NUMBER NINETY-TWO **'TRADER' SERVICE SHEETS**

G.E.C. 'SUPERHET BATTERY FOUR'

IN the G.E.C. "Superhet Battery Four" a 4-valve superhet chassis is employed, the circuit consisting of a heptode frequency changer, a variable-mu tetrode I.F. amplifier, a double diode triode and a double pentode output valve used in a Q.P.P. stage. Provision is made for an extension speaker and a gramophone pick-up.

CIRCUIT DESCRIPTION

Aerial input via coupling coil **L1** (M.W.) and L.W. tapping to primary **L2, L3, C17** of inductively coupled band-pass filter. Secondary **L4, L5** is tuned by **C19.**

First valve (**V1, Osram X21**) is a heptode operating as frequency changer with electron coupling. Oscillator grid coils **L6, L7** tuned by **C21**; anode reaction coils **L8, L9**; tracking by shaped condenser vanes and **C3, C24** (L.W.).

Second valve, a variable-mu H.F. tetrode (**V2, Osram metallised VS24**), operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L10, L11** and **L12, L13.**

Intermediate frequency 125 KC/S.

Diode second detector forms part of double diode triode valve (**V3, Osram HD22**). Second diode, fed from **V2** anode by condenser **C11,** provides D.C. potentials which are developed across **R10** and **R11,** and fed back as G.B. to F.C. and I.F. valves to give automatic volume control. Delay voltage is obtained from G.B. potential divider **R14, R15,** which also serves to discharge the battery at a rate calculated to give a degree of G.B. compensation as the H.T. potential falls.

Audio-frequency output from signal diode is developed across load **R5** and passed via coupling condenser **C8,** manual volume control **R6,** and coupling condenser **C9** to grid of **V3** triode section which operates as L.F. amplifier. Provision for connection of gramophone pick-up.

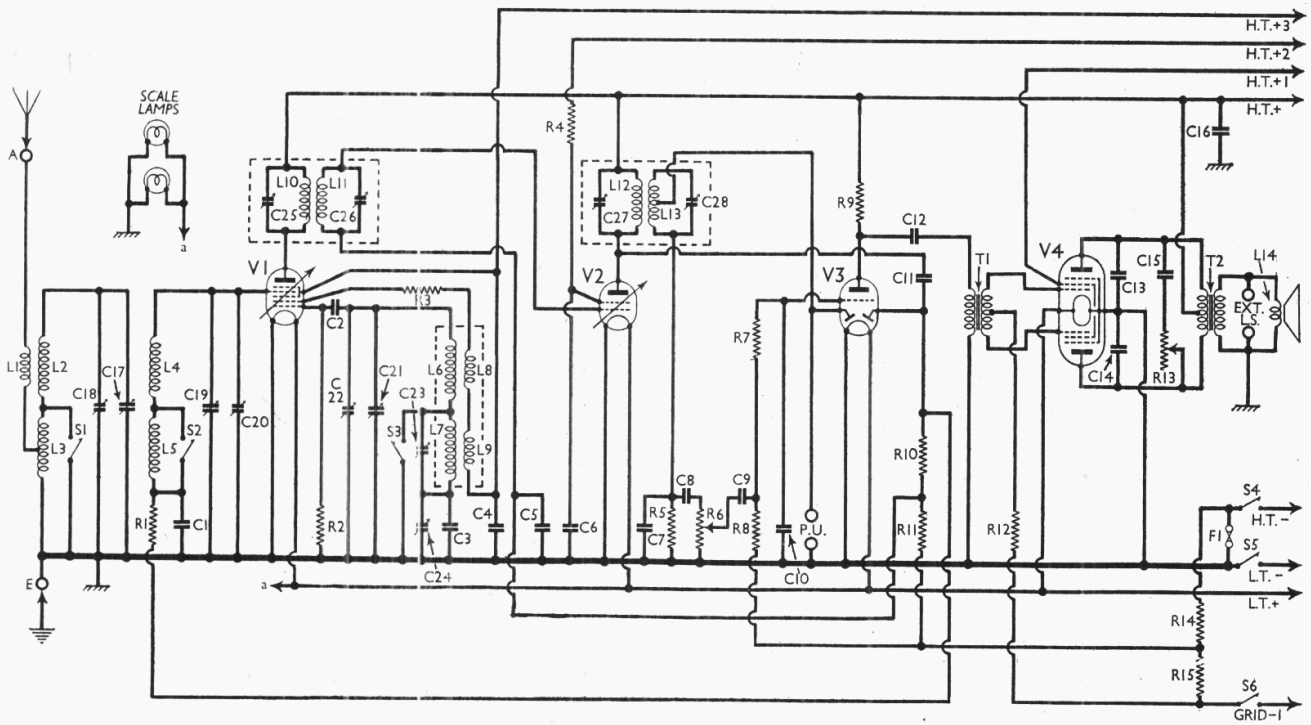
Parallel fed transformer coupling by **R9, C12** and **T1** to output stage comprising a double pentode (**V4, Osram QP21**) operating on the quiescent push-pull system. Variable tone control by R.C. filter **R13, C15** in anodes circuit. Provision for connection of low-impedance external speaker across secondary of internal speaker transformer **T2.**

COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	V1 tet. cont. grid decoupling	1,000,000
R2	V1 osc. grid resistance ..	99,000
R3	V1 osc. anode series resistance	2,000
R4	V2 S.G. H.T. feed	77,000
R5	V3 signal diode load	440,000
R6	Manual volume control ..	500,000
R7	V3 grid I.F. stopper	99,000
R8	V3 grid resistance	1,000,000
R9	V3 anode load	55,000
R10	V3 A.V.C. diode load ..	330,000
R11		220,000
R12	V4 anti-parasitic resistance ..	99,000
R13	Variable tone control	50,000
R14	G.B. potential divider	150
R15		600

	Condensers	Values (μF)
C1	V1 tet. cont. grid decoupling	0·05
C2	V1 osc. grid condenser ..	0·0001
C3	Oscillator L.W. tracker, fixed	0·0005
C4	V1 S.G.'s and osc. anode decoupling	0·25
C5	V2 cont. grid decoupling ..	0·05
C6	V2 S.G. by-pass	0·1
C7	I.F. by-pass	0·0001
C8	L.F. coupling to vol. control	0·02
C9	L.F. coupling to V3 triode ..	0·02
C10	V3 grid I.F. by-pass	0·0001
C11	Coupling to V3 A.V.C. diode	0·0001
C12	L.F. coupling to T1	0·25
C13	Fixed tone correctors ..	0·001
C14		0·001
C15	Part of tone control filter ..	0·005
C16	H.T. reservoir	0·25
C17†	Band-pass primary tuning ..	—
C18‡	Band-pass primary trimmer ..	—
C19†	Band-pass secondary tuning	—
C20‡	Band-pass secondary trimmer	—
C21†	Oscillator tuning	—
C22‡	Oscillator main trimmer ..	—
C23‡	Oscillator L.W. trimmer ..	—
C24‡	Oscillator L.W. tracker ..	—
C25‡	1st I.F. trans. pri tuning ..	—
C26‡	1st I.F. trans sec. tuning ..	—
C27‡	2nd I.F. trans pri. tuning ..	—
C28‡	2nd I.F. trans sec. tuning ..	—

† Variable. ‡ Pre-set.



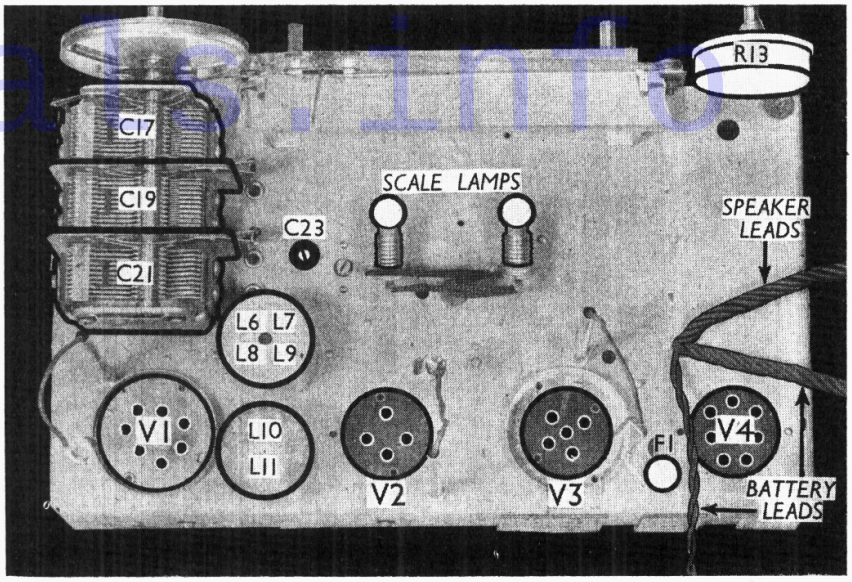
Circuit diagram of the G.E.C. "Superhet Battery Four." A double-pentode Q.P.P. output stage is employed. The colour coding and voltages of the battery leads are given under "General Notes."

	Other Components		Approx. Values (ohms)
L1	Aerial coupling coil (M.W.)		1·6
L2	Band-pass primary coils		4·0
L3			17·0
L4	Band-pass secondary coils		3·9
L5			17·0
L6	Oscillator tuning coils		3·8
L7			11·5
L8	Oscillator reaction coils, total		4·8
L9			
L10	1st I.F. trans.	Pri.	82·0
L11		Sec.	82·0
L12	2nd I.F. trans.	Pri.	82·0
L13		Sec.	82·0
L14	Speaker speech coil		1·9
T1	Intervalve trans.	Pri.	632·0
		Sec. total	3,370·0
T2	Speaker input trans.	Pri. total	1,390·0
		Sec.	0·96
S1-S3	Waveband switches		—
S4	H.T. switch		—
S5	L.T. switch		—
S6	G.B. switch		—
F1	H.T. circuit fuse		—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the back, batteries, false back to the lower compartment (two screws) and the battery shelf (two cheese-head screws). Remove the four control knobs (pull off) and the caps from the valve screens, then free the speaker leads from the cleat on the right-hand side of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes. When lifting the chassis out, take care that the condenser drive mechanism does not foul the clips holding the glass on the escutcheon.

To remove the chassis entirely, unsolder the leads on the speaker terminal panel and *when replacing*, note that the connections go on the outer row of tags and connect as follow, numbering the tags from bottom to top :—1, red ; 2, orange ; 3 and 5 joined together, yellow ; 4, black ; 6, orange ; 7, blank.



Plan view of the chassis. Note the fuse bulb, F1, which has the same rating as the two scale lamps.

Removing Speaker.—To remove the speaker, unsolder the connections and remove the nuts, spring washers, washers and presspahn washers from the three bolts holding it to the sub-baffle. *When replacing*, see that the transformer is pointing towards the right-hand top corner of the cabinet and connect as above.

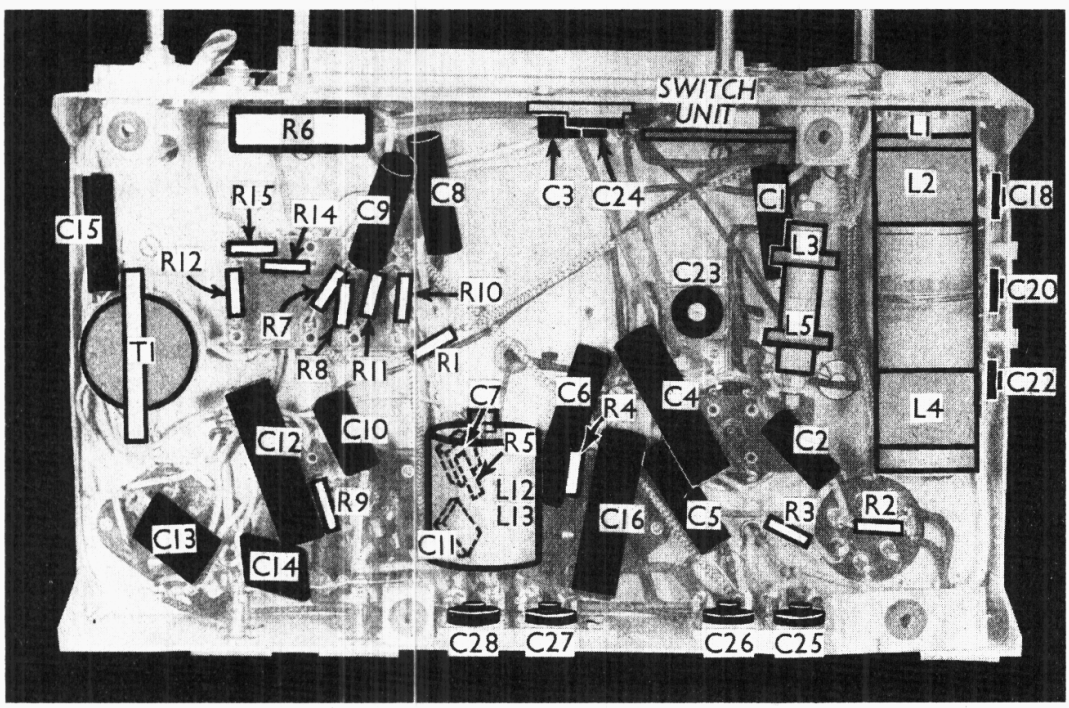
VALVE ANALYSIS

Valve voltages and currents given in the table overleaf were taken with the receiver operating from new batteries, the H.T. reading 158 V and the G.B. reading 9.4 V. The volume control was at maximum and the receiver was tuned to the lowest wavelength on the M.W. band, but there was no signal input.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

In the case of **V4,** the screen voltage depends on the letter marked on the bulb. These letters (V, W and X) correspond with similarly marked sockets on the battery. A grade V valve requires 132 V, a grade W valve needs 140 V, and a grade X valve requires 147 V.

(*Continued overleaf*)



Under-chassis view. The various trimmers are mounted round the sides of the chassis. A separate diagram of the switch unit is given overleaf. The components C7, C11, R5 are beneath the second I.F. transformer unit, not inside it.

G.E.C. 'SUPERHET BATTERY FOUR' (continued)

In our chassis the QP21 was a grade W valve.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 X21* ..	155	0·4	65	1·4
V2 VS24 ..	155	1·4	55	0·6
V3 HD22 ..	100	0·9	—	—
V4 QP21 ..	155†	1·1†	145‡	0·5 ‡

* Osc. anode (G2) 60 V, 2·9 mA.
† Each anode.
‡ In our chassis.

GENERAL NOTES

Switches.—The waveband and battery switches, **S1-S6,** are in a single unit, indicated in the under-chassis view, and shown in detail in a diagram, as it appears looking at the underside of the chassis, from the rear. The table below gives the switch positions for the various control settings, O indicating open, and C closed.

Switch	Off	M.W.	L.W.
S1	O	C	O
S2	O	C	O
S3	C	C	O
S4	O	C	C
S5	O	C	C
S6	O	C	C

Coils.—**L1-L5** are in two unscreened units beneath the chassis. **L1, L2** and **L4** are single layer coils on a tubular former, while **L3** and **L5** are wave-wound coils on a cylindrical wooden former.

L6-L9, the oscillator coils, are in a screened unit on the chassis deck, as are also **L10, L11,** forming the first I.F. transformer unit. The second I.F. transformer, **L12, L13,** is beneath the chassis, and is also screened. The I.F. trimmers are outside the coil units, and are mounted inside the back plate of the chassis.

Scale Lamps.—These are two Osram M.E.S. types, rated at 3.5 V 0.15 A.

Fuse Bulb F1.—This is also an Osram M.E.S. type 3.5 V 0.15 A lamp, so that in an emergency one of the scale lamps could be used to replace it.

External Speaker.—The two right-hand sockets at the rear of the chassis are for an external low resistance speaker (4-6 O).

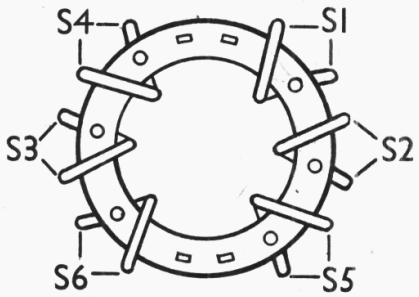


Diagram of the switch unit, as seen looking at the underside of the chassis from the rear.

Batteries.—The batteries supplied are a 2 V 40 AH G.E.C. Magnet celluloid accumulator cell for L.T. (Cat. No. B.C.140) and a G.E.C. black label type B.B.759 combined 150 V H.T. and 9 V G.B. battery.

Battery Leads and Voltages.—Separate red and black leads with spade tags for L.T.; 6-way cable for H.T. and G.B. White lead, H.T. negative (and G.B. positive); Red lead, H.T. positive, 150 V; Blue lead, H.T. positive 1, 132-147 V (see below); Orange lead, H.T. positive 2, 99 V; Brown lead, H.T. positive 3, 58 V; Yellow lead, G.B. negative, —9 V.

H.T. Positive 1 Tapping.—The voltage for this tapping depends on the particular Q.P.21 output valve in the set. Each valve is marked with a letter V, W or X on the glass bulb. The correct voltages are: V, 132 V; W, 140 V and X, 147 V. These tappings are also lettered on the battery.

Trimmers C18, C20, C22.—The tuning condenser trimmers are not mounted on the condenser itself, but at the side of the chassis just below the condenser.

Components C7, C11, R5.—These are shown by dotted lines in our under-chassis view, and are beneath the screen of **L12, L13,** not inside it.

E.M.I. Service Oscillator and Output Meter

(Continued from p. 1)

is supplied with each instrument, and the net price is £3 7s. 6d. Stock No. Q2473.

Performance Details

The consumption of the L.T. circuit was just under 0.4 A with the voltage accurately adjusted to 2.0 V. Consequently, it is advisable always to use an external 2.0 V accumulator cell for filament supply when using the oscillator in the service workshop, reserving the internal dry battery for work outside the workshop.

The H.T. consumption was only about 1.3 mA, which should result in the H.T. battery fitted having a long life.

When first using the oscillator, we were impressed by the difference between its modulation note and that of the type of oscillator using a single valve in a "squegger" circuit. The E.M.I. instrument gave a clear 400 c.p.s. note, free from noticeable harmonics, and with no trace of roughness. The modulation percentage is fixed.

We found that the oscillator was quite sharply tuned, and the scale could be accurately read, due to the knife-edged pointer moving close to the scale. The calibration figures on the lid give a number of points on each waveband, but for more accurate readings, the hand-drawn curves must be consulted. These are all drawn on a single chart, which is a little confusing at first. The subdivisions of the wavelength and frequency scales are well arranged except in the case of the No. 3 band, where one large division equals 30 metres, and a small division, 6 metres.

The attenuator, which only operates in the "Low Imp." output position, was found to be smooth and silent in operation, and well graded.

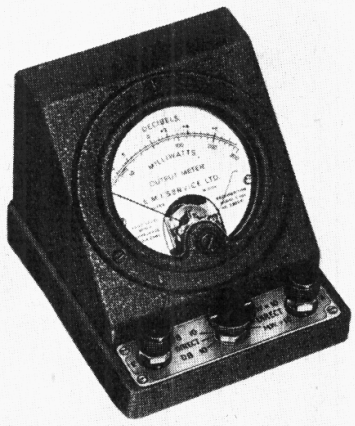
The four ranges provide for all possible requirements of modern M.W. and L.W. receivers, a good point being the inclusion of the higher intermediate frequencies.

There is no provision for external modulation, or for switching off the internal modulation and using the unmodulated carrier. E.M.I. Service, Ltd., do not consider these features to be important, and actually they are never required for ordinary receiver alignment work. It is pointed out that the calibration is carried out on the "Low Imp." output, and the "High Imp." setting may result in a slightly different calibration.

The general construction is good, and the instrument is well shielded. It closes up neatly for transport.

The output meter, although not essential, is a useful adjunct to the oscillator. The ranges provided are very suitable for ganging and for output measurement work, and in the latter respect the instrument is much more convenient than an A.C. voltmeter.

Both instruments are sent out with well produced and informative instruction books, which should be carefully studied, as they contain many useful hints.



The E.M.I. Output Meter.