SECTION 10

LOUDSPEAKER AMPLIFIERS: LSM AND AM8 SERIES

The LSM/4 is described in Section 13 and the LSM/9 in Section 20.

LSM/1

The LSM/1 is an a.c. mains-operated loudspeaker amplifier used for quality checking and talk-back purposes.

Circuit Description (Fig. 27)

The amplifier comprises two stages, the second employing two AC/P1's in push-pull. The volume control is connected in the grid circuit of the first stage across the loaded secondary winding of the input transformer and the valve is resistance-capacitance coupled to the inter-stage transformer. The supplies are obtained from a mains unit of conventional design, a.c. being used for filament heating. Rectified a.c. is applied to the anodes via a smoothing filter followed, in the case of the first stage, by a decoupling circuit. The current applied to the loadspeaker for polarising purposes is a.c. since the loudspeaker incorporates its own rectifier and smoothing circuit.

Valve Data

Valve	*Anode Current mA*	*Fil. Volts*	*Fil. Amps.*	*Grid Bias Volts*
Stage 1, AC/P	6·3	4	1	7·5
Stage 2, 2 AC/P1's	16·5 (each valve)	4	1 (each valve)	31·0
Rectifier UU60/250 or UU/4		4	2	

Total Feed, 39·3 mA.

H.T. Supply, 200-240 V. (The transformer primary should be tapped according to the voltage of the supply.)

Current drawn from a.c. mains

Amplifier, 0·25 A.
Loudspeaker, 0·15 A.

General Data

Volume Control :
Continuously-variable potentiometer.
Resistance, 100,000 Ω.

Impedances

Input	Z = 2,400 Ω.
Output	Z = 11 ,,
Normal Load	Z = 12 ,,

(Loudspeaker input.)

Test Data

Maximum Working Voltage Gain

Test Conditions :
Volume Control set for maximum gain.
Output loaded with 12 Ω and output level at + 4 dB.
Gain at 1,000 c/s, G = 20 ± 2 dB.

LSM/2

The LSM/2 is an a.c. mains-operated loudspeaker amplifier employed in loudspeaker units used in listening halls.

Circuit Description (Fig. 28)

The amplifier comprises two stages, the second stage employing two PX/25's in push-pull. The volume control is connected in the grid circuit of the first stage across the loaded secondary of the input transformer and the valve is choke-capacitance coupled to the screened inter-stage transformer.

Supplies are obtained from the mains unit, a.c. being used for heating the valves. Rectified a.c. is applied to the anodes via a smoothing filter, the choke having two windings on a common core, one winding being connected in each leg of the circuit. The supply to the first stage is further decoupled. Milliammeter shunts are provided in the anode

lead to each valve and, by means of the 3-position key, the milliammeter can be connected across any of the shunts so that the anode current taken by each valve can be measured individually.

The first stage uses an indirectly-heated valve and the bias is obtained from a resistor connected in the h.t. return circuit. The valves in the second stage have directly-heated filaments and automatic bias is obtained by returning h.t. negative to the centre point of the filament. This is provided by two 600-ohm resistors which are effectively paralleled in the common h.t. return circuit. The current supply to the loudspeaker for polarising purposes is a.c. since the loudspeaker incorporates its own rectifier and smoothing circuit.

A red lamp provided on the front panel is lit from the l.t. winding of the power transformer as soon as the amplifier is switched on.

Valve Data

Valve	*Anode Current mA*	*Fil. Volts*	*Fil. Amps.*	*Automatic Grid Bias Volts Negative*
Stage 1, AC/HL	9	4	1	3·1
Stage 2, 2PX/25's	50 (each valve)	4	2 (each valve)	30
Rectifier UU 120/500 or UU/5		4	2·5	

Total Feed, 109 mA.
H.T. Supply, 400 V.

Current drawn from Mains
Amplifier, 0·4 A.
Loudspeaker, 0·15 A.

General Data
Volume Control
Continuously variable potentiometer.
Resistance, 100,000 Ω.

Impedances

Input	Z = 4,400	Ω.
Output	Z = 0·5	,,
Normal Load	Z = 12	,,

(Loudspeaker input.)

Test Data
Maximum Working Voltage Gain
Test Conditions :
Volume Control set at maximum gain.
Output loaded with 12 Ω and output level at + 12 dB.
Gain at 1,000 c/s, G = 30 ± 2 dB.

LSM/3

The LSM/3 is a d.c. mains-operated loudspeaker amplifier used for quality checking and talk-back purposes. It is normally connected either in the output of the programme trap-valve amplifier or in that of the CPL unit.

Circuit Description (Fig. 29)

The amplifier has two stages, the first consisting of a DC/2P valve, resistance-transformer coupled to two P/650's in push-pull. The amplifier is transformer coupled on its input side to the line and on its output side to the loudspeaker.

All supplies are taken from 220-volt d.c. mains. The filament supply is taken, via a smoothing system consisting of series chokes, one in each lead, and parallel 8-μF capacitors which, in conjunction with the 4-μF capacitor between the negative lead and earth, also serves to suppress any mains-borne interference. Additional smoothing is provided in the h.t. supply lead, by the D/14 choke and 8-μF capacitor. The smoothing arrangements are such that either the positive or negative lead of the mains may be neutral (earthy) without affecting the performance of the amplifier but care must be taken to ensure that the supply is connected to the amplifier in the correct polarity, otherwise the electrolytic smoothing capacitors will be damaged. The mains plug is clearly marked with polarity symbols.

The heater of V1 takes 100 mA at 35 volts, and a suitable dropping resistor is included in the positive lead. This stage is biased by the anode current passing through the 1,000-ohm resistor connected in the cathode lead. The filaments of the P/60's take 0·5 A at 6 volts, and are connected in series. The voltage-dropping resistance for these valves is included partly in the positive lead and partly in the negative lead. A tapped resistor mounted on the back of the unit is shunted across the 72-ohm resistor in the negative lead. This serves

as a potential divider and provides the grid bias to the output stage. Since one of the filaments is at a higher potential than the other, separate leads are provided for each valve, tapping the potential divider at points differing in potential by the voltage drop across one of the filaments, in order that both valves may receive the same bias. This arrangement necessitates the secondary winding of the inter-stage transformer being split into two halves, each connected to the filament via a capacitor, in order to complete the grid circuits as regards a.c. The feeds to the two stages may be read by plugging a PTM/1 into the jacks provided.

A neon lamp is connected across the mains supply to take the inductive discharge from the loudspeaker polarising winding when the amplifier is switched off.

Valve Data

Valve	*Anode Current mA*	*Fil. Volts*	*Fil. Amps.*
Stage 1, DC/2P	7-8	35	0·1
Stage 2, 2 P/650's	38-40	6 (each valve)	0·5

Total Feed, 45-48 mA.
H T. Supply, 220 V d.c.
Current drawn from Mains
Amplifier, 700 mA.
Loudspeaker, 50 mA.

General Data
Volume Control
Continuously-variable potentiometer.
Resistance, 50,000 Ω.
Impedances
Input Z = 2,000 Ω.
Output Z = 10 ,,

Test Data
Maximum Working Voltage Gain
Test Conditions :
Output loaded with 12 Ω and output level at 0 dB.
Gain at 1,000 c/s, G = 17 ± 2 dB.

LSM/6
The LSM/6 forms part of the loudspeaker unit LSU/4.

Circuit Description (Fig. 30)
This is a single-stage amplifier employing a pentode Type AL60 and transformer input and output. The amplifier was designed to operate with an input level of + 4 dB and an output level of + 8 dB, but in order to obtain the correct output impedance for the speech coil, 8-dB voltage feedback was required which reduced the effective stage gain to −6 dB. The required overall gain of + 4 dB is achieved by using an input transformer having a voltage step-up of 1 to 3·16, which is equivalent to a voltage gain of + 10 dB.

The requisite amount of feedback is obtained by applying the whole of the voltage developed across the secondary winding of the output transformer back to the grid in a negative sense.

The input transformer is balanced, and because of its high impedance, may be connected across any line without introducing noticeable loss. The output transformer is unbalanced (one side being connected to negative h.t.) so that the amplifier as a unit is unsuitable for any purpose other than that for which it has been designed.

Valve Data

Valve	*Anode Volts*	*Anode Current mA*	*Screen Volts*	*Screen Current mA*	*Fil. Volts*	*Fil. Amps.*
Stage 1, AL60	262	60	235	6·7	4	2·1

Total Feed 66·7 mA.
H.T. Supply, 310 V.
L.T. Supply, 4·5 V a.c.

General Data
Gain Control
Type, Morganite Stackpole MNAP 10450.
Resistance, 100,000 Ω.

Impedances
Input Z = 10,000 Ω.
Output Z = 2·2 ,,
Normal Load Z = 2-4 ,,

Normal Working Levels
Input + 4 or 0 dB.
Output + 8 or + 4 dB.

Test Data

600-ohm Test Gain

Test Conditions :
Gain Control set for maximum gain
Tone Source Sending Level, zero dB.
Gain at 1,000 c/s G = + 13·3 dB.

Maximum Working Voltage Gain

Test Conditions.
Gain Control set for maximum gain.
Tone Source Sending Level, zero dB.
Measuring Instrument at high impedance.
Gain at 1,000 c/s G = + 4 dB.

Frequency Response

With reference to 1,000 c/s.

50 c/s	— 0·4 dB.
10,000 c/s	— 0·2 dB.
14,000 c/s	— 0·1 dB.

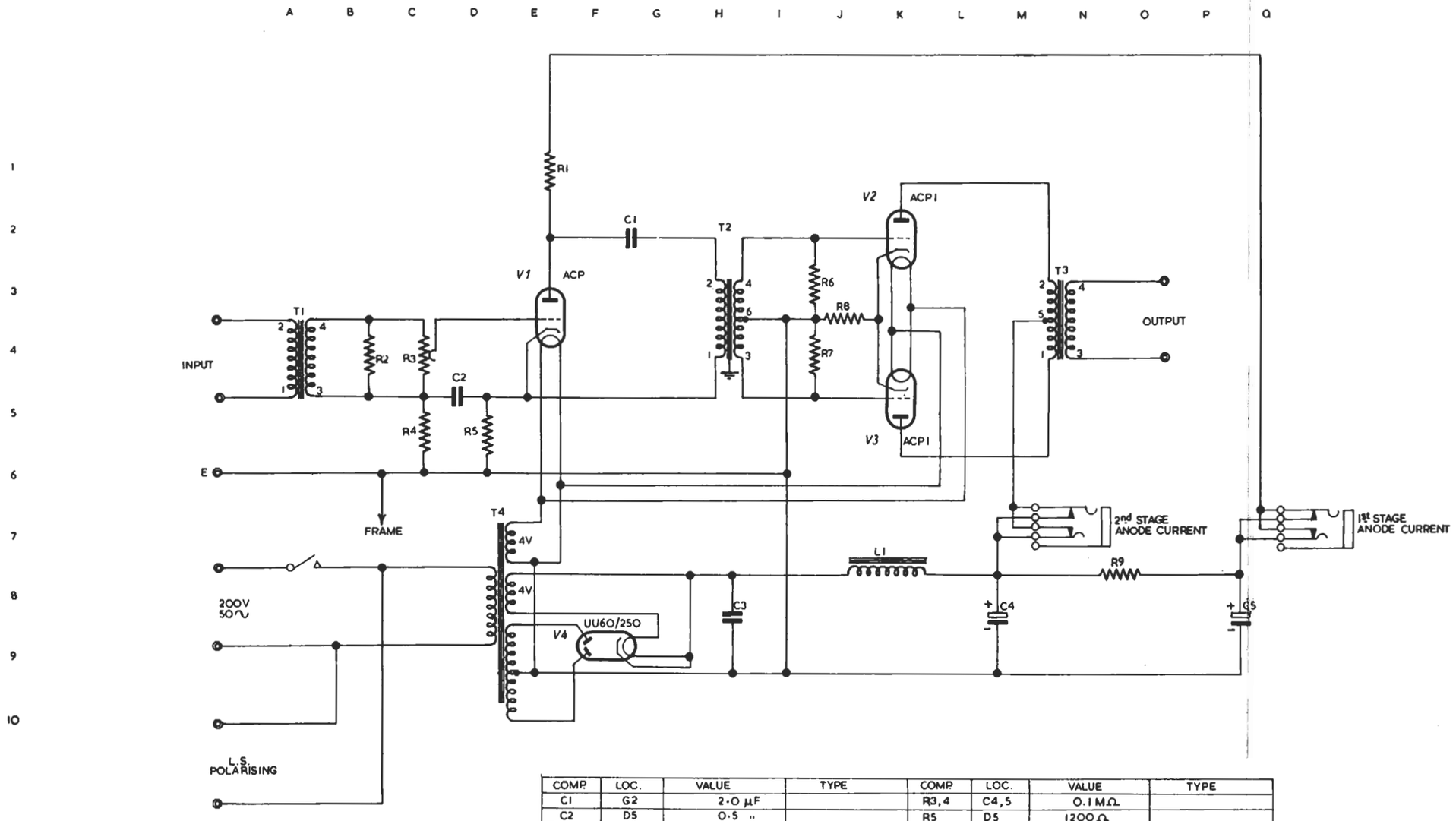
Total Percentage Harmonic Content

	Normal Level (*Input*+4 *Output*+8)		4*dB above normal level*	8*dB above normal level*
100 c/s		2·0%	4%	9%
1,000 c/s		1·2%	1·6%	2·7%

Mains Unit MUE/1

There are several variations of this mains unit, but the circuit is essentially the same for all (Fig. 30). The following are the chief modifications :

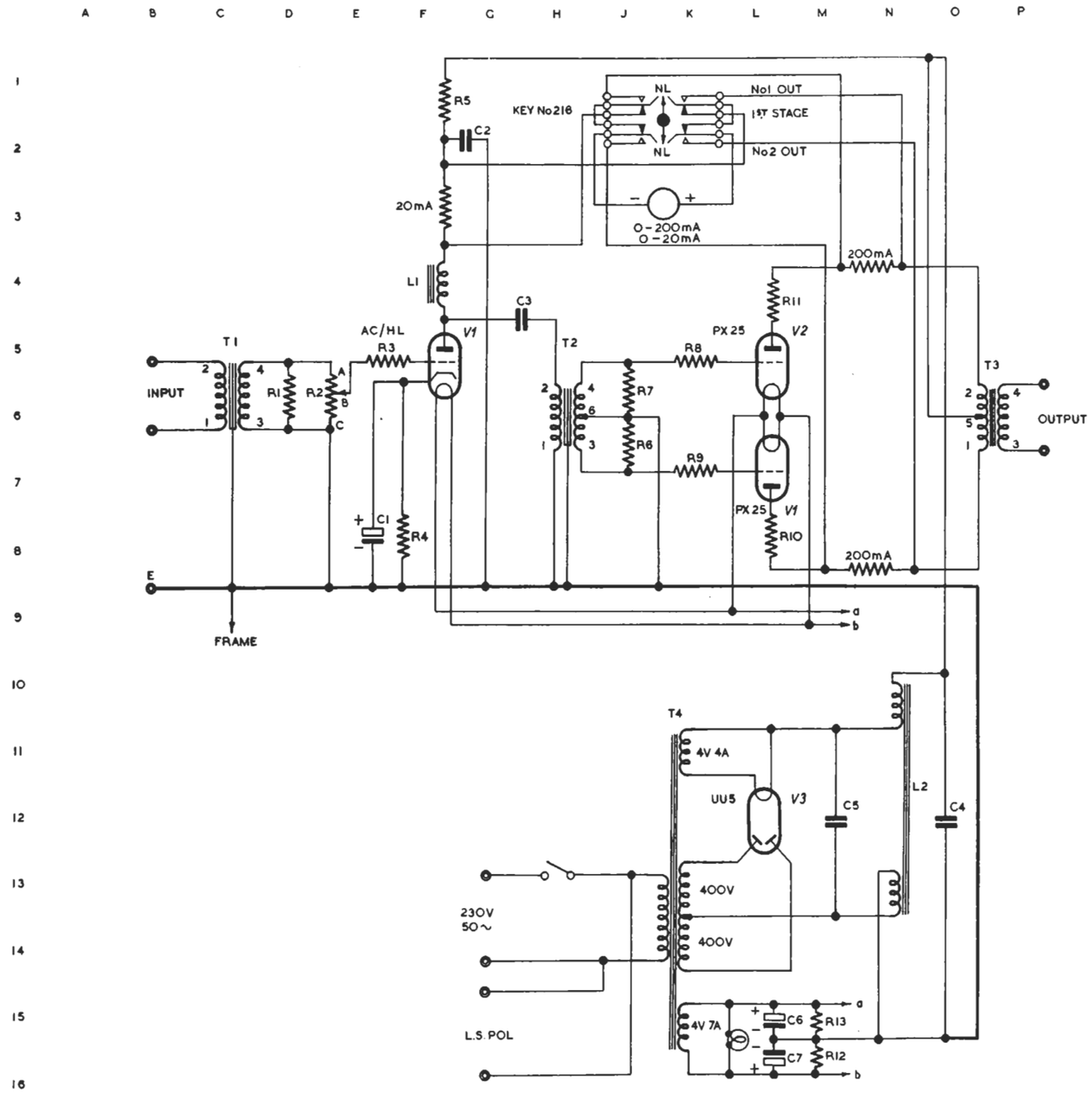
MUE/1A	Larger mains transformer than MUE/1.
MUE/1B	Fitted with metal cover.
MUE/1K	2-amp fuses ; commercial transformer and choke ; choke not tapped for series or parallel connection ; fitted with metal cover.



COMP.	LOC.	VALUE	TYPE	COMP.	LOC.	VALUE	TYPE
C1	G2	2·0 µF		R3,4	C4,5	0.1 MΩ	
C2	D5	0·5 "		R5	D5	1200Ω	
C3	H8	4·0 "		R6,7	J3,4	0.1 MΩ	
C4,5	M8,Q8	7·0 "		R8	J3	940Ω	
				R9	N7	10 000 "	
L1	K7		DI4				
				T1	A4		No 60
				T2	H3		No 128
R1	E1	10 000Ω		T3	N3		No 129
R2	B4	0·2 MΩ		T4	E8		A.G.I. M20

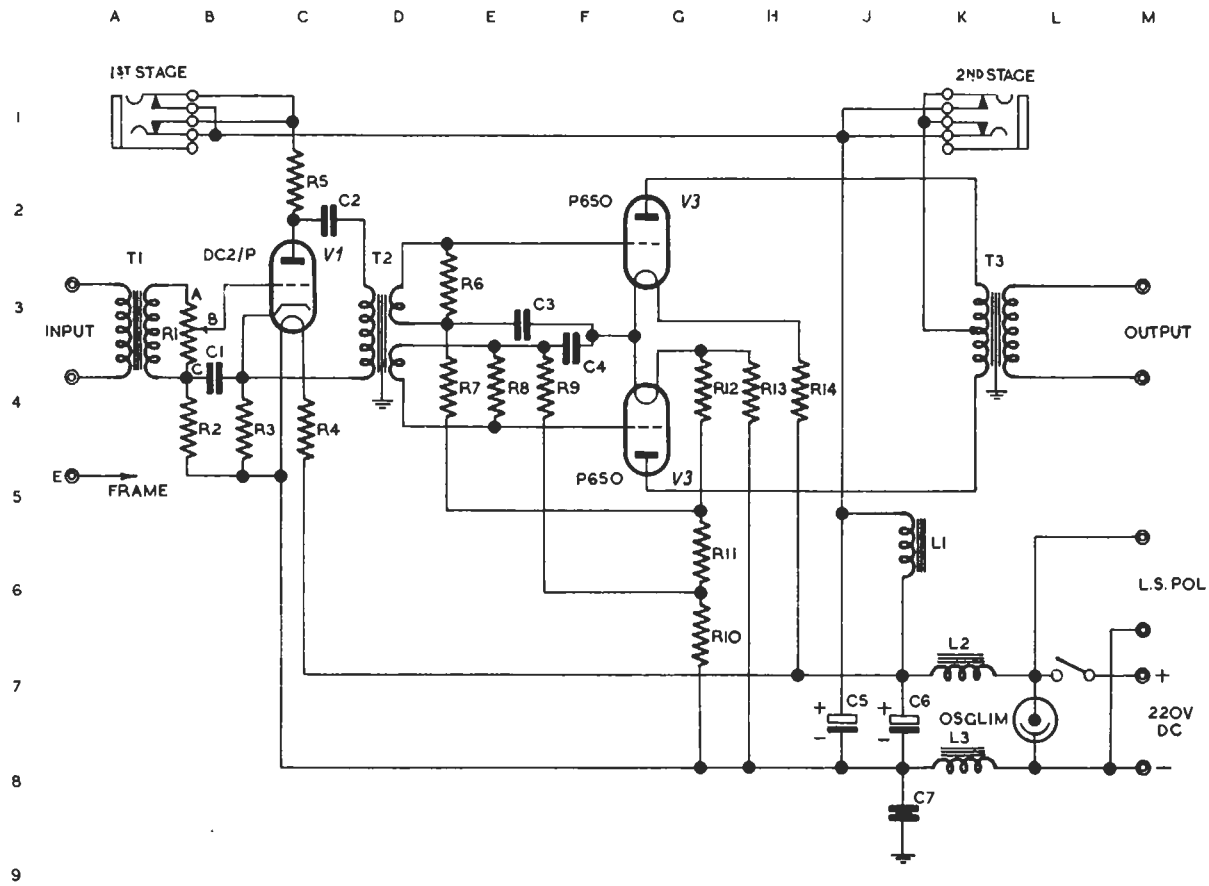
MAINS-OPERATED LOUDSPEAKER AMPLIFIER L S M/1

FIG 28



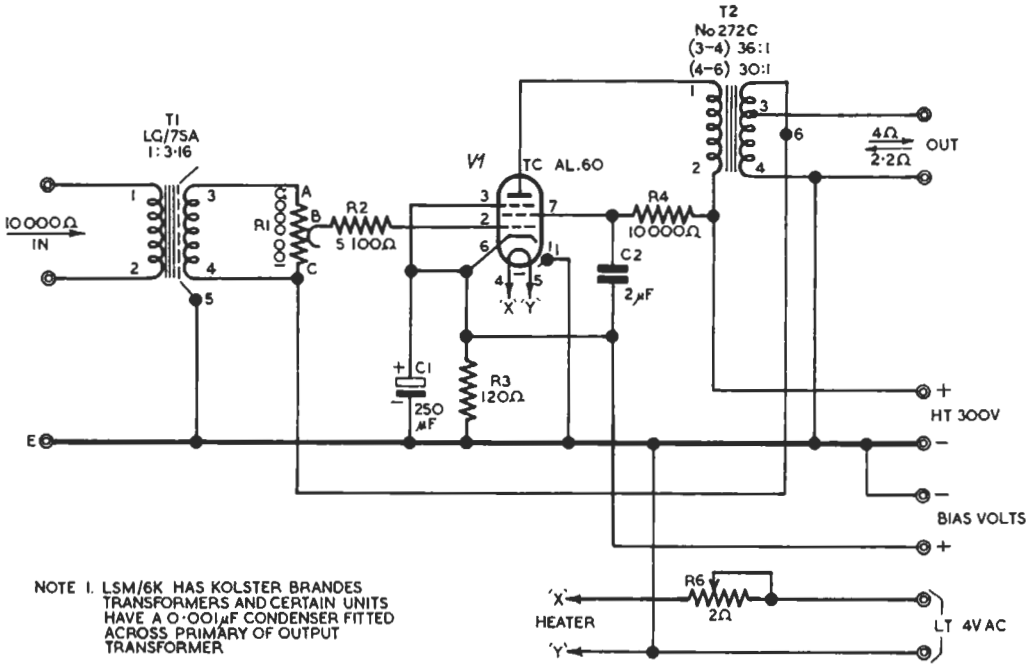
COMP.	LOC.	VALUE	TYPE
C1	E8	50 μF	
C2	G2	2 "	
C3	H5	0·5 "	
C4	O12	6 "	
C5	M12	6 "	
C6	M15	8 "	
C7	M16	8 "	
L1	F4		C.11
L2	N12		F.1
R1	D6	100 000 Ω	
R2	E6	100 000 "	
R3	F5	20 000 "	
R4	F8	350 "	
R5	F1	20 000 "	
R6	J7	0·1MΩ	
R7	J6	0·1 "	
R8	K5	5000 Ω	
R9	K7	5000 "	
R10	L8	100 "	
R11	L4	100 "	
R12	M16	600 "	
R13	M15	600 "	
T1		1 : 3·31	No45
T2		1 : 1·55	No221
T3		22·6 : 1	No188
T4	K11		

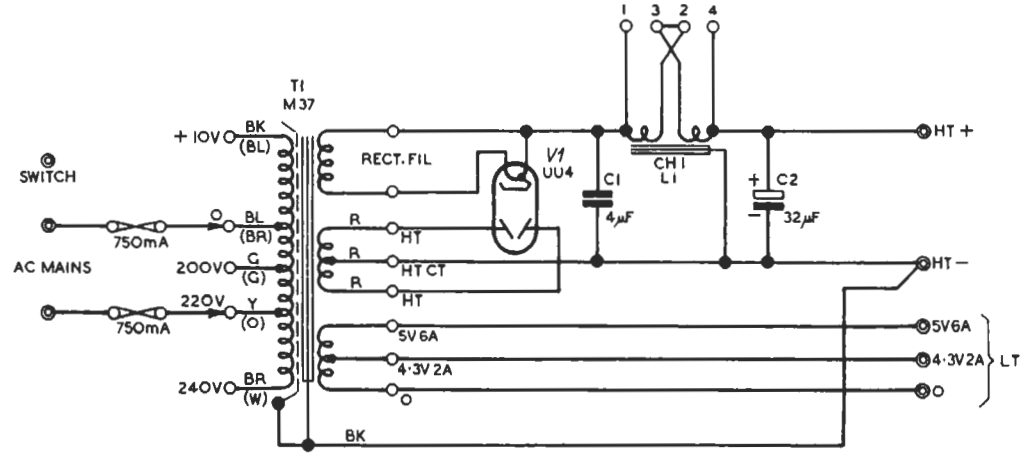
MAINS-OPERATED LOUDSPEAKER AMPLIFIER LSM/2



COMP	LOC.	VALUE	TYPE	COMP	LOC.	VALUE	TYPE
C1	B4	1 μF		R4	C4	1750 Ω	
C2	C2	2 "		R5	C2	10 000 "	
C3	E3	1 "		R6	E3	0·1 MΩ	
C4	F3	1 "		R7	E4	0·1 "	
C5	J7	7 "		R8	E4	0·1 "	
C6	K7	7 "		R9	F4	0·1 "	
				R10	J6	600 Ω	
				R11	J7	940 "	
L1	K6		D14	R12	G4	3260 "	
L2	K7		D17	R13	H4	72 "	
L3	K8		"	R14	J4	356 "	
R1	B3	50 000 Ω		T1	A3	1 : 5·52	No60
R2	B4	0·1 MΩ		T2	D3	1 : 4	No128A
R3	B4	1000 Ω		T3	K3	24·6 : 1	No129

MAINS-OPERATED LOUDSPEAKER AMPLIFIER LSM/3





NOTE 2. FOR MUE/1K
1. 2 AMP FUSES ARE FITTED.
2. TRANSFORMERS & CHOKE REF. DO NOT APPLY
3. WIRE COLOURS ON PRIMARY OF TRANSFORMER AS SHOWN IN BRACKETS
4. SERIES OR PARALLEL TERMINALS ON CHOKE NOT FITTED

LS AMPLIFIER LSM/6 & MAINS UNIT MUE/1