Supplement to The Wireless & Electrical Trader, June 28, 1947

"TRADER" SERVICE SHEET

817

PHILIPS 462A

3-BAND A.C. SUPERHET

THREE Continental type multiple valves with "Loctal" bases are used in the Philips 462A superhet, with a Mullard octal based rectifier. Brief details are given overleaf, and base diagrams are inset on the right of the circuit diagram below.

The three wavebands are 16.2-52 m, 190-575 m and 800-2,000 m, and the receiver is designed to operate from A.C. mains of 100-260 V, 50-100 c/s.

Release date and original price: March, 1947; £18 18s, plus £4 1s 4d purchase tax.

CIRCUIT DESCRIPTION

Aerial input on M.W. and L.W. via **L1, L2** and **C2** to mixed coupled band-pass filter. Primary coils **L3, L4** are tuned by **C30,** and secondary coils **L7, L8** by **C33.** Coupling by capacitors **C4** (M.W.), and **C3** (L.W.) in conjunction with coils **L9, L10.** Image rejection by **C1.** On S.W., input is via coupling coil **L5** to single tuned circuit **L6, C33.**

First valve **(V1, Mullard ECH21)** is a triode heptode operating as frequency changer with injector grid coupling between triode and heptode sections.

Triode oscillator anode coils **L15** (S.W.), **L16** (M.W.) and **L17** (L.W.) are tuned by **C40.** Parallel trimming by **C37** (S.W.), **C38** (M.W.) and **C12, C39** (L.W.); series tracking by **C11, C35** (M.W.) and **C36** (L.W.). Tracking on S.W. by **C34.** Reaction coupling by **L12** (S.W.), **L13** (M.W.) and **L14** (L.W.).

Second valve **(V2, Mullard ECH21)** is another triode heptode, in which the heptode section operates as a variable-mu intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C7, L18, L19, C8** and **C15, L20, L21, C16.**

Intermediate frequency 470 kc/s.

Diode second detector is part of double diode pentode output valve **(V3, Mullard EBL21).** Audio frequency component in rectified output is developed across manual volume control **R8,** which acts as diode load resistor, and passed via A.F. coupling capacitor **C18** and C.G. resistor **R6** to C.G. of **V2** triode section, which operates as A.F. amplifier. I.F. filtering by **R12, C20** in diode circuit.

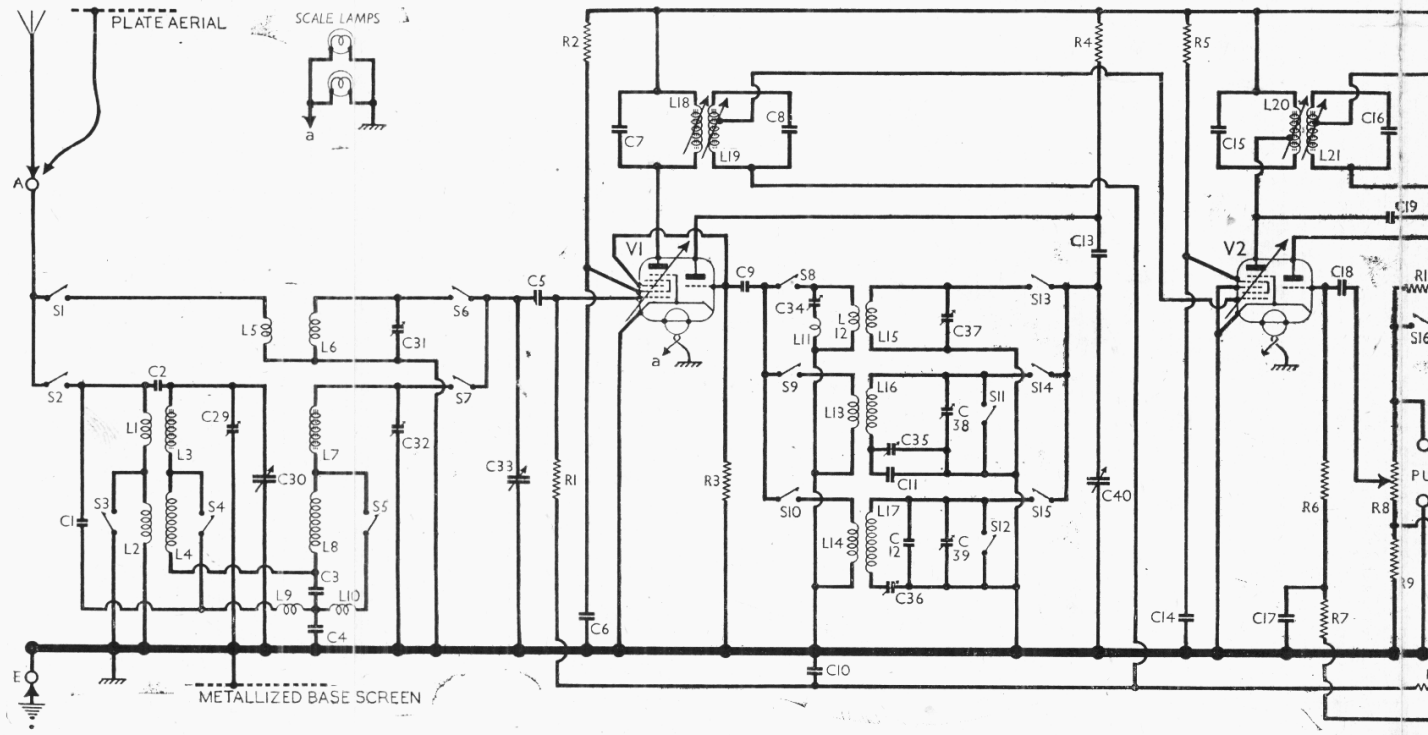
Provision for the donnection of a gramophone pick-up across **R8** by means of special sockets, one of which is associated with switches **S16, S17.** When the pick-up plug is inserted **S16** opens to connect the shunt resistor **R11,** and **S17** closes to mute radio.

Second diode of **V3,** fed from **V2** anode via **C19,** provides D.C. potential which is developed across load resistor **R18** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control.

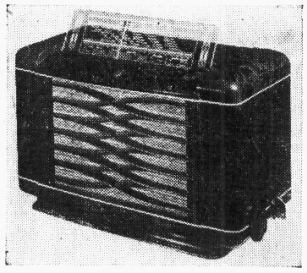
Resistance-capacitance coupling by **R14, C21, R15, R16** between **V2** triode and pentode section of **V3.** Variable tone control by **R15, C23** in C.G. circuit, and fixed tone correction in anode circuit by **C24.**

Voltages appearing across the secondary winding of the output transformer **T1** are applied to a frequency-discriminating network **L22, L23, R9,** and the voltages developed across **R9** are fed back to **V2** triode C.G. circuit in opposite phase to the input signals, giving negative feedback. Provision for the connection of a low impedance external speaker across the secondary winding of **T1.**

H.T. current is supplied by full-wave



Circuit diagram of the Philips 462A superhet. The plate aerial is a metal foil, like the base screen, in the cabinet, connected to a plug by a lead. **C34** is the oscillator circuit S.W. tracker. **S17** closes for pick-up work, muting radio and shunting **R11** across the pick-up in one op In most chassis, **S16** short-circuits **R11** on radio, but sometimes it is omitted. The three sections of the mains transformer primary are c the mains voltage adjustment pin panel as indicated by the letters **g** to **m**, although there are also several further connections between these do not show. A sketch of the panel is inset just above the mains transformer **T2,** where it is drawn as seen when viewed from the



The appearance of the Philips 462A superhet. The glass scale pulls straight out for dismantling.

rectifying valve **(V4, Mullard AZ31).** Smoothing by resistor **R17** and electrolytic capacitors **C26, C27,** residual hum being neutralized by passing the H.T. current through a portion of the output transformer primary winding. Fixed G.B. for **V1, V2, V3,** and A.V.C. delay voltage, is obtained from the drop along resistors **R19, R20** in the H.T. negative lead to chassis. Mains R.F. filtering by **C28.**

The mains transformer **T2** primary is wound in three isolated sections which are brought out to seven connections lettered **g, h, i, j, k, l, m** on the mains voltage adjustment panel. A rotating cap on the panel permits most mains voltages between 100 V and 260 V to be accommodated by interconnecting the contact pins on the panel.

COMPONENTS AND VALUES

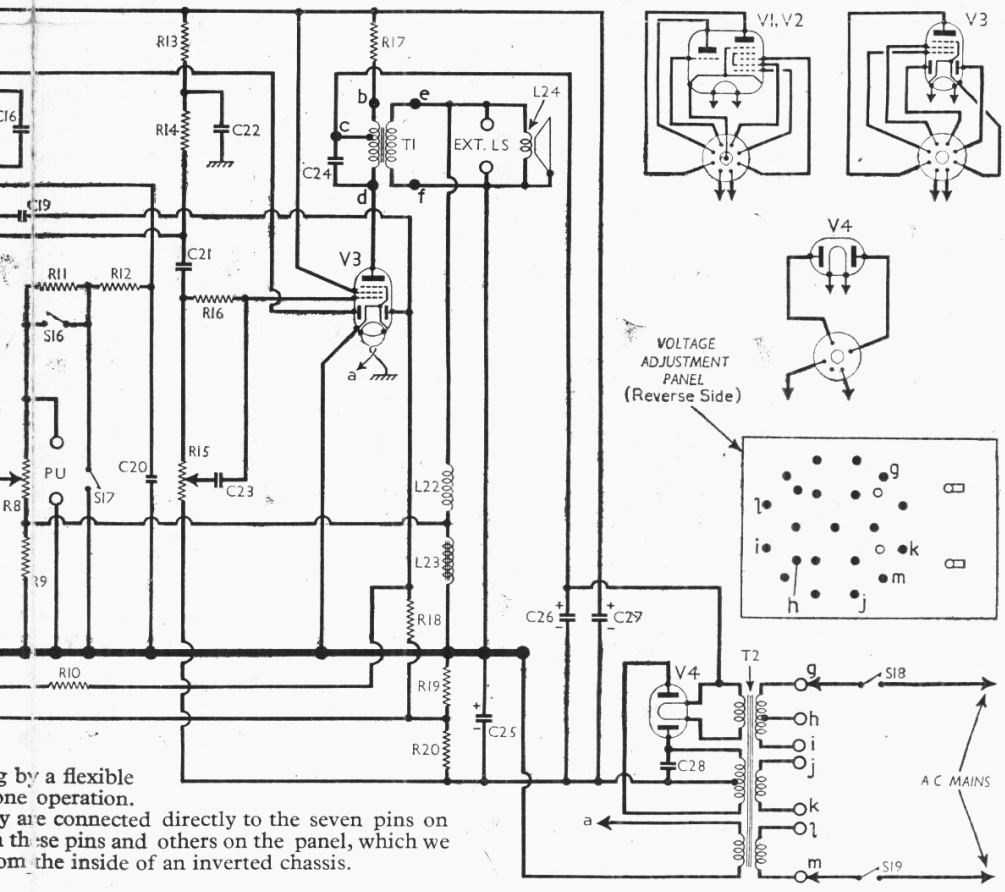
	CAPACITORS	Values (μF)
C1	Image suppressor	0·000012
C2	Aerial "top" coupling ...	0·00001
C3	Band-pass coupling capacitors ...	0·01
C4		0·039
C5	V1 hept. C.G. capacitor ...	0·00022
C6	V1 S.G. decoupling ...	0·047
C7	1st I.F. transformer fixed tuning capacitors ...	0·000102
C8		0·000102
C9	V1 osc. C.G. capacitor ...	0·000082
C10	A.V.C. line decoupling ...	0·047
C11	Osc. circ. M.W. fixed tracker	0·00033
C12	Osc. L.W. fixed trimmer...	0·000027
C13	V1 osc. anode coupling ...	0·00047
C14	V2 S.G. decoupling ...	0·047
C15	2nd I.F. transformer fixed tuning capacitors ...	0·000102
C16		0·000102
C17	V2 triode G.B. decoupling	0·047
C18	V2 triode C.G. coupling	0·01
C19	V3 A.V.C. diode coupling	0·000005
C20	I.F. by-pass capacitor ...	0·000082
C21	A.F. coupling to V3 pent.	0·022
C22	V2 triode H.T. decoupling	0·047
C23	Part variable tone control	0·0039
C24	Fixed tone corrector ...	0·001
C25*	V1, V2, V3 G.B. by-pass...	250·0
C26*	H.T. smoothing capacitors	47·0
C27*		47·0
C28	Mains R.F. by-pass ...	0·022
C29‡	B.-P. pri. M.W. trimmer...	0·00003
C30†	Band-pass primary tuning	—
C31‡	Aerial circ. S.W. trimmer	0·00003
C32‡	B.-P. sec. M.W. trimmer...	0·00003
C33†	Band-pass secondary tuning	—
C34‡	Osc. circ. S.W. tracker ...	0·0002
C35‡	Osc. circ M.W. tracker ...	0·0002
C36‡	Osc. circ. L.W. tracker ...	0·0002
C37‡	Osc. circ. S.W. trimmer ...	0·00003
C38‡	Osc. circ. M.W. trimmer ...	0·00003
C39‡	Osc. circ. L.W. trimmer	0·00003
C40†	Oscillator circuit tuning ...	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	V1 hept. C.G. resistor ...	820,000
R2	V1 S.G. H.T. feed ...	23,500*
R3	V1 osc. C.G. resistor ...	47,000
R4	V1 osc. anode H.T. feed	22,000
R5	V2 S.G. H.T. feed ...	39,000
R6	V2 triode C.G. resistor ...	2,200,000
R7	V2 triode G.B. decoupling	470,000
R8	Manual volume control	700,000
R9	Negative feed-back shunt	22
R10	A.V.C. line decoupling ...	1,500,000
R11	Pick-up shunt	100,000
R12	I.F. stopper	1,000,000
R13	V2 triode H.T. decoupling	100,000
R14	V2 triode anode load ...	100,000
R15	Variable tone control ...	500,000
R16	V3 C.G. stopper	120,000
R17	H.T. smoothing resistor...	1,200
R18	V3 A.V.C. diode load ...	820,000
R19	V1, V2, V3 fixed G.B. and A.V.C.-delay resistors	33
R20		68

* Two 47,000Ω resistors in parallel.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial M.W. and L.W. band-pass coupling coils ...	100·0
L2		150·0
L3	Band-pass primary coils ...	3·4
L4		50·0
L5	Aerial S.W. coupling coil...	2·0
L6	Aerial S.W. tuning coil ...	0·5
L7	Band-pass secondary coils	4·5
L8		45·0
L9	Band-pass coupling coils ...	1·025
L10		1·075
L11	Osc. S.W. reaction stabilizer	1·2
L12	Osc. S.W. reaction coil ...	2·1
L13	Osc. M.W. reaction coil ...	2·5
L14	Osc. L.W. reaction coil ...	4·7
L15	Osc. S.W. tuning coil ...	0·5
L16	Osc. M.W. tuning coil ...	7·5
L17	Osc. L.W. tuning coil ...	20·0
L18	1st I.F. trans. Pri. ...	9·0
L19	Sec., total	9·0
L20	2nd I.F. trans. Pri., total	9·0
L21	Sec., total	9·0
L22	Parts of negative feed-back circuit	155·0
L23		2·7
L24	Speaker speech coil ...	3·5
T1	Output trans. Pri., b-c... ...	22·0
	Pri., c-d... ...	800·0
	Sec., e-f... ...	0·7
T2	Pri., g-h ...	3·5
	Pri., h-i... ...	6·0
	Pri., j-k... ...	23·0
	Pri., l-m ...	21·0
	Heater sec. ...	0·2
	Rect. heat. sec....	0·4
	H.T. sec., total...	355·0
S1-S15	Waveband switches ...	—
S16, S17	"Gram" switches... ...	—
S18, S19	Mains switches, ganged R8	—



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om the inside of an inverted chassis.

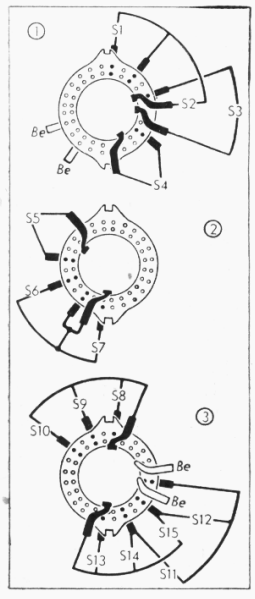
VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the manufacturers, who give the unsmoothed H.T. voltage as 270 V.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH21	240	2·0	85	6·0
	Oscillator			
	115	4·0		
V2 ECH21	240	6·0	90	3·6
	Triode			
	40	1·0		
V3 EBL21	245	32·0	240	3·5
V4 AZ31	285*	—	—	—

* Each anode, A.C.

SWITCH DIAGRAMS & TABLE



Diagrams of the three waveband switch units, drawn as seen when viewed from the mains input end of an inverted chassis, as indicated by the arrows (numbered **1, 2** and **3**) in our underchassis view. The associated table is below.

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	—	C	C
S3	—	C	—
S4	—	C	—
S5	—	C	—
S6	C	—	—
S7	—	C	C
S8	C	—	—
S9	—	C	—
S10	—	—	C
S11	C	—	—
S12	—	C	—
S13	C	—	—
S14	—	C	—
S15	—	—	C

DISMANTLING THE SET

Almost unimpeded access to the top and underside of the chassis may be gained upon removal of the back (four round-head wood screws, with washers) and bottom (six cheese-head screws, with washers) covers.

Removing Chassis.—Remove back and bottom covers as previously described.

Remove glass scale (pull out) and press cursor flat on top of cabinet;

remove all valves, and unsolder speaker leads from their connecting strip;

remove the four control knobs (two with recessed grub screws, and two with cheese-head screws);

remove the cardboard scale lamp light screen (two cheese-head screws with lock washers);

remove the knurled cursor locking screw (with washer);

from the underside of the cabinet remove the four cheese-head screws securing the chassis, and slide it out to the extent of the scale lamp leads, which is sufficient for normal purposes.

To free the chassis entirely, remove the round-head wood screws (with washers) securing the scale lamp holders to the upper left and right-hand corners of the sub-baffle.

When replacing, do not omit to reconnect the earthing lead under the appropriate base fixing screw.

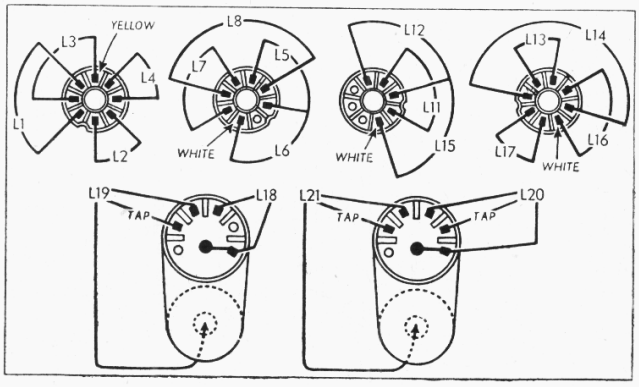
Connect the earthy speaker lead to the centre and left-hand tags, and the lead from tag **e** on **T1** to the right-hand tag.

Removing Speaker.—Loosen the screws of the three speaker retaining clamps;

support the speaker with one hand and swivel the clamps out of the way with the other.

When replacing, the connecting panel should point toward the upper right-hand corner of the cabinet.

Diagrams of the bases of the five screened coil units, showing the internal connections, as seen from the rear of an inverted chassis. The "blind" ends of the I.F. transformer secondaries can be contacted through the tops ofthe cans, as indicated.



GENERAL NOTES

Switches.—**S1-S15** are the waveband switches, ganged in three rotary units beneath the chassis. These are indicated in our under-chassis view by arrows and numbers in circles, and shown in detail in the diagrams in col. 1, where they are drawn as seen in the direction of the arrows in the under-chassis view. The table (col. 1) gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S16, S17 are the pick-up and radio muting switches, associated with the P.U. sockets. When the plug is inserted, **S16** opens and **S17** closes. **R11** is thus shunted across the P.U. sockets. In some chassis, **R11** is not short-circuited on radio.

S18, S19 are the Q.M.B. mains switches, ganged with the volume control **R8.**

Coils.—All the R.F., oscillator and I.F. coils are in six units on the chassis deck, fitted with spun-on screening covers. Diagrams in cols. 2 and 3 show the base connections as seen from the rear of an inverted chassis, four having a locating paint mark in one sector and the other two being unsymmetrical. In these two latter, one end of each secondary is accessible for D.C. measurement only through the hole in the tops of the cans.

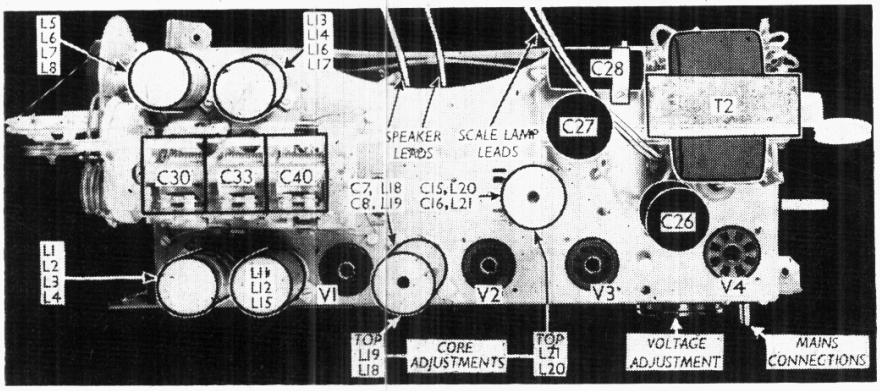
Transformer T1.—As it is very important that all the five contacts are connected to the correct parts of the circuit, they are lettered **b, c, d, e** and **f** in the circuit diagram and the under-chassis view. If the secondary connections are reversed, instability will result from positive feed-back.

Transformer T2.—The mains transformer primary is in three separate sections to permit a wide range of adjustment of 100-260 V. This is achieved by connecting together the various sections in opposition or addition, series or parallel, as required. The adjustment is performed simply by turning the voltage adjustment disc, containing shorting straps, until the required voltage range marking is uppermost, and pressing the disc on to the pin plate, which is connected to the transformer primary.

The seven tappings are lettered **g, h, i, j, k, l, m** in the circuit diagram, and just above the transformer there, a diagram of the panel is inset, the letters being repeated to show the pins to which the mains transformer leads are directly connected. The panel is drawn as seen from the front of an inverted chassis: that is, as seen inside the chassis.

The table below shows how the three windings are connected for the six mean settings marked on the disc. The second column shows the two points to which the mains are connected, and the third and fourth columns the two groups of interconnections. For mains of 110 V, for instance, the mains leads go to **j** and **m; k** and **m** are joined together; and **i, j l** are joined together.

Voltage Setting	Mains connections	Tappings connected together	
110	j, m	k, m	i, j, l
125	g, m	k, m	h, j, l
145	f, m	k, m	i, j, l
200	i, m	k, l	h, j
220	j, m	k, l	h, j
245	h, m	k, l	i, j



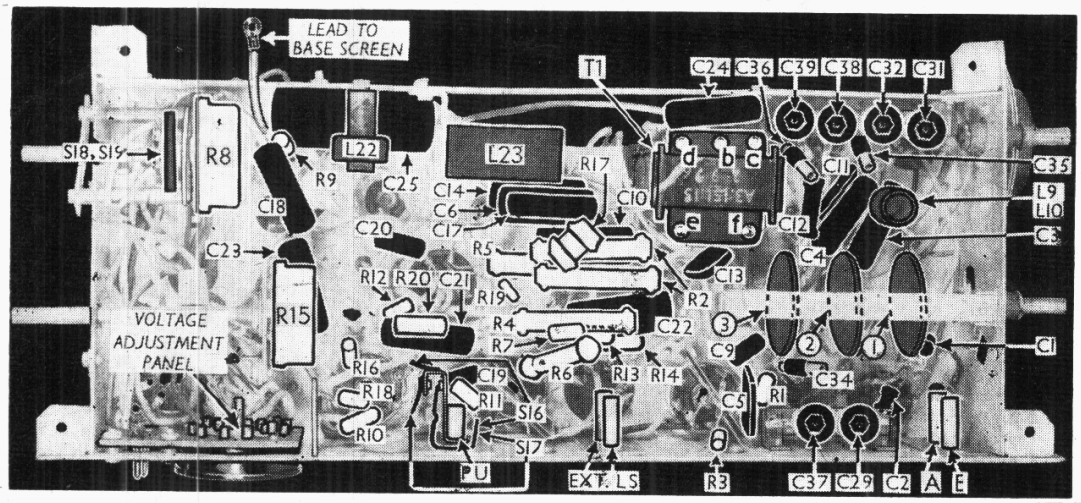
Plan view of the chassis. The core adjustments of the I.F. transformers are indicated, but the remaining alignment adjustments are beneath the chassis. **C26** and **C27** are mounted on isolating washers.

Scale Lamps.—These are two Philips lamps, with clear tubular bulbs and M.E.S. bases, rated at 6.3 V, 0.32 A. Their part No. is 8045D-00. They are fixed to the sub-baffle by one wood screw each.

Capacitors C26, C27.—These are two Philips wet electrolytics, in separate tubular metal containers, rated at 47 μF, 330 V working.

Valve Series.—The valve types for **V1, V2** and **V3** used in this model are "borrowed" from a Continental series, and their technical data do not appear so far in British valve charts. They are all fitted with a base similar to the American "Loctal." Their heaters are rated at 6.3 V, 0.33 A (ECH21) and 6.3 V, 0.9 A (EBL21). The AZ31 rectifier is a normal Mullard valve with an international octal base.

The ECH21 is a type which has no British equivalent, as its triode and hexode sections are separate except that they use a common cathode, and an external connection is used between the triode and the hexode injector grid when the valve is used as a frequency-changer. Its cathode, it is important to note, is connected to the centre spigot.



Under chassis view. An arrow indicating the mains voltage adjustment panel shows the direction in which it is viewed in the diagram inset in the circuit overleaf; that is, as from the top of this page. The letters **b, c, d, e, f** on the output transformer **T1** identify the connecting tags, which are similarly coded in the circuit diagram overleaf.

A perforated metal screen is fitted over **V3** and held to the chassis deck by a knurled screw.

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

DRIVE WIRE REPLACEMENT

There are separate drive systems for the gang and the scale pointer, their positions being shown in the sketch in col. 5 when viewed from the drive end of the chassis with the gang at maximum, the gang drive drum being viewed "through" the pointer drum. Two lengths of drive wire are required for each system, and although the materials can be obtained from the makers, the four lengths must be made up accurately to the dimensions given before fitting.

First ascertain that the nipple slot in the pointer drive drum (moulded) is diametrically opposite slot **A** in the gang drive drum (solid brass). To distinguish the large hollow gang drum, mounted on the gang spindle, from the brass one, it is called the gang spindle drum.

Gang Drive.—Make up inner wire **A** to an overall length of 425 mm, clamping a brass nipple firmly at each end but with loop beyond the nipple at one end, slipping on a 100 mm length of outer cable first. Make up inner wire "B" similarly, but 440 mm long with a 110 mm outer cable.

Swing the gang to minimum, and turn the drive drum assembly so that slot **B** is at 12 o'clock. As seen in the sketch, slot **A** will then be at 4 o'clock. Slip the nipple end of wire **B** in slot **B**, and turn the drum assembly anti-clockwise until slot **A** is at 12 o'clock. Slip the wire into the slot in the left-hand lower guide, and slide down the outer into the guide sleeve. The inner wire now leaves slot **B** at 8 o'clock and goes vertically upwards straight through the guide.

Take the wire through the further of the two upper guides (mounted on top of gang), round the further pulley, and anti-clockwise round the gang spindle drum 1¼ turns. Hook the loop on to the tension spring (as shown in our sketch, but with gang at minimum).

Slip the nipple end of wire **A** into slot **A** and take the wire anti-clockwise round the brass drum 1¾ turns then up through the right-hand lower guide, outer cable **A** and nearer upper guide, as explained for **B**. Wire **A** then goes over the nearer pulley and round the gang spindle drum half a turn clockwise, the loop being hooked on to the tension spring.

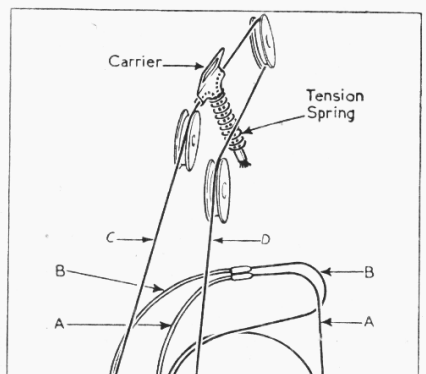
Pointer Drive.—The two wires **C** and **D** are joined together at both ends to form a complete loop, but at each join the two ends are clamped together in the brass nipple side by side, in the same direction. The two wires therefore lie side by side, except that one is longer than the other. **C** is 520 mm overall, and **D** is 930 mm overall, when made up.

Before joining the second pair of ends, thread on to the pair the pointer carrier (head first), the tension spring, and then the special washer. Finally, slip on the special nipple and, having checked that the two overall lengths are correct, clamp up the outer end of the nipple and cut off the surplus wire.

Turn the gang to maximum, as shown in our sketch, and slip the first end (smaller nipple) into the slot in the pointer drive drum, which is at 12 o'clock. Take wire **C** (the shorter length) 1¾ turns clockwise round the drum, and wire **D** ¾ turn anti-clockwise, then follow the sketch, **C** going over the upper pulley. The curved lips guiding the wires down into the tail of the pointer carrier should face the front. The second end of the loop (special nipple) is seen in our sketch at the tail of the carrier, the wire ends protruding through it.

CIRCUIT ALIGNMENT

All alignment operations involving scale readings must be carried out with the chassis in place in the cabinet, after removing the bottom cover. See that the vertical mark at the centre of the scale coincides with the mark on the cabinet at the centre of the scale slot.



Sketch showing the two wire drive systems as seen from the end of the chassis. Inset bottom right is the brass gang drive drum, as seen "through" the pointer drive drum moulding.

I.F. Stage.—Switch set to M.W., turn the gang to minimum capacitance, and the volume and tone controls fully clockwise. Connect signal generator leads to control grid (pin 6) of **V1** and chassis; feed in a 470 kc/s (638.3 m) signal and adjust the cores of **L21, L18, L20, L19,** in that order, for maximum output. When adjusting a primary core the associated secondary winding should be detuned with an 80 $\mu\mu$F (0.00008 μF) capacitor, and vice versa.

R.F. and Oscillator Stages.—With the gang at maximum the cursor should coincide with the 205 division mark on the S.W. logging scale. A knurled screw is provided on the cursor for adjustment purposes. Transfer signal generator leads to **A** and **E** sockets, via a suitable dummy aerial.

When adjusting a wire-wound trimmer, wire should be unwound until output, having reached maximum, just begins to fall back. Winding should be sealed with wax, and surplus wire cut off. Do not attempt to add wire to increase capacitance, as turns would not remain firm, but replace capacitor. Note that the local oscillator frequency is higher than the signal frequency on all bands.

S.W.—Switch set to S.W., tune to 16.85 m on scale, feed in a 16.85 m (17.8 Mc/s) signal, and adjust **C37,** then **C31,** for maximum output. Tune to 49.18 m on scale, feed in a 49.18 m (6.1 Mc/s) signal, and adjust **C34** for maximum output. Repeat the 16.85 m adjustments and re-seal trimmers.

M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C38, C32** and **C29** for maximum output. Tune to 545 m on scale, feed in a 545 m (550 kc/s) signal and adjust **C35** for maximum output. Repeat the 200 m adjustments and re-seal trimmers.

L.W.—Switch set to L.W., tune to 800 m on scale, feed in an 800 m (375 kc/s) signal, and adjust **C39** for maximum output. Tune to 1,875 m on scale, feed in a 1,875 m (160 kc/s) signal, and adjust **C36** for maximum output. Repeat the 800 m adjustment and reseal trimmers.

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