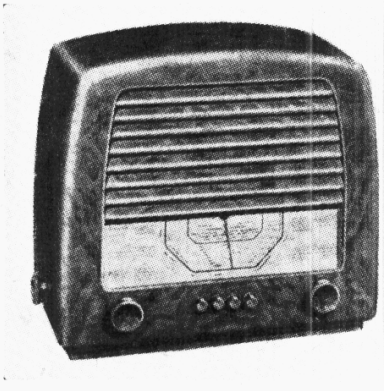
Supplement to The Wireless & Electrical Trader, December 14, 1946

"TRADER" SERVICE SHEET 796

G.E.C. BC4655

3-BAND A.C./D.C. SUPERHET



PARTICULAR care has been taken in the construction of the chassis of the G.E.C. 4655 receiver to avoid the possibility of accidental shock to the user. The set is a 4-valve (plus rectifier) 3-band superhet, designed to operate from A.C. or D.C. mains of 200-250 V, 25-100 c/s in the case of A.C. The S.W. range is 16.5-50 m.

Waveband changing is performed by a press-button switch unit, a fourth button marked "Off" switching off the set when pressed or switching it on when any other button is pressed. The S.W. button serves also as the pick-up switch.

Release date and original price: £16 16s. plus £3 12s. 3d. purchase tax.

CIRCUIT DESCRIPTION

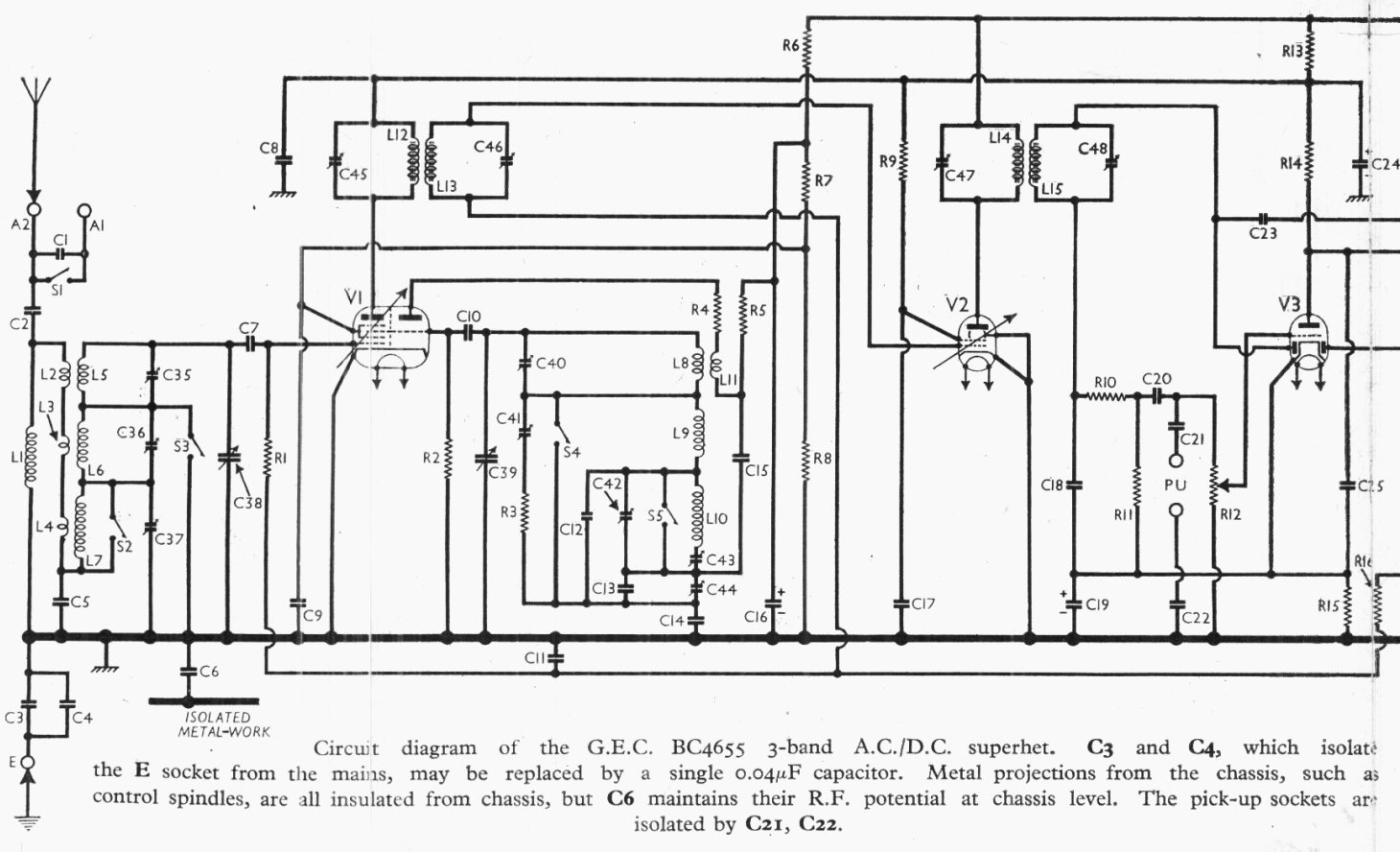
Two alternative aerial input sockets **A1** and **A2** are provided, and an R.F. choke **L1** shunts the input circuit to eliminate the possibility of modulation hum. Input from socket **A2** is coupled via **L2, L3, L4** and **C5** to single-tuned circuits comprising **L5** (S.W.), **L6** (M.W.), **L7** (L.W.) and **C38.**

On S.W., coupling is inductive from **L2,** the impedance of **L3, L4** and **C5** being out of circuit since **S3** connects the earthy end of **L5** to chassis. On M.W. and L.W., coupling is mixed but mainly capacitative, the tuned circuits deriving their input from **C5,** which is common to primary and secondary circuits on these bands. Inductive coupling is obtained from **L3** and **L4,** which are included for the purpose of image interference suppression. The impedance of **L2** is negligible on these bands.

Input from socket **A1** is taken to **A2** via the series capacitor **C1,** which is, however, short-circuited on the S.W. and L.W. bands by **S1,** which opens only upon depression of the M.W. switch button.

First valve **(V1, Osram metallized X61M)** is a triode-hexode operating as frequency changer with internal coupling. Oscillator grid coils **L8** (S.W.), **L9** (M.W.) and **L10** (L.W.) are tuned by **C39.** Parallel trimming by **C40** (S.W.), **C41** (M.W.) and **C12, C42** (L.W.); series tracking by **C14** (S.W.), **C13, C44** (M.W.) and **C43** (L.W.).

Reaction coupling is mixed on S.W., inductive coupling being obtained from **L11** and capacitative coupling from the common impedance of **C14,** via **C15, C13.** On M.W. and L.W., reaction coupling is entirely capacitative, being developed across the combined impedance of **C13, C44** and **C14,** via **C15.** Resistors **R3, R4** and **R5** stabilize the circuit and help to maintain a constant oscillator output over the range of frequencies covered.



Circuit diagram of the G.E.C. BC4655 3-band A.C./D.C. superhet. **C3** and **C4,** which isolate the **E** socket from the mains, may be replaced by a single 0.04μF capacitor. Metal projections from the chassis, such as control spindles, are all insulated from chassis, but **C6** maintains their R.F. potential at chassis level. The pick-up sockets are isolated by **C21, C22.**

Second valve **(V2, Osram KTW61)** is a variable-mu R.F. tetrode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C45, L12, L13, C46** and **C47, L14, L15, C48.**

Intermediate frequency 456 kc/s.

Diode second detector is part of double diode triode valve **(V3, Osram DH63).** Audio frequency component in rectified output is developed across load resistor **R11** and passed via A.F. coupling capacitor **C20** and manual volume control **R12** to control grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C18** and **R10** in diode circuit, and by **C25** in triode anode circuit. Provision for connection of a gramophone pick-up across **R12,** via isolating capacitors **C21** and **C22.**

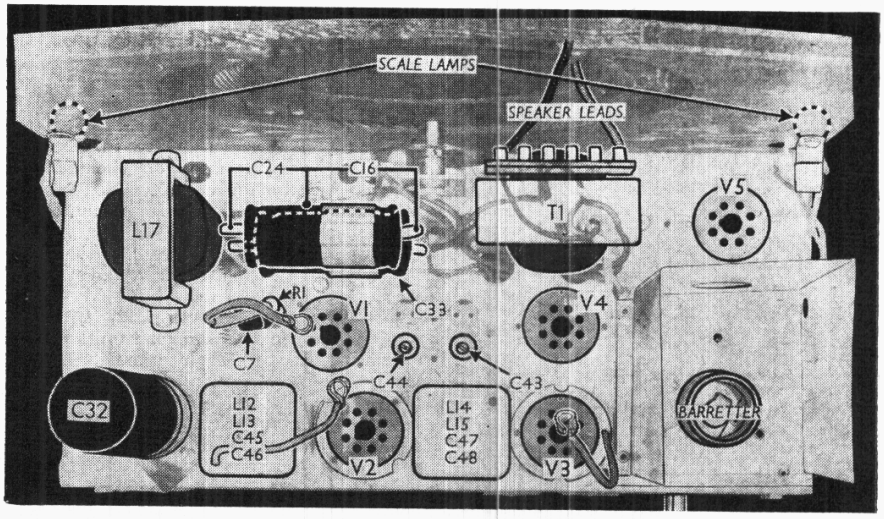
Second diode of **V3,** fed from **L15** via **C23,** provides D.C. potential which is developed across load resistor **R17** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control.

Resistance-capacitance coupling by **R14, C26, R21,** via tone correcting circuits **C27, R20** and **R18, C28,** between **V3** triode and beam tetrode output valve **(V4, Osram KT33C).** Fixed tone correction by **C29,** and variable tone control by **C31, R24** in tetrode anode circuit. The tone correcting circuit **C27** and **R20,** in the intervalve coupling, is short-circuited on S.W. and gramophone operation by the closing of **S6.**

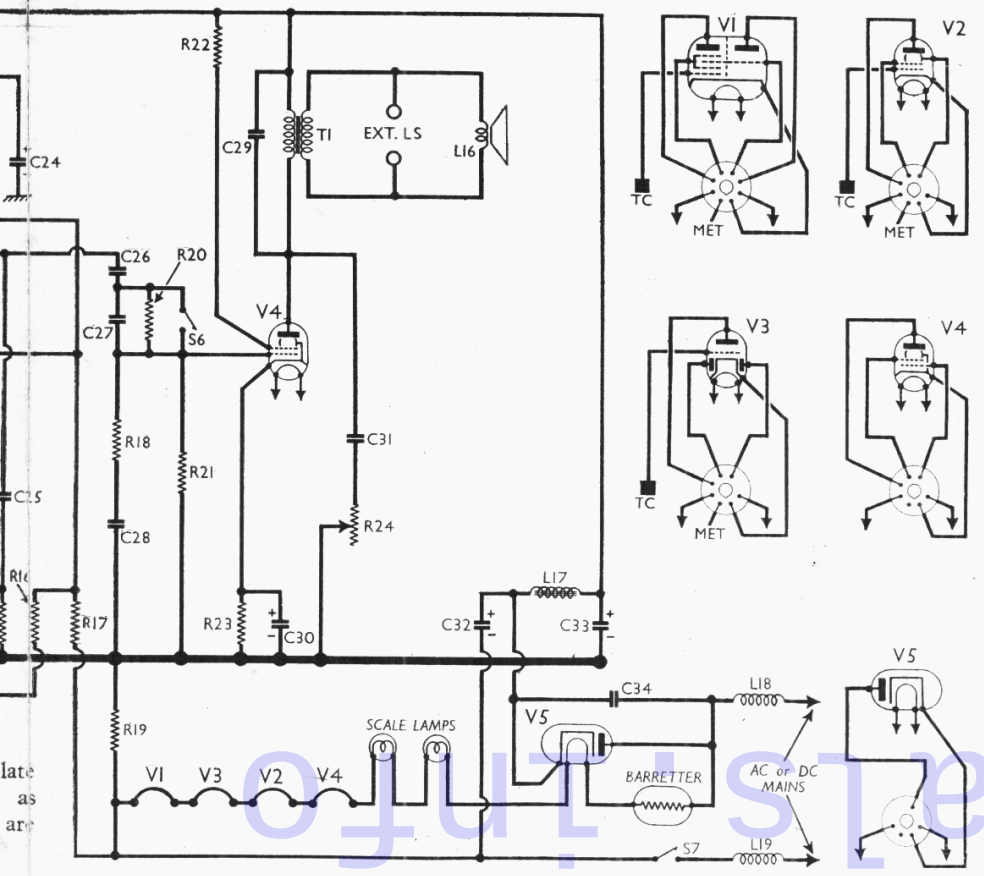
When the receiver is operated from A.C. mains, H.T. current is supplied by half-wave rectifying valve **(V5, Osram U31)** which, with D.C. mains, behaves as a low resistance. Smoothing is effected by iron-cored choke **L17** and electrolytic capacitors **C32, C33.** Filter circuit comprising chokes **L18, L19** and capacitor **C34** suppresses mains-borne interference.

Fixed G.B. potential for **V1** and **V2** is obtained from the drop along resistor **R19** in the negative H.T. lead to chassis, and is applied via the A.V.C. line. It thus forms part of the A.V.C. delay voltage, the balance of which is obtained from the drop along **R15** in **V3** cathode lead to chassis.

Valve heaters, together with scale lamps and current regulating barretter **(Osram 304),** are connected in series across mains input.



Plan view of the chassis. The I.F. trimming adjustments are reached from the underside of the chassis.



COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	A1 series coupling ...	0·000022
C2	Aerial isolator	0·001
C3, C4	Earth isolating capacitors	0·02, 0·02
C5	Aerial coupling capacitor	0·003
C6	Isolating capacitor ...	0·001
C7	V1 hex. C.G. capacitor ...	0·0001
C8	H.T. circuit R.F. by-pass	0·05
C9	V1 S.G. decoupling ...	0·05
C10	V1 osc. C.G. capacitor ...	0·0001
C11	A.V.C. line decoupling ...	0·05
C12	Osc. L.W. fixed trimmer...	0·000039
C13	Osc. M.W. fixed tracker ...	0·0001
C14	Osc. circ. S.W. tracker ...	0 00395
C15	Reaction coupling ...	0·005
C16*	V1 osc. anode decoupling	8·0
C17	V2 S.G. decoupling ...	0·05
C18	I.F. by-pass	0·0003
C19*	V3 cathode by-pass ...	25·0
C20	A.F. coupling to V3 triode	0·02
C21, C22	Pick-up isolating capacitors	0·01, 0·01
C23	A.V.C. diode coupling ...	0·000022
C24*	H.T. line decoupling ...	4·0
C25	V3 anode I.F. by-pass ...	0·0005
C26	A.F. coupling to V4 ...	0·02
C27, C28, C29	Part of tone correcting circuits	0·0002, 0·0015, 0·01
C30*	V4 cathode by-pass ...	25·0
C31	Part variable tone control	0·1
C32*, C33*	H.T. smoothing capacitors	16·0, 32·0
C34	Mains R.F. by-pass ...	0·01
C35‡	Aerial circ. S.W. trimmer	—
C36‡	Aerial circ. M.W. trimmer	—
C37‡	Aerial circ. L.W. trimmer	—
C38†	Aerial circuit tuning ...	—
C39†	Oscillator circuit tuning...	—
C40‡	Osc. circ. S.W. trimmer...	—
C41‡	Osc. circ. M.W. trimmer...	—
C42‡	Osc. circ. L.W. trimmer...	—
C43‡	Osc. circ. L.W. tracker ...	—
C44‡	Osc. circ. M.W. tracker ...	—
C45‡	1st I.F. trans. pri. tuning	—
C46‡	1st I.F. trans. sec. tuning	—
C47‡	2nd I.F. trans. pri. tuning	—
C48‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	V1 hex. C.G. resistor ...	1,000,000
R2	V1 osc. C.G. resistor ...	100,000
R3	Oscillator circuit damping resistors	68
R4		470
R5		6,800
R6	V1 S.G. and osc. anode H.T. feed potential divider	6,800
R7		8,200
R8		22,000
R9	V2 S.G. H.T. feed ...	47,000
R10	I.F. stopper	56,000
R11	V3 signal diode load ...	470,000
R12	Manual volume control ...	1,000,000
R13	H.T. line decoupling ...	10,000
R14	V3 triode anode load ...	100,000
R15	V3 triode G.B. resistor ...	2,200
R16	A.V.C. line decoupling ...	1,000,000
R17	A.V.C. diode load ...	470,000
R18	Part tone corrector ...	150,000
R19	V1, V2 fixed G.B. resistor, A.V.C. delay	39
R20	Part tone corrector ...	680,000
R21	V4 C.G. resistor	330,000
R22	V4 S.G. stopper	100
R23	V4 G.B. resistor	220
R24	Variable tone control ...	55,000

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial circuit shunt ...	60.0
L2, L3, L4	Aerial coupling and image rejector coils, total ...	0·36
L5	Aerial S.W. tuning coil ...	0·06
L6	Aerial M.W. tuning coil ...	2·8
L7	Aerial L.W. tuning coil ...	19·5
L8	Osc. S.W. tuning coil ...	0·06
L9	Osc. M.W. tuning coil ...	3·4
L10	Ocs. L.W. tuning coil ...	7·7
L11	Osc. S.W. reaction coil ...	0·32
L12	1st I.F. trans. Pri. ...	7·0
L13	1st I.F. trans. Sec. ...	7·0
L14	2nd I.F. trans Pri. ...	4·0
L15	2nd I.F. trans Sec. ...	4·0
L16	Speaker speech coil ...	2·3
L17	H.T. smoothing choke ...	380·0
L18	Mains R.F. filter chokes ...	2·7
L19		2·7
T1	Output trans. Pri. ...	210·0
	Output trans. Sec. ...	0·36
S1-S6	Waveband switches ...	—
S7	Mains switch	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the makers. They represent conditions to be expected in an average chassis when it is operating on A.C. mains of 230 V. The receiver should have been in operation for at least five minutes, tuned to 300m, but with no signal input.

Voltages were measured with a 1,200 V meter which required 6mA for full-scale deflection, chassis being the negative connection.

Valve		Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1	X61M	158	1·5	85	3·0
		Oscillator			
		115	3·7		
V2	KTW61	210	8·6	55	2·2
V3	DH63	75	0·7	—	—
V4	KT33C	200	53·0	210	8·5
V5	U31	†	—	—	—

† Cathode to chassis, 250 V, D.C.

GENERAL NOTES

Switches.—S1-S6 are the waveband switches, in a four-section press-button unit beneath the chassis, the switches being divided between three of the units (L.W., M.W. and S.W. sections) only. **S7** is the Q.M.B. mains switch, mounted on the press-button unit and operated by the "OFF" button, opening when that button is pressed.

The positions of all switches are shown in our diagram of the switch unit in col. 2, where it is drawn as seen when viewed from the rear of the underside of the chassis. The table below gives the action of the switches when respective buttons are depressed.

Coils.—The R.F. coils **L2-L7** and the oscillator coils **L8-L11** are in two unscreened units mounted on their wiring on the press-button switch unit. **L3** and **L4** consist only of a very small number of turns each, wound close to the flanges which carry the solder tags, and they cannot be seen beneath a thick covering of wax.

The I.F. transformers **L12, L13** and **L14, L15** are in two screened units on the chassis deck with their associated trimmers. The coils are iron-dust cored, and the trimming capacitor adjustments project into the under-chassis compartment. Their positions are indicated in our under-chassis view.

Scale Lamps.—These are two Osram M.E.S.-type lamps, with small spherical bulbs, rated at 6.5 V, 0.3 A. The correct type for replacements is Cat. No. O.S.75.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low-impedance (about 3-6 Ω) external speaker.

Gramophone Pick-up.—A second pair of sockets, on the left of those for the external speaker when viewed from the rear, is provided for the connection of a gramophone pick-up. These sockets are isolated from the "live" chassis by capacitors **C21, C22.** The S.W. button should be pressed for pick-up operation.

Capacitor C32.—This is Hunts type K7A surge proof tubular electrolytic unit, rated at 16 μF, 450 V D.C. working. Two tags are provided on the base of the unit, the positive one being coded red. The case is not the negative connection, therefore, but it is marked "Can not isolated."

Switch Table and Diagram

Button Pressed	Switches Closed	Switches Open
OFF ...	S1, S2, S5	S3, S4, S6
L.W. ...	S1	S2, S3, S4, S5, S6
M.W. ...	S2, S5	S1, S3, S4, S6
S.W. and P.U. ...	S1, S2, S3, S4, S5, S6	—

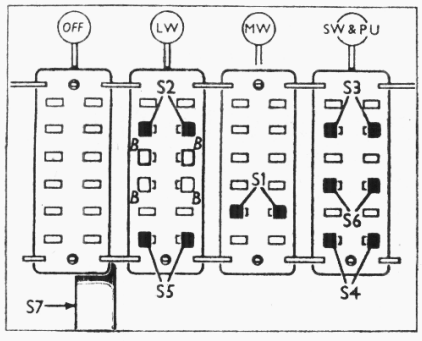


Diagram of the press-button switch unit, drawn as seen in our under-chassis view. The "OFF" plunger operates the attached Q.M.B. switch S7.

The negative tag is connected to H.T. negative, below chassis potential, and the can is consequently insulated from its fixing clip.

Capacitors C16, C24, C33.—These are in two dry electrolytic units of almost similar appearance, mounted in clips one above the other on the chassis deck.

The lower unit is **C33,** with a red tag (positive connection) at one end, and a plain (negative) tag at the other. The unit in our sample was a Hunts List No. J42A, rated at 32 μF, 350 V D.C. working. The can is not isolated, but it does not form the negative connection.

The upper unit is a double type, with a positive tag at each end, in which the can forms the common negative connection. The red tag is the positive of **C16** (8 μF) and the yellow tag is that of **C24** (4 μF). Our sample was a Hunts J57A, rated at 450 V D.C. working.

Isolated Components.—All the metal parts of the chassis structure that might come into contact with a user's hand should the control knobs come off their spindles are isolated from the main chassis pressing, and thus from the mains.

The frame of the switch unit and the volume control bush are returned to chassis via the isolating capacitor **C6.** These isolated parts are indicated in our circuit diagram as isolated metal-work.

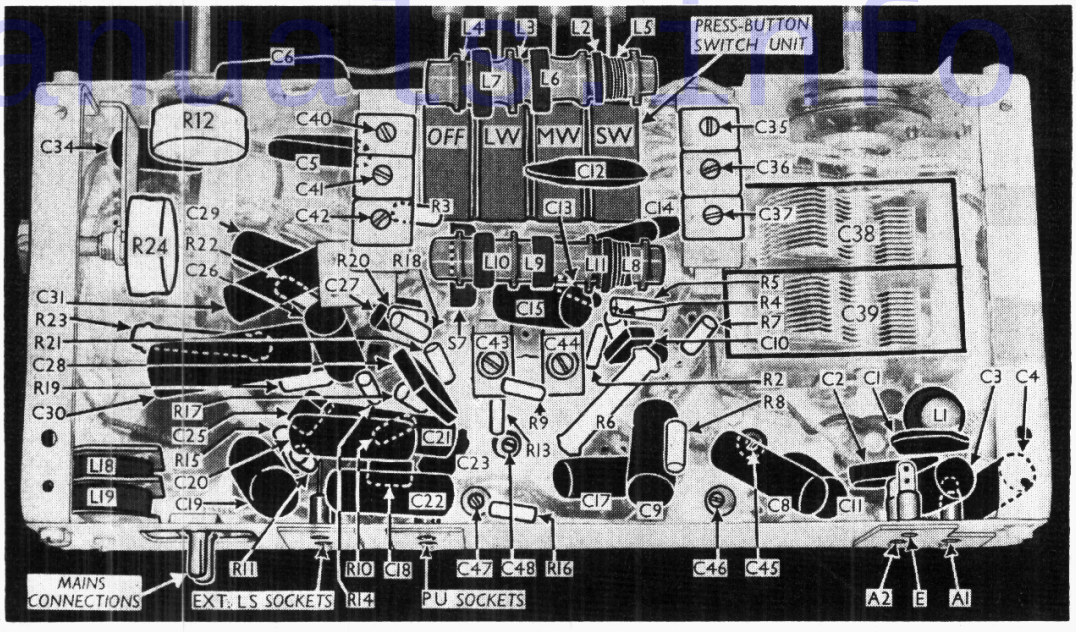
The earth socket **E** is isolated from chassis by the two capacitors **C3, C4,** which are connected in parallel. Normally a single 0.04 μF capacitor would be used here, provided suitable types of the required voltage rating (750 V) were available. At the time of manufacture they were not.

DISMANTLING THE SET

Almost unimpeded access may be obtained to the under-chassis compartment upon removing the back cover (two swivelled spring clips) and the bottom cover (two round-head screws with washers).

Removing Chassis.—Remove the two rotary control knobs (pull-off) from the front of the cabinet;
remove back cover and bottom cover as described above;
insert a long-bladed screwdriver from rear of cabinet, turn the tone control knob (side of cabinet) until the screw heads of the coupling bush face the rear, slacken the outer screw and withdraw knob and spindle stub;
remove the cheese-head set screws (with large flat metal washer and lock-washer) holding the two top corners of the sub-baffle to the front of the cabinet;
remove the four cheese-head screws (with small flat metal washers) holding the chassis to flanges at the base of the cabinet.
Chassis may now be withdrawn, complete with sub-baffle and speaker, in working order.
When replacing, note that the front edge of the cabinet bottom cover fits into grooves at the front of the cabinet, and that the distance-pieces on the bottom cover go inside, holding the cover off the side flanges.

Removing Speaker.—Unsolder from the speech coil tags on the speaker the two



Under-chassis view. The aerial and oscillator coil units are mounted on the press-button switch unit. A diagram of this unit, drawn in the position seen here, appears in col. 2. Most of the small components are rather closely grouped about the centre of the chassis, but their positions are clearly indicated by arrows.

leads connecting them to the transformer below, on the chassis deck;
remove the four cheese-head screws (with washers and lock-washers) holding the speaker to the sub-baffle.
When replacing, the tags should be on the right.

DRIVE WIRE REPLACEMENT

Before the drive wire can be replaced the pointer and speaker sub-baffle must be removed. Suitable drive wire is available from the manufacturers at 3d per length (about 33 inches).

Release the pointer by holding its spindle, with the aid of a screwdriver inserted in the slot at the rear end, and removing the lock-nut, when the pointer can be unscrewed in an anti-clockwise direction. The sub-baffle is held by four set screws (with washers and lock washers), two each side immediately beneath the scale lamps. The lamp holders should first be withdrawn from their brackets on the sub-baffle.

Facing the front of the chassis, turn the gang to *minimum* capacitance, and turn the pointer wheel so that its anchor screw is at about 9 o'clock. The position of each wheel should now be as shown in the drawing in the next column.

Fasten one end of the drive wire under the head of the anchor screw marked "Start" in the sketch (on the front of the lower (drive) wheel, at about 8 o'clock), pass the wire round the groove in an anti-clockwise direction for about half a turn, then away up to the upper pointer wheel. Take it round the groove something over one complete turn anti-clockwise, through the slot and round the anchor screw on the rear face of the wheel, and tighten up the screw.

Return through the slot to the groove, continue in the original direction for about one-quarter turn, then down under the drive wheel and round its groove, still anti-clockwise, to the third anchor screw, (on the rear face at about 10 o'clock), where it should be securely clamped.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator leads via a 0.1 μF capacitor to control grid (top cap) of **V1,** leaving original connector in position, and chassis. Turn the volume control to maximum, and the tone control fully clockwise. Press the L.W. button, and turn the gang to maximum.

Feed in a 456 kc/s (657.8 m) signal, and adjust **C48, C47, C46** and **C45** in that order for maximum output.

R.F. and Oscillator Stages.—Transfer signal generator leads to **A2** and **E** sockets, via a suitable dummy aerial. Check concentricity of pointer as follows: Turn gang to maximum, and set pointer

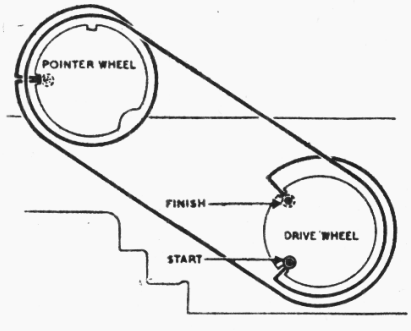


Diagram showing the course taken in fitting a new pointer drive wire. It is drawn as seen from the front of the set.

horizontally, pointing to the left. The short tail point of the pointer should now be directly over a small spot on the scale, and the point of the long arm over the centre of letter "I" in "Medium." With the gang at minimum, the pointer should again lie along the centre-line of the top line of lettering, its long point lying over the centre limb of the letter "E" in "Medium," and its tail point lying over a second small spot on the scale.

If the scale requires adjustment, this can be performed after slackening the six fixing screws. If the pointer requires adjustment, the lock-nut at the rear end of its threaded spindle must be slackened. This is best done with a long narrow-bladed screwdriver inserted through a box spanner, the nut first being heated with a soldering iron.

M.W.—Press M.W. button, tune to 214 m (spot on scale), feed in a 214 m (1,400 kc/s) signal, and adjust **C41,** then **C36,** for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal and adjust **C44** for maximum output, rocking the gang slightly either way for optimum results. Repeat 214 m adjustments.

L.W.—Press L.W. button, tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C42,** then **C37,** for maximum output. Tune to 1,818 m (spot on scale), feed in an 1,818 m (165 kc/s) signal, and adjust **C43** for maximum output, rocking the gang again for optimum results. Repeat 1,000 m adjustments.

S.W.—Press S.W. button, tune to 16.7 m (spot on scale), feed in a 16.7 m (18 Mc/s) signal, and adjust **C40,** then **C35,** for maximum output. Two peaks should be found for **C40,** and that involving the lesser trimmer capacitance should be selected. Both trimmers should then be readjusted while rocking the gang slightly about the correct tuning point to overcome "pulling" between circuits.

All trimmers should finally be sealed with a dab of paint. The makers use a substance called "Necol," and they suggest that it should be well spread over the upper plates of **C40, C41** and **C42** to damp down microphonic vibration, which may otherwise set up a "howl."

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