'TRADER' SERVICE SHEET 288

K.B. 650, 640 AND 670

THE K.B. 650 is a 4-valve (plus rectifier) A.C. 3-band superhet suitable for mains of 200-260 V, 40-60 C/S. It covers a short-wave range of 16.5-50 metres and has provision for a gramophone pick-up.

The chassis is practically the same as that fitted in the 640 table receiver, and similar to that of the 670 radiogram, and the differences are explained in "General Notes."

This *Service Sheet* was prepared on a 650.

CIRCUIT DESCRIPTION

Aerial input via **C1** and, on L.W. only **L1,** to coupling components **L2, C2** and single tuned circuits **L3, C25** (S.W.), **L4, C25** (M.W.) and **L5, C25** (L.W.) which precede heptode valve (**V1, Brimar 15D1**) which operates as frequency changer with electron coupling. Oscillator grid coils **L6** (S.W.), **L7** (M.W.) and **L8** (L.W.) are tuned by **C26**; parallel trimming by **C29** (S.W.), **C30** (M.W.) and **C7, C31** (L.W.); series tracking by **C27** (M.W.) and **C28** (L.W.). Reaction by coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.).

Second valve (**V2, Brimar 9D2**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C32, L12, L13, C33** and **C34, L14, L15, C35.**

Intermediate frequency 464 KC/S.

Diode second detector is part of double-diode triode valve (**V3, Brimar 11D3**). Audio frequency component in rectified output is developed across load resistance **R12** and passed via I.F. stopper **R10,** A.F. coupling condenser **C13** and manual volume control **R11** to C.G. of triode section, which operates as A.F. amplifier. Provisions for connection of gramophone pick-up across **R11.**

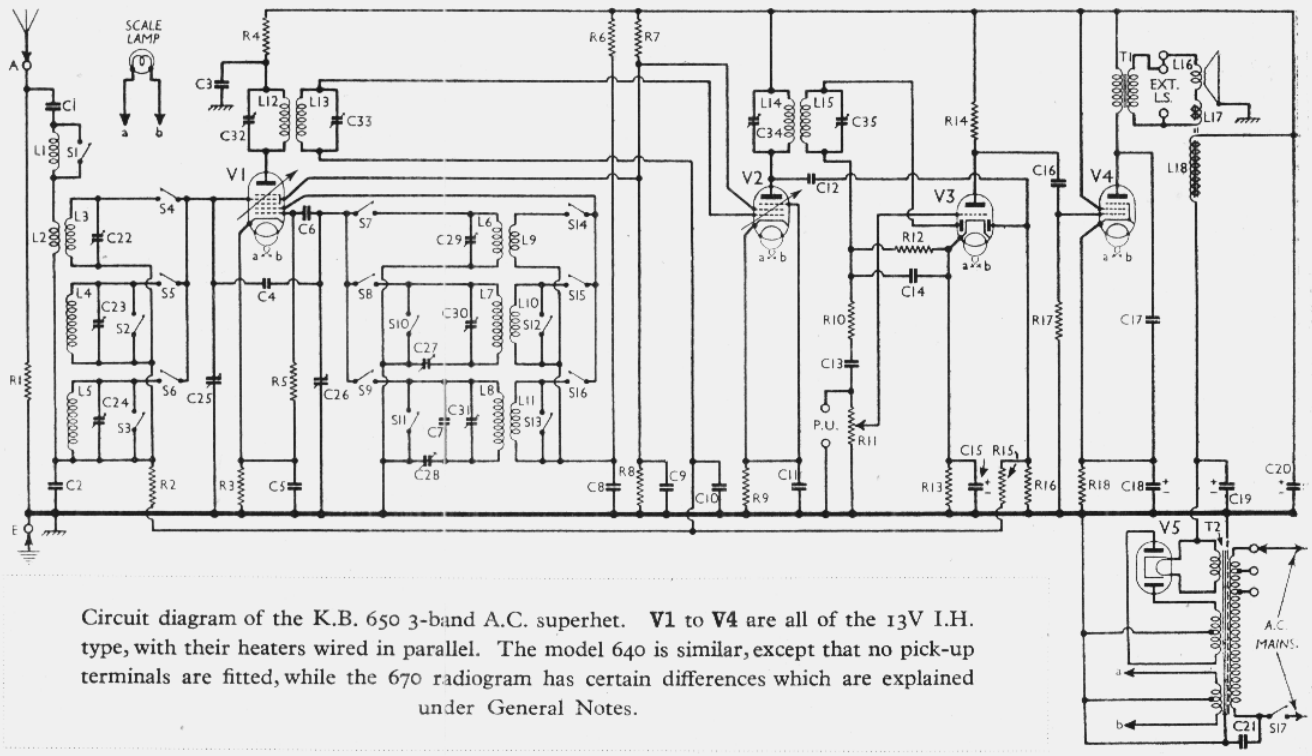
Second diode of **V3,** fed via **C12** from **V2** anode, provides D.C. potential which is developed across load resistance **R16** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along resistance **R13** in cathode circuit.

Resistance-capacity coupling by **R14, C16** and **R17** between **V3** triode and pentode output valve (**V4, Brimar 7D5**). Fixed tone correction in anode circuit by **C17.**

H.T. current is supplied by I.H.C. full-wave rectifying valve (**V5, Brimar R2**). Smoothing by speaker field **L18** and dry electrolytic condensers **C19, C20.** Mains circuit R.F. filtering by **C21.**

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial coupling condenser ..	0·0005
C2	M.W. and L.W. aerial coupling	0·005
C3	V1 tet. anode decoupling ...	0·1
C4	Small coupling	Very low
C5	V1 cathode by-pass ..	0·1
C6	V1 osc. C.G. condenser ..	0·0001
C7	Osc. circuit L.W. fixed trimmer	0·00007
C8	V1 osc. anode decoupling ..	0·1
C9	V1, V2 S.G.'s decoupling ..	0·1
C10	V2 C.G. decoupling	0·1
C11	V2 cathode by-pass	0·1
C12	Coupling to V3 A.V.C. diode..	0·00005
C13	A.F. coupling to V3 triode ..	0·02
C14	I.F. by-pass	0·0005
C15*	V3 cathode by-pass	25·0
C16	V3 triode to V4 A.F. coupling	0·02
C17	Fixed tone corrector	0·001
C18*	V4 cathode by-pass	25·0
C19*	H.T. smoothing ..	8·0
C20*		16·0
C21	Mains R.F. by-pass	0·01
C22‡	Aerial circuit S.W. trimmer	—
C23‡	Aerial circuit M.W. trimmer	—
C24‡	Aerial circuit L.W. trimmer	—
C25†	Aerial circuit tuning	0·0005
C26†	Oscillator circuit tuning ..	0·0005



Circuit diagram of the K.B. 650 3-band A.C. superhet. **V1** to **V4** are all of the 13V I.H. type, with their heaters wired in parallel. The model 640 is similar, except that no pick-up terminals are fitted, while the 670 radiogram has certain differences which are explained under General Notes.

CONDENSERS (Continued)		Values (μF)
C27‡	Osc. circuit M.W. tracker	—
C28‡	Osc. circuit L.W. tracker	—
C29‡	Osc. circuit S.W. trimmer	—
C30‡	Osc. circuit M.W. trimmer	—
C31‡	Osc. circuit L.W. trimmer	—
C32‡	1st I.F. trans. pri. tuning	—
C33‡	1st I.F. trans. sec. tuning	—
C34‡	2nd I.F. trans. pri. tuning	—
C35‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

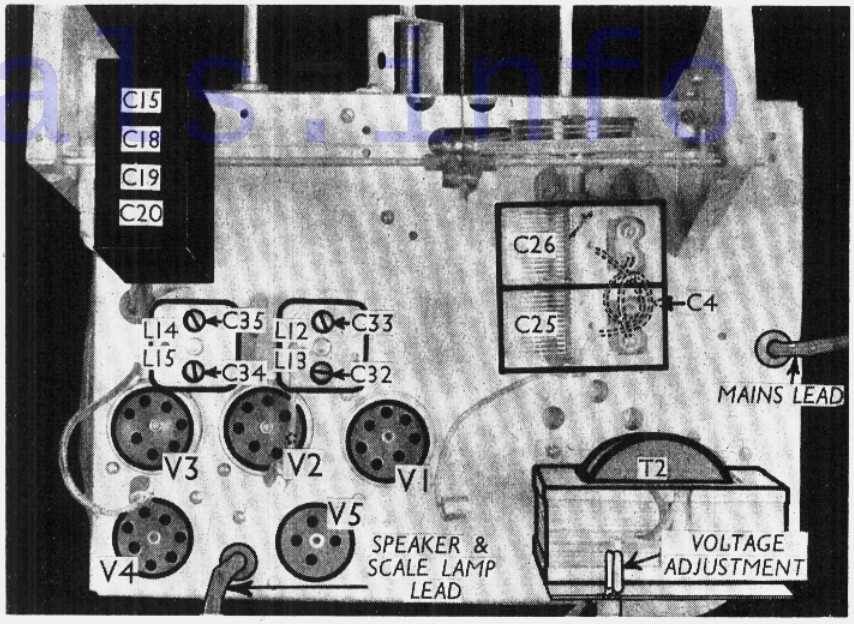
RESISTANCES		Values (ohms)
R1	Aerial circuit shunt	10,000
R2	V1 tetrode C.G. decoupling	100,000
R3	V1 tetrode fixed G.B.	250
R4	V1 tet. anode H.T. feed	5,000
R5	V1 osc. C.G. resistance	25,000
R6	V1 osc. anode H.T. feed	20,000
R7	V1, V2 S.G.'s H.T. feed potential divider resistances	20,000
R8		50,000
R9	V2 fixed G.B. resistance	250
R10	I.F. stopper	100,000
R11	Manual volume control	500,000
R12	V3 signal diode load	500,000
R13	V3 G.B. and A.V.C. delay	10,000
R14	V3 triode anode load	250,000
R15	A.V.C. line decoupling	500,000
R16	V3 A.V.C. diode load	500,000
R17	V4 C.G. resistance	100,000
R18	V4 G.B. resistance	400

OTHER COMPONENTS			Approx. Values (ohms)
L1	Aerial L.W. choke		16·5
L2	Aerial S.W. coupling coil		0·1
L3	Aerial S.W. tuning coil		0·05
L4	Aerial M.W. tuning coil		3·0
L5	Aerial L.W. tuning coil		13·0
L6	Osc. circuit S.W. tuning coil		0·05
L7	Osc. circuit M.W. tuning coil		3·5
L8	Osc. circuit L.W. tuning coil		7·25
L9	Oscillator S.W. reaction coil		0·1
L10	Oscillator M.W. reaction coil		2·7
L11	Oscillator L.W. reaction coil		4·4
L12	1st I.F. trans.	Pri.	7·5
L13		Sec.	7·5
L14	2nd I.F. trans.	Pri.	7·5
L15		Sec.	7·5
L16	Speaker speech coil		1·9
L17	Hum neutralising coil		0·05
L18	Speaker field coil		1,000·0
T1	Speaker input trans.	Pri.	410·0
		Sec.	0·35
T2	Mains trans.	Pri., total	29·0
		Heater sec.	0·5
		Rect. heat. sec.	0·2
		H.T. sec., total	200·0
S1-S16	Waveband switches		—
S17	Mains switch, ganged R11		—

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 is necessary to remove the chassis from the cabinet, remove the two small knobs (pull off) and the large tuning knob (recessed screw).



Plan view of the chassis. The tuning scale has been removed for the sake of clarity. The scale lamp is mounted on the speaker unit. **C4** is a small coupling formed of looped wires.

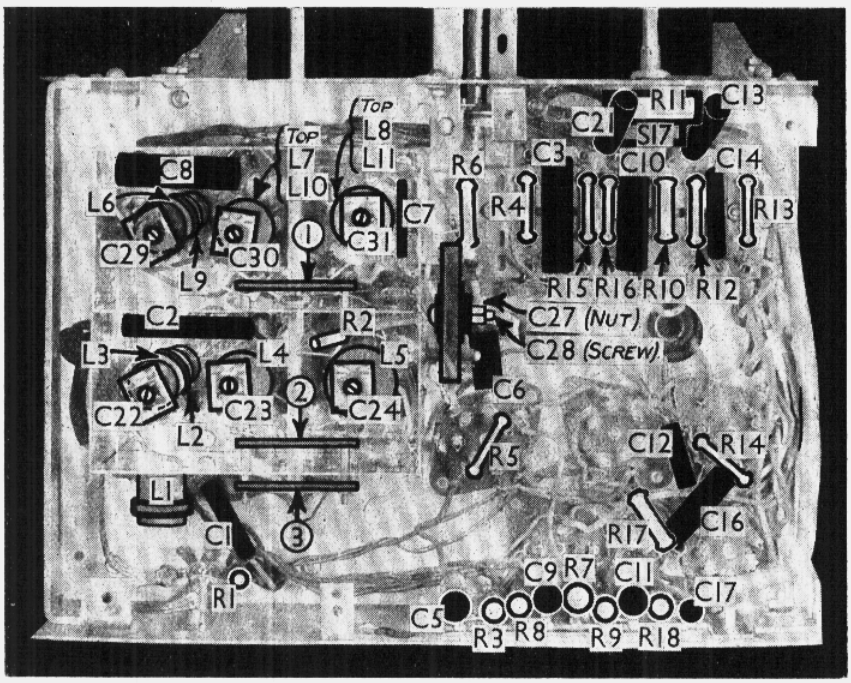
Then remove the four bolts (with claw washers and lock washers) holding the chassis to the bottom of the cabinet.

The chassis is now free but as the speaker leads are not long enough to allow it to be withdrawn, they must be unsoldered and the scale lamp and its holder removed. By tilting the back upwards, the chassis can now be withdrawn.

When replacing, connect the speaker leads as follows, numbering the tags from left to right:— 1, brown; 2 and 4 joined together, red; 5, blue. The black lead goes to the tag on the speaker frame. Note that the knob with the white dot goes on the spindle of the wave-change switch.

Removing Speaker.—If it is desired to remove the speaker, the chassis must first be removed as described above, then remove the nuts and lock washers from the four screws holding the speaker to the sub-baffle. *When replacing*, see that the transformer is at the top and connect the leads as given above.

Continued overleaf



Under-chassis view. The three switch units are indicated, and are shown in detail overleaf. Note the double tracker unit, containing **C27** and **C28**.

K.B. 650—*Continued*

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 220 V, using the 225 V tapping on the mains transformer. 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.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 15D1	233 (Oscillator anode)	3·3	88	5·5
	145 (Oscillator anode)	6·6		
V2 9D2	255	7·0	88	1·7
V3 11D3	103	0·2	—	—
V4 7D5	242	32·0	255	5·5
V5 R2	298†	—	—	—

† Each anode, A.C.

GENERAL NOTES

Switches.—**S1-S16** are the waveband switches, ganged in three rotary units beneath the chassis, which are indicated in our under-chassis view, and shown in detail in the diagrams on this page, where they are drawn as seen looking in the directions of the arrows in the under-chassis view.

The table (col. 3) gives the switch positions for the three control settings, starting from fully anti-clockwise. A dash indicates open, and **C,** closed.

S17 is the Q.M.B. mains switch, ganged with the volume control **R11.**

Coils.—The choke **L1** is in an unscreened unit beneath the chassis, while **L2-L11** are in six tubular units in screened compartments beneath the chassis, each unit having a trimmer mounted on the top of it.

The I.F. transformers **L12, L13** and **L14, L15** are in two screened units on the chassis deck, with their associated trimmers.

Scale Lamp.—This is a Vita M.E.S. type, rated at 12-14 V, 3 W. Its holder fits on the speaker unit.

External Speaker.—No sockets are provided for this, but a low impedance (about 2 O) external speaker could be connected across the secondary of **T1.** By breaking the existing link between two tags on **T1** and inserting a switch, the internal speaker can be muted if desired.

Condenser C4.—This is a very low capacity, formed by the leads to the stators of **C25** and **C26** being looped round each other.

Condensers C15, C18, C19, C20.—These are four dry electrolytics in a single carton mounted inside one of the tuning scale supports. The black lead is the common negative of **C19** and **C20.** The yellow lead is the positive of **C19** (8 μF) and the red is the positive of **C20** (16 μF).

The brown lead is the common negative of **C15** and **C18** (25 μF each). The green lead to **R13** is the positive of **C15,** and the green lead to **V4** holder is the positive of **C18.**

Trackers C27, C28.—These are in a single unit beneath the chassis, adjusted by a nut and screw. The nut adjusts **C27** and the screw **C28.**

Models 640 and 670.—In model 640 the only difference appears to be that no pick-up sockets are provided.

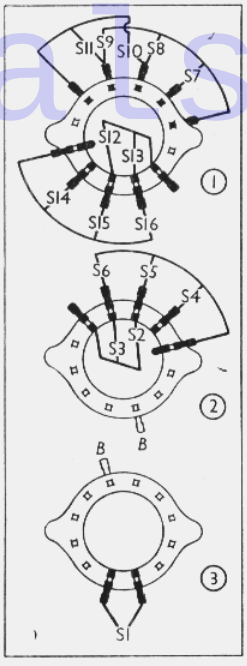
Model 670 is the radiogram version, and has a few modifications. Radio-gram. switching is performed by a double pole changeover switch which, in the radio position, breaks the pick-up circuit and connects the bottom of **C13** to the top of **R11,** as in our 650 diagram. In the gram. position, **C13** is disconnected from **R11,** thus muting radio, and the pick-up input is fed to the top of **R11** instead. Actually, in the gram. position two fixed resistors are placed in series between the top of **R11** and chassis. The upper one is a 250,000 O type, and the lower one (which goes to chassis) is a 10,000 O type. The pick-up is connected across the lower resistance, and not direct to the top of **R11.**

In addition, between **R14** and the H.T. line an extra 50,000 O decoupling resistance is inserted, and from the junction of the two resistances a 2 μF electrolytic condenser is connected to chassis.

A variable tone control is also fitted. This consists of a 0·02 μF condenser and 50,000 O variable resistance in series, connected between the anode of **V4** and chassis.

In this model the mains switch is ganged with the tone control resistance, not with the volume control.

DIAGRAMS AND TABLE OF THE SWITCH UNITS



Diagrams of the three switch units, as seen from the underside of the chassis, looking in the directions of the arrows in the under-chassis view.

Switch	L.W.	M.W.	S.W.
S1	—	C	C
S2	—	—	C
S3	—	C	C
S4	—	—	C
S5	—	C	—
S6	C	—	—
S7	—	—	C
S8	—	C	—
S9	C	—	—
S10	—	—	C
S11	—	C	C
S12	—	—	C
S13	—	C	C
S14	—	—	C
S15	—	C	—
S16	C	—	—

CIRCUIT ALIGNMENT

I..F Stages.—Connect signal generator to control grid (top cap) of **V1** and chassis, and feed in a 464 KC/S signal. Adjust **C35, C34, C33** and **C32** in turn for maximum output.

R.F. and Oscillator Stages.—M.W.—Connect signal generator to **A** and **E** sockets, and feed in a 214m. (1,400 KC/S) signal. Switch set to M.W., tune to 214 m. on scale, and adjust **C30,** then **C23,** for maximum output. Feed in a 500 m. (600 KC/S) signal, tune it in, and adjust **C27** (nut) for maximum output, rocking the gang slightly for optimum results.

L.W.—Switch set to L.W., tune to 1,200 m. on scale, feed in a 1,200 m. (250 KC/S) signal, and adjust **C31,** then **C24,** for maximum output. Feed in a 1,714 m. (175 KC/S) signal, tune it in, and adjust **C28** (screw) for maximum output, while rocking the gang for optimum results.

S.W.—Switch set to S.W., tune to 17·6 m. on scale, feed in a 17·6 m. (17 MC/S) signal, and adjust **C29,** then **C22,** for maximum output. Check the adjustments and calibration at 50 m. (6 MC/S).

MAINTENANCE PROBLEM

Unusual Station Shift

A PYE QAC2 was received with the complaint that "stations moved up the scale." Our outside engineer brought the set into the workshop with the report that there was bad frequency shift. The Welsh Regional station was tuned in on 373 m., quite O.K. After about ten minutes' working, signals vanished, but it was found possible to retune at about 377 m. This procedure was repeated till after half-an-hour's working, Welsh Regional was coming in at 410 m.

The frequency changer valve was replaced without effect. The oscillator coil and associated circuits were checked for dry joints, high resistance, etc., without success. Finally, we found that a test condenser in parallel with the 2 μF electrolytic condenser decoupling the reaction winding of the oscillator coil and the S.G. of the F.C. valve cleared the fault. This condenser was removed, tested on the bridge, and found to have a high power factor. A new condenser was fitted, and the set was then O.K.—J. APLIN, WHIMPLE.

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