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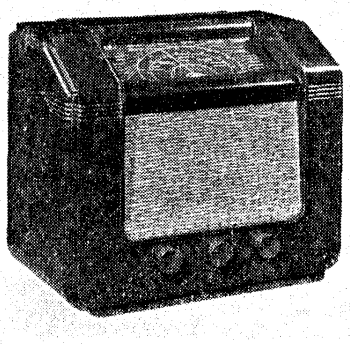
"TRADER" SERVICE SHEET

362

G.E.C. BC3946

BATTERY ALL-WAVE FOUR



COVERING a short-wave range of 16-50 m, the G.E.C. BC3946, Battery All-Wave Four, is a 3-band battery superhet with a heptode frequency changer, an RF pentode as IF amplifier, a double-diode triode and a tetrode output valve. Provision is made for an extension speaker, and there are alternative aerial sockets.

A feature is that a scale lamp switch is incorporated in the volume control so that the scale can be illuminated when tuning, this being brought about by pressing down the volume control knob.

Release date: June, 1938.

CIRCUIT DESCRIPTION

Two alternative aerial input sockets **A1, A2.** Input from **A1** is via coupling coil **L1** (SW) and coupling condenser **C2** (MW and LW), assisted by a single turn coil **L2** on MW, to single-tuned circuits **L3, C24** (SW), plus **L4, C24** (MW), plus **L5, C24** (LW) which precede first valve (**V1, Osram metallised X22**), a heptode operating as frequency changer with electron coupling.

Oscillator grid coils **L6** (SW), plus **L7** (MW), plus **L8** (LW) are tuned by **C25**; parallel trimming by **C26** (SW), **C27** (MW) and **C6, C28** (LW); series tracking by **C8** (SW), **C30** (MW) and **C29** (LW). Reaction by coils **L9** (SW) and **L10, L11** (MW and LW).

Second valve (**V2, Osram metallised W21**) is a variable-mu RF pentode operating with fixed GB as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C31, L12, L13, C32** and **C33, L14, L15, C34.**

Intermediate frequency 456KC/S.

Diode second detector is part of double-diode triode valve (**V3, Osram HD22**). Audio frequency component in rectified output is developed across load resistance **R10** and passed via AF coupling condenser **C14** and manual volume control **R11** to CG of triode section, which operates as AF amplifier. IF filtering by **C12, R9** and **C13** in diode circuit.

Second diode of **V3,** fed from **L15** via **C16,** provides DC potential which is developed across load resistance **R14** and fed back through decoupling circuit as GB to frequency changer valve, giving automatic volume control.

Resistance-capacity coupling by **R13, C17** and **R15,** via IF filter **C18, R16,** between **V3** triode and beam tetrode output valve (**V4, Osram KT21**). Fixed tone correction in anode circuit by **C19.**

Potentials for **V1** fixed GB, **V2** GB, **V3** triode GB, **V4** GB and AVC delay are obtained automatically from drop along resistances **R17** and **R18** in negative HT lead to chassis. Fuse **F1,** also in negative HT lead, affords protection against accidentally short-circuit.

It should be noticed that of the battery circuit switches, that in the HT circuit is in the positive lead.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial circuit shunt	9,900
R2	V1 tetrode CG resistance	1,000,000
R3	V1 tetrode CG decoupling	440,000
R4	V1 osc. CG resistance	99,000
R5	V1 osc. anode HT feed resistances	990
R6		[illegible],000
R7		500
R8	V1 SG HT feed	500
R9	IF stopper	[illegible],000
R10	V3 signal diode load	440,000
R11	Manual volume control	1,000,000
R12	V3 triode CG decoupling	99,000
R13	V3 triode anode load	99,000
R14	V3 AVC diode load	440,000
R15	V4 CG resistance	220,000
R16	IF stopper	33,000
R17	V1 fixed, V2, V3, and V4 auto GB and AVC delay resistances	100
R18		150

	CONDENSERS	Values (μF)
C1	A2 aerial series condenser	0·00002
C2	Aerial MW and LW coupling	0·003
C3	Aerial circuit LW fixed trimmer	0·00002
C4	V1 tetrode CG condenser	0·0005
C5	V1 tetrode CG decoupling	0·05
C6	Osc. circuit LW fixed trimmer	0·00004§
C7	HT circuit RF by-pass	0·25
C8	Osc. circuit SW tracker	0·00395
C9	V1 osc. anode RF by-pass	0·005
C10	V1 osc. anode decoupling	0·5§
C11	V1 SG decoupling	0·25
C12	IF by-pass condensers	0·0001
C13		0·0001
C14	AF coupling to V3 triode	0·02
C15	V3 triode CG decoupling	0·25
C16	Coupling to V3 AVC diode	0·00005
C17	V3 triode to V4 AF coupling	0·02
C18	V4 CG IF by-pass	0·0002
C19	Fixed tone corrector	0·005
C20*	Auto GB circuit AF by-pass	50·0
C21‡	Aerial circuit SW trimmer	—
C22‡	Aerial circuit MW trimmer	—
C23‡	Aerial circuit LW trimmer	—
C24†	Aerial circuit tuning	—
C25†	Oscillator circuit tuning	—

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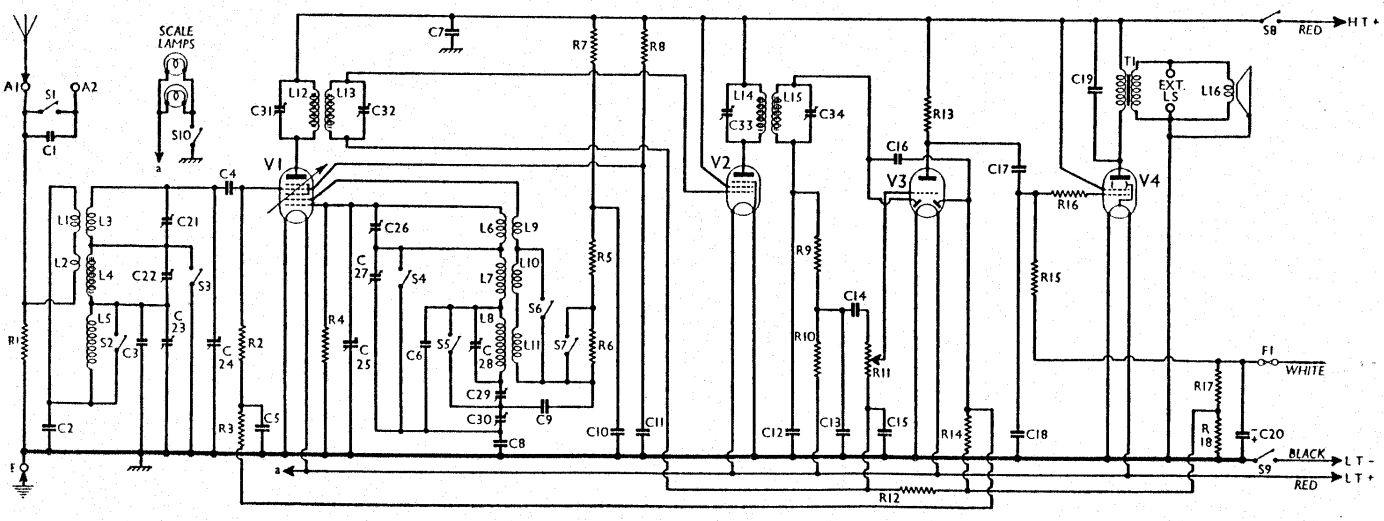
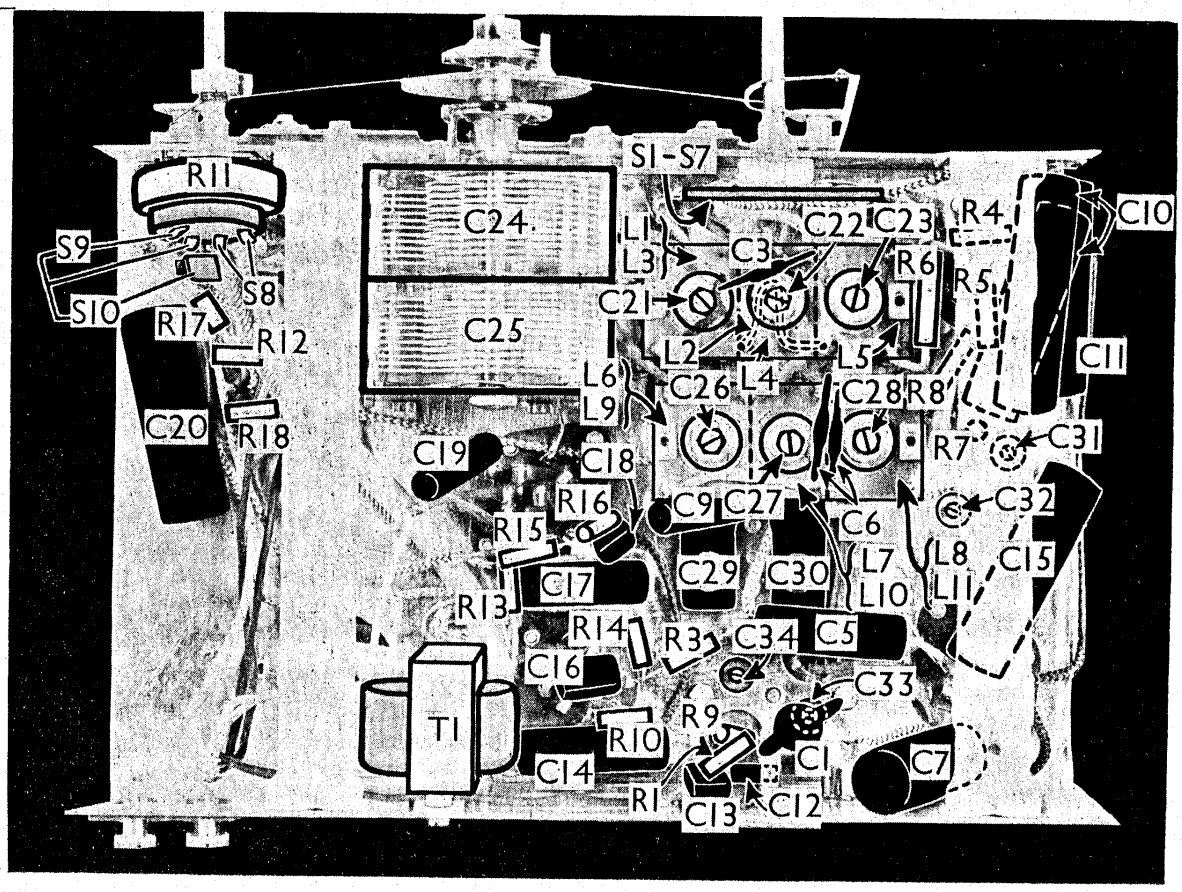


Circuit diagram of the G.E.C. BC3946 battery superhet. Note the unusual aerial coupling arrangements.



Under-chassis view. The coils are in units beneath the trimmers at the top right-hand corner of the chassis. Their positions are indicated roughly by arrows. **L2** is a single turn of thick tinned copper wire. **C6** and **C10** each consist of two condensers wired in parallel. The scale lamps switch **S10** is associated with the volume control **R11**, which is spring mounted. **S10** is closed when the knob of **R11** is depressed.

	CONDENSERS (*Continued*)	Values (μF)
C26‡	Osc. circuit SW trimmer	—
C27‡	Osc. circuit MW trimmer	—
C28‡	Osc. circuit LW trimmer	—
C29‡	Osc. circuit LW tracker	—
C30‡	Osc. circuit MW tracker	—
C31‡	1st IF trans. pri. tuning	—
C32‡	1st IF trans. sec. tuning	—
C33‡	2nd IF trans. pri. tuning	—
C34‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

§ Made up of two condensers in parallel.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial circuit SW coupling coil	0·3
L2	Aerial circuit MW coupling coil	Very low
L3	Aerial circuit SW tuning coil	0·08
L4	Aerial circuit MW tuning coil	2·0
L5	Aerial circuit LW tuning coil	22·0
L6	Osc. circuit SW tuning coil	0·07
L7	Osc. circuit MW tuning coil	2·7
L8	Osc. circuit LW tuning coil	8·0
L9	Oscillator SW reaction coil	0·4
L10	Oscillator MW reaction coil	1·2
L11	Oscillator LW reaction coil	2·8
L12	1st IF trans. Pri.	7·0
L13	1st IF trans. Sec.	7·0
L14	2nd IF trans. Pri.	4·0
L15	2nd IF trans. Sec.	4·0
L16	Speaker speech coil	2·3
T1	Output trans. Pri.	1,570·0
	Output trans. Sec.	0·385
S1-S7	Waveband switches	—
S8	H.T. circuit switch (ganged R11)	—
S9	L.T. circuit switch (ganged R11)	—
S10	Scale lamps switch (ganged R11)	—
F1	H.T. circuit fuse	—

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (six round-head wood screws with washers) gives access to most of the components beneath the chassis.

Removing Chassis.—If it is necessary to remove the chassis from the cabinet, remove the three control knobs (pull off), the four bolts (with washers and rubber washers) holding the chassis to the bottom of the cabinet and the two round-head self-tapping screws (with washers) holding the scale assembly to the top of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

When replacing, see that there are two rubber washers on each fixing bolt, one between the bolt head and the bottom of the cabinet and the other between the chassis and the bottom of the cabinet.

To free the chassis entirely, unsolder the speaker leads and *when replacing* take the black lead to the left-hand tag on the terminal strip.

Removing Speaker.—If it is desired to remove the speaker from the cabinet, it will first be necessary to remove the chassis as described above. Then remove the four bolts (with washers and spring washers) holding the speaker to the sub-baffle. *When replacing*, see that the terminal panel is at the top and take the black lead to the left-hand tag.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with an HT battery reading 120 V on load. 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.

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

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X22	117	1·0	54	1·8
	Oscillator 65	1·4		
V2 W21	117	1·2	117	0·4
V3 HD22	75	0·4	—	—
V4 KT21	110	4·8	117	0·9

GENERAL NOTES

Switches.—S1-S7 are the waveband switches, in a single rotary unit beneath the chassis. It is indicated in our under-chassis view, and shown in detail in the diagram on the back of this sheet. The table (on the back of this sheet) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates *open*, and **C**, *closed*.

S8 and **S9** are the QMB HT and LT circuit switches, ganged with the volume control **R11.**

S10 is the scale lamps switch, formed by one tag of **S9** and a spring leaf contact mounted on a small paxolin strip beneath the chassis. **R11** is also spring mounted, and

when its spindle is depressed, it causes the tag on **S9** to touch the leaf contact and so **S10** closes and switches on the scale lamps. Normally this switch is open.

Coils.—**L1-L11** are in unscreened units beneath the chassis, to the right of the gang condenser in our under-chassis view. They are underneath two paxolin panels carrying six trimmers, and their positions are roughly indicated by arrows in our illustration. **L2** is a small coupling coil consisting of one turn of thick tinned copper wire.

The IF transformers **L12, L13** and **L14, L15** are in two screened units on the chassis deck, their trimmers being at their bases, and adjustable from beneath the chassis.

Scale Lamps.—These are two Osram MES types, with 10 mm diameter bulbs, rated at 2 V, 0·6 A. They are controlled by **S10.**

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

Condensers C6, C10.—**C6** consists of two small fixed trimmers in parallel, while **C10** is made up of two 0·25 μF tubular paper condensers in parallel.

Components C4, R2.—These are attached to the top cap connector of **V1.**

Fuse F1.—This is an Osram MES bulb, rated at 3·5 V, 0·5 A, which screws into a holder on the chassis deck.

Batteries.—Recommended types are: LT, G.E.C. BC260 (2 V 60 AH) or BC120 (2 V 20 AH) accumulator cell; HT, G.E.C. Super, BB820, 120 V dry battery. GB is automatic.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; red lead, spade tag, LT positive 2 V; white lead, black plug, HT negative; red lead, red plug, HT positive 120 V.

CIRCUIT ALIGNMENT

A removable panel is fitted to the bottom of the cabinet so that complete alignment can be carried out without removing the chassis from the cabinet.

IF Stages.—Switch set to MW and turn gang to maximum. Turn volume control to maximum. Short-circuit **C25,** and connect signal generator via a 0·1 μF condenser to grid (top cap) of **V1** and chassis. Leave existing top cap connection in place.

Feed in a 456 KC/S signal, and adjust **C31, C32, C33** and **C34** for maximum output. Remove the short from **C25.**

RF and Oscillator Stages.—Check that the scale is central in its clips, and that the pointer is straight, and coincides with the horizontal mark on the scale when the gang is at maximum. Connect signal generator via a suitable dummy aerial to the **A2** and earth sockets.

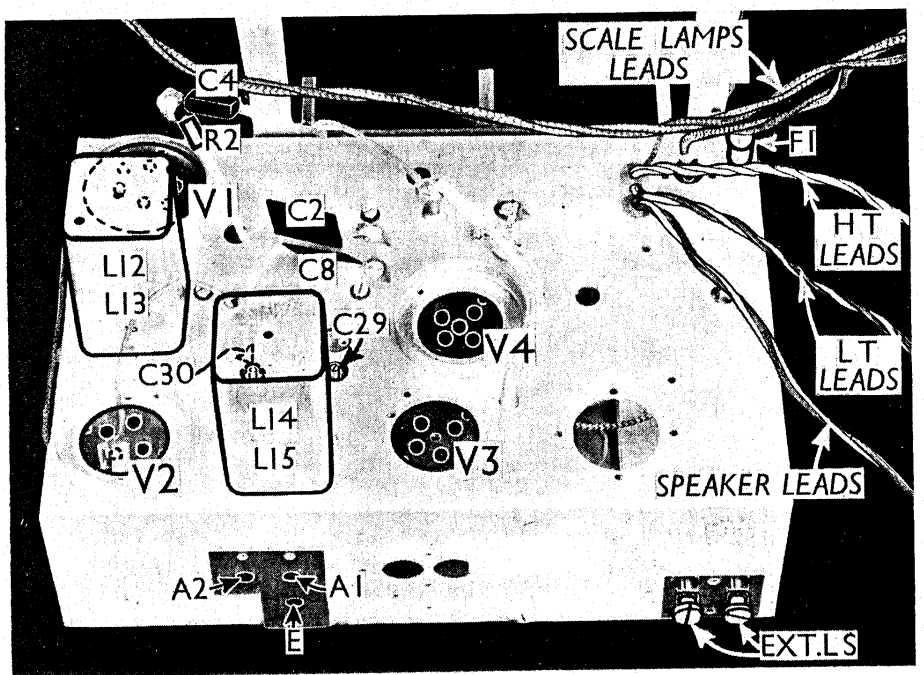
MW.—Switch set to MW, tune to 214 m on scale, feed in a 214 m (1,400 KC/S) signal, and adjust **C27,** then **C22,** for maximum output.

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 500 m (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 tuning control setting, adjust **C30** 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 **C28,** 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 **C29** for maximum output. Repeat the 1,000 m adjustments.

SW.—Switch set to SW, tune to 16·7 m on scale, feed in a 16·7 m (18 MC/S) signal (via a SW dummy aerial), and adjust **C26,** then **C21,** for maximum output. **C26** should be adjusted to the higher frequency peak (lower capacity). If "pulling" is experienced when **C21** is adjusted, rock the gang slightly to compensate for this.



Plan view of the chassis. **C29** and **C30** are adjusted through two holes in the chassis deck. The IF trimmers are reached from beneath the chassis.

SWITCH TABLE AND DIAGRAM

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

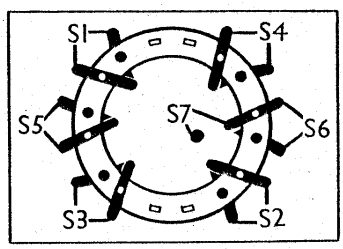


Diagram of the switch unit, looking from the rear of the underside of the chassis.

MAINTENANCE PROBLEMS

Loudspeaker Fault

WE have experienced a number of complaints with all Ultra models from 101 up to the latest releases. This takes the form of a high-pitched vibration which increases when registering high notes, and is similar to the effect produced by a fouled gap, or loose speech coil winding in the loudspeaker.

Actually it is caused by the fixing glue on the leading edge of the cone, where it is forced out under pressure when assembling, drying in a flake form, which vibrates in sympathy with the speaker.

This can be cured by running a blunt instrument round the *inside* edge of the cone between the speaker frame and the fixed edge of the cone, when the particles of will easily come away. Care should be t not to puncture the cone.—A. PARNELL, BIRMINGHAM.

Leaking Wet Electrolytic

AN Ultra Tiger superhet was received for service with the complaint of insensitivity. On test it was found that signals were receivable, but weak.

Tracing backwards the fault was finally located in the aerial stage. All coil resistances were normal and eventually it was discov that a wet electrolytic condenser, mou alongside the three-gang tuning condenser, had been spitting. The electrolyte had got on the vanes of the section tuning the first half of the band-pass coil and was causing a leak between the fixed and moving plates.

This was not traceable with the coil in circuit, as the resistance was much higher than that of the coil.—J. W. A. ORDISH.

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