'TRADER' SERVICE SHEET 265

K.B. 610

3-BAND BATTERY SUPERHET

A SHORT-WAVE range of 16·5-51 m. is covered by the K-B 610 4-valve battery-operated 3-band superhet. The valve arrangement employed comprises an octode frequency changer, a variable-mu pentode I.F. amplifier, a double-diode triode and pentode output.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via S.W. coupling coil **L5,** high impedance aerial circuit coils **L1, L2** and small condenser **C1** to mixed coupled band-pass filter circuit. Primary coils **L3, L4** are tuned by **C20**; secondaries **L8, L9** by **C23.** Coupling by small top capacity **C2** (L.W.), coil **L6,** and bottom coupling condenser **C3.** Series aerial resistance **R1** and switch **S1** form a local-distant sensitivity device to prevent overloading on powerful transmissions. On S.W. input is via **L5** to tuned circuit **L7, C23.**

First valve (**V1, Mullard metallised FC2A**) is an octode operating as frequency changer with electron coupling. Oscillator grid coils **L10** (S.W.), **L11** (M.W.) and **L12** (L.W.) are tuned by **C25**; parallel trimming by **C26** (M.W.) and **C7, C27** (L.W.); series tracking by **C8, C29** (M.W.) and **C28** (L.W.). Anode reaction by **L13** (S.W.), **L14** (M.W.) and **L15** (L.W.).

Second valve (**V2, Mullard metallised VP2**), a variable-mu R.F. pentode, operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C30, L16, L17, C31** and **C32, L18, L19, C33.**

Intermediate frequency 130 KC/S.

Diode second detector is part of double-diode triode valve (**V3, Mullard metallised TDD2A**), the two diodes being strapped. Audio frequency component in rectified output is developed across load resistance **R7** and passed via I.F. stopper **R8,** plug **X** and gram. socket **3,** A.F. coupling condenser **C15** and manual volume control **R10** to C.G. of triode section. I.F. filtering by **C12, C13, R8.** Provision for connection of gramophone pick-up by sockets **1** and **3** at rear of chassis; plug **X** is then inserted in socket **2,** thus muting radio.

D.C. potential developed across **R7** is fed back through decoupling circuits as G.B. to F.C. (except on S.W.), and I.F. valves, giving A.V.C.

Resistance-capacity coupling by **R11, C16** and **R12,** via stopper **R13** between **V3** triode and pentode output valve (**V4, Mullard PM22A**). Fixed tone correction in anode circuit by **C17.** Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T1,** whilst the latter may be muted at will by the insertion of a switch between two tags provided for that purpose.

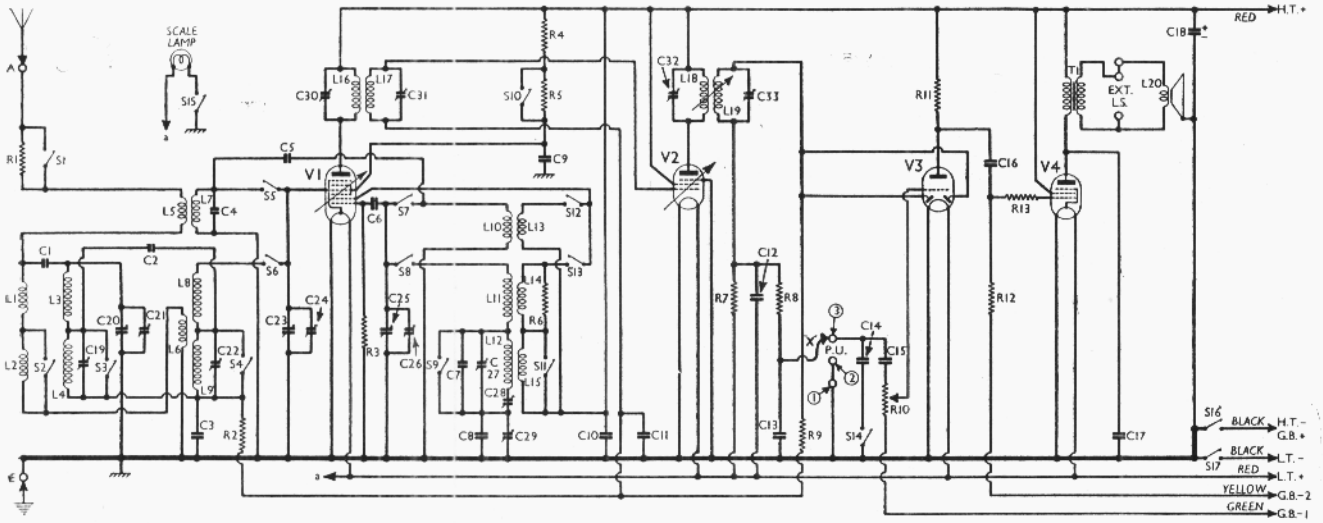
COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Aerial series resistance	100,000
R2	V1 pentode C.G. decoupling	100,000
R3	V1 osc. C.G. resistance	20,000
R4	Part V1 S.G. H.T. feed	50,000
R5	Part V1 S.G. H.T. feed, M.W. and L.W. only	50,000
R6	Oscillator M.W. reaction damping	5,000
R7	V3 diode load	500,000
R8	I.F. stopper	100,000
R9	A.V.C. line decoupling	500,000
R10	Manual volume control	500,000
R11	V3 triode anode load	50,000
R12	V4 C.G. resistance	500,000
R13	V4 grid stopper	100,000

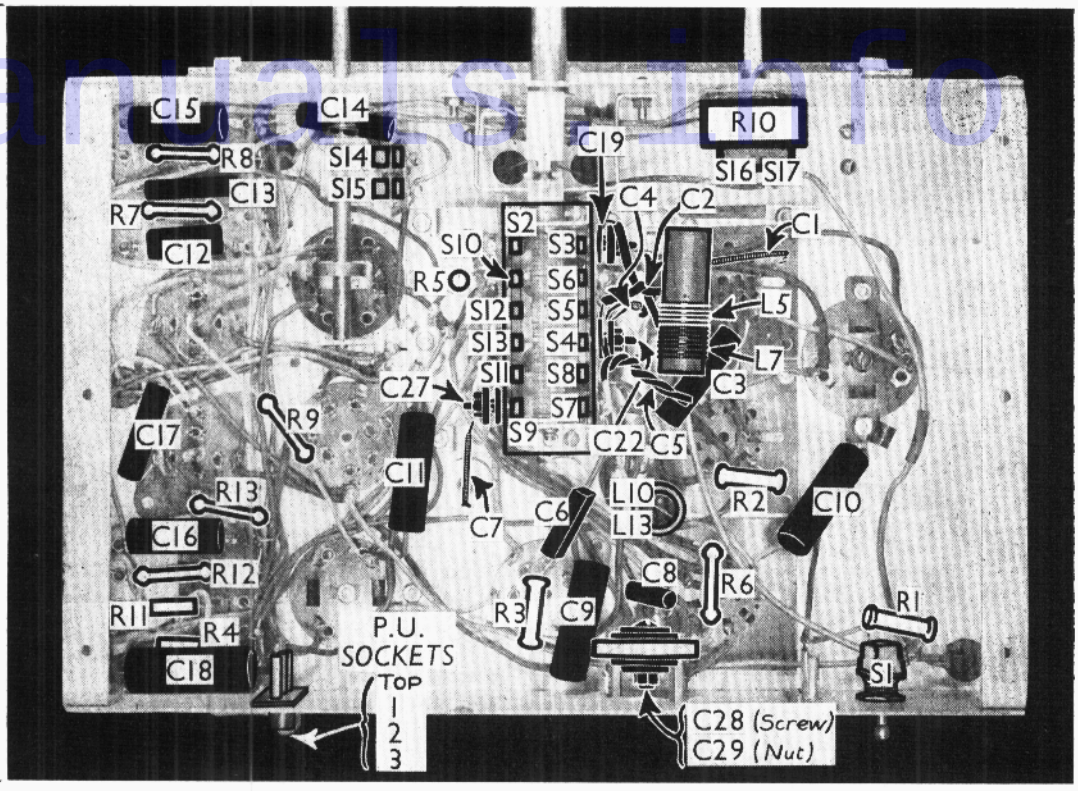
	CONDENSERS	Values (μF)
C1	Aerial M.W. and L.W. coupling	0·000018
C2	Band-pass L.W. top coupling	Very low
C3	Band-pass bottom coupling	0·02
C4	Aerial S.W. trimmer	0·000006
C5	Small S.W. coupling	Very low
C6	V1 osc. C.G. condenser	0·0001
C7	Osc. circuit L.W. fixed trimmer	Very low
C8	Osc. circuit M.W. fixed tracker	0·0005
C9	V1 S.G. decoupling	0·1
C10	V1 osc. anode R.F. by-pass	0·1
C11	V2 C.G. decoupling	0·1
C12	R.F. by-passes	0·0002
C13	R.F. by-passes	0·0001
C14	Part variable selectivity control	0·002
C15	A.F. coupling to V3 triode	0·02
C16	V3 triode to V4 coupling	0·02
C17	Fixed tone corrector	0·0025
C18*	H.T. reservoir condenser	2·0
C19‡	Band-pass pri. L.W. trimmer	—
C20†	Band-pass primary tuning	—
C21‡	Band-pass pri. M.W. trimmer	—
C22‡	Band-pass sec. L.W. trimmer	—
C23†	Band-pass sec. and S.W. aerial tuning	—
C24‡	Band-pass sec. M.W. trimmer	—
C25†	Oscillator circuit tuning	—
C26‡	Osc. circuit M.W. trimmer	—
C27‡	Osc. circuit L.W. trimmer	—
C28‡	Osc. circuit L.W. tracker	—
C29‡	Osc. circuit M.W. tracker	—
C30‡	1st I.F. trans. pri. tuning	—
C31‡	1st I.F. trans. sec. tuning	—
C32‡	2nd I.F. trans. pri. tuning	—
C33‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	High impedance aerial coils	7·8
L2	High impedance aerial coils	29·0
L3	Band-pass primary coils	4·5
L4	Band-pass primary coils	11·0
L5	Aerial S.W. coupling coil	0·1
L6	Band-pass coupling coil	0·1
L7	Aerial S.W. tuning coil	Very low
L8	Band-pass secondary coils	4·5
L9	Band-pass secondary coils	10·5



Circuit diagram of the K.B. 610 3-band battery superhet. "X" is a plug on a flying lead used in conjunction with the sockets 1 to 3 to mute radio on gram.



Under-chassis view. All the switches are clearly marked. **S14** and **S15** work in conjunction with the variable selectivity control. **C1, C2, C4, C5** and **C7** are small fixed condensers.

OTHER COMPONENTS (*Continued*)			Approx. Values (ohms)
L10	Oscillator S.W. tuning coil	..	Very low
L11	Oscillator M.W. tuning coil	..	4·0
L12	Oscillator L.W. tuning coil	..	13·0
L13	Oscillator S.W. reaction	..	0·2
L14	Oscillator M.W. reaction	..	3·4
L15	Oscillator L.W. reaction	..	6·75
L16	1st I.F. trans. Pri.	..	80·0
L17	1st I.F. trans. Sec.	..	80·0
L18	2nd I.F. trans. Pri.	..	80·0
L19	2nd I.F. trans. Sec.	..	80·0
L20	Speaker speech coil	.. ..	3·6
T1	Speaker input trans. Pri.	..	900·0
	Speaker input trans. Sec.	..	0·85
S1	Local-distant switch	.. ..	—
S2-S13	Waveband switches	.. ..	—
S14	Part of variable selectivity control	.. .. ..	—
S15	Scale lamp switch	.. ..	—
S16	H.T. circuit switch Ganged		—
S17	L.T. circuit switch R10		—

DISMANTLING THE SET

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

Removing Chassis.—If it should be necessary to remove the chassis from the cabinet, remove the tuning knob (recessed grub screw) and the other three knobs (pull off). Now remove the four bolts (with lock washers, washers, rubber washers and distance pieces) holding the chassis to the bottom of the cabinet and free the battery leads by removing the round-head wood screws from one end of each of the fibre strips holding them into the slots in the battery platform.

Next remove the four bolts (with nuts and spring washers) holding the battery platform and remove the platform. Free the speaker leads from the cleat holding them to the side of the cabinet, when the chassis can be withdrawn to the extent of the leads, which should be just sufficient for normal purposes.

When replacing the chassis, do not forget the felt washer between the tuning and switch knobs.

To free the chassis entirely, unsolder the speaker leads and *when replacing*, connect them as follows, numbering the tags from bottom to top:—4, blue; 5, red. The black lead goes to the tag on one of the screws holding the transformer to the speaker.

Removing Speaker.—To remove the speaker from the cabinet, remove the nuts and lock washers from the four screws holding it to the sub-baffle and *when replacing*, see that the transformer is on the right.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 FC2A	130	0·6	39	0·9
	Oscillator			
	130	2·1		
V2 VP2	130	2·2	130	0·8
V3 TDD2A	85	0·6	—	—
V4 PM22A	127	2·1	130	0·4

Valve voltages and currents given in the table above are those measured in our receiver when it was operating with an H.T. battery reading 130 V on load. The receiver was tuned to the lowest wavelength on the medium band and both the volume and sensitivity controls were at maximum (the latter down), but there was no signal input. Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

If **V1** should become unstable when measurements are being made of its anode current, as in our case, it can be stabilised by connecting a non-inductive condenser of about 0.1 μF from grid (top cap) to chassis.

GENERAL NOTES

Switches.—**S1** is the local-distant Q.M.B. switch, at the rear of the chassis. When the knob is *down*, the switch closes and shorts out **R1.**

S2-S13 are the waveband switches, ganged in a single unit beneath the chassis. All the switches are clearly indicated in our under-chassis view. The table below gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

Switch	S.W.	M.W.	L.W.
S2	C	C	—
S3	C	C	—
S4	C	C	—
S5	C	—	—
S6	—	C	C
S7	C	—	—
S8	—	C	C
S9	C	C	—
S10	C	—	—
S11	C	C	—
S12	C	—	—
S13	—	C	C

S14 and **S15** are in a separate unit, and are operated by a plate attached to the selectivity control spindle. Both switches are open for the major part of this spindle's rotation, but near the fully clockwise position **S14** closes, and at the fully clockwise position **S15** closes as well.

S16 and **S17** are the Q.M.B. battery circuit switches, ganged with the volume control **R10.**

Continued overleaf

K.B. 610—*Continued*

Coils.—**L1, L2**; **L3, L4**; **L6, L8, L9**; **L11, L12, L14, L15** and the I.F. transformers **L16, L17** and **L18, L19** are in six screened units on the chassis deck. The I.F. trimmers are in dual units at the tops of their respective cans, and each pair is adjusted by a nut and screw.

L5, L7 and **L10, L13** are in two unscreened units beneath the chassis deck, **L7** and **L10** being the thick wire windings.

Scale Lamp.—This is an M.E.S. type, rated at 2·5 V. The consumption, though not indicated, is 0·25 A. The lamp is switched into circuit by **S15** when the selectivity control is turned fully clockwise.

External Speaker.—An external low-impedance (2-4 O) speaker may be connected across the tags on the internal speaker transformer to which the secondary of **T1** is connected. With **T1** to the right of the speaker chassis, the tags are the second and third from the bottom. The bottom tag is joined to the second by a wire link. By removing this and connecting a switch in its place, the internal speaker can be muted when desired.

Condensers C1, C2, C4, C5, C7.—These are all small fixed condensers formed of twisted wires. **C1, C4** and **C7** consist of fine enamelled wire spiralled on a straight insulated wire. **C2** consists of two of the red wires to the switch unit twisted together, while **C5** is formed of two rubber insulated flexible wires twisted together.

Selectivity Control.—This operates a cam which slides the primary and secondary windings of the second I.F. transformer relative to each other, and so alters the coupling. If the cam should slip, it should be re-adjusted so that with the control fully clockwise, the bridge on which the cam bears is as far out of the unit as possible.

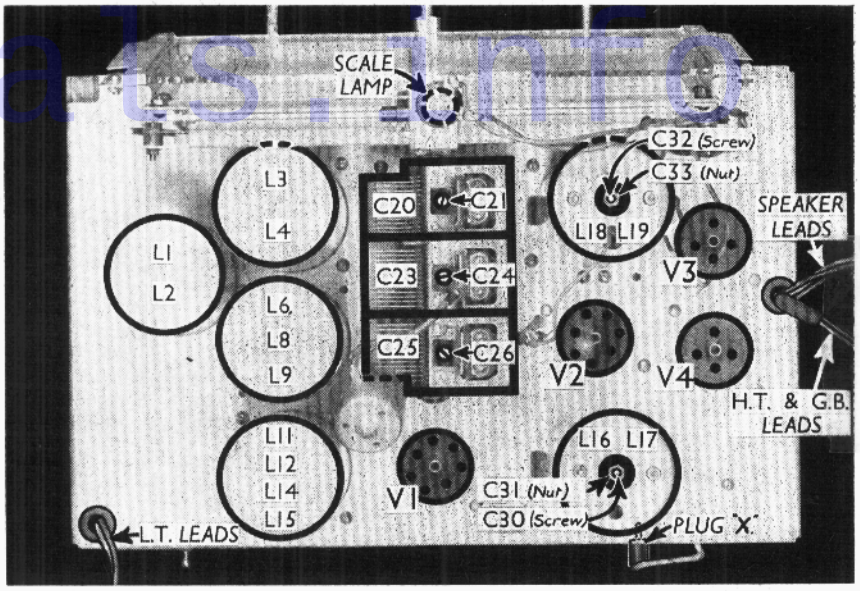
Pick-up Connections.—There are three sockets at the rear of the chassis, with a plug on a flying lead. The sockets are numbered **1** to **3** on our circuit diagram, and the plug is marked **X.** The plug, for radio reception, should be in the top (**3**) socket. For record reproduction, the plug should be placed in the centre socket (**2**), thus muting radio, and the pick-up is then plugged into sockets **1** and **3.**

Batteries.—L.T., Exide glass-cased 2 V accumulator cell, type GFG4. H.T. and G.B., Drydex 130 V H.T. plus 9 V G.B. battery, type H 1123.

Battery Leads and Voltages.—Black lead, spade tag, L.T. negative; red lead, spade tag, L.T. positive 2 V; black lead and plug, H.T. negative and G.B. positive; red lead and plug, H.T. positive 130 V; green lead and plug, G.B. negative 1, —1·5 V; yellow lead and plug, G.B. negative 2, —4·5 V (this may be increased to —6 V or even —7·5 V if desired, to economise H.T. consumption).

CIRCUIT ALIGNMENT

The selectivity control should be turned fully clockwise and the volume control should be at maximum.



Plan view of the chassis. Note the dual I.F. trimmers at the top of the I.F. coil cans.

I.F. Stages.—Connect signal generator via a 0·1 μF condenser to control grid (top cap) of **V1,** and chassis. Short circuit **C25.** Feed in a 130 KC/S signal, and adjust **C33, C32, C31** and **C30** for maximum output. Remove short from **C25.**

R.F. and Oscillator Stages.—Connect signal generator to **A** and **E** sockets, and feed in a 214 m. (1,400 KC/S) signal. Switch set to M.W., and tune to 214 m. on scale (a black dot is provided for this setting). Adjust **C26, C24** and **C21** for maximum output. Feed in a 500 m. (600 KC/S) signal, tune it in, and adjust **C29** for maximum output, while rocking the gang for optimum results.

Switch set to L.W., feed in a 1,200 m. (250 KC/S) signal, tune to 1,200 m. on scale, and adjust **C27, C22** and **C19** for maximum output. Feed in a 1,712 m. (175 KC/S) signal, tune it in, and adjust **C28** for maximum output, while rocking the gang for optimum results.

No separate S.W. adjustments are provided.

MAINTENANCE PROBLEMS

O/C A.F. Coupling Condenser

DURING the past few weeks I have serviced three Philips 727U receivers, each with a similar fault.

The volume of the sets had dropped to a whisper, and the reproduction was also very distorted. New valves were tried, but results were still the same as before. The chassis in each case was then removed from the cabinet and two or three tests were made around the output circuit. It was then found that the 0.01 μF A.F. coupling condenser was open circuited. Upon replacing this condenser with a new one, the receiver gave satisfactory results.

Three cases, all similar, within so short a time, seems rather more than coincidence. —L. BULLOCK, SWINDON.

Is This a Record ?

A BURNDEPT twin-speaker A.C. superhet was brought in for what was supposed to be merely a "tune up," but it proved to possess an extraordinary collection of faults.

The receiver was connected up and switched on, and, apart from a slight hum, no results were obtained. It was soon found that no H.T. volts were appearing on any of the valve anodes, and a broken down electrolytic condenser was found to be the cause. When a new condenser was fitted, H.T. was present in abundance, but there were still no results.

Measurement revealed the output valve (AC044) anode current to be zero, and it was found that the filament was not heating up. This was traced to a dry soldered joint on the valve holder. Still there were no results.

Further testing revealed lack of anode volts on the I.F. valve, and this time the tuning indicator (milliammeter type) was found to be open circuited. With this corrected weak signals were obtained, but all H.T. voltages were distinctly high.

Upon testing the voltage drop across the loud-speaker fields, which were in parallel, it was found to be practically nil. The field winding of one was short-circuiting. This was rewound, and results were then normal except for an intermittent crackle, which was traced to another dry joint.

The receiver had been left on test for an hour or so, when it suddenly ceased to function again, and a wisp of smoke was seen issuing from the tone control! This component was connected in series with a fixed condenser from the output valve anode to chassis, and the condenser had broken down.—L. S. NORRIS, FARNHAM.