Dual

704

Edition October 1976

704

Service-Manual

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

Specification

Current Type
AC 50 – 60 Hz, without motor changeover

Line voltages
110 – 125 Volt, 220 – 240 Volt

Drive
Electronically-controlled direct drive system
Dual EDS 900

Power Consumption
approx. 3.5 Watt
Motor during play < 50 mW

Current Consumption

with 220 V 50 Hz:		
on start-up 45 mA	during play	20 mA
with 110 V 60 Hz:		
on start-up 80 mA	during play app.	40 mA

Run-up Time (until nominal speed is reached)
2 - 2.5 sec. on 33 1/3 rpm

Platter
Non-magnetic, dynamically-balanced, detachable,
1.2 kg 300 mm ϕ
Total rotating mass of drive system (rotor with platter)
1.8 kg.

Platter Speeds
33 1/3 and 45 rpm, electronically switchable.

Pitch Control
For both speeds, adjustable in each case with variable resistor, range of adjustment 10 %

Speed Check
with light stroboscope for platter speed 33 1/3 rpm.
Strobe markings for 50 and 60 Hz provided on the platter edge.

Sensitivity of Light Stroboscope for 0.1 % Speed Deviation
3 graduations per minute at 50 Hz
3.6 graduations per minute at 60 Hz

Overall Speed Variation
(assessed in accordance with DIN 45 507)
< ± 0.05 %

Signal-to-Noise Ratio (in accordance with DIN 45 500)

Rumble unweighted signal-to-noise ratio	> 46 dB
Rumble weighted signal-to-noise ratio	> 67 dB

Tonearm
Torsion resistant, extra long tubular aluminum tonearm in super flat universal four-point gimbal suspension, tonearm balance weight with double acting vibration damping (2 anti-resonators).

Effective Tonearm Lenght
222 mm

Offset Angle
26° 4'

Tangential Track Error Angle
0.16° / cm

Tonearm Bearing Friction
(related to stylus point)

Vertical	< 0.07 mN (0.007 g)
Horizontal	< 0.15 mN (0.015 g)

Tracking Force
0 – 30 mN (0 – 3 grams) infinitely variable with 1 mN (0.1 g) calibrations from 0 to 15 mN (0 to 1.5 g), operable from 2.5 mN (0.25 g) stylus pressure up.
0 – 3 g continuously variable, with 1/10 calibration in the range from 0 – 1.5 g, reliable as from 0.25 g tracking force

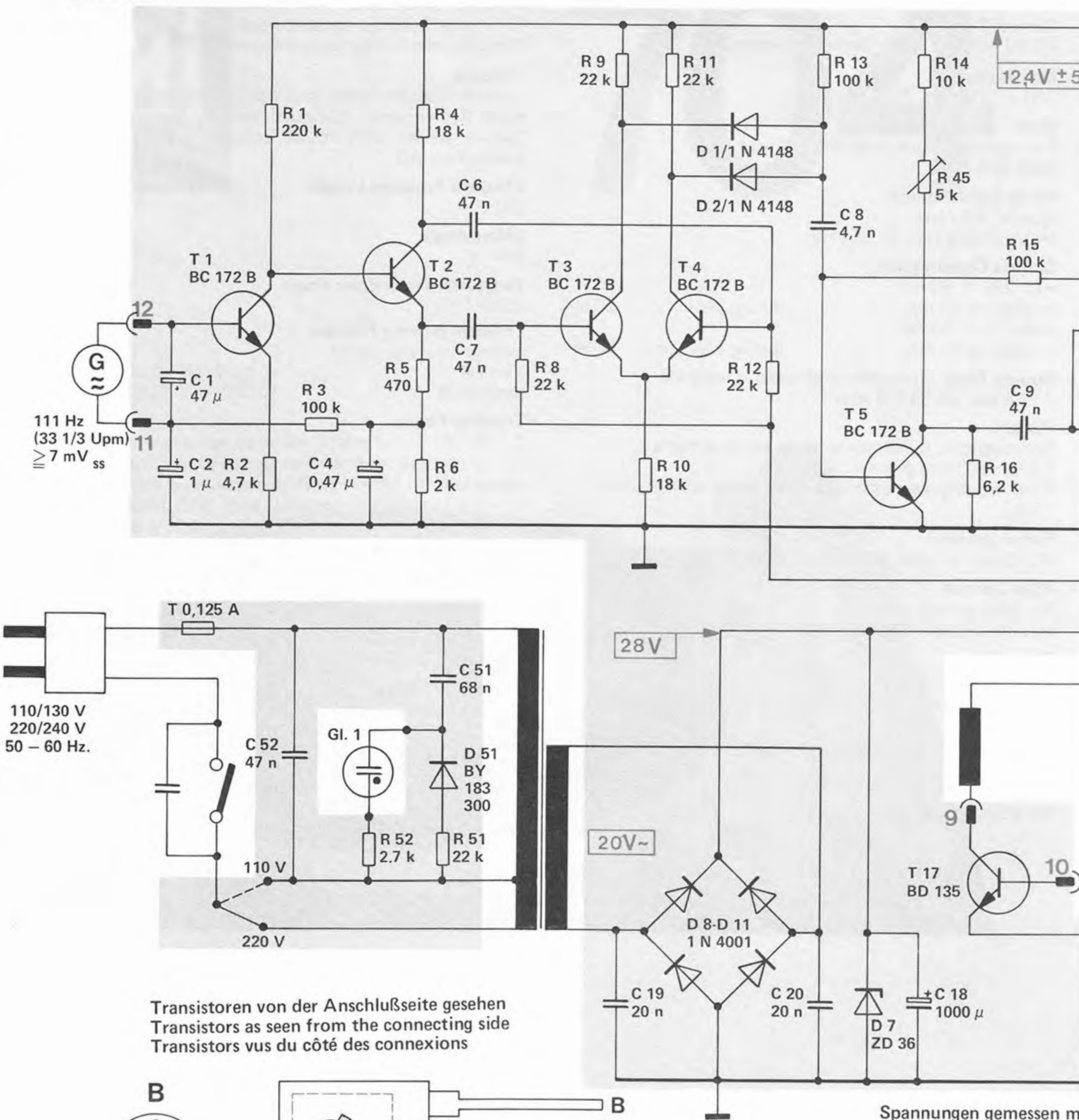
Pick-up Head
Detachable, suitable for all pick-up cartridges with 1/2" mounting and a deadweight of 4,5 – 10 g (including mounting material)

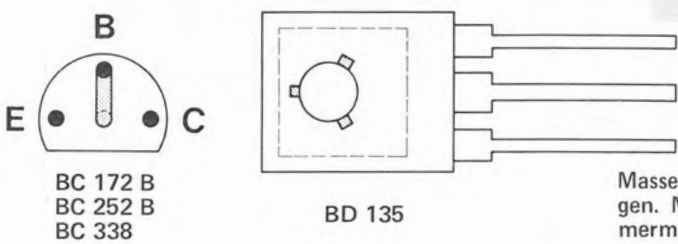
Adjustable Overhang 5 mm

Pick-up Cartridge
See separate data sheet

Weight
5.4 kg

Dimensions and Cutout Required
refer to Installation Instructions.





Spannungen gemessen mi
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Tensions mesurées avec ir

Masse der Elektronik ist Bezugspunkt für Messungen. Meßgeräte erdfrei anschließen, da Tonabnehmermasse an + 28 V liegt.

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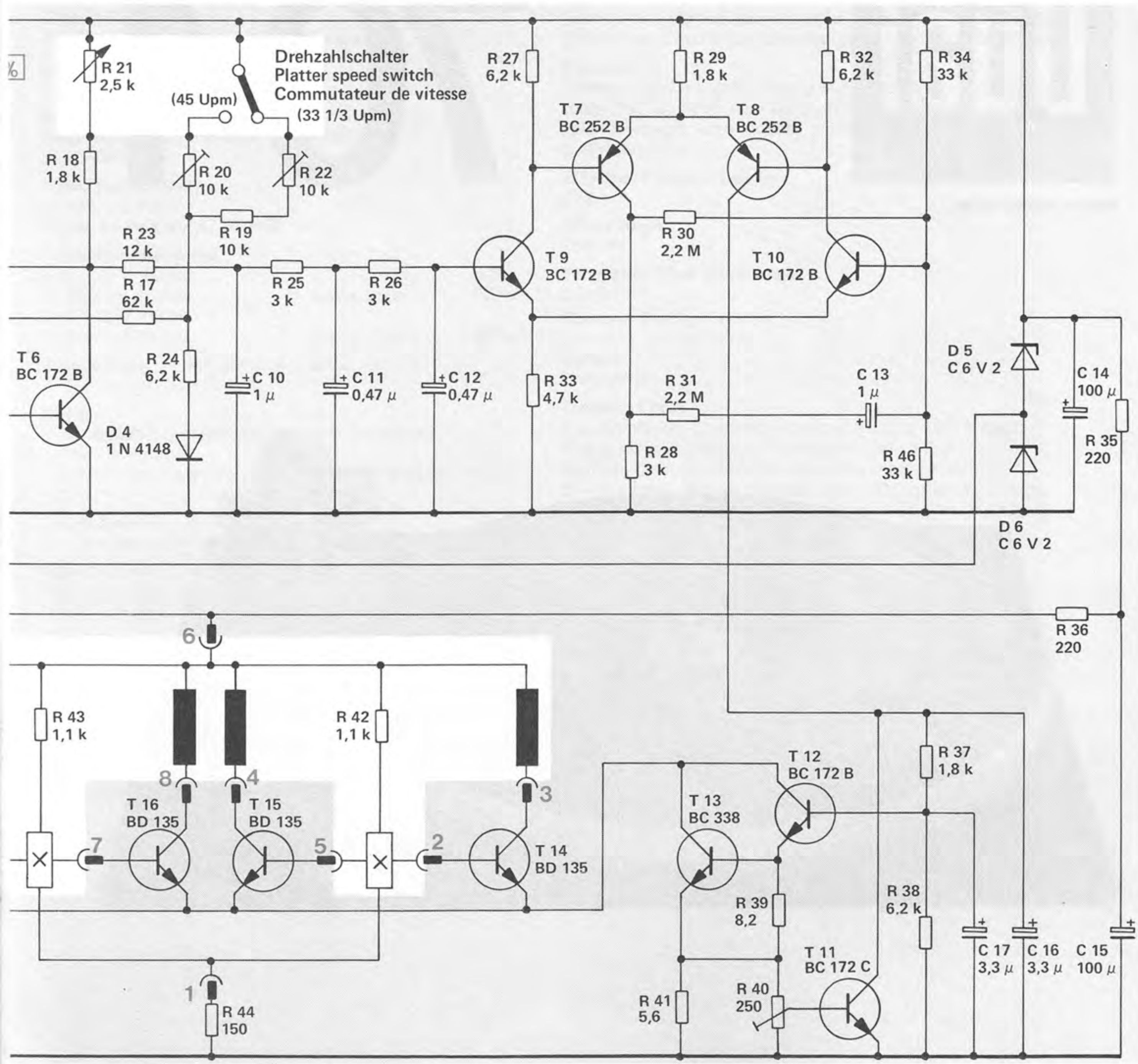
	52 51 16
C	1,2 3 4 6,7 8 9
	52 51 19 20 18

)S 900



t Meßinstrument (7 — 10 MOhm Eingangswiderstand) gegen Masse
ıeasuring instrument (7 — 10 MOhm input resistance) to ground
ıstrument de mesure (7 — 10 MOhm résistance d'entrée) contre masse

Änderungen vorbehalten
Alterations reserved
Sous réserve de modifications

ɔund of the electronics is the reference point ısurements. Do not connect measuring equip-ɔ ground as the pick-up cartridge ground is ted to + 28 V.

La masse de la partie électronique est point de référence pour les mesures. Brancher les instruments de mesure sans mise à la terre. La masse de la platine est à + 28 V.

Ausgabe 1/April 1976

21, 18, 23, 17, 20, 24, 19, 22, 25 26 27, 33 28, 29, 30, 31 32 34, 46 35

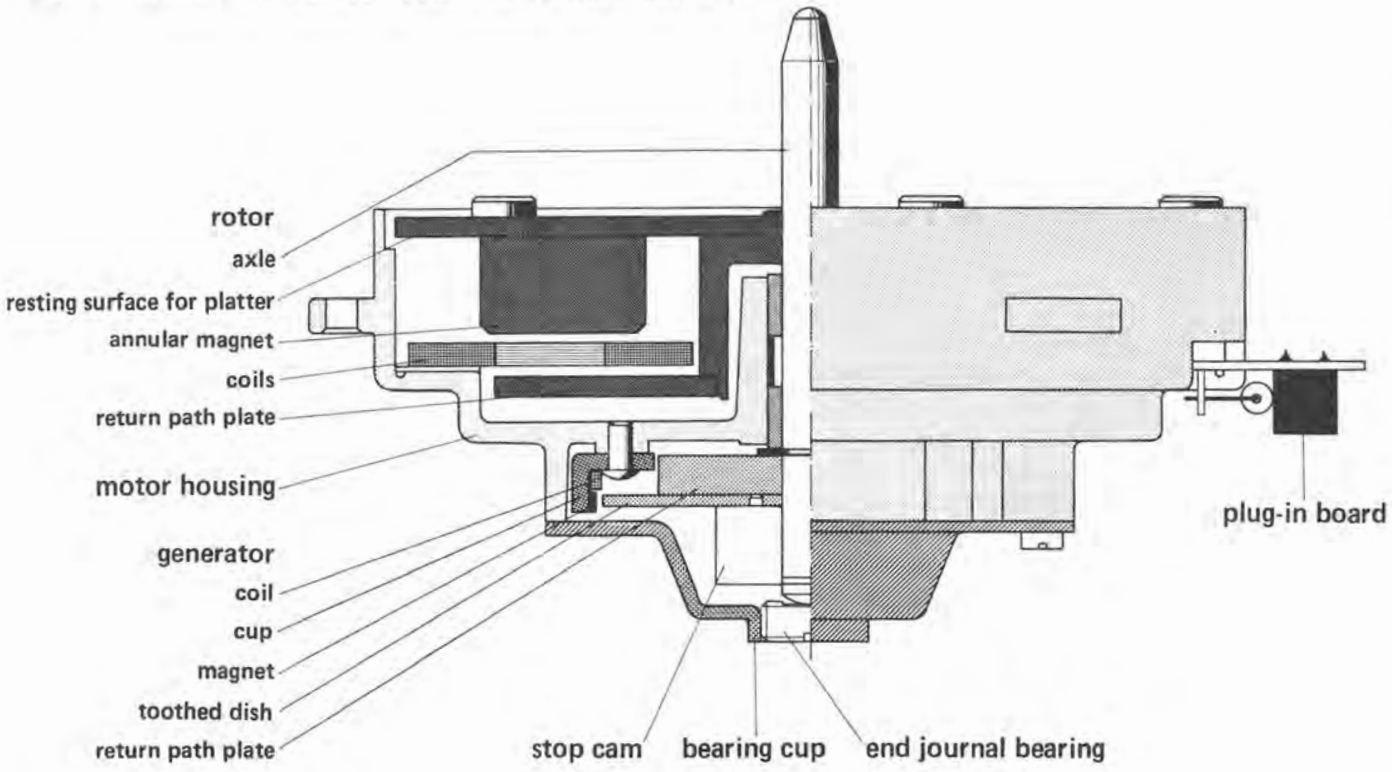
43 44 42 41 39, 40 37, 38 36

10 11 12 13 14

17 16 15

Contents

Fig. 2 Electronic Direct Drive System Dual EDS 900



Dual EDS 900 Electronic Direct Drive System

The Dual EDS 900 electronic direct drive system is a slow-running, no-commutator DC electronic motor. The electro-mechanical commutation normally carried out on DC motors by the commutator is electronically controlled in the case of the Dual EDS 900 by two Hall generators. These Hall generators - dependent on the rotor position - control via four switching transistors four coils of the motor succesively. The cyclic switching of the field coils exerts rotating magnetic field on the eight-pole annular magnet of the rotor. The field coils are located in the air gap between the annular magnet and the return path plate which form the magnetic return path. The speed is controlled by a frequency generator which is coupled to the rotor rigidly. A fixed flat coil is located in a magnetic circle which is formed by a 200 pole permanent annular magnet, a toothed disk and a return path cup. The toothed disk rotates with the rotor and generates a frequency in the coil which is proportional to the speed. Any error which might be caused by eccentricity between the permanent magnet and toothed disk is compensated thus generating a frequency of high uniformity which controls the regulating circuit. This frequency is transformed by a special electronic circuit into a DC voltage which is proportional to speed (digital/analog transformation). The voltage thus generated is compared to a highly stabilized reference voltage and used to control current of the direct drive.

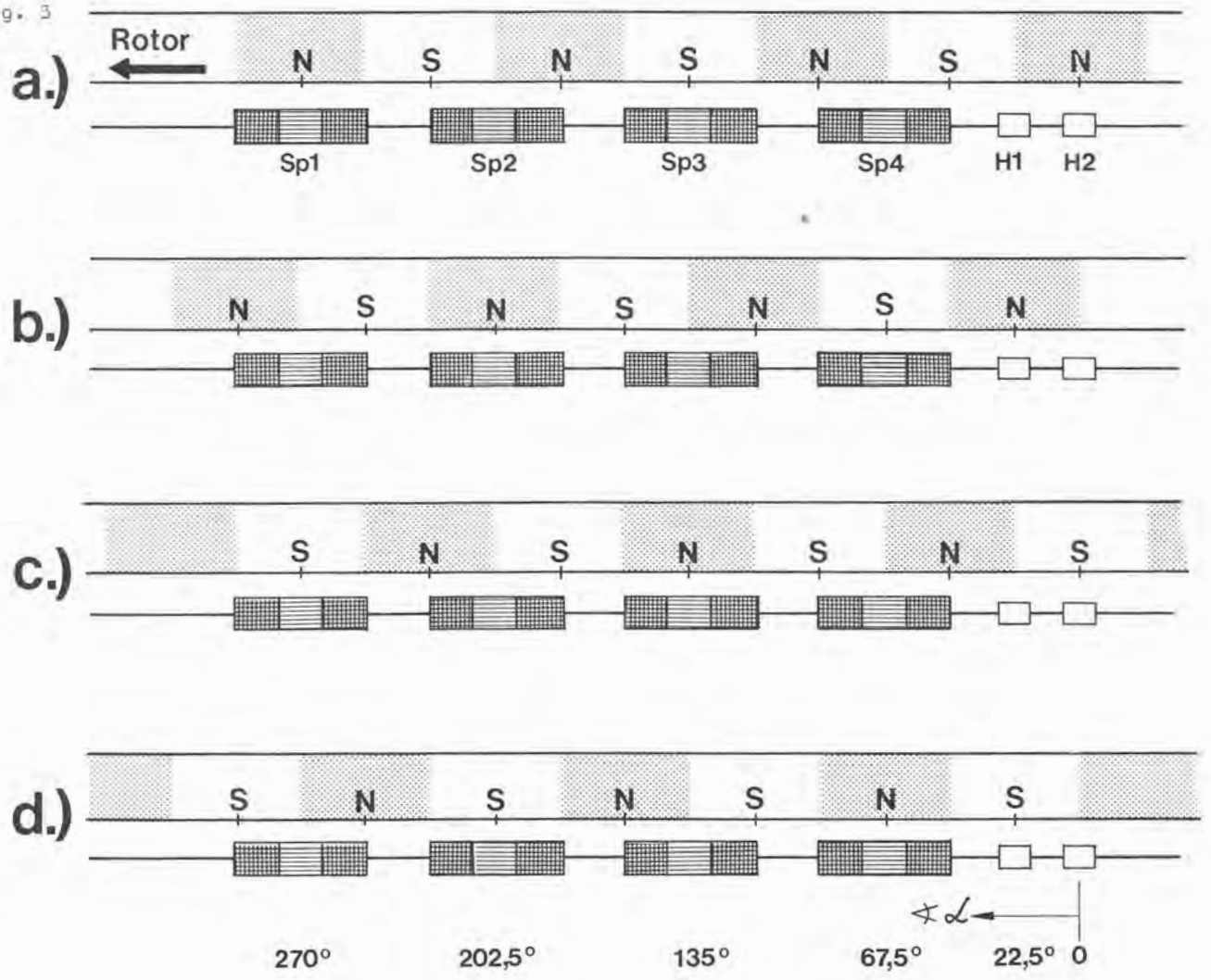
The unique design of drive and control results in distinct advantages: no pole sensitivity, hysteresis, eddy current losses, and disturbing groove frequencies; high-definition speed control without interference, thus enabling a momentary control of speed drop. These characteristics guarantee a completely vibration free and uniform drive source for the EDS 900.

Description of Function

The four bifilar coils of the electronic motor and the two Hall generators are rigidly connected to the motor flange. The 8 pole annular magnet forms the rotor and also moves the magnetic return. The four coils and the two Hall generators are arranged between the annular magnet and the magnetic return.

When a north pole is above the Hall generator H 1 (Fig. 3 a), the base of transistor T 17 becomes positive and the transistor conductive or low-ohmic. Current flows through coil 3 which has the effect of a south pole. The north pole of the annular magnet displaced by 22.5° from coil 3 is attracted. A section of coil 1 is also connected to the collector of transistor T 17, which, as related to coil 3 will be subjected to current flow in counter direction. This section of coil 1 has the function of the north pole and attracts the south pole of the annular magnet displaced by 22.5°. The north pole of the annular ring which was above the Hall generator H 1 has been rotated by 22.5° and is now above the Hall generator H 2 (Fig. 3 b).

Fig. 3



Transistor T 15 becomes conductive and current flows through a part of coil 2, so that a south pole is formed while current flows through a part of coil 4 in counter direction which acts as north pole. The rotation of the rotor through 22.5° moves the subsequent south pole of the annular magnet on the Hall generator H 1 (Fig. 3 c). Transistor T 16 becomes conductive, coil 1 is the south pole and coil 3 forms a northpole. By a further rotation through 22.5° the south pole moves via Hall generator H 2, which controls Transistor T 14 (Fig. 3 d). Coil 2 becomes the north pole, coil 4 the south pole.

Speed Regulation

The rotor rotates with a toothed disk having 200 teeth. A magnetic tape is cemented round the motor flange. On one side the tape has 200 north poles on the other side 200 south poles. The north poles are arranged directly opposite the rotor center. A coil is mounted in the vicinity of the magnetic tape and the toothed disk. A changing magnetic field is produced by the rotating toothed disk. This magnetic field induces in the coil a voltage with the corresponding frequency. This frequency is 111 Hz at a rotational speed of 33.3 rpm.

The pulses produced by induction are lead to the input amplifier consisting of transistor T 1 and T 2. The signal across emitter and collector of transistor T 2 is lead to the frequency doubler. The doubled pulses are applied to transistor 5 (via capacitor C 8) which, together with transistor T 6, works as a mono flop. The rectangular pulses thus gained are integrated via resistors R 23, R 25, R 26 and capacitors C 10, C 11, C 12 and produce a base voltage at transistor T 9. The pulse/pause ratio of the monoflop can be varied by controls R 45 (basic setting monoflop), R 20 (coarse speed control 45 rpm), R 22 (coarse speed control 33 rpm) and R 21 (fine speed adjustment). As a result also the potential across the base of transistor T 9 changes after integration T 9 and T 10 take the form of a differential amplifier which controls - via the collector of transistor T 9 - the base of T 7 which, together with T 8 also takes the form of a differential amplifier. The amplified control voltage is lead from the collector of transistor T 8 to the base of T 12 via resistor R 37. The transistor T 12 and T 13, which are connected as an emitter follower, control the current for the four switching transistors. The maximum starting current is controlled by R 40 via transistor T 11.

Mounting Instructions for Dual EDS 900

For repair of the Dual EDS 900 special tools and measuring means are required. Work on the motor or motor electronic system should, therefore, only be carried out by an authorized Dual service station. Expenses arising from unauthorized interference will be charged to the conisgnor.

Removal

1. Extract unit plug from power line. Lift off platter (4). Bring unit into head position. Remove machine screws (174) and washers (173). Lift off cover (175).
2. Remove machine screws (117) and cover of power pack (123).
3. Unsolder leads for operating voltage on line transformer (124). Unsolder connecting leads on fine speed control (197) and knob (242).

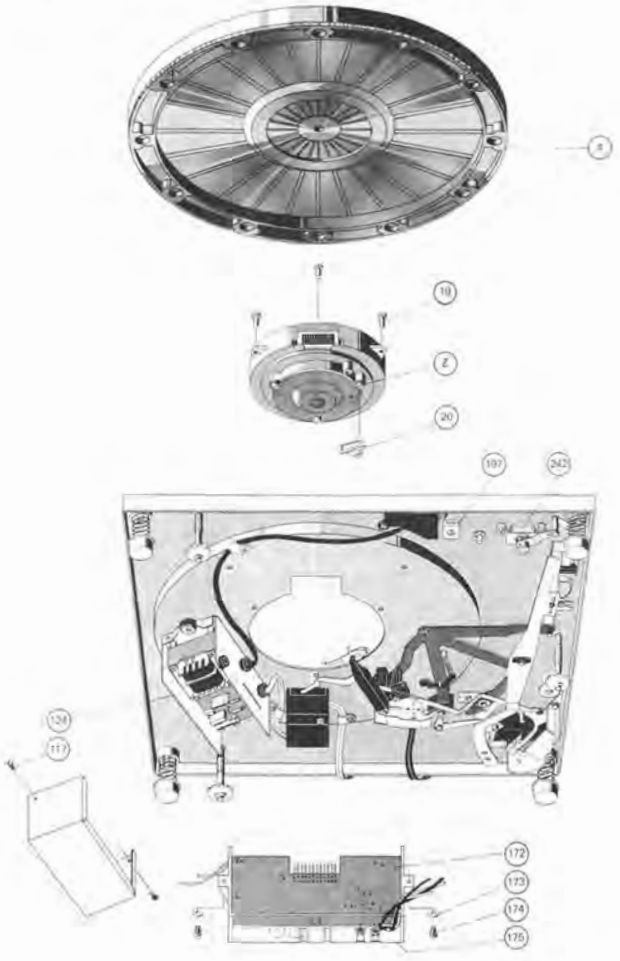
   Attention: Do not unsolder cable on motor (172).

4. Pull off motor electronic system from motor (18) carefully.
5. Fix replacement motor electronic system on motor (18).
6. Solder connecting cables (see connection diagram Fig. 6).
7. Slide cover over power pack and fix it by means of machine screws (117).
8. Slide cover (175) over motor electronic system (172) and fix it by means of machine screws (174).
9. With the unit in normal position connect it to power line. Switch on unit and check power consumption on operation:

   220 V/50 Hz approx. 20 mA
   110 V/60 Hz approx. 40 mA

   Check nominal speeds. If necessary, readjust as described below.

Fig. 4



Replacement of Motor

1. Extract unit plug from power line. Remove platter (4).
2. With the unit in head position remove machine screws (174) and washers (173). Pull off motor electronic board (172) together with cover (175) carefully from the motor (18).
3. With the unit in normal position remove the three machine screws (19). Remove motor (18). Loosen machine screw (Z) and remove set spring (20).
4. Mount set spring (20) on the replacement motor. Place motor (18) on installation plate (23) and mount it with machine screws (19).
5. With the unit in head position the motor electronic system (172) with cover (175) to the motor (18) and secure it with washers (173) and machine screws (174).
6. 6. With the unit in normal position connect it to the power line Switch on unit and check power consumption when operating:

   220 V/50 Hz approx. 20 mA
   110 V/60 Hz approx. 40 mA

   Check nominal speeds. If necessary, readjust as described below.

Setting nominal speeds

With knob (44) bring the fine speed control (242/R 21) into center position. With controls (R 22) and (R 20) on the motor electronic system adjust nominal speeds. Control (R 22) is used for 33 1/3 rpm, R 20 for 45 rpm (refer to Fig. 6). Check with strobe disk.

Changeover to 78 rpm nominal speed

Instead of 45 rpm the Dual 704 can be changed to a nominal speed of 78 rpm.

To change the speed bring the fine speed control (242/R 21) in center position using knob (44). Using control R 20 on the motor electronics board (172) adjust for 78 rpm (refer to Fig. 6). Check with strobe disk.

Stroboscope

Accurate setting of the platter speeds 33 1/3 and 45 rpm can be checked during play with the aid of the stroboscope.

When the platter (4) is rotating at exactly 33 1/3 or 45 rpm the lines of the stroboscope appear to stand still. If the lines move in the direction of rotation of the platter, the platter speed is too high. If the lines move backwards, the platter is rotating more slowly than the nominal speed. Adjustment of platter speeds 33 1/3 and 45 rpm is carried out separately with the "pitch" controls (44).

Strobe markings are provided on the outer edge of the platter for 50 and 60 Hz line frequencies.

To replace glow lamp (103) remove machine screws (105) and remove strobe cover (104).

It can happen that the stroboscope lines appear to move slightly although the exact speed setting with stroboscope stationary has not been altered. This apparent contradiction is explained by the fact that the electronic central drive motor operates fully independently of line frequency whilst the only relatively accurate line frequency of the AC current supply is used for speed measurement with the light stroboscope. The constantly detectable fluctuations of line frequency by ± 2 % (according to the information of the electricity supply companies) brief frequency fluctuations up to 1 % are possible - only effect the stroboscope indication and can cause the lines to "wander" although the platter speed is as constant and absolutely accurate as before.

Pitch Control

Each of the two standard speeds 33 1/3 and 45 rpm (78 rpm) can be varied by about 10 %. The variable speed control (242/R 21) located in the voltage divider is adjusted by turning the pitch control knob (44). By this means the differential amplifier is altered and the motor speed accordingly.

Fig. 5 Stroboscope

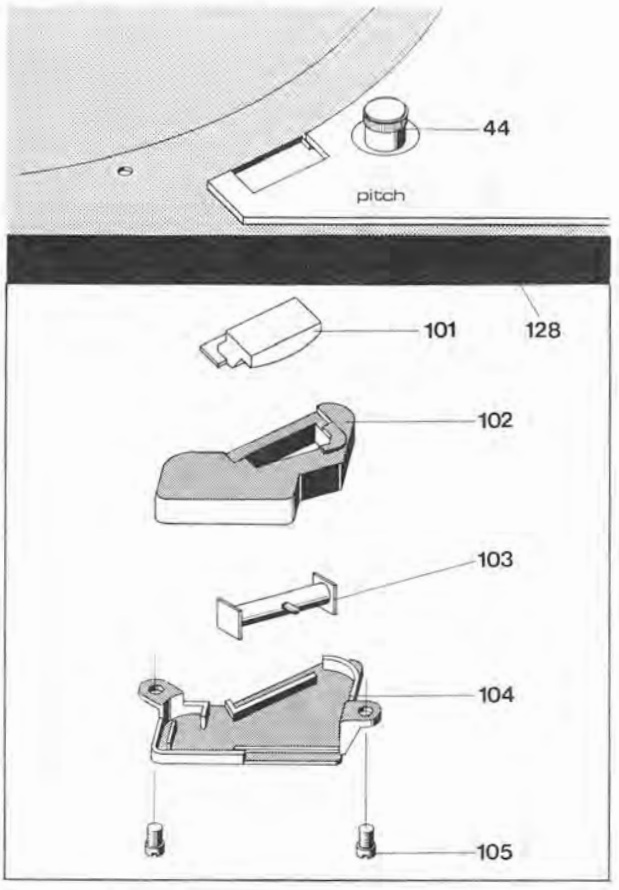


Fig. 6

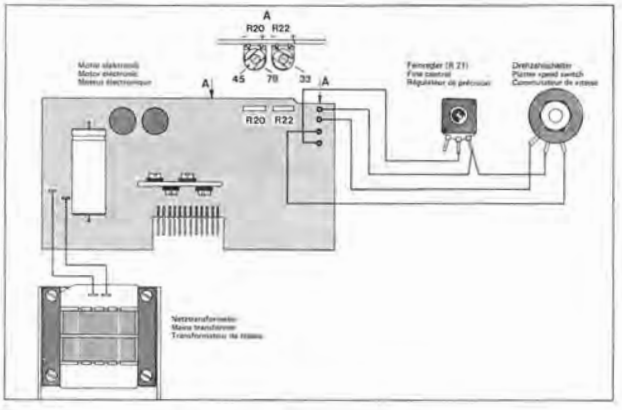


Fig. 7 Power Supply Board (component side)

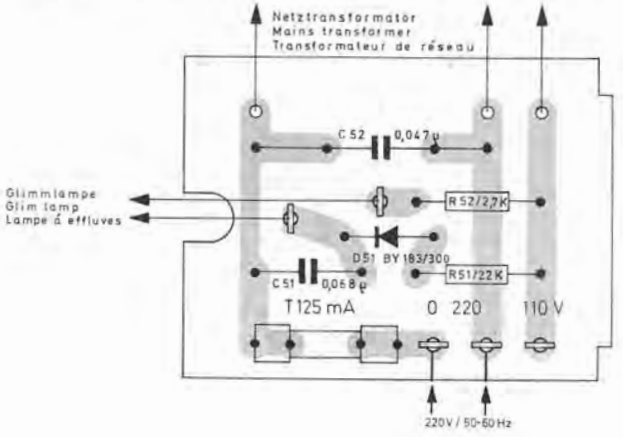
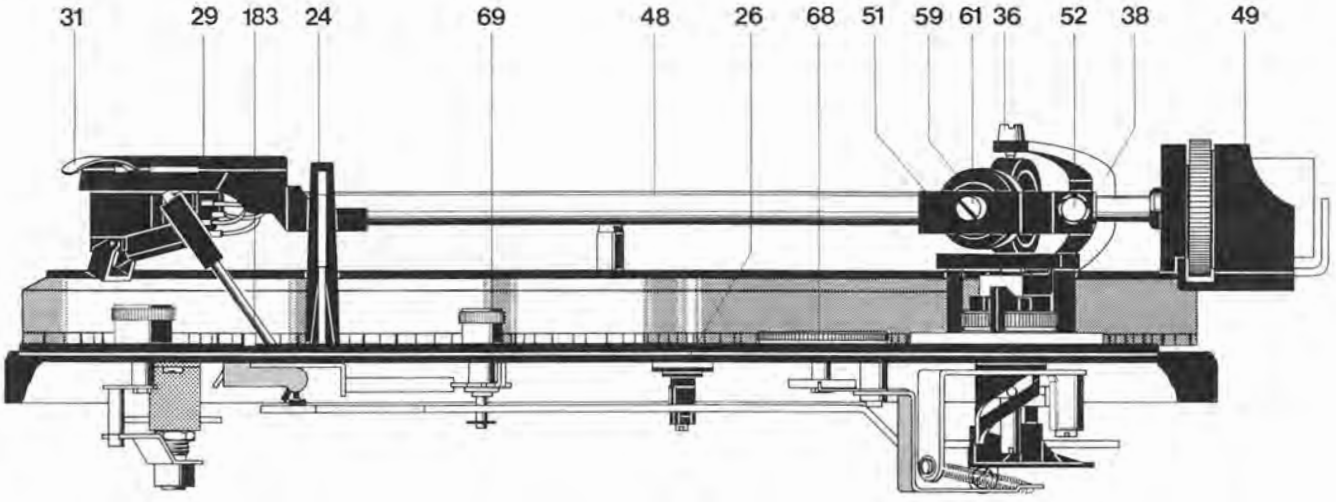


Fig. 8 Tonearm-Tonearm Suspension



Tonearm-Tonearm Suspension

The feather-light, extremely torsion resistant all-metal tonearm is suspended in a gimbal. Suspension is by means of 4 hardened and precision polished steel points which rest in precision ball bearings. Tonearm bearing friction is thus reduced to a minimum.

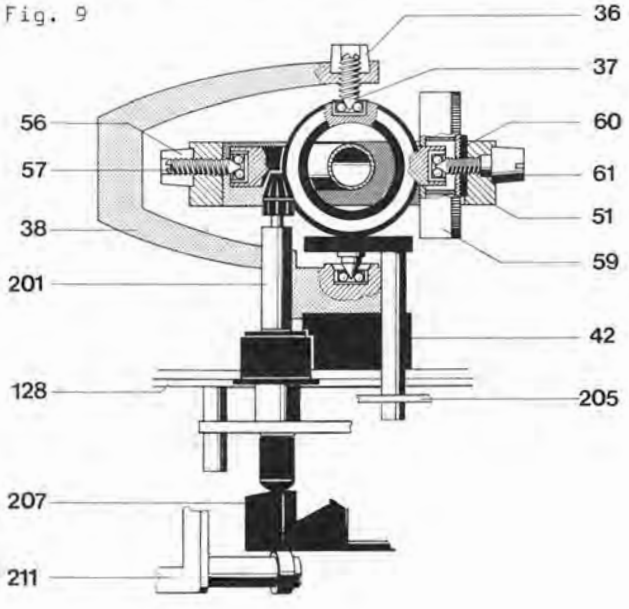
Bearing friction vertical ≦ 0.007 p
Bearing friction horizontal ≦ 0.015 p

as related to stylus point.

As a result, it ensures most favourable pick-up conditions. Before adjusting the pick-up force to suit the built-in pick-up cartridge the tonearm is balanced with the scale set to zero. Coarse adjustment is carried out by moving the weight with the stem (49), the subsequent fine adjustment by turning the weight. The balance weight is designed such that pick-up cartridges having a deadweight of 4.5 - 10 g can be balanced. It takes the form of a anti-resonator thus absorbing the vibration energy in the range of tonearm and chassis resonance. For this purpose, the inner part weight is matched to the tonearm resonance and thus acts as anti-resonator by means of antiphase vibration. The outer part of the balance weight taking the form of a higher balanced anti-resonator prevents transmission of partially occurring chassis resonance to the tonearm.

The tracking force is adjusted by turning the graduated spring housing (59) incorporating a coil spring. The scale has markings for a range of adjustment from 0 to 30 mN (0 to 3 p) which permit accurate adjustment of the tracking force. One graduation in the range of 2 - 15 mN (0.2 - 1.5 p) corresponds to 1 mN (0.1 p), in the range of 15 - 30 mN (1.5 - 3 p) to 2.5 mN (0.25 p).

Fig. 9



Removal of tonearm assembly with tonearm bearing

1. Secure unit in repair jig. Remove weight (49) undo fixing screw (52). Set tracking force scale (59) to zero.
2. Move unit into head position. Remove screening plate (150). Unsolder tonearm on muting switch (149).
3. Move unit into normal position. Turn both mounting screws - SW 4.5 - (55) counterclockwise to the stop of the bearing frame (51).

Attention: Observe the bayonet mounting. Slide tonearm (48) rearwards and remove it upwards from the bearing frame.

For installation proceed in the reverse order.

Removal of tonearm from bearing frame

Proceed as follows:

1. Secure unit in repair jig. Set graduated spring housing (58) to zero. Arrest tonearm (48). Remove weight (49).
2. Loosen tension lever (63) and bring tonearm (48) in its highest position using knob (65). Fasten tension lever (63). Bring knurled ring (68) in position "3".

3. Turn unit into head position. Remove screening plate (150). Unsolder tonearm leads on the muting switch (149).
4. Remove machine screw (234), hex nut (236) and fillister head screw (67). Also remove transition plate (233) and guard plate (235).
5. Unscrew machine screw (226) and holding spring (224).
6. Hold tonearm (48) and unscrew pin (220). Unlock tonearm (48) and remove it carefully.

When installing the tonearm completely with suspension, proceed in reverse order considering the following points:

Place pressure spring (39) on axle of frame (38). Both axles of bearing (58) should align segment (205) accurately. Frame (38) should not contact cover (42) after tightening bolt (220). Mount holding spring so that it does not contact the setting plate when moving the tonearm (48) (Fig. 16).

Replacing spring housing

Remove tonearm (48) from bearing frame (51) as described above. Loosen lock nut (56) and threaded pin (57). Unscrew bearing screw (61). Lift bearing frame (51). Remove spring housing (59) and washer (60). When installing note that the helical spring catches the bearing frame. Slide in washer (60) and tighten bearing screw (61). Reinstall tonearm (48). Set bearing play as described below using threaded pin (57) and lock nut (56).

Adjusting the tonearm bearing

First balance tonearm exactly. Both bearings must have slight, just perceptible play. The horizontal tonearm bearing is correctly adjusted when at anti-skating settings "0.5" and being touched it slides in without resistance. The vertical tonearm bearing is correctly adjusted when it swings in after being touched. The play of the horizontal tonearm bearing should be adjusted with threaded pin (57).

Vertical Tonearm Control

After loosening the tension lever (63) the tonearm can be shifted vertically within the range of about 8 mm by turning knob (65). When turning knob (65) the pivot cam (217) is moved thus shifting the cue control assembly (201) and the tonearm bearing (38) vertically. This device is used to maintain the vertical tracking angle of the pick-up cartridge independent from its height (distance between the mounting level of the cartridge and stylus tip). The vertical tracking angle is properly adjusted - with the stylus tip on the record - when the tonearm is exactly paralled to it.

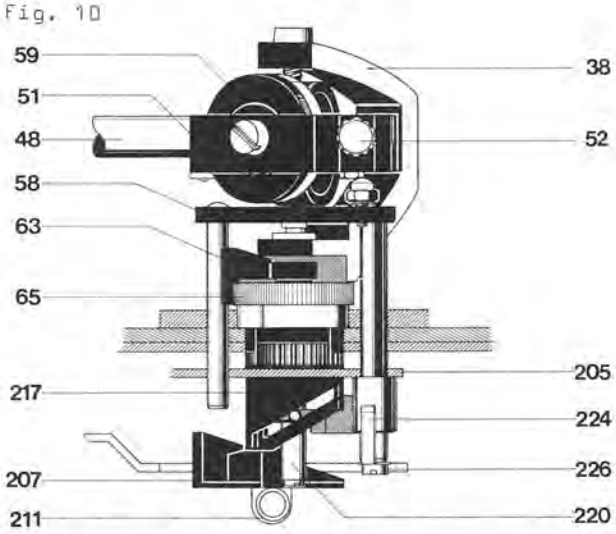
To check for correct adjustment proceed as follows:

Disconnect unit plug from power line. Correctly balance tonearm and adjust tracking force. Put a 30 cm record on the platter. Now, lower the stylus on the run-out groove using the cue control. Check setting, correct if necessary. Tighten tension lever (63) clockwise. Operate cue control (▼) and bring back tonearm manually on the rest. Lower cue control (▼). Connect unit plug to power line. For automatic adjustment of the mechanical gear and the shut-off mechanism the unit should be started for the first time with the tonearm locked.

Adjustment Point:

Knob (65) should not be moveable when tension lever (62) is tightened. Adjustment can be made after loosening machine screw (216) and sliding or shifting adjustment plate (215).

Fig. 10



Anti-skating Device

To compensate for skating force use the knurled ring (68). The asymmetric cam plate (231) displaces the skating lever (228) from the tonearm pivoting point. The anti-skating force is transmitted to the segment (205) and to the tonearm (48) by tension spring (223).

Optimum adjustment is carried out at the works for styli having a tip radius of 15 µ (conical), 5/6 and 18/22 µm (elliptical), and CD 4-cartridges.

Any alteration can only be carried out with the aid of a Dual-Skate-O-Meter and a test record and should only be done by an authorized service station.

Recheck as follows:

Balance tonearm (48) correctly. Set knurled ring (68) to 0. The tonearm should remain at any desired point within its turning range. The hole of the skating lever (228) should be in alignment with the center line of the tonearm. Adjustment is made by the eccentric pulley (E) which is accessible through the hole in the installation plate (23) between the knurled ring (68) and the tonearm mounting plate (41) See Fig. 14.

The set knurled ring (68) to "0.5". The tonearm should now smoothly rotate from the platter center to its rest (24).

Tonearm set-down mechanism

When turning knob (69) to "V" position the recesses of slide bar (211) are positioned in the area of the spring pin (F) of segment (205).

When moving slowly the tonearm with tonearm cue control in ▼ position the spring pin (F) is arrested in the recesses of slide bar (211) thus designing the set-down point of stylus for 30 cm and 17 cm records.

To enable set-down in the catching range of the arresting point of the appropriate set-down position, the tonearm set-down mechanism can be disengaged "▲".

Adjustment Points:

a) Balance tonearm (48) exactly. Bring knob (69) into " V " position. Let tonearm catch in catch point for tonearm set-down point. Check catch force by means of a spring balance. It should read 10 - 20 p. The force is adjustable by means of a threaded pin.

b) The tonearm set-down point can be adjusted by turning set screw (26). Adjustment can be made for 17-cm- and 30-cm records. Any difference between the 17-cm and 30-cm set-down point are to be compensated by eccentric pulley (E) and segment (205) (Fig. 16).

Cue Control

By moving the lever (183) forward (▼) lift cam (184) rotates. The slide bar (211) connected to it transmits this movement to the lift pin (201) (via the compensating cam (207) which then raises the tonearm. As a result, the cue control permits setdown of the tonearm at any desired point.

The lever (183) is released by moving the cue control lever rearwards (▲). As a result of the action of compression spring (203) the lift pin (201) is brought back to its normal position and the tonearm lowered slowly. Lowering of the tonearm is damped by silicone oil in the lift tube.

The height of the stylus above the record can be varied by turning the adjustment bus (202). The distance should be approximately 5 - 7 mm.

Fig. 11 Anti-skating

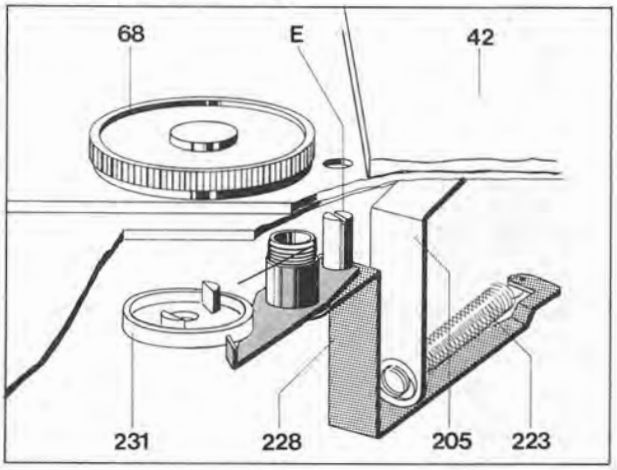
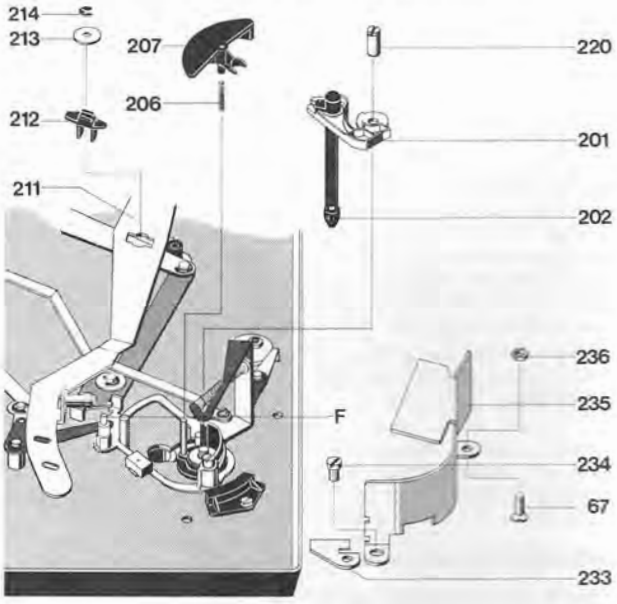


Fig. 12 Replacement of Cue Control Plate



Replacement of Cue Control Plate

Replace cue control plate (201) as follows:

1. Fix unit on repair jig and lock tonearm. Remove weight (49).
2. Loosen tension lever (63), bring tonearm in its lowest position using knob (65).
3. Set knurled ring (68) of the anti-skating device to position "3". Turn unit into head position.
4. Remove machine screw (234), hex nut (236) and fillister head screw (67). Remove the transition plate (233) and guard plate (225). Remove safety washer (241).
5. Remove safety washer (214) and washer (213). Remove slide bar (211) together with bearing (212). Pull off compensating cam (207) and compression spring (206).
6. Unscrew pin (220). Disengage cue control plate (201) from cam (217) and remove it.

For installation proceed in the reverse order.

Starting and shut off

Turning the tonearm (48) rotates the segment (205) thus actuating the power switch (106) via pawl (135) and shift arm (146) and starting motor (18) and platter (4) rotating.

The shut-off cycle after placing a record is initated by the dog (M) of the platter (4) and shut-off lever (163).

The shut-off lever (163) is guided onto the dog by the movement of the tonearm when playing the record with the aid of the shut-off bar (164) proportionate to the groove lead (Fig. 13 a). The eccentrically-mounted dog forces the shut-off lever (163) back with each revolution as long as the advance of the tonearm only amounts to the width of one groove.

Only the run-out groove with its increased lead guides the shut-off lever (163) onto the dog at a higher rate so that the shut-off lever is picked up and moved along (Fig. 13 b).

As a result the shift arm is brought into its neutral position the power switch interrupting the power supply. Simultaneously, the lift actuating lever (146) coupled to the shift arm (155) is actuated and the tonearm (48) lifted.

Fig. 13

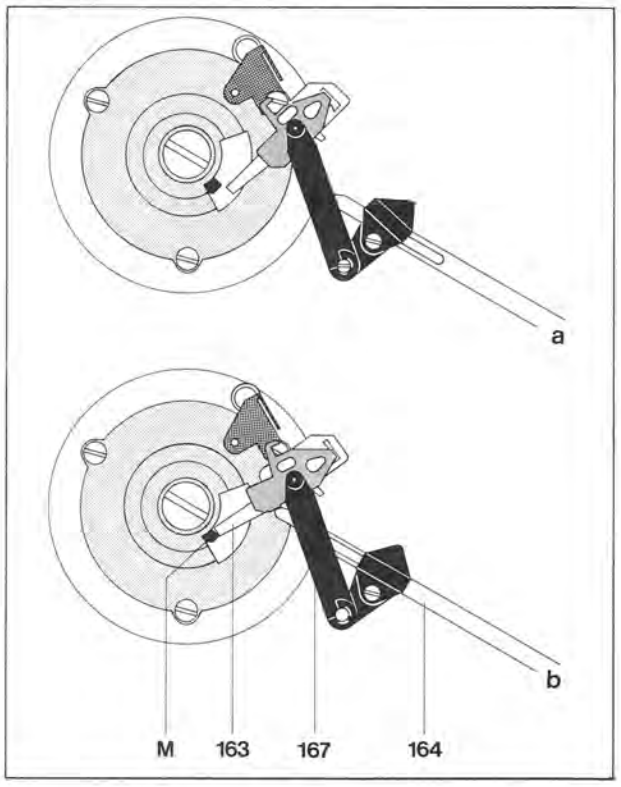
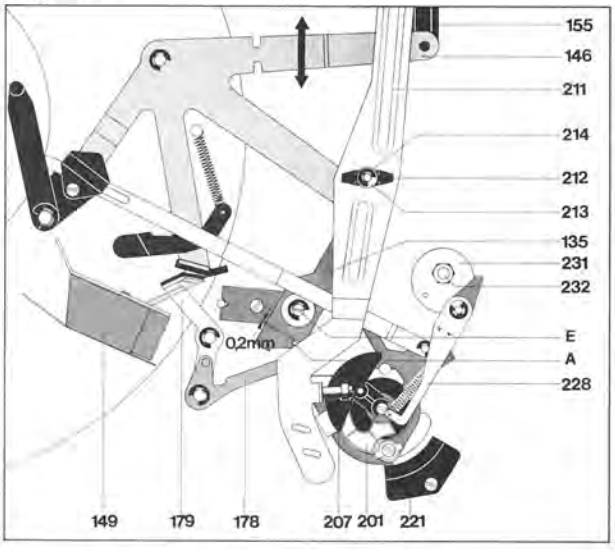


Fig. 14



Adjustment points:

1. Pawl

a) Lock tonearm (48) on its rest. Pawl should not be pressed against segment (205). The distance between pawl (135) and stop (A) should be 0.1 - 0.2 mm (refer to Fig. 14). If necessary, bend shift arm (146).

b) Move tonearm (48) inwards. Shift arm (146) should be moved by cam (135) to its inner stop. Adjustable with eccentric pulley (E) (Fig. 14).

2. Power Switch

Extract unit plug from power line. Move tonearm (48) to its rest (24). The power switch (106) should operate shortly before the tonearm (48) reaches its rest (24) (approx. 3 mm) (Fig. 15). Adjust by bending the shut-off lever (158).

3. Segment

The shut-off point can be changed with the eccentric pulley (S) on segment (205) (Refer to Fig. 16).

Fig. 15

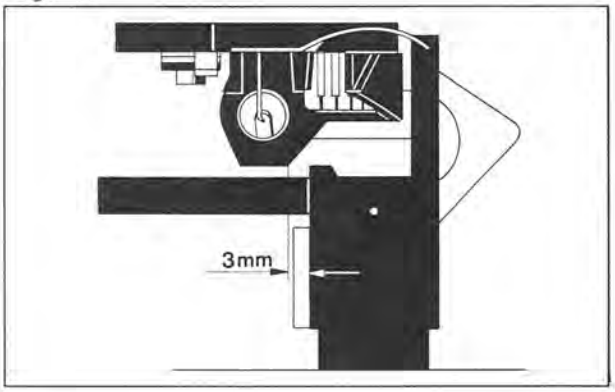


Fig. 16

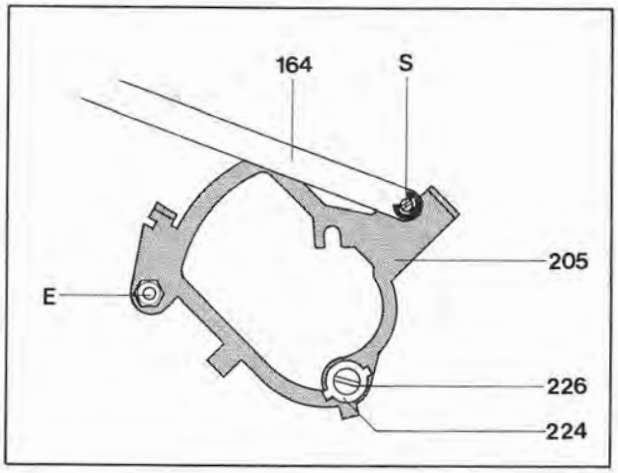


Fig. 17

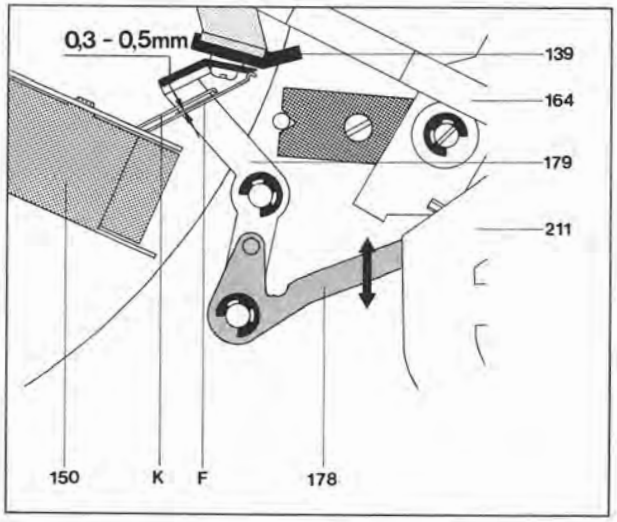
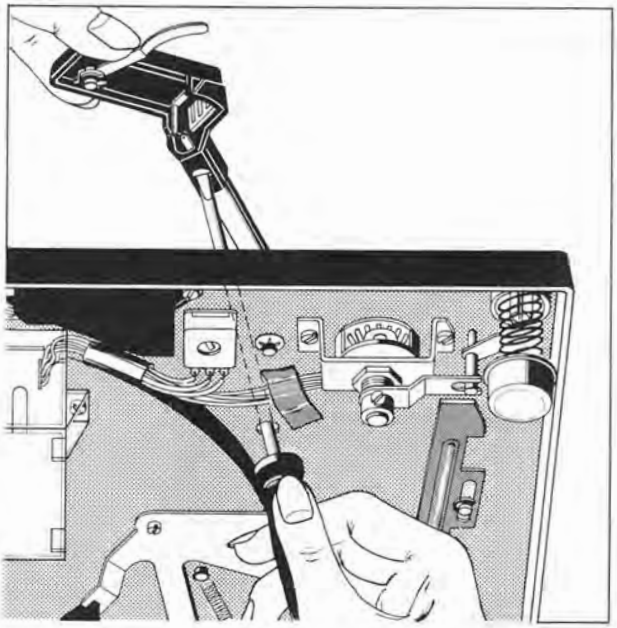


Fig. 18



Muting switch

To prevent disturbing noises after playing a record the unit is equipped with a muting switch.

When moving the tonearm (48) inwards the contact springs are actuated by pivoted lever (179) and the lifting piece (139) on the control arm.

After playing a record the contacts are closed. If the tonearm is returned to its rest, the contacts are reopened.

Adjustment Points:

a) The contact springs (F) of the muting switch should have a spring pressure of 40 - 50 p. If necessary, slightly bend contacts (K).

b) In neutral position the contact spring (F) (Fig. 17) should rest on the radius of the pivoted lever (179). Adjust by bending the deflection lever (178). The distance between contacts should be 0.3 to 0.5 mm. If necessary, bend contacts (K).

Defect

Tonearm head not parallel to platter.

Cause

Seat of tonearm head on the tonearm tube has changed during transit.

Remedy

Remove platter. Insert screwdriver through the hole in the chassis mounting plate. Align tonearm head and retighten screw (Fig. 18).

Defect	Cause	Remedy
Stylus slips out of playing groove	a) Tonearm is not balanced	a) Balance tonearm
	b) Tonearm tracking force is too low	b) Adjust tracking force to the value stated by the cartridge manufacturer
	c) Anti-skating setting incorrect	c) Correct anti-skating setting
	d) Stylus tip worn or chipped	d) Renew stylus
	e) Excessive bearing friction in tonearm bearing	e) Check tonearm bearings and readjust if necessary
	f) Steel ball (165) of shut-off bar (164) missing	f) Renew steel ball (136)
	g) Friction of dog of segment (205) in guide piece (221)	g) After using the vertical tonearm control the tonearm should be returned to its rest (24) to center the segment (205). Bend holding spring, if necessary.
Tonearm does not set down on record or lowers too quickly when operating the cue control lever (182).	Excessive or insuffidient damping as a result of contamination of the silicone oil in the lift tube.	Referring to page 12 remove cue control plate (201). Remove adjustment bush. Remove lift pin (204) and compression spring (203). Clean lift tube and lift pin. Smear lift pin evenly with "Wacker Silicone Oil AK 300 000". Reassemble components.
With tracking force and anti-skating in 0 position tonearm moves outwards or inwards.	a) Anti-skating device maladjusted	a) Readjust anti-skating device as described on pages 11/12
	b) Tight tonearm leads cause a torque	b) Slacken leads
Motor does not switch off when tonearm sets down on rest.	Capacitor type suppressor (110) in power switch is defective (shorted).	Replace capacitor type suppressor in power switch.
Acoustic feedback	a) Chassis components (e.g. connecting leads) rubbing on board cut out.	a) Line up mounting board cut-out according to installation instructions.
	b) Connecting leads too light.	b) Slacken or lengthen leads.

Replacement Parts

Pos.	Part. No.	Description	Qty.	
1	220 213	Centering disc	1	
2	238 071	Washer	1	
3	240 882	Turntable mat complete	1	
4	240 883	Turntable complete with mat	1	
5	239 414	Shipping screw complete	3	
6	237 668	Special screw	3	
7	210 146	Lock washer 3.2	7	
8	201 632	Rubber washer	3	
9	237 117	Washer	3	
10	237 118	Lock washer	3	
11	240 884	Dual emblem complete	1	
12	200 444	Spring washer	8	
13	234 433	Spring mount complete (Tonearm side)	2	
	234 432	Spring mount complete (Supply unit side)	1	
	237 227	Spring mount complete (Type plate side)	1	
14	230 529	Threaded piece	4	
15	232 842	Compression spring (Supply unit side)	1	
	232 843	Compression spring (Tonearm side)	2	
	236 711	Compression spring (Type plate side)	1	
16	200 723	Rubber damping block	4	
17	200 722	Steel cup	4	
18	240 885	Electronic direct drive system EDS 900	1	
19	210 516	Machine screw AM 4 x 8	3	
20	241 089	Locating spring	1	
23	240 886	Chassis complete	1	
24	236 911	Tonearm rest complete	1	
25	210 362	Hex nut BM 3	6	
26	234 781	Locating screw	1	
27	234 818	Pin screw	1	
28	237 536	Hex nut	1	
29	239 417	Tonearm head, complete	1	
30	237 223	Contact plate, complete	1	
31	234 611	Handle	1	
32	210 182	Spring washer	1	
33	210 630	Washer 4.2/8/0.5	1	
34	210 197	"C" Clip	1	
35	236 242	Cartridge mouth TK 24	1	
36	234 635	Lock nut	2	
37	230 063	Grub screw	1	
38	239 418	Frame complete	1	
39	237 481	Compression spring	1	
40	237 738	Fillister head screw countersunk M 3 x 8	1	
41	240 887	TA-Plate complete	1	
42	240 888	Rear cover complete	1	
43	200 444	Spring washer	8	
44	237 530	Turning knob complete	1	
45	237 661	Grub screw M 3 x 4	1	
46	240 889	Supporting plate	1	
47	200 444	Spring washer	8	
48	239 188	Clamp bolt	1	
49	239 420	Pointer	1	
50	236 160	Supporting plate	2	
51	240 890	Bearing rock complete	1	
52	236 051	Clamp bolt	1	
53	237 671	Needle	1	
54	237 672	Pin 1.4 x 6	1	
55	234 617	Fixing screw	2	
56	234 635	Lock nut	2	
57	217 438	Grub screw	1	
58	240 891	Bearing complete	1	
59	236 907	Spring housing complete	1	
60	237 563	Washer	1	
61	237 565	Mounting screw	1	
62	237 471	Shaft	1	
63	237 581	Tension lever	1	
64	234 303	Compression spring	1	
65	237 577	Turning knob complete	1	
66	210 361	Hex nut	1	
67	237 737	Fillister head screw countersunk M 3 x 10	2	
68	237 618	Knurled ring	1	
69	237 544	Turning knob, complete	1	
70	238 040	Turning knob, complete	1	
101	237 678	Deflecting prism	1	
102	237 677	Case, lower part	1	
103	225 321	Tubular lamp	1	
104	237 679	Strobe cover	1	
105	210 472	Machine screw M 3 x 4	12	

Fig. 19 Exploded view of parts above the plate

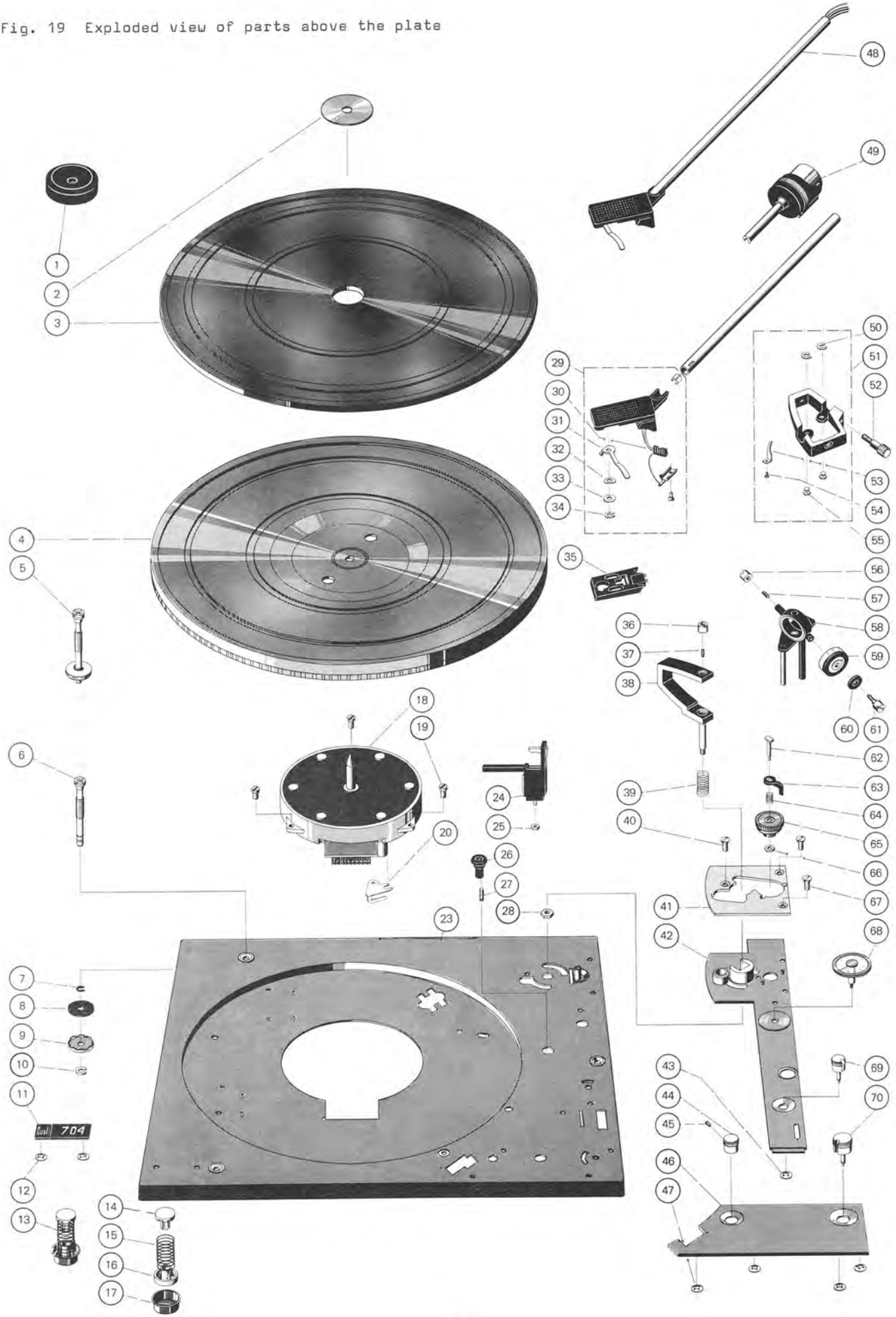
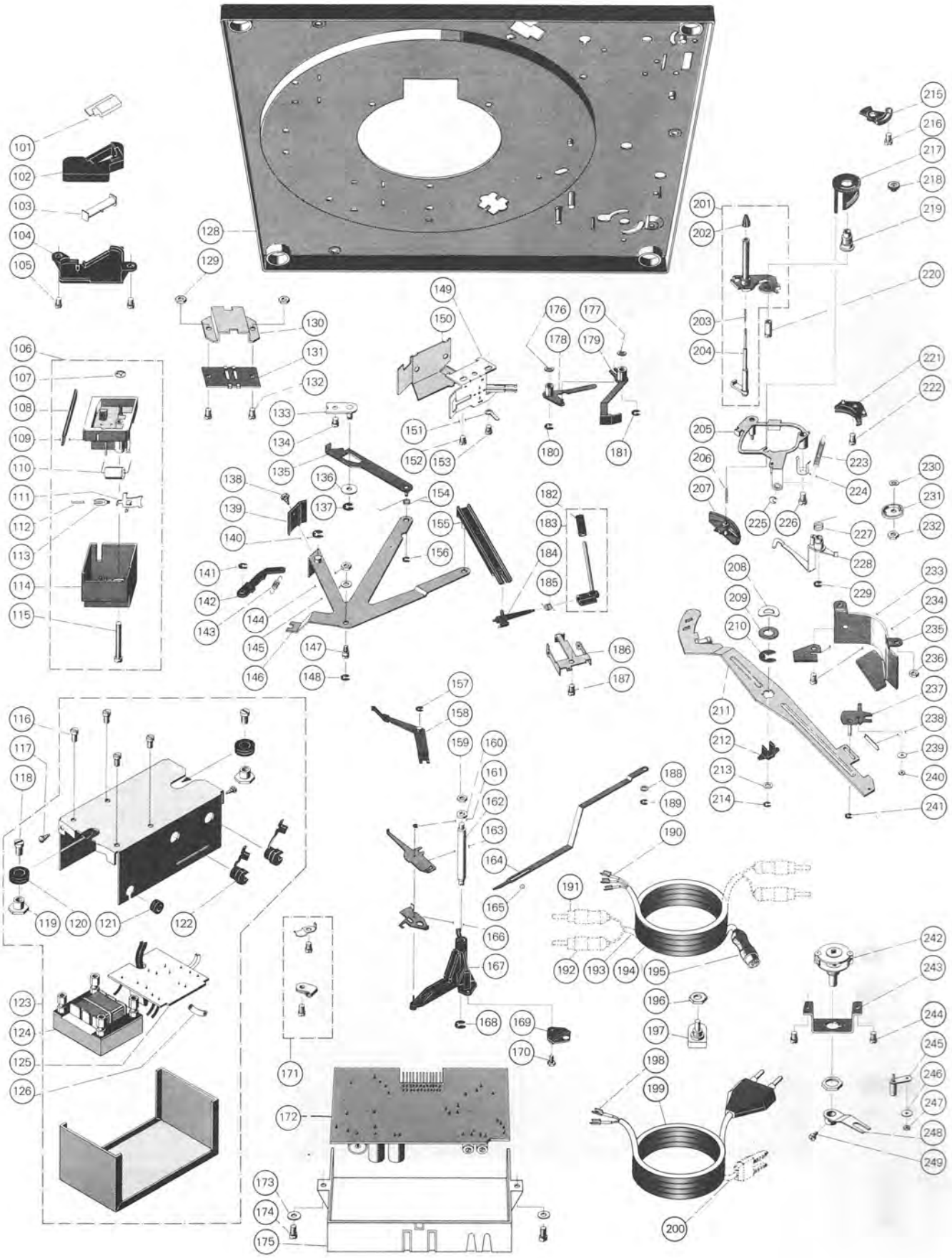


Fig. 20 Exploded view of parts under the plate



Pos.	Part. No.	Description	Qty.	
106	233 009	Power switch complete	1	
107	200 444	Spring washer	8	
108	236 335	Slide	1	
109	233 012	Switch plate, complete	1	
110	209 505	Capacitor 10 nF/1000 V/10 %	1	
111	230 148	Switch slide	1	
112	230 296	Tension spring	1	
113	219 200	Snap spring	1	
114	233 010	Power switch cover, complete	1	
115	210 498	Machine screw M 3 x 28	1	
116	210 480	Machine screw M 3 x 6	4	
117	213 471	Machine metal screw B 2.9 x 6.5	2	
118	210 516	Machine screw M 4 x 8	2	
119	227 159	Joining nut M 4	2	
120	209 939	Rubber sleeve	2	
121	209 934	Sleeving	1	
122	223 811	Sleeving with strain relief	2	
123	240 892	Power supply unit complete	1	
	241 767	Power supply unit complete *	1	
124	229 058	Power transformer complete	1	
	241 769	Power transformer complete *	1	
125	229 073	Power plate complete	1	
	241 770	Power plate complete *	1	
126	209 719	Fuse 0.125 A/250 V	1	
C 51	225 322	Foil capacitor 68 nF/400 V/10 %	1	
C 52	224 886	Foil capacitor 47 nF/250 V/20 %	1	
D 51	225 247	Silicon diode BY 183/300	1	
R 51	225 916	Carbon resistor 22 kohms/0.25 W/5 %	1	
R 52	225 915	Carbon resistor 2.2 kohms/0.125 W/5 %	1	
128	240 886	Chassis complete	1	
129	210 362	Hex nut M 3	6	
130	233 089	Shield	1	
131	227 254	RCA-type socket plate	1	
132	210 472	Machine screw M 3 x 4	12	
133	238 031	Adjusting plate	1	
134	210 472	Machine screw M 3 x 4	12	
135	234 786	Pawl	1	
136	210 146	Lock washer 3.2	7	
137	210 643	Washer 4.2/12/1	1	
138	227 467	Hexagon metal screw 2.9 x 6.5	2	
139	238 020	Lifting piece	1	
140	210 147	Lock washer 4	2	
141	210 196	"C" clip 3 x 0.6	1	
142	238 072	Stop lever	1	
143	234 799	Tension spring	1	
144	210 362	Hex nut BM 3	6	
145	210 586	Washer 3.2/7/0.5	3	
146	238 017	Switch arm complete	1	
147	234 759	Screw bolt	1	
148	210 146	Lock washer 3.2	7	
149	236 402	Muting switch complete	1	
150	232 084	Shield	1	
151	239 562	Soldering lug	1	
152	210 472	Machine screw AM 3 x 4	12	
153	210 472	Machine screw AM 3 x 4	12	
154	234 789	V-spring	1	
155	234 780	Lift actuating lever	1	
156	210 145	Lock washer 2.3	4	
157	210 145	Lock washer 2.3	4	
158	238 026	Shut-off lever complete	1	
159	210 362	Hex nut BM 3	6	
160	238 025	Distance ring	1	
161	210 142	Lock washer 1.2	1	
162	238 024	Bearing axle	1	
163	234 766	Shut-off lever	1	
164	238 058	Shut-off bar	1	
165	209 357	Ball 3.2	1	
166	238 022	Friction plate	1	
167	238 021	Support assembly complete	1	
168	210 147	Lock washer 4	2	
169	232 104	Ball bearing (bed)	1	
170	227 467	Hexagon metal screw 2.9 x 6.5	3	
171	231 079	Cable holder complete	1	
172	240 896	Motor electronic direct drive system, complete	1	
173	210 586	Washer 3.2/7/0.5	3	
174	210 472	Machine screw AM 3 x 4	12	
175	238 075	Cover complete	1	
176	221 430	Lock washer 3.2	2	
177	221 430	Lock washer 3.2	2	
178	238 062	Guide angle	1	

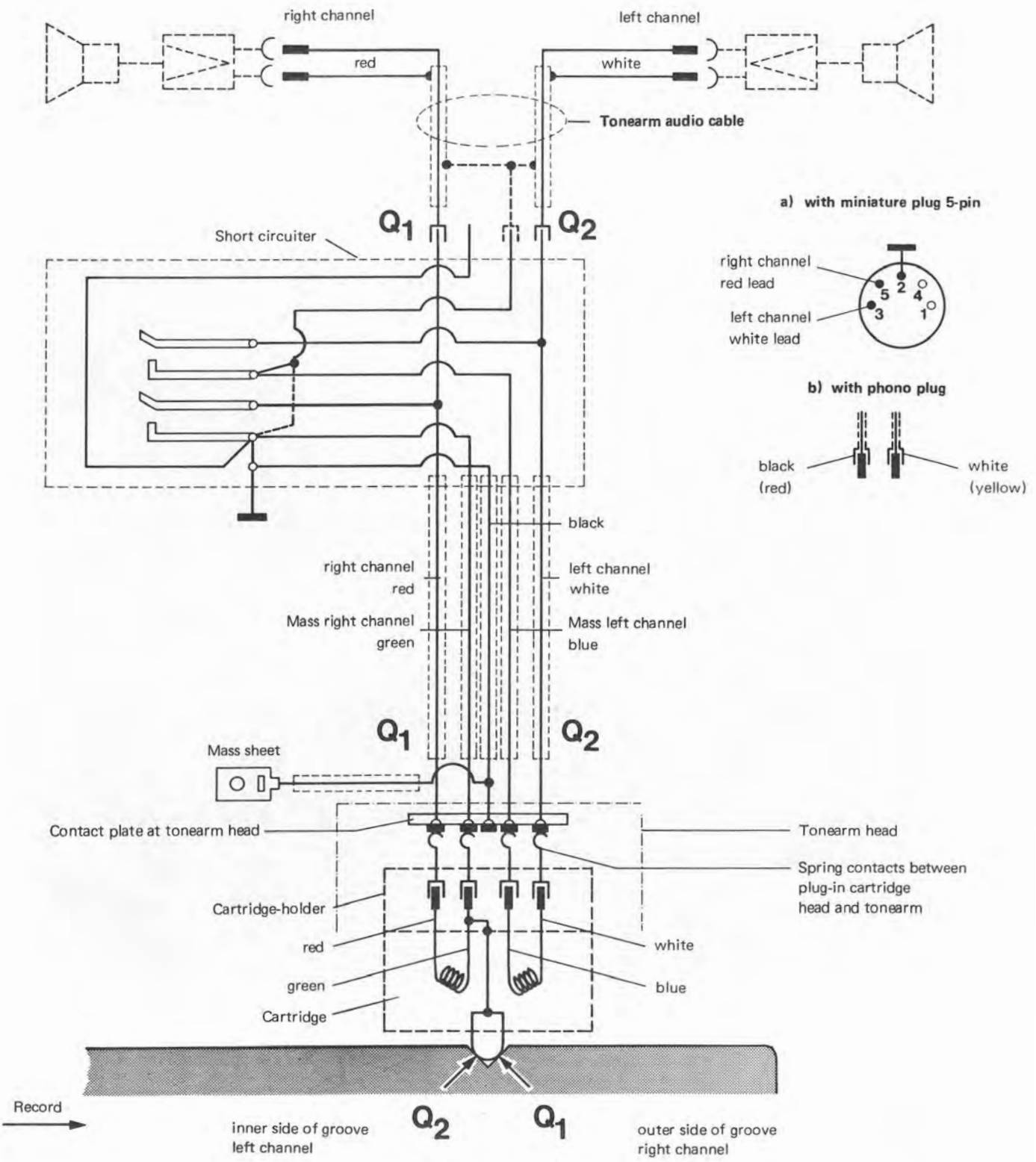
* Scandinavian version (D-N-S)

Pos.	Part. No.	Description	Qty.	
179	238 525	Swing lever	1	
180	210 146	Lock washer 3.2	7	
181	210 146	Lock washer 3.2	7	
182	237 543	Rubber sleeve	1	
183	240 893	Lift mave	1	
184	234 777	Lift cam	1	
185	234 778	Torsion spring	1	
186	234 776	Support brucket	1	
187	210 472	Machine screw AM 3 x 4	12	
188	201 187	Sliding washer	1	
189	210 145	Lock washer 2.3	4	
190	209 436	Socket for flat prong	3	
191	209 425	Cynch plug white	2	
192	209 426	Cynch plug black	2	
193	226 817	Pick-up lead complete with Cynch plug	1	
194	207 303	Pick-up lead complete with 5-pole plug and flat connector sleeve	1	
195	209 424	5-pole-plug	1	
196	237 782	Potentiometer nut	1	
197	238 073	Fine speed control (R 21)	1	
198	214 602	AMP-Connector	1	
199	232 996	Power cable Europe complete	1	
200	232 995	Power cable US complete	1	
201	240 894	Lift tube assembly	1	
202	234 800	Adjustment bush	1	
203	234 798	Compression spring	1	
204	238 052	Lift pin	1	
205	240 892	Segment kpl.	1	
206	239 743	Compression spring	1	
207	237 476	Compensating cam	1	
208	234 782	Lock washer	1	
209	210 713	Washer 9.1/15/1	1	
210	210 151	Lock washer 7	1	
211	238 055	Slide bar	1	
212	234 784	Bearing	1	
213	210 586	Washer 3.2/7/0.5	3	
214	210 146	Lock washer 3.2	7	
215	237 482	Adjustment plate	1	
216	210 480	Machine screw AM 3 x 6	1	
217	237 451	Pivoting cam	1	
218	237 480	Intermediate gear	1	
219	237 450	Bearing bush	1	
220	237 465	Pin	1	
221	237 474	Guide	1	
222	210 472	Machine screw AM 3 x 4	12	
223	218 591	Tension spring	1	
224	237 475	Holding spring	1	
225	201 184	Adjusting washer	1	
226	210 472	Machine screw AM 3 x 4	12	
227	229 688	V-spring	1	
228	237 483	Skating lever	1	
229	210 146	Lock washer 3.2	7	
230	216 867	Lock washer 5.2/10	1	
231	225 176	Curre washer	1	
232	210 361	Hex nut M 3	1	
233	239 481	Intermediate shim	1	
234	237 621	Machine screw AM 3 x 4	12	
235	237 488	Shield	1	
236	210 362	Hex nut M 3	6	
237	239 678	Rotary lever	1	
238	232 545	Laminated spring	1	
239	203 477	Washer 2.7/8/1	2	
240	210 353	Hex nut M 2	2	
241	210 145	Lock washer 2.3	4	
242	238 034	Rotary switch complete	1	
243	238 033	Bearing plate	1	
244	210 469	Machine screw AM 3 x 3	3	
245	238 037	Strap	1	
246	203 477	Washer 2.7/8/1	2	
247	210 353	Hex nut M 2	2	
248	238 035	Contact piece	1	
249	210 469	Machine screw AM 3 x 3	3	
***	214 120	Hardware for cartridge mounting	1	
***	238 467	Mounting instructions	1	
***	238 470	Operating instructions	1	
***	238 957	Operating instructions UAP	1	
***	229 321	Packing carton 704	1	
***	239 624	Packing carton CS 704	1	

*** Not illustratet

Alterations reserved!

Fig. 21 Audio Connection Diagram



Lubrication

All bearings and friction points are adequately lubricated by the manufacturer. Replenishment of oil and grease is only necessary after approximately 2 yours of normal use of the turntable as the most important bearing points (motor bearings) have sintered metal bushes.

Bearing points and friction faces should be lubricated sparingly rather than generously.

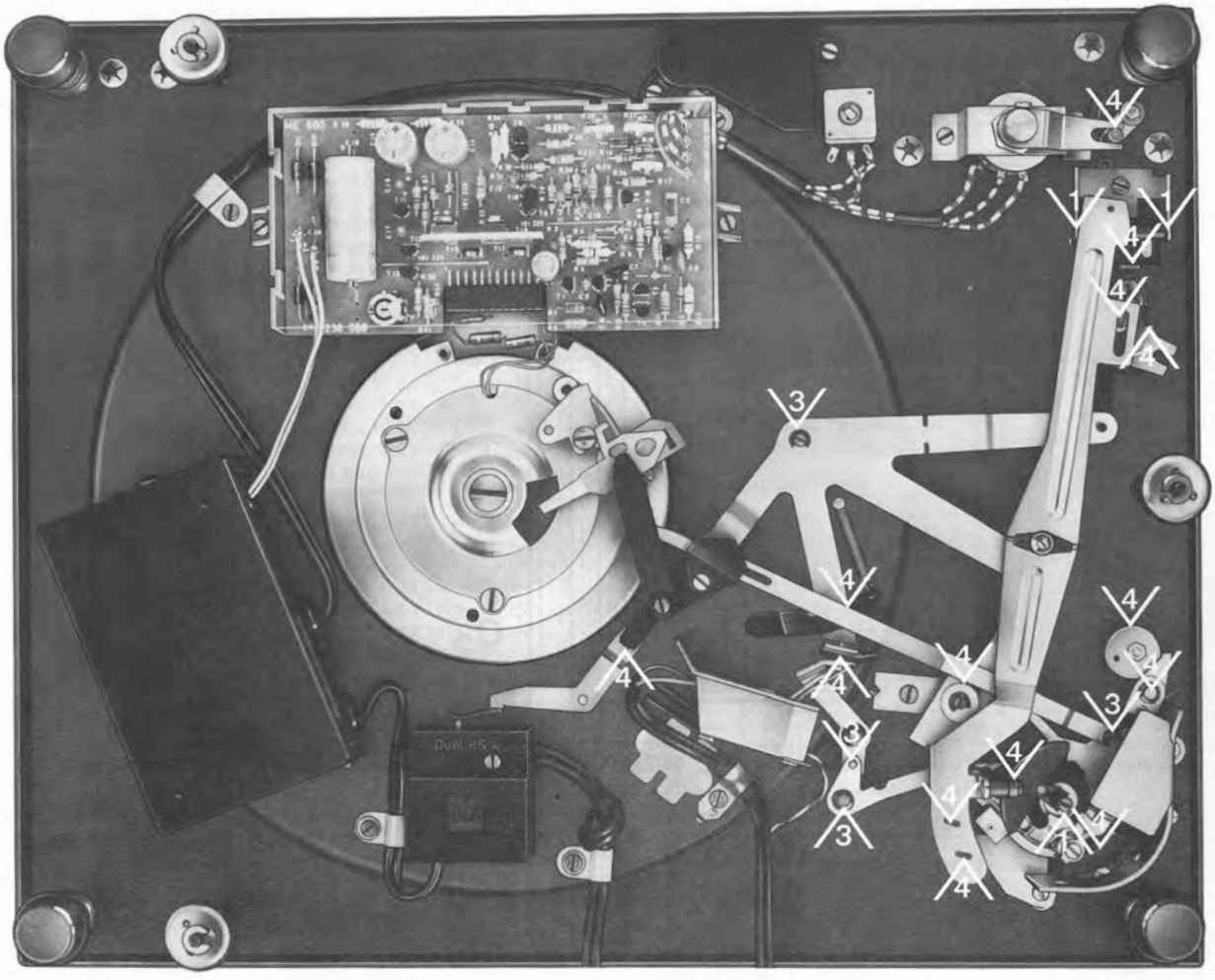
When using different lubricants, chemical decomposition can ofter occur. To prevent failure of lubrication we recommend using the original lubricants stated below.

1 Wacker Silicone oil AK 500 000

3 BP Super Viskostatik 10 W/30

4 Shell Alvania No. 2

Fig. 22



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