

**Model RT391** is a portable 4 track tape recorder incorporating the B.S.R. TD2 tape deck. Tape speed is  $3\frac{3}{4}$ " per second, and the four valve circuit produces an output of 3 watts, available via the internal 7" x 4" loud-speaker, or from the extension loud-speaker sockets.

An electronic level indicator and both high and low level input sockets are fitted.

In appearance, it is almost identical with Ekco RT366 but can be readily identified by the additional control at the top front right.

**Mains Supply :** 200-250 Volts A.C. only.

**Mains Consumption :** 46 Watts.

#### Mains Adjustment :

Recorders are despatched already set for 230-250V operation but for 200-220V, the tape deck must be removed as described below, to gain access to the transformer tags. The flying lead is then clipped to the 200-220V mains voltage terminal.

**Loud-speaker :** 7" x 4" elliptical.

#### Valves :

V1 : Low level A.F. Amplifier EF86  
 V2A : Frequency Correction Stage ECC83  
 V2B : A.F. Amplifier ECC83  
 V3 : Record-Oscillator, Playback-Output EL84  
 V4 : Record Level Indicator EM84

#### Metal Rectifier :

MR1 : Bridge H.T. Rectifier

Westinghouse EC1

#### Controls :

The three controls on the amplifier panel are :—

Extreme Left : Volume-Record Level.  
 Inner Left : Track Selection.  
 Right : Tone, On-Off.

The two mechanical controls on the tape deck are :—

Left : Record-Playback.  
 Right : Function.

#### Important Note :

The Track Selection switch must not be altered, while the machine is in the record condition, as the Record-Playback head could become permanently magnetised.

#### Chassis Removal :

The three amplifier control knobs are released by slackening the grub screws, after which the control panel escutcheon is freed by the removal of four screws. Next, release the two large screws in the sides of the deck and the two screws on the cabinet base. The deck, complete with amplifier, can now be lifted out to the extent of the loud-speaker and input leads.

#### Voltage and Current Data :

The following readings were obtained from a recorder with the mains input tap set to 230-250 volts, on a 240V supply. Recorder on playback, Volume control at minimum.

Voltmeter sensitivity : 20,000 ohms per volt.  
 Mains input current : 267mA  
 Heater Volts : 6.4V A.C.

H.T. Volts at junction R25/C24 : 270V D.C.  
 " " " " : 260V D.C.  
 R25/R22 : 260V D.C.  
 R22/R8 : 240V D.C.  
 R8/R6 : 220V D.C.  
 " " " " : 235V A.C.  
 Volts across T1 H.T. Sec. : 235V A.C.  
 Total H.T. Current : 49.5 mA

#### Valve Operating Conditions :

Valve	Anode		Screen		Cathode	
	Pin	V	Pin	V	Pin	V
V1 EF86	6	60	1	44	3	—
V2A ECC83	6	147	—	—	8	1.47
V2B ECC83	1	152	—	—	3	1.2
V3 EL84	7	242	9	258	3	7.5
V4 EM84	9.6	50	—	—	3	—
						mA
						0.9
						0.42
						0.84
						45.8
						1.4

#### D.C. Resistance of Windings :

Winding	Ohms
T1 Primary	75
T1 H.T. Secondary	120
T2 Primary	400
T3 Primary	16
T3 Secondary	3

**Important Note :** Under no circumstances should the resistance of the heads be checked with an ohmmeter unless proper demagnetisation facilities are available.

#### Circuit Description :

##### Record :

The screened socket box has both High (JK1) and Low (JK2) level jack sockets. Weak input signals, e.g., from a microphone, are applied via JK2, and the voltage thus

developed across R3 is fed to the grid of V1 via C2. Stronger signals, e.g., from a gram, or pick-up are applied via JK1 across R1, R2 and from their junction the reduced signal is fed to V1, the first A.F. amplifier. The amplified signal is passed to the grid of V2A via C3 and the network RV1, C6 which compensates for variations in head response. The network R9, C9, R10, C10 and R12, C11 is a frequency compensation arrangement, applying selective negative feedback between the anode and grid of V2A. The compensated signal is fed via C12, RV2 (the Record Level control) to the grid of V2B.

After further amplification, the signal is passed through a filter network to the appropriate coil in the Record head, and to the grid of V4, the recording level indicator, via C22, R29. The negative feedback loop is rendered inoperative by SW2.

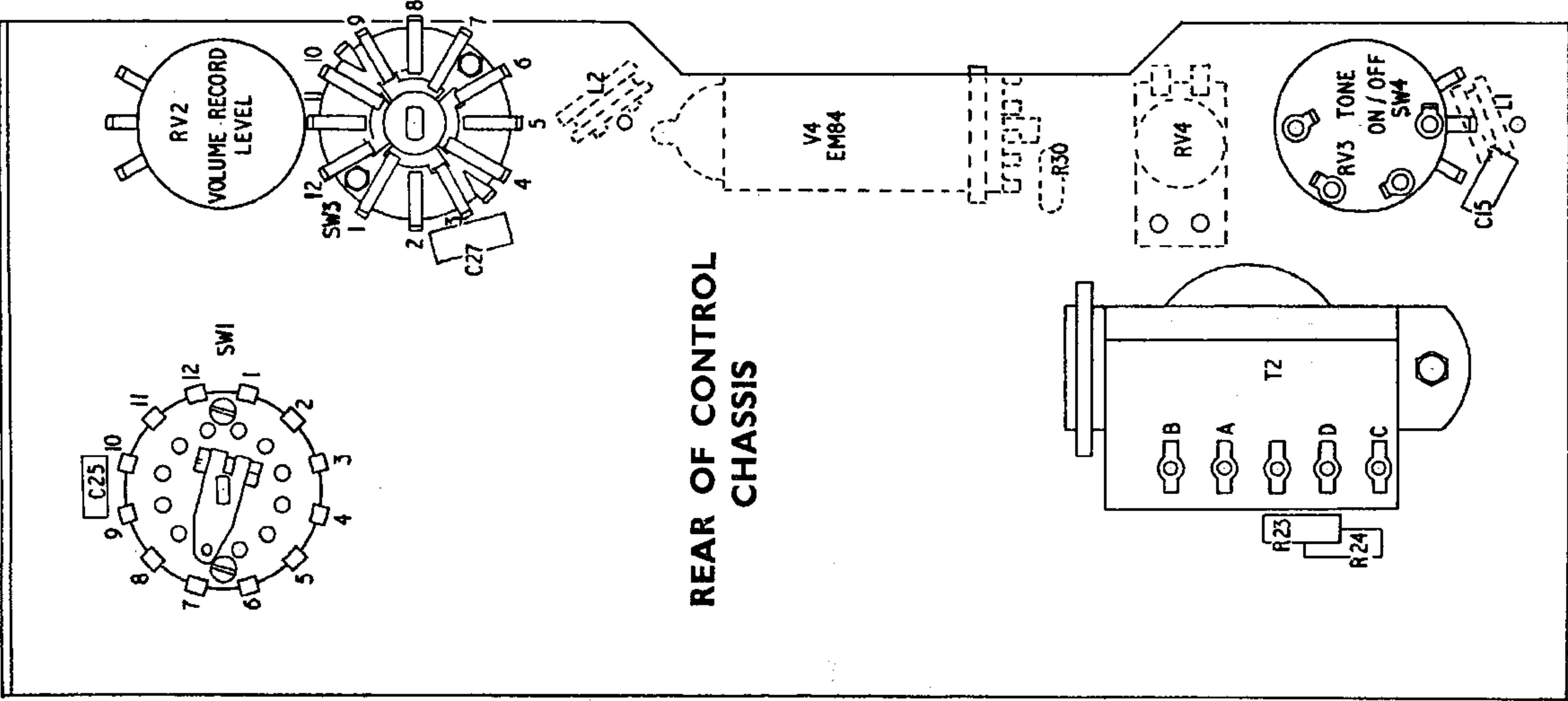
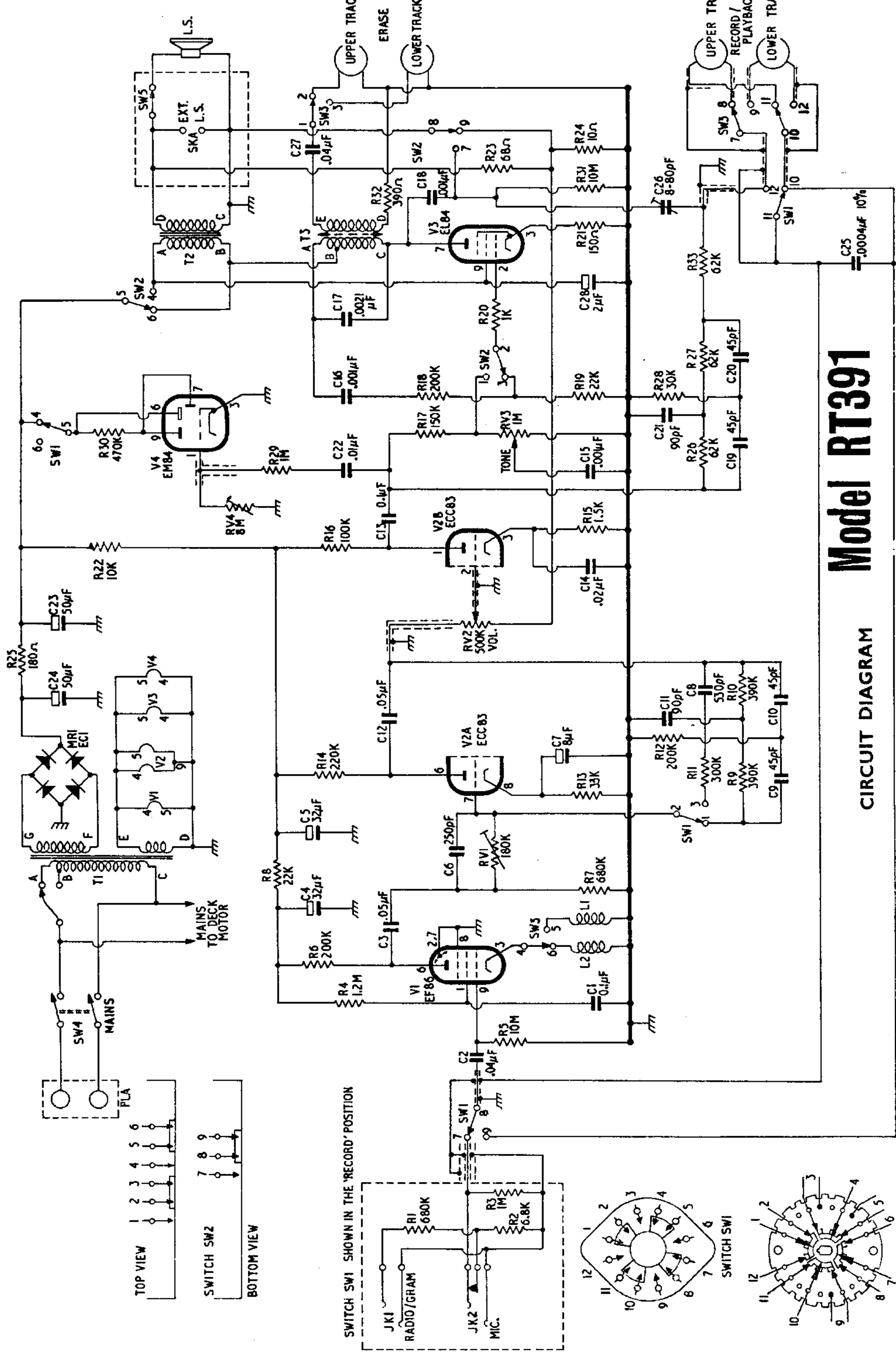
The recording head bias is derived from the anode-tuned oscillator circuit of V3, and is applied to the Record head via the trimmer C26, which is preset to give the correct bias level. The rest of the oscillator voltage appears at T3 secondary and is taken via C27 and R32 to the Erase head.

C19-C21 and R26-R28, form a bias rejector circuit which prevents bias oscillator voltages from overloading the level indicator.

#### Playback :

The low level signal derived from the appropriate coil in the Playback head is applied via SW3 to the grid of V1. The coils L1 and L2 in the cathode circuit reduce the residual hum in the amplifier for each track. The amplified signal is then fed to the grid of V2A. R11, C8 form a negative feedback circuit around V2A. The frequency compensated signal is fed

C	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88.	89.	90.	91.	92.	93.	94.	95.	96.	97.	98.	99.	100.	
R	L	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.	81.	82.	83.	84.	85.	86.	87.	88.	89.	90.	91.	92.	93.	94.	95.	96.	97.	98.	99.	100.
M	JKA.	JKB.	PLA.	SWI.	SW4.	VI.	SW3.	L2.	LI.	TL.	RVIL.	MRI.	V2A.	RV2.	V2B.	RV4.	RV3.	SWL.	V4.	SW2.	SKA.	SW3.	L.S.	M																																																																												



# Model RT391

## CIRCUIT DIAGRAM

via RV2 the Volume control to V2B, which amplifies it still further, and is then applied to the output stage V3, via the Tone control RV3. The oscillator circuit is broken by SW2, and the signal fed to the output transformer primary, T2, and thence via the secondary to the loud-speaker. Negative feedback from the secondary is developed across R23,R24, and fed via the Volume control to V2B grid.

**Note :** H.T. to the level indicator, V4, is switched out during the playback condition.

#### **Adjustment of Pre-Set Components :**

Certain component changes will necessitate pre-set trimmer and resistor adjustment as described below :—

**Head Change Adjustment :** (a), (b), (c) (d) and (e).

**V1 Change :** (d) only

**V3 Change :** (e) only

**V4 Change :** (b) only

#### **(a) Azimuth Alignment :**

A standard test tape with a frequency output of approximately 5 Kc/s is required. With the machine switched to playback the tape should be played, and the two head adjusting screws set to give the greatest audio output on each track optimising the settings as necessary.

#### **(b) Set RV4 :**

Instruments required : (1) a Valve Voltmeter (2) an Output Meter, (or high resistance 0-3V A.C. meter and a 3 ohms load) (3) an A.F. Signal Generator.

**Note :** This setting should also be checked when changing V4. Short-circuit pin 2 of V3 to chassis, to avoid spurious reading being obtained from bias voltages.

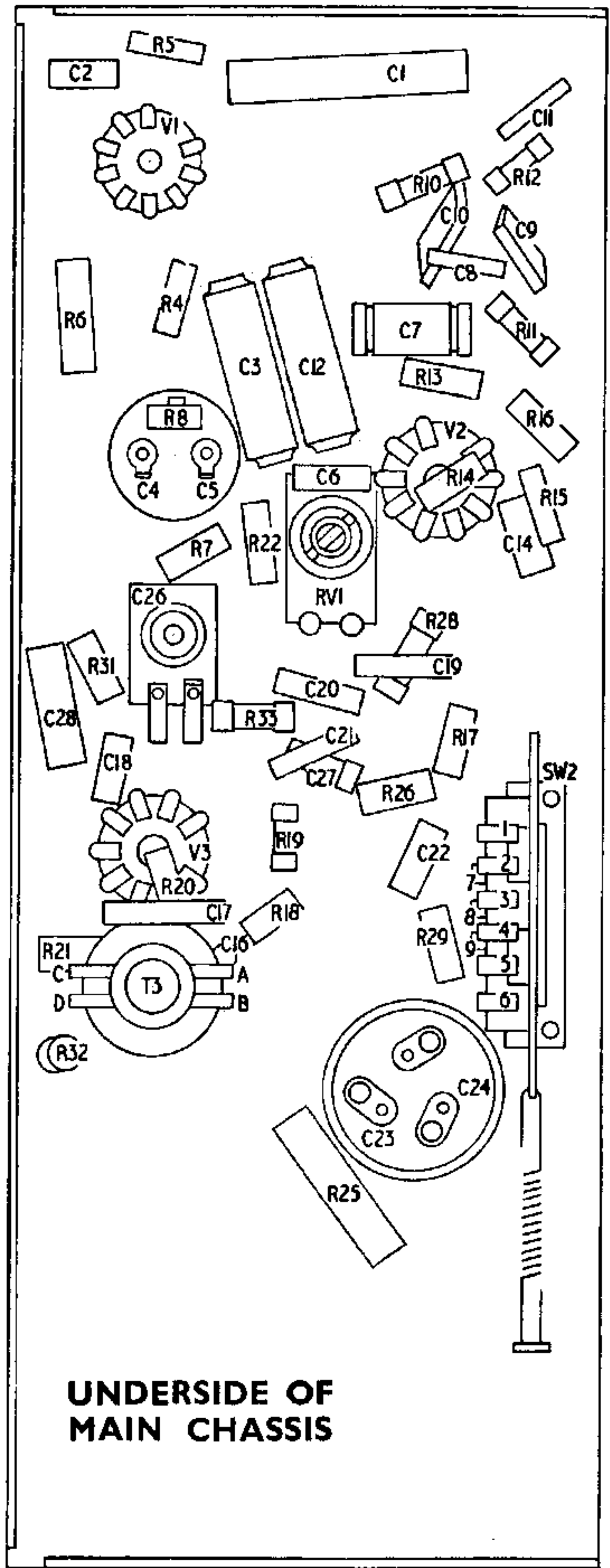
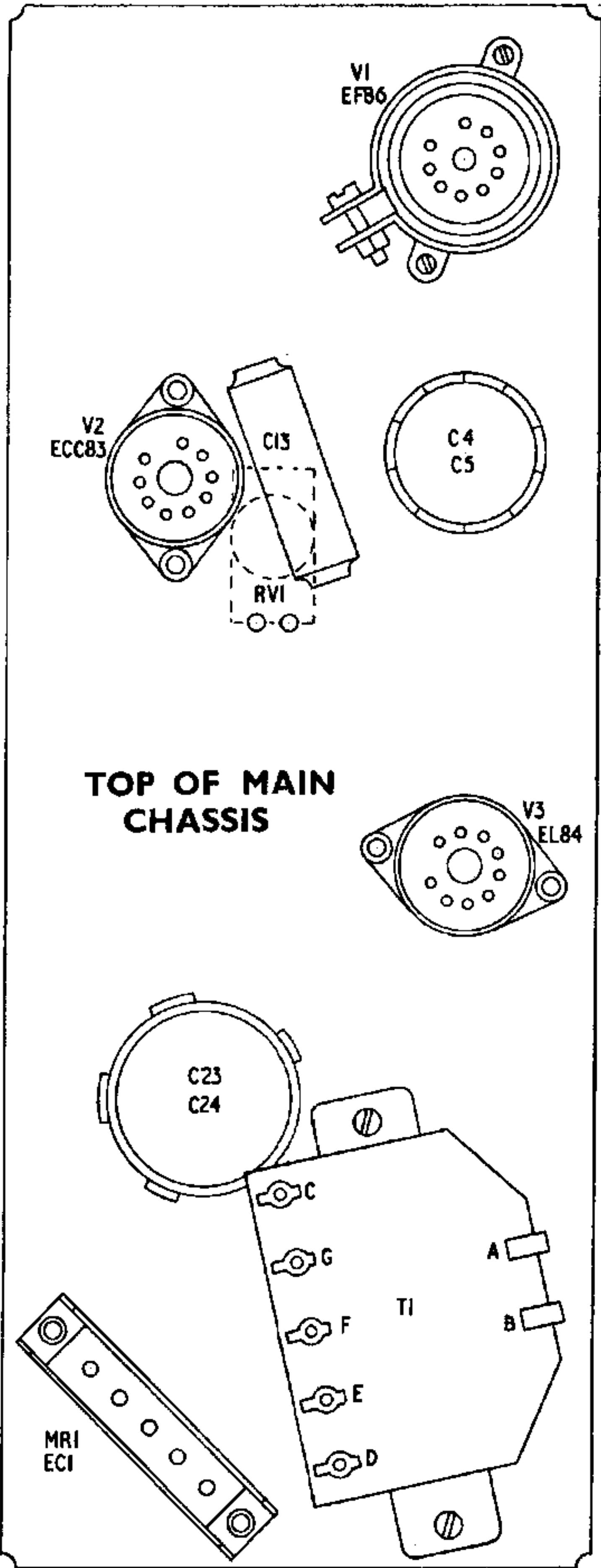
Connect the Generator to the Gram. input socket, and the Valve Voltmeter between the junction of C13,R17, and chassis. Feed in a 1 Kc/s signal, and adjust the generator out-

put or Record Level control to produce a reading of 15V on the voltmeter. Check that turning RV4 fully clockwise causes the magic eye beams to overlap. If this will not occur, the EM84 is not suitable in this particular application, and another should be tried. Now turn RV4 until the beams just meet, without overlapping. Remove short on pin 2 V3. Make a recording at between 400-1,000 c/s with the magic eye just closed as above. On Playback, the total harmonic distortion should be between 3% and 6%. If the distortion is too low, readjust RV4 with 18 volts output and re-check distortion. If the distortion is too high, reset RV4 with 12 volts and repeat the test. The above test ensures that the tape is fully modulated when recording.

#### **(c) Set RV1 :**

Instruments required : (1) and (2) as above. This setting should be made after the adjustment of RV4 and oscillator trimmer (C26). Connect the Signal Generator to the Gram. socket, and the Output Meter across the loud-speaker terminals. Turn RV1 fully anti-clockwise, then inject a 1 Kc/s signal and adjust either the input signal or the recording level to just close the Magic Eye. Attenuate the generator output by approximately 20 dB and, keeping the input constant at this level, make a recording at 90, 400, 1,000, 3,000, 5,000 and 8,000 c/s. On playback the output at all frequencies should be  $\pm 3$  dB of the output at 1,000 c/s. If the H.F. response is more than 3dB down re-check the bias. If this is correct, turn RV1 approximately 90°, and repeat the above procedure. This should improve the frequency response, but if it is still insufficient, increase RV1 still further, until the frequency response is satisfactory.

**Note :** The reason for setting the input 20 dB down is to avoid overload, as there is considerable treble boost in the recording amplifier.



**(d) Hum Bucking Coils :**

With the machine switched to Playback, but without tape, and the Volume control at maximum, the coils L1 and L2 should be re-oriented to produce the lowest hum level with SW3 in each position. To further this, the positions of L1 and L2 may be interchanged.

**(e) Oscillator Adjustment and Bias Setting :**

With the Instrument switched to Record, using either a standard or low capacity valve voltmeter, adjust T3 core for minimum voltage output at point A.

Switch to Record. (i) If a low capacity valve voltmeter is available, measure the voltage at the junction of C26 and R33, and adjust by means of C26 to 75V. (ii) If a standard valve voltmeter is used, turn the Record Level control fully anti-clockwise, and connect

a 1.8K ohms resistor between the red lead on the Record head and the tag to which it was connected. Adjust C26 to give a reading of 1.25V across the resistor when switched to Record. The 'earthy' side of the voltmeter should be connected to the junction of the resistor and the red lead.

**Service Notes :**

(1) The capacitor C25 must have a tolerance of  $\pm 10\%$ , and be of the type originally fitted. (400V Hunt W99).

(2) If it is necessary to separate the tape deck from the amplifier chassis, ensure that the spring loaded Record-Playback switch is in the 'Playback' position. This eliminates the possibility of damaging the wafer of switch SW1 upon re-assembly, as the wafer is 'keyed' for mating with the switch shaft and will only align if left in the 'Playback' position.

**RESISTORS :****SPARE PARTS LISTS**

<i>Circuit Ref.</i>	<i>Ohms</i>	<i>Tolerance <math>\pm\%</math></i>	<i>Type</i>	<i>Part No.</i>
R1	680K	10	Erie 7AD	93596
R2	6.8K	10	Erie 7AD	93572
R3,29	1M	10	Erie 7AD	93598
R4	1.2M	10	Erie 7AD	93599
R5,31	10M	20	Erie 7AD	93537
R6	200K	5	Erie 108	92404D
R7	680K	20	Erie 7AD	93530
R8	22K	20	Erie 7AD	93521
R9,10	390K	5	Erie 7A	92959
R11	300K	5	Erie 7A	92978C
R12,18	200K	5	Erie 7A	92955
R13	3.3K	10	Erie 7AD	93568
R14	220K	10	Erie 7AD	93590
R15	1.5K	10	Erie 7AD	93564
R16	100K	10	Erie 7AD	93586
R17	150K	20	Erie 7AD	93526
R19	22K	5	Erie 7A	92941
R20	1K	20	Erie 7AD	93513
R21	150	10	RMA8	94052
R22	10K	20	Erie 7AD	93519
R23	68	10	Erie 7AD	93548
R24	10	10	Erie 7AD	93538
R25,33	180	10	Erie 10AD	94416B
R26,27	62K	5	Erie 7A	92948
R28	30K	5	Erie 7A	92943
R30	470K	20	Erie 7AD	93529
R32	390	10	Erie 10AD	94420B

## RESISTORS VARIABLE :

Circuit Ref.	Ohms	Function	Type	Part No.
RV1	180K	Pre-set Volume Tone Pre-set	Carbon, Linear	122698
RV2	500K		Carbon, Log.	108295/8
RV3	1M		Carbon, Log.	108543/7
RV4	8M		Carbon, Linear	122698/1

## CAPACITORS :

Circuit Ref.	Capacity	Tol. $\pm$ %	Wkg. V	Type	Part No.
C1	0.1 $\mu$ F	—	350	Plasticseal	109327
C2,27	.04 $\mu$ F	—	150	Hunt W99	41904/10
C3,12	.05 $\mu$ F	—	350	CP35N	52660/1
C4,5	32 $\mu$ F	—	350	CE26LE	108436
C6	250 pF	2	—	P.S.M.	105711/64
C7	8 $\mu$ F	—	6	CE131AE	122353
C8	530 pF	2	—	P.S.M.	105711/62
C9,10	45 pF	2	—	P.S.M.	105711/60
C11,21	90 pF	2	—	P.S.M.	105711/61
C13	0.1 $\mu$ F	—	350	CP37N	52661/1
C14	.02 $\mu$ F	—	150	Hunt W99	41904/8
C15,16	.001 $\mu$ F	—	400	Hunt W99	41904
C17	.0021 $\mu$ F	5	—	P.S.M.	105711/63
C18	.001 $\mu$ F	—	400	Hunt W99	41904
C19,20	45 pF	2	—	P.S.M.	105711/60
C22	.01 $\mu$ F	—	400	Hunt W99	41904/4
C23,24	50 $\mu$ F	—	350	Elect.	47865
C25	.0004 $\mu$ F	10	—	Hunt W99	41904/31
C26	8—80 pF	—	—	Trimmer	40199/6
C28	2 $\mu$ F	—	350	CE132LF	49362/28

## MISCELLANEOUS :

Circuit Ref.	Description	Type	Part No.
V1	Valve, pre-amp.	Mullard EF86	55471
V2	Valve, frequency correction	Mullard ECC83	55594
V3	Valve, output	Mullard EL84	55473
V4	Level indicator	Mullard EM84	56862
T1	Mains transformer	—	SA5653
T2	Output transformer	—	SA5922/A
T3	Oscillator transformer	—	30242
LI,2	Hum bucking coil	—	30260B
MRI	Metal rectifier	Westinghouse ECI	108287
SKA	External L.S. socket	—	DP30232
JK1	Jack socket	Radio/Gram	122620
JK2	Jack socket	Microphone	122620/1
SW1 } SW2 }	Record/Playback switch	Rotary } Ganged Slider }	122573
SW3	Track selection switch	Rotary	C123442
SW4	Mains switch	On/Off	108543/7
SW5	Speaker muting switch	—	A43338/4
LS1	Loud-speaker	7" x 4"	122857

Department :  
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tend 42296.