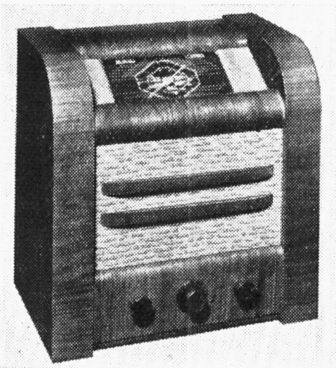
'TRADER' SERVICE SHEET

305

G.E.C. BATTERY AW QPP4

AND BATTERY AW RECEIVER



COVERING a short-wave range of 16-50 m, the G.E.C. Battery All-Wave QPP4 Receiver (BC3856) is a 4-valve battery-operated 3-band superhet. The chassis of the Battery All-Wave Receiver (BC3846) is very similar, but has a pentode or tetrode output valve instead of the double pentode QPP valve, and the differences are explained under "BC3846 Divergencies."

CIRCUIT DESCRIPTION

Two aerial input sockets; **A2** direct, and **A1** via series condenser **C1**, except on LW, when the two sockets are connected by **S1**. From **A2**, input is via coupling condenser **C2**, coupling coil **L1** (SW) and condenser **C3** (MW and LW) to single-tuned circuits comprising **L2** (SW), plus **L3** (MW), plus **L4** (LW), tuned by **C21**, which precede first valve (**V1**, **Osram metallised X22**), a heptode operating as frequency changer with electron coupling. Oscillator grid coils **L5** (SW), plus **L6** (MW), plus **L7** (LW) are tuned by **C22**; parallel trimming by **C23** (SW), **C24** (MW) and **C7**, **C25** (LW); tracking by **C8** (SW), **C27** (MW) and **C26** (LW). Reaction by coils **L8** (SW), **L9** (MW) and **L10** (LW) and **C9**.

Second valve (**V2**, **Osram metallised W21**) is an RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C28**, **L11**, **L12**, **C29** and **C30**, **L13**, **L14**, **C31**.

Intermediate frequency 456 KC/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 **R9** and passed via AF coupling condenser **C14** and manual volume control **R10** to CG of triode section, which operates as AF amplifier. IF filtering by **C12**, **R8**, **C13**.

Second diode of **V3**, fed from **L14** via **C15**, provides DC potential which is developed across load resistance **R13** and fed by through decoupling circuit as GB to FC valve, giving automatic volume control.

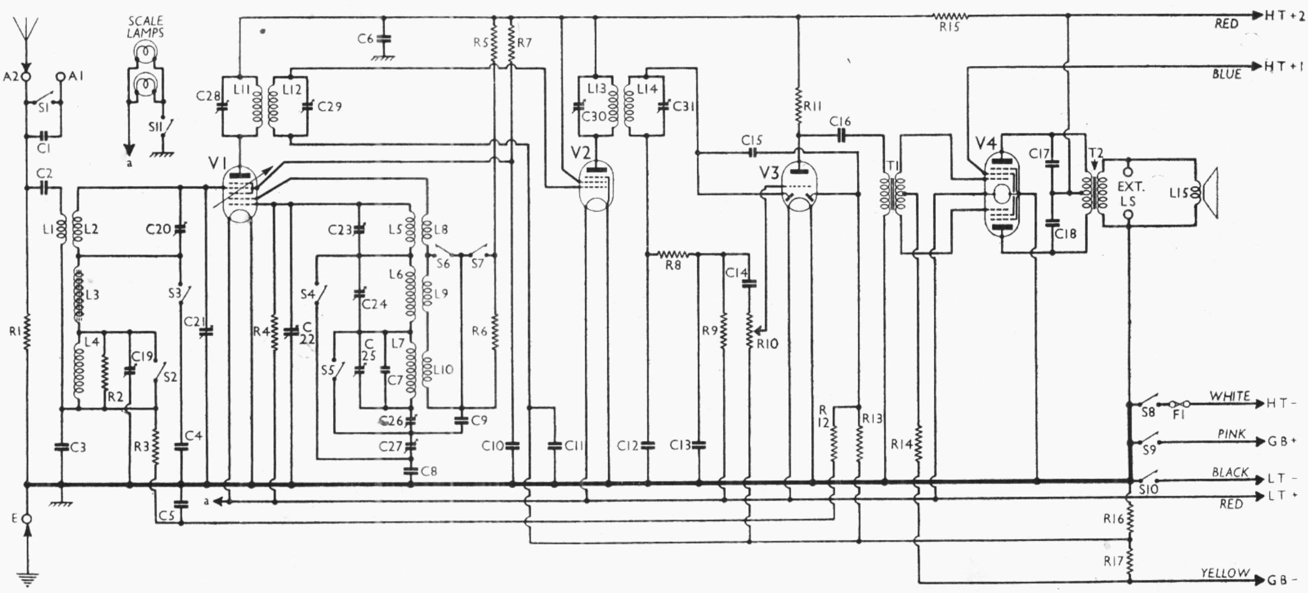
Parallel-fed transformer coupling by **R11**, **C16** and **T1**, between **V3** triode and quiescent push-pull output valve (**V4**, **Osram QP21**). Fixed tone correction in anodes circuit by **C17**, **C18**. Provision for connection of low impedance external speaker across secondary of output transformer **T2**.

GB potential for **V4** is obtained via GB—connection direct. Minimum GB potential for **V1** tetrode, and GB for **V2**, **V3** triode and AVC delay is obtained from junction of **R16**, **R17**, which form a potential divider across GB battery. HT circuit RF filtering by **C6**. **F1** affords protection against accidental short-circuits in HT circuit.

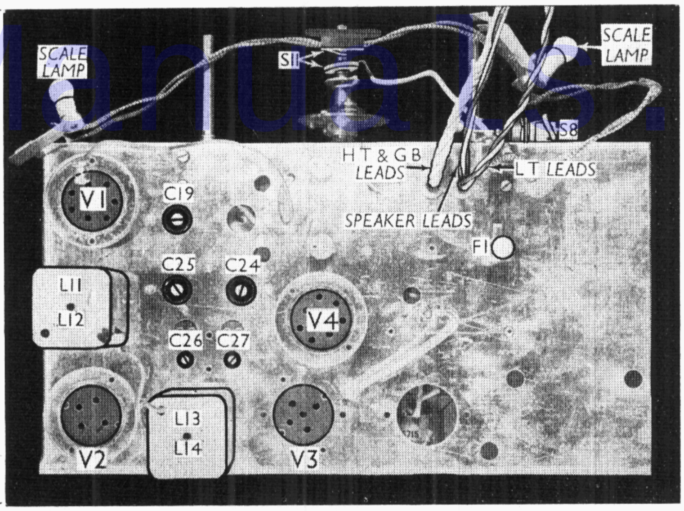
COMPONENTS AND VALUES

CONDENSERS		Values (μF)
C1	A1 aerial socket series	0·00002
C2	Aerial coupling condensers	0·005
C3		0·003
C4	V1 tetrode CG SW decoupling	0·1
C5	AVC line decoupling	0·05
C6	HT circuit RF by-pass	0·25
C7	Osc. circuit LW fixed trimmer	0·00002
C8	Osc. circuit SW tracker	0·004
C9	V1 osc. anode coupling	0·005
C10	V1 SG decoupling	0·25
C11	V2 CG decoupling	0·02
C12	IF by-pass condenser	0·0001
C13		0·0001
C14	AF coupling to V3 triode	0·02
C15	Coupling to V3 AVC diode	0·00005
C16	AF coupling to T1	0·25
C17	Fixed tone correctors	0·001
C18		0·001
C19‡	Aerial circuit LW trimmer	—
C20‡	Aerial circuit SW trimmer	—
C21†	Aerial circuit tuning	—
C22†	Oscillator circuit tuning	—
C23‡	Osc. circuit SW trimmer	—
C24‡	Osc. circuit MW trimmer	—
C25‡	Osc. circuit LW trimmer	—
C26‡	Osc. circuit LW tracker	—
C27‡	Osc. circuit MW tracker	—
C28‡	1st IF trans. pri. tuning	—
C29‡	1st IF trans. sec. tuning	—
C30‡	2nd IF trans. pri. tuning	—
C31‡	2nd IF trans. sec. tuning	—

† Variable. ‡ Pre-set.



Circuit diagram of the G.E.C. Battery All-Wave QPP4 (BC3856). The Battery All-Wave Receiver (BC3846) is similar, but has a single pentode or tetrode in the output stage.



Plan view of the chassis. Note the special scale lamp switch, **S11.** **F1** is a fuse bulb.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with a new HT battery reading 140 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.

In our receiver **V4** was Grade W.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X22 ..	115 / Oscillator 51	0·9 / Oscillator 1·6	67	2·0
V2 W21 ..	115	1·7	115	0·6
V3 HD22 ..	73	0·4	—	—
V4 QP21 ..	138†	1·3†	123	0·7

† Each anode.

	RESISTANCES	Values (ohms)
R1	Aerial circuit shunt	9,900
R2	Aerial circuit LW damping ..	440,000
R3	V1 tetrode CG decoupling ..	220,000
R4	V1 osc. CG resistance	99,000
R5	V1 osc. anode HT feed re-	6,600
R6	sistances	33,000
R7	V1 SG HT feed resistance ..	22,000
R8	IF stopper	55,000
R9	V3 signal diode load	440,000
R10	Manual volume control ..	1,000,000
R11	V3 triode anode load	99,000
R12	AVC line decoupling	440,000
R13	V3 AVC diode load	440,000
R14	V4 CG's circuit decoupling ..	99,000
R15	V1, V2, V3 HT feed	3,300
R16	V1, V2, V3 triode and AVC	150
R17	delay potential divider ..	500

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil ..	0·2
L2	Aerial SW tuning coil	0·035
L3	Aerial MW tuning coil ..	2·25
L4	Aerial LW tuning coil ..	17·5
L5	Osc. circuit SW tuning coil ..	0·05
L6	Osc. circuit MW tuning coil ..	2·8
L7	Osc. circuit LW tuning coil ..	14·5
L8	Oscillator SW reaction ..	0·55
L9	Oscillator MW reaction ..	1·2
L10	Oscillator LW reaction ..	3·6
L11	1st IF trans. Pri.	7·0
L12	1st IF trans. Sec.	7·0
L13	2nd IF trans. Pri.	4·0
L14	2nd IF trans. Sec.	4·0
L15	Speaker speech coil	1·9
T1	Intervalve trans. Pri. ..	632·0
	Intervalve trans. Sec., total	3370·0
T2	Output trans. Pri., total ..	1390·0
	Output trans. Sec.	0·77
F1	HT circuit fuse	—
S1-S7	Waveband switches	—
S8	HT circuit switch	—
S9	GB circuit switch	—
S10	LT circuit switch	—
S11	Scale lamps switch	—

DISMANTLING THE SET

Removing Chassis.—To remove the chassis from the cabinet, remove the three knobs (pull off) and the scale lamp switch plate, then remove the four bolts (with rubber washers and washers) holding the chassis to the bottom of the cabinet. Now remove the two battens across the back of the cabinet (four round-head wood screws) and the two round-head wood screws (with washers) holding the scale assembly to the top of the cabinet, when the chassis can be withdrawn to the extent of the speaker leads, which is adequate for normal purposes.

When replacing, see that the washer, spring and squash plate for the scale lamp switch are on the spindle of the gang condenser, make sure that there is a rubber washer for each fixing bolt between the chassis and the bottom of the cabinet, and note that the top batten should be fixed so that the clips which hold the back are below the fixing screws.

If it is desired to free the chassis entirely, unsolder the speaker leads and *when replacing,* take the black lead to the left-hand tag on the speaker terminal panel.

Removing Speaker.—To remove the speaker from the cabinet, remove the three screws (with spring washers) holding it to the sub-baffle and *when replacing,* see that the terminal panel is at the top.

GENERAL NOTES

Switches.—**S1-S7** are the waveband switches, in a single rotary unit beneath the chassis. This is indicated in our under-chassis view, and shown in detail in the diagram on page IV, where it is as seen looking from the rear of the underside of the chassis.

The table (p. IV) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C** closed.

S8 is the QMB HT circuit switch, operated by a striker fixed to the spindle of the volume control **R10.** **S9** and **S10,** the GB and LT circuit switches, are also ganged with **R10,** and are in the usual moulded type of unit at its rear.

S11 is the scale lamp switch, associated

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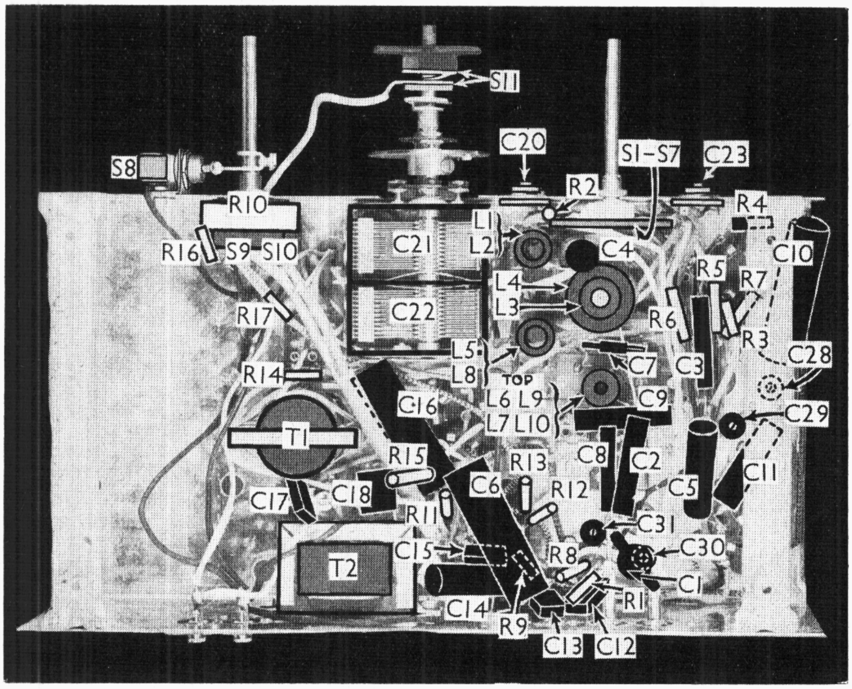


Under-chassis view. **S8,** like **S9** and **S10,** is ganged with the volume control, **R10.** A diagram of the **S1-S7** unit is on page IV.

G.E.C.—*Continued*

with the tuning drive, which closes when the moulded circular collar behind the tuning knob is pushed in.

Coils.—All the RF and oscillator coils are in four unscreened tubular units beneath the chassis, while the IF transformers **L11, L12** and **L13, L14** are in two screened units on the chassis deck. Their trimmers are adjusted from beneath the chassis.

Scale Lamps—These are two Osram MES types, rated at 2·0 V, 0·6 A. They are only switched on when **S11** is closed.

Fuse F1.—This is an Osram MES type lamp, rated at 3·5 V, 0·15 A. It screws into a holder on the chassis deck.

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

Batteries.—LT, G.E.C. 2 V 60 AH celluloid cased cell, type BC230; HT, G.E.C. 135 V unit, type BB376; GB, G.E.C. 9 V unit, type BB9.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; red lead, spade tag, LT positive 2 V; pink lead, red plug, GB positive; yellow lead, black plug, GB negative, −7·5 V; white lead, black plug, HT negative; red lead, red plug, HT positive 2, +135 V; blue lead, red plug, HT positive 1, voltage depending on letter marked on bulb of **V4**: V, 111 V; W, 120 V; X, 126 V.

BC3846 DIVERGENCIES

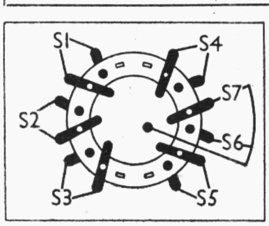
The Battery All-Wave Receiver (BC3846) is very similar to the BC3856 model dealt with above, except for the output stage. This uses a PT2 pentode or KT2 tetrode in place of the QP21. A 120 V HT battery is used, and provides GB as well as HT. The GB negative connection in our diagram is taken to the negative HT socket. GB positive, HT negative and HT positive 1 are not used, HT positive 2 being connected to the +120 V socket.

The coupling between **V3** and **V4** is by a resistance-capacity arrangement. **R15** is not used, and several other AF and bias components have different values.

However, up to the double diode section of **V3** the circuits are identical, and therefore most of the information given above, and the alignment given below, will apply.

SWITCH TABLE AND DIAGRAM

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



Switch diagram, looking from the rear of the underside of the chassis.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to MW, and turn gang and volume control to maximum. Short circuit **C22** by connecting fixed vanes to chassis. Connect signal generator, via a 0·1 μF condenser, to control grid (top cap) of **V1** and chassis, leaving the normal top cap connection in position.

Feed in a 456 KC/S signal, and adjust **C28, C29, C30** and **C31** in turn for maximum output, reducing input progressively. Remove short from **C22.**

RF and Oscillator Stages.—See that scale is central in clips. With gang at maximum, pointer should coincide with horizontal line on scale. Connect signal generator to **A2** socket and **E** terminal via a dummy aerial.

SW.—Switch set to SW, tune to 17·6 m on scale, feed in a 17·6 m (17 MC/S) signal, and adjust **C23** and **C20** for maximum output. **C23** must be adjusted at the peak requiring the lowest capacity. If "pulling" is experienced when adjusting **C20,** rock the gang slightly to compensate for this.

MW.—Switch set to MW. The dummy aerial should be adjusted for this band. Disconnect **C22** by unsoldering the wire from the connecting tag at the side of the condenser beneath the chassis. Connect an external variable condenser between the disconnected lead and chassis.

Feed in a 214 m (1,400 KC/S) signal, and adjust receiver tuning control and external condenser for maximum output. Disconnect external condenser and re-connect **C22.** Without touching tuning control, adjust **C24** for maximum output.

Again disconnect **C22** and connect external condenser. Feed in a 500 m (600 KC/S) signal and adjust tuning control and external condenser for maximum output. Disconnect external condenser, re-connect **C22,** and adjust **C27** for maximum output. Repeat the 214 m adjustments.

LW.—Switch set to LW, and tune to 1,000 m on scale. Feed in a 1,000m (300 KC/S) signal and adjust **C25**, then **C19,** for maximum output.

Disconnect **C22,** connect external variable condenser, feed in an 1,818 m (165 KC/S) signal, and adjust tuning control and external condenser for maximum output. Disconnect external condenser, re-connect **C22,** and adjust **C26** for maximum output. Repeat the 1,000 m adjustments.

MAINTENANCE PROBLEMS

Usefulness of High-Voltage Test

An obscure and elusive fault can occur in the Philips 588A and similar chassis. A common symptom is intermittent crackle and fading on both wavebands, often resulting in a temporary hiatus in reproduction.

I have completely overhauled, reganged and tested such a receiver only to have the same complaint return a few days later, unfortunately never long enough to allow any testing to be carried out. I decided to disconnect every condenser, including trimmers, and to give them an insulation test. This was first of all done with the neon test on the Mullard Test Board and resulted in every one being indicated O.K.

Fortunately, at that moment the wireman returned with the 500 V megger, an instrument which I have found of great use in many cases. With the aid of this I was able to trace a leakage between the primary and the secondary trimmers of the second IF transformer, which are mounted on a common bolt, one being adjusted by means of a nut and the other by the screw which passes through a threaded bush. On "revving-up" the megger a final break-down took place.

Replacement of the trimmer unit, and readjustment cured the trouble.—S.G.P.

Metallising Disconnected

A PYE P/B in for overhaul functioned quite well on the LW band, although calibration was slightly incorrect; the MW band was singularly unproductive and it was found impossible to force a 350 m modulated signal through the set.

In the routine manner all valves were first tested and found to be O.K. except for a slight electrode short on one of the SG type; this was temporarily replaced. Gramophone reproduction was normal (here I may mention that the jack contacts can give rise to some peculiar faults and should always receive attention). Waveband switches and the ohmic values of coils were checked, but were O.K.

Reganging was now commenced and an oscillator peak could not be obtained. The trimmers were carefully checked and a further attempt was made, but the same result was apparent. This was thought to be a case of the oscillator coils having changed their inductance. It was then noticed that the hand placed inside the receiver gave rise to a howl under certain conditions, and therefore the inference was faulty screening.

Cans and metallising were given a test to chassis, and the screening of the oscillator valve was found to be entirely disconnected. The remedy was then obvious.—S.G.P.

Handling AC/DC Chassis

Anyone who handles a universal receiver on AC will know that the chassis can become "live," but can be safely handled if the mains plug is reversed; this is not the case with positive earthed DC mains.

I keep a small gadget handy to indicate the safe side of the AC mains. An ordinary batten holder mounted at the back of the bench contains a neon bulb, one side of which is permanently connected to earth; the other is joined to a flying lead suitably terminated. The contact of this lead with any AC/DC chassis will light the neon if the chassis is live, but on reversal of the plug the chassis becomes safe to handle and no light is seen.—S. G. Parnell, Raunds.