SECTION 25

PAMPHONIC PUBLIC-ADDRESS EQUIPMENT

Introduction

Pamphonic public-address equipment commonly used within the Corporation comprises 30- and 50-watt amplifiers and line-source loudspeakers. Information on these items is given here. A few 10-watt amplifiers are also in use. This type is described in Instruction RX.2. (See page 52 and Fig. 4.)

General Description

The Pamphonic amplifiers, Type 601V (30 watts) and Type 602V (50 watts), are transportable loudspeaker amplifiers of commercial design and manufacture. They are used by the BBC for calling systems and for sound reinforcement in auditoria. For the latter purpose, they are generally used respectively to feed up to six or up to ten Pamphonic 6-ft line source loudspeakers Type 780.

The circuit of the 30-watt amplifier is given in Fig. 60 and that of the 50-watt amplifier in Fig. 61. The two circuits are similar except for the output stage and the h.t. rectifier.

Both types of amplifier are mains-operated, and have a (normally) 30-ohm microphone input and an input for gramophone or radio at two levels. Separate volume controls allow mixing at any level. A visual indication of level and overloading is provided and there are separate bass and treble controls for tone balance. In some of the early amplifiers the microphone-input transformer has been changed to give a 300-ohm input.

A socket is provided to take a plug-in relay for remote-control purposes if required. The relay switches between the microphone input and the gram/radio input, and is energised by a dry battery, for which a compartment is provided; the relay is controlled by a single-pole switch at the remote position. A mains-supply socket for a gramophone is fitted.

Each amplifier in its case measures $18\frac{7}{8}$ in. wide by $11\frac{3}{4}$ in. deep by $13\frac{1}{8}$ in. high. The 30-watt amplifier weighs 45 lb and the 50-watt amplifier 57 lb. Each chassis can be removed from its case and fitted to a 19-in. bay if desired.

Circuit Description (Figs. 60 and 61)

In both amplifiers, the microphone input transformer, T1, is connected to first-stage amplifying valve, V1, which is coupled via gain control P1 and bass and treble controls P3, P4, to the double-triode phase-splitter V3. The low-level input for gramophone or radio goes direct to first-stage amplifying valve V2, the high-level input being taken via potential divider R2, R1. V2 is coupled via gain control P2 to the tone controls, in parallel with the output from V1 via P1.

The two sections of V3 are connected to a driver stage comprising the two sections of another double-triode V4. From this point on the two amplifiers differ in order to provide the output power required. In the 30-watt amplifier (Fig. 60) the output stage comprises two valves, V5, V6, whereas in the 50-watt amplifier this stage has four valves, V5, V6, V7, V8, operating in parallel push-pull pairs. In both amplifiers an output transformer, T2, is fitted, with level indicator V7 in its secondary circuit.

Voltage negative feedback is applied by cathode injection to each section of V4 from the ends of T2 primary winding.

When the remote-control system is used, the pins marked 1, 2, 6, 7 and 8 on the relay engage with corresponding sockets on the amplifier. Pins 1 and 8 connect the battery and remote-control switch to the winding. Pins 6, 7 and 2 pick up the outputs of V1 and V2 and the earth line. With the control switch open, the relay is unoperated, pins 6 and 2 are connected together via the contact-springs, and the microphone input is short-circuited. With the control switch closed, the relay is operated, pins 7 and 2 are connected, and the gram/radio input is short-circuited instead.

Amplifier Type 601V: General Data

Output

30 watts at 100 volts.

Harmonic Distortion

Less than 3 per cent at 1 kc/s.

Sensitivity
Microphone: 440 μV for 30 watts at 1 kc/s.
Radio or gram: 50 or 270 mV for 30 watts at 1 kc/s.

Input Impedance
Microphone: 30 ohms.
Radio or gram: 220 kilohms, either input.

Noise Level
Both volume controls at minimum: better than — 60 dB.
Gram volume control at maximum: better than — 60 dB.
Microphone volume control at maximum: better than — 50 dB.

Frequency Characteristic
Gram: 6-dB bass lift at 100 c/s, substantially flat from 1 kc/s to 15 kc/s.
Microphone: substantially flat from 200 c/s to 10 kc/s.

Valves
2 EF86, 1 ECC83, 1 ECC82, 2 KT66, 1 GZ32, 1 DM70.

Mains Consumption
Full drive: 140 VA.
Quiescent: 120 VA.

Amplifier Type 602V: General Data
As for amplifier Type 601V except as indicated in next column.

Output
50 watts at 100 volts.

Valves
2 EF86, 1 ECC83, 1 ECC82, 4 KT66, 2 GZ32, 1 DM70.

Mains Consumption
Full drive: 284 VA.
Quiescent: 254 VA.

Line Source Loudspeaker Type 780
The Pamphonic line-source loudspeaker Type 780 comprises an acoustically-treated wooden cabinet, 6 ft high, containing two columns of loudspeaker units, eight in one column and five in the other, on an internal wooden baffle board.

The speakers in each column are mounted vertically above one another and are linked internally by specially-designed attenuators so that the resultant sound emerges as a fan-shaped beam without secondary lobes. This beam has a vertical main-beam angle of 37 degrees and a horizontal coverage of approximately 120 degrees at 4 kc/s. The vertical angle is maintained reasonably constant down to 800 c/s.

The maximum power output is 5 watts. The number of loudspeakers used for sound-reinforcement purposes is governed by the field to be covered.

W.G.4/61

PAMPHONIC AMPLIFIER TYPE 661W

Introduction

The Pamphonic amplifier Type 661W is a modern replacement for the Pamphonic amplifier Type 601V, described earlier in this section, although many amplifiers Type 601V remain in service. Minor differences exist between the two types in that the new model has an additional microphone input but does not possess the level indicator and remote control facilities of the older one. In the BBC, the amplifier Type 661W is used for calling and talkback systems, for studio loudspeaker foldback and for sound reinforcement in auditoria.

General Specification

Output

30 watts at 100 volts.

Harmonic Distortion

Less than 2% for 30 watts output at 1 kc/s.

Sensitivity

Microphone:	100 μV for 30 watts output at 1 kc/s.
Gramophone:	200 mV for 30 watts output at 1 kc/s.
Radio or Tape:	250 mV for 30 watts output at 1 kc/s.

Input Impedances

Microphone:	30 ohms (balanced).
Gramophone:	100 kilohm (unbalanced).
Radio or Tape:	250 kilohm (unbalanced).

Noise Level

Better than 55 dB below full output.

Frequency Characteristic

With bass and treble controls set for flat response from 20 c/s to 17 kc/s:	±3 dB with respect to level at 1 kc/s.
Treble control range:	−14 dB to +9 dB at 10 kc/s.
Bass control range:	−10 dB to 0 dB at 100 c/s.

Valves

3 ECC83, 1 ECC81, 2 KT88, 1 GZ34.

Mains Consumption

110 watts.

General Description

The amplifier is a transportable 30-watt loudspeaker amplifier designed to work into a 100-volt line. All stages prior to the output stage utilise a printed wiring board. The output stage together with the mains-power supply is chassis mounted.

One gramophone input, one radio or tape input and two microphone inputs are provided. Each input has an associated gain control which permits variable level mixing. Separate bass and treble controls operate after the mixing stage.

Normally the amplifier is supplied in a case with fitted end-piece stands that are shaped to give the amplifier a slight tilt backwards. The dimensions of the amplifier in its case are 21 in. wide by 11 in. high by 10 in. deep; it weighs 25 lb. However, the chassis may be removed from the case and fitted in a 19-in. bay. In this form, known as Type 661W/RM when supplied by the manufacturer, the vertical panel space required is 7 in.; the other dimensions are unchanged.

Circuit Description (Fig. 70)

Amplifier Type 661W comprises a 30-watt power amplifier preceded by three triode preamplifiers, V1A, V1B, V2B, and one triode mixing stage V2A.

The two low-level microphone input sockets, SKT 1 and SKT 2, are transformer coupled to their respective preamplifiers, V1A and V1B. The gramophone input socket SKT4 is connected by way of gain control RV4 to preamplifier V2B. All three preamplifiers, together with the high-level radio input socket SKT3, are coupled to the grid of the mixing amplifier V2A. Coupling of V1A, V1B and SKT3 is achieved by way of gain controls RV1, RV2 and RV3 and the star mixing network comprising resistors R6, R7 and R9. The output of the gramophone preamplifier is passively equalised to the RIAA replay characteristic by the network consisting of C7, C8, C26, R14 and R15; coupling of the preamplifier to the grid of V2A is completed by the stand-off resistor R13. To provide a low mixing-impedance at the grid of V2A, parallel-applied voltage negative feedback is applied to V2A by C4 and R8.

The mixed output at V2A anode is coupled, by bass and treble control networks, to the grid of triode amplifier V3A and this stage is followed by a phase splitter V3B. Fine balance of the phase splitter is obtained by adjustment of variable cathode resistance RV7.

Outputs, taken from the anode and cathode of V3B, feed push-pull driver stages V4A and V4B and these are followed by a push-pull output stage comprising V5 and V6 which is connected in a class AB_1, ultra-linear mode.

Several feedback circuits have been employed in the output stages to reduce distortion and provide a good output regulation. A resistor, directly connected from the anode of each output valve to the cathode of its preceding stage, provides voltage negative feedback between associated output and driver stages. Current negative feedback is applied to each driver stage by the omission of cathode decoupling components. It should be noted that the output stage feedback resistors R43 and R44 also contribute towards the biasing of the driver stages, owing to their direct connections.

Overall voltage negative feedback is applied from a tertiary winding of the output transformer T3 to the cathode of amplifier stage V3A.

Power-supply requirements are met by a full-wave rectifier circuit consisting of mains transformer T4, rectifier V7 and series connected reservoir capacitors C24 and C27; resistance capacity smoothing is provided by C25 and R53. The potential divider chain R56 and R57 tends to equalise the voltages across the electrolytic smoothing capacitors. A hum-balance control RV6 is connected across the 6·3-volt supply.

The double pole switch SW1, marked as *Stand-by* on the amplifier front panel, breaks simultaneously the amplifier output feed to line and the h.t. rail to all stages except the power output stage. This arrangement provides instant muting, which may be desirable in some public address installations, and also ensures that the output stage is not driven by a signal when it is off-load in the stand-by condition.

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PAMPHONIC AMPLIFIER TYPE 602W

General Description

The Pamphonic Type-602W equipment is a bay-mounting loudspeaker amplifier delivering a maximum output of 50 watts to a 100-volt line. It is mains-operated, and has a high-impedance input circuit. A socket is provided at which the h.t. and heater supplies, together with a 26-volt negative supply, are available for connection to other apparatus. The amplifier is carried on a standard 19-in. panel which is 7 in. high and has an overall depth of 12 in.; when bay-mounted, it projects through the bay.

Circuit Description (Fig. 71)

A circuit diagram of the amplifier is given in Fig. 71. The early stages are built on a printed-wiring board; the output stage and power-supply circuits are of conventional construction.

A gain control precedes the first two stages, formed by cascaded arrangement of a double-triode V1. These work with negative feedback applied via R6 from the second anode to the first cathode. The second-stage cathode resistor is shunted by a small-value capacitor C4, to enhance circuit stability by compensating for phase shifts in the two stages.

The third stage employs a triode-connected pentode V2 as a phase-splitter. The cathode-circuit load includes RV2 to allow accurate matching of the signal voltages taken from anode and cathode to individual sections of another double-triode V3. These feed a push-pull output stage using beam tetrodes V4 and V5.

Negative feedback for the last two stages is provided by connecting the V4 and V5 anodes through C9, R20 and C10, R21, respectively, to the associated V3 cathodes. For phase-shift compensation the grid resistors of the output stage are shunted by series *RC* combinations, C12, R23 and C13, R24. R29 is connected between the V4 and V5 cathodes to improve the stability of output-stage balance, by reducing bias-voltage inequality where different cathode currents flow because the valves are imperfectly matched.

The only unusual feature of the h.t. supply circuit is the use of paired capacitors in series connection to obtain shunt elements capable of withstanding the high voltage, about 530 volts on load. Resistors across the capacitors ensure equal sharing of the working voltage. Tappings on the T2 h.t. winding are used in connection with a metal rectifier producing the 26-volt negative supply for external use. To improve output-voltage regulation the *RC* filtering of this supply is effected with paralleled thermistors instead of a resistor. R35 is used to avoid a no-load condition.

Note that the negative side of the amplifier and its supply circuit is connected to chassis via a low-value resistor (R30), whereas the earth pin of PL2 is directly connected to chassis. Thus the resistor is placed between the mains earth and the programme-earth connection via the PL1 outer contact, so it serves to limit unwanted circulation of hum-producing current in the loop completed via the two earth connections.

General Data

Input impedance	100 kilohms
Sensitivity	200 mV at 100 kilohms
Frequency response	Better than ±1 dB between 30 Hz and 20 kHz
Output	50 watts (at 100 volts)
Harmonic distortion	Less than 2 per cent for 50-watt output at 1 kHz
Noise level	−70 dB with respect to full output
Valves	1 ECC83, 1 EF86, 1 ECC81, 2 KT88, 1 GZ34

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COMPONENT TABLE: FIG. 60

Comp.	Loc.	Type	Tolerance per cent
C1	B5	350V tubular	
C2	B3	25V tubular electrolytic	
C3	B6	25V tubular electrolytic	
C4	C3	350V tubular	
C5	C6	350V tubular	
C6	C2	350V tubular	
C7	C5	350V tubular	
C8	E1	450V electrolytic	
C9	E4	Moldseal	20
C10	E5	Moldseal	20
C11	F5	350V tubular	
C12	H3	350V tubular	
C13	H3	350V tubular	
C14	H1	450V electrolytic	
C15	H1		
C16	H5	350V tubular	
C17	K3	500V tubular	
C18	K5	500V tubular	
C19	L4	50V electrolytic	
C20	L6	50V electrolytic	
C21	N1	400V paper	
LP1	P6	6·3V 0·3A M.E.S.	
LP2	P6	6·3V 0·3A M.E.S.	
P1	C3	Logarithmic	
P2	C5	Logarithmic	
P3	E5	Linear	
P4	E5	Linear	
			20
R1	A6	¼W	20
R2	A6	¼W	20
R3	A6	¼W	10
R4	B1	¼W	10
R5	B4	¼W	

Comp.	Loc.	Type	Tolerance per cent
R6	B5	¼W	10
R7	B3	¼W	10
R8	B6	¼W	10
R9	C1	¼W	20
R10	C4	¼W	20
R11	D3	¼W	20
R12	D6	¼W	20
R13	E6	¼W	20
R14	F1	¼W	20
R15	F5	¼W	20
R16	F6	¼W	20
R17	F5	¼W	20
R18	G2	¼W	5
R19	G2	¼W	5
R20	G5	¼W	10
R21	G6	¼W	10
R22	H5	¼W	20
R23	H1	¼W	20
R24	H6	¼W	20
R25	J2	¼W	5
R26	J2	¼W	5
R27	J5	¼W	5
R28	J5	¼W	5
R29	K6	¼W	20
R30	L1	¼W	20
R31	L3	¼W	5
R32	L4	¼W	5
R33	L5	¼W	5
R34	L6	¼W	5
R35	L3	¼W	20
R36	L5	¼W	20
R37	M3	½W	20
R38	M5	½W	20
R39	M4	¼W	20
R40	O6	¼W	20
R41	O4	¼W	5
R42	O6	1W	5
R43	L7	1W	5
R44	L7	1W	5

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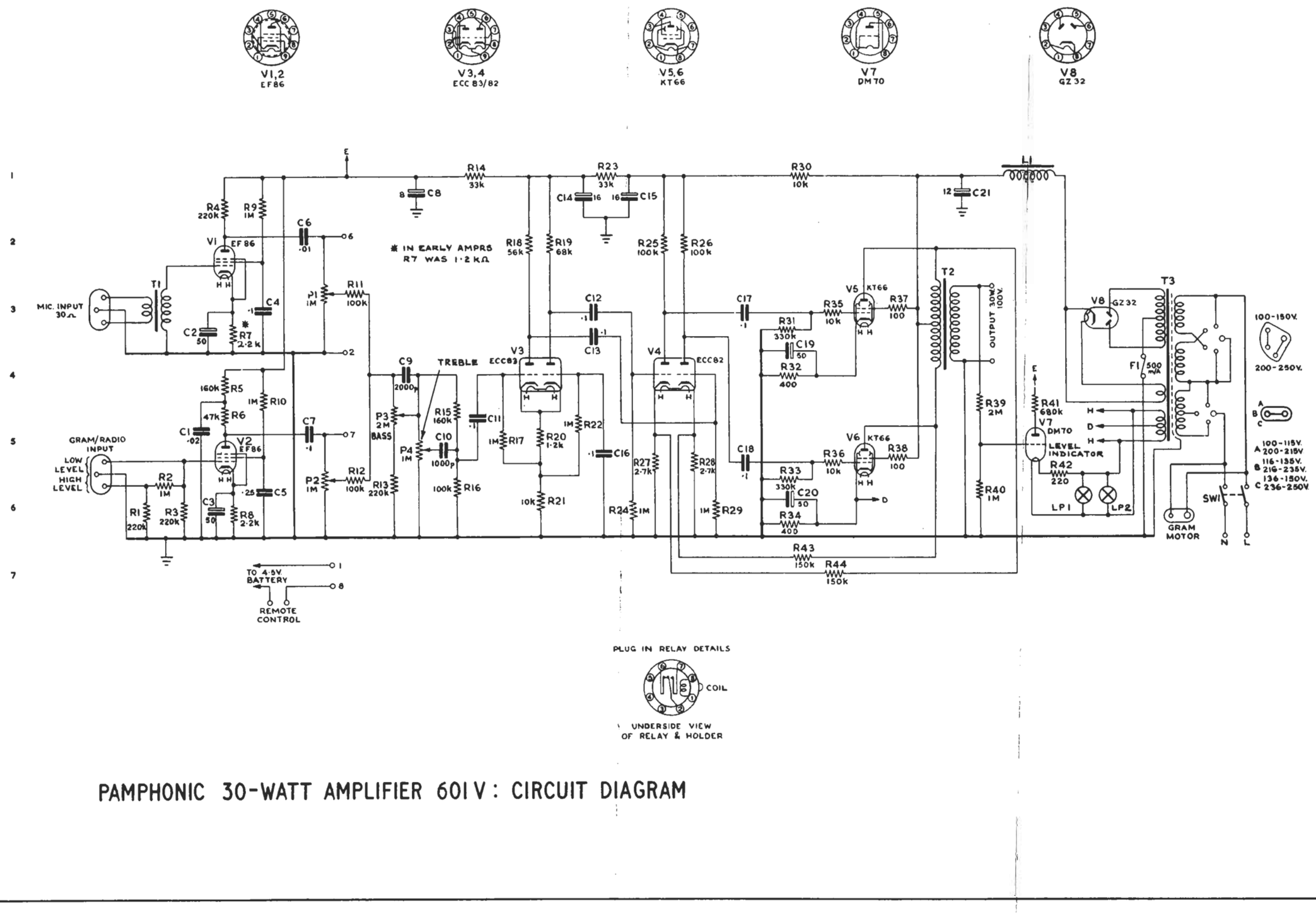
FIG 60



PAMPHONIC 30-WATT AMPLIFIER 601V: CIRCUIT DIAGRAM

COMPONENT TABLE: FIG. 61

Comp.	Loc.	Type	Tolerance per cent
C1	B5	350V tubular	
C2	B3	25V tubular electrolytic	
C3	B6	25V tubular electrolytic	
C4	C3	350V tubular	
C5	C6	350V tubular	
C6	C2	350V tubular	
C7	C5	350V tubular	
C8	E1	450V electrolytic	
C9	E4	Moldseal	20
C10	E5	Moldseal	20
C11	F5	350V tubular	
C12	H3	350V tubular	
C13	H3	350V tubular	
C14	H1	450V electrolytic	
C15	H1		
C16	H5	350V tubular	
C17	L2	500V tubular	
C18	L3	500V tubular	
C19	L4	500V tubular	
C20	L5	500V tubular	
C21	L2	50V electrolytic	
C22	L3		
C23	L5	50V electrolytic	
C24	L6		
C25	O1	400V paper	
LP1	Q6	6·3V 0·3A M.E.S.	
LP2	Q6	6·3V 0·3A M.E.S.	
P1	C3	Logarithmic	
P2	C5	Logarithmic	
P3	E5	Linear	
P4	E5	Linear	
R1	A6	¼W	20
R2	A6	¼W	20
R3	A6	¼W	20
R4	B1	¼W	10
R5	B4	¼W	10
R6	B5	¼W	10
R7	B3	¼W	10
R8	B6	¼W	10

Comp.	Loc.	Type	Tolerance per cent
R9	C1	¼W	20
R10	C4	¼W	20
R11	D3	¼W	20
R12	D6	¼W	20
R13	E6	¼W	20
R14	F1	¼W	20
R15	F5	¼W	20
R16	F6	¼W	20
R17	F5	¼W	20
R18	G2	¼W	5
R19	G2	¼W	5
R20	G5	¼W	10
R21	G6	¼W	10
R22	H5	¼W	20
R23	H1	¼W	20
R24	J6	¼W	20
R25	J2	¼W	5
R26	J2	¼W	5
R27	J5	¼W	5
R28	K5	¼W	5
R29	K6	¼W	20
R30	L1	¼W	20
R31	L2	¼W	5
R32	L3	¼W	5
R33	L4	¼W	5
R34	L5	¼W	5
R35	L3	4W wire-wound	5
R36	L4	4W wire-wound	5
R37	L5	4W wire-wound	5
R38	L6	4W wire-wound	5
R39	M2	¼W	20
R40	M3	¼W	20
R41	M4	¼W	20
R42	M5	¼W	20
R43	N2	½W	20
R44	N3	½W	20
R45	N4	½W	20
R46	N5	½W	20
R47	O4	½W	20
R48	O6	½W	20
R49	P6	1W	5
R50	P5	½W	5
R51	M7	1W	5
R52	M7	1W	5

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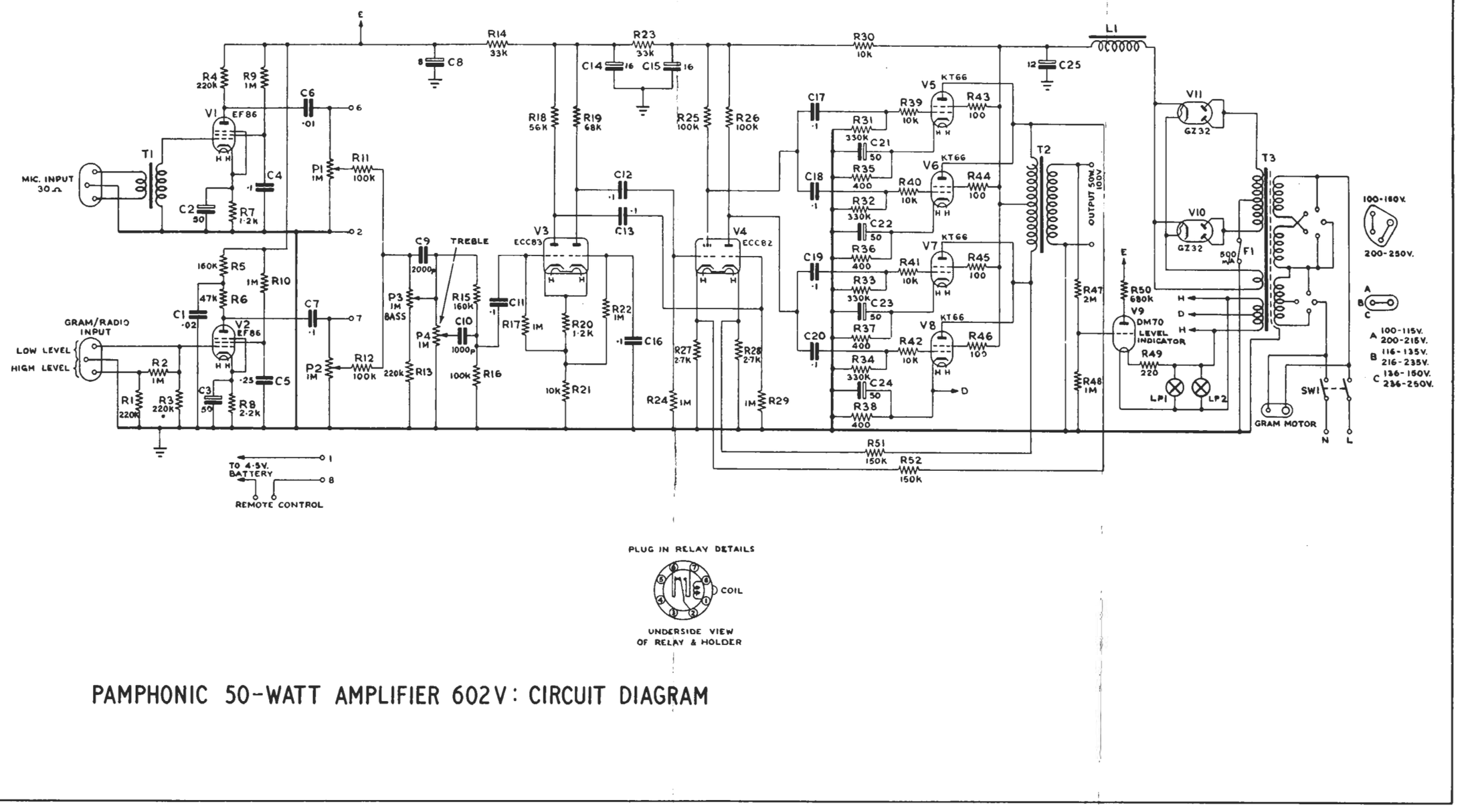
FIG 61



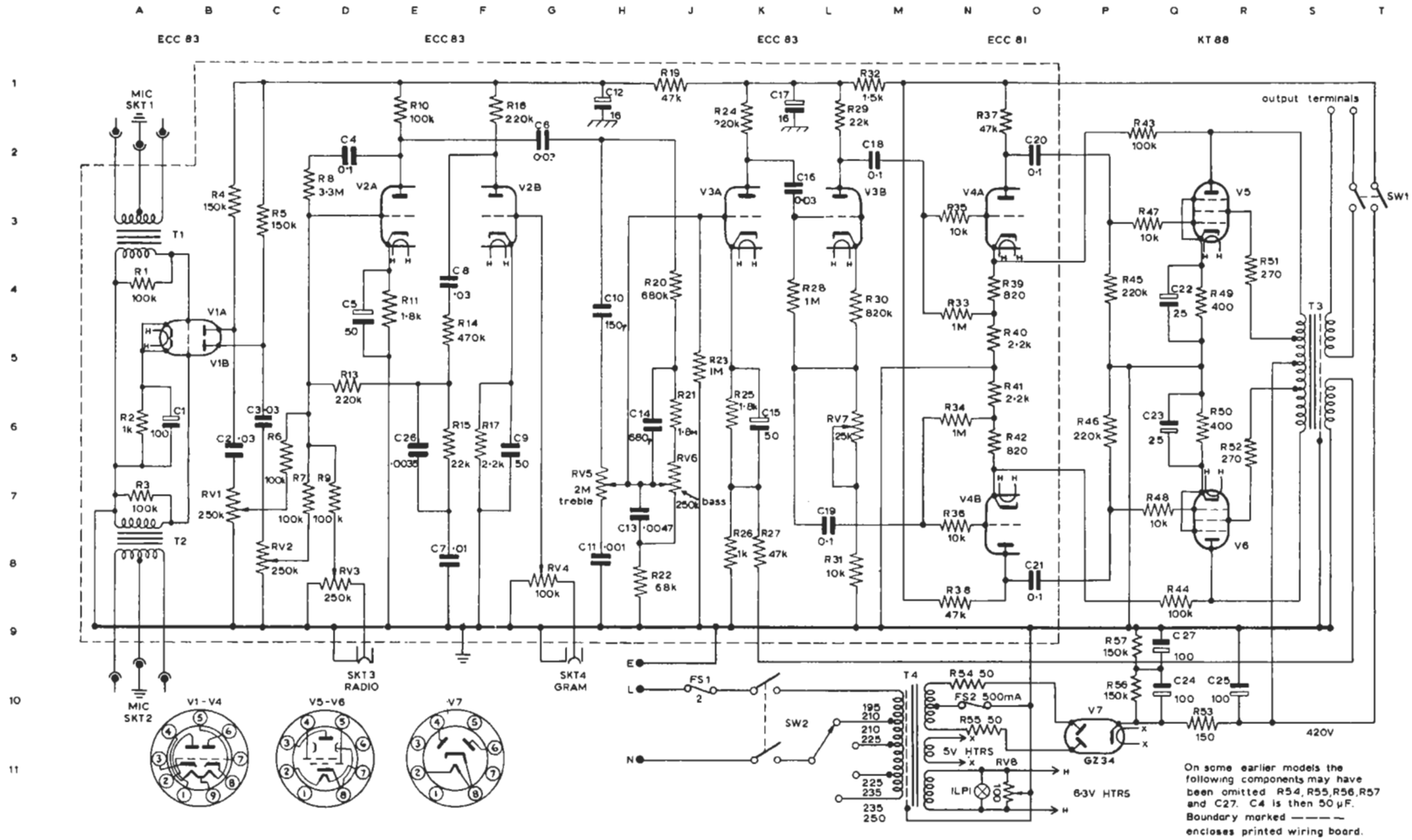
PAMPHONIC 50-WATT AMPLIFIER 602V: CIRCUIT DIAGRAM

COMPONENT TABLE: FIG. 70

Comp.	Loc.	Type	Tolerance per cent
C1	B6	6V electrolytic	
C2	B6	500V ceramic	
C3	C6	500V ceramic	
C4	D2	250V tubular paper	
C5	D4	12V electrolytic	
C6	G2	500V ceramic	
C7	F8	150V electrolytic	
C8	E4	500V ceramic	
C9	F6	12V electrolytic	
C10	H4	silver mica	10
C11	H8	silver mica	10
C12	H1	450V electrolytic	
C13	H7	silver mica	10
C14	H6	silver mica	10
C15	K6	12V electrolytic	
C16	K2	500V ceramic	
C17	K1	450V electrolytic	
C18	M2	450V tubular paper	
C19	L7	450V tubular paper	
C20	O2	450V tubular paper	
C21	O8	450V tubular paper	
C22	Q4	100V electrolytic	
C23	Q6	100V electrolytic	
C24 *	Q10	350V electrolytic	
C25	R10	450V electrolytic	
C26	E6	silver mica	10
C27	Q9	350V electrolytic	
R1	A3	¼W	10
R2	A6	¼W	10
R3	A7	¼W	10
R4	B3	⅛W high stability	10
R5	C3	⅛W high stability	10
R6	C6	¼W	10
R7	C7	¼W	10
R8	C2	¼W	10
R9	D7	¼W	10
R10	E1	¼W	10
R11	E4	¼W	10
R12		no resistor fitted	
R13	D5	¼W	10
R14	F4	¼W	10
R15	F6	¼W	10
R16	F1	¼W	10
R17	F6	¼W	10
R18		no resistor fitted	
R19	J1	¼W	10

Comp.	Loc.	Type	Tolerance per cent
R20	J4	¼W	10
R21	J6	¼W	10
R22	H9	¼W	10
R23	J5	¼W	10
R24	K2	¼W	10
R25	K6	¼W	10
R26	K8	¼W	10
R27	K8	¼W	5
R28	K4	¼W	10
R29	L1	¼W	10
R30	L4	¼W	10
R31	L8	¼W	20
R32	M1	¼W	10
R33	N4	¼W	10
R34	N6	¼W	10
R35	N3	¼W	20
R36	N7	¼W	20
R37	O2	½W	10
R38	N8	½W	10
R39	N4	¼W	10
R40	N5	¼W	10
R41	N6	¼W	10
R42	N6	¼W	10
R43	P2	2·0W	5
R44	Q8	2·0W	5
R45	P4	¼W	10
R46	P6	¼W	10
R47	Q3	¼W	20
R48	Q7	¼W	20
R49	Q4	5·0W	5
R50	Q6	5·0W	5
R51	R3	¼W	20
R52	R6	¼W	20
R53	Q10	10W	5
R54	N10	3W	5
R55	N10	3W	5
R56	P10	½W	20
R57	P9	½W	20
RV1	B7	logarithmic	
RV2	C8	logarithmic	
RV3	D8		
RV4	G8	logarithmic	
RV5	H7	logarithmic	
RV6	J7	logarithmic	
RV7	L6	wire wound	
RV8	O11	wire wound	

*C24 is 450V electrolytic in early versions



PAMPHONIC 30-WATT AMPLIFIER 661W : CIRCUIT

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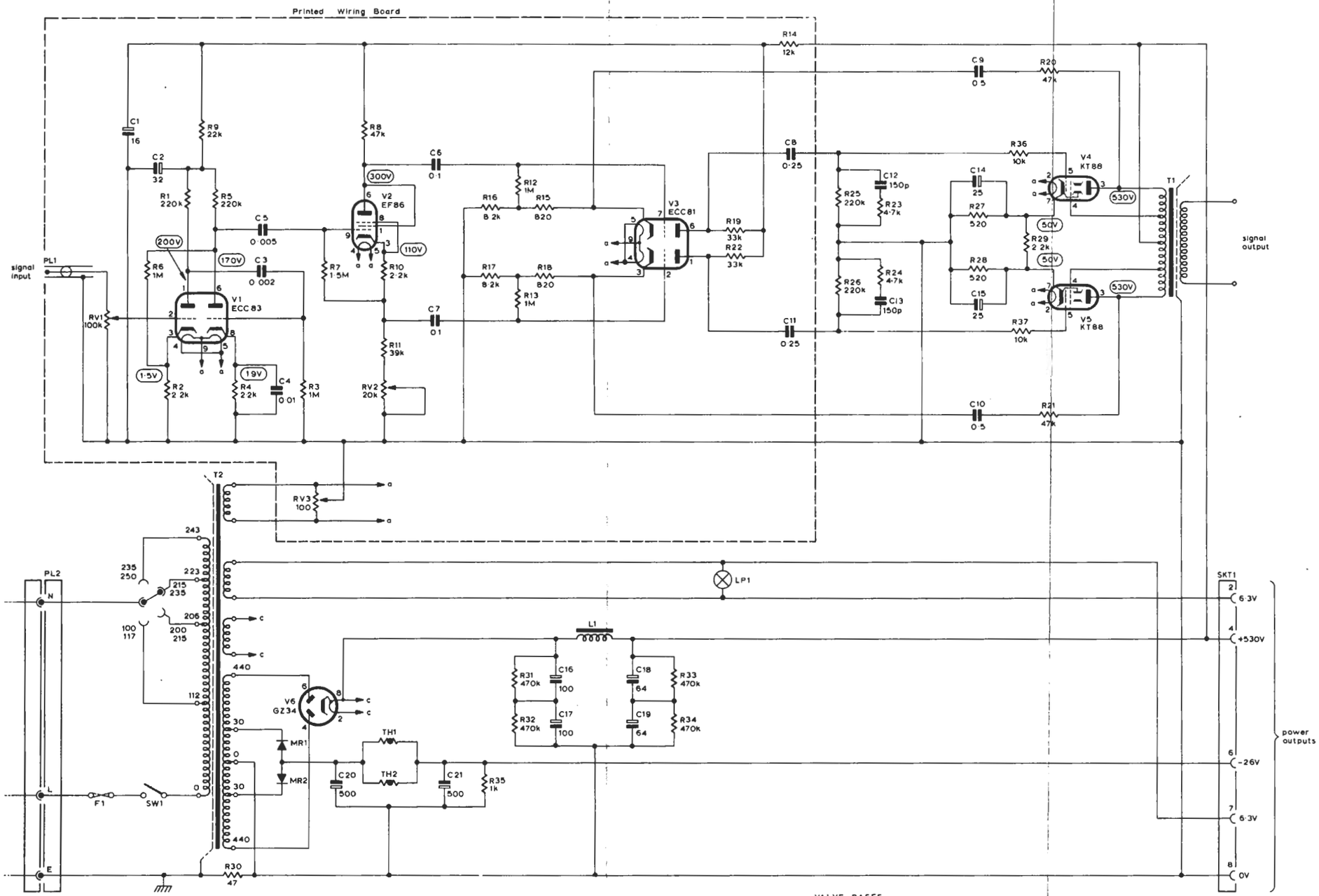
FIG. 71



PAMPHONIC 50-WATT AMPLIFIER 602W : CIRCUIT

VALVE BASES