indicated here, but the primary adjustments project beneath the chassis and are indicated in the under-chassis view overleaf.

GENERAL NOTES

Switches.—**S1-S12** are the waveband switches, and **S13-S15** the radio/gramophone change switches, in a double-sided press-button unit beneath the chassis. The unit is indicated in our under-chassis view, and shown in detail in the diagrams in cols. 5 and 6; one diagram is given for each side of the unit. The switch unit has four plungers, which are arranged as follows when viewed from the front of the receiver and numbered from left to right: 1, gram; 2, LW; 3, MW; 4, SW.

In the case of the three waveband buttons, four switches are associated with each button, two in the aerial circuit and two in the oscillator circuit. Those in the aerial circuit are all on the underside of the unit, seen in our under-chassis view, and those in the oscillator circuit are all on the upper side, facing the underside of the chassis deck. When a button is pressed, all the switches associated with it close, and when it is released by pressing another button, they all open.

S14 and **S15** are on the underside of the unit, and **S13** is on the upper side. When

the gram button is pressed, **S13** and **S15** close, and **S14** opens, and when the button is released the reverse is the case.

S16 is the QMB mains switch, ganged with the manual volume control **R14.**

Coils.—The IF rejector coil **L1** is wound on an unscreened tubular former mounted on the rear member of the chassis. Its fixed tuning condenser **C1** is mounted on the end of the former, and the pre-set trimmer **C32** is mounted on the rear member beside **L1.**

The aerial coils **L2, L4; L3, L5; L6,** and the oscillator coils **L7, L10; L8, L11; L9, L12,** are in six unscreened tubular units. All except **L6** are beneath the chassis, mounted on either side of the metal shield carrying the trimmer assembly.

The IF transformers **L13, L14** and **L15, L16** are in two screened units on the chassis deck with the associated fixed tuning condensers. The adjustments for the iron-dust cores protrude from the ends of the two units, and are indicated in our chassis illustrations. In each case the secondary adjustment is at the top of the unit, and the primary adjustment is reached from beneath the chassis.

Scale Lamps.—These are two Osram MES types with small spherical bulbs, rated at 6.5 V, 0.3 A. They are energised from a separate secondary winding on the mains transformer **T2.**

Gramophone Pick-up.—Two sockets are provided at the rear of the chassis for a gramophone pick-up. Since gramophone switching is provided, the pick-up leads may be left permanently connected if desired.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-6 O) external speaker. The plug and socket device close to the speaker sockets permits the internal speaker to be muted if desired.

Condenser C23.—This is a TCC tubular electrolytic type FW. It is rated at 50 μF, 12 V DC working.

Condensers C29, C30.—These are two dry electrolytics in a single cardboard tubular container mounted vertically in a metal clip on the chassis deck. They are rated at 450 V peak working, 525 V surge. The tags protrude into the under-chassis compartment, and are daubed with paint for identification purposes. The red tag is the positive of **C30** (16 μF) and the yellow tag the positive of **C29** (8 μF). The remaining tag is the common negative, and is connected directly to chassis.

CIRCUIT ALIGNMENT

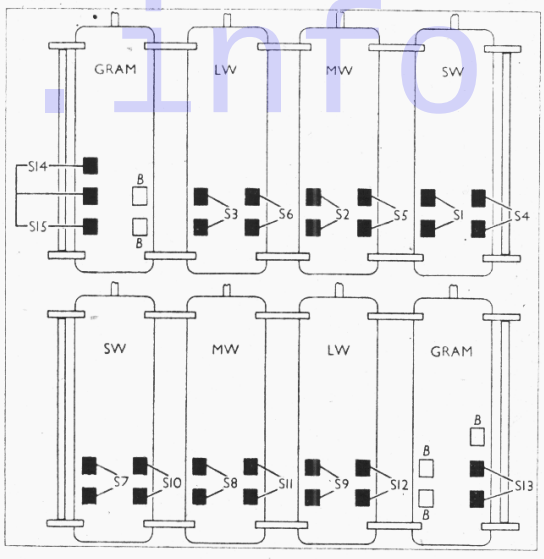
IF Stages.—Switch set to MW and turn the gang and volume control to maximum. Connect signal generator to **A** and **E** sockets, feed in a 470 KC/S (638.3 m) signal, and adjust the cores of **L13, L14, L15** and **L16** for maximum output, reducing the signal input as the circuits come into line.

IF Rejector.—With the signal generator leads connected as above, feed in a strong 470 KC/S signal, and adjust **C32** for *minimum* output.

RF and Oscillator Stages.—The pointer should reach a point about an equal distance from each end of the scales at the two extremes of the travel of the gang. If it requires adjustment, it can be slid along the drive cord, which is twisted one turn round the hook behind the pointer carrier. The signal generator leads should be connected via a suitable dummy aerial to the **A** and **E** sockets.

MW.—With the set still switched to MW, tune to 200 m on scale, feed in a 200 m (1,500 KC/S) signal, and adjust **C40,** then **C34,** 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 200 m adjustments.

LW.—Switch set to LW, tune to 1,000 m on scale, feed in a 1,000 m (300 KC/S) signal, and adjust **C41,** then **C35,** for maximum output. Feed in a 1,700 m (176 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.



Diagrams of the two sides of the press-button switch unit. Above is the underside, as seen in our under-chassis view; below is the upper side.

SW.—Switch set to SW, tune to 19 m on scale, feed in a 19 m (15.8 MC/S) signal, and adjust **C39,** then **C33,** for maximum output. Check calibration.

Servicing American Midgets

QUITE a number of newcomers to radio servicing, many of them dealers who have lost their normal staff of service personnel and are bravely trying to carry on the good work without them, find themselves very much at sea when they are confronted with an American Midget receiver. The construction is unfamiliar, and so are the valve base connections, and the underside of the chassis is a meaningless network of valveholders, resistances and wire, with an occasional condenser here and there. To add to the difficulty, no circuit diagram is obtainable.

Rectifier Connections

We cannot hope in the space of a few lines to remove these difficulties, but it may be helpful if we explain the connections to the rectifier valve holders, which, with their blank tags being used as bearers for connections in no way associated with the valve itself, and the natural manner in which the rectifier tends to become the principal point of junction between the mains lead and the chassis proper, are as difficult to sort out as any part of the circuit.

The first thing to do, of course, if it is possible, is to consult a chart showing the base connections of the type of rectifier used. If this is not available, the heater connections can usually be traced by noting to which pin the line cord resistance (the white, fluffy lead as a rule) is taken; this will usually be one end of the heater. The second pin will almost always be connected directly to the output valve holder.

The anode is usually connected directly to one side of the mains, so that one of the rubber covered conductors from the mains lead will be taken to it; the other will go to the switch on the volume control. If there is a resistance of about 100 ohms (brown body, black tip, no dot) connected to the valve holder, it can usually be assumed that one end of it will be connected to the rectifier anode, and in such a case the rubber covered lead will not go directly to the anode pin, but to the other end of this resistance, where they will probably both be anchored to an unused tag on the holder.

The cathode pin can usually be identified by the fact that a lead from the electrolytic block is connected to it, with a second lead from the speaker field, but in some cases this is difficult to identify, because the other side of the speaker field and another lead from the electrolytic block may be anchored to an unused tag. This second tag may be identified, however, by the fact that it is also connected to the primary of the output transformer.

Earlier Information

Dealers who have kept back issues of *The Trader* may like to refer to a series of articles entitled "American Midgets", where many of the peculiarities of these receivers were explained. They appeared in the September 21, October 12 and November 30, 1940, and February 22, 1941, issues. If the valves are octal based, some help may also be obtained from our *Service Sheet* 522, which gave the basings of 33 "GT" type valves.

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