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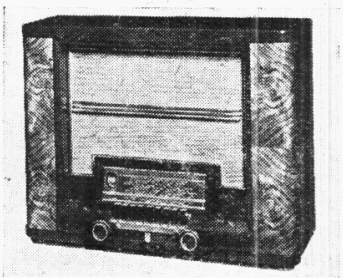
"TRADER" SERVICE SHEET

438

PHILIPS 735A AND 711A RADIOGRAM



The Philips 735A table receiver.

THE Philips 735A is a table 3-band AC superhet, with the new Philips mechanical automatic tuning unit, having six keys for station selection (three of which are for MW and three for MW or LW stations), together with three keys for manual waveband switching.

The set employs four valves, plus valve rectifier, one of the valves being a combined AF amplifier and tuning indicator. The SW range is 13.8-51m, and the set is suitable for 100-260 V, 50-100 C/S AC mains.

A similar chassis is used in the 711A radiogram, the differences being explained under "Radiogram Divergencies."

Release Dates: 735A, *August*, 1939; 711A, *September*, 1939.

Note.—When ordering spares for these models, dealers quoting our component numbers should mention that they are *Trader* Service Sheet numbers, to avoid confusion.

CIRCUIT DESCRIPTION

Aerial input on MW and LW is via coupling coils **L2** and **L3** to mixed-coupled band-pass filter. Primary coils **L4, L5** are tuned by **C39**; secondaries **L10, L11** by **C41.** Coupling by condensers **C3, C4** and coils **L6, L7.** Image suppression by **C1.** IF filtering by **L1, C37** across aerial circuit.

On SW, input is via coupling coil **L8** to single tuned circuit **L9, C41.**

First valve (**V1, Mullard ECH3**) is a triode heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L15** (SW), **L16** (MW), and **L17** (LW) are tuned by **C46**; parallel trimming by **C44** (MW) and **C12, C45** (LW); series tracking by **C10, C42** (MW), and **C11, C43** (LW). Reaction by coils **L12** (SW), **L13** (MW), and **L14** (LW).

Second valve (**V2, Mullard EF9**) is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C47, L19, L20, C48,** and **C49, L22, L23, C50.**

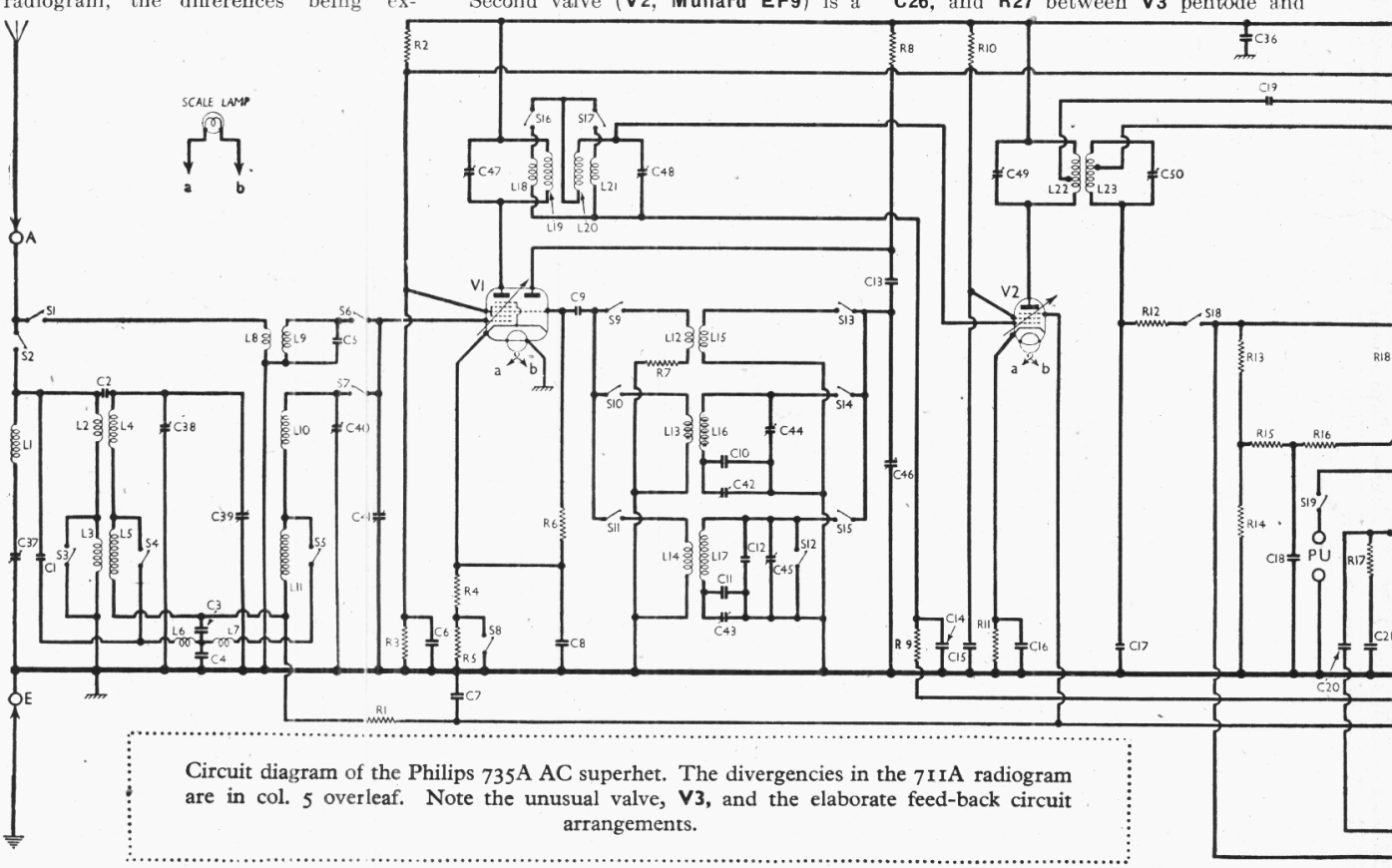
Intermediate frequency 128KC/S.

Coils **L18** and **L21** are coupled alternatively via switches **S16, S17** to the coils of the first IF transformer to provide a two-position selectivity control.

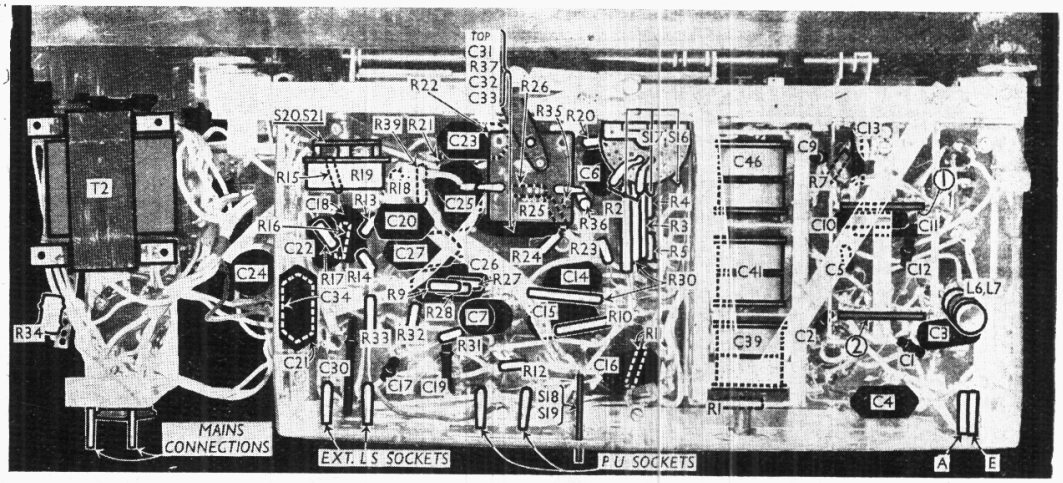
Diode second detector is part of double diode output pentode valve (**V4, Mullard EBL1**). Audio frequency component in rectified output is developed across load comprising resistances **R13, R14** in parallel with output limiting resistance **R18** and manual volume control **R19,** and passed via AF coupling condenser **C22** to control grid of pentode section of cathode ray tuning indicator (**V3, Mullard EFM1**), the pentode amplifier section of which operates as AF amplifier in the receiver circuit.

IF filtering by **C17, R12.** Tone compensation by **R15, C18, R16,** and **R17, C21.** Provision for connection of gramophone pick-up across **R19** via **S19,** which closes, while **S18** opens to mute radio, when the gram switch lever is moved upwards.

Resistance-capacity coupling by **R24, C26,** and **R27** between **V3** pentode and



Circuit diagram of the Philips 735A AC superhet. The divergencies in the 711A radiogram are in col. 5 overleaf. Note the unusual valve, **V3,** and the elaborate feed-back circuit arrangements.



Under-chassis view. Diagrams of the wavechange and radio/gram switch units are in column 3 overleaf. **R22** is the lever-operated tone control. **R30** consists of two resistors in series.

pentode section of **V4**. Fixed tone correction in anode circuit by **C29**. Variable tone control by **C30, C34** and **R22** between **V4** anode and **V3** cathode circuit. Provision for connection of low impedance external speaker across speaker secondary of output transformer **T1**.

A second secondary on **T1** provides voltages for negative and positive feed-back, which are introduced at various points in one of the earlier stages of the receiver. This secondary has four outlets, one of which is connected to chassis so that those either side of it are in opposite phase to one another; that which is returned to **C20** and **R19** introduces negative feed-back, while positive feed-back is introduced at the junction of **S18** and **R13, R18**.

The effect of this latter voltage becomes more pronounced as the volume control is advanced, until at maximum position the negative and positive voltages in the circuit neutralise each other, and maximum gain is established between **V3** pentode CG and the output circuit.

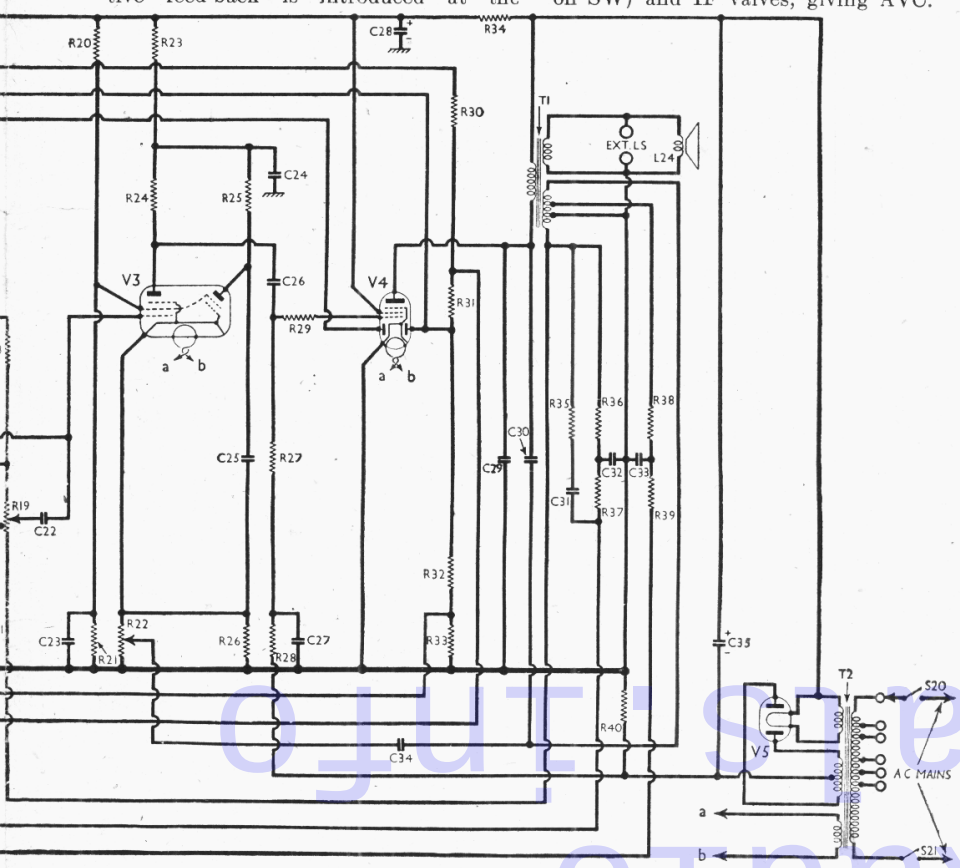
The resistances **R35, R36, R37, R38** and **R39** together with condensers **C31, C32** and **C33** correct the frequency response of the feed-back voltages.

Second diode of **V4**, fed from tapping on **L22** via **C19**, provides DC potentials which are developed across load resistances **R32** and **R33** and fed back through decoupling circuits as GB to FC (except on SW) and IF valves, giving AVC.

Delay voltage is obtained from potential divider comprising resistances **R30, R31, R32, R33** which is connected across **R3**. This biases the diode anode positively, and the diode is thus prevented from rectifying the applied signal until the signal exceeds the delay in magnitude. The positive potential thus applied to **V1** and **V2** control grids is offset by correspondingly high GB resistances in their cathode circuits.

HT current is supplied by full-wave rectifying valve **(V5, Philips AZ1)**. Smoothing by two electrolytic condensers **C28, C35,** and resistance **R34**.

GB potential for **V4** pentode is obtained from drop along resistance **R40**.



COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 heptode CG decoupling	100,000
R2	HT potential divider resistances	47,000
R3		33,000
R4	V1 fixed GB resistances	330
R5		150
R6	V1 osc. CG resistance	47,000
R7	Oscillator SW reaction damping	15
R8	V1 osc. anode HT feed	27,000
R9	V2 CG decoupling	1,800,000
R10	V2 SG HT feed resistance	100,000
R11	V2 fixed GB resistance	120
R12	IF stopper	220,000
R13	V4 signal diode load resistances	270,000
R14		390,000
R15	Parts of tone compensator circuit	1,500,000
R16		1,000,000
R17		22,000
R18	Volume control limiter	180,000
R19	Manual vol. control, total	700,000*
R20	V3 SG HT feed potential divider	330,000
R21		470,000
R22	Variable tone control	50,000
R23	V3 anode and target HT feed resistance	39,000
R24	V3 pentode anode load	120,000
R25	V3 T.I. target HT feed	47,000
R26	V3 pentode GB resistance	1,000
R27	V4 CG resistance	470,000
R28	V4 CG decoupling	180,000
R29	V4 grid stopper	1,000
R30	Parts of HT potential divider for AVC delay	9,400,000†
R31		1,000,000
R32	V4 AVC diode load resistances	470,000
R33		470,000
R34	V1, V2, V3 (and V4 SG) HT feed	1,500
R35	Feed-back feed resistances	3,300
R36		1,500
R37		4,700
R38		10,000
R39		820,000
R40	V4 auto GB resistance	100

* Tapped at 50,000 Ω from low potential end
† Made up of two 4,700,000 Ω resistances in series

	CONDENSERS	Values (μF)
C1	Image rejector	0·000039
C2	Aerial "top" coupling ...	0·00001
C3	Band-pass coupling con-	0·012
C4	densers	0·039
C5	Aerial circuit SW trimmer	0·0000022
C6	V1 SG decoupling	0·047
C7	AVC line decoupling ...	0·1
C8	V1 cathode by-pass... ...	0·047
C9	V1 osc. CG condenser ...	0·000047
C10	Osc. circuit MW fixed tracker	0·001362
C11	Osc. circuit LW fixed tracker	0·000325
C12	Osc. circuit LW fixed trimmer	0·000012
C13	V1 osc. anode coupling ...	0·00047
C14	V2 CG decoupling	0·068
C15	V2 SG decoupling	0·047
C16	V2 cathode by-pass... ...	0·047
C17	IF by-pass	0·000056
C18	Part of tone compensator	0·068
C19	Coupling to V4 AVC diode	0·000018
C20	Part feed-back coupling	0·056
C21	Part of tone compensator	0·18
C22	AF coupling to V3 pentode	0·033
C23	V3 SG decoupling	0·056
C24	V3 pent. anode decoupling	0·18
C25	V3 T.I. target decoupling...	0·18
C26	V3 pent. to V4 AF coupling	0·047
C27	V4 CG decoupling	0·22
C28*	HT smoothing condenser ...	32·0
C29	Fixed tone corrector ...	0·0047
C30	Part of variable tone control	0·00033
C31	Feed-back tone corrector	0·0022
C32	condensers	0·022
C33		0·01
C34	Part of variable tone control	0·0039
C35*	HT smoothing condenser ...	50·0
C36	HT circuit RF by-pass ...	0·001
C37‡	Aerial IF filter tuning ...	0·0001
C38‡	Band-pass pri. MW trimmer	0·00002
C39†	Band-pass pri. tuning ...	0·00049
C40‡	Band-pass sec. MW trimmer	0·00002
C41†	Band-pass sec. and aerial SW tuning	0·00049
C42‡	Osc. circuit MW tracker ...	0·0002
C43‡	Osc. circuit LW tracker ...	0·0002
C44‡	Osc. circuit MW trimmer ...	0·00002
C45‡	Osc. circuit LW trimmer ...	0·00002
C46†	Oscillator circuit tuning ...	0·00049
C47‡	1st IF trans. pri. tuning ...	0·0001
C48‡	1st IF trans. sec. tuning ...	0·0001
C49‡	2nd IF trans. pri. tuning ...	0·0001
C50‡	2nd IF trans. sec. tuning ...	0·0001

* Electrolytic. † Variable. ‡ Pre-set.

	OTHER COMPONENTS	Approx. values (ohms)
L1	Aerial IF filter coil ...	110·0
L2	Aerial MW and LW	26·0
L3	coupling coils	90·0
L4	Band-pass primary coils	4·5
L5		48·0
L6	Band-pass coupling coils	0·7
L7		0·7
L8	Aerial SW coupling coil...	2·0
L9	Aerial SW tuning coil ...	0·1
L10	Band-pass secondary	4·4
L11	coils	45·0
L12	Oscillator SW reaction ...	1·0
L13	Oscillator MW reaction...	2·0
L14	Oscillator LW reaction...	8·5
L15	Osc. circuit SW tuning coil	0·1
L16	Osc. circuit MW tuning coil	8·0
L17	Osc. circuit LW tuning coil	32·0
L18	Variable selectivity coil...	23·0
L19	1st IF Pri.	125·0
L20	trans. Sec.	125·0
L21	Variable selectivity coil...	23·0
L22	2nd IF Pri., total...	130·0
L23	trans. Sec., total...	135·0
L24	Speaker speech coil ...	3·5
T1	Output Pri.	800·0
	trans. Speaker sec....	1·5
	Feed-back sec., total	850·0
T2	Mains. Pri., total ...	47·0
	trans. Heater sec. ...	0·1
	Rect. heat sec.	0·15
	H.T. sec., total	300·0
S1–S15	Waveband switches ...	--
S16, S17	Variable selectivity switches	--
S18, S19	Radio/gram change switches	--
S20, S21	Mains switches, ganged R19...	--

DISMANTLING THE SET

The cabinet is fitted with a detachable bottom, upon removal of which access can be gained to most of the components beneath the chassis.

Removing Chassis.—Remove the four screws (with rubber and metal washers) holding the mains transformer, the two screws (with metal washers) holding the power supply assembly, and the two screws (with metal cup washers and rubber washers) holding the chassis, to the bottom of the cabinet. Then remove the eight screws (with metal washers) holding the front cabinet moulding, on which is mounted the complete receiver assembly, to the corners of the cabinet surround, when the assembly may be withdrawn as a single unit.

When replacing, note that a thick rubber washer is fitted on each of the two chassis fixing screws between the chassis and the bottom of the cabinet.

Removing Speaker.—Unsolder from the speaker connecting panel the two leads connecting it to the output transformer and slacken the four square nuts (with square lock-nuts) holding the fixing clamps to the speaker rim.

When replacing, the connecting panel should point to the output transformer. The black lead should be connected to the bottom tag, and the yellow lead to the two upper tags.

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 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength 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 ECH3	245	1·25	67	1·5
	Oscillator			
	125	4·5		
V2 EF9	245	6·0	77	1·7
V3 EFM1	57	0·8	38	0·7
	Target			
	136	0·4		
V4 EBL1	247	36·0	245	4·3
V5 AZ1	265†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—S1—S15 are the waveband switches, ganged in two rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams in col. 3, where they are drawn as seen looking from the rear of the underside of the chassis.

The table (col. 3) gives the switch positions for the three wavebands, when the appropriate waveband keys are depressed. A dash indicates open, and **C** closed.

S16, S17 are the variable selectivity switches in a small unit beneath the chassis, controlled by a bakelite lever beneath the horizontal tone control operating disc. In the maximum selectivity position (bakelite lever to the left) **S17** is closed, and **S16** open, while in the "broad" position (lever to right, **S16** is closed and **S17** open.

S18, S19 are the radio/gram change switches, in a small unit at the rear of the chassis, operated by a metal lever. A diagram of the unit, looking at the underside of the chassis from the mains input end, is below. In the radio position (switch lever towards base of cabinet), **S18** is closed and **S19** open. In the gram. position (switch lever up) **S19** is closed, and **S18** is open.

S20, S21 are the QMB mains switches, ganged with the volume control **R19.**

Coils.—All the coils, except **L6, L7,** are mounted on the chassis deck. **L1** is in an unscreened unit, while **L2-L5; L8, L9; L10, L11; L12, L15; L13, L14, L16, L17** and the IF transformers **L18-L21** and **L22, L23** are in seven screened units on the chassis deck.

L6, L7 are in an unscreened tubular unit beneath the chassis.

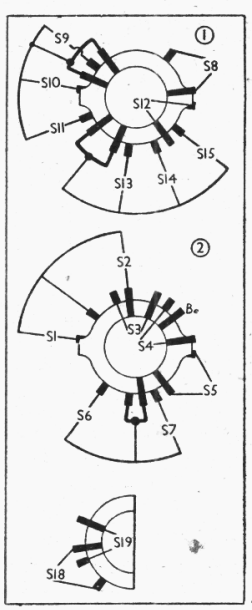
Scale Lamp.—This is a Philips M.E.S. type, Part No. 8091 D, mounted in a black moulded holder fitting into a moulded bracket on the chassis deck. The lamp can be removed by rotating the holder anti-clockwise, and withdrawing it towards the back of the chassis.

External Speaker.—Two sockets are provided at the rear of the chassis for a low impedance (5—7 O) external speaker.

Tone Control R22.—This is operated

SWITCH TABLE

SWITCH	LW	MW	SW
S1	—	—	C
S2	C	—	—
S3	—	C	C
S4	—	—	—
S5	—	C	—
S6	—	—	C
S7	C	C	—
S8	—	—	C
S9	—	—	C
S10	—	C	—
S11	C	—	—
S12	—	C	—
S13	—	—	C
S14	—	C	—
S15	C	—	—



Diagrams of the two wavechange switch units, seen from the rear of the underside of the chassis, and (bottom) the **S18, S19** unit, seen from the **T2** end of the chassis.

through a link system by a horizontal milled disc beneath the keyboard. It is a carbon-type potentiometer.

Valve V3.—Note that the EFM1 is a combined pentode AF amplifier and tuning indicator. It is fitted with the usual "E" type base, and the contact connections, looking at the underside of the base, and numbering as usual are: 1, metallising; 2, heater; 3, heater; 4, cathode; 5, target; 6, control grid; 7, screen grid; 8, anode. Note that although contact 1 is stated by the makers to be the metallising contact, the EFM1 fitted is not metallised.

Resistance R30.—This consists of two 4,700,000 Ω resistances in series.

Condensers C42, C43.—These are two wire-wound pre-set condensers mounted on the chassis deck.

Condenser C29.—This is mounted on the output transformer **T1**, on the baffle to the right of the speaker.

Chassis Divergencies.—**R14** is not shown in the makers' diagram, **R13** being taken direct to chassis. **R15**, instead of going to the junction of **R13, R14**, goes to the junction of **R18** and **R19** in their diagram. The other connections of **R15, R16** and **C18** remain as in our diagram. **R21** is omitted from the makers' diagram, as is also **C36**. The makers' diagram shows a 100 Ω surge limiting resistor in series with the HT positive line between **V5** heater secondary and the top of **C35**; this was not present in our chassis. The lower end of **C30**, in the makers' diagram, is returned to the opposite side of **C34**, that is, to the slider of **R22**.

AUTO-TUNING ADJUSTMENT

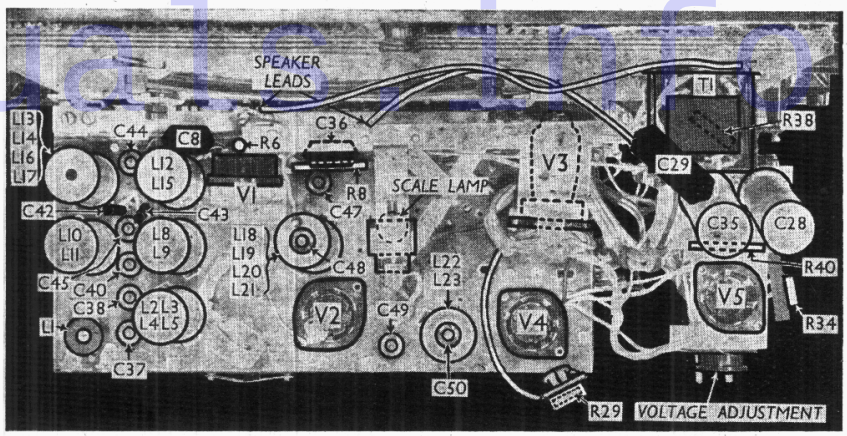
The first six keys, from left to right, are for station selection. The remaining three keys are for manual waveband switching. Of the six station keys, the first three can be adjusted for MW or LW stations; the remaining three are for MW stations only.

To adjust a station key (without altering the waveband to which it is set, if it is one of the first three), use the tool which is kept in a hole in the back of the receiver at the top left-hand corner. Press down the key concerned, and insert the adjusting tool into the aperture underneath the keyboard, immediately below the key concerned.

Rotate the tool until it engages with the head of the adjusting screw (this can be felt), then turn it one way or the other until the required station is tuned in. The pointer and tuning indicator will show when the desired station is tuned accurately. Do not press on the tool more than is necessary to keep it engaged with the adjusting screw. When the station is tuned, withdraw the tool.

The head of the tool is recessed to fit the ornamental-headed screws holding the station name escutcheon in place, and can be used to remove these screws when it is desired to change a name.

To change the waveband covered by any one of the three left-hand keys, the same tool is used, but this time the key must not be depressed. If it is, first release it by pressing any other key. Then insert the tool through the aperture as before. To change the key from LW to MW operation, turn the tool anti-clockwise (unscrew) about five complete turns. To change from MW to LW, insert the tool, press it forward, and rotate it clockwise until it is tight.



Plan view of the whole assembly, with the speaker removed. **C42, C43** are wire-wound condensers.

RADIOGRAM DIVERGENCIES

Model 711A radiogram has a chassis very similar to that of the 735A, but is suitable for 50-60 C/S mains only, and is fitted with a 10-in speaker. The radiogram switch unit is as shown in our illustrations, but is operated remotely.

There is a switch for cutting out the internal speaker when desired by breaking its speech coil circuit. At the same time two 39 Ω resistances in parallel are connected across **T1** secondary.

Condenser **C20** is omitted, the junction between **R37** and **C31** being connected direct to the tap on **R19**. Between the slider of **R19** and the HT negative line (centre tap of HT secondary of **T2**) are connected a 22,000 Ω resistor and a 0.0033μF condenser in series.

CIRCUIT ALIGNMENT

IF Stages.—Press MW key, tune to 180m on scale, turn volume control to maximum, and switch set to minimum band-width (maximum selectivity).

Connect signal generator to control grid (top cap) of **V1**, and chassis. Connect an 80$\mu\mu$F condenser across **C49**, feed in a 128 KC/S signal, and adjust **C50** for maximum output. Now connect the 80$\mu\mu$F condenser across the larger portion of **L23** (or from **V4** signal diode to chassis), and adjust **C49** for maximum output. Remove the 80$\mu\mu$F condenser, and adjust **C48**, then **C47**, for maximum output. Seal all the IF trimmers.

RF and Oscillator Stages.—Connect signal generator to **A** and **E** sockets, via a suitable dummy aerial. Turn volume control to maximum. For setting the gang accurately at the lower wavelength end of each band a special trimming jig will be necessary (Part No. 2V.351.063). For certain adjustments an auxiliary receiver will be required.

MW.—Press MW key and tune to 180m on scale. Fit trimming jig to the rear of the gang spindle, so that it acts as a distance piece between the large washer secured to the end of the spindle and the rear-end plate of the gang assembly. Turn back the gang until it rests on the jig. Feed in a 1,600 KC/S (187.5m) signal, and adjust **C44, C40** and **C38** in turn for maximum output. Repeat these adjustments.

Remove trimming jig and feed in a 546 KC/S (550m) signal. Connect aerial socket of an auxiliary receiver, via a 25$\mu\mu$F condenser, to hexode anode (contact 8) of **V1**, and connect output meter to the output of auxiliary receiver. Tune both receivers to about 550m, then accurately adjust the tuning of the 735A receiver for maximum output on the output meter of the auxiliary receiver. *Without disturbing the tuning of the 735A receiver*, disconnect auxiliary receiver, and connect output meter to the 735A. Adjust **C42** (by altering the length of its wire winding) for maximum output. Finally, readjust **C44** as described above, using the trimming jig.

LW.—Press LW key. Connect aerial socket of auxiliary receiver via a 25$\mu\mu$F condenser to hexode anode of **V1**, and connect output meter to auxiliary receiver. Feed a 400 KC/S (750m) signal into **A** and **E** sockets of the 735A receiver, tune both receivers to about 750m, then tune the 735A accurately for maximum output from the auxiliary receiver. *Without disturbing the tuning of the 735A receiver*, disconnect auxiliary receiver, and connect output meter to the 735A. Adjust **C45** for maximum output. Re-connect auxiliary receiver as described earlier, with an output meter, and feed a 160 KC/S (1,875m) signal to the 735A. Tune both sets to about 1,875m, then adjust the 735A accurately for maximum output from the auxiliary receiver. *Without disturbing the tuning of the 735A receiver*, disconnect auxiliary receiver, and connect output meter to the 735A. Adjust **C43** (by altering the length of its wire winding) for maximum output. Finally, re-adjust **C45** as described above.

IF Filter.—Feed a 128 KC/S signal into **A** and **E** sockets of the 735A, and adjust **C37** for *minimum* output.

Calibration.—Feed in a 566 KC/S (530m) signal, and tune it in accurately. Pointer should read 530m on scale. If not, adjust *horizontal* castellated-head screw at end of wire link to pointer arm until it does. Feed in a 1,250 KC/S (240m) signal and tune it in. Pointer should read 240m on scale. If not, adjust *vertical* castellated-head screw at end of wire link to pointer arm until it does. Repeat these adjustments until pointer registers accurately at 530m and 240m.

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