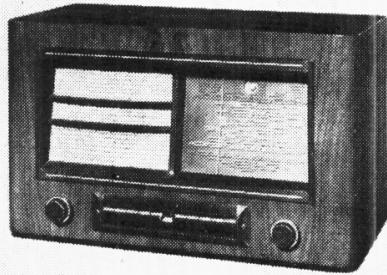


"TRADER" SERVICE SHEET
424

K.B. 840

KEY-BOARD TUNING AC SUPERHET



THE K.B. 840 is a 5-valve (plus rectifier) 3-band AC superhet, with "keyboard" tuning for eight stations, operating on the permeability principle, and three keys for manual waveband switching. Two pentodes are used in push-pull in the output stage.

There is provision for the use of a pick-up and an extension speaker, and the receiver is for use on 100-250 V, 40-60 C/S AC mains.

Release date : July, 1939.

CIRCUIT DESCRIPTION

All the switches associated with the keyboard unit have been numbered in such a manner as to indicate their functions: all switches bearing the same number are operated by the same key; a suffix letter **a**, **b** or **c** indicates that its

switch closes, while an **x**, **y** or **z** indicates that its switch opens, when its key is pressed; when the key is released, by pressing another, the **a**, **b** and **c** switches open, and the **x**, **y** and **z** switches close. The switches are numbered in groups, in which each member of a group bears the same number, and each key controls two groups: one in the aerial circuit and one in the oscillator circuit.

Two alternative aerial input sockets are provided, **A1** and **A2**. Input from **A1** is via series condenser **C1** and coupling coil **L1** (SW), **C1**, **L1** and coupling condensers **C2**, **C3** (MW and LW manual) or **C1**, **L1** and **C2** (automatic), to single tuned circuits **L2**, **C33** (via **S1a** and **S1b**, SW), **L3**, **C33** (via **S1x**, **S2a** and **S2b**, MW) and **L4**, **C33** (via **S1x**, **S2x**, **S3a** and **S3b**, LW) for manual tuning, or to pre-tuned automatic coils **L5** to **L12** (via **S1x**, **S2x**, **S3x** and one of the selector switches **S4a** to **S11a**) and fixed tuning condenser **C4** (auto). On MW and LW manual operation, when **S2c** or **S3c** is closed, the aerial coupling is modified by the addition of **C3**.

Input from **A2** socket feeds the same aerial input circuit via a potential divider **R1** and **R2** for the reception of strong transmissions.

First valve (**V1**, **Brimar 20D2**) is a triode hexode operating as frequency changer with internal coupling. Triode

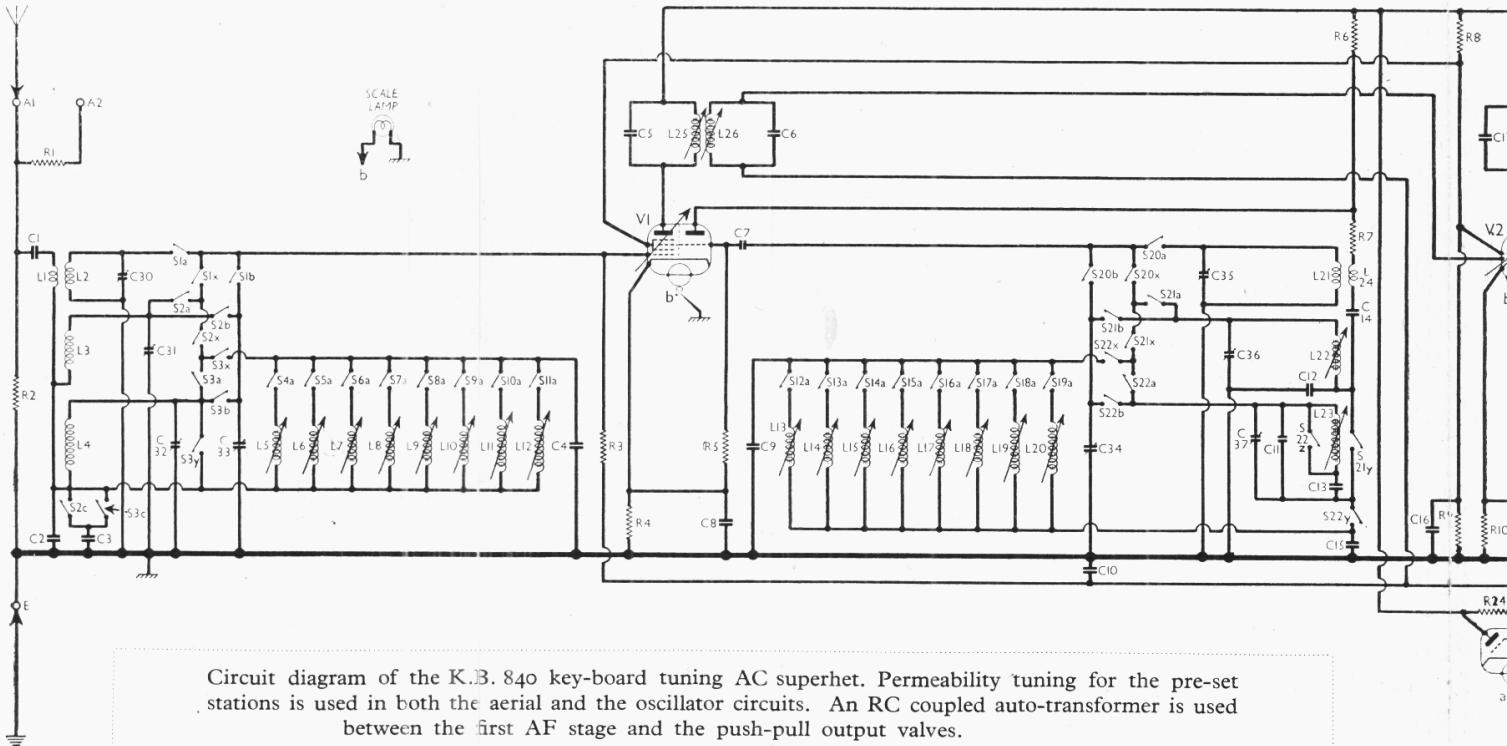
oscillator manual tuning grid coils **L21** (SW), **L22** (MW) and **L23** (LW) are tuned by **C34**; parallel trimming by **C35** (SW), **C36** (MW) and **C11**, **C37** (LW); and tracking by **C12** (MW), **C13** (LW) and specially shaped vanes of **C34**. Reaction by coil **L24** (SW) and direct coupling via **L24** and **C14** (MW and LW).

Automatic tuning coils **L13** to **L20** are connected via **S20x**, **S21x**, **S22x**, **S12a** to **S19a** and **C15** between control grid and chassis, and tuned by fixed condenser **C9**. As **C15** is also in the anode circuit, reaction coupling is thus established.

Second valve (**V2**, **Brimar 9D2**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings **C5**, **L25**, **L26**, **C6** and **C17**, **L27**, **L28**, **C18**. Alignment adjustments are effected by varying the iron cores.

Intermediate Frequency 464 KC/S.

Diode second detector is part of double diode triode valve (**V3**, **Brimar 11D5**). Audio frequency component in rectified output is developed across load resistance **R14** and passed via AF coupling condenser **C22**, switch **S23** and manual volume control **R13** to CG of triode section, which operates as AF amplifier. Provision for connection of gramophone pick-up across



R13; when the knob controlling **S23** is unscrewed, **S23** opens to mute radio. IF filtering by **C20** and **R11**.

DC potential appearing at the junction of **R11** and **R14** is fed via decoupling circuit **R12** and **C21** to control grid of cathode ray tuning indicator (**T.I.**, **Brimar 6U5**). It should here be observed that a special tapping is provided on the mains transformer **T3** heater secondary at 6.3 V for this valve. The remaining valves and the scale lamp are operated from the total winding voltage.

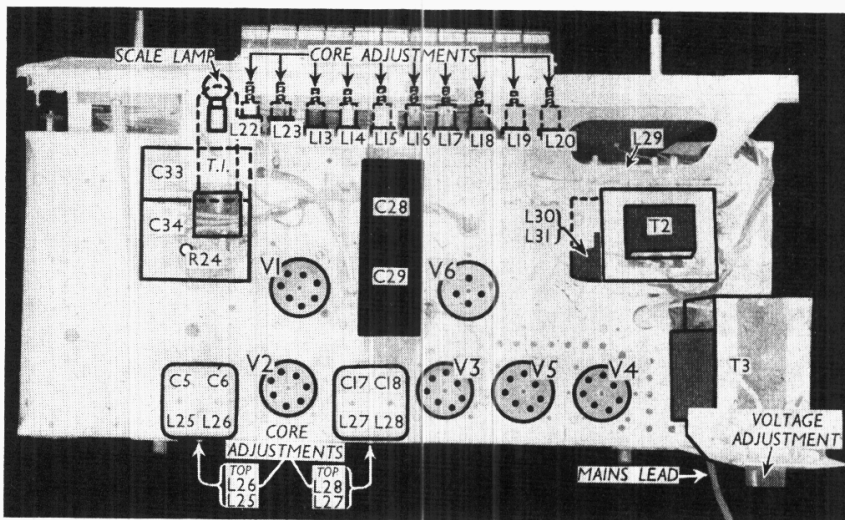
Second diode of **V3**, fed from **V2** anode via **C23**, provides DC potential which is developed across load resistance **R19** and fed back through a decoupling circuit as GB to FC (except on SW) and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained from drop along **R15** in cathode lead to chassis.

Resistance-capacity fed auto transformer coupling by **R17**, **C26** and **T1**, via grid stoppers **R20**, **R21**, between **V3** triode and push-pull output stage comprising two pentode valves (**V4**, **V5 Brimar 7D5's**). Variable tone control by **R23**, **C27** between anodes. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T2**. Switch **S24** permits internal speaker speech coil to be interrupted, for muting purposes.

HT current is supplied by IHC full-wave rectifying valve (**V6**, **Brimar R2**). Smoothing by speaker field **L31** and dry electrolytic condensers **C28** and **C29**.

DISMANTLING THE SET

The manual tuning circuit trimmers and a number of components are accessible through an aperture in the bottom of the cabinet, upon removal of the detachable cover.



Plan view of the chassis, showing the core adjustments for the permeability-tuned oscillator coils, and for the IF transformers.

Removing Chassis.—If it should be necessary to remove the chassis from the cabinet, remove the four control knobs (recessed grub-screws, of which there are two in each of the large knobs) from the front of the cabinet and the four bolts (with claw washers and lock-washers) holding the chassis to the bottom of the cabinet. If the wood-screw holding the rubber-bushed bracket which clamps the top of the speaker rim to the sub-baffle is now loosened, and the bracket is swivelled round, the complete chassis, with the speaker, can be removed as a single unit.

When replacing, note that one large knob and one small knob are fitted on the right-hand (tuning) control spindle. The

other two knobs go on the left hand spindles, which are concentric.

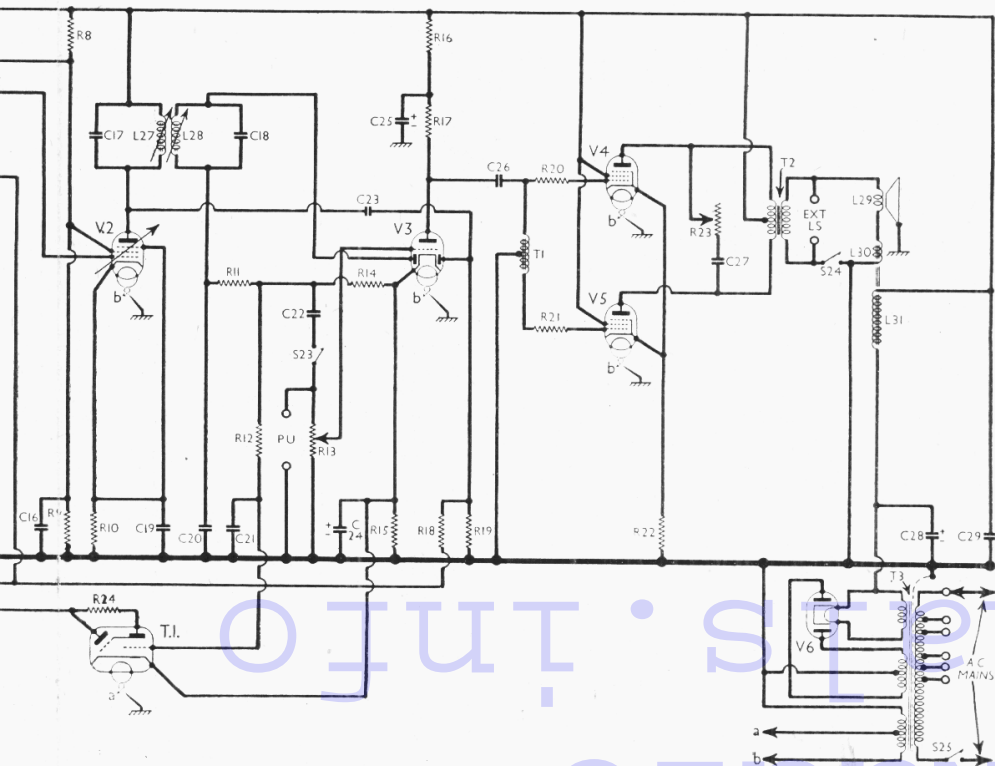
Removing Speaker.—The speaker assembly is mounted on a pair of brackets, whose flanges are bolted, through rubber washers, to the chassis deck. To remove the assembly, unsolder the six leads connecting it to the chassis and remove the four fixing nuts and bolts (with two metal cross-bars, rubber bushes, and lock washers).

When replacing, connect the leads as follows, numbering from left to right: top row: 1, brown (together with red from speaker); 2, green; 3, yellow. Bottom row: 1, blue, 2, red (together with yellow lead from speaker); 3, blue.

COMPONENTS AND VALUES

CONDENSERS		Values (μF)
C1	Aerial coupling condensers . . .	0.005
C2		0.002
C3		0.002
C4		0.0004
C5	Automatic aerial circuit fixed tuning condenser . . .	0.00015
C6	First IF transformer fixed tuning condensers . . .	0.00015
C7	V1 osc. CG condenser . . .	0.00005
C8	V1 cathode by-pass . . .	0.1
C9	Automatic oscillator circuit fixed tuning condenser . . .	0.0008
C10	AVC line decoupling . . .	0.1
C11	Osc. circuit LW fixed trimmer . . .	0.000025
C12	Osc. circuit MW tracker . . .	0.0004
C13	Osc. circuit LW tracker . . .	0.00023
C14	V1 osc. anode coupling condensers . . .	0.001
C15	condensers . . .	0.0004
C16	V1, V2 SG.'s. decoupling . . .	0.1
C17	Second IF transformer fixed tuning condensers . . .	0.00015
C18	V2 tuning condensers . . .	0.00028
C19	V2 cathode by-pass . . .	0.02
C20	IF by-pass . . .	0.0005
C21	T.I. CG decoupling . . .	0.01
C22	AF coupling to V3 triode . . .	0.005
C23	Coupling to V3 AVC diode . . .	0.000025
C24*	V3 cathode by-pass . . .	25.0
C25*	V3 triode anode decoupling . . .	2.0
C26	AF coupling to Tr . . .	0.02
C27	Part of variable tone control . . .	0.03
C28*	HT smoothing condensers . . .	16.0
C29*	condensers . . .	16.0
C30†	Aerial circuit SW trimmer . . .	0.000045
C31†	Aerial circuit MW trimmer . . .	0.000045
C32†	Aerial circuit LW trimmer . . .	0.000045
C33†	Aerial circuit manual tuning . . .	—
C34†	Osc. circuit manual tuning . . .	—
C35†	Osc. circuit SW trimmer . . .	0.000045
C36†	Osc. circuit MW trimmer . . .	0.000045
C37†	Osc. circuit LW trimmer . . .	0.000045

* Electrolytic. † Variable. ‡ Pre-set.



RESISTANCES		Values (ohms)
R1	Aerial input potential divider resistances	10,000
R2	V1 hexode CG resistance	5,000
R3	V1 fixed GB resistance	500,000
R4	V1 osc. CG resistance	300
R5	V1 osc. anode HT feed	50,000
R6	V1 osc. anode stabiliser	150
R7	V1, V2 SG's. HT feed potential divider resistances	20,000
R8	V2 fixed GB resistance	25,000
R9	IF stopper	300
R10	T.I. CG decoupling resistance	50,000
R11	Manual volume control	2,000,000
R12	V3 signal diode load	500,000
R13	V3 triode GB resistance	1,000
R14	V3 triode anode decoupling	50,000
R15	V3 triode anode load	150,000
R16	AVC line decoupling	500,000
R17	V3 AVC diode load	500,000
R18	V4 grid stopper	50,000
R19	V5 grid stopper	50,000
R20	V4, V5 GB resistance	250
R21	Variable tone control	100,000
R22	T.I. anode HT feed resistance	1,000,000
R23		
R24		

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
L25	1st IF trans. (Pri.)	4.0
L26	1st IF trans. (Sec.)	4.0
L27	2nd IF trans. (Pri.)	4.0
L28	2nd IF trans. (Sec.)	3.0
L29	Speaker speech coil	0.05
L30	Hum neutralising coil	720.0
L31	Speaker field coil	—
T1	Intervolve auto trans., total	680.0
T2	Speaker in-put trans. (Pri., total) (Sec.)	330.0
T3	Mains trans. (Pri., total) (Heater sec., total) (HT sec., total)	9.0 0.2 320.0
S1a, b, x to x, y	Aerial circuit manual waveband switches	—
S3a, b, c	Aerial auto selector switches	—
S4a to S11a	Oscillator auto selector switches	—
S12a to S19a	Oscillator circuit manual waveband switches	—
S20a, b, x to S22a, b, x, y, z	Radio muting switch	—
S23	Speaker switch	—
S24	Speaker switch	—
S25	Mains switch, ganged R23	—

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial SW coupling coil	0.7
L2	Aerial SW tuning coil	Very low
L3	Aerial MW tuning coil	3.0
L4	Aerial LW tuning coil	30.0
L5	Aerial circuit MW auto-tuning coils	3.0
L6	Aerial circuit MW auto-tuning coils	4.0
L7	Aerial circuit MW auto-tuning coils	4.0
L8	Aerial circuit MW auto-tuning coils	5.0
L9	Aerial circuit MW auto-tuning coils	5.0
L10	Aerial circuit MW auto-tuning coils	6.0
L11	Aerial circuit LW auto-tuning coils	20.0
L12	Aerial circuit LW auto-tuning coils	22.0
L13	Oscillator circuit MW auto-tuning coils	1.6
L14	Oscillator circuit MW auto-tuning coils	2.0
L15	Oscillator circuit MW auto-tuning coils	2.2
L16	Oscillator circuit MW auto-tuning coils	2.5
L17	Oscillator circuit MW auto-tuning coils	2.5
L18	Oscillator circuit MW auto-tuning coils	2.8
L19	Oscillator circuit LW auto-tuning coils	4.8
L20	Oscillator circuit LW auto-tuning coils	4.8
L21	Osc. circ. SW tuning coil	Very low
L22	Osc. circ. MW tuning coil	5.25
L23	Osc. circ. LW tuning coil	11.5
L24	Oscillator SW reaction	0.5

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 20D2	285 { Oscillator } 105	1.9 { 3.8 } —	90	4.8
V2 9D2	285	6.0	90	1.3
V3 11D5	92	1.0	—	—
V4 7D5	282	31.0	285	5.2
V5 7D5	282	31.0	285	5.2
V6 R2	345†	—	—	—
V7 6E5	11 { Target } 285	0.25 { 1.5 } —	—	—

† Each anode, A.C.

mains of 232 V, using the 250 V tapping on the mains transformer. The receiver was tuned to the lowest wave-length

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.

GENERAL NOTES

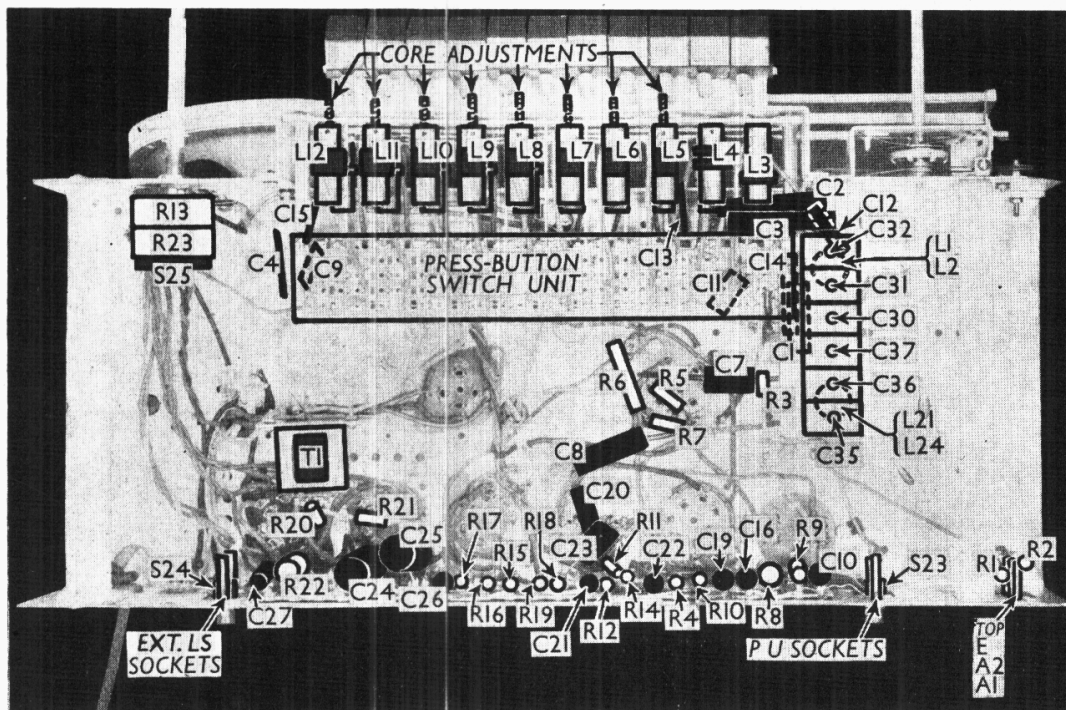
Switches.—S1a, b, x to S22a, b, x, y, z are the station selector and manual waveband switches, in a single unit beneath the chassis, and are operated by eleven "keys," in place of press-buttons. Of these, the first eight, starting from the left, are for pre-set stations, while the last three are for manual waveband switching. The switches are coded in our circuit diagram, and in the switch diagrams in cols. 5 and 6 with suffix letters to indicate their operation. This is fully explained at the beginning of the Circuit Description.

S23 is a screw-type switch, operated by a small milled knob, and associated with the pick-up sockets at the rear of the chassis. When the knob is unscrewed it breaks the connection of **C22** to **R13**, and so mutes radio.

S24 is a similar switch, associated with the external speaker sockets, also at the rear of the chassis. When it is unscrewed the **L29** circuit is broken, thus muting the internal speaker.

S25 is the QMB mains switch, ganged with the tone control **R23**.

Coils.—**L1, L2** and **L21, L24** are in two unshielded tubular units beneath the chassis, mounted below the bank of six pre-set condensers towards the right of our under-chassis view. **L3-L12** and **L13-L20, L22, L23** are in separate tubular units in two rows of ten between the switch unit and the front of the chassis; all these coils, except **L3** and **L4**



Under-chassis view, showing the core adjustments for the aerial section of the receiver, and also the various condenser trimmers in a bank on the right. Diagrams of the press-button switch unit are in cols. 5 and 6. Note **S23** and **S24**, associated with the pick-up and external speaker sockets respectively.

have variable iron cores adjusted by screws which are indicated in our two chassis pictures. Note that **L22** and **L23** are the manual oscillator coils, and are only adjusted when aligning the manual section of the receiver. The remaining adjustments are for key-board tuning.

L25, L26 and **L27, L28** are the IF transformers, in two screened units on the chassis deck. These also have variable iron cores, the adjustments being reached through holes in the rear of the cans.

The small auto-transformer **T1** is beneath the chassis, while **T2** and **T3** are on the chassis deck.

Scale Lamp.—This is an MES type, rated at 12-14 V.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2.5 O) external speaker. **S24**, associated with the sockets, opens and mutes the internal speaker when its milled knob is unscrewed. It should not be unscrewed until an external speaker is connected up.

Condensers C28, C29.—These are two 16 μ F (550 V peak) dry electrolytic condensers, in a single carton on the chassis deck, having a common negative (black) lead. The brown lead (to **V6** holder) is the positive of **C28**, and the red lead (to **R6**) is the positive of **C29**.

Pre-Set Condensers.—All the pre-set condensers are in a bank of six beneath the chassis. All the remaining trimming adjustments are carried out by adjustable iron cores.

T3 Heater Secondary.—Note that this gives 13 V for the receiver valve heaters and scale lamp, but is tapped at 6.3 V for the **T.I.** heater.

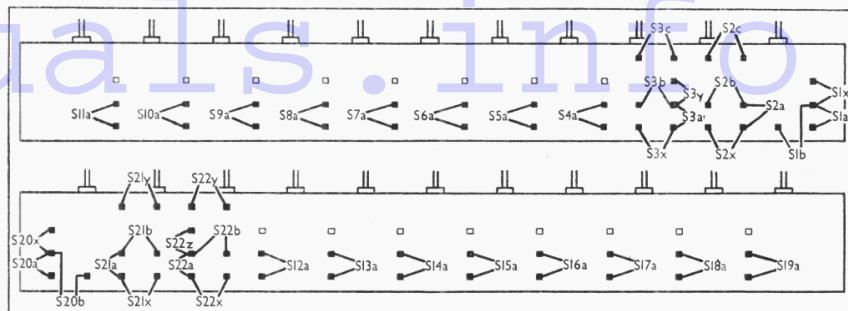
Chassis Divergencies.—**R2** was 5,000 O in our chassis, but the makers give it as 2,000 O. Some models have a 0.0002 μ F fixed condenser connected from the slider to the top of the volume control **R13**, but this was not present in our chassis.

KEY-BOARD STATION SETTING

The wavelength ranges covered by the eight station keys, looking at the front of the set and numbering from the left are given in the next column.

Each of the eight keys has one adjusting screw above it, and one below. To increase

DIAGRAMS OF THE KEY-BOARD SWITCH UNIT



Diagrams of the key-board switch unit. The upper one is the view as seen from beneath the chassis, and the lower one is the reverse side of the unit.

the wavelength, unscrew the adjustment; to reduce it, screw up the adjustment.

To set a station, remove the escutcheon plate, press the appropriate key, and first

Key	Wavelength Range
1	2,000—1,340 m
2	1,565—1,100 m
3	552—400 m
4	460—315 m
5	416—300 m
6	363—250 m
7	363—250 m
8	286—193 m

adjust the oscillator coil core (above the key) to give the maximum signal from the required station, as shown by the tuning indicator. Now adjust the aerial coil core (beneath the key) for maximum output from the station. Re-check the oscillator coil adjustment. When making a change to a station remote in wavelength from that previously selected, it is best to proceed with each trimmer from station to station until the desired one is reached. Alternatively a signal generator can be used for the preliminary setting. Always adjust finally on the actual station, with the aerial with which the set is to be used.

On no account alter the settings of the last two adjusting screws on the right above the keys, unless the set is being aligned for manual tuning, as they control the MW and LW tracking.

CIRCUIT ALIGNMENT

IF Stages.—Connect signal generator between control grid (top cap) of **V1** and chassis. Feed in a 464 KC/S signal, and adjust the cores of **L25, L26, L27** and **L28** in turn for maximum output. Check these settings.

RF and Oscillator Stages.—With gang at maximum, pointer should coincide with the vertical lines at the extreme right-hand ends of the wavelength scales. Connect signal generator, via a suitable dummy aerial, to the **A1** and **E** sockets.

MW.—Press MW key, tune to 500 m on scale, feed in a 500 m (600 KC/S) signal, and adjust core of **L22** for maximum output. Tune to 214 m on scale (white dot), feed in a 214 m (1,400 KC/S) signal and adjust **C36**, then **C31**, for maximum output. Return to 500 m, and re-adjust core of **L22** for maximum output, while rocking the gang for optimum results.

LW.—Press LW key, tune to 1,714 m on scale (red dot), feed in a 1,714 m (175 KC/S) signal, and adjust core of **L23** for maximum output. Tune to 857 m on scale, feed in an 857 m (350 KC/S) signal, and adjust **C37**, then **C32** for maximum output. Return to 1,714 m, and re-adjust core of **L23** for maximum output, while rocking the gang for optimum results.

SW.—Press SW key, tune to 20 m on scale, feed in a 20 m (15 MC/S) signal, and adjust **C35** for maximum output, using the peak involving the lesser trimmer capacity. Then adjust **C30** for maximum output, rocking the gang very slightly for optimum results.

S A T O R

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