

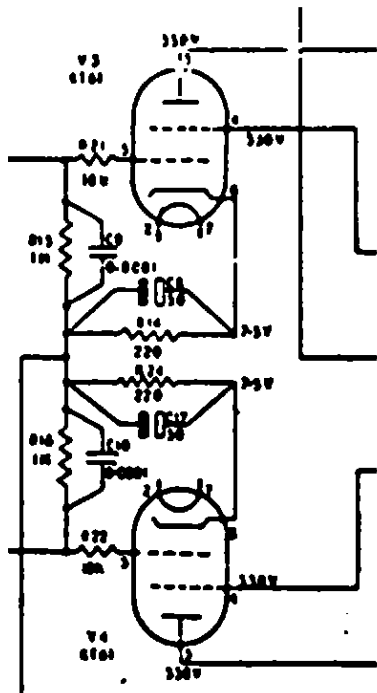
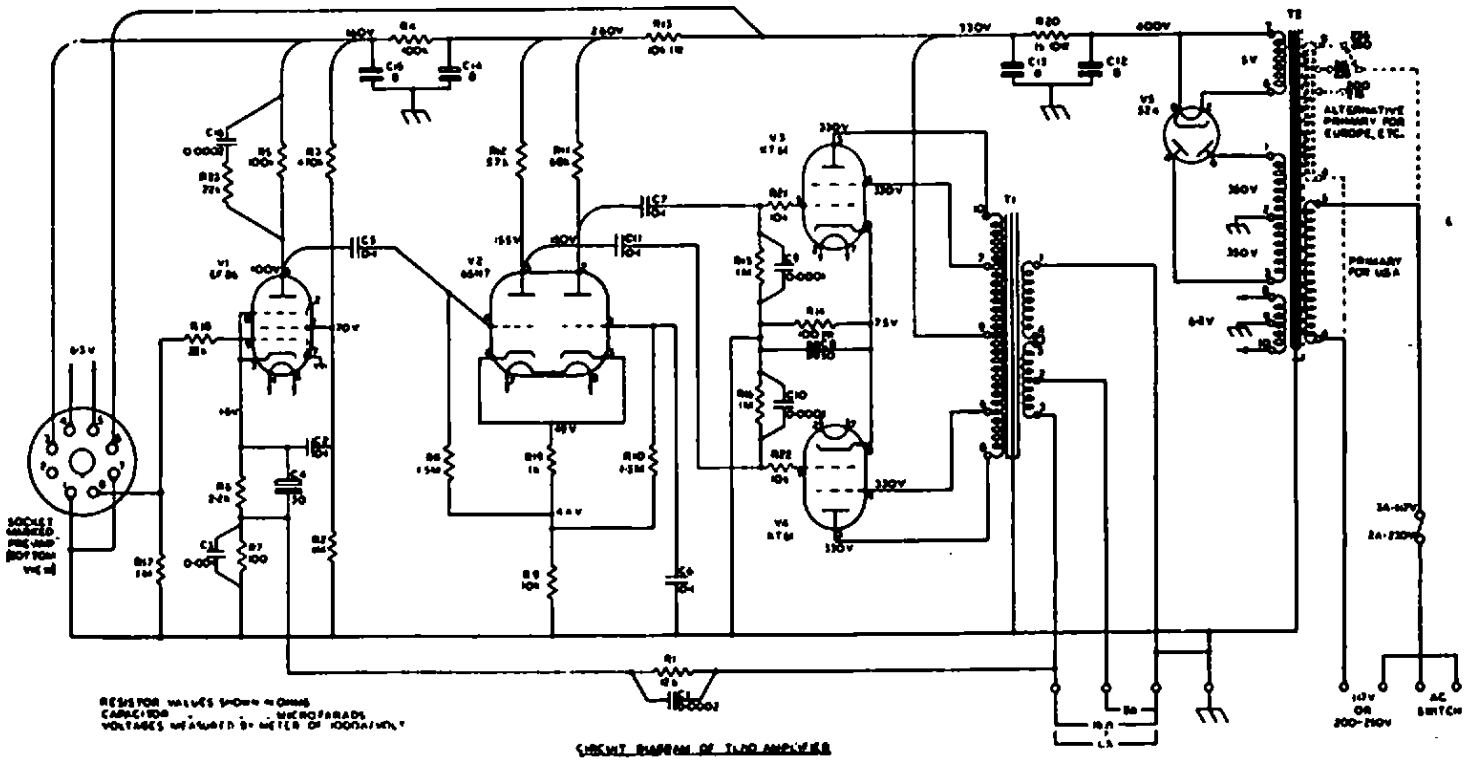
LEAK

"TL-"

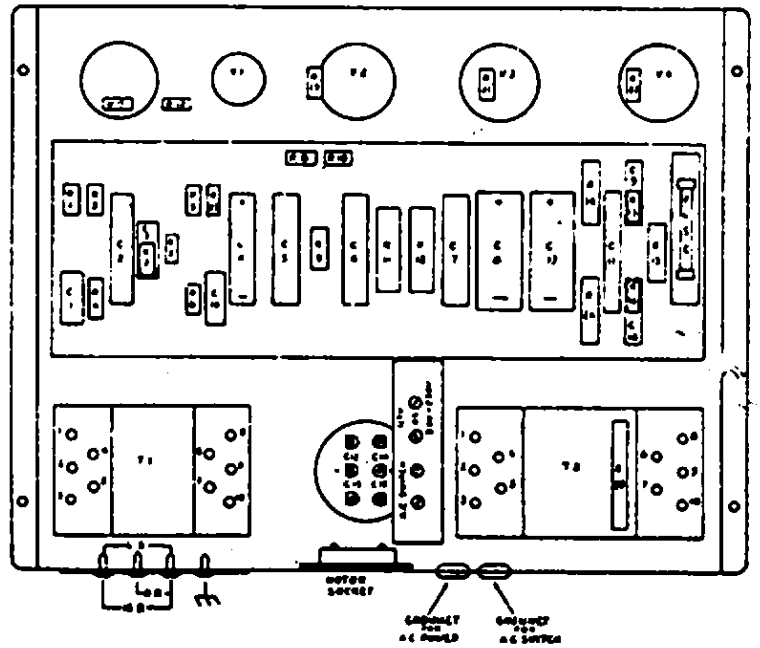
Series

All Versions

Service and Operating



Leak TL10 alternative output stage.



Leak TL10 component layout for alternative output stage.

NOTE: Brimar 6AG6G is an exact equivalent for the KT61.
6L6 valves may be used instead of the KT61,
provided the following modifications are made:

R3 changed from 470k to 1M
R5 changed from 100k to 330k
R14 changed from 100 Ohms to 300 Ohms, 3 Watt
C8 to be omitted (these mods refer to the o/p stage
with single cathode resistor for two valves)

TL/12 FEEDBACK AMPLIFIER

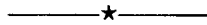
INSTALLATION, OPERATION and MAINTENANCE



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TL/12 FEEDBACK AMPLIFIER

INSTALLATION, OPERATION and MAINTENANCE



The TL/12 power amplifier may be used in conjunction with any Leak pre-amplifier.

CONNECTING THE TL/12 AMPLIFIER.

1. Check that all valves (tubes) are correctly seated in their holders and that the top connector of the shielded first valve (tube) is in place.
2. The amplifier should stand on its base in a well-ventilated position. If it is placed in the bottom of a cabinet the back should be ventilated.

The amplifier should be kept at least 2 ft. (60 cms.) away from pickups, because some designs of pickup are very susceptible to induced hum from power transformers.

3. On the British model the mains transformer primary is tapped for voltages of 205, 225 and 245, and the voltage selector plug should be set as under :—
 - In "200" position for mains voltages between 195 and 215.
 - In "230" position for mains voltages between 216 and 235.
 - In "250" position for mains voltages between 236 and 255.

On the U.S. model the mains transformer primary is tapped for voltages of 108, 115 and 122, and the voltage selector plug should be set as under :—

- In "108" position for mains voltages between 100 and 111.
- In "115" position for mains voltages between 112 and 118.
- In "122" position for mains voltages between 119 and 125.

The A.C. mains should be connected to the two terminals nearest the guide key on the removable plug portion of the mains connector.

For some applications the amplifier may, on request, be fitted with a mains switch adjacent to the fuse. Normally, a switch is not fitted in order that the amplifier may be remotely controlled, and as it leaves the factory the mains switch terminal block (mounted on the terminal board of the mains transformer) is strapped by a wire link (see drawing on page 3). A remote switch may be run from the mains switch terminal block, after removing the link, the flex being passed through the adjacent grommet. Most users will wish to make use of the mains switch incorporated in the volume control of the pre-amplifier, and a plug and twin flex is supplied for this purpose. The bare ends of the flex should be inserted in the mains switch terminal block, and the plug inserted in the socket marked "A.C. Switch" on the pre-amplifier. If hum is experienced when connecting the switch leads to the pre-amplifier, the mains input leads to the three-pin plug on the TL/12 should be reversed. The mains connector plug should not be used as a switch; neither the fuse nor the voltage selector plug should be removed when the amplifier is in operation.

4. The socket marked "A.C. Outlet" is fitted as a convenient source of supply for a gramophone (phono) motor or tape deck motors. The power taken from this socket should be limited to 60 watts or thereabouts. This socket is not controlled by the amplifier switch or fuse.
5. A connection to earth (ground) should be taken from the third terminal on the removable plug portion of the mains connector. This terminal is the one furthest away from the guide key, and its corresponding terminal on

the fixed portion of the connector is marked on the chassis by the symbol \oplus . It is very bad practice to omit this connection, which may be made to the water system or to the steel conduit encasing the house wiring provided that these are themselves properly grounded.

No other earth connections should be made elsewhere, particularly when a pre-amplifier is also used, if freedom from "earth loops" and hum is to be obtained.

6. The loudspeaker should be connected by a *twisted* pair of wires to the loudspeaker socket. It will be seen from the circuit drawing (page 3) that one side of the loudspeaker winding is connected to the chassis, and no part of the loudspeaker wiring should be earthed elsewhere. The D.C. resistance of the connecting wires should be as low as possible, and not more than one-tenth the D.C. resistance of the loudspeaker. It is bad practice to operate any power amplifier without a loudspeaker, and if it is desired to mute the loudspeaker by switching it out of circuit this should be accomplished by use of a change-over switch which replaces it with a resistor of corresponding value and rating.

7. THE CHOICE OF A LOUDSPEAKER SYSTEM.

Space does not allow for detailed explanations, but the following points should be noted.

- (a) If you want the best results do not mount the loudspeaker in the same cabinet as the turntable and pickup.
- (b) The assembly commonly called a "loudspeaker" consists of a magnet, a moving coil, and a diaphragm (or "cone"). This assembly is a motor. You do not listen to a motor: you listen to a loudspeaker system, which consists of one or more motors mounted in a housing, (baffle, box, cabinet, or horn). The housing plays a profound part in determining the quality of reproduction. The effects of various housings are discussed by L. L. Beranek in "Acoustics," McGraw-Hill Publishing Co. Ltd., 1st Edition, 1954.
- (c) One good loudspeaker motor, properly housed, is capable of giving good results. Two good motors properly housed will give noticeably better results: in this case one motor is designed to reproduce bass, and the other, treble. A filter ("dividing network") must be used in conjunction with the two motors.

8. GENERAL NOTES ON MAINTENANCE.

The schematic drawing of the TL/12 amplifier provides nearly all information required for servicing. However, the following points may be of interest.

C10, 11, 13 are all 600V (D.C. working) paper capacitors housed in one outer casing.

The TL/12 amplifier does not rely on the output valves (tubes) being a matched pair to give the performance stated, and if one output valve (tube) fails it is not necessary to replace both valves (tubes).

METHOD OF STRAPPING OUTPUT TRANSFORMER TERMINALS AND CHECKING FEEDBACK RESISTOR (R18) AND CAPACITOR (C9).

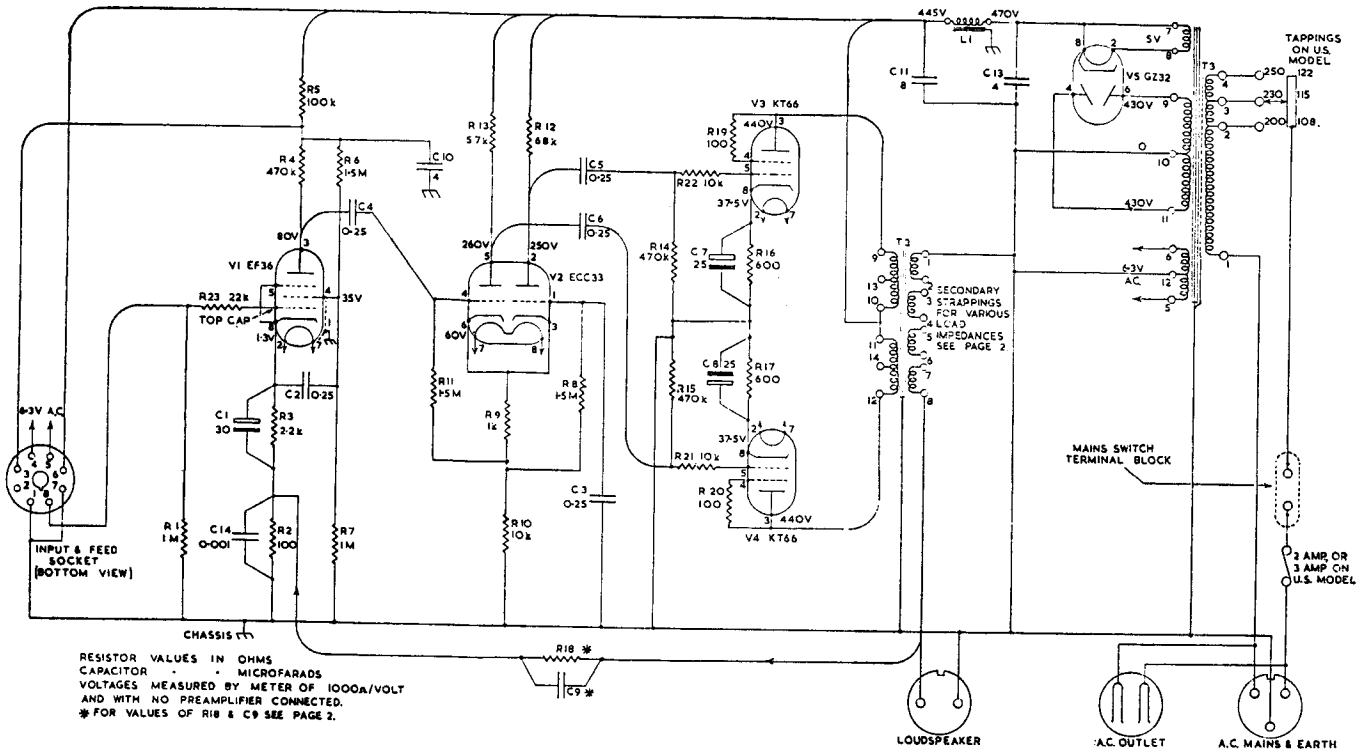
STANDARD TRANSFORMER TL/12/T2/2 for nominal load impedances of 2 ohms, 8 ohms, 18 ohms, 32 ohms.

LOAD	STRAPPINGS	RESISTOR (R18)	CAPACITOR (C9)
For 1.7 ohms—2.3 ohms	strap 1—3—5—7: 2—4—6—8.	3k ohms	0.0002mF
For 6.8 ohms—9.2 ohms	strap 1—5: 2—3—6—7: 4—8.	6k ohms	0.0001mF
For 15 ohms—20 ohms	strap 2—3—5: 4—6—7.	10k ohms	0.0001mF
For 27 ohms—36 ohms	strap 2—3: 4—5: 6—7.	12k ohms	0.0001mF

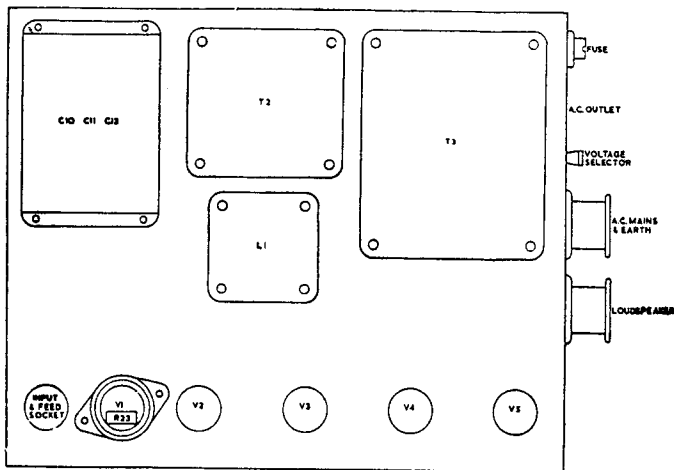
NON-STANDARD TYPE TL/12/T2/1 for nominal load impedances of 1 ohm, 4 ohms, 9 ohms, 16 ohms.

For 0.85 ohms—1.15 ohms	strap 1—3—5—7: 2—4—6—8.	2.2k ohms	0.0005mF
For 3.4 ohms—4.6 ohms	strap 1—5: 2—3—6—7: 4—8.	4.7k ohms	0.0005mF
For 7.5 ohms—10 ohms	strap 2—3—5: 4—6—7.	6.6k ohms	0.0003mF
For 13.5 ohms—18 ohms	strap 2—3: 4—5: 6—7.	10k ohms	0.0003mF

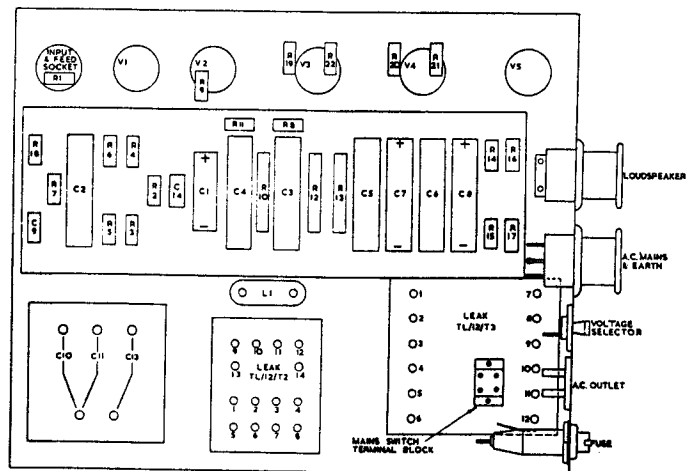
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CIRCUIT DIAGRAM

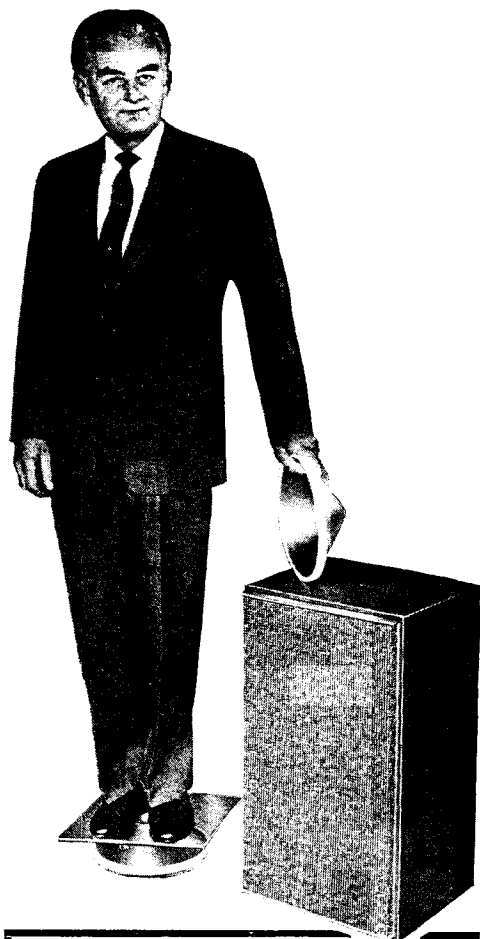


TOP CHASSIS VIEW



UNDER CHASSIS VIEW

A MAJOR LOUDSPEAKER INVENTION*



Harold J. Leak demonstrates immense stiffness of piston-action 'Sandwich' diaphragm which supports his weight below plate glass square.

THROUGHOUT the history of broadcasting and recording, certain exceptional developments have become milestones in the progress of sound reproduction.

ONE such milestone was the world's first very-low-distortion amplifier, the famous original Leak 'Point One', in 1945.

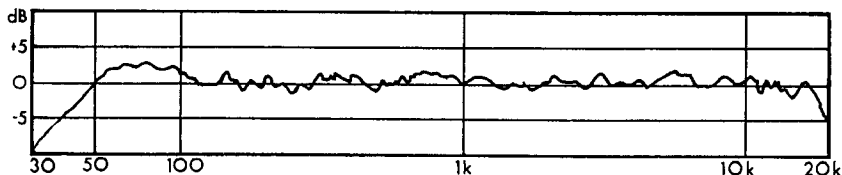
WE now pioneer another major breakthrough, the invention of the fantastically rigid 'Sandwich' cone diaphragm, which is demonstrably of great strength and hundreds of times stiffer than all conventional forms of cone. The photographs on this page illustrate the astonishing superiority of the Leak 'Sandwich' invention.

THE 'Sandwich' diaphragm is the invention of Donald A. Barlow, M.Sc., who leads the Leak Transducer Research Team. The theoretical treatise on his invention was given by Mr. Barlow in the *Wireless World*, December, 1958.

TO understand the impact of this invention one must remember that to obtain low distortion the movement of a loudspeaker diaphragm or cone should follow as accurately as possible the waveform of the signals applied to its speech coil. The ability of the cone to follow these impulses accurately depends upon the LIGHTNESS and STIFFNESS of the cone assembly.

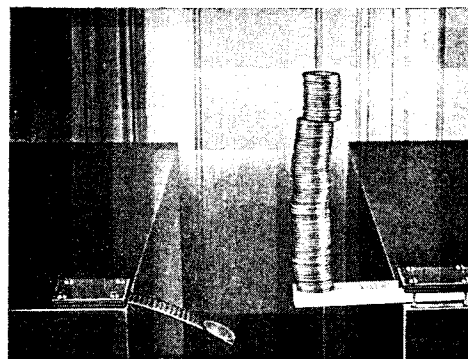
CONVENTIONAL cones (paper, impregnated fabric, plastics, aluminium) suffer from low stiffness. This results in significantly large areas of the cone vibrating in motions uncontrolled by the speech coil. These uncontrolled motions produce transient 'hangover', amplitude distortion (peaks and hollows in the frequency response) and intermodulation distortion (lack of clarity and spurious tones). These shortcomings are inherent in all direct-radiator loudspeaker systems using conventional cones, irrespective of cost.

ALL the above shortcomings of conventional loudspeakers are overcome by the Leak Piston-Action 'Sandwich' construction. Using engineering design principles as applied to air-frame construction, the 'Sandwich' cone comprises stiff aluminium skins for the outer surfaces where the stresses are greatest, bonded to a thick core of featherweight expanded plastic where the stresses are lowest, giving far greater stiffness than the same total weight of either material used separately. This use of the most suitable materials in optimum proportions and dispositions gives immense stiffness and rigid piston-action over a range of more than six octaves, and for the first time in audio history gives a direct-radiator diaphragm which reproduces the signal applied to the speech coil totally free from mechanical break-up and its associated distortions. The result is a remarkably smooth frequency response free from violent peaks or troughs over a very broad frequency range, indicative of excellent transient response (see graph below).



AXIAL PRESSURE RESPONSE OF 'SANDWICH' SYSTEM

The illustration shows a section of a paper cone flexing under the weight of one $\frac{1}{2}$ d., and a section of the immensely stiff 'Sandwich' cone, which weighs the same as the paper cone supporting the weight of 100 halfpennies. The revolutionary Leak cone comprises two skins of very thin aluminium separated by a filler of very light plastic material expanded to a thickness of $\frac{1}{8}$ inch.



* U.S. Patent Number 3,111,187 granted to applicants D. A. Barlow and H. J. Leak & Co., Ltd.

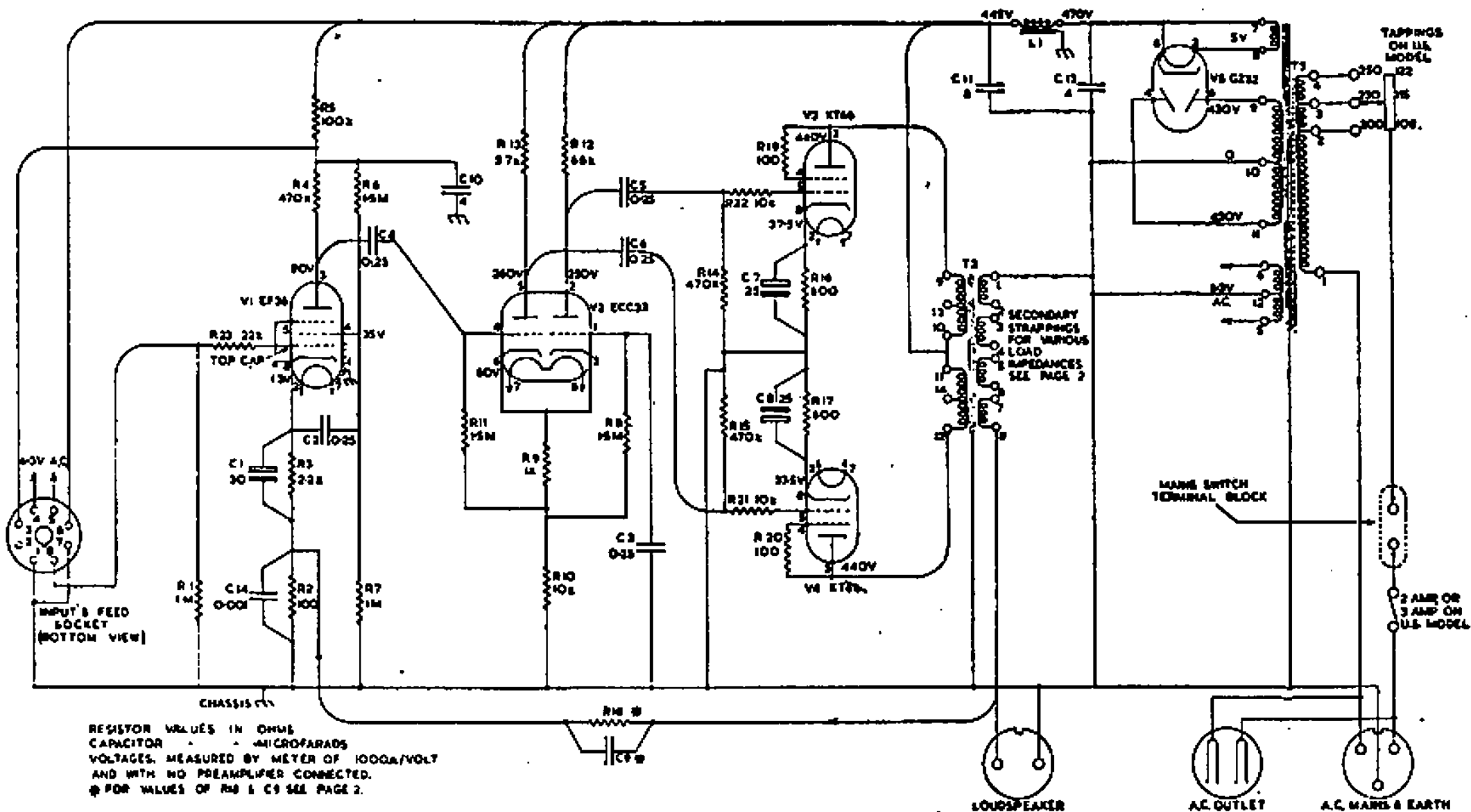
H. J. LEAK & CO., LTD.

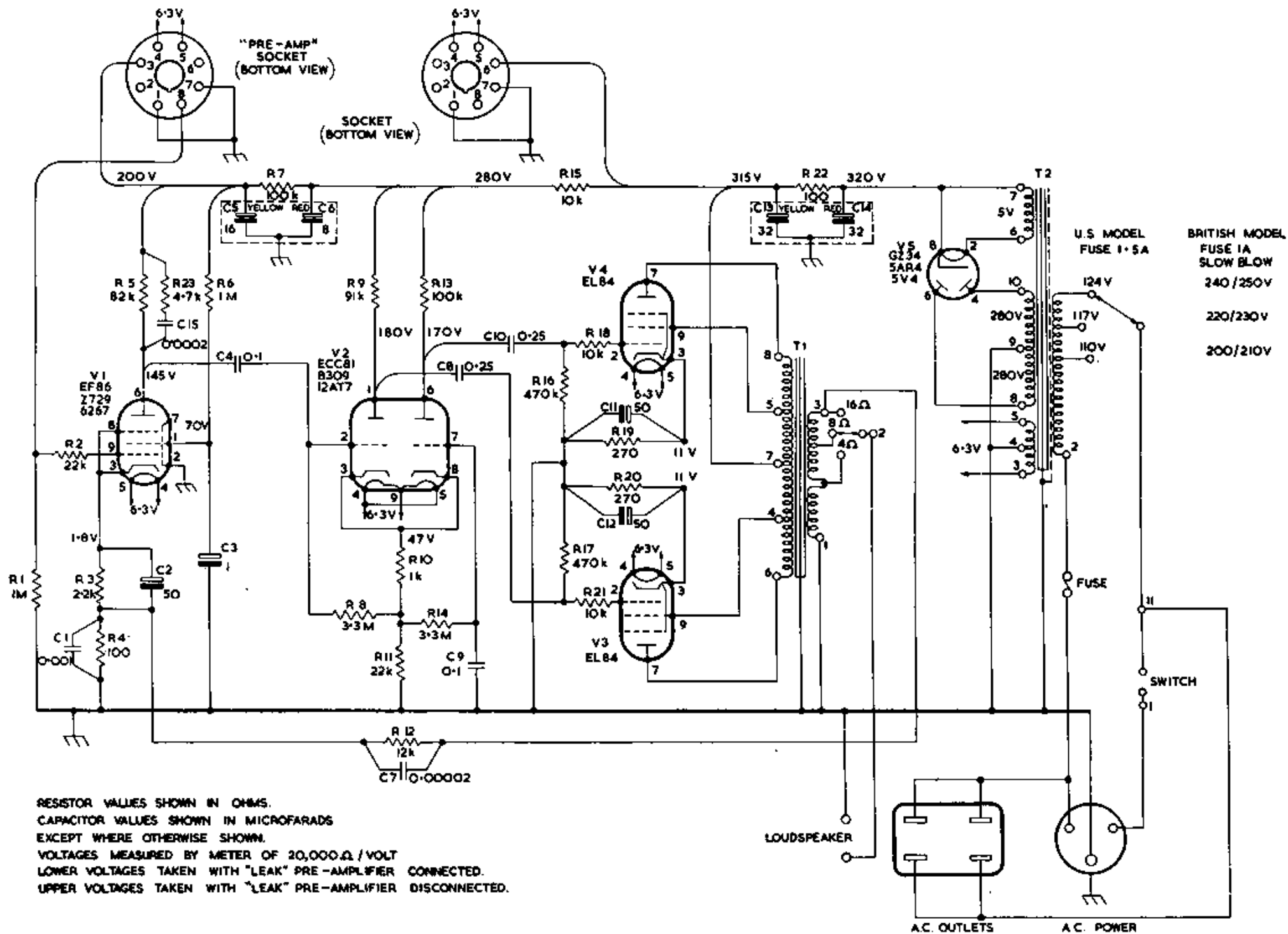
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RESISTOR VALUES SHOWN IN OHMS.
 CAPACITOR VALUES SHOWN IN MICROFARADS
 EXCEPT WHERE OTHERWISE SHOWN.
 VOLTAGES MEASURED BY METER OF 20,000 Ω/VOLT
 LOWER VOLTAGES TAKEN WITH "LEAK" PRE-AMPLIFIER CONNECTED.
 UPPER VOLTAGES TAKEN WITH "LEAK" PRE-AMPLIFIER DISCONNECTED.

U.S. MODEL
 FUSE 1.5A

BRITISH MODEL
 FUSE 1A
 SLOW BLOW
 240/250V
 220/230V
 200/210V

A.C. OUTLETS

A.C. POWER



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'TL/12 PLUS' POWER AMPLIFIER

INSTALLATION · OPERATION · MAINTENANCE

NOTES ON THE CHOICE AND PERFORMANCE OF LOUDSPEAKER SYSTEMS

OPERATION

1. The 'TL/12 PLUS' may be fed from the LEAK 'VARISLOPE MONO' pre-amplifier, or from any other suitable source. A source impedance higher than 25,000 ohms will tend to raise the hum level above the advertised figure of 82db below 12 watts. An input of 125mV r.m.s. will give a power output of 12 watts.

INSTALLATION

2. Check that all valves (tubes) are correctly seated in their holders and that the markings on the valves correspond with those on the chassis adjacent to the holders. The amplifier will work equally well with any of the alternative valves.
3. The amplifier should stand on its base in a well-ventilated position. If placed in a case or cabinet, ventilation must be provided. Four separate fixing feet with screws are provided with the amplifier.
4. On the British model the mains transformer is tapped for voltages of 205, 225 and 245 and the voltage selector plug on top of the mains transformer (see 'TOP CHASSIS' drawing) should be set appropriately. On the U.S.A. model the mains transformer is tapped for voltages of 105, 110 and 117 and the voltage selector plug should be set appropriately. The A.C. power supply should be connected to the two terminals nearest the guide key on the removable plug portion of the mains connector marked 'A.C. POWER'. In order that the amplifier may be remotely controlled we have provided two terminals marked 'SWITCH' underneath the mains transformer (see 'UNDER CHASSIS' drawing). The amplifier will not work unless these terminals are electrically joined, and when the amplifier leaves our factory a wire link joins the terminals. A remote switch may be run from the 'SWITCH' terminals, after removing the link, the flex being passed through the adjacent grommet marked 'SWITCH CABLE'. The flex should be knotted behind the grommet to avoid strain on the 'SWITCH' terminals. Most users will wish to make use of the switch incorporated in the volume control of an associated LEAK pre-amplifier, which is supplied with a plug and twin flex for this purpose. Full details are given in the installation sheets which accompany every pre-amplifier.
5. A double socket marked 'A.C. OUTLETS' is fitted as a convenient source of power supply for gramophone motors, self-powered radio tuners, etc. The power taken from this socket should be limited to 100 watts or thereabouts. This socket is not fused but is controlled by the amplifier switch.
6. Many British tuner units have no built-in power supplies and require a source for heater and anode currents. The octal socket marked 'SPARE SUPPLIES' on the back of the amplifier is provided for this purpose. The pins are numbered as indicated on the circuit diagram, and connections should be made to the pins similarly numbered on the removable plug which is supplied. The high tension supply is 300V and on some tuner units it may be necessary to provide a dropping resistor of suitable value, and some units may also require a condenser for smoothing and/or decoupling after the dropping resistor. An earth connection should not be made directly to the tuner unit, as this is automatically effected by the above connections via the power amplifier. The maximum current available from the 6·3V terminals is 2·1A and the maximum high tension current is 40mA.
7. A connection to earth (ground) should be taken from the third terminal on the removable plug portion of the 'A.C. POWER' connector. This terminal is the one furthest away from the guide key and its corresponding terminal on the fixed portion of the connector is marked on the chassis by the symbol \oplus . It is very bad practice to omit this connection, which may be made to the water system or to the steel conduit encasing the house wiring, providing that these systems themselves are properly grounded. No other earth connections should be made elsewhere, particularly when a pre-amplifier is also used, if freedom from 'earth loops' and hum is to be obtained.

- 2
8. The loudspeaker should be connected by a *twisted* pair of wires to the terminals marked 'LOUDSPEAKER'. It will be seen from the circuit drawing that one side of the loudspeaker winding is connected to the chassis, and no part of the loudspeaker wiring should be earthed elsewhere. The D.C. resistance of the connecting wires should be as low as possible, and not more than one-tenth the D.C. resistance of the loudspeaker. It is bad practice to operate any power amplifier without a loudspeaker, and if it is desired to mute the loudspeaker by switching it out of circuit this should be accomplished by use of a change-over switch which replaces it with a resistor of corresponding value and rating. The selector plug on top of the output transformer (see 'TOP CHASSIS' drawing) should be adjusted for the nearest match to the advertised impedance of the loudspeaker.

GENERAL NOTES ON MAINTENANCE

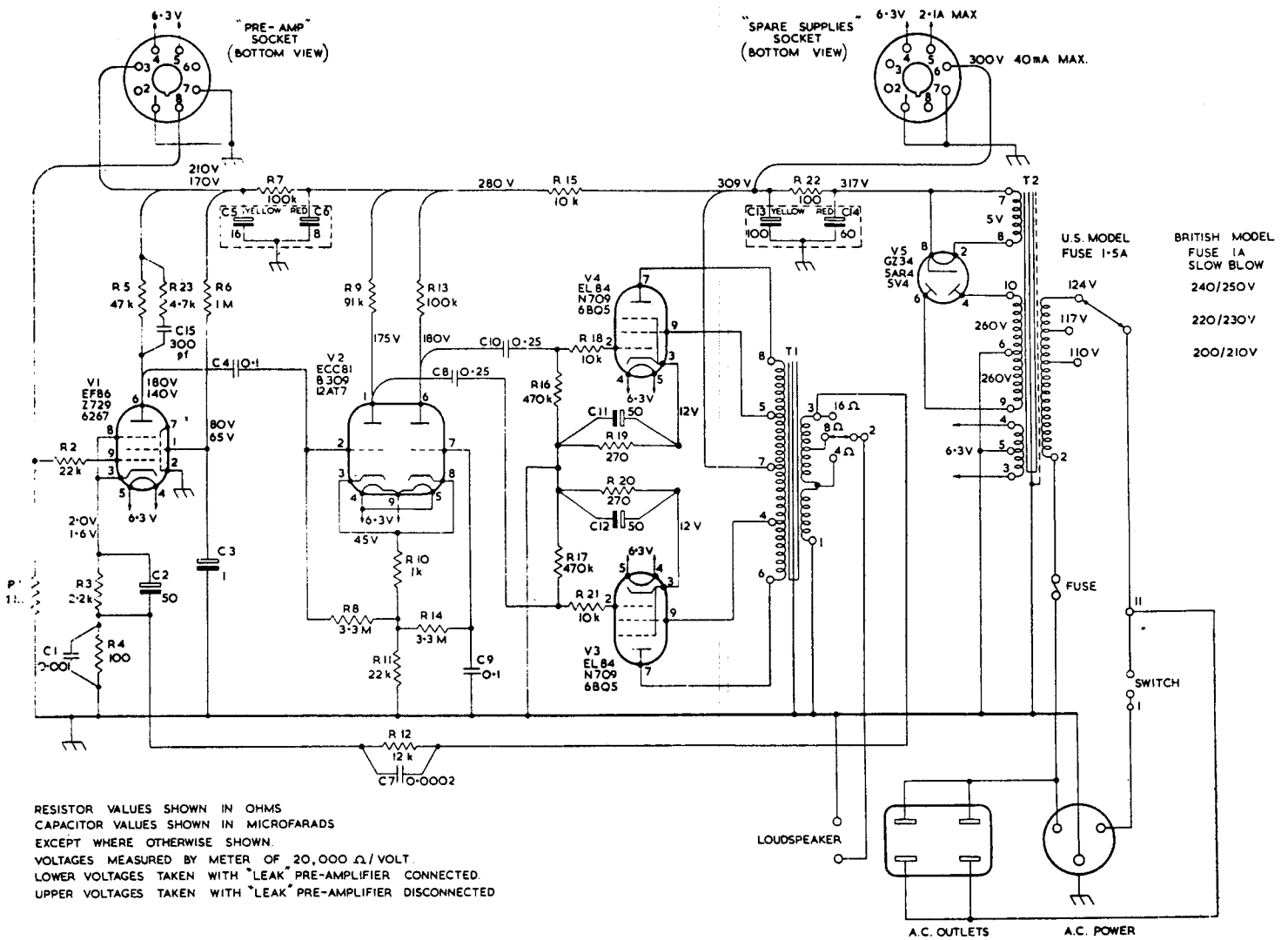
The circuit diagram provides a qualified engineer with all information required for servicing. However, the following points may be of interest:—

- (a) The 'TL/12 PLUS' does not depend upon the output valves (tubes) being a matched pair to give the stated performance, and if one output valve fails it is not necessary to replace both.
- (b) Should it ever be necessary to replace the reservoir capacitor C14 (which is in the same can as C13) note that C14 must be of a type capable of handling a heavy ripple current. The C14 fitted has a very high margin of safety, being capable of handling 380mA. The values of 60mfd. and 100mfd. are made high for the sole purpose of minimising the hum resulting from the unavoidable 'earth loop' which must be occasioned by the connection of non-powered tuner units.

NOTES ON LOUDSPEAKER SYSTEMS

Space does not allow for detailed explanations on this vast subject, but the following points should be noted:—

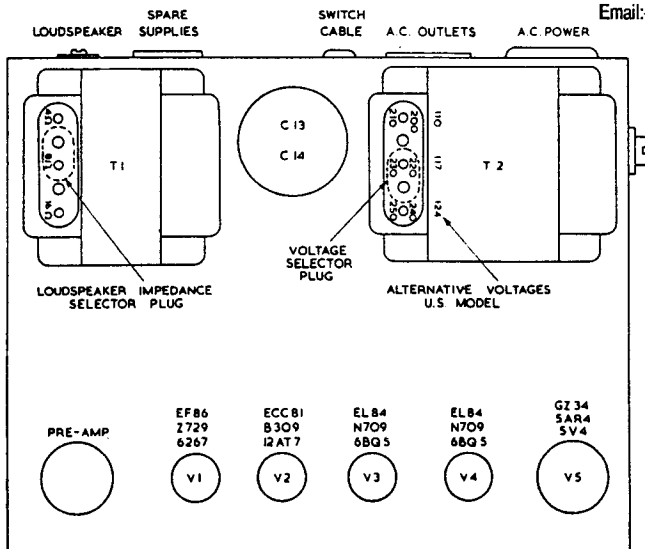
- (a) You *cannot* get high fidelity results if you mount a loudspeaker in the same cabinet as the turntable and pickup.
- (b) The assembly commonly called a 'loudspeaker' consists of a magnet, a moving coil and a diaphragm (or 'cone'). This assembly is a 'motor'. You do not listen to a motor; you listen to a loudspeaker system, which consists of one or more motors mounted in a housing (baffle, box, cabinet, or horn). The housing plays a profound part in determining the quality of reproduction. The effects of various housings are discussed by L. L. Beranek in *Acoustics*, McGraw-Hill Publishing Co. Ltd., 1st Edition.
- (c) One good motor, properly housed, is capable of giving fairly good results, but two good motors, properly housed, will give noticeably better results: in this case one motor is designed to reproduce bass, and the other, treble. A filter ('dividing network') must be used in conjunction with the two motors.
- (d) Remember that even the best conventional loudspeaker systems are by far the weakest link (i.e., the greatest source of distortion) in a high fidelity chain, and that such systems are relatively expensive. The fundamental weaknesses of conventional loudspeakers are discussed succinctly in a paper by H. J. Leak, *High Fidelity Loudspeakers: The Performance of Moving-Coil and Electrostatic Transducers*, Journal of the British Institution of Radio Engineers, Vol. 16, No. 12, December, 1956. Copies are available from the Institution, 9 Bedford Square, London, W.C.1, price 7/-. However, such systems have become out-moded by the revolutionary Leak invention of the composite 'sandwich' diaphragm. The basic principles are described by D. A. Barlow, M.Sc. (Head of the Leak Transducer Research Department) in *Wireless World*, December, 1958. A further paper describing the complete Leak 'Sandwich' loudspeaker system was delivered to the British Institution of Radio Engineers by D. A. Barlow and H. J. Leak on January 24, 1962, and will be published in a forthcoming journal of the Institution.



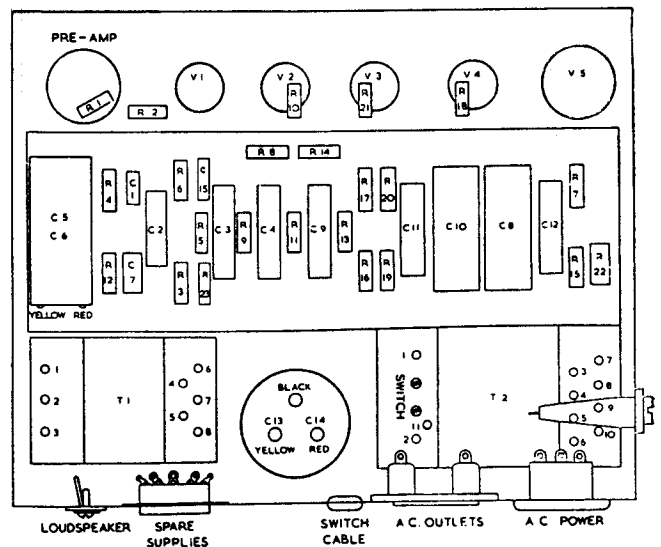
CIRCUIT DIAGRAM

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TOP CHASSIS



UNDER CHASSIS



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A MAJOR LOUDSPEAKER INVENTION*

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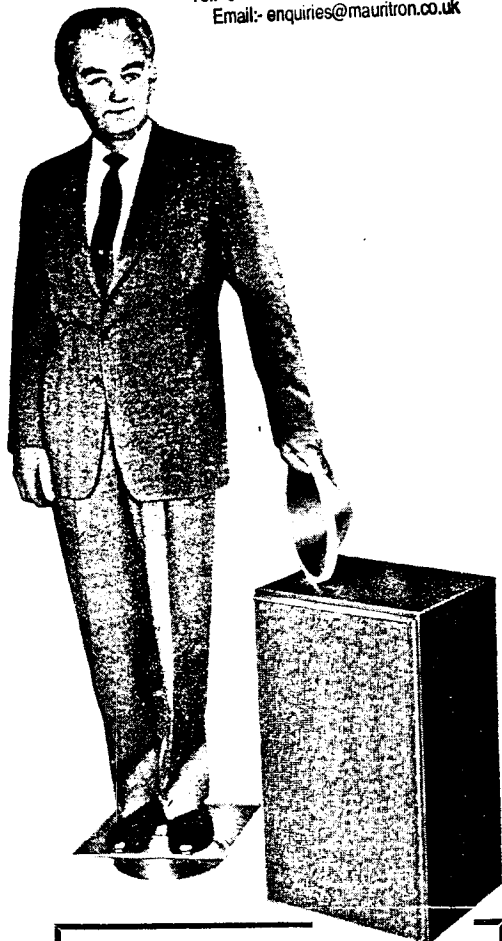
WE now pioneer another major breakthrough, the invention of the fantastically rigid 'Sandwich' cone diaphragm, which is demonstrably of great strength and hundreds of times stiffer than all conventional forms of cone. The photographs on this page illustrate the astonishing superiority of the Leak 'Sandwich' invention.

THE 'Sandwich' diaphragm is the invention of Donald A. Barlow, M.Sc., who leads the Leak Transducer Research Team. The theoretical treatise on his invention was given by Mr Barlow in the *Wireless World*, December, 1958.

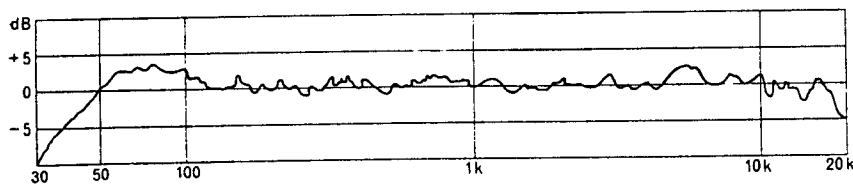
TO understand the impact of this invention one must remember that to obtain low distortion the movement of a loudspeaker diaphragm or cone should follow as accurately as possible the waveform of the signals applied to its speech coil. The ability of the cone to follow these impulses accurately depends upon the LIGHTNESS and STIFFNESS of the cone assembly.

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ALL the above shortcomings of conventional cone loudspeakers are overcome by the Leak Piston-Action 'Sandwich' construction. Using engineering design principles as applied to air-frame construction, the 'Sandwich' cone comprises stiff aluminium skins for the outer surfaces where the stresses are greatest, bonded to a thick core of featherweight expanded plastic where the stresses are lowest, giving far greater stiffness than the same total weight of either material used separately. This use of the most suitable materials in optimum proportions and dispositions gives immense stiffness and rigid piston-action over a range of more than six octaves, and for the first time in audio history gives a direct-radiator diaphragm which reproduces the signal applied to the speech coil totally free from mechanical break-up and its associated distortions. The result is a remarkably smooth frequency response free from violent peaks or troughs over a very broad frequency range, indicative of excellent transient response (see graph below).

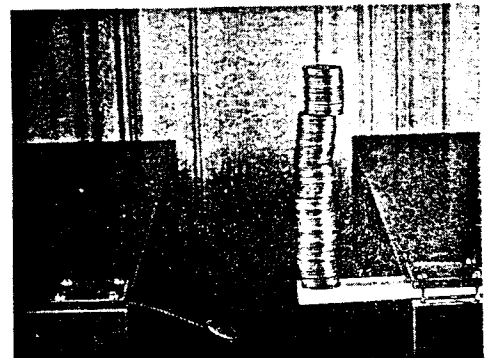


Harold J. Leak demonstrates immense stiffness of piston-action 'Sandwich' diaphragm which supports his weight below plate glass square.



AXIAL PRESSURE RESPONSE OF 'SANDWICH' SYSTEM

The illustration shows a section of a paper cone flexing under the weight of one $\frac{1}{4}$ d., and a section of the immensely stiff 'Sandwich' cone, which weighs the same as the paper cone supporting the weight of 100 halfpennies. The revolutionary Leak cone comprises two skins of very thin aluminium separated by a filler of very light plastic material expanded to a thickness of $\frac{3}{8}$ inch.



* U.S. Patent Number 3,111,187 granted to applicants D. A. Barlow and H. J. Leak & Co., Ltd.

H. J. LEAK & CO., LTD.

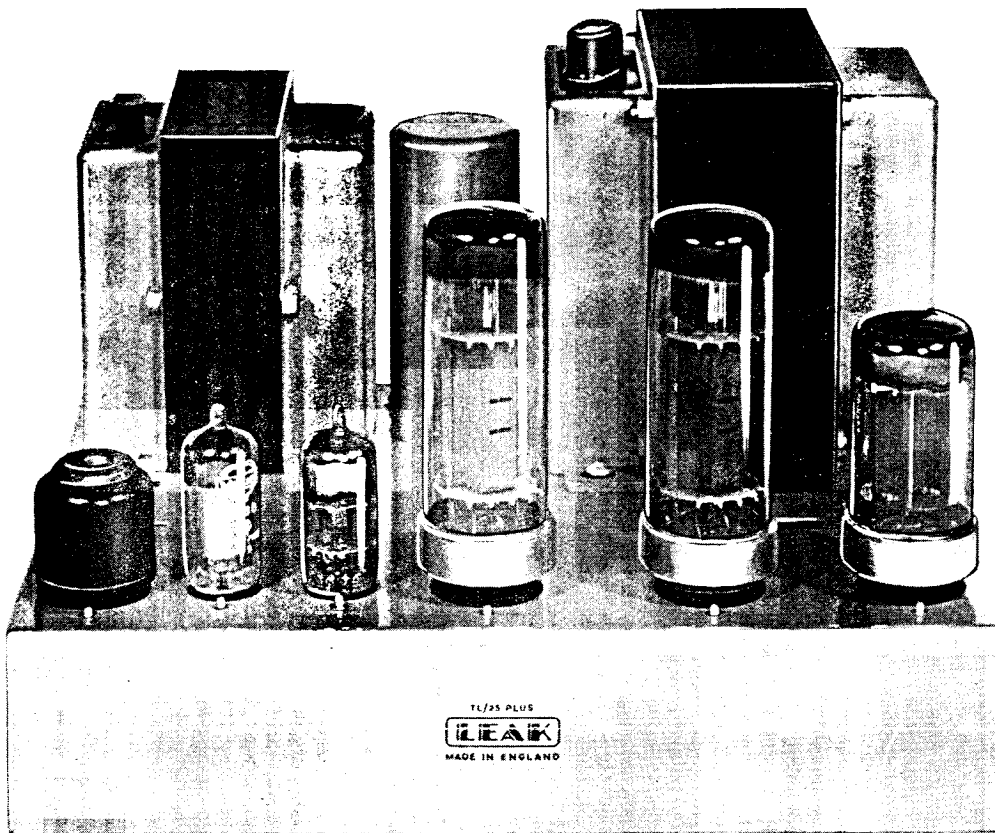
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LEAK

... the first name in High Fidelity



“TL/25 PLUS” POWER AMPLIFIER

SUCCESSOR TO
THE WORLD-FAMOUS TL/25 “POINT ONE”^o POWER AMPLIFIER

DESIGNED BY HAROLD J. LEAK
for
THE PROFESSIONAL ENGINEER and THE MUSIC-LOVER

TRADITIONAL LEAK ENGINEERING AND CRAFTSMANSHIP

“I can most certainly say at this stage that the workmanship and finish are of a quality which I have never before encountered in the radio industry, despite the fact that my association with the industry in one capacity or another extends back over 27 years. I think you are to be congratulated all the more on this achievement in view of the increasing tendency nowadays towards inferior workmanship and design.”

Part of a letter from a purchaser of the TL/12 amplifier who is a very well-known engineer and whose identity is known to the Editor of “Wireless World.”

*“POINT ONE” is the Trade Mark of H. J. Leak & Co., Ltd. It was originally applied to the first power amplifiers having a total distortion as low as point one of one per cent., when, in June, 1945, H. J. Leak, M.BRIT.I.R.E., revolutionised the performance standards for audio amplifiers by designing the original “POINT ONE” series.

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THE LEAK DYNAMIC PICKUP

This pickup results from five years continuous development of our first moving-coil design. Reports from users have justified our earlier belief that the pickup might earn recognition as the best in the world.

SPECIFICATION

THE ARM.

This is of advanced design having very low inertia. Friction is kept to a minimum by using a single pivot bearing. The arm is counter-weighted and has provision for plug-in interchangeable heads. An arm rest is provided.

GENERATING SYSTEM.

Dynamic (moving-coil). Coil impedance approximately 10 ohms, 1,000 c/s. No magnetic material is embodied in the moving parts, and the pickup is free from the inherent distortions of moving iron (magnetic variable reluctance) types. These distortions are also inherent in those dynamic pickups in which the moving-coil is wound on a magnetic core.

STYLUS.

Material: Diamond, guaranteed unconditionally not to chip or break.
Stylus sizes: LP, 0.001" radius + nothing -0.0001".
78, 0.0025" radius \pm 0.0001"

PLAYING WEIGHTS.

Between 3 and 4 grammes for LP.
Between 5 and 6 grammes for 78.
Automatically adjusted by the weight of the head.

FREQUENCY RESPONSE.

Total variation \pm 1 db 20,000 c/s to 40 c/s with the L.P. head, including transformer. (Recorded velocity 1.2 cms/sec. r.m.s. above turnover).

Low frequency resonance:

20 c/s \pm 5 c/s. with our lightweight arm.

High frequency resonance: (damped):

0.001" radius on Vynil, 21,000 c/s \pm 2,000 c/s.
0.0025" radius on shellac, above 27,000 c/s.

The frequency response does not change with temperature.

RECORD AND STYLUS WEAR.

These are lower than any pickup of which we have cognisance. Diamond has a playing life approximately 100 times longer than sapphire, and because it will take a higher polish than any other material it therefore causes less record wear.

OUTPUT.

The shielded step-up transformer delivers an output of 8mV for each cm/sec. r.m.s. recorded velocity. This means

that an amplifier with a sensitivity of 40mV at 1,000 c/s will be easily loaded by the pickup from commercial records.

SIGNAL-TO-HUM RATIO.

It is not possible to specify this important ratio without stipulating the strength of the interfering fields. These fields will, of course, vary according to the installation. However, for the purposes of comparison, measurements have been taken under working conditions, i.e. with various pickups mounted normally within inches of the electric turntable motor and within 2-ft. of a power transformer in an amplifier. The results show that the Leak Dynamic pickup has a lower hum content than any variable reluctance (moving-iron, magnetic) pickup and a very much lower hum content than a single turn moving-coil (i.e. "ribbon") pickup. This confirms what would be expected from theoretical considerations.

DIMENSIONS.

From the centre of the fixing stem to the front of the pickup head, 9 $\frac{1}{4}$ ". From the centre of the fixing stem to the rear of the arm, 2". The height of the pickup is adjustable and it can be used with any turntable.

MOUNTING.

A template of original Leak design is supplied, enabling the pickup to be accurately located on the turntable mounting board. There is a single fixing hole and the stem contains a miniature socket which accepts the plug leading to the transformer (see illustration).

TRANSFORMER.

The transformer has a step-up ratio of 1:80, and is heavily shielded in mu-metal. The primary lead is terminated in a plug and a shielded secondary lead is supplied. The secondary load impedance should be 100,000 ohms.

PRICES:

The arm:

£2 15 0d. plus 17/4d. Purchase Tax.

Long arm for 16" records:

£3 5 0d. plus £1 0 6d. Purchase Tax.

L.P. head with diamond stylus:

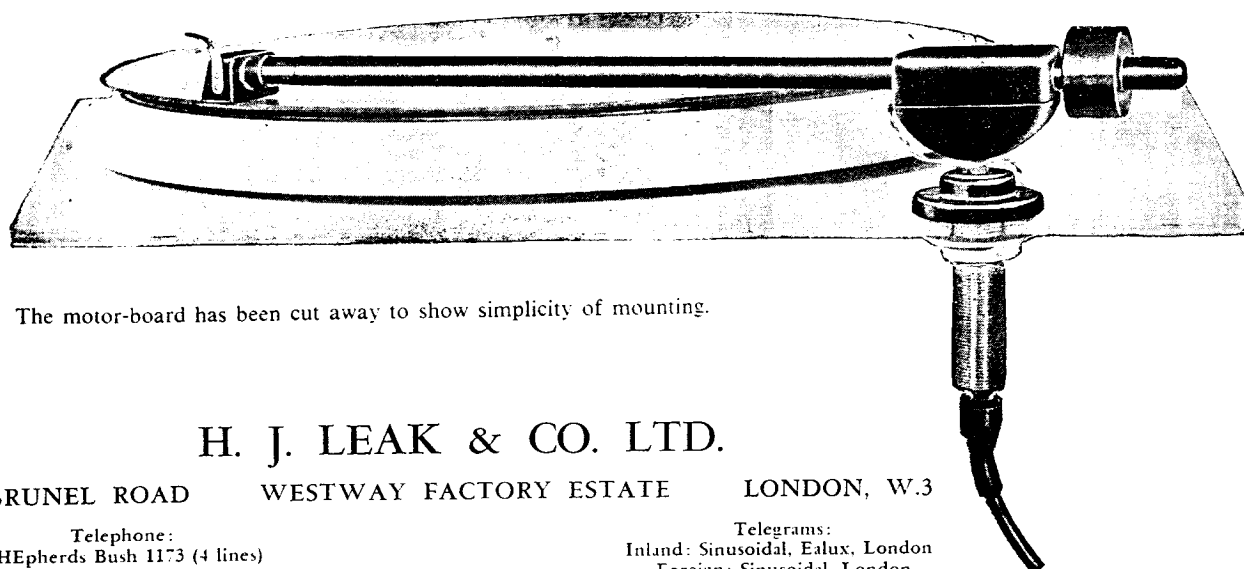
£5 15 0d. plus £1 16 3d. Purchase Tax.

78 head with diamond stylus:

£5 15 0d. plus £1 16 3d. Purchase Tax.

Mumetal-cased transformer:

£1 15 0d. No Tax.



The motor-board has been cut away to show simplicity of mounting.

H. J. LEAK & CO. LTD.

BRUNEL ROAD WESTWAY FACTORY ESTATE LONDON, W.3

Telephone:
SHEpherds Bush 1173 (4 lines)

Telegrams:
Inland: Sinusoidal, Ealux, London
Foreign: Sinusoidal, London

Valves (Tubes)

First stage — one EF86 or Z729 or 6267.
Second stage — one ECC81 or B309 or 12AT7.
Output stage — two EL34 or KT66 or 5881.
Rectifier — one GZ34 or 5V4 or 5AR4.

(International standard types of world-wide availability).

Power Output

28 watts r.m.s. maximum.

Total Harmonic Distortion

0.1% for 25 watts output (± 1 db) at 1,000 c/s.

Hum and Noise

80db, ± 3 db, below 25 watts with a source impedance of 25,000 ohms.

Sensitivity

An input of 125mV at 1,000 c/s gives 25 watts output.

Frequency Response

± 0.5 db, 20 c/s to 20 kc/s.

Damping Factor

25, measured at 1,000 c/s.

Input Impedance

1 megohm, plus approximately 5 mmfd.

Stability Margins

Gain, 10db ± 3 db.
Phase, $20^\circ \pm 10^\circ$.

Loudspeaker Impedances

Loudspeakers of any impedance between 3 ohms and 20 ohms may be used. An adjustable plug on top of the output transformer selects three tappings, nominally 16 ohms, 8 ohms and 4 ohms.

Power Supply

200 - 250V, 50 - 100 c/s.
or, (alternative model)
100 - 125V, 50 - 100 c/s.

A voltage selector plug is fitted on top of the mains transformer.

Consumption

130 watts (135 watts with Leak pre-amplifier).

Spare Supplies

A double socket marked "A.C. Outlets" is fitted as a convenient source of power supply for gramophone motors, etc. Corresponding plugs, with 6-ft. (2 metre) cables are supplied with the amplifier. British users :- note that heater and anode supplies are NOT available for a tuner.

Dimensions

10" \times 7 $\frac{7}{8}$ " \times 6 $\frac{11}{16}$ " high (25.4 \times 20 \times 17 cms.).

Weight

17 lbs. 6 ozs. (7.88 kgs.).

Fixing

Four brackets and screws are supplied for fixing the amplifier to a baseboard.

Price : £25.4.0d.

TO ENGINEERS IN COMMUNICATIONS ESTABLISHMENTS

We have a very wide experience of modifying our amplifiers to suit special requirements. As examples, meter switching can be incorporated and a variety of panel mountings have been arranged. Please do not hesitate to let us know your physical requirements. Kindly note that modifications are undertaken only on minimum orders of 100 amplifiers of one type.

For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel: 01844-351694 Fax: 01844-352554
Email: enquiries@mauritron.co.uk

FUNCTION

The TL/25 PLUS power amplifier has been designed to give the highest possible fidelity. In electrical performance, reliability, appearance and craftsmanship, it is in advance of the earlier TL/25 and similarly acceptable to the professional communications engineer.* For broadcast monitoring, recording, etc., the amplifier can be supplied with line input transformer, input gain control, baseplate and top cover.

For public address work the power output permits its use in, for instance, movie-theatres seating three thousand people. Out-doors, it will cover crowds dispersed over a 10 acre field when using horn loudspeakers.

For use by the music-lover at home this amplifier will normally follow a Leak Varislope III or "Point One" pre-amplifier. The power output of 30 watts is adequate when the house is wired for the simultaneous use of loudspeakers in several rooms.

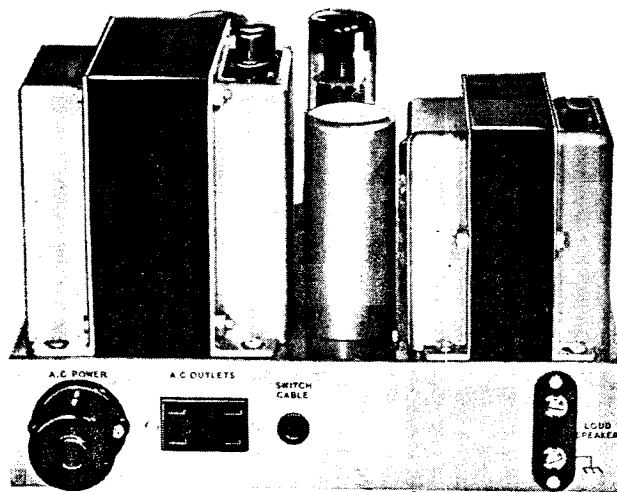
APPEARANCE AND FINISH

The TL/25 PLUS is finished in light bronze stoved paint; and all visible accessory fittings are in black. The general finishes are similar to the TL/12 and TL/25, which have operated for years in high-humidity, high-temperature locations such as Malaya and Hong-Kong.

It is appropriate here to mention one of the basic principles of LEAK design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased costs incurred for high-grade materials, components and finishes, and this together with quantity production (made possible only by a world-wide market) explains how quality products may be sold at reasonable prices.

CIRCUITRY

This is almost identical with the original TL/25, using a 3-stage triple loop feedback circuit, the main loop applying 26db of negative voltage feedback over the complete amplifier from input to output terminals. A low-noise, high-gain pentode feeds into a second-stage double-triode phase-splitter, which in turn feeds two push-pull output valves (tubes) arranged in the distributed-load condition. The innovation of grain-orientated steel enables us to provide a better output transformer than on the original TL/25.



* LEAK amplifiers are the choice of professional engineers such as the B.B.C. (over 500 delivered), the South African Broadcasting Corporation (600), ITV and many other Commonwealth and overseas broadcasting and TV systems, who use them for transmitting and/or monitoring (quality checking) the broadcasts to which you listen. Also, many of the gramophone records you buy are cut via LEAK amplifiers.

"POINT-ONE PLUS" PRE-AMPLIFIER

INSTALLATION, OPERATION and MAINTENANCE

NOTES ON ASSOCIATED APPARATUS

15-4

The "Point-One Plus" pre-amplifier is designed for use specifically with Leak power amplifiers TL/12 Plus, TL/25 Plus and TL/50. It will also operate perfectly with any previous Leak power amplifier, though the facility of a socket for picking up heater and anode supplies for a tuner will not be available unless an additional octal socket is fitted to the power amplifier. Instructions for carrying out this modification will be sent on request.

CONNECTING THE "POINT-ONE PLUS" PRE-AMPLIFIER

1. This unit may be used free-standing on a table, or it may be mounted on a panel of any thickness, through a cut-out of $10\frac{5}{8}'' \times 3\frac{7}{8}''$ (27 cms. \times 9.85 cms.) To mount on a panel: remove the rubber feet by pulling smartly out of their retaining holes; pass the body of the pre-amplifier through the cut-out until the front plate butts against the panel, then pass the U-shaped bracket over the back of the pre-amplifier and fix it by passing the wing screw through the hole in the bracket and into the threaded hank-bush in the centre of the rear panel on the pre-amplifier. Tighten the wing screw just enough to prevent the metal backing on the front plate of the pre-amplifier from slipping on the panel.
2. A multiple cable of 4 ft. (1.22 metres) is supplied for connecting the "Point-One Plus" to the Leak power amplifier. The male plug on this cable fits the socket on the power amplifier marked "PRE-AMP." The female plug on the cable fits the male socket on the "Point-One Plus" marked "FROM AMPLIFIER." Longer cables can be supplied to special order, up to a maximum of 16 ft. (5 metres).
3. To enable you to control the power amplifier from the "Point-One Plus," a switch is incorporated in the "VOLUME" control. To make use of this facility a 2-core flexible cable is supplied with the "Point-One Plus"; one end of the cable is fitted with a plug which inserts into the socket marked "SWITCH" on the rear of the "Point-One Plus"; the other end of the cable must be passed through the rubber grommet marked "SWITCH CABLE" at the rear of the associated Leak power amplifier, knotted behind the grommet, and the two bared ends connected to the terminals marked "SWITCH" situated underneath the mains transformer. If excessive hum is experienced, particularly with the Leak power amplifier not "earthed" (grounded), this can be reduced by reversing the mains input leads to the power amplifier. Reversing the "SWITCH" connections will not be effective. We strongly deprecate NOT earthing the power amplifier.

4. THE CONNECTION OF PICKUPS

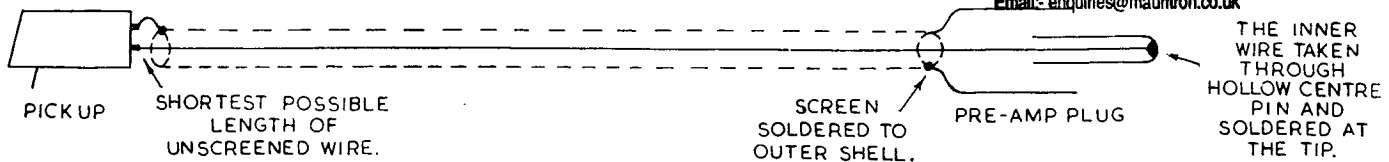
The pickup is connected to the co-axial socket marked "PICKUP" at the rear of the "Point-One Plus." Below this socket is the associated input volume control.

The greatest care has been taken in the design of this pre-amplifier to ensure that any pickup generally available in the world can be connected to give optimum results, i.e., the highest quality obtainable from the chosen make of pickup. Our prime aim is for you to obtain the optimum results from the pickup of your choice. Please follow our instructions very carefully, even if they appear to conflict with other advice.

We know from experience that the main troubles encountered by the music-lover at home are with the reproduction of records. There are five major reasons for these troubles:—

- (a) No record can possibly give perfect reproduction, and many records (perhaps the majority) contain noticeable distortions due to imperfections in recording and/or processing. These imperfections may show up as "rattle", high surface noise, recorded hum and rumble, and recorded "wow". Shrill treble may be due to a poor record, and/or due to a pickup having its high-frequency resonance within the audible range.
- (b) No pickup is perfect and the majority have performances **very much** below those which are attainable.
- (c) Hum. This often arises because insufficient attention is given during the design of a pickup to the commonly-found circumstances in which it will operate, i.e., near an electric motor and near a power amplifier. Hum can also arise from incorrect connection of the pickup by the user.
- (d) "Rumble". Vibration from the motor is transmitted to the pickup stylus and appears in the sound output as a rumbling or humming noise. Rumble disappears when the pickup is lifted from the record.
- (e) Acoustic feedback. If a loudspeaker is placed in the same cabinet as a pickup, then vibration from the movement of the loudspeaker can be transmitted to the stylus of the pickup. As the volume is increased a stage is reached where a sustained roaring noise is set up. At volume levels considerably below this point distortion is noticeable. Acoustic feedback disappears when the pickup is lifted from the record.

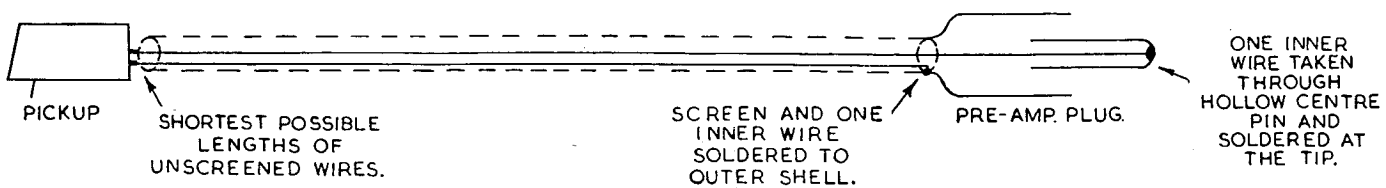
(f) **Connecting pickups having a single wire within a screen.**



If hum is to be kept to a minimum the outer screening should either have an insulated covering, or it should be prevented from touching any metal on the motor, motor-board or anywhere else. The outer screening **must not** be used for earthing any part of the motor and turntable assembly, which should be earthed by a separate wire taken to the \perp terminal on the Leak power amplifier. If the "tone-arm" is of metal and the outer screening is connected to it, then the arm must not make metallic contact through its bearings with the metal turntable and motor assembly.

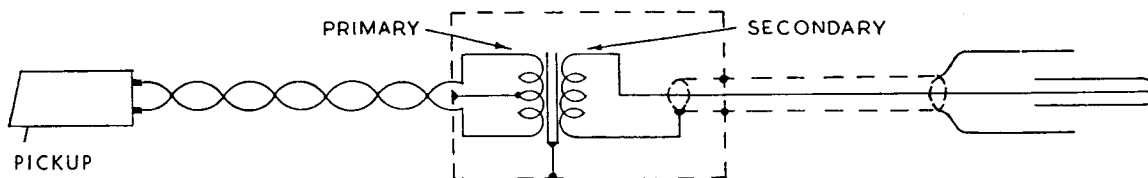
Unfortunately, some record-players and record-changers are wired as shown above, the screen then being connected to the body of the motor mounting-plate. This is bad practice on the part of the makers, and is very likely to cause hum, particularly when using a low output pickup. If you have this type of wiring, you are most strongly urged to replace it with the system (g) below.

(g) **Connecting pickups having two wires within a screen.**



Again, as in (f) above, the outer screen should either have an insulated covering, or it should be prevented from touching the motor, motor-board or anywhere else. If, however, the screening does touch, then hum is less likely to be caused than by using the single-wire system of (f).

(h) **Connecting low impedance pickups using a transformer.**



NOTE WELL.

The transformer **must** be enclosed in a screening can of high-permeability metal, i.e., mu-metal or permendur. The primary winding **must** be balanced, the centre-tap being taken to the chassis.

The primary terminals are to be as small as possible and to be as close together as is practiceable, in order to obviate a loop in the wiring. The primary leads to be tightly twisted for the same reason. The "live" secondary terminal to be screened and to be as small as possible. Ideally **all** terminals should be inside the can. The above precautions are not yet universally followed, though they have been standard practice on Leak pickups for ten years. These precautions are **essential** if the lowest hum level is desired.

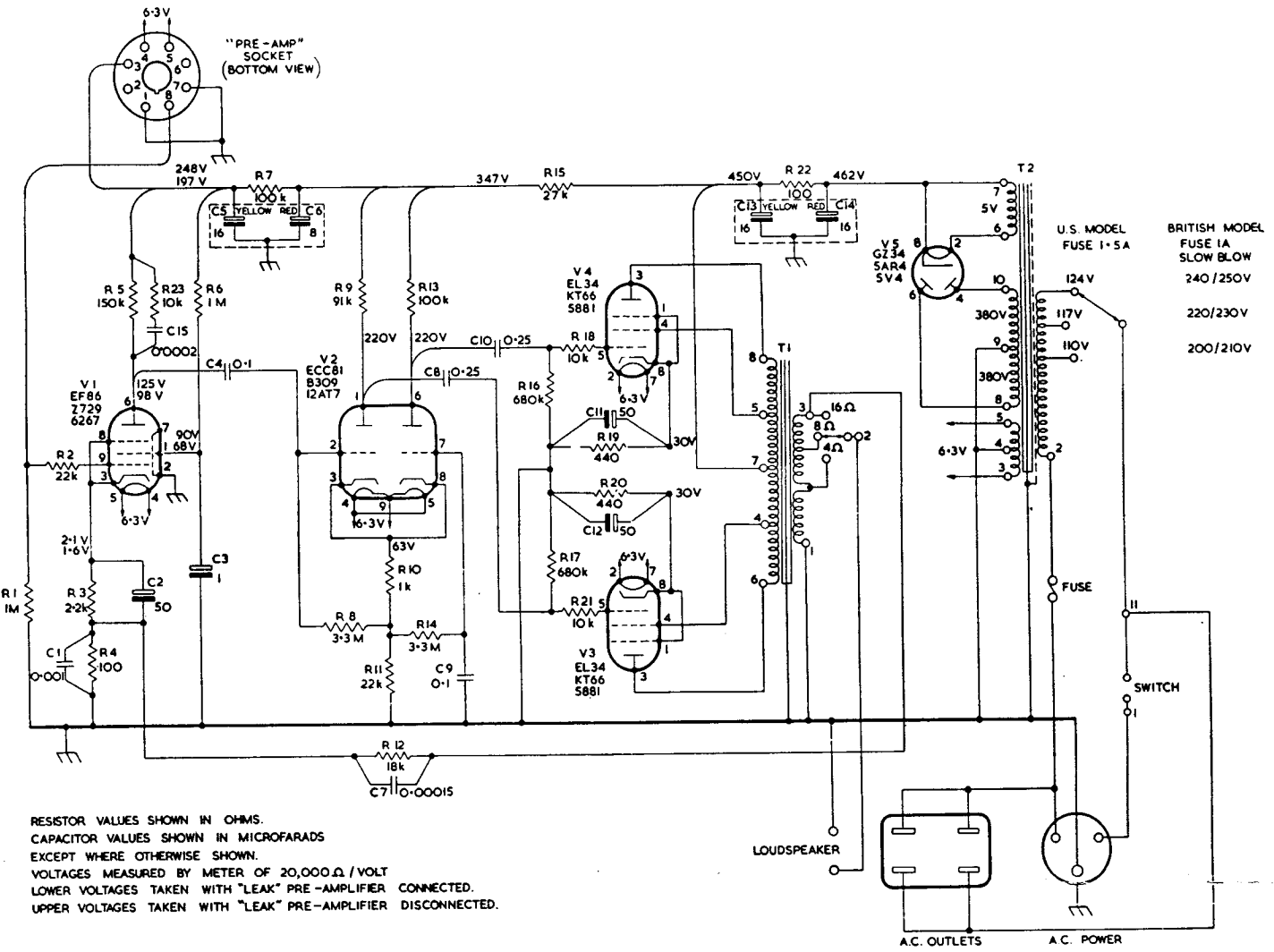
(i) **Hum.**

The "Point-One Plus" pre-amplifier has an extraordinarily low hum level, which can be checked by removing pickup plug and turning up the "VOLUME" control. The connection of any input device to the pickup socket will lower the input impedance and should, therefore, reduce the hum level. If the hum level increases on connecting the pickup, the cause of the hum must lie outside the pre-amplifier, and our instructions on the choice and connection of pickups should be carefully read in an attempt to locate the cause of the hum.

Hiss.

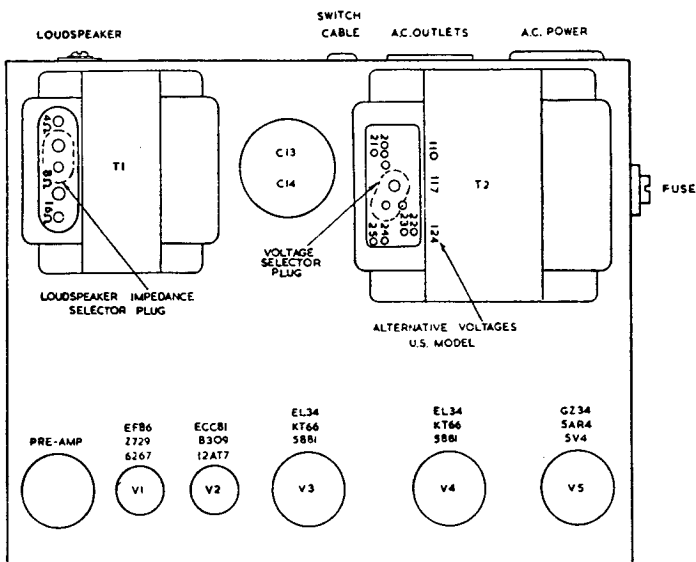
With the input control switched to a pickup position and the "VOLUME" control at maximum, a certain amount of hiss will be heard. This hiss is as low as is possible to obtain at the present day, and it is inherent in high-gain vacuum tube amplifiers.

It is a fact that with the highest quality pickups (moving-coil types used with a transformer) the "VOLUME" control will not need to be anywhere near the maximum position, and therefore the hiss will be unobtrusive; but with competitively-priced variable-reluctance (moving-iron) pickups the output will be so low, for reasons explained later (see 6c (2), p.5), that hiss will be more noticeable. This is the price that the user has to pay in return for a modest outlay with reasonably good results!

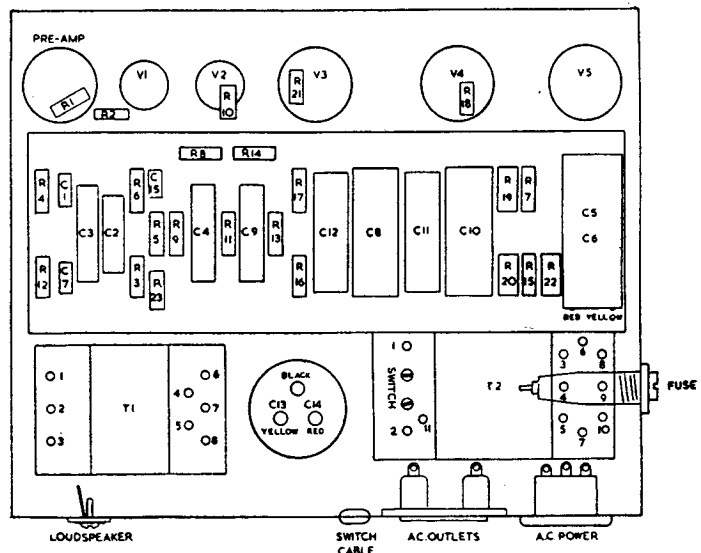


CIRCUIT DIAGRAM 'TL/25 PLUS' POWER AMPLIFIER

For Service Manuals Contact
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Email: enquiries@maurtron.co.uk



TOP CHASSIS



UNDER CHASSIS

A MAJOR LOUDSPEAKER INVENTION*

THROUGHOUT the history of broadcasting and recording, certain exceptional developments have become milestones in the progress of sound reproduction.

ONE such milestone was the world's first very-low-distortion amplifier, the famous original Leak 'Point One', in 1945.

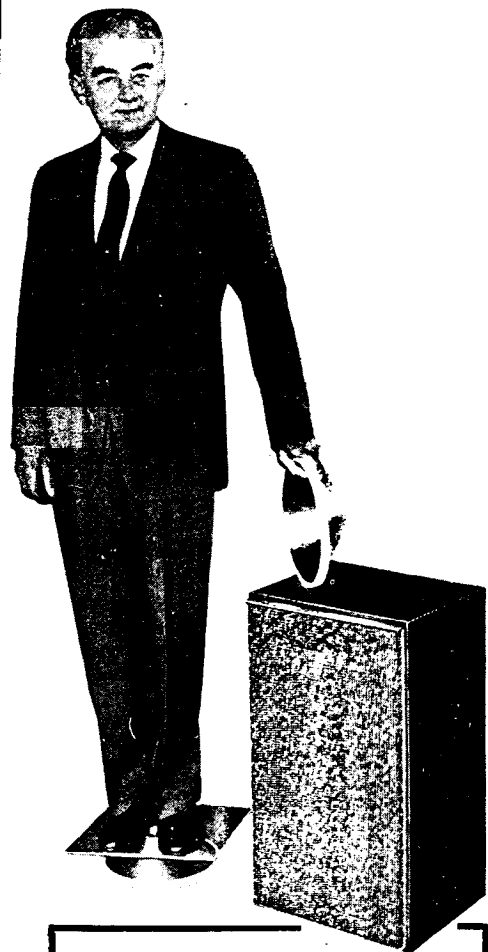
WE now pioneer another major breakthrough, the invention of the fantastically rigid 'Sandwich' cone diaphragm, which is demonstrably of great strength and hundreds of times stiffer than all conventional forms of cone. The photographs on this page illustrate the astonishing superiority of the Leak 'Sandwich' invention.

THE 'Sandwich' diaphragm is the invention of Donald A. Barlow, M.Sc., who leads the Leak Transducer Research Team. The theoretical treatise on his invention was given by Mr Barlow in the *Wireless World*, December 1958.

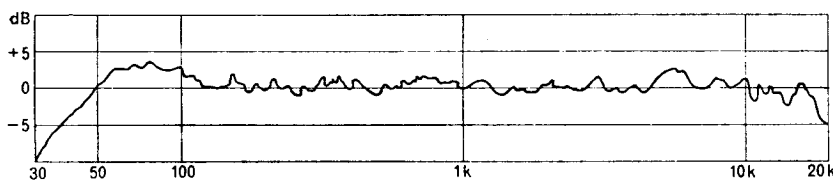
TO understand the impact of this invention one must remember that to obtain low distortion the movement of a loudspeaker diaphragm or cone should follow as accurately as possible the waveform of the signals applied to its speech coil. The ability of the cone to follow these impulses accurately depends upon the LIGHTNESS and STIFFNESS of the cone assembly.

CONVENTIONAL cones (paper, impregnated fabric, plastics, aluminium) suffer from low stiffness. This results in significantly large areas of the cone vibrating in motions uncontrolled by the speech coil. These uncontrolled motions produce transient 'hangover', amplitude distortion (peaks and hollows in the frequency response) and intermodulation distortion (lack of clarity and spurious tones). These shortcomings are inherent in all direct-radiator loudspeaker systems using conventional cones, irrespective of cost.

ALL the above shortcomings of conventional cone loudspeakers are overcome by the Leak Piston-Action 'Sandwich' construction. Using engineering design principles as applied to air-frame construction, the 'Sandwich' cone comprises stiff aluminium skins for the outer surfaces where the stresses are greatest, bonded to a thick core of featherweight expanded plastic where the stresses are lowest, giving far greater stiffness than the same total weight of either material used separately. This use of the most suitable materials in optimum proportions and dispositions gives immense stiffness and rigid piston-action over a range of more than six octaves, and for the first time in audio history gives a direct-radiator diaphragm which reproduces the signal applied to the speech coil totally free from mechanical break-up and its associated distortions. The result is a remarkably smooth frequency response free from violent peaks or troughs over a very broad frequency range, indicative of excellent transient response (see graph below).

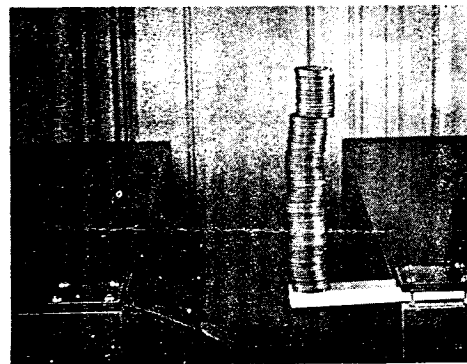


Harold J. Leak demonstrates immense stiffness of piston-action 'Sandwich' diaphragm which supports his weight below plate glass square.



AXIAL PRESSURE RESPONSE OF 'SANDWICH' SYSTEM

The illustration shows a section of a paper cone flexing under the weight of one $\frac{1}{2}$ d., and a section of the immensely stiff 'Sandwich' cone, which weighs the same as the paper cone, supporting the weight of 100 halfpennies. The revolutionary Leak cone comprises two skins of very thin aluminium separated by a filler of very light plastic expanded to a thickness of $\frac{1}{8}$ inch.



* U.S. Patent Number 3,111,187 granted to applicants D. A. Barlow and H. J. Leak & Co., Ltd.

H. J. LEAK & CO., LTD.

BRUNEL ROAD • WESTWAY FACTORY ESTATE • LONDON W.3

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Telegrams: Inland: Sinusoidal, Ealux, London Foreign: Sinusoidal, London

GENERAL NOTES ON MAINTENANCE

The circuit diagram provides a qualified engineer with all information required for servicing. However, the following points may be of interest:—

- (a) The 'TL/25 PLUS' does not depend upon the output valves (tubes) being a matched pair to give the stated performance, and if one output valve fails it is not necessary to replace both.
- (b) Should it ever be necessary to replace the reservoir capacitor C14 (which is in the same can as C13) note that C14 must be of a type capable of handling a heavy ripple current. The C14 fitted has a very high margin of safety, being capable of handling 220mA.

NOTES ON LOUDSPEAKER SYSTEMS

Space does not allow for detailed explanations on this vast subject, but the following points should be noted:—

- (a) This amplifier will operate any high fidelity loudspeaker system, both moving-coil and electrostatic types, including the small low sensitivity assemblies currently popular, particularly in the U.S.A.
- (b) You *cannot* get high fidelity results if you mount a loudspeaker in the same cabinet as the turntable and pickup.
- (c) The assembly commonly called a 'loudspeaker' consists of a magnet, a moving-coil and a diaphragm (or 'cone'). This assembly is a 'motor'. You do not listen to a motor; you listen to a loudspeaker system, which consists of one or more motors mounted in a housing (baffle, box, cabinet, or horn). The housing plays a profound part in determining the quality of reproduction. The effects of various housings are discussed by L. L. Beranek in *Acoustics*, McGraw-Hill Publishing Co Ltd, First Edition.
- (d) One good motor, properly housed, is capable of giving fairly good results, but two good motors, properly housed, will give noticeably better results: in this case one motor is designed to reproduce bass, and the other, treble. A filter ('dividing network') must be used in conjunction with the two motors.
- (e) Remember that even the best conventional loudspeaker systems are by far the weakest link (i.e. the greatest source of distortion) in a high fidelity chain, and that such systems are relatively expensive. The fundamental weaknesses of conventional loudspeakers are discussed succinctly in a paper by H. J. Leak, *High Fidelity Loudspeakers: The Performance of Moving-Coil and Electrostatic Transducers*, Journal of the British Institute of Radio Engineers, Vol. 16, No. 12, December 1956. Copies are available from the Institution, 9 Bedford Square, London, W.C.1, price 7/-. However, such systems have become out-moded by the revolutionary Leak invention of the composite 'sandwich' diaphragm. The basic principles are described by D. A. Barlow, M.Sc. (Head of the Leak Transducer Research Department), in *Wireless World*, December 1958. A further paper describing the complete Leak 'Sandwich' loudspeaker system was delivered to the British Institution of Radio Engineers by D. A. Barlow and H. J. Leak on the 24th January, 1962, and will be published in a forthcoming journal of the Institution.



'TL/25 PLUS' POWER AMPLIFIER

INSTALLATION • OPERATION • MAINTENANCE

For Service Manuals Contact
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8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
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Email: enquiries@mauritron.co.uk

OPERATION

1. The 'TL/25 PLUS' may be fed from the LEAK 'VARISLOPE MONO' pre-amplifier, or from any other suitable source. A source impedance higher than 25,000 ohms will tend to raise the hum level above the advertised figure of 83db below 25 watts. An input of 125mV r.m.s. will give a power output of 25 watts.

INSTALLATION

2. Check that all valves (tubes) are correctly seated in their holders and that the markings on the valves correspond with those on the chassis adjacent to the holders. The amplifier will work equally well with any of the alternative valves.
3. The amplifier should stand on its base in a well-ventilated position. If placed in a case or cabinet, ventilation must be provided. Four separate fixing feet with screws are provided with the amplifier.
4. On the British model the mains transformer is tapped for voltages of 205, 225 and 245 and the voltage selector plug on top of the mains transformer (see 'TOP CHASSIS' drawing) should be set appropriately. On the U.S. model the mains transformer is tapped for voltages of 110, 117 and 124 and the voltage selector plug should be set appropriately. The A.C. power supply should be connected to the two terminals nearest the guide key on the removable plug portion of the mains connector marked 'A.C. POWER'.

In order that the amplifier may be remotely controlled we have provided two terminals marked 'SWITCH' underneath the mains transformer (see 'UNDER CHASSIS' drawing). The amplifier will not work unless these terminals are electrically joined, and when the amplifier leaves our factory a wire link joins the terminals. A remote switch may be run from the 'SWITCH' terminals, after removing the link, the flex being passed through the adjacent grommet marked 'SWITCH CABLE'. The flex should be knotted behind the grommet to avoid strain on the 'SWITCH' terminals. Most users will wish to make use of the switch incorporated in the volume control of an associated LEAK pre-amplifier, which is supplied with a plug and twin flex for this purpose. Full details are given in the installation sheets which accompany every pre-amplifier.

5. A double socket marked 'A.C. OUTLETS' is fitted as a convenient source of power supply for gramophone motors, self-powered radio tuners, etc. The power taken from this socket should be limited to 100 watts or thereabouts. This socket is not fused but is controlled by the amplifier switch.
6. A connection to earth (ground) should be taken from the third terminal on the removable plug portion of the 'A.C. POWER' connector. This terminal is the one furthest away from the guide key and its corresponding terminal on the fixed portion of the connector is marked on the chassis by the symbol \oplus . It is very bad practice to omit this connection, which may be made to the water system or to the steel conduit encasing the house wiring providing that these systems themselves are properly grounded. No other earth connections should be made elsewhere, particularly when a pre-amplifier is also used, if freedom from 'earth loops' and hum is to be obtained.
7. The loudspeaker should be connected by a *twisted* pair of wires to the terminals marked 'LOUDSPEAKER'. It will be seen from the circuit drawing that one side of the loudspeaker winding is connected to the chassis, and no part of the loudspeaker wiring should be earthed elsewhere. The D.C. resistance of the connecting wires should be as low as possible, and not more than one-tenth the D.C. resistance of the loudspeaker. It is bad practice to operate any power amplifier without a loudspeaker, and if it is desired to mute the loudspeaker by switching it out of circuit this should be accomplished by use of a change-over switch which replaces it with a resistor of corresponding value and rating. The selector plug on top of the output transformer (see 'TOP CHASSIS' drawing) should be adjusted for the nearest match to the advertised impedance of the loudspeaker.

"VARISLOPE III" PRE-AMPLIFIER

INSTALLATION, OPERATION and MAINTENANCE

NOTES ON ASSOCIATED APPARATUS

The Varislope III pre-amplifier is designed for use specifically with Leak power amplifiers TL/12 Plus, TL/25 Plus and TL/50 Plus. It will also operate perfectly with any previous Leak power amplifier, though the facility of a socket for picking up heater and anode supplies for a tuner will not be available unless an additional octal socket is fitted to the power amplifier. Instructions for carrying out this modification will be sent on request.

CONNECTING THE VARISLOPE III PRE-AMPLIFIER

1. This unit may be used free-standing on a table, or it may be mounted on a panel of any thickness, through a cut-out of $10\frac{5}{8}'' \times 3\frac{7}{8}''$ (27 cms. \times 9.85 cms.) To mount on a panel: remove the rubber feet by pulling smartly out of their retaining holes; pass the body of the pre-amplifier through the cut-out until the front plate butts against the panel, then pass the U-shaped bracket over the back of the pre-amplifier and fix it by passing the wing screw through the hole in the bracket and into the threaded hank-bush in the centre of the rear panel on the pre-amplifier. Tighten the wing screw just enough to prevent the metal backing on the front plate of the pre-amplifier from slipping on the panel.
2. A multiple cable of 4 ft. (1.22 metres) is supplied for connecting the Varislope III to the Leak power amplifier. The male plug on this cable fits the socket on the power amplifier marked "PRE-AMP." The female plug on the cable fits the male socket on the Varislope III marked "FROM AMPLIFIER." Longer cables can be supplied to special order, up to a maximum of 16 ft. (5 metres).
3. To enable you to control the power amplifier from the Varislope III a switch is incorporated in the "VOLUME" control. To make use of this facility a 2-core flexible cable is supplied with the Varislope III; one end of the cable is fitted with a plug which inserts into the socket marked "SWITCH" on the rear of the Varislope III; the other end of the cable must be passed through the rubber grommet marked "SWITCH CABLE" on the associated Leak power amplifier, knotted behind the grommet, and the two bared ends connected to the terminals marked "SWITCH" (situated underneath the mains transformer), after removing the wire link joining these terminals.

We strongly recommend that the power amplifier should be 'earthed' (grounded). If excessive hum is experienced, particularly with the power amplifier not 'earthed' (grounded) this can be reduced by reversing the mains input leads to the power amplifier. Reversing the "SWITCH" connections will not be effective.

4. THE CONNECTION OF PICKUPS

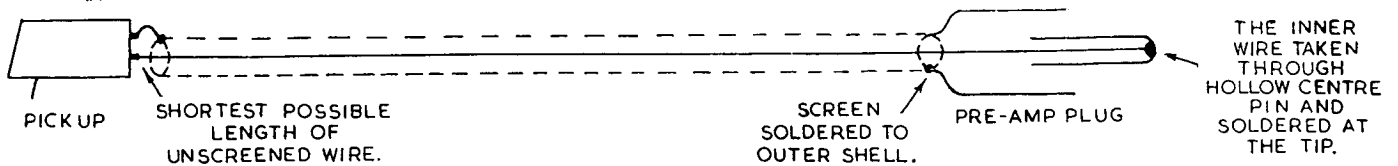
Two pickups can be connected to the co-axial sockets marked "PICKUP 1" and "PICKUP 2" at the rear of the Varislope III. Below these sockets are the associated input volume controls. On the front panel is the 2-way selector switch marked "PICKUP."

The greatest care has been taken in the design of this pre-amplifier to ensure that any pickup generally available in the world can be connected to give optimum results, i.e., the highest quality obtainable from the chosen make of pickup. Our prime aim is for you to obtain the optimum results from the pickup of your choice. Please follow our instructions very carefully, even if they appear to conflict with other advice.

We know from experience that the main troubles encountered by the music-lover at home are with the reproduction of records. There are five major reasons for these troubles:—

- (a) No record can possibly give perfect reproduction, and many records (perhaps the majority) contain noticeable distortions due to imperfections in recording and/or processing. These imperfections may show up as "rattle", high surface noise, recorded hum and rumble, and recorded "wow". Shrill treble may be due to a poor record, and/or due to a pickup having its high-frequency resonance within the audible range.
- (b) No pickup is perfect and the majority have performances **very much** below those which are attainable.
- (c) Hum. This often arises because insufficient attention is given during the design of a pickup to the commonly-found circumstances in which it will operate, i.e., near an electric motor and near a power amplifier. Hum can also arise from incorrect connection of the pickup by the user.
- (d) "Rumble". Vibration from the motor is transmitted to the pickup stylus and appears in the sound output as a rumbling or humming noise. Rumble disappears when the pickup is lifted from the record.
- (e) Acoustic feedback. If a loudspeaker is placed in the same cabinet as a pickup, then vibration from the movement of the loudspeaker can be transmitted to the stylus of the pickup. As the volume is increased a stage is reached where a sustained roaring noise is set up. At volume levels considerably below this point distortion is noticeable. Acoustic feedback disappears when the pickup is lifted from the record.

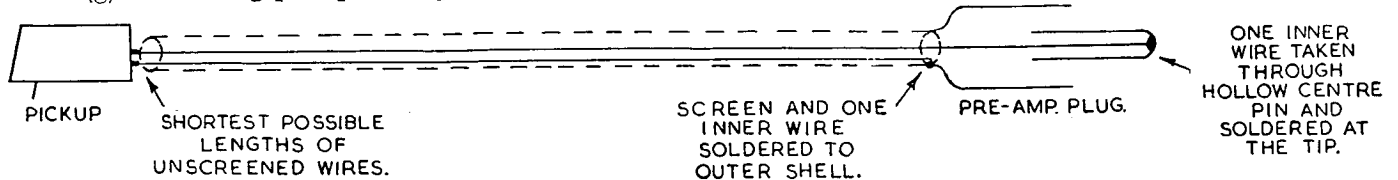
(f) Connecting pickups having a single wire within a screen.



If hum is to be kept to a minimum the outer screening should either have an insulated covering, or it should be prevented from touching any metal on the motor, motor-board or anywhere else. The outer screening **must not** be used for earthing any part of the motor and turntable assembly, which should be earthed by a separate wire taken to the Δ terminal on the Leak power amplifier. If the "tone-arm" is of metal and the outer screening is connected to it, then the arm must not make metallic contact through its bearings with the metal turntable and motor assembly.

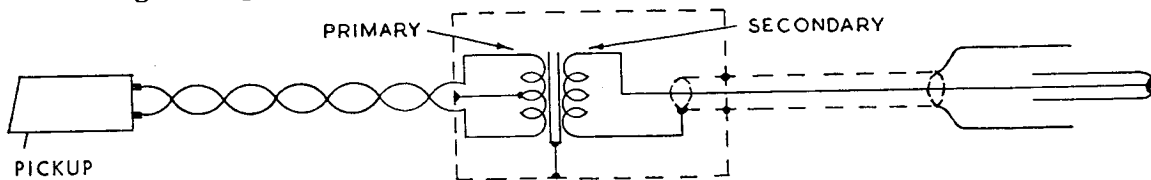
Unfortunately, some record-players and record-changers are wired as shown above, the screen then being connected to the body of the motor mounting-plate. This is bad practice on the part of the makers, and is very likely to cause hum, particularly when using a low output pickup. If you have this type of wiring, you are most strongly urged to replace it with the system (g) below.

(g) Connecting pickups having two wires within a screen.



Again, as in (f) above, the outer screen should either have an insulated covering, or it should be prevented from touching the motor, motor-board or anywhere else. If, however, the screening does touch, then hum is less likely to be caused than by using the single-wire system of (f).

(h) Connecting low impedance pickups using a transformer.



NOTE WELL.

The transformer **must** be enclosed in a screening can of high-permeability metal, i.e., mu-metal or permendur. The primary winding **must** be balanced, the centre-tap being taken to the chassis.

The primary terminals are to be as small as possible and to be as close together as is practicable, in order to obviate a loop in the wiring. The primary leads to be tightly twisted for the same reason. The "live" secondary terminal to be screened and to be as small as possible. Ideally **all** terminals should be inside the can. The above precautions are not yet universally followed, though they have been standard practice on Leak pickups for ten years. These precautions are essential if the lowest hum level is desired.

(i) Hum.

The Varislope III pre-amplifier has an extraordinarily low hum level, which can be checked by removing the pickup plug and turning up the "VOLUME" control. The connection of any input device to the pickup socket will lower the input impedance and should, therefore, reduce the hum level. If the hum level increases on connecting the pickup, the cause of the hum must lie outside the pre-amplifier, and our instructions on the choice and connection of pickups should be carefully read in an attempt to locate the cause of the hum.

Hiss.

With the input control switched to a pickup position and the "VOLUME" control at maximum, a certain amount of hiss will be heard. This hiss is as low as is possible to obtain at the present day, and it is inherent in high-gain vacuum tube amplifiers.

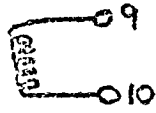
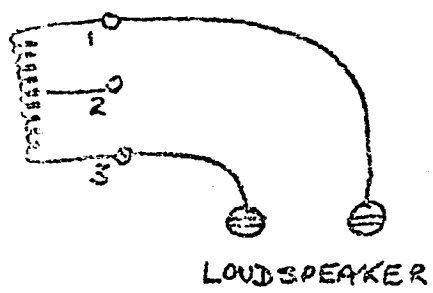
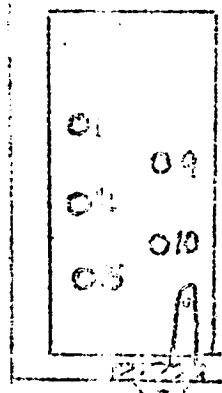
It is a fact that with the highest quality pickups (moving-coil types used with a transformer) the "VOLUME" control will not need to be anywhere near the maximum position, and therefore the hiss will be unobtrusive; but with competitively-priced variable-reluctance (moving-iron) pickups the output will be so low, for reasons explained later (see 6c (2), p.5), that hiss will be more noticeable. This is the price that the user has to pay in return for a modest outlay with reasonably good results!

P.M.

TL/85 PLUS HIGH IMPEDANCE MODEL.

This amplifier has been fitted with a special output transformer having a centre tapped secondary winding capable of developing 100 volts across a load impedance of 400 ohms. The feedback is taken from a separate winding and the secondary connections are as shown below:-

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Terminals 1 and 3 are connected to the loudspeaker strip and the centre tap (terminal 2) is connected to earth. It is permissible for the earth connection to terminal 2 to be removed provided that it is reconnected to either terminal 1 or terminal 3.

A capacitor has been connected across R.5 and its value is 200 pf.

300 750 pF
22K - F.12 }
150 pF } MS.

(j) **The matching of pickups.**

(i) **Moving-coil and variable-reluctance (magnetic, moving-iron) pickups.**

Some manufacturers state a value of resistor to be placed across their pickups. To follow these recommendations you should add a resistor of value shown below ; this table takes into account the input impedance of the Varislope III pre-amplifier (100,000 ohms). As this resistor can pick up hum unless screened, we strongly recommend that you solder the resistor across the co-axial input socket inside the pre-amplifier.

<i>Maker's Recommendation</i>	<i>Value of additional resistor</i>
100,000 ohms	No resistor required
50,000 ohms	100,000 ohms
33,000 ohms	50,000 ohms
20,000 ohms	25,000 ohms
10,000 ohms	12,000 ohms
5,000 ohms	5,000 ohms

(ii) **Crystal and ceramic pickups.**

For optimum results no additional resistor is required. The input loading on the pre-amplifier forces this type of pickup to give approximately the same frequency characteristic as moving-coil and variable-reluctance pickups. This type of pickup may be accompanied by recommendations that a high input impedance (1 megohm) should be used ; these instructions must be disregarded as they apply only when you are using a pre-amplifier which does not incorporate record compensation. If more bass is desired insert a 100,000 ohm resistor in series with the "live" lead.

5. OPERATING THE CONTROLS WHEN PLAYING RECORDS.

- (a) The extreme left-hand control is the input selector, which gives you the choice of four playback characteristics. These are the inverse of the record maker's stated characteristics, and we would warn you that the importance of this detail has often been over-emphasized. The recording characteristic does not take into account the acoustics of the recording studio, the position of the microphone relative to the artistes, your pickup, your loudspeaker system, the acoustics of your room and your particular ears ! In other words, the playback characteristic is of use only as an approximation, and it may well be necessary to adjust the final result by using the controls marked "BASS" and "TREBLE" ; this is the reason for their presence.

You are advised to play records as follows :—

78 r.p.m. Records.

OLD EUROPEAN (prior to 1955). Switch to "78OE". Set "BASS" and "TREBLE" to "FLAT". Adjust "VOLUME" to your liking. Re-adjust "BASS" and "TREBLE" to your liking, and also try the "FILTER" and "SLOPE" facilities (see 5b below) to see if you prefer the results.

EUROPEAN (1955 onwards). Switch to "LP" (which is the same as British Standard 1928/55 for Coarse Groove records) and proceed as above.

AMERICAN (prior to 1955). Switch to "NARTB" and proceed as above.

(1955 onwards). Switch to "RIAA" and proceed as above.

33½ and 45 r.p.m. Records.

Prior to 1955. Switch to either "NARTB" or "LP" and proceed as above. (You will notice that "NARTB" gives more bass than "LP"). However, you may well find you prefer some of these older records when switched to "RIAA" ; if so, play them that way.

1955 onwards. Switch to "RIAA" and proceed as above. (This is now an internationally agreed standard, but remembering the factors not taken into account, (see 5a above), you will find that records cut to this standard will vary between themselves ; therefore, use the "BASS" and "TREBLE" controls to please your ear).

- (b) The "FILTER" knob can be used to give very comprehensive control of the treble frequencies. When the control is turned to "9" a filter is switched into circuit, the turnover frequency being 9 kc/s (i.e., the frequency at which the response falls 3db). Other turnover frequencies of 6 kc/s and 4 kc/s are also obtainable. The "SLOPE" control varies the rate of attenuation above the turnover frequency from 5db per octave (fully clockwise) to 25db per octave fully anti-clockwise). The "TREBLE" control is also operative at the same

time, and it can be seen that all these three controls give increasing high frequency attenuation as they are turned anti-clockwise. These controls are very useful when reproducing music in which there is high distortion at high frequencies, making it possible to remove much of the offensiveness whilst losing a minimum of the musical content.

The "SLOPE" control is inoperative when the "FILTER" is at "OFF."

SPECIAL NOTE

With our previous Varislope pre-amplifiers a number of users reported that the filter "does not work" on the 9 kc/s and 6 kc/s positions. In every case on our checking the pre-amplifier it was faultless.

The explanation must be that either the high frequencies were not being reproduced due to inadequate complementary equipment, i.e., pickups, loudspeakers, etc., and/or the particular listener could not hear large changes of intensity at high frequencies.

(c) "BASS" CONTROL

Consumer opinion in some countries insists on a magnitude of available bass boost which, if used at maximum, can only result in a travesty of the original music. We have provided you with an availability of bass boost which you certainly should not need if your pickup and loudspeaker are moderately good. It is not possible to obtain true bass from small loudspeaker systems by turning the "BASS" control to maximum, though an intermediate setting may be helpful, particularly when listening at low intensity levels (as in an apartment late at night).

(d) "RUMBLE"

This control appears on the front panel: "IN" indicates that you have the maximum level of rumble communicated from the motor to the pickup stylus; "CUT" indicates that the rumble level is cut down (as also is the bass musical content of the record). The turnover frequency is 70 c/s (see also 4d, page 1, and 7, page 5).

6. NOTES ON THE CHOICE AND PERFORMANCE OF PICKUPS

(a) Pickup Arms.

An arm should be as light and as rigid as possible with the lowest possible friction in the pivot. A heavy arm will be necessary with a pickup cartridge (head) which is inferior in respect of its bass-resonance frequency being initially too high. We do not recommend viscous damping of an arm. Ideally, an arm and cartridge should be designed conjunctively, as in the Leak "Dynamic" pickup; it is not possible to specify the performance of one without the other.

(b) The Stylus.

We most emphatically recommend **only** diamond. The initial cost will be greater, but the long term cost is much less, for diamond will last 100 times longer than the next best material, sapphire. Furthermore, because diamond does not chip and retains its contour, it is less likely to damage expensive records.

(c) Pickup Cartridges.

Generalising, one can place the three types of pickup generators in order of merit (this being also the order of cost):

- (1) **Moving-coil or Dynamic.** The best pickups in the world are of this type. Ideally the moving-coil should be wound on a non-magnetic former. A shielded transformer will be essential for the best signal/hiss ratio. (See 4h and 4i, page 2).
- (2) **Variable-reluctance (magnetic, moving-iron).**

These are the most widely used type, being cheap to manufacture, robust and capable of good results when well designed. Their limitations stem from the inherent nature of the device, which is a producer of odd-order (mainly 3rd) harmonics. To reduce this distortion the designer **must** employ a large air gap and/or a weak flux; this perforce makes an insensitive pickup, and in an attempt to rectify this weakness many turns of wire must be used on the coil. This, in turn, leads to two troubles: (1) a relatively high ratio of induced hum (as compared with moving-coil types) and (2) a high-frequency electrical resonance between the relatively high-inductance coil and the capacitance of the shielded cable joining it to the pre-amplifier. This is the resonance which the makers hope to flatten out when telling you to place a certain value of resistor across their pickup. Unfortunately, the magnitude and peak frequency of the resonance will vary according to the capacitance and length of the input cable, which you must keep as small as possible. Also, unfortunately, the added resistor will lower the overall output from the pickup, and the signal will require more amplification, giving a greater proportion of valve (tube) hiss as a background. Summing up, the best variable-reluctance pickups will give more distortion, more hum and more hiss in the output than the best moving-coil.

(3) Crystal types.

These are the cheapest. Some European types can give very pleasing results, and because the output is high the hum and hiss levels can be extremely low.

7. GRAMOPHONE (PHONOGRAPH) MOTORS OR TURNTABLES

The main trouble with the cheaper turntables and with record changers is vibration, which is transmitted to the pickup stylus and appears in the sound output as a low-pitched "rumble". Expensive transcription turntables are relatively free from "rumble" because they are more precisely engineered than mass-produced units.

8. THE CONNECTION OF RADIO TUNERS

The output of the tuner must be connected to the co-axial socket marked "TUNER" on the rear of the Varislope III. A separate earth (ground) connection should **NOT** be made to the tuner. Most British tuner units require an external source for heater and anode currents; these can be drawn from the associated Leak TL/12 Plus amplifier. Details are given on the TL/12 Plus installation leaflet.

9. THE CHOICE OF RADIO TUNERS

It is not possible to obtain very high quality from the signals broadcast by medium-wave and long-wave amplitude-modulated (A.M.) transmitters. At their very best, the signals from such stations will not approach the quality obtainable from a good L.P. record with a first-class pickup.

On the other hand, the quality from short-wave frequency-modulated (F.M.) transmitters is better than the best record, provided that the programme is "live" and that good land-lines are used between studio and transmitter, and provided that a first-class F.M. tuner is used.

10. CONNECTING TAPE RECORDERS AND/OR REPRODUCERS

Special Note.—It is **NOT** possible to operate directly from so-called tape "decks". It is essential that the tape system is complete, i.e., with built-in low level amplifiers.

In general, any normally designed tape system may be connected, using the shortest possible lengths of screened wire, either to the jack sockets on the front panel or to the co-axial sockets on the rear of the Varislope III.

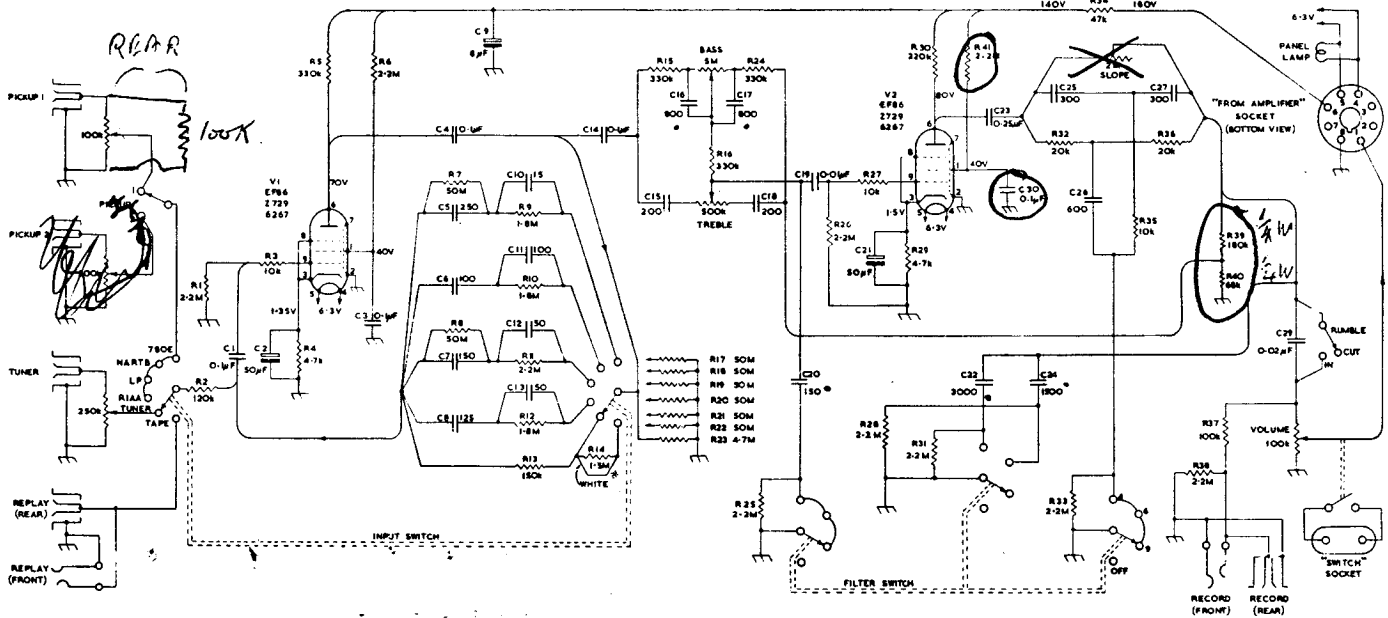
The following points should be noted :—

- (a) The output impedance of the tape recorder may be of any value up to 100,000 ohms.
- (b) The input impedance presented by the Varislope III pre-amplifier, in the "TAPE" position, is approximately 120,000 ohms.
- (c) The impedance of the record input on the tape recorder should be at least 100,000 ohms. The output level from the "RECORD" socket on the Varislope III pre-amplifier will be approximately 125mV for the input sensitivities quoted on page 6.
- (d) An earth (ground) connection should not be made to the tape recorder, as this may cause an "earth loop" and hum. The recorder will automatically be earthed through the pre-amplifier and Leak power amplifier.
- (e) When recording it may be desired to monitor the signal going to the recorder using the loudspeaker connected to the Leak power amplifier. The volume control in the pre-amplifier can be used, without affecting the level of recording.

11. CONNECTION OF MICROPHONES

Any dynamic (moving-coil) or ribbon microphone, together with its associated grid-matching transformer, may be plugged into either of the sockets marked "REPLAY" on front and back panels. The gain of the pre-amplifier will need to be raised and this can easily be done by cutting the only white wire used on the input switch (see circuit diagram and chassis lay-out). The input control must, of course, be switched to "TAPE," and any replay connection to a tape mechanism must be withdrawn from the pre-amplifier.

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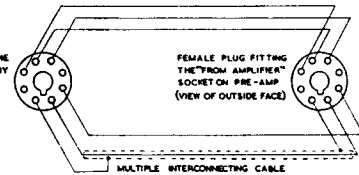
RESISTOR VALUES SHOWN IN OHMS
CAPACITOR VALUES SHOWN IN MICRO-MICROFARADS
EXCEPT WHERE OTHERWISE SHOWN
VOLTAGES MEASURED ON A METER OF 20000Ω/VOLT

TO INCREASE THE SENSITIVITY OF THE TAPE REPLAY
INPUT FOR MICROPHONE OPERATION,
CUT THE WHITE LEAD ON THE INPUT SWITCH.

MALE PLUG FITTING THE
"PRE-AMP" SOCKET ON ANY
"LEAK" POWER AMPLIFIER
(VIEW OF OUTSIDE FACE)

FEMALE PLUG FITTING THE
"FROM AMPLIFIER"
SOCKET ON PRE-AMP
(VIEW OF OUTSIDE FACE)

CIRCUIT DIAGRAM



Sensitivities for 125mV output (sufficient to give full output from any Leak power amplifier) at 1,000 c/s.

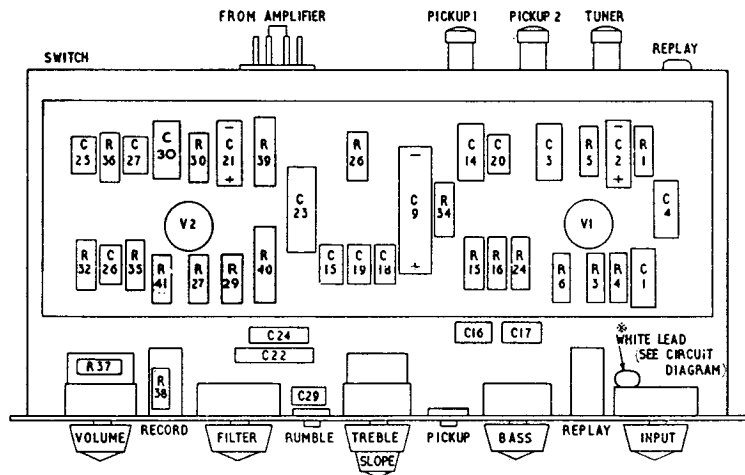
- Pickup 1 or Pickup 2 3mV
- Input impedance 70k-100k ohm
- Tuner 50mV
- Input impedance 125k-200k ohm
- Tape 50mV
- Input impedance 120k ohm
- Microphone (see 11 p.5) 2mV
- Input impedance 200k ohm

Bass Control : ±14db at 50 c/s.

Treble Control : ±14db at 20 kc/s.

Distortion :
Less than 0.01% for 125mV output.

Hum and Noise :
When plugged into any Leak power amplifier approximately 60db below full power output on Radio and Tape, and 52db below on other inputs.



CHASSIS LAYOUT, BOTTOM COVER REMOVED

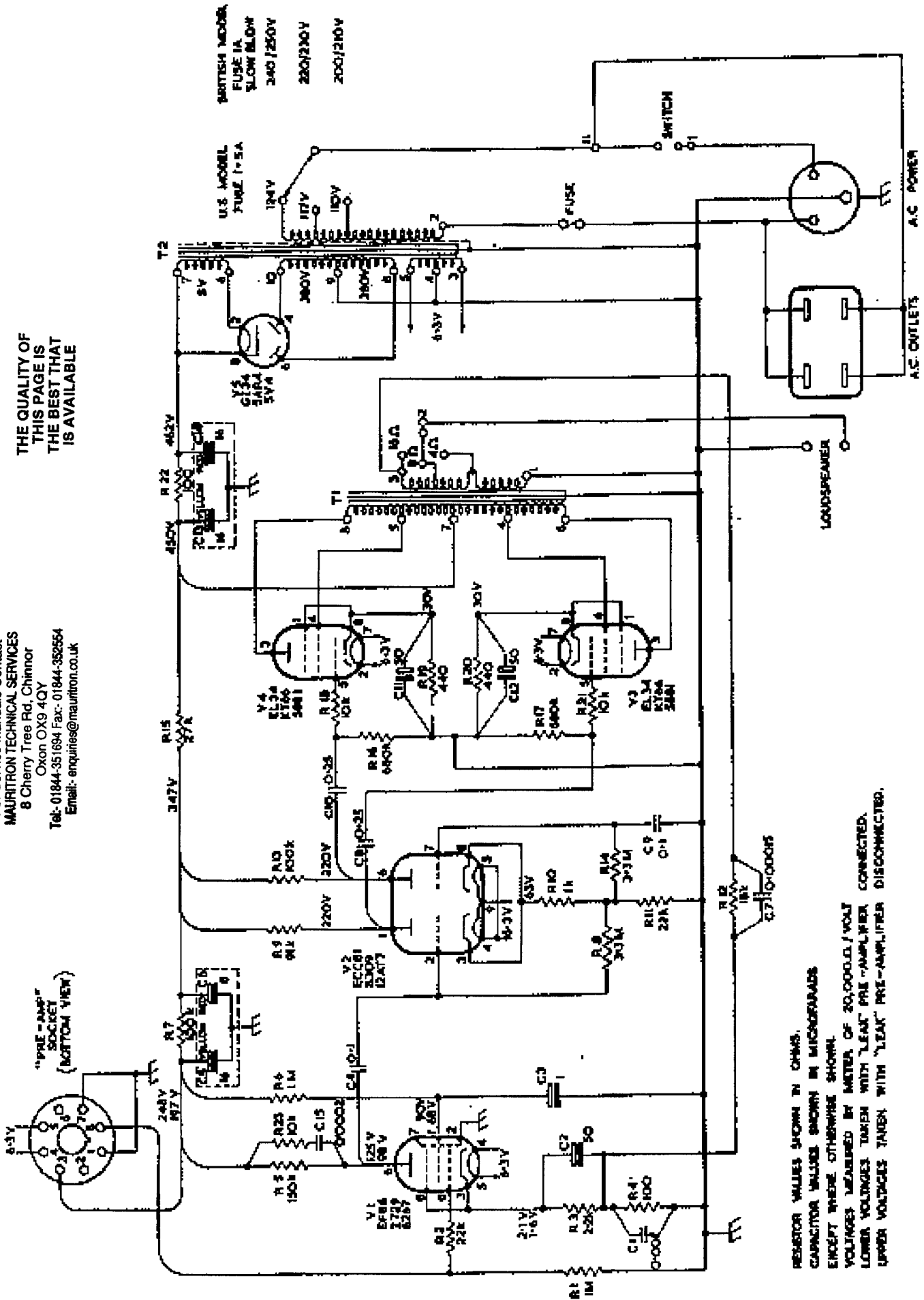
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BRUNEL ROAD, WESTWAY FACTORY ESTATE
LONDON, W.3

Telephone:
SHEpherds Bush 1173/4/5

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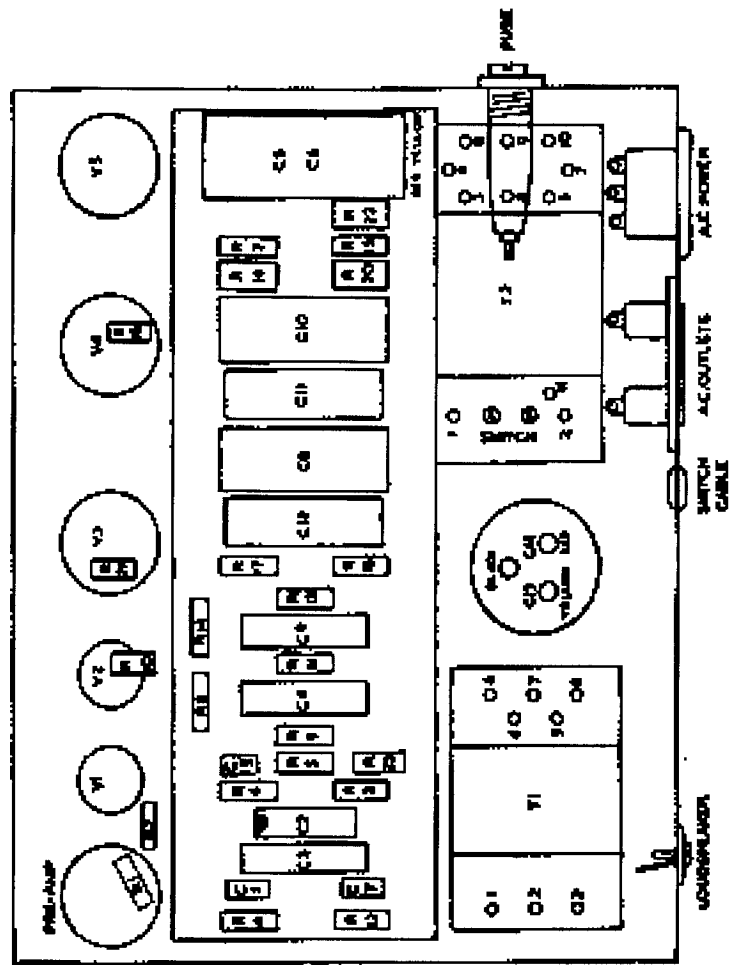
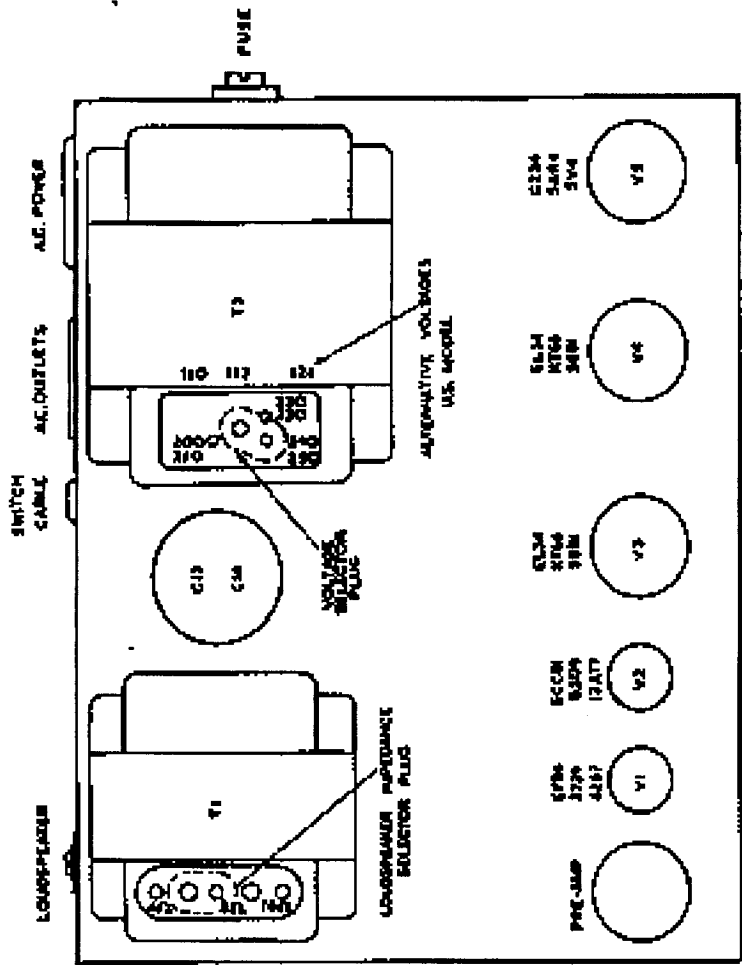
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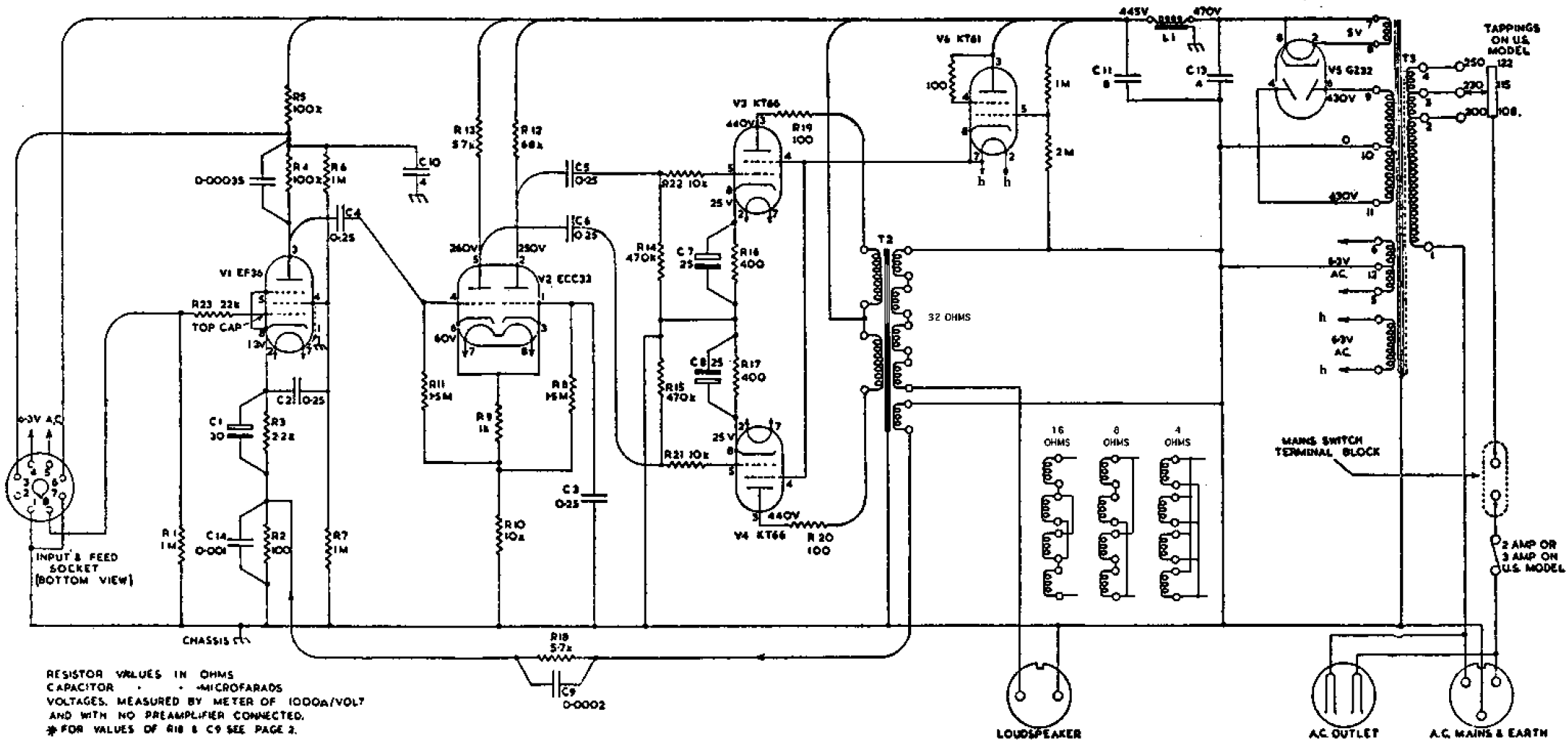
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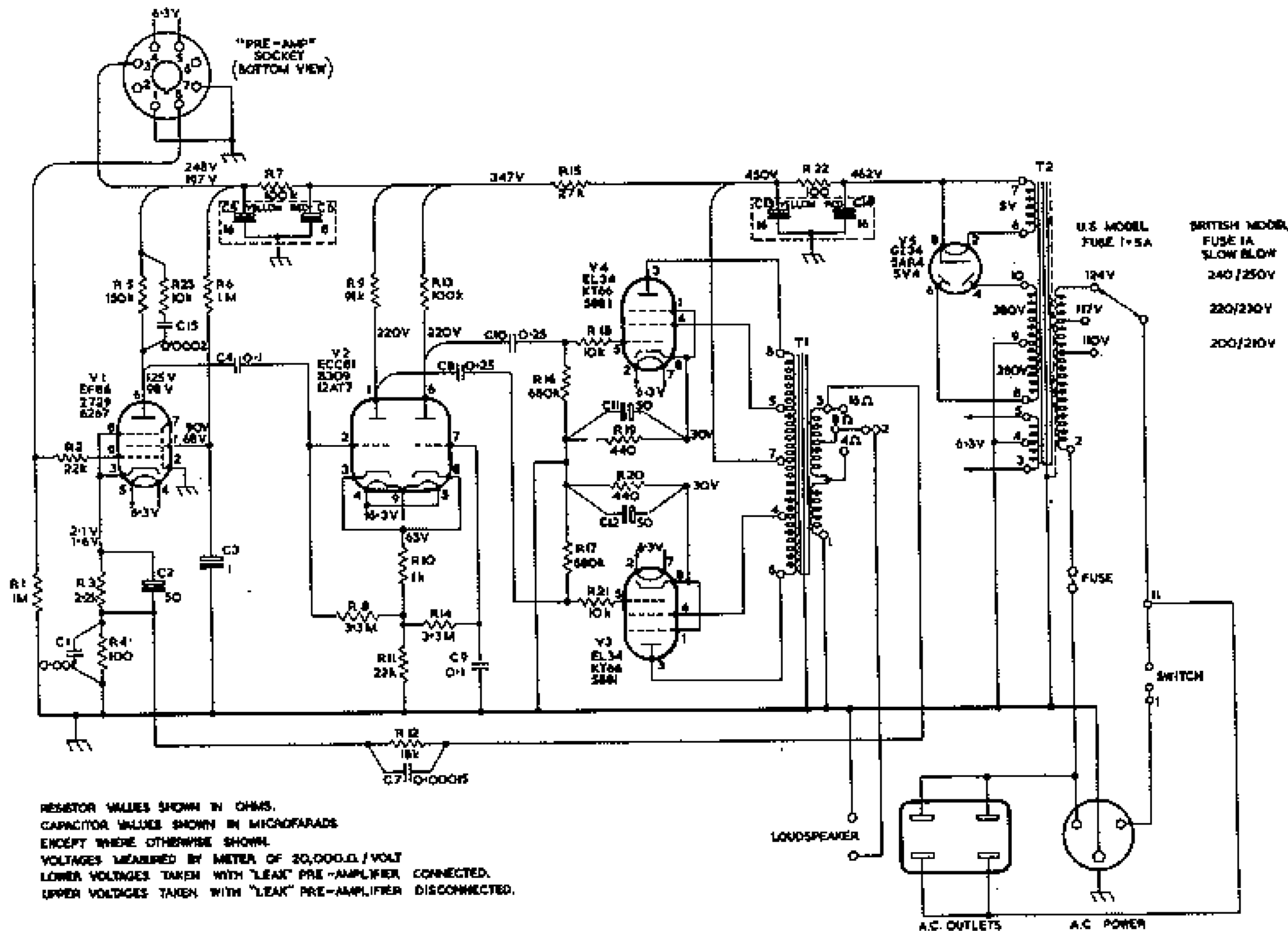


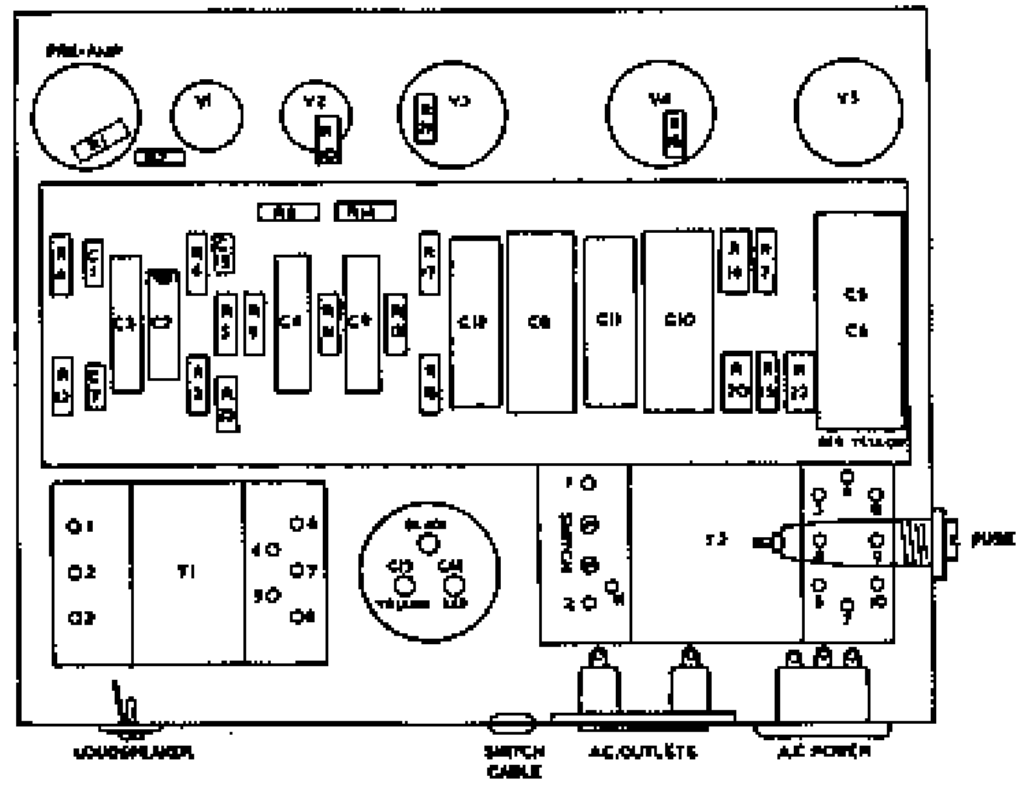
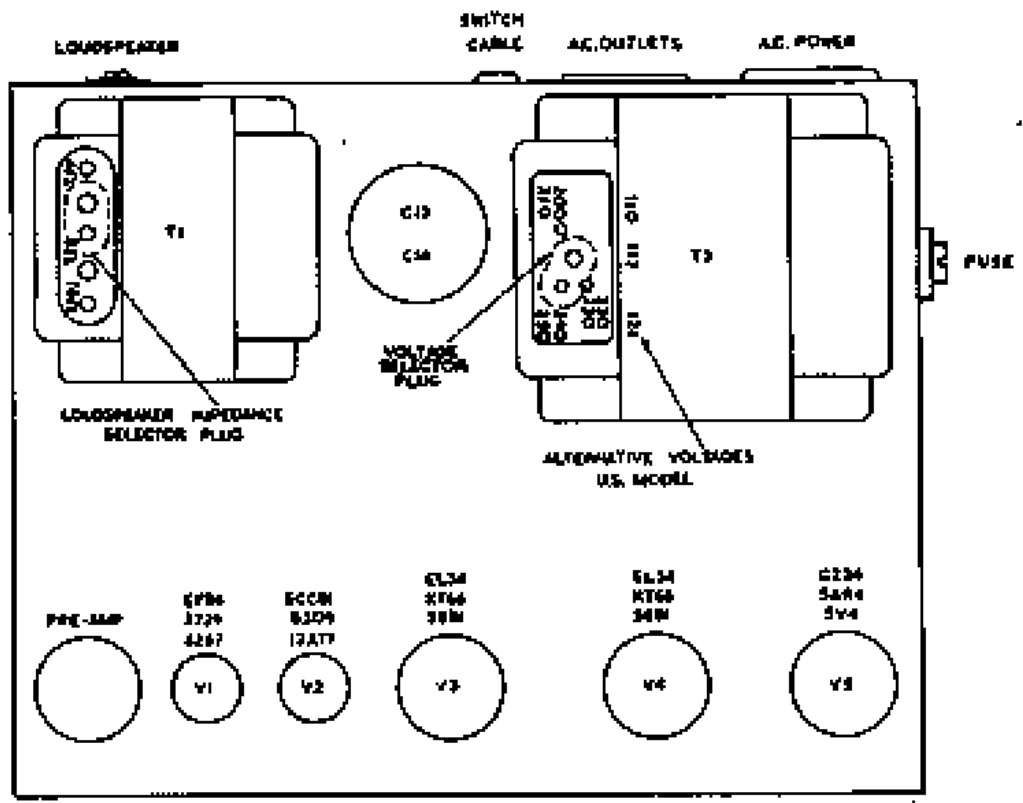
RESISTOR VALUES SHOWN IN OHMS.
 CAPACITOR VALUES SHOWN IN MICROFARADS
 EXCEPT WHERE OTHERWISE SHOWN.
 VOLTAGES MEASURED BY METER OF 20,000.0/VOH
 LOWER VOLTAGES TAKEN WITH "LEAK" PRE-AMPLIFIER CONNECTED.
 UPPER VOLTAGES TAKEN WITH "LEAK" PRE-AMPLIFIER DISCONNECTED.

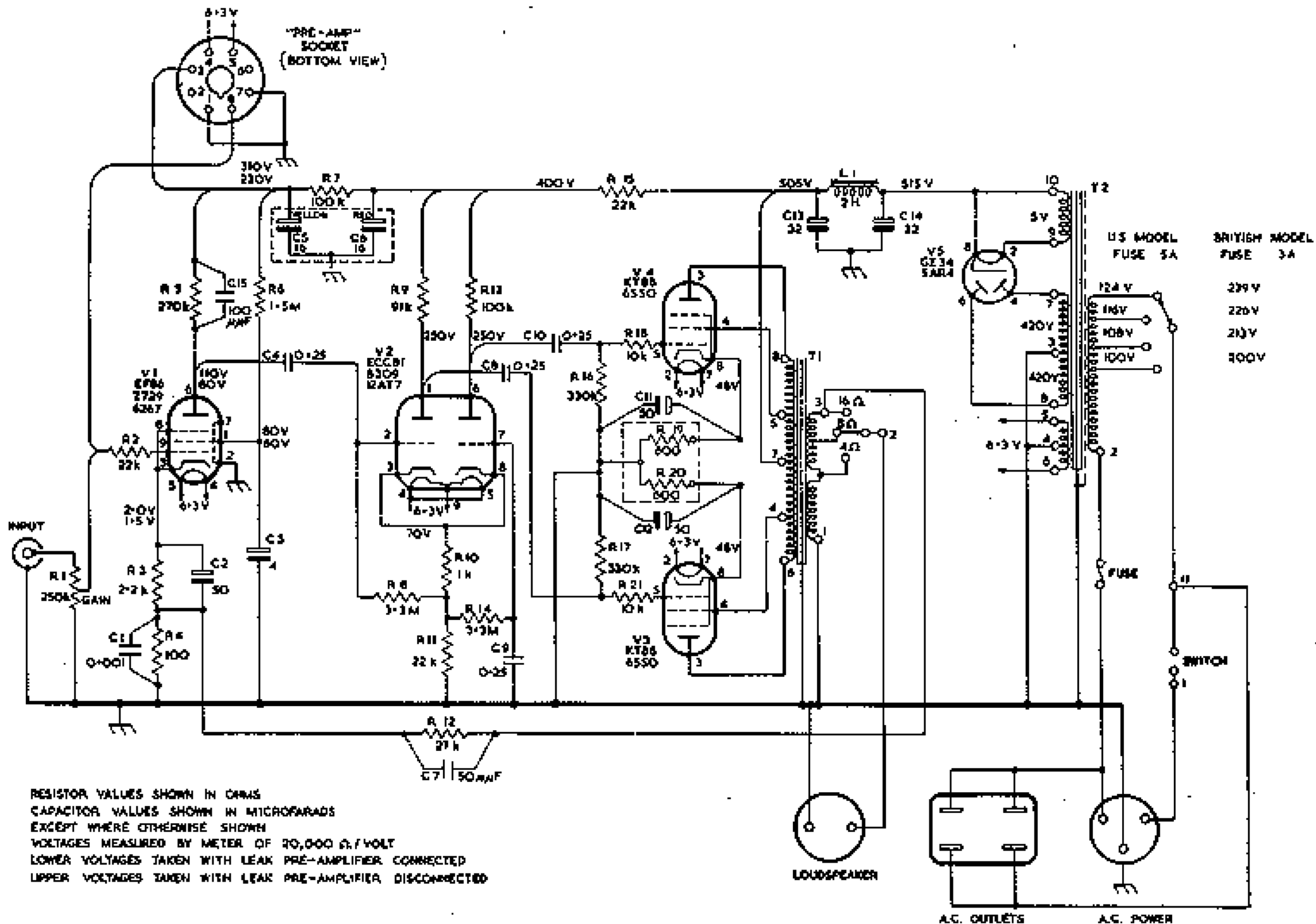
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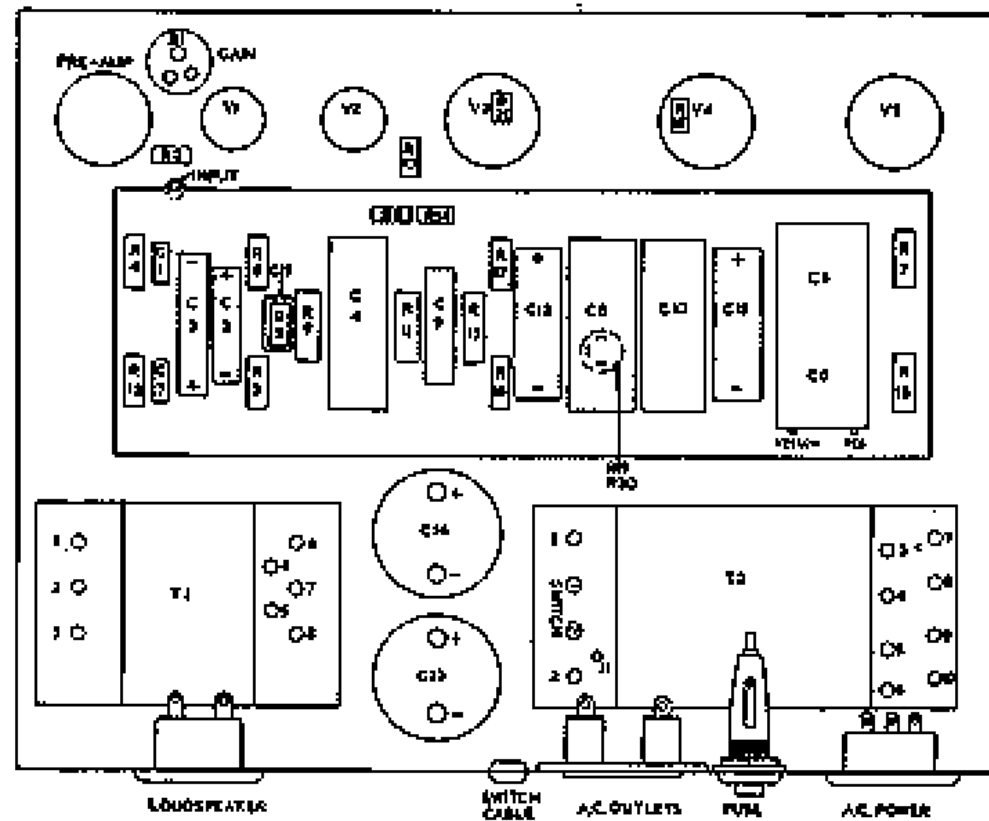
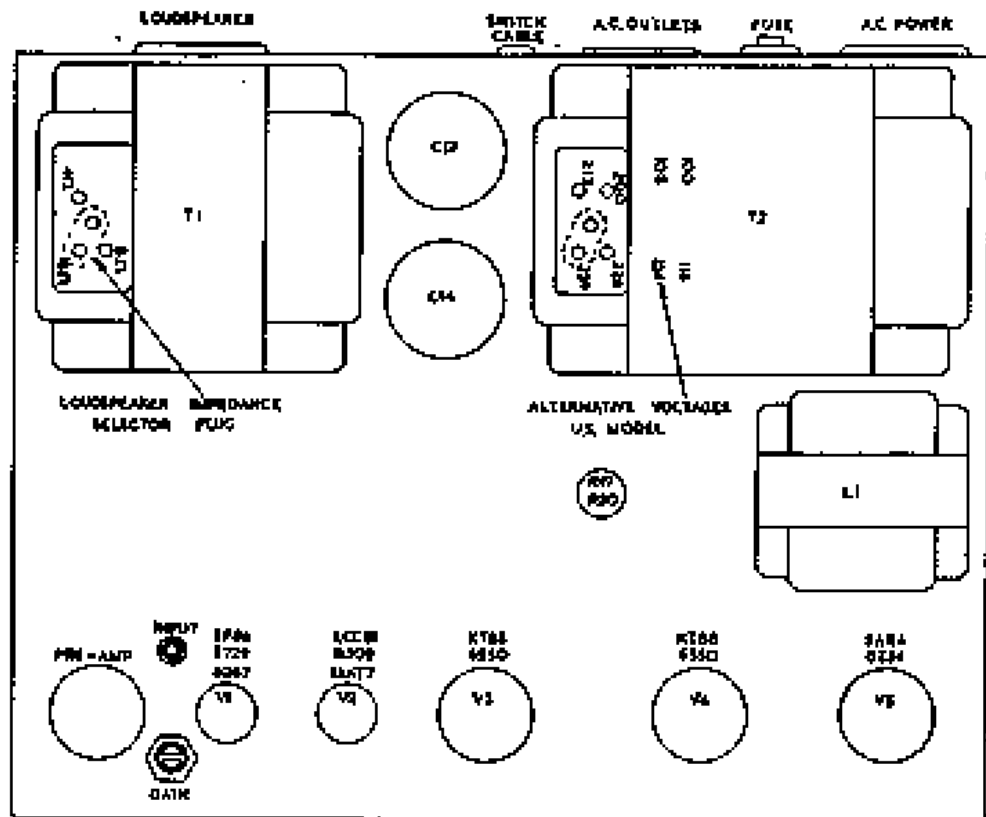


U.S. MODEL FUSE 5A	BRITISH MODEL FUSE 3A
124 V	229 V
100 V	220 V
80 V	210 V
60 V	200 V

LOUDSPEAKER

A.C. OUTLETS

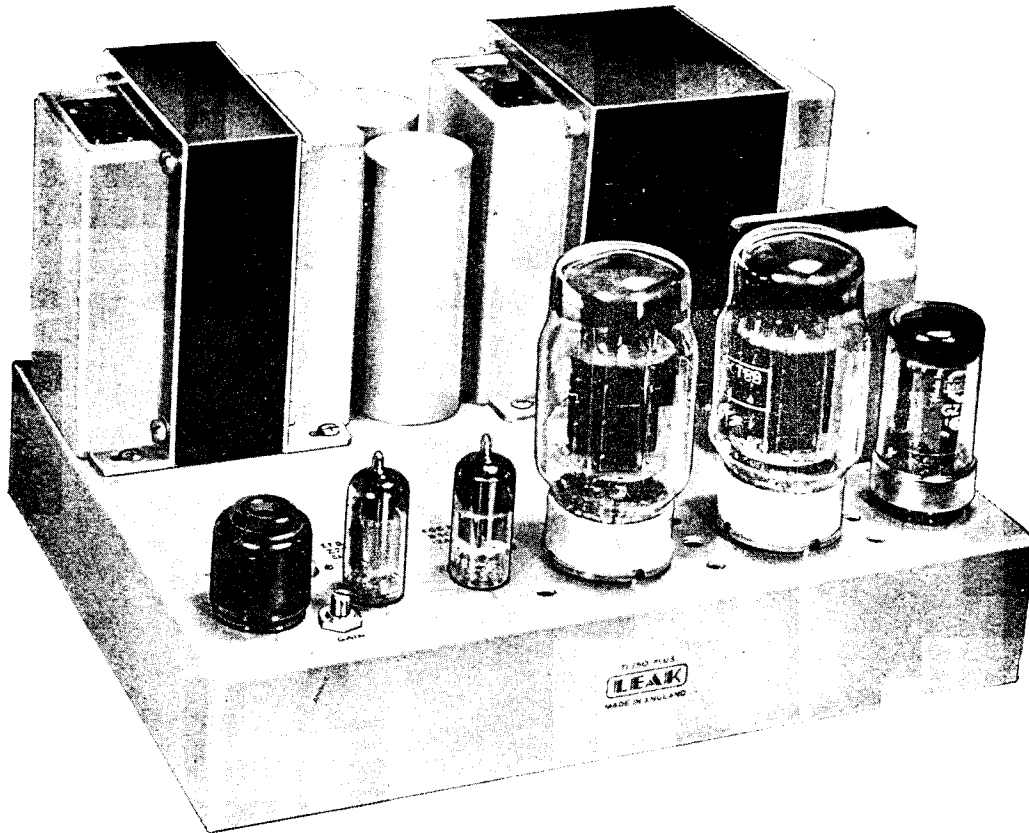
A.C. POWER



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LEAK

. . . the first name in High Fidelity



“TL/50 PLUS” POWER AMPLIFIER

THE MOST POWERFUL VERSION OF
THE WORLD-FAMOUS “POINT ONE”^{*} POWER AMPLIFIERS

DESIGNED BY HAROLD J. LEAK
for

THE PROFESSIONAL ENGINEER and THE MUSIC LOVER

TRADITIONAL LEAK ENGINEERING AND CRAFTSMANSHIP

“I can most certainly say at this stage that the workmanship and finish are of a quality which I have never before encountered in the radio industry, despite the fact that my association with the industry in one capacity or another extends back over 27 years. I think you are to be congratulated all the more on this achievement in view of the increasing tendency nowadays towards inferior workmanship and design.”

Part of a letter from a purchaser of the TL/12 amplifier who is a very well-known engineer and whose identity is known to the Editor of “Wireless World.”

^{*} “POINT ONE” is the Trade Mark of H. J. Leak & Co., Ltd. It was originally applied to the first power amplifiers having a total distortion as low as point one of one per cent., when, in June, 1945, H. J. Leak, M.I.E.R.E., revolutionised the performance standards for audio amplifiers by designing the original “POINT ONE” series.

FUNCTION

The TL/50 PLUS power amplifier has been designed to give the highest possible fidelity. In electrical performance, reliability, appearance and craftsmanship, it is in advance of earlier Leak amplifiers and similarly acceptable to the professional communications engineer.* For broadcast monitoring, recording, etc., the amplifier can be supplied with line input transformer, baseplate and top cover.

For public address work the power output permits its use in the largest auditorium. Out-doors, it will cover crowds dispersed over a 10 acre field when using horn loudspeakers.

For use by the music-lover at home this amplifier will normally follow a Leak "Varislope Mono" pre-amplifier. The output of 50 watts is adequate when the house is wired for the simultaneous use of loudspeakers in several rooms.

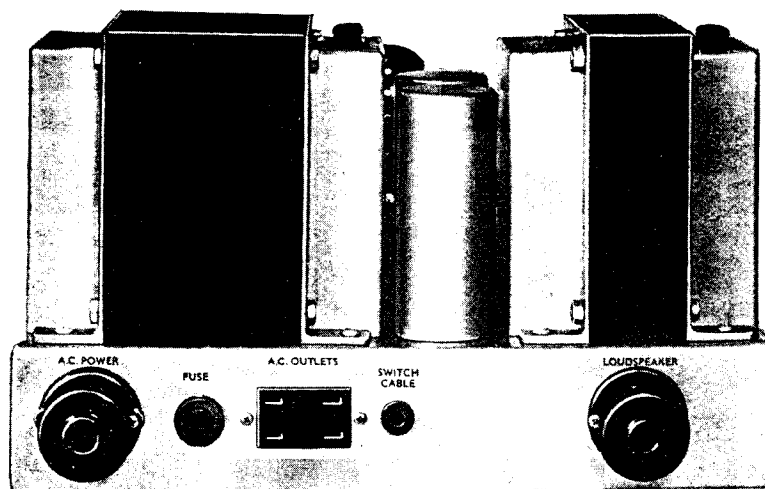
APPEARANCE AND FINISH

The TL/50 PLUS is finished in blue-steel stoved paint; and all visible accessory fittings are in black. The general finishes are similar to the TL/12 and TL/25, which have operated for years in high-humidity, high-temperature locations such as Malaya and Hong-Kong.

It is appropriate here to mention one of the basic principles of Leak design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased costs incurred for high-grade materials, components and finishes, and this together with quantity production (made possible only by a world-wide market) explains how quality products may be sold at reasonable prices.

CIRCUITRY

This is identical with the basic circuit of the TL/12 Plus and TL/25 Plus amplifiers, a 3-stage triple loop feedback circuit. A low-noise, high-gain pentode feeds into a second-stage double-triode phase-splitter, which in turn feeds two push-pull output valves (tubes) arranged in the distributed-load condition. The massive output transformer has a core of high grade orientated steel.



* LEAK amplifiers are the choice of professional engineers such as the B.B.C. (over 500 delivered), the South African Broadcasting Corporation (600), ITV and many other Commonwealth and overseas broadcasting and TV systems, who use them for transmitting and/or monitoring (quality checking) the broadcasts to which you listen. Also, many of the gramophone records you buy are cut via LEAK amplifiers.

Valves (Tubes)

First stage — one EF86 or Z729 or 6267.
Second stage — one ECC83 or B339 or 12AX7.
Output stage — two KT88 or 6550.
Rectifier — one GZ34 or 5AR4.

(International standard types of world-wide availability).

Power Output

50 watts r.m.s. maximum (British rating).
100 watts peak (American rating).

Total Harmonic Distortion

0.1% for 45 watts output (± 1 db) at 1,000 c/s.

Hum and Noise

83db, ± 3 db, below 50 watts with a source impedance of 25,000 ohms.

Sensitivity

An input of 125mV at 1,000 c/s gives 50 watts output.

Frequency Response

± 0.5 db, 20 c/s to 20 kc/s.

Damping Factor

15, measured at 1,000 c/s.

Input Impedance

250k ohm, plus approximately 5 mmfd.

Feedback Magnitude

- 23db at 1 kc/s.

Loudspeaker Impedances

Loudspeakers of any impedance between 3 ohms and 20 ohms may be used. An adjustable plug on top of the output transformer selects three tapings, nominally 16 ohms, 8 ohms and 4 ohms.

Power Supply

200 - 250V, 50 - 100 c/s.
or, (alternative model)
100 - 125V, 50 - 100 c/s.

Consumption

145 watts (150 watts with Leak pre-amplifier).

Spare Supplies

A double socket marked "A.C. Outlets" is fitted as a convenient source of power supply for gramophone motors, etc. British users :- Note that heater and anode supplies are NOT available for a tuner.

Dimensions

11½" × 9" × 6⅝" (29.2 × 22.8 × 16.8 cms.).

Weight

28 lbs. 10 ozs. (13 kgs.).

Fixing

Four brackets and screws are supplied for fixing the amplifier to a baseboard.

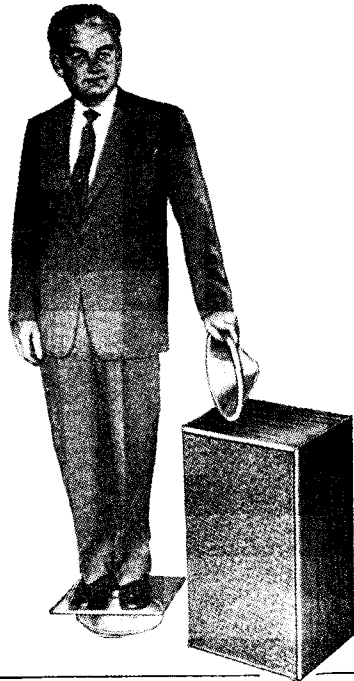
Price : £35 · 10 · 0d.

For Service Manuals Contact
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8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
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PUBLIC ADDRESS APPLICATIONS

A special model of the TL/50 Plus is available giving output line voltages of 50 and 100. In this model the feedback is applied via a tertiary winding and the feedback magnitude is reduced; these modifications ensure stability over the wide range of transmission line characteristics found in public address work. The price is increased by 10% on this model.

A MAJOR LOUDSPEAKER INVENTION *



Harold J. Leak demonstrates immense stiffness of piston-action 'Sandwich' diaphragm which supports his weight below plate glass square.

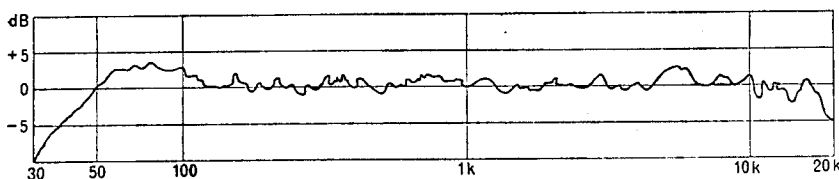
THROUGHOUT the history of broadcasting and recording, certain exceptional developments have become milestones in the progress of sound reproduction. ONE such milestone was the world's first very-low-distortion amplifier, the famous original Leak 'Point One', in 1945.

WE now pioneer another major breakthrough, the invention of the fantastically rigid 'Sandwich' cone diaphragm, which is demonstrably of great strength and hundreds of times stiffer than all conventional forms of cone. The photographs on this page illustrate the astonishing superiority of the Leak 'Sandwich' invention.

THE 'Sandwich' diaphragm is the invention of Donald A. Barlow, M.Sc., who leads the Leak Transducer Research Team. The theoretical treatise on his invention was given by Mr. Barlow in the *Wireless World*, December 1958. TO understand the impact of this invention one must remember that to obtain low distortion the movement of a loudspeaker diaphragm or cone should follow as accurately as possible the waveform of the signals applied to its speech coil. The ability of the cone to follow these impulses accurately depends upon the LIGHTNESS and STIFFNESS of the cone assembly.

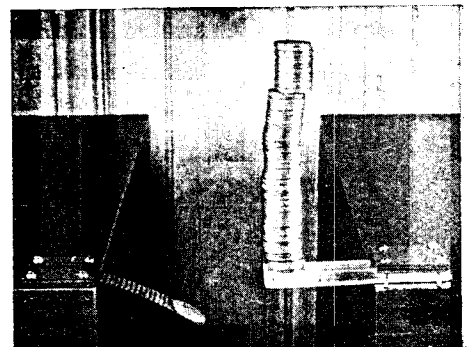
CONVENTIONAL cones (paper, impregnated fabric, plastics, aluminium) suffer from low stiffness. This results in significantly large areas of the cone vibrating in motions uncontrolled by the speech coil. These uncontrolled motions produce transient 'hangover', amplitude distortion (peaks and hollows in the frequency response) and intermodulation distortion (lack of clarity and spurious tones). These shortcomings are inherent in all direct-radiator loudspeaker systems using conventional cones, irrespective of cost.

ALL the above shortcomings of conventional cone loudspeakers are overcome by the Leak Piston-Action 'Sandwich' construction. Using engineering design principles as applied to air-frame construction, the 'Sandwich' cone comprises stiff aluminium skins for the outer surfaces where the stresses are greatest, bonded to a thick core of featherweight expanded plastic where the stresses are lowest, giving far greater stiffness than the same total weight of either material used separately. This use of the most suitable materials in optimum proportions and dispositions gives immense stiffness and rigid piston-action over a range of more than six octaves, and for the first time in audio history gives a direct-radiator diaphragm which reproduces the signal applied to the speech coil totally free from mechanical break-up and its associated distortions. The result is a remarkably smooth frequency response free from violent peaks or troughs over a very broad frequency range, indicative of excellent transient response (see graph below).



AXIAL PRESSURE RESPONSE OF 'SANDWICH' SYSTEM

The illustration shows a section of a paper cone flexing under the weight of one $\frac{1}{2}l.$, and a section of the immensely stiff 'Sandwich' cone, which weighs the same as the paper cone, supporting the weight of 100 halfpennies. The revolutionary Leak cone comprises two skins of very thin aluminium separated by a filler of very light plastic material expanded to a thickness of $\frac{1}{8}$ inch.



* U.S. Patent Number 3,111,187 granted to applicants D. A. Barlow and H. J. Leak & Co., Ltd.

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'TL/50 PLUS' POWER AMPLIFIER

INSTALLATION · OPERATION · MAINTENANCE

NOTES ON THE CHOICE AND PERFORMANCE OF LOUDSPEAKER SYSTEMS

For Service Manuals Contact
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OPERATION

1. The 'TL/50 PLUS' may be fed from the LEAK 'VARISLOPE MONO' pre-amplifier, or from any other suitable source. This LEAK pre-amplifier is supplied with a black multiple connecting cable terminating in an octal plug which fits the socket on the 'TL/50 PLUS' marked 'PRE-AMP', and automatically makes the input connection. In this case the input 'GAIN' control should be turned fully clockwise. An input of 125mV r.m.s. will give a power output of 50 watts.
2. When a LEAK pre-amplifier is not used the input connections should be taken via a screened co-axial cable to the plug fitting the socket marked 'INPUT', and the 'GAIN' control adjusted to suit the signal level.

INSTALLATION

3. Check that all valves (tubes) are correctly seated in their holders and that the markings on the valves correspond with those on the chassis adjacent to the holders. The amplifier will work equally well with any of the alternative valves.
4. The amplifier should stand on its base in a well-ventilated position. If placed in a case or cabinet, ventilation must be provided. Four separate fixing feet with screws are provided with the amplifier, and these *must* be fitted, so raising the bottom of the amplifier, and allowing circulation of air.
5. On the British model the mains transformer is tapped for voltages of 200, 213, 226 and 239 and the voltage selector plug on top of the mains transformer (see 'TOP CHASSIS' drawing) should be set appropriately. On the U.S. model the mains transformer is tapped for voltages of 100, 108, 116 and 124 and the voltage selector plug should be set appropriately. The A.C. power supply is connected to the two terminals nearest the guide key on the removable plug portion of the mains connector marked 'A.C. POWER', and the supply frequency can be either 50 c/s or 60 c/s.

In order that the amplifier may be remotely controlled we have provided two terminals marked 'SWITCH' underneath the mains transformer (see 'UNDER CHASSIS' drawing). The amplifier will not work unless these terminals are electrically joined, and when the amplifier leaves our factory a wire link joins the terminals. A remote switch may be run from the 'SWITCH' terminals, after removing the link, the flex being passed through the adjacent grommet marked 'SWITCH CABLE'. The flex should be knotted behind the grommet to avoid strain on the 'SWITCH' terminals. Most users will wish to make use of the switch incorporated in the volume control of an associated LEAK pre-amplifier, which is supplied with a plug and twin flex for this purpose. Full details are given in the installation sheets which accompany every pre-amplifier.

6. A double socket marked 'A.C. OUTLETS' is fitted as a convenient source of power supply for gramophone motors, self-powered radio tuners, etc. The power taken from this socket should be limited to 100 watts or thereabouts. This socket is not fused but is controlled by the amplifier switch.
7. A connection to earth (ground) should be taken from the third terminal on the removable plug portion of the 'A.C. POWER' connector. This terminal is the one furthest away from the guide key and its corresponding terminal on the fixed portion of the connector is marked on the chassis by the symbol \oplus . It is very bad practice to omit this connection, which may be made to the water system or to the steel conduit encasing the house wiring providing that these systems themselves are properly grounded. No other earth connections should be made elsewhere, particularly when a pre-amplifier is also used, if freedom from 'earth loops' and hum is to be obtained.

8. The loudspeaker should be connected by a *twisted* pair of wires to the plug marked 'LOUDSPEAKER'. It will be seen from the circuit drawing that one side of the loudspeaker winding is connected to the chassis, and no part of the loudspeaker wiring should be earthed elsewhere. The D.C. resistance of the connecting wires should be as low as possible, and not more than one-tenth the D.C. resistance of the loudspeaker. It is bad practice to operate any power amplifier without a loudspeaker, and if it is desired to mute the loudspeaker by switching it out of circuit this should be accomplished by use of a change-over switch which replaces it with a resistor of corresponding value and rating. The selector plug on top of the output transformer (see 'TOP CHASSIS' drawing) should be adjusted for the nearest match to the advertised impedance of the loudspeaker.

GENERAL NOTES ON MAINTENANCE

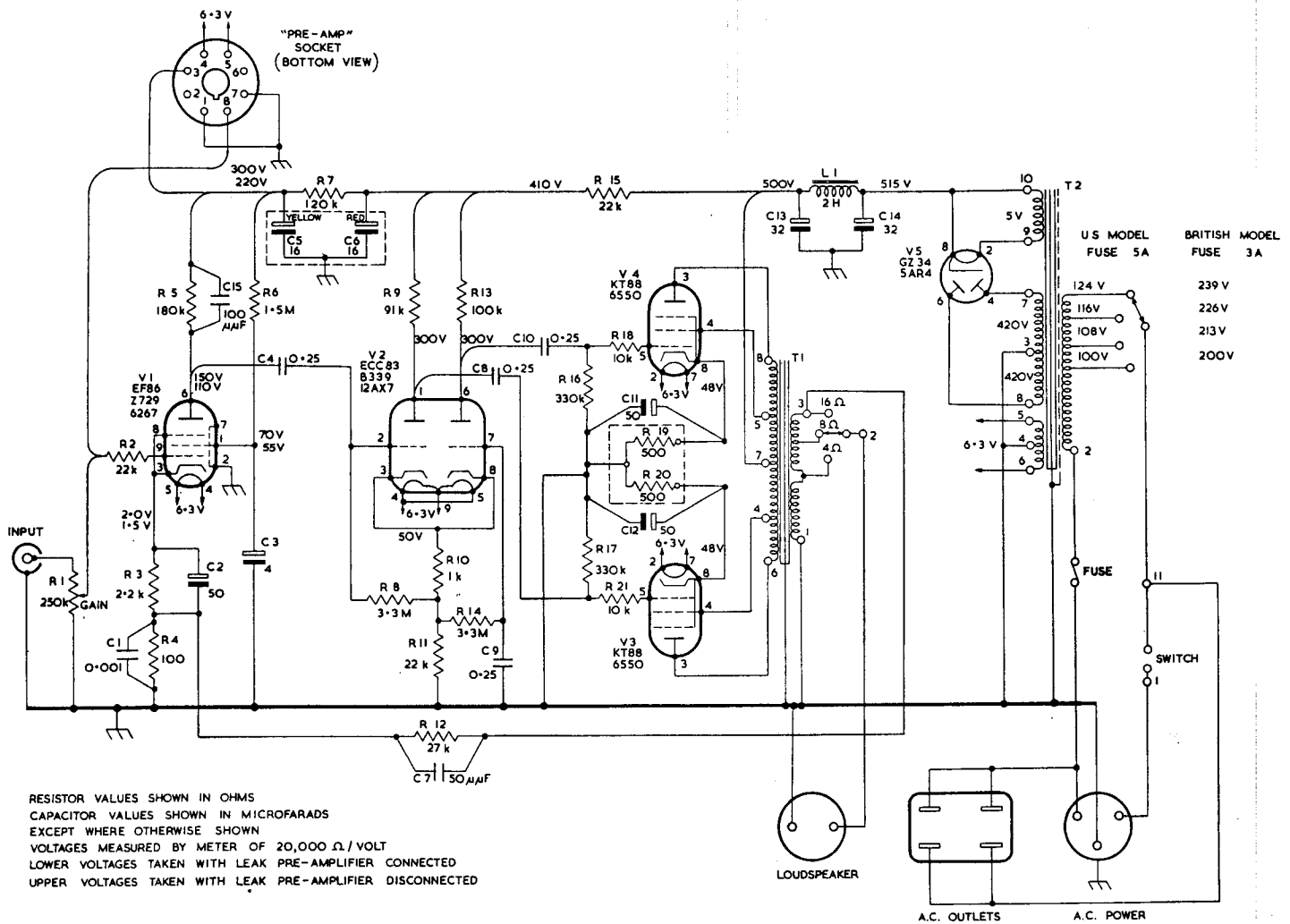
The circuit diagram provides a qualified engineer with all information required for servicing. However, the following points may be of interest:—

- (a) The 'TL/50 PLUS' does not depend upon the output valves (tubes) being a matched pair to give the stated performance, and if one output valve fails it is not necessary to replace both.
- (b) Should it ever be necessary to replace the reservoir capacitor C14 note that it must be of a type capable of handling at least 200mA ripple current. The C14 fitted has a high margin of safety, being capable of handling 240mA.

NOTES ON LOUDSPEAKER SYSTEMS

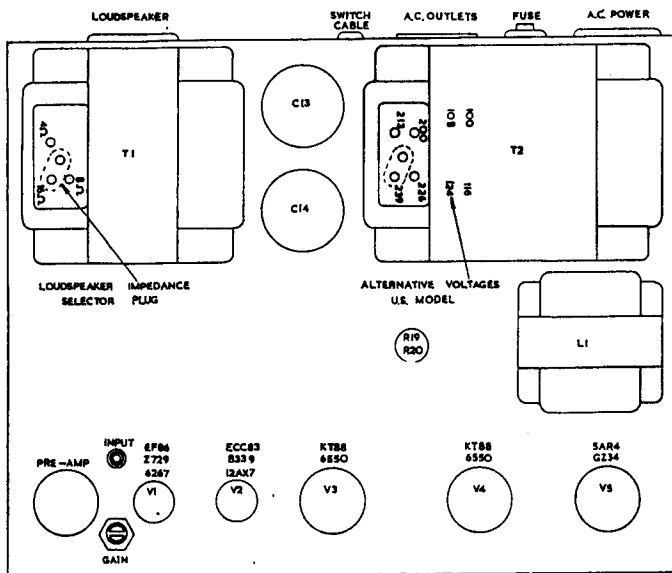
Space does not allow for detailed explanation on this vast subject, but the following points should be noted:—

- (a) This amplifier will operate any high fidelity loudspeaker system, both moving-coil and electrostatic types, including the small low sensitivity assemblies currently popular, particularly in the U.S.A.
- (b) You *cannot* get high fidelity results if you mount a loudspeaker in the same cabinet as the turntable and pickup.
- (c) The assembly commonly called a 'loudspeaker' consists of a magnet, a moving-coil and a diaphragm (or 'cone'). This assembly is a 'motor'. You do not listen to a motor; you listen to a loudspeaker system, which consists of one or more motors mounted in a housing (baffle, box, cabinet, or horn). The housing plays a profound part in determining the quality of reproduction. The effects of various housings are discussed by L. L. Beranek in *Acoustics*, McGraw-Hill Publishing Co Ltd, First Edition.
- (d) One good motor, properly housed, is capable of giving fairly good results, but two good motors, properly housed, will give noticeably better results: in this case one motor is designed to reproduce bass, and the other treble. A filter ('dividing network') must be used in conjunction with the two motors.
- (e) Remember that even the best conventional loudspeaker systems are by far the weakest link (i.e. the greatest source of distortion) in a high fidelity chain, and that such systems are relatively expensive. The fundamental weaknesses of conventional loudspeakers are discussed succinctly in a paper by H. J. Leak, *High Fidelity Loudspeakers: The Performance of Moving-Coil and Electrostatic Transducers*, Journal of the British Institute of Radio Engineers, Vol. 16, No. 12, December 1956. Copies are available from the Institution, 9 Bedford Square, London, W.C.1, price 7 -. However, such systems have become out-moded by the revolutionary Leak invention of the composite 'sandwich' diaphragm. The basic principles are described by D. A. Barlow, M.Sc. (Head of the Leak Transducer Research Department) in *Wireless World*, December 1958. A further paper describing the complete Leak 'Sandwich' loudspeaker system was delivered to the British Institution of Radio Engineers by D. A. Barlow and H. J. Leak on the 24th January, 1962, and will be published in a forthcoming journal of the Institution.

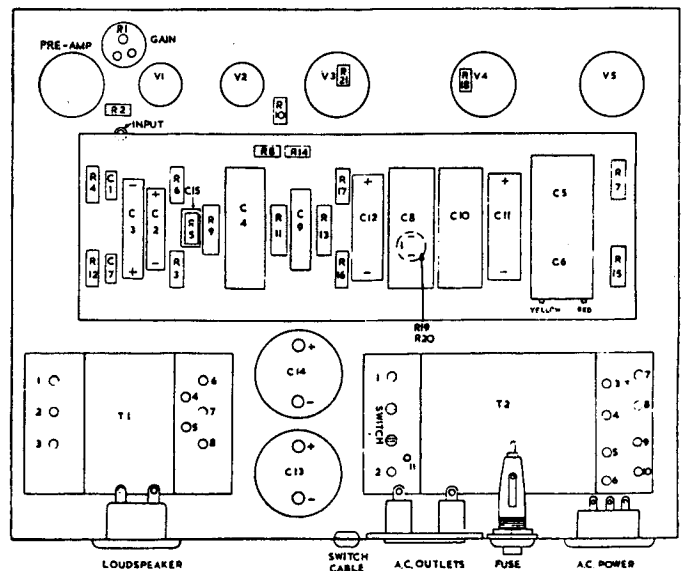


CIRCUIT DIAGRAM OF 'TL/50 PLUS' POWER AMPLIFIER

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TOP CHASSIS



UNDER CHASSIS

A MAJOR LOUDSPEAKER INVENTION*

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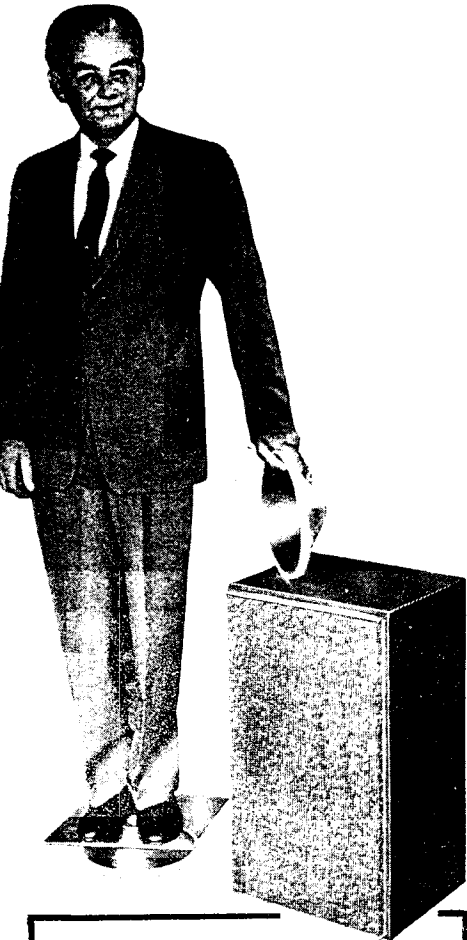
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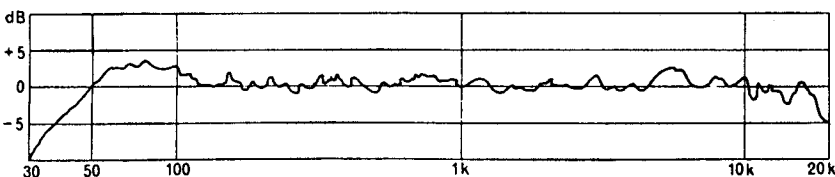
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CONVENTIONAL cones (paper, impregnated fabric, plastics, aluminium) suffer from low stiffness. This results in significantly large areas of the cone vibrating in motions uncontrolled by the speech coil. These uncontrolled motions produce transient 'hangover', amplitude distortion (peaks and hollows in the frequency response) and intermodulation distortion (lack of clarity and spurious tones). These shortcomings are inherent in all direct-radiator loudspeaker systems using conventional cones, irrespective of cost.

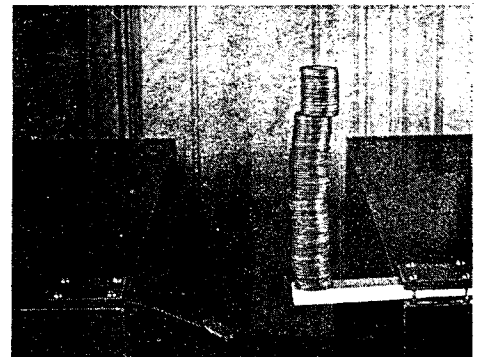
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Harold J. Leak demonstrates immense stiffness of piston-action 'Sandwich' diaphragm which supports his weight below plate glass square.



The illustration shows a section of a paper cone flexing under the weight of one $\frac{1}{4}$ lb., and a section of the immensely stiff 'Sandwich' cone, which weighs the same as the paper cone, supporting the weight of 100 halfpennies. The revolutionary Leak cone comprises two skins of very thin aluminium separated by a filler of very light plastic material expanded to a thickness of $\frac{1}{8}$ inch.



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