

# McMICHAEL 372

## 3-BAND A.C. SUPERHET

**A**N unusual feature of the design of the McMichael 372 3-band A.C. superhet is that the R.F. amplifier is employed on short waves only, the valve arrangement comprising a variable-mu pentode R.F. amplifier (S.W. only), a triode-hexode frequency changer, a variable-mu pentode I.F. amplifier, a double diode and a pentode output valve.

The receiver is suitable for mains of 200-260 V, 40-100 C/S, and includes a cathode ray tuning indicator and provision for a gramophone pick-up and an extension speaker, a jack switch allowing the internal speaker to be cut out.

### CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via coupling components **C2**, **C3**, **L2** to inductively coupled band-pass filter. Primary coils **L4**, **L5** are tuned by **C30**; secondaries **L7**, **L8** by **C33**. Image suppression by **L6**. Output from band-pass filter is taken directly to second valve (**V2**, Mazda metallised AC/TH1), a triode hexode operating as frequency changer with internal coupling.

On S.W., however, aerial input is via **C1** and coupling coil **L1** to single-tuned circuit **L3**, **C30**, which precedes a pentode R.F. amplifying valve (**V1**, Mazda metallised AC/VP2), which in turn precedes **V2**, coupling being effected by tuned-secondary R.F. transformer **L9**, **L10** tuned by **C33**.

**V2** triode oscillator anode coils **L14** (S.W.), **L15** (M.W.) and **L16** (L.W.) are tuned by **C36**; parallel trimming by **C34** (M.W.) and **C35** (L.W.); series tracking by **C12** (M.W.), **C13** (L.W.), and specially shaped vanes of **C36**. Reaction by **L11** (S.W.), **L12** (M.W.) and **L13** (L.W.).

Third valve (**V3**, Mazda metallised AC/VP2) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C37**, **L17**, **L18**, **C38** and **C39**, **L19**, **L20**, **C40**.

### Intermediate frequency 128.5 KC/S.

Diode second detector is part of separate double diode valve (**V4**, Mazda **V914**). Audio frequency component in rectified output is developed across load resistance **R18** and passed via A.F. coupling condenser **C18**, switch **S20**, manual volume control **R24** and stopper resistance **R25** to C.G. of pentode output valve (**V5**, Mazda AC/2 Pen). Fixed tone correction by **C21** and variable tone control by **C22**, **R29** in anode circuit.

Provision for connection of low impedance external speaker across secondary of internal speakers input transformer **T1**. Switch **S21** is opened by fully inserting connecting plug, muting internal speakers. Provision, by means of a second connecting plug, for connection of gramophone pick-up across **R24**; when this plug is fully inserted **S20** opens, muting radio.

Second diode of **V4**, fed via **C16** from **V3** anode, provides D.C. potentials which are developed across load resistances **R22**, **R23** and fed back through decoupling circuits as G.B. to F.C. (except on S.W.) and I.F. valves, giving A.V.C.

Operating potential for cathode ray tuning indicator (**T.I.**, Mullard **TV4**) is obtained from potential divider **R19**, **R20** across **R18**.

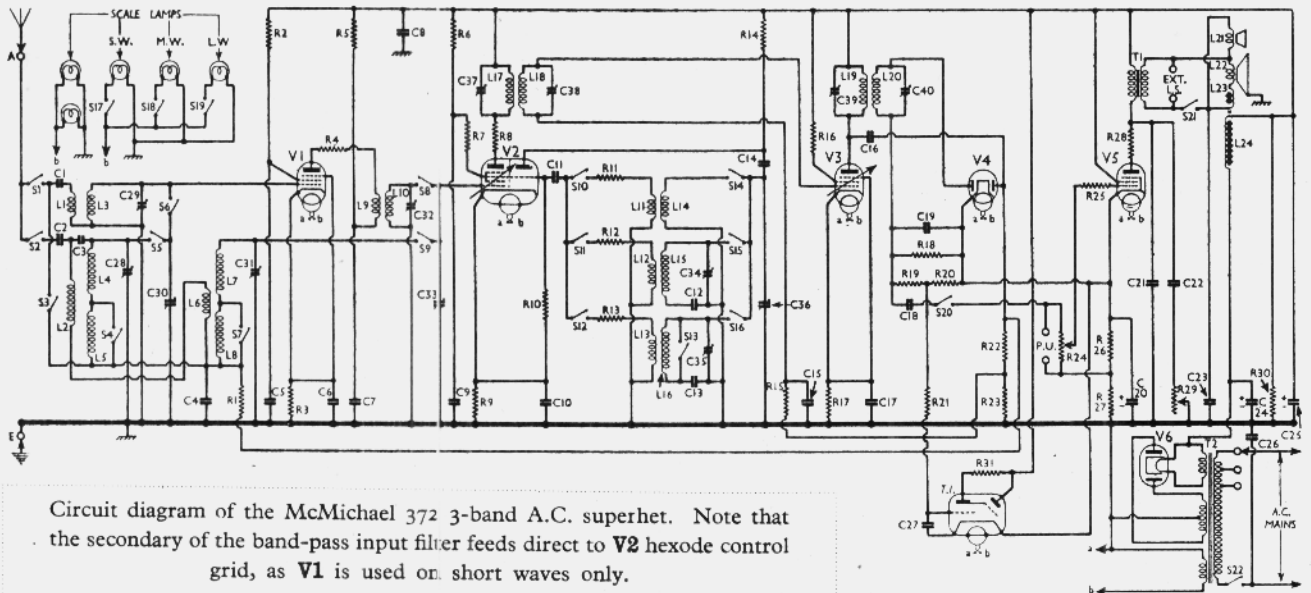
H.T. current is supplied by I.H.C. full-wave rectifying valve (**V6**, Mazda **UU4**). Smoothing by speaker field **L24**

and dry electrolytic condensers **C24**, **C25**. H.T. circuit R.F. filtering by **C8**. Mains R.F. filtering by **C26**.

### COMPONENTS AND VALUES

CONDENSERS		Value (μF)
C1	Aerial S.W. series condenser	0.00005
C2	Aerial M.W. and L.W. couplings	0.0002
C3	couplings	0.00001
C4	V2 hex. C.G. decoupling	0.5
C5	V1 S.G. decoupling	0.1
C6	V1 cathode by-pass	0.1
C7	V1 anode decoupling	0.0002
C8	H.T. circuit R.F. by-pass	0.002
C9	V2 S.G. decoupling	0.1
C10	V2 cathode by-pass	0.1
C11	V2 osc. C.G. condenser	0.0001
C12	Osc. circuit M.W. tracker	0.00223
C13	Osc. circuit L.W. tracker	0.000719
C14	V2 osc. anode coupling	0.0001
C15	V3 C.G. decoupling	0.1
C16	Coupling to V4 A.V.C. diode.	0.0001
C17	V3 cathode by-pass	0.1
C18	A.F. coupling to V5	0.005
C19	I.F. by-pass	0.0001
C20*	V5 cathode by-pass	25.0
C21	Fixed tone corrector	0.002
C22	Part of variable tone control	0.03
C23	Speech coils R.F. by-pass	0.01
C24*	H.T. smoothing	8.0
C25*	H.T. smoothing	8.0
C26	Mains R.F. by-pass	0.002
C27	T.I. C.G. decoupling	0.1
C28†	Band-pass pri. M.W. trimmer	—
C29†	Aerial circuit S.W. trimmer	—
C30†	Band-pass pri. and aerial S.W. tuning	—
C31†	Band-pass sec. M.W. trimmer	—
C32†	S.W. R.F. trans. sec. trimmer	—
C33†	Band-pass sec. and S.W. R.F. trans. sec. tuning	—
C34†	Osc. circuit M.W. trimmer	—
C35†	Osc. circuit L.W. trimmer	—
C36†	Oscillator circuit tuning	—
C37†	1st I.F. trans. pri. tuning	—
C38†	1st I.F. trans. sec. tuning	—
C39†	2nd I.F. trans. pri. tuning	—
C40†	2nd I.F. trans. sec. tuning	—

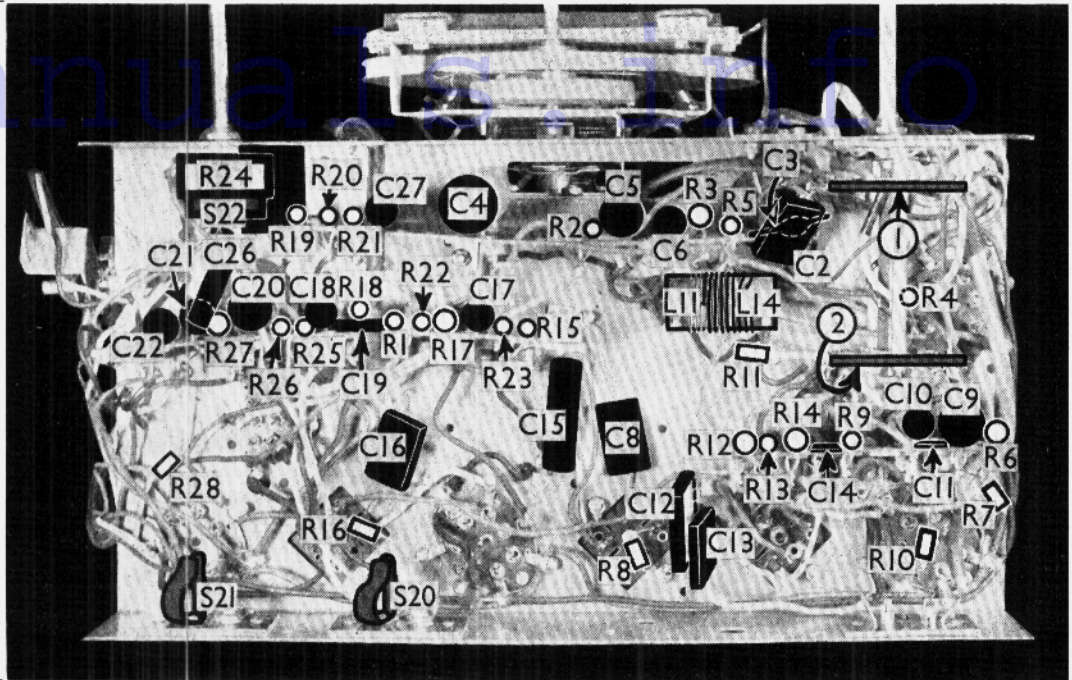
\* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the McMichael 372 3-band A.C. superhet. Note that the secondary of the band-pass input filter feeds direct to **V2** hexode control grid, as **V1** is used on short waves only.



Note the jack switches **S20**, **S21** mounted on the rear member of the chassis. Diagrams of the two switch units, drawn in the directions of the arrows marked here, are on page VIII. The numbers in circles correspond to those on the diagrams on that page.



RESISTANCES		Values (ohms)
R1	V2 hex. C.G. M.W. and L.W. decoupling ..	1,000,000
R2	V1 S.G. H.T. feed ..	200
R3	V1 G.B. resistance ..	750
R4	V1 anode circuit stabiliser ..	50
R5	V1 anode H.T. feed ..	1,000
R6	V2 S.G. H.T. feed ..	20,000
R7	V2 S.G. anti-parasitic resistance ..	40
R8	V2 hex. anode circuit stabiliser ..	50
R9	V2 hex. fixed G.B. resistance ..	250
R10	V2 osc. C.G. resistance ..	50,000
R11	Osc. circ. S.W. reaction stabiliser ..	50
R12	Osc. circ. M.W. reaction stabiliser ..	2,500
R13	Osc. circ. L.W. reaction stabiliser ..	5,000
R14	V1 osc. anode H.T. feed ..	40,000
R15	V3 C.G. decoupling ..	500,000
R16	V3 S.G. anti-parasitic resistance ..	40
R17	V3 fixed G.B. resistance ..	100
R18	V4 signal diode load ..	500,000
R19	Tuning indicator feed potential divider resistances ..	1,000,000
R20	T.I. C.G. decoupling ..	250,000
R21	V4 A.V.C. diode load resistances ..	1,000,000
R22	Manual volume control ..	500,000
R23	V5 grid stopper ..	500,000
R24	V5 G.B. and A.V.C. delay voltage resistances ..	100,000
R25	V5 anode stopper ..	150
R26	V5 anode stopper ..	500
R27	V5 anode stopper ..	50
R28	Variable tone control ..	100,000
R29	Voltage surge reducer ..	40,000
R30	T.I. anode H.T. feed ..	2,000,000

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial S.W. coupling coil ..	0.2
L2	Aerial M.W. and L.W. coupling coil ..	11.0
L3	Aerial S.W. tuning coil ..	0.05
L4	Band-pass primary coils ..	3.75
L5		11.0
L6	Image suppressor ..	0.42
L7	Band-pass secondary coils ..	3.4
L8		11.35
L9	S.W. R.F. trans. primary ..	0.25
L10	S.W. R.F. trans. secondary ..	0.08
L11	Osc. circuit S.W. reaction ..	6.0
L12	Osc. circuit M.W. reaction ..	2.5
L13	Osc. circuit L.W. reaction ..	4.3
L14	Osc. circuit S.W. tuning coil ..	0.1
L15	Osc. circuit M.W. tuning coil ..	3.0
L16	Osc. circuit L.W. tuning coil ..	13.75

OTHER COMPONENTS (Continued)		Approx. Values (ohms)	
L17	1st I.F. trans. { Pri. ..	63.0	
L18		Sec. ..	63.0
L19		Pri. ..	63.0
L20	2nd I.F. trans. { Pri. ..	63.0	
L21		Sec. ..	63.0
L22	P.M. speaker speech coil ..	3.2	
L23	Energised speaker speech coil ..	3.0	
L24	Hum neutralising coil ..	0.2	
T1	Speakers input trans. { Pri. ..	1,200.0	
	{ Sec. ..	460.0	
T2	Mains { Pri., total ..	0.25	
	{ Heater sec. ..	19.0	
	{ Rect. heat. sec. ..	0.05	
	{ H.T. sec., total ..	0.05	
S1-S16	Waveband switches ..	325.0	
S17-19	Scale lamp switches ..	—	
S20	Radio muting switch (Gram.) ..	—	
S21	Internal speakers switch ..	—	
S22	Mains switch, ganged R24 ..	—	

**DISMANTLING THE SET**

**Removing Chassis.**—If it is desired to remove the chassis from the cabinet, remove the knobs (pull off) and the felt washers from the three controls at the front of the cabinet, taking care not to lose the springs from the knobs, and remove the knob from the tone control at the side of the cabinet (grub screw accessible from the inside of the cabinet).

Now remove the four bolts (with washers) holding the chassis to the bottom of the cabinet, and the four screws (with nuts, two with washers) holding the power unit. Remove the bracket carrying the tone control (two round-head wood screws) and the holder for the tuning indicator (two knurled nuts and lock washers).

The chassis and power unit may now be withdrawn to the extent of the speaker leads, and if the cabinet is turned upside down, this will be sufficient for normal purposes. *When replacing*, see that the power unit is positioned so that **V6** is at the back and note that the two screws on the right should have their heads

upwards, with washers between the nuts and cabinet, while the screws on the left have their heads under the cabinet. Do not forget to replace the felt washers on the control spindles.

To free the chassis entirely, unsolder the leads from the chassis to the right-hand speaker and *when replacing*, connect them as follows, numbering the tags from bottom to top:—1, brown; 2, yellow; 3, blue; 4, green; 5, white; 6, red. The black lead goes to the soldering tag on the speaker frame.

**Removing Power Unit.**—To remove the power unit from the cabinet, remove the four screws (with nuts, two with washers) holding it to the bottom of the cabinet. *When replacing*, see the note above.

If the leads have been unsoldered, reconnect them as follows, numbering the tags from left to right:—1, green; 2, green; 3, brown; 4, black; 5, red; 6, red.

**Removing Speaker.**—If it is desired to remove either speaker, unsolder the leads, slacken the four clamps (four round-head wood screws) and swivel them out of the way. *When replacing the smaller speaker*, see that the soldering tags are on the right and take the green lead to the bottom tag and the white lead to the top tag.

*When replacing the larger speaker*, see that the transformer is on the left and connect the leads as follows, numbering the tags from bottom to top:—1, brown and one red lead from the electrolytic; 2, yellow; 3, blue; 4, green and green lead to the other speaker; 5, white, white lead to the other speaker and one end of **C23**; 6, red, the other red lead from the electrolytic and one end of **R30**. The black lead, the black lead from the electrolytic, the other end at **C23** and the other end of **R30** go to the soldering tag on the speaker frame.

*Continued overleaf*



## McMICHAEL—Continued

## VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 222V, using the 220 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium 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/VP2	225	4.9	230	1.4
V2 AC/TH1	230	4.5	110	5.8
V3 AC/VP2	67	4.1	230	3.6
V4 V914	230	12.0	—	—
V5 AC/2Pen	215	27.0	230	6.7
V6 UU4	300†	—	—	—
T.L. TV4	22	0.1	—	—
	230	0.1	—	—

† Each anode, A.C.

## GENERAL NOTES

**Switches.**—S1-S16 are the wavechange switches, ganged, together with the scale lamp switches (S17-S19), in two rotary units beneath the chassis.

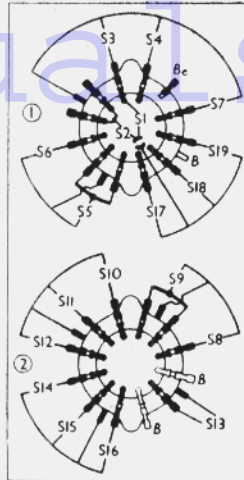
Diagrams showing them in detail, are seen looking from the rear of the underside of the chassis, are given in col. 2.

The table (col. 3) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open and C closed.

S20 is the radio muting jack switch, at the rear of the chassis, which opens when the pick-up plug is fully inserted and mutes radio.

S21 is the jack switch for the internal

## DIAGRAMS AND TABLE OF SWITCH UNITS



Diagrams of the switch units, which are shown as seen when looking from the rear of the underside of the chassis. A table of the switch positions is on the right.

Switch	S.W.	M.W.	L.W.
S1	C	C	C
S2	—	—	—
S3	—	C	C
S4	—	C	C
S5	—	C	C
S6	C	C	—
S7	—	C	—
S8	C	C	C
S9	—	C	C
S10	C	—	—
S11	—	C	—
S12	—	—	C
S13	—	C	—
S14	C	—	—
S15	—	C	—
S16	C	—	C
S17	C	—	—
S18	—	C	—
S19	—	—	C

impedance (20) external speaker. On inserting the special plug to its full extent, S21 opens and mutes the internal speaker.

**Components Inside Cabinet.**—The sub-baffle carries the two speakers, the wiring connecting them, T1, R30, C23 and the dry electrolytic condenser block (Dubilier type 317, working voltage rating 450 V) containing C24, C25. The connections for all these components are given under "Dismantling the Set."

T2, the valve-holder for V6 and the tone control resistance (R29) are also inside, the cabinet, the holder for V6 being mounted on the top of T2 which in turn is secured to the bottom of the cabinet. The connections to T2 are given under "Dismantling the Set." R29 is mounted on the right-hand side of the cabinet (viewed from the back).

**T.I. Connections.**—The TV4 cathode ray tuning indicator (T.I.) is fitted with a side-contact base having eight contacts. The contacts are numbered on the underside of the holder, and the connections are as follows:—1, blank; 2, black lead (heater); 3, yellow lead (heater); 4, blue lead (cathode); 5, blank; 6, green lead (control grid); 7, red lead and one end of R31 (target); 8, other end of R31 (triode anode).

**Chassis Divergency.**—The makers' diagram shows a small R.F. choke in place of R8 in the anode circuit of V2, so that early chassis may actually have a choke instead of R8.

## CIRCUIT ALIGNMENT

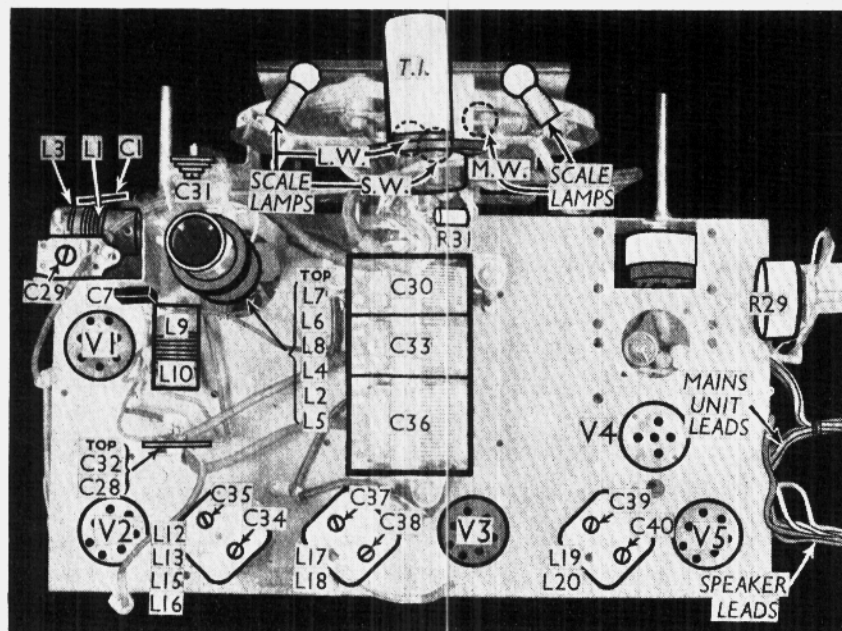
**I.F. Stages.**—Connect a condenser of 0.1  $\mu$ F or more across C36 to swamp the oscillator circuit. Remove the top cap connection of V2 and connect in its place the high potential output lead from the signal generator, the earth lead going to chassis. Feed in a 128.5 KC/S signal and adjust C40, C39, C38 and C37 in that order for maximum output, keeping the input low to avoid A.V.C. action. Finally, swing the signal generator control a few KC/S each side of 128.5 KC/S and watch the output meter for symmetrical response. Remove the swamp condenser and replace V2 top cap.

**R.F. and Oscillator Stages.**—Switch the set to M.W., turn gang condenser to maximum and make sure that the leading edge of the M.W. scale light is in line with the last calibration mark  $\frac{1}{8}$  in. from the end of the scale. If this is not so, adjust by means of the set screws on the condenser spindle coupling.

**M.W.**—Tune to bring the scale light over the mark opposite the name "Rad. Lyons" at the bottom of the scale. Feed a 1,400 KC/S (214 m.) signal into the aerial and earth sockets, and adjust C34, then C31, C28 for maximum output.

**L.W.**—Switch the set to L.W., tune to 1,000 m. on the scale and feed a 300 KC/S (1,000 m.) signal into the aerial and earth sockets. Adjust C35 for maximum output.

**S.W.**—Switch the set to S.W., feed an 18 MC/S (16.6 m.) signal into the aerial and earth sockets and tune the receiver to the signal. Adjust C29, then C32 for maximum output.



R29, the tone control, is not mounted on the chassis as might appear from this plan view, but is secured to the side of the cabinet.