'TRADER' SERVICE SHEET 162

McMICHAEL 368

4-VALVE BATTERY SUPERHET

THE chassis in the McMichael 368 battery operated receiver employs a superhet circuit using a triode-pentode frequency changer, a variable-mu pentode I.F. amplifier, a double-diode triode and a double pentode output valve in a Q.P.P. stage.

Provision is made for using both a gramophone pick-up and an extension speaker, and at the rear of the chassis there is fitted a two-position sensitivity switch.

CIRCUIT DESCRIPTION

Aerial input via series condenser **C1**, coupling coil **L1** and small coupling condenser **C2** to inductively coupled band-pass filter. Primary **L2, L3** tuned by **C21**; secondary **L5, L6** tuned by **C23**; image suppression by small coil **L4**. Switch **S1** operates as sensitivity control by shunting aerial-earth circuit with resistance **R1**.

First valve (**V1, Mazda metallised TP22**) is a triode-pentode operating as frequency changer with suppressor grid coupling. Oscillator grid coils **L7, L8**; anode coils, **L9, L10** tuned by **C26**; trimming by **C25** (L.W.) and **C27** (M.W.); tracking by shaped condenser plates and additional fixed series condenser **C9** (L.W.).

Second valve, a variable-mu H.F. pentode (**V2, Mazda metallised VP210**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C28, L11, L12, C29** and **C30, L13, L14, C31.**

Intermediate frequency 128.5 KC/S.

Diode second detector is part of double diode triode valve (**V3, Mazda metallised HL21/DD**). Audio-frequency component in rectified output is developed across load resistance **R9** and passed via coupling condenser **C12**, manual volume control **R11** and I.F. stopper **R12** to C.G. of triode section which operates as L.F. amplifier. I.F. by-passing by condensers **C11** and **C14.** Provision for connection of gramophone pick-up by plug-operated switch **S5.**

Second diode of **V3,** fed from **V2** anode via **C13,** provides D.C. potential which is developed across load **R14** and fed back through decoupling circuit **R10, C5** as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **R19** in automatic G.B. circuit.

Parallel-fed transformer coupling by **R13, C15** and **T1** to quiescent push-pull output stage which comprises a double pentode valve (**V4, Mazda QP230**). Fixed tone correction in anode circuit by condensers **C16, C17**; variable tone control by R.C. filter **R16, C18.** Provision for connection of external low impedance speaker across secondary of internal speaker transformer **T2.** Switch **S6** breaks internal speaker speech coil circuit.

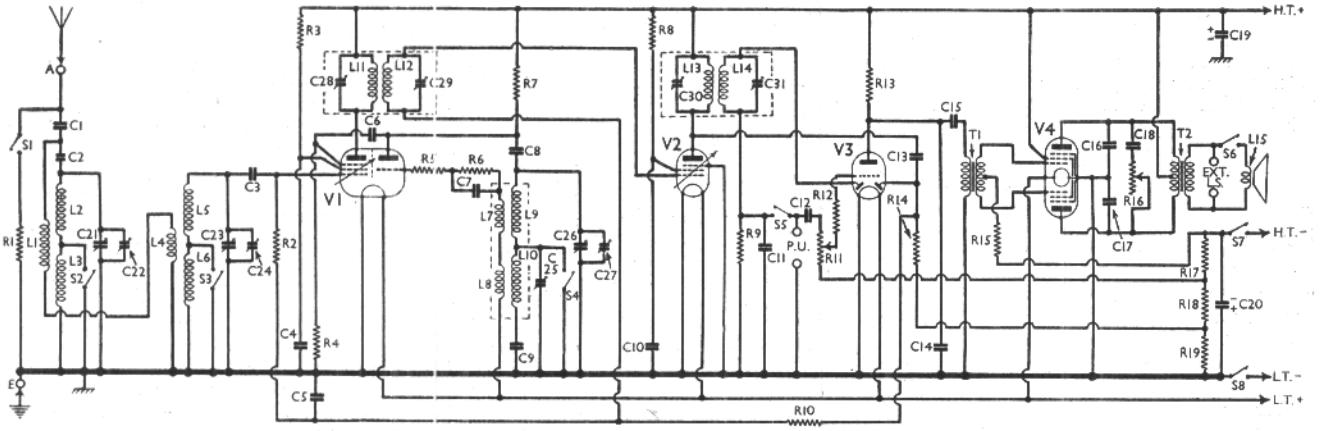
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial-earth shunt	40
R2	V1 pentode C.G. resistance	1,000,000
R3	V1 pentode S.G. H.T. feed	100,000
R4	V1 pentode supp. grid resistance	2,000,000
R5	V1 osc. harmonic suppressor	1,000
R6	V1 osc. C.G. resistance	100,000
R7	V1 osc. anode resistance	70,000
R8	V2 S.G. H.T. feed	100,000
R9	V3 signal diode load	500,000
R10	A.V.C. line decoupling	500,000
R11	Manual volume control	1,000,000
R12	V3 triode C.G. I.F. stopper	100,000
R13	V3 triode anode load	50,000
R14	V3 A.V.C. diode load	1,000,000
R15	V4 C.G.'s circuit stabiliser	100,000
R16	Variable tone control	100,000
R17, R18	Automatic G.B. and A.V.C. delay voltage resistances	800
R19		20
		100

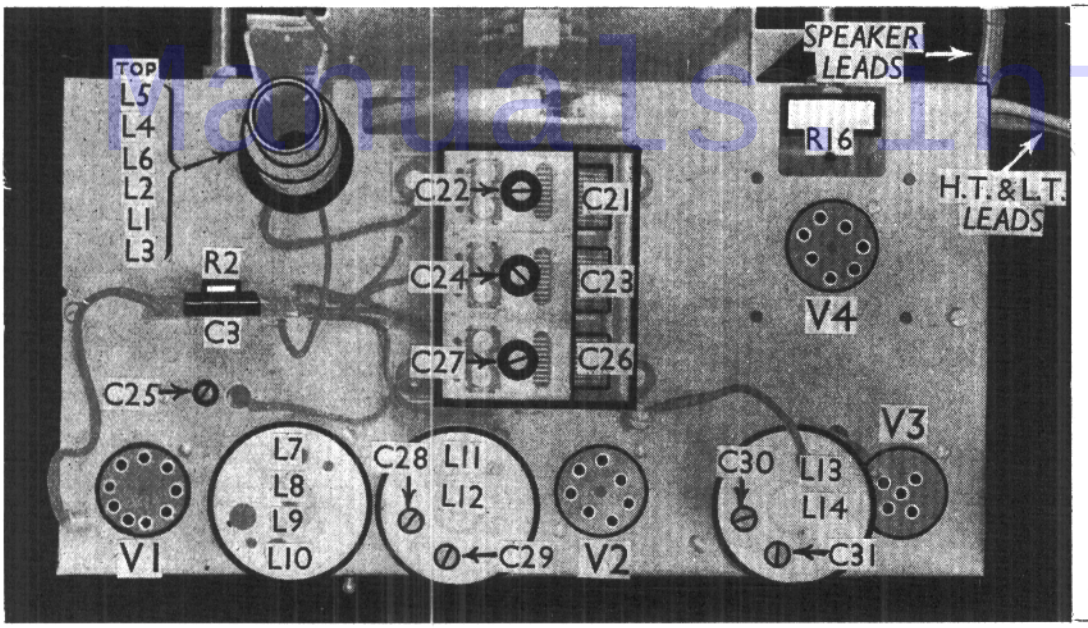
	CONDENSERS	Values (μF)
C1	Aerial series condenser	0·0002
C2	Capacitative aerial coupling	0·00003
C3	V1 pentode C.G. condenser	0·001
C4	V1 pentode S.G. by-pass	0·1
C5	A.V.C. line decoupling	0·1
C6	V1 osc. anode to supp. grid coupling	0·0005
C7	V1 osc. C.G. condenser	0·0005
C8	V1 osc. anode condenser	0·0001
C9	V1 osc. L.W. tracker	0·001081
C10	V2 S.G. by-pass	0·1
C11	I.F. by-pass	0·0001
C12	L.F. coupling to V3 triode	0·005
C13	Coupling to V3 A.V.C. diode	0·0001
C14	V3 anode I.F. by-pass	0·0003
C15	L.F. coupling to T1	0·1
C16, C17	Fixed tone correctors	0·001, 0·001
C18	Part of T.C. filter	0·01
C19*	H.T. supply reservoir	8·0
C20*	Auto. G.B. circuit by-pass	50·0
C21†	Band-pass primary tuning	—
C22‡	Band-pass primary trimmer	—
C23†	Band-pass secondary tuning	—
C24‡	Band-pass secondary trimmer	—
C25‡	Oscillator L.W. trimmer	—
C26†	Oscillator tuning	—
C27‡	Oscillator M.W. trimmer	—
C28‡	1st I.F. trans. pri. tuning	0·00022
C29‡	1st I.F. trans. sec. tuning	0·00022
C30‡	2nd I.F. trans. pri. tuning	0·00022
C31‡	2nd I.F. trans. sec. tuning	0·00022

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial coupling coil	8·0
L2, L3	Band-pass primary coils	3·6, 11·0
L4	Image suppression coil	0·4
L5, L6	Band-pass secondary coils	3·6, 12·5
L7, L8	Oscillator grid coils, total	1·8
L9, L10	Oscillator anode coils	4·0, 7·5
L11	1st L.F. trans. Pri.	42·0
L12	1st L.F. trans. Sec.	42·0



Circuit diagram of the McMichael 368 battery superhet. Note the sensitivity control consisting of S1 and R1 across the aeria circuit. Automatic grid bias is provided in the receiver.



Plan view of the chassis. The individual coils in the unscreened unit are numbered from the top. C25 is the oscillator L.W. trimmer, adjustable through a hole in the chassis deck.

OTHER COMPONENTS (*Continued*)			Approx. Values (ohms)
L13, L14	2nd I.F. trans.	Pri. ..	42·0
		Sec. ..	42·0
L15	Speaker speech coil		1·6
T1	Intervalve trans.	Pri. ..	700·0
		Sec. total ..	5,000·0
T2	Speaker input trans.	Pri. total	750·0
		Sec. ..	0·2
S1	Sensitivity switch		—
S2-S4	Waveband switches		—
S5	Gram. pick-up switch		—
S6	Internal speaker switch ..		—
S7	H.T. circuit switch		—
S8	L.T. circuit switch		—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, first remove the four control knobs (pull off), taking care not to lose the springs, and then remove the wooden strip across the back of the speaker (two countersunk-head wood screws). Now unsolder the leads from the speaker and remove the four bolts (with washers) holding the chassis to the bottom of the cabinet.

The chassis can now be withdrawn, but if it is desired to put it into operation, it will be necessary to re-connect the speaker leads. The leads should be connected as follows, numbering the tags from bottom to top:—1, yellow; 2, white; 3, green; 4, blue; 5, red; 6, yellow.

Alternatively, instead of disconnecting the speaker leads, the battery shelf may be removed (four bolts with nuts and washers), when the chassis can be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

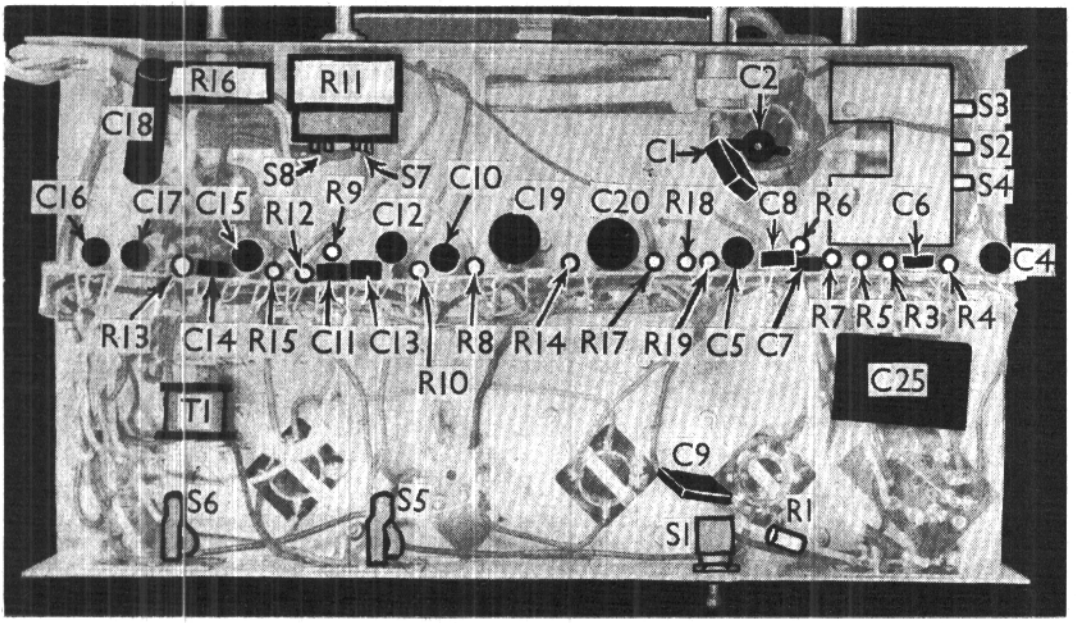
When replacing, note that the knobs are marked so that they must be placed on the correct spindles.

Removing Speaker.—To remove the speaker from the cabinet, slacken the four clamps (round-head wood screws) holding it to the sub-baffle. *When replacing*, see that the transformer is on the right.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a new H.T. battery reading 128 V. The set was tuned to the lowest wavelength on the medium band, and the volume control was at maximum, as was the sensitivity control (down). There was no signal input.

(*Continued overleaf*)



Under-chassis view. Most of the small components are on a paxolin strip stretching across the chassis. There are only three wave-change switches, indicated in the top right hand corner.

McMICHAEL 368—*Continued*

Voltages were measured on the 1,200 V scale of an Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TP22*	118	0·8	50	0·6
V2 VP210	118	1·0	60	0·5
V3 HL21/DD	78	0·6	—	—
V4 QP230	112†	2·2†	118	1·0

* Oscillator anode, 55 V, 0·7 mA.
† Each anode.

GENERAL NOTES

Switches.—**S1** is the Q.M.B. sensitivity switch at the rear of the chassis, which is *closed* when the knob is up.

S2-S4 are the wavechange switches in a single unit beneath the chassis. They are all *closed* on the M.W. band and *open* on the L.W. band.

S5 is the pick-up jack switch at the rear of the chassis, which opens when the pick-up plug is inserted. **S6** is another jack switch at the rear of the chassis, which opens, and disconnects the internal speaker when the plug of the external speaker is fully inserted.

S7 and **S8** are the Q.M.B. H.T. and L.T. circuit switches in a dual unit, ganged with the volume control **R11**.

Coils.—**L1** to **L6** are in a single unscreened unit mounted above the chassis. In our plan chassis view, the coils are numbered from the top downwards. **L7-L10** are in a screened unit on the chassis deck, while **L11, L12** and **L13, L14,** the two I.F. transformers, are in two further screened units, with their trimmers.

External Speaker.—This should be of the low resistance type (2 O) and should be plugged into the appropriate sockets at the rear of the chassis. When the plug is pushed fully home, **S6** opens, and the internal speaker is disconnected.

Batteries.—L.T., Exide PLF5 2 V 26 AH celluloid cased cell. H.T., Drydex H1132 yellow triangle 120 V unit. Automatic grid bias is provided in the receiver.

Battery Leads and Voltages.—Black lead, spade tag, L.T. negative; Red lead, spade tag, L.T. positive 2 V. Black lead, black plug, H.T. negative; Red lead, red plug, H.T. positive 120 V.

CIRCUIT ALIGNMENT

I.F. Stages.—Switch set to M.W. and connect across the oscillator tuning condenser **C26** a 0.1 μF or larger condenser to swamp out the local oscillation. Lift off the top cap connection to **V1**, and connect in its place the screened output lead from a signal generator, the other lead going to chassis.

Feed in a 128.5 KC/S signal, and adjust **C31, C30, C29** and **C28** in turn for maximum output.

H.F. and Oscillator Stages.—It is first necessary to see that the positions of the pointers are correct relative to the tuning condenser. Turn the tuning knob as far as it will go to bring the pointers to the top of the M.W. band. Ascertain that the moving vanes of the condenser are now fully in mesh.

The large pointer should now rest exactly over the thin line which will be seen just behind and below the 300 m. calibration of the small hexagonal scale. The small pointer should now be approximately vertical.

If the pointers do not take up these positions, it will be necessary to loosen the centre screws of the pointers, and make the necessary adjustments.

Now turn the tuning knob to bring the pointer to 214 m. The correct setting is when the top edge of the large pointer is just touching the bottoms of the words "Rad. Lyons."

Inject a 214 m. signal into the **A** and **E** sockets, and adjust **C27** for maximum output. The correct tuning point is that obtained with the trimming screw in the slacker position. Next adjust **C24** and **C22** for maximum output in each case, reducing input if necessary.

Switch set to L.W., and tune so that the pointer indicates 1000 m. In this case the larger pointer should lie between the words "Fecamp" and "Newcastle."

Inject a 1000 m. signal into **A** and **E** sockets, and adjust **C25** (through hole in chassis deck) for maximum output.

MAINTENANCE PROBLEMS

(*Continued from page V.*)

Tuning Indicator Faults

By a strange coincidence, three Ferranti Magna A.C. receivers which had been in use only a short time were found, upon test, to be suffering from burnt-out visual tuning indicators. In the first one tested the trouble was due to the 0·1 μF (C13 Ferranti service manual) VPT4 anode decoupling condenser having developed an internal short-circuit.

The second set also had its visual tuning indicator out of action, and upon examination it was obvious that it had been very hot due to a short-circuit. The C13 condenser was suspected, but this time it was the 0·1 μF C9 decoupling the VHT4 anode. The 1,000 O (R7) in the same circuit had also been overloaded and the coding colours burned off.

The last of the three sets, too, had its indicator burnt out, and I thought it would be either C9 or C13; but the diagnosis, in this instance, was faulty, and it was not the condensers. The fault, which was intermittent, was traced to the metal sheathing covering the braided flexible wire connected to the anode (top cap) of the VPT4 valve; part of the sheathing was broken and had pricked the flex, thus short-circuiting the tuning indicator and primary winding of the second I.F. transformer.

* * *

When it is necessary to fit a new tuning indicator in a Ferranti receiver the lower of the two screws securing the indicator to the tuning scale frame can be rendered easily accessible by temporarily removing the four screws which hold the transformer on the chassis and moving the transformer a little towards the end of the chassis, taking care not to strain the leads connected to the transformer.

* * *

Another trouble experienced recently with Ferranti sets employing the Magnascopic scale for fine adjustment was the symptom of a jumping scale when the slow-motion tuning control knob was turned slowly. In this case the fault was due to the end of the Magnascopic scale catching one of the leads to the wavechange switch.

In another case with similar symptoms the trouble was due to the ganged condenser chassis, which is mounted on rubber buffers; the nuts securing the condenser were not screwed down tight enough, with the result that the ends of the scale when passing through the slots in the chassis actually rubbed against it and caused the jumping effect.

In another instance the same effect was caused by the pointer carriage rubbing against the edge of the strip upon which the magnified scale figures were reflected.

In two or three cases one of the reflecting mirrors has been found in the bottom of the cabinet; this is usually due to the spring clip which should hold the mirror in position not fitting properly. This can be cured by slightly bending the spring in the middle to make it bow shaped. The turned-over ends of the spring must not be squeezed in, as the spring is tempered and the ends would snap. M. FOSTER, BRIGHTON.

L.F. Circuit Trouble

An old K-B mains receiver of the "straight three" type was recently brought in for service, with the complaint that, after working for a short time, the reproduction became very distorted. The set was put on "soak," and after about an hour, the reproduction went "fuzzy."

It was soon established that the speaker and valves were quite O.K., so a check was then made on the voltages, which proved to be more or less correct, except that the volts on the output valve were lower than usual.

Measurements were next made on the anode current of the output valve, which proved to be high, and was accompanied by downward kicks of the milliammeter needle.

The bias circuit was at first suspected, but tests showed this to be quite in order, so the L.F. coupling condenser came under suspicion. Ordinary tests on this component failed to show up any fault, so a 75 V battery was connected in series with the Avo 1MO range, and this revealed a leak of 0·75 MO. A new condenser put the set right.—JAMES GIBBONS, WALLASEY.

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