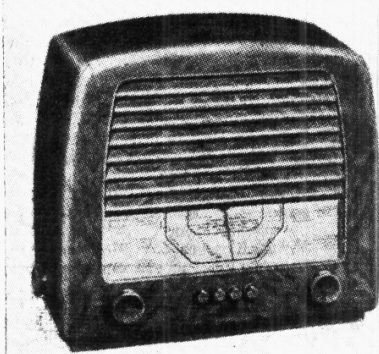


"TRADER" SERVICE SHEET
761

G.E.C. BC4650

THREE-BAND A.C. SUPERHET



The G.E.C. BC4650 3-band superhet. The press-buttons are for wave-band changing and "Off."

A POST-WAR production, the G.E.C. BC4650 is a 4-valve (plus rectifier) 3-band superhet designed to operate from AC mains of 190-260v, 40-100 c/s.

Wavechanging is performed by a press-button switch unit, a fourth button marked "Off" switching off the set when pressed or switching on when any other button is pressed. The SW button is also pressed for pick-up work.

The BC4650L is a low-voltage model with a special mains transformer tapped for 115v, 125v and 220v mains, but otherwise it is similar in every respect to the standard model, on which this *Service Sheet* was prepared.

Release date and original prices: January, 1946 (both models); BC4650, £14 14s., plus £3 3s. 3d. purchase tax; BC4650L, £15 15s., plus £3 5s. 7d. purchase tax.

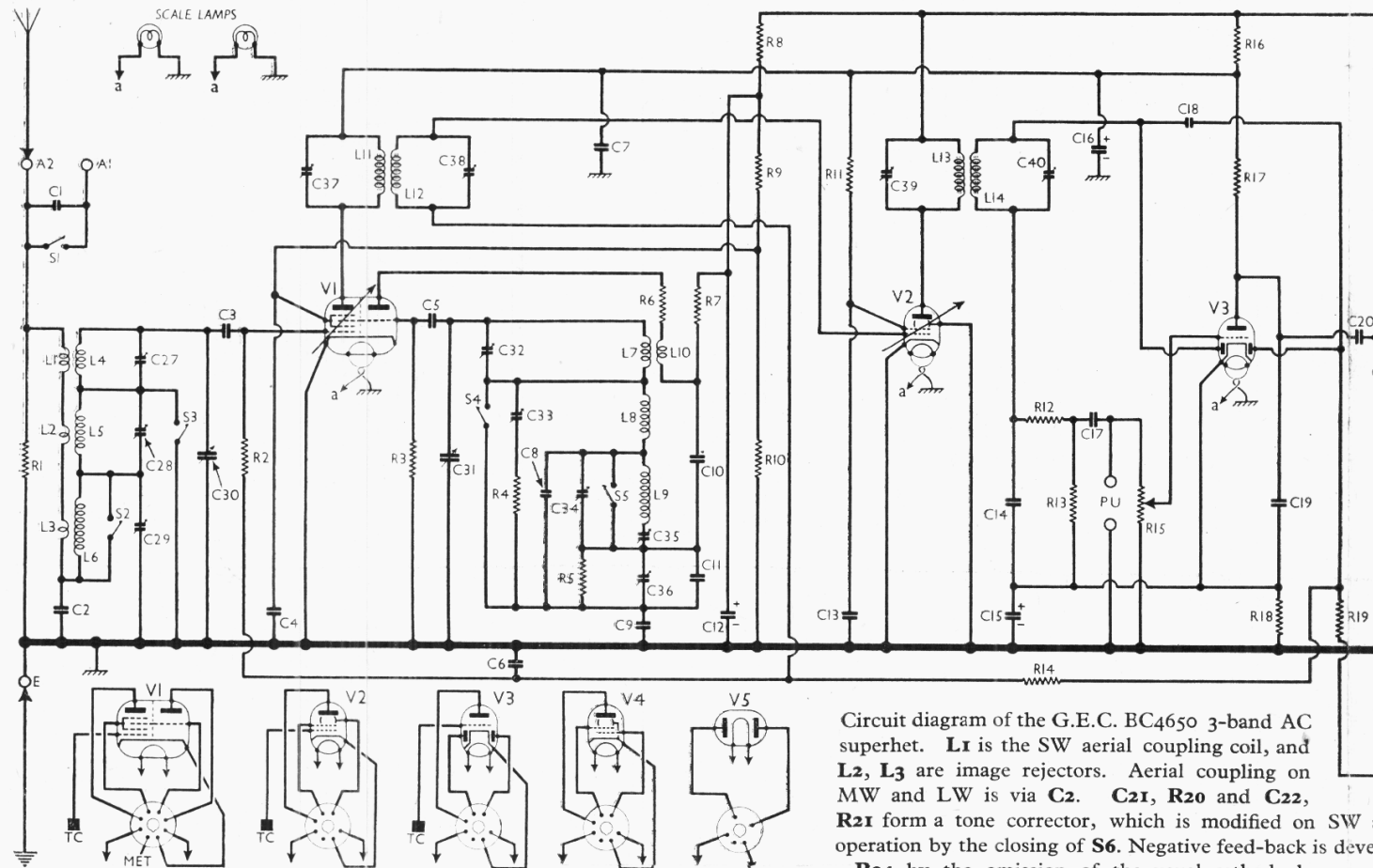
CIRCUIT DESCRIPTION

Two alternative aerial input sockets **A1** and **A2** are provided, and a resistor **R1** shunts the input circuit. Input from socket **A2** is coupled via **L1**, **L2**, **L3** and

C2 to single-tuned circuits comprising **L4**, (SW), **L5** (MW), **L6** (LW) and **C30**.

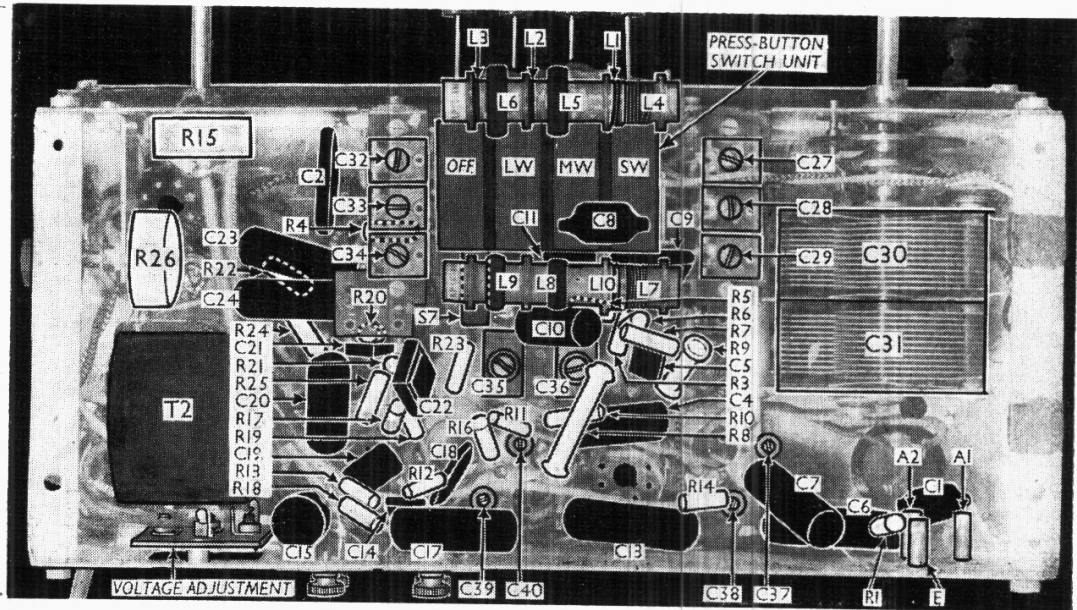
On SW, coupling is inductive from **L1**, the impedance of **L2**, **L3** and **C2** being out of circuit as **S3** connects the earthy end of **L4** to chassis. On MW and LW, coupling is mixed, but is mainly capacitive, the tuned circuits deriving their input from **C2**, which is common to primary and secondary circuits on these bands. Inductive coupling is obtained from **L2** and **L3**, but these are included for the suppression of image interference. The impedance of **L1** is negligible on these bands.

First valve (**V1**, Osram metallised **X61M**) is a triode-hexode operating as frequency changer with internal coupling. Oscillator grid coils **L7** (SW), **L8** (MW) and **L9** (LW) are tuned by **C31**. Parallel trimming by **C32** (SW), **C33** (MW) and **C8**, **C34** (LW); series tracking by **C9** (SW), **C11**, **C36** (MW) and **C35** (LW).



Circuit diagram of the G.E.C. BC4650 3-band AC superhet. **L1** is the SW aerial coupling coil, and **L2**, **L3** are image rejectors. Aerial coupling on MW and LW is via **C2**. **C21**, **R20** and **C22**, **R21** form a tone corrector, which is modified on SW operation by the closing of **S6**. Negative feed-back is derived by the omission of the usual cathode by-pass

Under - chassis view, showing the positions of the aerial and oscillator tuning coils, trimmers, and the press-button switch unit whose sections are identified. A detailed diagram of the switch unit appears in col. 5 overleaf. Most of the small components are grouped about the middle of the chassis, their positions being indicated by arrows.



Reaction coupling is mixed on SW, inductive coupling being obtained from **L10** and capacitive coupling from the common impedance of **C9**, via **C10**, **C11**. On MW and LW, reaction coupling is entirely capacitive, being developed across the

combined impedance of **R5**, **C36**, **C11** and **C9**, via **C10**. The resistors **R4**, **R5**, **R6** and **R7** stabilise the circuit and level the performance over the ranges of frequency covered.

Second valve (**V2**, Osram **KTW61**) is a variable-mu RF tetrode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C37**, **L11**, **L12**, **C38** and **C39**, **L13**, **L14**, **C40**.

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 **R13** and passed via AF coupling capacitor **C17** and manual volume control **R15** to control grid of triode section, which operates as AF amplifier. IF filtering by **C14** and **R12** in diode circuit, and by **C19** in triode anode circuit. Provision for connection of gramophone pick-up across **R15**.

Second diode of **V3**, fed from **L14** via **C18**, provides DC potential which is developed across load resistor **R19** and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving automatic volume control.

Resistance-capacitance coupling by **R17**, **C20**, **R23** and tone correcting circuits between **V3** triode and beam tetrode output valve (**V4**, Osram **KT61**). Fixed tone correction by **C23** in anode circuit; variable tone control by **C24**, **R26**, also in anode circuit. The tone correcting circuits **R20**, **C21** and **R21**, **C22** in the intervalve coupling is modified on SW and gramophone operations by the closing of **S6**.

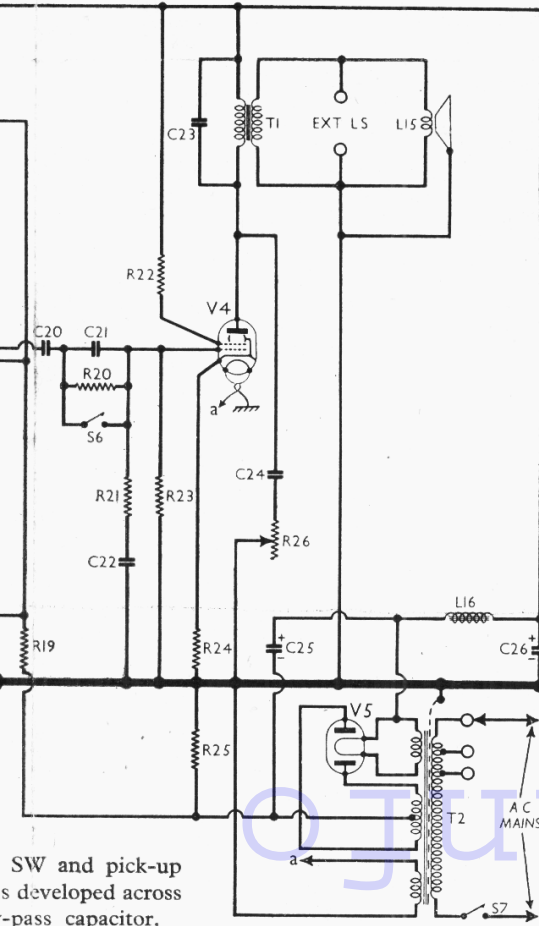
HT current is supplied by full-wave rectifying valve (**V5**, Osram **U50**). Smoothing by iron-cored choke **L16** and dry electrolytic capacitors **C25**, **C26**. Fixed GB potential for **V1** and **V2** is obtained from the drop along resistor **R25** in the nega-

tive HT lead to chassis, and is applied via the AVC line. It thus forms part of the AVC delay voltage, the balance of which is obtained from the drop along **R18** in **V3** cathode lead to chassis, where this drop provides GB for the triode section of the valve. GB for **V4** is obtained from a separate cathode resistor **R24**, such a biasing system being an essential feature in the operation of a **KT61**.

COMPONENTS AND VALUES

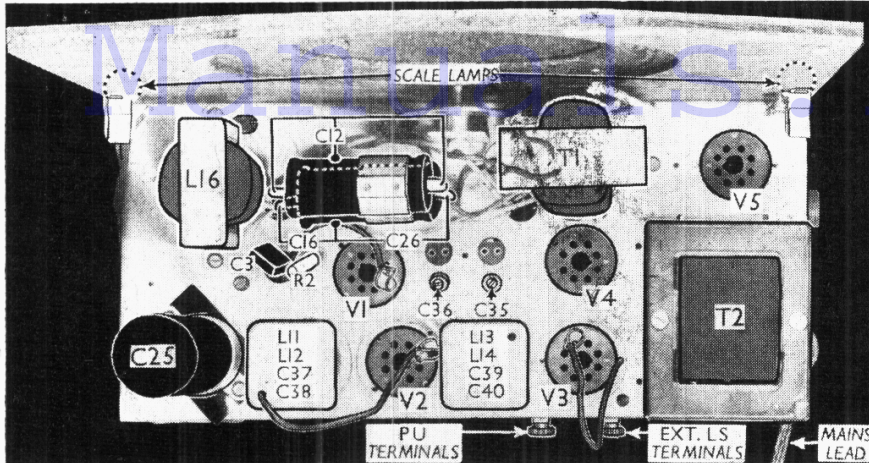
CAPACITORS		Values (μF)
C1	A1 series coupling ...	0-000022
C2	Aerial coupling capacitor ...	0-003
C3	V1 hex. CG capacitor ...	0-0001
C4	V1 SG decoupling ...	0-05
C5	V1 osc. CG capacitor ...	0-0001
C6	AVC line decoupling ...	0-05
C7	HT circuit RF by-pass ...	0-05
C8	Osc. LW fixed trimmer ...	0-000039
C9	Osc. circ. SW tracker ...	0-00395
C10	Reaction coupling ...	0-005
C11	Osc. MW fixed tracker ...	0-0001
C12*	V1 osc. anode decoupling ...	12-0
C13	V2 SG decoupling ...	0-05
C14	IF by-pass ...	0-0003
C15*	V3 cathode by-pass ...	25-0
C16*	HT line decoupling ...	4-0
C17	AF coupling to V3 triode ...	0-02
C18	Coupling to AVC diode ...	0-000022
C19	IF by-pass ...	0-0005
C20	AF coupling to V4 ...	0-02
C21	Parts of tone correcting circuits ...	0-0015
C22	Part of tone control ...	0-005
C23	HT smoothing capacitors ...	16-0
C24	...	8-0
C25*	Aerial circ. SW trimmer ...	—
C26*	Aerial circ. MW trimmer ...	—
C27†	Aerial circ. LW trimmer ...	—
C28†	Aerial circuit tuning ...	—
C29†	Oscillator circuit tuning ...	—
C30†	Osc. circ. SW trimmer ...	—
C31†	Osc. circ. MW trimmer ...	—
C32†	Osc. circ. LW trimmer ...	—
C33†	Osc. circ. LW tracker ...	—
C34†	Osc. circ. MW tracker ...	—
C35†	1st IF trans. pri. tuning ...	—
C36†	1st IF trans. sec. tuning ...	—
C37†	2nd IF trans. pri. tuning ...	—
C38†	2nd IF trans. sec. tuning ...	—
C39†	...	—
C40†	...	—

* Electrolytic. † Variable. ‡ Pre-set.



SW and pick-up developed across -pass capacitor.

Radio



Plan view of the chassis. C37, C38 and C39, C40 are inside their respective IF coil cans as indicated, but their adjustments are reached from below. These are indicated in our under-chassis view overleaf. C16 and C26 are the two sections of an electrolytic unit, just in front of V1. C12 consists of a similar unit in which both sections are connected in parallel.

RESISTORS		Values (ohms)
R1	Aerial circuit shunt	10,000
R2	V1 hex. CG resistor	1,000,000
R3	V1 osc. CG resistor	100,000
R4		68
R5	Oscillator circuit damping resistors	10,000
R6		470
R7		22,000
R8	V1 SG and Osc. anode HT feed potential divider	10,000
R9		15,000
R10		22,000
R11	V2 SG HT feed	56,000
R12	IF stopper	56,000
R13	V3 signal diode load	470,000
R14	AVC line decoupling	1,000,000
R15	Manual volume control	1,000,000
R16	HT feed resistor	15,000
R17	V3 triode anode load	100,000
R18	V3 triode GB	2,200
R19	AVC diode load	470,000
R20	Parts of tone correcting circuit	680,000
R21		150,000
R22	V4 SG stopper	100
R23	V4 CG resistor	330,000
R24	V4 GB resistor	91
R25	V1, V2 GB resistor, AVC delay	39
R26	Variable tone control	55,000

OTHER COMPONENTS		Approx. Values (ohms)	
L1	Aerial coupling and image rejector coils, total	0.36	
L2			
L3			
L4	Aerial SW tuning coil	0.06	
L5	Aerial MW tuning coil	2.8	
L6	Aerial LW tuning coil	19.5	
L7	Osc. SW tuning coil	0.06	
L8	Osc. MW tuning coil	3.4	
L9	Osc. LW tuning coil	7.7	
L10	Osc. SW reaction coil	0.32	
L11	1st IF trans.	Pri. ... 7.0	
L12		Sec. ... 7.0	
L13	2nd IF trans.	Pri. ... 4.0	
L14		Sec. ... 4.0	
L15	Speaker speech coil	2.3	
L16	HT smoothing choke	650.0	
T1	Output trans.	Pri. ... 430.0	
		Sec. ... 0.49	
	Pri., total	34.0	
T2	Mains Heater sec. trans.	0.16	
		Rect. heat. sec.	0.13
		HT sec., total	340.0
S1-S6	Waveband switches	—	
S7	Mains switch	—	

DISMANTLING THE SET

Almost unimpeded access may be had 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;

inserting 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 fixing flange.

Removing Speaker.—Unsolder from the speech coil tags on the speaker the two leads connecting them to the transformer below on the chassis deck, and a third (earthing) lead from the tag on the speaker frame;

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.

The fixing screws go into brass inserts in the sub-baffle. There were two complete circles of these in our sample, and those used were on the inner circle.

Connect the white lead from the right-hand end tag on the output transformer to the upper speech coil tag, and a black lead from the left-hand end of the

transformer to the lower tag. A second black lead from the same transformer tag goes to the earthing tag on the speaker frame.

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 mains of 230 V, using the 230 V tapping on the mains transformer. The receiver should be tuned to 300 m and should have been running for at least five minutes, but there should be no signal input.

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

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 X61M	181 Oscillator 74	1.7 3.3	70	2.6
V2 KTW61	256	8.2	60	2.3
V3 DH63	92	0.68	—	—
V4 KT61	239	42.0	256	6.9
V5 U50	320†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1-S6 are the waveband switches, in a four-section press-button unit beneath the chassis, these switches being divided between two of the units (LW and SW sections) only. S7 is the QMB 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. 5, 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.

There are no connections to the "OFF" and "MW" sections, except in so far as the "OFF" section operates the QMB mains switch S7 which carries its own connecting tags. The action which results from pressing the MW button is simply to release any other button that may be depressed. The set therefore is switched to MW if all the buttons are out.

Switch Table

Button Pressed	Switches Closed	Switches Open
OFF ...	S2, S5	S1, S3, S4, S6
LW ...	S1	S2, S3, S4, S5, S6
MW ...	S2, S5	S1, S3, S4, S6
SW and PU ...	S2, S3, S4, S5, S6	S1

Coils.—The RF coils L1-L6 and the oscillator coils L7-L10 are in two un-screened units mounted on their wiring on the press-button switch unit. L2 and L3 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.

BOOK REVIEW

INTO

CONTINENTAL VALVE DATA

DEALERS who frequently come across unfamiliar Continental valves will be glad to learn that a publication is now available which gives full characteristic and basing data on most of them. It is called "Radio Valve Vade-Mecum."

The old Telefunken RE, REN, RENS, RES types, and so on, are given; so are Triotron, Record, Tungram and Impex, besides many other makes not well known over here. In addition, the unfamiliar newer types of valves are there, conforming to the more recently adopted Continental standardised nomenclature, but including code letters which were introduced during the war and are now being encountered fairly frequently in this country. Such types, for instance, as DCH11, UY1N, UCH11, DCH25 and other valves in these series. Most American valves are included, and English and Russian valves.

The book has an explanatory introduction which is written in four languages, Dutch, French, English and German. The remainder of the book is divided into seven sections. Six of these are tabular, and the other one gives base diagrams.

Section I gives the characteristic data directly of about a thousand valves, probably more than half of which are American. Section II gives similar information on about a thousand English valves. Sections III and IV deal with replacements and equivalents. It is from Section III, which gives between four and five thousand comparative types, that data on the older types is obtained, by reference to a newer equivalent valve that will be found in the tables of Section I.

Section V consists of over 500 valve diagrams, which are linked with Sections I and II by numbers quoted in the tables. Section VI consists of tables of Russian valves, while Section VII gives "Services" valves, with their approximate commercial equivalents. These "Services" valves are those used by the Allies.

The various sections are indicated by black labels whose positions are visible when the book is closed, so that it may be readily opened at the correct section. The reviewer found it helpful to cut a thumb-hole from the cover to page XX so that the English reference explanations could be found quickly.

The book is published by P. H. Brans, of Antwerp. Single copies can be obtained from the English agents, Ritchie Vincent & Telford, Ltd., 136A Kenton Road, Harrow, Middlesex, at 12s 6d post free.

SERVICE SHEET INDEX

Dealers who wish to order reprints of "Trader" Service Sheets are requested first to see if they are included in the latest edition of the Index, a copy of which was included with our issue of December 29 last.

The Index shows whether the receiver in question has ever been covered in a "Trader" Service Sheet, and, if so, if it is still in print.

Dealers requiring an additional copy or copies of the Index may have them upon request. A penny stamp should be included where nothing else is required.

The IF transformers L11, L12 and L13, L14 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 MES-type lamps, with small spherical bulbs, rated at 6.5 V, 0.5 A. They are mounted on clips on the speaker sub-baffle, and may be withdrawn for replacement without disturbing the chassis.

External Speaker.—Two terminals are provided at the rear of the chassis for the connection of a low-impedance (about 3-6 Ω) external speaker. A second pair of sockets, beside those for the speaker, is provided for the connection of a gramophone pick-up.

Capacitors C12, C16, C26.—These are in two similar double dry electrolytic units, mounted in special clips one above the other on the chassis deck. They are both Hunts type J57, rated at 8 μ F plus 4 μ F, 450 V DC working, 500 V peak. Each has a red tag at one end, which is the positive of the 8 μ F section, and a yellow tag at the other end, which is the positive of the 4 μ F section. The case is the common negative connection.

In the case of C12, the red and yellow tags are connected together, so that the two sections are connected in parallel to give a total capacitance of 12 μ F. In the second (lower) unit, the yellow tag is the positive of C16 (4 μ F) and the red tag is that of C26 (8 μ F).

Capacitor C25.—This is Hunts type K7 surge proof tubular electrolytic unit, rated at 16 μ F, 450 V DC 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." The negative tag is connected to HT negative, below chassis potential, and the can is consequently insulated from its fixing clip.

Low Voltage Model.—The BC4650L is a special model of the BC4650 embodying special mains transformer to operate on low voltage and high voltage mains. Its three adjustment tappings are 115 V, 125 V, 220 V. The overall DC resistance of the primary winding is 26 Ω ; from the fixed end to the 115 V tapping it is 10.5 Ω , and to the 125 V tapping 11.5 Ω .

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator leads via a 0.1 μ F 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 LW button, and turn the gang to maximum capacitance.

Feed in a 456 kc/s (657.8 m) signal, and adjust C40, C39, C38 and C37 in that order for maximum output.

RF 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 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.

MW.—Press MW button, tune to 214 m (spot on scale), feed in a 214 m (1,400 kc/s) signal, and adjust C33, then C28, for maximum output. Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust C36 for maximum output, rocking the gang slightly either way for optimum results. Repeat 214 m adjustments.

LW.—Press LW button, tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust C34, then C29, for maximum output. Tune to 1818 m (spot on scale), feed in an 1818 m (165 kc/s) signal, and adjust C35 for maximum output, rocking the gang again for optimum results. Repeat 1,000 m adjustments.

SW.—Press SW button, tune to 16.7 m (spot on scale), feed in a 16.7 m (18 Mc/s) signal, and adjust C32, then C27, for

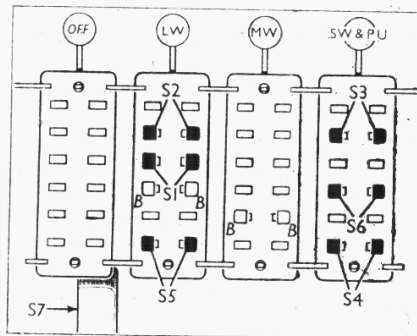


Diagram showing the connections of the press-button waveband switch unit, as seen in our under-chassis view overleaf. The "MW" section has no connections at all, its function being merely to release the other plungers when its own button is pressed. The "OFF" button operates the QMB mains switch S7.

maximum output. Two peaks should be found for C32, 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 C32, C33 and C34 to damp down microphonic vibration, which may otherwise set up a "howl."