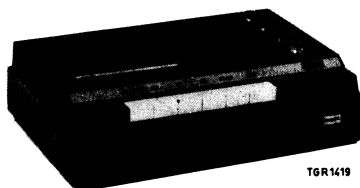


PHILIPS Service

RECORDERS

EL3312A/00/12D/16D/17D
/19D/22D/38D



TECHNICAL DATA

Mains voltages	: 110, 127, 220 and 245 V
Mains frequency	: 50 or 60 c/s (adjustable)
Power consumption	: 20 W
Tape speed	: 4.75 cm/sec. (1 7/8"/sec)
Number of tracks	: 2 x 2 (stereo)
Tape width	: 3.81 mm
Track width	: 0.6 mm
Loudspeaker cabinets	: 2 x AD 5059 (8 Ω)
Weight	: 2.9 kg
Dimensions	: 320 x 210 x 85 mm
Microphone	: EL 1979
Connection cable	: EL 3768/14

SENSITIVITIES

Microphone	: 2 x 0.25 mV across 1 kΩ
Diode	: 2 x 0.25 mV across 1 kΩ
Record player	: 2 x 1.10 mV across 1 MΩ

OUTPUT VOLTAGES

Diode	: 2 x 1 V across 18 kΩ
Power	: 2 x 1.8 W with 8 Ω loudspeaker
Transistors	: 4 x BC108, 4 x BC109, 2 x AC187/01 (AC175/01) 2 x AC188/01 (AC117/01), 2 x AF124, 1 x BC107

It is recommended to clean the recorder and to lubricate the various points after approx. 1000 hrs.

Clean with methylated spirits or alcohol

Tape guides, erase head, recording/playback head, capstan, pressure roller, cord grooves.

Lubricating instructions; see Fig. 18

Conversion from 50 to 60 c/s and vice versa, see Fig. 2

For this it is sufficient to place the cord in the other cord grooves of the pulley and the flywheel. The smallest pulley diameter corresponds to 60 c/s and the largest diameter to 50 c/s.

REPLACEMENT OF PARTS

Removing the case, Fig. 1

- Remove the 4 screws, item 1.
- The complete top plate, item 126, and the wooden frame, item 125, can now be removed.
- For repairs underneath the mounting plate the 4 screws, item 1a (Fig. 5), should be removed.

Replacing the cassette container, Fig. 5

- Remove springs, item 68 and item 67, and remove bracket, item 56, by detaching spring 47.
- Pull the spindle item 310 out of the container.
- The cassette container can now be removed.
- If necessary bracket, item 25, and the springs, item 27, can also be removed.

Replacing indicator lamp LA

- Turn up the cassette container.
- Detach bracket, item 56, so that the cassette container can be lifted higher.
- The lamp can now be replaced.

Removing the flywheel, Fig. 5

- Remove cord, item 119.
- Remove bracket, item 300.
- Pull the flywheel slightly upwards and remove cord, item 69, from friction wheel, item 76.
- The flywheel can now be taken out of the bearing.
- Slip coupling, item 76, can now also be replaced.

Replacing the drive cord, item 69

- Remove the flywheel as already described.
- Remove the pulley, item 37, and pulley bracket, item 39. The cord can now be replaced.

Replacing the drive cord of the counter, item 57, see Fig. 5

- Take the cord off the counter wheel.
- Turn the recorder upside down and turn up the cassette container.
- Now detach bracket, item 56, so that the cassette container can be lifted higher.
- Switch the recorder to position playback. Brake bracket, item 89, is now lifted off turntable 9, so that the cord can be removed via the opening between the turntable, brake bracket and pressure felt, item 53.
- The cord is refitted by placing it on the pulley under the turntable and passing it between the brake bracket and the pressure felt.
- Put the recorder upright again and pull the cord forwards with the aid of tweezers, pass its underneath spring, item 46, and fit it on the counter wheel.

Replacing the right-hand turntable, see Fig. 5

- Turn up the cassette container.
- Subsequently detach bracket, item 56, so that the container can be lifted further.
- Successively remove cover, item 82, and ring, item 83.
- Now depress the playback button so far that the turntable can be pulled up along switching plate, item 302.

Replacing the left-hand turntable, see Fig. 5

- Turn up the cassette container.
- Detach bracket, item 56, so that the container can be lifted further.
- Unscrew pressure bracket, item 53.
- Successively remove cover, item 82, and ring, item 83.
- The turntable can now be removed.
- Mounting is done in the reverse order.

MECHANICAL ADJUSTMENTS

Adjusting the flywheel thrust-bearing, see Fig. 2

The clearance between the lower side of the capstan and the thrust-bearing should be 0.5 mm. This can be adjusted by turning screw, item 73, and locking it again with nut, item 10.

Adjusting the motor pulley and the motor shaft, see Fig. 2

- Press the motor shaft against thrust-bearing, item 118.
- Now turn the bearing until the clearance between the stator assembly and the lower side of the copper edge of the rotor is 1 mm.
- Then adjust the pulley so that the cord grooves of the pulley and the flywheel are in line.

List of case parts

Item	Code number	Description
125	4822 443 40012	Case (wood)
126	4822 443 30102	Case (upper part)
127	4822 454 20116	Ornamental strip
128	4822 413 40275	Knob
129	4822 454 20115	Ornamental strip
130	4822 347 10002	Indicating meter
131	4822 443 50099	Case (lower part)
132	4822 443 60196	Cover
133	4822 462 40113	Foot
	4822 492 60413	Fixing spring of indicator cover for voltage adapter
	4822 263 40019	Knob for voltage adapter
	WT 260 69	Knob for voltage adapter

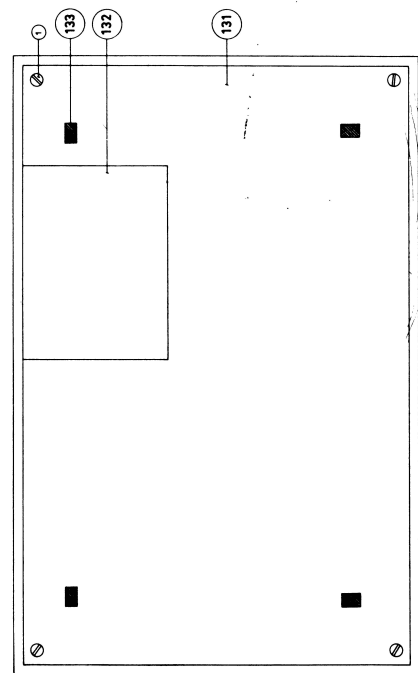
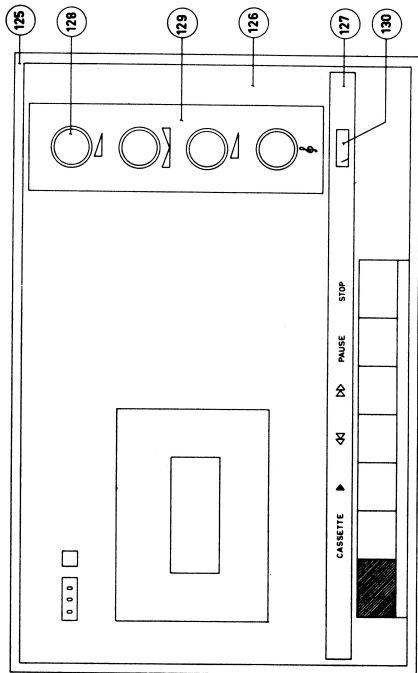


Fig. 1

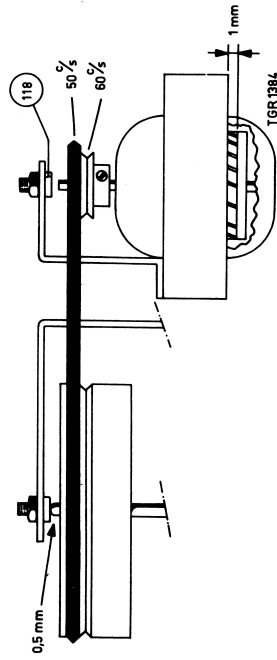


Fig. 2

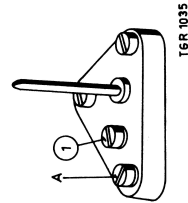


Fig. 3

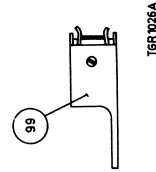


Fig. 4

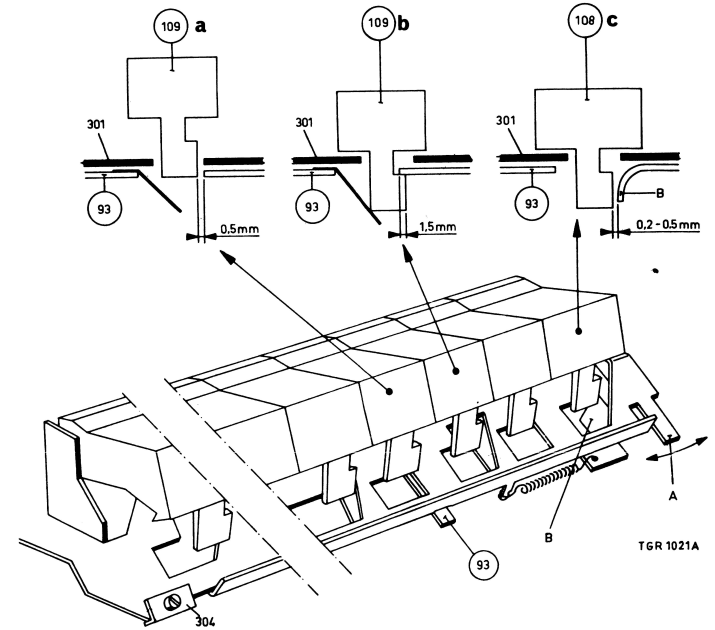


Fig. 6

P4-2. PHILIPS MODEL EL3312A

Adjusting the capstan, see Fig. 3

- Turn the cassette container completely upwards by detaching bracket, item 56.
- Loosen locking screw, item 1.
- Insert a test cassette (with mirror) - (code number of cassette 4822 397 30011).
- Now adjust the capstan by means of screw A until the tape runs smoothly along the tape guides and the erase head and symmetrically with respect to the tape guide of the recording/playback head, see Fig. 4.

Adjusting the push-button unit, see Fig. 6a-b-c

- None of the push-buttons depressed.
- Bend tag A until the clearance between the recording button and bracket, item 93, is at least 0.5 mm, see Fig. 6a.

Check, see Fig. 10

The clearance between a button, which is not fully depressed, and bracket, item 93, should be approx. 1.5 mm. This can be adjusted by shifting bracket, item 304.

Stop button, see Fig. 6c

Depress the stop button. The clearance between the button and tag B should be between 0.2 and 0.5 mm. Adjustable by bending tag B.

Check

Depress the cassette ejection button. The clearance between this button and the tag on bracket, item 93, should also be 0.2 - 0.5 mm as is shown in Fig. 6c.

Adjusting the fast-winding roller, item 37, see Fig. 7

- None of the buttons depressed.
- Spindle A of bracket, item 39, should be positioned above the notch in the mounting plate. This can be adjusted by bending bracket, item 81.
- The pressure of the pulley should be > 100 g, measured as indicated in Fig. 8 with rewinding button depressed.

Check, see Fig. 8

Press idler wheel, item 90, against stop C. The clearance between the fast winding roller, item 37, and the idler wheel should now be approx. 0.2 mm. This is adjustable by bending bracket, item 39, see Fig. 7. When the winding or rewinding button is depressed brackets, item 70 and item 71, should be shifted equally for.

Adjusting the brake bracket, item 89, see Fig. 8

- Turn the cassette container completely upwards by detaching bracket, item 56.
 - Depress the playback button.
 - The brake bracket should now have a minimum clearance of 1 mm with respect to the turntables.
- This can be adjusted by bending tags A and B on operating bracket 302.

Check

The clearance between the brake bracket and the turntable should be 0.5 mm during fast winding or rewinding. This can be adjusted by bending tag A for fast winding and tag B for fast rewinding.

Adjusting the fast stop button, see Fig. 9

- Remove the printed circuit board on which the supply section is accommodated.
- Detach bracket, item 306, and shift this bracket until the clearance between the stop on the push-button and bracket, item 121, is approx. 0.5 mm. Depress the playback button and the interval button; the clearance between the capstan and the pressure roller should then be 0.5 mm. This clearance can be adjusted by bending tag A on bracket, item 106, see Fig. 10.

Check, see Fig. 10

Depress the playback button only. Bracket C should then be free. If the interval button is depressed idler wheel, item 110, and the pressure roller should be lifted simultaneously. This can be adjusted by bending tag B on bracket, item 106.

Adjusting the brake, item 53, see Fig. 11

- None of the buttons depressed.
 - The clearance between the brake felt and the turntable should be approx. 1 mm.
- This can be adjusted by bending tag A. The pressure exerted by this felt should be 30-40 g.

Check

In position playback the brake should press against the turntable.

Adjusting the rearmost cassette support (bracket, item 58), see Fig. 12.

This bracket should be bent until the distance between the upper side of the bracket and the mounting plate is $9.2 \text{ mm} \pm 0.1 \text{ mm}$.

Alignment of the recording/playback head; see Fig. 13

- Insert a test cassette (6300 c/s) - (code number 4822 397 30005).
- Switch the recorder to position playback.
- Now adjust the head by means of screen A until a maximum signal is measured with a valve voltmeter connected to BU2, point 3, or BU2, point 5.

Pressure roller, item 98, see Fig. 10

- Depress the playback button.
 - The force exerted on the capstan by the pressure roller should be approx. 320 g, measured as shown in Fig. 10.
- This can be adjusted by means of spring, item 97.

Cassette lock, see Fig. 14

If a premodulated cassette (a cassette from which the cams in both corners have been removed) is inserted, the recording button should be locked. If not, bracket, item 63, should be bent slightly downwards.

SWITCH ADJUSTMENTS

SK1, Recording Switch, see Fig. 15

Depress the recording button. The switch should now be adjusted as indicated in Fig. 15. This can be adjusted by bending bracket, item 40.

SK2, Playback Switch, see Fig. 16

Depress the playback button. The switch should now be adjusted as indicated in Fig. 16. Readjustment is effected by bending bracket, item 44.

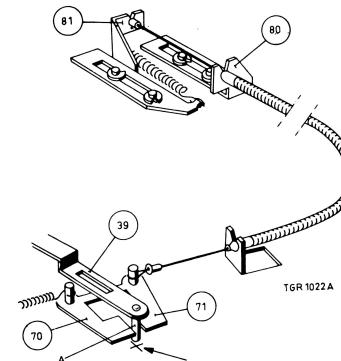


Fig. 7

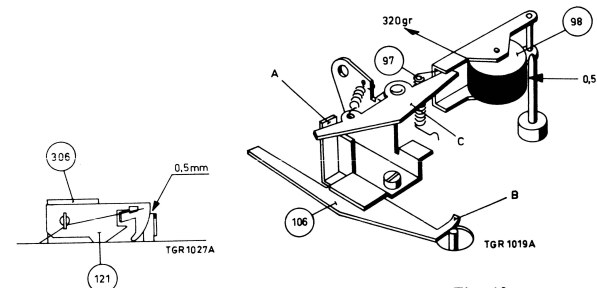


Fig. 9

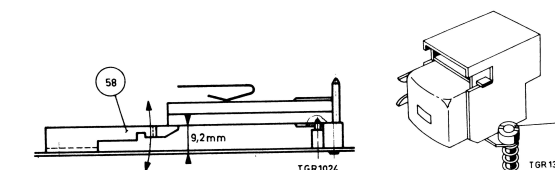


Fig. 12

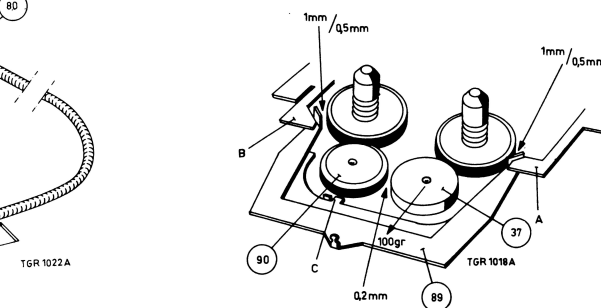


Fig. 8

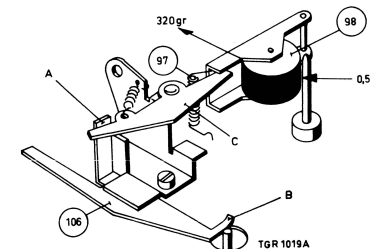


Fig. 10

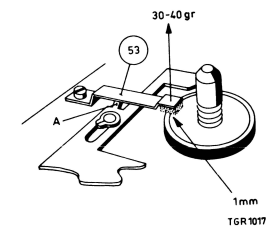


Fig. 11

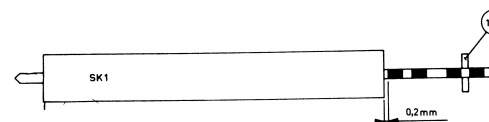


Fig. 15

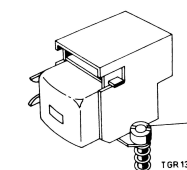


Fig. 13

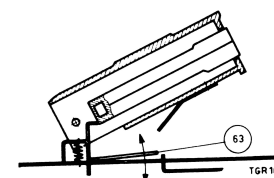


Fig. 14

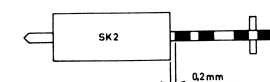
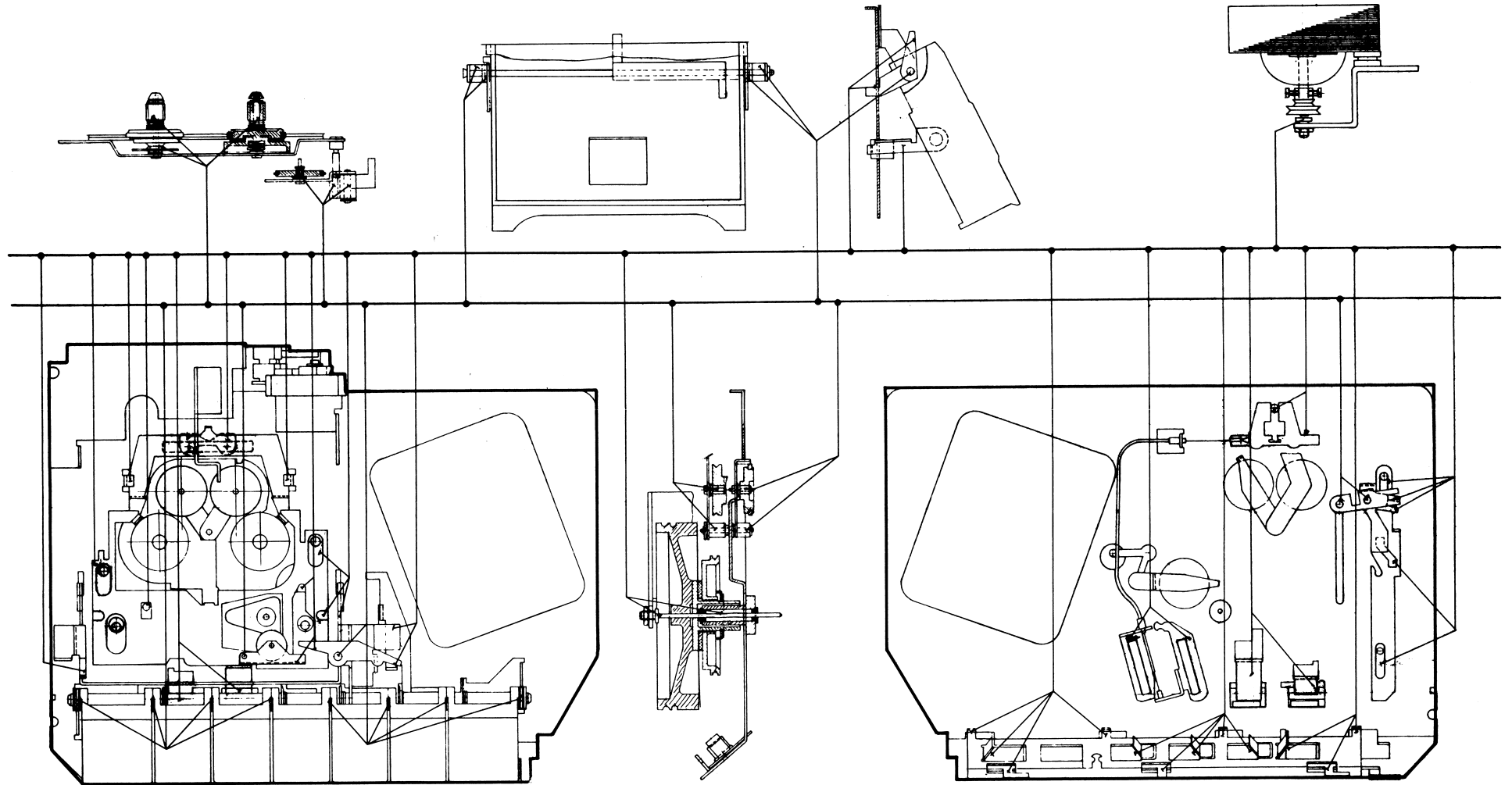


Fig. 16

SHELL ALVANIA
A9 881 22/P 50

TELLUS 33
4822 077 00104



TGR 1382

Fig. 18

P4-4. PHILIPS MODEL EL3312A

LIST OF MECHANICAL PARTS

Item	Code number	Description	Item	Code number	Description
1-1a-4	4822 502 10041	Screw (3x10 mm)	71	4822 403 20005	Bracket
2	4822 502 10558	Screw (3x5 mm)	72	4822 492 30373	Bracket
3	4822 502 10036	Screw (2.6x15 mm)	73	4822 502 10531	Thrust bearing
5	4822 532 10203	Ring (5 mm dia.)	74	4822 492 60712	Ring
6	4822 530 70002	Retaining ring (3 mm)	75	4822 492 50402	Pressure spring
7	4822 530 70004	Retaining ring (5 mm)	76	4822 528 80117	Friction disc
8	4822 530 70043	Retaining ring (2.3 mm)	77	4822 508 40091	Felt disc
9	4822 530 70042	Retaining ring (1.9 mm)	78	4822 528 60029	Flywheel
10	4822 505 10006	Nut (4 mm)	79	4822 492 30376	Tension spring
11	4822 530 80006	Lock washer (4 mm)	80	4822 403 20006	Bracket
12	4822 530 80005	Lock washer (3 mm)	81	4822 403 20007	Bracket
13	4822 502 10026	Screw (2x5 mm)	82	4822 462 70107	Cover
14	4822 502 10055	Screw (4x50 mm)	83	4822 532 50043	Ring (2 mm dia.)
15	4822 532 10202	Ring (4 mm dia.)	84	4822 528 10079	Turntable (right)
16	4822 532 50262	Retaining ring (2 mm)	85	4822 532 50262	Ring (2 mm dia.)
17	4822 502 30011	Self-tapping screw	86	4822 528 80116	Pulley
18	4822 321 30052	Wire	87	4822 249 40035	Erase head
19	4822 532 50377	Nipple	88	4822 492 30374	Tension spring
20	4822 321 30044	Spiral	89	4822 403 10051	Brake bracket
21	4822 532 10247	Clamp	90	4822 528 70106	Idler wheel
25	4822 403 20003	Bracket	91	4822 532 50262	Ring (2 mm dia.)
26	4822 528 80063	Roller	92	4822 403 40014	Bracket
27	4822 492 30379	Tension spring	93	4822 403 10049	Locking bracket
28	4822 381 10149	Frame	94	4822 411 50061	Red push-button
29	4822 492 60714	Leaf spring	95	4822 492 40183	Tension spring
30	4822 443 60087	Cassette container	96	4822 532 50043	Ring (2 mm dia.)
31	4822 443 60088	Frame	97	4822 492 40117	Tension spring
32	4822 349 50022	Counter	98	4822 403 40004	Pressure roller
33	4822 403 10052	Bracket	99	4822 249 10027	Recording/playback head (K1-K101)
34	4822 403 10058	Locking bracket	100	4822 492 50273	Pressure spring
35	4822 403 20009	Bracket	101	4822 520 30115	Flywheel bearing
36	4822 532 50262	Retaining ring (2 mm dia.)	102	4822 532 50265	Ring
37	4822 528 80118	Winding pulley	103	4822 492 50399	Pressure ring
38	4822 532 50262	Ring	104	4822 403 20001	Bracket
39	4822 403 40015	Bracket	105	4822 492 30369	Tension spring
40	4822 403 30092	Bracket	106	4822 403 10053	Bracket
41	4822 403 10085	Bracket	107	4822 492 30367	Tension spring
42	4822 492 30374	Tension spring	108	4822 411 50962	Stop button
43	4822 492 30472	Tension spring	109	4822 411 50059	White push-button
44	4822 403 30093	Bracket	110	4822 528 70116	Idler wheel
46	4822 492 30377	Tension spring	111	4822 532 50262	Ring (2 mm dia.)
47	4822 492 40233	Tension spring	112	4822 403 30041	Bracket
49	4822 443 60089	Ring	113	4822 403 30042	Bracket
50	4822 492 30368	Tension spring	114	4822 492 30375	Tension spring
51	4822 403 50359	Bracket	115	4822 361 70145	Motor (50-60 c/s)
52	4822 403 20002	Bracket	116	4822 528 80249	Pulley (50-60 c/s)
53	4822 492 60713	Brake bracket	117	4822 325 60039	Grommet
54	4822 466 40041	Felt pad	118	4822 502 10531	Thrust bearing
55	4822 528 10032	Turntable (left)	119	4822 358 30051	Drive cord
56	4822 403 10059	Bracket	120	4822 492 40184	Tension spring
57	4822 358 30052	Cord for counter	121	4822 403 10056	Bracket
58	4822 403 10054	Bracket	122	4822 535 90135	Pin for switches
63	4822 403 10055	Locking bracket			See Fig. 15
64	4822 492 30372	Tension spring			
65	4822 403 20011	Bracket			
66	4822 492 30381	Tension spring			
67	4822 492 30173	Tension spring			
68	4822 492 30173	Tension spring			
69	4822 358 30076	Winding cord			
70	4822 403 20004	Bracket			

ELECTRICAL ADJUSTMENTS

The test point for the left-hand channel is BU1, point 6, and for the right-hand channel BU2, point 6.

Sensitivities recording amplifier

Record-player input (BU2, point 3 and BU2, point 5)

- Depress the recording and playback buttons.
- Recording volume control at maximum.
- Balance control in the centre position.
- Volume control at minimum.
- Remove the supply voltage for the oscillator.
- With the aid of an A. F. generator apply a 1 kc/s signal and adjust the voltage of this signal until a voltage of 10.5 mV is measured on the test points (MP1, MP2).
- The output voltage of the signal generator should then be between 120 mV and 200 mV.

Microphone input (BU1, point 1 and BU1, point 4)

- Depress the recording and playback buttons.
- Recording volume control at maximum.
- Volume control closed.
- Supply voltage for oscillator disconnected.
- Balance control in the centre position.
- Apply a 1-kc/s signal from a signal generator via a circuit as shown in Fig. 17, in such a way that the voltage on the test points (MP1-MP2) is 10.5 mV.
- The output voltage of the signal generator should be 185-315 mV.

Oscillator voltage

- Depress the recording and playback buttons.
- Balance control in the centre position.
- The oscillator voltage measured across erase head K2 should be more than 13 V at a frequency from 51 - 63 kc/s.

Adjusting the recording bias current

- Depress the recording and playback buttons.
- The voltage at test points MP1 and MP2 should now be approx. 32 mV. This can be adjusted with R21 and R121 respectively.

Playback sensitivity at 250 c/s

- Depress the playback button.
- Volume control closed.
- Apply a 250 c/s, 180 mV signal to MP1 and MP2 respectively via a 100 kΩ resistor. The voltage at the diode output (BU1, points 3 and 5) should be approx. 1 V.

Frequency response of the playback amplifier

- Depress the playback button.
- Balance control in the centre position.
- Volume control closed.
- Apply a 1-kc/s signal from an A. F. generator to test points MP1-MP2 via a 100 kΩ-resistor. Adjust the signal generator voltage until the voltage at the diode output (BU1, points 3 and 5) is 85 mV.
- Now keep the output voltage of the generator constant and adjust the A. F. generator to the following frequencies and corresponding voltages.

Frequency	Voltage on the diode output
62.5 Hz	320 mV
250 Hz	220 mV
1000 Hz	85 mV
10000 Hz	46 mV

Adjusting the output transistors

This is done with the aid of R46 and R146 until the voltage between R44 and R45 and the voltage between R144 and R145 is half the voltage on point A.

Frequency response of the recording amplifier

Adjusting L1-L101

- During this measurement the R. F. adjusting potentiometers R21 and R121 should be in centre position.
- Depress the recording and playback buttons.
 - Interrupt the supply voltage for the oscillator.
 - Recording volume control at maximum.
 - Apply a 1 kc/s signal from an A. F. generator to the record player input (BU2, points 3 and 5). The voltage of this signal should be such that the voltage on the testpoint (MP1-MP2) is 1 mV. The output voltage of the A. F. generator should then be approx. 15.5 mV.
 - Now set the generator to 10 kc/s - 15.5 mV and adjust L1 and L101 until the voltage on the testpoint is 10 mV. At 60 c/s (15.5 mV) the voltage on the testpoint should be 1.8 mV.

Overall frequency response

- Depress the recording and playback buttons.
- Recording volume control at maximum.
- Volume control closed.
- Tone control fully counter-clockwise.
- Balance control in the centre position.
- Connect an A. F. generator to the record player input (BU2 points 3 and 5).
- Now record frequencies between 60 and 10,000 c/s at a constant input voltage of 8 mV.
- Subsequently switch the recorder to position playback and measure the output voltage on the diode output for the recorded frequencies. The difference between the signal with the highest and lowest amplitude should not be more than a factor 2.

Gain of the various stages (recording)

- Depress the recording button.
- Recording volume control at maximum.
- Balance control in the centre position.
- Volume control closed.
- Connect an A. F. generator to the record player input (BU2, point 3 and BU1, point 5) and adjust this generator to a frequency of 1 kc/s and an output voltage of 110 mV. Then measure the following voltage with a milli-voltmeter via a 10 kΩ resistor.

Collector TS1	(TS101)	16.8 mV
Collector TS2	(TS102)	8.2 mV
Collector TS3	(TS103)	1420 mV

Gain of the various stages (playback)

- Depress the playback button.
- Volume control at maximum.
- Connect an A. F. generator to testpoint MP1 (MP2) via a 100 kΩ resistor. Adjust the frequency to 1 kc/s at an output voltage of 260 mV.

Then check the following voltages with a millivoltmeter via a 10 kΩ resistor:

Collector TS1	(TS101)	6 mV
Collector TS2	(TS102)	4 mV
Collector TS3	(TS103)	530 mV
Collector TS4	(TS104)	4300 mV

Note: All voltages specified for stage gain, both in case of recording and playback, are average values.

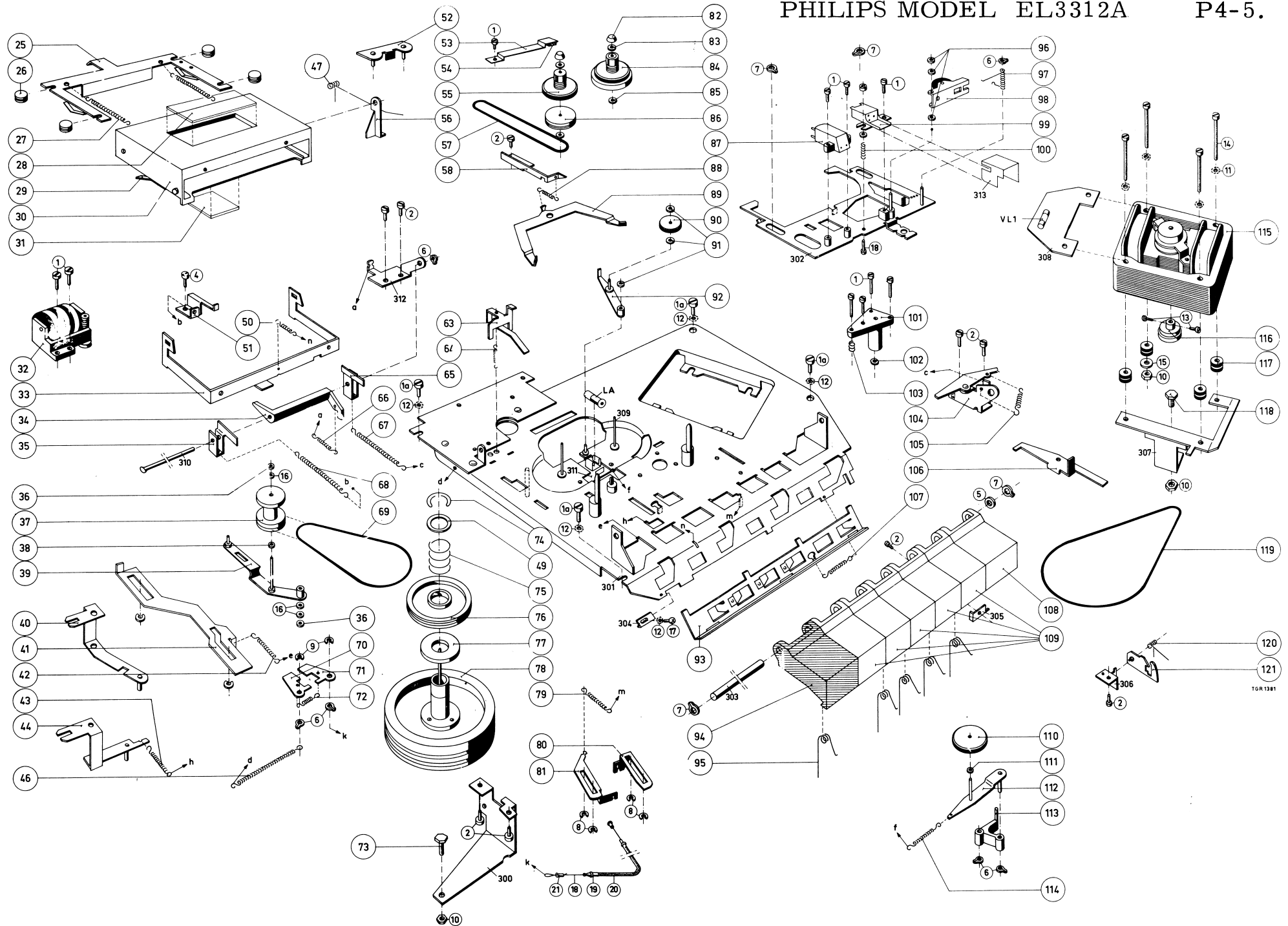
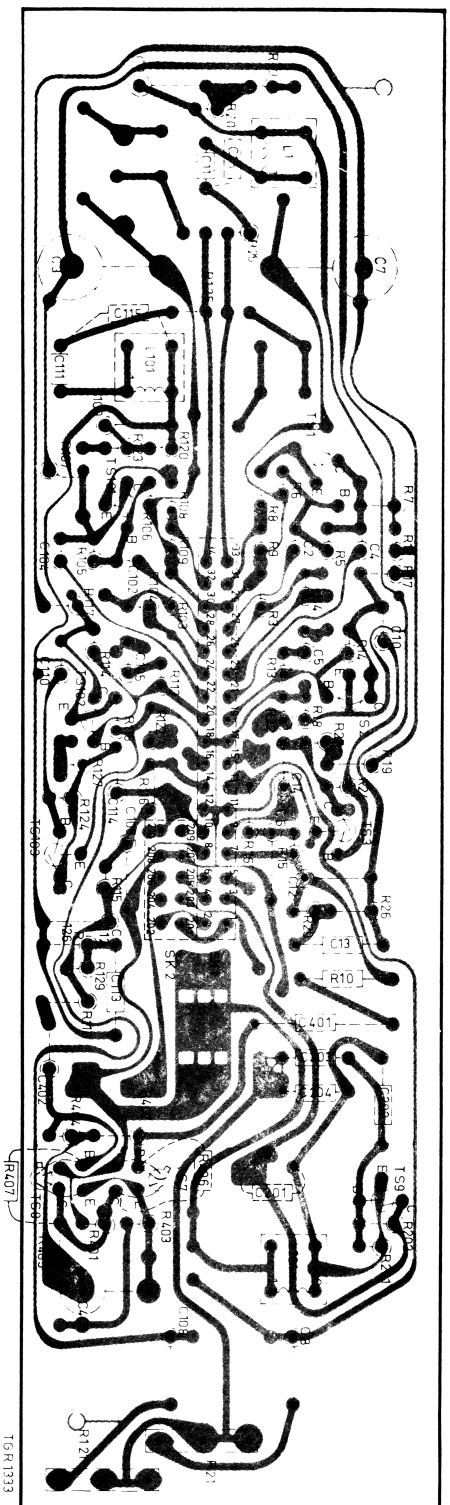
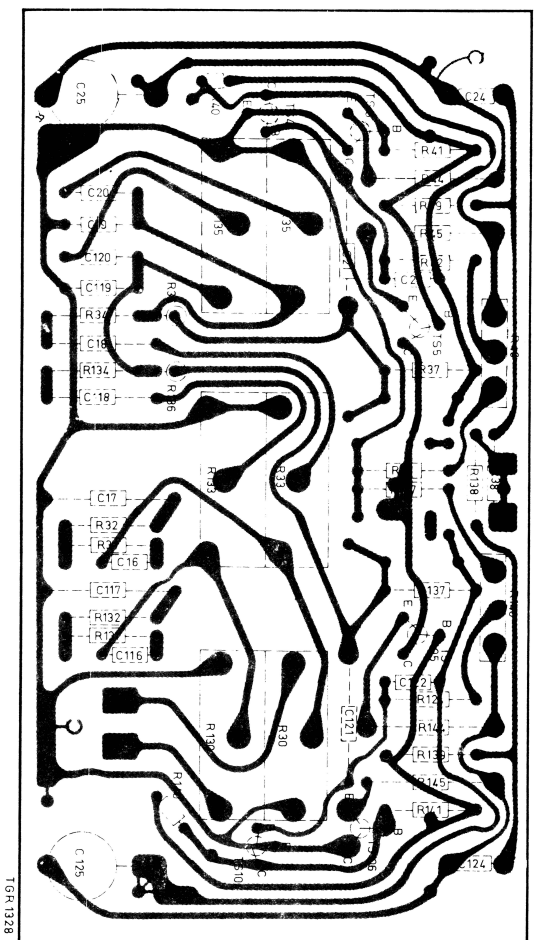
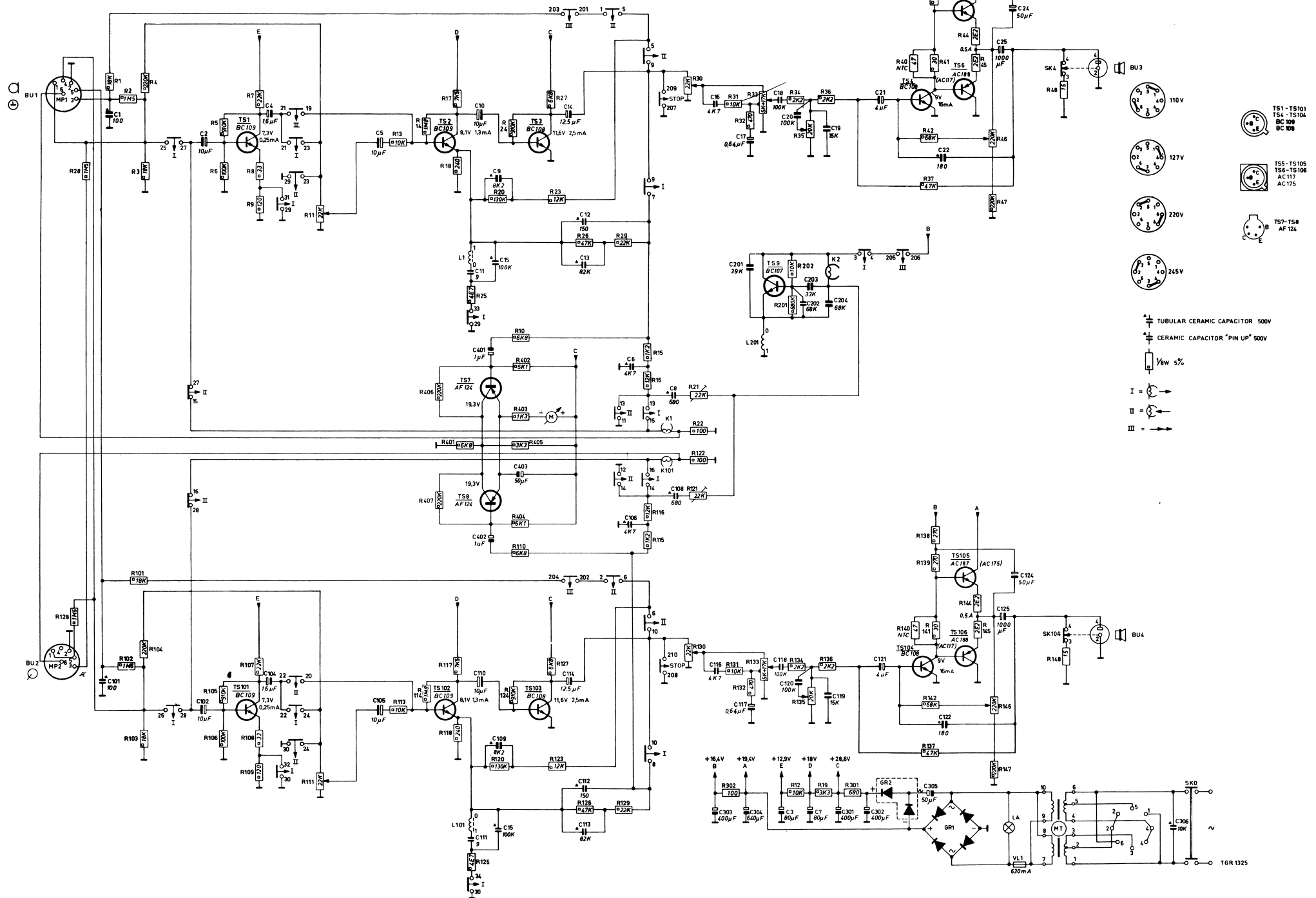


Fig. 5





Fault system

Noise of cord

Casette container is not lifted

Recording can be depressed in case of a pre-modulated cassette

Recording button cannot be depressed

Incorrect winding

Shortly after switching on the recorded signal disappears x (tape shifts)

If one of the fuses blows, the recorder continues to play with reduced output power.

Cause and remedy

The cord grooves of the flywheel and motor are not aligned. The pulley must be adjusted.

- a. Grease the stop pin and centring pin of the cassette with Molycote A.
- b. The sides of the cassette are clamped in the container. Bend bracket, item 62.

Cassette lock not properly adjusted. See technical adjustment.

- a. Occurs with closed cassette container without cassette.
- b. With premodulated cassette.
- c. With non-premodulated cassette, if recording lock is not properly adjusted.

- a. Friction brake near left turntable does not engage recess of cassette container. Cassette container exerts pressure on the turntable.
- b. Adjustment not correct.

- a. Pressure of pressure roller insufficient.
- b. Greasy capstan.
- c. Counter friction of brake, item 53, insufficient.
- d. Capstan adjustment not correct.

List of electrical parts

L1-L101	4822 157 50316		
L201	4822 152 10049		
C1-C101	4822 120 20081	100 pF	
C2-C102	4822 124 20077	10 μF	16 V
C3	4822 124 20016	80 μF	25 V
C4-C10-C104-C110	4822 124 20051	1.6 μF	25 V
C5-C105	4822 124 20077	10 μF	16 V
C6-C106	4822 120 20125	4700 pF	
C7	4822 124 20016	80 μF	16 V
C8-C108	4822 120 20103	680 pF	
C9-C109	4822 120 20132	8200 pF	
C11-C111	4822 121 40079	9 pF	
C12-C112	4822 120 20085	150 pF	
C13-C113	4822 121 40058	82000 pF	
C14-C114	4822 124 20052	12.5 μF	25 V
C15-C115	4822 121 40059	0.1 μF	
C16-C116	4822 120 20125	4700 pF	
C17-C117	4822 124 20092	0.64 μF	64 V
C18-C118	4822 121 40079	0.22 μF	
C19-C119	4822 121 40049	15000 pF	
C20-C120	4822 121 40059	0.1 μF	
C21-C121	4822 124 20088	4 μF	40 V
C22-C122	4822 120 20087	180 pF	
C24-C124	4822 124 20055	50 μF	25 V
C25-C125	4822 124 20116	1000 μF	16 V
C201	4822 121 50298	39000 pF	

C202	4822 121 40057	68000 pF
C203	4822 121 40054	33000 pF
C204	4822 124 40057	68000 pF
C301-C303	4822 124 20026	400 μF 40 V
C304	4822 124 20038	640 μF 25 V
C305	4822 124 20055	50 μF 25 V
C306	4822 120 10134	10000 pF
R21	4822 101 10074	22 kΩ lin. adjusting pot. meter
R30-R130	4822 102 30083	22 kΩ log. potentiometer
R33-R133	4822 102 30084	5 kΩ+17 kΩ log. potentiometer
R11-R111-R35-R135	4822 102 30082	22 kΩ log. potentiometer
R40	4822 116 30059	N.T.C. resistor, 47 Ω
R41	4822 116 60024	2.2 Ω, 1/8 W
R46	4822 101 10071	220 kΩ, adjusting potentiometer
R48	4822 116 00025	15 Ω, 1/4 W
R301	4822 110 30103	680 Ω, 1/8 W
R302	4822 111 30123	100 Ω, 1/8 W
L. A.	4822 134 40078	(16 V - 30 mA)
GR1	BY122	
GR2	4822 130 50221	15 V, 200 mA
BU1-BU2	4822 267 40031	5-pole connection socket
BU3-BU4	4822 267 30135	2-pole connection socket
SK1	4822 277 30309	recording/playback switch
SK2	4822 277 30311	Start/stop switch
VL1	4822 253 30018	630 mA

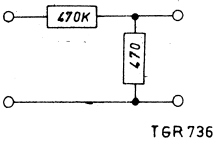
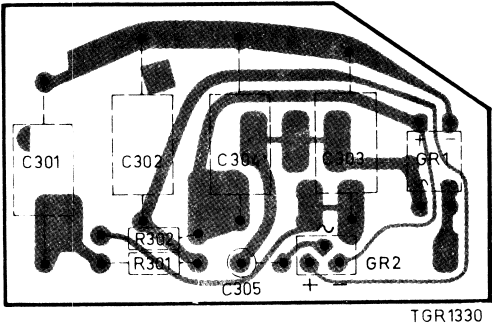
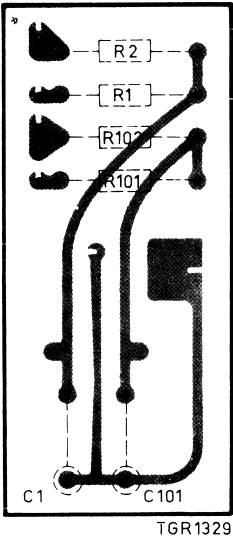


Fig. 17