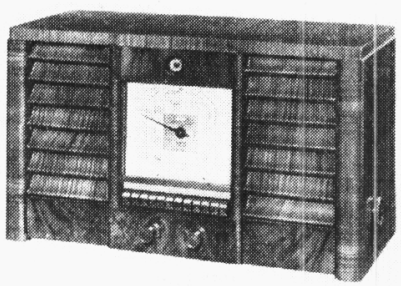
Supplement to The Wireless & Electrical Trader, Jan. 27, 1940.

"TRADER" SERVICE SHEET 447

G.E.C. BC 4070

PRESS-BUTTON AC SUPERHET



THE GEC model 4070 is a 5-valve (plus valve rectifier) 3-band AC superhet, with press-button mechanical automatic tuning for eight stations, and press-button wavechange and "off" switching. The station press-buttons select their correct waveband (MW or LW). The SW range is 16.5-50 m.

The receiver is fitted with a tuning indicator, and there is waveband indication by coloured lights, visible through two holes in the scale.

The circuit incorporates an RF stage preceding the frequency-changer. The receiver is suitable for 190 to 250 V, 40 to 100 C/S AC mains.

Release date: August, 1939.

CIRCUIT DESCRIPTION

Aerial input across shunt resistance **R1** appears also across **C1, L1, C2** which are in parallel with **R1.** On SW, input is then via **L1** to single tuned circuit **L2, C45.** On MW and LW, **L1** has a negligible impedance and input is coupled via **C1, C2,** which form potential divider across **R1,** to single tuned circuits **L3** (MW), plus **L4** (LW) tuned by **C45.**

First valve **(V1, Osram KTW61)** is a variable-mu tetrode operating as RF amplifier.

Tuned-secondary RF transformer coupling by **L5, L7, C49** (SW), **L6, L8, C49** (MW); and capacitatively coupled grid tuning by **C8, C9, L9, C49** (LW) between **V1** and triode hexode valve **(V2, Osram X65)** which operates as frequency changer with internal coupling.

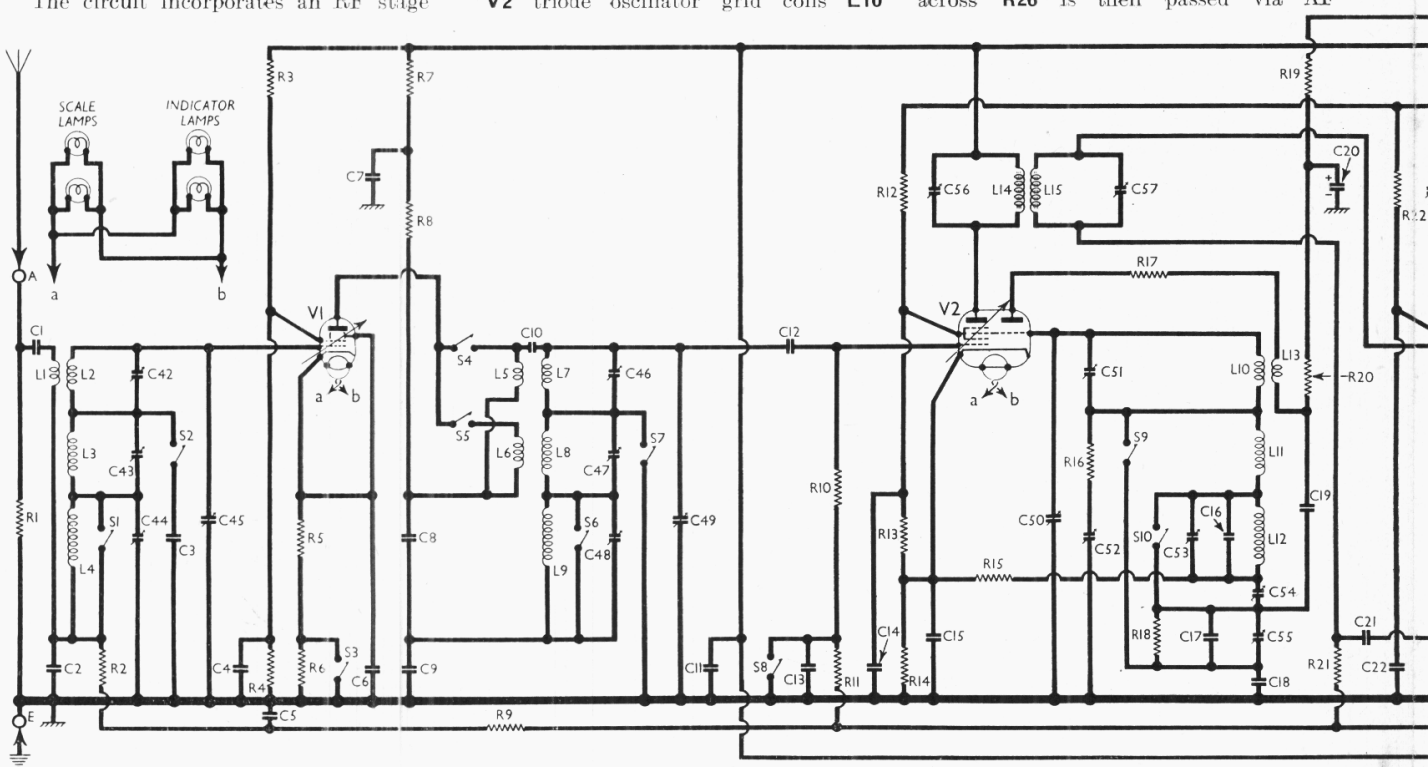
V2 triode oscillator grid coils **L10** (SW), plus **L11** (MW), plus **L12** (LW) are tuned by **C50;** parallel trimming by **C51** (SW), **C52** (MW) and **C16, C53** (LW); series tracking by **C18** (SW), **C17, C55** (MW) and **C54** (LW). Reaction by **L13** (SW), and common impedance of **C17, C55** and **C18** which couple grid and anode circuits via **C19** (MW and LW).

Third valve **(V3, Osram KTW61)** is a second RF tetrode, operating as intermediate frequency amplifier with tuned-primary, tuned-secondary iron-cored transformer couplings **C56, L14, L15, C57** and **C58, L16, L17, C59.**

Intermediate frequency 456 KC/S.

Diode second detector is part of double diode triode valve **(V4, Osram DL63).** Audio frequency component in rectified output is developed partly across tone corrector filter **R25, C28** and partly across diode load resistance **R26** which is in turn shunted by further tone filter **R27, C29,** the proportion of signal across each limb of the tone filter being determined by the frequency.

The modified signal as developed across **R26** is then passed via AF



Circuit diagram of the G.E.C. BC 4070 AC superhet. Note that an RF stage is employed. The **V2** oscillator anode feed is taken from the rectifier side of the smoothing choke **L19.**

coupling condenser **C30** and manual volume control **R28** to CG of triode section, which operates as AF amplifier.

IF filtering by **C25, R24, C26** in diode circuit and **C32** in triode anode circuit. Provision for connection of gramophone pick-up across **R28.**

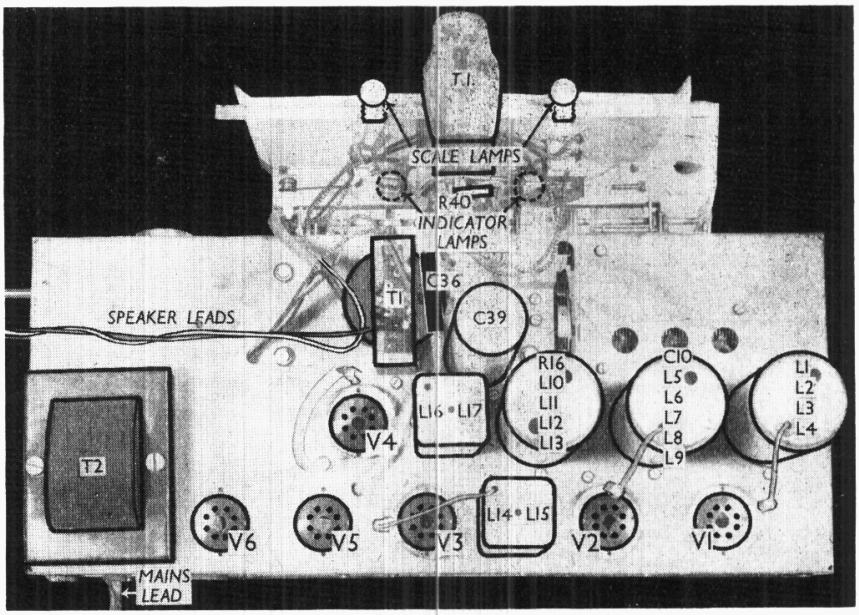
Second diode of **V4,** fed from **V3** anode via **C24,** provides DC potential which is developed across load resistance **R32** and fed back through decoupling circuits as GB to RF, FC (except on SW) and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained from drop along **R31.**

AVC line potential is applied via decoupling circuit **R41, C41** as control voltage to CG of cathode ray tuning indicator **(T.I., Osram Y63).**

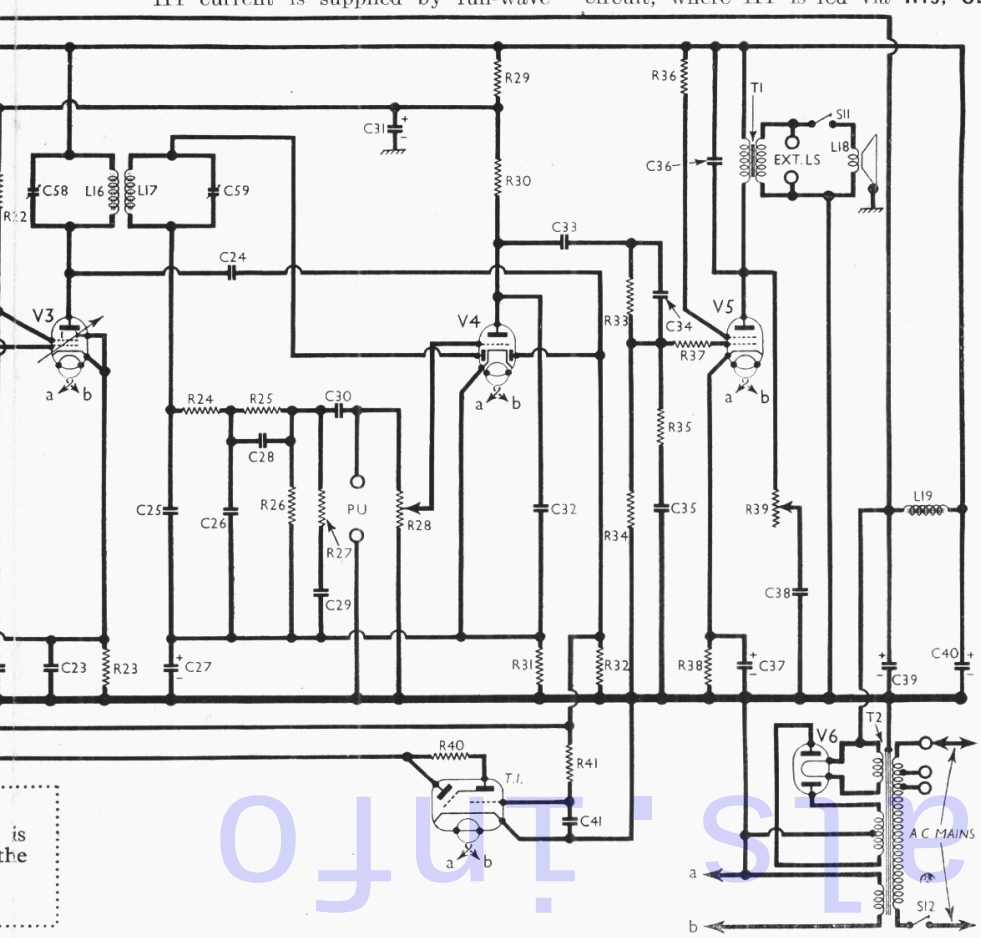
Resistance-capacity coupling by **R30, C33** and second tone filter network **R33, C34, R35, C35,** with CG resistance **R34** and grid stopper **R37,** between **V4** triode and tetrode output valve (**V5, Osram KT61).**

Fixed tone correction in **V5** anode circuit by **C36,** and variable tone control by **R39, C38** also in anode circuit. Provision for connection of low impedance external speaker across secondary of output transformer **T1.** Switch **S11,** which is operated by the external speaker connecting plug, disconnects internal speaker speech coil **L18** to mute internal speaker if desired.

HT current is supplied by full-wave rectifying valve **(V6, Osram U50).** Smoothing by iron-cored choke **L19** and dry electrolytic condensers **C39, C40** except in the case of **V2** oscillator anode circuit, where HT is fed via **R19, C20.**



Plan view of the chassis. All the trimmers are reached from beneath the chassis.



DISMANTLING THE SET

The bottom of the cabinet is fitted with a detachable cover, upon removal of which (six wood-screws, with washers) access may be gained to the components beneath the chassis. This cover is fixed to two wooden battens, upon which the chassis is mounted.

Before the chassis can be withdrawn, the loudspeaker must be removed.

Removing Speaker.—Unsolder the two connecting leads from the three tags on the speaker;

remove the four cheese-head screws (with washers and lock-washers) holding the speaker and sub-baffle to the front of the cabinet.

The speaker may now be withdrawn, together with its sub-baffle.

When replacing, the connecting panel should be at the top;

connect the white lead to the right-hand tag on the connecting panel;

connect the black lead to the left-hand tag on the connecting panel, and to the earthing tag on the speaker frame.

Removing Chassis.—Remove the three control knobs (pull-off);

remove the wood-screw (with metal washer and rubber grommet) holding the top right-hand corner of the scale assembly to the front of the cabinet;

remove the detachable cover from the bottom of the cabinet;

remove the four bolts (with washers and lock-washers) holding the two battens to the bottom of the cabinet.

The chassis, with the two battens attached to it, can now be withdrawn.

Removing Battens.—Remove the volume and tone control bracket from the front batten (three long cheese-head bolts with washers, reached from the rear of the batten, into which they are sunk);

remove the four large cheese-head bolts (with large metal and rubber washers) holding the battens to the chassis.

When replacing battens, the wide one goes at the front, and the cut-away part should be on the front edge.

Both should be so mounted that the threaded metal blocks shall be uppermost when in the cabinet.

Two large rubber washers should be fitted to each of the chassis bolts, one going on each side of the batten.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial shunt resistance ...	9,900
R2	V1 CG decoupling	1,000,000
R3	V1 SG HT feed potential divider resistances	38,500*
R4		22,000
R5	V1 fixed GB resistances ...	300
R6		300
R7	V1 anode HT feed resistances	2,200
R8		9,900
R9	AVC line decoupling ...	1,000,000
R10	V2 hexode CG resistance ...	1,000,000
R11	V2 hexode CG decoupling...	1,000,000
R12	V2 SG and fixed GB potential divider resistances	16,500†
R13		22,000
R14		200
R15	V2 osc. CG resistance ...	99,000
R16	Osc. circuit damping ...	150
R17	Osc. reaction damping ...	300
R18	Osc. circuit damping ...	2,200
R19	V2 osc. anode decoupling ...	22,000‡
R20	V2 osc. anode HT feed ...	9,900
R21	V3 CG decoupling	2,000,000
R22	V3 SG HT feed	77,000
R23	V3 fixed GB resistance ...	300
R24	IF stopper	55,000
R25	Part of fixed tone corrector	330,000
R26	V4 signal diode load	150,000
R27	Part of fixed tone corrector	99,000
R28	Manual volume control ...	1,000,000
R29	V2, V3 SG and V4 triode anode HT feed	4,400
R30	V4 triode anode load ...	99,000
R31	V4 GB ; AVC delay... ...	3,300
R32	V4 AVC diode load	440,000
R33	Part of fixed tone corrector	220,000
R34	V5 CG resistance	330,000
R35	Part of fixed tone corrector	150,000
R36	V5 SG stabiliser	75
R37	V5 grid stopper	9,900
R38	V5 GB resistance	90
R39	Variable tone control ...	55,000
R40	T.I. anode HT feed ...	1,000,000
R41	T.I. CG decoupling ...	2,000,000

* Two 77,000 Ω resistances in parallel.
† Two 33,000 Ω resistances in parallel.
‡ Two 44,000 Ω resistances in parallel.

	CONDENSERS	Values (μF)
C1	Aerial coupling condensers	0·005
C2		0·003
C3	V1 CG SW decoupling ...	0·01
C4	V1 SG decoupling	0·05
C5	AVC line decoupling ...	0·05
C6	V1 cathode by-pass... ...	0·05
C7	V1 anode decoupling ...	0.1
C8	V1 to V2 hexode LW coupling condensers	0·005
C9		0·0032
C10	V1 to V2 hex. SW top coupling	0·000004
C11	HT circuit RF by-pass ...	0·1
C12	V2 hexode CG condenser ...	0·0003
C13	V2 hex. CG decoupling ...	0·05
C14	V2 SG decoupling	0·05
C15	V2 cathode by-pass... ...	0·05
C16	Osc. circuit LW fixed trimmer	0·00005
C17	Osc. circuit MW fixed tracker	0·0003
C18	Osc. circuit SW tracker ...	0·00395
C19	Part osc. reaction coupling	0·005
C20*	V2 osc. anode decoupling ...	8·0
C21	V3 CG decoupling	0·05
C22	V3 SG decoupling	0·05
C23	V3 cathode by-pass... ...	0·1
C24	Coupling to V4 AVC diode	0·0001
C25	IF by-pass condensers ...	0·0003
C26		0·0001
C27*	V4 cathode by-pass... ...	30·0
C28	Parts of fixed tone correcto	0·6
C29		0·01
C30	AF coupling to V4 triode ...	0·02

	CONDENSERS—(*Continued*)	Values (μF)
C31*	V3 triode anode decoupling	4·0
C32	IF by-pass condenser ...	0·001
C33	V4 triode to V5 AF coupling	0·02
C34	Parts of fixed tone corrector	0·0005
C35		0·0015
C36	Fixed tone corrector ...	0·005
C37*	V5 cathode by-pass... ...	30·0
C38	Part of variable tone control	0·05
C39*	HT smoothing condensers	24·0
C40*		24·0
C41	T. I. CG decoupling... ...	0·01
C42‡	Aerial circuit SW trimmer	—
C43‡	Aerial circuit MW trimmer	—
C44‡	Aerial circuit LW trimmer	—
C45†	Aerial circuit tuning ...	—
C46‡	RF trans. SW sec. trimmer	—
C47‡	RF trans. MW sec. trimmer	—
C48‡	RF LW trimmer	—
C49†	RF trans. sec. tuning ...	—
C50†	Oscillator circuit tuning ...	—
C51‡	Osc. circuit SW trimmer ...	—
C52‡	Osc. circuit MW trimmer ...	—
C53‡	Osc. circuit LW trimmer ...	—
C54‡	Osc. circuit LW tracker ...	—
C55‡	Osc. circuit MW tracker ...	—
C56‡	1st IF trans. pri. tuning ...	—
C57‡	1st IF trans. sec. tuning ...	—
C58‡	2nd IF trans. pri. tuning ...	—
C59‡	2nd IF trans. sec. tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil ...	0·29
L2	Aerial SW tuning coil ...	0·03
L3	Aerial MW tuning coil ...	3·7
L4	Aerial LW tuning coil ...	30·0
L5	RF trans. SW pri. coil ...	3·17
L6	RF trans. MW pri . coil ...	0·66
L7	RF trans. SW sec. coil ...	0·03
L8	RF trans. MW sec. coil ...	3·68
L9	RF LW tuning coil	30·0
L10	Osc. circuit SW tuning coil	0·03
L11	Osc. circuit MW tuning coil	2·54
L12	Osc. circuit LW tuning coil	8·1
L13	Osc. SW reaction coil ...	0·39
L14	1st IF trans. Pri.... ...	7·0
L15	Sec. ...	7·0
L16	2nd IF trans. Pri.... ...	4·0
L17	Sec. ...	4·0
L18	Speaker speech coil	2·0
L19	HT smoothing choke ...	380·0
T1	Output trans. Pri.... ...	450·0
	Sec. ...	0·4
T2	Mains trans. Pri., total ...	21·0
	Heater sec. ...	0·16
	Rect. heat. sec.	0·17
	HT sec., total	400·0
S1-S10	Waveband switches... ...	—
S11	Internal speaker switch ...	—
S12	Mains switch	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 225 V using the 210-230 V 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.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 KTW61	183	4·2	72	1·3
V2 X65	247	1·5	74	3·9
	Oscillator			
	121	4·7		
V3 KTW61	247	6·0	63	1·9
V4 DL63	94	0·8	—	—
V5 KT61	226	38·0	247	7·5
V6 U50	288†	—	—	—
	13	0·25		
T.I. Y63	Target		—	—
	247	2·0		

† Each anode, AC.

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

If the valve screens are removed when making current measurements, it is advisable to slip them over the valve and earth them temporarily while the reading is being taken.

GENERAL NOTES

Switches.—S1-S10 are the waveband switches, in two rotary units beneath the chassis. They are indicated in our under-chassis view, and shown in detail in the diagrams below. The diagrams are drawn looking in the directions of the arrows in the under-chassis view, that is, looking at them from the aerial socket end of the chassis.

The table below gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the spindle, looking from its lever end.

These switches are operated by the three wave-change buttons through a rocking framework and link, and also by the station buttons, when changing over from a MW to LW or LW to MW station, in the same manner.

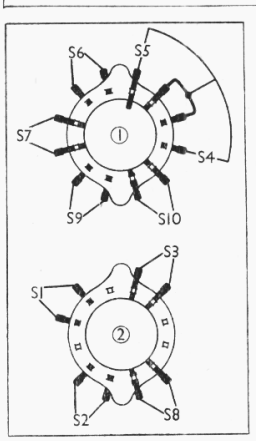
S11 is the internal speaker jack switch, associated with one of the external speaker sockets at the rear of the chassis. When the external speaker plug is fully inserted, **S11** opens and mutes the internal speaker.

S12 is the QMB mains switch, on a bracket inside the rear member of the chassis. It is switched on by any of the wavechange or station buttons, through a bar and link system, while pressing the "off" button opens **S12** and switches the set off.

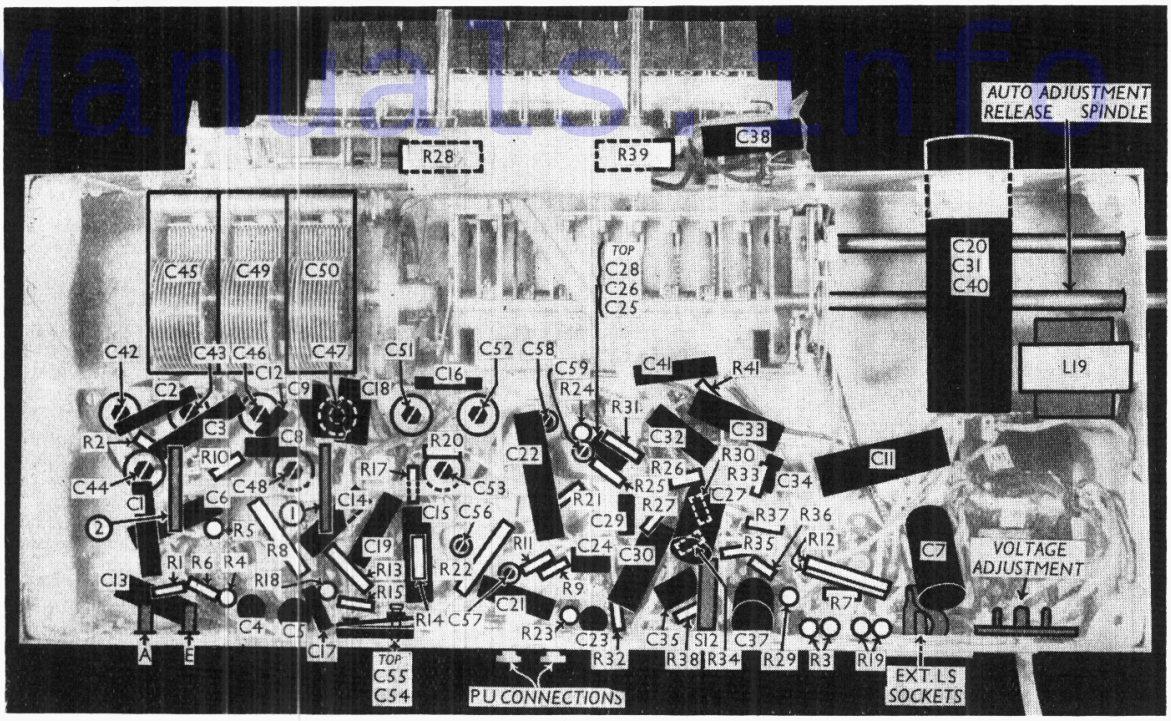
Coils.—L1-L4, L5-L9, L10-L13 and the IF transformers **L14, L15** and **L16, L17** are in five screened units on the chassis

SWITCH TABLE

Switch	LW	SW	MW
S1	—	C	C
S2	—	C	—
S3	—	C	—
S4	—	C	—
S5	C	—	C
S6	—	C	C
S7	—	C	—
S8	—	C	—
S9	—	C	—
S10	—	C	C



Diagrams of the switch units looking in the directions of the arrows in the under-chassis view



Under-chassis view. There are three groups of three trimmers, two groups of two (for the IF transformers), and two trackers on the rear chassis member.

deck. Note that the second and third of these units contain **C10** and **R16** respectively. All the trimmers are adjusted from beneath the chassis.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-4 Ω) external speaker. On fully inserting the plug, **S11** opens and mutes the internal speaker.

Scale and Indicator Lamps.—The two scale and two indicator lamps are all Osram MES types rated at 6.5V, 0.3A, and having small clear bulbs.

Condensers C20, C31, C40.—These are three dry electrolytics in a tubular metal can mounted horizontally beneath the chassis. The can is the common negative connection; the plain tag is the positive of **C31** (4μF); the yellow coded tag is the positive of **C20** (8μF) and the red coded tag is the positive of **C40** (24μF).

Trimmers.—The aerial, RF and oscillator trimmers are mounted on three triangular paxolin plates beneath the chassis, under their respective coil units. The IF trimmers are also reached from beneath the chassis, through holes underneath their cans. The trackers, **C54, C55,** are reached through holes in the rear member of the chassis.

Resistances R3, R12, R19.—These each consist of two resistors connected in parallel.

Resistance R40.—This is mounted on the T.I. holder.

Auto Tuning Unit. — The mechanical automatic tuning unit incorporated in this receiver is of the type which converts a direct movement of the press-button into a rotary movement of the gang condenser by means of internally toothed forks and toothed wheels.

A full description of the construction and action, with illustrations, was given in *Radio Maintenance* for May 28, 1938, and in the *ABC of Automatic Tuning* on pages 3 and 4. The unit in the model 4070 is an elaboration of the unit described, in that the station buttons also select the correct waveband. From left to right, after the "off" and manual wavechange buttons, there are five MW and three LW auto buttons.

Each press-button can be set to tune to any point on the scale in the following manner. Operate the manual tuning control until the pointer is fully anti-clockwise. With a screwdriver, slacken the locking screw (at the side of the cabinet near the tuning control) by one complete turn. Tune in the required station manually, and, holding the manual control firmly, depress the required button to its fullest extent, without jarring, and without allowing the manual control to move. Release the button, and also the manual control. Proceed similarly for each new station required, then rotate the manual control until the pointer is fully clockwise, and tighten up the locking screw. Check the press-button settings.

If desired, any of the three LW buttons can be used for MW station selection by pulling off the button, sliding off the T-shaped metal waveband selection member, reversing it, and replacing it.

When any station button is pressed, a mechanism comes into action which releases the slow-motion gang condenser drive, permitting the gang to be turned easily to its correct position.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to MW, turn gang to maximum, volume control to maximum, and tone control fully anti-clockwise. Connect signal generator, via a 0.1μF condenser to control grid (top cap) of **V2**, and to chassis, leaving existing top cap connection in place. Feed in a 456 KC/S signal, and adjust **C59, C58, C57** and **C56** in turn for maximum output. Re-check these settings.

RF and Oscillator Stages.—With gang at maximum, pointer should cover dot at upper wavelength end of MW scale. Connect signal generator via a suitable dummy aerial to **A** and **E** sockets.

MW.—Switch set to MW, and tune to 214 m on scale. Feed in a 214 m (1,400 KC/S) signal, and adjust **C52,** then **C47** and **C43,** for maximum output. Disconnect **C50** by unsoldering its green lead, and connect an external variable condenser between the disconnected lead and chassis. Feed in a 500 m (600 KC/S) signal, and tune it in by means of the receiver tuning control and the external condenser. Disconnect the external condenser, re-connect **C50,** and without touching the tuning control, adjust **C55** for maximum output. Repeat the 214 m adjustments.

LW.—Switch set to LW, and tune to 1,000 m on scale. Feed in a 1,000 m (300 KC/S) signal, and adjust **C53,** then **C48** and **C44,** for maximum output. Disconnect **C50** as before and connect the external variable condenser. Feed in a 1,818 m (165 KC/S) signal, and tune it in by means of the receiver tuning control and the external condenser. Disconnect the external condenser, re-connect **C50,** and without touching the tuning control, adjust **C54** for maximum output. Repeat the 1,000 m adjustments.

SW.—Switch set to SW, tune to 16.7 m (dot on scale), and feed in a 16.7 m (18 MC/S) signal. Adjust **C51** for maximum output, using the peak involving the lesser trimmer capacity, then adjust **C46** and **C42** for maximum output, rocking the gang slightly if "pulling" is experienced.

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