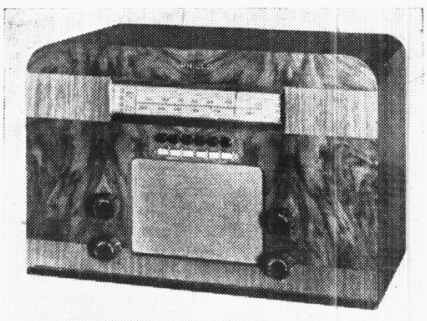
Supplement to The Wireless & Electrical Trader, March 16, 1940.

"TRADER" SERVICE SHEET

456

PHILCO A3

TRANSPORTABLE AC SUPERHET



THE Philco A3 table receiver is a 5-valve (plus valve rectifier) AC superhet with a self-contained aerial system of special design. Actually, two electrostatically-shielded frame aerials are employed. The set is also novel in that it has an RF stage aperiodically coupled to the frequency-changer.

The receiver covers the MW and LW bands only, and is suitable for use on 200-250V, 50-60 C/S AC mains, without adjustment.

Release date: January, 1940.

CIRCUIT DESCRIPTION

A fairly straightforward system of press-button switching is employed in this receiver and, as in previous service sheets, the switches have been numbered in groups and lettered to indicate their action.

Each press-button plunger controls two groups of switches: one in the aerial circuit, and one in the oscillator circuit. The MW plunger, for instance, controls the two groups numbered **S1** and **S7.**

The lettered suffixes indicate the action of the individual switches of each group. If the suffix is **a** or **b** its switch *closes* when its plunger is pressed, while if the suffix is **x** the switch *opens*. When the plunger is released, owing to depression of another button, the action is reversed so that the **a's** and **b's** become open and the **x's** closed.

Input from MW frame aerial winding **L2** is tuned by **C30** (manual) or one of the trimmers **C28, C29** (auto); or on LW, input from frame winding **L3** is tuned by **C30** (manual) or one of the trimmers **C26, C27.**

Special electrostatically-screened frame aerial windings are used, and the vertical dotted lines beside **L2** and **L3** in the diagram represent the screen winding.

Provision is made for connection of an external aerial via **C1** (MW) or rejector circuit **L1,C43** and tapping on **L3** (LW).

First valve **(V1, Brimar 7C7E)** is a variable-mu pentode operating as RF amplifier with resistance-capacity coupling by **R3, C6** and **R4** to pentode section of heptode valve **(V2, Brimar 7A8E)** which operates as frequency changer with electron coupling.

V2 oscillator grid coils **L4** (MW) and **L5** (LW) are tuned manually by **C31**; parallel trimming by **C32** (MW) and **C9, C37** (LW); series tracking by **C38** (LW) and specially shaped vanes of **C31.** For automatic operation, **L4** is tuned by **C33** or **C34,** or **L5** is tuned by **C35** or **C36.** Reaction by coil **L6** (MW and LW) assisted by the common impedance of **C38** in grid and anode circuits (LW).

Third valve **(V3, Brimar 7B7E)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C39, L7, L8, L9, C40** and **C41, L10, L11, C42.**

The third coil **L9** in the first IF transformer assembly introduces a negative coupling to reduce the gain of the amplifier as the signal frequency approaches the intermediate frequency. This is claimed to result in a practically level response throughout the MW band.

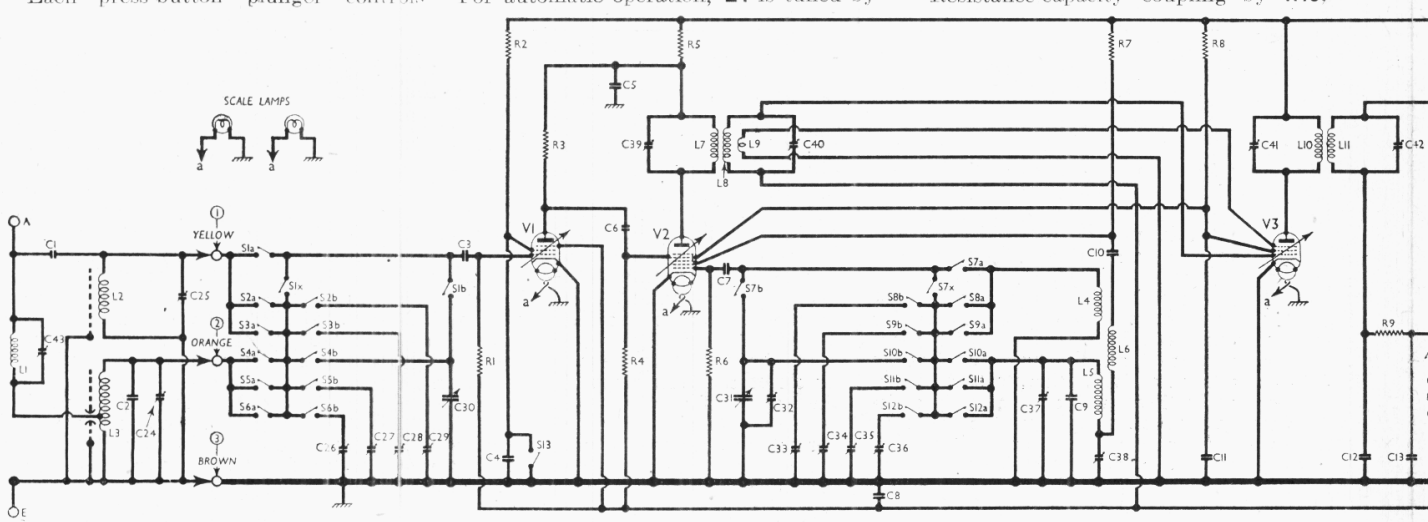
Intermediate frequency 451KC/S.

Diode second detector is part of double diode triode valve **(V4, Brimar 7C6).** Audio frequency component in rectified output is developed across manual volume control **R10,** which also operates as load resistance, and passed via AF coupling condenser **C14** to CG of triode section, which operates as AF amplifier. IF filtering by **C12, R9** and **C13** in diode circuit, and **C15** in triode anode circuit.

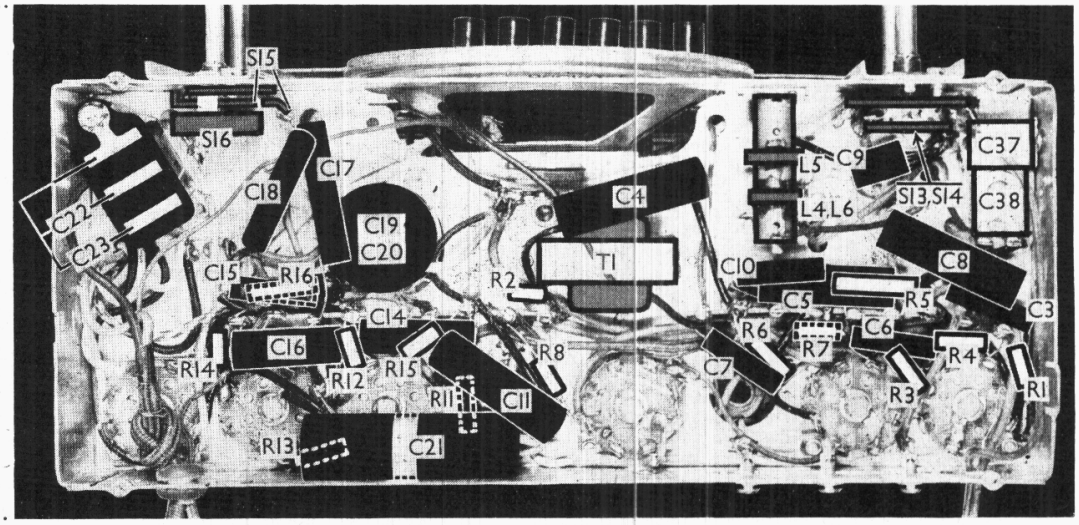
Provision is made for connection of gramophone pick-up across **R10** via switch **S14,** and when **S14** is closed, **S13** also closes to connect **V1** SG to chassis and thus mute radio.

DC potential developed across **R9** and **R10** is fed back via **L11** and decoupling resistance **R11,** to the outer end of which is connected the second diode of **V4,** as GB to RF, FC and IF valves, giving automatic volume control.

Resistance-capacity coupling by **R13.**



Circuit diagram of the Philco A3 transportable AC superhet. The dotted lines to the left of **L2** and **L3** represent the electrostatic screens, which are earthed. Note the untuned coupling between the RF valve **V1** and the frequency-changer **V2.** **L9,** in the first IF transformer, is a degenerative coupling coil

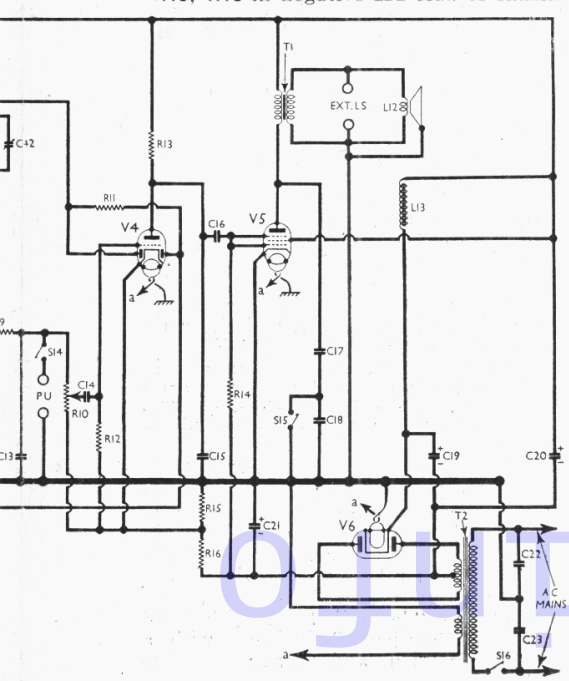


Under-chassis view. A diagram of the **SI3, SI4** unit is overleaf. **SI5** and **SI6** are ganged. The electrolytic unit, **C19, C20** is actually situated mainly above the chassis. **C22** and **C23** are in a single unit with one common connection

C16 and **R14** between **V4** triode and pentode output valve **(V5, Brimar 7B5E).** Two-position tone control by **C17, C18** and switch **S15** in anode circuit. Provision for connection of low impedance external speaker across secondary of output transformer **T1.**

HT current is supplied by IHC full-wave rectifying valve **(V6, Brimar 7Y4).** Smoothing by speaker field **L13** and electrolytic condensers **C19, C20. V6** heater is connected across the same secondary winding of **T2** and the other valves in the receiver, so that only two secondary windings are required on the transformer. Also, since the receiver will operate satisfactorily from any AC mains voltage between 200V and 250V, no voltage adjustments are provided.

Fixed GB potential for **V1, V2** and **V3,** and GB for **V4** triode (on gram only) and **V5,** are obtained from the potential divider comprising resistances **R15, R16** in negative HT lead to chassis.



COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 CG resistance	1,000,000
R2	V1 SG HT feed	150,000
R3	V1 anode load resistance...	4,000
R4	V2 pentode CG resistance	400,000
R5	V1 and V2 pentode anodes HT feed	900
R6	V2 osc. CG resistance ...	51,000
R7	V2 osc. anode HT feed ...	10,000
R8	V2, V3 SG's HT feed ...	20,000
R9	IF stopper	47,000
R10	Manual volume control; V4 signal diode load ...	500,000
R11	AVC line decoupling ...	1,500,000
R12	V4 triode CG resistance ...	4,000,000
R13	V4 triode anode load ...	250,000
R14	V5 CG's resistance	1,000,000
R15	V1, V2, V3 fixed GB; V4 triode (gram) and V5	50
R16	GB resistances	200

	CONDENSERS	Values (μF)
C1	External aerial MW coupling	0·000004
C2	Frame aerial LW fixed trimmer	0·000035
C3	V1 CG condenser	0·00025
C4	V1 SG decoupling	0·065
C5	V1, V2 pentode anodes decoupling	0·065
C6	V1 to V2 pentode RF coupling	0·000077
C7	V2 osc. CG condenser ...	0·00025
C8	AVC line decoupling ...	0·065
C9	Osc. circ. LW fixed trimmer	0·0001
C10	V2 osc. anode coupling ...	0·00025
C11	V2, V3 SG's decoupling ...	0·065
C12	IF by-pass condensers ...	0·0001
C13		0·0001
C14	AF coupling to V4 triode ...	0·01
C15	IF by-pass	0·00025
C16	V4 triode to V5 AF coupling	0·004
C17	Tone control condensers ...	0·025
C18		0·025
C19*	HT smoothing condensers	8·0
C20*		16·0
C21*	Auto GB circuit by-pass ...	35·0
C22	Mains RF by-pass condensers	0·015
C23		0·015
C24‡	Frame aerial LW trimmer	0·00002
C25‡	Frame aerial MW trimmer	0·00002
C26‡	Aerial circuit auto tuning trimmers	—
C27‡		—
C28‡		—
C29‡		—
C30†	Frame aerial manual tuning	—
C31†	Oscillator circuit manual tuning	—
C32‡	Osc. circuit MW trimmer	—
C33‡		—
C34‡	Oscillator circuit auto tuning trimmers	—
C35‡		—
C36‡		—
C37‡	Osc. circuit LW trimmer ...	0·00011
C38‡	Osc. circuit LW tracker ...	0·0007
C39‡	1st IF trans. pri. tuning ...	—
C40‡	1st IF trans. sec. tuning ...	—
C41‡	2nd IF trans. pri. tuning ...	—
C42‡	2nd IF trans. sec. tuning	—
C43‡	Aerial image rejector tuning	—

*Electrolytic. †Variable. ‡Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	External aerial coupling image rejector coil ...	3·0
L2	Frame aerial (MW)	1·0
L3	Frame aerial (LW), total ...	30·0
L4	Osc. circuit MW tuning coil	4.0
L5	Osc. circuit LW tuning coil	4·0
L6	Oscillator reaction coil ...	1·0
L7	1st IF trans. Pri. ...	20·0
L8	1st IF trans. Sec. ...	20·0
L9	Degenerative coupling coil	Very low
L10	2nd IF trans. Pri. ...	30·0
L11	2nd IF trans. Sec. ...	30·0
L12	Speaker speech coil	3·0
L13	Speaker field coil	1,700·0
T1	Output trans. Pri. ...	700·0
	Output trans. Sec. ...	0·5
T2	Mains trans. Pri.	65·0
	Mains trans. Heater sec. ...	0·2
	Mains trans. HT sec., total	700·0
S1a, b, x to S6a, b	Aerial circuit manual and auto selector switches ...	—
S7a, b, x to S12a, b	Oscillator circuit manual and auto selector switches	—
S13, S14	Radiogram change switches	—
S15	Tone control switch ...	—
S16	Mains switch	—

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull-off);
remove the back cover, on which is mounted the LW frame winding;
disconnect the four leads from the three screw terminals at the rear of the chassis;
disconnect from the socket-panel on the back cover the two pairs of leads emerging from opposite ends of the rear of the chassis;
disconnect from MW frame connecting strip (on left inside cabinet) the red waxed lead coming from the socket-panel;
remove the two round-head wood screws

holding the scale assembly to the front of the cabinet;
remove the four unslotted hexagon-head self-tapping screws (with washers) holding the chassis to the bottom of the cabinet.

When replacing, see that the sub-baffle is in position before replacing chassis.
Connect the red lead of the thick pair coming from the left-hand end of the chassis (viewed from rear) to the end **PU** socket on the socket panel;
Connect the brown one to the middle **PU** socket.
Connect the green lead of the thin pair coming from the right-hand end of the chassis to the upper **S** tag;
connect the brown one to the lower **S** tag.
Connect the red waxed lead from the **A** socket on the socket-panel to the bottom tag on the MW connecting strip;
connect the remaining four waxed leads to the screw terminals on the rear of the chassis as follows, numbering the terminals from left to right as viewed from the rear of the chassis:

1. yellow from middle tag on MW frame connecting strip;
2. orange from top tag on LW frame connecting strip;
3. brown lead from **E** socket on socket-panel and brown lead from top tag on MW connecting strip.

Removing Speaker.—This is mounted on a bracket which is spot welded to the side members of the field magnet and bolted to the chassis deck.
Unsolder two leads from the lower speech coil tag (beneath the chassis deck);
Unsolder the two field coil leads from their terminations beneath the chassis;
remove the two self-tapping screws (with unslotted hexagon heads and lock-washers) holding the bracket to the chassis deck.
When replacing, connect the green lead from the output transformer (mounted beneath the chassis) and the brown lead of the thin pair (passing through the same grommet as the mains lead) to the lower speech coil tag. The other tag, above the chassis deck, is already soldered to the speaker frame.
Connect the black field coil lead to the HT+ tag beneath the chassis;
connect the yellow field coil lead to pin 7 of **V6**.

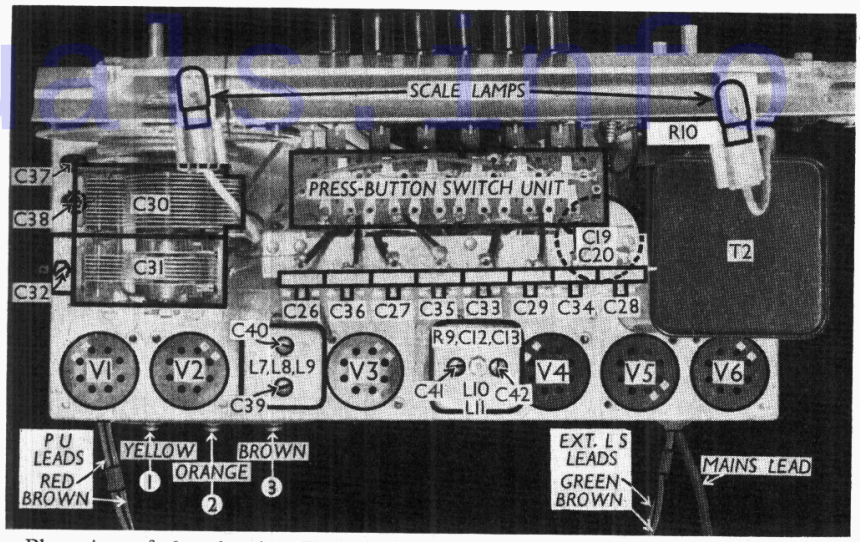
VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 230V. The receiver was tuned to the lowest wavelength on the MW band, and the volume control was at maximum. The frame windings were disconnected so that there should be 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 7C7E	156	2·4	79	0·5
V2 7A8E	173 (Oscillator) 125	1·5 4·9	86	3·1
V3 7B7E	176	7·0	86	1·6
V4 7C6	70	0·4	—	—
V5 7B5E	159	25·0	176	5·2
V6 7Y4	275†	—	—	—

† Each anode, AC.



Plan view of the chassis. Two detailed diagrams of the press-button unit are given in a separate drawing. The frame aerial terminals are numbered and colour-coded

GENERAL NOTES

Switches.—**S1a, b, x** to **S12a, b** are the switches contained in the press-button unit. Their action is fully explained at the beginning of the Circuit Description. Each press-button plunger controls two groups of switches. Switches with the suffix **a** or **b** close when their button is pressed; those with the suffix **x** open when their button is pressed. Two detailed views of the press-button unit are given in cols. 5 and 6 opposite. The upper one shows the unit as seen from above the chassis, and the lower one is the underside view.

S13, S14 are the radio-gram switches, in a rotary unit beneath the chassis. This is indicated in our under-chassis view, and shown in detail in the diagram below. In the anti-clockwise (radio) position, both switches are open, while in the clockwise position (gram), both switches are closed.

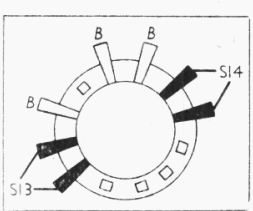


Diagram of the **S13, S14** unit, as seen from the rear of the underside of the chassis

S15 is the tone control switch, and **S16** the mains switch. These are ganged together, and are shown in our under-chassis view. In the anti-clockwise position of the knob ("off"), both switches are open; in the middle position ("on"), **S15** is open and **S16** closed; while in the clockwise position ("bass"), both switches are closed.

Coils.—**L1** is in a small screening box, (together with **C43**) fitted inside the back of the cabinet; **L2** and **L3** are the frame aerial windings, **L2** being inside the cabinet on the left, with **C1** and **C25** mounted on its former, and **L3** being mounted on the back of the cabinet, with **C2** and **C24** mounted on an insulating strip on its former. **C24** is adjustable through a hole in the back of the cabinet.

Both aerials are electrostatically shielded by wire networks wound over their formers. The shields are connected to the earth socket on the panel on the cabinet back.

L4-L6 are in an unscreened unit beneath the chassis, while **L7-L9** and **L10, L11** are the IF transformers, in two screened units on the chassis deck. Each unit contains its associated trimmers, and in addition the second unit also contains **R9, C12, C13. C12** and **C13,** together with the trimmer **C42,** form a single unit.

External Speaker.—Two sockets are provided on the panel at the back of the cabinet for a low impedance (2-3Ω) external speaker.

Scale Lamps.—These are two Tung-Sol types, with miniature bayonet cap bases, rated at 6-8 V (presumably 0.3A).

Condensers C19, C20.—These are two dry electrolytics in a tubular metal can, mounted on the chassis deck. The can is the common negative, but it is insulated from chassis. The red tag is the positive of **C19** (8μF), and the plain tag is the positive of **C20** (16μF).

Condensers C22, C23.—These are in a single black moulded unit, the common connection going to chassis. The tags are indicated in our under-chassis view.

Frame Aerial Connections.—The leads from the frame aerial to the chassis go to three terminals at the rear of the chassis, which are colour-coded in our plan chassis view, and are fully explained under Dismantling the Set.

Valve Connections.—The valves used are of the "loctal" type, with 6·3V heaters. They have 8-pin bases, with a key for location, and there are no top

caps. Numbering the pins in the same way as ordinary octals, the base connections are as follows:

V1 (7C7), 1, heater; 2, anode; 3, screen; 4, suppressor; 5, shielding; 6, control grid; 7, cathode; 8, heater.

V2 (7A8), 1, heater; 2, anode; 3, osc. anode; 4, osc. grid; 5, screens; 6, control grid; 7, cathode; 8, heater.

V3 (7B7), as **V1**.

V4 (7C6), 1, heater; 2, anode; 3, grid; 4, blank; 5, diode 1; 6, diode 2; 7, cathode; 8, heater.

V5 (7B5), 1, heater; 2, anode; 3, screen; 4, suppressor; 5, blank; 6, control grid; 7, cathode; 8, heater.

V6 (7Y4), 1, heater; 2, blank; 3, anode 1; 4, blank; 5, blank; 6, anode 2; 7, cathode; 8, heater.

PRESS BUTTON DETAILS

There are six press-buttons, and, from left to right, looking at the front of the set, they are: 1, MW auto (295-555m); 2, MW auto (200-230m); 3, MW manual; 4, LW manual; 5, LW auto (1,200-2,000m); 6, LW auto (1,000-1,300m).

The four pre-set stations are selected by eight pre-set condensers, mounted in a row behind the press-button unit. The condensers associated with each button are: 1, **C28, C34**; 2, **C29, C33**; 5, **C27, C35**; 6, **C26, C36.**

To select a station, press the appropriate button, feed a signal of the correct wavelength into the external **A** and **E** sockets via a dummy aerial, and adjust the appropriate oscillator trimmer, and then the aerial trimmer, for maximum output. Screwing up a trimmer increases the wavelength. To check that the receiver is not tuned to an image signal, vary the signal generator input over the whole of the MW and LW bands and make certain that only the one signal, of the correct wavelength, is obtained from the set. In all these adjustments, keep the signal generator input low; if it cannot be attenuated sufficiently, remove the direct connection and use the radiation from a short length of wire connected to the generator output.

CIRCUIT ALIGNMENT

It is necessary, when aligning, that the frame aerials be mounted in their correct positions relative to the chassis. If the set is left in the cabinet, and the LW frame aerial (on the back of the set) is laid down at the rear of the receiver, this will be satisfactory.

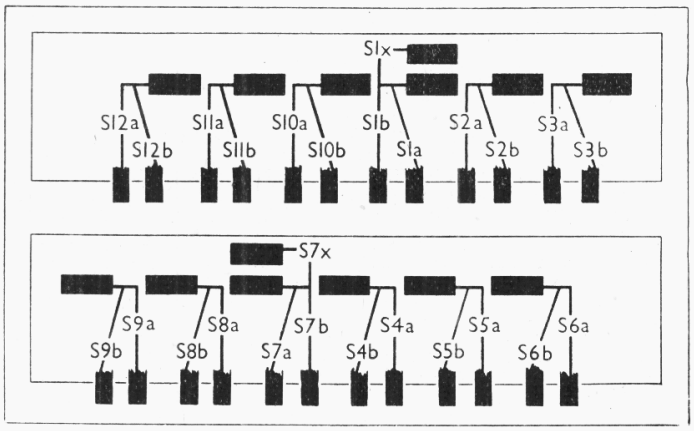
IF Stages.—Press MW manual button, turn gang to maximum, and volume control to maximum. Connect signal generator via a 0·1μF condenser to control grid (pin 6) of **V2**, and to chassis. Feed in a 451 KC/S signal, and adjust **C42, C41, C40** and **C39** in turn for maximum output. Repeat these adjustments.

RF and Oscillator Stages.—With gang at maximum, pointer should cover index line at left-hand end of scale. Connect signal generator, via a suitable dummy aerial, to external aerial and earth sockets.

LW.—Press LW manual button and tune to 290 KC/S (corresponding to dot at 1,034·5m on scale, above letter T in Tiflis). Feed in a 290 KC/S (1,034·5m) signal, and adjust **C37** for maximum output. Feed in a 232 KC/S (1,293m) signal, tune it in, and adjust **C24** (on LW frame, adjusted through hole in back of receiver) for maximum output. Feed in a 160 KC/S (1,875m) signal, tune it in, and adjust **C38** for maximum output, while rocking the gang for optimum results. Re-adjust **C37** at 290 KC/S.

Image Rejector.—Connect signal generator direct to the **A** and **E** sockets, and press LW manual button. Feed in a 1,095 KC/S (274m) signal. Tune in the image of this signal at about 193 KC/S (1,554·4m) and adjust **C43** (through hole in back of cabinet behind **L1, C43** screening box) for *minimum* output.

MW.—Connect signal generator via dummy aerial again, and press MW manual button. Tune to 1,400 KC/S (corresponding to 214m on scale, below letter D in word Dublin). Feed in a 1,400 KC/S (214m) signal and adjust **C32**, then **C25**, for maximum output. Check calibration at 600 KC/S (500m). There is no tracking adjustment on this band.



Diagrams of the press-button switch unit. Above, the view looking down on the chassis deck; below, the view from beneath the unit

Thermostatic Control of Domestic Heating

IN view of the obvious advantages of temperature control of electric heating in the home, it is surprising that, until now, there has been no serious attempt to provide for this form of control by a reasonably priced unit which can be used with any existing type of electric heater. It is true that thermostats for this purpose have been available, but they have been relatively expensive for home use, and have involved permanent wiring; again, certain types of heaters are available with thermostats incorporated in them, and are perfectly satisfactory, but few people will be prepared to incur the expense of scrapping existing heaters in order to obtain the benefits of temperature control.

With these facts in mind, the British Thermostat Co., Ltd., have recently designed an inexpensive device, known as the Adaptastat, which is announced in the "For the Buyer" feature on page 255 this week.

It can be used with any form of heater up to 1.5KW on 200-250V AC mains, and can be taken from room to room as required. It needs no wiring, and is reasonably priced.

The Trader recently had the opportunity of visiting the British Thermostat works at Sunbury-on-Thames, to see this and other thermostatic devices in production. The Adaptastat, despite its low cost, is a precision device, operating by means of a bi-metal strip which bends with changes in temperature and opens or closes a robust switch, thus switching the heater off or on.

A very interesting means is provided for securing a snap action, and the temperature at which the control operates can be set by means of a knob. Although not calibrated in actual temperatures, the range is from about 40° to 70° F.

The Adaptastat opens up a new field for sales by electrical dealers. While it is not claimed that the device will save a definite amount of electric power, the manifest advantages of such a control from the points of view of comfort and convenience should prove to be excellent selling points, while the fact that no installation or technical knowledge is required should be of considerable help.

While visiting the works one was impressed by the precision which exists everywhere. A constant check is kept on all gauges and tools used in the toolroom and in the works, and instruments capable of measuring to one ten-thousandth of an inch are used for this purpose.

Some of the processes used in the manufacture of thermostats are exceedingly interesting, many having been developed in the works, together with the necessary machines and jigs.

Throughout the works one is impressed by the happy relations existing between the employees and the management, and it has always been the policy of the directors to cater for the social welfare of their staff in the fullest possible measure.

Printed in Great Britain by ST. CLEMENTS PRESS, LTD., Portugal Street, Kingsway, London, W.C.2.

★