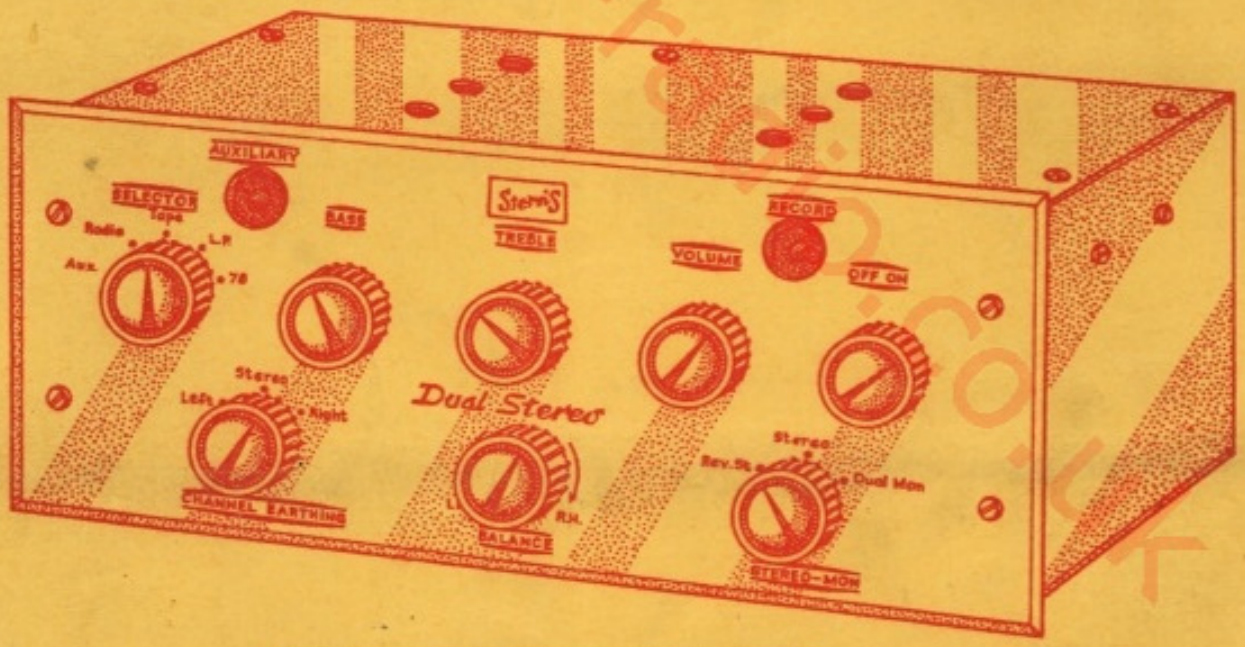
Stern's

COMPLETE ASSEMBLY DATA and DIAGRAMS FOR THE CONSTRUCTION OF

STEREOPHONIC DUAL CHANNEL TWO STAGE PRE-AMPLIFIER

- A STERN PRESENTATION OF A MULLARD DESIGN.
- STEREOPHONIC & DUAL CHANNEL MONAURAL FACILITIES.
- FIVE SEPARATE INPUTS AVAILABLE FOR EACH CHANNEL.
- CONTINUOUSLY VARIABLE SEPARATE BASS & TREBLE CONTROLS.
- SIMPLE, EASY TO FOLLOW, STAGE BY STAGE DRAWINGS FOR RAPID ASSEMBLY.



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INTRODUCTION ....

The circuitry used in this design is strictly to the specification presented by Mullard Applications Laboratories. Fundamentally it consists of a combination of two 2 Valve Pre-Amplifiers built into a single self-contained unit to provide for very high quality Stereophpnic, Monaural or Dual Channel Monaural sound operation. Although the design is primarily for use with our range of Mullard Power Amplifiers such as the "5-10" and "3-3" Circuits it is equally suitable for use with any high grade Power Amplifier, Stereophonic or Monaural, which has an input drive voltage requirement of up to 250 Millivolts.

Correctly matched inputs are provided for Stereophonic, or Monaural Magnetic and Crystal Pick-Ups, High Impedance Tape Replay Heads, and VHF/Radio Tuners. An Auxiliary input, duplicated on the front panel provides a very convenient input source for the rapid connection of Stereophonic or Monaural signals. this Jack socket has the additional facility of automatically disconnecting the Auxiliary input being fed into the rear sockets when a Jack Plug is inserted into the front Jack. With the carefully chosen values of impedance and sensitivity (See under Technical Specification) the five input channels should meet most requirements. Other values may, however, be obtained by altering the value of the appropriate series resistor or feedback network.

The equalisation for disc recordings conforms to the present R.I.A.A. characteristics which have been adopted by most major recording Companies. The Tape playback characteristic is intended for use with High Impedance Heads when replaying pre-recorded tapes at a speed of 7½ inches per second. The Tone Controls used in each channel provide boost and cut for high and low frequencies. Frequency response curves, together with tone control and equalisation characteristics are reproduced on page 10 Figs 1 to 4. A'Tape Record' output Jack is provided on the front panel, this allows for the signals, Stereophonic or Monaural, passing through the Pre-Amplifier to be fed to a Tape Recorder. This output is not affected by the Tone or Volume controls, and due to the Jack socket arrangements the rear Record sockets will be automatically disconnected when a Jack Plug is inserted into the front panel Jack.

We have presented the layout and Stage by Stage practical drawings in a very simple form, so that even the semi-experienced constructor can successfully complete the assembly without difficulty and therefore be assured of first time results. Added to this the assembled unit presents a truly professional Stereophonic Pre-Amplifier both in appearance and performance at a very low cost.

CIRCUIT DESCRIPTION ...

Each channel of the Pre-Amplifier incorporates two stages, and each stage uses a Mullard high gain pentode, type EF86. All the equalisation takes place in the first stage, and is achieved by means of frequency-selective feedback between the anode and the grid of the first EF86 (VI). There is no feedback in the second stage, and the output from the anode of the second EF86 is taken by way of the capacitor CI2 to a passive tone-control network.

This arrangement has been chosen because the grid circuit impedance of the first stage should be low. A low impedance at this grid lessens hum pick-up and reduces the effect of plugging in external low-impedance circuits.Furthermore, the arrangement also results in low gain in the first stage. Hence Miller effect between the anode and grid of the first EF86 (VI) is reduced.

Series resistors are used in the input circuits so that the sensitivity and impedance of any input can be adjusted accurately. The component values are intended for sources most frequently encountered but the sensitivity and inpedance for each input can be altered by changing the value of the appropiate series resistor. (The impedance at each input includes the grid impedance of the EF86 modified by the feedback components as well as the impedance of the input network.)

The second stage, V2, is normal-voltage-gain arrangement. The anode load of the valve is arranged to produce a maximum output across the volume control VR4 of 250 Milli-volts, and this is sufficient to drive the Mullard "20 Watt" Power Amplifier. The output voltage can be attenuated to the level required to drive other Power Amplifiers by introducing the appropiate network shown in the table page and circuit diagram (Ra and Rb). The "Record" output Jack is also fed from a point down the anode load of V2, and with the value chosen approximatel y 250 Milli-volts is tapped off via CII and taken to J2 for programme monitoring.

To compensate for any difference in acoustical output that may occur in the two amplifying channels, a balance Control VRI is included between the two

stages. This consists of logarithmic potentiometer connected in reverse in one channel and ganged to an antilogarithmic potentiometer connected normally in the other channel. For the theory of this type of Balance Control reference should be made to the publication by Mullard - "Circuits for Audio Amplifiers". - Dual ganged potentiometers are used for the Tone Controls VR2 - VR3 and for the Volume Control VR4.

An octal power take-off socket is incorporated to provide a convenient point from which a Tuner unit may draw power, provided of course that a sufficient reserve of H.T. and L.T. current is available from the Power Amplifier in use.

STEREOPHONIC SOUND ...

The word monaural is commonly used to depict conventional sound reproduction in which a single pick up head is used. Monaural means, literally of one ear and a monaural effect is that of listening with one ear, where no impressions of space or position are conveyed to the listener. Stereophonic Reproduction of sound is the most recent of the many advances which have been made towards realism and fidelity, it must be understood, however, that stereophony is not a new invention, as far back as 1931 E.M.I. engineers perfected a system for the simultaneous recording of two separate sound tracks on a single disc, but due to difficulties in recording techniques, pick up designs etc., the idea was not then applied commercially. The basic principles of a stereophonic sound systems are shown pictorially in Fig. 5, and it will be apparent from this that the recording engineer uses two microphones in the same way that we use our ears, each microphone is arranged to make a sound track independent of the other microphone, but at precisely the same time. If we then arrange to listen to one track at a time they would in fact appear to be the same, but there are subtle differences because the microphones are carefully positioned relative to the medium being recorded. Hence stereophonic sound conveys to the listener the exciting sense of movement, the feeling of the light and colour of the concert hall. In addition to this a stereophonic system can be operated at a lower level of sound intensity without losing a sense of reality. whereas with monaural systems there is often a position in the volume level where the music seems to lose its presence.

LOUDSPEAKERS ...

Only a general guide can be given as to the placement of the loud-speakers to complete the stereophonic sound installation. Much will depend on the type of loudspeakers and cabinets chosen and also on the acoustics of the room in which the equipment is to be used. Some experimenting on the part of the listener will therefore be necessary in positioning the loudspeakers for the best results. The most successful stereo speaker arrangement, is the one which the two speakers face outwards from a short wall of listening room (See Fig. 6) with the speakers between six and twelve feet apart, the actual distance being arrived at by experiment. The optimum position for obtaining the best stereophonic effect will be at a point equidistant from the two speakers. We recommend a good quality stereophonic record be used for your tests and that the same track or section of the record is used for each change of speaker position. It is also important to ensure that the loudspeakers are correctly phased. This is achieved by reversing the leads connected to one speaker and again conducting a listening test. The speakers are correctly phased when the sound appears to come from a wide source rather than from two separate loudspeakers.

BUILDING THE PRE-AMPLIFIER ....

The drawings give simple stage by stage instructions for assembly and wiring of the amplifier. No difficulty will be experienced by the home constructor if these are followed precisely and in the sequence given, provided all components are exactly as specified.

Ensure that each connection is effected with neat and positive solder joint and that the wiring and components are positioned precisely as shown in the practical diagrams. This will avoid the possibility of instability that may result from indifferent wiring.

TOOLS ...

The main requirements are a Small Soldering Iron of the instrument type - a screwdriver - a small pair of pliers or strong tweezers - and a pair of side cutters, a reel of 18 swg Ersin Multicore cored solder.

COMPONENTS.....

The wire ends of Condensers and Resistors should be trimmed to the required length by first arranging the component in its approximately correct position, bending the leads as neccessary and cutting them at the proper point, allowing of course sufficient wire to make the solder joint. Sleeving should be used wherever necessary to prevent shorting to other components. Always observe the polarity with Electrolytic condensers. The black ring round one end of the paper condenser indicates the "outside foil" and should be treated as the "Earthy End".

SOLDERING ....

It is most important to ensure good solder joints. We recommend therefore that a small electric Soldering Iron of the instrument type be used. Use a good flux-cored solder, such as Ersin Multicore 18 s.w. g. The best method is where possible to first secure the component or wire to the tag so that it will remain in position without having to hold it, and then lay the point of the solder over the joint and then apply the tip of the iron on top. The iron must never be applied for longer than is necessary to secure a good joint. Otherwise overheating of the component or plastic wire will cause damage. Too much solder should be avoided, as it will run down the tag and possibly form a short-circuit to an adjacent tag, this can very easily happen when soldering the valve sockets, as the pins are spaced close to one another. If the solder does not run easily the tag wire should be lightly scraped with a small blade, and then the clean part should be well 'tinned' before actually soldering to its appropiate connecting point. Remember that the golden rule for soldering is to ensure that the wires to be soldered must be clean and then if the two surfaces to be joined are heated simultaneously and good cored solder used, a perfect electrical joint will result.

GENERAL .....

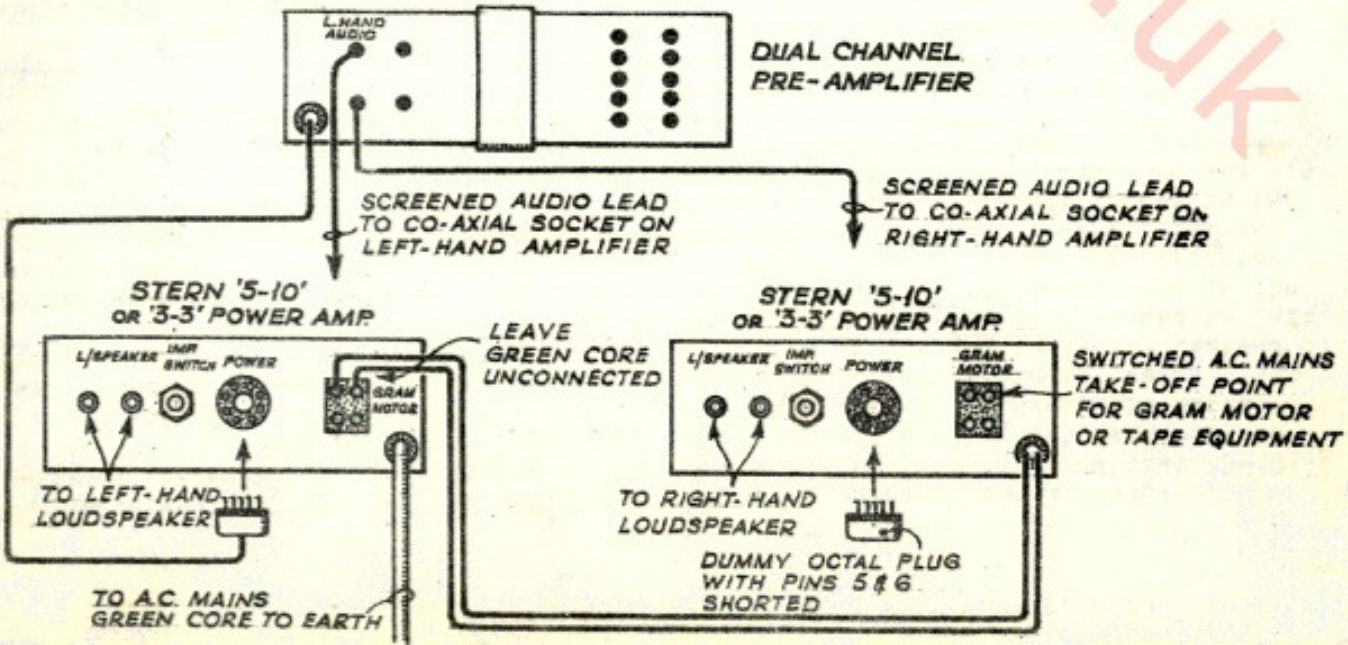
Keep a continous watch on the stage wiring and instructions and check each stage carefully before proceeding to the next - it will be much easier to trace an incorrect connection in this way than having to fault find when the Pre-Amplifier has been completed.

It will be observed that as the stage by stage wiring progresses the wiring shown in the previous stage has been omitted for clarity. The heater wiring and any wires carrying A.C. must be lightly twisted together to avoid hum radiation, such wiring is indicated on the drawing thus

Tinned copper wire is supplied for the main wiring and this should be bent and cut and then sleeved before fitting into the chassis. Wiring shown dotted -- -------- on drawing indicates that it runs underneath components.

INSTALLATION

For Stereophonic operation the Pre-Amplifier should be connected to two Power Amplifiers of identical performance. They may be seperate matched units, or a twin Amplifier of intergral construction. Our '3-3' Power or '3-3 Dual Power' Amplifiers are ideal for small or medium sized rooms. For large rooms, halls or where more power is required a matched pair of Stern '5-10' Amplifiers are recommended. The most convenient method of connecting two separate Stern Power Amplifiers to enable the Mains switching of both to be controlled by the remote ON/OFF Switch in the Pre-Amplifiers is shown pictorially below

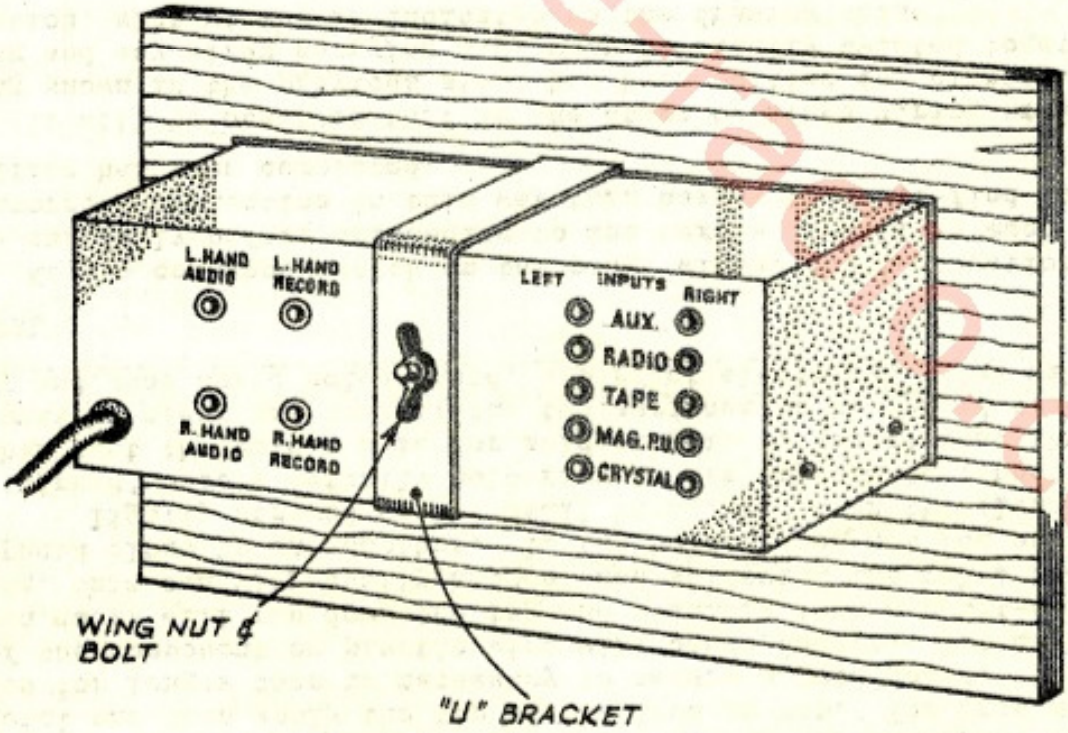


When the Dual Channel Pre-Amplifier is drawing current from a '5-10' Amplifier the extra power available to supply auxiliary equipment from that '5-10' will be 30 milli-amps HT and 1.5 amps LT. Therefore, if the current requirements of the auxiliary unit, such as a tuner, exceeds this figure the available extra power from the second '5-10' can with advantage be utilised. This is easily achieved by connecting the tuner to the Octal Socket on the second '5-10' instead of to the octal socket on the side of the Pre-Amplifier. Pins 5 and 6 should be left shorted as shown on the dummy plug in the pictorial drawing. This will enable the whole equipment to be controlled by the master ON/OFF Switch in the Pre-Amplifier. A further advantage of this arrangement is that a Type 'C' Tape Pre-Amplifier can draw its power supplies from the first '5-10' via the Tuner Take-off socket on the Pre-Amplifier. The power requirements of the Type 'C' are 25 milli-amps HT and 1.5 Amps LT, and therefore can with safety be drawn from the '5-10' which is also supplying Power to the Dual Channel Pre-Amplifier.

FIXING ...

The Pre-Amplifier may be mounted in any position i.e. vertically or horizontally, through a wooden panel of any thickness. It is strongly recommended that it be positioned as far away as possible from Mains Transformers, and Gramaphone or Tape Deck Motors, and that the input and output screened audio leads connected to the Pre-Amplifier be kept well clear of these components. This will ensure minimum pick-up and transmission through the equipmentm of the hum fields associated with Mains Transformers, etc..

To mount on a panel; pass the body of the Pre-Amplifier through a cut-out of approx. 11.1/16 x 4.1/16 inches until the front panel of the Pre-Amplifier rests against the outer face of the mounting board. Pass the 'U' bracket over the back of the Pre-Amplifier and fix it by passing the 4BA Wing bolt through the hole in the bracket and into the hank bush located on the rear panel of the Pre-Amplifier. The wing-bolt should be tightened just sufficiently for the open ends of the 'U' bracket to 'Butt' firmly against the underside of the mounting board.



REAR VIEW — FIXING & LOCATION OF INPUT AND OUTPUT SOCKETS

NOTE! All Input and Output connections MUST be made with good quality screened cable having an insulated outer covering. The centre core must in all cases be soldered to the CENTRE pin of the miniature co-axial plug, and the outer screened braiding to the plug OUTER.

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CONTROLS.....

The operation of the controls in the Pre-Amplifier are really self-explanatory but for the benefit of those using Stereophonic equipment for the first time a brief outline of the function of each control is given as a guide. The correct setting of each is essential to obtain the first class results of which the Pre-Amplifier is capable.

SI, SELECTOR SWITCH...

A five position switch which selects one dual input at a time in the following sequence. (a) AUXILIARY. (b) RADIO. (c) TAPE. (See under input sensitivities) (d)Microgroove Records. (e) 78 r.p.m. Records. This switch also short circuits the unused sockets to earth an arrangement which reduces considerably the amount of 'break-through' between inputs.

S2, CHANNEL EARTHING...

A three position switch which permits either or both channels of the Pre-Amplifier to be used. In position (1) the switch short circuits the left-hand channel to earth, in position (2, centre) both channels are available. Whilst in position 3 the right-hand channel is short circuited to earth and inoperative.

S3, STEREO- MONAURAL...

A three position switch incorporated between the Volume Control and the output to the Power Amplifier which connects the two channels for (1) Reversed Stereo* (2) Stereo (3) Dual Channel Monaural. *Reversed stereophony is achieved when the left and right-hand input signals are conveyed to the right and left-hand loudspeakers respectively. With this facility one can change the left-hand side of the orchestra over to the right-hand and vice-versa.

S4, ON/OFF....

A.C. Mains ON/OFF. Allows for remote switching of the Power Amplifier/s.

VR1, BALANCE CONTROL ...

The dual ganged Balance Control is provided to compensate for any differences in acoustical output resulting from unequal outputs from the stereophonic input device, such as a pick-up. For differences in sensitivity between loudspeakers, and component tolerances within the equipment. Rotation of the control to one side or the other will increase the amplification of the one channel relative to the other, up to a point of elimination of one channel and full output from the other. It must therefore be set up so that the volume from both loudspeakers is equal. Carefully adjust the control until the sound source appears to come from the absolute centre of the space between the two loudspeakers.
If this effect cannot be obtained reverse the connections to one of the loudspeakers as detailed under 'Loudspeaker Positioning'.

VR2, TREBLE CONTROL.....

A dual ganged control providing approximately I5 dB of Treble Cut and Treble Boost on each side of a level position.

VR3, BASS CONTROL...

A dual ganged control providing approximately I5 dB of Bass Cut and Bass Boost on each side of a level position. Full Bass Boost should not be neccessary with even moderately good loudspeaker systems and the tendency to "over use" this control should be avoided. It is not possible, for instance, to obtain a natural Bass from small or inferior loudspeakers by'turning the control'.

VR4, VOLUME CONTROL...' A dual ganged control which allows for the adjustment of the listening level.

PICK UPS ....

Stereophonic pick up heads of various manufacture have quite different terminations for connection to the Pre-Amplifier. It is most essential to care fully follow the installation instructions given by the pick up manufacturer and to ensure that the Left and Right- Hand outputs are connected to the right input sockets on the Pre-Amplifier. Monaural microgroove records may be reproduced with Stereo Pick Up Leads but on NO ACCOUNT should a Stereophonic record be played with a standard monaural pick up.

JACK PLUG CONNECTIONS - TYPE BULGIN P505...

A special 3 Pole Jack Plug is available at 4/6d for connecting two separate

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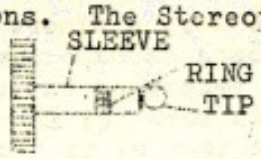
inputs to the "Auxiliary Jack" (JI),or for feeding a Stereophonic Tape Recorder from the "Record Output" (J2). Twin screened cable with an insulated outer cover is recommended for both Jack Plug connections. The Stereophonic sense being.

JACK PLUG TIP - Left Hand Channel.
JACK PLUG RING - Right Hand Channel.
JACK PLUG SLEEVE - METAL OUTER BRAIDING.



HUM and MULTIPLE EARTHS...

In audio equipment it is advisable to have only one direct connection to the chassis, and this is normally made close to the input sockets, with a number of connections to the chassis, eddy currents can be set up in the chassis and hum voltages can be induced in the sensitive sections of the equipment by magnetic fields associated with these currents. For this reason a single earth line or 'Bus-Bar' is incorporated in this unit. To maintain a low level of hum when two or more units are used together (such as the Power Amplifier and Pre-Amplifier) the chassis of the units should be connected by One lead only. This connection is arranged to be via the outer screened braiding of the AUDIO LEAD and as this is the only earth or negative return between the units we recommend that the equipment be disconnected from the mains supply entirely before removing the audio co-axial plug from the Amplifier otherwise a shock will be experienced. A separate EARTH line terminated to Pin I of the OCTAL SOCKET is provided for a Tuner Unit. This must NOT be connected to the Pre-Amplifier Bus-Bar or chassis. With the majority of Tuner Units it will be left unused as the single inter-chassis connection will be via the outer braiding of the audio lead as recommended above.In isolated cases however it may be preferable to use this connection, leaving one end of the outer braiding of the Tuner audio lead disconnected.

The design of the Pre-Amplifier ensures very low hum level indeed, but it must be understood that in the more sensitive positions of the Selector Switch SI, and with the volume control at maximum a certain amount of background noise will be apparent, this is due to an inherent factor in high-gain vacuum- tube Amplifiers. Hum can also arise due to the pick up head itself being positioned close to an electric motor or near to a mains transformer. If then hum is to be kept to a minimum care must be taken during the initial installation of the equipment, to position the Power Amplifier with its associated mains transformer as far away as possible from the Pick Up Lead, to keep all input and output audio leads clear of such components and also any A.C. carrying wires. The outer screened braiding of the pick up lead should NOT be used for earthing any part of the motor or turntable assembly. This should be earthed by a separate wire taken to the earth pin of the mains supply. Finally when using our Dual Power 3-3 Amplifier it may be found best to leave the screened braibing of ONE audio output lead unconnected at the Power Amplifier input socket.

TECHNICAL SPECIFICATION

SIGNAL INPUTS... (Identical for Both Channels).

(a) AUXILIARY.. Impedance I Meg-ohm.
Sensitivity at I Kc/s ...330 mV.

With the values chosen, this input is suitable for High Output Crystal Stereophonic or Monaural Pick-ups, or for Tape Pre-Amplifiers such as our Mullard Type 'C'. If desired the input impedance and sensitivity may be varied by altering the values of the series resistor RI and feedback network R7. The input is interconnected with a Jack (JI) which is located on the front panel. It should be noted that the insertion of a Jack Plug into this Jack will disconnect the Auxiliary co-axial inputs on the rear of the chassis.

(b) RADIO .... Impedance I Meg-ohm.
Sensitivity at 5 Kc/s ....330 mV.

With the values of impedance and sensitivity chosen, this input should meet most requirements. Other values may easily be obtained by altering the series resistor R2 and feedback network R7. If for instance the input impedance is too high it can be reduced by connecting a resistor of the appropiate- value between the input end of R2 and chassis. The frequency response characteristic of this input is shown in Fig. I.

(c) TAPE PLAYBACK ....Impedance 80 K ohm (approx).
Sensitivity at 5 Kc/s ..... 5 mV.

This input is intended for replaying Pre-Recorded tapes DIRECT from high-

impedance Tape Heads. For frequencies above 100 c/s the equalisation curve follows the C.C.I.R. characteristics, but below this frequency, slightly less boost is used. (See Fig. 2) If a greater sensitivity is required the value of the series resistor R3 can be reduced until the desired sensitivity is obtained.

(d) PICK-UP - MAGNETIC ... Impedance 100 K-ohm (approx.)

Microgroove Sensitivity at 1Kc/s ...7 mV.
78 r.p.m. Sensitivity at 1Kc/s....18mV.

This input is most suitable for Pick-Ups of the Variable Reluctance type. Moving-coil Pick-Ups which have higher outputs can be used if the value of the series resistor R4 is increased.

(e) PICK-UP - CRYSTAL ...Impedance 100 K- ohm.
Microgroove Sensitivity at 1 Kc/s ... 80 mV.
78 r.p.m. Sensitivity at 1 Kc/s ... 220 mV

This input is suitable for LOW and Medium-Output Crystal Pick-Ups. The input is loaded with R6 (100K) in order that its characteristics shall approximate to a Magnetic Cartridge and to allow the same feedback network to be used. If however the Pick-Up to be used is not suitable for this form of loading or if its output is too high it must be connected instead into the AUXILIARY INPUT (a). Equalisation curves for magnetic and the Crystal Pick-Up functions are shown in Fig. 3.

AUDIO OUTPUT ... (Identical for both Channels).

The input figures quoted above will produce up to 250 Milli-volts across the output socket of each channel. A simple potential divider Ra andRb is used to attenuate this output to the level required by the Power Amplifier/s being Incorporated.

Power Amplifier	Drive Required	Attenuation in Each Channel	
MULLARD 3-3	100 mV.	Ra 270K.	Rb 150K.
STERN DUAL 3-3	100 mV.	Ra 270K.	Rb 150K.
MULLARD 5-10	40 mV.	Ra 680K.	Rb 180K.
MULLARD 20 WATT	250 mV.	Ra Not req.	Rb Not req.

TAPE RECORD OUTPUT .... (Identical for Both Channels).

This output is taken from the anode of the second EF86 (Each Channel), It is terminated at the rear of the chassis and also to a 3 Pole Jack on the front panel. Thus Single channel or stereophonic Recording of programme material may be made with Tape Equipment. The output voltage is approx. 250 milli- volts,and is not effected by the Tone or Volume controls. Recording equipment plugged into this output should have an input impedance of not less than 500K-ohms. When the Jack (J2) on the front panel is used, the insertion of the Jack Plug will automatically disconnect the co-axial Record Outputs at the rear.

It should be noted that the Pre-Amplifier has no equalising network for Tape Recording and therefore it is essential that it be incorporated in the Record Amplifier. We must emphasise that to form a complete Tape Recorder the addition of a Bias Oscillator/Tape Pre-Amplifier is essential.A Tape Deck alone is not sufficient for Recording

VALVES ... Four Low Noise Pentodes (Two in Each Channel) MULLARD EF86.

CONTROLS ...

S1 Input Selector. (a) Auxiliary. (b) Radio. (c) Tape Replay Head direct.
(d) Standard 78 r.p.m. Disc.
(e) Microgroove, L.P. Disc.

S2 Channel Earthing Switch. (1) Earths L.H. Channel. (2) Normal.
(3) Earths R.H. Channel.

S3 Stereo Monaural Switch. (1) Stereo Reverse* (2) Stereo.
(3) Dual Channel Monaural.

* Reverse Stereo is achieved when the left and right hand input signals are conveyed to the right and left hand loundspeakers respectively.

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S4 Mains Off/ On Switch.

VR1 Balance Control. Dual Ganged Potentiometer Logarithmic in L.H. Channel, Anti-Logarithmic in R.H. Channel.

VR2 Treble Control. Dual Ganged Potentiometer Logarithmic in both Channels.

VR3 Bass Control. Dual Ganged Potentiometer Logarithmic in both Channels. The Tone Controls are low -Impedance to ensure that any capacitance resulting from the use of long co-axial leads between the Pre-Amplifier and the Power Amplifier/s will have a minimum effect on the output impedance of the Pre-Amplifier. The tone control characteristics are shown in Fig. 4.

VR4 Volume Control. Dual ganged Potentiometer Logarithmic in both Channels.

HARMONIC DISTORTION ..Total Harmonic Distortion of each channel is less than 0.15% at normal output levels.

POWER REQUIREMENTS ....H.T. 250/350 Volts D.C. Smoothed at 6 milli- amps. L.T. 6.3 Volts A.C. at 1 Amp.

INDICATOR LAMP ..... 6.5 Volts 2 Amp. Miniature Lilliput.

CHASSIS DIMENSIONS Length 11" x Projection behind panel 5" x Height 4".

FRONT PANEL DIMENSIONS .... 12" x 4¾ " x 1/8" thick.

WEIGHT.....5½ lbs.

TERMINATIONS... Inputs and Outputs at Rear of Chassis....Miniature Co-Axial
Jack Sockets on Front Panel ..... Bulgin J14.
(Special 3 Pole Plugs available .... Bulgin P505)
Power Plug to Power Amplifier ..... Int. Octal Plug.
Take-Off Socket for Tuner ..... Int. Octal.

FINISH - CHASSIS ... Heavy Gold Hammer. Totally enclosed case with easily removable top and bottom covers.

FINISH- FRONT PANEL....Highly Polished Perspex. Ivory engraved, with Black.

FIXING- By "U" Bracket, fitted over Rear of Pre-Amplifier and fixed by passing a Wing-Screw through the hole in the bracket and into the Hank Bush located in the centre of the Pre-Amplifier REAR PANEL.

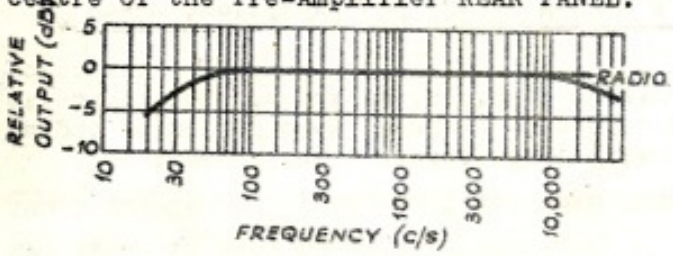

FIG. 1 — FREQUENCY-RESPONSE CHARACTERISTIC FOR RADIO INPUT SIGNALS

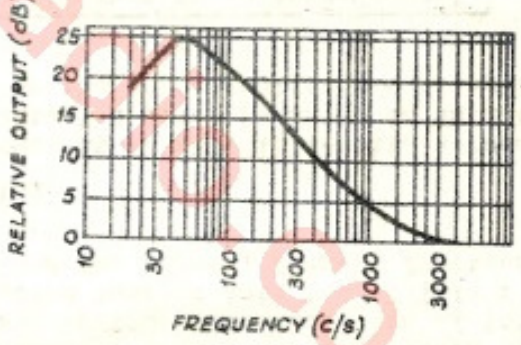

FIG. 2 — EQUALISATION CHARACTERISTIC FOR TAPE PLAYBACK INPUT SIGNALS

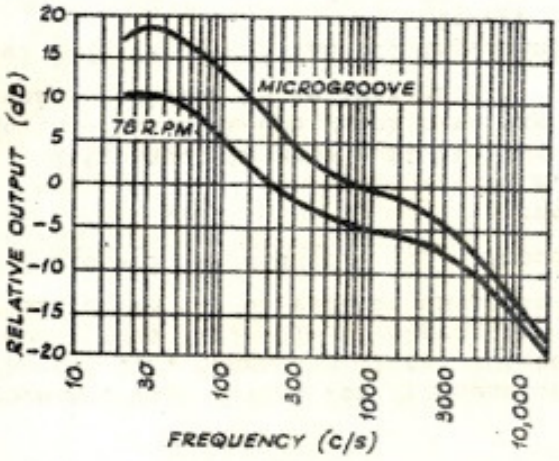

FIG. 3 — EQUALISATION CHARACTERISTIC FOR

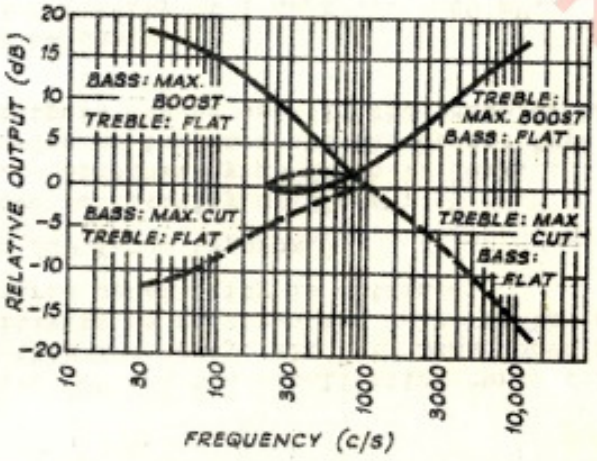

FIG. 4 — TONE CONTROL CHARACTERISTICS

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COMPONENTS PARTS & PRICE LIST

RESISTORS.... All ½ Watt Rating, 10% Tolerance Unless Otherwise Stated.

2xR1	1 Meg	Brn-Blk-Green	8
2xR2	1 Meg	Brn-Blk-Green	8
2xR3	56K	Grn-Blue-Orange	8
2xR4	39K ~~68K~~	Blue-Grey-Orange	8
2xR5	1 Meg	Brn-Blk-Green	8
2xR6	100K	Brn-Blk-Yellow	8
2xR7	150K	Brn-Grn-Yell) Incorp-	
2xR8	560K	Grn-Blue-Yell) orated	
2xR9	560K	Grn-Blue-Yell) in	
2xR10	5.6Meg	Grn-Blue-Grn) Selector	
2xR11	220K	Red-Red-Yell) Switch	
2xR13	220K	H/Stab. As marked	2-0
2xR14	2.2K	H/Stab. As marked	2-0
2xR15	1 Meg	H/Stab. As marked	2-0
2xR16	33K	Orange-Orange-Orange	8
2xR17	8.2K	H/Stab As marked	2-0
2xR18	100K	H/Stab.As marked	2-0
2xR19	1.2K	H/Stab As marked	2-0
2xR20	390K	H/Stab.As marked	2-0
2xR21	47K	Yell-Mauve-Orange	8
2xR22	39K	Or-White-Or.	8
2xR23	68K	Blue-Grey-Orange	8
2xR24	6.8K	Blue-Grey-Red	8
2xR25	15K	Brn-Grn-Orange	8
2xRa	680K	Blue-Grey-Yell) For	8
2xRb	180K	Brn-Grey-Yell)5-10	8
		or	
2xRa	270K	Red-Mauve-Yell) For	8
2xRb	150K	Brn-Grn-Yell) 3-3	8

CONTROLS...

VR1 1 Meg Log/1 Meg Anti-Log Potentiometer. QB/QE	6-9
VR2 250/250K Log Pot. QB.	6-9
VR3 250/250K Log. Pot.QB.	6-9
VR4 250/250K Log. Pot.QB.	6-9

VALVES ... B.V.A. GUARANTEED.

V1L Mullard EF86	15-9
V2L Mullard EF86	15-9
V1R Mullard EF86	15-9
V2R Mullard EF86	15-9

CHASSIS & FRONT SCALE...

Box Type Chassis, Complete with Valves Platform, Top & Bottom Cover Plates, Indicator Lamp Bracket & Fixing Bracket. £1-1-6

Engraved Perspex Front Panel 10-6

1 Instruction Manuel. 3-0

CAPACITORS...

2xC1	150pF. S.M.	) Incorp-	
2xC2	2200pF. S.M.	) orated	
2xC3	390pF. S.M.	) in	
2xC4	560pF. S.M.	) Selector	
2xC5	220pF. S.M.	) Switch.	
2xC6	25mfd	12/25V Elect.	4-0
2xC7	0.1mfd	350V Tubular	2-0
2xC8	0.1mfd	150V Tubular	2-0
2xC9	Refer to C18.		
2xC10	25 mfd	12/25V Elect.	4-0
2xC11	0.1mfd	350V Tubular	2-0
2xC12	0.1mfd	350V Tubular	2-0
2xC13	0.1mfd	350V Tubular	2-0
2xC14	560pF.	Silvered Mica	1-6
2xC15	8200pF.	Silvered Mica	2-6
2xC16	2200pF.	Silvered Mica	1-6
2xC17	0.02mfd	350 Tubular	2-0
2xC18-9	16+16mfd	350V Elect.	9-0

SWITCHES...

S1 Selector 4 Pole-5Way, 4 Bank. Supplied Wired & Tested, Incorporating Feedback Networks R7 to R12 & C1 to C5 £1-7-6.

S2 1 Pole-3 Way, Single Bank	2-9
S3 3 Pole-3 Way, Single Bank	3-0
S4 Off-On Switch, Walters.	2-3

MISCELLANEOUS

J1 Bulgin J14 Pole Jack, with Insulating Bush.	4-6
J2 Bulgin J14 Pole Jack, with Insulating Bush.	4-6
2x5 Way Input Sockets,Clix.	4-6
2x2 Way O/P Sockets, Cinch 79/841.	1-6
2x2 Way Insulation Plates, Cinch 79/861.	3
4x5 Way Tag Boards, Denco.	4-8
1x5 Way Tag Strip.	4
3xSingle Tag Posts.	6
4xB9A Valve Bases with Skirt	3-0
1xInt. Octal Valve BASE.	9
1xIntern. Octal Plug.	2-3
14xMiniature Phono Co-Axial Plugs	5-3
2xPaxolin Condenser Mounting Bases Small.	4
1xLilliput Lamp Holder.	9
1xLilliput Lamp 6.5 Volt	1-1
1xCable Clip.	2
8xControl Knobs.	6-0
1 yd 7/8 Core Cable.	1-9
2 yds Thin Plastic Flex, for heaters - Green	6
20 Inches Insulated Screened Cable	9
4 yds. 2mm. Sleeving	1-0
6 yds. 20/22 s.w.g. Tinned Copper.	4
2x12 inches 18 s.w.g. Tinned Copper for Bus-Bar.	3
1 Packet of Nuts and Bolts.	4-6
1x4BA Thumb Screw.	3

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S P E C I A L P R I C E O F F E R S

WE WILL SUPPLY THE COMPLETED KIT OF PARTS INCLUDING
MULLARD VALVES TO BUILD THIS PRE-AMPLIFIER FOR.....£12-10-0

or alternatively

WE WILL SUPPLY THE PRE-AMPLIFIER COMPLETELY WIRED
AND TESTED FOR.....£15-0-0

Carriage and insurance on each of the above, 5/- extra

WHEN ORDERING PLEASE ADVISE TYPE OF POWER AMPLIFIER(S) TO BE USED.

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S P E C I A L P R I C E R E D U C T I O N S

QUALITY OF THIS NATURE HAS NEVER BEFORE BEEN OFFERED AT SUCH A LOW COST

WE WILL SUPPLY THESE .....COMPLETE KIT OF PARTS

(a) TO BUILD TWO "5-10" MAIN AMPLIFIERS (incorporating Parmeko Output Transformers) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT.....£31.0.0.

(b) TO BUILD TWO "5-10" MAIN AMPLIFIERS (incorporating Partridge Output Transformers) and the DUAL CHANNEL PRE-AMPLIFIER- - CONTROL UNIT ..... £33.0.0.

(c) TO BUILD ONE "5-10" MAIN AMPLIFIER (Parmeko Transformer) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT ..... £21.10.0.

(d) TO BUILD ONE "5-10" MAIN AMPLIFIER (Partridge Transformer) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT ..... £22.10.0.

ALTERNATIVELY WE SUPPLY.....ASSEMBLED AND TESTED

(a) TWO "5-10" AMPLIFIERS (Parmeko Transformers) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT ..... £40.0.0.

H.P. TERMS: Deposit £8.0.0 and 12 monthly payments of £3.1.4.

(b) TWO "5-10" AMPLIFIERS (Partridge Output Transformers) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT £42.0.0

H.P. TERMS: Deposit £8.8.0 . and 12 monthly payments of £3.4.6.

(c) "5-10" AMPLIFIER (Parmeko Transformer) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT ..... £27.0.0.

H.P. TERM: Deposit £5.8.0. and 12 monthly payments of £2.1.4

(d) ONE "5-10" AMPLIFIER (Partridge Transformer) and the DUAL CHANNEL PRE-AMPLIFIER - CONTROL UNIT ..... £29.0.0.

H.P. TERMS: Deposit £5.16.0. and 12 monthly payments of £2.4.5.

ORCHESTRA

MICROPHONE CHANNEL 1

MICROPHONE CHANNEL 2

RECORDING AMPLIFIER CHANNEL 1

RECORDING AMPLIFIER CHANNEL 2

RECORDING SYSTEM

STEREO DISC CUTTER AND PROCESS SYSTEM

PLAYBACK SYSTEM

STEREO CHANNEL 1

PICK-UP CHANNEL 2

REPLAY AMPLIFIER CHANNEL 1

REPLAY AMPLIFIER CHANNEL 2

LOUDSPEAKERS

1

2

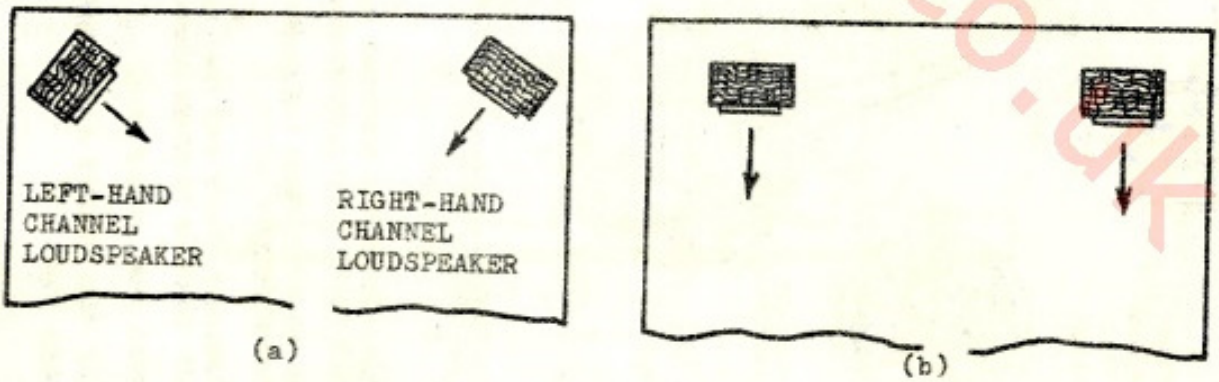
MAIN LISTENING AREA

= DIRECT SOUND

= DISTANT & REVERBERANT SOUND

FIG.5

BLOCK DIAGRAM OF STEREOPHONIC DUAL CHANNEL SYSTEM.



The left-hand diagram (a) illustrates the loudspeakers placed in the corners of the room, and facing towards centre. This arrangement produces good low frequency sound, but the listening position is somewhat restricted.

Diagram (b) illustrates the most used stereophonic loudspeaker arrangement The distance between the loudspeakers must be found by experiment. It should not be less than 6 feet.

FIG.6 LOUDSPEAKER POSITIONING.

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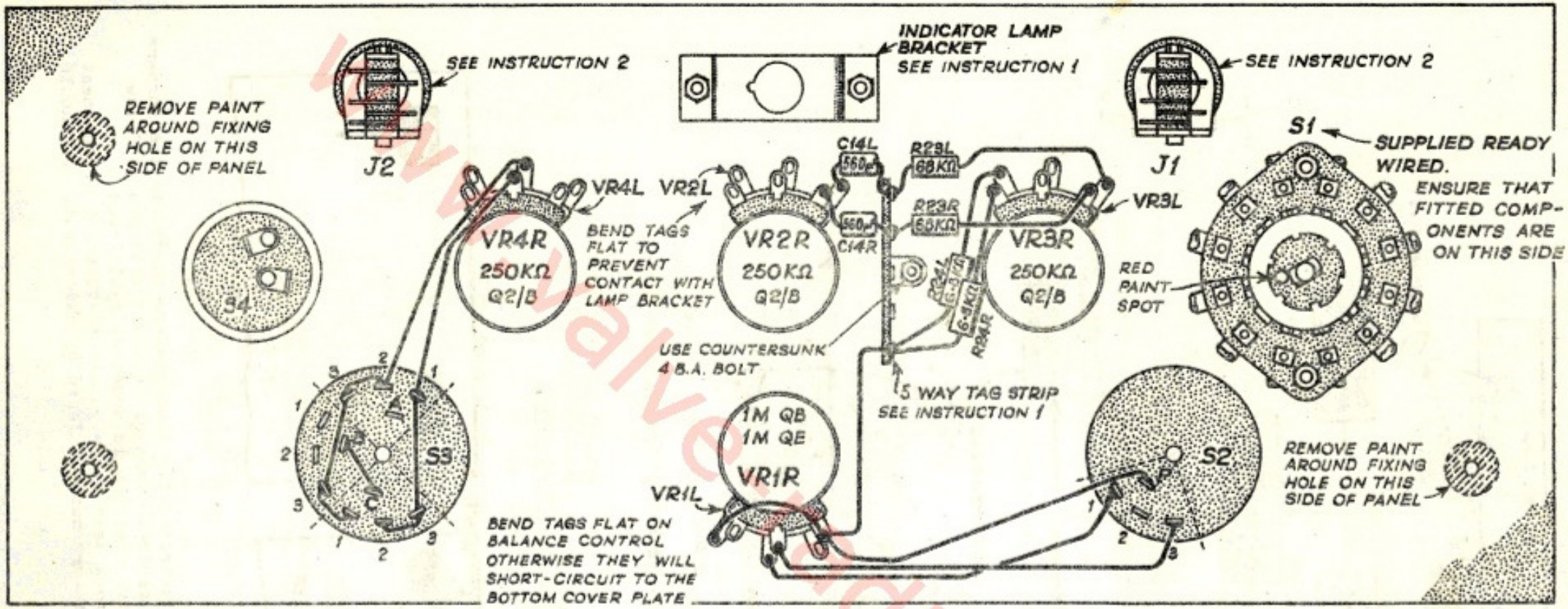

INSTRUCTIONS

1. MOUNT ALL COMPONENTS IN THE POSITIONS ILLUSTRATED. ENSURE THAT THE SHAKEPROOF WASHERS SUPPLIED WITH THE POTENTIOMETERS ARE POSITIONED INSIDE THE CHASSIS PLATE. USE COUNTERSUNK BOLTS FOR FIXING INDICATOR LAMP BRACKET & TAG STRIP.
2. JACKS J1 & J2 ARE ISOLATED FROM THE CHASSIS PLATE BY SPECIAL PAXOLIN BUSHES AND WASHERS. REFER TO INSERT DRAWING FOR CORRECT MOUNTING METHOD. (STAGE ONE FIG.2).
3. ENSURE PERFECT SOLDER JOINTS AND THAT THE WIRING AND COMPONENTS ARE POSITIONED PRECISELY AS SHOWN. USE SLEEVING WHEREVER NECESSARY TO PREVENT SHORT-CIRCUITS TO OTHER COMPONENTS.
4. IT WILL BE OBSERVED THAT AS THE STAGE WIRING PROGRESSES, THE WIRING SHOWN IN THE PREVIOUS STAGE HAS BEEN OMITTED FOR CLARITY.
5. CHECK CAREFULLY ALL WIRING AND COMPONENT VALUES, THAT THE SELECTOR SWITCH S1 IS CORRECTLY MOUNTED AND PROCEED TO STAGE TWO.

STAGE ONE — CONTROL PANEL COMPONENT MOUNTING AND WIRING — FIG.1 REAR VIEW

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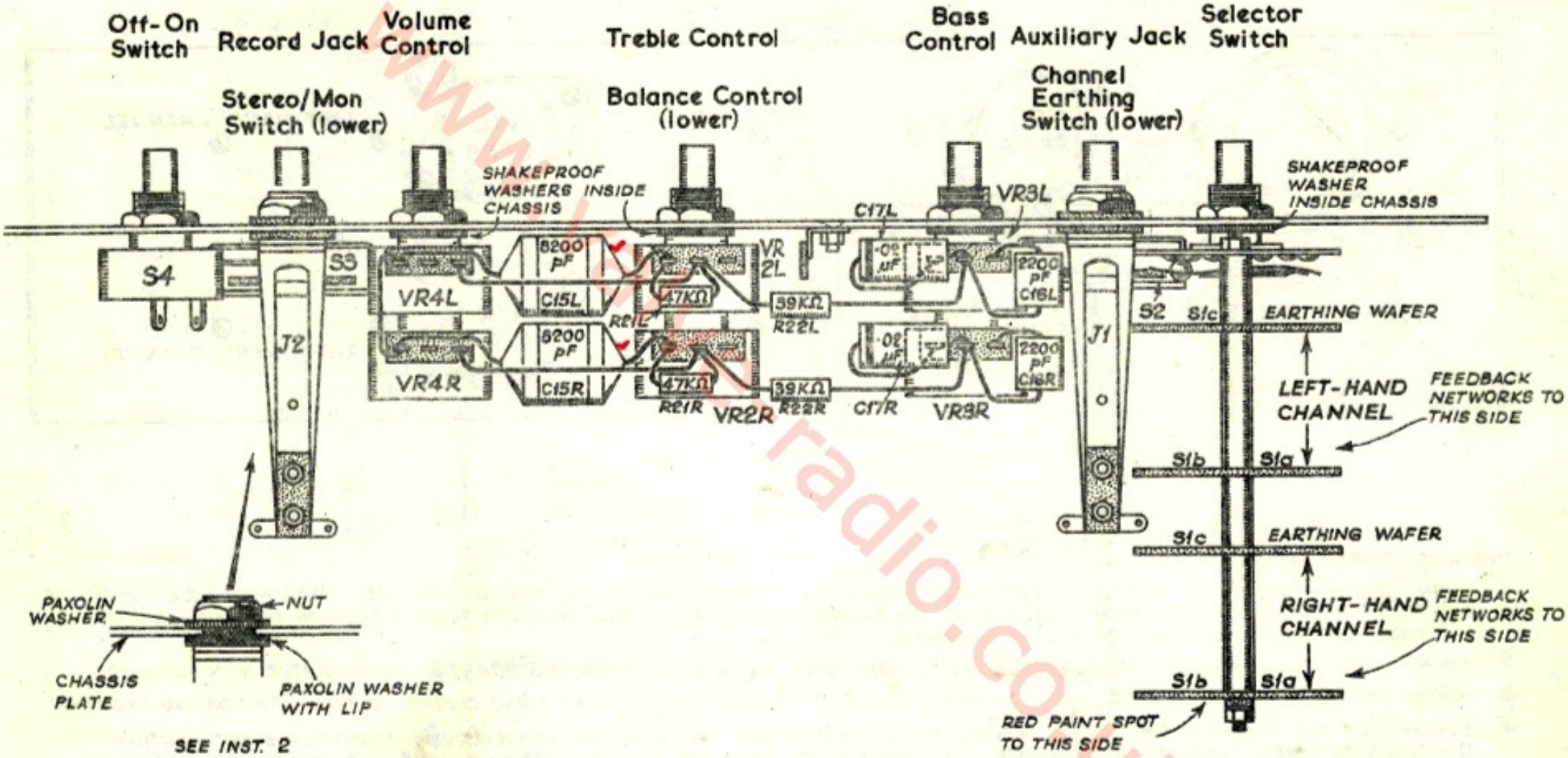

STAGE ONE - CONTROL PANEL WIRING Continued - FIG. 2 TOP VIEW

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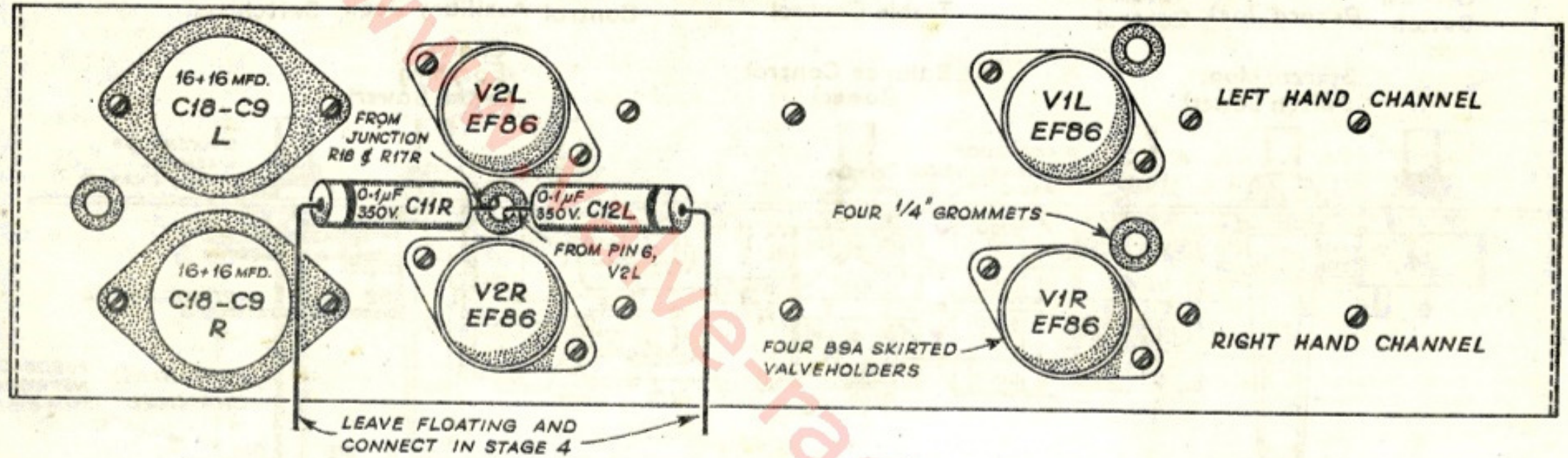

INSTRUCTIONS:

1. MOUNT TAG BOARDS, VALVE BASES, 16+16 MFD. CONDENSERS IN POSITIONS SHOWN. THE COMPONENTS ARE FITTED WITH 6B.A. x 1/4" BOLTS AND NUTS. SHORT BOLTS ARE ESSENTIAL TO FIX THE TAG BOARDS, OTHERWISE THEY WILL PROTRUDE TOO FAR THROUGH THE FIXING BUSHES AND SHORT-CIRCUIT THE COMPONENTS MOUNTED THEREON.
2. WIRING SHOWN THUS ---- ON TAG BOARDS MUST BE CONNECTED FIRST, RUN FLAT ON TAG BOARDS AND INSULATED WITH SLEEVING.
3. HEATER LEADS SHOWN THUS MUST BE LIGHTLY TWISTED TOGETHER AND RUN FLAT ALONG CHASSIS TO PREVENT A.C OR HUM RADIATION.
4. ENSURE THAT ALL WIRING IS POSITIONED PRECISELY AS ILLUSTRATED. USE SLEEVING WHEREVER NECESSARY TO PREVENT SHORT-CIRCUITS TO OTHER COMPONENTS. REMEMBER THAT AS THE STAGE DRAWINGS PROGRESS PREVIOUS WIRING IS OMITTED FOR CLARITY.
5. CHECK ALL COMPONENT VALUES AND WIRING. ENSURE GOOD SOLDER JOINTS AND THEN PROCEED TO STAGE THREE.

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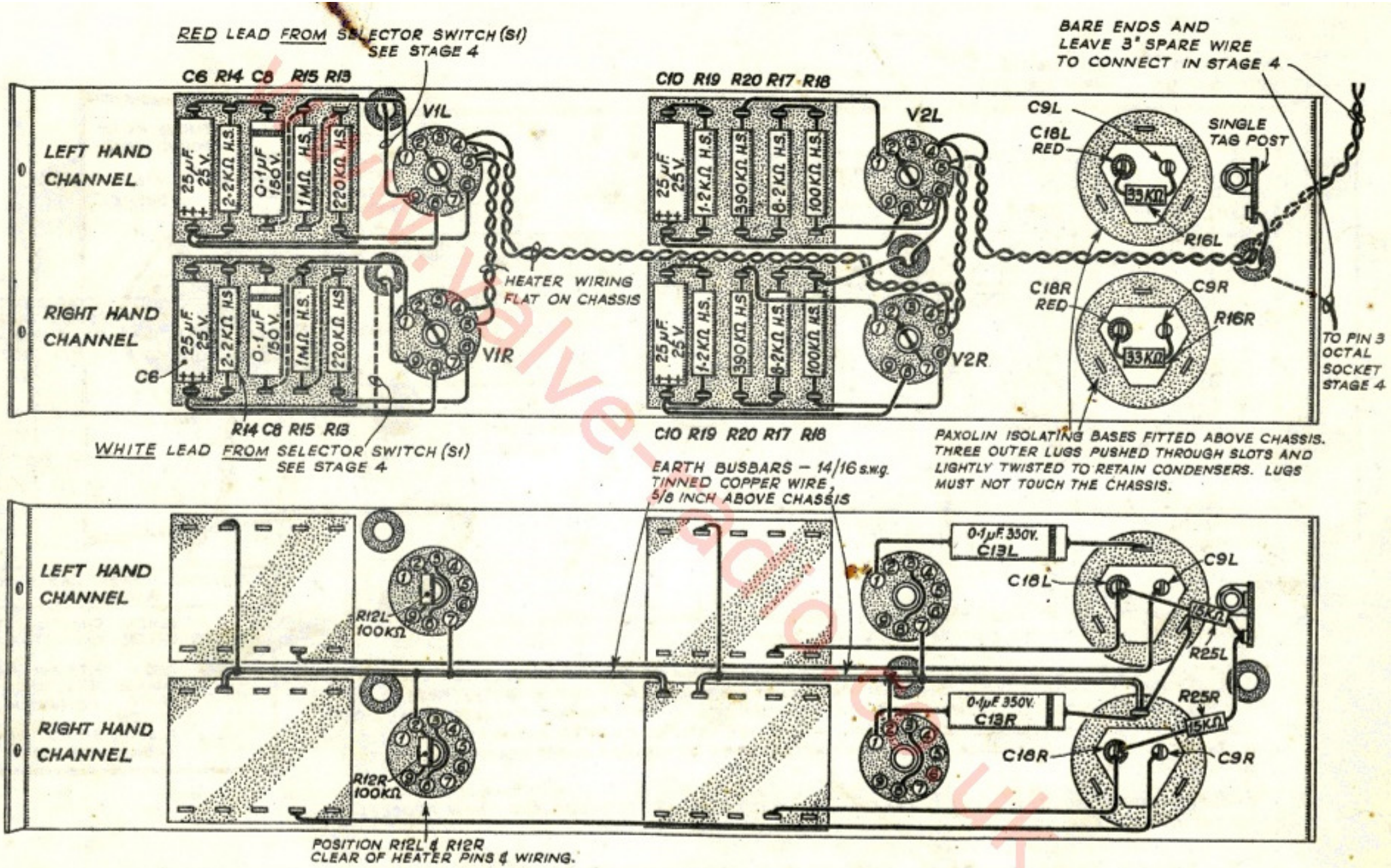

STAGE TWO – VALVE PLATFORM WIRING, Continued – FIG. 2 UNDERSIDE VIEW.

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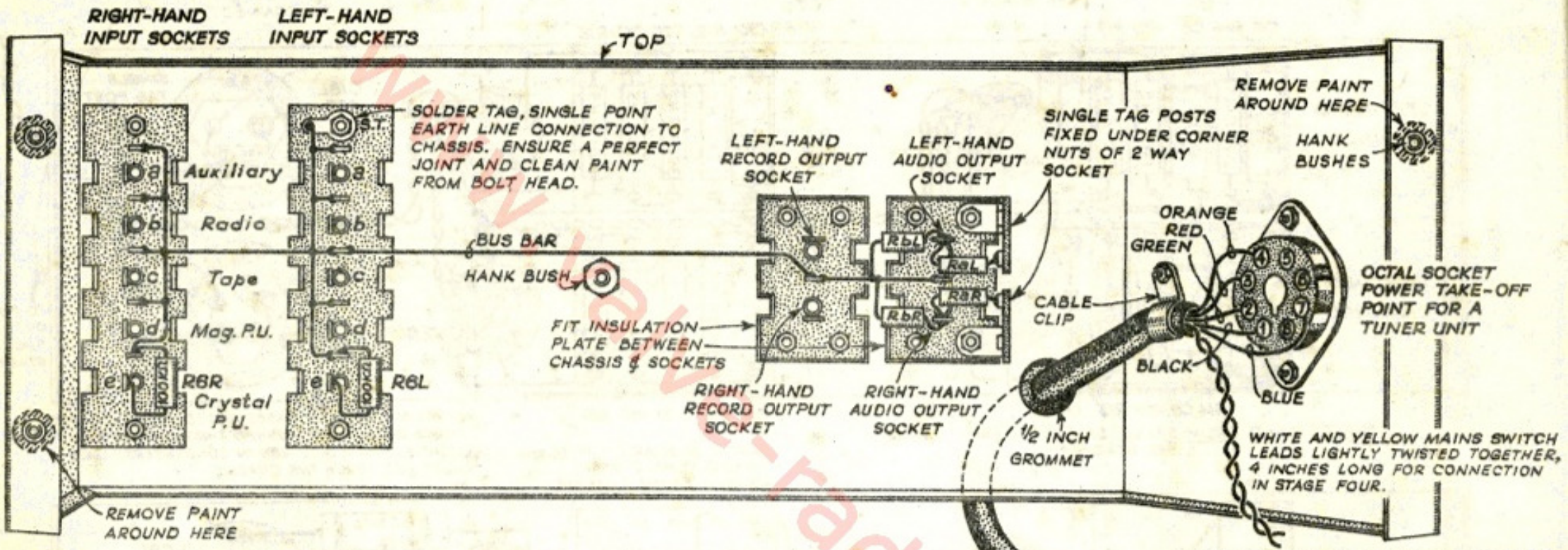

7/8 CORE POWER CABLE TO MAIN AMPLIFIER

BLACK	CHASSIS/EARTH
GREEN	6·3 VOLT HEATER
RED	H.T.+ PRE-AMP. ONLY
ORANGE	H.T.+ TUNER UNIT
WHITE / YELLOW	A.C. SWITCH LINE
BLUE	6·3 VOLT HEATER
BROWN	NOT USED

INSTRUCTIONS

1. ENSURE THAT THE MULTI-CORED POWER CABLE IS CORRECTLY TERMINATED TO THE OCTAL SOCKET, OTHERWISE SERIOUS DAMAGE TO THE VALVES MAY RESULT.

2. RESISTORS Ra & Rb FORM THE OUTPUT ATTENUATION. THE VALUES TO PROVIDE THE CORRECT DRIVE VOLTAGE FOR THE THE MULLARD "5-10" & "3-3" POWER AMPLIFIERS ARE GIVEN IN THE TABLE. (PAGE 8). FOR THE MULLARD "20 WATT" POWER AMPLIFIER NO ATTENUATION IS NECESSARY. THEREFORE RaL & RaR MUST BE REPLACED BY A DIRECT CONNECTION. RbL & RbR MUST BE OMITTED ENTIRELY. IT IS MOST IMPORTANT TO ENSURE THE CORRECT ATTENUATION OTHERWISE UNSATISFACTORY RESULTS WILL BE OBTAINED.

3. ENSURE PERFECT SOLDER JOINTS, THAT ALL CONNECTIONS ARE CORRECT AND THEN PROCEED TO THE NEXT STAGE.

STAGE THREE — REAR AND END PANEL COMPONENT MOUNTING — INSIDE VIEW

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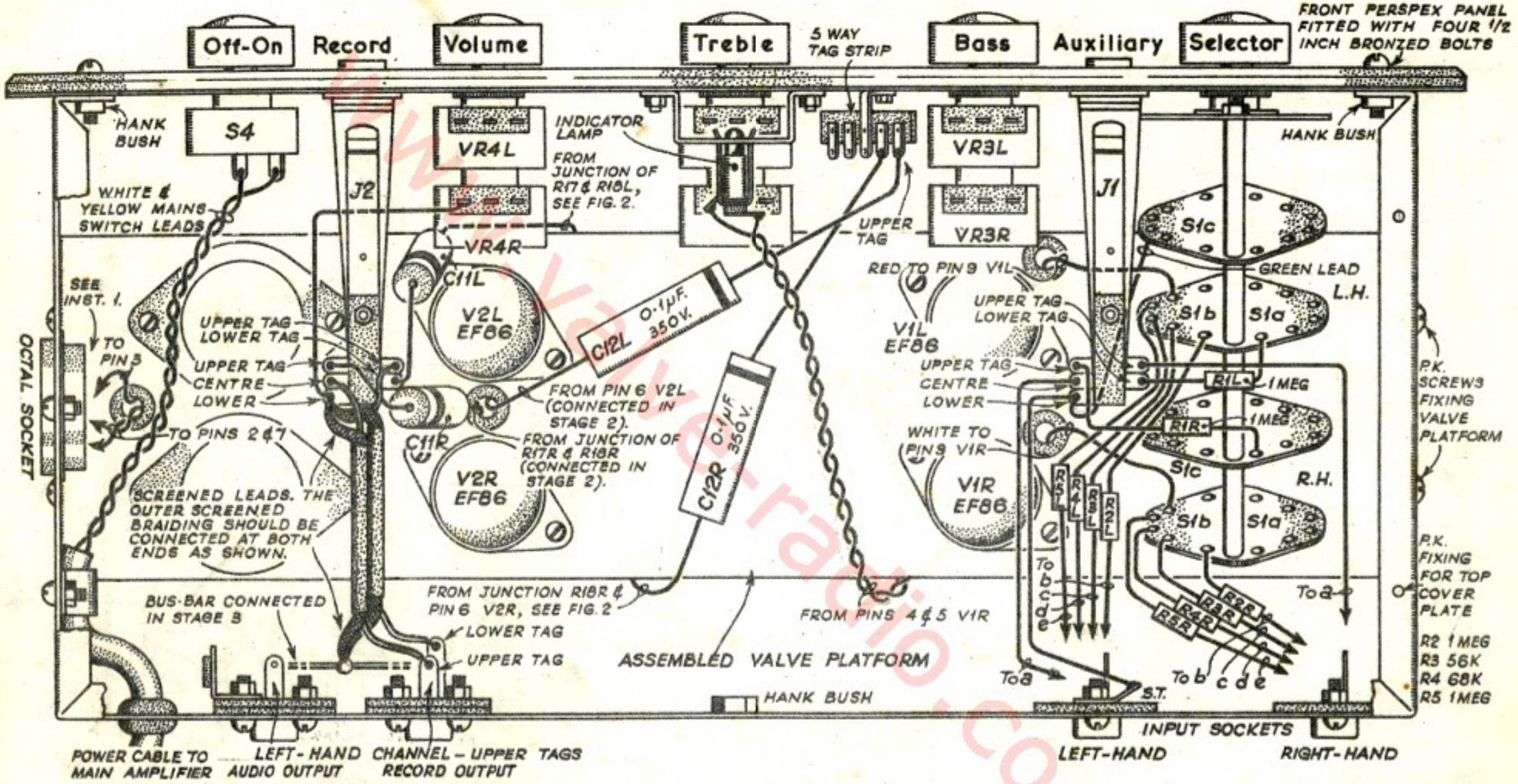

INSTRUCTIONS.

1. FOR EASE OF ASSEMBLY THE VALVE PLATFORM SHOULD BE FITTED INTO THE OUTER CASE FIRST, AND THE HEATER & H.T. CONNECTIONS SOLDERED TO THE APPROPRIATE PINS ON THE OCTAL SOCKET.
2. NEXT THE CONTROL PANEL TOGETHER WITH THE FRONT PERSPEX SCALE SHOULD BE FITTED TO THE OUTER CASE BY THE FOUR BRONZED HEADED BOLTS.
3. TAKE GREAT CARE TO MAKE THE CONNECTIONS SHOWN IN THIS STAGE CORRECTLY WITH PARTICULAR ATTENTION TO THE INPUT SOCKETS a to e AND THE JACKS J1 & J2.
4. THE TWISTED HEATER LEADS FEEDING THE INDICATOR LAMP MUST BE KEPT CLEAR OF OTHER COMPONENTS.
5. THE COLOURED LEADS SUPPLIED WIRED ON THE SELECTOR SWITCH (S1) SHOULD BE SHORTENED TO THE CORRECT LENGTH BEFORE BEING CONNECTED.

STAGE FOUR – FINAL ASSEMBLY & WIRING – Fig. 1 TOP VIEW

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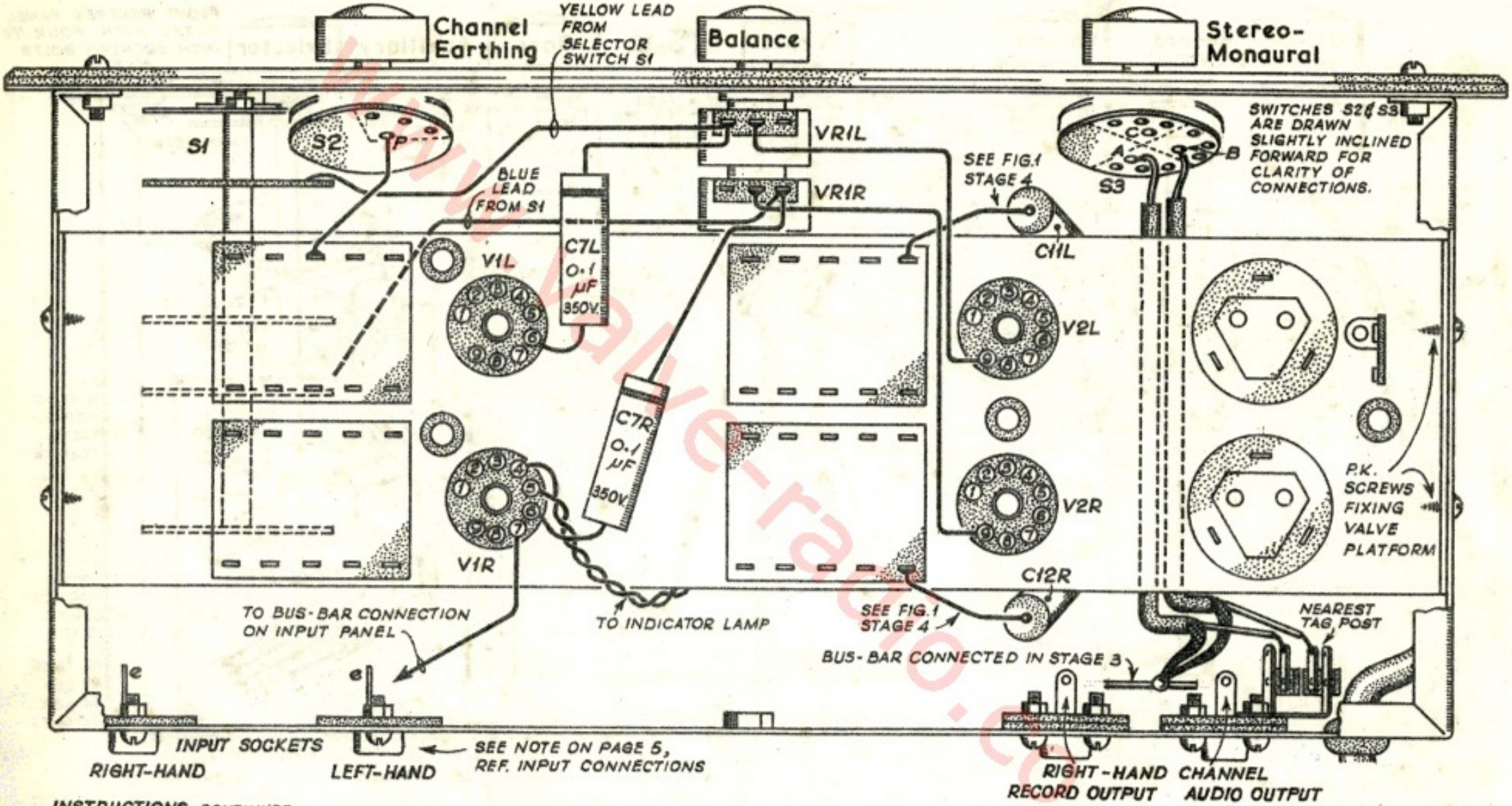

INSTRUCTIONS, CONTINUED.

6. THE PRE-AMPLIFIER HAS NOW BEEN COMPLETELY WIRED. THE VALVES SHOULD BE PLUGGED INTO THEIR RESPECTIVE BASES AND THE CONSTRUCTOR MUST SATISFY HIMSELF THAT THE WIRING AND COMPONENT VALUES ARE CORRECT IN EVERY RESPECT BY CAREFULLY CHECKING BACK THROUGH EACH STAGE.

7. FIT THE TOP AND BOTTOM COVER PLATES BY MEANS OF THE P.K. SCREWS PROVIDED. ENSURE THAT THE TAGS ON THE BALANCE CONTROL DO NOT SHORT-CIRCUIT TO THE COVER PLATE.

STAGE FOUR – FINAL ASSEMBLY & WIRING – Fig.2 UNDERSIDE VIEW

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COMPONENTS LIST

MODEL DUAL CHANNEL PRE-AMPLIFIER DATE _____

IMPORTANT Please check carefully. Some components are very small and can easily be discarded with the packing. Discrepancies must be advised immediately and this list should be returned to us together with any components that appear incorrect.

	RESISTORS
2	6.8K ½ watt
2	15K
2	33K
2	39K
2	47K
2	56K
4	68K
4	100K
2	150K
2	180K
2	270K
2	680K
6	1 MEG
2	1.2K High Stab
2	2.2K
2	8.2K
2	100K
2	220K
2	390K
2	1 MEG

	POTENTIOMETERS
1	1 MEG LOG/ 1 MEG ANTI LOG Potentiomer QB/QE
3	250/250K Log QB

	CAPACITORS
2	560 Pf S/M
2	2200 Pf
2	8200 Pf
2	.02 Mfd 350v
10	.1 Mfd
4	25 Mfd 12/25v
2	16 + 16 Mfd 350v

	SWITCHES
1	Selector Pre Wired
1	1 Pole 3 way
1	3 Pole 3 way
1	Rotary ON/OFF

	MISCELLANEOUS
2	Bulgin Jack Sockets
2	5 way Clix Sockets & Plates
2	2 way Clix Sockets & Plates
4	5 Way Tag Boards (DENCO)
1	5 Way Tag Strip
3	Single Tag Posts
4	B9A Valve Bases W/S
1	Int Octal Base
1	Int Octal Plug
14	Phono Plugs
2	Pax Mounted Bases Small
1	Lilliput Lamp
1	Lilliput Lampholder
1	Cable Clip
8	Control Knobs
1	Pkt Nuts & Bolts
1	4BA Thumb Screw
1	Instruction Manual

	WIRE AND CABLE
1	Yd 7/8 Core
2	Yds Heater Wire
20	Inches Single Screened
4	Yds Sleeving
6	Yds 20/22 SWG Tinned Copper Wire
2	12 inches 18 SWG Tinned Copper Wire

	VALVES
4	EF86

	CHASSIS WORK
1	Box Type Chassis
1	Valve Platform
1	Top and Bottom Plates
1	Front Plate
1	Lamp Bracket
1	Front Panel

NOTE: Components values or tolerances may differ slightly from the above list. Where substitutes are included they have been tested and approved as alternatives.

STOREMAN BQ

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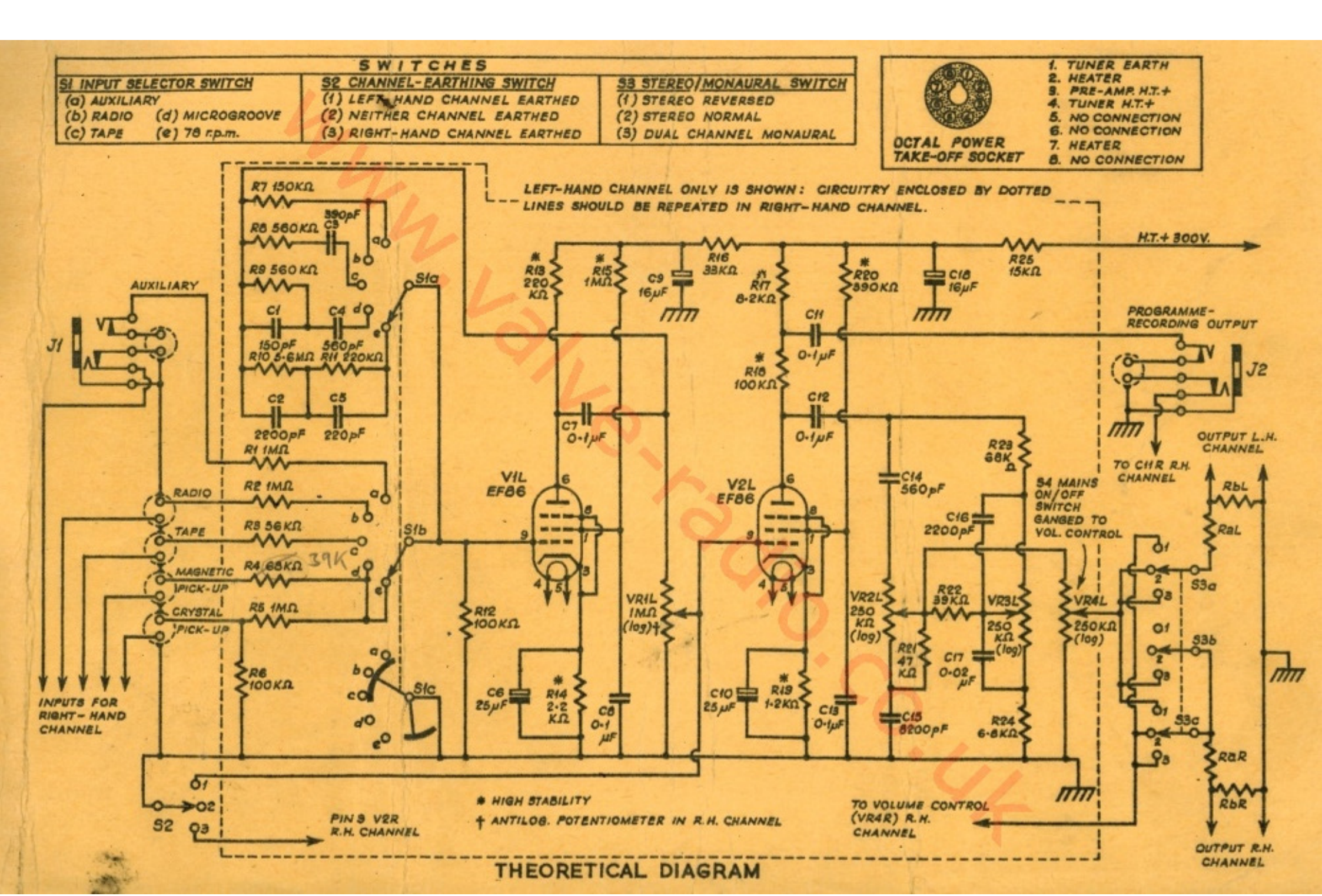

THEORETICAL DIAGRAM

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