

Stern's

COMPLETE ASSEMBLY DATA and DIAGRAMS FOR THE
CONSTRUCTION OF

THE MULLARD 2 VALVE PRE-AMPLIFIER CONTROL UNIT MK II

SUITABLE FOR OPERATION WITH MOST POWER AMPLIFIERS INCLUDING
● MULLARD '3-3' ● MULLARD '5-10' ● MULLARD '20 WATT'

INCORPORATES

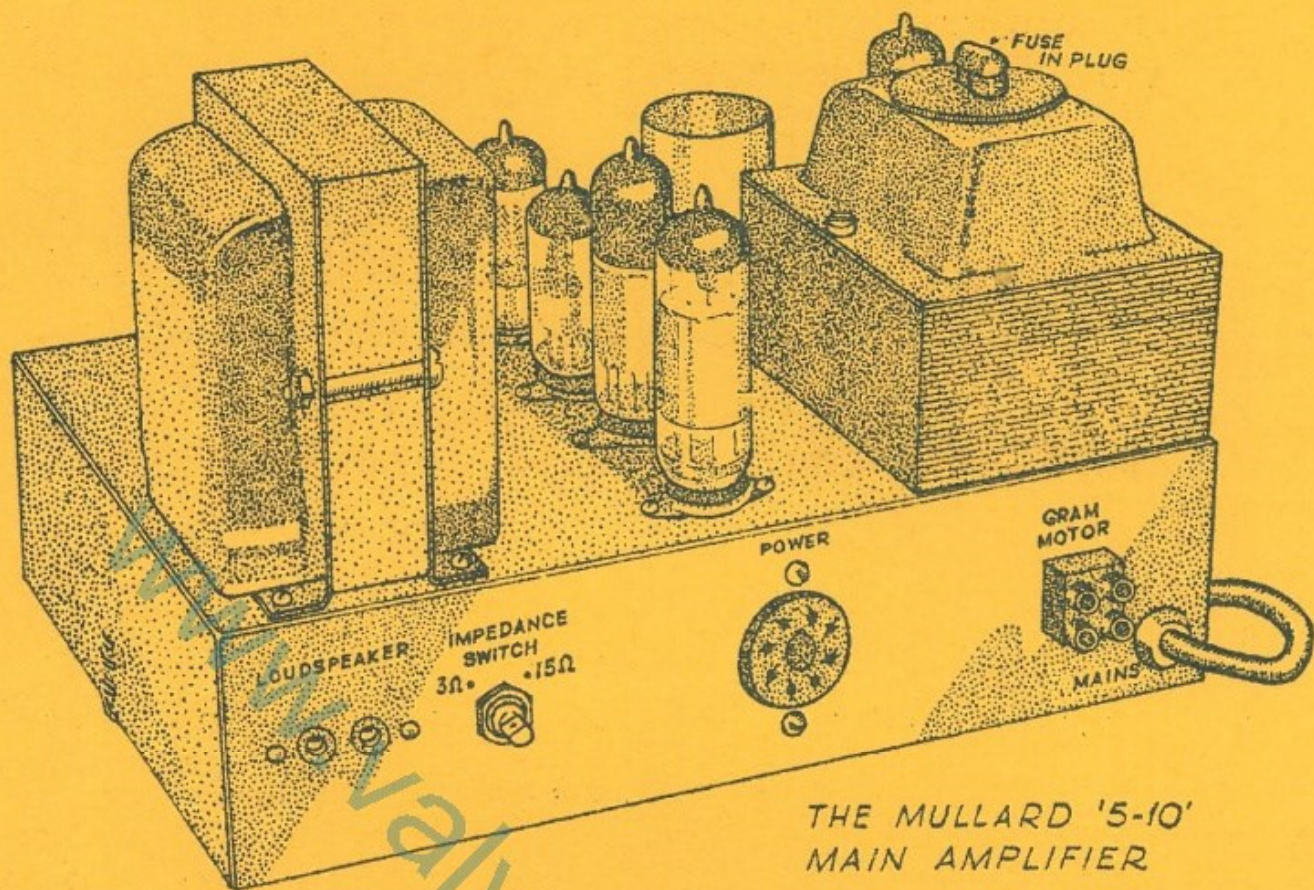
- Equalisation for the latest R.I.A.A. characteristics
- Input for variable reluctance magnetic pick up
- Input for crystal pick up
- Inputs for tape replay
 - ⓐ direct from high impedance tape head
 - ⓑ or from a tape pre-amplifier
- Sensitive microphone channel
- Wide range separate bass and treble controls
- Front panel styled to match into modern furnishings

POSTAL ENQUIRIES
and
MAIL ORDERS TO ...
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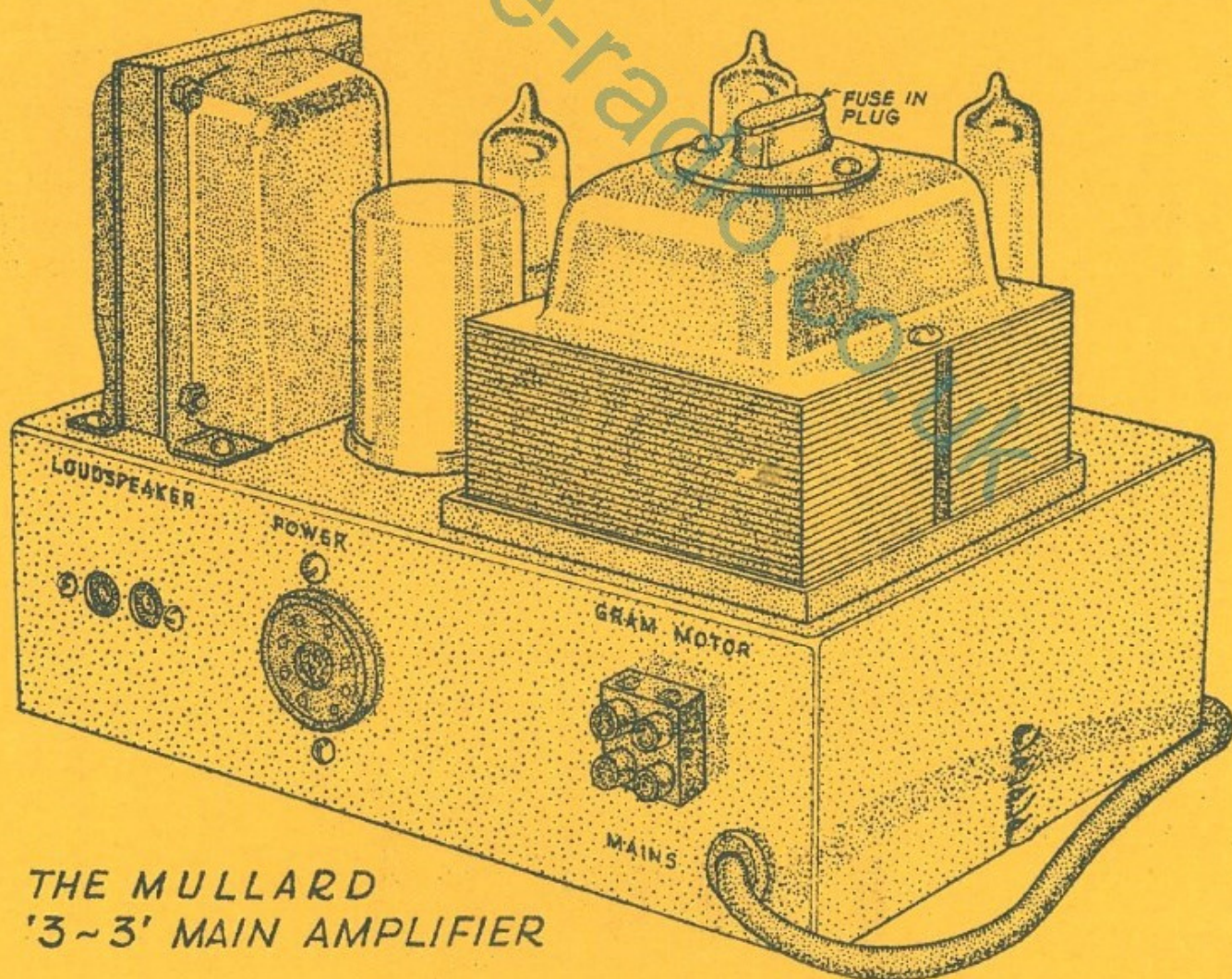
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THE MULLARD '5-10'
MAIN AMPLIFIER



THE MULLARD
'3-3' MAIN AMPLIFIER

Introduction ...

This versatile Pre-Amplifier has been designed mainly for use with Amplifiers based on the Mullard 20, 10 and 3 Watt circuits. It can also be used with any Power Amplifier which does not require an Input Signal larger than 250 milli-volts for full Output.

The circuitry is to the specification of Mullard Ltd. but we have presented the layout in a very simple form so that even now the novice constructor will be able to follow the stage by stage assembly instructions without difficulty and therefore be assured of first time operation.

General ...

Input facilities are provided for both Magnetic and Crystal Pick Ups for high impedance Tape Heads, also for Microphone and VHF/Radio Tuning Units.

Selection of an input channel is readily achieved by the six way Selector Switch, but it is important that Magnetic and Crystal Pick Ups are not used at the same time. Equalisation for disc recording conforms to the latest R.I.A.A. characteristics now adopted by most of the major recording companies.

Tape 1. is intended to accept the output from a Tape Record Amplifier or Pre-Amplifier, such as our Type 'C' and therefore provides for high fidelity replay through the system. This input is also suitable for high output Crystal Pick Ups which if fed into the standard Crystal input would cause overloading and distortion.

Tape 2. offers the advantage of a sensitive input (4 milli-volts) to accept the output direct from a high impedance Tape Replay Head therefore by the addition of a Tape Deck only pre-recorded tapes may be replayed in the same way as a gramophone record. This facility we feel will appeal to those who have no desire to make their own recording but nevertheless would like to listen to some of the "Hi-Fi" Pre-recorded tapes, it also dispenses with the expense of a Tape Pre-Amplifier, which of course could always be added later if one then decides to effect their own recordings. A "TAPE RECORD" Jack is provided on the front of the Pre-Amplifier so that the signal passing through the Pre-Amplifier may be taken off and fed into a Tape Recorder. The Jack is fed from a point down the anode of V2 therefore the signal is not affected by the Pre-Amplifier Tone or Volume controls.

Low impedance Tone controls which cover a wide range of frequencies are used. They provide sufficient control for most applications.

Circuit Description ...

The Pre-Amplifier is made up of two stages each of which uses a Mullard high gain pentode type EF86 valve.

First Stage

All the equalisation takes place in this stage and is achieved by means of frequency-selective feedback. A low-impedance grid circuit is used to lessen hum pick up and also to reduce the effect of plugging-in external low impedance circuits. As far as possible the impedance and sensitivity of each input channel has been chosen to cater for the values which will be encountered most frequently. The input impedance quoted for each channel comprises the input network together with the grid impedance of the EF86 valve modified by the feedback components.

Second Stage

This is a voltage-gain stage in which there is no feedback. The anode load at V2 is arranged to produce the standard output of 250 milli-volts across the Volume control VR3 for the stated input figures. This output is only suitable to drive the MULLARD 20 WATT Amplifier, and for use with the Mullard 5-10 or 3-3 Amplifiers a simple resistive attenuator is added across the output control to reduce the 250 milli-volts to 40 and 100 milli-volts respectively. It will be seen therefore that any output from 250 milli-volts may be obtained by adjusting the values of the attenuators RA and RB.

It is essential to incorporate the correct attenuation, otherwise insufficient drive or gross overloading of the Pre-Amplifier will occur. The following resistor values, and drive voltages are correct for the MULLARD AMPLIFIERS.

Mullard 20 Watt Amplifier	250 millivolts ..	RA & RB Not Required.
Mullard 5-10 Amplifier	40 millivolts ..	RA 680K $\frac{1}{2}$ Watt 10%
			RB 150K $\frac{1}{2}$ Watt 10%
Mullard 3-3 Amplifier	100 millivolts ..	RA 270K $\frac{1}{2}$ Watt 10%
			RB 180K $\frac{1}{2}$ Watt 10%

TECHNICAL SPECIFICATION

SIGNAL INPUTS ...

1. Radio Impedance: 1 Meg ohm.
 Sensitivity: 300 mV.

With these values of impedance and sensitivity, this channel should meet most requirements. However, other values can easily be obtained by altering the feedback resistor R10 and the series resistor R1.

2. Tape Playback (Tape 1) Impedance: 1 Meg ohm.
Crystal Pick Ups (High Output) Sensitivity: 300 mV.

This channel is designed for use with Tape Pre-Amplifiers, or High Output Crystal Pick Ups.

3. Tape Playback (Tape 2) Impedance: 100 k ohms (approx.)
 Sensitivity: 4 mV.

Full C.C.I.R. correction is not provided in this channel of the Pre-Amplifier, but the curve adopted results in good performance with high-impedance heads.

4. Microphone (Jack 1) Impedance: 1 Meg ohm.
 Sensitivity: 7.5 mV.

This channel is designed for use with Crystal Microphones.

5. Pick-Up - Magnetic (L.P. - 78) Impedance: 100 k ohms (approx.)
 Sensitivity: 5 mV. L.P. records.
 13 mV. Std. 78 rpm records.

This input channel is most suitable for pick-ups of the variable reluctance type, but Moving-Coil types which have higher outputs can also be used by replacing the present series Resistor R5 by one of larger value.

6. Pick-Up - Crystal (L.P. - 78) Impedance: 100 k ohms.
 Sensitivity: 70 mV. L.P. records.
 200 mV. 78 rpm records.

Low- and medium-output crystal pick-ups can be used for this input channel. The input is loaded with the 100 k ohm resistor R7 in order that its characteristic shall approximate to that of a magnetic cartridge and to allow the same feedback network to be used.

OUTPUT - TO POWER AMPLIFIER.

The input figures above will produce up to 250 millivolts across the volume control VR3. Depending on the attenuation network incorporated the following drive voltages are obtained across the AUDIO OUTPUT LEAD.

40 millivolts for Mullard 5-10 Amplifier.

100 millivolts for Mullard 3-3 Amplifier.

No Attenuation Required ... 250 millivolts for Mullard 20 Watt Amplifier.

TAPE RECORD - Jack No. 2

The output Jack is fed from the anode of V2 therefore the signal voltage at this point is not affected by the Tone or Volume Controls. It should be remembered that the Pre-Amplifier has no equalising

network for Tape Recording and therefore, it is essential to use it with the Recording Amplifier. We must emphasise that to form a complete Recorder the addition of a low level Tape Amplifier and bias oscillator is essential. A Tape Deck alone is not sufficient for recording purposes.

POWER REQUIREMENTS H.T. ... 300 Volts at 3 mA. (Smoothed).
L.T. ... 5.3 Volts at 0.6A.

VALVES V1 ... EF86, First Stage - Equaliser.
V2 ... EF86, Second Stage - Voltage Amplifier and Tone Control.

CONTROLS

S1 Input Selector

Six position Switch. (A) Radio. (B) Tape/P.U. 1. (C) Tape 2.
(D) Microphone. (E) L.P. (F) 78 r.p.m.

VR1 ... Treble

VR2 ... Bass

} Low impedance - continuously variable.

VR3 ... Volume and on/off Switch.

Dimensions

Length ... $9\frac{1}{2}$ inches
Depth ... $4\frac{1}{2}$ inches
Height ... $2\frac{5}{8}$ inches
Weight ... $3\frac{1}{4}$ lbs.

Front Panel

Finish ... Highly polished Perspex.
Black with Gold engraving or
White with Black engraving.
Size ... $10\frac{1}{2}$ " x $2\frac{7}{8}$ "

NOTES ON WIRING ... The newcomer to Amplifier construction will find the following general hints useful.

Tools ... The main requirements are a small soldering iron, preferably of the instrument type - a screwdriver - a small pair of pointed pliers or strong tweezers - and a pair of side cutters.

Wiring ... No difficulty will be experienced with the construction of this Pre-Amplifier if the simple stage by stage instructions are followed carefully, and the specified components used.

It is essential with the high gain Pre-Amplifiers to keep wiring short and direct. We accordingly advise constructors to ensure that all wiring and components are positioned as nearly as possible as that shown in the practical diagrams. A little extra care to effect neat and positive solder joints, will be well rewarded, bad joints result in noise and intermittent crackles, and special attention should be paid to ensure that the wires to be soldered are "clean" even to the point of scraping lightly with a blade and "tinned" before actually soldering to the appropriate connecting point.

High Stability resistors normally have the resistor value stamped on the body, therefore the constructor must satisfy himself that the correct value is identified before the resistor is fitted in position.

Wires carrying A.C. such as heater and switch leads must be lightly twisted together to avoid hum radiation. All input and output connections, excepting the seven core cable must be effected with grade insulated single screened cable.

To avoid "Earth Loops" when the Pre-Amplifier is connected to a Main Amplifier a single earth or chassis connection is used, this is via the screened braiding of the audio output lead. The earth or inter-chassis line connection from the Main Amplifier to pin 1 of the octal socket, is the earth return for a Tuning Unit only and must not be connected to the chassis or bus-bar in the Pre-Amplifier. In consequence the screened braiding of the audio lead is also the negative return and a shock will therefore be experienced if the audio co-axial plug is removed from the Main Amplifier whilst the equipment is in operation. We recommend that the equipment will be disconnected from the main supply before removing the audio lead.

 A VERY HIGH QUALITY TAPE PRE-AMPLIFIER SPECIFICALLY DESIGNED TO FORM THE 'LINK' REQUIRED TO ADD TAPE FACILITIES TO HIGH FIDELITY SOUND INSTALLATIONS ...

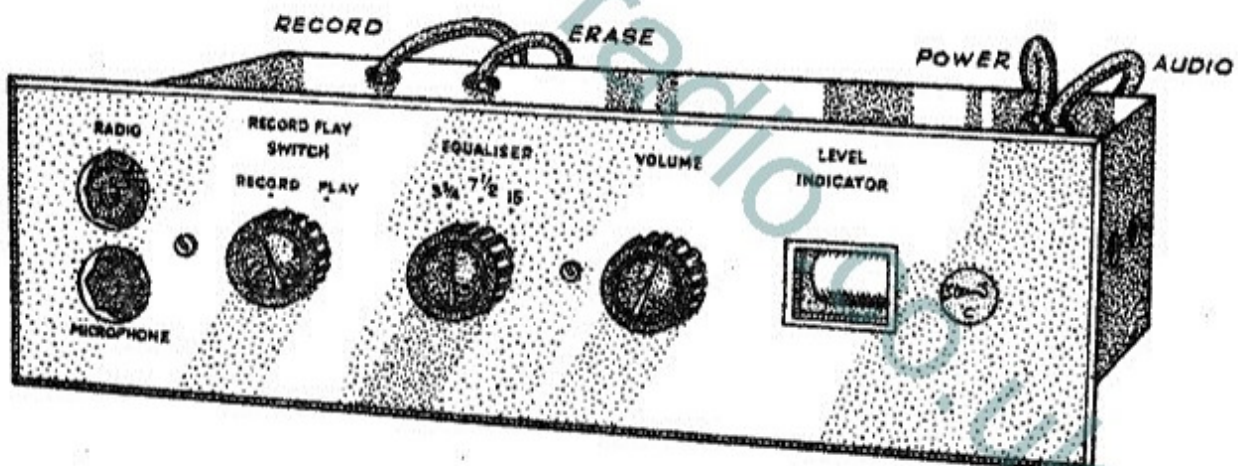
----- STERN'S "TYPE C" TAPE PRE-AMPLIFIER -----

Based Entirely on the latest Design by Mullard Laboratories
 INCORPORATING FERROXCUBE POT CORES

For

Push Pull OSCILLATOR - - - -and- - - - Treble EQUALISATION
 (Tapped Secondary for Head Matching) (Switched for Three Tape Speeds)

CAN BE SUPPLIED MATCHED FOR BRENNELL, COLLARO, LANE, MOTEK, TRUVOX TAPE DECKS



Available as a Complete Kit of Parts £14. 0. 0.
 Alternatively, fully Assembled and Tested £19. 10. 0.
 (Carr. & ins. 5/- extra)

Hire Purchase Terms - Assembled Unit only. Deposit £3. 8. 0. and
 12 monthly payments of £1. 4. 11.

The above prices include supply of separate small POWER SUPPLY UNIT.
 PRICES EXCLUDING this Unit are £11.15.0. and £14.10.0. respectively.

The Assembly Manual containing complete specification, drawings, etc.,
 is available for 4/- including postage, or send S.A.E. for fully
 descriptive leaflet

PARTS LIST & COMPONENT PRICES

RESISTORS ...

R1	1 Meg	Brn-Blk-Grn	$\frac{1}{2}$ W. 10%	4
R2	1 Meg	Brn-Blk-Grn	$\frac{1}{2}$ W. 10%	4
R3	56K	Grn-Blue-Or	$\frac{1}{2}$ W. 10%	4
R4	1 Meg	Brn-Blk-Grn	$\frac{1}{2}$ W. 10%	4
R5	68K	Blue-Grey-Or	$\frac{1}{2}$ W. 10%	4
R6	1 Meg	Brn-Blk-Grn	$\frac{1}{2}$ W. 10%	4
R7	100K	Brn-Blk-Yell	$\frac{1}{2}$ W. 10%	4
R8	560K	Grn-Blue-Yell	$\frac{1}{2}$ W. 5%	6
R9	10 Meg	Brn-Blk-Blue	$\frac{1}{2}$ W. 5%	6
R10	150K	Brn-Grn-Yell	$\frac{1}{2}$ W. 5%	6
R11	560K	Grn-Blue-Yell	$\frac{1}{2}$ W. 5%	6
R12	5.6 Meg	Grn-Blue-Grn	$\frac{1}{2}$ W. 5%	6
R13	220K	Red-Red-Yell	$\frac{1}{2}$ W. 5%	6
R14	100K	Brn-Blk-Yell	$\frac{1}{2}$ W. 10%	4
R15	220K	As marked, H/Stab.	10%	1/-
R16	1 Meg	As marked, H/Stab.	10%	1/-
R17	2.2K	As marked, H/Stab.	10%	1/-
R18	1 Meg	Brn-Blk-Grn	$\frac{1}{2}$ W. 10%	4
R19	33K	Orange-Or-Or	$\frac{1}{2}$ W. 10%	4
R20	8.2K	As marked, H/Stab.	10%	1/-
R21	100K	As marked, H/Stab.	10%	1/-
R22	1.2K	As marked, H/Stab.	10%	1/-
R23	390K	As marked, H/Stab.	10%	1/-
R24	22K	Red-Red-Or	$\frac{1}{2}$ W. 10%	4
R25	47K	Yell-Mauve-Or	$\frac{1}{2}$ W. 10%	4
R26	39K	Or-White-Or	$\frac{1}{2}$ W. 10%	4
R27	68K	Blue-Grey-Or	$\frac{1}{2}$ W. 10%	4
R28	6.8K	Blue-Grey-Red	$\frac{1}{2}$ W. 10%	4
*	(RA 680K	Blue-Grey-Yell	$\frac{1}{2}$ W. 10%	4
	(RB 150K	Brn-Grn-Yell	$\frac{1}{2}$ W. 10%	4
**	(RA 270K	Red-Mauve-Yell	$\frac{1}{2}$ W. 10%	4
	(RB 180K	Brn-Grey-Yell	$\frac{1}{2}$ W. 10%	4
VR1	250K	Log Potentiometer		3/3
VR2	250K	Log Potentiometer		3/3
VR3	250K	Log Potentiometer		5/-
		(with single pole switch)		

* 5-10 Amplifier only.
 ** 3-3 Amplifier only.
 For 20 Watt Amplifiers substitute 56K.

CHASSIS AND PANEL ...

1	Box Chassis complete with valve platform, indicator bracket and top cover.	13/6
1	Engraved Perspex Front Panel	7/9

VALVES

2	Mullard EF86 BVA Valves	£1-11-6.
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CAPACITORS ...

C1	390pF. Silver Mica	5%	9
C2	150pF. Silver Mica	5%	9
C3	2200pF. Silver Mica	10%	9
C4	560pF. Silver Mica	5%	9
C5	220pF. Silver Mica	5%	9
C6	25mfd Elect	12/25 volt.	2/-
C7	0.1 mfd Paper Tub.	350V.	1/-
C8	0.1 mfd Small Paper Tub	150V	1/-
C9	16 mfd Electrolytic	350V	3/6
C10	25 mfd Elect.	12 or 25V.	2/-
C11	0.1 mfd Paper Tub.	350V.	1/-
C12	0.1 mfd Paper Tub.	350V.	1/-
C13	560 pF. Silver Mica	10%	9
C14	8200pF. Silver Mica	10%	1/3
C15	2200pF. Silver Mica	10%	9
C16	0.02 mfd Paper Tub	350V.	9
C17	16 mfd Electrolytic	350V.	3/6
C18	0.1 mfd Paper Tub.	350V.	1/-

MISCELLANEOUS ...

1	1 pole 6 way 2 bank Switch	7/9
2	Igranic Jacks.	6/6
1	10 Way Tag Board, Large.	1/3
1	10 Way Tag Board, Small.	1/8
1	5 Way Tag Board, Small.	1/2
1	Single Tag Post.	2
2	B9A Valveholders with Skirt	1/6
1	Int. Octal Valveholder.	9
1	5 Way Clix Input Socket	
	Panel.	2/3
5	Miniature Clix Plugs.	1/10
1	Lilliput Lamp Holder.	9
1	Lilliput Lamp 6.3 volt.	1/1
1	Co-axial Plug.	1/3
1	Cable Clip.	3
4	Control Knobs.	3/-
1	yard 7/8 Core Cable.	1/9
1	yard Insulated Single Screened Cable.	1/-
3	yards 2mm Sleeving.	9
18	inches Thin Flexible for Heaters.	2
1	packet Nuts, Screws, Grommets, etc.	3/3
1	Instruction Manual.	2/-

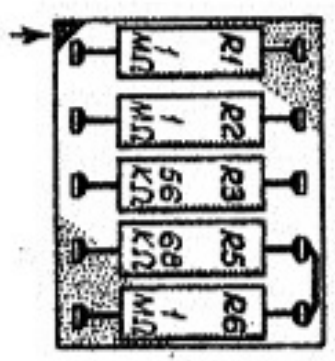
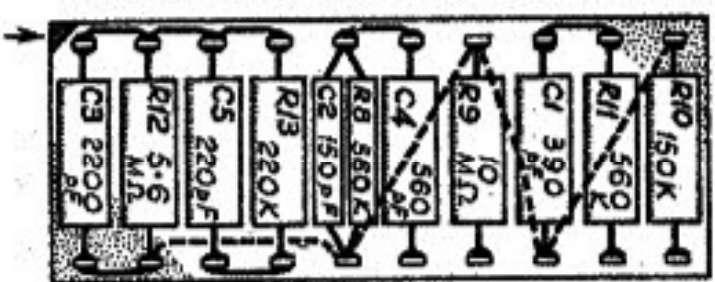
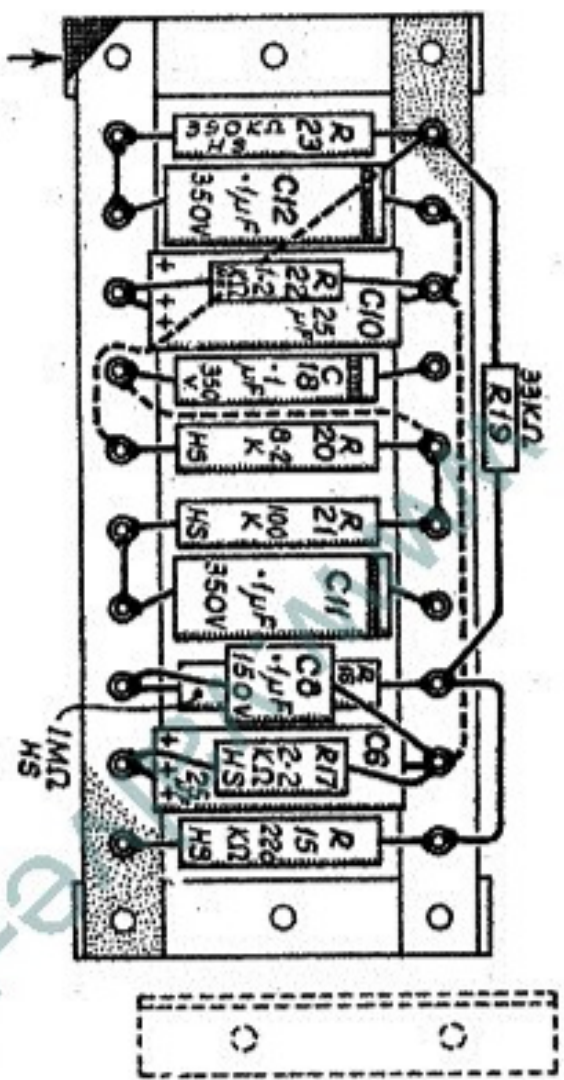
SPECIAL PRICE OFFERS

We will supply the COMPLETE KIT OF PARTS , including Mullard Valves to build this Pre-Amplifier for £6. 6. 0.

We will supply the Unit COMPLETELY WIRED and Tested for £9.10. 0.

(Carriage and Insurance is 5/- extra)

STAGE ONE — TAG BOARD WIRING

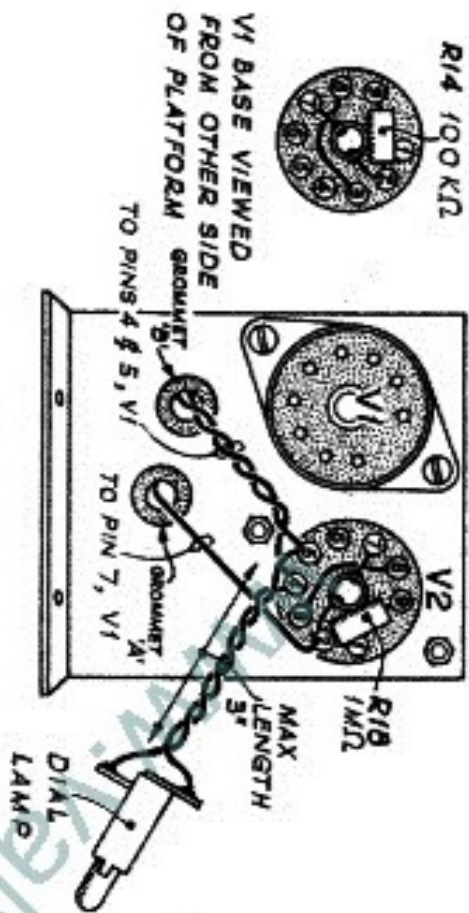


TAG BOARD No. 3
Anode - Screen & Cathode Components

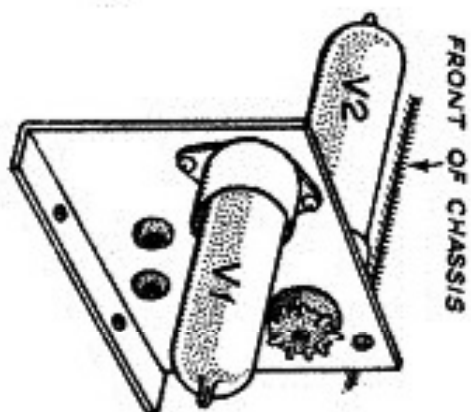
TAG BOARD No. 2 TAG BOARD No. 1
Equalisation Input Resistors

SPECIAL INSTRUCTIONS:

1. WIRING SHOWN THUS ----- MUST BE CONNECTED FIRST, RUN FLAT ON TAG BOARD AND INSULATED WITH SLEEVING.
2. WIRING SHOWN THUS _____ ARE SHORT DIRECT LINKS AND NEED NOT BE SLEEVED WITH THE EXCEPTION OF TAG BOARD 3, WHERE THE LINK BETWEEN R19, R23, R17, R16 RUNS CLOSE TO ADJACENT TAGS.
3. ARROWS ↘ INDICATE CORRECT MOUNTING POSITION OF THE TAG BOARD ONTO CHASSIS (SHOWN IN LATER STAGE).
4. CHECK WIRING & COMPONENT VALUES. ENSURE PERFECT SOLDERING AND THEN PROCEED TO STAGE TWO.

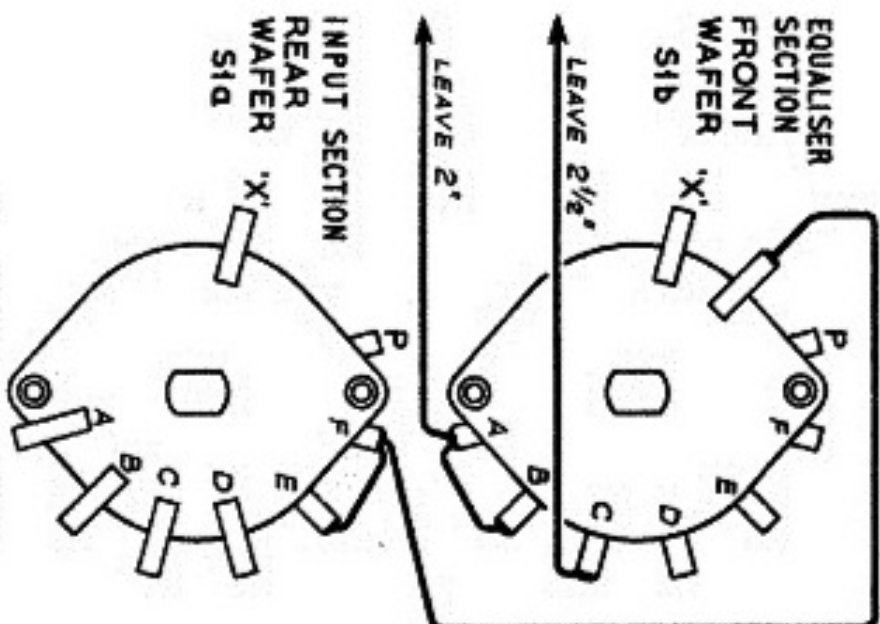


Valve Platform Basic Wiring



Valve Positions on Platform

- SPECIAL INSTRUCTIONS:**
- THE BASIC WIRING OF V1 & V2 AND THE SELECTOR SWITCH SHOULD BE COMPLETED BEFORE MOUNTING THE VALVE PLATFORM ONTO CHASSIS. NOTE THAT THE VALVE BASES MUST BE MOUNTED SO THAT WHEN THE PLATFORM IS FITTED INTO THE CHASSIS, V2 MUST BE NEAREST THE FRONT WITH THE UNDERSIDE OF THE BASE POINTING TO THE RIGHT AND THE UNDERSIDE OF V1 TO THE LEFT. THE WIRING MUST BE SHORT AND DIRECT, WITH THE HEATER LEADSTWISTED TOGETHER TO AVOID HUM RADIATION. ENSURE THAT GRID RESISTORS R14 & R18 ARE POSITIONED CLEAR OF HEATER PINS AND WIRING.

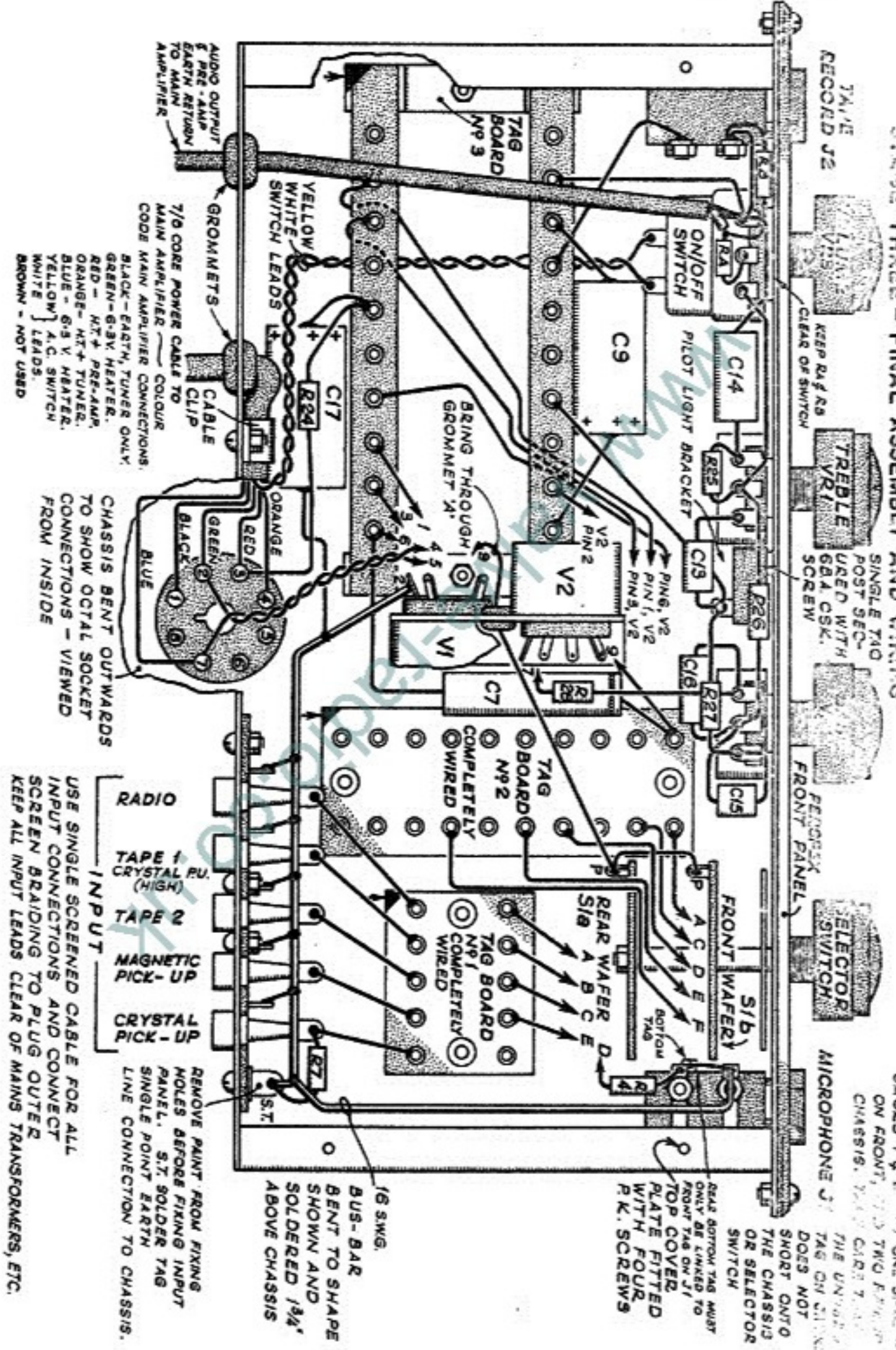


Selector Switch

- SPECIAL INSTRUCTIONS** ...
- Link the two tags marked 'X' (one on each wafer) together and connect to the 16 s.w.g. Bus Bar at the point where it connects to the Microphone Socket J1 (See also Stage Three).

STAGE TWO BASIC WIRING OF VALVE PLATFORM & SELECTOR SWITCH

STAGE THREE - FINAL ASSEMBLY AND WIRING



JACKS 1 & 2 - AT ONE END ON FRONT, TWO AT OTHER END ON CHASSIS. TAGS CARRY 7.5V

MICROPHONE JACK - TAG ON CHASSIS

SELECTOR SWITCH

FRONT PANEL

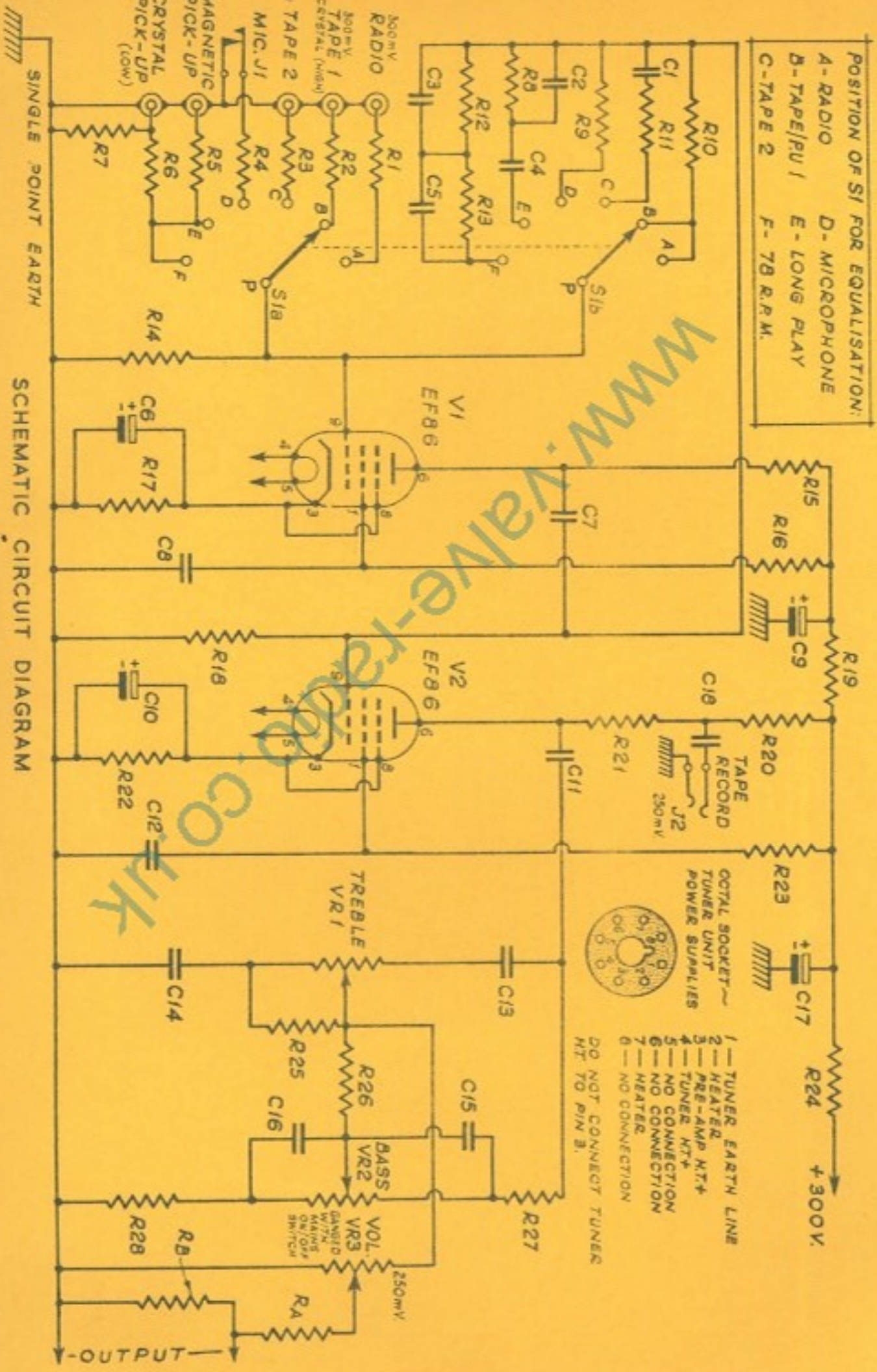
SINGLE TAD POST SEC. USED WITH 6BA CSK.

TREBLE VOLUME CONTROL

KEEP RAJ RB CLEAR OF SWITCH

TAPE RECORD JACK

POSITION OF S1 FOR EQUALISATION:
 A - RADIO D - MICROPHONE
 B - TAPE/PU 1 E - LONG PLAY
 C - TAPE 2 F - 78 R.P.M.



SCHEMATIC CIRCUIT DIAGRAM

DO NOT CONNECT TUNER HT TO PIN 3.

1 - TUNER EARTH LINE
 2 - HEATER
 3 - PRE-AMP HT+
 4 - TUNER HT+
 5 - NO CONNECTION
 6 - NO CONNECTION
 7 - HEATER
 8 - NO CONNECTION