SECTION 15

TRAP VALVE AMPLIFIERS TV/17 TO TV/21

Introduction

The function of a trap valve amplifier is to enable a given programme to be distributed to a number of selected points in such a way that a fault occurring on one distribution circuit will not affect the programme on the remaining circuits. In many cases a trap valve amplifier comprises two or more trap valves having a common input and independent outputs.

The input impedance of a trap valve amplifier is conditioned by the source impedance to which it is connected and the number of such amplifiers likely to be connected to that source. Similarly, the output impedance is conditioned by the maximum variation in load likely to be placed across it. Thus for feeding a number of Post Office lines with a given programme, a separate output is required for each line, hence a large number of trap valves may be used, each having a high input impedance and a 600-ohm output impedance. For distribution of programme to house-phone circuits, which involves the feeding of a given programme to a large and varying number of high impedance circuits, the input impedance is usually matched to the source impedance, while the output impedance is made very low to accommodate the maximum required load without affecting level conditions.

Its normal function is that of a low-gain amplifier for feeding a number of Post Office lines, but it can also be used as a medium-gain level-raising or D amplifier. The condition under which it works is determined by the setting of a two-way input switch controlling an attenuator network. With the input switch in the *Amplifier* position, the unit functions as a distribution or C amplifier having an input impedance of 3,300 ohms and a gain of 6 dB. With the switch in the *Line* position, it functions as a level raiser having an input impedance of 530 ohms and a gain of 28·5 dB.

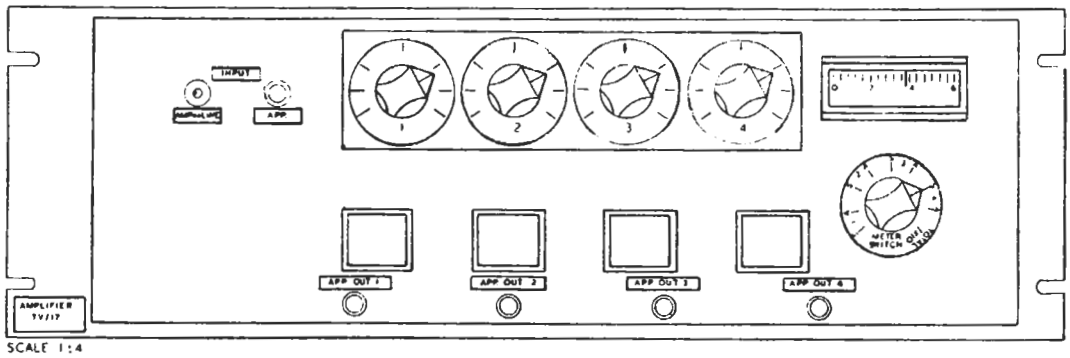


Fig. 15.1 Face Panel TV/17

The unit comprises four trap valves having a common input, each valve feeding a separate output transformer, designed for an output impedance of 600 ohms. The TV/17 is therefore capable of performing the same function as four C amplifiers.

The programme input and output circuits are connected through a 12-pin plug and socket, the details of which are shown on the circuit diagram.

Trap Valve Amplifier TV/17

The Trap Valve Amplifier TV/17 was designed as a dual-purpose amplifier for use in emergency control rooms.

Circuit Description (Fig. 35)

The circuit comprises an input transformer feeding into the paralleled grids of four pentodes, Type AC/SP3B, the output of each pentode being fed to a separate output transformer. The input transformer is preceded by a resistance network which can be connected in two ways according to the position of the input switch. With the switch in the *Amplifier* position, a 1,500-ohm resistor is inserted in each leg of the transformer primary, the latter being shunted by a 600-ohm resistor,

R2. The input impedance under these conditions is 3,300 ohms.

In the *Line* position of the input switch, the primary is shunted by the whole of the resistance network in series. The secondary winding is shunted by a 300,000-ohm resistor, R4, and four gain controls each of 300,000 ohms. The transformer impedance ratio is 1 : 100. The input impedance is therefore equal to $\frac{60{,}000}{100}$ ohms in parallel with 3,300 ohms, that is 530 ohms approximately. A gain-control switch is connected in the grid circuit of each valve which, when the amplifier is used as a trap valve for programme distribution, is normally adjusted so that the output level is + 4 dB. The primary of each output transformer is connected in the anode circuit of the valve, the secondary winding being built out to an impedance of 600 ohms by the insertion of a 200-ohm resistor, R18, R19, in each leg.

The cathode return circuit is taken through an additional winding on the output transformer by means of which 20·2 dB negative voltage feedback is applied in series with the grid-cathode circuit.

An edgewise-type feed-meter is provided with each unit, together with a multi-point rotary switch by means of which anode and screen grid currents for each stage can be obtained.

Power Supplies

Power supplies are taken from a mains unit, type MU/8A or type MU/16. Where the type MU/8A is used, two TV/17 amplifiers are fed from each mains unit.

Valve Data

Valve	*Anode Current* mA	*Screen Current* mA	*Fil. Volts*	*Fil. Amps.*
AC/SP3B RH	4·5	1·7	4	1

Total feed for four stages, 24·8 mA.
H.T. Supply, 250 or 300 V.
L.T. Supply, 4 V a.c.

General Data

Volume Control (4)
Type, Morganite Stackpole MNAP 30450.
Resistance, 300,000 Ω.
Meter. Elliott Edgewise. Specification No. ED 1456.
Meter Switch. Yaxley Type A, 2-bank, 9-position.
Impedances

Input Amp. Position	Z = 3,300 Ω
,, Line ,,	Z = 530 Ω
Output	Z = 600 Ω
Normal Load Line	100-2,000 Ω

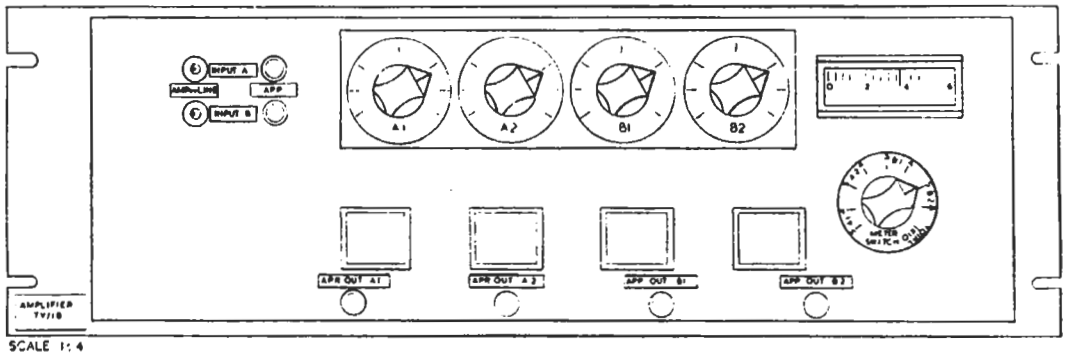


Fig. 15.2 Face Panel TV/18

Normal Working Levels

	Amplifier	*Line*
Input	+ 4 dB	− 24 to +4 dB.
Output	+ 4 dB	+ 4 dB.

Test Data

600-Ω *Test Gain*
Test Conditions :
Volume control set at maximum gain.
Tone Source Sending Level.
Amplifier − 1·5 dB.
Line − 24·5 dB.
Gain at 1,000 c/s.

Amplifier G = 10·5 dB.
Line G = 26·5 dB.
Gain at 50-10,000 c/s G = + 1 dB relative to gain at 1,000 c/s.

Maximum Working Voltage Gain
Test Conditions :
Output loaded with 600 Ω and output level at + 4 dB.

		Amplifier	*Line*
Gain at 1,000 c/s	G =	6 dB	26·5 dB

Total Percentage Harmonic Content

	8 dB above normal level
100 c/s	< 1·0
1,000 c/s	< 1·0

Trap Valve Amplifier TV/18 (Fig. 36)

This unit is similar to the TV/17, except that it is provided with two inputs each of which is coupled to two output stages. The TV/18, therefore, comprises two separate amplifiers, mounted on a single chassis.

The two inputs are referred to as Input A and Input B, and the outputs as A1, A2; B1, B2. The secondary of the input transformer in this case is loaded with two volume controls only, hence to obtain an input impedance similar to that of the TV/17, the shunt resistance (R4) is 100,000 ohms.

In all other respects the electrical design is similar to and the unit functions in the same way as a TV/17 amplifier, but, because of its two inputs, it can be used for two programmes simultaneously, each programme being distributed to two lines or other destinations.

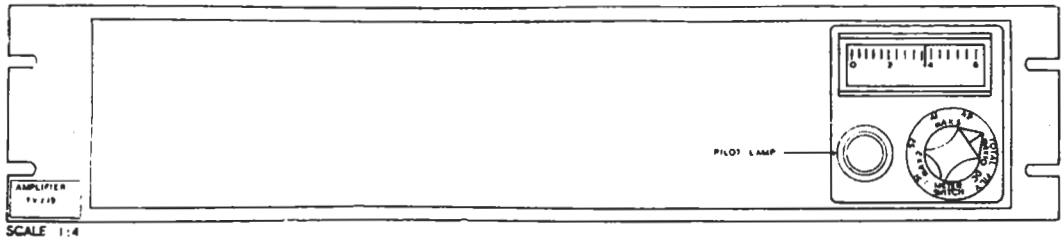


Fig. 15.3 Face Panel TV/19

The amplifier is used extensively at Broadcasting House, London. The Valve, General and Test Data are identical to the Data given for TV/17.

Trap Valve Amplifier TV/19

The Trap Valve Amplifier TV/19 was designed for the distribution of programme to multipled house-phone circuits and is used for this purpose at Broadcasting House, London.

It comprises a single push-pull stage using pentodes Type AC/SP3B. The gain of the amplifier is pre-set at zero, + 2 or + 4 dB, according to the conditions under which it is required to work.

Circuit Description (Fig. 37)

The input transformer secondary winding is fed in push-pull to the grids of the two pentodes. The winding is centre-tapped, each half being shunted by three resistors in series, from which tappings are taken to provide the pre-set gain adjustment.

The anodes of V1, V2 are connected to the h.t. supply through the split primary of the output transformer, T2. An additional centre-tapped winding on T2 provides 14-dB voltage feedback in series with the cathode circuits of the two valves. A variable resistor (R5) is included in the screen-grid circuit of V2, the purpose of which is to balance the anode feeds.

Meter Circuits

An edgewise meter mounted on the face panel can be switched across shunts to obtain individual anode and screen currents, total feed, or filament volts (d.c.).

Valve Data

Valve	*Anode Current mA*	*Screen Current mA*	*Fil. Volts*	*Fil. Amps.*
AC/SP3B RH	10·0	4·5	4	1

Total feed, 29 mA.

H.T. Supply, 300 or 250 V.
L.T. Supply, 4 V a.c. or 6 V d.c.

General Data

Adjust Feed Control
Type, Morganite Stackpole MNAP 10350.
Resistance, 10,000 Ω.

Meter. Elliott Edgewise. Specification No. E.D. 1456.
Meter Switch. Yaxley Type A, 2-bank, 9-position.
Impedances

Input	$Z = 50{,}000\ \Omega$
Output	$Z = 5\ \Omega$
Normal Load	$Z = 12\ \Omega$

Normal Working Levels

Input	0 dB.
Output	0 to + 4 dB.

Test Data

600-Ω *Test Gain*

Test Conditions :
Volume control set at maximum gain.
Tone Source Sending Level, − 9 dB.
Gain at 1,000 c/s, G = 13 dB.
Gain at 50-10,000 c/s, G = ± 0·3 dB relative to gain at 1,000 c/s.

Maximum Working Voltage Gain

Test Conditions :
Output loaded with 12 Ω and output level at + 4 dB.
Gain at 1,000 c/s G = 4 dB.

Total Percentage Harmonic Content

	Normal level	*8 dB above normal level*
100 c/s	< 0·7	< 1·3
1,000 c/s	< 0·4	< 1·0

Trap Valve Amplifier TV/20

The Trap Valve Amplifier TV/20 was designed as a programme distribution amplifier and comprises two separate amplifiers on one mounting, each having two separate outputs, so that each half of the unit is capable of feeding one programme to two Post Office lines. Each output is normally adjusted to deliver a level to line of + 4 dB by means of a variable gain control.

Circuit Description (Fig. 38)

The two sections of the TV/20 unit are referred to as A and B, the outputs being designated A1, A2; B1, B2. Since the two sections are identical, only one will be described.

The secondary of the input transformer is coupled to the grids of two single amplifying valves, AC/SP3, a volume control being included in the grid circuit of each valve. 18-dB negative current feedback is obtained from the voltage developed across R6, R7, and is applied through C2. The amount of feedback is designed to give the amplifier an overall gain of 10 dB with the volume control in the maximum position.

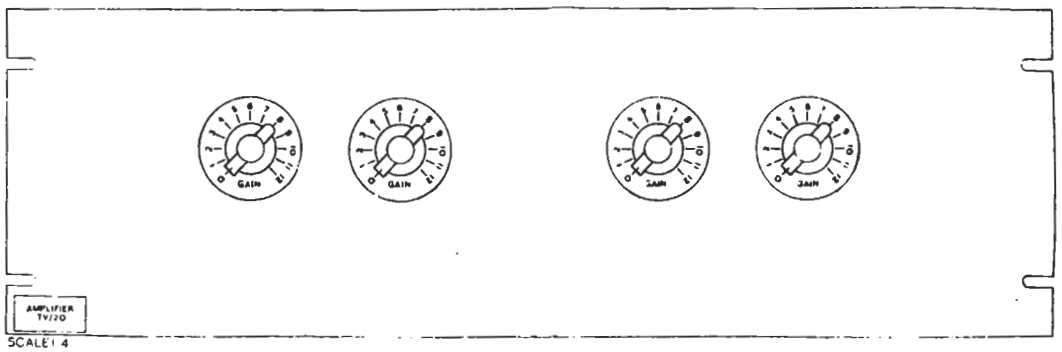


Fig. 15.4 Face Panel TV/20

The TV/20 is not equipped with a feed meter and switch, but a jack is provided in each section of the amplifier for measuring total cathode current.

Where a special portable feed-meter is not available, an Avometer should be used. It should be remembered that the reading obtained will represent anode and screen currents for two valves in each case. This test is carried out by means of a single-ended cord, the blue lead (ring) of which should be connected to common negative and the white lead (tip) to the + connection on the meter. In the case of an Avominor, the white lead should be connected to the 25-mA socket, the reading being taken from the centre scale and divided by 2.

Valve Data

Valve	Anode Current mA	Screen Current mA	Fil. Volts	Fil. Amps.
AC/SP3B RH	9	3·5	4	1
Total per Section	18	7·0		

H.T. Supply 300 V.
L.T. Supply 4 V a.c. or 6 V d.c.

General Data

Volume Control
Type, Morganite Stackpole MNAP 20450.
Resistance, 200,000 Ω.

Impedances
Input Z = 8,500 Ω
Output Z = 580 Ω
Normal Load Z = 600 Ω

Normal Working Levels
Input 0 or + 4 dB.
Output + 4 dB or + 10 dB.

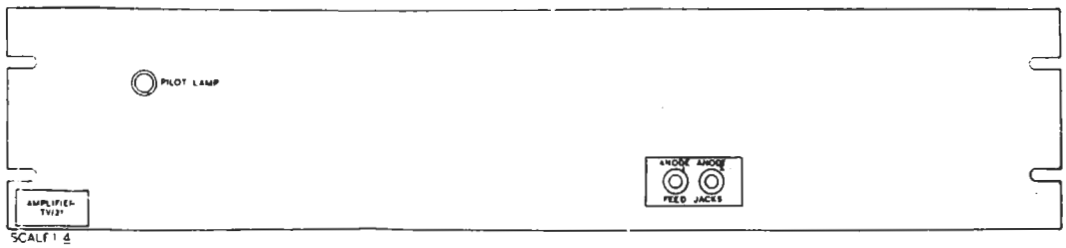


Fig. 15.5 Face Panel TV/21

Test Data

600-Ω *Test Gain*
Test Conditions :
Volume control set at maximum gain,
Tone Source Sending Level − 8 dB.
Gain at 1,000 c/s, G = 17·5 dB.
Gain at 50-10,000 c/s, G = ± 0·5 dB relative to gain at 1,000 c/s.

Maximum Working Voltage Gain
Test Conditions :
Output loaded with 600 Ω and output level at + 4 dB.
Gain at 1,000 c/s, G = 12 dB.

Total Percentage Harmonic Content

	Normal level (+ 10 dB)	8 dB above normal level
100 c/s	< 1·26	< 2·4
1,000 c/s	< 0·5	< 1·3

Trap Valve Amplifier TV/21

The Trap Valve Amplifier TV/21 was designed for feeding ring-main systems, comprising house-phone, loudspeaker and recording-room circuits. It normally works from zero level and delivers nominal output level of zero or + 4 dB, the gain being pre-set according to which output level is required. The input impedance is 1,200 ohms, hence, in order to maintain a terminating impedance of 600 ohms, two TV/21 amplifiers are normally tied to a 600-ohm source. In the event of an amplifier being connected independently to a 600-ohm source, the input should be loaded with a resistance of 1,200 ohms.

Circuit Description (Fig. 39)

The circuit comprises a single push-pull stage using pentode valves, Type AC/SP3B. The input transformer has an impedance ratio of 1 : 100, each half of the split secondary winding being loaded with 50,000-ohms resistance (R2, R3) which gives a theoretical input impedance of 1,000 ohms. This is increased to 1,200 ohms by the total a.c. resistance of the two secondary windings. Grid stoppers, R17, R18, are fitted in each grid lead, the resistor being mounted inside the grid cap. The two valves are independently biased by resistors R5 and R8, the bias being applied through R7 and R10.

Negative feedback is applied as follows :—

Voltage feedback is tapped off from the potentiometers comprising R11, R12 and R13, R14, and fed to the respective grids through C2, C3. Current feedback, derived from the undecoupled cathode resistors R5, R6 and R8, R9, is fed to the grids through the same path as the voltage feedback via C1. The total feedback obtained is either 22 dB or 26 dB according to the values of R12 and R14. These values are determined on installation according to whether a nominal gain of zero or + 4 dB is required. For zero level the value is 13,000 ohms and for + 4 dB 6,000 ohms.

The anodes of the valves are connected direct

to a split-primary output transformer, T2, which has a very low output impedance. The amplifier has no permanent metering facilities. A feed jack has, however, been inserted in the positive h.t. supply lead to each anode. In the absence of a special feed-meter, feeds should be taken by means of an Avometer, as indicated in the instruction on TV/20.

Valve Data

	Anode Current	*Screen Current*	*Fil. Volts*	*Fil. Amps.*
Valve	*mA*	*mA*		
AB'SP3B RH (2)	13	4·5	4	1

H.T. Supply, 300 V.
L.T. Supply, 4 V a.c.

General Data

Impedances

Input	Z = 1,200	Ω
Output	Z = 5·3	Ω
Normal Load	Z = 10	Ω

Normal Working Levels

Input	0 dB.
Output	+ 4 dB into 10 ohms.

Test Data

600-Ω *Test Gain*

Test Conditions :
Tone Source Sending Level, − 2·5 dB.
Gain at 1,000 c/s, G = 10 dB.
Gain at 50-10,000 c/s, G = ± 0·2 relative to gain at 1,000 c/s.

Maximum Working Voltage Gain

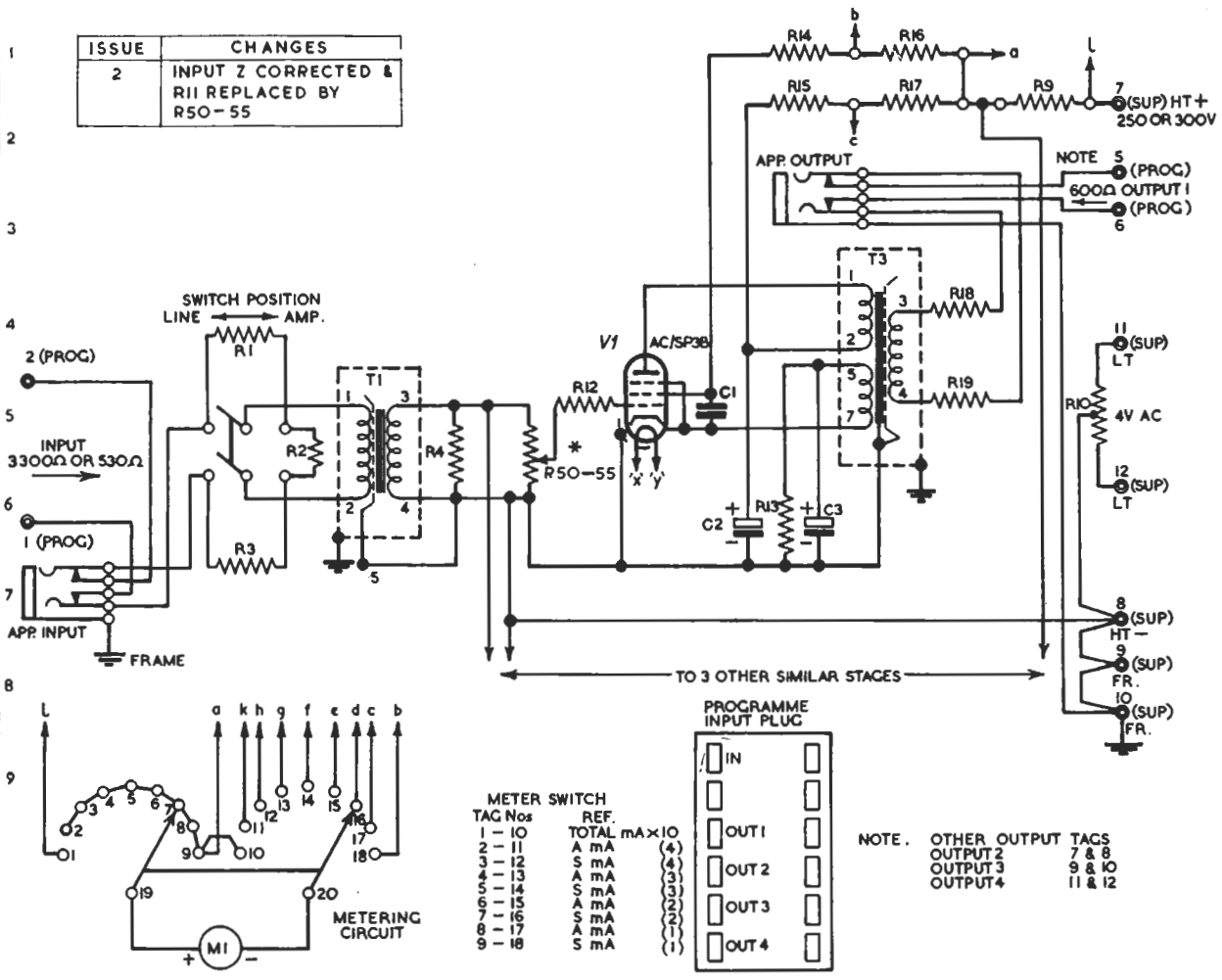
Test Conditions :
Output loaded with 10 Ω and output level at + 4 dB.
Gain at 1,000 c/s, G = 4 dB.

Total Percentage Harmonic Content

	Normal level (+ 4 dB)	*8 dB above normal level*
100 c/s	< 0·2	< 1·0
1,000 c/s	< 0·2	< 0·5
1,000 c/s at 12 dB above normal level		10

FIG.35 S3
2ND ISSUE

ISSUE	CHANGES
2	INPUT Z CORRECTED & RII REPLACED BY R50-55



TAG Nos	REF. TOTAL mA×10	
1 – 10	A mA	(4)
2 – 11	S mA	(4)
3 – 12	A mA	(3)
4 – 13	S mA	(3)
5 – 14	A mA	(2)
6 – 15	S mA	(2)
7 – 16	A mA	(1)
8 – 17	S mA	(1)
9 – 18	S mA	(1)

NOTE. OTHER OUTPUT TAGS
OUTPUT 2 7 & 8
OUTPUT 3 9 & 10
OUTPUT 4 11 & 12

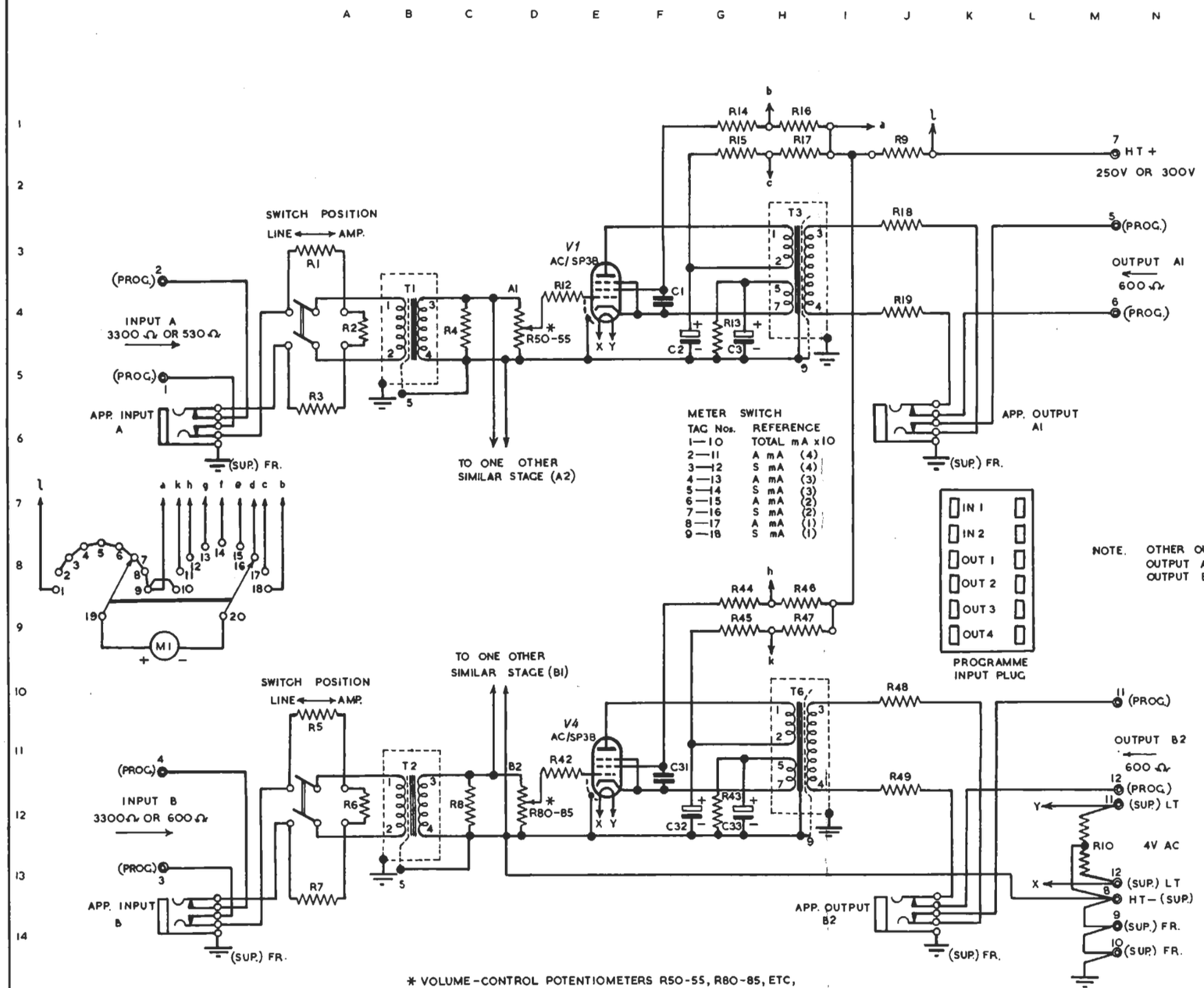
* VOLUME-CONTROL POTENTIOMETERS R50-55 ETC CAN BE SWITCHED FOR OUTPUT LEVELS OF +6, +4, +2, 0, −2 & −4db OR TO 'OFF'

COMP	LOC	VALUES	TYPE	COMP	LOC	VALUES	TYPE
C1	G5	2μF	78	R15	H2	10 000Ω	0·25 WATT
C2	G6	16 "	MAI4556	R16	I1	33·3 "	
C3	H6	250 "	MAI0154	R17	I2	33·3 "	
				R18	J4	200 "	0·25 WATT
				R19	J5	200 "	" "
R1	B4	1500Ω	0·25 WATT	R50	E5	62 000Ω ±5%	0·125 WATT
R2	C5	600 "	" "	R51	E5	47 000 " "	" "
R3	B7	1500 "	" "	R52	E5	39 000 " "	" "
R4	D5	300 000Ω	" "	R53	E5	30 000 " "	" "
R9	K2	2·56Ω		R54	E6	24 000 " "	" "
R10	K5	10+10 "		R55	E6	100 000 " "	" "
R12	F5	5000 "	0·25 WATT				
R13	H6	250 "	" "	T1	C5	1:10	LG/8SA
R14	H1	100 000Ω	" "	T3	I4	8·05:1	AL/6RA

TRAP VALVE AMPLIFIER TV/17

FIG 36 S3

ISSUE	CHANGES
2	INPUT Z CORRECTED & R11, R41 REPLACED BY R50-55, R80-85



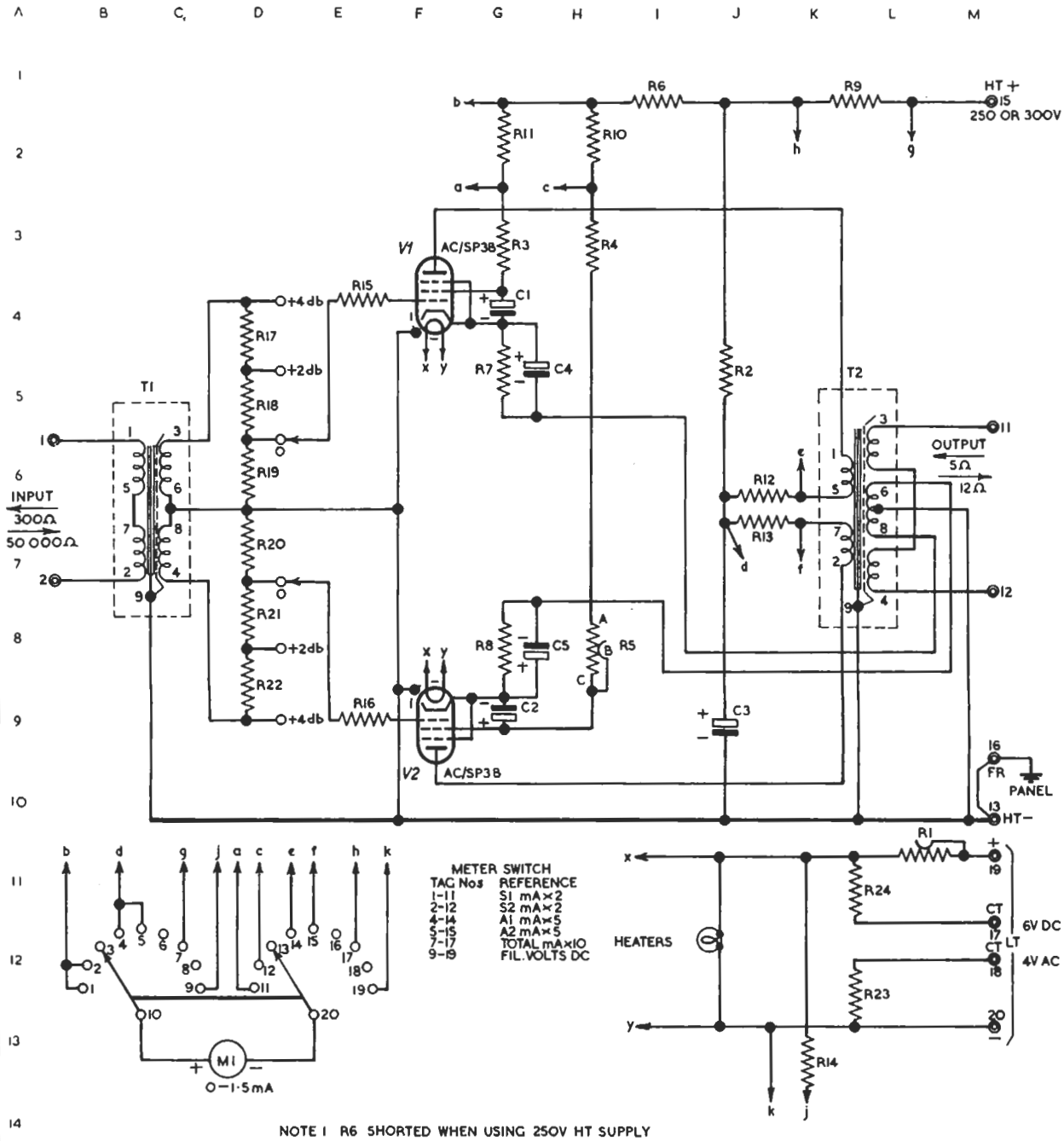
NOTE. OTHER OUTPUT TAGS
OUTPUT A 2,7 & 8
OUTPUT B 1,9 & 10

COMP.	LOC.	VALUE	TYPE
C1	F4	2 μF	TCC TYPE 87
C2	F5	16 "	BEC MA 14556
C3	G5	250 "	BEC MA 10154
C31	F11	2 "	TCC TYPE 87
C32	F12	16 "	BEC MA 14556
C33	G12	250 "	BEC MA 10154
R1	A3	1500 Ω	0·25 WATT
R2	A4	600 "	" "
R3	A6	1500 "	" "
R4	C4	100 000 "	" "
R5	A10	2 000 "	" "
R6	A12	600 "	" "
R7	A13	2 000 "	" "
R8	C12	100 000 "	" "
R9	J2	2·56 "	
R10	M13	10 + 10 "	
R12	E4	5 000 "	0·25 WATT
R13	G4	250 "	" "
R14	G1	100 000 "	0·5 "
R15	G2	10 000 "	" "
R16,17	H1,2	33·3 "	
R18,19	J3,4	200 "	0·25 "
R42	D11	5 000 "	0·25 "
R43	G12	250 "	" "
R44	G9	100 000 "	0·5 "
R45	G9	10 000 "	" "
R46,47	H8 H9	33·3 "	
R48,49	J10, J12	200 "	0·25 "
T1	B4	1 : 10	LG/8SA
T2	B12	1 : 10	LG/8SA
T3	H3	8·05 : 1	AL/6RA
T6	H11	8·05 : 1	AL/6RA
R50,80	D4, D11	62 000 Ω ± 5%	0·125 WATT
R51, 81	D4, D11	47 000 " "	" "
R52,82	D4, D12	39 000 " "	" "
R53,83	D5, D12	30 000 " "	" "
R54,84	D5, D13	24 000 " "	" "
R55,85	D5, D13	100 000 " "	" "

* VOLUME-CONTROL POTENTIOMETERS R50-55, R80-85, ETC, CAN BE SWITCHED FOR OUTPUT LEVELS OF +6, +4, +2, 0, −2 & −4 db OR TO 'OFF'

TRAP VALVE AMPLIFIER TV/18

FIG.37 S3

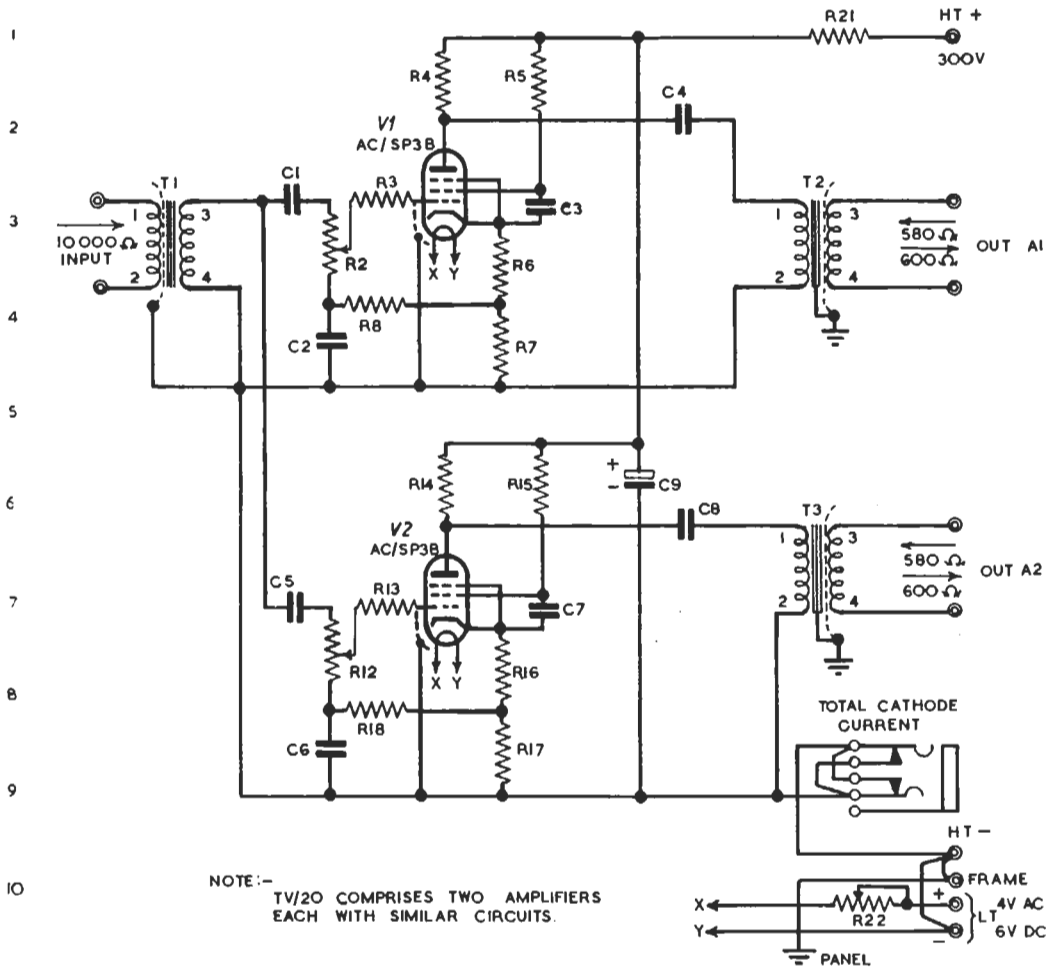


NOTE 1 R6 SHORTED WHEN USING 250V HT SUPPLY

2 WHEN LT SUPPLY IS AC TERMINALS 13 & 17 AND 17 & 18 ARE TO BE STRAPPED R1 TO BE SHORTED BY ADJUSTING SLIDER

COMP.	LOC.	VALUES	TYPE	COMP.	LOC.	VALUES	TYPE	COMP.	LOC.	VALUES	TYPE
C1,2,3	G4,9,J9	16 µF	MA14556	R6	I1	5000Ω	1·0 WATT	R18	D5	50 000Ω	0·25 WATT
C4,5	G5,8	250 "	MA14580	R7,8	G5,8	150 "	·5 "	R19,20	D6,7	210 000 "	" "
				R9	K1	2·56 "		R21	D8	50 000 "	" "
				R10,11	H2,G2	14·3 "		R22	D9	70 000 "	" "
R1	L11	2Ω		R12	J6	5·26 "		R23,24	K12,11	10 "	
R2	J5	2000 "		R13	J6	5·26 "					
R3	G3	20 000 "	1·0 WATT	R14	J13	3900 "					
R4	H3	15000 "	" "	R15,16	E4,9	5000 "	0·25 "	T1	C6	1:3·63	LCC/7R8
R5	H8	10000 "		R17	D4	70000 "	" "	T2	L6	64·8:1	ALL/9RA

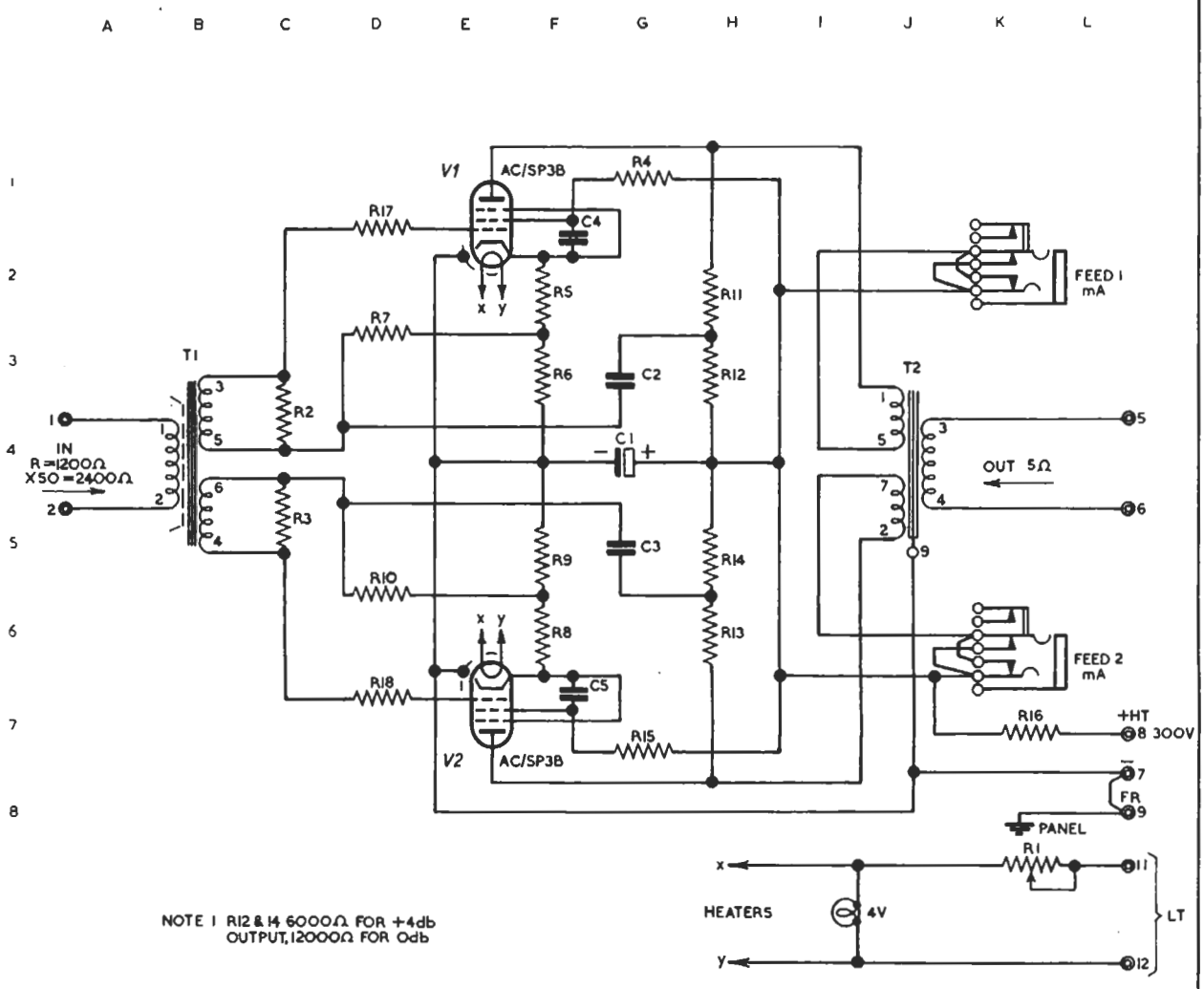
TRAP VALVE AMPLIFIER TV/19



COMP.	LOC.	VALUE	TYPE	COMP.	LOC.	VALUE	TYPE	COMP.	LOC.	VALUE	TYPE
C1	B3	0·2 µF	TCC TYPE 431	R2	C3	200 000 Ω		R16	E8	250 Ω	0 5 W
C2	C4	0·5 "	" " 87	R3	C3	5 000 "	0·25 W	R17	E9	1300 "	0·5 "
C3	E3	2 "	" " "	R4	D2	20 000 "	3 "	R18	C8	100 000 "	0·25 "
C4	F2	0·5 "	" " "	R5	E2	30 000 "	1 "	R21	H1	1 000 "	1 "
C5	B7	0·2 "	" " 431	R6	D3	250 "	0·5 "	R22	H10	2 "	
C6	C9	0·5 "	" " 87	R7	D4	1300 "	0·5 "	T1	A3	1:3·16	LG/7SG OR
C7	E7	2 "	" " "	R8	C4	100 000 "	0·25 "				LG/16RD
C8	F6	0·5 "	" " "	R12	C8	200000 "		T2	H3	5·9 : 1	No 271C OR
C9	F6	16 "	TYPE BEC MA 14556	R13	C7	5 000 "	0·25 "				AL/20RD
				R14	D6	20 000 "	3 "	T3	H7	5·9 1	No 271C OR
				R15	E6	30 000 "	1 "				AL/20RD

TRAP VALVE AMPLIFIER TV/20

FIG.39 S3
2ND ISSUE



NOTE 1 R12 & 14 6000Ω FOR +4db
OUTPUT, 12000Ω FOR 0db

COMP.	LOC.	VALUES	TYPE	COMP.	LOC.	VALUES	TYPE
C1	G4	16 μF	BEC MA1S129	R9	F5	240 Ω	0·25W OR ·5W
C2,3	G3,5	0·1 "	TCC 431	R10	D6	200000 "	0·25W
C4,5	F1, 7	2 "	" 87	R11	H2	110000 "	0·25W OR ·5W
				R12	H3	SEE NOTE	" " "
				R13	H6	110000Ω	" " "
R1	L8	2Ω	PAINTON 3B1	R14	H5	SEE NOTE	" " "
R2,3	C4,5	50000 "	0·25W	R15	G7	20000Ω	·5W
R4	G1	20000 "	·5W	R16	K7	1000 "	1W
R5	F2	170 "	0·25W OR ·5W	R17,18	D1,7	5000 "	0·25W
R6	F3	240 "	" " "				
R7	D3	200000 "	0·25W	T1	B4	1:10 OVERALL	LGG/135A
R8	F6	170 "	0·25W OR ·5W	T2	J4	70·7:1	AAL/11RD

TRAP VALVE AMPLIFIER TV/21