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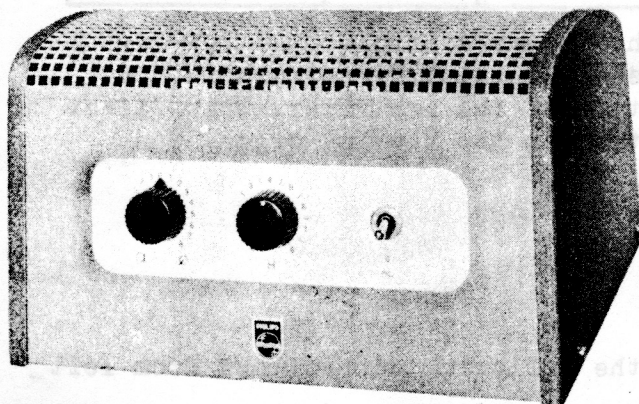
SERVICE NOTES

With the Compliments of ...
RADIO WHOLESALERS LTD.
P.O. Box 527
INVERCARGILL

for the
amplifier

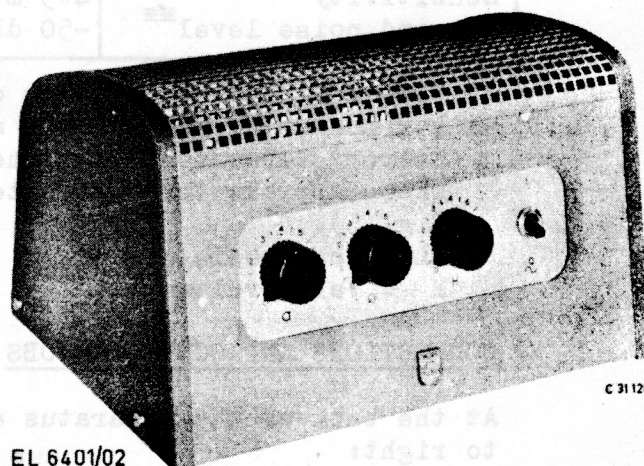
EL 6401

1956.



EL 6401/00

C 31125



EL 6401/02

C 31126

SPECIFICATION.

The EL 6401/00 has been designed for "public address" purposes. The amplifier has 2 inputs: 1 microphone and 1 radio pick-up input.
1 Common volume control. Mixing is not possible.

The EL 6401/02 = EL 6401/00, however, with 2 volume controls:
1 for the microphone and one for the radio pick-up channel.
Mixing is possible.

DIMENSIONS

Length : 300 mm
Width : 225 mm
Height : 165 mm

WEIGHT

Complete with valves 5.5 kg.

VALVES

B1 : ECC40 B3 : EL81
B2 : ECC81 B4 : EL81

LIST OF DIAGRAMS

- | | | |
|-----------------------------|--------------|--|
| Fig. 1 : Circuit diagram. | } EL 6401/00 | Fig. 7 : Frequency response curve (φ). |
| Fig. 2 : Top view | | |
| Fig. 3 : Circuit diagram | } EL 6401/02 | Fig. 8 : Frequency response curve (α). |
| Fig. 4 : Top view | | |
| Fig. 5 : R.M.A. filter. | | Fig. 9 : Mains transformer. |
| Fig. 6 : Measuring diagram. | | Fig. 10: Output transformer. |

ELECTRICAL DATA.

Mains voltage	110, 125, 145, 200, 220 or 245 V			
Mains frequency	50 - 100 Hz			
Power consumption	without signal 40 W ($\cos \varphi = 0.9$) with maximum signal 78 W ($\cos \varphi = 0.9$)			
Output voltage	10, 50 and 100 V			
Load resistance	about 550 Ohm			
Distorsion (at 1000 c/s and 18 W output)	<10%			
	EL 6401/00		EL 6401/02	
	α	φ/R	α	φ/R
Input resistance	1 M	500.000 *	1 M	500.000 *
Sensitivity	4.5 mV	80 mV	10 mV	200 mV
Hum and noise level **	-50 dB	-60 dB	-50 dB	-60 dB

* Dependent on the position of the volume control.

** For measuring the hum and noise a special R.C. network (R.M.A. filter) is connected to the output of the amplifier. This filter gives approx. the same attenuation as the hearing organ. See fig. 5).

RL = load resistor.

M = Valve voltmeter.

CONNECTIONS AND CONTROL KNOBS

At the back of the apparatus are the following connections from left to right:

- The mains lead with plug and 4 mm pins.
- The output connection executed with 4 terminal screws on a hard paper plate.
From left to right 0, 10, 50 and 100 V (terminal 0 is earthed).
- The earth terminal.
- The socket φ (Pick-up/Radio) for a 19 mm plug with flat centre pin.
The right-hand contact (viewed from the back of the amplifier) is earthed.
- The microphone input (α), executed with a three-pole male socket.
Pin 1 is the "hot" side.
Pin 2 is earthed.
Pin 3 is earthed and also serves for earthing the screening braid of the connecting cable.

On the front panel of the amplifier are the following connections from left to right:

I. With the EL 6401/00

- a. A volume control with a zero position in the middle. The volume of the microphone channel is adjusted to the left, that of the pick-up channel to the right.
- b. A knob for adjusting the high tone filter. If this knob is turned entirely to the left, the high tones are cut off at 10.000 c/s about 14 dB.
If the knob is turned to the right, the reproduction characteristic is straight.
- c. A mains switch. In the position "0" the apparatus is switched off.

II. With the EL 6401/02

- a. A volume control for the microphone channel.
- b. A volume control for the pick-up channel.
- c. Like Ib.
- d. Like Ic.

In the interior of the apparatus are various cams on the transformer in order to be able to solder the apparatus on the desired mains voltage. (see fig. 9).

Therefore the cap must be removed, as it is the case when replacing valves and/or a fuse.

CIRCUIT DESCRIPTION. (See fig. 1 and 3).

The microphone input "Q" is connected to the control grid of valve B1' via the blocking capacitor C1 and resistor R4. The negative grid bias for this valve has been obtained by giving the leak resistor R3 a high value (1 MOhm).

The amplified microphone voltage is fed via C2 to the volume control R1.

I. With the EL 6401/00.

The pick-up/radio input is connected to the other side of R1. The centre tapping of the volume control is earthed. Mixing is not possible.

II. With the EL 6401/02

The pick-up/radio input is connected to the volume control R22. In order to avoid that when mixing, the microphone and pick-up/radio signal influence each other, the resistors R22 and R24 are inserted in series with the sliding contacts.

The signal derived from the potentiometer (s) is fed to the grid of B1 via the capacitor C3.

The signal amplified by B1 is led to the high tone control via C5. If R2 is turned in the maximum position, C2 will be connected in parallel to the potentiometer. C6 has a low impedance for the high frequencies with regard to the low and middle frequencies. The result is that these high frequencies are more attenuated than the low and middle frequencies, (ca. 14 dB at 10.000 c/s). See fig. 7. Then the signal is led to the phase inverter B2. The cathode of both triodes are interconnected. The grid of the lower triode is earthed. When the signal of the grid of the upper triode is increasing, the anode current increases and as a consequence of this also the voltage over the cathode resistor R10.

The result of this is that the grid of the lower triode becomes more negative with regard to the cathode. The anode current of the lower valve section decreases. The signals of the anodes of both triodes are opposit in phase.

By choosing the right of the anode resistors R11 and R12, and the grid leak resistors R14 and R15, the signals with a phase shift of 180° on the control grids of the output valves B3 and B4 are of equal value.

The control grids of B3 and B4 obtain their negative initial voltage across the resistors R14 and R15. This voltage is derived from the circuit S4-B5-R20. The cell B5 provides the rectification, R19 forms a fixed charge whereas C10 serves for smoothing.

Between the anodes of the output valves B3 and B4, a spark-gap has been applied which on delivery has been adjusted at 0.3 mm and is sealed with wax. This adjustment should not be changed.

For rectifying the supply voltage for the valves, a selenium rectifier (Gr1) is used in this apparatus.

CHECKING AND MEASUREMENTS

The volume control(s) is set on "0" (with the exception of the measurements of the output valves in full load, $V_o = 100 \text{ V} - 1000 \text{ c/s}$). The amplifier is charged at the terminals of 0 and 100 V with a resistor of about 550 Ohm (10 W).

VOLTAGES OF THE SUPPLY PART

Point	+1	+2	+3	-4
Direct voltage	+275--295 V	+230--250 V	+170--190 V	-47.5--48.5

MEASUREMENT

Valve Measurement	B1 (ECC40)	B2 (ECC81)	B3-B4 (EL81)	B3, B4 (EL81) Full load $V_o=100\text{V}; 1000\text{Hz}$
$V_{a'}$	53-73	95-123	-	-
V_a	24-34	140-180	270- 290	230- 250
V_{g2}	-	-	267- 287	200- 220
$-V_{g'}$	0.73-0.92	-2.09--2.55	-	-
$-V_g$	0	-2.09--2.55	-47.5--49.5	-46.5--48.5
V_f	6.15-6.45	6.15- 6.45	6.15- 6.45	6.1-6.4

The above values are extreme values. The measurement should fall within these limits.

If a possible fault in the amplifier **cannot** be found with the voltage tables, the amplifier should be measured stage by stage. For this check, a valve voltmeter e.g. GM 4132 or GM 6005 and a A.F. oscillator e.g. GM 2315 or GM 2307 are required.

DESCRIPTION OF THE MEASUREMENT. (See fig. 1 and 3).

A resistor of 550 Ohm (10 W) is connected to the 100 V output terminal. The volume control "Q" is turned to maximum. (With the EL 6401/02, the volume control "Q" at minimum).

Turn the high tone control H entirely to the right.

Adjust the tone generator at 1000 c/s and

I. With the EL 6401/00 apply a voltage of 1.25 mV.

II. With the EL 6401/01 apply a voltage of 2.7 mV.

to the microphone input. This corresponds to a voltage of 25 V across

the load resistance. If this voltage is not measured across the output, measure the voltage consecutively on the points B, C, D, E, F, G, H, H', J, J', and K and localize the fault in this manner. A deviation of more than 20% indicates a fault in the respective stage.

MEASURING THE FREQUENCY RESPONSE CURVES

A resistor of approx. 550 Ohm (10 W) is connected to the loudspeaker terminals (100 V). The volume control of the channel to be measured is adjusted at maximum (the other volume control is set to minimum). The set of measuring apparatus is the same as mentioned under "voltages at the valves". For the measuring diagram, see fig. 6.

IMPORTANT.

When measuring via both channels a resistor of 12.000 Ohm must be inserted connected in series with the measuring cord.

Fig. 7 indicates the frequency response curve of the radio/pick-up channel.

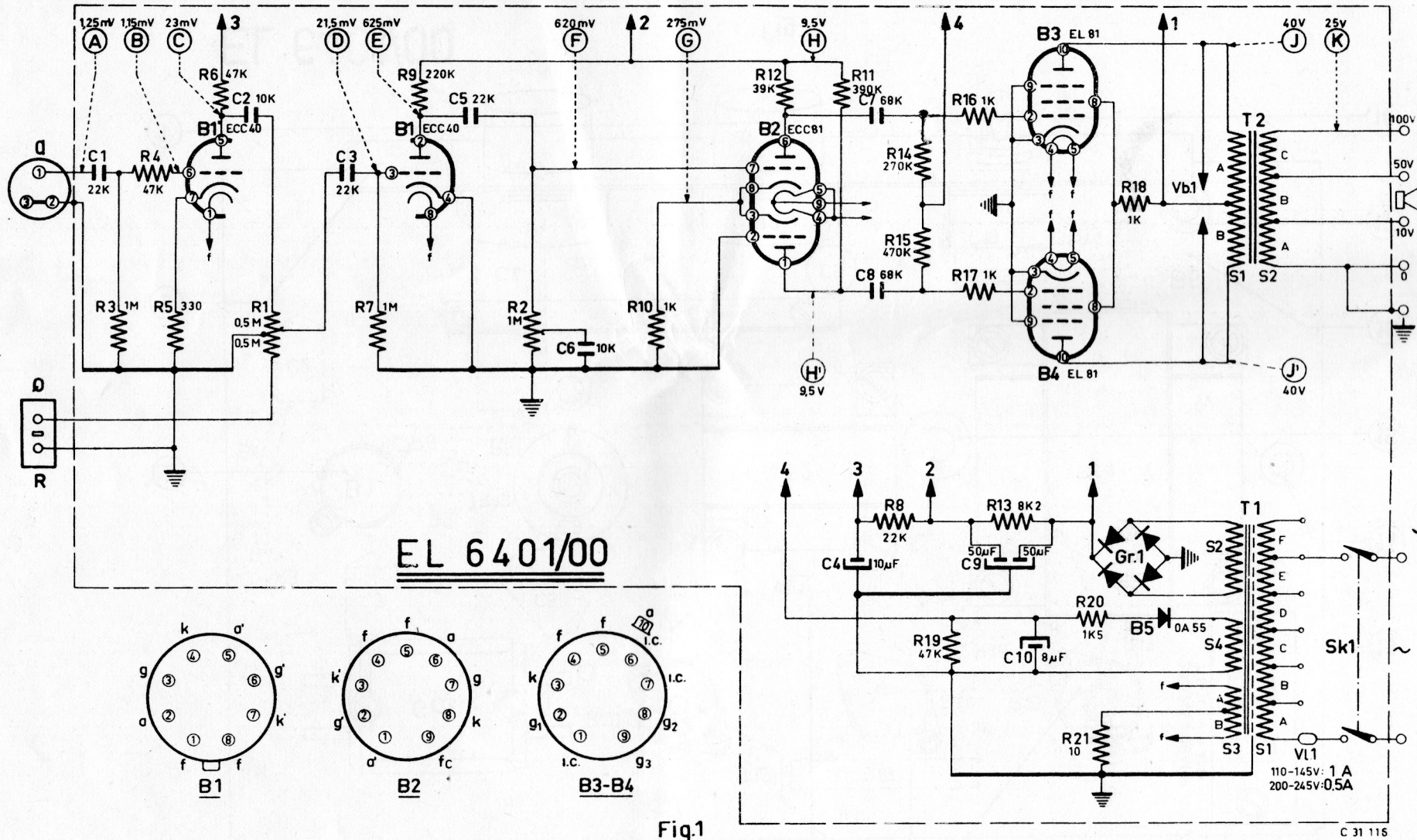
Fig. 8 indicates the frequency response curve of the microphone channel.

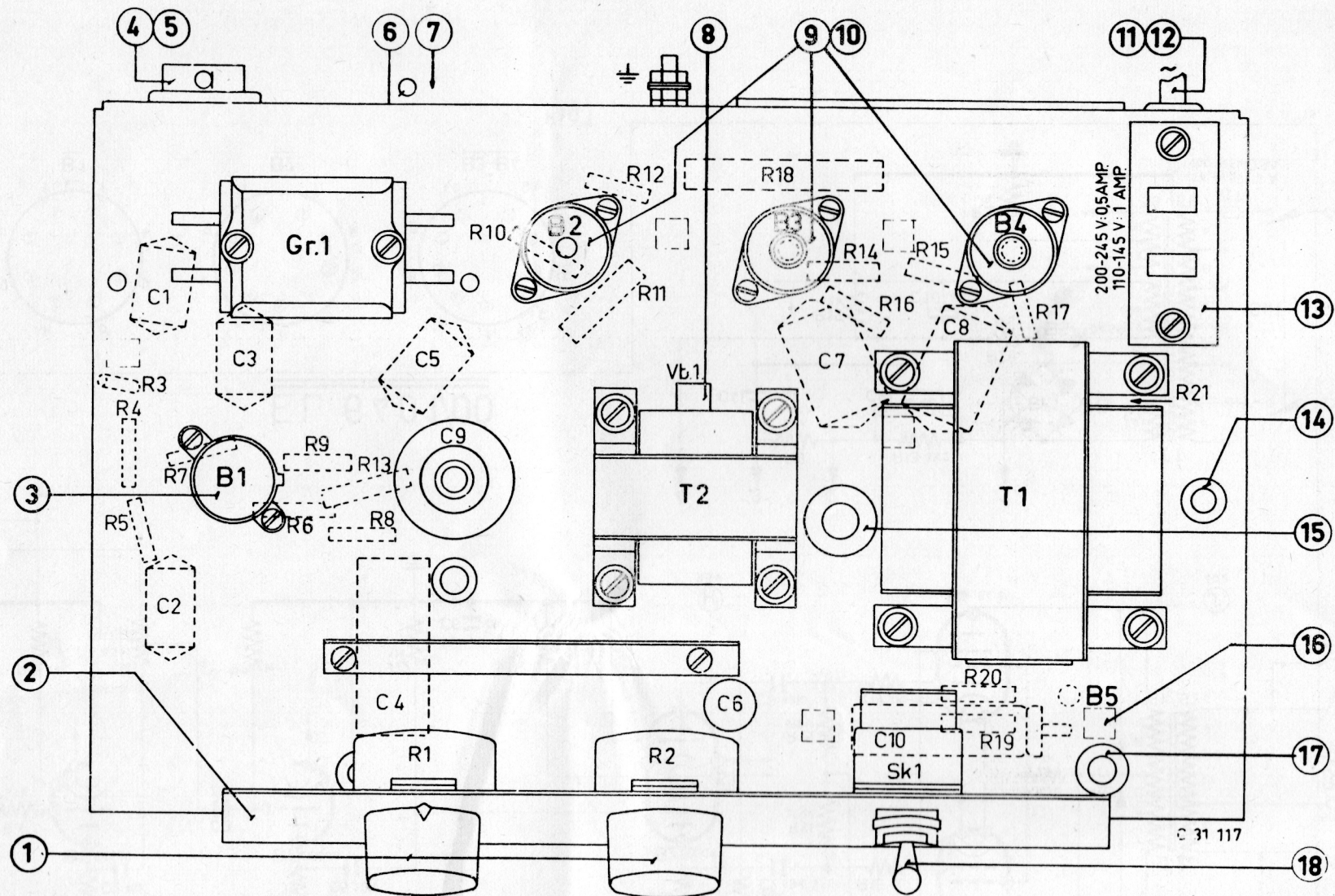
LOUDSPEAKER ADAPTION

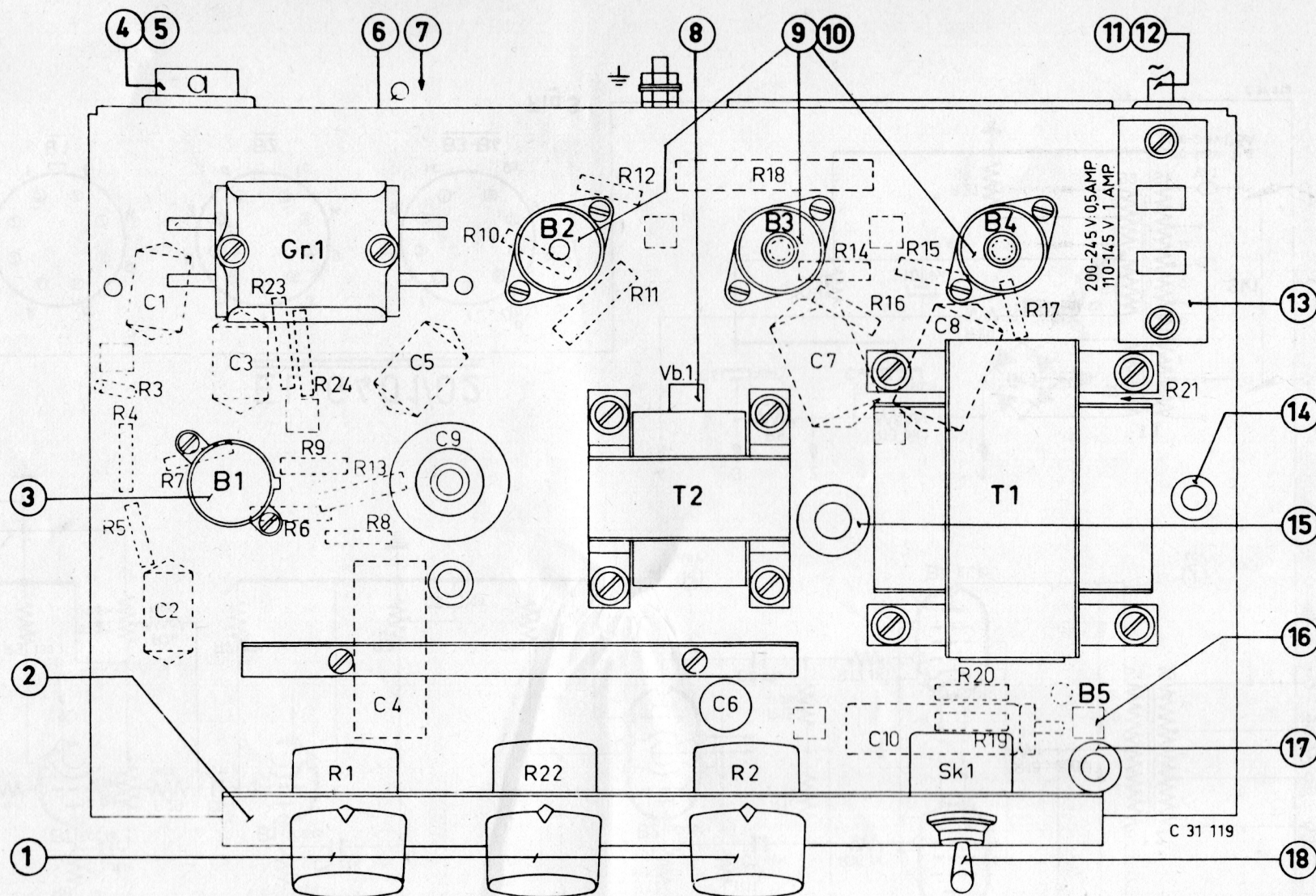
The secondary winding of the output transformer is executed according to the 100 V system. The output has to be converted to 100-50 and 10 V. The loudspeakers should be connected in parallel.

				/00	/02
T1			V3 616 75.0	x	x
T2			V3 621 34.0	x	x
R1	2x 0,5	MOhm	49 501 43.0	x	-
	0,5	MOhm	A9 999 16/GL500K	-	x
R2			A9 999 15/E1M	x	-
			A9 999 16/GEIM		x
R3	1	MOhm	A9 999 00/1M	x	x
R4	47000	Ohm	A9 999 00/47K	x	x
R5	330	Ohm	A9 999 00/330E	x	x
R6	47000	Ohm	A9 999 00/47K	x	x
R7	1	MOhm	A9 999 00/1M	x	-
	10	MOhm	A9 999 00/10M	-	x
R8	22000	Ohm	A9 999 00/22K	x	x
R9	0,22	MOhm	A9 999 00/220K	x	x
R10	1000	Ohm	A9 999 00/1K	x	x
R11	0,39	MOhm	A9 999 00/390K	x	x
R12	39000	Ohm	A9 999 00/39K	x	x
R13	8200	Ohm	A9 999 00/8K2	x	x
R14	0,27	MOhm	A9 999 00/270K	x	x
R15	0,47	MOhm	A9 999 00/470K	x	x
R16	1000	Ohm	A9 999 00/1K	x	x
R17	1000	Ohm	A9 999 00/1K	x	x
R18	1000	Ohm	48 767 05/1K	x	x
R19	47000	Ohm	A9 999 01/47K	x	x
R20	1500	Ohm	A9 999 01/1K5	x	x
R21	10	Ohm	A9 999 00/10E	x	x
R22	0,5	MOhm	A9 999 15/E1M	-	x
R23	0,18	MOhm	A9 999 00/180K	-	x
R24	0,18	MOhm	A9 999 00/180K	-	x
C1	22000	pF	A9 999 06/22K	x	x
C2	10000	pF	A9 999 06/10K	x	x
C3	22000	pF	A9 999 06/22K	x	x
C4	10	uF	A9 999 11/P8	x	x
C5	22000	pF	A9 999 06/22K	x	x
C6	10000	pF	A9 999 06/10K	x	x
C7	68000	pF	A9 999 06/68K	x	x
C8	68000	pF	A9 999 06/68K	x	x
C9	50+50	uF	A9 999 12/L50+50	x	x
C10	8	uF	A9 999 11/L8	x	x
V11	0,5 A (220-245 V)		08 142 29.0	x	x
	1 A (110-145 V)		08 142 30.0	x	x
Gr1			V3 696 60.0	x	x

R:	3.	4.	5.	6.	1.	7.	9.	2.	10.	12.	11.	14.	15.	16.	17.	18.
C:	1.	2.	3.	5.	6.	4.	7.	8.	9.	10.	13.	19.	20.	21.		







EL 6401/02

Fig.4

EL6401