"TRADER" SERVICE SHEET

1240

McMICHAEL FM5

Covering Table Model FM55, Console Models 255, 255S and

EMPLOYING a folded-dipole internal F.M. aerial and ferrite rod internal A.M aerials, the McMichael FM55 is a 5-valve (plus rectifier and tuning indicator) A.M./F.M. table receiver, designed to operate from A.C. mains of 190-250 V, 40-100 c/s. The waveband ranges are: A.M., 190-540 m, 900-2,000 m; F.M., 88-95 Mc/s

Model 255 is a console version and model 255 S is a bookcase console version of the FM55. Model 555 is a 3-speed auto-radiogram. Model 555/3 is the same as the 555 but uses three speakers and a modified FM55 chassis. Small differences between these models and the FM55 are explained under "General Notes" overleaf.

Release dates and original prices: FM55, May 1955, £23 1*s.; 255, June* 1955, £33 7*s.* 10*d.; 255 S, June* 1955, £35 15*s.* 6*d.; 555, 555/3 June* 1955, £59 12*s.* 5*d. Purchase tax extra.*

CIRCUIT DESCRIPTION

A.M. aerial input is coupled via I.F.. filter **L10, C16** and the common impedance of **C17** to single-tuned aerial circuits **L11, C21** (M.W.) and **L12, C21** (L.W.). **L11** and **L12** are mounted on on separate lengths of ferrite rod to form the internal A.M. aerials.

Section **b** of **V2 (Mullard ECH 81)** operates as A.M. mixer and section **a** operates as A.M. oscillator. Oscillator anode coils **L14** (M.W.) and **L16** (L.W.) are tuned by **C33.** Parallel trimming by **C28, C29** (M.W.) and **C30, C31** (L.W.); series tracking by **C26** (M.W.) and **C27** (L.W.); Reaction-coupling from oscillator grid by **L13, L15.**

V3 (Mullard EF 85) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C37, L19, L20, C38** and **C44, L24, L25, C45.**

A.M. intermediate frequency 470 kc/s.

Section **c** of **V4 (Mullard EABC 80)** operates as A.M. signal detector. Audio frequency component in its audio output is developed across **R18** and is passed via **C52,** volume control **R23,** and **C53** to **V4d** which operates as A.F. amplifier, D.C. component in the rectified output of **V4c** is developed across **R18** and fed back as bias via filter circuit **R21, R22** to **V3,** giving automatic gain control.

Provision is made for the connection of a gramophone pick-up across the volume control circuit via **S17,** which closes in the gram position of the band switch. **S8** closes and **S15, S16** open in this position to prevent radio break-through.

Resistance-capacitance coupling by **R27, C55** and **R28** between **V4d** and pentode output valve **V5 (Mullard EL 84).** Tone correction in **V5** anode circuit by **C60.** Tone control by **R28** in the negative feed-back circuit **C61, R28** between **T1** secondary winding and **V5** control grid circuit. Provision is made for the connection of a low-impedance external speaker across **T1** secondary winding. The internal speaker can be muted by **S18.**

H.T. current is supplied by I.H.C. full-wave rectifying valve (**V6, Mullard EZ 80**). H.T. smoothing by **R31, R32** and electrolytic capacitors **C56, C58, C59.** Residual hum is neutralized in **T1** by feeding H.T. current through section **a** of its primary winding.

Operation on F.M.

300Ω balanced or 75Ω co-axial F.M. aerial input via coupling transformer **L1, L2** to earthed grid R.F. amplifier, section **a** of **V1 (Mullard ECC85).** Anode to grid internal capacitance of **V1a** is neutralized by returning its grid to chassis via **R1** and a section of **L2.**

Section **b** of **V1** operates as oscillator/mixer valve with tuned oscillator grid circuit **L5, C7, C8, C9.** Reaction coupling from anode via **C11, L6.** Oscillator radiation is reduced by means of a bridge neutralizing circuit, formed by **C7, C8, C10** and the inter-electrode capacitances of **V1b,** which prevents coupling between the oscillator and R.F. circuits. F.M. tuning is by means of the ganged cores of **L4** and **L5** which are cam-driven from the A.M. tuning gang.

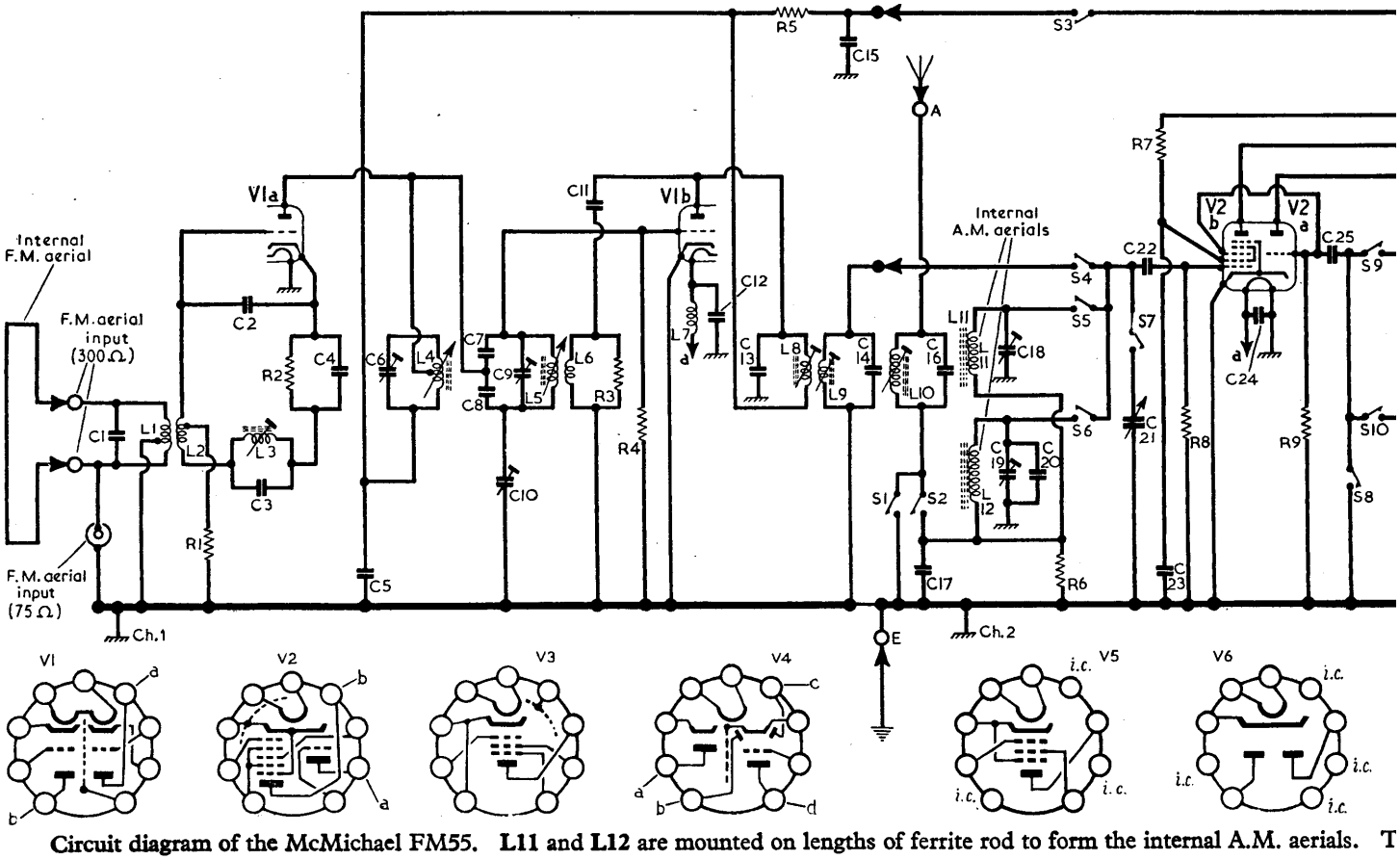
V2b and **V3** form the two-valve F.M. intermediate frequency amplifier, which is coupled by tuned transformers **C13, L8, L9, C14; C35, L17, L18, C36;** and discriminator transformer **C42, L21, L22, L23, C43** to diode sections **a** and **b** of **V4,** connected in a ratio detector circuit.

F.M. intermediate frequency 10.7 Mc/s.

The A.F. output of the ratio detector is developed across **C46** and passed via de-emphasis circuit **R16, C47** to the volume control circuit. Limiting is performed by the "fly-wheel" effect of D.C. reservoir **C50.** D.C. potential developed across **R20** is fed as bias via **R19** to the A.G.C. line.

GENERAL NOTES

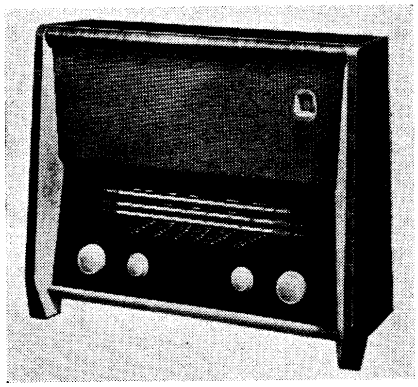
Switches.—**S1-S17** are the band switches ganged in three rotary units beneath the chassis. These units are indicated in the under-chassis illustration and are shown in detail in the



Circuit diagram of the McMichael FM55. **L11** and **L12** are mounted on lengths of ferrite rod to form the internal A.M. aerials. T

5 Series

Auto-radiogram Models 555, 555/3



Appearance of the McMichael FM55.

diagrams overleaf (col. 2) where they are drawn as seen from the front of an inverted chassis. The associated switch table indicates the switch operations in the four control settings, starting with the control in its fully anti-clockwise setting. A dash indicates open, and **C** closed.

Scale Lamp.—This is a 230-250 V, 15 W pygmy lamp with a small bayonet cap base.

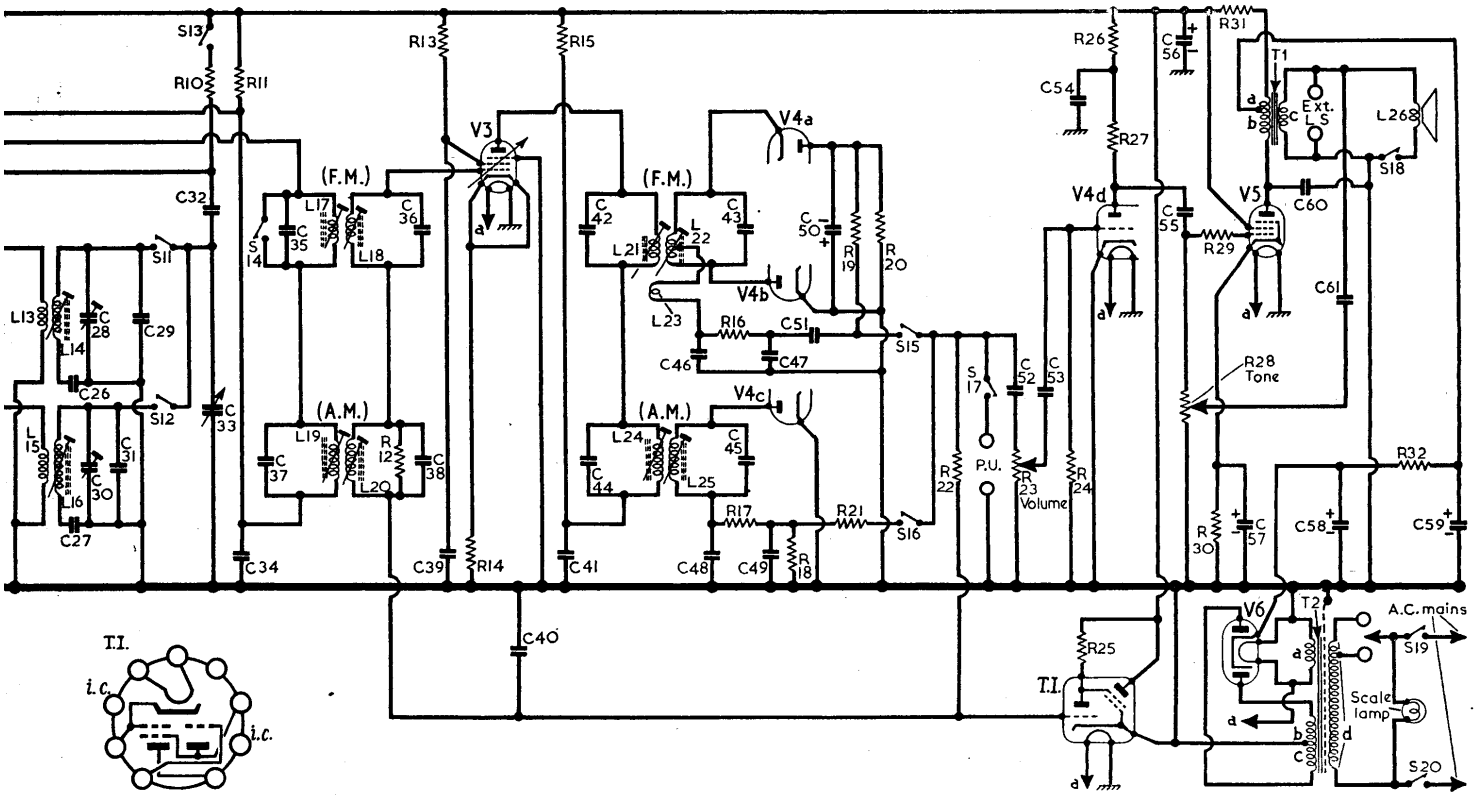
Drive Cord Replacement.—About five feet of nylon-braided glass yarn is required for a new drive. Turn the gang to maximum capacitance. Tie off one end of the drive cord to anchor ring and secure this ring to the lug on the drive drum. Run the cord on as shown in the

(Continued col. 1 overleaf)

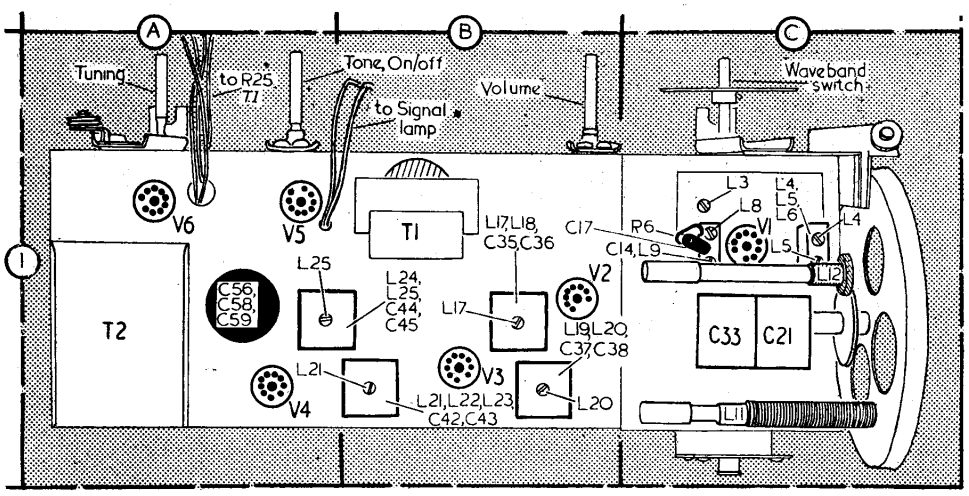
	CAPACITORS	Values	Locations
C1	F.M. aerial shunt...	15pF	D2
C2	V1a C.G.	8·2pF	D2
C3	I.F. filter tune ...	47pF	D2
C4	V1a G.B. ...	0·001μF	D2
C5	H.T. decoupling ...	570pF	D2
C6	F.M. R.F. trim. ...	30pF	D2
C7	F.M. R.F. to osc.	39pF	D2
C8	coupling ...	39pF	D2
C9	F.M. osc. trimmer	30pF	D2
C10	F.M. osc. neut. ...	30pF	D2
C11	F.M. osc. coupling	18pF	D2
C12	R.F. by pass ...	2,200pF	D2
C13	1st F.M. I.F.T.	12pF	D2
C14	tuning	15pF	C1
C15	H.T. decoupling ...	2,200pF	D2
C16	I.F. filter tune ...	1,500pF	D3
C17	A.M. aerial coupling ...	0·005μF	C1
C18	M.W. aerial trim.	30pF	D3
C19	L.W. aerial trim-	30pF	D3
C20	mers	30pF	D3
C21	A.M. aerial tuning	532pF	C1
C22	V2b C.G.	100pF	E2
C23	V2b S.G. decoup.	0·005μF	E3
C24	R.F. by-pass ...	0·001μF	E2
C25	V2a C.G.	50pF	E3
C26	A.M. osc. trackers	580pF	D2
C27		200pF	D3
C28		30pF	D3
C29	A.M. osc. trimmers	20pF	E3
C30		30pF	D3
C31		100pF	D3
C32	A.M. osc. coupling	500pF	E3
C33	A.M. osc. tuning ...	532pF	C1
C34	H.T. by pass ...	0·005μF	E3
C35	2nd F.M. I.F.T.	50pF	B1
C36	tuning	50pF	B1
C37	1st A.M. I.F.T.	60pF	B1
C38	tuning	100pF	B1
C39	V3 S.G. decoupling	0·005μF	F3
C40	T.I. decoupling ...	0·05μF	E3
C41	H.T. decoupling	0·005μF	F3
C42	3rd F.M. I.F.T.	10pF	B1
C43	tuning	30pF	B1
C44	2nd A.M. I.F.T.	100pF	B1
C45	tuning	180pF	B1
C46	A.F. load ...	300pF	F3
C47	Part de-emphasis...	0·001μF	F3
C48	A.M. I.F. by-	100pF	F3
C49	passes	100pF	F3

	CAPACITORS—*continued*	Values	Locations
C50	D.C. reservoir ...	5μF	F3
C51	A.F. couplers ...	0·05μF	F2
C52		0·05μF	E2
C53		0·02μF	F3
C54	H.T decoupling ...	0·1μF	G3
C55	A.F. coupling ...	0·05μF	F2
C56	H.T. smoothing ...	32μF	A1
C57	V5 G.B.	50μF	G2
C58	H.T. smoothing ...	32μF	A1
C59		16μF	A1
C60	Tone corrector ...	0·001μF	F2
C61	Part tone control...	0·01μF	F2

	RESISTORS	Values	Locations
R1	V1a C.G.	120Ω	D2
R2	V1a G.B.	220Ω	D2
R3	F.M. osc. shunt ...	2·2kΩ	D2
R4	V1b C.G.	1MΩ	D2
R5	H.T. decoupling ...	4·7kΩ	D2
R6	A.M. aerial shunt	1kΩ	C1
R7	V2b S.G. feed ...	33kΩ	E3
R8	V2b C.G.	1MΩ	E3
R9	V2a osc. C.G. ...	47kΩ	E3
R10	H.T. feeds ...	33kΩ	E2
R11		220Ω	E3
R12	A.M. I.F.T. shunt	150kΩ	E3
R13	V3 S.G. feed ...	82kΩ	F3
R14	V3 G.B.	100Ω	E3
R15	H.T. feed	220Ω	F3
R16	Part de-emphasis	47kΩ	F3
R17	A.M. I.F. stopper	47kΩ	F3
R18	A.M. diode load ...	1MΩ	F3
R19	T.I. feed ...	2·2MΩ	F3
R20	F.M. D.C. load ...	33kΩ	F3
R21	Tone corrector ...	1MΩ	F2
R22	T.I. feed ...	1MΩ	D2
R23	Volume control ...	1MΩ	E2
R24	V4d C.G.	10MΩ	G3
R25	T.I. anode load ...	470kΩ	A1
R26	H.T. feed	100kΩ	F3
R27	V4d anode load ...	100kΩ	G3
R28	Tone control ...	250kΩ	F2
R29	V5 C.G. stopper ...	12kΩ	F2
R30	V5 G.B.	150Ω	G2
R31	H.T. smoothing ...	2kΩ	F2
R32		500Ω	G2



The output stage of models 255, 255S, 555 and 555/3 is modified as indicated in the section of circuit diagram at the top of column 3 overleaf.



Plan view of the chassis showing A.M. internal aerials **L11** and **L12** in location C1.

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	F.M. aerial coupling coils	—	D2
L2		—	D2
L3	F.M. I.F. filter	1.0	D2
L4	F.M. R.F. tuning	—	C1
L5	F.M. osc. tuning	—	C1
L6	F.M. osc. reaction	—	C1
L7	R.F. heater choke	—	D2
L8	1st F.M. I.F.T. Pri.	1.0	C1
L9	1st F.M. I.F.T. Sec.	1.0	C1
L10	A.M. I.F. filter	4.0	D3
L11	A.M. internal aerials	2.0	C1
L12	A.M. internal aerials	9.0	C1
L13	A.M. oscillator coils	2.0	D3
L14	A.M. oscillator coils	3.0	D3
L15	A.M. oscillator coils	7.0	D3
L16	A.M. oscillator coils	8.0	D3
L17	2nd F.M. I.F.T. Pri.	—	B1
L18	2nd F.M. I.F.T. Sec.	—	B1
L19	1st A.M. I.F.T. Pri.	14·0	B1
L20	1st A.M. I.F.T. Sec	14·0	B1
L21	3rd F.M. I.F.T. Pri.	—	B1
L22	3rd F.M. I.F.T. Sec., total	—	B1
L23	3rd F.M. I.F.T. Tert	—	B1
L24	2nd A.M. I.F.T. Pri.	15·0	A1
L25	2nd A.M. I.F.T. Sec.	10·0	A1
L26	Speech coil	2·5	—
T1	O.P. trans. a	12·0	
	O.P. trans. b	270·0	B1
	O.P. trans. c	—	
T2	Mains trans. a	—	
	Mains trans. b	150·0	A1
	Mains trans. c	150·0	
	Mains trans. d	32·0	
S1-S17	Band switches	—	D2
S18	Int. speaker sw.	—	F3
S19, S20	Mains sw., g'd R28	—	F2

General Notes—*continued*

sketch of the drive cord system at the top of columns 4 and 5.

Models 255 and 255S.—These are console and bookcase console versions of the **FM55** respectively. They employ a basic FM55 chassis, but the output stage is modified as indicated in the section of circuit in column 3.

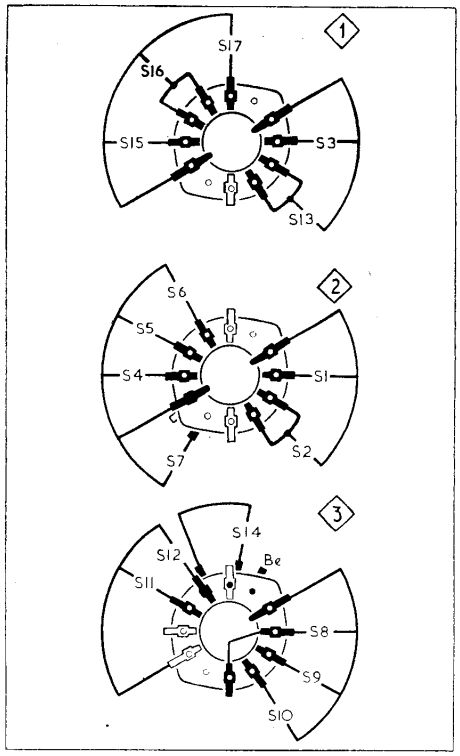
Model 555.—This is an autoradiogram version of the FM55. It employs a basic FM55 chassis, but the output stage is modified as indicated in the section of circuit in column 3. The 3-speed auto-changer fitted to this receiver is the Collaro RC54.

Model 555/3.—This is the same as the 555 but employs a moving coil speaker for middle and low note reproduction and two parallel-connected electrostatic speakers for high note reproduction.

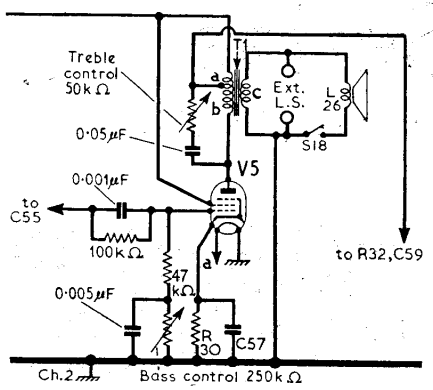
The speakers are connected via an 0.002μF capacitor between the anode of the output valve and chassis. A 100 kΩ resistor is connected between the junction of **R32, C59** and the live side of the electrostatic speakers. A 12 kΩ stopper is connected in **V5** control grid circuit.

Switch Table

Switches	F.M.	M.W.	L.W.	Gram.
S1	C	—	—	—
S2	—	C	C	—
S3	C	—	—	—
S4	C	—	—	—
S5	—	C	—	—
S6	—	—	C	—
S7	—	C	C	—
S8	—	—	—	C
S9	—	C	—	—
S10	—	—	C	—
S11	—	C	—	—
S12	—	—	C	—
S13	—	C	C	—
S14	—	C	C	—
S15	C	—	—	—
S16	—	C	C	—
S17	—	—	—	C



Diagrams of the waveband switch units as seen from the front of an inverted chassis. The units are indentified by diamond-enclosed numbers 1-3 in the under-chassis illustration.



Circuit showing the modified output stage employed in the console and auto-radiogram versions of the FM55.

CIRCUIT ALIGNMENT

Equipment Required.—An A.M. signal generator covering the range of 150-1,600 kc/s, together with the F.M. intermediate frequency of 10.7 Mc/s and the F.M. tuning range of 88-95 Mc/s; a 0-10 V high-resistance D.C. voltmeter; an output meter with an internal resistance of 3 Ω; a valve voltmeter.

A.M. I.F. Stages

1.—Switch receiver to M.W. and turn gang to maximum capacitance. Connect output leads of signal generator to the junction of **S7, C22** and to chassis. Connect output meter across **T1** secondary winding in place of speaker. Check that with gang at maximum, the cursor coincides with calibration mark "D" on drive drum.

2.—Feed in a 470 kc/s signal and adjust the cores of **L25** (location reference A1), **L24 (F3), L20** (B1) and **L19** (E3) for maximum output.

3.—Adjust the core of **L10** (D3) for minimum output.

A.M. R.F. and Oscillator Stages

4.—Switch receiver to M.W. and tune to calibration mark "A" on drive drum. Transfer signal generator leads, via a dummy aerial, to **A** and **E** sockets.

5.—Feed in a 1,580 kc/s signal and adjust **C28** (D3) and **C18** (D3) for maximum output.

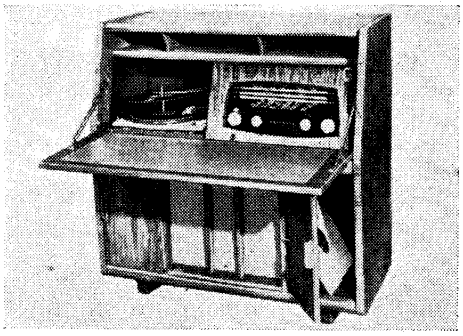
6.—Tune receiver to calibration mark "B" on drive drum. Feed in a 600 kc/s signal and adjust the core of **L14** (D3) for maximum output. Adjust the inductance of **L11** (C1) for maximum output by sliding the coil along the ferrite rod.

7.—Switch receiver to L.W. and tune to calibration mark "A" on drive drum. Feed in a 333 kc/s signal and adjust **C30** (D3) and **C19** (D3) for maximum output.

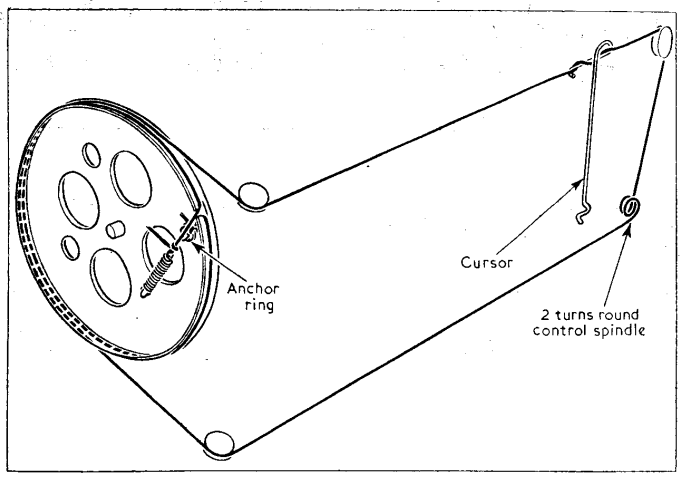
8.—Tune receiver to calibration mark "C." Feed in a 150 kc/s signal and adjust the core of **L16** (D3) for maximum output. Adjust the inductance of **L12** (C1) for maximum output by sliding the coil along its ferrite rod.

F.M., I.F. Stages

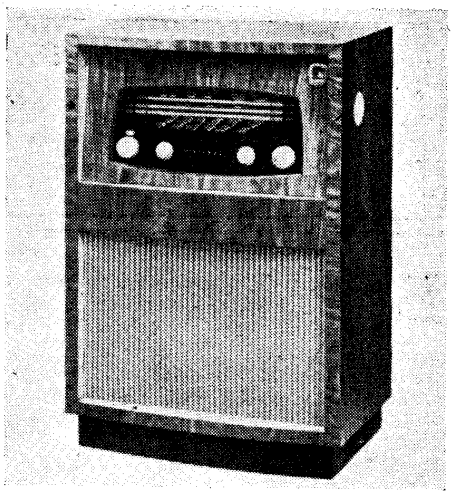
9.—Connect output leads of signal generator to junction of **S7, C22** and to chassis. Connect



Appearance of the McMichael 555.



Sketch showing the tuning drive system as seen from the front left-hand corner of the chassis with the gang at maximum capacitance.



Appearance of the McMichael 255.

high-resistance D.C. voltmeter across **R20** (positive to chassis). Switch receiver to F.M.

10.—Feed in an unmodulated 10.7 Mc/s signal and adjust the cores of **L22** (F3), **L21** (B1), **L18** (E2) and **L17** (B1) for maximum output.

11.—Adjust output of signal generator to give a 3 V reading on meter. Tune signal generator to 10.6 Mc/s and to 10.8 Mc/s and check that meter reading does not fall below 2.1 V. Repeat operation 10 if necessary.

12.—Connect two accurately matched 100 kΩ resistors in series across **R20**. Connect D.C. voltmeter to junction of these two resistors and to junction of **R16**, **C47**.

13.—Feed in a 10.7 Mc/s unmodulated signal and readjust the core of **L22** (F3) for zero reading on meter (this will occur mid-way between a positive-going and a negative-going peak). Disconnect 100 kΩ resistors, and reconnect meter across **R20**.

14.—Transfer signal generator leads to 300 Ω F.M. aerial sockets. Short-circuit **L3** and adjust the cores of **L9** (C1) and **L8** (C1) for maximum output on meter.

15.—Remove short-circuit from **L3** and adjust its core for minimum output on meter.

F.M. R.F. and Oscillator Stages

16.—With receiver switched to F.M., tune it to highest frequency end of band. Set **C6** (D2) and **C9** (D2) to mid-capacitance. Connect valve voltmeter between chassis and junction **C7**, **C8** (D2). Adjust **C10** (D2) for minimum reading on meter, choosing the lesser capacitance peak if two are available. Disconnect valve voltmeter.

17.—Tune receiver to calibration mark "E" on drive drum. Feed in an unmodulated 88 Mc/s signal to the aerial sockets and adjust **C6** and **C9** for maximum output.

18.—Feed in a 95 Mc/s signal and tune it in on receiver. Check that this setting corresponds with calibration mark "A" on the drive drum. This can be adjusted if necessary by moving together, or separating, **C7** and **C8** (D2).

19.—If calibration is still incorrect, the following procedure should be followed. Tune receiver to calibration mark "F," feed in a 91 Mc/s signal and adjust **C9** (D2) for maximum output. Check calibration at 88 Mc/s (calibration mark E) and at 95 Mc/s (calibration mark A). If only the 95 Mc/s setting is inaccurate, repeat operation 18. If both the 95 Mc/s and the 88 Mc/s settings are inaccurate, the core of **L5** (C1) should be adjusted and operation 14 repeated.

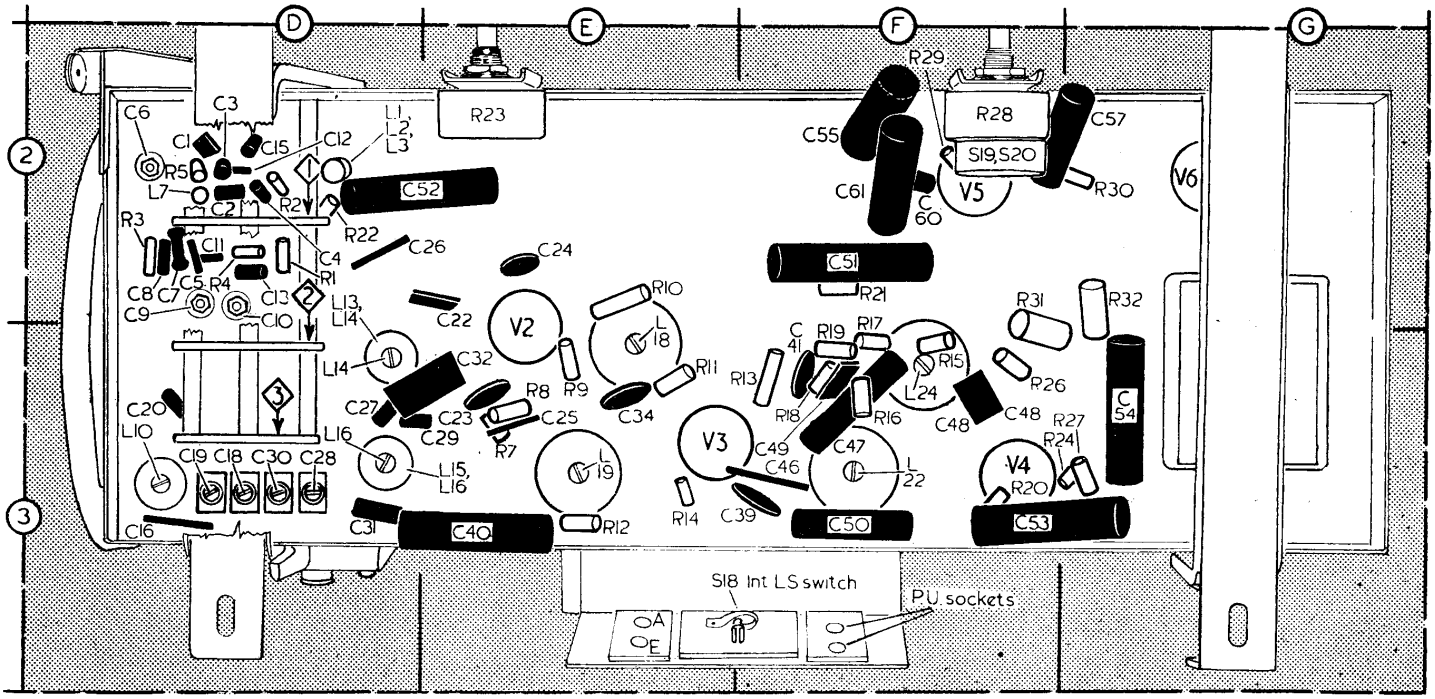
VALVE ANALYSIS

Valve voltages and currents given in the table (next col.) were measured in our sample receiver. The receiver, except where otherwise indicated, was switched to M.W. with the gang at maximum capacitance.

Voltages were measured on an Avo Electronic Test Meter and as this instrument has a high internal resistance allowance should be made for the current drawn by other types of meter. Chassis was the negative connection in every case.

Valve	Anode		Screen		Cath.
	V	mA	V	mA	V
V1 ECC85 a	55*	—	—	—	1·75
V1 ECC85 b	50*	—	—	—	—
V2 ECH81					
a ...	70	4·2	—	—	—
b ...	205	1·8	56	5·0	—
V3 EF85 ...	205	6·4	75	1·5	0·8
V4 EABC80					
a ...	—	—	—	—	—
b ...	76	0·75	—	—	—
V5 EL84 ...	250	36·2	205	3·8	6·0
V6 EZ80 ...	260†	—	—	—	290‡
T.I. EM80	80§	—	—	—	—

*Receiver switched to F.M. †A.C. reading, each anode. ‡Cathode current 60 mA. §Target anode 205V.



Underside view of the chassis showing the majority of the R.F. and oscillator adjustments in location references D2 and D3.

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