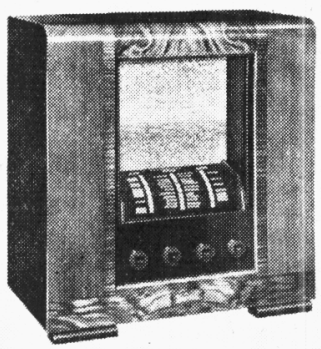
Supplement to The Wireless & Electrical Trader, March 30, 1940.

"TRADER" SERVICE SHEET 458

McMICHAEL 398

3-BAND BATTERY SUPERHET



THE McMichael 398 is a 4-valve 3-band battery superhet, employing a double-pentode in a QPP output stage. The SW range is 17 to 50m. A 4-position tone control is provided, and also gives 2-point selectivity switching.

Release date: May, 1939.

CIRCUIT DESCRIPTION

Aerial input on MW and LW is via series condenser **C1** and coupling components **L1, C2** (MW) and **L2, C3** to inductively coupled band-pass filter. Primary coils **L3** (MW) and **L4** (LW) are tuned by **C33**; secondaries **L9** (MW) and **L10** (LW) by **C36**. Coupling by **L6** (MW) and **L5** (LW) which are common to primary and secondary circuits.

On SW, input is via **C1** and coupling coil **L7** to single tuned circuit **L8, C36**.

Condenser **C4** permits unused circuits to be shunted by muting switches **S4, S5** or **S6** without short-circuiting the AVC line.

First valve **(V1, Mazda metallised TP25)** is a triode pentode operating as frequency changer with internal coupling. Triode oscillator anode coils **L14** (SW), **L15** (MW) and **L16** (LW) are tuned by **C40**; parallel trimming by **C41** (SW), **C38** (MW) and **C39** (LW); series tracking by **C12** (SW), **C13** (MW) and **C14** (LW). Reaction by grid coils **L11** (SW), **L12** (MW) and **L13** (LW) via damping resistances **R3** (on all bands), plus **R4** (MW) and **R5** (LW).

Second valve **(V2, Mazda metallised VP23)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C42, C8, L17, L18, L19, L20, C9, C43** and **C44, C17, L21, L22, C18, C45.**

Two-position variable selectivity is provided by the introduction of the coupling coils **L17, L20** in the first IF transformer, the band-width depending upon which of the control switches **S22** and **S23** is closed.

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mazda metallised HL23DD).** Audio frequency component in rectified output is developed across load resistance **R11** and passed via AF coupling condenser **C22**, manual volume control **R12** and grid stopper **R13** to CG of triode section, which operates as AF amplifier.

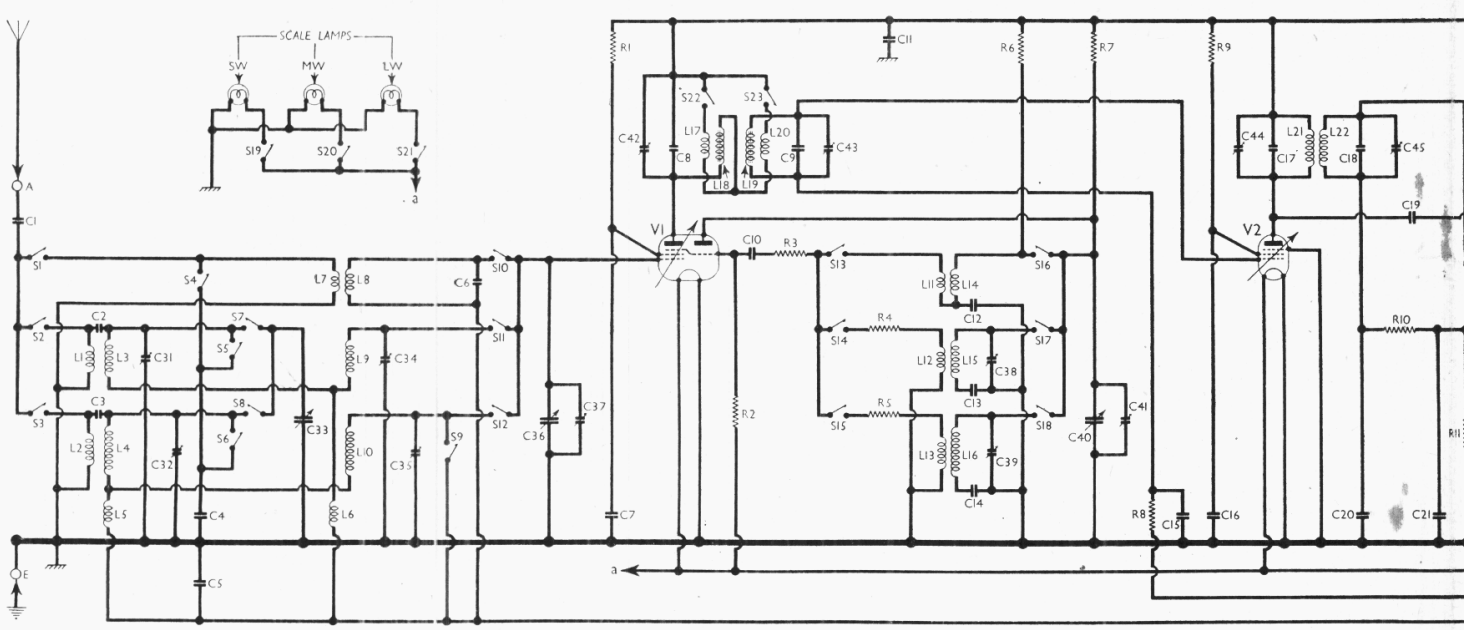
IF filtering by **C20, R10** and **C21** in diode circuit, and **C23** in triode anode circuit. Provision for connection of gramophone pick-up across **C22, R12.**

Second diode of **V3**, fed from **V2** anode via **C19**, provides DC potentials which are developed across load resistances **R16, R17** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control.

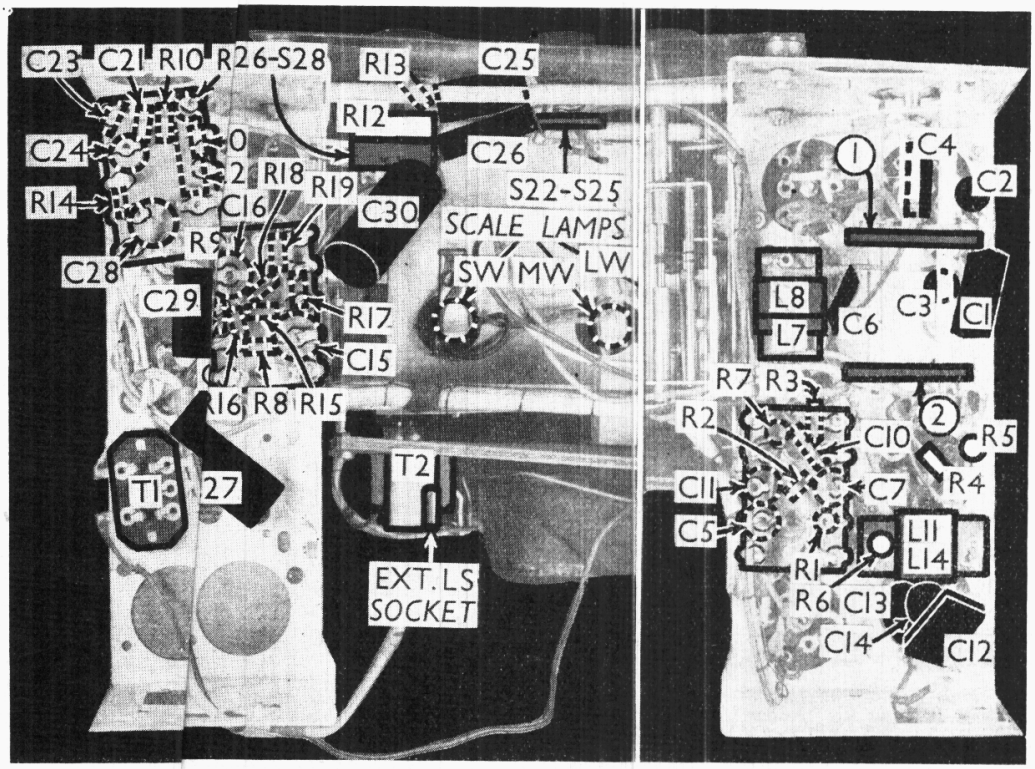
Parallel-fed transformer coupling by **R14, C24** and **T1** between **V3** triode and quiescent push-pull double-pentode output valve **(V4, Mazda QP25).** Variable tone control by condensers **C25, C26** in conjunction with **S24, S25** across **T1** primary. Switches **S22, S23, S24** and **S25** together form a four-position frequency response control in a single unit.

Fixed tone correction by **C28, C29** between **V4** anodes and HT positive line. Provision for connection of low impedance speaker by sockets across **T2** secondary winding.

Fixed GB potential for **V1** and **V2**, GB potentials for **V3** triode and **V4**, and AVC delay potential, are obtained from drop along resistances **R18** and **R19** which form a potential divider in negative HT lead to chassis. The positive end of the by-pass condenser **C30** is isolated from chassis when the receiver is switched off so that in the



Circuit diagram of the McMichael 398 battery superhet. **S22** and **S23** are ganged with **S24** and **S25** to provide selectivity and tone control



Underneath view of each end of the chassis, with part of the central portion omitted for compactness. The section omitted carries no components except the LW scale-lamp. Components beneath the paxolin panels of the three main component assemblies are shown in dotted outline.

event of the condenser developing a fault it will not connect HT negative to chassis.

DISMANTLING THE SET

Removing Chassis.—Slacken the two wood screws and swivel the clamps holding the speaker aperture structure to the front of the cabinet;

remove the four bolts (with large metal washers) holding the chassis to the bottom of the cabinet.

The complete receiver can now be withdrawn by sliding it towards the rear of the cabinet and tilting the top forward.

When replacing, the two washers with flats on them should be fitted to the front chassis fixing bolts.

If the valves have been disturbed, the loose screening cap should be fitted over the top of **V3** (HL23DD).

Removing Speaker.—Unsolder the four leads connecting the speaker transformer to the chassis;

remove the wood screws holding the two upper speaker fixing clamps to the sub-baffle;

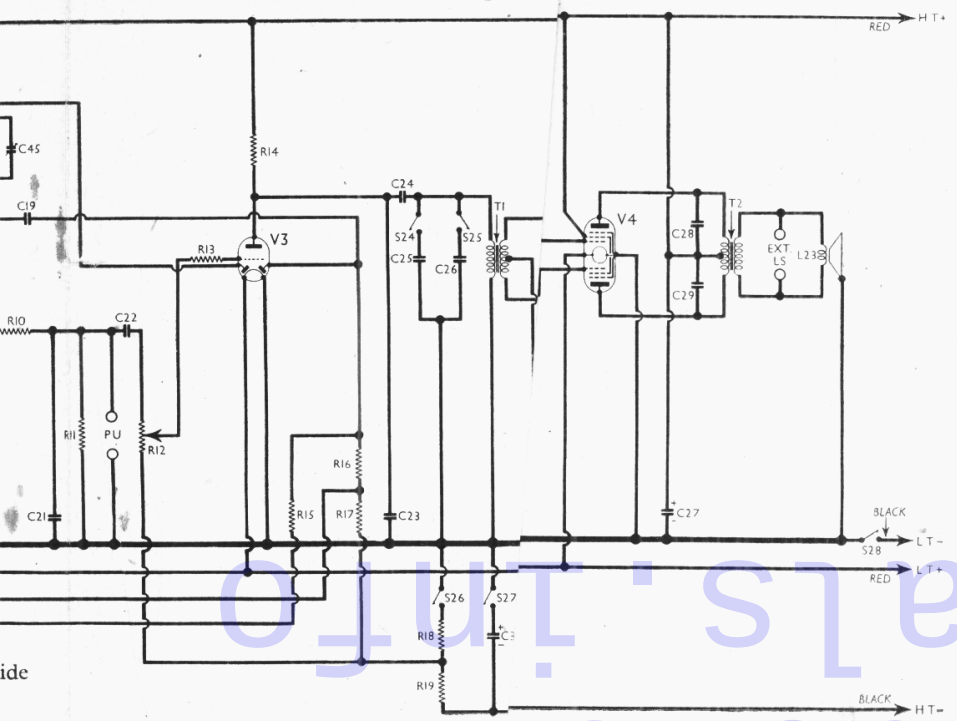
slacken the two wood screws holding the lower fixing clamps, when the speaker may be lifted out.

When replacing, the transformer should be on the right.

Connect the leads as follows, numbering the tags on the transformer from top to bottom:

1. yellow;
2. red;
3. and 4, no external connection;
5. yellow.

The black lead should be connected to the soldering tag fitted under the lower transformer fixing bolt.



COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 SG HT feed	100,000
R2	V1 osc. CG resistance ...	25,000
R3	Oscillator reaction	50
R4	stabilising resistances	1,500
R5		2,500
R6	V1 osc. anode SW HT feed	30,000
R7	V1 osc. anode HT feed ...	40,000
R8	V2 CG decoupling	1,000,000
R9	V2 SG HT feed	200,000
R10	IF stopper	50,000
R11	V3 signal diode load ...	500,000
R12	Manual volume control ...	1,000,000
R13	V3 triode CG stopper ...	100,000
R14	V3 triode anode load ...	50,000
R15	V1 pentode CG decoupling	1,000,000
R16	V3 AVC diode load	500,000
R17	resistances	500,000
R18	V1, V2 fixed GB; V3 triode, V4 GB; AVC delay; pot. divider	120
R19		800

	CONDENSERS	Values (μF)
C1	Aerial series condenser ...	0·0002
C2	Aerial MW "top" coupling	0·000005
C3	Aerial LW "top" coupling	0·000015
C4	Swamp condenser	0·001
C5	V1 pentode CG decoupling	0·1
C6	Aerial circuit SW fixed trimmer	0·00002
C7	V1 SG decoupling	0·1
C8, C9	1st IF transformer fixed trimmers	0·00005, 0·000135
C10	V1 osc. CG condenser ...	0·0002
C11	HT circuit RF by-pass ...	0·1
C12	Osc. circuit SW tracker ...	0·0035
C13	Osc. circuit MW tracker ...	0·0005075
C14	Osc. circuit LW tracker ...	0·0001692
C15	V2 CG decoupling	0·1
C16	V2 SG decoupling	0·1
C17, C18	2nd IF transformer fixed trimmers	0·00005, 0·00005
C19	Coupling to V3 AVC diode	0·0001
C20, C21	IF by-pass condensers ...	0·0001, 0·0001
C22	AF coupling to V3 triode	0·005
C23	IF by-pass	0·0003
C24	AF coupling to T1	0·1
C25, C26	Tone control condensers ...	0·02, 0·01
C27*	HT reservoir condenser ...	8·0
C28, C29	Fixed tone correctors ...	0·001, 0·001
C30*	Auto GB circuit by-pass ...	50·0
C31‡	Band-pass pri.MW trimmer	—
C32‡	Band-pass pri.LW trimmer	—
C33†	Band-pass pri. tuning ...	—
C34‡	Band-pass sec.MW trimmer	—
C35‡	Band-pass sec LW trimmer	—
C36†	Band-pass sec. and SW aerial tuning	—
C37‡	Aerial circuit SW trimmer	—
C38‡	Osc. circuit MW trimmer	—
C39‡	Osc. circuit LW trimmer	—
C40†	Oscillator circuit tuning ...	—
C41‡	Osc. circuit SW trimmer...	—
C42‡	1st IF trans. pri. tuning ...	—
C43‡	1st IF trans. sec. tuning ...	—
C44‡	2nd IF trans. pri. tuning...	—
C45‡	2nd IF trans. sec. tuning...	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial MW coupling coil ...	13·0
L2	Aerial LW coupling coil ...	60·0
L3	Band-pass pri. MW coil ...	2·25
L4	Band-pass pri. LW coil ...	22·0
L5	LW band-pass coupling ...	2·0
L6	MW band-pass coupling ...	0·05
L7	Aerial SW coupling coil ...	0·1
L8	Aerial SW tuning coil ...	Very low
L9	Band-pass sec. MW coil ...	2·25
L10	Band-pass sec. LW coil ...	22·0
L11	Oscillator SW reaction ...	6·0
L12	Oscillator MW reaction ...	3·75
L13	Oscillator LW reaction ...	5·0
L14	Osc. circuit SW tuning coil	0·1
L15	Osc. circuit MW tuning coil	2·5
L16	Osc. circuit LW tuning coil	9·25
L17	Variable selectivity coil ...	0·4
L18, L19	1st IF trans. Pri. ... ... Sec.	6·5, 3·0
L20	Variable selectivity coil ...	0·6
L21, L22	2nd IF trans. Pri.... ... Sec. ...	13·0, 16·0
L23	Speaker speech coil... ...	2·5
T1	Intervalve trans. Pri. ... ... Sec., total ...	470·0, 5000·0
T2	Speaker input trans. Pri., total Sec. ...	550·0, 0·2
S1-S18	Waveband switches ...	—
S19-S21	Scale lamps switches ...	—
S22, S23	Variable selectivity switches	—
S24, S25	Tone control switches ...	—
S26, S27, S28	LT circuit switch, HT circuit switches ganged R12	—

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 2) are those measured in our receiver when it was operating with a new HT battery reading 115V on load. The receiver was tuned to the lowest wavelengtth on the MW band and the volume control was at m mum, but there was no signal inpu

Voltages were measured on the 4 scale of a model 7 Universal Avome chassis being negative.

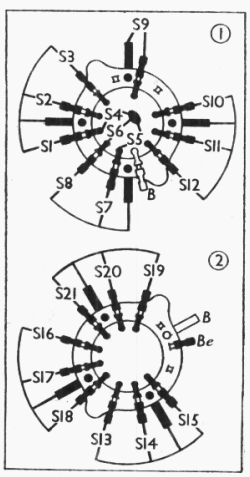
Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Scree Curre (mA
V1 TP25	105 Oscillator 43	0·5 1·8	43	0·6
V2 VP23	105	1·0	41	0·3
V3 HL23DD	70	0·6	—	—
V4 QP25	104†	2·25†	105	1·2

† Each anode.

GENERAL NOTES

Switches.—**S1-S18** are the waveban switches, and **S19-S21** the scale lamp switches, ganged in two rotary unit beneath the chassis. These are indica ted in our under-chassis view, and shown in detail in the diagrams below, where they are drawn as seen looking in the directions of the arrows in the under-chassis view. The table (below) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S22-S25 are the selectivity and tone control switches, ganged in a single rotary unit beneath the chassis. This is also indicated in our under-chassis view, and is shown in a diagram below, where it is drawn as seen looking from the rear of the underside of the chassis. The table below gives the switch positions for the four control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.



Diagrams of the **S1-S21** units, as seen looking in the directions of the arrows in the under-chassis view. Note the blank and bearer tags

S1—S21 TABLE

Switch	SW	MW	LW
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	—	—	C
S5	C	—	—
S6	—	C	—
S7	—	C	—
S8	—	—	C
S9	—	C	—
S10	C	—	—
S11	—	C	—
S12	—	—	C
S13	C	—	—
S14	—	C	—
S15	—	—	C
S16	C	—	—
S17	—	C	—
S18	—	—	C
S19	C	—	—
S20	—	C	—
S21	—	—	C

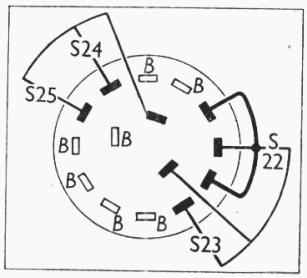


Diagram of the **S22-25** switch unit, as seen from the rear of the underside of the chassis

S22—S25 TABLE

Switch	Fid.	Norm.	ss	For'n
S22	—	C	C	C
S23	C	—	—	—
S24	—	—	C	—
S25	—	—	—	C

S26-S28 are the QMB battery circuit tches, ganged with the volume con- **R12.** Of the four tags, one is mon to the three switches, and goes chassis. **C30** goes to the other tag **S27**; the red/yellow lead goes to the r tag of **S28**; and the green lead to the other tag of **S26.**

ils.—L1-L4; L5, L6, L9, L10; L12, L15, L16; and the IF transformers **L20** and **L21, L22** are in five ned units on the decks of the is. Each unit contains two trim- and in addition the IF trans- rs contain two fixed trimmers

L8 and **L11, L14** are in two un- ed tubular units beneath the hand chassis (in our under-chassis **L8** and **L14** are the thick wire gs.

rnal Speaker.—Two sockets are ed on the internal speaker con- panel for a low impedance external speaker.

Lamps.—These are three Ever MES types, rated at 2·0V, 0· They are switched by **S19-S21,** an minate their respective tuning sc

ners.—Apart from the ten trim- me the five screened coil units, thee only the two on the gang con r completing the total.

Bes.—LT, 2V accumulator cell; HT V or 120V dry battery, which nee be tapped. No specific recom- mens are made.

Ba Leads and Voltages. — Black rub ad, spade tag, LT negative; red r lead, spade tag, LT positive 2V; lead and plug, HT negative; red and plug, HT positive 108V or 1

V2 lead.—This is taken from one sectic the chassis to the other

through a metal tube which also assists in holding the two sections of the chassis together.

Chassis Divergencies.—In the makers' diagram **R2** is shown returned to L.T. negative, but in our chassis it goes to the positive line; also the positive connection of **C30** goes to chassis via **S27** in our model, whereas the makers show it connected to the junction of **R18, S26,** and leave out **S27.**

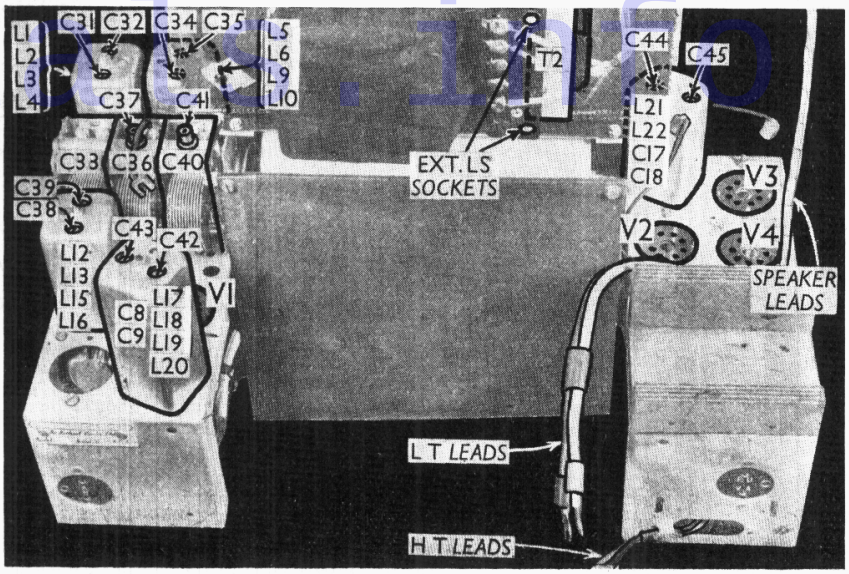
CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator, via a 0·1μF condenser, to control grid (top cap) of **V1** and chassis. Feed in a 465 KC/S signal, and with tone control switched to "bass," adjust **C45, C44, C43** and **C42** in turn for maximum output. Repeat these adjustments.

RF and Oscillator Stages.—With gang at maximum, pointers should cover marks at upper wavelength ends of the scales. Connect signal generator, via a suitable dummy aerial, to **A** and **E** sockets.

SW.—Switch set to SW, turn gang to minimum, feed in a 16·2m (18·5 MC/S) signal, and adjust **C41** for maximum output. Tune to 18·5m on scale, feed in an 18·5m (16·2 MC/S) signal, and adjust **C37** for maximum output.

MW.—Switch set to MW, turn gang to minimum, feed in a 193m (1,580 KC/S) signal, and adjust **C38** for maximum output. Tune to 214m on scale, feed in a 214m (1,400 KC/S) signal, and adjust **C34,** then **C31,** for maximum output.



Half-plan view of the chassis, showing most of the coil units and all the trimmers

LW.—Switch set to LW, and tune to 1,100m on scale. Feed in a 1,100m (272·7 KC/S) signal, and adjust **C39,** then **C35** and **C32** for maximum output.

All trackers are fixed in this receiver.

Using the "Service Sheet" Index

INCLUDED as a loose supplement with this *Service Sheet* is the latest index to all the sheets published to date—four hundred and fifty-eight of them. Each one of these sets, in its time, has passed through our laboratory, and in passing has been almost completely stripped for checking against the manufacturers' information (if any) concerning it. The result is that in many cases we have found divergencies in component values and wiring—some, indeed, of which even the manufacturers themselves were apparently unaware.

The result is that our information, being based on actual point-by-point checks on each receiver, can be relied upon to a greater extent than if we had merely re-written the manufacturers' own material.

Although four hundred and fifty *Service Sheets* have been published, many of them cover more than one receiver of a manufacturer's range, while others cover the "equivalent" receivers produced by other associated manufacturers. In this way, the total number of models covered is in the region of nine hundred and fifty.

In the index, many of the equivalents are included under their own manufacturers' trade names, though the sheets referred to may only bear the name and number of the set on which the sheet was actually prepared. Further, in some cases, after a sheet has been published, the manufacturer has produced a "new" model with the same chassis, in which case the model number is included in the index, but may not appear on the actual sheet.

These points are mentioned to avoid the doubt which might arise if the sheet indicated in the index does not happen to bear the name and number of the particular set for which the information is required.

A further check, of course, is to compare the valve types and chassis layout of the set with the information and illustrations in the *Service Sheet.* Sheets numbered from 293 onwards start with an illustration of the external appearance of the model on which the information was actually prepared.

In using the index, everything is straightforward if the maker and model number is known. If there does not appear to be a sheet dealing with this model, look up a few models of the same period made by associated manufacturers. Equivalents are not included in the index in all cases, as some manufacturers are still shy of admitting relationship—in print, at any rate. Dealers will be well aware of this, however.

If the manufacturer is known, but the model number is not, the only course is the somewhat laborious one of looking up the sheets on all likely sets. Time can be saved if the release date of the model is known, as the sheets are rarely issued more than six months after the release date of the set.

If, despite all this, a sheet on the particular set does not appear to have been published, it is often possible to get a good deal of information from similar models by the same manufacturer released at about the same time. Most service engineers will also find it not too difficult to service an AC/DC receiver working from the information on the AC model, and vice-versa.

NEW TECHNICAL BOOKS REVIEWED

Short-Wave Radio, by J. H. Reyner. 2nd edition. Sir Isaac Pitman and Sons, Ltd. Price 10s. 6d., postage extra.

The second edition of this manual, first published in 1937, has not undergone any very extensive modifications, but in places the information has been slightly extended. There are altogether 177 pages of specialist information on wave propagation, aerials, transmitters, and receivers, in which the special advantages and problems of the waveband spectrum from under one metre to 150 metres or so are fully explored.

Cathode-Ray Oscillographs, by J. H. Reyner. Sir Isaac Pitman and Sons, Ltd. Price 8s. 6d., postage extra.

In view of the widely increasing use of the cathode ray tube for oscillographic work in all spheres of testing and research, a new volume added to the rather sparse literature on the subject cannot be considered out of place.

The author, who has had a long experimental and manufacturing experience of cathode ray oscillographs, has, in 177 pages, set down and illustrated the subject in a very comprehensive manner.

There are nine chapters, but their headings do not indicate the large number of aspects of the subjects that are dealt with, and the sub-headings throughout the book are much more helpful.

Naturally, apart from a detailed treatment of the design features of oscillographs, the book deals mainly with the application of the instrument to radio and electrical measurements and investigations, but the final chapter gives some indications of special applications, such as engine indicator diagrams.

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