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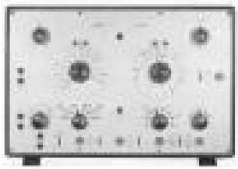
SERVICE NOTES

for the

PULSE GENERATOR

GM 2314-01



1958.

A. GENERAL

Caution — The chassis of this apparatus is connected to the positive side of the supply part. The caps of the electrolytic capacitors carry, therefore, a high tension relative to the chassis.

A1. Application

The generator can inter alia be used for:

a. Measurements on wide-band amplifiers.
b. Measurements on networks and cables.
c. Measurements on time constants, delay times, etc.
d. Testing of electronic counters, GM-counters, radar installations and suchlike.
e. Frequency measurements and scale calibration of oscillators and receivers by means of beat frequencies with harmonics of a pulse-shaped signal with a standard frequency.

A2. Properties

a. The apparatus supplies simultaneously the following voltages :

1. A sinusoidal voltage the frequency as well as the amplitude of which are adjustable.
2. A symmetrical rectangular voltage with adjustable frequency and fixed amplitude.
3. A small pulse with adjustable frequency, fixed amplitude and constant duration.
4. A rectangular pulse of good quality with adjustable frequency, adjustable amplitude and adjustable pulse duration.

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b. The frequency and the pulse duration are directly readable.
c. The generator for rectangular and pulse-shaped voltages can be controlled at will by the R.C.-generator or by an external alternating voltage.
d. The R.C.-generator can be synchronized with an external alternating voltage.
e. The polarity of the rectangular and pulse-shaped output voltages can be chosen independently on each other. Two voltages of opposite polarity can be used simultaneously.

A3. Technical data.

a. Principle (see fig.1)

The generator GM 2314/01 is a pulse generator containing a.o. an R.C. generator (B2-B1-B2') intended to determine the frequency of the pulse voltages.
The first square-wave converter (B4-B4') is controlled by this R.C.-generator.
By commutation of SK6 this converter can also be triggered by an external voltage.
The sinusoidal voltage of the R.C.-generator is continuously adjustable available at Bu1.
The second square-wave converter (B15-B15') is controlled by the first one and supplies a symmetrical square-wave voltage meant as an auxiliary voltage for synchronisation purposes and the like. The other output voltage of the second converter is differentiated by a differentiator (C27-R32-R35).
The pulses formed here are in the positions 2 to 6 inclusive of SK4 applied to the multivibrator (B5-B6) with which a control of the pulse width of the square-wave voltage at the output bushes Bu7, Bu10 and Bu11 is possible. In the first position of SK4 this multivibrator is connected as square-wave converter with the output voltage of the first converter (B4-B4') as a control voltage.
In this way a symmetrical square-wave voltage arises at the output bushes.
The output voltage of the multivibrator-converter (B5-B6) is applied, via the cathode-follower (B16), to the push-pull output stage (B12-B13), in which is incorporated an output attenuator.
The polarity of the output voltage can be selected by means of the switches SK2 and SK9. To obtain small pulses, the output voltage of the cathode-follower is differentiated and amplified (B11-B11'). The polarity of the pulses can be selected with the aid of SK7.
Part of the valves works on a voltage of 350V; the other valves on a voltage of 200V. Both voltages are stabilized.

b. Frequency ranges

Position SK3	Period duration T	Range
1	26 - 5 µsec.	37,5 - 200 kc/s
2	130 - 25 µsec.	7,5 - 40 kc/s
3	650 - 125 µsec.	1,5 - 8 kc/s
4	2.6 - 0.5 msec.	375 - 2000 c/s
5	13 - 2.5 msec.	75 - 400 c/s
6	65 - 12.5 msec.	15 - 80 c/s

Continuous adjustment takes place by means of R3-R4. Frequency and period duration can be read directly on the scale of R3-R4 with an accuracy of 8% for all ranges.

c. Pulse duration

Position SK4	Pulse duration	Position SK4	Pulse duration
1	½ T	5	75 -400 µsec.
2	0.75 - 4 µsec.	6	0,375 - 2 msec.
3	3,75 - 20 µsec.	7	1.5 - 8 msec.
4	15 - 80 µsec.	8	7.5 - 40 msec.

Continuous adjustment takes place by means of R5. The accuracy of the scale of R5 amounts to 12% in the positions 3 to 8 inclusive of SK4 and 20% for position 2 of SK4.

d. Voltages

Bu1 : Sinusoidal 0 - 1.5 Vrms, adjustable with R1.
The maximum amplitude depends on the frequency.
Distortion amounts to approx. 5%.

Bu3 : Symmetrical square-wave voltage or square pulses 0 - 1 V_{p-p}, adjustable with R2.
The scale of R2 serves as an orientation. By means of SK2 the voltage is shifted in phase by 180°.

Bu8 : Needle-shaped pulses, 0 -15 V_{p-p}, pulse duration ≤0,3 µsec. By means of S.7 the pulses is shifted in phase by 100%

Bu9 : Symmetrical square-wave voltage, 7-13 V p-p at symmetrical adjustment by means of R6.
By means of SK8 the voltage is shifted in phase by 180°.

Bu10-Bu11 : Symmetrical square-wave voltage or rectangular pulses. 2, 4, 10, 20 and 40 V_{p-p}, adjustable with SK5.
max. deviation 4 %. Since the voltages at Bu10 and Bu11 are in anti-phase and can be taken up simultaneously, also voltages of 4, 8, 20, 40 and 80 V are available.

The rise time of the voltage at Bu10-Bu11 is 65 nsec. with 40V, 50 nsec. with 20 V and 35 nsec. with 10 V.

e. Output resistance

Bu 3 : 0 - 250Ω
Bu10-11 ; 22Ω/V

f. External-synchronization ("sync.ext.')

The R.C.-generator may be synchronized by means of a voltage applied to Bu4. If a sinusoidal alternating voltage of 0,5 V_{rms} is applied, a synchronization range of 1% is obtained. If synchronization voltages higher than 5 V_{rms} are applied, undesirable secundary effects may occur.

g. External triggering ("trigg.ext.")

With SK6 in the position "trigg.ext." the first square-wave converter is driven via B2-B1 -B2' by a voltage connected to Bu6. The valves B2-B1 -B2' are now connected as amplifier. A sinusoidal voltage of 0,5 V_{rms} is sufficient. It is recommended not to use an external triggering voltage in excess of this value.

The driving of the first square-wave converter is adjustable with R6. If the voltage applied consists of negative or positive pulses, R6 is to be turned anti-clockwise or clockwise respectively.

h. Supply

The apparatus can be adjusted for A.C. voltages of 110 to 245 incl. with frequencies of 50-100 c/s. The supply transformer is secured by a thermal release; both the mains lines by fuses.

The power consumption is approx. 950 mA max., at 220 V., 50 c/s.

i. Dimensions and weight

Width	:	440 mm
Height	:	310 mm (inclusive legs)
Depth	:	290 mm (inclusive knobs)
Weight	:	20 kg

j. Tubes

B1 - B1'	:	ECC85	B9	:	EL81
B2 - B2'	:	ECC85	B10-B10'	:	ECC81
B3 - B3'	:	ECC81	B11-B11'	:	ECC81
B4 - B4'	:	E92CC	B12	:	EL84
B5	:	E180F	B13	:	EL84
B6	:	E180F	B14	:	85A2
B7	:	GZ34	B15-B15'	:	E92CC
B8	:	EL81	B16-B16'	:	ECF80

k. Figures

1. Circuit diagram (see under D2)
2-21. Unit A-X.
22. Bottom view.
23. Top view.
24. Front view.
25. Block diagram.
26. Detailed circuit diagram : amplitude limiter.
27. T1.
28. B5 - B6 as converter.
29. B5 - B6 as multivibrator.
30. Coaxial plug.
31. Plug.
32. Spanner, dimensioned sketch.

B. Description (see fig.1)

B1. The R.C.-generator.

a. The generator consists of an pre-amplifier with the tubes B2 - P1 - B2'. The output, the cathode of B2', is connected via a Wien-bridge to the input, the grid of B2. The frequency of the voltage produced is adjustable in steps by means of SK3 and continuously adjustable in each position of SK3 by means of R3 - R4.

b. Amplitude limiting of the voltage produced (see fig.26).

The alternating voltage at the anode of B2' is rectified by the diodes Gr5 and Gr6 in Greinacher arrangement. The diodes and the cathode of B1' are given the correct bias by means of the potentiometer formed by the resistors R21, 141, R51 and R143.

Whenever the amplitude of the produced voltage would increase, the direct voltage at G76 will drop. This voltage drop is coupled to the grid of B1', causing a decrease in its mutual conductance. This means an increase of the impedance (consisting of the series connection of the impedance of B1' and the impedance of G80) parallel to the cathode resistance of B1. As a consequence of this, the feedback in the grid circuit of B1 increases, owing to which the amplification of the R.C.-generator reduces in such a way that the amplitude of the produced voltage remains constant.

c. Synchronization

The R.C.-generator can be synchronized by applying a synchronization voltage to Bu4 (sync.ext). B1 then serves as a synchronization amplifier.

B2. The first square-wave converter (B4-B4')

a. With SK6 in position "trigg.int." this converter is driven by the amplified (by B3) output voltage of the R.C.-generator. Square-wave voltages are then produced at the anodes of B4 and B4'. These voltages are only then symmetrical if the grid voltage of B4 has a specific value. This value is adjusted with R61. The voltage at the anode of B4 shows further deviation from the rectangular shape, which is caused by the fact that B4 is controlled by a more or less sinusoidal voltage.

b. With SK6 in position "trigg.ext", the converter can also be driven by an external voltage applied to Bu6 (trigg.ext.). This voltage can be either sinusoidal or rectangular. Control by means of a pulse-shaped voltage is likewise possible, with the provision that the pulse duration is not too short. If the pulses applied to Bu6 are positive, they reach the grid of B4 as negative pulses. These pulses are only then effective, if the grid voltage of B4 has such a value that B4 is conducting. This value of the grid voltage is adjusted with R6. If positive pulses are applied to Bu6, the knob of R6 is to be turned clockwise.

If negative pulses are applied to Bu6, then the pulses on the grid of B4 are positive. The grid voltage of B4 should then be negative to such an extent that B4 is not conducting. In this case, the knob of R6 is to be turned anti-clockwise.

B3. The second square-wave converter (B15-B15')

Dependent upon the position of S18, this converter is driven by the "square-wave" voltage at the anode of either B4 or B4'.

So the voltage at Bu9 can be shifted in phase by 180° by means of SK8. The voltages at the anodes of B15 and B15' are purely rectangular.

If the square-wave voltage, supplied to the grid of B15 is symmetrical, then also the voltage at Bu9 is symmetrical, with the provision that R109 has the correct value. (see under 03-a).

B4. The square-wave converter/multivibrator. (B5-B6)

a. B5 and B6 as square-wave converter

In the first position of SK4 (position $\frac{1}{2}T$) B5 and B6 are arranged as square-wave converter (fig.29). Tube B5 working as a diode, does not influence the working of the converter in this position of SK4, because the potential of the anode of B5 is always smaller than or equal to that of the cathode.
The converter is controlled by the square-wave voltage at the anode of B4'.

b. B5 and B6 as multivibrator

In the remaining seven positions of SK4, B5 and B6 are arranged as a monostable multivibrator (cf. fig.29). In the stable condition B6 is conducting and B5 is cut off, i.e. a positive pulse should be used for triggering. This positive needle-shaped pulse is obtained by differentiation of the square-wave voltage at the anode of B15. The negative pulses arising during this process are suppressed by the diodes Gr1, Gr2 and Gr3.

c. Adjusting the width of the rectangular pulses

The moment when the positive pulse occurs, determines the moment when B6 changes from the conducting into the non-conducting condition. The moment when B6 returns to the subsequent rest-condition, however, is determined by the discharge time of the coupling capacitor between B5 and B6. This discharge time is dependent upon the value of this capacitor (according to the position of SK4) and upon the position of R5. This means that the width of the rectangular pulse at the anode of B6 is determined by the positions of SK4 and R5. After the multivibrator has returned to the stable condition, a subsequent triggering pulse at the grid of B5 can create again a rectangular pulse at the anode of B6.
This means that the R.C.-time of the multivibrator must always be shorter than the period of the alternating voltage produced by the R.C.-generator.

d. Function of B5; constant triggering sensitivity

In the stable condition of the multivibrator, the current through B6 will, as a rule, not be actually determined. This current depends on the position of R5.

Since the voltage across the cathode resistor R39 depends on the current through B6, the negative grid voltage of B5 will not be fixed either. As a consequence of this, the triggering sensitivity of the multivibrator will be dependant upon the position of R5.
In the stable condition, owing to the presence of tube B3 functioning in the circuit as a diode, the grid voltage of B6 is maintained at a constant value, independent of the position of R5, so that the grid voltage of B5 likewise remains constant. In this way, a constant triggering sensitivity of the multivibrator is achieved.

B5. The differentiator C27 -R32 -R35

If B5 and B6 are connected as multivibrator, triggering should occur with a positive needle-shaped pulse. However, the differentiator C27 -R32 -R35 itself delivers positive as well as negative needle-shaped pulses.
So the negative pulses must be suppressed.

During the time that the anode voltage of B15 is constant, current flows through Gr2 and Gr3, whilst no current flows through Gr1. Gr2 and Gr3 then have a low differential resistance, whereas that of Gr1 is high. When the anode voltage of B15 suddenly drops, C27 will discharge via Gr2. Since Gr2 has a low differential resistance, the voltage across it will rise only slightly. This slight voltage change across Gr2 is furthermore attenuated owing to the high differential resistance of Gr1 and the low differential resistance of Gr3.
The negative pulses are thus suppressed.
When the anode voltage of B15 shows a sudden rise, Gr1 becomes conducting and Gr2 and Gr3 do not pass any current, so that the positive pulse is transmitted.

B6. The cathode follower (B16a-B16b)

The output voltage of B6 is applied to a two-stage cathode follower (B16a-B16b).
B16b forms the cathode resistor of the cathode follower B16a. With this circuit the same is approximately reached as can be reached with one valve having a mutual conductance equal to the total of mutual conductances of both valves.
A greater mutual conductance has a favorable effect on the rise time of the pulses delivered.

B7. The push-pull output stage with the tubes B12-B13

In the rest condition B13 is conducting and B12 non-conducting. The negative grid bias of B12 is a few volts more than necessary to block the anode current. This means that the grid voltage is allowed to rise a few volts before B12 becomes conducting and thus before the anode current of B13 decreases.

As a consequence of this, the lower part of the rectangular voltage applied to B12 is cut off. As the grid voltage of B12 is rising further, B12 becomes conducting and the anode current of B13 decreases. At a given moment B13 stops conducting, whilst the grid voltage of B12 is still rising. The cathode resistor then causes a strong negative feedback, so that in spite of the increase in the grid voltage of B12, the anode current of B12 does not rise anymore. This means that only the middle part of the rectangular voltage is amplified by the final stage, so that some possible distortion of the positive or negative tops is not fed to the output plugs.

The rectangular voltages on the anodes of B12 and B13 are applied via SK5 and SK9 to Bu10 and Bu11. The magnitude of the voltage is adjustable in steps with SK5, whereas the output voltage can be shifted in phase by 180° with SK9.

A small part (1V) of the anode voltage is applied to the potentiometer R2 via SK2. The voltage at Bu3 is adjustable between 0 and 1 V by means of R2. A 180° phase shift of the voltage can be obtained with SK2.

B8. The pulse shaper with the tubes B11 and B11'

The outputvoltage of the cathode-follower (B16a-B16b) is differentiated by means of C66 and RB3. Only the positive pulse is passed-on to the grid of B11'. The negative pulse is suppressed by Gr4. Part of the pulse voltage at the anode of B11' is applied to the grid of B11. This tube functions as a phase inverter. The polarity of the needle-shaped at Bu8 can be selected by means of SK7.

B9. The supply part

This part includes a conventional rectifying and smoothing circuit. The voltage of 350V (+1) is stabilized by means of tube B8 and regulating tube B10. The second supply voltage of 200V (+2) is stabilized by means of gating-tube B9 and regulating tube B10'. The reference voltage for both regulating tubes is derived from the voltage-reference tube B14.

C. ADJUSTING AND CHECKING

Taking the apparatus out of its case

The chassis can be removed from its case after the following bolts and nuts have been taken out:

1. The two screws on top, left and right in the front-plate.
2. The four screws next to the brackets at the bottom of the case.
3. The nuts at the rear of the case.

CAUTION !!!

The chassis of the apparatus is connected to the positive of the 350 V voltage.

The caps of the electrolytic capacitors carry, therefore, a high tension relative to the chassis

C1. The supply part

a. The resistors R65 and R66

1. Mains voltage: nominal value.
2. Adjust R63 to max. value.
3. Connect a resistor (R135) in parallel to R65 or R66, having such a value that the voltage at C57 is 350 V.

b. Resistor R62

1. The value of R63 should be as low as possible, with the understanding that the voltage at C57 does not show any change when the mains voltage is increased by 10 % above the nominal value.
2. At mains voltage fluctuations of + 10% of the nominal value, the voltage at C57 does not vary more than 10 V.
3. The ripple voltage at C57 must not exceed 30 mV (if necessary, check C54).

c. The resistors R70 and R71

1. Mains voltage: nominal value.
2. Connect a resistor (R136) in parallel to R70 or R71, having such a value that the voltage at C59 is 200 V.
3. At mains-voltage fluctuations of + 10% of the nominal value, the voltage at C59 must not vary by more than 1V.

C2. The R.C.-generator

a. SK3 in position 5 (75 - 400 c/s)

1. Set SK6 to position "trigg.int".
2. Adjust the frequency at 400 c/s to the appropiate value with R72.
3. Adjust the frequency at 100 c/s to the appropiate value with C10.
4. Repeat both adjustments a few times.
5. Check the scale at 100, 200 and 400 c/s.
The deviation should nowhere be more than + 8%.

b. SK3 in position 1 37.5 - 200 kc/s)

1. Set SK6 to position "trigg.int".
2. Adjust the frequency at 200 kc/s to the appropiate value by means of C22.
3. Ditto with C18 at 50 kc/s.
4. Repeat both adjustments a few times.

c. SK3 in position 6 (15 - 80 c/s)

1. Set SK6 to position "trigg. int".
2. Adjust the frequency at 28 c/s to the appropiate value by means of C8.

d. SK3 in position 2 (7.5 - 40 kc/s)

1. Set SK6 to position "trigg.int".
2. Adjust the frequency at 20 kc/s to the appropiate value by means of C16.

e. SK3 in position 3 (1.5 - 8 kc/s)

1. Set SK6 to position "trigg.int".
2. Adjust the frequency at 4 kc/s to the appropiate value by means of C14.

f. SK3 in position 4 (375 - 2000 c/s)

1. Set SK6 to position "trigg.int".
2. Adjust the frequency at 1000 c/s to the appropiate value by means of C12.

g. Frequency tolerance

In no position of SK3 and R3 - R4 must the frequency deviation exceed ± 8%

h. Synchronization

1. Apply an alternating voltage of 0.5 V_{rms} to Bu4.
2. The synchronization range of the R.C.- generator must be wider than 1%.

k. Voltage at Bu1

1. Turn knob of R1 fully clockwise.
2. SK3 in position 1 to 6 incl. : 1 - 1.5 V_{rms}
3. Voltage to be corrected by selecting a different value for R141.

C3. The square-wave converters B4-B4' and B15-B15'

a. Resistor R109

1. Set SK6 to position "trigg.ext".
2. Apply a sinusoidal voltage of 0,5 V_{rms} (400 c/s) to Bu6.
3. Connect oscilloscope to Bu9.
4. R109 should have such a value that the symmetry deviation of the rectangular voltage at Bu9 is equal in the two extreme positions of R6.

b. Tolerance of the symmetry

1. SK6 in position "trigg.int".
2. Adjust the R.C.-generator to 200 kc/s.
3. Make the rectangular voltage at Bu9 symmetrical by means of R6.
4. Successively adjust R.C.-generator to 15 kc/s and to 20 c/s.
5. The pulse duration of the rectangular voltage at Bu9 should lie between 40 and 60% of the period.

c. Triggering sensitivity

1. SK6 in position "trigg.ext".
2. Apply a pulse-shaped voltage of an amplitude of 1 V_{p-p}, having a pulse duration of 0,2 period, to Bu6.
3. Successively apply this voltage at frequencies of 50 kc/s, 15 kc/s and 20 c/s.
4. Check, by means of an oscilloscope connected to Bu9, whether the converters can be properly triggered.
5. If triggering is effected by means of negative pulses, the knob of R6 should be turned a number of degrees anti-clockwise.
   If triggering takes place with positive pulses, then R6 should be turned a larger number of degrees clockwise.
6. The voltage at Bu9 should have a value of $10V_{p-p}$.

C4. The differentiator

1. SK6 in position "trigg.int".
2. Adjust the R.C.-generator to 200 kc/s.
3. Set SK4 to position 1 (GT).
4. Observe the voltage at junction R35-Gr1-Gr3 with the aid of an oscilloscope (GM 5654).
5. No negative pulse should be visible.

6. The amplitude of the positive pulse should be between 4 and 8 V.

7. The half-value width of the pulse should be smaller than 0.6 µsec.

C5. The pulse-duration multivibrator B5-B6

a Resistor R47

1. SK6 in position "trigg,ext.". No control voltage should be applied to Bu6.

2. Resistor R47 should have the smallest possible value with a minimum of 1300 Ω, with the understanding that the tubes B5 and B6 are not permitted to oscillate in any position of SK4 and R5.
By increasing or reducing the value of R47, the risk of oscillating is reduced and increased respectively.

3. Whether oscillation takes place it can be checked by means of an oscilloscope connected to Bu10.

b. Resistor R40

1. SK6 in position "trigg.int.".

2. SK4 in position 1 ($\frac{1}{9}$T).

3. R40 should have such a value that the rectangular voltage at the anode of B6 lies between 25 and 35 V_{p-p}.

c. The potentiometer R7

1. SK6 in position "trigg.int.".

2. SK4 in position 1 ($\frac{1}{9}$T).

3. Adjust the R.C.-generator to 200 kc/s.

4. Connect Bu10 and Bu11 to the vertical deflection plates of an oscilloscope.

5. Adjust R7 for obtaining the purest possible rectangular voltage.

6. Seal spindle of R7.

d. Checking the cut-off point of B12 and B13

1. SK6 in position "trigg.ext.". No control voltage is applied to Bu6.

2. Connect a mA-meter to Bu10; set switch SK9 to the lower position.

3. The meter must not indicate any current, i.e. B12 is non-conducting.

4. Connect the control grid of B12 to the 200 V supply voltage available in the apparatus.

5. Set SK9 in the upper position.

6. The meter must not indicate any current; i.e. B12 is non-conducting.

e. Adjusting the pulse duration

I. Range 7,5 -40 msec. SK4 in position 8.

Resistor R46 and capacitor C32.

1. SK6 in position "trigg.ext.". No control voltage is applied to Bu6.
   Set SK5 to position 40 V. Set R6 approximately to central position.
2. Connect D.C. mA-meter (P 811 00) to Bu11.
   Set SK9 to lower position.
3. The meter now shows a current which will be designated by I.
4. Apply an alternating voltage of 3 V_{rms}, 20 c/s, to Bu6.
5. Set R5 to position 30 msec.
6. R46 should have such a value that the meter now indicates a current of 0.4 I.
7. Set R5 to position 10 msec.
8. C32 should have such a value that the current through the meter is 0.8 I.
9. If necessary, repeat the adjustments of R46 and C32.
10. Set R5 to position 7,5 msec. The current should now be 0.85 I.
11. Set R5 to position 4 msec. The current should now be 0.72 I.
12. Set R5 to position 20 msec. The current should now be 0,6 I.

II. Range 1,5 - 8 msec. SK4 in position 7.

Capacitor C34

1. See items 1-3 under I.
2. Apply an alternating voltage of 3 V_{rms}, 100 c/s, to Bu6.
3. R5 in position 4 msec.
4. C34 should have such a value that the current through the meter is 0.6 I.

III. Range 0,375 - 2 msec. SK4 in position 6.

Capacitor C36

1. See items 1-3 under I.
2. Apply an alternating voltage of 3 V_{rms}, 400 c/s to Bu6.
3. R5 in position 1 msec.
4. C36 should have such a value, that the current through the meter is 0.6 I.

IV. Range 75- 400 msec. SK4 in position 5.

Capacitor C38

1. See items 1-3 under I.

2. Apply an alternating voltage of 3 V_{rms}, 2 kc/s, to Bu6.
3. R5 in position 200 µsec.
4. C38 should have such a value, that the current through the meter is 0,6 I.

V. Range 3,75 - 20 µsec. SK5 in position 3.

Capacitor C42

1. See items 1-3 under I.
2. Apply an alternating voltage of 3 V_{rms}, 40 kc/s, to Bu6.
3. R5 in position 10 µsec.
4. So adjust C42, that the current through the meter is 0,6 I.

VI. Range 7,5 - 80 µsec. SK4 in position 4.

Capacitor C40

1. See items 1-3 under I.
2. Apply an alternating voltage of 3 V_{rms}, 10 kc/s, to Bu6.
3. R5 in position 40 µsec.
4. So adjust C40, that the current through the meter is 0,6 I.

VII. Range 0.75 - 4 µsec. SK4 in position 2.

Resistor R43.

1. See items 1-3 under I.
2. Supply an alternating voltage of 3 V_{rms}, 200 kc/s, to Bu6.
3. R5 in position 2 µsec.
4. R43 should have such a value, that the current through the meter is 0.6 I.

VIII. Remarks.

1. The adjustment of capacitor C42 (SK4 in position 3) is carried out before that of C40 (SK4 in position 4), because C42 is used both in position 3 and in position 4.
2. Maximum permissible deviation of the scale of R5:
   SK4 in position 2 : 20%
   SK4 in position 3-8 : 12%

C6. The push-pull output stage B12-B13

a. Voltage at Bu10 and Bu11. Resistors R104 and R84

1. Set SK6 to position "trigg.ext". No control voltage is applied to Bu6.
2. Set SK4 to position 1 ($\frac{1}{2}$T).
3. Set SK5 to position 5 (40 V); set SK9 to upper position.
4. Connect a direct-voltage tube voltmeter (GM6008) to Bu10.
5. R104 should have such a value, that the meter indicates 40 V.

6. Set SK6 to position "trigg.int". Set SK3 to position 5 (75-400 c/s).
7. Adjust R3-R4 on the middle of the scale.
8. Adjust the voltage on the meter to 20 V by means of R6.
9. Set SK9 to lower position.
10. By means of R84 readjust the voltage on the meter to 20 V.
11. The tolerance of the voltage must be exceed 4%.

b. Voltage at Bu3.

1. This voltage is checked after that the voltages at Bu10 and Bu11 have been adjusted.
2. Set SK6 to position "trigg.int", and SK4 to position $\frac{1}{2}$T, and SK3 to position 5.
3. Adjust R3-R4 on the middle of the scale.
4. Connect a GM 6008 to Bu10, set SK5 to position 5.
5. Adjust the voltage on the meter to 20 V by means of R6.
6. Connect a GM 6008 to Bu3, turn the knob of R2 fully clockwise.
7. In both positions of SK2 the meter should indicate 0.5 V. Tolerance $\pm$ 4%

C7. The pulse shaper B11-B11'. Resistor R83

a. Width of the needle-shaped pulse at Bu8

1. Set SK6 to position "trigg.int."
2. Adjust an R.C.-generator to 200 kc/s.
3. Connect an oscilloscope (GM5654) to Bu8.
4. Set SK7 to upper position (positive pulse).
5. Adjust the half-value width of the pulse to 0.3 msec. by means of R83.
6. Only a very small negative pulse is permitted to occur between two positive pulses. (Check on Gr4).
7. When SK7 is set to the lower position, a negative pulse should be present at Bu8. Its half-value width should not exeed 0.3 msec. Now the positive pulse must have a very small value.

D1. Replacing the coaxial plug (fig 30c)

a. When this plug is to be assembled or taken apart, a simple spanner is necessary. This can be made of a piece of metal pipe; see fig. 32. By means of this spanner the annular nut B can be removed; after which holder G can be removed, so that the soldered joints become accessible.

b. Fig. 30A indicates how insulation and screening of the coaxial cable has to be cut and removed for assembling the plug; fig. 30B shows to what length the core and the two equally divided bundles made of the screening have to be tinned. Tinning should take place rather quickly since the insulation material weakens already at a pretty low temperature.

c. In fig. 30c the following parts are indicated :

A = core	D = screening	G = holder
B = annular ring	E = core insulation	H = cable
C = lock nut	F = clamping piece	I = lead-in

D2. Remarks regarding the circuit diagram

a. The voltages indicated have been measured relative to the negative lead of the supply part, under identical circumstances as stated under b.

b. The voltage-shapes indicated in the circuit diagram have been measured under the following conditions :

1. Earth-side of the probe of the oscilloscope GM 5654 connected to the negative lead of the supply part.
2. Attenuator of probe in position 20 : 1.
3. Oscilloscope externally synchronized with voltage of Bu' ; knob of R1 turned fully clockwise.
4. BK3 in position 7 (7.5 - 40 kc/s).
5. B3-B4 in position 20 sc/s (T = 50 µsec).
6. BK4 in position 3 (3.75 - 20 µsec).
7. B5 in position 10 µsec.
8. The square-wave voltage at Bu9 is symmetrically adjusted by means of R6.
9. Switches SK2, SK6, SK7, SK8 and SK9 placed in lower position.

D3. Transformer data

Coil	Number of turns	Wire diameter mm	No-load voltage
S1A	24	2x 0.7	35
S1B	33	2x 0.7	20
S1'	180	0.7	110
S1''	180	0.7	110
S2	775	0.3	475
S2'	775	0.3	475
S3	11	1.2	6.7
S4	11	1.2	6.7
S5	11	0.8	6.7
S6	9	2x 0.8	5.5

E. LIST OF MECHANICAL BOARD PARTS

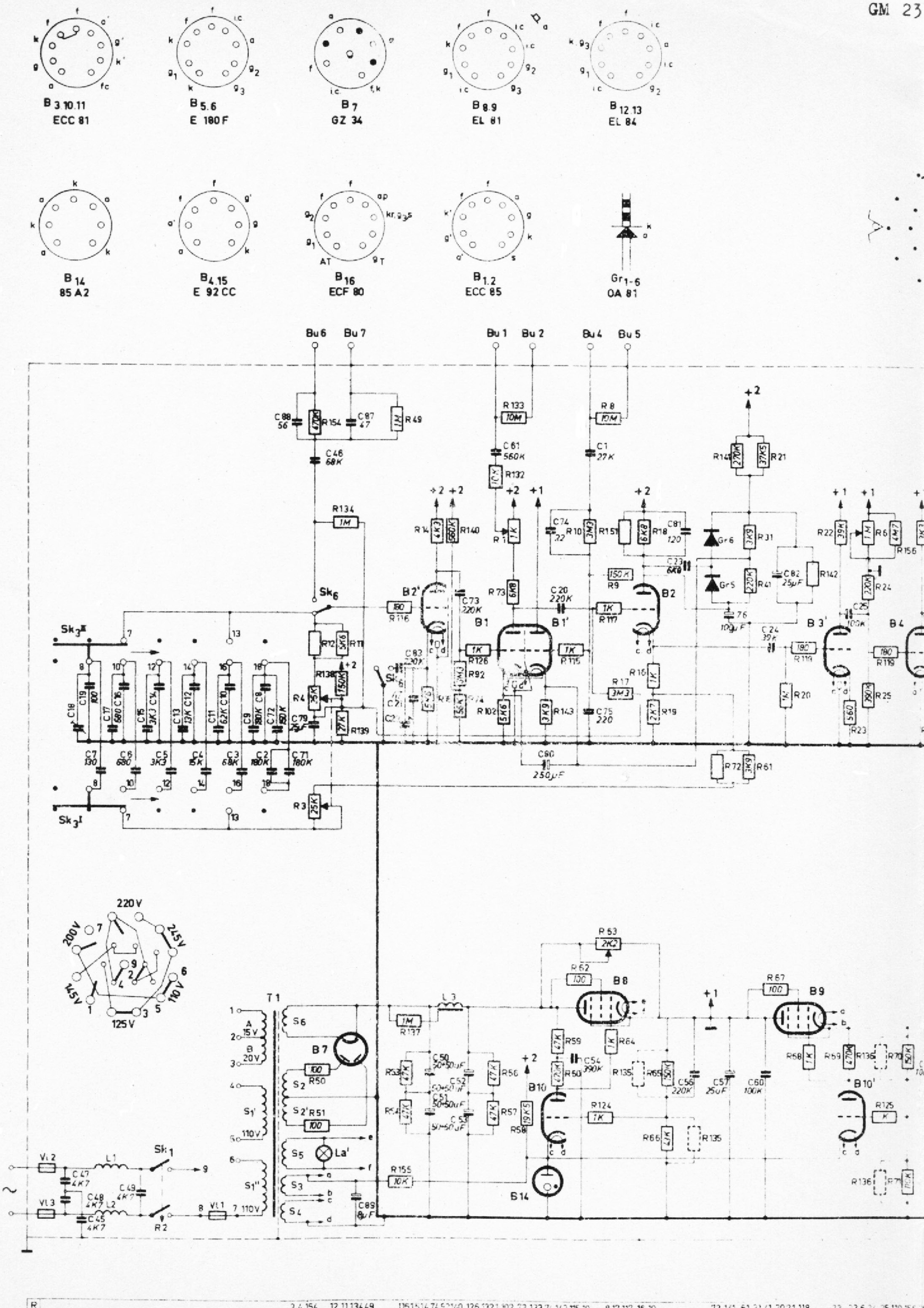
Pos	Fig.	Description	Code number
1	23	Tube holder (noval)	976/9x12
2	23	Tube holder (octal)	976/8x17
3	23	Tube holder (miniature)	976/7x10
4	23	Fuse holder	974/4x50
5	23	Plate with pins for voltage adapter	K7 437 32
6	23	Mains socket	K7 603 27
7	23	Fuse holder	974/4x50
8	23	Lamp holder	976/1x9
9	23	Feed-through insulator	978/D17
10	24	Text plate	K7 487 70
11	24	Dial with knob	K7 726 80
12	24	Indication plate	P5 655 29/04AB
13	24	Indication plate	P5 655 30/04AB
14	24	Dial with knob	K7 726 90
15	24	Knob	973/03
16	24	Arrow	973/P01
17	24	Cap	973/D02
18	24	Socket	B1 610 05
19	24	Socket	B1 610 05
	30	Co-axial plug (ass)	977/C101
0	31	Plug (ass)	978/4x65
1	31	Plug pin	K7 340 18
2	31	Cable (when ordering state length required)	R 209KA/115B0
			LZ/01

Item	Fig.	Value	Code number
R20	9	1 MΩ	900/1M
R21	3	37.5 kΩ	90 /75K-2 par.
R22	8	39 kΩ	900/39K
R23	22	560 Ω	901/560E
R24	8	220 kΩ	901/220K
R25	8	390 kΩ	901/390K
R26	12	3.3 kΩ	900/3K3
R27	12	390 kΩ	901/390K
R28	12	18 kΩ	48 766 10/18K
R29	12	330 kΩ	901/330K
R30	12	3.3 kΩ	900/3K3
R31	3	3.9 kΩ	901/3K9
R32	9	22 kΩ	901/22K
R33	9	1.3 MΩ	900/3M3
R34	9	1.3 MΩ	900/3M3
R35	9	22 kΩ	901/22K
R36	15, 21	1 MΩ	900/1M
R37	13	1.5 kΩ	901/3K-2 par.
R38	21	820 kΩ	901/820K
R39	9	2.2 kΩ	900/2K2
R40	13	2.2 kΩ	901/2K2
R41	3	220 kΩ	900/220K
R42	13	180 kΩ	901/180K
R43	13	10-220 kΩ	901/10K-/220K
R44	13	220 kΩ	901/220K
R45	13	820 kΩ	901/820K
R46	15	1-6.8 kΩ	901/1K-/6K8
R47	15	1.3-2.2 kΩ	901/1K3-/2K2
R48	15	5.6 kΩ	901/5K6
R49	22	1 MΩ	900/1M
R50	11	100 Ω	48 767 05/100E
R51	11	100 Ω	48 767 05/100E
R53	16	47 kΩ	48 767 05/47K
R54	16	47 kΩ	48 767 05/47K
R56	16	47 kΩ	48 767 05/47K
R57	16	47 kΩ	48 767 05/47K
R58	22	19.5 kΩ	900/39K-2 par.
R59	7	47 kΩ	900/47K
R60	7	470 kΩ	901/470K
R61	5	5.6 kΩ	901/5K6
R62	7	100 Ω	900/100E
R63	23	2.2 kΩ	B8 300 45B/2K2
R64	7	1 kΩ	900/1K
R65	6	150 kΩ	901/3K-2 par.
R66	6	43 kΩ	901/43K
R67	22	100 Ω	900/100E
R68	22	1 kΩ	900/1K
R69	22	470 kΩ	90 /470K
R70	16	150 kΩ	901/150K
R71	16	110 kΩ	901/110K
R72	5	15-100 kΩ	901/15K-/100K
R73	2	5.6 kΩ	901/5K6
R74	4	56 kΩ	901/56K
R75	10	10 kΩ	901/10K

Item	Fig.	Value	Code number
R76	10	3.9 kΩ	900/3K9
R77	22	10 MΩ	900/10M
R78	14	82 kΩ	900/82K
R79	14	3.3 kΩ	901/3K3
R80	10	270 Ω	901/270E
R81	10	3.3 kΩ	901/3K3
R83	14	1,8-2.7 kΩ	901/1K8-/2K7
R84	20	3.9- 33 kΩ	901/3K9-/33K
R85		180 Ω	900/180E
R86	20	24 Ω	901/24E
R87	20	22 Ω	901/22E
R88	20	43 Ω	901/43E
R89	20	130 Ω	901/130E
R90	20	220 Ω	901/220E
R91	20	430 Ω	901/430E
R92	4	3.3 MΩ	900/3M3
R93	22	100 Ω	900/100E
R94	23	3.3 kΩ	B6 300 34B/3K3
R95	23	220 Ω	900/220E
R96	20	24 Ω	901/24E
R97	20	22 Ω	901/22E
R98	20	43 Ω	901/43E
R99	20	130 Ω	901/130E
R100	20	220 Ω	901/220E
R101	20	430 Ω	901/430E
R102	18	5.6 kΩ	901/5K6
R103	22	100 Ω	900/100E
R104	20	3.3-33 kΩ	901/3K3-/33K
R105	22	150 kΩ	901/150K
R106	22	300 Ω	901/300E
R107	7	560 kΩ	900/560K
R108	7	470 kΩ	900/470K
R109	7	22-220 kΩ	900/22K-/220K
R110	8	2.7 kΩ	900/2K7
R111	8	330 kΩ	900/330K
R112	6	18 kΩ	46 766 10/18K
R113	8	330 kΩ	900/33K
R114	6	1 kΩ	900/1K
R115	2	1 kΩ	900/1K
R116	22	180 Ω	900/180K
R117	2	1 kΩ	900/1K
R118	9	180 Ω	900/180E
R119	8	180 Ω	900/180E
R120	12	180 Ω	900/180E
R121	21	180 Ω	900/180E
R122	13	180 Ω	900/180E
R124	6	1 kΩ	900/1K
R125	22	1 kΩ	900/1K
R126	3	1 kΩ	900/1K
R127	7	180 Ω	900/180E
R128	8	180 Ω	900/180E
R129	19	180 Ω	900/180E
R130	14	180 Ω	900/180E
R131	8, 22	180 Ω	900/180E
R132	23	10 kΩ	900/10K

Item	Fig.	Value	Code number
R133	23	10 MΩ	900/10M
R134	2	1 MΩ	900/1M
R135	6	560K-1.8 MΩ	901/560K /1M8
R136	16	560K-1.8 MΩ	901/560K-/1M8
R137	23	1 MΩ	900/1M
R138	2	150 kΩ	900/150K
R139	2	27 kΩ	901/27K
R140	4	560 kΩ	901/560K
R141	3	270 kΩ	901/270K
R142	3	27-100 kΩ	901/27K-/100K
R143	18	3.9 kΩ	901/3K9
R144	13	180 Ω	900/180E
R145	12	820 Ω	900/820E
R146	12	180 Ω	900/180E
R147	12	10 kΩ	900/10K
R148	12	4.7 kΩ	900/4K7
R149	12	470 kΩ	900/470K
R150	12	180 Ω	900/180E
R151	4	6.8- ∞ Ω	901/6K8-/
R152	22	10 kΩ	900/10K
R153	12	1.2 MΩ	900/1M2
R154	22	470 kΩ	900/470K
R155	22	10 kΩ	901/10K
R156	22	4.7 MΩ	901/4M7
T1			M7 614 47
V11			08 100 97
V12		5 A	974/5000
V13		5 A	974/5000

LJ/SR



R	3 4 154 12 11.13 4 49 116 151 14 74 52 140 126 132 1 102 73 133 74 143 115 10 9 17 117 16 19 72 141 61 31 41 20 21 118 22 23 6 24 25 119 156
R	50 51 53 54 137 155 56 57 58 59 60 62 63 64 124 55 66 135 67 68 69 136 125 70 71
C	18 19 7 17 16 6 15 14 5 13 12 4 11 10 3 9 8 2 72 71 88 46 79 87 22 83 21 73 61 80 20 74 1 75 23 81 76 24 82 25
C	47 48 45 49 89 50 51 52 53 54 56 57 60

I 2314-01

I

Sk 6

Sk 7,8

Sk 2,9

Sk 3 I,II

Sk 4 I

Sk 4 II,III

Sk 4 IX

Sk 5 I

Sk 5 II

Bu 9

Fig.1

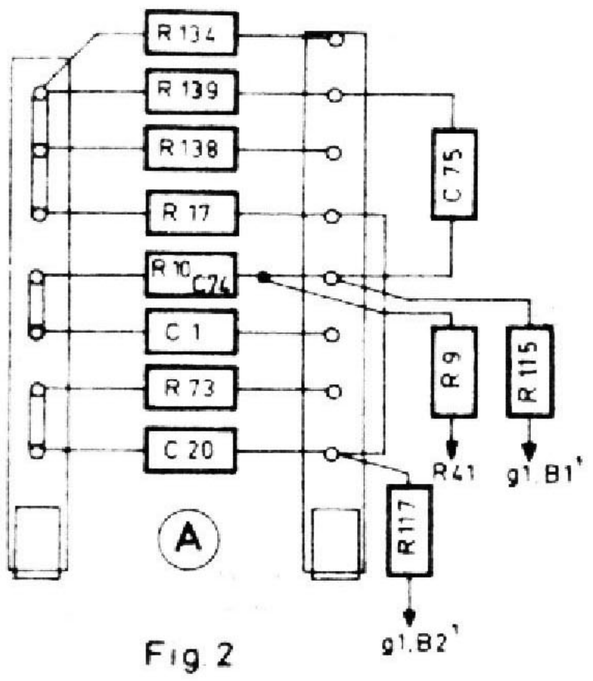
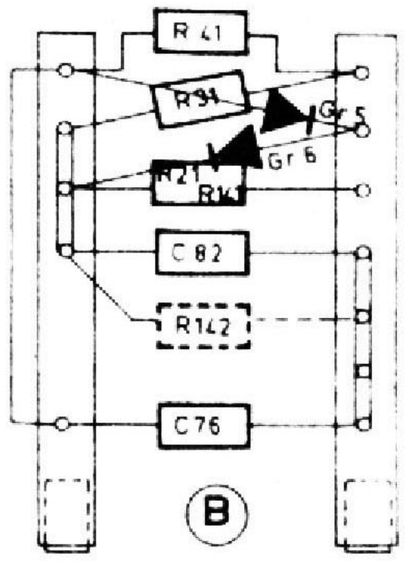


Fig 2



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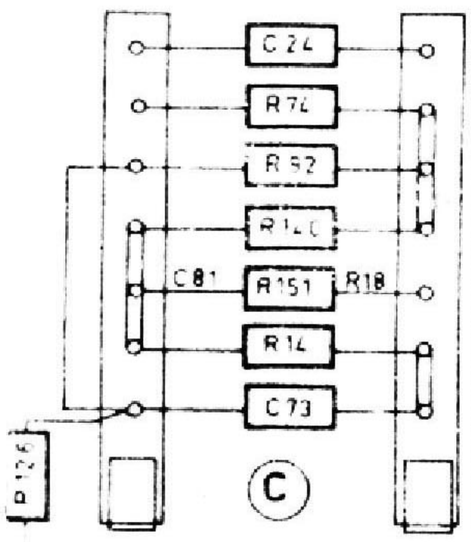

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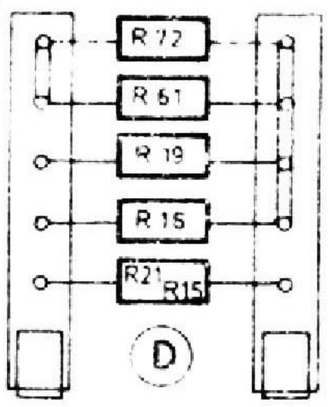

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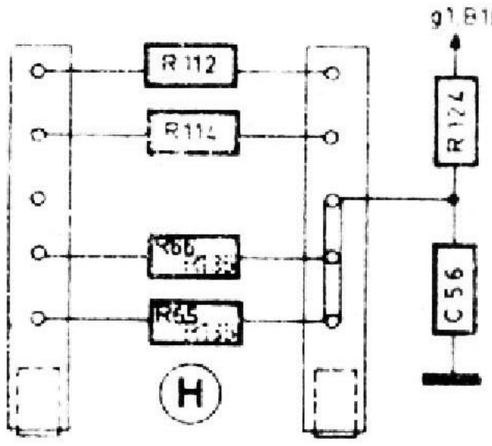


Fig. 6

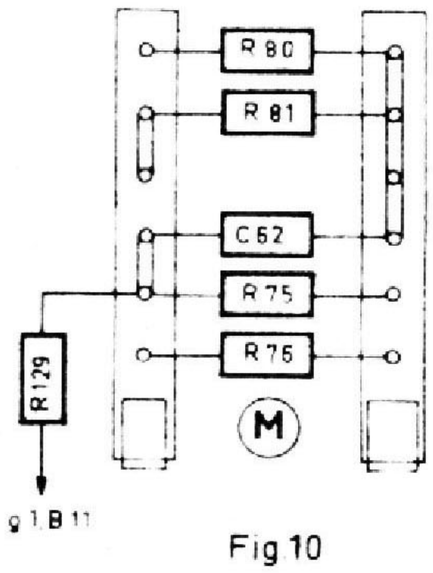


Fig 10

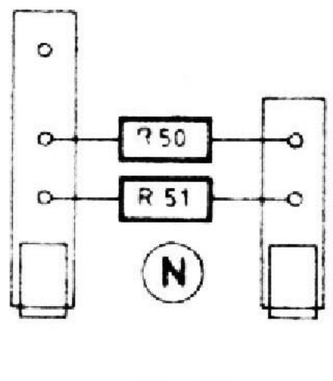


Fig 11

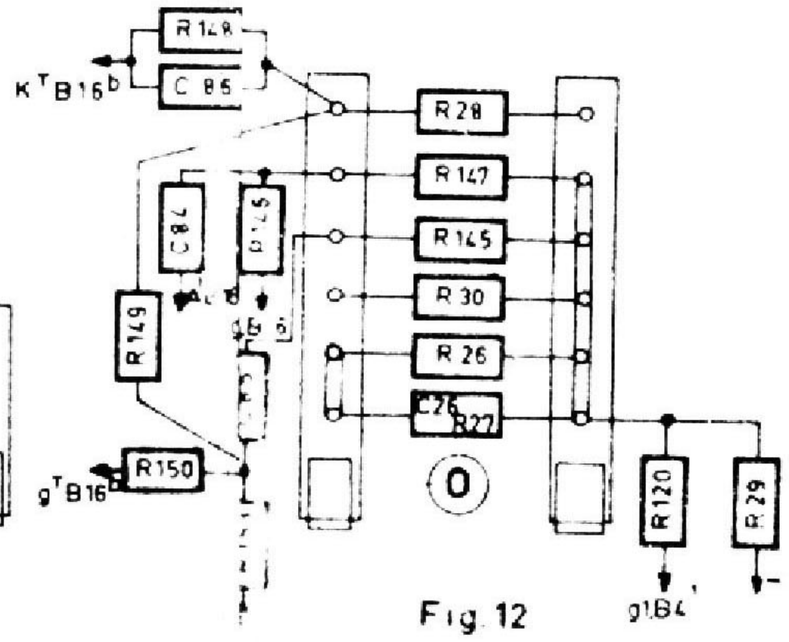


Fig 12

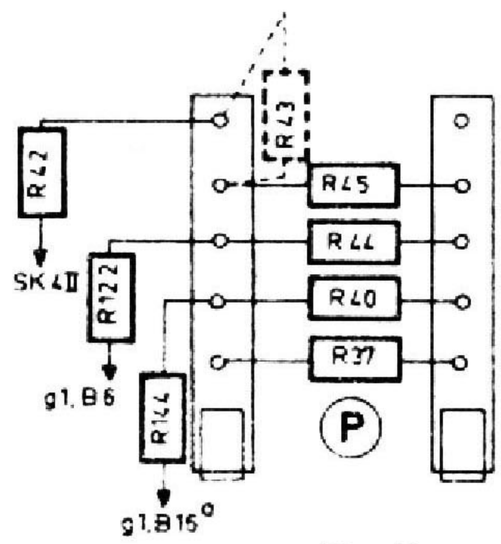


Fig.13

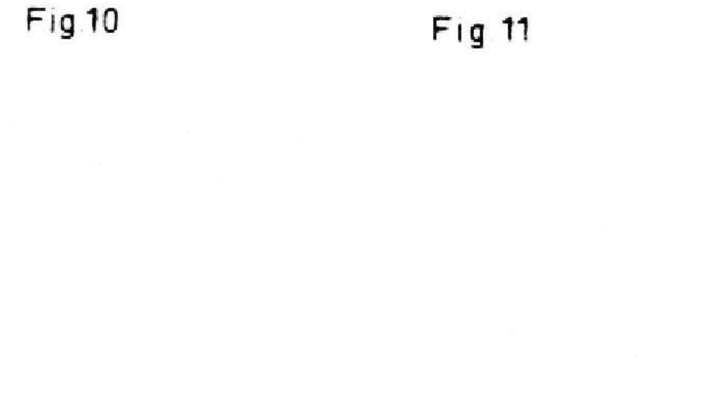


Fig 17

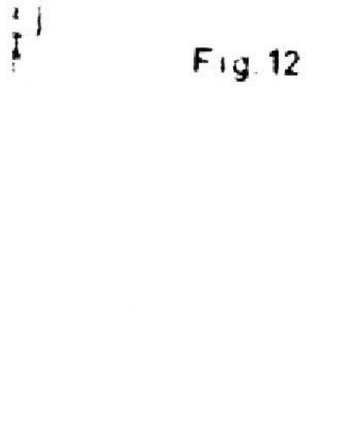


Fig 18

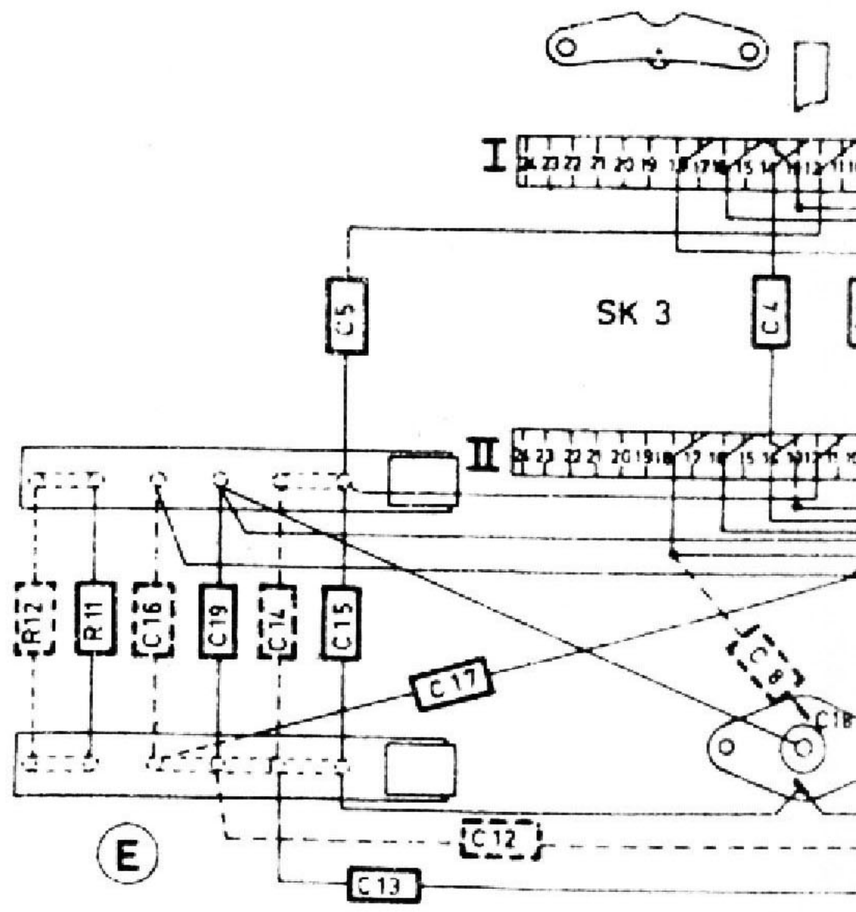


Fig 19

I 240 01

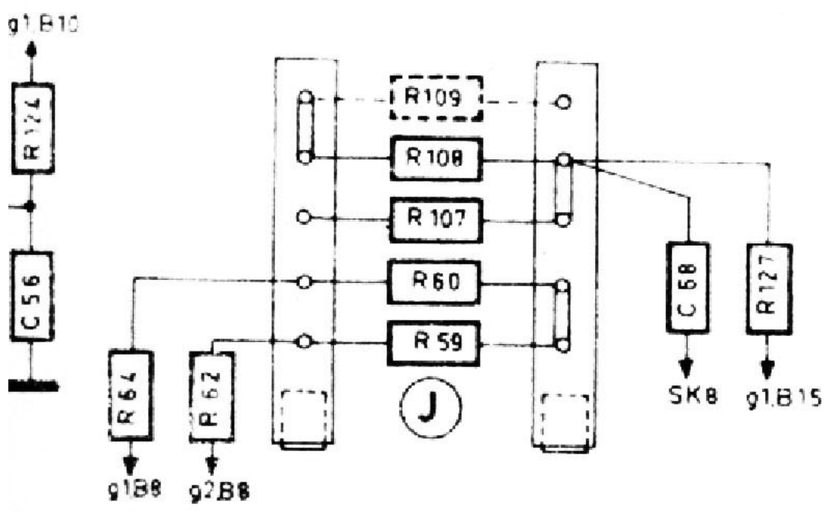


Fig.7

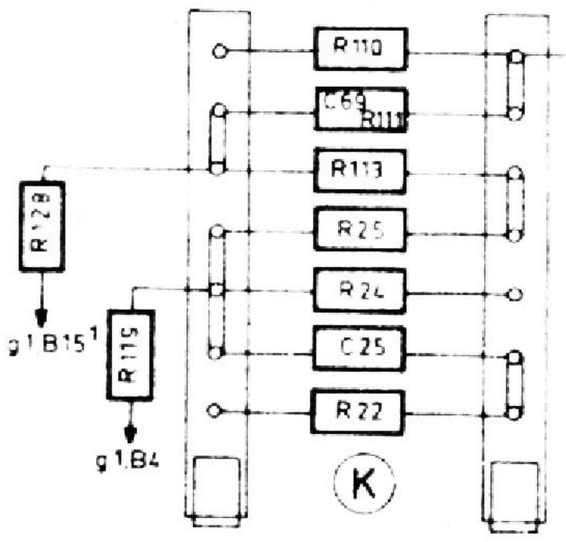


Fig. 8

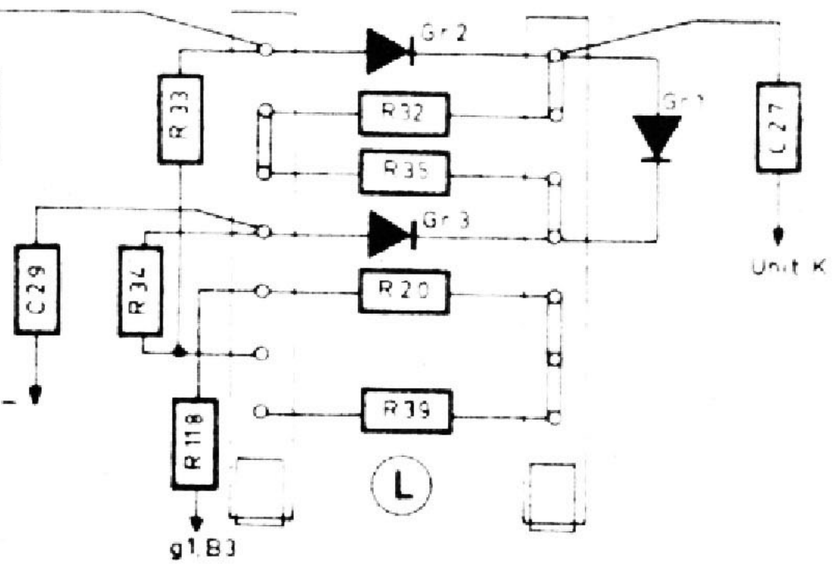


Fig 9

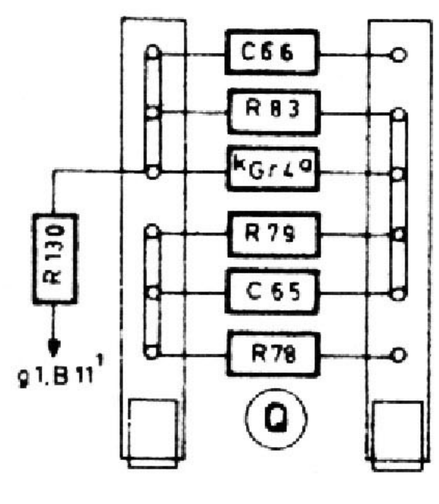


Fig 14

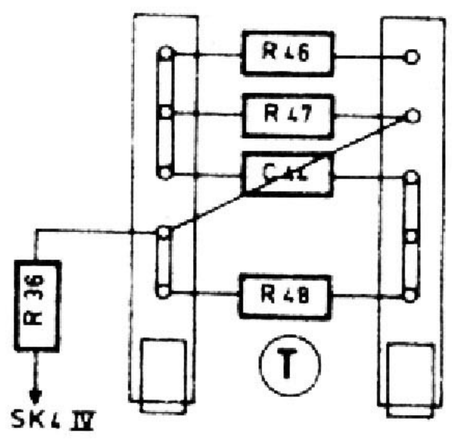


Fig.15

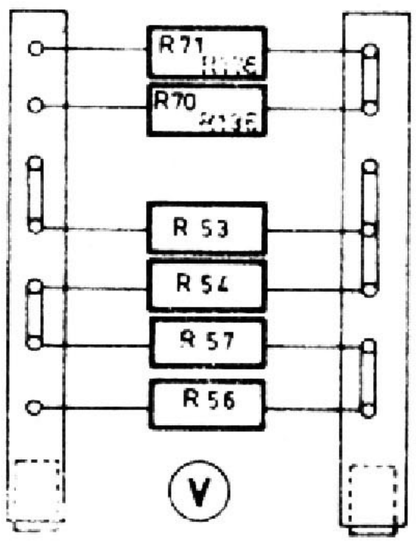


Fig.16

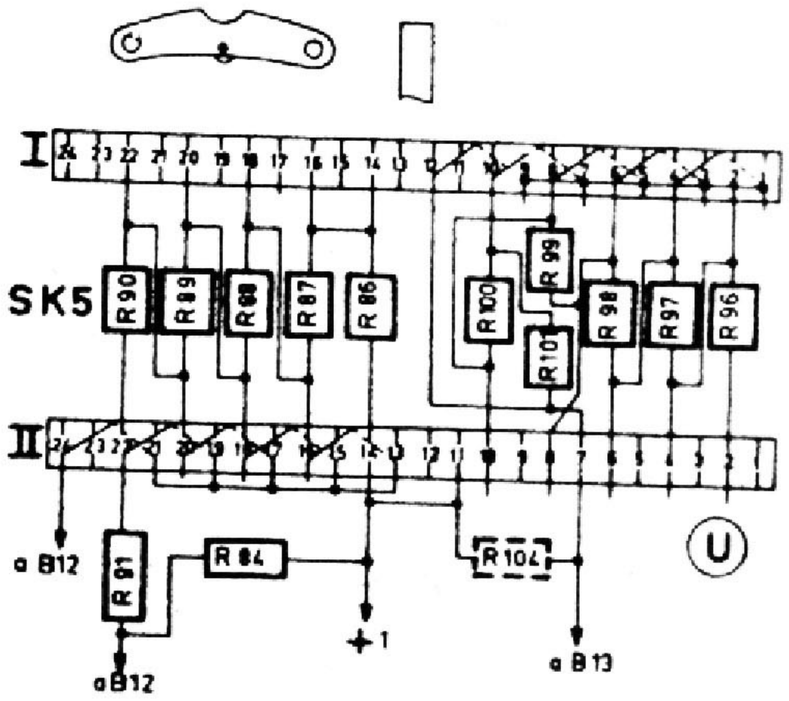


Fig.20

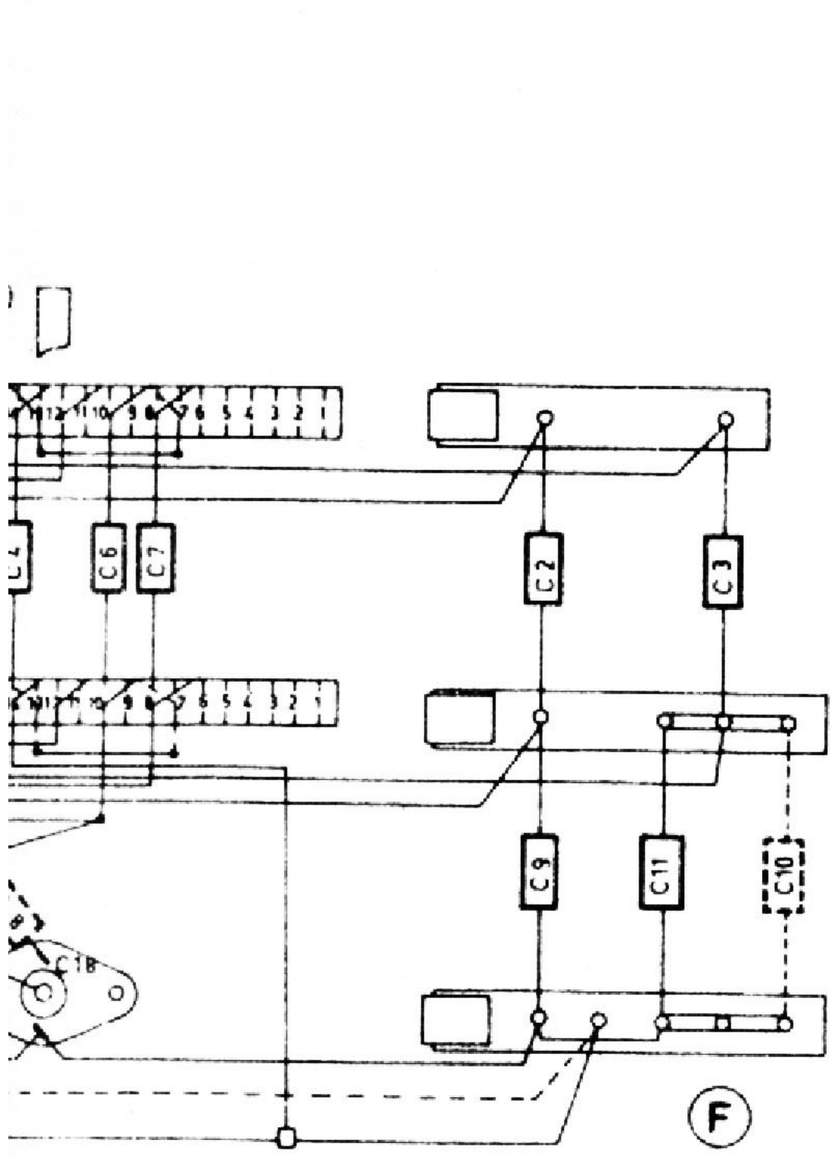


Fig 19

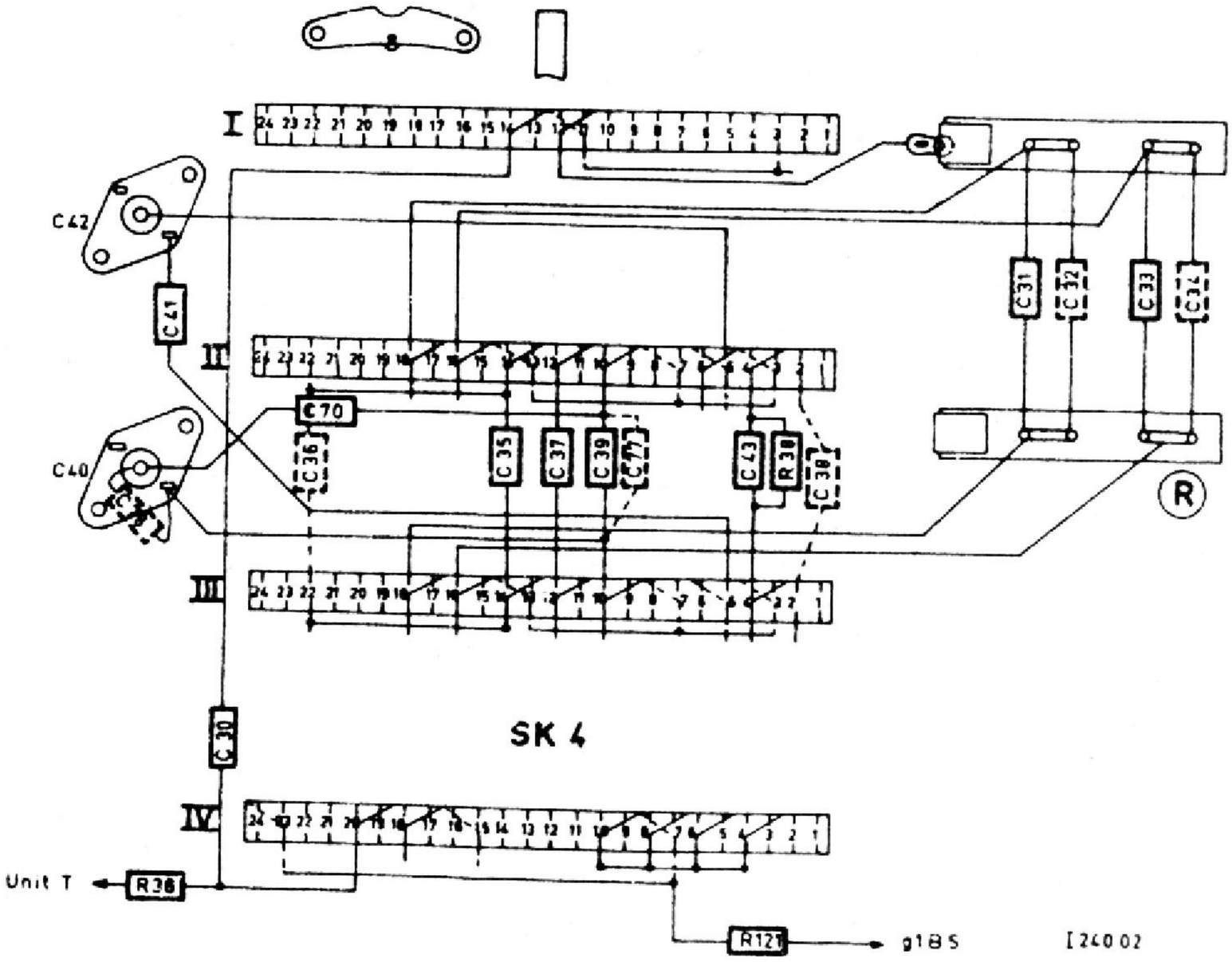
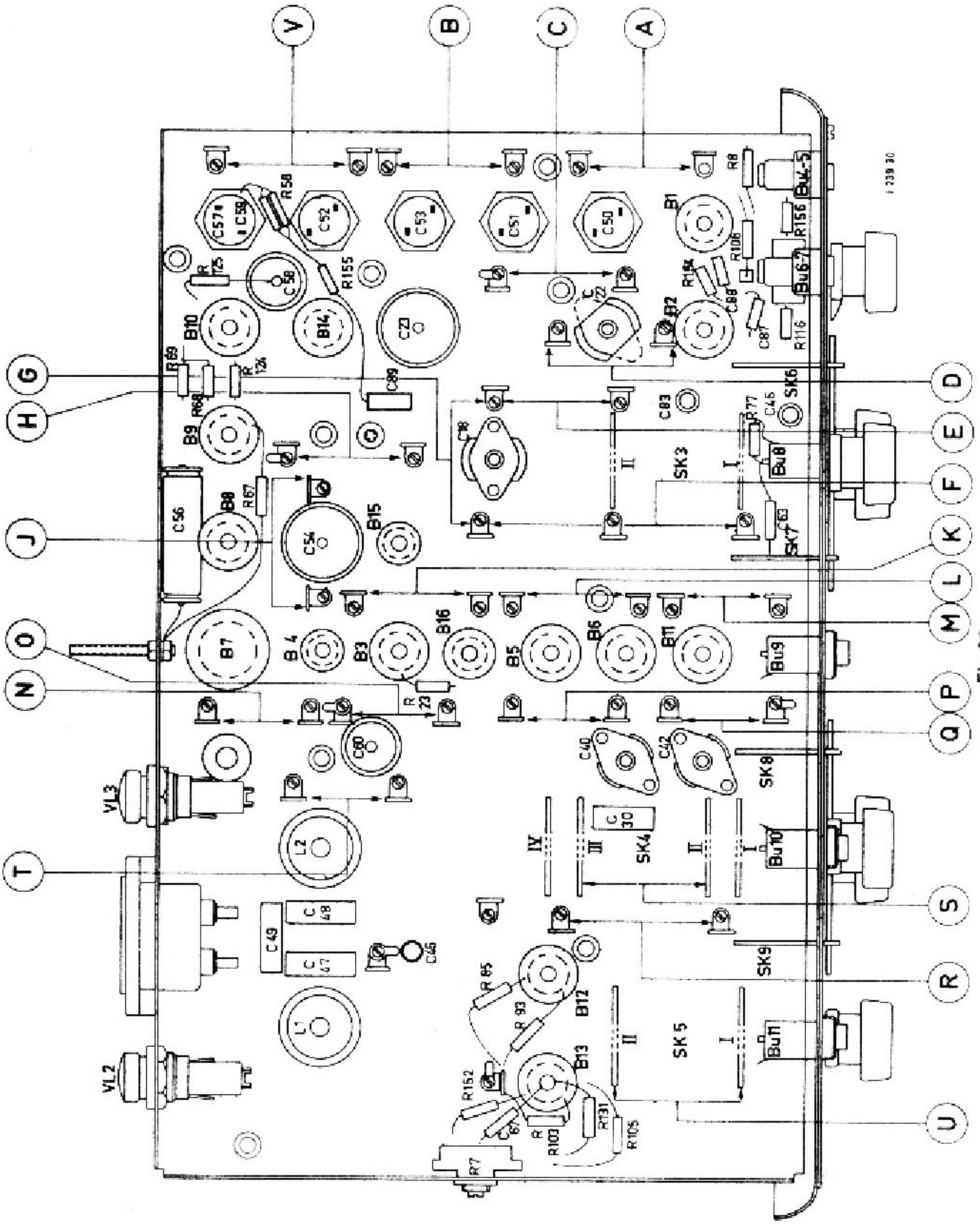


Fig. 21


V
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C63
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C80
C83
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C88
C89
L1
L2
R8
R58
R67
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R85
R93
R103
R105
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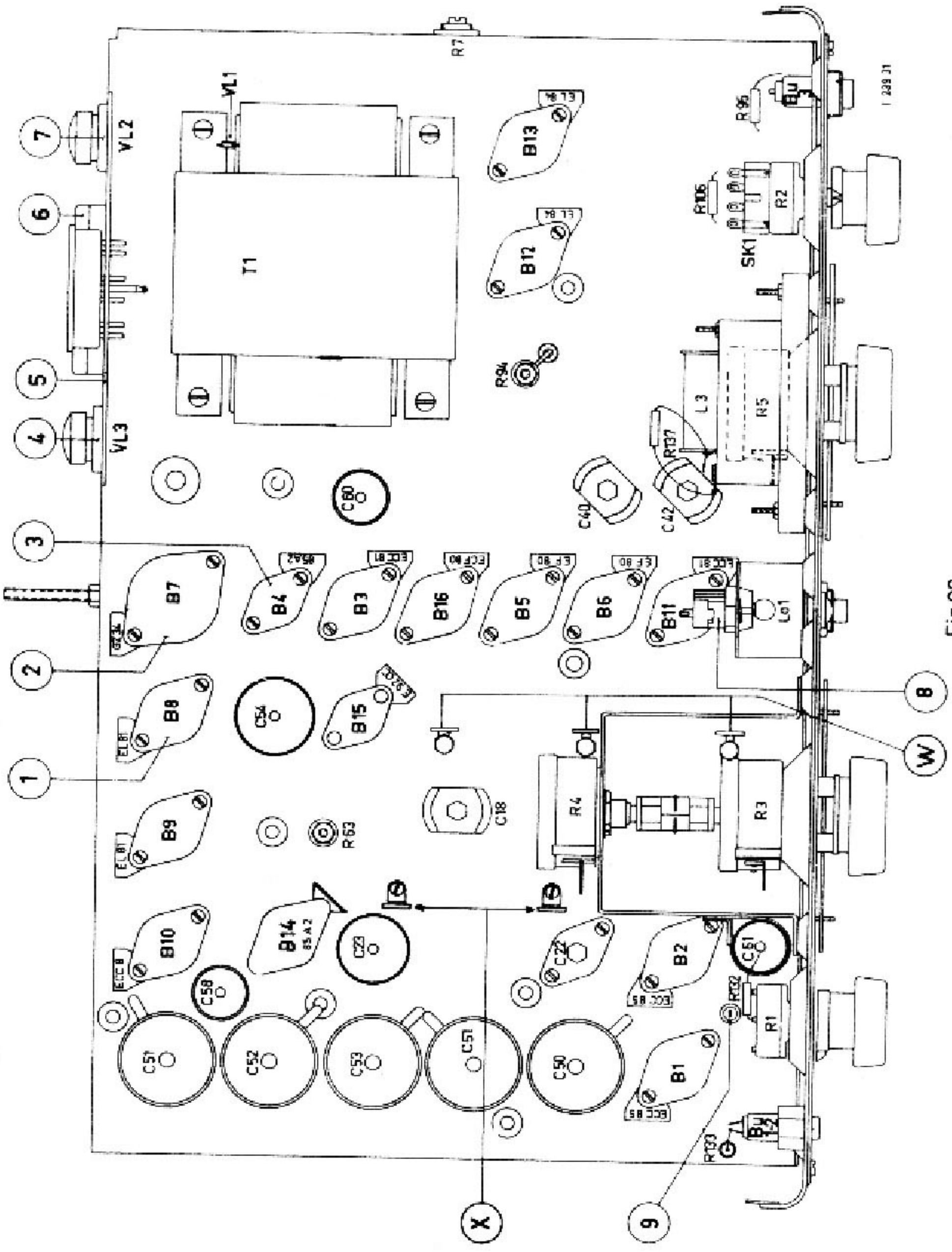
R116
R131
R152
R154
R155
R156
SK3
SK4
SK5
SK6
SK7
SK8
SK9
Bu3
Bu4
Bu5
Bu6
Bu7
Bu8
Bu9
Bu10
Bu11
VL2
VL3
I
II
III
IV
I 239 30

Fig.22


R7
VL1
VL2
VL3
T1
B13
B12
R96
R106
R2
SK1
R94
L3
R5
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C42
C60
B7
B4
B3
B16
B5
B6
B11
L91
B8
C54
B15
B9
R63
C18
R4
R3
B10
B14
C22
C58
C22
B2
C51
R132
R1
C51
C52
C53
C57
C50
B1
R133
By 1-2
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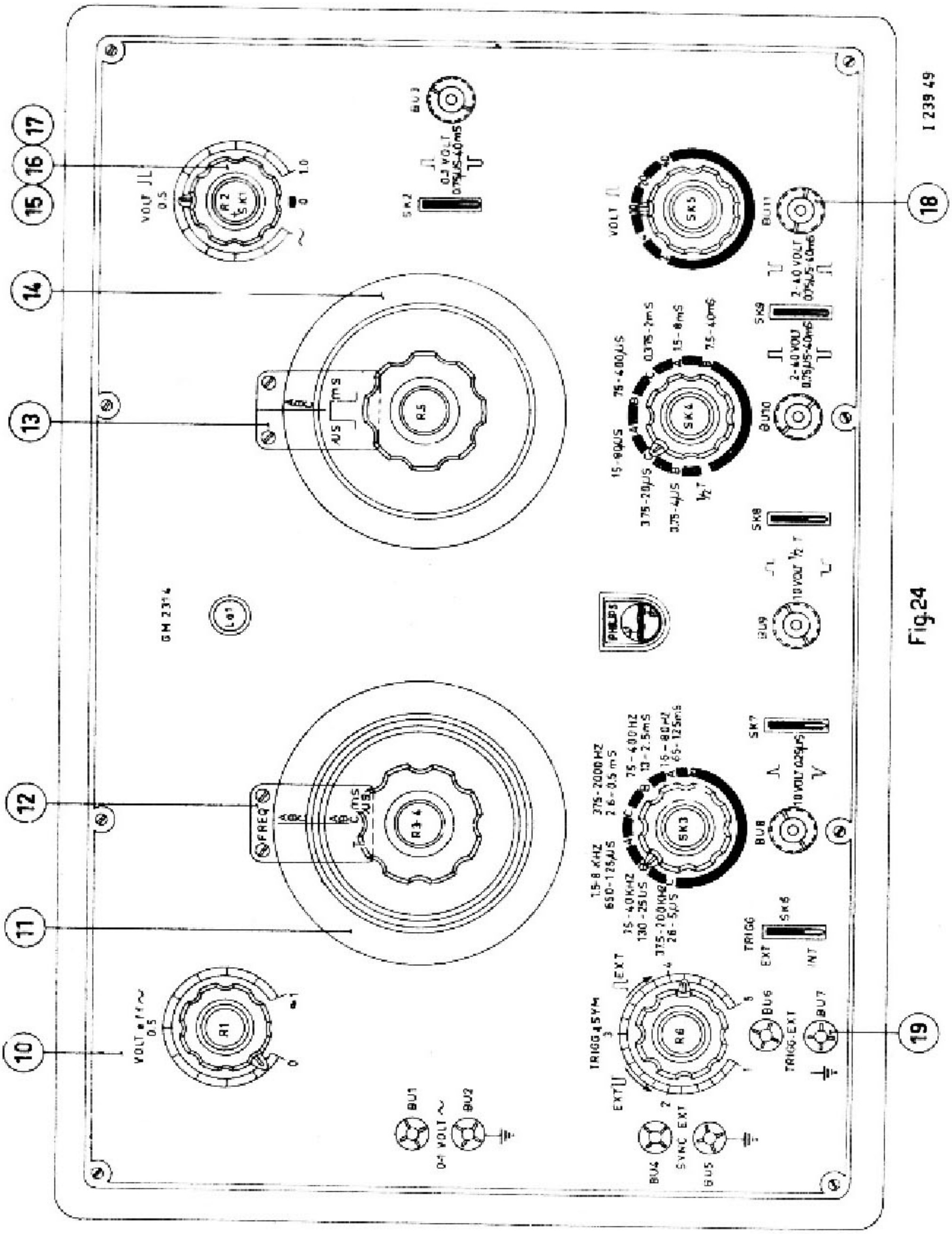
Fig.23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GM 2314
R1
R2
R3
R4
R5
R6
SK1
SK2
SK3
SK4
SK5
SK6
SK7
SK8
SK9
BU1
BU2
BU3
BU4
BU5
BU6
BU7
BU8
BU9
BU10
BU11
PHILIPS
0-1 VOLT ~
SYNC EXT
TRIGG-EXT
TRIGG
EXT
INT
FREQ

Fig.24

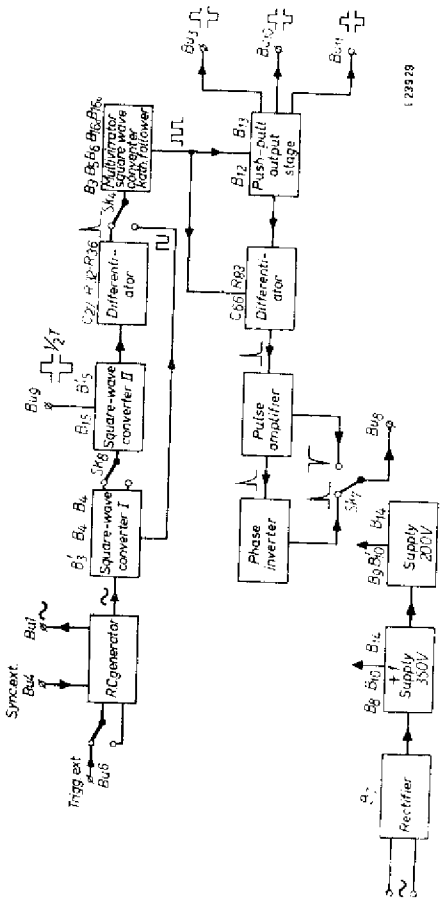

Sync.ext.
Trigg.ext
RC-generator
Square-wave converter I
Square-wave converter II
Differenti-ator
Multivibrator Square-wave converter Kath.-Tailgower
Differenti-ator
Pulse amplifier
Phase inverter
Push-pull output stage
Supply 200V
Supply 350V
Rectifier
~ 23939

Fig.25

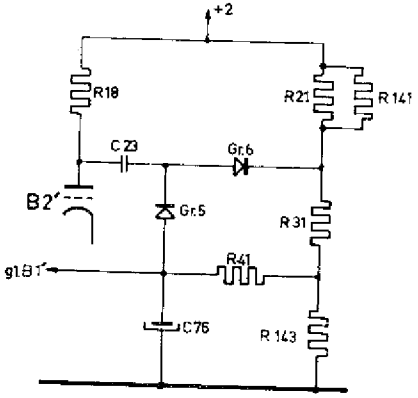

+2
R18
R21
R141
CZ3
Gr6
B2'
Gr5
R31
g1B1'
R41
C76
R143

Fig.26

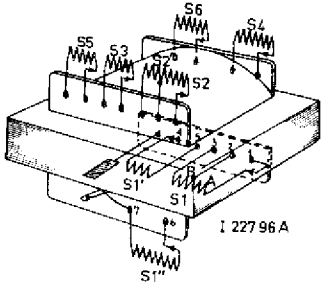

S6
S4
S5
S3
S2
S2'
S1'
S1
I 22796 A
S1''

Fig.27

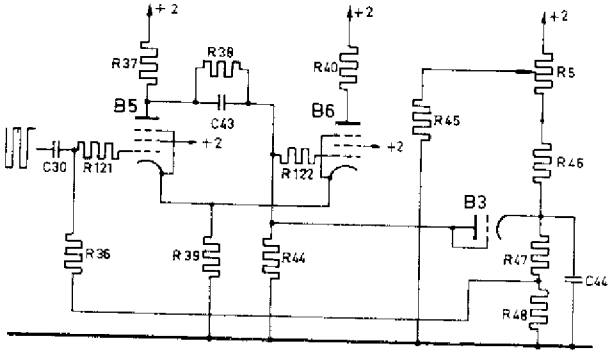

+2
R37
R38
B5
C43
C30
R121
R40
B6
R122
R5
R45
R46
B3
R36
R39
R44
R47
C44
R48

Fig.28

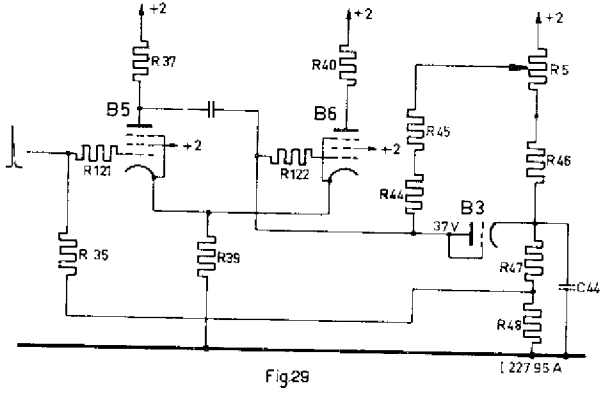

+2
R37
B5
R121
R40
B6
R122
R5
R45
R46
R44
B3
37V
R35
R39
R47
C44
R48
[22795A

Fig.29

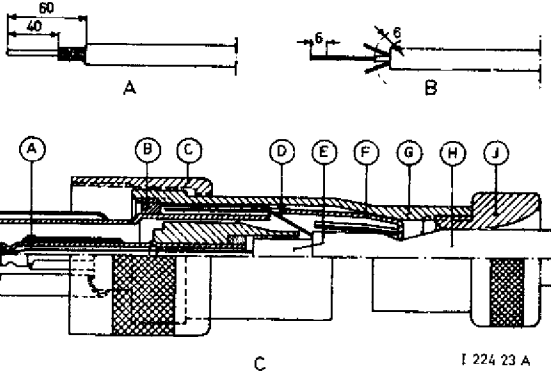


Fig.30

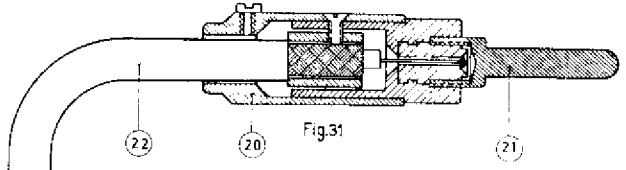


Fig.31

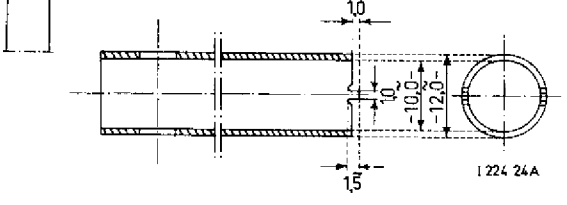


Fig.32

N.V. PHILIPS' GLOEILAMPEN-FABRIEKEN EINDHOVEN	**Delivery Test**	I
		DATE 15-4-1958
CENTRAL SERVICE DIVISION	GROUP: P.I.T. - E.M.A. ARTICLE: Pulse generator TYPE: GM 2414-0	3/3P

A. The external appearance of the apparatus should be in excellent condition.

B. R.C.-generator

a. Frequency check

Check the frequency of the voltage produced with SK3 and R3-R4 in the following positions:
(connect oscilloscope to Bu1-Bu2; R1 fully clockwise; SK6 in position "trigg.int.").

Position SK3	Successively adjust R3-R4 to:
1	50 kc/s, 100 kc/s, 200kc/s
2	10 kc/s, 40 kc/s
3	2 kc/s, 8 kc/s
4	500 c/s, 2 kc/s
5	100 c/s, 200 c/s, 400 c/s
6	20 c/s, 80 c/s

The frequency deviation must not exceed ± 10%

b. Over-oscillation

In all positions of SK3, gradually turn R3-R4 from maximum to minimum. Throughout this time the generator should oscillate properly and not show any over-oscillation.

c. Synchronization range

Apply an alternating voltage of 0.5 V_{rms}, to Bu4-Bu5. The synchronization range at 20 c/s, 15 kc/s, and 200 kc/s should be wider than 1%.

d. Voltage available at Bu1

Turn knob of R1 fully clockwise.
Throughout the whole frequency range of the R.C.-generator this voltage should have a value of 1-1.5 V_{rms}.

e. Distortion

The distortion of the voltage at Bu1 amounts to 5% max.

C. Rectangular voltage at Bu9

a. Set SK6 to position "tr gg.ext.".
Apply a sinusoidal voltage of 0.5 V_{rms}, 200 kc/s, to Bu6.
Under this condition it should be possible to obtain a symmetrical rectangular voltage at Bu9 by adjusting R6.

b. Set SK6 to position "trigg.int.".
Adjust the frequency of the R.C.-generator to 200 kc/s.
Under this condition it should be possible to obtain a symmetrical rectangular voltage at Bu9 by adjusting R6.

c. For all frequencies the square wave voltage on Bu9 should have a value of 7-13 V, peak to peak.
This voltage may be distorted by a small sinusoidal component of the same frequency and small amplitude.

D. Rectangular voltage at Bu3, Bu10 and Bu11

a. Voltage at Bu10 and Bu11

1. Sk4 in position gT. SK5 in position 40 V. SK6 in position "trigg.int". Adjust R.C.-generator to 200 kc/s. Connect a GM6008 to Bu10 or Bu11.

2. So adjust R6 that in both positions of SK9 the meter indicates the same value (approx. 20V); in this case the rectangular voltage is symmetrical. (With a symmetrical square wave voltage the effective value is half the peak to peak value).

3. When SK5 is set to positions 20, 10, 4 and 2 V, the meter readings would be 10, 5 , 2 and 1 V respectively. Maximum permissible deviation 5%.

4. Connect Bu10 and Bu11 to the vertical plates of the oscilloscope. Adjust R.C.-generator for 200 kc/s. The voltage should have the appropiate rectangular shape.

b. Voltage at Bu3

1. Same setting as under Da-1 and 2, then connect a GM6008 to Bu3 and turn knob of R2 fully clockwise.

2. In both positions of SK2 the meter would indicate 0.5 V. Tolerance 5%.

E. Checking the pulse duration. Dial of R5.

1. SK6 in position "trigg.ext". No control voltage on Bu6.
   SK5 in position 40 V. R6 about in the middle position.
2. Connect an Universal measuring instrument (P 8'1 00) to Bu11.
   SK9 in lower position.
3. The meter now indicates a current, which will be designated by I.
4. Connect an alternating voltage generator to Bu6.
   Adjust voltage to 2 V_{rms}.

Applied frequency	Position SK4	Position SK5	Current through meter.
20 c/s	8 (7.5 - 40 msec)	30 msec	0.1 I
20 c/s	8 (7.5 - 40 msec)	10 msec	0.3 I
100 c/s	6 (0.375 - 2 msec)	1 msec	0. I
2 kc/s	5 (75 - 400 µsec)	200 µsec	0.5 I
10 kc/s	4 (15 - 80 µsec)	40 µsec	0.5 I
40 kc/s	3 (3.75 - 20 µsec)	10 µsec	0.5 I
200 kc/s	2 (0.75 - 4 µsec)	2 µsec	0.5 I

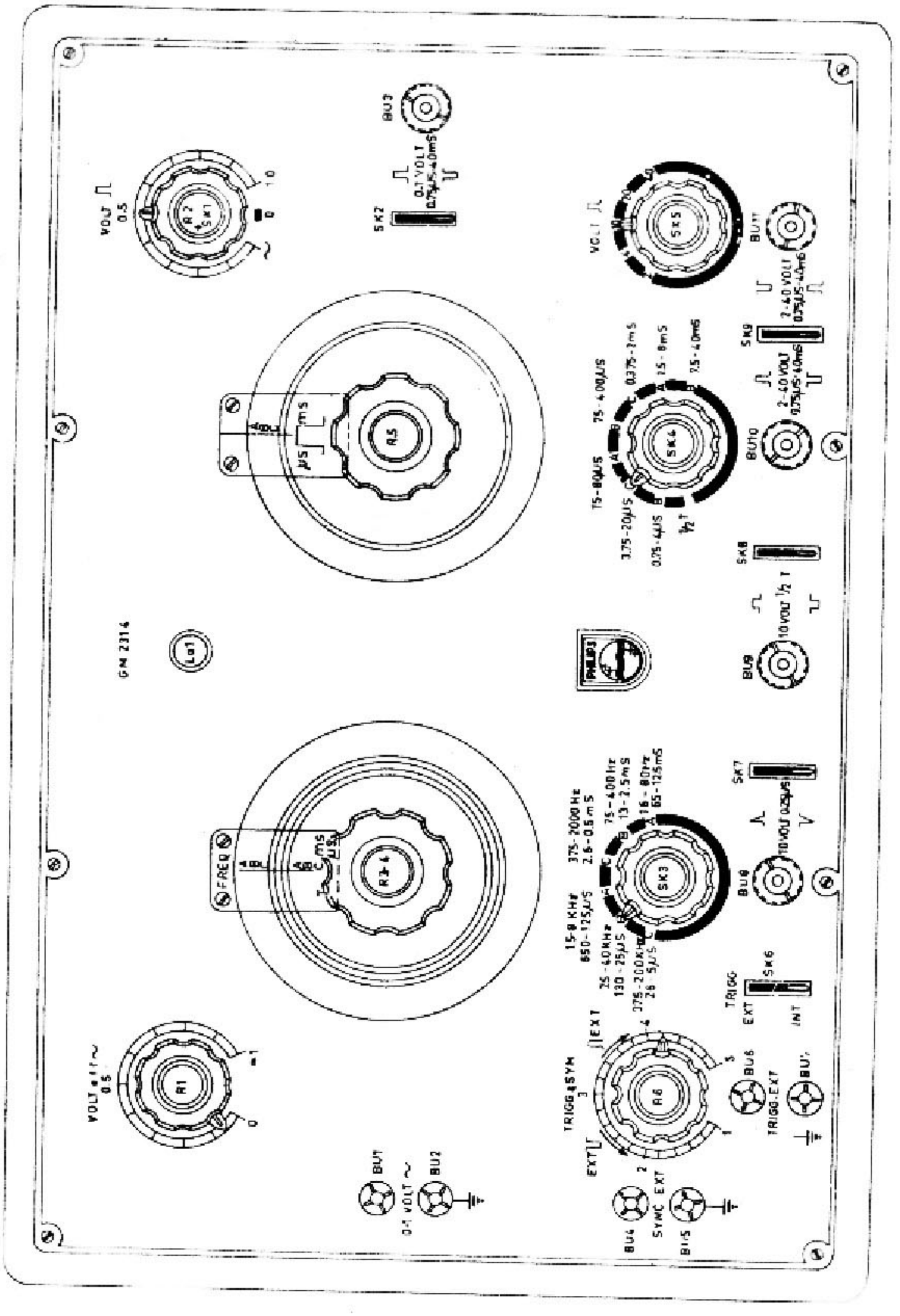
Maximum permisible deviation of the dial of R5:

SK4 in position : 25%

SK4 in position 3-8: 15%

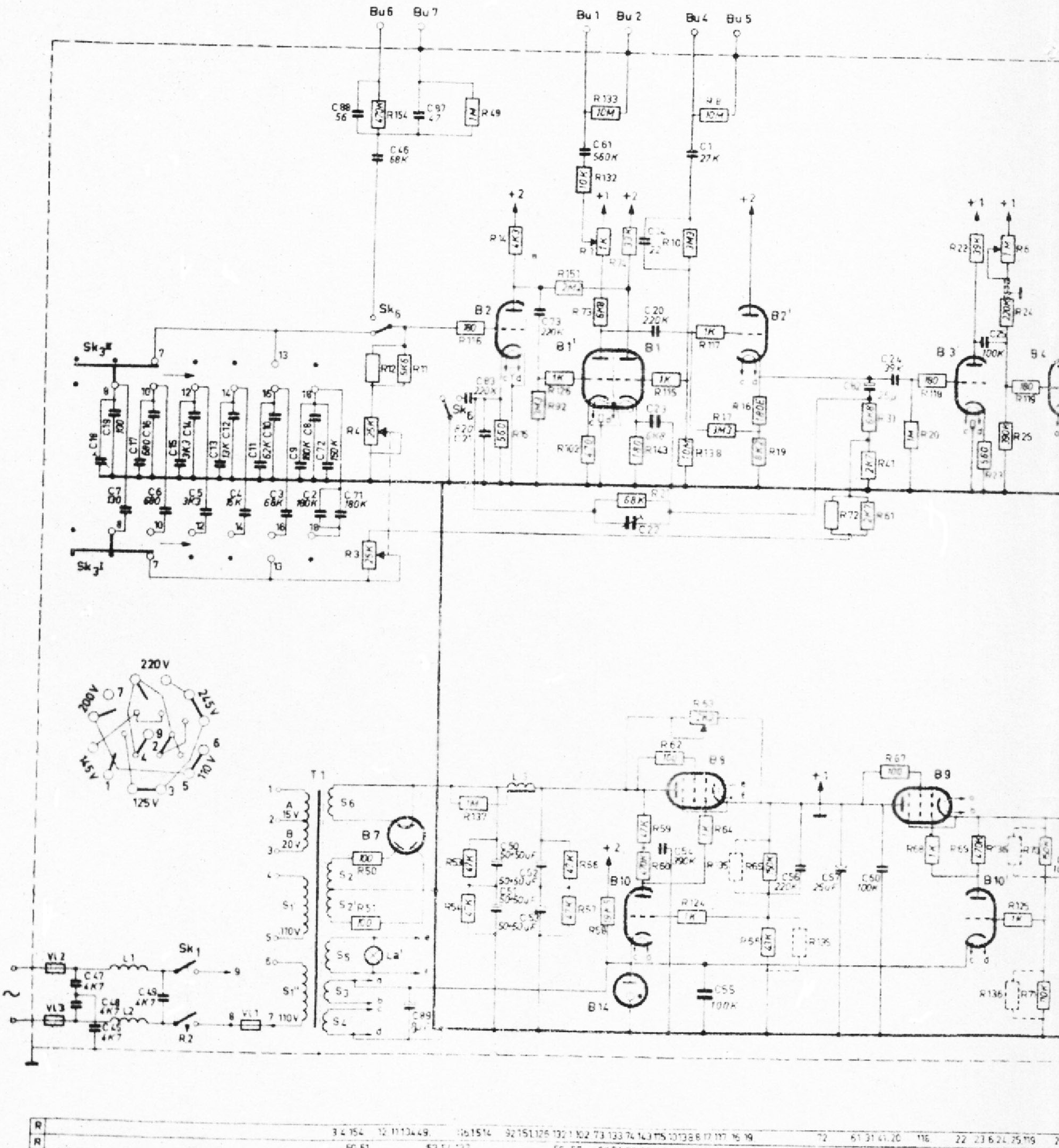
F. Pulse shaper. Needle-shape pulse at Bu8.

1. SK6 in position "trigg.int".
2. Adjust R.C.-generator to 200 kc/s.
3. Connect oscilloscope (GM5654) to Bu8.
4. The pulse should have a peak value of 5-15 V.
   The half-value width should be between 0.3 and 0.35 µsec.
5. SK7 to upper position. The pulse should be positive.
   SK7 to lower position. The pulse should be negative.
   In both cases only a very small pulse of opposite polarity should occur.


GM 2314
R1
R2
R2-1
R3-1
R4
R5
R6
SK1
SK2
SK3
SK4
SK5
SK6
SK7
SK8
SK9
BU1
BU2
BU3
BU4
BU5
BU6
BU7
BU8
BU9
BU10
FREQ
TRIGG.EXT
SYNC EXT
0-1 VOLT ~
10 VOLT 1/2 T
2-40 VOLT
15-9 KHz
650-125µS
375-2000 Hz
2.6-0.5 mS
25-40 KHz
130-25µS
75-400 Hz
13-2.5 mS
16-80 Hz
65-12.5 mS
75-400µS
375-2mS
7.5-80µS
3.75-20µS
0.75-4µS
7.5-40mS
1.5-8mS
0.1 VOLT
0.75µS-40mS
PHILIPS

I 239 49

I



R	3 4 154 12 11 13 4 49 16 15 14 92 151 126 102 1 102 73 133 74 143 115 10 138 8 17 117 16 19 72 61 31 41 20 116 22 23 6 24 25 119
R	50 51 53 54 137 56 57 58 21 59 60 62 63 64 124 65 66 135 67 68 69 136 125 70 71
C	18 19 7 17 16 6 15 14 5 13 12 4 11 10 3 9 8 2 72 71 88 46 97 83 21 73 61 23 20 74 1 24 82 25
C	47 48 45 49 59 50 51 52 53 22 54 55 56 57 60

GM 2314-01
Cd 207

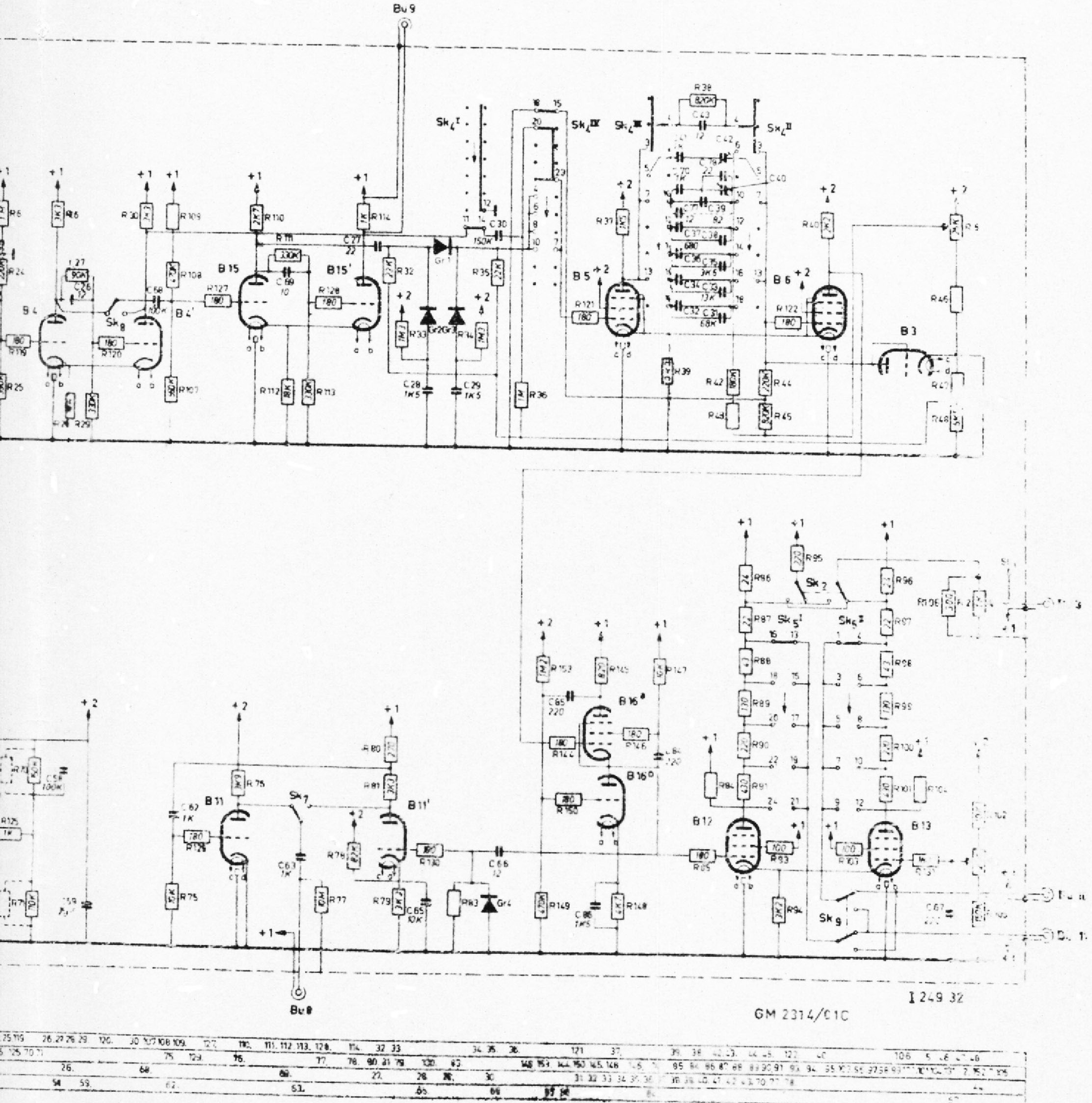
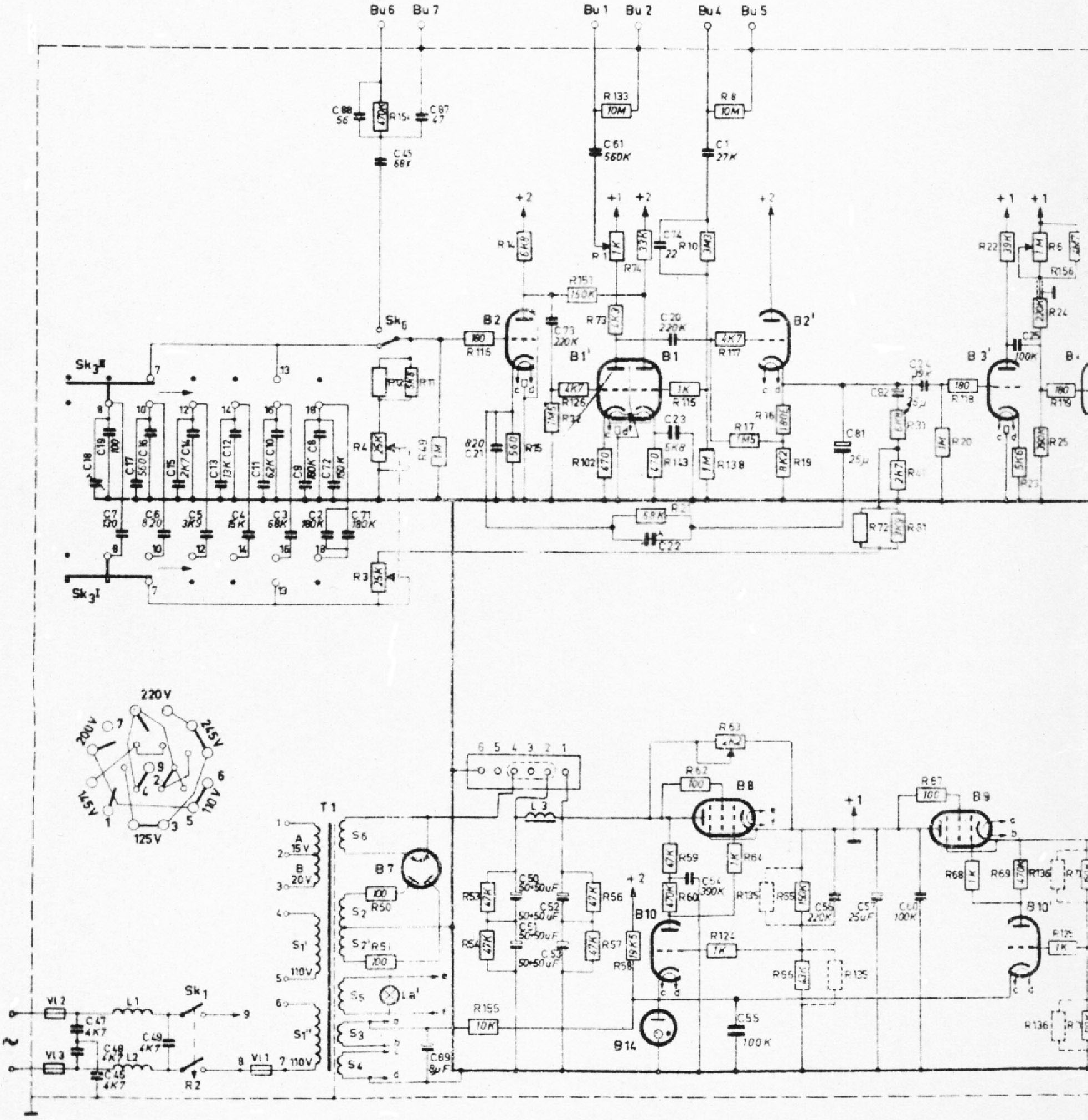
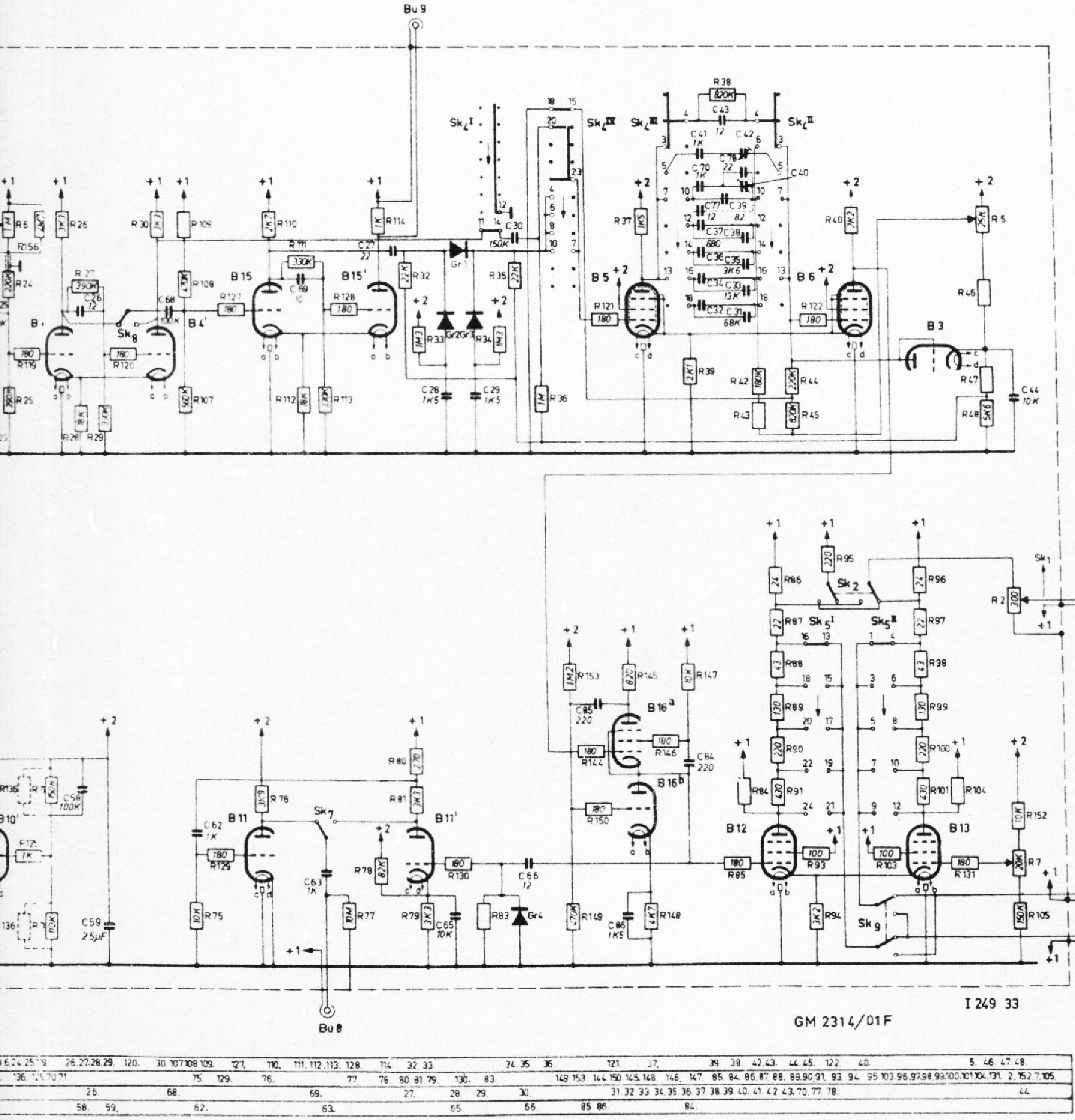


Fig.1



R	3 4 154 12 11 4 9. 116 15 14 92 151 126 1 102 73 133 74 143 115 10 138 8 17 117 16 19. 72 61 31 41 20. 118. 22 23 6 24 25 '9
R	50 51 53 54 155 56 57 58 21 59 60 62 63 64 124 65 66 135. 67 68 69. 136 1̇2̇7
C	18 19 7 17 16 6 15 14 5 13 12 4 11 10 3 9 8 2 72 71 88 46. 27 83 21. 73 61. 23 20 74 23 1. 81. 24 82. 25.
C	47 48 45. 49 09 50 51. 52 53. 22. 54 55 56. 57. 60.

G 2314-01
d 207



6.24.25.19. 26.27.28.29. 120. 30.107.108.109. 127. 110. 111.112.113. 128. 114. 32.33. 34.35. 36. 121. 37. 39. 38. 42.43. 44.45. 122. 40. 5. 46. 47.48.
136. 124.70.71. 75. 129. 76. 77. 76. 80.81.79. 130. 83. 149.153. 144.150.145.148. 146. 147. 85. 84. 86.87.88. 89.90.91. 93. 94. 95.103.96.97.98.99.100.101.104.131. 2.152.7.105.
26. 68. 69. 27. 28. 29. 30. 31.32.33.34.35.36.37.38.39.40.41.42.43.70.77.78. 44.
58. 59. 62. 63. 65. 66. 85.86. 84.

Fig. 2

PHILIPS Service

INFORMATION

PIT-EMA

26-9-1960	GC 2314-01	Cd 253

Already published: Cd 207.

Re: Various modifications

1. As in the case of type 9000 with serial numbers starting from 18577 the output of the AF power may become higher than indicated in the technical specification, the resistor R13 has been added in parallel to R1 (VOLT r.m.s.~).

2. The capacitors C1, C10, C11, C26, C36, C39 and C38 will be chosen from now on from the series 27 pF to 56,000 pF. For the values 27 pF to 470 pF one will be made of ceramic capacitors, whereas for the values 1000 pF to 56,000 pF polyester capacitors will be used.

- - - - - - - - - - -

Re: Diverse wijzigingen

1. Door bij apparaten met serienummers vanaf 18577 de uitgangsspanning van de AF-generator groter te kunnen doen zijn in de technische specificatie is aangegeven, is parallel aan R1 (VOLT eff.~) de weerstand R13 toegevoegd.

2. De kondensatoren C1, C10, C11, C26, C34, C36 en C38 worden voortaan gekozen uit de reeks 27 pF t/m 56.000 pF. Voor de waarden 27 pF t/m 470 pF wordt gebruik gemaakt van keramische kondensatoren, voor de waarden 1000 pF t/m 56.000 pF van polyester kondensatoren.

- - - - - - - - - -

Concerne: Diverses modifications

1. Etant donné que nous les appareils avec numéros de série à partir de 18577 la tension de sortie du générateur B.F. peut devenir plus grande qu'il a été indiqué dans la spécification technique, la résistance R13 a été ajoutée en parallèle sur R1 (VOLT eff.~).

2. Les condensateurs C1, C10, C11, C26, C34, C36 et C38 sont choisis à l'avenir de la gamme 27 pF à 56.000 pF inclus. Pour les valeurs 27 pF à 470 pF inclus on fait usage de condensateurs céramiques, pour les valeurs 1000 pF à 56.000 pF de condensateurs polyestère.

Printed in Holland

Central Service Division N.V. PHILIPS' GLOEILAMPENFABRIEKEN, Eindhoven
Confidential information for Philips Service Dealers

Betrifft: Diverse Aenderungen

1. Da bei Apparaten mit [illegible] ab '65TF die Ausgangsspannung des RC-Generators größer werden kann, als in der technischen Spezifikation angegeben werden ist, ist parallel zu R1 (VOLT eff. ~) der Widerstand R13 hinzugefügt worden.

2. Die Kondensatoren C8, C10, C12, C32, C34, C36 und C38 werden von nun an aus der Reihe 27 pF - 56.000 pF gewählt.
Für die Werte 27 pF bis 820 pF wurden keramische Kondensatoren und für die Werte 1000 pF - 56.000 pF Polyesterkondensatoren benutzt.

Asunto: Varias modificaciones

1. Puesto que en aparatos con números de serie a partir de '65TF la tensión de salida del generador de RC puede sobrepasar la indicada en la especificación técnica, se ha añadido en paralelo a R1 (VOLT105 ef.~) la resistencia R13.

2. Los condensadores C8, C10, C12, C32, C34, C36 y C38 serán elegidos desde hoy de la serie 27 pF a 56.000 pF. Para los valores 27 pF a 820 pF se aprovechan condensadores cerámicos y para los valores 1000 pF a 56.000 pF condensadores de poliéster.

R13	Carbon resistor	0.5 W 5 %	22K/5K7
C8,C10,C12, C32,C34,C36,C38	Ceramic capacitor	500 V	30E/27E....3n3/820E
	Polyester capacitor	400 V	40P/1K.....39 0/56K

CENTRAL SERVICE DEPARTMENT

H.v.Silverda

HvS/PV

Point 6: add:

"Negative pulse $<$ 10 % of the positive pulse".

Point 7: add:

"Tolerance 0.27 - 0.33 μ sec.
Positive pulse $<$10 % of the negative pulse".

CIII. Modification in the pre-sale test

To point F4 of the pre-sale test has been added:
"At a capacitive charge of 50 pF".

OLD			NEW		
C5	3300 pF	906/V3K3	C5	3900 pF	906/V3K9
C6	680 pF	905/680E	C6	820 pF	905/820E
C15	3300 pF	906/V3K3	C15	2700 pF	906/V2K7
C17	680 pF	905/680E	C17	560 pF	905/560E
C67	220 pF	904/220E	C67	1500 pF	904/1K5
C81	-	-	C81	25 uF-50 V	910/G25
C83	0.22 μF	906/V220K	C83	-	-
R2	1 kΩ-lin	916/DE1K	R2	300 Ω-lin	916/DE300E
R14	4300 Ω	901/4K3	R14	6.8 kΩ-1W	E003AG/D6K8
R17	3.3 MΩ	900/3M3	R17	1.5 MΩ	901/1M5
R23	560 Ω	901/560E	R23	5.6 kΩ	901/5K6
R39	2.2 kΩ-1W	900/2K2	R39	2.2 kΩ-2W	B8 305 08B/2K2
R61	2.7 kΩ	901/2K7	R61	3.9 kΩ	901/3K9
R73	6.8 kΩ-1W	E003AG/D6K8	R73	4.3 kΩ	901/4K3
R92	3.3 MΩ	900/3M3	R92	1.5 MΩ	901/1M5
R106	300 Ω	901/300E	R106	-	-
R117	1 kΩ	900/1K	R117	4.7 kΩ	901/4K7
R126	1 kΩ	900/1K	R126	4.7 kΩ	901/4K7
R132	10 kΩ	900/10K	R132	-	-
R138	10 MΩ	901/10M	R138	1 MΩ	901/1M
R143	180 Ω	901/180E	R143	470 Ω	901/470E
R151	2.2 MΩ	901/2M2	R151	150 kΩ	901/150K
R156	-	-	R156	4.7 MΩ	901/4M7
R157	-	-	R157	39 kΩ	901/39K
R158	-	-	R158	68 Ω	901/68E
R159	-	-	R159	68 Ω	901/68E

Remark: Apart from the capacitor C67 and the resistors R137, R157, R158 and R159 (which do not occur) fig. 2 can be used as a guide for the above apparatuses.

DI. Modifications to apparatuses with code letter F. (Modifications with respect to the previous chapter).

Entirely completed circuit diagram according to fig. 2.

1. The coaxial female plugs Bu3-8-9-10-11 have been replaced by coaxial female plugs of a more modern type (so-called N-connectors).
The coaxial plugs to the measuring cords supplied separately (apparatus side) have also been modified to coaxial plugs of the type N.

2. The construction of the choke L3 has been modified somewhat so that it is no longer necessary to connect the core to the high tension and R137 is obsolete.

3. The fuses VL2 and VL3 have been changed to 3,15A .

4. R39 has been modified from 2200Ω - 2 W to 2 x 4200 Ω - ½ W in parallel. By this R157 could be deleted again.

5. On the fixing screw of choke L3 a contact plate with printed wiring has been mounted. (See fig. 2) This contact plate with soldering pins is used when adjusting the apparatus in the works. For safety reasons the apparatus is then fed from a measuring rack and not from the built-in supply unit. For normal use points 2 and 4 must be interconnected.

6. The paper capacitors C1 - C20 - C24 - C25 - C30 - C44 - C46 C56 - C60 - C65 - C68 - C73 have been replaced by polyester capacitors (400 V).

7. As a result of the change in the position of some parts a unit X has been introduced again.
This unit X now contains C54 - C55 - C58.

8. R94, a wire-wound resistor of 3200 Ω - 25 W, has been replaced by a parallel circuit of eight carbon resistors of 27 kΩ - 2 W and 1 carbon resistor of 68 kΩ - 1W.
The resistors have been mounted on two added mounting supports and form a new unit, namely Unit Y.

DII. Modifications in the documentation.

1. By the modification of R94 (Unit Y) and the removal of C67, R158 and R159 the overshoot on Bu10 and Bu11 has been reduced to $\leqslant 5$ %; to be measured with an H.P. oscillograph with measuring probe (for example GM 5662 and GM 5662P).

   N.B. Add the above to point C6a of the documentation and to point Da4 of the pre-sale test.

2. Of point C2K of the documentation point 3 has been deleted and replaced by: "3. H1 on 0.5; SK3 on range 75 - 400 c/s. The voltage on Bu1 should lie between 0.4 and 0.6 of the full voltage".

C1	27	kpF	906/V27K	C1	27kpF	906/27K
C20	0.22	µF	906/V220K	C20	0.22 µF	906/220K
C24	39	kpF	906/V39K	C24	39kpF	906/39K
C25	0.1	µF	906/V100K	C25	0.1 µF	906/100K
C30	0.15	µF	906/V150K	C30	0.15 µF	906/150K
C44	10	kpF	906/V10K	C44	10kpF	906/10K
C46	68	kpF	906/V68K	C46	68kpF	906/68K
C56	0.22	µF	906/V220K	C56	0.22 µF	906/220K
C60	0.1	µF	906/V100K	C60	0.1 µF	906/100K
C65	10	kpF	906/V10K	C65	10kpF	906/10K
C67	1500	pF	904/1K5	C67	-	-
C68	0.1	µF	906/V100K	C68	0.1 µF	906/100K
C73	0.22	µF	906/V220K	C73	0.22 µF	906/220K
R39	2200	Ω-2W	B830508B/2K2	R39	2100 Ω-2W	B830518D/4K2 2x par.
R94	3200	Ω-25W	B830034B/3K3	R94	(8x27kΩ-2W) par (1x68kΩ-1W)	B830508B/27K E 003AG/D68K
R137	1	MΩ	900/1M	R137	-	-
R157	39	kΩ	901/39K	R157	-	-
R158	68	Ω	901/68E	R158	-	-
R159	68	Ω	901/68E	R159	-	-
VL2	5	A	974/5000	VL2	3,15 A	974/3150
VL3	5	A	974/5000	VL3	3,15 A	974/3150
2x coaxial plug			B1 610 10 (977/CM01)	2x coaxial plug		977/CM04
5x coaxial female plug			B1 610 05	5x coaxial female plug		977/003

CENTRAL SERVICE DEPARTMENT,

Ch.F. Salverda.

N.V. PHILIPS GLOEILAMPEN-FABRIEKEN EINDHOVEN	Service Information	No. Cd 207
		14-8-1959
CENTRAL SERVICE DIVISION	GROUP: P.I.T. - E.M.A. ARTICLE: Pulse-generator TYPE: GM 2314-01	BE/AB

ALREADY PUBLISHED:

RE: Various modifications

A. The apparatusses with the code letter C behind the serial number have been modified according to the points mentioned below:
In order to shorten the switching on time and to reduce the distortion the circuit around the valve B1 and B2 (R.C. generator) has been modified entirely (see fig. 1).
As a result of the change of the position of some parts Unit X has been deleted.
C55 has been connected in parallel to B14.
The electrical parts list has been modified according to the parts list given below.

OLD			NEW		
C21	47 pF	904/47E	C21	820 pF	904/820E
C23	0.82 µF	906/V820K	C23	6800 pF	904/6K8
C55	-		C55	0.1 µF	906/100K
C75	220 pF	904/220E	C75	-	-
C76	100 µF	910/C100	C76	-	-
C79	25 µF	910/D25	C79	-	-
C80	350 µF	910/B250	C80	-	-
C81	120 pF	904/120E	C81	-	-
R15	5600 Ω	901/5K6	R15	560 Ω	901/560E
R16	1 KΩ	901/1K	R16	180 Ω	901/180E
R18	6800 Ω	901/6K8	R18	-	-
R19	2700 Ω	901/2K7	R19	8200 Ω-1W	E003AG/C8K2
R21	37.5 KΩ	2x901/75K par.	R21	68 KΩ-NTC	B8 320 04P/68K
R31	3900 Ω	901/3K9	R31	6800 Ω	901/6K8
R41	220 KΩ	900/220K	R41	2700 Ω	901/2K7
R61	5600 Ω	901/5K6	R61	2700 Ω	901/2K7
R73	5600 Ω	901/5K6	R73	6800 Ω	E003AG/B6K8
R74	56 KΩ	901/56A	R74	33 KΩ	E003AG/B33K
R102	5600 Ω	901/5E6	R102	470 Ω	901/470E
R134	1 MΩ	900/1M	R154	-	-
R138	150 KΩ	900/150K	R138	10 MΩ	901/10M
R139	27 KΩ	901/27K	R139	-	-
R140	560 KΩ	901/260K	R140	-	-
R141	270 KΩ	901/270K	R141	-	-
R143	3900 Ω	901/3K9	R143	180 Ω	901/180E
R151	6800 Ω-	901/6K8-	R151	2.2 MΩ	901/2M2
GR5	OA81	-	GR5	-	-
GR6	OA81	-	GR6	-	-

B. Modifications to apparatuses with serial numbers 1355 to 1605 inclusive.

A few small modifications of the resistance values in the F-C generator with respect to the apparatuses modified according to the previous point.

OLD			NEW		
R61	2700 Ω	901/2K7	R61	5600 Ω	901/5K6
R138	10 MΩ	901/10M	R138	1 MΩ	901/1M
R143	180 Ω	901/180E	R143	470 Ω	901/470E
R151	2.2 MΩ	901/2M2	R151	150 KΩ	901/150K

CI. Modifications to apparatuses with serial numbers 1607 to 1956 inclusive, with respect to the apparatuses with code letter C (chapter A).

1. R21//C22 has not been connected any more to the junction C62-R31 but via an added electrolytic capacitor of 25 nF (C81) connected to the junction C24-C82.
2. C83 has been deleted, just as the pertinent part of switch SK6 (2 contact springs and pertinent rotor contact).
3. The value of the potentiometer R2 has been changed and the resistor R106 connected in parallel to it has been deleted.
4. The position of R49 (parallel to C87) has been changed and this resistor has now been mounted between R116-SK6 and the negative side of the supply part.
5. In parallel to R6 a resistor of 4,7 MΩ (R156) has been added.
6. R142 has been deleted.
7. In parallel to R39 a resistor of 39 KΩ (R157) has been added.
8. Resistors of 68 Ω (R154 and R155 respectively) have been added in the connecting wires between SK9 and Bu10 and Bu11 respectively.
9. Further a few modifications in capacitances and resistances according to the list of parts given below.

CII. Modifications in the documentation.
(Serial numbers 1607 to 1956 inclusive)

1. In the documentation of the GM 2314-01 there has been added to point A5d "Voltages" at Bu8.

"This voltage holds good with a capacitive charge of 40 pF. For smaller capacitive charge the pulse duration decreases and the voltage increases."

2. To C7: Pulse former A"1:311".

Point 5: has been deleted and replaced by:

"On Bu8 a sharp positive pulse must be present with a half-value width of about 0.4 μ sec at a capacitive charge of 40 to 50 pF. If necessary, bring the half-value width to the proper value with R83.
Tolerances: 0.27 - 0.53 μ sec."