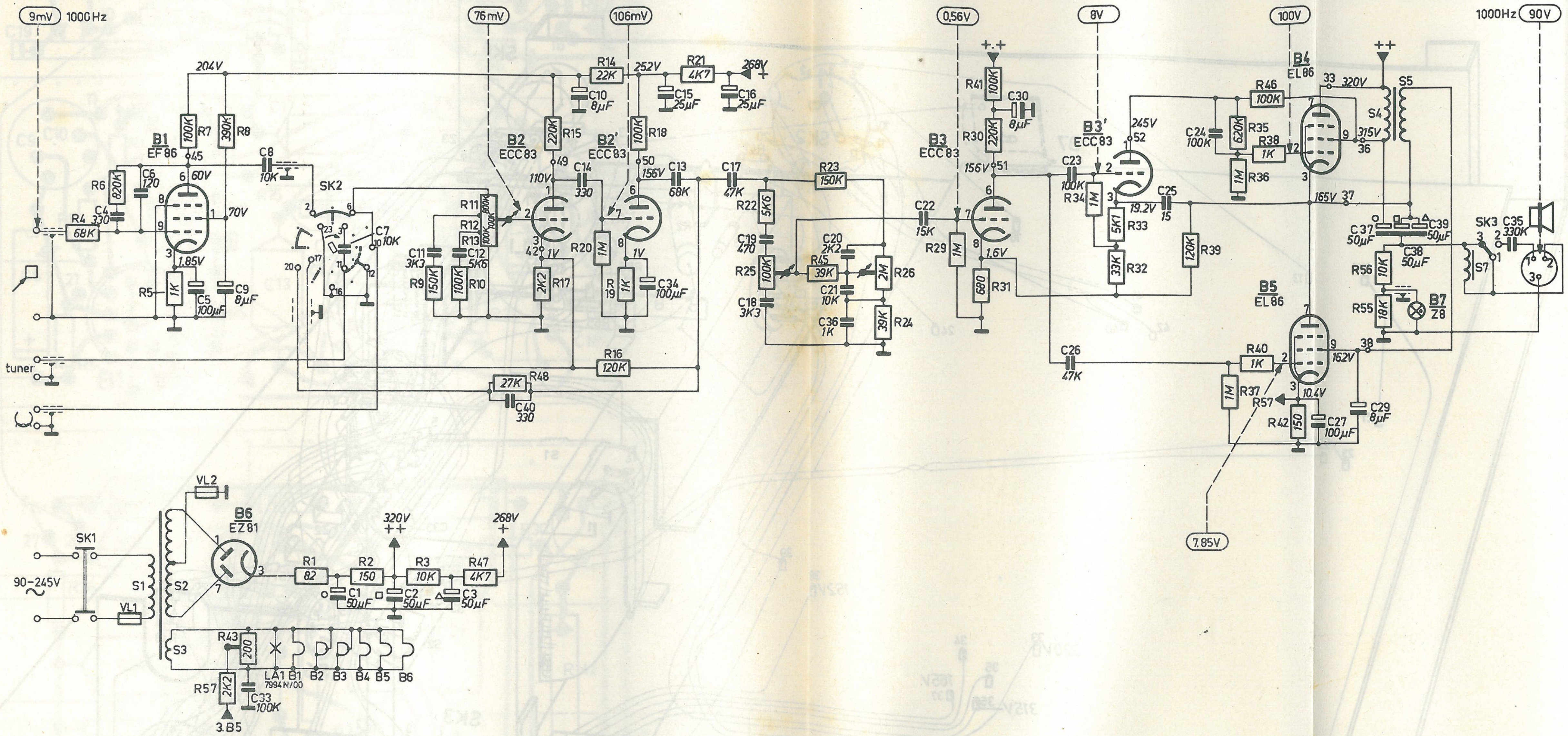

S:	1. 2. 3. 4. 5. 7.
C:	4. 6. 5. 9. 33. 8. 1. 7. 2. 11. 3.12. 40. 14.10. 34 15. 13. 17.16.19.18. 20.21.36 22. 30. 26.23. 25. 24. 27. 29.37.38.39. 35.
R:	4. 6. 5. 7. 57. 8. 43. 1. 2. 3.9. 10.47.11.12.13.48. 17. 15. 20. 14.16.19.18. 21. 22.25. 45.23. 26.24. 29. 31.30.41. 34.33.32 39. 37.35.36.40.46.38.42. 56.55.

R180 99

Fig.1

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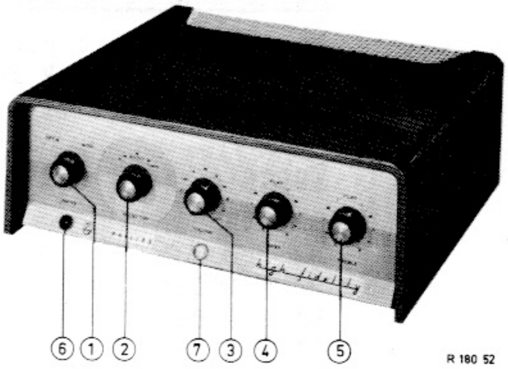
PHILIPS

SERVICE NOTES

for the
Hi-Fi amplifier

AG9013



R 180 52

1958. For A.C. mains supply.

Controls

A. Front side

1. On/off switch
2. Selector switch
3. Volume control
4. Bass control
5. Treble control
6. Check lamp
7. Output indicator

B. Rear side (see fig. 2)

8. Input for magneto-dynamic pick-up
9. Input for crystal pick-up or tuner
10. Input for magnetophone
11. Loudspeaker connection
12. Switch for the built-in cross-over filter
13. Voltage adaptor
14. Hum-compensation potentiometer

Consumption and mains voltages

63.5 Watt at 220 V (50~).
90, 110,127, 145, 165, 190, 220, 245 V.

Hum and noise level

When using a magneto-dynamic pick-up -60 dB, with respect to 10 Watt output.
At the other inputs -75 dB with respect to 10 Watt output.
All this is measured with the tone controls in the position (middle position.

Output and distorsion

The output amounts to 10 Watt, the harmonic distortion being 0.2 %. The intermodulation distortion amounts to 0.8 % at signals of 40 and 12,500 c/s, amplitude proportion 4 : 1.

Output impedance

ZU = 800 Ohms.

Damping factor

The damping factor is 40.

Cross-over point

The cross-over point of the built-in separating filter is approx. 500 c/s.

Output indicator

This indicator starts lighting up at 10 Watt output.

Printed in Holland

93 997 51.1.10

Frequency characteristic

This is straight from 20 c/s - 20,000 c/s.
At 50,000 c/s the decrease amounts to 3 dB.

Input sensitivities

Magneto-dynamic pick-up : Vi = 9 mV for 10 Watt output.
Tuner Vi = 320 mV for 10 Watt output.
Magnetophone : Vi = 75 mV for 10 Watt Output.

Tubes

B1 : EF86
B2 : ECC83
B3 : ECC83
B4 : EL86
B5 : EL86
B6 : EZ81
B7 : Z8
La1: 7994N-00

Fuses

V11 = temperature fuse on supply transformer
V12 = 200 mA, 974/00.

Dimensions

125 x 300 x 345 mm.

List of figures

Application

This Hi-Fi amplifier is destined for Hi-Fidelity reproduction of records, radio and tape recorder. This in combination with a record player e.g. AG 2009, loudspeaker combination e.g. 1x AD 5035A + 2x AD5036B, an A.M. - F.M. tuner e.g. A5X83A and a tape recorder e.g. EL 3516.

Cross-over network

The amplifier is equipped with a built-in cross-over network, which can be switched on and off with SK3.
If only the box AD5035A is used, SK3 must be set in such a way that point 1 and 3 are interconnected (see circuit diagram).

Record correction

At present almost all records are recorded according to the R.I.A.A. curve a.o. Philips, Decca, D.G.G., Columbia, H.M.V., R.C.A. and Capitol.
In fig. 4 can be seen that the low notes are attenuated at the recording, e.g. at 30 c/s approx. 18 dB, the high notes are amplified, e.g. at 15,000 c/s approx. 18 dB. So if a perfect playback is wanted the inverse must be done in the playback amplifier. The AG 9013 has a pre-amplifier with R.I.A.A. correction. If records are concerned recorded according to older curves, a full correction can nevertheless be obtained with the aid of the tone control.

Some details on the circuit diagram

A. R.I.A.A. Correcting amplifier

The signal coming from a magneto-dynamic pick-up, reaches the control grid of B1 via R4, B1 amplifies this signal Via R6, C6 and C4 a frequency dependent negative feedback voltage is applied to the control grid. In this way a complete R.I.A.A. correction has been obtained (see fig. 5).

B. Selector switch SK2

With the aid of SK2 the pick-up amplifier (B1) can be switched on, or the tuner, or the tape recorder.
In the circuit diagram SK2 is represented in the pick-up position. In the position tuner the signal on the anode of B2' is fed back negative via R48, C40 on the cathode of B2. The high notes above 15,000 c/s are thus specially attenuated. This is for noise suppression.

C. Physiologic volume control

Via SK2 the signal reaches the volume control R11-R12+R13.
The volume control has 2 tappings. By means of C11-R9 and C12-R10 physiologic volume control is obtained.
At low positions of the volume control the low notes are amplified This is done because our ear at low sound intensity perceives the low notes with more difficulty than the notes in the middle range.

D. Rumble filter

Via a small capacitor the anode of B2 is coupled to the grid of B2'. After being amplified by B2' part of the output voltage of B2' is fed back to the cathode of B2 via C13 and R16. This causes a frequency dependent negative feedback, which, added to the small value of the coupling capacitor (C14) causes a strong reject of the frequencies under 20 c/s (12 dB/octave).
Via C13-C17 the signal is applied to the tone control circuits. The C-R proportion between C13 - C17 on one part and the tone control circuit on the other part is so dimensioned that still an extra attenuation of 6 dB/octave is obtained. The total attenuation of the low notes under 20 c/s thus amounts to 18 dB/octave.
The rumble filter is built in, because in case of use of a gramophone so-called rumble occurs.
The frequencies of the rumble voltages are rather different, but under 20 c/s rather high voltages can arise; since the frequencies under 20 c/s cannot be represented without distortion by the loudspeakers they can be "cut off" without interfering with the sound reproduction.

Tone control

As a tone control normal passive R.C. networks were selected, whereby extra care was given to a "smooth" running of the tone control curves. In the middle position of the tone controls the frequency curve is straight.
For the tone control curves see fig. 6. R26 is the bass - R25 the treble control.
As the principle of the above tone control is already known, we shall not go further into its operation.

Output amplifier with positive and negative feedback

A. General

B3 acts as preamplifier, the output voltage of B3 arising over R30, is applied to the grid of B5.
The above voltage is also applied to the grid of B3', this valve acts as a phase inverter.
The output voltage of B3' arising over R46 is applied to the grid of B4. The voltages on the grid of B4 and B5 are thus in counterphase. If no signal is applied to the amplifier, the anode currents of B4 and B5 are equally high. If a signal is applied, the anode current of one output valve becomes higher and that of the other will decrease.
Now a current will flow through C38-C39 and the loudspeaker to earth, this current is equal to the sum of the decrease of one anode current and the increase of the other anode current.

Example : The anode rest current of the output valves is e.g. 75 mA, a signal is applied by which one valve will carry 90 mA and the other 60 mA. Then the increase of one anode current is 15 mA, the decrease of the other is also 15 mA. Now a current of 15 + 15 = 30 mA will flow through the loudspeaker. The above results from the first Kirchhof law.

B. Control voltage for the grid of B4

Supposed that the control voltage for the grid of B5 is V2, and the output voltage of B5 is Vo, then the control voltage between the grid of B4 and earth must be equal to Vo + V2. The phase inverter B3' should then supply a greater voltage than the output voltage of the amplifier.
To avoid this, the anode voltage of B3' is taken from the screen grid of B4 being on output potential via C37.

The screen grid supply of the output valves B4 and B5

The screen grids of B4 and B5 must have about the same direct voltage with respect to earth as their anodes, they must, however, have the alternating current level of their respective cathodes.
So it would be possible that the screen grids are fed via resistors; if these resistors are small the output signal will be shortcircuited. If the resistors are made great, the output of the amplifier will decrease. This must be seen as follows :
The screen grid current of the penthode will increase at increasing output; so the voltage drop over the screen grid resistance will increase, so that the screen grid voltage will become too small, resulting in smaller output.

Therefore there must be a great impedance for alternating voltage between anode and screen grid, to prevent shortcircuit of the output voltage and at the same time a small resistor must be connected for direct voltage between anode and screen grid.
These requirements are met by the use of the double choke S4, S5. The two chokes are wound on 1 core, they are so locked that the screen grid currents are flowing through the coils in opposite direction, so that no magnetic biasing of the core takes place.

Positive and negative feedback

The amplifier is equipped with positive and negative feedback; by an exact dimensioning of these circuits a great damping factor can be obtained ≈ 40 and a great output at very low distortion.
The positive feedback is obtained by connecting the cathode of B3', via R33-R32, to the cathode of B3. Negative feedback is obtained by feeding part of the output voltage of the amplifier to the cathode of B3.

Hum compensation control

Via R57 a direct voltage is taken from the cathode of B5 and fed to the sliding contact of the hum compensation potentiometer R43, which is parallel to the filaments of the valves.
Now the amplifier can be adjusted to minimum hum with the aid of R43.

Output indication

Via the voltage divider R56-R55 the output signal comes on B7.
If the output of the amplifier is locked with a 16 Watt resistor of 800 Ohms, B7 must start lighting up at a voltage of 90 V over the above resistor.
This can be adjusted by modifying the value of R55 or R56. The 800 Ohms resistor can be selected from the range 4876805/820 Ohms, with the aid of a Philoscope. Is this resistor too great, a 1 Watt resistor of great value can be connected in parallel. Is the resistor too small, a small resistor of 1 Watt can be connected in series.

Measurements

The various direct voltage measurements at this amplifier (see circuit and wiring diagrams) have been executed with the Philips Universal Meter P 812 00. For these measurements no signal was applied to the amplifier.

The stage sensitivities can be measured as follows :

a. Connect a resistor of 800 Ohms, 16 Watt to the output of the amplifier and switch off the built-in cross-over filter with the aid of SK3.

b. Connect an A.F. tube voltmeter over this resistor (e.g. GM 6017).

c. Now connect a tone generator e.g. GM 2317 to the input for the dynamic pick-up and adjust the tone generator to 1000 c/s. Adjust the output voltage of the tone generator in such a way that the A.F. tube voltmeter indicates 90 V.

With the A.F. tube voltmeter the various stage sensitivities can now be measured.

DJ/JH

S 1		)
S 2		) A3 143 17
S 3		)
S 4		) A3 166 46
S 5		)
S 7		WE 166 02
V12	200 mA	974/V200
C 1	50 µF	)
C 2	50 µF	) AC5 480/50+50+50
C 3	50 µF	)
C 4	330 pF	904/330E
C 5	100 µF	909/B100
C 6	120 pF	904/120E
C 7	10.000 pF	904/10K
C 8	10.000 pF	904/10K
C 9	8 µF	) AC8 208/8+8
C10	8 µF	)
C11	3.300 pF	904/3K3
C12	5.600 pF	904/5K6
C13	68.000 pF	906/68K
C14	330 pF	904/330E
C15	25 µF	) AC8 308/25+25
C16	25 µF	)
C17	47.000 pF	906/L47K
C18	3.300 pF	904/3K3
C19	470 pF	904/470E
C20	2.200 pF	904/2K2
C21	10.000 pF	904/10K
C22	15.000 pF	906/L15K
C23	0,1 µF	906/100K
C24	0,1 µF	906/100K
C25	15 pF	904/15E
C26	47.000 pF	904/47K
C27	100 µF	909/B100
C29	8 µF	) AC8 208/8+8
C30	8 µF	)
C33	0,1 µF	906/L100K
C34	100 µF	909/B100
C35	0,33 µF	906/L330K
C36	100 pF	904/1K
C37	50 µF	)
C38	50 µF	) AC5 480/50+50+50
C39	50 µF	)
C40	330 pF	904/330E
R 1	82 Ω	E 001AK/A82E
R 2	150 Ω	E 001AK/A150E
R 3	10.000 Ω	E 001AD/A10K
R 4	68.000 Ω	902/68K
R 5	1.000 Ω	902/1K
R 6	0,82 MΩ	902/820K
R 7	0,1 MΩ	902/100K
R 8	0,39 MΩ	902/390K
R 9	0,15 MΩ	902/150K
R10	0,1 MΩ	902/100K

/MB

R11	0,8 MΩ	)
R12	0,1 MΩ	) B1 640 31
R13	0,1 MΩ	)
R14	22.000 Ω	902/22K
R15	0,22 MΩ	902/220K
R16	0,12 MΩ	902/120K
R17	2.200 Ω	902/2K2
R18	0,1 MΩ	902/100K
R19	1.000 Ω	902/1K
R20	1 MΩ	902/1M
R21	4.700 Ω	E 001AC/A4K7
R22	5.600 Ω	902/5K6
R23	0,15 MΩ	902/150K
R24	39.000 Ω	902/39K
R25	0,1 MΩ	B1 640 29
R26	2 MΩ	916/GL400K+1M6
R29	1 MΩ	902/1M
R30	0,22 MΩ	902/220K
R31	680 Ω	901/680E
R32	33.000 Ω	901/33K
R33	5.100 Ω	901/4K7+901/390E
R34	1 MΩ	902/1M
R35	0,62 MΩ	901/470K+901/150K
R36	1 MΩ	901/1M
R37	1 MΩ	902/1M
R38	1.000 Ω	902/1K
R39	0,12 MΩ	901/120K
R40	1.000 Ω	902/1K
R41	0,1 MΩ	900/100K
R42	150 Ω	B8 305 08B/150E
R43	200 Ω	B8 315 00P/200E
R45	39.000 Ω	902/39K
R46	0,1 MΩ	901/100K
R47	4.700 Ω	E 001AC/A4K7
R48	27.000 Ω	902/27K
R55	18.000 Ω	902/18K
R56	5.600 Ω	902/5K6
R57	2.200 Ω	902/2K2

DJ/MB

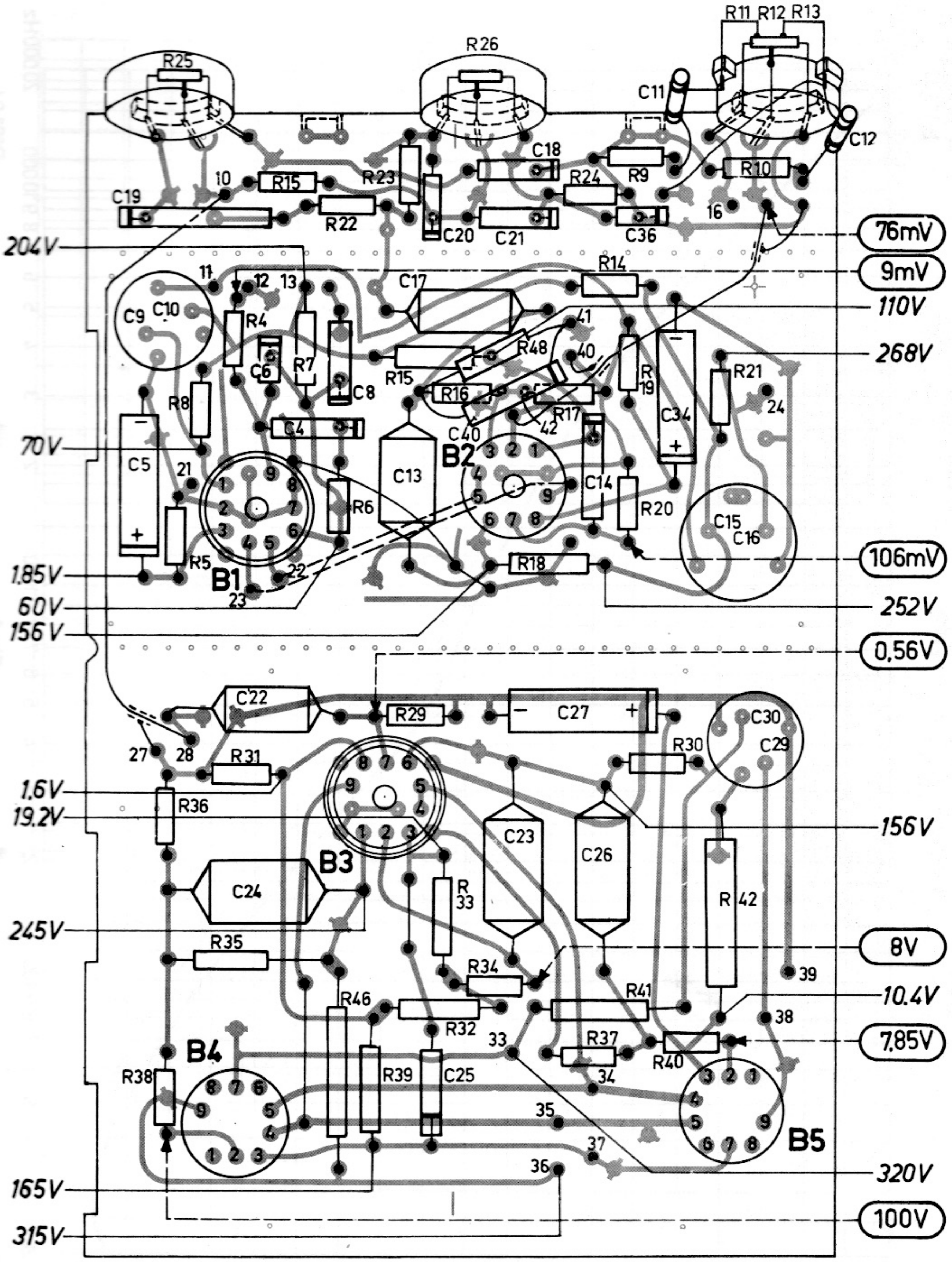

76mV
9mV
110V
268V
204V
70V
1,85V
60V
156V
252V
106mV
0,56V
1,6V
19,2V
156V
245V
8V
10,4V
7,85V
320V
165V
100V
315V
B1
B2
B3
B4
B5

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Fig.3