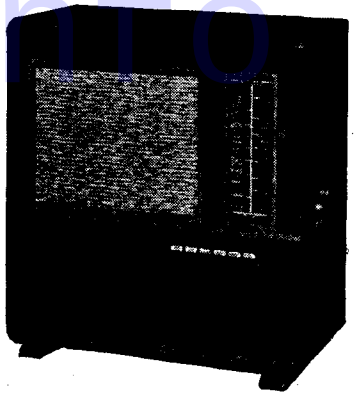
ULTRA 209 PUSH-BUTTON FIVE



Press-button tuning of six stations by an ingenious mechanical system is a feature of the Ultra 209 four-valve plus rectifier, two-band receiver.

CIRCUIT.—The aerial is connected either directly or through a small condenser to what is in effect an auto-coupled input transformer. The aerial circuit also contains a wave-trap.

The triode-hexode frequency changer, V1, derives its control bias through the usual type of condenser and resistance-isolating circuit. The oscillator circuit is conventional, but the grid condenser and leak are on the low potential side.

For pick-up reproduction the triode portion of the frequency-changer is used as an L.F. amplifier, the anode resistance which normally feeds the oscillator circuit forming the low-frequency coupling impedance. Change of circuit is provided by the wavechange switches.

The first I.F. transformer leads to the I.F. amplifier, V2, which is supplied with A.V.C. from a double-diode valve, V3. Separate decoupling is used for the grid returns of V1 and V2.

One diode of V3 is used for demodulation and the other for A.V.C. The cathode is connected to a potentiometer consisting of two resistances connected across the H.T. supply. For variable tone control there are a fixed condenser and variable resistance arranged across the diode load. The diode works into V4, a high-slope pentode volume control being obtained by the usual grid potentiometer. There is a stabilising resistance in the anode circuit and the shunt condenser is directly across the transformer. Extension speaker sockets are on the low-impedance side.

Power supply is obtained from a U5, full wave rectifier which uses the speaker field for smoothing. The mains transformer is fitted with a filter condenser.

Chassis Removal.—Remove all control knobs and unscrew all press-button controls. Remove four chassis-retaining bolts and the screw which anchors the top of the tuning scale. The chassis can then be withdrawn.

The cord drive for the tuning indicator

(*Continued on page* 51.)

RESISTANCES

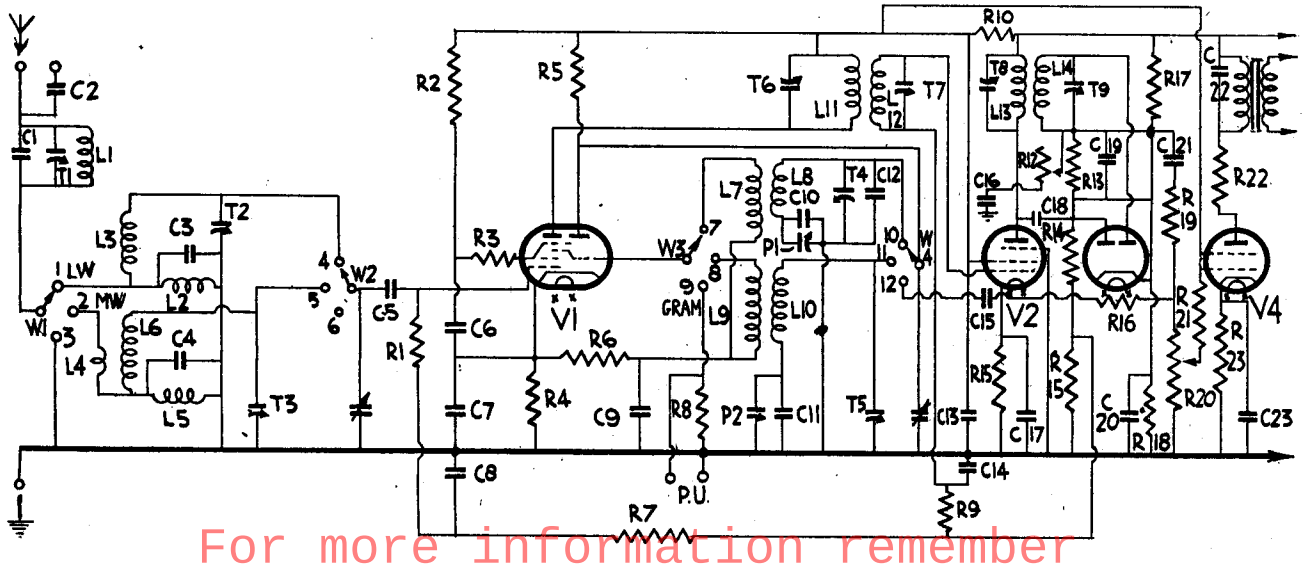
R.	Purpose.	Ohms.
1	V1 grid feed	1 meg.
2	V1 screen decoupling	10,000
3	V1 screen stabiliser	600
4	V1 cathode bias	200
5	V1 osc. anode load	40,000
6	V1 osc. grid leak	25,000
7	V1 A.V.C. decoupling	1 meg.
8	Pick-up shunt	250,000
9	V2 A.V.C. decoupling	1 meg.
10	V2 screen decoupling	2,000
11	V2 cathode bias	130
12	Tone control	2 meg.
13	Demodulating diode load	500,000
14	A.V.C. diode load (part)	250,000
15	A.V.C. diode load (part)	750,000
16	Grid stopper	100,000
17	V3 cathode bias potr. (part)	1 meg.
18	V3 cathode bias potr. (part)	50,000
19	H.F. filter	100,000
20	Volume control	1 meg.
21	V4 grid stopper	1,000
22	Anode stabiliser	60
23	V4 grid bias	140

CONDENSERS

C.	Purpose.	Mfds.
1	Aerial trap	.002
2	Aerial coupling	.00005
3	L.W. aerial shunt	.002
4	M.W. aerial shunt	.004
5	V1 grid isolating	.0002
6	V1 screen decoupling	.1
7	V1 cathode bias decoupling	.1
8	V1 A.V.C. decoupling	.05
9	V1 osc. grid	.0002
10	L.W. fixed padder	.000045
11	M.W. fixed padder	.00025
12	L.W. osc. shunt	.00001
13	V2 screen decoupling	4
14	V2 bias decoupling	.05
15	L.F. coupling	.004
16	Tone control	.002
17	V2 cathode bias shunt	.1
18	A.V.C. decoupling	.0001
19	H.F. filter	.0002
20	V3 bias shunt	.1
21	L.F. coupling	.01
22	V4 anode load shunt	.004
23	V4 cathode bias shunt	50
24	H.T. smoothing	8
25	H.T. smoothing	16
26	Mains filter	.004

WINDINGS (D.C. Resistances)

L.	Ohms.	Range.	Where measured.
L1	3.7	—	Across C1.
L2	32	L.W.	C1 and chassis.
L3	47	L.W.	W1 and W2.
L4	.3	M.W.	C1 and C4.
L5	15.2	M.W.	C1 and chassis.
L6	2.6	M.W.	C4 and W2.
L7	1.7	L.W.	Osc. grid (R6 and C9).
L8	15	L.W.	Osc. anode and C10.
L9	1.3	M.W.	Osc. grid (R6 and C9).
L10	6.1	M.W.	Osc. anode (P2 and C11).
L11	12.4	—	V1 anode and (R5 and R10).
L12	13	—	V2 grid (C14 and R9).
L13	12.2	—	V2 anode and H.T. positive.
L14	11.8	—	Demodulatingdiode and R12 slide.
M.T.prim.	32	—	Across mains plug.
O.T. prim.	440	—	Across C22.
Field	1250	—	Red and black tags on strip.



How to Adjust the Push-buttons

THE Ultra 209 provides push-button tuning by an ingenious mechanical system. There are six push-buttons each on the end of a push rod. At the other ends of the push rods are semi-circular plates. Each plate is pivoted and is adjustable so that the angle of the straight side is adjustable.

Facing these sector plates is a flat plate pivoted at the centre. When any button is pressed in, the flat side of its sector plate comes into contact with the tilting bar and turns it, in one direction or the other, until the bar is flat against the sector plate.

The tilting bar drives the gang condenser through a sickle and link motion. Consequently, it will be seen that the position assumed by the gang condenser depends on the angle to which the sector plate is adjusted.

For adjustment then, the receiver is tuned manually to a required station. The sector plate on the push rod is then freed so that it can assume any position. The button is pressed in and the sector plate turns until it rests flat against the tilting bar.

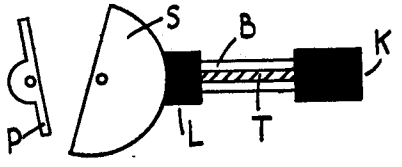
The sector plate is then locked in position.

The diagram illustrates the practical arrangements. *S* is a sector plate mounted on the push rod *B*. When the button *K* is rotated, the clamp *L* clamps or unclamps the sector plate.

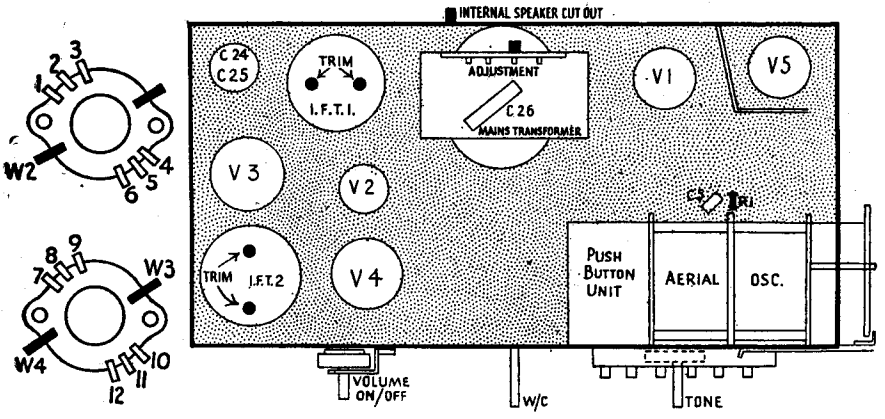
It will readily be seen that *S* will rotate to lie flat with the tilting plate *P* when free to do so, or, alternatively, when it is clamped will turn *P*, and with it the gang condenser, to a predetermined position.

To adjust a button, therefore, proceed as follows: Tune in the required station by hand. Slacken the knob of any press-

(*Continued on page* 51.)



The principle of the mechanical push-button tuning system.



Left, the two switch banks with wipes and contacts numbered corresponding to the circuit. Right, the top-of-chassis layout diagram.

Ultra 209 on Test

MODEL 209.—A.C. mains operation, 200-260 volts, 40-100 cycles. Price, 9½ gns.

DESCRIPTION. — Four-valve, plus rectifier, two-band model with mechanical press-button tuning.

FEATURES. — Vertical full-vision scale, with medium and long wave calibration side by side and a common pointer. Tuning control at the side and six push-buttons on the front. No reduction gearing between drive and condenser. Controls for tone, wave switch with gramophone, and combined master switch and volume control. Sockets for two aerials, earth, pick-up, extension speaker, and an internal speaker plug switch. Inspection plate on bottom of cabinet for quick service.

LOADING.—62 watts.

Sensitivity and Selectivity

MEDIUM WAVES (195-550 metres). —Very good gain and selectivity, with small local station spread. Gain well maintained and clean background.

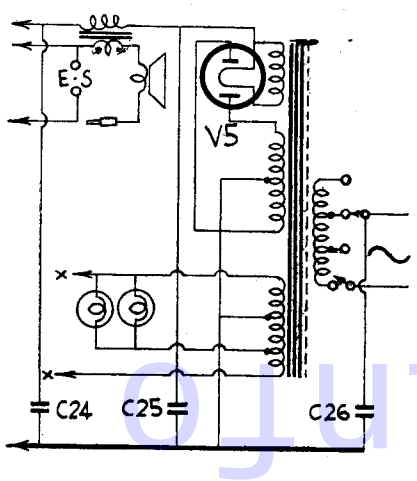
LONG WAVES (900-2,000 metres). —Excellent gain and selectivity. All main stations easily received and only very slight side splash on Deutschlandsender.

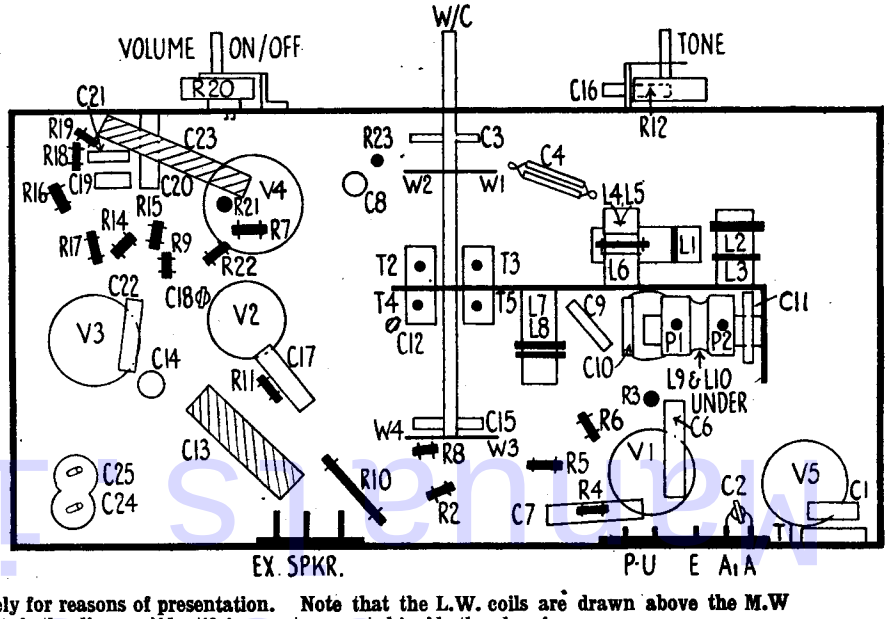
Acoustic Output

Ample volume for an ordinary room, with pleasing tone. A reasonable amount of high note response and satisfactory lower note radiation. Slight colouration on speech and a general deep tone with a not too vigorous tone control.

Push-button Notes

The push-button controls are easily set and do not appear to shift during operation.





The circuit, left, is shown divided solely for reasons of presentation. Note that the L.W. coils are drawn above the M.W coils. Right, is the diagram identifying parts mounted inside the chassis.

Ultra 209 Push-button Five

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is attached to the push-button and main condenser assembly, and comes away with the chassis. The scale need not be removed. The lower pilot lamp holder is fitted with a special extension clip to facilitate removal.

The internal speaker is disconnected by a plug-and-socket arrangement on the back of the chassis. Colour coded leads to the speaker strip are provided by small dabs of paint on a uniform yellow coloured braid.

Special Notes.—It is important to see that the push-button knobs are screwed up tightly, as otherwise the setting will slip.

Both leads of the pilot lamps circuit are insulated from the chassis.

All adjustments can be carried out without removing the chassis, the trimmers and padders being available by removing the inspection cover from the base of the cabinet. The trap circuit trimmer is accessible from the back of the cabinet.

Wavechange Switches.—Wavechanging is accomplished by two switch wafers, one wafer controlling the aerial and input-tuned circuit and the other the oscillator circuits. The third position of the switch changes over the oscillator circuit to the gramophone input as explained above.

The wafer nearer the click plate carries the aerial circuits—that is, W1 and W2—and the second wafer carries W3 and W4, controlling the oscillator and pick-up.

Alignment Notes

I.F. Circuits.—Connect an output meter across the primary of the speaker transformer, switch receiver to MW band, turn gang to maximum capacity, tone to "high" position and volume to maximum.

Connect a service oscillator between the top grid cap of V1 and chassis.

Tune service oscillator to 470 kc. and adjust trimmers of the I.F. transformers (starting with I.F.T. 2) for maximum response, reducing the input from the service oscillator as the circuits come into line to render the A.V.C. inoperative.

Signal Circuits.—Connect the service oscillator to the aerial and earth sockets, progressively reducing the input as the circuits come into line so as to obtain only reliable peaks in the output meter.

I.F. Wave-trap.—Tune the set to 950 metres on scale, inject a strong 470 kcs. signal from the output meter, and adjust T1 for minimum response.

Medium Waves.—Tune set and oscillator to 200 metres (1,500 kc.) and adjust T5, then T3 for maximum.

Tune set and oscillator to 500 metres (600 kc.) and adjust P2 for maximum, simultaneously rocking the gang.

Repeat both operations until no further improvement results.

Long Waves.—Tune set and oscillator to 1,300 metres (230 kc.) and adjust T4 and then T2 for maximum.

Tune set and oscillator to 1,700 metres (176.5 kc.) and adjust P1 for maximum, simultaneously rocking the gang.

Repeat both operations until no further improvement results.

QUICK TESTS

Quick tests are available between the chassis and the colour coded leads on the speaker strip.
Black lead, 235 volts, smoothed H.T.
White, 220 volts, output anode.
Red, 310 volts, unsmoothed H.T.

VALVE READINGS

V.	Type.	Electrode.	Volts.	Ma.
	All Mazda.			
1	AC/TH1 ..	Anode ..	180	6.75
		Screen ..	110	7
		Osc.anode	65	3
2	AC/VP2 ..	Anode ..	230	12
		Screen ..	182	2.2
3	V914	Diodes	only.	
5	AC/5/Pen ..	Anode ..	220	38
		Screen ..	185	6
6	UU4	Heater ..	310	—
	Pilot lamp .. (Osram).		4.5	300

Adjustment of Push-buttons

(*Continued from page* 45.)

button. Then, holding the manual tuning control to prevent any shift, press home the push-button. Tighten up the button while holding it "home."

Finally, check the automatic against the manual setting to make sure no slip has occurred.

Replacement Condensers

Exact replacement condensers are available from A. H. Hunt, Ltd., Garratt Lane, Wandsworth, London, S.W.18, as follows: for C24 and C25, 1014, price 9s. 6d.; C23, 2915, 1s. 9d.; and C13, 2958, 2s. 6d.

MULLARD MAS15

(*Continued from page* 43.)

socket of receiver *via* normal artificial aerial. Tune auxiliary apparatus to about 550 m. Tune the receiver under test.

Disconnect auxiliary apparatus and condenser short-circuit. Connect output indicator to receiver. Do not alter the setting of the variable condenser.

Trim P1 for maximum output. Replace 15-deg. jig in position and adjust variable condenser to it (minimum capacity). Apply modulated 1,442-kc. signal to aerial socket *via* standard artificial aerial. Retrim T8 for maximum output.

Long Waves.—Fit 15-deg. jig and set variable condenser to it (minimum capacity). Switch receiver to long waves and turn volume control to maximum.

Apply modulated 405-kc. signal to aerial socket *via* standard artificial aerial. Successively trim T9, T6 and T3 for maximum output. Remove 15-deg. jig.

Connect auxiliary apparatus to anode of V2 *via* 25-mmfd. condenser and connect output indicator to output of auxiliary apparatus. Short-circuit oscillator by means of a piece of wire across C5.

Apply modulated 160-kc. signal to aerial socket of receiver under test *via* standard artificial aerial. Tune both auxiliary apparatus and receiver to about 1,875 m. Disconnect auxiliary apparatus and condenser short-circuit. Connect output indicator to receiver under test. Do not alter setting of variable condenser.

Trim P2 for maximum output. Replace 15-deg. jig and set condenser (minimum capacity). Apply modulated 405-kc. signal to aerial socket *via* standard artificial aerial, and retrim T9. Remove 15-deg. jig and lock trimmers.

Short Waves.—Fit 15-deg. jig and set variable condenser to it (minimum capacity). Switch receiver to short waves and apply modulated 17-mc. signal to aerial socket *via* short-wave artificial aerial.

Successively trim T11, T4, and T1 for maximum output (adjust T11 to first peak from minimum capacity). Remove 15-deg. jig and lock trimmers.

Calibrating.—Connect output indicator to output of receiver. Set volume control to maximum and wavelength switch to medium waves. Apply modulated 811-kc. signal (370 m.) to aerial socket *via* standard artificial aerial. Tune the receiver. Adjust the pointer carefully to 370 m. by means of the knurled screw.

Replacement Condensers

Exact replacement condensers are available from A. H. Hunt, Ltd., Garratt Lane, Wandsworth, London, S.W.18. These are: C1, unit 4233, 7s.; C2, 2989, 7s. 6d.; C24, 4232, 6s. 6d.; and for C46, 2918, 1s. 9d.

WINDINGS (D.C. Resistances)

L.	Ohms.	Range.	Where Measured.
5	280	Any	C1 and C2.
6	3.5	S.W.	Chassis and aerial switch.
7	Very low	S.W.	Ch. and first gang.
8	28	M.W.	Chassis and aerial switch.
9	5	M.W.	Ch. and first gang.
10	100	L.W.	Chassis and aerial switch.
11	45	L.W.	Ch and first gang.
12	2.5	S.W.	Anode V1 and (R37 and C49).
13	Very low.	S.W.	Ch. and aerial gang.
14	280	M.W.	Anode V1 and (R37 and C49).
15	5	M.W.	Ch. and aerial gang.
16	470	L.W.	Anode V1 and (R37 and C49).
17	45	L.W.	Chassis and aerial gang.
18	Very low.	S.W.	Osc. gang and C26.
19	1	S.W.	Osc. anode and (R10 and R35).
20	8.5	M.W.	Osc. gang and P1.
21	35	M.W.	Osc. anode and R35.
22	19	L.W.	Osc. gang and P2.
23	3.5	L.W.	Osc. anode and R35.
24	7.5	Any	V2 anode and H.T. plus.
26	7.5	Any	V3 grid and P.U. socket.
27	4.5	Any	V3 anode and C33.
28	3.5	Any	C33 and H.T. plus.
29		Any	C34 and demodulator diode.
30	5	Any	Demodulator diode and C36.
31	640	Any	On tags.
M.T. prim.	52	Any	Mains plug.