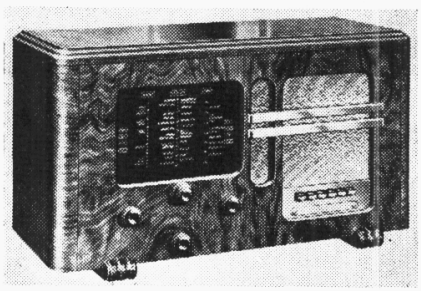
Supplement to The Wireless & Electrical Trader, April 22, 1939

"TRADER" SERVICE SHEET

399

McMICHAEL 381 AND 803 RADIOGRAM



The McMichael 381 press-button table receiver.

THE McMICHAEL 381 is a 4-valve (plus valve rectifier) table 3-band AC receiver, with press-button permeability tuning for six stations.

The manual wavelength ranges are 19-51, 200-550 and 800-2,500 m, and the receiver is for 200-250 V, 50-100 C/S mains.

Model 803 is a table "Compact" radiogram with a very similar chassis except for the omission of the auto-tuning circuits. The modifications on this model, which is for 50-60 C/S mains only, are explained under "Radiogram Model 803."

This *Service Sheet* was prepared on a model 381.

Release Dates: Model 381, September, 1938; Model 803, November, 1938.

CIRCUIT DESCRIPTION

Aerial input for manual tuning on MW and LW is via series condenser **C1,** image filter coil **L3** (LW only) and coupling coils **L2, L1** to mixed coupled band-pass filter. Primary coils **L4** and **L5** are tuned by **C36**; secondaries **L10** and **L11** by **C40**; coupling by coils **L7** (MW) and **L6** (LW), and condenser **C5.** Additional coupling between aerial and band-pass primary circuit by **C2** (MW) and **C3** (LW). On SW, input is via **C1** and coupling coil **L8** to single tuned circuit **L9, C40.**

For automatic tuning, **S1** closes to short **C1, S5** and **S17** close and **S18** opens. Input is then via rejector circuit **L28, C50** to potential divider comprising **C51** and **C4**; the voltage developed across **C4** is fed to the automatic tuning coils **L29** to **L32** (MW) and **L33, L34** (LW), which are tuned by **C6, C49.** Selection of the appropriate coil is effected by closing one of the switches **S41** to **S46,** according to which button is pressed.

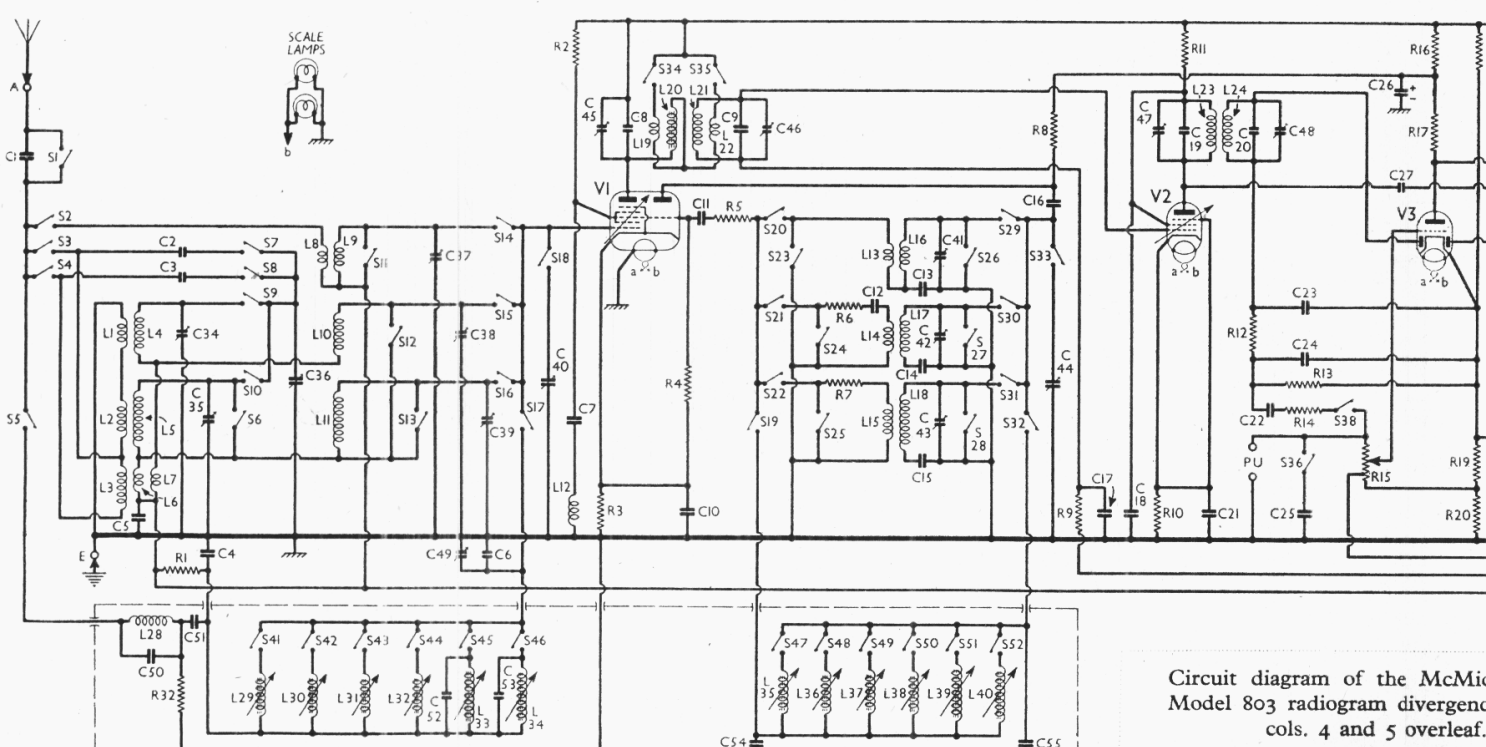
First valve (**V1, Mazda metallised AC/TH1**) is a triode pentode operating as frequency changer with internal coupling. For manual tuning, triode oscillator anode coils **L16** (SW), **L17** (MW) and **L18** (LW) are tuned by **C44**; parallel trimming by **C41** (SW), **C42** (MW) and **C43** (LW); series tracking by **C13** (SW), **C14** (MW) and **C15** (LW). Reaction by coils **L13** (SW), **L14** (MW) and **L15** (LW).

For automatic tuning, when **S19** and **S32** are closed and **S33** is open, one of the coils **L35** to **L40** is connected between control grid and anode of the oscillator via one of the switches **S47** to **S52** according to which button is depressed. Tuning by fixed condensers **C54** and **C55.**

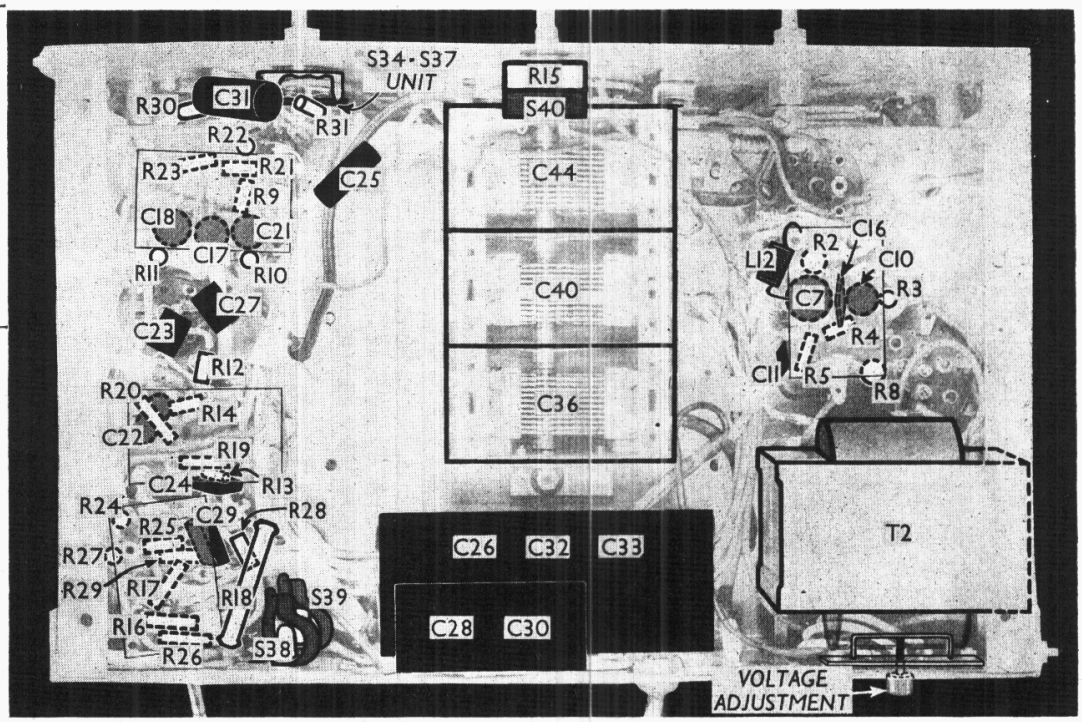
Second valve (**V2, Mazda metallised AC VP2**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C45, L19, L20, L21, L22, C46** and **C47, L23, L24, C48.** Arrangements are made to vary the band-width to which the first IF transformer will respond: in the "Fidelity" position of the tone control **S34** opens and **S35** closes, so that **L22,** instead of **L19,** is in series with **L20,** and the coupling is modified.

Intermediate frequency 465 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 load resistance **R13** and passed via AF coupling condenser **C22,** IF stopper **R14,** radio muting switch **S38** and manual volume control **R15** to CG of triode section, which operates as AF amplifier. IF filtering by **C23, R12, C24** and **R14.** Provision for connection of gramophone pick-up across **R15**; upon insertion of the special pick-up connector, **S38** opens



Circuit diagram of the McMic
Model 803 radiogram divergenc
cols. 4 and 5 overleaf.



Under-chassis view. Many of the components are beneath paxolin panels, and so are dotted in this view.

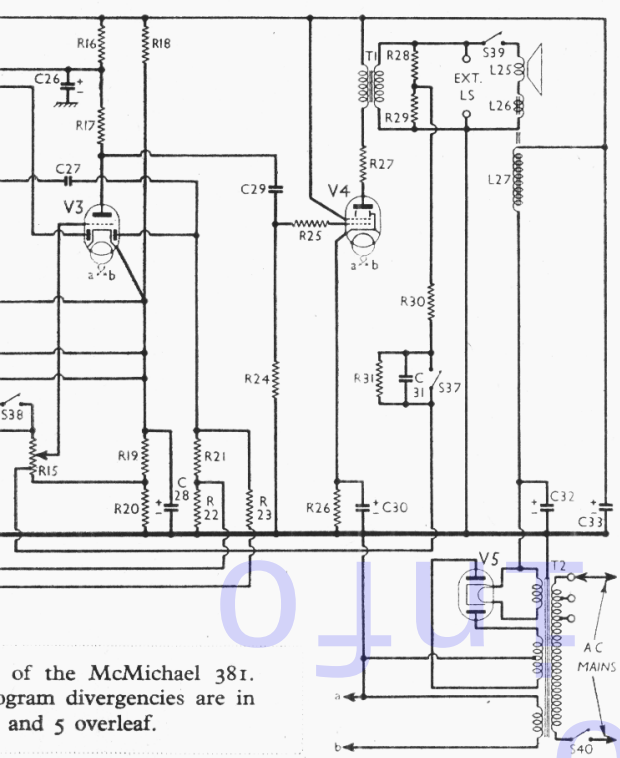
automatically to mute radio. In the "Bass" and "Foreign" positions of the tone control, **S36** closes to connect **C25** across **R15**.

Second diode of **V3**, fed from **V2** anode via **C27**, provides DC potentials which are developed across load resistances **R21** and **R22** and fed back through decoupling circuits as GB to FC (manual and automatic) and IF valves, giving automatic volume control. Delay voltage, together with triode GB, is obtained from potential divider **R18, R19** and **R20** across HT supply.

Resistance-capacity coupling by **R17, C29** and **R24**, via grid stopper **R25**, between **V3** triode and beam tetrode output valve (**V4, Mazda AC/5 Pen**).

Provision by means of a special plug for connection of a low impedance external speaker across secondary of internal speaker input transformer **T1**; when this plug is fully inserted, **S39** opens to mute the internal speaker. Part of the output from **T1** is developed across potential divider **R28, R29**, that across **R29** being fed back via **R30** and **S37** (when **S37** is closed) to the tapping on **R15** and thus to **V3** triode control grid circuit. In the "High Fidelity" and "Bass" positions of the tone control, **S37** opens, and the feedback coupling is then modified by the inclusion of **R31, C31.**

HT current is supplied by IHC full-wave rectifying valve (**V5, Mazda UU4**). Smoothing by speaker field **L27** and dry electrolytic condensers **C32** and **C33.**



of the McMichael 381. ogram divergencies are in and 5 overleaf.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Part of auto aerial coupling	2,000
R2	V1 SG HT feed resistance	40,000
R3	V1 fixed GB resistance	250
R4	V1 osc. CG resistance	50,000
R5	V1 osc. CG stabiliser	150
R6	MW reaction damping	2,500
R7	LW reaction damping	5,500
R8	V1 osc. anode HT feed	40,000
R9	V2 CG decoupling	500,000
R10	V2 fixed GB resistance	200
R11	V2 anode HT feed	2,000
R12	IF stopper	50,000
R13	V3 signal diode load	200,000
R14	IF stopper	500,000
R15	Manual volume control	500,000*
R16	V1 osc. and V3 triode anodes decoupling	5,000
R17	V3 triode anode load	30,000
R18	V3 triode GB and AVC delay	60,000
R19	V3 triode GB and AVC delay potential divider	500
R20	V3 triode GB and AVC delay potential divider	1,000
R21	V3 AVC diode load resistances	500,000
R22	V3 AVC diode load resistances	500,000
R23	AVC line decoupling	500,000
R24	V4 CG resistance	500,000
R25	V4 CG stopper	50,000
R26	V4 GB resistance	180
R27	V4 anode stopper	50
R28	Negative feed-back potential divider	500
R29	Negative feed-back potential divider	300
R30	Negative feed-back coupling resistances	5,500
R31	Negative feed-back coupling resistances	200,000
R32	Auto aerial input shunt	10,000

* Tapped at 4,000 Ω from "earthy" end.

	CONDENSERS	Values (μF)
C1	Aerial series condenser	0·0002
C2	Aerial MW and LW coupling condensers	0·000007
C3	Aerial MW and LW coupling condensers	0·000012
C4	Part aerial coupling on auto.	0·002
C5	Part of band-pass coupling	0·2§
C6	Auto aerial circuit trimmer	0·000075
C7	V1 SG decoupling	0·1
C8	1st IF transformer fixed trimmers	0·00005
C9	1st IF transformer fixed trimmers	0·000135
C10	V1 cathode by-pass	0·1
C11	V1 osc. CG resistance	0·0001
C12	Osc. MW reaction series	0·0001
C13	Osc. circuit SW tracker	0·0035
C14	Osc. circuit MW tracker	0·000519
C15	Osc. circuit LW tracker	0·000164
C16	V1 osc. anode coupling	0·0001
C17	V2 CG decoupling	0·1
C18	V2 anode and SG decoupling	0·1
C19	2nd IF transformer fixed trimmers	0·00005
C20	2nd IF transformer fixed trimmers	0·00005
C21	V2 cathode by-pass	0·1
C22	AF coupling to V3 triode	0·005
C23	IF by-pass condensers	0·0001
C24	IF by-pass condensers	0·0001
C25	Tone control condenser	0·001
C26*	V1 osc. and V3 triode anodes decoupling	8·0
C27	Coupling to V3 AVC diode	0·0001
C28*	V3 cathode by-pass	50·0
C29	V3 triode to V4 AF coupling	0·01
C30*	V4 cathode by-pass	100·0
C31	Part neg. feed-back coupling	0·06
C32*	HT smoothing condensers	8·0
C33*	HT smoothing condensers	16·0
C34‡	Band-pass pri. MW trimmer	—
C35‡	Band-pass pri. LW trimmer	—
C36†	Band-pass pri. tuning	—
C37‡	Aerial circuit SW trimmer	—
C38‡	Band-pass sec. MW trimmer	—
C39‡	Band-pass sec. LW trimmer	—
C40†	SW aerial and band-pass secondary tuning	—
C41‡	Osc. circuit SW trimmer	—
C42‡	Osc. circuit MW trimmer	—
C43‡	Osc. circuit LW trimmer	—
C44†	Oscillator circuit tuning	—
C45‡	1st IF trans. pri. tuning	—
C46‡	1st IF trans. sec. tuning	—
C47‡	2nd IF trans. pri. tuning	—
C48‡	2nd IF trans. sec. tuning	—
C49‡	Auto aerial circuit tuning	—
C50	Part auto aerial filter	0·0007
C51	Part auto aerial coupling	0·02
C52	Auto aerial circuit LW fixed trimmers	0·000015
C53	Auto aerial circuit LW fixed trimmers	0·000015
C54	Auto oscillator circuit fixed tuning condensers	0·000714
C55	Auto oscillator circuit fixed tuning condensers	0·000212

* Electrolytic. † Variable. ‡ Pre-set.
§ Two 0·1 μF in parallel.

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	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial MW and LW coupling coils	3·7
L2		13·0
L3	Image filter coil	60·0
L4	Band-pass primary coils	1·9
L5		21·0
L6	Band-pass coupling coils	0·15
L7		1·9
L8	Aerial SW coupling coil	0·3
L9	Aerial SW tuning coil	Very low
L10	Band-pass secondary coils	1·9
L11		21·0
L12	V1 SG stabilising choke	Very low
L13	Oscillator SW reaction coil	0·3
L14	Oscillator MW reaction coil	3·5
L15	Oscillator LW reaction coil	4·6
L16	Osc. circuit SW tuning coil	0·1
L17	Osc. circuit MW tuning coil	2·3
L18	Osc. circuit LW tuning coil	9·0
L19	Variable selectivity coil	0·5
L20	1st IF trans. Pri.	5·5
L21	1st IF trans. Sec.	2·7
L22	Variable selectivity coil	1·0
L23	2nd IF trans. Pri.	14·0
L24	2nd IF trans. Sec.	14·0
L25	Speaker speech coil	2·3
L26	Hum neutralising coil	0·15
L27	Speaker field coil	900·0
L28	Auto aerial filter coil	2·0
L29	Aerial circuit automatic tuning coils	2·8
L30		3·2
L31		3·2
L32		10·0
L33		40·0
L34		50·0
L35	Oscillator circuit automatic tuning coils	3·5
L36		4·2
L37		4·2
L38		8·3
L39		14·0
L40		14·0
T1	Speaker input trans. Pri.	290·0
	Speaker input trans. Sec.	0·25
T2	Mains trans. Pri., total	21·0
	Mains trans. Heater sec.	0·05
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	250·0
S1-S33	Waveband and auto/manual change switches	—
S34-37	Tone control switches	—
S38	Radio muting switch	—
S39	Speaker muting switch	—
S40	Mains switch, ganged R15	—
S41-46	Aerial auto selector switches	—
S47-52	Oscillator auto selector switches	—

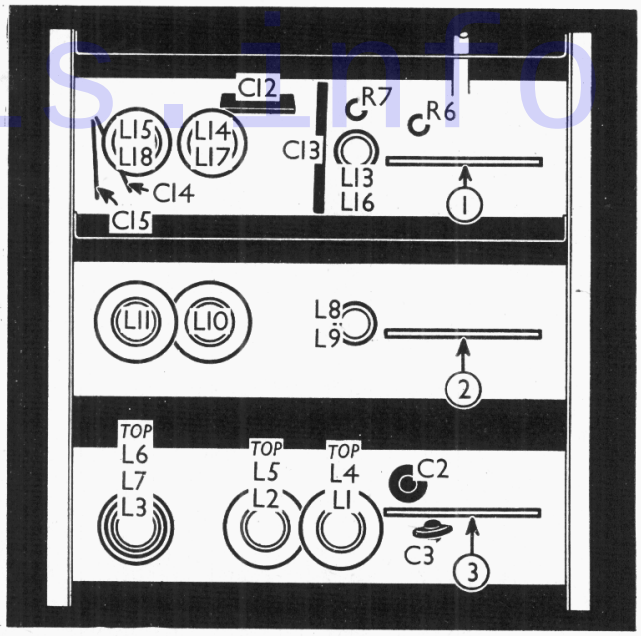
DISMANTLING THE SET

Removing Chassis.—The receiver consists of two units: the main chassis, which is in the larger compartment of the cabinet, and another unit comprising the speaker and press-button tuning unit.

A detachable bottom is fitted to the cabinet, upon removal of which access can be gained to the underside of the main chassis. To remove the main chassis, first remove the five control knobs and the four bolts (with large washers) holding the chassis to the bottom of the cabinet, and *when replacing*, note that the large washers are slipped between the detachable cover and the bottom of the cabinet. Now disconnect from the vertical paxolin strip on the speaker unit the six leads connecting the press-button unit to the chassis, and *when replacing*, connect them as follows, numbering from top to bottom: 1, yellow; 2, black systoflex; 3, black braided lead; 4, green braided lead; 5, blue; 6, red.

If the speaker leads are now freed from the cleats holding them to the cabinet the main chassis can be withdrawn to the extent of the speaker leads.

To free the chassis entirely, disconnect the six speaker leads from the horizontal paxolin strip at the top of the speaker unit, and *when replacing*, connect them as follows, numbering from left to right: 1, blue; 2, white; 3, green; 4, yellow; 5, red; 6, brown.



A drawing of the underside of the manual tuning unit on the chassis deck, as seen when this unit is removed and inverted. Diagrams of the three switch units are in col. 6.

Removing the Speaker and Press-button Unit.—Disconnect the twelve leads from the two paxolin strips and remove the five countersunk wood screws holding the sub-baffle to the front of the cabinet, when the whole unit, including the sub-baffle, can be withdrawn from the cabinet by easing it out top foremost.

Removing the Manual Tuning Unit.—This unit is the large structure on the chassis deck. Should it be necessary to remove the unit, first code the eight leads connecting it to the chassis, then unsolder them. Now disconnect the press-button leads from the speaker unit, and free them from the cleat on the chassis deck; loosen the screw in the boss on the switch spindle, between the unit and the scale assembly and remove the six nuts holding the unit to the chassis deck. The unit must now be lifted just clear of the chassis deck and eased away from the scale assembly so that the switch drive boss slips from the switch spindle, when the unit may be removed from the chassis.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 225 V, using the 220 V tapping on the mains transformer. 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.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 AC/TH1	250	2·4	80	4·0
	Oscillator			
	60	4·0		
V2 AC/VP2	222	11·0	222	2·8
V3 HL41DD	140	2·8	—	—
V4 AC5/Pen	236	42·0	250	6·3
V5 UU4	300†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S33** are the waveband and auto/manual change switches, in three rotary units ganged together inside the manual tuning unit on the chassis deck. They can only be inspected when this unit is detached from the chassis and inverted. A line sketch shows the disposition of the three switch units as seen under these conditions, and the units themselves are shown in the diagrams in col. 6. The table (col. 5) gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the spindle. A dash indicates open, and **C**, closed.

S34-S37 are the selectivity and tone switches, ganged in a single rotary unit beneath the main chassis, and indicated in our under-chassis view. A diagram of this unit, as seen from the rear of the underside of the chassis, is below, with a table of the switch positions in the four control settings, starting from fully anti-clockwise.

S34-S37 Switch Unit

Switch	Fidelity	Normal	Bass	Foreign
S34	—	C	C	C
S35	C	—	—	—
S36	—	—	C	C
S37	—	C	—	C

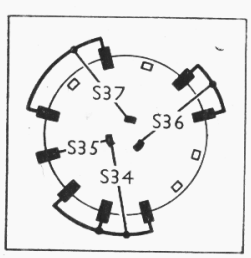


Diagram of the selectivity and tone switch unit.

S38 is the radio muting switch, of the jack type, at the rear of the chassis, associated with the pick-up sockets. When the pick-up plug is fully inserted, **S38** opens, thus muting radio. **S39** is a similar switch, also at the rear of the chassis, for muting the internal speaker. When the external speaker plug is fully inserted, **S39** opens, and disconnects the internal speaker speech coil circuit.

S40 is the QMB mains switch, ganged with the volume control **R15.**

S41-S52 are the aerial and oscillator auto-selector switches, in a press-button unit mounted beneath the speaker. There are six press-buttons, each controlling two switches, one aerial and one oscillator. Thus the left-hand button in our view of the auto-unit controls **S41** and **S47,** while the right hand one controls **S46** and **S52.** The tags of all the switches are identified in this view.

When a button is depressed, its associated switches close, while the remainder are open.

Coils.—**L1-L11** and **L13-L18** are in nine tubular units inside the manual tuning unit on the main chassis deck. They are indicated in the line sketch of the inside of this unit. **L12** is a small self-supporting coil beneath the chassis.

The first IF transformer **L19-L22** and the second IF transformer **L23, L24,** are in two screened units on the chassis deck, with their fixed and pre-set trimmers.

L28 is a filter coil on a wooden former beneath the auto-coil assembly. **L29-L34** are the aerial auto-coils, while **L35-L40** are the oscillator auto-coils, in pairs on six formers mounted on the press-button switch assembly. They all have variable iron cores ; the cores of each aerial coil and its associated oscillator coil are ganged, so that one adjusting screw varies both simultaneously.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-4 O) external speaker. Full insertion of its 2-pin plug causes **S39** to open, and mute the internal speaker.

Scale Lamps.—These are two Ever Ready MES types, rated at 6.2 V, 0·3 A.

Condensers C26, C32 and C33.—These are three dry electrolytics in a single carton beneath the chassis, having a common negative (black) lead. The yellow lead is the positive of **C26** (8μF), the red lead is the positive of **C32** (8μF), and the blue lead is the positive of **C33** (16μF).

Condensers C28, C30.—These are two dry electrolytics (15 V surge) in a smaller unit beneath the chassis, with a common negative (black) lead. The red lead is the positive of **C28** (50μF) and the yellow the positive of **C30** (100μF).

Speaker and Auto Unit.—Note that a number of components are mounted on the wooden panel at the back of the speaker, their positions being indicated roughly in our view of the speaker and auto-tuning unit.

Condenser C5.—Note that this consists of two 0·1μF tubular condensers wired in parallel, but separated physically. They are indicated in our plan chassis view.

Resistance R5.—This is shown as 100 O in the makers' diagram, but was 150 O in our chassis.

Coil L12.—The correct position in the circuit for this is as shown in our diagram. The wiring of it may be slightly different in some early chassis.

IF Transformer L23, L24.—The secondary of this is shown untuned in the makers' diagram, but in practice it is tuned.

AUTO-TUNING ADJUSTMENTS

Looking at the front of the receiver, the buttons, from left to right, cover the following wavebands : 1, 1,400-1,880 m ; 2, 1,200-1,550 m ; 3, 350-550 m ; 4, 250-380 m ; 5, 250-380 m ; 6, 200-300 m.

There is only one screw adjustment for each button, as the aerial and oscillator coil cores are ganged. Turning a screw clockwise reduces the wavelength, and vice-versa.

RADIOGRAM MODEL 803

In the main, the table radiogram model 803 has a chassis similar to that of the model 381, with the important difference that the auto-tuning system is omitted. This, of course, means that all the components beneath the chassis line on the left of our diagram are omitted, and it also leaves the first (Selector) position of the wavechange switch free. The position is then used for gram. switching.

Switch **S1** remains ; **S5** is omitted ; **S17** returns, via a 2,000 O resistor, to chassis ; **S19** returns to chassis ; **S32** returns to chassis ; and extra switches are included which, on the three radio positions connect **R14** to the top of **R15**, while in the gram position they break this connection, and connect the top of **R15** to the high potential end of the pick-up circuit.

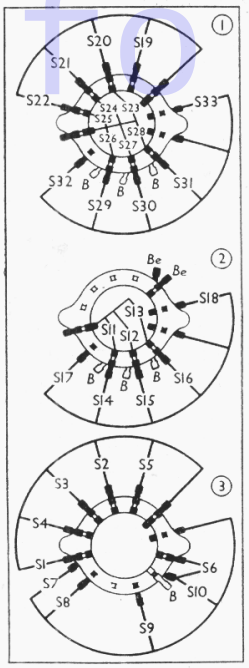
The pick-up is shunted by a 10,000 O resistor and a 0·003μF condenser in series, the junction of the pick-up and condenser going to chassis. The junction of the resistor and condenser go, via a 60,000 O resistor and one of the radio/gram switches to the top of **R15**, as mentioned above.

The motor and pick-up unit fitted is a Garrard AC7A.

TABLE AND DIAGRAMS OF THE SWITCH UNITS

Switch	Selector (Auto)	SW	MW	LW
S1	C	—	—	—
S2	—	C	—	—
S3	—	—	C	—
S4	—	—	—	C
S5	C	—	—	—
S6	—	—	C	—
S7	—	—	C	—
S8	C	—	—	C
S9	—	—	C	—
S10	—	—	—	C
S11	C	—	—	—
S12	—	C	—	—
S13	—	—	C	—
S14	—	C	—	—
S15	—	—	C	—
S16	—	—	—	C
S17	C	—	—	—
S18	—	C	C	C
S19	C	—	—	—
S20	—	C	—	—
S21	—	—	C	—
S22	—	—	—	C
S23	C	—	—	—
S24	—	C	—	—
S25	—	—	C	—
S26	C	—	—	—
S27	—	C	—	—
S28	—	—	C	—
S29	—	C	—	—
S30	—	—	C	—
S31	—	—	—	C
S32	C	—	—	—
S33	—	C	C	C

Diagrams of the wave-change and auto/manual change switches, as seen from the rear of the underside of the manual tuning unit on the chassis deck.



SW.—Switch set to SW, tune to a point mid-way between the top of the SW calibration mark (19 m) and the centre of the 20 m mark. Feed in a 19 5 m (15·3 MC/S) signal, and adjust **C41**, then **C37**, for maximum output.

MW.—Switch set to MW, and tune to 214 m on scale. Feed in a 214 m (1,400 KC/S) signal, and adjust **C42**, then **C38** and **C34**, for maximum output.

LW.—Switch set to LW, and tune to 1,100 m on scale. Feed in a 1,100 m (272·5 KC/S) signal, and adjust **C43**, then **C39** and **C35**, for maximum output.

Press-Button Alignment.—Before the press-buttons are adjusted to the various wavelengths it is essentia that **C49** is adjusted correctly.

The first procedure is to screw the adjustments on all auto-coils in a clockwise direction as far as possible so that all coils are now tuned to minimum wavelength.

Feed a signal of 1,400 KC/S (214 m) into the **A** and **E** sockets. Push in the button on the extreme right, that is the one covering the highest frequency or lowest wavelength, and adjust **C49** for maximum signal strength to 1,400 KC/S, the switch on the receiver being adjusted to the selector (auto) position.

Having carried out this one adjustment on the aerial trimmer condenser, the press-buttons can be adjusted in the usual way, rotating the adjusting screws for the required signal.

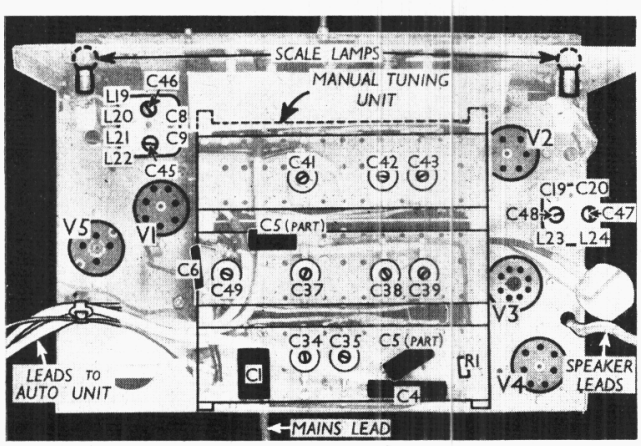
CIRCUIT ALIGNMENT

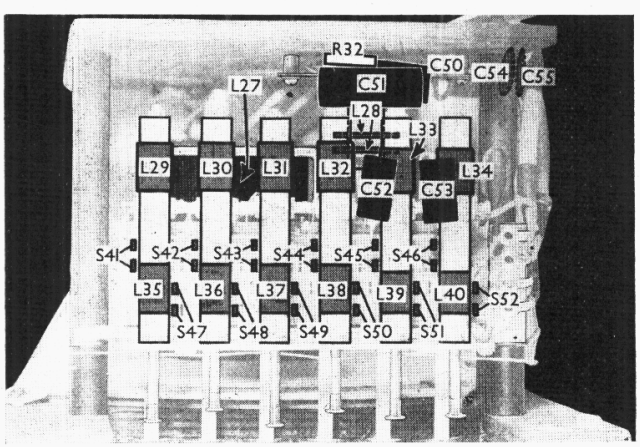
IF Stages.—Connect signal generator to control grid (top cap) of **V1** and chassis, and feed in a 465 KC/S signal. Adjust **C45, C46, C47** and **C48** in turn for maximum output. Re-check these settings.

RF and Oscillator Stages.—The first procedure is to set the glass scale correctly in alignment with the metal backing plate. This is done by noticing that the two red rings at the side of the wave-change indicator and tone control indicator are coincident with the holes in the metal backing plate. This is important. Do not adjust the scale by paying any attention to the wave-change and tone control indicator lettering, but only to the two holes mentioned above.

Next, turn the variable condenser to mechanical maximum and see that the bottom edges of the three pointers are in line with the marks at the extreme bottom of the wavelength scale.

Connect signal generator, via a suitable dummy aerial, to the **A** and **E** socket.





Left, plan view of the chassis. *Right*, view of the press-button unit, showing the switches and coils. Each pair of coils has a single core adjustment.