HACKER 'MAYFLOWER' II MODEL RV20 SERVICE MANUAL

CONTENTS

1. GENERAL DESCRIPTION

The 'Mayflower' II RV20 is an eight valve, high fidelity F.M. A.C. mains operated table receiver having push-pull output and a very attractive walnut veneered cabinet. Designed solely for the listener seeking the highest possible standard of reproduction and simplicity of operation from a table receiver.

Provision is made for tape and gramophone facilities, as well as coupling to large high fidelity speaker.

2. TECHNICAL DESCRIPTION

Operating Controls

1. Combined volume and on/off switch control (left hand).
2. Tuning Control (right hand).
3. I.F. sensitivity control (rear of cabinet).
4. Treble cut control (rear of cabinet).
5. A.F.C. on/off switch (rear of cabinet).

Special Features

1. Adjustable local station markers.
2. Combined ratio detector and limiter stage.
3. Automatic frequency correction.
4. Internal aerial for local reception
5. Visual tuning indicator.
6. Pre-set sensitivity control.
7. Pre-set tone control.
8. Sockets for tape and pick-up.
9. Push-pull output.
10. Large, wide range speaker.

Valves and Rectifier

Mullard	ECC85	Double triode R.F. and mixer oscillator.
Mullard	EF89	Variable mu Pentode I.F. amplifier.
Mullard	EF80	Pentode I.F. amplifier.

Valves and Rectifiers (cont'd)

Mullard	EF80	Pentode limiter.
Mullard	EB91	Double diode ratio detector.
Mullard	EM84	Tuning indicator
Mullard	ECL86	Triode pentode A.F. amplifier and half of push-pull output stage.
Mullard	ECL86	Triode pentode phase invertor and half of push-pull output stage.
Westinghouse		Westinghouse full wave bridge rectifier (contact cooled).

Coverage

87 – 104 Mc/s.

Output

Push-pull ultra linear output of 6.5 watts. 30c/s – 15,000c/s plus or minus 1 db at 5 watts level.

Power Supply

200–250 V AC. 40-60c/s. 60 watts.

Dimensions

Height: 12" Width: 18½"
Depth: 7¾"

Weight

19 lb.

Speaker

10" x 6" (15 ohm impedance)

Aerial

Inductively loaded internal aerial for local station use.

3. REMOVAL FROM CABINET

The volume and tuning control knobs must first be removed by pulling them off the control shafts at alternate ends of the cabinet. The four hexagon headed bolts must then be unscrewed from the chassis underneath the cabinet. After removing all plugs and sockets the chassis is then free for removal. Lifting the left hand end of the chassis while still in the cabinet from the rear, will assist the removal.

4. REPLACEMENT OF COMPONENTS

Initial operations are dealt with in the previous chapter and these are necessary for all replacements apart from general components, i.e. valves.

Loudspeaker

This operation is self explanatory, the only precaution to be observed is upon replacement of the new speaker, that the nuts are tightened gradually all round and definitely not over-tightened as this may result in a twisted frame.

Local Station Markers

Replacement of these should never be necessary unless force has been applied to them in the wrong direction. They may be changed however, by removing the screws holding the front dial.

Internal Aerial

The only damage likely to occur in this assembly is the coil which, in some cases, may be replaced without obtaining a complete aerial assembly. This coil consists of six turns of 16 S.W.G. tin copper wire, wound such that the internal diameter is approximately ⅝" and the total winding length spaced over ¾"

For either replacement of the coil or the complete assembly it is first imperative to remove the aerial from the case.

NOTE:–Do not attempt to remove the coil while the aerial is still in situ otherwise the heat from the soldering iron will damage the finish on the cabinet.

V.H.F. Tuner Unit

In order to remove this unit the drive cord must first be detached by stretching the tension spring and unhooking the cord from the pulleys. Unsolder the coaxial lead, the A.F.C. lead and also the four supply leads under the chassis. Four 6BA nuts and bolts secure the tuner to the chassis and after removing these it may be lifted from the main unit and replaced. Make a careful note of all connections and especially the position of the drive drum.

Replacement is simple, but caution must be observed when replacing the drive cord and this is dealt with in the next section.

Drive Cord

If the existing drive cord is broken, another should be made to the drawing shown in the rear of this manual. Rotate turning drum fully clockwise, thread marked loop through top hole in drum edge and hook over spigot provided. Take the shortest length to the spring and put on two turns anti-clockwise round the drum. The other length must then pass to right and flow over the bottom pulley. Put two turns anti-clockwise around tuning drive spindle, back over top pulley, then stretch cord and place around pulley at left hand end of dial plate. Check R.F. calibration after this operation, as dealt with in chapter 6c.

Mains Transformer

After unsoldering all connections to this component, it is easily removed by undoing the two 2BA nuts and bolts holding it to the chassis.

Ensure that these two bolts are properly tightened upon replacement otherwise the laminations will vibrate when the instrument is in operation.

Output Transformer

Before removal of this component it is advisable to make a careful note of the coded connections.

The transformer is retained by two self-tapping screws to the chassis.

I.F. Transformers and Ratio Detector Coil

Make a note of the connections and also the approximate position of the associated components.

Two 6BA nuts secure these to the chassis and when replacing these only tighten them sufficiently to hold the transformer tight to the chassis. Over-tightening these will result in the fixing studs being wrenched from the aluminium screening can.

The type number of the transformer or the colour coding must be readable from the rear of the chassis in order that the connections appear in their correct sequence.

After replacement of any I.F. transformer, it will be necessary to carry out complete I.F. alignment as dealt with in Chapter 6b.

Sensitivity and Tone Controls

These are easily replaced by withdrawing the screws.

Volume Control

Make a note of the connections, particularly those on the mains on/off switch on the rear of the control, before this item is replaced.

General Resistances and Capacitors

The usual precautions against heat are necessary and provided these are replaced in approximately the same position as the originals, cooling should be satisfactory. When changing components associated with the I.F. stages, I.F. re-alignment may be necessary.

5. CIRCUIT DESCRIPTION

V.1. (ECC85) is a grounded grid R.F. amplifier and oscillator mixer front end. H.T. feed to this unit is provided by R.1. and R.41. The signal is fed from this unit to V.2. (EF89) grid via the secondary of the I.F. transformer in the anode of V.1b.

V.2. is the first I.F. amplifier whose gain is controlled by the adjustment of V.R.1. When this control is in the minimum gain position, the grid is biased some 20 volts. R.7. allows current to flow through V.R.1 in order to increase the range of this control. R.2. and C.3. are the screen de-coupling components. R.4. and C.5. are the anode de-coupling components. The signal is fed from this stage to V.3. (EF80) grid via a 47pf condenser from the secondary of the I.F. transformer in V.2. anode circuit.

V.3 is the second I.F. amplifier and partial limiter and has a fixed steady bias resulting from R.11. and C.12 in its cathode stream, R.8. and C.10 are the screen de-coupling components and R.10 and C.11 are the anode de-coupling components. R.40 across the primary of L.2 is to provide sufficient damping to reduce the working Q and enable this stage to have an adequate band width. The signal is fed to V.4 (EF80) via a 47pf condenser from the secondary of the I.F. transformer in V.3 anode circuit. V.4 is a partial limiter whose anode circuit contains the primary of the ratio detector transformer. The screen voltage on this valve is held at approximately 30 volts to obtain sufficient limiting action by R.13 and R.12, C.16 being the screen de-coupling condenser. R.16 is to provide a small amount of negative feedback to improve the stability in this stage. R.15 and C.17 are the anode de-coupling components.

V.5 (EB91) conforms to a semi-balanced ratio detector circuit. The resulting A.F. developed in the secondary of L.3 is fed via R.17 to the de-emphasis circuit R.18 and C.22 and then to the volume control V.R.3 via C.21. C.39 is an R.F. de-coupling condenser. C.20 and V.R.2 provide the treble cut control circuit. C.25 is to provide a steady D.C. potential across the diode loads R.21 and R.22. C.24 and C.25 are R.F. de-coupling components and are returned to the bifilliar windings on the primary of L.3, R.19 and R.20 constitutes a potential divider network across the diode loads feeding a D.C. voltage to the grid of the tuning indicator V.8 (EM84). C.26 is a de-coupling condenser providing a low resistance path to A.C. signals which might become present at this state and de-focus the indicator. R.23 and R.24 form a potential divider network to feed the A.F.C. diode in the mixer (V.1b) circuit.

The A.F. voltage developed across V.R.3 goes to the grid of V.6a which is the triode section of the first E.C.L.86 via the tone control circuit. R.26 and C.29 provide a steady bias for the grid and in the earthy end of these two components is an undecoupled resistance, R.27 to enable negative feedback to be applied over all the amplifier via R.28 from the secondary of the output transformer. C.37 across the anode load of V.6a is to prevent audio instability. R.29 is the anode load of V.6a and the resulting A.F. developed across this resistor is fed to V.6b grid via C.31. An out of phase A.F. voltage is then fed from the potential divider network R.33, R.35 and R.36 to the second triode grid

V.7a. R.31 and C.30 provide a steady bias for this stage and R.30 is the anode load. The correct phase voltage is fed to the grid of V.7b via C.32.

V.6b and V.7b conform to the usual class AB output stage, bias being achieved for these two pentodes by R.37 and C.32, R.38 and C.34. The anodes and screens are connected to the ultra linear output transformer primary, inducing the audio across the 15 ohm loudspeaker in the secondary. R.42 is to safeguard the output pentodes in the event of the receiver being used with the secondary unloaded.

The power supply for the instrument is conventional, but with adequate power reserve and is free from mains hum.

6. TEST SPECIFICATION AND STATIC VOLTAGES

a) Amplifier Checks

Statics:	V.6a	Anode	110V
	V.6a	Cathode	1V
	V.7a	Anode	110V
	V.7a	Cathode	1V
	V.6b	Anode	270V
	V.6b	Screen	275V
	V.6b	Cathode	8V
	V.7b	Anode	270V
	V.7b	Screen	275V
	V.7b	Cathode	8V

Equipment Required

O/P Meter (15 ohm)	Audio Generator (600 ohm)
C.R.O.	Avo 8

Sensitivity

I/P across volume control, O/P meter across L/S terms

I/P required for 5 watts O/P at 1000 c/s should be approximately 160 M/V.

Frequency Response

Using 1000 c/s at 1W level for 0 db check response is approximately ± 3 db between 30–20,000 c/s.

Hum and Noise

With no I/P and volume at maximum check that residual noise is less than 1 m/w.

b) **I.F. Alignment and Sensitivity Check (If Gain at Minimum)**

Statics:	Front end pin 2	90V	
	Front end pin 3	100V	
	V.1 Anode	235V	
	V.1 Screen	225V	
	V.1 Cathode	27V	(gain control at maximum 22V)
	V.2 Anode	235V	
	V.2 Screen	140V	
	V.2 Cathode	1.9 V	
	V.3 Anode	235V	
	V.3 Screen	35V	
	V.3 Cathode	0.1 V	

Equipment Required

AVO 8 Meter C.R.O.

Wobbulator Covering 10.7 Mc/s.

R.F. signal generator covering 10.7 Mc/s and 88–100 Mc/s FM and AM (30% AM Mod) and for use as marker.

I.F. Alignment

a) C.R.O. across volume control. Wobbulator with 75 K/s deviation at 10.7 Mc/s on grid of V.4. Adjust primary and secondary cores of L.3 to obtain a linear S-curve displayed on the C.R.O. This curve should have a bandwidth of approximately 400 Kc/s peak to peak and the base line must be cut by the centre of the linear section of the S-curve at 10.7 Mc/s. Straight portion of curve should be at least 200 Kc/s long.

b) Disconnect link on C.25 2Mfd and connect C.R.O. between R.21 (15 K) and chassis. Wobbulator with 75 k/c deviation on the grid of V.3. Adjust primary and secondary coils of L.2 to produce an I.F. response greater than 200 k/c bandwidth. This transformer has a small coupling core in between the primary and secondary cores and should only be touched if the recommended bandwidth cannot be obtained.

c) Move input to grid of V.2 and adjust primary and secondary cores of L.1 to produce an I.F. response of not less than 200 K/c at –3 db. This transformer also has a small coupling core and only need be touched in the event of the required bandwidth being unobtainable. The I.F. gain control should be kept at minimum otherwise instability may result due to positive feedback from the later stages back to the grid of the first I.F. amplifier.

d) If there is not a D.C. blocking condenser in the lead from the wobbulator, a .1Mfd must be inserted before the next operation is undertaken. Place the input on the tuner side of the R.1 6.8K and tune primary and secondary of the I.F. transformer in the front end. This transformer is easily located since it is the only screw core tuned coil in the front end. The response curve here should be within −3db at ± 75 k/c.

I.F. Sensitivity

Replace link on C.25 2Mfd and remove C.R.O. Leaving input on pin 2 of the front end (6.8K) place Output Meter across loudspeaker sockets. Switch input source to 10.7M/cs. FM 75 K/cs deviation. Adjust 10.7 M/cs input to give a reading of 1W with volume at maximum on the Output Meter. The input required for this measurement should be in the order of 2mV with sensitivity at minimum.

c) R.F. Alignment

Two small calibrating marks should be visible on the dial backing plate. If, however, they cannot be noticed, then two more may be lightly pencilled on to the following dimensions.

With the chassis the right way up and with the dial backing plate facing the first mark may be made 1 1/32" from the right hand end of the plate. This marks the end of the tuning scale and the pointer before commencement of R.F. alignment should co-incide with this mark when the instrument is tuned to the lowest RF frequency, i.e. 87½ M/cs. The second mark must be made 2" to the left of the first and this marks the 90 M/cs calibration point.

After checking that the pointer lines up with the right hand mark at the L.F. end of the tuning scale as described before, set the marker to the 90M/cs. calibration point. Switch the R.F. signal generator to 90M/cs. C.W. and either loosely couple or feed in the aerial socket. The Avo 8 should then be switched to the 25 volt DC range and placed between the junction of R.23 and R.24, this voltage will be negative to chassis. In order to obtain a maximum deflection on the meter the oscillator trimmer, which is the one nearest V.1., must first be adjusted. The R.F. trimmer must also be adjusted. The output from the R.F. signal generator should be kept as low as possible to avoid false indication by V.4 limiting action.

A.M. Rejection

Due to a certain amount of residual F.M. when switched to A.M. (and vice versa) which occurs with most signal generators, the customary method of carrying out measurement of AM rejection might prove to be inaccurate, therefore the following method is used.

Connect the output of the FM/AM generator to Pin 2 on the tuner (6.8K) via an isolating condenser of .1Mfd. Adjust generator to 10.7Mc/s

F.M. deviation 75Kc/s and with output meter across the loudspeaker, and volume control at maximum, increase the generator output to give 5 watts audio output.

Switch generator to A.M. and note the change in output. Under ideal conditions this should exceed 40 dbs, but will depend to some extent upon the class of generator used for the test.

Signal to Noise Ratio and R.F. Sensitivity Test

With F.M. generator set to 90Mc/s, connect to aerial socket of receiver and adjust to 50Kc/s deviation. Increase generator output to give 5 watt audio output, this signal should not exceed 11 μV.

Now reduce deviation to zero and note the change in output. This should be in excess of 30 db.

A.F.C. Check

With the A.F.C. switch off, tune receiver to 90Mc/s and feed FM signal of 75Kc/s deviation at this frequency to the aerial socket. Adjust generator output to give approximately 100M/v output. Now detune receiver 100Kc/s either side switching in A.F.C. each time and checking that the signal is pulled in to the point of minimum distortion as indicated by C.R.O. across the receiver output.

7. LIST OF REPLACEMENT COMPONENTS AND PRICES

Cct. Ref.	Description		Type No.	Alternative Types	List Price
V.1	Valve (double triode)	Mullard	ECC85	Brimar ECC85	11/- + P.T.
V.2	Valve R.F. Pentode	Mullard	EF89	Brimar EF89	9/- + P.T.
V.3/4	Valve R.F. Pentode	Mullard	EF80	Brimar EF80	10/6 + P.T.
V.5	Valve Double diode	Mullard	EB91	Brimar EB91	7/- + P.T.
V.6/7	Valve Triode Pentode	Mullard	ECL86	–	12/6 + P.T.
V.8	Valve Tuning indicator	Mullard	EM84	Brimar EM84	13/- + P.T.
	R.F. Unit		311/0051 (low osc with AFC)	–	£4.12.3d.
L.1/L.2	Transformer I.F.		SD48A		8/6
L.3	Transformer (Ratio det.)		SD48B		10/-
T.1	Transformer output		7569	–	30/-
T.2	Transformer mains		7589	–	45/-
MR.1	Rectifier	Westinghouse	FC124	EC1/4567	13/6
L.5	Speaker	Goodmans	T27B/61004/15	–	35/6 + P.T.
SWL	AFC switch		2P/C/O	–	3/6
VR.3	Volume control		475 1 meg log		6/6
VR.1	Gain control	Welwyn	P22/10K		3/9
VR.2	Tone control	Morganite	301/1 meg		2/6
R.1/R.34	Resistor 6.8K 2W	Erie	10 AD		1/9
R.41	Resistor 22K 1W	Erie	7 AD		1/-
R.32	Resistor 1.5K W/W	Erie	SKC/2400/22		2/-
R.39	Resistor 120 ohm W/W	Erie	SKC/2400/22		2/-
R.37/38	Resistor 222 ohm 1W	Erie	8 AD		1/6
C.33/34	Condenser electrolytic 50 Mfd 15V	TCC	Elkomold		1/6
C.35/36	Condenser electrolytic 50 Mfd + 50 Mfd 350V	Hunts			7/6
C.25	Condenser electrolytic 2 Mfd	TCC	Elkomold		1/6
C.26	Condenser electrolytic (reversible) 8 Mfd 12V	TCC			1/9
C.27/28	Condenser electrolytic 50 + 50 Mfd 200V				6/-
LP.1	Pilot lamps 6.5V .3A				1/6 + P.T.
F.1	Fuse/plug 500 m/a (HT)				1/6
F.2	Fuse/plug 1A (mains)				1/6

PRICES SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

**NOTE:–Please quote serial number when ordering spares.*

8. POSSIBLE FAULTS AND CORRECTIONS

No Output

C.22, C.39, C.37 s/c (replace)
C.31, C.21 o/c (replace)
Gram socket switch intermittent o/c (replace or repair)
Extension speaker socket switch intermittent o/c (replace or repair)

Low Gain

Low H.T. supply (check rectifier etc.)
Valves low emission (replace)
I.F. gain pot VR1. Poor contact on slider (clean)
R.18 high resistance (replace)
Misadjustment of R.F. or I.F. coils (realign)
Aerial inadequate for area (fit suitable type)

R.F. Instability

Check C.4, C.10, C.38, C.26, C.3, C.16 for o/c (replace)

Audio Instability

R. 28 high resistance or o/c (replace)

Distortion

Check:– ECL86 valves faulty (replace)
C.32 for o/c (replace)
C.31 and C.32 for leakage (replace)
C.33, C.34, C.29 and C.30 for s/c (replace)
R.26, R.31, R.37 and R.38 for value (replace)
Discriminator off alignment (replace)

Hum

Valves Heater/Cathode leakage (especially EB91) (replace)
Check C.27, C.28, C.35, C.36 for low capacity (replace)

Tuning Indicator not working

Check supply voltage
Check: C.26 s/c (replace)
R.20, R.43 high resistance or o/c (replace)

No A.F.C.

Check C.41, C.26 for leakage or s/c (replace)
Faulty A.F.C. switch.

MODIFICATIONS

ADDENDUM TO MAYFLOWER II RV20 SERVICE MANUAL

Changes incorporated in later versions up to July, 1966:

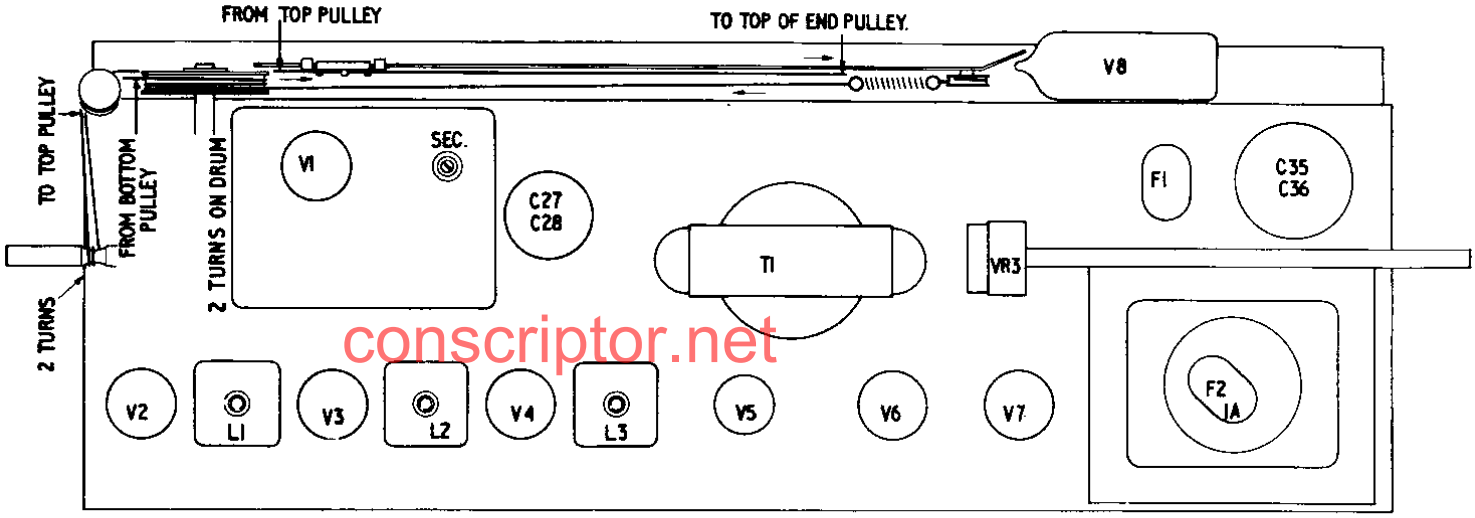
1. Switched 'Gram' Socket replaced by unswitched type.

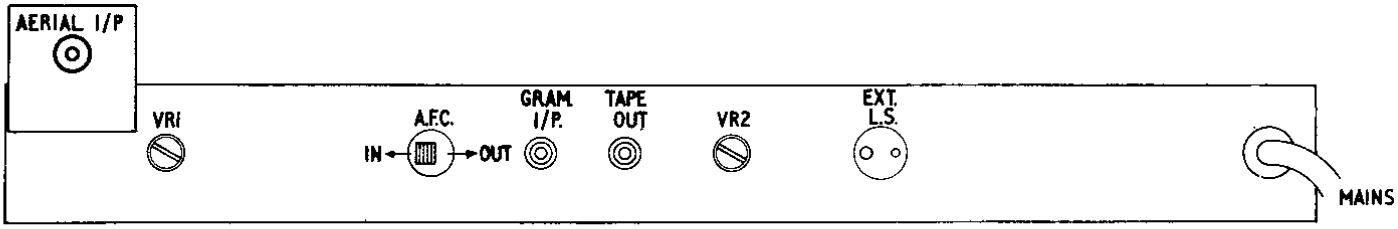
2. AFC In/Out 2 position switch replaced by 3 position switch giving AFC In/Out and 'Gram' positions.

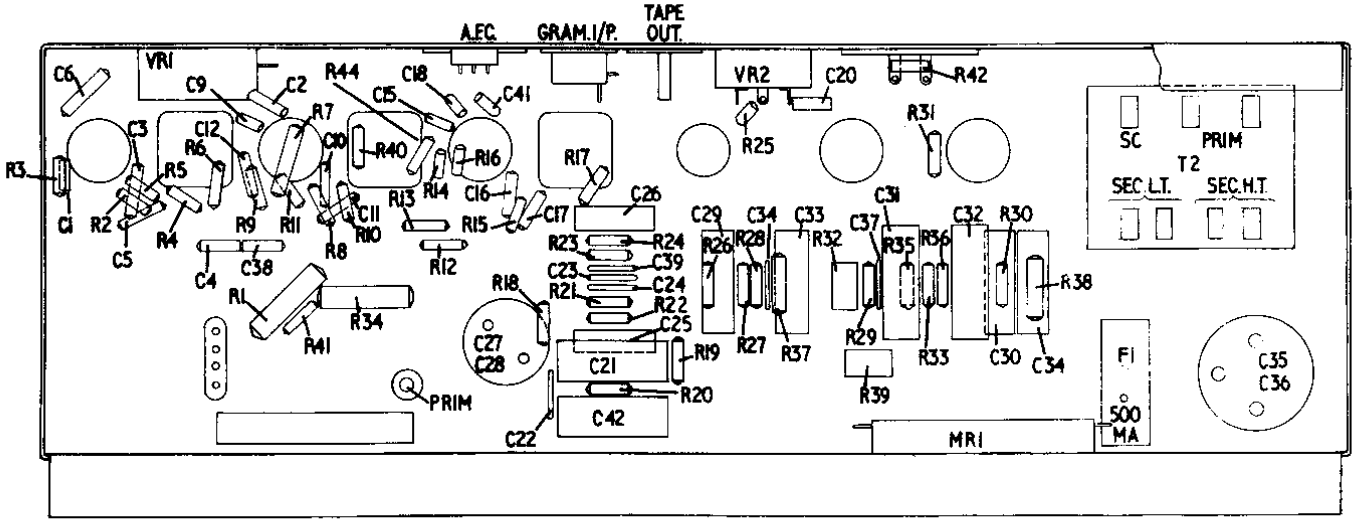
3. To prevent 'ringing' in amplifier 51 ohms resistors inserted in the anodes of the output pentodes (i.e. between the anodes and the output transformer).

4. C43 (250 pf.) deleted.

Hacker Radio Limited: July, 1966







GENERAL COMPONENTS.

C.C.T. REF.	DESCRIPTION.
VR1	SENS. CONTROL. WELWYN P22. 10K. LIN. W.W. 4 1/2 W.
VR2	TONE CONTROL. 1MEG. LOG. MORGAN. 330.
VR3	VOL. CONTROL. (DRG. A/20/11.) 1MEG. LOG. A.B. METAL. 475.
L.S.	SPEAKER. GOODMANS 10x6. T/27B/610004/15.
L1	IF TRANS. (10·7mc/s.) DRG. B/20/7.
L2	IF TRANS. (10·7mc/s.) DRG. B/20/7.
L3	RATIO TRANS. (10·7mc/s.) DRG. B/20/8.
LP1	6·5V. 0·3A DIAL LAMP.
T1	O/P. TRANS. HINCHLEY ENG. TYPE 7569.
T2	MAINS. TRANS. HINCHLEY ENG. TYPE 7589.
MR1	WESTING HOUSE F.C.124.
F1	FUSE. 500mA
F2	FUSE. 1mA

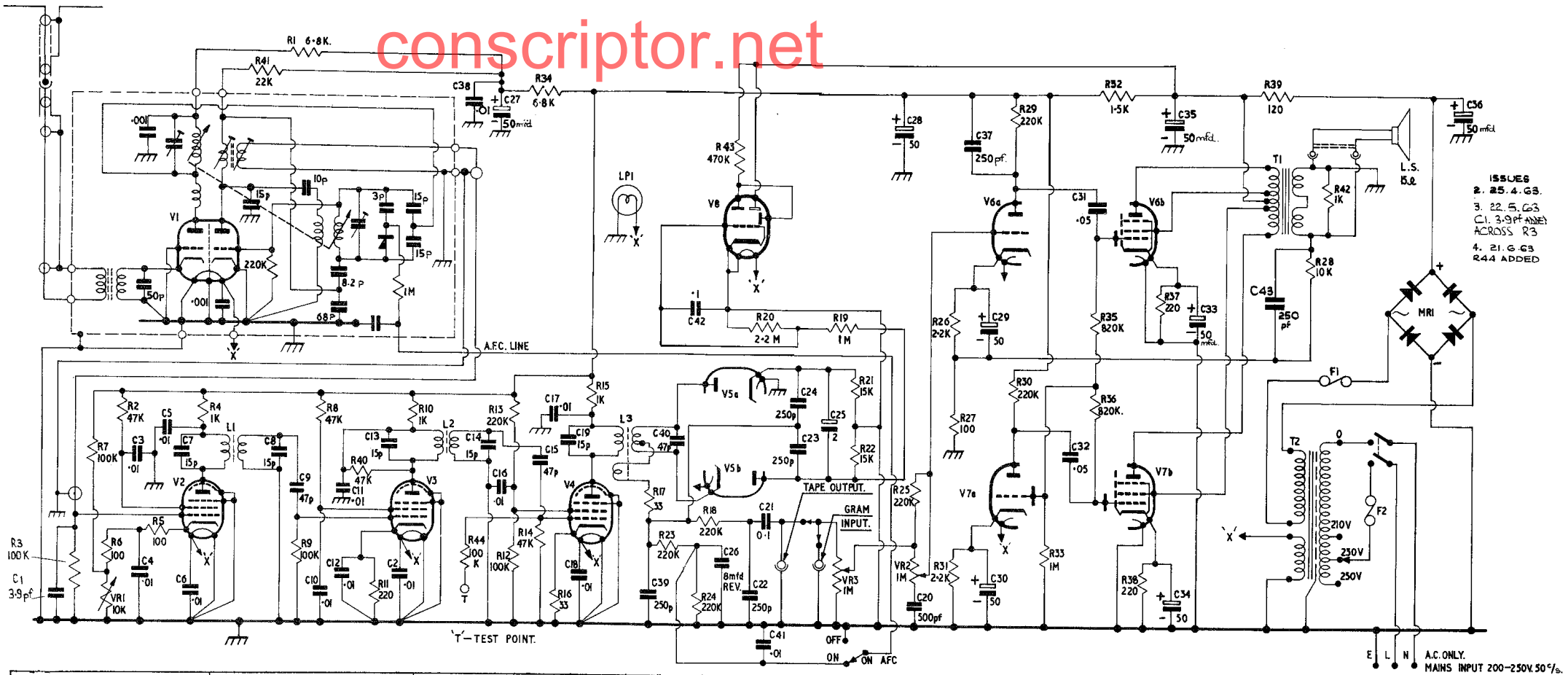
CIRCUIT COMPONENT. LIST.

REF.	VALUE	TOL %
	RESISTORS.	
R1	6·8K	10
R2	4·7K	10
R3	100K	10
R4	1K	10
R5	100Ω	10
R6	100Ω	10
R7	10K	10
R8	47K	10
R9	100K	10
R10	1K	10
R11	220Ω	10
R12	100K	10
R13	220K	10
R14	47K	10
R15	1K	10
R16	33Ω	10
R17	33Ω	10
R18	220K	10
R19	1M	10
R20	2·2M	10
R21	15K	5
R22	15K	5
R23	220K	10
R24	220K	10
R25	220K	10
R26	2·2K	10
R27	100Ω	10
R28	10K	10
R29	220K	10
R30	220K	10
R31	2·2K	10
R32	1·5K. W.W. 4W.	
R33	1M	10
R34	6·8K	10
R35	820K	10
R36	820K	10
R37	220Ω	10
R38	220Ω	10
R39	120Ω W.W. 4W.	
R40	47K	10
R41	22K	10
R42	1K	10
R43	470K	10
R44	100K	10

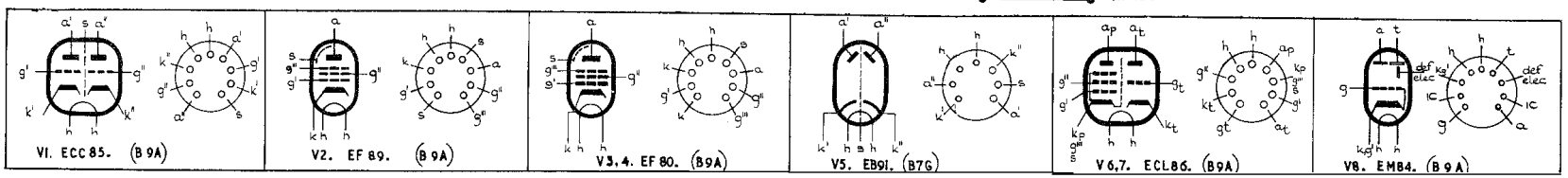
REF.	VALUE	V. W. D.C.	TOL %
	CAPACITORS		
C1			
C2	·01 mfd.		20
C3	·01 mfd.		20
C4	·01 mfd.		20
C5	·01 mfd.		20
C6	·01 mfd.		20
C7	15 pf		5
C8	15 pf		5
C9	47 pf		10
C10	·01 mfd		20
C11	·01 mfd		20
C12	·01 mfd		20
C13	15 pf		5
C14	15 pf		5
C15	47pf		10
C16	·01 mfd.		20
C17	·01 mfd.		20
C18	·01 mfd.		20
C19	15pf		5
C20	500pf	600V	
C21	0·1 mfd	350V	
C22	250pf		5
C23	250pf		5

CIRCUIT COMPONENT LIST.

REF	VALUE	V.W.DC	TOL	REF.	VALUE	TOL
	CAPACITORS					
C25	2 mfd.	150				
C26	8 mfd (REV.)	12 v				
C27 + C28	50 mfd + 50 mfd	300v				
C29	50 mfd.	15 v				
C30	50 mfd.	15 v				
C31	·05 mfd.	350V				
C32	·05 mfd.	350V				
C33	50 mfd.	15 v				
C34	50 mfd.	15 v				
C35 + C36	50 mfd + 50 mfd	350v				
C37	250 pF		5			
C38	·01 mfd.		20			
C39	250 pf		5			
C40	47 pF		5			
C41	·01 mfd.		20			
C42	·1 mfd.	350v				
C43	250 pF		5			
V1	ECC 85					
V2	EF89					
V3	EF80					
V4	EF80					
V5	EB91					
V6	ECL86					
V7	ECL86					
V8	EM84.					



ISSUES
2. 25.4.63.
3. 22.5.63 C1. 3·9pf ADDED ACROSS R3
4. 21.6.63 R44 ADDED



HACKER RADIO LTD. MAIDENHEAD, BERKS.	
CIRCUIT DIAGRAM. RV.20. MAYFLOWER II.	
DRG. NO.	CD/20/4.