"TRADER" SERVICE SHEET
1479

H.M.V. 1421

A.M./F.M. Transistorized Table Receiver

TWO unusual features in the H.M.V. 1421 receiver, quite apart from the fact that it is a transistorized A.M./F.M. table receiver, are that it employs conventional wiring, with a conventional pressed-metal chassis, and that although the transistors are of the p-n-p type, the *negative* battery lead goes to chassis, giving the circuit diagram an upside-down look.

The receiver employs nine transistors and four crystal diodes and covers the Band II F.M. range and M.W. and L.W. A.M. ranges. It has push-pull class B output with a 35Ω 8 × 5in speaker, and provides up to 1W output from a 9V battery.

Release date and original price: June 1960; £22 5s 2d. Purchase tax extra.

TRANSISTOR ANALYSIS

Transistor voltages given in the table in col. 1 are those obtained from the manufacturers manual. They are negative and were measured on a model 8 Avometer, the 9V positive battery line being the positive connection in each case. A meter having a resistance of not less than 20,000Ω/V was used, and is recommended, in order to obtain satisfactory measurements and prevent possible damage to the transistors.

CIRCUIT DESCRIPTION

For A.M. operation, the ferrite rod aerial system is tuned by **L10** (M.W.) or **L11** (L.W.) and coupled by low impedance coils **L12, L13** to the first A.M. transistor **TR3**, a high frequency transistor that operates at signal frequency as R.F. amplifier. Provision is made by means of **L9** and a series loading coil **L8** for connecting an external aerial.

TR3 collector is resistance-capacitance coupled by **R13, C29** to the base of **TR4**, which operates as self-oscillating mixer and performs the frequency changing process.

Transistor Table

Transistor		Collector (V)	Base (V)	Emitter (V)
TR1 OC171	F.M.	7·85	0·91	0·74
TR2 OC171	F.M.	7·85	0·88	0·74
TR3 OC170	A.M.	7·2†	0·66	0·6
	F.M.		1·01	0·86
TR4 OC170	A.M.	8·2	1·05†	1·01
	F.M.	7·6		0·86
TR5 OC170	A.M.	8·35	1·05†	0·88†
	F.M.	7·6		
TR6 OC71	A.M.	3·15	0·11†	Zero
	F.M.	2·75		
TR7 OC81D	A.M.	8·4†	1·75†	1·7†
	F.M.			
TR8, TR9 OC81'S*		8·95†	‡	‡

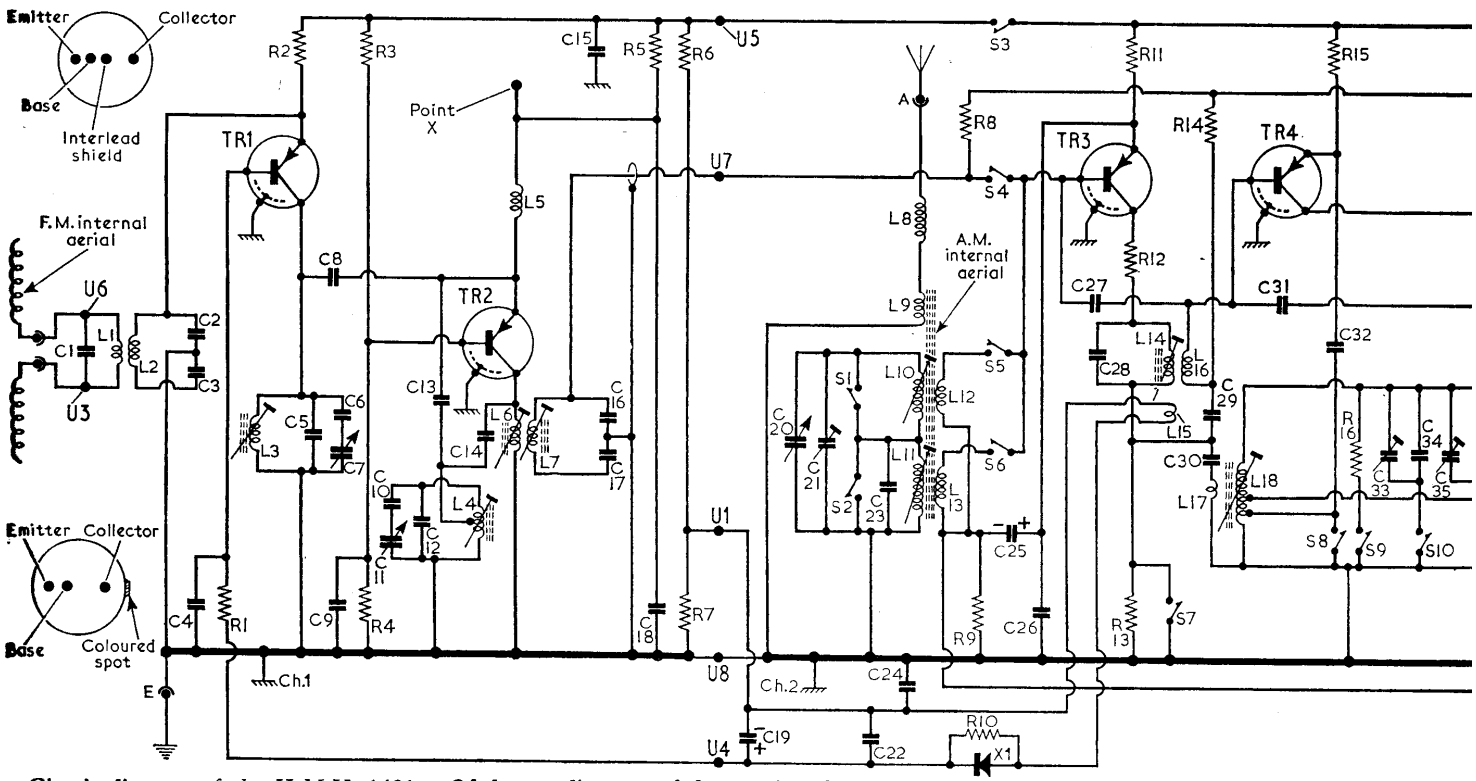
**Matched pair.*
†Only one reading given.
‡No reading quoted.

Resistors

R1	1kΩ	J6
R2	180Ω	J6
R3	2·2kΩ	J5
R4	12kΩ	J5
R5	470Ω	J5
R6	2·2kΩ	J6
R7	12kΩ	J6
R8	4·7kΩ	G3
R9	330kΩ	F3
R10	5·6kΩ	G4
R11	470Ω	G3
R12	220Ω	F3
R13	680Ω	G3
R14	4·7kΩ	F4
R15	820Ω	F4
R16	100kΩ	G3
R17	220Ω	G4
R18	4·7kΩ	G4
R19	18kΩ	F4
R20	820Ω	F4
R21	270Ω	F4
R22	1·5kΩ	F4
R23	18kΩ	C2
R24	10kΩ	F4
R25	220Ω	F4
R26	100Ω	F4
R27	12kΩ	F4
R28	12kΩ	F4
R29	10kΩ	F3
R30	18kΩ	F3
R31	5kΩ	F3
R32	330kΩ	F3
R33	250kΩ	E3
R34	6·8kΩ	F3
R35	1kΩ	F3
R36	2·7kΩ	F4
R37	120Ω	E3
R38	1·1kΩ	E3
R39	330Ω	E4
R40	10Ω	E4
R41	82Ω	E4
R42	33Ω	E4
R43	1·2kΩ	E4
R44	5·6Ω	E4
R45	100Ω	D2
R46	100Ω	E4

Capacitors

C1	47pF	J6
C2	47pF	J6
C3	25pF	J6
C4	0·001μF	J6
C5	10pF	J6
C6	47pF	J6
C7	13·5pF	B1
C8	5pF	J5
C9	0·001μF	J5
C10	50pF	J5
C11	13·5pF	B2
C12	14pF	J5
C13	5pF	J5
C14	25pF	J5



Circuit diagram of the H.M.V. 1421. Of the two diagrams of the transistor base connections, the top one relates to the first five transistors a chassis in the conventional pos

The oscillator tuning circuit **L18, C36,** etc. (M.W.) (with the addition of **C33, C34** for L.W.) is coupled between the collector circuit, via sections of **L19** and **L22,** and the emitter circuit via **C32,** and operates in the grounded emitter mode. Oscillation voltage is neutralized on the base by **L17, C30** to prevent feed-back to aerial circuit.

TR5 is the only purely I.F. amplifier, with A.M. input and output transformers **L19, L20** and **L24, L25,** which couple the I.F. output to the detector diode **X2.** Audio frequency component in rectified output is developed across **R24, C49** and passed via **R30, C54** and **S12** to volume control **R31.**

Intermediate frequency 470kc/s

The D.C. potential developed across **R24** acts in opposition to a bias potential derived from potential divider **R22, R19** and applied to **TR3** base via **R29** and **R9,** thus providing automatic gain control. Individual bias stabilization is provided by **R11, R20.** Resistors **R12, R17, R21** are inserted to control the characteristics of the transistors should they "bottom" at large signal inputs.

A.F. signal is coupled from volume control to base of **TR6** via electrolytic capacitor **C55,** and **TR6** is coupled in turn by **R34** and another electrolytic **C57** to the driver transistor **TR7.** Current stabilization in **TR6** is provided with feed-back by **R32,** while across it is connected a variable tone control circuit **C56, R33.**

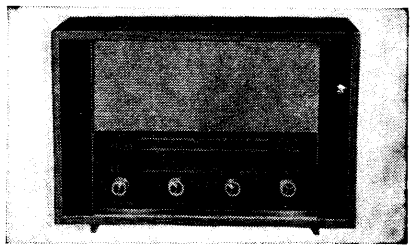
TR7 is coupled by driver transformer **T1** to class B push-pull output stage comprising **TR8, TR9** and output transformer **T2,** which matches the output impedance of the speaker speech coil at 35Ω. Tappings are also provided for the connection of a 3Ω external speaker. Negative feed-back by **R43, R40, C60** between **T2** and **TR7** collector.

F.M. Operation

Balanced input via **L1, L2** to emitter of earthed-base transistor **TR1,** which operates as R.F. amplifier. Tuned-collector coupling by **L3, C6, C7,** etc., and **C8** to **TR2,** which operates as self-oscillating mixer. Oscillator circuit **L4, C10, C11,** etc., is coupled via **C13** and **C14** to emitter and collector circuits. **L5, C18** effectively earth **TR2** emitter at intermediate frequency.

First I.F. transformer **L6, L7** couples **TR2**

(Continued overleaf, col. 1)



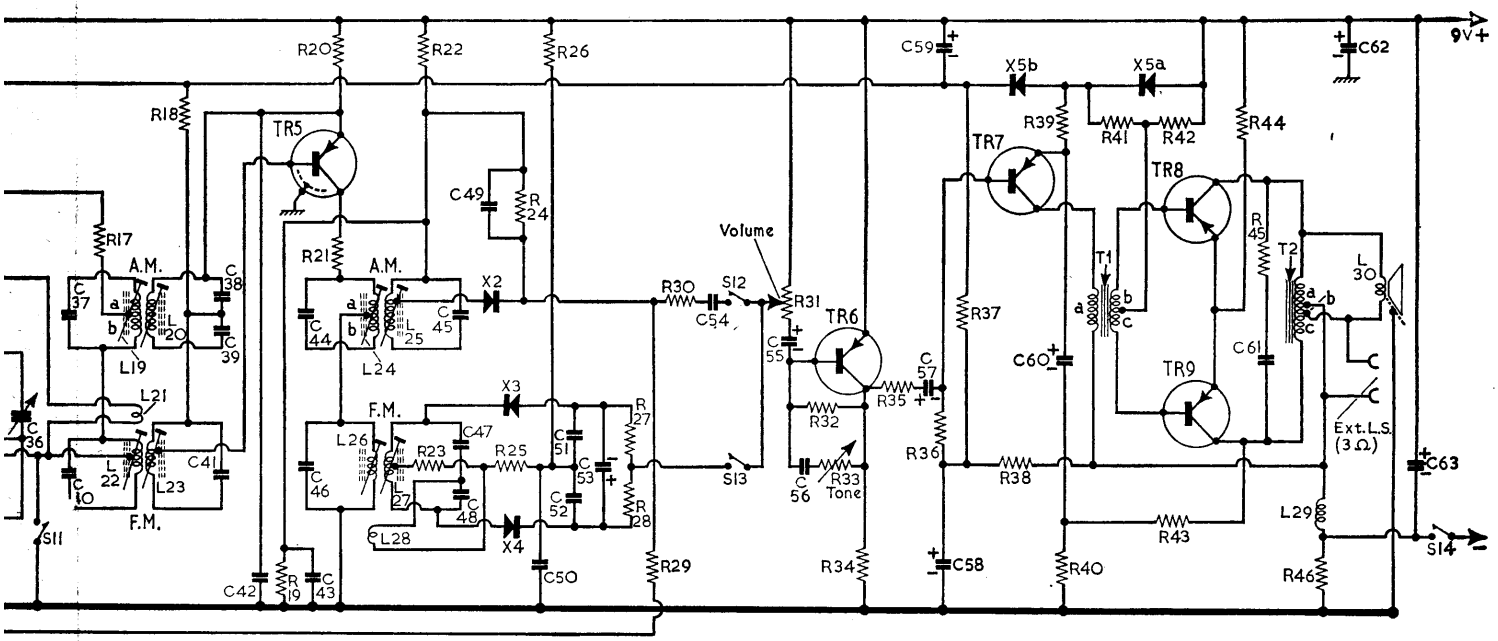
Appearance of the H.M.V. 1421.

Note: *If the component numbers which are given in these tables are used when ordering spare parts, dealers are particularly requested to mention the fact on the order, as these numbers may differ from the ones which are used by the manufacturers in their service manual.*

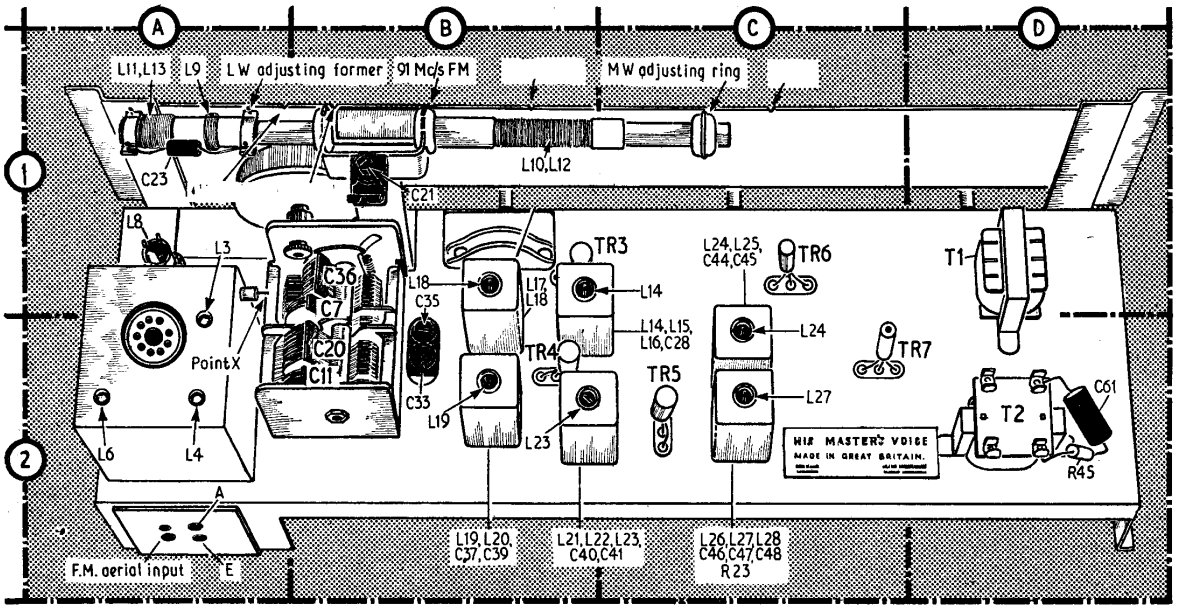
C15	0·01μF	J6	C36	136pF	B1	C57	8μF	F4	L12	—	B1
C16	220pF	J5	C37	400pF	B2	C58	100μF	E4	L13	—	A1
C17	25pF	J5	C38	0·005μF	G4	C59	100μF	F4	L14	—	B1
C18	220pF	J5	C39	400pF	B2	C60	100μF	F4	L15	—	B1
C19	8μF	H4	C40	33pF	B2	C61	0·1μF	D2	L16	—	B1
C20	316pF	B2	C41	33pF	B2	C62	350μF	F4	L17	3·2	B1
C21	30pF	B1	C42	0·04μF	F4	C63	100μF	E3	L18	total	B1
C22	0·01μF	G3	C43	0·04μF	F4				L19 a	2·0	B2
C23	70pF	A1	C44	400pF	C2				L19 b	2·2	
C24	0·01μF	G4	C45	400pF	C2	**Coils***			L20	4·0	B2
C25	8μF	G3	C46	100pF	C2	L1	—	J6	L21	—	B2
C26	0·04μF	G3	C47	100pF	C2	L2	—	J6	L22	—	B2
C27	4pF	G3	C48	100pF	C2	L3	—	J6	L23	—	B2
C28	47pF	B1	C49	0·01μF	F4	L4	—	J5	L24 a	2·2	C2
C29	1,500pF	G4	C50	0·01μF	F4	L5	—	J5	L24 b	1·8	
C30	85pF	G3	C51	0·005μF	F4	L6	—	J5	L25	3·2	C2
C31	4pF	G4	C52	0·005μF	F4	L7	—	J5	L26	—	C2
C32	0·02μF	G4	C53	8μF	F4	L8	16·0	A1	L27	—	C2
C33	30pF	G4	C54	0·5μF	F4	L9	2·0	A1	L28	—	C2
C34	265pF	G4	C55	8μF	F3	L10	—	B1	L29	—	E3
C35	30pF	G3	C56	0·006μF	F3	L11	16·0	A1	L30	27·0	—

Transformers*			
T1	a	175·0	D1
	b	37·0	
	c	37·0	
T2	a	0·9	D2
	b	0·3	
	c	0·9	
Miscellaneous			
X1	OA70	G4	
X2	OA70	F4	
X3	OA79	F4	
X4	OA79	F4	
X5	D9-1-1YZ	E4	
S1-S13	—	G3	
S14	—	E3	

**Approximate D.C. resistance in ohms.*



nd the other to the last four. In this receiver, chassis is not the positive side of the circuit as it is in many transistor receivers, but our diagram is drawn with sition and with the positive line at the top.



Plan view of the chassis. The notches cut in the top edge of the scale backing plate for alignment purposes are not indicated. Reading from left to right, along the top edge, they are: Zero; M.W. track; 91Mc/s F.M.; L.W. check; M.W. trim. The circuit does not include a valve in the base shown in location A2.

Circuit Description—*continued*

collector to **TR3** base via **S4**, and **S7** closes to short-circuit **R13**. **C14** acts as tuning capacitor for **L6**, and **C16**, **C17** form a capacitative potential divider to tune **L7** and pass on the signal to **TR3**.

TR3 becomes a tuned I.F. amplifier with single-tuned transformer coupling by **L14, L16** in collector circuit. Part of the signal is picked up by **L15** and rectified by **X1**, whose output is applied to **TR1** base as A.G.C.

TR4 and **TR5** provide two further stages of I.F. amplification, **L18** being short-circuited by **S8**, using double-tuned I.F. transformers **L22, L23** and **L26, L27, L28.** Coil **L21** feeds back a neutralizing voltage via **C31** to **TR4** base, and **C27** performs a similar function for **TR3.**

Intermediate frequency 10·7Mc/s

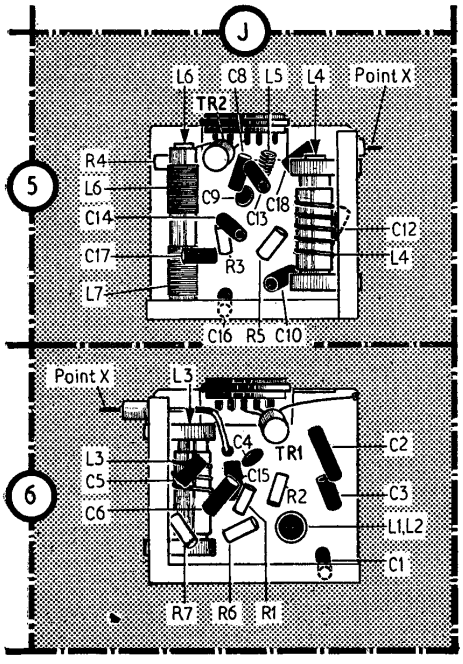
The output of **TR5** is applied via discriminator transformer **L26, L27, L28** to the balanced ratio detector circuit comprising **X3, X4,** stabilizing capacitor and D.C. load **C53, R27, R28.** A.F. output is taken from junction of **R27, R28** and applied via **S13** to volume control. The rest of the circuit is as described for A.M.

The positive side of the battery in this receiver, which usually in p-n-p transistor circuits goes to chassis, is remote from chassis. The negative battery terminal goes directly to the negative side of the power circuit for the output stages (**TR7, TR8, TR9**), but the remainder of the receiver is separated from it by a decoupling circuit comprising **C63, R46** and **C62.**

This would be easier to see if our diagram were drawn the other way up, with the negative battery line and the collector circuits above the transistors as usual, but the presence of a good solid chassis in this set led us to show the heavy chassis line in the usual position.

The bias to **TR7** and the current to **X5a** and **X5b** are derived from the potential divider **R38, R37,** while the two selenium rectifiers **X5a** and **X5b** provide a stabilized voltage line for the base bias of **TR3, TR4** and **TR5.** The line is stabilized at 1.2V, and in order to stabilize gain with varying battery voltage resistors **R8, R9, R14** and **R18** are included in the base leads.

X5a and **X5b** together with **R37** and **R38** form a potential divider across the battery supply. Base bias for **TR7** is derived from the potential divider, and base bias for the output transistors **TR8, TR9** is derived from the potential divider **R41, R42** across **X5a.** In order to compensate for the current drain through **R41, R42,** the current of **TR7** emitter is taken from the junction of **X5a** and **X5b,** through **R39.**



Two views of the F.M.tuner unit. The valve base included is only used as a tag block for making connections.

CIRCUIT ALIGNMENT

Equipment Required.—A 30 per cent A.M. signal generator with an output impedance of 75Ω covering the M.W. and L.W. ranges and the I.F. of 470kc/s. An F.M. signal generator covering Band II and the I.F. of 10.7Mc/s, with adjustable modulation, also with 75Ω output. An output meter of 35Ω, which should be connected in place of the external speaker, or a 2.5V A.C. voltmeter which must be connected directly across the load speaker. Care must be taken to avoid contact between the meter and chassis. A 30pF and a 0.1μF capacitor and the normal trimming tools are required. An output of 100mW (1.8V) should be maintained throughout across **L30.**

A.M. Alignment

I.F. Stages.—Switch set to M.W. and connect A.M. signal generator via a 0.1μF capacitor to top of **C20** (B2). Feed in a 30 per cent. modulated signal at 470kc/s and adjust **L25** (F4), **L24** (C2), **L20** (G4) and **L19** (B2) in that order. Repeat until no further improvement can be obtained.

R.F. Stages.—Transfer signal generator leads, via the 0.1μF capacitor, to external aerial and earth socket connections. Note that indentations are cut in the scale backing plate to mark "zero" (near tuning control), "M.W. track," "91Mc/s F.M.," "L.W. check," and "M.W. trim," in that order working up towards the tone control. M.W. alignment must be performed before L.W.

M.W.—With set still switched to M.W. check that with gang at maximum capacitance the cursor coincides with the "zero" notch on the scale backing plate (C1). Feed in a 1,400kc/s signal, tune cursor to notch at "M.W. trim," and adjust **C35** and **C21** (G3, B1) for maximum output. Tune to notch at "M.W. track," feed in a 580kc/s signal, and adjust the core of **L18** (B1) for maximum output. Then adjust **L10** similarly by sliding its adjusting ring along the ferrite rod (C1).

L.W.—Switch set to L.W., feed in a 220kc/s signal, tune it in on the receiver, and check calibration. Cursor should cover the "L.W. check" notch. If it does not, adjust **C33** and position of **L11** on ferrite rod in turn in an endeavour to obtain maximum response at the correct calibration point.

F.M. Alignment

I.F. Stages.—Connect F.M. signal generator via the 30pF capacitor to test point X on F.M. tuner unit (A1). Feed in a 10.7Mc/s F.M. signal, and adjust **L27** (C2), **L26** (F4),

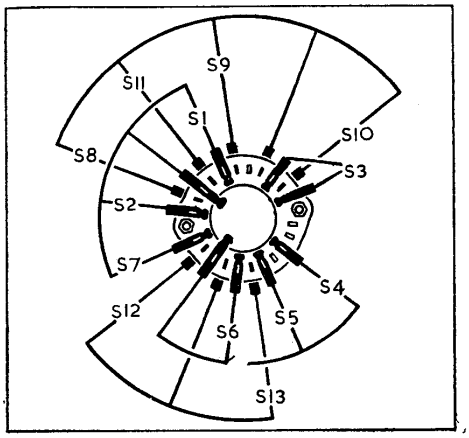
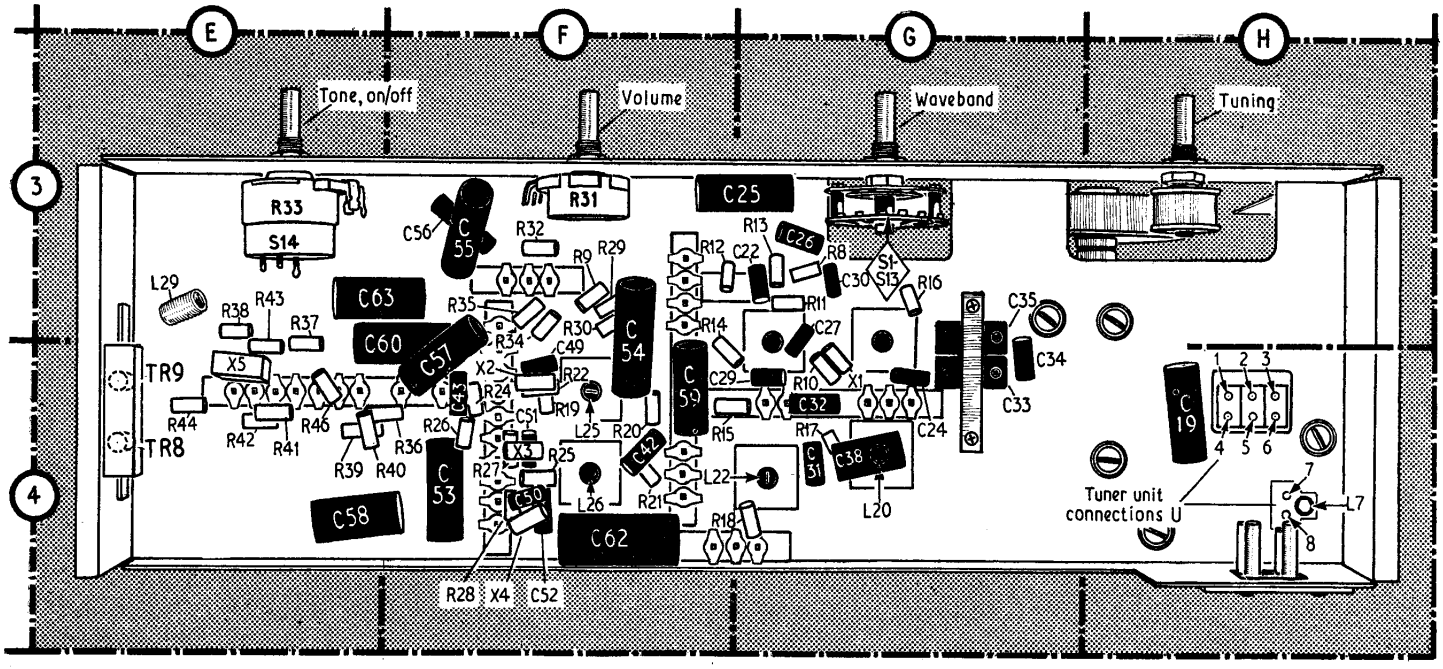


Diagram of the waveband switch unit.



View of the underside of the chassis. Transistors are connected through the chassis. **TR8, TR9** *are enclosed in a metal heat sink.*

L23 (B2), **L22** (G4) and **L14** (B1) for maximum output. Feed in a 10.7Mc/s A.M. signal and adjust **L27** for minimum output. Feed in a 10.7Mc/s F.M. signal and adjust **L7** (H4) and **L6** (A2) for maximum output. Repeat the whole of the F.M. I.F. alignment until no further improvement can be obtained.

R.F. Stages.—Check again that with the gang at maximum the cursor coincides with the "zero" marker notch on the scale backing plate. Then tune to the "91Mc/s F.M." notch. Transfer signal generator leads to F.M. aerial sockets, without the capacitor, feed in a 91Mc/s F.M. signal, and adjust **L4** for maximum output. If two peaks are found, use the first one reached when screwing in from the top of the former.

Still feeding in a 91Mc/s F.M. signal, adjust **L3** (A2) for maximum output. Then check the calibration over the F.M. range.

GENERAL NOTES

Switches.—S1-S13 are the waveband switches, ganged in a single rotary unit. The individual switches are identified in the diagram in col. 3 which represents the switch unit as seen when viewed in the direction of the arrow in location G3 of our underside illustration. The associated table gives the switch operations in the three control settings, starting with the control turned fully anti-clockwise. A dash indicates open, and **C** closed.

Removing Chassis.—To withdraw the chassis, take off the cabinet back and pull off the four control knobs; disconnect the speaker leads and remove the cable cleat on the cabinet front; either disconnect or remove the external speaker sockets. The chassis is clamped to the bottom of the cabinet by means of two metal angle strips, one at each end; slacken off the four nuts and slide out the chassis.

Drive Cord Replacement.—Approximately 66in of nylon-braided glass yarn is required for a new drive cord. To replace the cord, withdraw the chassis as described under "Removing Chassis" and remove the scale backing plate with the nylon thread which supports the bottom of the cursor.

Turn the gang to minimum capacitance. Tie a knot in one end of the cord and thread it through the hole in the rear of the drive drum, feeding it through from the front until the knot anchors. Pull the free end of the cord through the slot in the rim of the drive drum and run it as indicated in the sketch of the tuning drive system shown in sketch below. Finally, pass the cord through the slot in the front of the drum and slip it through one end of the tension spring, attaching the other end of the spring to the moulded peg. Before knotting the cord to the spring, ensure that the spring is exerting sufficient tension on the cord.

Replace the cursor, scale backing plate and nylon thread. With the gang at m :imum capacitance, check that the cursor is at the zero notch in the backing plate.

External Connections.—Care must be exercised in connecting external instruments to the receiver as the chassis line is on the negative side of the supply battery, which has not been the normal practice in the past, and further as the chassis line is not quite at the same potential as the negative battery lead.

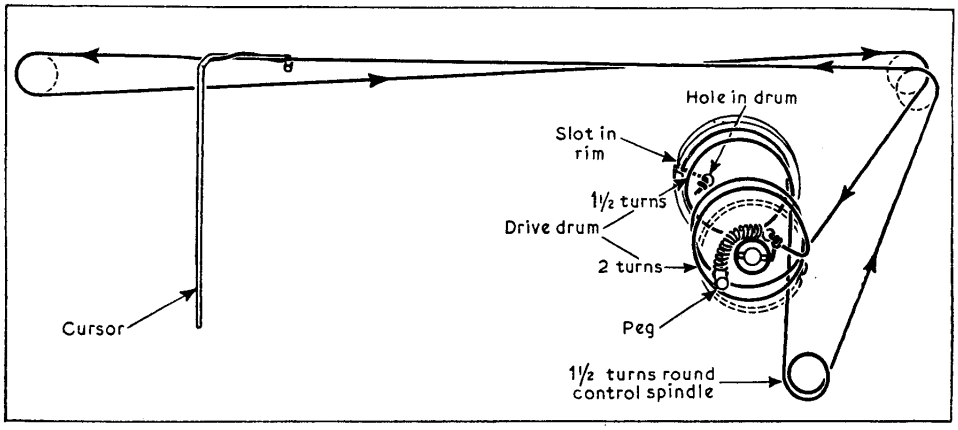
When feeding in an R.F. signal, the signal generator may be connected as explained under circuit alignment, but in connecting up any kind of output indicator care must be taken to see that neither side of it comes into contact with chassis, as that would short-circuit certain components. Instruments with earthed cases, such as oscilloscopes, may be connected to chassis but it would be advisable to connect their earthy lead to the same earthing point (chassis or battery positive) as any other instrument in use. The live lead could go to **TR8** or **TR9** collector.

To feed in an audio signal, it is advisable to connect the signal generator leads across the volume control, the earthy lead going to the battery positive line. If an unloaded meter is connected across the speech coil connections, **L30** must remain connected, as it also must if a speaker is connected to the 3Ω external speaker connections.

Batteries.—One of the following 9V batteries is recommended. Ever-Ready PP10, G.E.C. BB30, or Vidor T6010.

Switch Table

Switches	L.W.	M.W.	F.M.
S1	C	—	—
S2	—	C	C
S3	—	—	C
S4	—	—	C
S5	—	C	—
S6	C	—	—
S7	—	—	C
S8	—	—	C
S9	C	—	C
S10	C	—	—
S11	—	—	C
S12	C	C	—
S13	—	—	C



The drive cord system drawn as seen from the front of the chassis with the backing plate removed; and with the drum extended for clarity.

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