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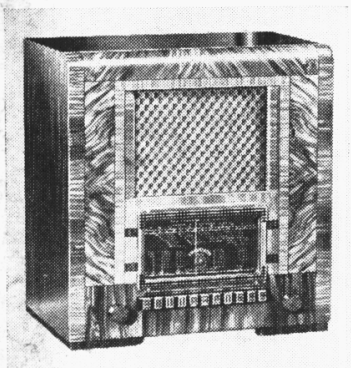
"TRADER" SERVICE SHEET

363

FERGUSON 772 AND 775 RADIOGRAM



THE Ferguson 772, Pressabutton, receiver is a 6-valve (plus rectifier) AC 3-band superhet with press-button trimmer tuning for seven stations and press-button switches for gramophone and wave-change purposes. It is suitable for mains of 200-250 V, 50-100 C/S, and has a short-wave range of 16-50 m, while provision is made for an extension speaker and a gramophone pick-up.

An identical chassis is fitted in the 775 radio-gramophone, but this *Service Sheet* was prepared on a 772.

Release date for both models : August, 1938.

CIRCUIT DESCRIPTION

Aerial input is fed on MW and LW via series condenser **C1** to coupling condensers **C2, C3,** via switch **S1x,** that fraction of the signal voltage which is developed across **C3** being coupled to the tuning coils **L3** (MW) and **L4** (LW). On SW, input is via **C1** and coupling condensers **C2, C4** to tuning coil **L2, S1x** then being open. Manual tuning is effected in the conventional manner by the variable condenser **C32** connected to the appropriate coil via switches **S1b** (SW), **S2b** (MW) and **S3b** (LW), **V1** tetrode control grid being connected similarly via switches **S1a** (SW), **S2a** (MW) and **S3a** (LW).

This operation can be followed quite easily from the diagram when it is explained that all switches throughout the diagram are so numbered that those operated by the same press-button bear the same number, and each number has a lettered suffix to indicate its function ; **a, b** or **c** indicating that it closes when its button is depressed while that with the suffix **x** will open. It will be seen that all switches bearing the number **1** belong to the SW button, **2** to the MW button and **3** to the LW button.

Automatic tuning is effected by pressing one of the automatic press-buttons which, in the aerial circuit, are associated with switches numbered **4** to **10,** numbers **4** to **8** being connected to the MW coil and **9** and **10** to the LW coil, thus applying one of the automatic tuning trimmers across the appropriate tuning coil according to which button is depressed.

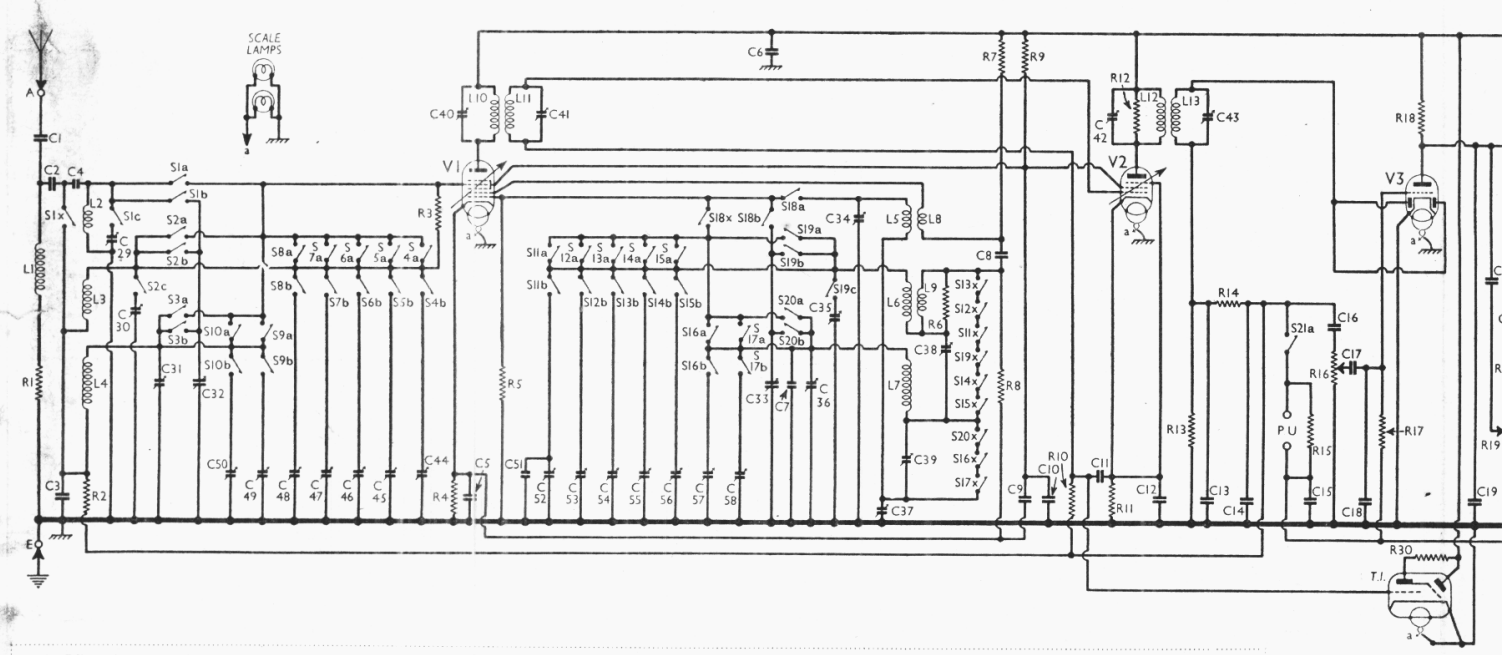
Resistance **R3** is connected between **V1** tetrode CG and **L3** to prevent the grid becoming free when all switches are open.

First valve (**V1, 6A8G**) is a heptode operating as frequency changer with electron coupling. Oscillator grid coils **L5** (SW), **L6** (MW) and **L7** (LW) are tuned by **C33** via switches **S18b** (SW), **S19b** (MW) and **S20b** (LW) for manual tuning, or by one of the trimmers **C52** to **C58** for automatic tuning via switches numbered **11** to **15** (MW) and **16, 17** (LW). Normal parallel trimming by **C34** (SW), **C35** (MW—manual only) and **C7, C36** (LW) ; series tracking by **C37** (SW), **C38** (MW) and **C39** (LW). Reaction by coils **L8** (SW), **L9** (MW) and direct coupling via **C8** (LW). When a MW station is being received, auto or manual, one of the switches **S11x** to **S15x** and **S19x,** whichever is associated with the depressed button, is open, while if a SW or LW station is being received they are all closed, their buttons being out ; when a LW station is being received **S16x, S17x** or **S20x** will be open, all three being closed when operating on SW or MW.

Second valve (**V2, 6U7G**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer coupling **C40, L10, L11, C41** and **C42, R12, L12, L13, C43.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode triode valve (**V3 6Q7G**), both diode anodes being strapped together. Audio frequency component in rectified output is developed across load resistance **R13** and passed via IF stopper **R14,** AF coupling condenser **C16,** manual volume control **R16**



Circuit diagram of the Ferguson 772 press-button AC superhet. The 775 radiogram has an identical circuit. Early models of the 772 may differ somewhat from the diagram above, as explained under "Early Chassis Divergencies" on the back of this sheet.

and further AF coupling condenser **C17,** to CG of triode section, which operates as AF amplifier. IF filtering by **C13, R14, C14** in diode circuit, **C18** in grid circuit and **C19** in anode circuit. Variable tone control by **C20, R19** in anode circuit. Provision for connection of gramophone pick-up across **C16, R16** via switch **S21a,** the **a** indicating of course that the switch closes when the **" GR "** button is depressed.

DC potential developed across **R13** is fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving automatic volume control. This potential, taken from the junction of **L11, R10,** is also used to control the cathode ray tuning indicator (**T.I.6G5**).

Resistance-capacity coupling by **R18, C23, R25** between **V3** triode and one side of push-pull output stage comprising two beam tetrode valves (**V5, V6 6V6G's**). The other side, **V5,** is fed via phase reversing valve (**V4, 6C5G**) which obtains its input from junction of **R20, R21** forming a step-down coupling to balance the valve gain. Provision is made for connection of high impedance external speaker between **V5, V6** anodes.

HT current is supplied by full-wave rectifying valve (**V7, 5Y3G**). Smoothing by speaker field **L16** and dry electrolytic condensers **C25, C26.**

GB potential for **V3** triode and **V4** are automatically obtained from drop along **R28** in negative HT lead to chassis.

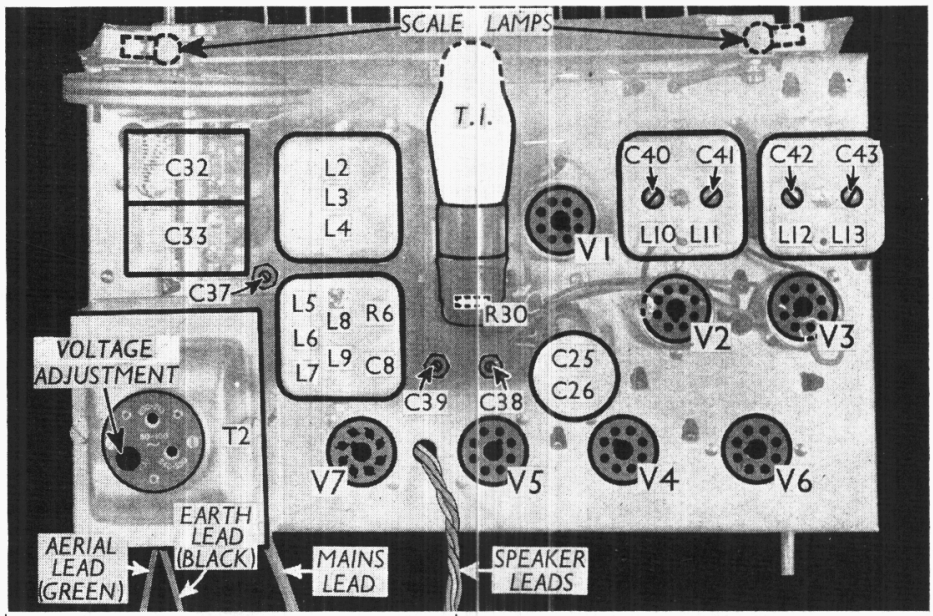
DISMANTLING THE SET

Removing Chassis.—To remove the chassis from the cabinet, remove the two control knobs (pull off), the eleven buttons (pull off) and the four bolts (with washers and spring washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which will be found to be sufficient for normal purposes.

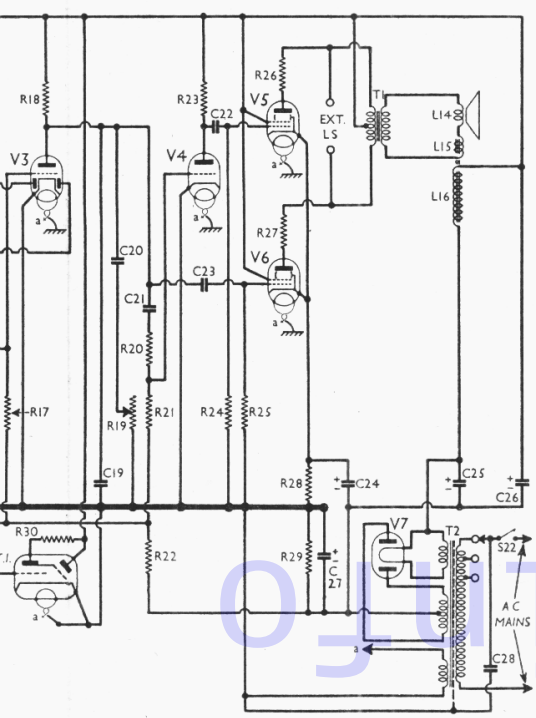
When replacing, make sure that the buttons are replaced properly. When the set leaves the factory the buttons are arranged as follows, reading from left to right :—National, Midland, London, Gram, SW, MW, North, Athlone, LW, Luxembourg, Droitwich.

To free the chassis entirely, unsolder the speaker leads, and *when replacing,* connect them as follows, noting that the tags are marked : F, red/white ; 3, blue ; 2 and F joined, red ; 1, blue.

Removing Speaker.—The speaker can be removed from the cabinet by removing the nuts from the four screws holding it to the sub-baffle. *When replacing,* see that the transformer is on the left.



Plan view of the chassis. Note the adjustments for the trackers **C37, C38** and **C39. R30** is inside the T.I. holder. The **L5-L9** unit also contains **R6** and **C8.**

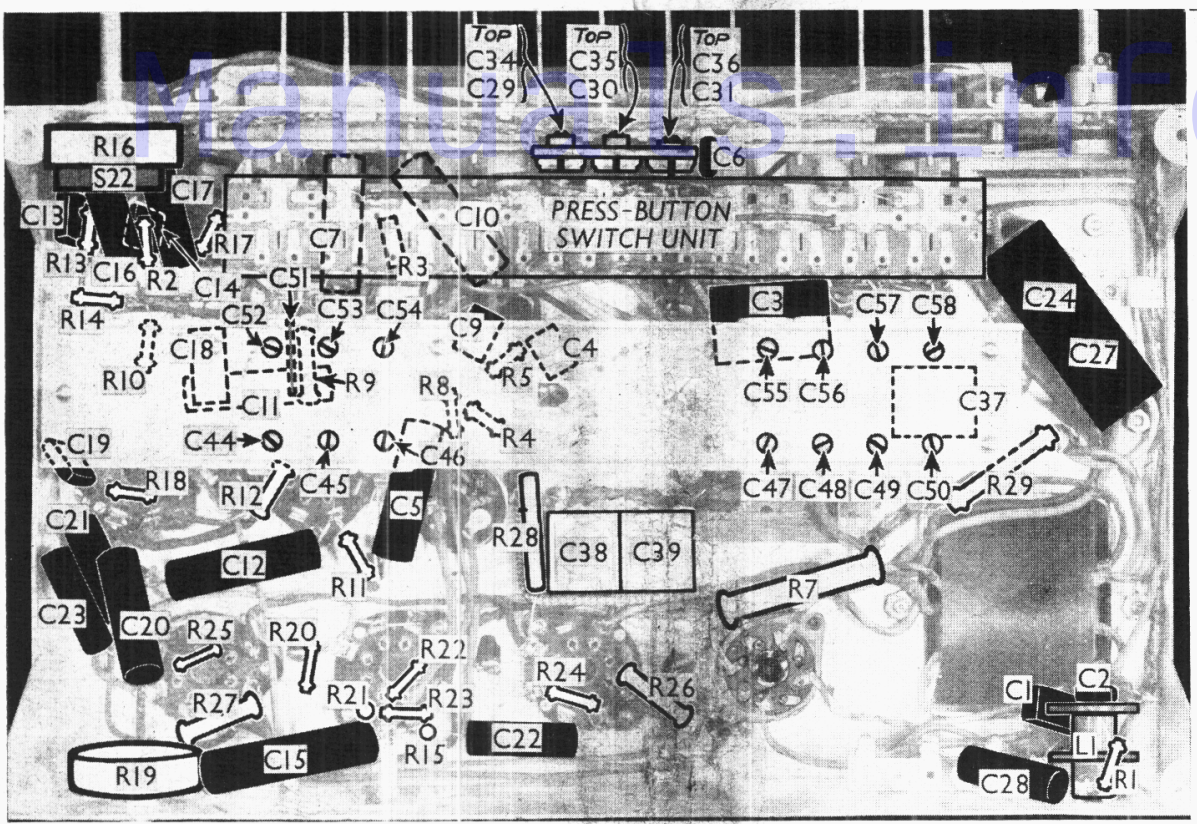


COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	Anti-modulation choke damping	10,000
R2	V1 tetrode CG decoupling	500,000
R3	V1 tetrode CG resistance	3,000,000
R4	V1 fixed GB resistance	150
R5	V1 osc. CG resistance	500,000
R6	Osc. circuit MW reaction damping	2,500
R7	V1 osc. anode HT feed resistance	25,000
R8	V1 osc. CG resistance	50,000
R9	V1, V2 SG's HT feed resistance	25,000
R10	V2 and T.I. CG's decoupling	500,000
R11	V2 fixed GB resistance	300
R12	2nd IF trans. pri. damping	600,000
R13	V3 diodes load resistance	500,000
R14	IF stopper	25,000
R15	Gramophone PU shunt	25,000
R16	Manual volume control	500,000
R17	V3 triode CG resistance	50 ,000
R18	V3 triode anode load	250,000
R19	Variable tone control	100,000
R20	V4 CG input pot. divider	500,000
R21		35,000
R22	V3 triode and V4 CG's decoupling	250,000
R23	V4 anode load resistance	250,000
R24	V5 CG resistance	500,000
R25	V6 CG resistance	500,000
R26	V5 anode RF stopper	100
R27	V6 anode RF stopper	100
R28	V5, V6 GB resistance	300
R29	V3 triode and V4 auto GB resistance	25
R30	T.I. anode HT feed	250,000

	CONDENSERS	Values (μF)
C1	Aerial series condenser	0·0005
C2	Aerial circuit MW and LW coupling potential divider	0·0001
C3		0·004
C4	Aerial SW coupling condenser	0·00002
C5	V1 cathode by-pass	0·1
C6	HT circuit RF by-pass	0·1
C7	Osc. circuit LW fixed trimmer	0·00006
C8	V1 osc. anode coupling	0·00025
C9	V1 SG RF by-pass	0·00025
C10	V1, V2 SG's decoupling	0·1
C11	V2 CG decoupling	0·1
C12	V2 cathode by-pass	0·1
C13	IF by-pass condensers	0·00025
C14		0·00025
C15	V3 triode and V4 CG's decoupling	0·25
C16	AF coupling condensers to V3 triode	0·02
C17		0·02
C18	IF by-pass condensers	0·00015
C19		0·00025
C20	Part of variable tone control	0·01
C21	V3 triode to V4 AF coupling	0·01
C22	V4 to V5 AF coupling	0·01
C23	V3 triode to V6 AF coupling	0·01
C24*	V5, V6 cathodes by-pass	5·0
C25*	HT smoothing	16·0
C26*		8·0
C27*	Auto GB circuit by-pass	25·0
C28	Mains RF by-pass	0·01
C29‡	Aerial SW (manual) trimmer	—
C30‡	Aerial circuit MW (manual) trimmer	—
C31‡	Aerial circuit LW trimmer	—
C32†	Aerial circuit manual tuning	—
C33†	Oscillator circuit manual tuning	—
C34‡	Osc. circuit SW trimmer	—
C35‡	Osc. circuit MW (manual) trimmer	—
C36‡	Osc. circuit LW trimmer	—
C37‡	Osc. circuit SW tracker	—
C38‡	Osc. circuit MW tracker	—
C39‡	Osc. circuit LW tracker	—
C40‡	1st IF trans. pri. trimmer	—
C41‡	1st IF trans. sec. trimmer	—
C42‡	2nd IF trans. pri. trimmer	—
C43‡	2nd IF trans. sec. trimmer	—
C44‡		
C45‡	Aerial circuit MW automatic tuning trimmers	—
C46‡		
C47‡		
C48‡		
C49‡	Aerial circuit LW automatic tuning trimmers	—
C50‡		
C51		0·00005
C52‡		
C53‡	Oscillator circuit MW automatic tuning trimmers	—
C54‡		
C55‡		
C56‡		
C57‡	Oscillator circuit LW automatic tuning trimmers	—
C58‡		

* Electrolytic. † Variable. ‡ Pre-set.



Under-chassis view. Diagrams of the press-button switch unit are on this side of this sheet. The three trimmers at the top are **C34-C36**, while **C29-C31** are beneath the switch unit. The adjusting screws of the station trimmers **C44-C50** and **C52-C58** are all indicated. **C37-C39** are adjustable through holes in the chassis deck. Note the components beneath the station trimmer assembly.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial anti-modulation choke	20·0
L2	Aerial circuit SW tuning coil	0·1
L3	Aerial circuit MW tuning coil	3·0
L4	Aerial circuit LW tuning coil	17·0
L5	Osc. circuit SW tuning coil	0·1
L6	Osc. circuit MW tuning coil	3·0
L7	Osc. circuit LW tuning coil	5·0
L8	Oscillator SW reaction coil	0·5
L9	Oscillator MW reaction coil	1·0
L10	1st IF trans. Pri.	9·0
L11	1st IF trans. Sec.	11·0
L12	2nd IF trans. Pri.	12·0
L13	2nd IF trans. Sec.	9·0
L14	Speaker speech coil	2·0
L15	Hum neutralising coil	0·15
L16	Speaker field coil	1,000·0
T1	Speaker input trans. Pri., total	660·0
	Speaker input trans. Sec.	0·5
T2	Mains trans. Pri., total	17·5
	Mains trans. Heater sec.	0·05
	Mains trans. Rect. heat. sec.	0·1
	Mains trans. HT sec., total	200·0
S1a, b, c, x S18, a, b, x	SW manual button groups	—
S2a, b, c S19a, b, c, x	MW manual button groups	—
S3a, b S20a, b, x	LW manual button groups	—
S4a, b S8a, b S11a, b, x S15a, b, x	MW automatic button groups	—
S9a, b S10a, b S16a, b, x S17a, b, x	LW automatic button groups	—
S21a	Gram PU switch	—
S22	Mains switch, ganged R16	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 230 V, using the 220-230 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.

If, as in our case, **V2** should become unstable when its screen current is being measured, it can be stabilised by connecting a non-inductive condenser of about 0.1 μF from grid (top cap) to chassis.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6A8G	248	4·9	102	3·8
	Oscillator 133	3·8		
V2 6U7G	248	7·0	102	1·8
V3 6Q7G	100	0·5	—	—
V4 6C5G	50	0·8	—	—
V5 6V6G	235	26·0	248	1·7
V6 6V6G	235	25·0	248	1·7
V7 5Y3G	328†	—	—	—
T.I. 6G5	40	0·8	—	—
	Target 248	1·3		

† Each anode, AC.

GENERAL NOTES

Switches.—All the switches, with the exception of **S22,** the mains switch, are of the press-button type, and are contained in a single double-sided unit mounted inside the front of the chassis. The switches controlled by each press-button are assigned a number, followed by a suffix letter **a, b, c** or **x.** The **a, b** and **c** switches *close* when their button is pressed, while the **x** switches *open* when their button is pressed.

The action of the switches is explained in detail under "Circuit Description."

The switch unit is indicated in our under-chassis view, but for identification of the individual switches the diagrams on this side of this sheet must be consulted. These diagrams are of the two sides of the switch unit. The lower one shows the switches seen when looking at the underside of the chassis, while the upper one shows the switches on the unit which are normally hidden from view by the chassis deck.

To examine these, the whole switch unit must be removed. First unsolder the fourteen leads from the pre-set station trimmers tags and remove the trimmer assembly (two screws). Now code in a rough sketch the remaining external connecting wires to the switch unit and unsolder them. Then remove the screws holding the two banks of three trimmers (above and below the switch unit) and the two screws holding the unit to the chassis. *When replacing,* note that each wire from the switch unit to the pre-set station trimmers goes straight across to the nearest tag.

S22 is the QMB mains switch, ganged with the volume control **R16.**

Coils.—**L1** is beneath the chassis, close to the aerial lead entry point. **L2-L4**; **L5-L9** and the IF transformers **L10, L11** and **L12, L13,** are in four screened units on the chassis deck. The second unit also contains **R6, C8,** while the IF units contain their associated trimmers.

Scale Lamps.—These are two National Union miniature bayonet cap types, marked N51. The rating is presumably 6-8 V, 0·3 A.

External Speaker.—Two sockets are pro-

vided at the rear of the chassis for a high impedance (10,000 O) external speaker.

Condensers C25, C26.—These are two dry electrolytics in a single tubular metal case on the chassis deck. Beneath the chassis there are three tags. That spotted black is the common negative; that spotted red is the positive of **C25** (16 μF); while the plain tag is the positive of **C26** (8μF).

Condensers C24, C27.—These are two dry electrolytics (35V working) in a single carton beneath the chassis, having a common negative (black) lead. The red lead is the positive of **C24** (5μF), while the yellow lead is the positive of **C27** (25μF).

Trimmers.—The fourteen pre-set station trimmers are mounted beneath a metal strip across the underside of the chassis. These are **C44** to **C50** and **C52** to **C58.** In addition, there is a small fixed trimmer (**C51**) connected across **C52.** The adjusting screws of these pre-set trimmers are indicated in our under-chassis view.

The aerial circuit (manual) trimmers (**C29-C31**) are in a row below the press-button switch unit (looking from the underside of the chassis), while the oscillator circuit (manual) trimmers (**C34-C36**) are in a similar row above the switch unit. All six trimmers are adjustable through holes in the front of the chassis.

Trackers.—The three variable trackers (**C37-C39**) are mounted beneath the chassis, and are adjustable through holes in the chassis deck.

EARLY CHASSIS DIVERGENCIES

A few chassis went out at the beginning of the run with a rather different circuit. Our sheet has been prepared from one of the later chassis, which can be identified by the fact that the screw holding the **L1** unit at the back of the chassis has a black washer underneath its head, while the early models have no such washer. The arrangement of the press-buttons is also different. Reading from left to right, looking at the front of the set, our chassis has buttons as follows: Three MW pre-set; gram; SW; MW; two MW pre-set; LW; two LW pre-set. The arrangement in the early chassis was: Three MW pre-set; Gram; SW; MW; LW; two MW pre-set; two LW pre-set.

In early chassis **V3** was a 6R7G, not a 6Q7G. The aerial coupling on SW was different, the bottom end of **L2** being taken to the junction of **R2, C3** and **S1x,** and its leads being omitted. The oscillator switching and coil arrangements were also slightly different.

A resistance and condenser in series were across the primary of **T1.** **C18** was omitted and the bias resistor **R29** was 50 O. **C20** was 0·05 μF. **C2** was 0·0005 μF. Trackers **C37** and **C38** were interchanged in position.

RADIOGRAM 775 MODIFICATIONS

The only difference in the 775 radiogram (apart from the inclusion of a 2,000 O pick-up and a motor) is that the speaker is a 10 in. model, instead of the 8 in. model used in the 772. Its resistance values remain the same.

CIRCUIT ALIGNMENT

IF Stages.—Remove the grid (top cap) connection of **V1,** and connect a 0·5 MO resistor between the connection and the cap. Connect signal generator between the cap (via a 0·00025 μF condenser) and chassis. Switch set to MW, and turn gang and volume control to maximum.

Feed in a 465 KC/S signal, and adjust **C43, C42, C41** and **C40** for maximum output. Re-check these settings, then remove the 0·5 MO resistor and replace top cap.

RF and Oscillator Stages.—With the gang at maximum, pointer should be at the right hand terminations of the horizontal scales. Connect signal generator to **A** and **E** leads, via a suitable dummy aerial. Turn volume control to maximum.

SW.—Since the SW tracker is in series with the MW and LW trackers it is essential to align the SW band first.

Switch set to SW, tune to 15 MC/S on scale, and feed in a 15 MC/S (20 m) signal. Adjust **C34** for maximum output, using the peak involving the least trimmer capacity. Now adjust **C29** for maximum.

Feed in a 6 MC/S (50 m) signal, tune it in, and adjust **C37** for maximum output, while rocking the gang for optimum results. Return to 15 MC/S and re-check **C29** and **C34.** Repeat until no further improvement results.

MW.—Switch set to MW and tune to 250 m on scale. Feed in a 250 m (1,200 KC/S) signal, and adjust **C35,** then **C30** for maximum output. Feed in a 520 m (580 KC/S) signal, tune it in, and adjust **C38** for maximum output, while rocking the gang for optimum results. Return to 250 m and re-check **C35** and **C30.** Repeat until no further improvement results.

LW.—Switch set to LW, and tune to 1,250 m on scale. Feed in a 1,250 m (240 KC/S) signal, and adjust **C36,** then **C31,** for maximum output. Feed in a 2,000 m (150 KC/S) signal, tune it in, and adjust **C39** for maximum output, while rocking the gang for optimum results. Return to 1,250m and re-check **C36** and **C31.** Repeat until no further improvement results.

STATION SETTING

In the model 772 the station trimmers may be adjusted through holes in the bottom of the cabinet. In radiogram model 775 it is necessary to withdraw the chassis to re-set the trimmers.

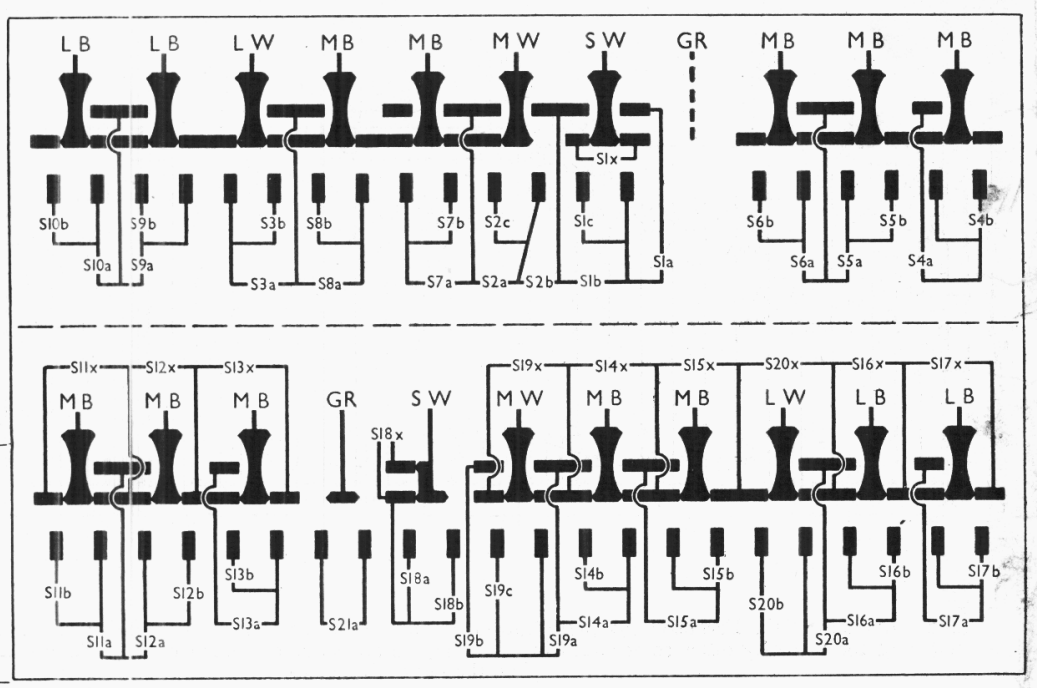
Looking at the front of the set, the first three buttons counting from the left cover wavebands of 200-300 m, 250-350 m and 300-400 m respectively. The seventh and eighth buttons cover 350-500 m and 400-550 m. The tenth and eleventh buttons (LW) cover 1,000-1,600 m and 1,400-2,000 m respectively.

The trimmer screws are indicated in our underchassis view. Thus **C44** and **C52** belong to the first button (200-300 m) while **C50** and **C58** belong to the eleventh button (1,400-2,000 m).

Select the button covering the wavelength of the required station, and adjust the corresponding oscillator trimmer until the station is heard. Then adjust the corresponding aerial trimmer for maximum output. Finally readjust both trimmers.

If the station to which the button is being adjusted is not very strong, it may be difficult to hear it on the oscillator trimmer while its aerial trimmer is far off tune. It may then be necessary to tune both trimmers to the nearest strong known station, and then to take the aerial trimmer up or down in small steps, searching on the oscillator trimmer for the required station at each step.

Alternatively, a signal generator may be used for rough adjustment, and then final check can be made on the station itself.



Diagrams of both sides of the press-button switch unit. The lower view is that as seen when looking at the underside of the chassis. The upper view is that seen if the switch unit is removed from the chassis and turned over.