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Norelco®

Turntable
GA202

Service
MANUAL

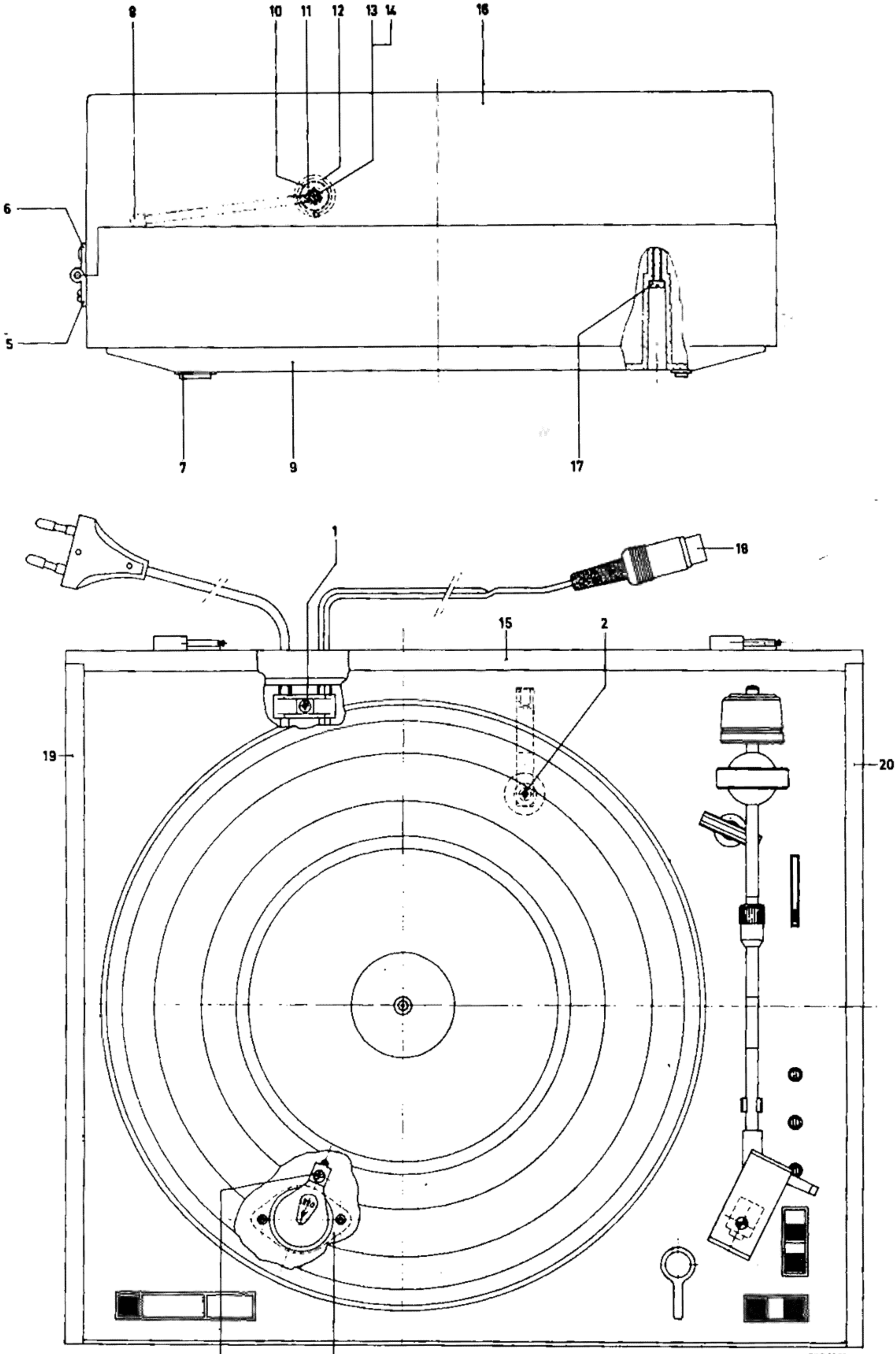
NORTH AMERICAN PHILIPS CORPORATION • Home Entertainment Division • 100 East 42nd Street, New York, N. Y. 10017

TECHNICAL DATA

Mains voltage	: 110 - 127 - 220 - 240 V
Mains frequency	: 50 - 60 Hz
Turntable speeds	: 33 1/3 - 45 - 78 r.p.m.
Speed fine control	: ± 2 % (control located on mounting plate)
PU head	: 22GP411
Stylus pressure	: 1...4 grammes (adjustable)
Anti-skating	: adjustable, dependent on stylus pressure

LIST OF CABINET PARTS

Item		
1-2	self-tapping screw	4822 502 30001
3	screw M3x5	4822 502 10039
4	voltage adapter	4822 272 10021
5	hinge with pin	4822 417 10161
6	hinge	4822 417 10162
7	foot	4822 462 40014
8	cap	4822 462 70538
9	lower casing section	4822 444 50116
10	spring	4822 492 40302
11	disc	4822 466 80351
12	cup spring	4822 462 70541
13	screw M3x10	4822 502 10673
14	nut M3	4822 505 10325
15	strip at the rear	4822 444 40031
16	lid	4822 444 20086
17	screw M4x20	4822 502 10051
18	plug	4822 264 40023
19	strip, left-hand side	4822 444 40032
20	strip, right-hand side	4822 444 40033



TGR 2378

R	6 8 9 10 12 11 13 19 38 20 30 36 32 22 18 16 24 31 39 15 21 17 27 5 23 14 40 35 1 33 3 4 25 28 24 29 2 37 26
C	2 3 4 1 7

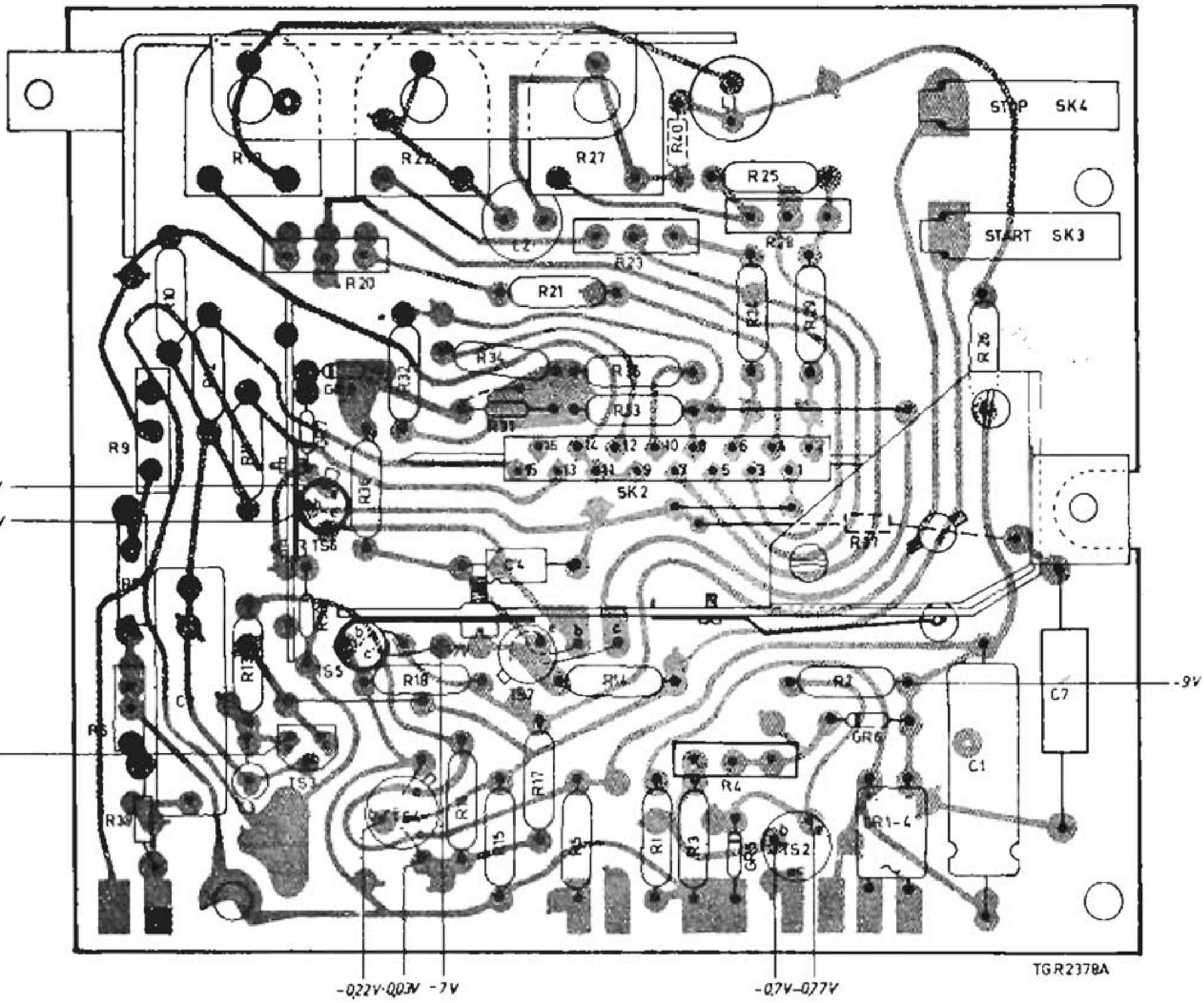


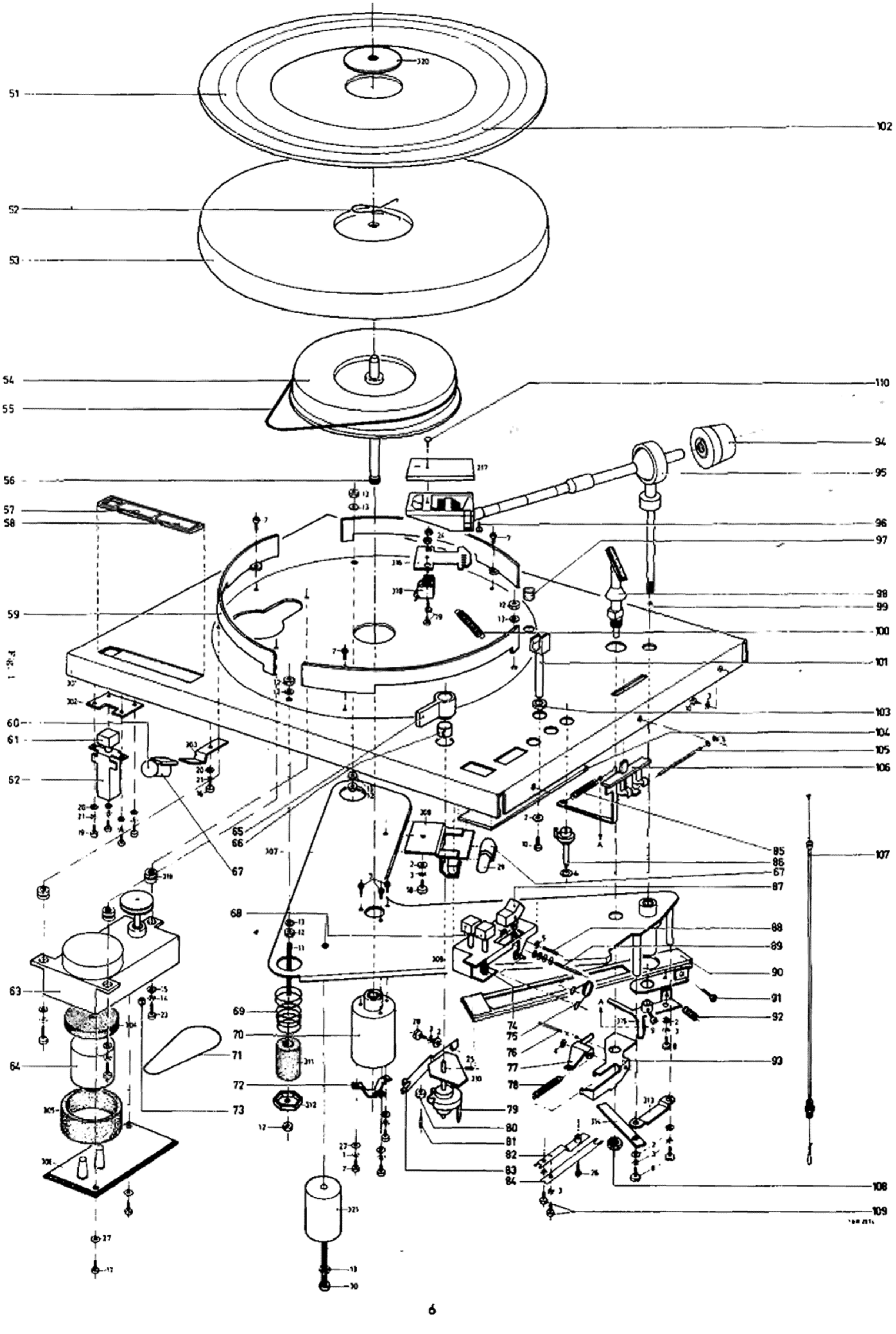
Fig. 4

LIST OF ELECTRICAL PARTS

T1	mains transformer	4822 145 30056	LA1	lamp, 6.3 V-0.1 A	4822 134 40017
Z1	fuse	4822 252 20001	LA2	lamp, 2.5 V-0.12 A	4822 134 40123
SK1	mains switch	4822 276 10267	L1	coil	4822 157 50626
SK2	slide switch	4822 277 30392	L2	coil	4822 157 50588
M	motor	4822 361 60083	R4	preset potentiometer 1 kΩ	4822 101 10005
GR1-4	rectifier BY122	4822 130 30261	R6	preset potentiometer 4.7 kΩ	4822 101 10014
GR5-7-8	diode OF132 (= BA114)	4822 130 30271	R7	L.D.R.	4822 116 10001
GR6	zener diode BZY88/C7V5	4822 130 30287	R9	preset potentiometer 4.7 kΩ	4822 101 10014
TS1	transistor AD162	4822 130 40213	R10-22-27	preset potentiometer 100 Ω	4822 101 10108
TS2	transistor AC127	4822 130 40096	R20-23-28	preset potentiometer 220 Ω	4822 101 10013
TS3	transistor BC149C	4822 130 40216	R31	resistor 1 Ω	4822 116 60005
TS4	transistor ASY26	4822 130 40268	C1	electrolytic capacitor 400 µF, 16 V	4822 124 20153
TS5	transistor AC128	4822 130 40095	C4	electrolytic capacitor 4.7 µF, 63 V	4822 124 20346
TS6	transistor BC108A	4822 130 40344	C7	electrolytic capacitor 125 µF, 16 V	4822 124 20385
TS7	transistor 2N2905A	4822 130 40468	SK3-4	contact springs	4822 492 61299

LIST OF MECHANICAL PARTS

Item	Description	Code number
1	circlip 6 mm	4822 530 70126
2	ring 3.2 mm	4822 532 10332
3	toothed washer 2.2 mm	4822 530 80079
4	circlip 1.9 mm	4822 530 70122
5	circlip 2.3 mm	4822 530 70043
6	toothed washer 5 mm	4822 530 80077
7	self-tapping screw 4Nx5/16"	4822 502 30001
8	screw M3x6	4822 502 10558
9	screw M3x10	4822 502 10689
10	screw M3x8	4822 502 10689
11	stud M4x55	4822 535 80172
12	nut M4	4822 505 10326
13	toothed washer 4 mm	4822 530 80083
14	toothed washer 3 mm	4822 532 10332
15	ring 3.2 mm	4822 532 10332
16	self-tapping screw 4Nx¼"	4822 502 30001
17	self-tapping screw 4Nx3/8"	4822 502 30001
18	screw M3x4	4822 502 10558
19	screw M2.6x5	4822 502 10034
20	ring 2.6 mm	4822 532 10215
21	toothed washer 2.8 mm	4822 530 80081
23	self-tapping screw 5Nx½"	4822 502 30043
24	nut M2.6	4822 505 10324
25	grub screw M3x8	4822 502 10664
26	screw M2.6x10	4822 502 10687
27	ring 6.4 mm	4822 532 10335
28	screw M2x5	4822 502 10679
29	lamp 6.3 V-0.1 A	4822 134 40017
30	screw M4x50	4822 502 10696
51	mat (complete)	4822 466 50068
52	spring	4822 492 61297
53	turntable disc	4822 528 10184
54	turntable	4822 528 10199
55	cord	4822 358 30133
56	pivot cap	4822 462 70566
57	frame	4822 459 40195
58	lens	4822 381 10239
59	spacer	4822 402 60247
60	lamp 2.5 V-0.12 A	4822 134 40123
61	knob	4822 410 20757
62	mains switch	4822 276 10267
63	motor housing assy.	4822 691 30029
64	motor	4822 361 60083
65	knob	4822 411 50154
66	circlip	4822 492 60741
67	lamp holder	4822 255 10007
68	knob	4822 410 40021
69	spring	4822 492 50617
70	bearing bush	4822 520 10256
71	cord	4822 358 30132
72	bracket	4822 520 10224
73	pivot cap	4822 520 10239
74	spring	4822 492 50657
75	spring	4822 492 40303
76	spindle	4822 535 90507
77	bracket	4822 402 50094
78	spring	4822 492 30587
79	disc	4822 528 30102
80	roller	4822 532 50329
81	spindle	4822 535 90129
82	leaf spring	4822 492 61185
83	leaf spring	4822 492 61298
84	leaf spring	4822 492 61184
85	spring	4822 492 30636
86	knob	4822 411 50153
87	knob	4822 411 50143
88	spindle	4822 535 90504
89	spindle	4822 535 90555
90	bracket assy.	4822 403 10098
91	screw	4822 502 10559
92	spring	4822 492 50658
93	bracket assy.	4822 402 60242
94	counter-weight	4822 691 30031
95	pick-up arm assy.	4822 251 70104
96	screw	4822 502 10796
97	plug	4822 462 40199
98	pick-up arm lift	4822 402 60243
99	ball 4 mm	4822 520 40012
100	spring	4822 492 30637
101	pick-up arm support	4822 402 60238
102	ornamental ring	4822 460 20041
103	ornamental ring	4822 532 20431
104	ornamental plate	4822 459 80022
105	spindle	4822 535 90557
106	knob assy.	4822 411 60143
107	cable assy.	4822 321 30104
108	nut	4822 505 10043
109	screw	4822 502 10039
110	ornamental screw	4822 502 10811


51
320
102
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110
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217
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CS2394

WORKING

A. Supply voltage stabilisation

The supply voltage has been adjusted to -9 V. Assume that the voltage on point 1 (see circuit diagram) drops, e.g. by increasing the load. Via GR6 and R4 the base of TS2 will become less negative with respect to the emitter. The emitter setting is fixed, as diode GR5 is biased to its knee voltage. As a result of the supply voltage decrease TS2 will become more conductive, so that the collector current of TS2 and consequently the base current of TS1 increases. As a result TS1 will become more conductive.
The circuit has been proportioned so that due to the increase in conductivity of TS1 the emitter-collector voltage is reduced. Thus the supply voltage drop is exactly compensated for.

B. Start stop circuit

The circuit comprises transistor TS3, TS4 and TS5. It has been designed so that during switching on transistor TS3 is not conductive, whereas transistor TS4 is conductive and TS5 is cut off (TS4 and TS5 form a bistabile multivibrator). Because TS5 is off, the transistor-controlled motor will not be started. However, when start button SK3 is depressed, the base of TS4 will come at earth potential; the multivibrator changes over and the transistor-controlled motor will receive current via TS5, which is now conductive so that it starts running. The stylus of the pick-up head can now be lowered onto the record by means of knob item 87. The record player can be switched off in two ways, viz:

1. When the stop button is depressed
   The base of TS5 then comes at earth potential, the multivibrator changes over and the transistor-controlled motor receives no current anymore. As a result the motor is stopped.
2. When the stylus of the pick-up head comes in the lead-out groove of a record. When the stylus of the pick-up head is at approx. 65 mm from the turntable centre during the inward movement, L.D.R. R7 will be exposed less due to the film on bracket item 90. As a result the resistance of L.D.R. will increase, which again results in a voltage increase.
   During one revolution of the turntable the pick-up stylus will have moved one groove further, so that the L.D.R. is exposed less again, which again results in a voltage increase of Δ E volts per revolution of the turntable.
   This increase of Δ E volts is also present across series circuit C2-R10-R9-R8 (in position 33 r.p.m.).
   The R-C time of these components has been selected so that the voltage increase per turntable revolution can just be drained. Consequently it will have no effect.
   However, when the pick-up stylus reaches the lead-out groove of the record, which has a larger pitch than the music groove, the voltage increase across L.D.R. R7 per revolution of the turntable will be more than ΔE volts.
   This voltage increase cannot be drained completely in the same time, so that part of this voltage will be present between the base and the emitter of TS3. This transistor is turned on, so that the base of TS4 becomes more negative. TS4 is then also turned on. The multivibrator changes over and the transistor-controlled motor no longer receives any current. As a result the motor is stopped.

C. Transistor-controlled motor

The purpose of the circuit is:
a. correction of the speed in case of supply voltage variations
b. correction of the speed in case of load variations.

a. Supply voltage variations, Fig. 2

When the supply voltage increases, and there is no control circuit, the terminal voltage U_k across the motor will increase by ΔU_k and so will the motor speed as

$$n = \frac{U_k - I.R.}{C_1}$$

This is because the following formula applies to the motor
$U_k = I.R. + E_t$.

U_k = terminal voltage of motor
I = load current
R = internal resistance of motor
E_t = counter e.m.f. of the motor
C = a constant

$E_t = C.n.\Phi$ As it may also be assumed that the flux Φ is also constant

$E_t = C_1.n$

The terminal voltage U_k then becomes $I.R + C_1.n$, from which it follows that

$$n = \frac{U_k - I.R.}{C_1}$$

The voltage variation ΔU_k is now compensated for as follows: When the terminal voltage across the motor increases with ΔU_k volts, the emitter voltage of TS8 across R40 will increase, as the diodes GR9 and GR10 are biased so (knee voltage) that the voltage across these diodes is constant. The base voltage of TS8 will then increase with a factor $\frac{R38}{R38 + R39} . \Delta U_k$ V (with respect to -9 V).

As a result TS8 becomes less conductive so that the base current of TS9 will also decrease.
The circuit has been proportioned so that the increase in the base current of TS9 will result in a collector-emitter voltage increase of TS9 of exactly ΔU_k V. As a result the speed will remain constant.

b. Load variations, Fig. 3

When the load I increases the motor speed will decrease if there is no control circuit, as:

$$n = \frac{U_k - I.R.}{C_1}$$

Therefore, the terminal voltage U_k should be increased with ΔU_k V in order to keep the speed constant. This is effected as follows: When the load increases the voltage drop across R41 will increase, so that the base of TS8 becomes more positive. As a result TS8 will become more conductive, so that the base of TS9 increases. The circuit has been proportioned so that due to the base current increase of TS9 the voltage across the collector emitter decreases ΔU_k volts. Consequently the speed n will remain constant.

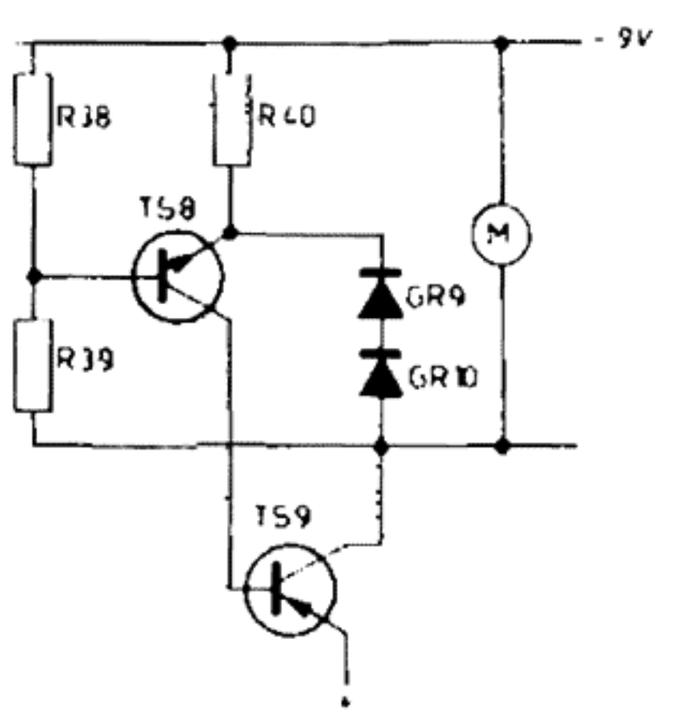


Fig. 2

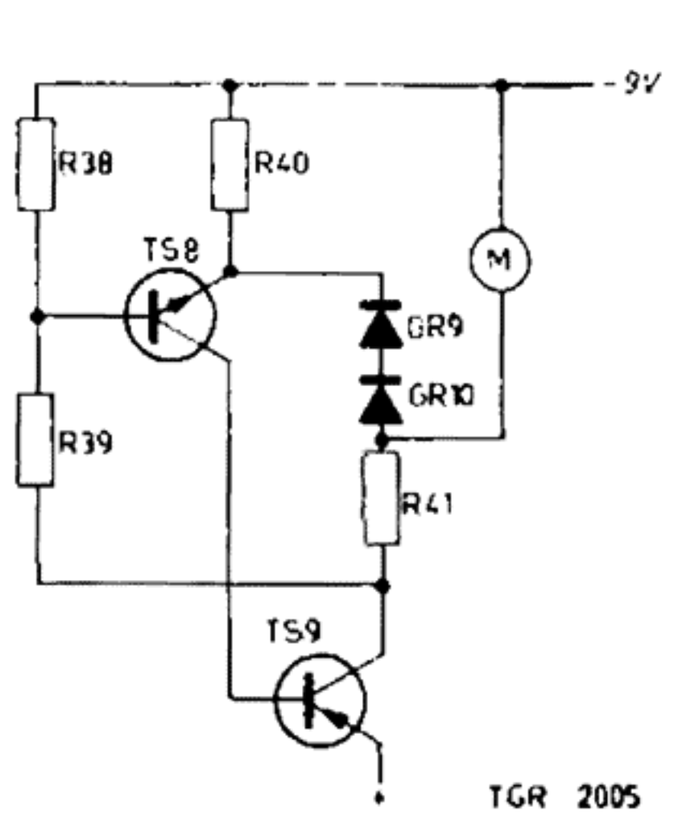


Fig. 3

CS22395

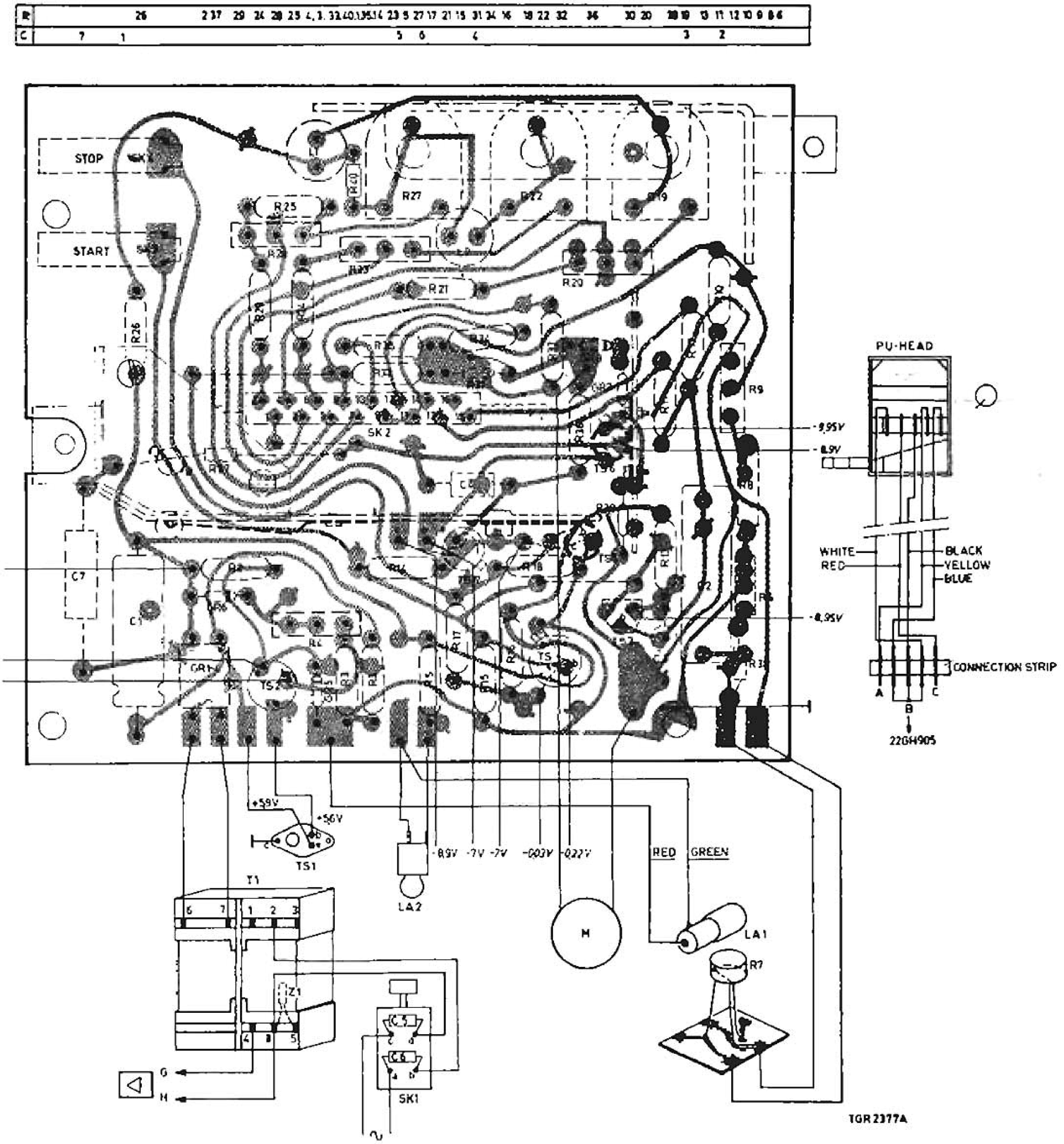

R
C
26 2 37 29 24 28 25 4, 3, 33 40, 1, 35 36 14 23 5 27 17 21 15 31 34 16 18 22 32 36 30 20 38 19 13 11 12 10 9 8 6
7 1 5 6 4 3 2
STOP
SK1
START
R25
R27
R22
R19
R20
R21
R23
R26
R17
SK2
C4
C7
C1
R2
R4
R6
R14
R15
R16
R17
R18
R30
R9
R8
R34
GR1
TS2
TS3
TS4
TS5
TS6
TS7
D2
-9V
-0,77V
-0,7V
-9,95V
-8,9V
-8,95V
+59V
+56V
TS1
LA2
-8,9V
-7V
-7V
-0,03V
-0,22V
RED
GREEN
M
LA1
R7
T1
6
7
1
2
3
4
8
5
Z1
C5
C6
SK1
G
H
PU-HEAD
WHITE
RED
BLACK
YELLOW
BLUE
CONNECTION STRIP
A
B
C
22GH905
TGR 2377A

Fig. 5

ELECTRICAL MEASUREMENTS

1. The supply voltage with respect to chassis should be -9 V. To be adjusted by turning R4.
2. The record player should have the correct speed at 33, 45 and 78 r.p.m. Check this by means of a stroboscopic disc or test record, code number 4822 397 30007.
   Adjustment is possible by:
   a. Setting R20, R23 and R26 to the centre position.
   b. By adjusting R19, R22 and R27 for 33, 45 and 78 r.p.m. respectively so that the stroboscopic disc is stationary with the stylus on the record.
3. The distance between the film on bracket item 90 and R7 (L.D.R.) should be 0.5 to 2 mm.
   Adjust by loosening screw item 9 on bracket item 315 and moving bracket item 90.
   All adjustments mentioned below should be checked at a supply voltage of -9 V.
4. When the arm is positioned on the pick-up arm support the voltage across R7 (L.D.R.) should be 0,75 V.
   Adjust by turning R6.
5. When the pick-up stylus is at a distance of 65 mm from the turntable centre the voltage across R7 (L.D.R.) should be 1.35 ± 0.15 V. Adjust by turning screw item 91. (As a result of this the position of the film with respect to the pick-up arm changes.)
6. For a record with a pitch of 1.2 mm or less the record player should not be switched off until the stylus is 44 mm from the turntable centre.

However, for records with a pitch of 1.8 mm or more the record player should be switched off when the stylus is 60 mm or less from the turntable centre. Check this by means of test record, code number 4822 397 30015. Repeat this check for the three speeds.
Adjust by turning R9.

MECHANICAL ADJUSTMENTS

1. The distance between mounting plate item 301 and motor mounting plate item 307 should be 3 mm.
   Adjust by turning nuts item 12 and cup springs item 312. After this lockpaint the nuts.
2. When the pick-up arm is lifted by pick-up lift item 98 the distance between the pick-up stylus and the turntable mat should be 10 mm.
   Adjust by turning screw item 26 on leaf spring item 82. After this lockpaint the screw.
3. In the lowest position of the pick-up arm the top of the turntable mat and the pick-up stylus should be level.
   Adjust by turning the nipple at the end of bowden cable item 107. After this lockpaint the lock nut.
4. When knob item 106 is in the lowest position against the mounting plate and the pick-up arm rests on the pick-up arm support, spring item 85 should exert no tensile force on bracket item 315.
   Adjust by bending the iron tag on knob item 106, onto which the spring is secured.

LUBRICATING INSTRUCTIONS

To be lubricated with Lubricant 10, code number 4822 390 10003:
- spindle 88
- spindle 89

To be lubricated with Shell Tellus 33, code number 4822 390 10006:
- spindle of pick-up arm item 95
- spindle of turntable item 54
- bowden cable item 107

To be lubricated with Shell Alvania 2, code number 4822 390 20001:
- spindle item 105

To be lubricated with Silicone oil, code number 4822 390 10045:
- spindle of pick-up lift, item 98

VOLTAGES

The direct voltages given in the circuit diagram have been measured in the rest position. In the list below these voltages are given once again, together with the voltages measured in the operating condition (33 r.p.m.). All voltages have been measured with respect to the collector of TS1 (= chassis).

		Rest position	Operating position (33 r.p.m.)
Voltage secondary side of transformer		12,8 V	12,8 V
Supply voltage		- 9 V	- 8,9 V
V_e	TS1	+ 5,6 V	+ 5,55 V
V_b	TS1	+ 5,6 V	+ 5,3 V
V_e	TS2	- 0,77 V	- 0,77 V
V_b	TS2	- 0,7 V	- 0,66 V
V_e	TS3	- 8,95 V	- 8,95 V
V_b	TS4	- 0,22 V	- 0,02 V
V_c	TS4	- 0,03 V	- 1,75 V
V_c	TS5	- 7,0 V	- 0,025 V
V_e	TS6	- 8,95 V	- 6,75 V
V_b	TS6	- 8,9 V	- 6,1 V
V_b	TS7	- 7,0 V	- 0,20 V
V_c	TS7	- 8,9 V	- 5,10 V

SERVICE NOTES

Apparatuses marked AH03 and higher:

Re: Modified case ,

As from marking AH03 a modified ornamental plate is used on the mounting plate. For this reason frame item 15 has been replaced by three wooden strips in the above-mentioned units.

22GA202/00Z/15Z/16Z

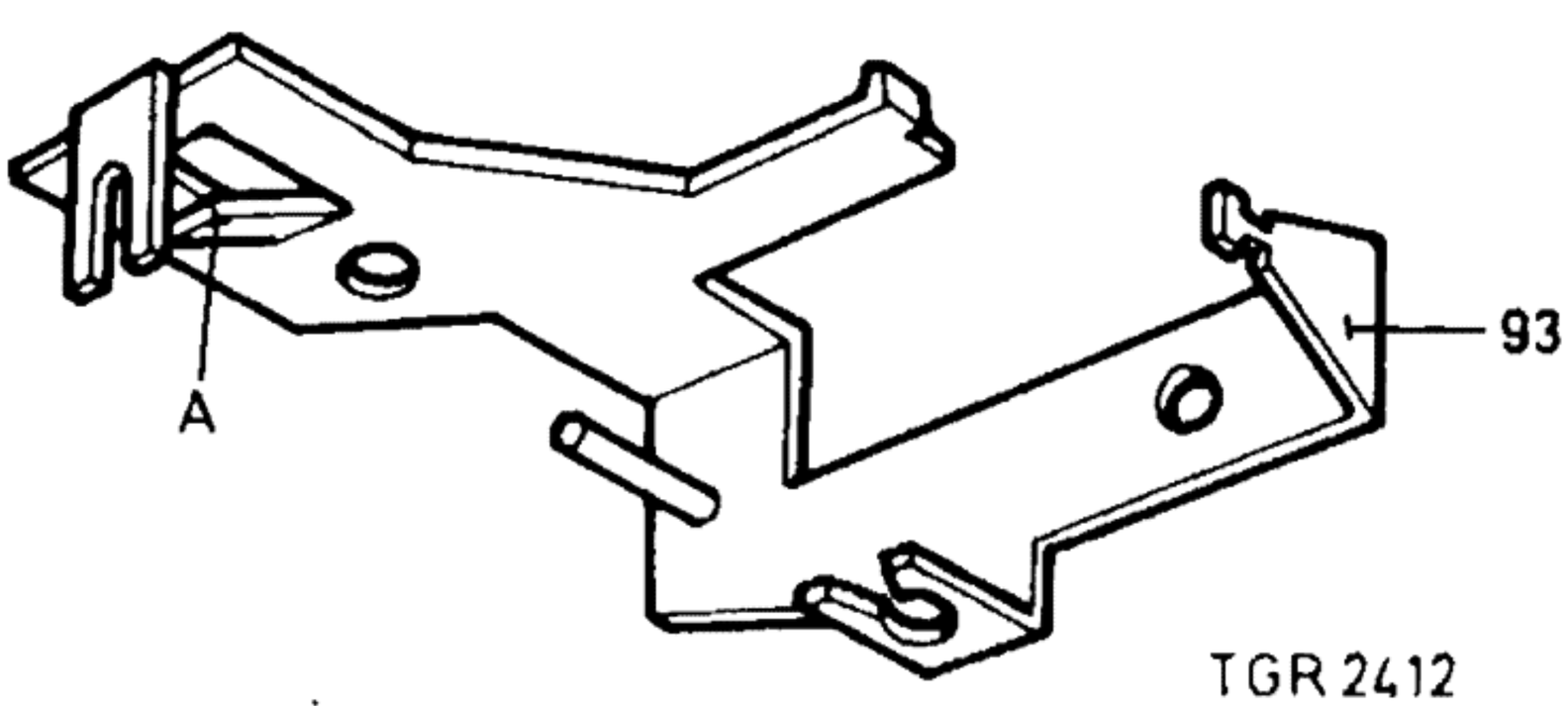
Code number left-hand side strip : 4822 444 40035
Code number right-hand side strip : 4822 444 40034
Code number rear strip : 4822 444 40036

22GA202/00T/05T/15T/16T/33T/65T

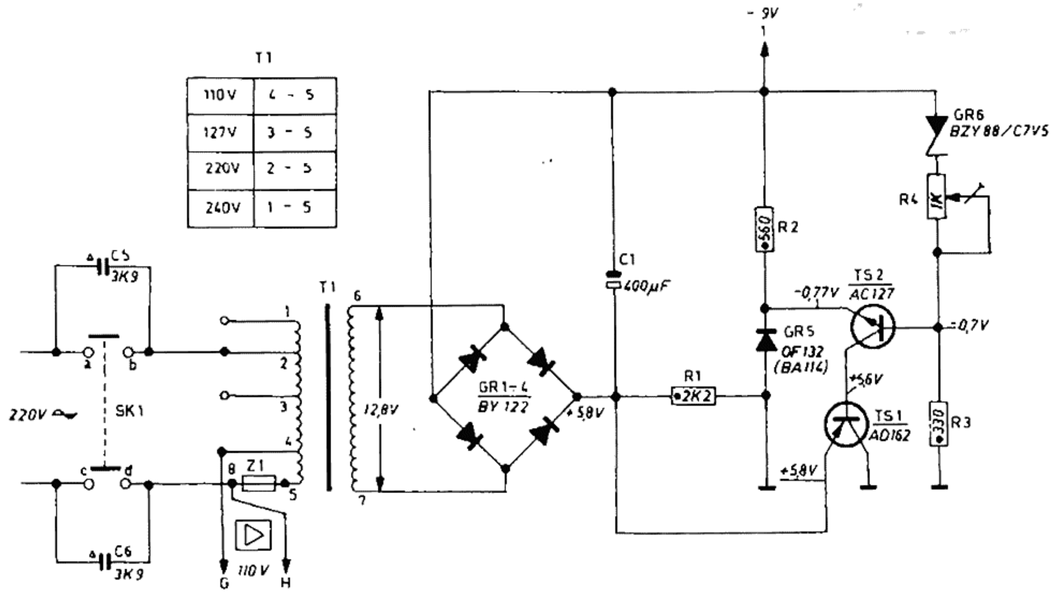
Code number left-hand side strip : 4822 444 40032
Code number right-hand side strip : 4822 444 40033
Code number rear strip : 4822 444 40031

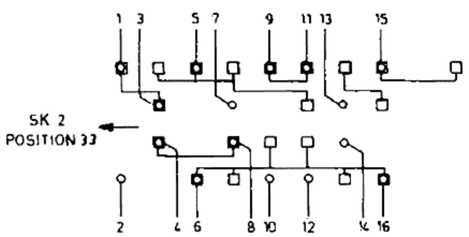
For apparatuses marked AH00...AH02 only teak frame item 15 is available for all versions.
Code number teak frame item 15: 4822 444 40022.

As from factory marking AH06/907 bracket assy item 93, code no. 4822 402 60242, has been modified.
The modified bracket item 93 has been provided with an additional tag A (see Fig.) so that leaf spring assy item 82, code no. 4822 492 61185, is cancelled.
The adjustment described under point 2 of Mechanical adjustments should now be carried out by bending the above-mentioned tag A (see Fig.).
Code no. of the new bracket assy. item 93 is 4822 402 60288.

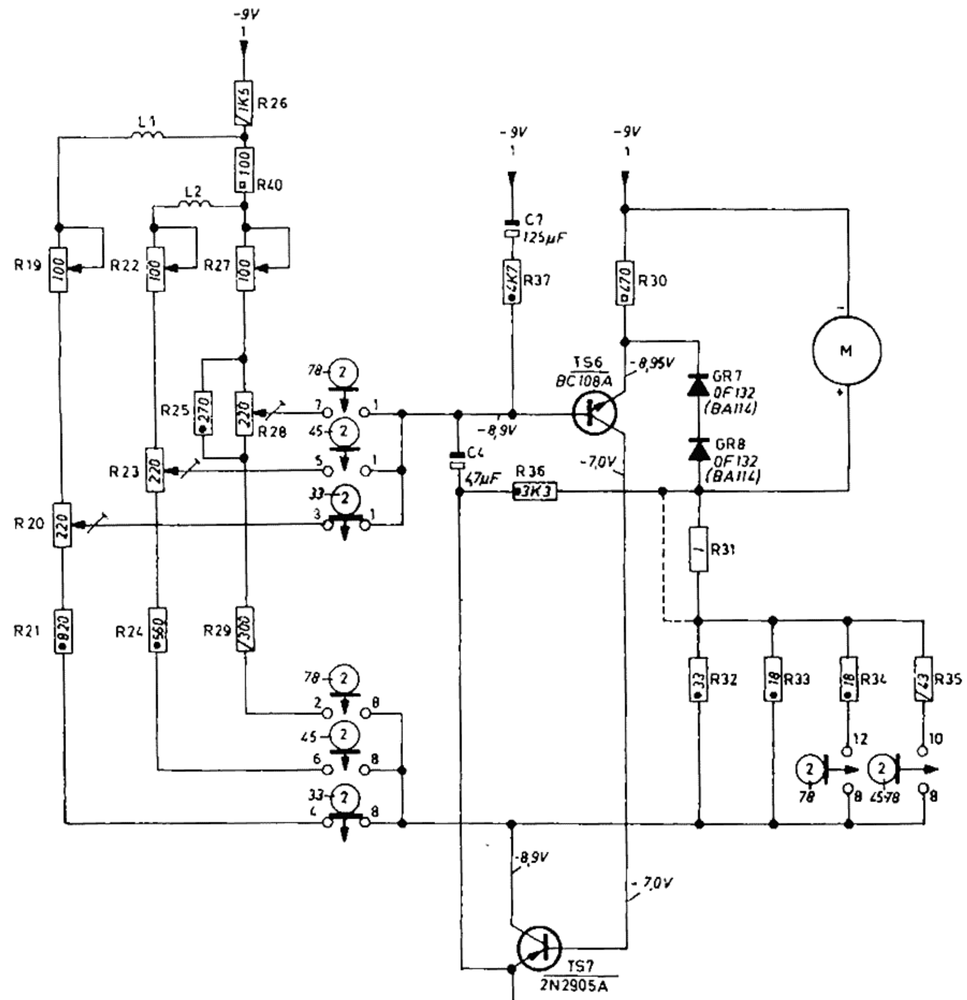


T1	
110V	4 - 5
127V	3 - 5
220V	2 - 5
240V	1 - 5





INTERCONNECTED CONTACTS SK2			
33	1 - 3	8 - 4	
45	1 - 5	8-6-12	11 - 13
78	1 - 7	8-2-12-10	11 - 15



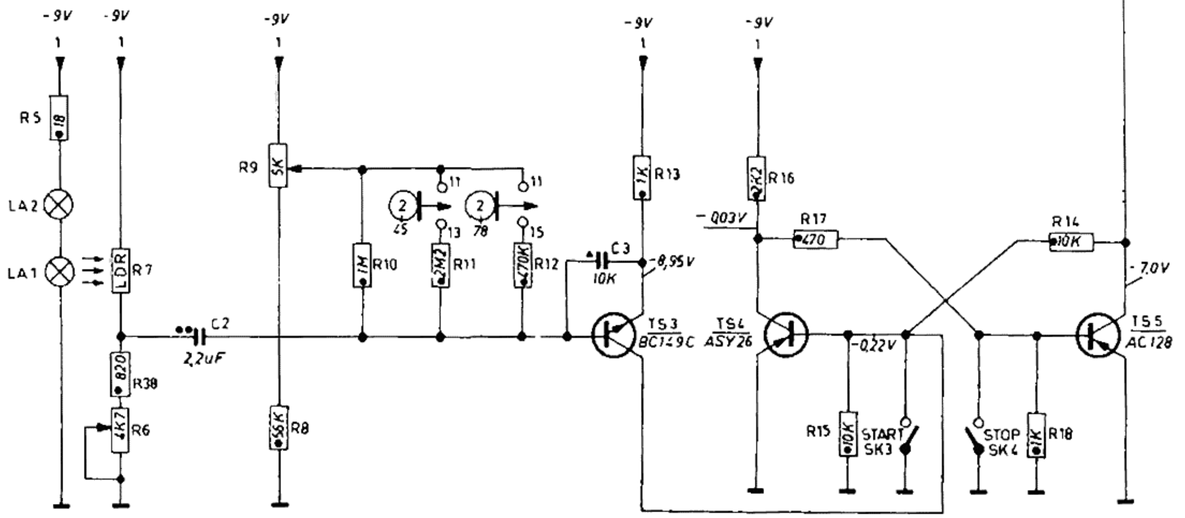


Fig. 6

(2) SK 2

1% - 1/2W

5% - 1/4W

5% 1/8W

-20+50%, 125V, PIN UP

± 10% - 250V, POLYESTER

VOLTAGES MEASURED IN STOP POSITION
(Rmeter 40 kΩ/VOLT)

TGR 2375

CS22396