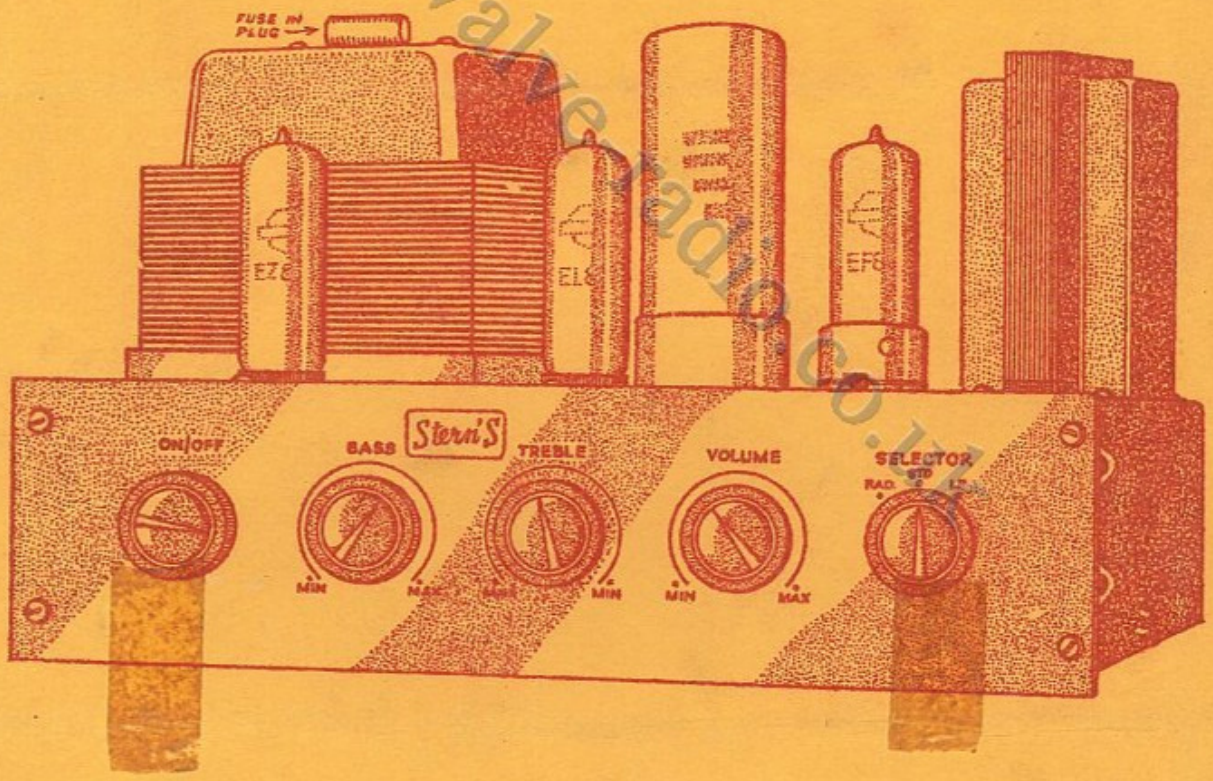
Stern's

COMPLETE ASSEMBLY DATA and DIAGRAMS FOR THE CONSTRUCTION OF

MULLARD 3 VALVE 3 WATT AMPLIFIER

INCORPORATING MODIFIED LAYOUT

SERIES II*



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ISSUE 6/63

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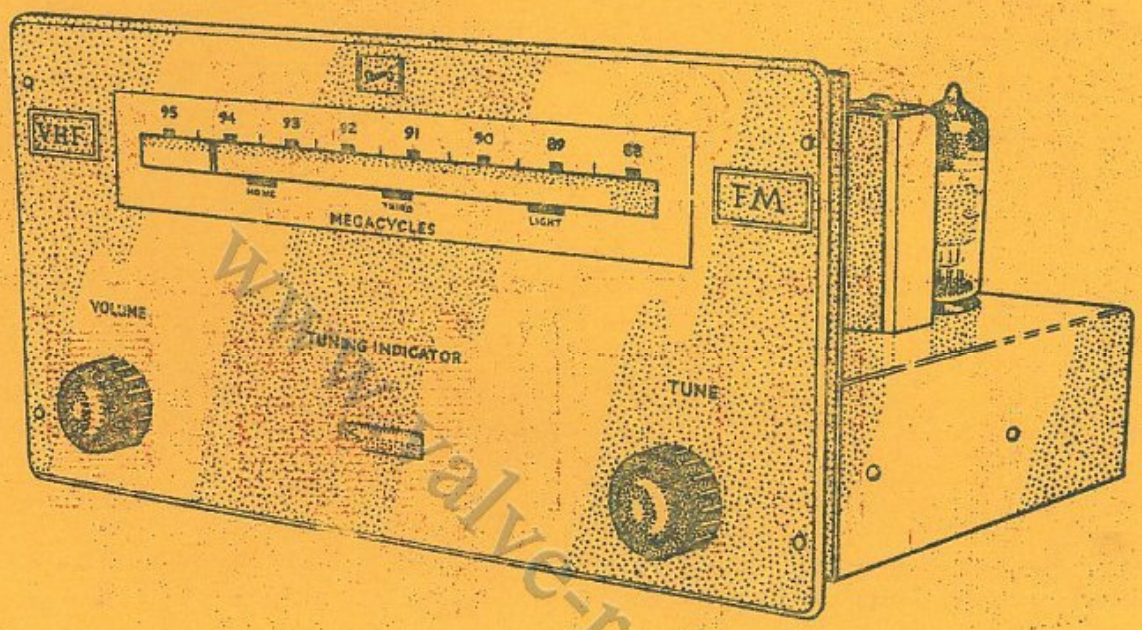

IT IS AVAILABLE AT £14.5.0. ASSEMBLED AND TESTED or HOME CONSTRUCTORS CAN BUILD IT FOR £10.10.0.

Send S.A.E. for full details or the complete Assembly Manual is available for 1/6d.

OUR MULLARD "3-3" HAS SUFFICIENT POWER SUPPLY AVAILABLE TO DRIVE THE TUNING UNIT.

THE "3-3 QUALITY AMPLIFIER"

This circuit has been developed from the very popular 3 Valve 3 Watt Amplifier designed in the Mullard Laboratories. Its purpose is to provide Home Constructors with a simple Amplifier to construct but at the same time enjoying very high quality reproduction. In presenting it we have strictly adhered to the design created by the Mullard Technicians but we have in addition incorporated arrangements for switching Gram and Radio Inputs and we have also provided additional Power Supply to enable a Radio Tuning Unit to draw its H.T. and L.T. supply from the Amplifier Power Unit. The "3-3" circuit gives an output of 3 Watts at a total harmonic distortion of 1%. Full performance figures are given in the summary below. The engraved Front Panel is very attractively finished and is arranged for surface mounting on a Cabinet.

CIRCUIT DESCRIPTION ...

The Amplifier is operated from A.C. Mains supply of 200 to 250 Volts and uses three Mullard Valves, an EF86 as the voltage amplifier, an EL84 in the output stage and an EZ80 (or EZ81) as the Rectifier. The circuit includes five controls, Volume (VR1), Treble (VR2), Bass (VR14), Selector Switch (Radio and Gram) and a separate Mains On/Off Switch.

The comparatively high sensitivity of the amplifier permits the use of all types of cyrstal pick-ups. The 3.75 ohm and the 15 ohm output terminations are suitable for all kinds of loudspeaker, and, although the circuit is designed to make the most effective use of the single output valve, the best possible results will only be achieved if a suitably housed, high quality speaker is used.

The EF86 is used under 'starvation' conditions; the valve currents and voltages are very much smaller than they would be under normal working conditions because of the high resistance (R4 = 1.0 Meg ohm) in the anode circuit. Direct coupling from the anode of the EF86 to the control grid of the EL84 is also used. These two factors together produce a very high stage gain, and, although feedback of approximately 20 dB is used around the whole circuit, an output of only 100 mV on Radio and 100/150 mV on Gram is required to give an output of 3 Watts.

The working points of the valves are stabilised by the D.C. negative feedback provided when the screen grid feed of the EF86 is taken from the cathode circuit of the output stage.

PERFORMANCE ...

With the Trable and Bass controls in their minimum effective positions, the frequency response is essentially flat from 35 c/s to 30 kc/s (Fig.5) With maximum application of the respective controls, a treble cut of 20 dB is available at 10 kc/s, and a bass boost of 15 dB is available at 70 c/s. The bass boost is obtained by reducing the main feedback at low frequencies by means of VR14 and C6.

The relationship between the total harmonic distortion and the output power is shown in Fig. 6. It will be seen that, for a typical amplifier, for outputs above about 3.5 W, the distortion increases rapidly this indicates the point beyond which overloading of the amplifier occurs.

CONSTRUCTIONAL ...

All components should be placed as nearly as possible in the precise positions shown on the diagrams and all wiring must be kept as short and direct as possible consistent with the general layout shown in the drawings.

SUMMARY OF PERFORMANCE ...

Output Power (at 400 c/s) ... 3 W at 1.0% total harmonic distortion.

Power Response ... Flat from 100 c/s to 10 kc/s.

Frequency Response ... Flat within ± 1 dB (relative to the response level at 1 kc/s) from 35 c/s to 30 kc/s.

Tone Control ... Maximum Treble Cut: Approx. 20 dB at 10 kc/s.
Maximum Bass Boost: Approx. 15 dB at 70 c/s.

Hum and Noise Levels ... At least 70 dB below 3 Watts.

Sensitivity ... Radio - 100 m/v for 3 Watts.
Gram - 100/150 m/v for 3 Watts.

Selector Switch ... Provides position for Radio Tuning Unit and Gram positions for L.P. and Standard Records.

Radio Tuning Unit ... Additional power is available for this purpose, 250V at 30 m/a and 6.3 Volts 1½ amps.

Dimensions ... Overall size of assembled Amplifier is 10" x 6" x 6" high. The Front Panel is 11" x 3".

Fuse ... ½ inch Tubular 2 Amp. Incorporated in Voltage Adjustment Plug

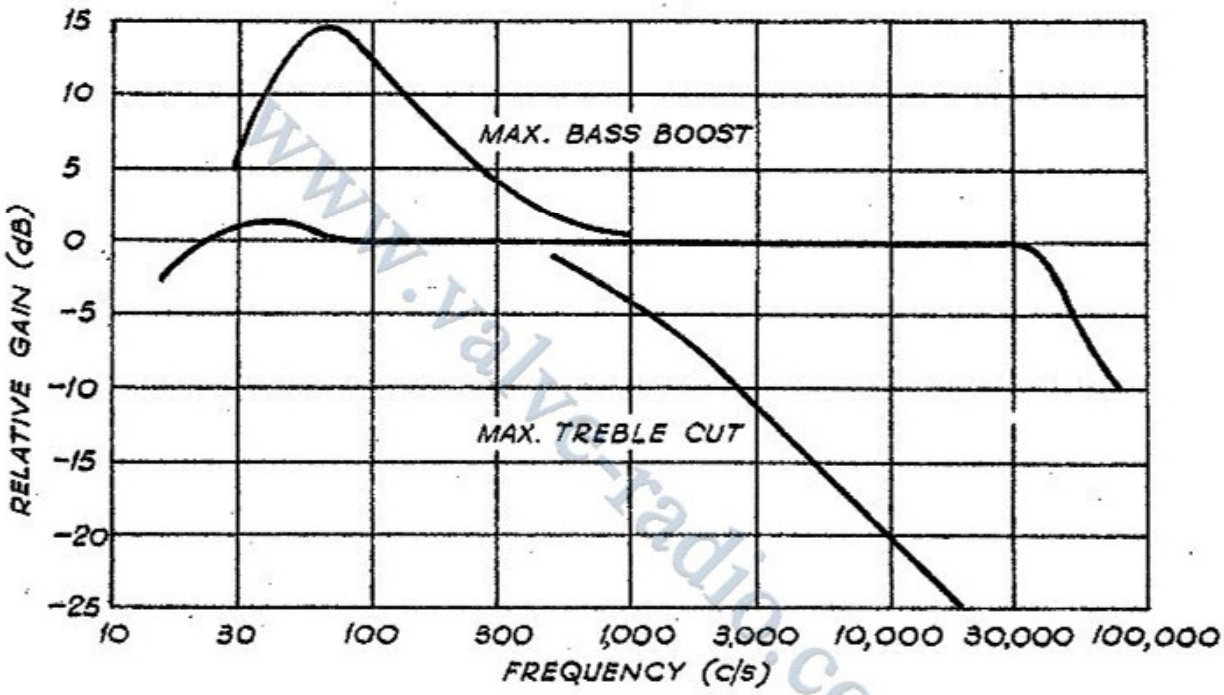

FIG. 5 FREQUENCY RESPONSE OF AMPLIFIER, SHOWING RELATIVE GAIN WITH MINIMUM TONE CONTROLS, AND ALSO WITH MAXIMUM TREBLE CUT AND MAXIMUM BASS BOOST.

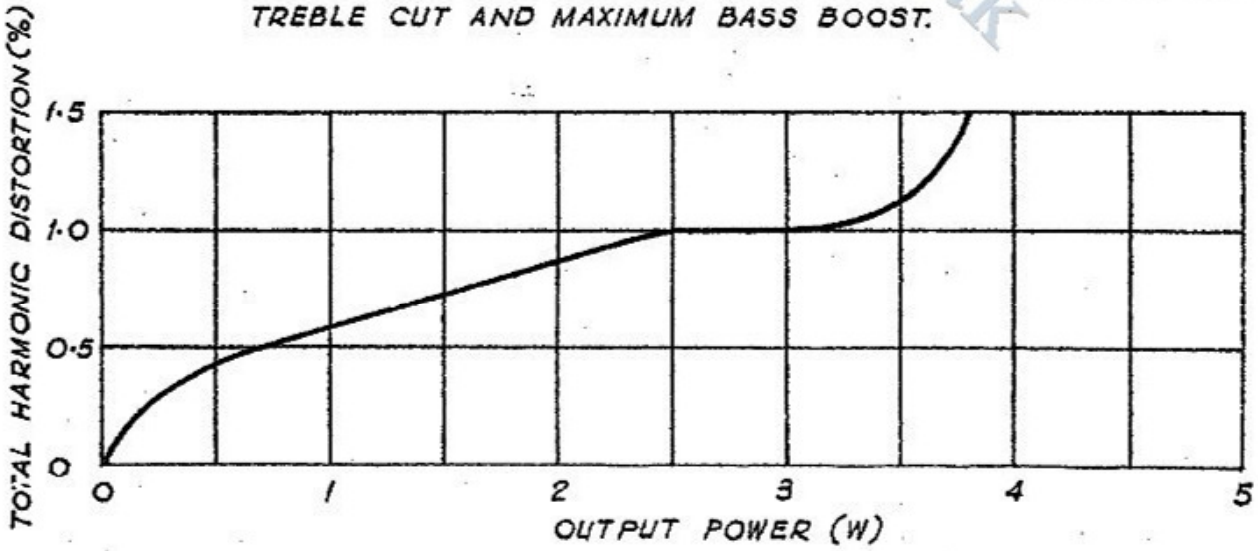

FIG. 6 TOTAL HARMONIC DISTORTION PLOTTED AGAINST OUTPUT POWER.

PARTS LIST and COMPONENT PRICES

RESISTORS ...	s	d
VR1 ... ½ Meg Log Potentiometer	3	3
VR2 ... ½ Meg Linear "	3	3
R3 10 Meg ½W Brn-Blk-Blue		4
R4 1 Meg High Stability 10% Brown-Black-Green	1	0
R5 82 ohm ½W. Grey-Red-Black (for 15 ohm Speakers) or 150 ohm ½W. Brn-Grn-Brn. (for 3 ohm Speakers)		4
R6 390K ½W. Orge-White-Yell.		4
R7 1K ½W. Brown-Black-Red.		4
R8 500/560 ohm, 3 Watt, as marked.	1	3
R9 6.8K ½W. Blue-Grey-Red		4
R10 150 ohm ½W. Brn-Grn-Brn		4
R11 22K ½W. Red-Red-Orange		4
R12 3.9K ½W. Orange-White-Red		4
R13 500/560 ohm 3 Watt, as marked.	1	3
VR14 50K Log Poteniometer	3	3
R15 1K ½W. Brn-Black-Red		4
R16 1 Meg ½W. Brn-Black-Green		4

CONDENSERS ...	s	d
C1 0.02 mfd. 150/350 Volts.	1	0
C2 390pF S/Mica or Ceramic		9
C3 0.25 mfd. 350 Volts	1	6
C4 390pF. S/Mica or Ceramic		9
C5 50-50 mfd. 350 Volts C8 (or 40-40mfd) Electrol'c	7	9
C6 0.1 mfd. 150/350 Volts.	1	0
C7 25 mfd 50V Electrolytic	2	6
C9 25 mfd 50V Electrolytic	2	6
C10 30/33pF. S/Mica or Tube		9

T1	Output Transformer (Parmeko P2641)	£1-7-0	
T2	Mains Transformer Parmeko 5085-1D Fused	£1-13-6	
1	Bulgin 3 pin plug and skt	4	0
1	Loudspeaker 2 Way Socket		5
2	Coaxial Socket, Flush.	2	0
2	Coaxial Plugs.	2	6
1	Lilliput Midget Lampholder		9
1	Lilliput 6.3V Lamp	1	1
2	B9A Valveholders	1	4
1	B9A Valveholder with skirt.		9
1	Paxolin Condenser Mounting Base.		2
1	Octal Valveholder.		9
1	Pkt. of Screws, Nuts, etc.	3	6
2	yds of mm. Sleeving.		6
2	yds of Single PVC Connecting Wire (for Heaters)		4
3	yds of 3 Core Mains Lead	2	3

1	Rotary ON/OFF Switch Bulgin	2	9
1	2 Pole 3 Way Switch. B	2	9
1	10 Way Group Board	1	3
1	Cut and Drilled Chassis and Screen.	14	9
1	Engraved Front Panel	7	6
5	Control Knobs.	3	9

VALVES ... New Mullard Valves are available as follows ...
Type EF86 ... 15/9d Type EL84 ... 11/1d. Type EZ81 ... 8/2d.

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SPECIALLY REDUCED PRICE FOR PURCHASERS OF COMPLETE AMPLIFIER

(a) We supply the COMPLETE KIT OF PARTS as scheduled above for ..... £8. 8. 0.

(b) We supply the '3-3' Amplifier ASSEMBLED AND TESTED for ..... £11. 10. 0.

(Carriage and Insurance in both cases is 6/6d. extra)

Valves supplied with the above are fully guaranteed for 90 days.

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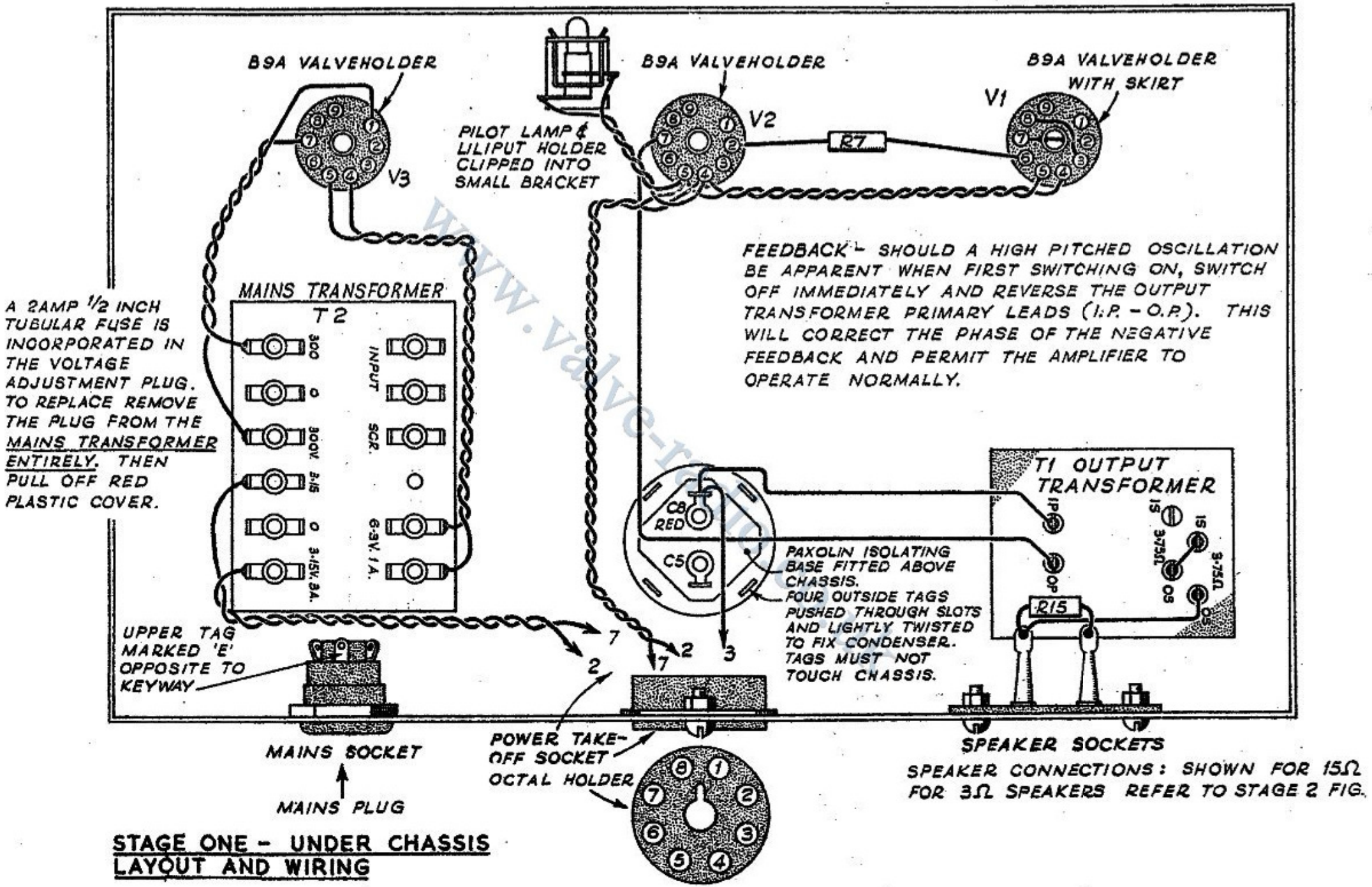


STAGE ONE - UNDER CHASSIS LAYOUT AND WIRING

STAGE TWO

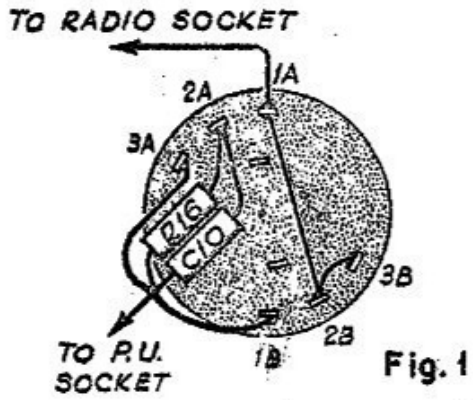


Fig. 1

SWITCH WAFER VIEWED FROM REAR

WIRING OF SELECTOR SWITCH BEFORE ASSEMBLY TO CHASSIS

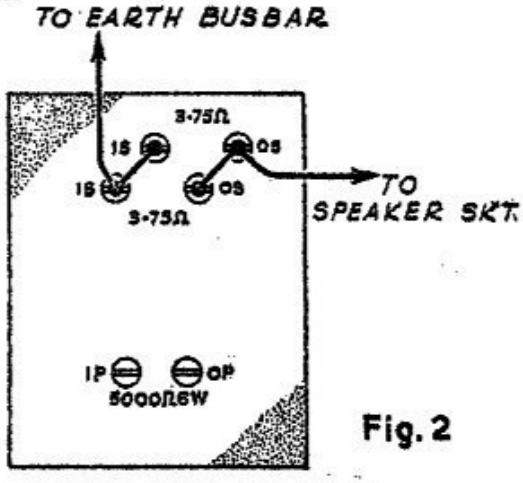


Fig. 2

NOTE CHANGE R5 * TO 150Ω

OUTPUT TRANSFORMER CONNECTION FOR 3 OHM LOUDSPEAKERS

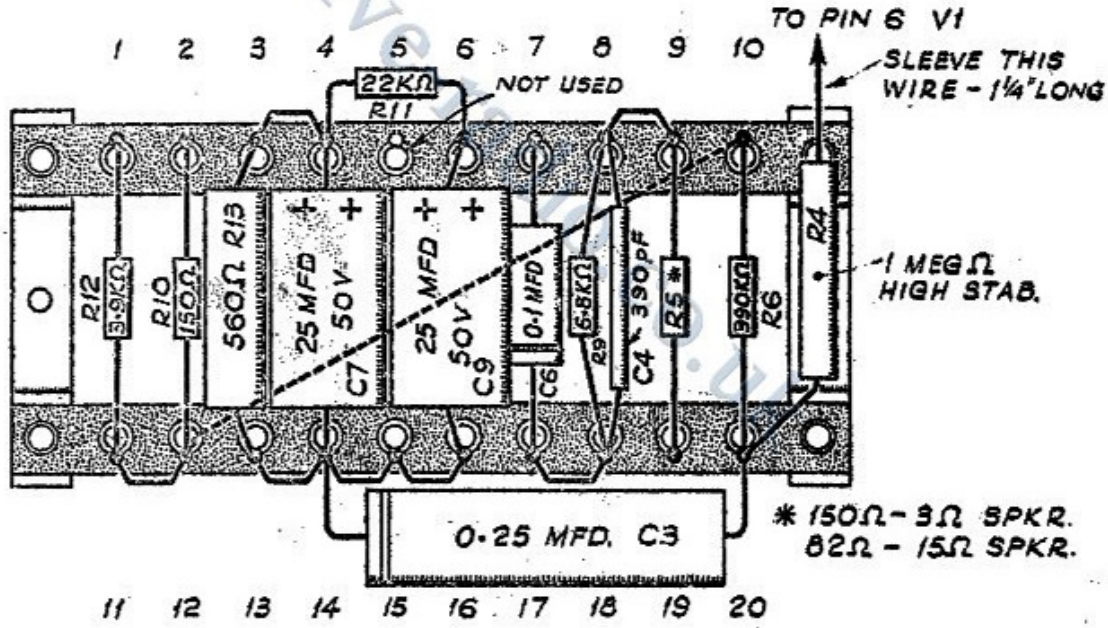
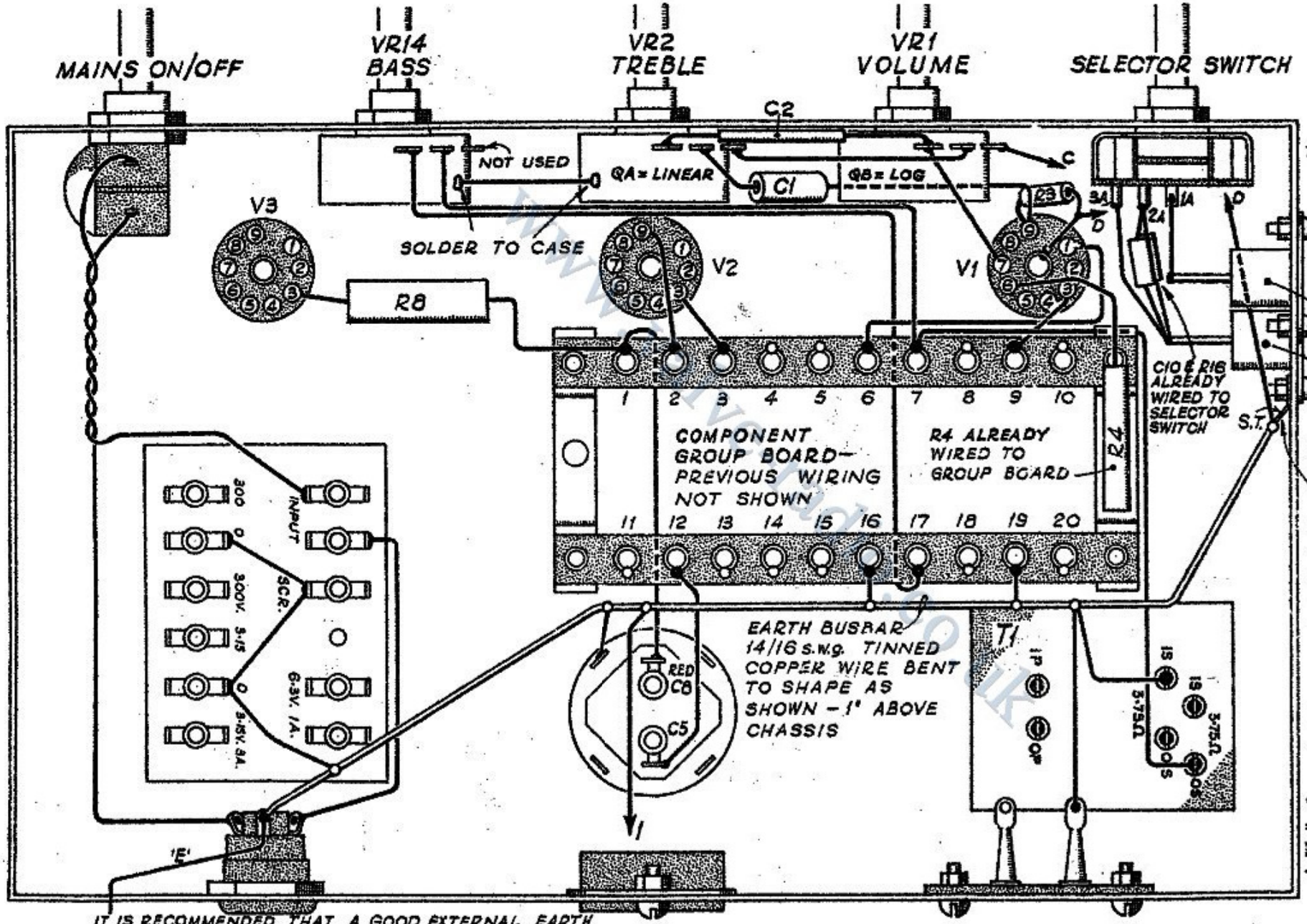
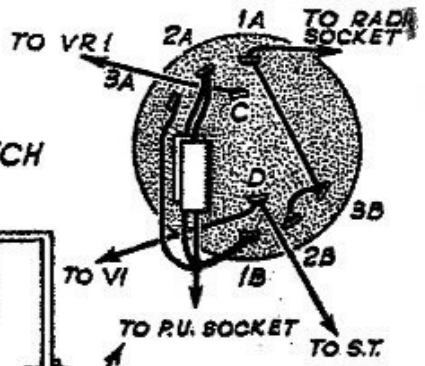


Fig. 3

WIRING OF COMPONENT GROUP BOARD BEFORE ASSEMBLY TO CHASSIS

STAGE THREE — FINAL ASSEMBLY AND WIRING OF THE CHASSIS





END VIEW OF SELECTOR SWITCH— PREVIOUS WIRING IS SHOWN

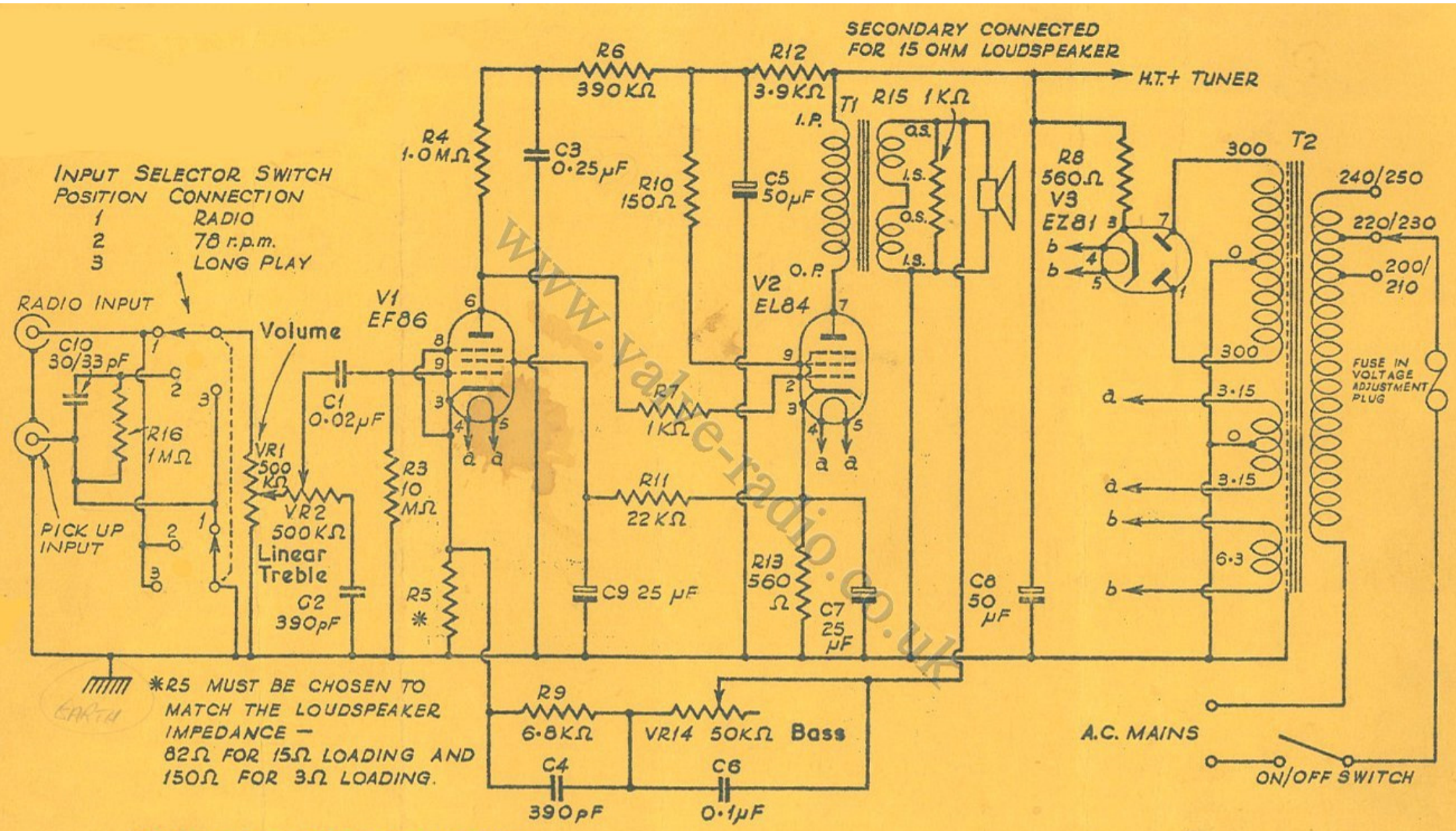
RADIO SOCKET (TOP)

PICK UP SOCKET (UNDERNEATH RADIO SOCKET)

SINGLE POINT CHASSIS CONNECTION

REMOVE PAINT BEFORE FIXING SOLDER TAG 'S.T.' TO CHASSIS. THIS WILL ENSURE GOOD ELECTRICAL CONTACT AT EARTHING POINT.

FIT SCREEN TO CHASSIS AFTER ASSEMBLY IS COMPLETED



SCHEMATIC CIRCUIT DIAGRAM