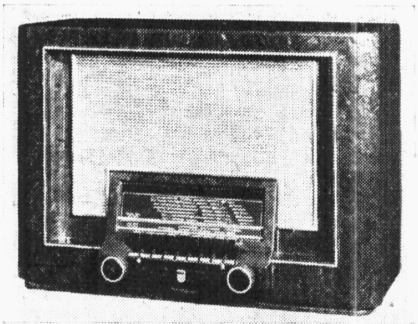
Supplement to The Wireless & Electrical Trader, May 11, 1940

"TRADER" SERVICE SHEET

464

PHILIPS 680A

(AND 599A CONSOLE)



The Philips 680A table model

THE Philips 680A is a table 3-band AC superhet, with the new Philips mechanical automatic tuning unit, having six keys for station selection (three of which are for MW and three for MW or LW stations), together with three keys for manual waveband switching.

The set employs three valves, plus valve rectifier. The SW range is 13.8-51m, and the set is suitable for 100-260 V, 50-100 C/S AC mains.

Model 599A is the corresponding console model, the divergencies being explained under "599A Divergencies."

Release date, both models: August, 1939.

Note.—When ordering spares for these models, dealers quoting our component numbers should mention that they are *Trader* Service Sheet numbers, to avoid confusion.

CIRCUIT DESCRIPTION

Aerial input on MW and LW is via coupling components **L2, C2** (MW), plus **L3** (LW) to mixed coupled band-pass filter. Primary coils **L4, L5** are tuned by **C31**; secondaries **L10, L11** by **C33.** Coupling by **L6, L7** and **C3, C4.** IF filtering in aerial circuit by **L1, C29** across **L2, L3.** Image suppression by **C1.**

On SW, input is via coupling coil **L8** to single tuned circuit **L9, C33.**

First valve **(V1, Mullard ECH3)** is a triode heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L15** (SW), **L16** (MW) and **L17** (LW) are tuned by **C35;** parallel trimming by **C34** (MW) and **C12** (LW); series tracking by **C10** (MW) and **C11** (LW). Reaction by grid coils **L12** (SW), **L13** (MW), and **L14** (LW).

Second valve **(V2, Mullard EF9)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C36, L18, L19, C37** and **C38, L20, L21, C39.**

Intermediate frequency 128KC/S.

Diode second detector is part of double diode pentode output valve **(V3, Mullard EBL1).** Audio frequency component in rectified output is developed across **R12** and manual volume control **R13,** which operates as part of the load resistance, and passed via AF coupling condenser **C21** and CG resistance **R15** to CG of pentode section, which provides the only AF amplification.

Provision for connection of gramophone pick-up between the top of **R13** and chassis. Provision also for connection of low impedance external speaker.

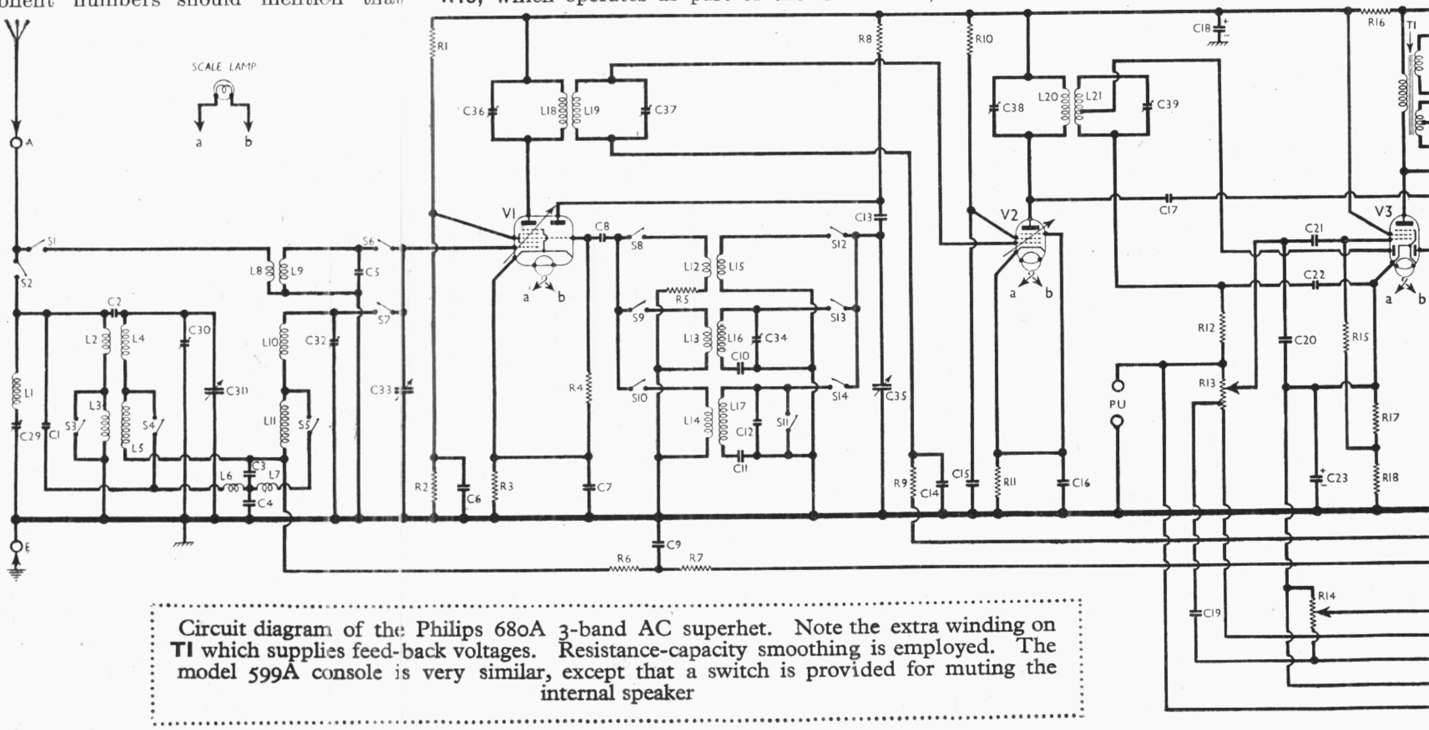
Tertiary winding on **T1** provides positive and negative voltages which are fed back through tone correcting filter **R21, R22, C26, C27, R23** and **R24** to the grid circuit of **V3** pentode. The feed-back circuit is so arranged that towards the low-potential end of the volume control its sense is negative to the signal, while at the other end it is positive.

Consequently, when the slider of the volume control is turned "down" and little gain is required, the feed-back is mainly negative; but as the position of the slider is advanced for the reception of a weak signal, the feed-back becomes increasingly positive until the "top" of the travel is reached, when the feed-back voltage is in phase with the signal and maximum gain is established.

On radio, the range of the volume control is limited by **R12,** across which part of the signal voltage is developed.

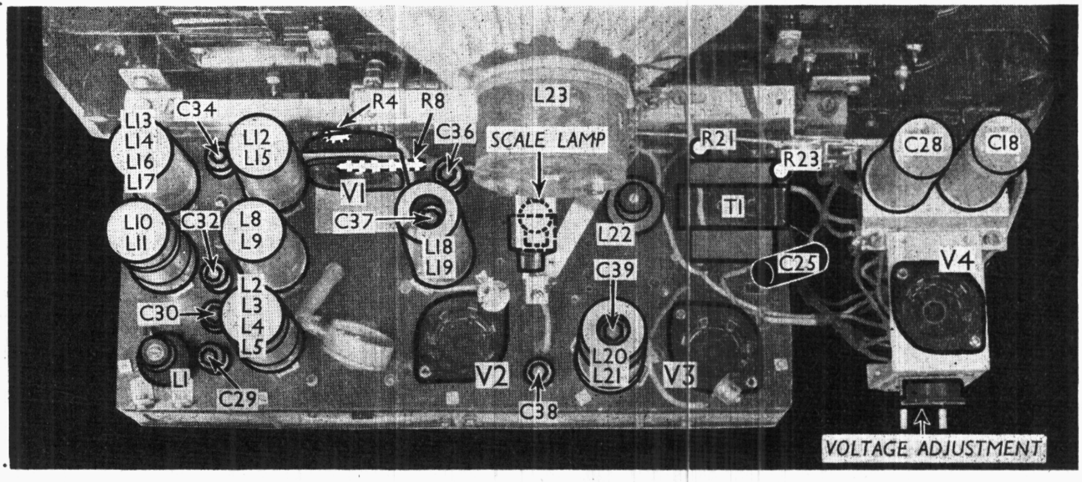
Variable tone control by **C24, R14** and **L22.** Fixed tone correction by **C25** in **V3** pentode anode circuit.

HT current is supplied by full-wave rectifying valve **(V4, Mullard AZ1).** Smoothing by electrolytic condensers **C18, C28** and feed resistance **R16.**



Circuit diagram of the Philips 680A 3-band AC superhet. Note the extra winding on **T1** which supplies feed-back voltages. Resistance-capacity smoothing is employed. The model 599A console is very similar, except that a switch is provided for muting the internal speaker

Plan view of the chassis. Note the various air-dielectric trimmers. Some of them have small parallel fixed condensers attached to them beneath the chassis. Condensers **C18, C28** may be in a single unit in some models



DISMANTLING THE SET

Removing Chassis.—Remove the six screws (two in each top corner and one in each bottom corner, with washers) holding the brackets on the cabinet surround to the front moulding;

remove the two long transit bolts (with washers and wooden blocks), if still in position, holding the ends of the rear member of the chassis to the bottom of the cabinet;

remove the two screws (with washers) holding the flexible mounting clamp, in the centre of the rear chassis member, to the bottom of the cabinet;

remove the two small diameter mains input bracket mounting screws (with washers);

remove the four screws (with washers) holding the mains transformer to the bottom of the cabinet.

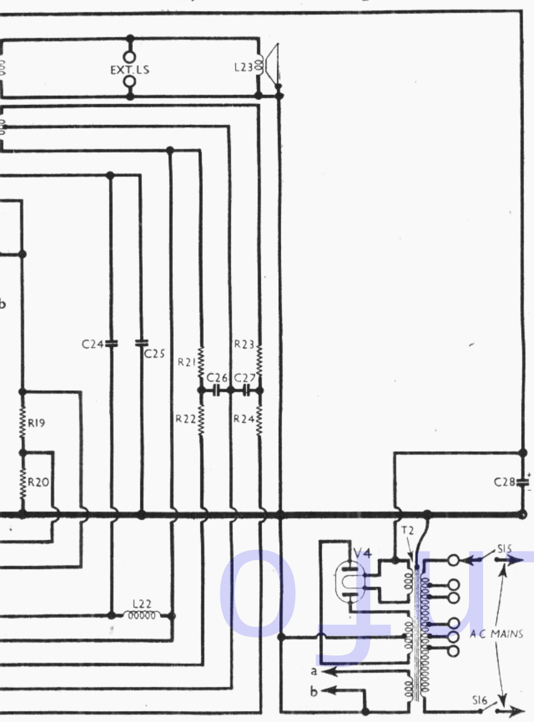
The front moulding can now be withdrawn, with the complete assembly.

Removing Speaker.—Unsolder from the connecting strip on the speaker the two leads connecting it to chassis; remove the four hexagon nuts (with washers) and one cheese-head screw (at top, with washer) holding the speaker to the front moulding.

When replacing, the speaker connecting strip should be on the right.

Connect the lead from the upper left-hand tag on the rear of the output transformer to the two upper tags on the connecting strip;

connect the remaining lead (from the lower left-hand tag on the rear of the output transformer) to the bottom tag on the connecting strip.



COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Image rejector	0·000039
C2	Aerial "top" coupling ...	0·00001
C3	Band-pass coupling condensers	0·012
C4		0·039
C5	Aerial circuit SW trimmer	0·0000022
C6	V1 SG decoupling	0·047
C7	V1 cathode by-pass	0·047
C8	V1 osc. CG condenser ...	0·000047
C9	AVC line decoupling ...	0·047
C10	Osc. circuit MW tracker ...	0·00145
C11	Osc. circuit LW tracker ...	0·000394
C12	Osc. circuit LW trimmer ...	0·000033
C13	V1 osc. anode coupling ...	0·00047
C14	V2 CG decoupling	0·047
C15	V2 SG decoupling	0·047
C16	V2 cathode by-pass... ...	0·047
C17	Coupling to V3 AVC diode	0·0000082
C18*	HT smoothing condenser ...	32·0
C19	Part of feed-back coupling	0·027
C20	IF by-pass	0·0001
C21	AF coupling to V3 pentode	0·0033
C22	IF by-pass	0·000056
C23*	V3 cathode by-pass... ...	25·0
C24	Part of variable tone control	0·0047
C25	Fixed tone corrector ...	0·001
C26	Feed-back tone corrector condensers	0·033
C27		0·0056
C28*	HT smoothing condenser...	32·0
C29‡	Aerial IF filter tuning ...	0·0001
C30‡	Band-pass pri. MW trimmer	0·00002
C31†	Band-pass pri. tuning ...	0·00049
C32‡	Band-pass sec. MW trimmer	0·00002
C33†	Aerial SW and band-pass secondary tuning	0·00049
C34‡	Osc. circuit MW trimmer ...	0·00002
C35†	Oscillator circuit tuning ...	0·00049
C36‡	1st IF trans. pri. tuning ...	0·0001
C37‡	1st IF trans. sec. tuning ...	0·0001
C38‡	2nd IF trans. pri. tuning ...	0·0001
C39‡	2nd IF trans. sec. tuning ...	0·0001

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTANCES	Values (ohms)
R1	V1 SG HT feed potential divider	47,000
R2		33,000
R3	V1 fixed GB resistance ...	330
R4	V1 osc. CG resistance ...	47,000
R5	Osc. SW reaction damping	15
R6	AVC line decoupling resistances	100,000
R7		1,500,000
R8	V1 osc. anode HT feed ...	27,000
R9	V2 CG decoupling	1,800,000
R10	V2 SG HT feed	100,000
R11	V2 fixed GB	330
R12	Volume control limiter ...	47,000
R13	Manual volume control; V3 signal diode load	700,000*
R14	Variable tone control ...	50,000
R15	V3 pentode CG resistance...	1,000,000
R16	HT feed resistance	1,800
R17	V3 pentode GB; AVC delay resistances	150
R18		390
R19	V3 AVC diode load resistances	560,000
R20		560,000
R21	Feed-back feed resistances	1,500
R22		12,000
R23		10,000
R24		820,000

*Tapped at 50,000 O from low potential end

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial IF filter coil	110·0
L2	Aerial MW coupling coil ...	26·0
L3	Aerial LW coupling coil ...	90·0
L4	Band-pass primary coils ...	4·5
L5		48·0
L6	Band-pass coupling coils ...	0·7
L7		0·7
L8	Aerial SW coupling coil ...	2·0
L9	Aerial SW tuning coil ...	Very low
L10	Band-pass secondary coils	4·4
L11		45·0
L12	Oscillator SW reaction coil	1·0
L13	Oscillator MW reaction coil	2·5
L14	Oscillator LW reaction coil	9·5
L15	Osc. circuit SW tuning coil	Very low
L16	Osc. circuit MW tuning coil	8·0
L17	Osc. circuit LW tuning coil	32·0
L18	1st IF trans. Pri.... ...	115·0
L19	1st IF trans. Sec. ...	115·0
L20	2nd IF trans. Pri.... ...	115·0
L21	2nd IF trans. Sec., total	125·0
L22	Tone control choke	800·0
L23	Speaker speech coil	2·5
T1	Output trans. Pri.... ...	700·0
	Output trans. Sec. ...	1·0
	Output trans. Tert., total	360·0
T2	Mains trans. Pri., total... ...	45·0
	Mains trans. Heater sec. ...	0·1
	Mains trans. Rect. heat. sec. ...	0·2
	Mains trans. HT sec., total ...	300·0
S1-S14	Waveband switches... ...	—
S15, S16	Mains switches, ganged R13	—

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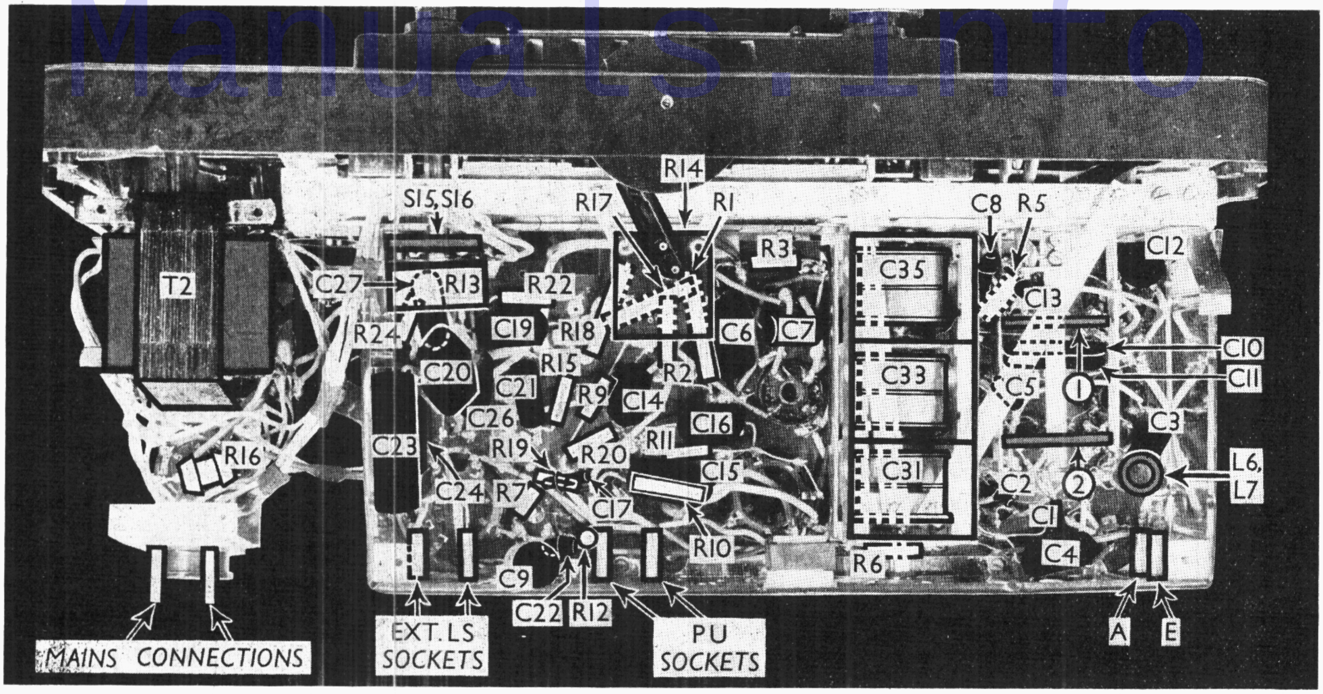


Under-chassis view. Diagrams of the two switch units are below. The tone control **R14** is operated by a disc and lever device. **R16** is a wire-wound resistor

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 236V, using the 245V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the MW band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH3	239	1·0	65	1·6
	Oscil 126	lator 3·5		
V2 EF9	239	5·5	82	1·7
V3 EBL1	252	34·0	239	3·8
V4 AZ1	256†	—	—	—

† Each anode, AC

GENERAL NOTES

Switches.—S1-S14 are the waveband switches, in two rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams (col. 2), where they are drawn as seen looking from the rear of the underside of the chassis. The table (col. 3) gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the spindle. A dash indicates open, and **C**, closed.

S15, S16 are the mains switches, in a unit fitted in front of the volume control **R13**, and ganged with it.

Coils.—L2-L5; L8, L9; L10, L11; L12, L15; L13, L14, L16, L17; and the IF transformers **L18, L19** and **L20, L21** are in seven screened units on the chassis deck. Each of the last two contains one trimmer, reached through a hole in the top of the can.

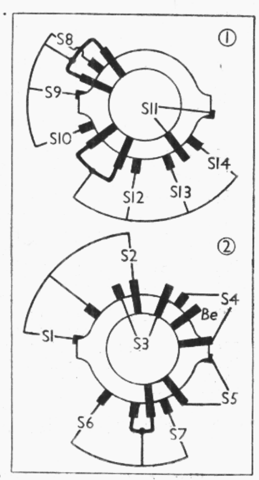
L6, L7 is in an unscreened unit beneath the chassis, while **L1** and **L22** are also in unscreened units, but on the chassis deck.

Scale Lamp.—This is a Philips MES type, code No. 8091D. It is screwed into a moulding which is held in a box-like bracket on the chassis deck by means of a bayonet catch.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (3-5O) external speaker.

Condensers C18, C28.—In our chassis these are two separate 32μF condensers, mounted on a bracket above **T2.** In some models they may take the form of a single metal cased unit, with **C18** in the upper section and **C28** in the lower section. The can is the common negative connection, the tag emerging from the top of the unit is the positive of **C18**, and the tag emerging beneath the mounting bracket is the positive of **C28. C18** is 15μF, and **C28,** 50μF.

Diagrams of the two switch units, as seen from the rear of the underside of the chassis



Trimmers. — Apart from the two situated one in each IF can, there are six air-dielectric trimmers mounted on the chassis deck. **C29, C36, C37, C38** and **C39** each have a small tubular fixed condenser attached to their bases, which is connected in parallel with the variable section of the unit in each case.

Resistance R16.—This is a small tubular wire-wound unit.

Tone Control R14.—This is operated by a milled disc projecting horizontally beneath the keyboard. The disc moves a lever carrying the slider of the control.

Transformer T1.—Note that this has an extra secondary winding used for feed-back purposes only.

MODEL 599A DIVERGENCIES

The console model 599A has an almost identical chassis. The main difference

SWITCH TABLE

SWITCH	SW	MW	LW
S1	C	—	—
S2	—	C	C
S3	C	C	—
S4	—	C	—
S5	—	C	—
S6	C	—	—
S7	—	C	C
S8	C	—	—
S9	—	C	—
S10	—	—	C
S11	—	C	—
S12	C	—	—
S13	—	C	—
S14	—	—	C

is that a switch is provided (at the back of the cabinet) for muting the internal speaker. It is a single pole change-over type. In one position the top of **L23** is connected to the top of **T1** speech coil secondary; in the other, this connection is broken, and a load resistance is connected across **T1** speech coil secondary. The load resistance consists of two 39O resistors in parallel.

In addition a larger loudspeaker unit is fitted in the console.

AUTO-TUNING ADJUSTMENT

The first six keys, from left to right, are for station selection. The remaining three keys are for manual waveband switching. Of the six station keys, the first three can be adjusted for MW or LW stations; the remaining three are for MW stations only.

To adjust a station key (without altering the waveband to which it is set, if it is one of the first three), use the tool which is kept in a hole in the back of the receiver at the top left-hand corner. Press down the key concerned, and insert the adjusting tool into the aperture underneath the keyboard, immediately below the key concerned.

Rotate the tool until it engages with the head of the adjusting screw (this can be felt), then turn it one way or the other until the required station is tuned in. Do not press on the tool more than is necessary to keep it engaged with the adjusting screw. When the station is tuned, withdraw the tool.

The head of the tool is recessed to fit the ornamental-headed screws holding the station name escutcheon in place, and can be used to remove these screws when it is desired to change a name.

To change the waveband covered by any one of the three left-hand keys, the same tool is used, but this time the key must not be depressed. If it is, first release it by pressing any other key. Then insert the tool through the aperture as before. To change the key from LW to MW operation, turn the tool anti-clockwise (unscrew) about five complete turns. To change from MW to LW, insert the tool, press it forward, and rotate it clockwise until it is tight.

CIRCUIT ALIGNMENT

IF Stages.—Press MW key, tune to 180m on scale and turn volume control to maximum.

Connect signal generator to control grid (top cap) of **V1**, and chassis. Connect an 80μμF condenser across **C38**, feed in a 128 KC/S signal, and adjust **C39** for maximum output. Now connect the 80μμF condenser from tapping on **L21** to junction of **R12, C22,** and adjust **C38** for maximum output. Remove the 80μμF condenser, and connect it across **C36**, then adjust **C37** for maximum output. Transfer 80μμF condenser to **C37**, and adjust **C36** for maximum output. Remove the 80μμF condenser and seal all trimmers.

RF and Oscillator Stages.—Connect signal generator to **A** and **E** sockets, via a suitable dummy aerial. Turn volume control to maximum. For setting the gang accurately at the lower wavelength end of the MW band a special trimming jig will be necessary (Part No. 2V.351.063).

Press MW key and tune to 180m on scale. Fit trimming jig to the rear of the gang spindle, so that it acts as a distance piece between the large washer secured to the end of the spindle and the rear-end plate of the gang assembly. Turn back the gang until it rests on the jig. Feed in a 1,600 KC/S (187.5m) signal, and adjust **C34, C32** and **C30** in turn for maximum output. Repeat these adjustments, seal trimmers and remove jig.

IF Filter.—Feed a 128 KC/S signal into **A** and **E** sockets, and adjust **C29** for *minimum* output.

Calibration.—Feed in a 566 KC/S (530m) signal, and tune it in accurately. Pointer should read 530m on scale. If not, adjust *horizontal* hexagonal-head screw at end of wire link to pointer arm until it does. Feed in a 1,250 KC/S (240m) signal and tune it in. Pointer should read 240m on scale. If not, adjust *vertical* hexagonal-head screw at end of wire link to pointer arm until it does. Repeat these adjustments until pointer registers accurately at 530m and 240m.

Notes on the Oscillator Stage

A Likely Cause of Superhet Failure

IN a superheterodyne receiver the oscillator section of the frequency changer is often a source of trouble, yet it is probably the section of the receiver which is most taken for granted.

Failure of the oscillator will result in no signals being produced, for the simple reason that a superhet depends for its functioning on the mixing of locally generated oscillations with the incoming signal to produce an intermediate frequency signal in the anode circuit of the frequency-changer valve, this being subsequently amplified to the required degree.

Complete or Partial Failure

It is clear that if the local oscillator fails, no IF signal will be produced, and the receiver will be completely dead. In some cases the oscillator may not fail entirely at all parts of the tuning scale. This means that signals within certain wavelength bands will be obtainable, but the set will be dead between these bands. Such a state of affairs generally points to oscillator trouble.

Low sensitivity of the receiver, if not traceable to any other cause, may be due to weakness of the local oscillation. On the other hand, if the oscillator is operating too strongly, sensitivity may in some cases be reduced, and in addition harmonics of the oscillator fundamental frequency may be generated, which will tend to produce spurious IF signals resulting in interference.

In order to secure the most satisfactory operation of the frequency changer stage, the oscillator must produce a signal of definite voltage, known as the optimum heterodyne voltage. In some valves this voltage can vary over wide limits without seriously affecting results, which is a good point; in all frequency changers low heterodyne volts will result in loss of sensitivity (due to a reduction in conversion conductance of the valve), and in some a high heterodyne voltage will also result in reduced sensitivity. Usually the optimum heterodyne voltage is of the order of 5 to 15V.

Now it is a well-known fact that as one tunes an oscillator over a waveband the circuit values change, with the result that the degree of oscillation varies. The designer tries to engineer the circuit so that the resultant heterodyne voltage remains fairly constant; service engineers will have noted that on the SW bands the oscillator anode voltage is sometimes increased for this purpose.

When specifying oscillator anode voltages and currents it is usual to state on what waveband and at what part of the band the measurements were made, for the voltage and current usually varies quite appreciably.

There is a simple method of checking whether an oscillator is functioning, and that is to insert a milliammeter in series with the oscillator anode circuit, preferably at the low RF potential end of the circuit, which will often be where the anode supply is taken from the HT line. Note the reading of the meter, and then deliberately put the oscillator circuit out of action by short-circuiting the oscillator tuning condenser, or by connecting a large capacity swamp condenser across it. When this is done, a change in oscillator anode current should occur; if it does not, it is safe to assume that the circuit was not oscillating originally. The current may rise or fall, depending on the type of oscillator circuit in use, but this does not matter, the main point being that a change in current denotes that the oscillator was working originally.

Checking by Voltage Drop

Instead of measuring the current, the voltage drop across the oscillator anode feed resistance can be measured, but in this case the voltmeter should have a high internal resistance to avoid upsetting the circuit conditions appreciably.

In the case of partial failure of the oscillator, this will be shown up by swinging the tuning of the set while the meter is connected, and noting if the anode current changes suddenly at any points. It if does, it probably indicates that the valve is going in and out of oscillation at these points.

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