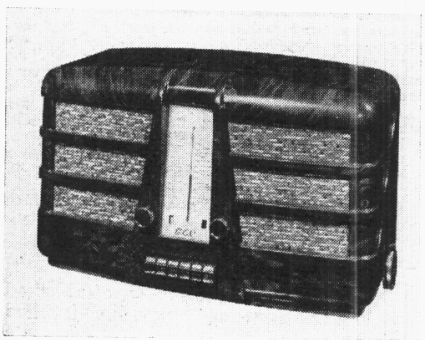
Supplement to The Wireless & Electrical Trader, Sept. 30, 1939

"TRADER" SERVICE SHEET 429

G.E.C. BC4040

2-BAND AC SUPERHET



THE G.E.C. BC4040 receiver is a 4-valve (plus rectifier) 2-band superhet. It is suitable for mains of 190-250V, 40-100 C/S, and has provision for an external speaker, but not for a gramophone pick-up.

Press-button tuning of the mechanical type for six pre-set stations is provided.

Model BC4040L is the corresponding low voltage model, which is suitable for operation from mains of 110-130V and 210-230V.

Release date, both models: June 1939.

CIRCUIT DESCRIPTION

Aerial input appearing across **R1**, which is connected between the aerial and earth sockets, is also developed across condensers **C1, C2,** which form a potential divider across **R1.** The resulting signal developed across **C2,** which is common to both the aerial and RF tuning circuits, is thus coupled to the tuned circuit.

First valve **(V1, Osram X63)** is a heptode operating as frequency changer with electron coupling. Triode oscillator grid coils **L3** (MW), plus **L4** (LW) are tuned by **C25**; parallel trimming by **C26** (MW) and **C5, C27** (LW); series tracking by **C29** (MW) and **C28** (LW). Reaction by **L5** (MW) and **L6** (LW), which are connected in series, and direct coupling via **C6** from anode.

Second valve **(V2, Osram KTW61)** is a variable-mu RF tetrode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings **C30, L7, L8, C31** and **C32, L9, L10, C33.** Tuning is effected by adjustment of capacitative trimmers.

Intermediate Frequency 456KC/S.

Diode second detector is part of double diode triode valve **(V3, Osram DL63).** Audio frequency component in rectified output is developed across load resistances **R10, R11,** and that across **R11** is passed via AF coupling condenser **C11** and manual volume control **R12** to CG of triode section, which operates as AF amplifier. IF filtering by **C10** in diode circuit and **C15** in triode anode circuit.

Second diode of **V3,** fed from **V2** anode via **C13,** provides DC potential which is developed across load resistance **R18** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained from resistances **R13, R14** in cathode lead to chassis.

Resistance-capacity coupling by **R16, C17** and **R20** between V3 triode and tetrode output valve **(V4, Osram KT61).** Fixed tone correction by **C18** in anode circuit; variable tone control by **C19** and **R22,** also in anode circuit. Provision for connection of low impedance external speaker across secondary of output transformer **T1.**

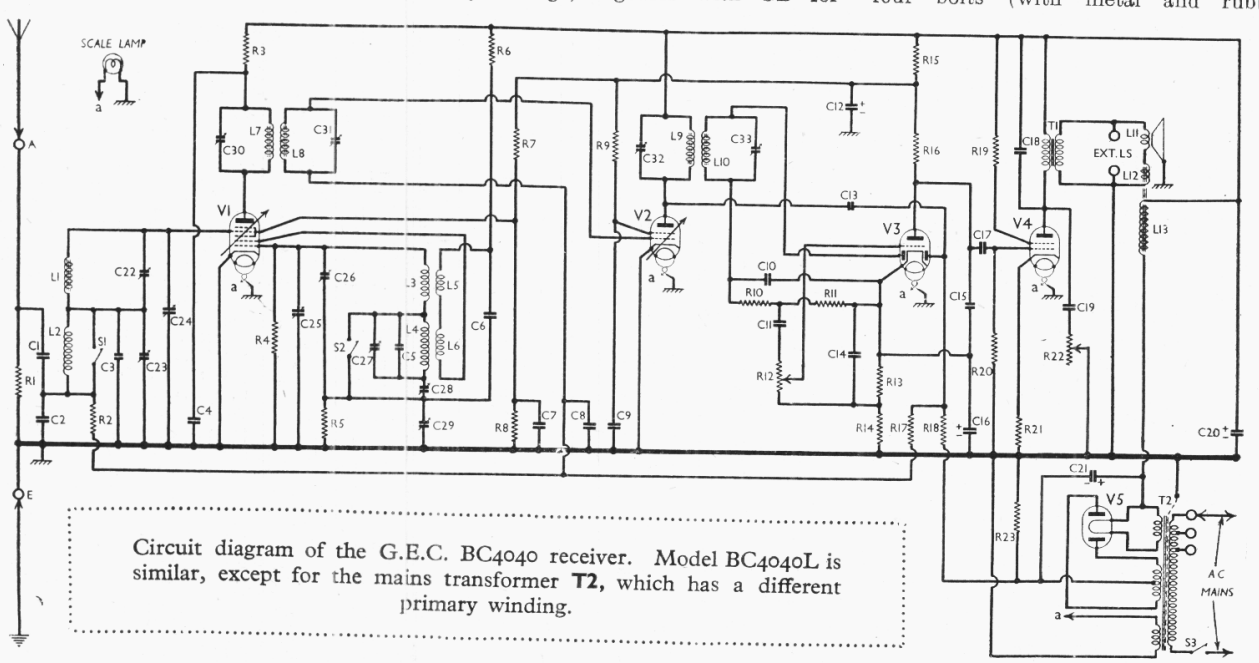
HT current is supplied by full-wave rectifying valve **(V5, Osram U50).** Smoothing by speaker field **L13** and dry electrolytic condensers **C20** and **C21.** The negative of the latter is connected to HT negative, while that of the former is connected to chassis.

Fixed GB potential for **V1** and **V2** is obtained from drop along resistance **R23** in negative HT lead to chassis and fed via the AVC diode load resistance **R18** and decoupling resistance **R17.** This voltage is also additional AVC delay to that obtained from **R13** and **R14.**

DISMANTLING THE SET

Removing Chassis.—The cabinet is fitted with a detachable bottom, upon removal of which access may be gained to some of the components beneath the chassis.

To remove the chassis, remove the four control knobs (three of these pull off, but it will be necessary to withdraw the locking screw from the tuning control before this can be removed), the four bolts (with metal and rubber



Circuit diagram of the G.E.C. BC4040 receiver. Model BC4040L is similar, except for the mains transformer **T2,** which has a different primary winding.

washers) holding the chassis to the bottom of the cabinet, pull off the scale lamp from its bracket, and free the driving cord from the tuning scale by loosening the clamp holding it to the coloured ribbon wavelength indicator. The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder the speaker leads, and *when replacing* join the black lead to the right hand tag on the speech coil connecting panel, the white lead to the left hand tag on the same panel, the red lead to the right hand tag on the field coil connecting panel, and the red/white lead to the left hand tag on the same panel. Also join the black lead to the tag on the speaker frame by means of a short length of wire.

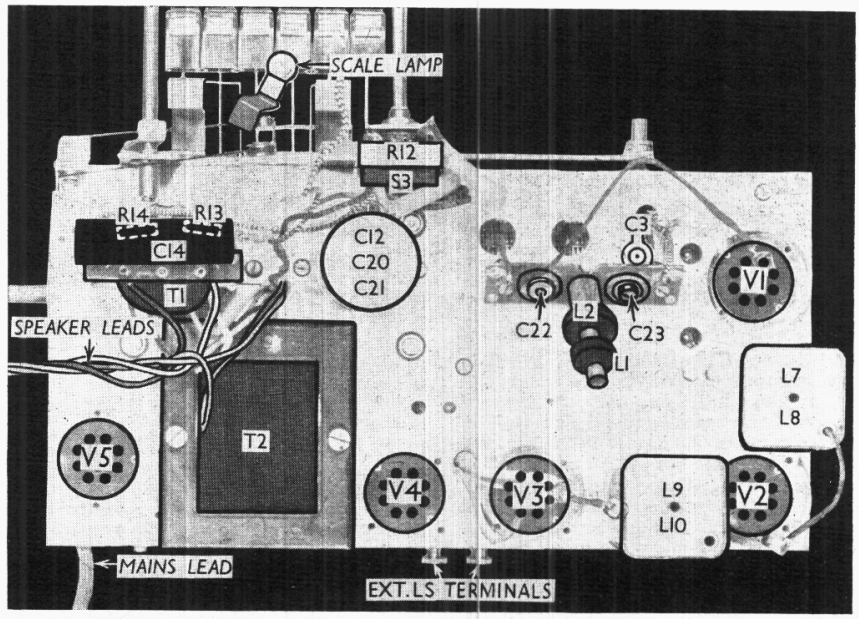
Do not forget to place two rubber washers with a brass bush between the chassis and the bottom of the cabinet over each fixing bolt.

Removing Speaker.—Unsolder the four leads from the connecting panel, and remove the four cheese head bolts holding it to the sub-baffle. *When replacing*, the connecting panel should be at the top, and the leads connected as previously indicated.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial input resistance ...	9,900
R2	V1 tetrode CG decoupling ...	1,000,000
R3	V1 tet. anode HT feed ...	5,500
R4	V1 osc. CG resistance ...	99,000
R5	Osc. circuit damping... ...	77,000
R6	V1 osc. anode HT feed ...	22,000
R7	V1 SG HT feed pot	22,000
R8		66,000
R9	V2 SG HT feed	44,000
R10	V3 signal diode load resistances	330,000
R11		99,000
R12	Manual volume control ...	1,000,000
R13	V3 triode GB, AVC delay resistances	2,200
R14		15,000
R15	V1, V2 SG'S; V3 triode HT feed	4,400
R16	V3 triode anode load... ...	99,000
R17	AVC line decoupling... ...	1,000,000
R18	V3 AVC diode load	440,000
R19	V4 SG stabiliser	100
R20	V4 CG resistance	440,000
R21	V4 GB resistance	90
R22	Variable tone control ...	55,000
R23	V1, V2 fixed GB	50

	CONDENSERS	Values (μF)
C1	Aerial coupling condensers	0·005
C2		0·003
C3	Aerial LW fixed trimmer ...	0.00002
C4	V1 tet. anode decoupling ...	0·05
C5	Osc. circuit LW fixed trimmer	0·00005
C6	V1 osc. anode coupling ...	0·005
C7	V1 SG decoupling	0·05
C8	V2 CG decoupling	0·05
C9	V2 SG decoupling	0·05
C10	IF by-pass	0·0003
C11	AF coupling to V3 triode ...	0·02
C12*	V3 triode anode decoupling	8·0
C13	Coupling to V3 AVC diode	0·00002
C14	V3 cathode AF by-pass ...	0·25
C15	IF by-pass	0·0005
C16*	V3 cathode by-pass	30·0
C17	V3 triode to V4 AF coupling	0·02
C18	Fixed tone corrector ...	0·005
C19	Part of variable tone control	0·05
C20*	HT smoothing condensers	8·0
C21*		8·0
C22‡	Aerial circuit MW trimmer	—
C23‡	Aerial circuit LW trimmer	—
C24†	Aerial circuit tuning ...	—
C25†	Oscillator circuit tuning ...	—
C26‡	Osc. circuit MW trimmer ...	—
C27‡	Osc. circuit LW trimmer ...	—



Plan view of the chassis. The IF trimmer adjustments are reached from beneath the chassis.

	CONDENSERS (Continued)	Values (μF)
C28‡	Osc. circuit LW tracker ...	—
C29‡	Osc. circuit MW tracker ...	—
C30‡	1st IF trans. pri. tuning ...	—
C31‡	1st IF trans. sec. tuning ...	—
C32‡	2nd IF trans. pri. tuning ...	—
C33‡	2nd IF trans. sec. tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial MW tuning coil ...	2·2
L2	Aerial LW tuning coil ...	22·0
L3	Osc. circuit MW tuning coil	3·0
L4	Osc. circuit LW tuning coil	6·0
L5	Oscillator MW reaction	1·3
L6	Oscillator LW reaction ...	1·9
L7	1st IF trans. Pri ...	7·0
L8	Sec. ...	7·0
L9	2nd IF trans. Pri. ...	4·0
L10	Sec. ...	4·0
L11	Speaker speech coil ...	2·2
L12	Hum neutralising coil ...	0·1
L13	Speaker field coil	1,500·0
T1	Output trans. Pri. ...	580·0
	Sec. ...	0.4
T2	Mains trans. Pri., total ...	41·5
	Heater sec....	0·19
	Rect. heat. sec.	0·16
	HT sec., total	580·0
S1, S2	Waveband switches ...	—
S3	Mains switch, ganged R12	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 232V, using the 210/230V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium 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 X63	215	2·5	85	2·8
	Oscillator			
	125	4·8		
V2 KTW61	232	6·0	72	2·8
V3 DL63	78	1·0	—	—
V4 KT61	205	36·0	231	7·4
V5 U50	335†	—	—	—

† Each anode, A.C.

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

GENERAL NOTES

Switches.—There are only three switches in this receiver: the waveband switches **S1** and **S2**; and the QMB mains switch **S3**, which is ganged with the manual volume control **R12.**

As the receiver has only two wavebands, the control switch has only two positions. In the MW (anti-clockwise) position, **S1** and **S2** are closed; in the LW (clockwise) position, they are open.

A diagram of the **S1, S2** switch unit is shown below, as seen from the rear of the underside of the chassis.

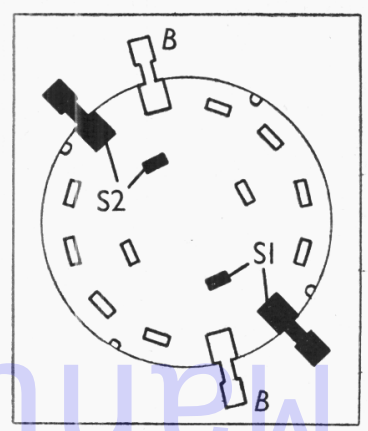


Diagram of the switch unit.

Coils.—The aerial coils **L1, L2** are on an unscreened tubular unit mounted on a paxolin strip, with their associated trimmers, on the chassis deck.

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The oscillator coils **L3, L5** and **L4, L6** are similarly mounted, with their trimmers, beneath the chassis.

The IF transformers **L7, L8** and **L9, L10** are in two screened units on the chassis deck with their associated trimmers which are accessible from beneath the chassis.

Scale Lamp.—This is an Osram MES type with a 10 mm. bulb, and is rated at 6·5V, 0·3A.

External Speaker.—Two terminals are provided at the rear of the chassis for a low impedance (2-4O) external speaker.

Condensers C12, C20, C21.—These are three 8μF dry electrolytics (500V working) in a single tubular metal-cased unit on the chassis deck. The case is the negative of **C12** and **C20**; the tag coded yellow is the positive of **C12**; that coded green is the positive of **C20**; **C21** is brought out to two tags coded red and black, which are respectively the positive and negative connections. This condenser is isolated from the case.

Resistances R13, R14.—These two resistances, which are connected in series between **V3** cathode and chassis, are mounted on the paxolin connecting strip on the output transformer **T** on the chassis deck, with the associated by-pass condenser **C14. R14** is connected directly to chassis via a black-braided lead, but **R13** is connected to **V3** cathode via the triode control grid lead screening, which is also connected to the cathode, as it leaves the volume control **R12.** The connection between screening and the cathode is a pink-braided lead joined to the screening near the top cap connector.

Model BC4040L.—The only difference in the low voltage models is in the mains transformer primary winding, which has a total resistance of 26 O, instead of 41·5 O, and has tappings which enable the receiver to be operated from mains of 110-130V or 210-230V.

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.

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 spindle is fully anti-clockwise. With a screw-driver, slacken the locking screw (which is concentric with the tuning control knob) by one complete turn. Switch the receiver to the correct waveband, and tune in the required station manually. 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 spindle is fully clockwise, and tighten up the locking screw. Check the press-button settings.

CIRCUIT ALIGNMENT

IF stages.—Switch set to LW and turn gang to maximum. Turn volume control to maximum, and tone control to brilliant. Connect signal generator via a 0·1μF condenser to control grid (top cap) of **V1** and chassis, leaving existing top cap connection in place.

Feed in a 456KC/S signal, and adjust **C33, C32, C31** and **C30** in that order, for maximum output.

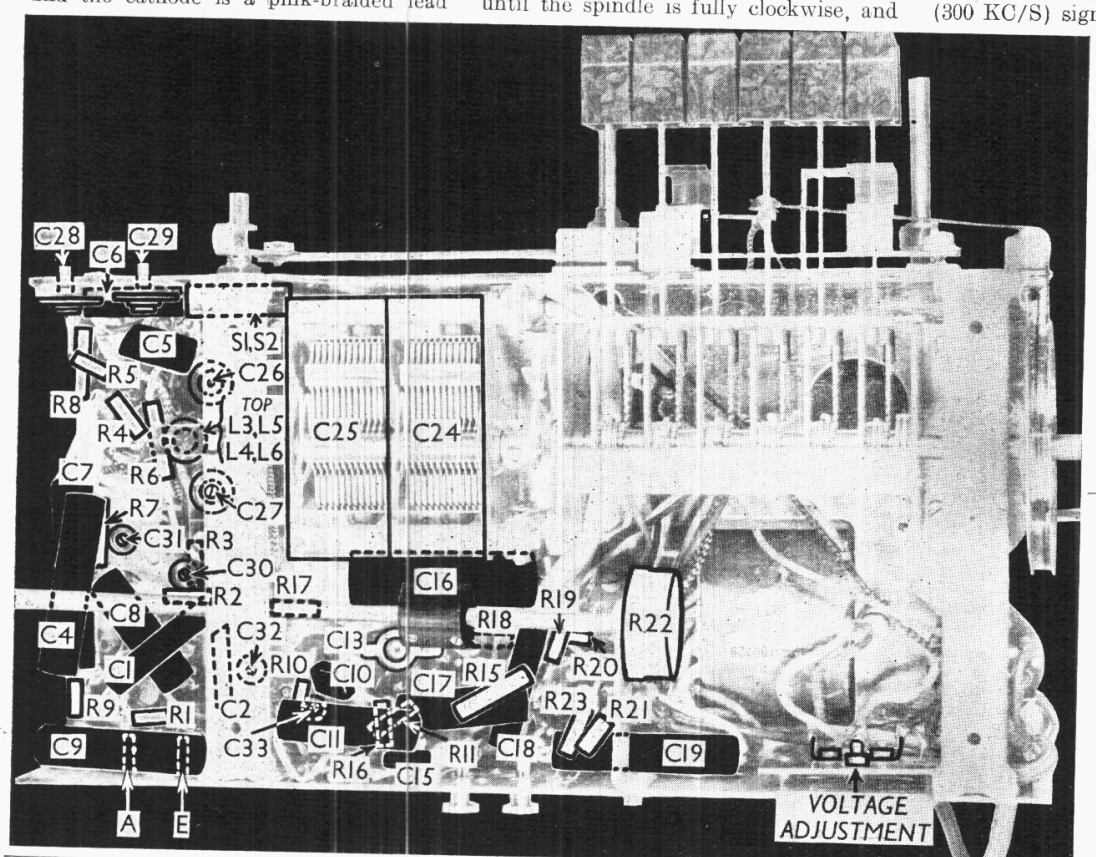
RF and Oscillator Stages.—Check that the junction of the red and yellow sections of the indicator ribbons coincides with the two horizontal marks near the top of the ribbon aperture when the gang is at maximum. Connect signal generator to **A** and **E** sockets via suitable dummy aerial.

MW.—Switch set to MW, tune to 214 m. (dot on scale), feed in a 214 m. (1,400 KC/S) signal, and adjust **C26,** then **C22,** for maximum output.

Disconnect **C25** by unsoldering the lead from its fixed plates, and connect an external variable condenser between the disconnected lead and chassis. Feed in a 500m (600 KC/S) signal, and adjust external condenser and receiver tuning control together for maximum output. Disconnect external condenser and re-connect **C25.** Without altering the tuning control setting, adjust **C29** 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 **C27,** then **C23,** for maximum output.

Disconnect **C25** as before, and connect external condenser. Feed in an 1,818 m (165 KC/S) signal, and adjust external condenser and receiver tuning control together for maximum output. Disconnect external condenser, re-connect **C25,** and without altering tuning control setting, adjust **C28** for maximum output. Repeat 1,000 m adjustments.



Under-chassis view. All the trimmers except **C22** and **C23** (which are above the chassis) are indicated.

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