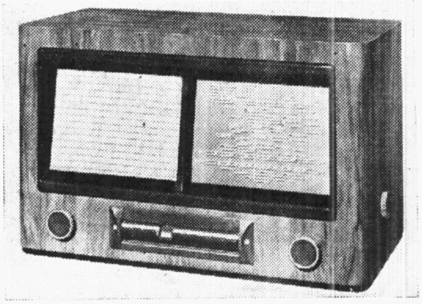
Supplement to The Wireless & Electrical Trader, May 4, 1940

"TRADER" SERVICE SHEET

463

K.B. 820

BATTERY SUPERHET



THE K.B. 820 is a 4-valve 3-band battery superhet with keyboard tuning for six stations, operating on the variable permeability principle, together with three keys for manual waveband switching. There is provision for the use of a pick-up, and for an external speaker, with internal speaker muting. The SW range is 16.5-52m.

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, C30** (via **S1a** and **S1b**, SW), **L3, C30** (via **S2a**, and **S2b**, MW) and **L4, C30** (via **S1x, S2x, S3a** and **S3b**, LW) for manual tuning, or to pre-tuned automatic coils **L5** to **L10** (via **S1x, S2x, S3x** and one of the selector switches **S4a** to **S9a**) 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.

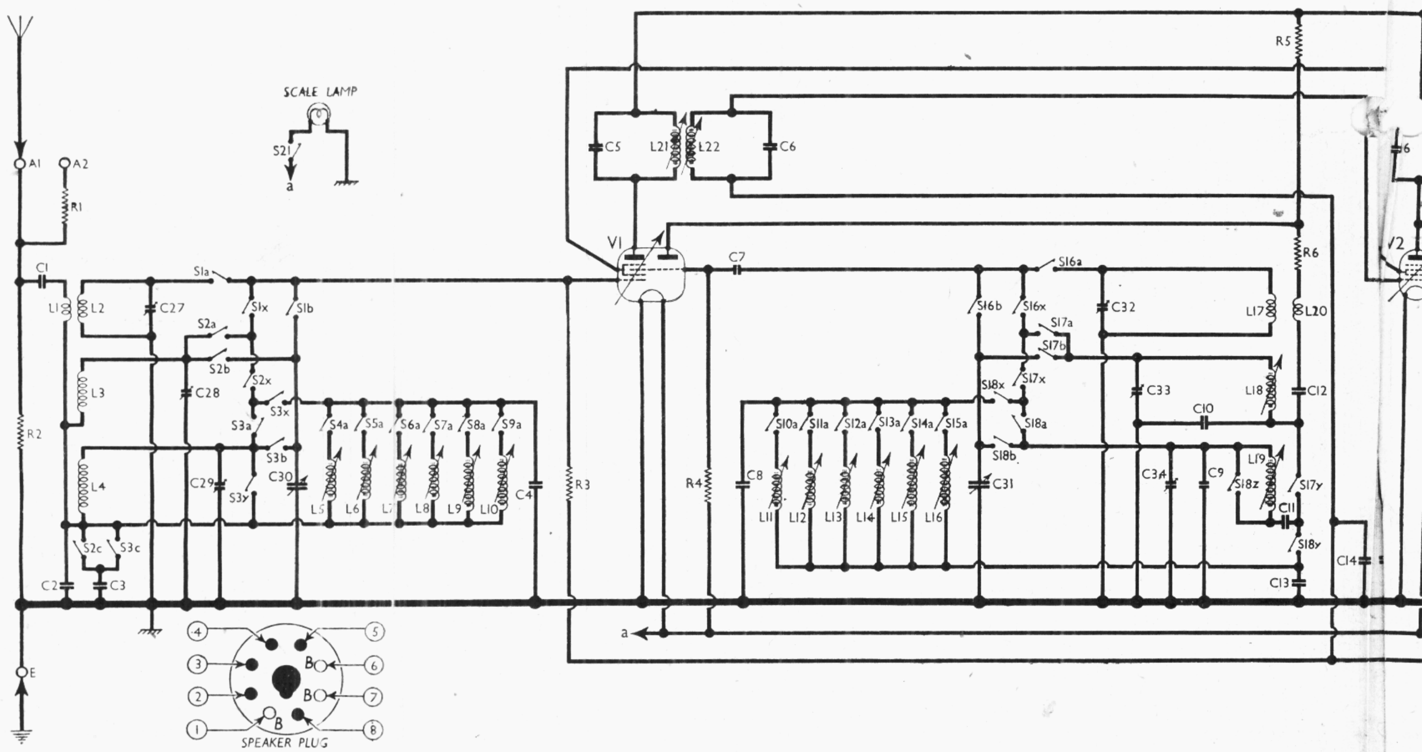
First valve **(V1, Mullard metallised TH2)** is a triode hexode operating as frequency changer with internal coupling. Triode oscillator manual tuning grid coils **L17** (SW), **L18** (MW) and **L19** (LW) are tuned by **C31**; parallel trimming by **C32** (SW), **C33** (MW) and **C9, C34** (LW); series tracking by **C10** (MW), **C11** (LW) and specially shaped vanes of **C31.** Reaction coupling by **L20** (SW), common impedance of **C10** (MW and LW), via stabilising resistance **R6** and condenser **C12.**

Automatic tuning coils **L11** to **L16** are connected via **S16x, S17x, S18x,** the selector switches **S10a** to **S15a** and **C13** between control grid and chassis, and tuned by **C8.** Since **C13** is also in the anode circuit, reaction coupling is thus established.

Second valve **(V2, Mullard metallised VP2B)** is a variable-mu RF hexode operating as intermediate frequency amplifier with tuned-primary tuned-secondary iron-cored transformer couplings **C5, L21, L22, C6** and **C16, L23, L24, C17.** Alignment adjustments are effected by varying the positions of the iron cores.

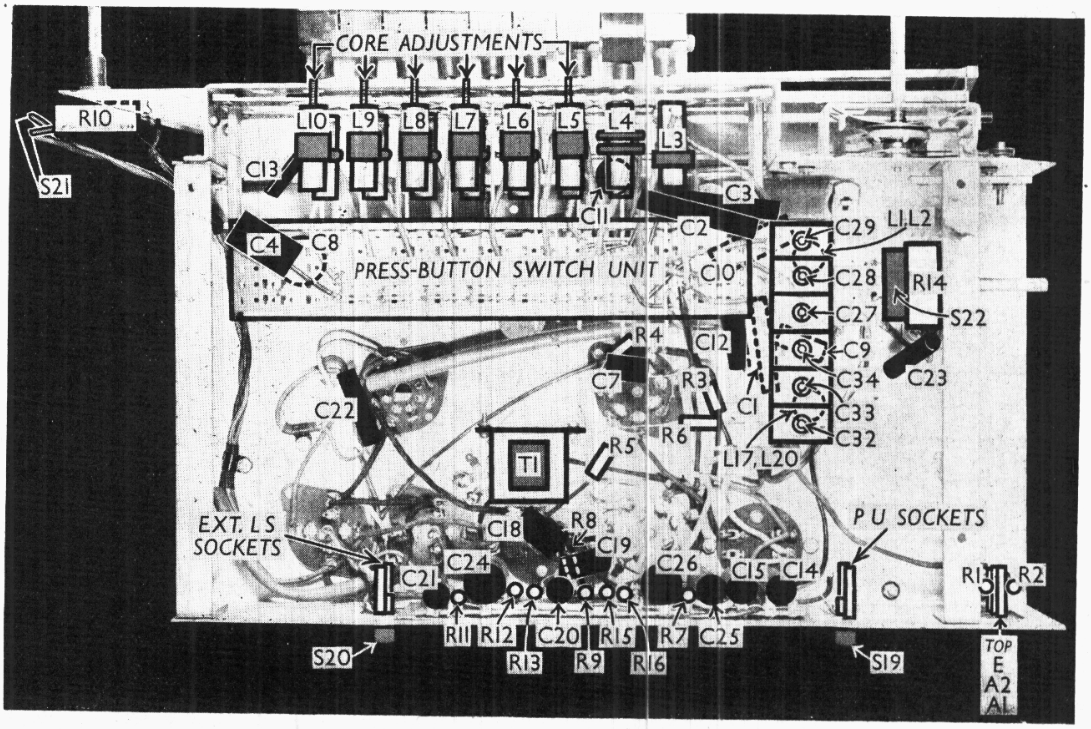
Intermediate frequency 464 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mullard metallised TDD2A).** Audio frequency component in rectified output is developed across load resistance **R9** and passed via AF coupling condenser **C20,** switch **S19** and manual volume control **R10** to CG



Circuit diagram of the K.B. 820 key-board tuning battery superhet. Inset at the bcis a

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 overleaf. Note **S19** and **S20**, associated with the pick-up and external speaker sockets respectively.

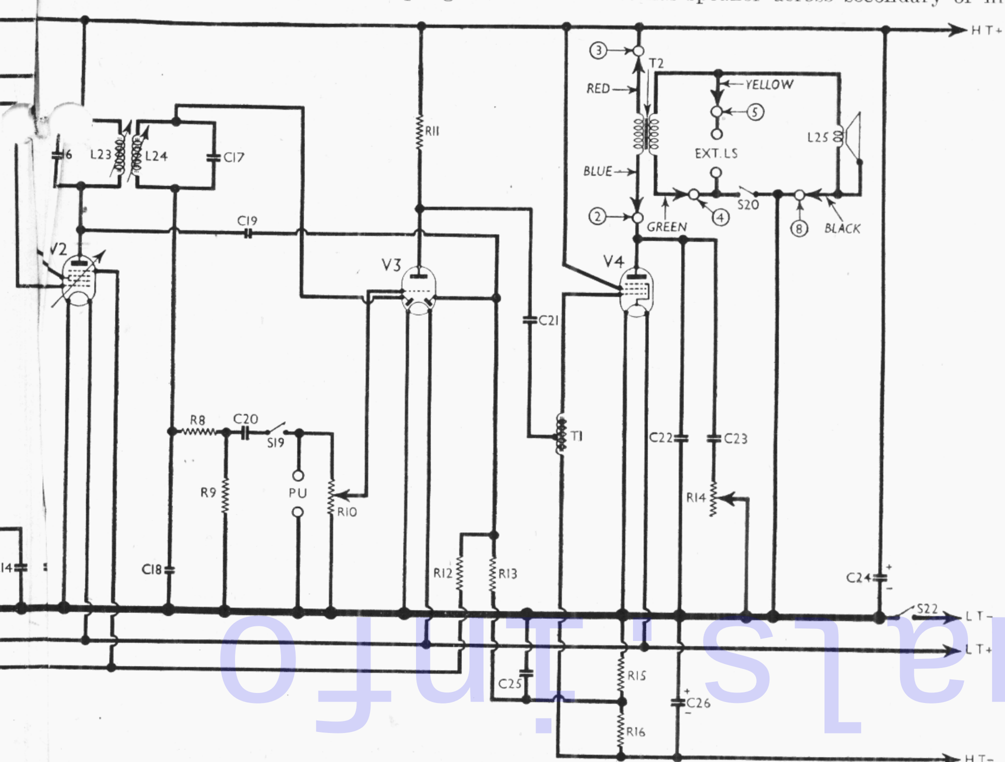


of triode section, which operates as AF amplifier. Provision for connection of gramophone pick-up across **R10**; when the knob controlling **S19** is unscrewed, the switch opens to mute radio. IF filtering by **C18** and **R8**.

Second diode of **V3**, fed from **V2** anode via **C19** provides DC potential which is developed across load resistance **R13** and fed back through a decoupling circuit as GB to FC (except on SW) and IF valves, giving automatic volume control.

Parallel-fed auto-transformer coupling by **R11, C21** and **T1** between **V3** triode and pentode output valve **(V4, Mullard PM22A)**. Fixed tone correction by **C22** in anode circuit. Variable tone control by **C23, R14,** also in anode circuit. Provision for connection of low impedance external speaker across secondary of internal speaker input transformer **T2.** The screw-type switch **S20** permits internal speaker to be muted if desired.

Fixed GB potential for **V1** and **V2,** GB for **V4,** and AVC delay potential are obtained from drop along resistances **R15** and **R16** which form a potential divider in negative HT lead to chassis.



ne bo is a diagram of the speaker connector

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial coupling condensers	0·005
C2		0·002
C3		0·002
C4	Automatic aerial circuit fixed tuning condenser ...	0·0004
C5	First IF transformer fixed tuning condensers ...	0·00015
C6		0·00015
C7	V1 osc. CG condenser ...	0·00008
C8	Automatic osc. circuit fixed tuning condenser	0·0008
C9	Osc. circuit LW fixed trimmer	0·000025
C10	Osc. circuit MW tracker ...	0·0004
C11	Osc. circuit LW tracker ...	0·00023
C12	V1 osc. anode coupling condensers	0·001
C13		0·0004
C14	AVC line decoupling ...	0·1
C15	V1, V2 SG's decoupling ...	0·1
C16	Second IF transformer fixed tuning condensers	0·00015
C17		0·00028
C18	IF by-pass	0·00005
C19	Coupling to V3 AVC diode	0·000025
C20	AF coupling to V3 triode ...	0·02
C21	V3 triode to V4 AF coupling	0·02
C22	Fixed tone corrector ...	0·001
C23	Part of variable tone control	0·02
C24*	HT circuit reservoir ...	2·0
C25	Auto GB by-pass condensers	0·1
C26*		25·0
C27‡	Aerial circuit SW trimmer	0·000045
C28‡	Aerial circuit MW trimmer	0·000045
C29‡	Aerial circuit LW trimmer	0·000045
C30†	Aerial circuit manual tuning	—
C31†	Osc. circuit manual tuning	—
C32‡	Osc. circuit SW trimmer ...	0·000045
C33‡	Osc. circuit MW trimmer ...	0·000045
C34‡	Osc. circuit LW trimmer ...	0·000045

* Electrolytic. † Variable. ‡ Pre-set.

RESISTANCES		Values (ohms)
R1	Aerial input potential	10,000
R2	divider resistances ...	5,000
R3	V1 hexode CG resistance ...	500,000
R4	V1 osc. CG resistance ...	100,000
R5	V1 osc. anode HT feed ...	25,000
R6	V1 osc. anode stabiliser ...	100
R7	V1, V2 SG's HT feed... ...	50,000
R8	IF stopper	50,000
R9	V3 signal diode load	500,000
R10	Manual volume control ...	500,000
R11	V3 triode anode load... ...	100,000
R12	AVC line decoupling... ...	500,000
R13	V3 AVC diode load	500,000
R14	Variable tone control ...	50,000
R15	V1, V2 fixed GB; V4 GB and	150
R16	AVC delay pot.	400

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial SW coupling coil	0·7
L2	Aerial SW tuning coil...	Very low
L3	Aerial MW tuning coil	2·7
L4	Aerial LW tuning coil...	37·0
L5	Aerial circuit automatic tuning coils	2·5
L6		3·6
L7		4·8
L8		6·5
L9		18·0
L10		22·0
L11	Oscillator circuit automatic tuning coils ...	1·5
L12		1·8
L13		2·1
L14		2·5
L15		4·3
L16		4·3
L17	Osc. circ. SW tuning coil	Very low
L18	Osc. circ. MW tuning coil	5·25
L19	Osc. circ. LW tuning coil	11·5
L20	Oscillator SW reaction	0·5
L21	1st IF trans. Pri...	3·7
L22	1st IF trans. Sec ..	3·7
L23	2nd IF trans. Pri...	3·7
L24	2nd IF trans. Sec ..	2·7
L25	Speaker speech coil ...	2·5
T1	Intervalve auto trans., total	5,700·0
T2	Speaker input trans. Pri...	750·0
	Sec ..	0·3
S1a, b, x to S3a, b, c, x, y	Aerial circuit manual waveband switches ...	—
S4a to S9a	Aerial auto selector switches	—
S10a to S15a	Oscillator auto selector switches	—
S16a, b, x to S18a, b x,y,z	Oscillator circuit manual waveband switches	—
S19	Radio muting switch	—
S20	Speaker muting switch	—
S21	Scale lamp switch, ganged R10	—
S22	LT circuit switch, ganged R14	—

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom, upon removal of which (four round-head wood screws) access may be gained to most of the components beneath the chassis.

Removing Chassis.—Remove the two control knobs (recessed grub screws) from the front of the cabinet and one from the side (set screw, with projecting head, inside cabinet and reached through hole in bottom of cabinet);

withdraw speaker connecting plug from socket on chassis deck;

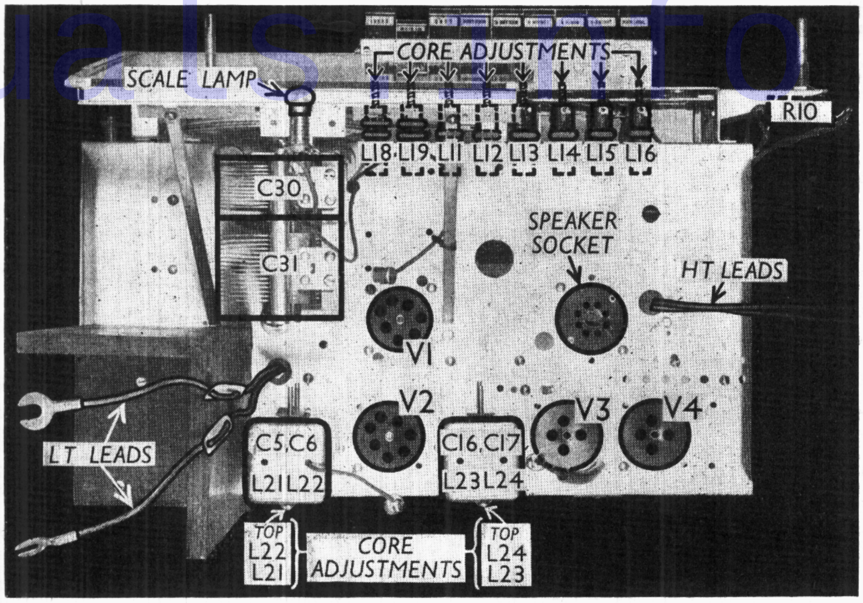
remove the four bolts (with claw washers and lock-washers) holding the chassis to the bottom of the cabinet.

Removing Speaker.—Withdraw plug from chassis deck;

slacken the four clamp screws (with lock-washers) holding speaker frame to sub-baffle;

swivel the clamps and lift out the speaker.

When replacing, the transformer should be at the top.



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

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating with a new HT battery reading 135 V on load. The receiver was tuned to the lowest wave-length on the MW 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 TH2	129	0·9	46	1·0
	Oscil	lator		
	65	2·6		
V2 VP2B	129	1·7	46	0·5
V3 TDD2A	45	0·6	—	—
V4 PM22A	128	2·7	129	0·5

GENERAL NOTES

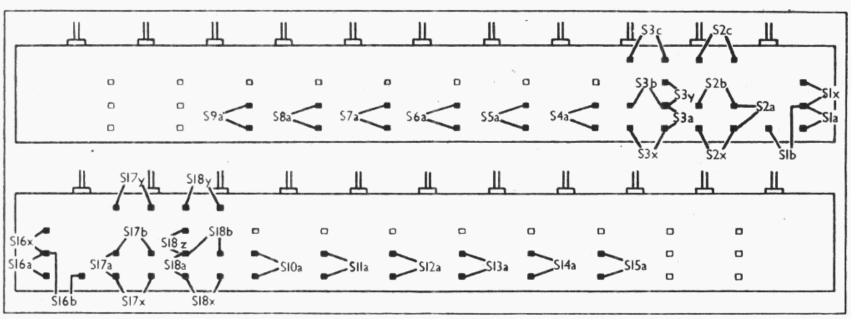
Switches.—S1a, b, x to S18a, b, x, y, z are the station selector and manual waveband switches, in a single unit beneath the chassis, and are operated by nine "keys," in place of press-buttons. Of these, the first six, starting from the left, are for pre-set stations, while the last three are for manual waveband switching. The switches are coded in our circuit diagram, and in the switch diagrams (shown below) with suffix letters to indicate their operation. This is fully explained at the beginning of the Circuit Description.

S19 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 **C20** to **R10**, and so mutes radio.

S20 is a similar switch, associated with the external speaker sockets, also at the rear of the chassis. When it is unscrewed the **L25** circuit is broken, thus muting the internal speaker.

S21 is the scale lamp switch, fitted inside the volume control **R10.** It is normally open, but closes when the volume control spindle is pushed in.

S22 is the QMB battery switch, ganged



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 with the tone control **R14** (see also Chassis Divergencies).

Coils.—**L1, L2** and **L17, L20** are in two unscreened tubular units beneath the chassis, mounted below the bank of six pre-set condensers towards the right of our under-chassis view. **L3-L10** and **L11-L16, L18, L19** are in separate tubular units in two rows of eight between the switch unit and the front of the chassis; all these coils, except **L3** and **L4** have variable iron cores adjusted by screws which are indicated in our two chassis pictures. Note that **L18** and **L19** 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.

L21, L22 and **L23, L24** 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.

Scale Lamp.—This is an MES type, rated at 2.5 V.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (2-5 0) external speaker. **S20**, 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.

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.

Batteries.—LT., 2V accumulator cell; H.T., 135V dry HT battery, which need not be tapped. Grid bias is automatic.

Battery Leads and Voltages.—Black lead, spade tag, LT negative; red lead, spade tag, LT positive 2V; black lead and plug, HT negative; red lead and plug, HT positive 135V.

Speaker Connector.—The speaker is connected up to the chassis by an octal plug and socket, of which pins 1, 6 and 7 are blank. A diagram of the plug is inset beneath the circuit, and its connections are shown by circles and arrows in the circuit diagram. The colour coding of the leads is: 2, blue; 3, red; 4, green; 5, yellow; 8, black.

Chassis Divergencies.—According to the makers' diagram there are two ganged battery switches, **S22** as shown in our diagram and another between chassis and the chassis sides of **R15, C26.** Our receiver was actually fitted with a double switch unit, but only one of the switches was wired up.

C9, C34 were returned to chassis in our model, but the makers' diagram shows them returned to the junction of **C11, S17y** and **S18y.**

KEY-BOARD STATION SETTING

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

Each of the six keys has one adjusting screw above it, and one below. To increase 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 adjust the oscillator coil core (above the key) to give the maximum signal from the required station. 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.

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

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 via a 0.1μF condenser between control grid (top cap) of **V1** and chassis. Press the MW key, and feed in a 464 KC/S signal, then adjust the cores of **L21, L22, L23** and **L24** 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 **L18** for maximum output. Tune to 214 m on scale (white dot), feed in a 214 m (1,400 KC/S) signal and adjust **C33,** then **C28,** for maximum output. Return to 500 m, readjust core of **L18** for maximum output, while rocking the gang for optimum results.

LW.—Press LW key, tune to 1,714 m on scale (white dot), feed in a 1,714 m (175 KC/S) signal, and adjust core of **L19** for maximum output. Tune to 857 m on scale, feed in an 857 m (350 KC/S) signal, and adjust **C34,** then **C29,** for maximum output. Return to 1,714 m, and readjust core of **L19** 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 **C32** for maximum output, using the peak involving the lesser trimmer capacity. Then adjust **C27** for maximum output, rocking the gang very slightly for optimum results.

Printed in Great Britain by St. Clements Press, Ltd., Portugal Street, Kingsway, London, W.C.2.