'TRADER' SERVICE SHEETS *NUMBER TWENTY - EIGHT (VOLUME TWO)*

McMICHAEL A.C. SUPERHET

McMICHAEL'S 1934-5 A.C. superheterodyne receiver employs a 4-valve circuit with several somewhat unconventional features. The frequency-changer is of the triode-pentode type, while the I.F. amplifier is a variable-mu tetrode, the intermediates being iron-cored transformers tuned to 408 KC/S. A double diode triode gives diode detection, A.V.C., and L.F. amplification in the usual way, and the output valve is a power pentode. High-tension current is supplied by a Westinghouse rectifier.

CIRCUIT DESCRIPTION

Aerial input by way of fixed series condenser **C1** and single-pole change-over switch **S1** to M.W. coupling coil **L3.** Single tuned circuit **L4, L5, C26.** Special filter coils **L1, L2** in aerial circuit. First valve (**V1, Mazda metallised AC/TP**) is a triode-pentode functioning as frequency-changer with cathode injection. Variable-mu pentode section operates as first detector, while triode forms separate oscillator with anode coils **L8, L9** tuned by **C30,** and coupling coils **L6, L7** in common cathode circuit. **R4** is a stopping resistance inserted in the oscillator grid circuit to suppress harmonics.

One variable-mu tetrode intermediate frequency amplifier (**V2, Mazda metallised AC/SGVM**) with tuned-primary tuned-secondary iron - cored transformer couplings **L10, L11** and **L12, L13. I.F. 406-410 KC/S.**

Diode second detector forming part of double diode triode (**V3, Mazda metallised AC/HL.DD**). Second diode develops steady potential across **R16** which is fed back by way of decoupling circuits as G.B. to frequency-changer and I.F. amplifier to give automatic volume control. L.F. output from rectifier diode s developed across **R11** and passed by way of radio-gramophone switch **S5,** coupling condenser **C12,** and manual volume control **R13** to grid of triode section which operates as first L.F. amplifier. Provision for connection of gramophone pick-up across **R13.** Tone control filter **C11** and **R12** in grid circuit of **V3.**

Resistance-capacity coupling to output pentode (**V4, Mazda AC/Pen**). Fixed tone correcting condenser **C18,** and voltage-limiting filter **C17, R18** in anode circuit. Provision for connection of external high-resistance speaker, and for cutting out internal speaker by switch **S7.**

H.T. current supplied by Westinghouse metal rectifier working on voltage-doubler system with electrolytic condensers **C21** and **C22.** Smoothing by speaker field winding **L16** and electrolytic condensers **C20** and **C23.** Mains disturbance by-passes **C24, C25** in primary circuit of transformer.

DISMANTLING THE SET

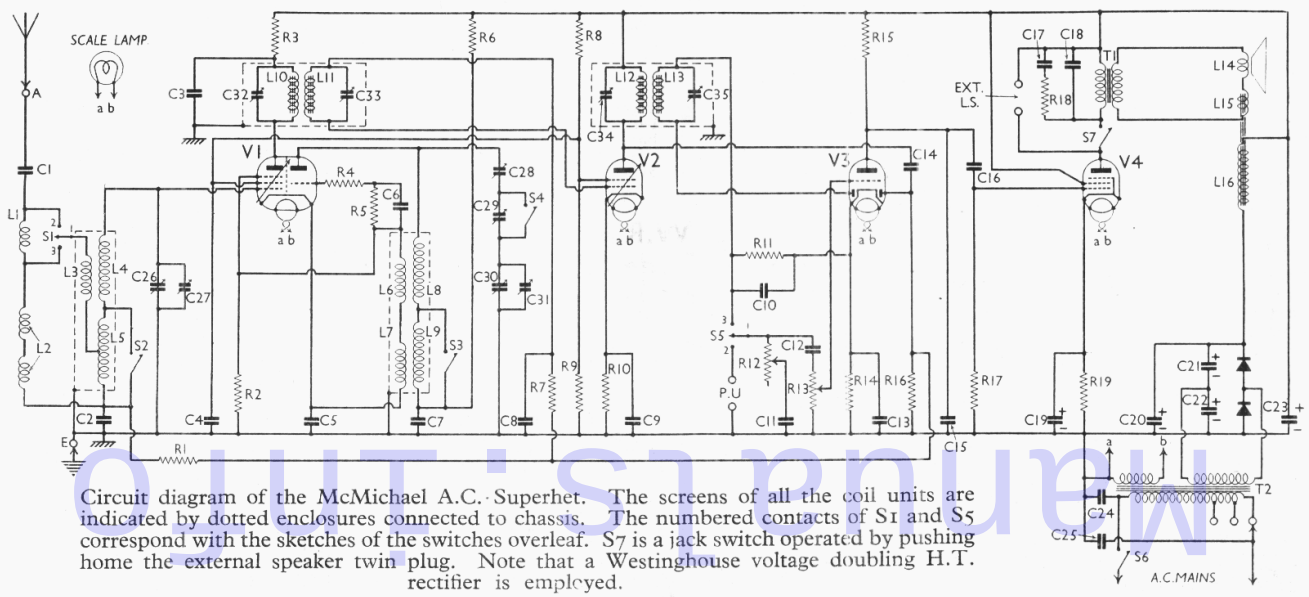
Removing Chassis.—Remove knobs. Those on the left and right at the top have grub screws. The third (bottom centre) has an axial screw at the front. *When replacing* do not forget the spring washer behind this lever knob. The lever portion should be at the top. After removal of the knobs, free the speaker lead from the two clips on the side of the cabinet. Undo the three screws and washers from underside of base of cabinet. Chassis can now be withdrawn sufficiently for most service needs. To remove it entirely, unsolder the four flexible leads of the speaker cable from the tags on the speaker input transformer. These wires are colour-coded, and the speaker tags are marked F, 1, 4, F. The wires are connected as follows: F, red; 1, green; 4, blue; F, black. In addition, the first F and tag 1 are joined by a wire link.

Removing Speaker.—If this becomes necessary, remove the four clips holding the speaker to its sub-baffle. Each is held by a single slotted screw. It is not possible to remove the sub-baffle.

COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	V1 cont. grid decoupling ..	500,000
R2	V1 fixed G.B. resistance ..	2,000
R3	V1 pent. anode decoupling ..	10,000
R4	V1 harmonic suppressor ..	2,000
R5	V1 triode grid resistance ..	50,000
R6	V1 osc. anode decoupling ..	50,000
R7	V2 cont. grid decoupling ..	500,000
R8	V1 and V2 S.G.'s pot. divider	20,000
R9		20,000
R10	V2 fixed G.B. resistance ..	500
R11	Rectifier diode load	1,000,000
R12	Tone control, variable	500,000
R13	Manual volume control, variable	500,000
R14	V3 G.B. resistance	500
R15	V3 anode resistance	100,000
R16	A.V.C. diode load	2,000,000
R17	V4 grid resistance	500,000
R18	Part of voltage-limiting circuit	10,000
R19	V4 G.B. resistance	500

(*Continued overleaf*)



Circuit diagram of the McMichael A.C. Superhet. The screens of all the coil units are indicated by dotted enclosures connected to chassis. The numbered contacts of S1 and S5 correspond with the sketches of the switches overleaf. S7 is a jack switch operated by pushing home the external speaker twin plug. Note that a Westinghouse voltage doubling H.T. rectifier is employed.

McMICHAEL A.C. SUPERHET (continued)

	Condensers	Values (μF)
C1	Aerial series condenser	0·0002
C2	V1 cont. grid decoupling	0·1
C3	V1 pent. anode decoupling	0·1
C4	V1 and V2 S.G.'s by-pass	0·1
C5	V1 cathode by-pass	0·0002
C6	V1 triode grid condenser	0·0002
C7	V1 osc. anode decoupling	0·1
C8	V2 cont. grid decoupling	0·1
C9	V2 cathode by-pass	0·1
C10	Rectifier diode reservoir	0·0001
C11	Tone control condenser	0·01
C12	L.F. coupling to V3	0·1
C13	V3 cathode by-pass	0·5
C14	A.V.C. diode coupling	0·0001
C15	V3 anode H.F. by-pass	0·001
C16	L.F. coupling to V4	0·01
C17	Part of voltage-limiting circuit	0·01
C18	Fixed tone corrector	0·002
C19	V4 cathode by-pass, electrolytic	25.0
C20	H.T. smoothing, electrolytic	8·0
C21	Voltage-doubler condensers, electrolytic	4·0
C22		4.0
C23	H.T. smoothing, electrolytic	8.0
C24	Mains H.F. by-passes	0·002
C25		0·002
C26	Aerial circuit tuning	—
C27	Aerial circuit trimmer, pre-set	—
C28	Osc. M.W. tracker, pre-set	—
C29	Osc. L.W. tracker, pre-set	—
C30	Oscillator tuning	—
C31	Oscillator trimmer, pre-set	—
C32	1st I.F. trans. pri. tuning	—
C33	1st I.F. trans. sec. tuning	—
C34	2nd I.F. trans. pri. tuning	—
C35	2nd I.F. trans. sec. tuning	—

	Other Components	Values (ohms)
L1	Aerial filter coils	19·0
L2		30.0
L3	M.W. aerial coupling coil	0·55
L4	Aerial tuning coils	2·75
L5		16·0

	Other Components (*contd.*)		Values (ohms)
L6	Oscillator coupling coils		0·15
L7			
L8	Oscillator anode tuning coils		1·75
L9			7·0
L10	1st I.F. transformer	Pri.	2·3
L11		Sec.	2·3
L12	2nd I.F. transformer	Pri.	2·3
L13		Sec.	2·3
L14	Speaker speech coil		1·7
L15	Hum neutralising coil		0·1
L16	Speaker field winding		2500·0
T1	Speaker input trans.	Pri.	360·0
		Sec.	0·25
T2	Mains trans.	Pri. total	36·0
		Heater sec.	0·1
		H.T. sec.	60·0
S1-S4	Waveband switches, ganged		—
S5	Radio-gramophone switch		—
S6	Mains switch (ganged R13)		—
S7	Internal speaker switch		—

VALVE ANALYSIS

The voltage and current readings given in the table below were obtained from a representative chassis working with no aerial or earth connected. All voltages were measured on the 1,200 V scale of an Avometer with the chassis as negative.

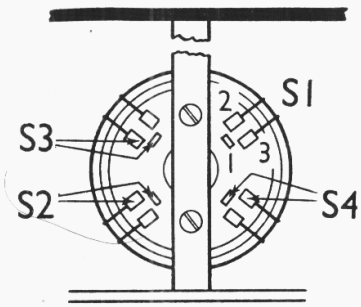
The anode and screen currents were taken, where necessary, with a milli-ammeter inserted in the low H.F. potential ends of the circuits to avoid instability.

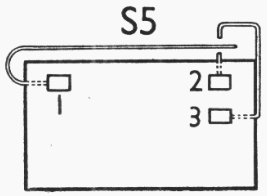
Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 AC/TP*	210	1·5	100	0·55
V2 AC/SG.VM	240	9·0	100	0·75
V3 AC/HL.DD	70	1·5	—	—
V4 AC/Pen	230	25·0	240	4·5

* Osc. anode (triode) 120 V 1·5 mA.

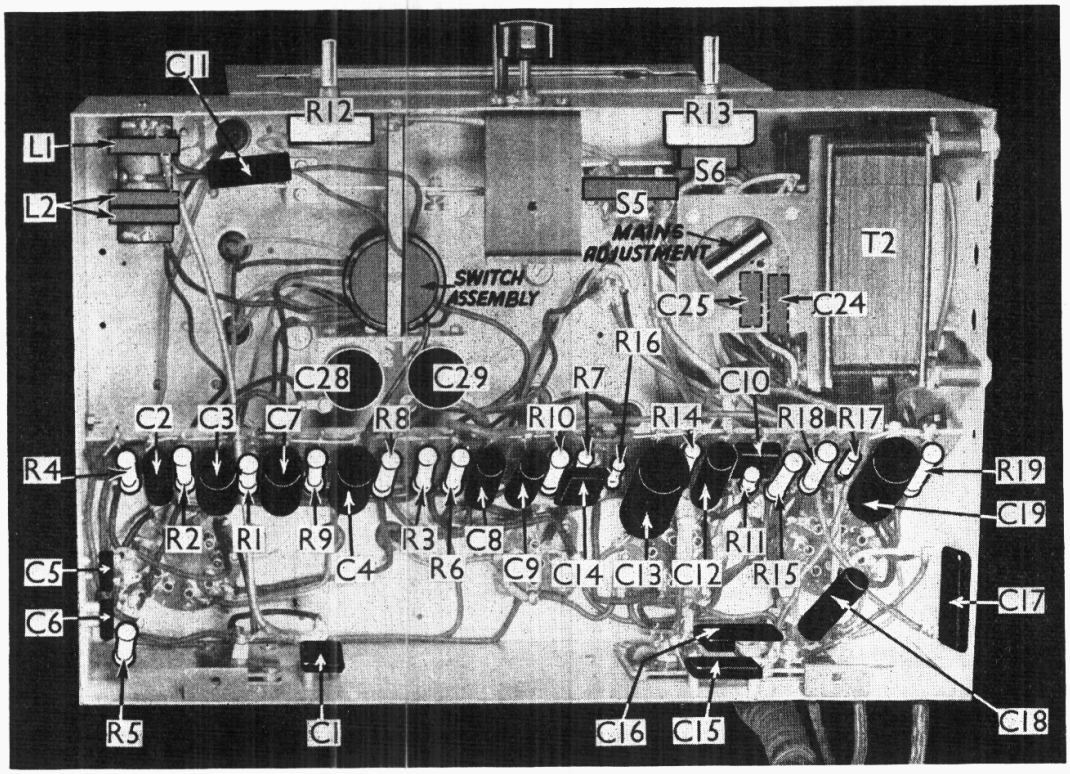
GENERAL NOTES

Switches.—The waveband switches, **S1-S4**, are in a single circular assembly indicated in the under-chassis view, and also shown in detail in a separate sketch. This assembly is operated by a rotary motion imparted by a system of links and bars working from the switch lever. The rotation of the lower part of the assembly causes flat spring contacts to press against one or other of the fixed

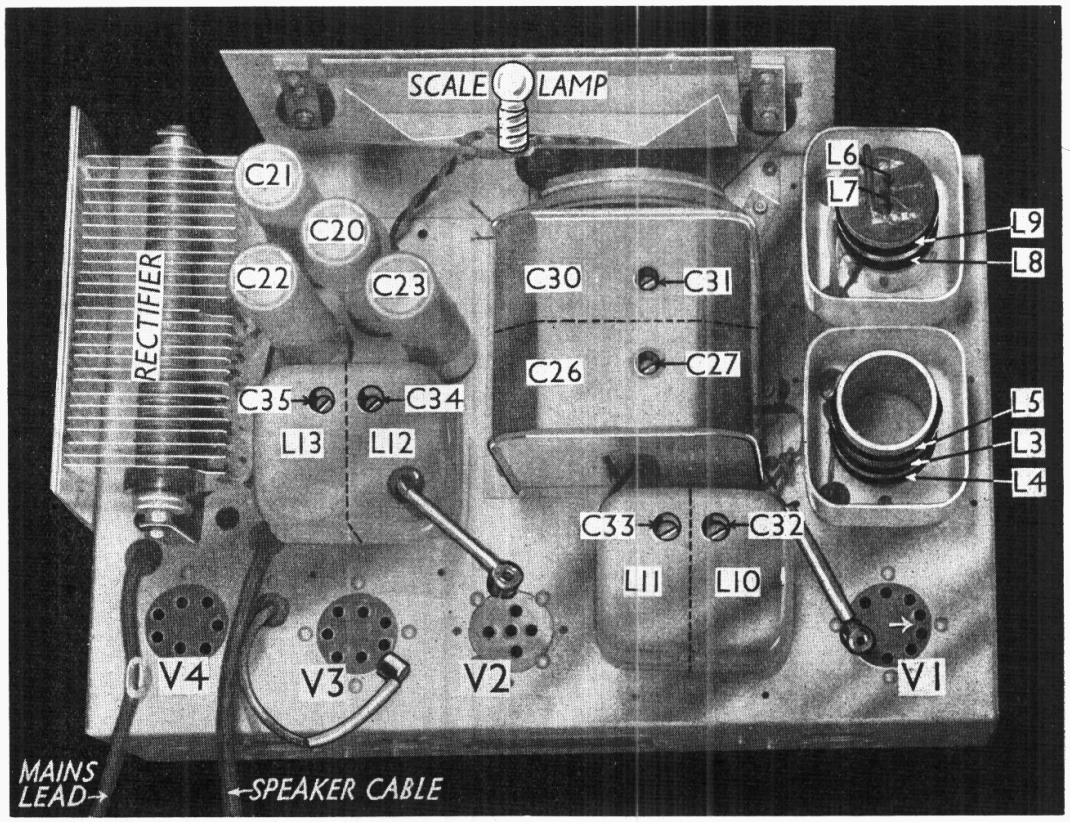




Above: a plan view of the wavechange switch assembly, seen from the underside of chassis. The thick line represents the front of the chassis. S1 has three numbered contacts, while in the case of S2, S3, S4, the two contacts of each are indicated. *Below:* a side view of S5, the radio-gram switch, with its three contacts numbered.



Under-chassis view. The wavechange switch assembly and S5 are shown in a separate sketch in col. 3 of this page. C24 and C25 are hidden beneath the mains adjustment panel. C28 and C29 are the pre-set oscillator tracking condensers. L1 and L2 form the aerial filter circuit.



Plan view of the chassis. The lids of the screens of the aerial and oscillator coil units have been removed. L6 and L7 are beneath the ebonite disc closing the top of the coil former of the oscillator unit. L3 is wound over L4. The positions of the I.F. coils in each unit are indicated by their numbers on the cans.

contacts inset into the upper part of the assembly. Each of the switches has three contacts, two fixed and one moving, but except in the case of **S1**, only one fixed contact and the moving contact are employed. The actual contacts used are shown in the sketch.

In the case of **S2, S3** and **S4,** the contacts used are *closed* on the M.W. band and *open* on the L.W. band. The three contacts of **S1** are numbered in the sketch and the circuit diagram. Contacts 1 and 2 are *closed* on the M.W. band, and *open* on the L.W., while contacts 1 and 3 are *closed* on the L.W. band and *open* on the M.W.

S5 is the radio-gramophone switch, ganged with the wave-change assembly by means of a horizontally moving bar. The switch is indicated in the under-chassis view and a side view of it is given in a separate sketch. The switch is of the S.P.C.O. type, with a moving contact (1) and two fixed contacts (2 and 3). These numbers are marked in the sketch and the circuit diagram. Contacts 1 and 3 are closed on radio, while contacts 1 and 2 are closed on gramophone.

S6 is the mains switch, ganged with the volume control **R13.**

S7 is a jack switch, fitted at the back of the extra loud-speaker sockets. This is arranged so that it only operates when the external speaker twin plug is pushed right home. Partial insertion of the plug merely places the external speaker in parallel with the internal one. When the plug is pushed right in, however, the jack opens, disconnecting the internal speaker, but leaving the external one in use.

Coils.—The aerial filter, **L1, L2,** is seen in the under-chassis view, but the remaining coils are in screened cans mounted on top of the chassis, as seen in the plan view. The aerial and oscillator coils, **L3, L4, L5** and **L6, L7, L8, L9,** are in separate cans, of which the covers have been removed in our plan view. Note that **L3** is wound over **L4.** In the other unit, **L6** and **L7** are beneath the ebonite disc which closes the top of the cylindrical former.

In the case of the I.F. coil units, the primary and secondary windings are on separate formers, and their positions are indicated by the numbers on the covers of the screening cans.

Oscillator Trackers, C28, C29.—These are circular pre-set condensers, adjustable from the underside of the chassis by means of hexagonal nuts.

Valve Connections.—Base connections of valves **V1, V3, V4,** have been given in previous service sheets, as follow:—**V1,** Sheet No. 19, p. 13, col. 2, L.H. diagram. **V3** and **V4,** Sheet No. 13, p. 35, col. 2, R.H. and L.H. diagrams.

Scale Lamp.—This is of the M.E.S. type, and is rated at 4.0 V, 0.3 A. The lamp-holder clips on to the reflector at the back of the scale, and can be detached by moving it sideways to the left.

Condenser C21.—This is an electrolytic condenser forming part of the voltage doubler circuit, and is the only one of the four, **C20-C23,** which is insulated from the chassis. This point should be remembered if it becomes necessary to replace **C21.**

Loose Tags.—Several of the connections underneath the chassis are made to soldering tags held by nuts and bolts to the components. Make certain that none of these has worked loose, otherwise crackling noises may be set up.

CIRCUIT ALIGNMENT

I.F. Adjustments.—The I.F. transformers are tuned to a frequency between 406 and 410 KC/S. When re-tuning, it is satisfactory to set the modulated oscillator at 408 KC/S. The two output leads of the oscillator should be connected to the top cap of **V1** and chassis, and an output meter should be connected to the output of the receiver. Switch on the receiver, set wave-change switch to long waves, and volume control to maximum. Adjust oscillator attenuator to give about a half-scale reading on the output meter.

Now carefully adjust the four I.F. trimmers in the order **C35, C34, C33, C32,** in each case tuning for maximum deflection of the output meter. After **C32** has been adjusted, return to **C35,** and attempt to improve the output by very slight re-adjustment.

H.F. and Oscillator Adjustments.—Feed a signal from the test oscillator to the aerial and earth terminals of the receiver. Set the test oscillator to 500 metres, and switch the receiver to the M.W. band, tuning it to 500 metres on the scale. Now adjust **C28** for maximum output. Set oscillator to 210 metres, tune receiver to this wavelength on the scale, and adjust **C31** for maximum output. Next adjust **C27,** also for maximum output.

Switch receiver to the L.W. band, set signal generator to a wavelength towards the top of the L.W. band, say 1,800 metres, and tune the receiver to this signal. Adjust **C29** for maximum output.