

# Dual

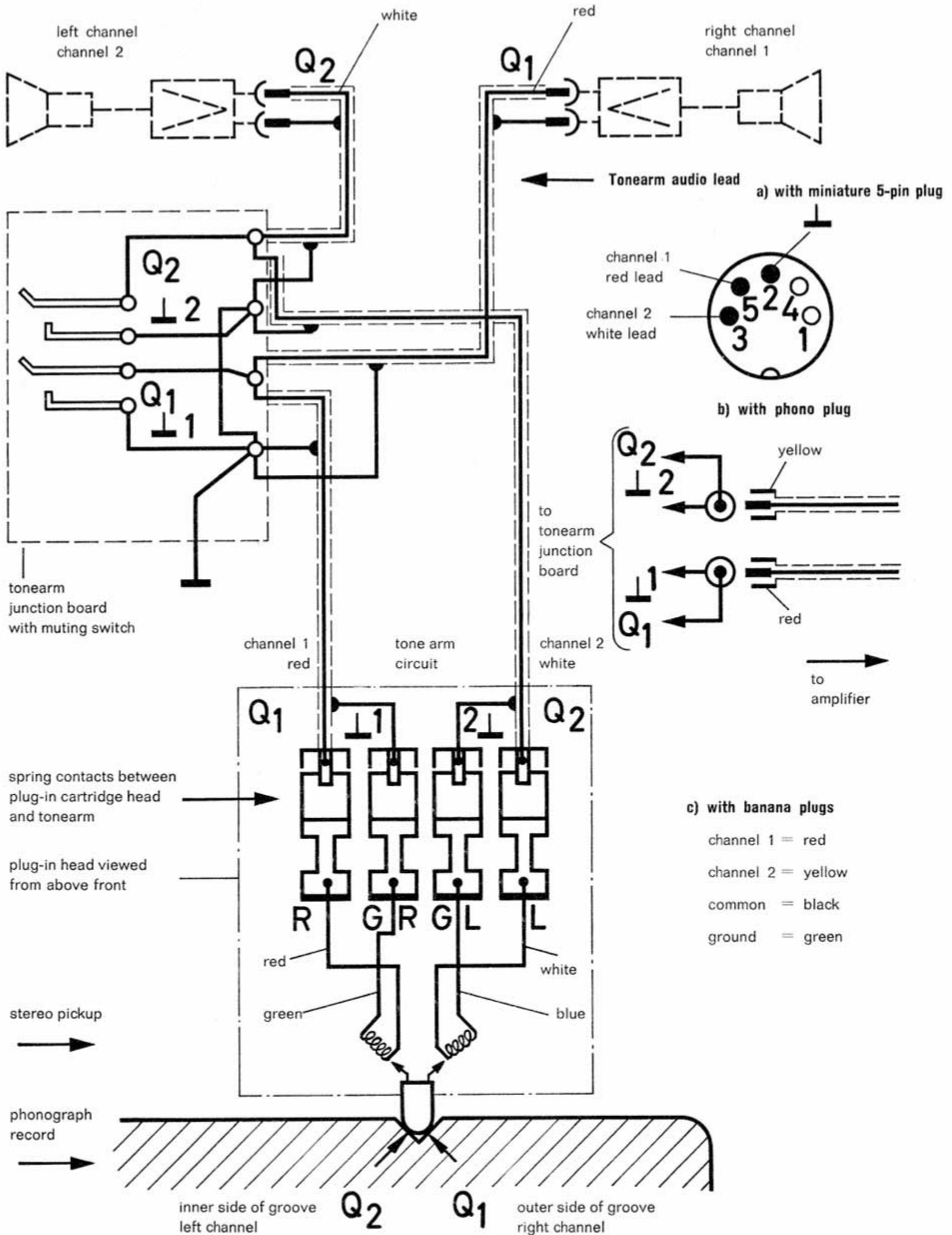
# Service Manual Dual 1019



## Technical Data:

|                                  |   |
|----------------------------------|---|
| Current:                         | alternating, 50 or 60 cycle, with appropriate motor pulleys   |
| Line voltage:                    | selector for 110, 150, or 220 volts (see schematic P. 4)  |
| Drive:                           | four-pole, single-phase, induction motor  |
| Power consumption:               | 6.5 watts approximately   |
| Current requirements:            | 50 mA maximum at 220 V, 50 cycle; 90 mA maximum at 117 V, 60 cycle  |
| Turntable speeds:                | 78, 45, $33\frac{1}{3}$ and $16\frac{2}{3}$ r.p.m.  |
| Speed adjustment:                | adjustment range of 6% at all four turntable speeds   |
| Turntable:                       | non-magnetic, $7\frac{1}{2}$ lbs., balanced   |
| Wow and flutter:                 | $\pm 0,1 \%$  |
| Signal-to-noise:                 | at 100 c.p.s., better than 50 db  |
| Tonearm:                         | balanced on all three axes, extremely low mass, and precision, friction-free suspension (vertical and horizontal friction bearing friction less than 0.05 gm) |
| Pickup cartridge:                | tonearm will accept all cartridges with $\frac{1}{2}$ " mounting and weighing from 1—16 gms.  |
| Weight of unit:                  | $16\frac{1}{4}$ lbs., less packing  |
| Dimensions and mounting cutouts: | see installation instructions   |

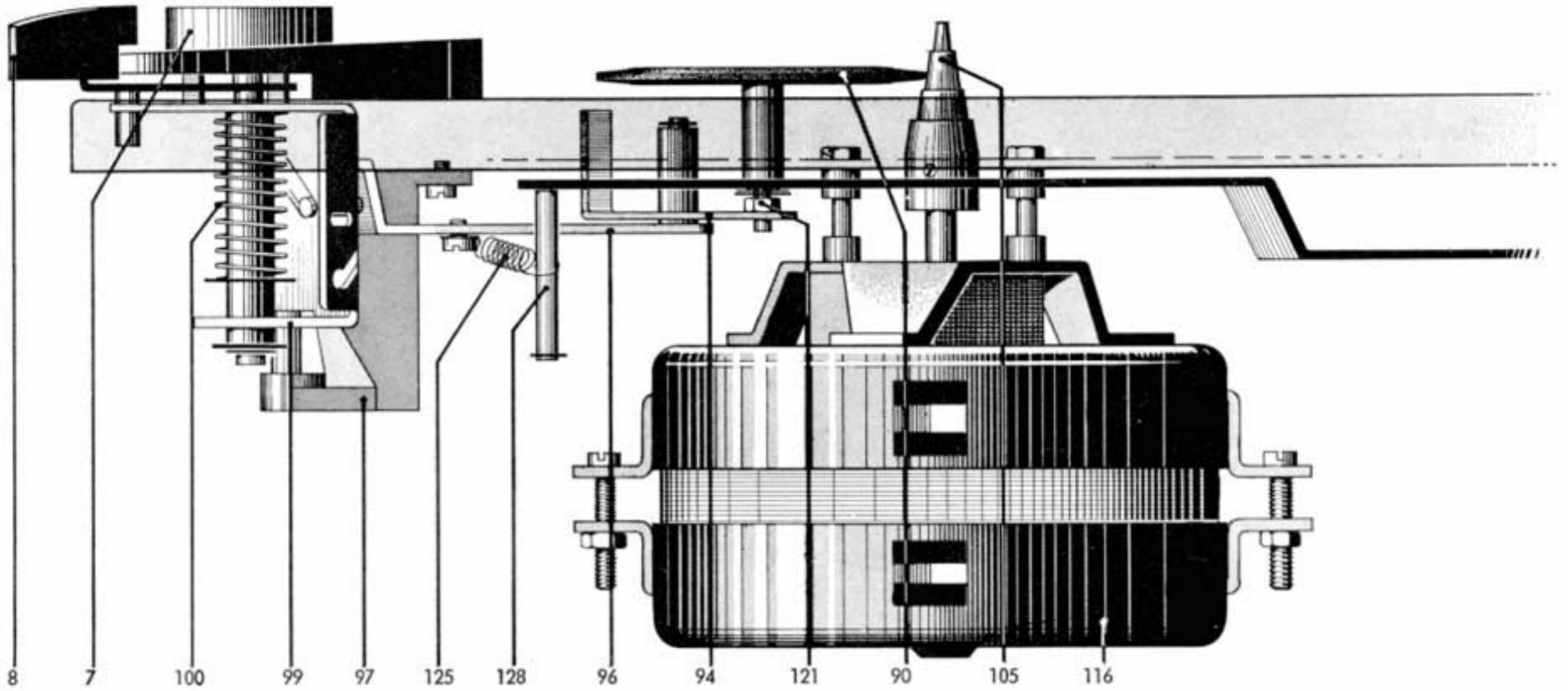
Fig. 1 Tonearm hook-up schematic



# Contents

|   | Page  |
|---|-------|
| <b>Technical data</b>   | 1     |
| <b>Tonearm hook-up schematic</b>  | 2     |
| <b>Motor and drive</b>  | 4     |
| <b>Fine-speed regulation</b>  | 5     |
| Turntable does not turn when unit plugged in and "Start" switch operated                    | 5     |
| Turntable does not come up to speed   | 5     |
| Correct speed obtained only by extreme adjustment of fine-speed adjustment                  | 5     |
| Fine-speed adjustment inoperative   | 5     |
| <b>Tonearm and suspension</b>   | 6     |
| <b>Tonearm anti-skating mechanism</b>   | 7     |
| Needle slides out of groove   | 7     |
| Tonearm sets down beside arm-rest   | 7     |
| Horizontal friction too great   | 7     |
| Arm set-down not free   | 7     |
| <b>Tonearm movements</b>  | 8     |
| <b>Tonearm set-down and lift</b>  | 8     |
| Tonearm does not move onto record when drop cycle actuated                                  | 9     |
| Tonearm lowers too quickly onto record when drop cycle actuated                             | 9     |
| Tonearm misses edge of record   | 9     |
| Tonearm strikes record during change cycle  | 9     |
| <b>Start cycle</b>  | 10    |
| <b>Manual operation</b>   | 10    |
| <b>Stop switching</b>   | 11    |
| <b>Record drop</b>  | 11    |
| <b>Shut-off</b>   | 12    |
| <b>Shut-off and change cycle</b>  | 12    |
| Tonearm returns to arm rest immediately after being manually placed on record               | 13    |
| Turntable does not run after automatic set-down of tonearm                                  | 13    |
| Tonearm returns to its rest after each record   | 13    |
| Turntable does not turn when switch moved to "Manual" and tonearm off resting post          | 13    |
| Last record of stack keeps repeating  | 13    |
| Record drops after switch moved to "stop" another record drops when switch moved to "start" | 13    |
| Record drop does not operate  | 13    |
| Turntable slows down when record drops  | 13    |
| Acoustic feedback   | 13    |
| <b>Lubrication</b>  | 14    |
| <b>Replacement parts and exploded view</b>  | 15—20 |

Fig. 2 Motor suspension and turntable drive



### Motor and Drive

The turntable and change cycle are driven by a four-pole induction motor (116) with an extremely low magnetic field and vibration-free drive.

Motor speed is constant for line variations of  $\pm 10\%$ . Motor speed is dependent on, and proportional to, line frequency.

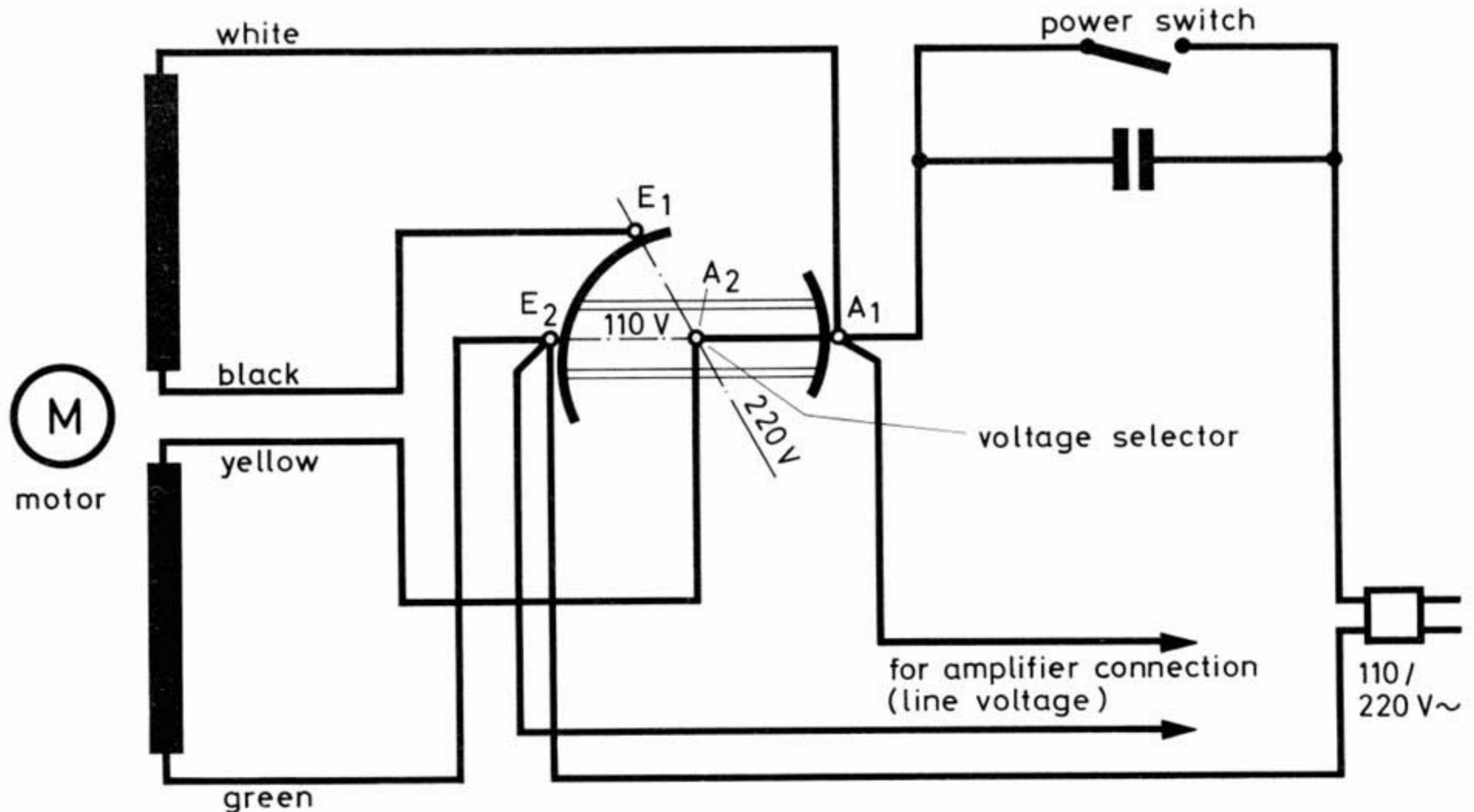
Adapting for operation at line frequencies of 50 or 60 cycle is accomplished by the use of replaceable motor pulleys (105).

Motor pulley, 50 cycle Part No. 31 N - U 20

Motor pulley, 60 cycle Part No. 31 N - U 28

The motor pulley is secured to the motor shaft by means of a set screw. When changing pulleys, care must be taken

Fig. 3 Motor field connections, voltage selector in 110 volt position



that it is set at the correct height (see Fig. 3 of the troubleshooting chart).

The turntable is driven by means of the idler wheel (90) which, to prevent damage to its friction surfaces, automatically disengages when the tonearm is in the rest position. Setting the turntable speed to  $16\frac{2}{3}$ ,  $33\frac{1}{3}$ , 45 and 78 r.p.m. is accomplished by raising or lowering the drive wheel to the corresponding step of the motor pulley.

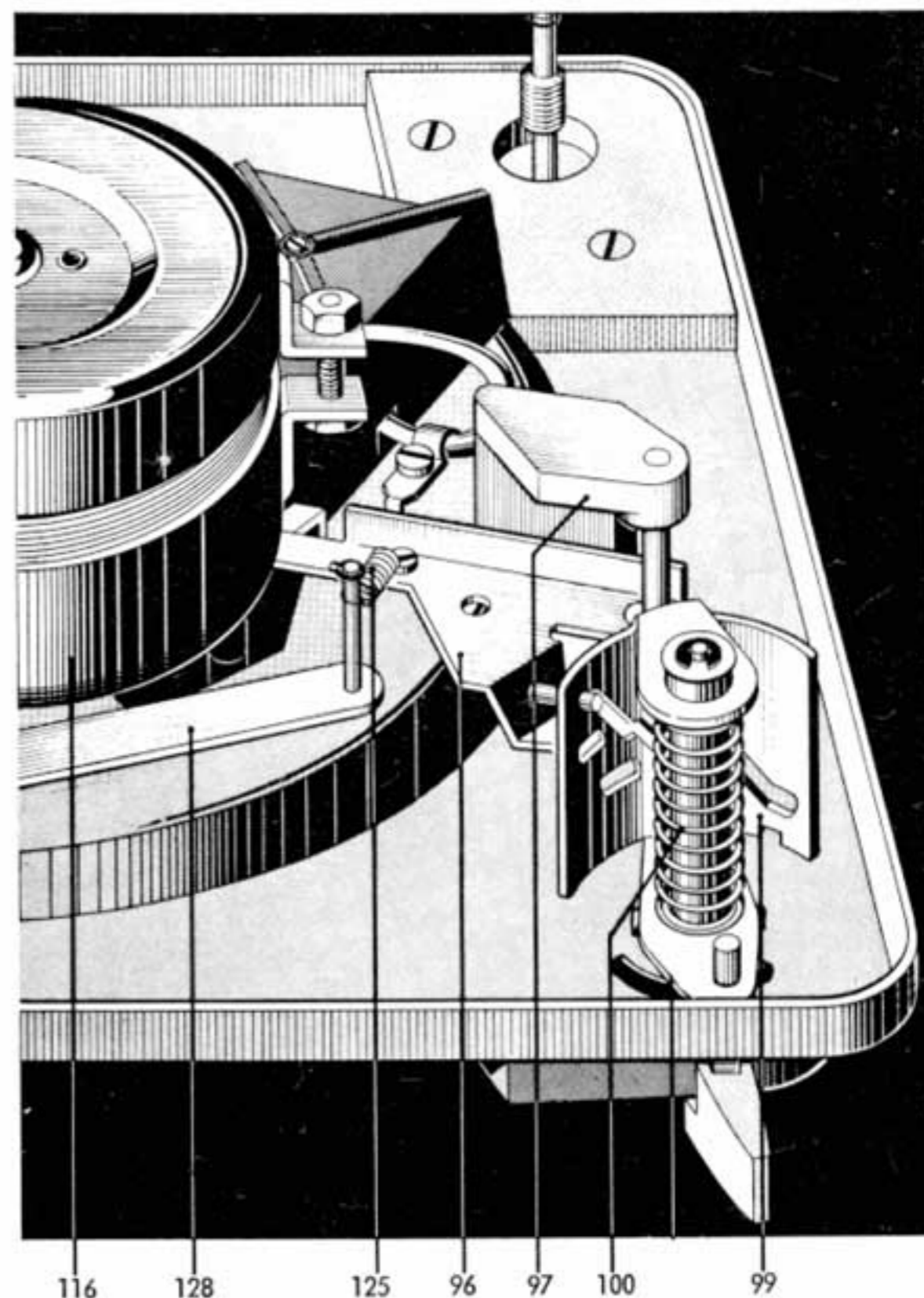
Similarly, moving the speed change knob (8) causes the switch segment (99) to rotate. The grooves in the switch segment guide the rocker assembly (96) on which the drive wheel is mounted. The idler wheel is thus lifted vertically from the motor pulley and placed in the desired position.

## Fine-Speed Regulation

A fine speed adjustment for all four record speeds —  $16\frac{2}{3}$ ,  $33\frac{1}{3}$ , 45 and 78 r.p.m. — permits a variation in turntable speed of 6%.

Turning the control knob (7) causes the switch segment (99) and with it the rocker assembly (96) to move up and down. This vertical motion changes the position of the idler wheel on the selected step of the motor pulley. The tapered shape of the motor pulley gives an adjustment range of  $\pm 3\%$  from the nominal speed.

Fig. 4 Turntable speeds and drive wheel shift mechanism



## Trouble shooting:

| Symptom   | Cause   | Remedy   |
|---|---|--|
| Turntable does not run when unit plugged in and "Start" switch operated   | a) Current path to motor interrupted                        | a) Check connection at switch plate and voltage selector   |
|   | b) Idler wheel (90) not in contact with turntable           | b) Check rocker assembly (96)  |
|   | c) Motor pulley (105) loose                                 | c) Tighten motor pulley (105)  |
| Turntable does not come up to speed                                       | a) Motor pulley does not correspond to local line frequency | a) Change motor pulley   |
|   | b) Slippage between drive wheel (90) and motor pulley (105) | b) Clean friction surface of idler wheel (90) and motor pulley. Change drive wheel, if necessary                                 |
|   | c) Motor bearing friction                                   | c) Clean motor bearings and re-lubricate from lubrication chart  |
| Correct speed obtained only by extreme adjustment of fine-speed regulator | Idler wheel does not contact motor pulley correctly         | Correct idler wheel position. Loosen lock nut (121) and rotate idler wheel shaft (92)  |
|   |   | The correct position of the idler wheel is in the center of the selector motor pulley step (speed regulator (7) in mid-position) |
|   |   | Re-secure lock nut after adjusting   |
| Fine-speed regulator inoperative  | Control knob shaft (7) pushed down as a result of shipment  | Replace control knob (7)   |

Fig. 5 Tonearm bearing assembly

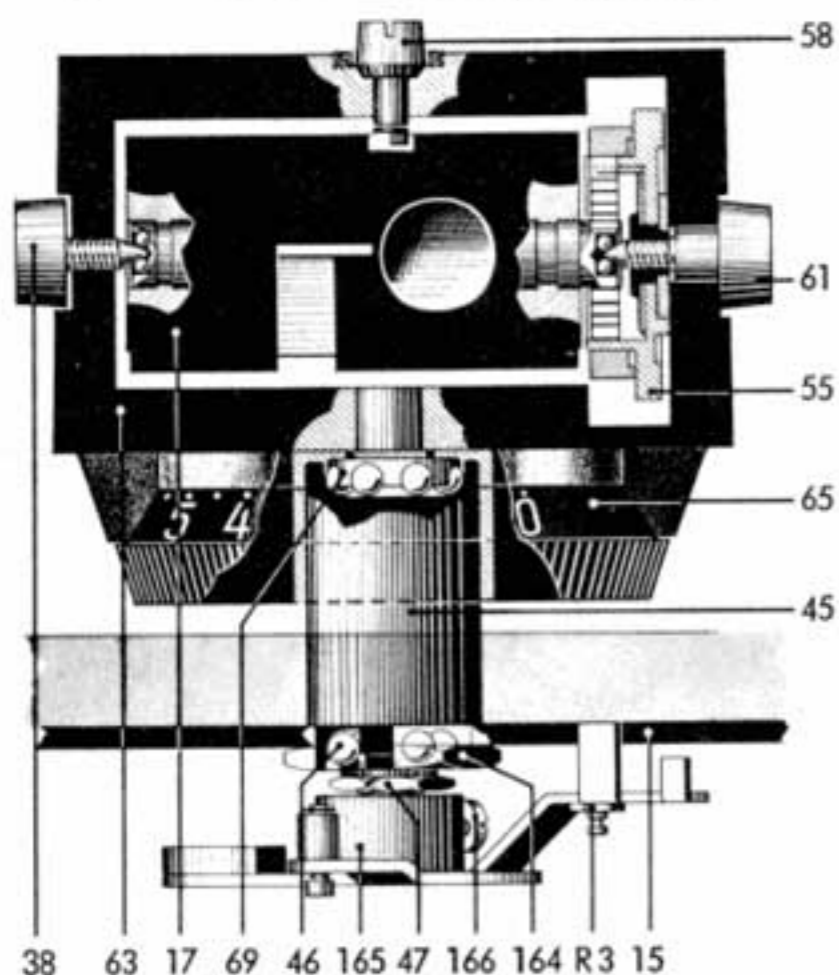


Fig. 6 Tonearm suspension with anti-skating compensation

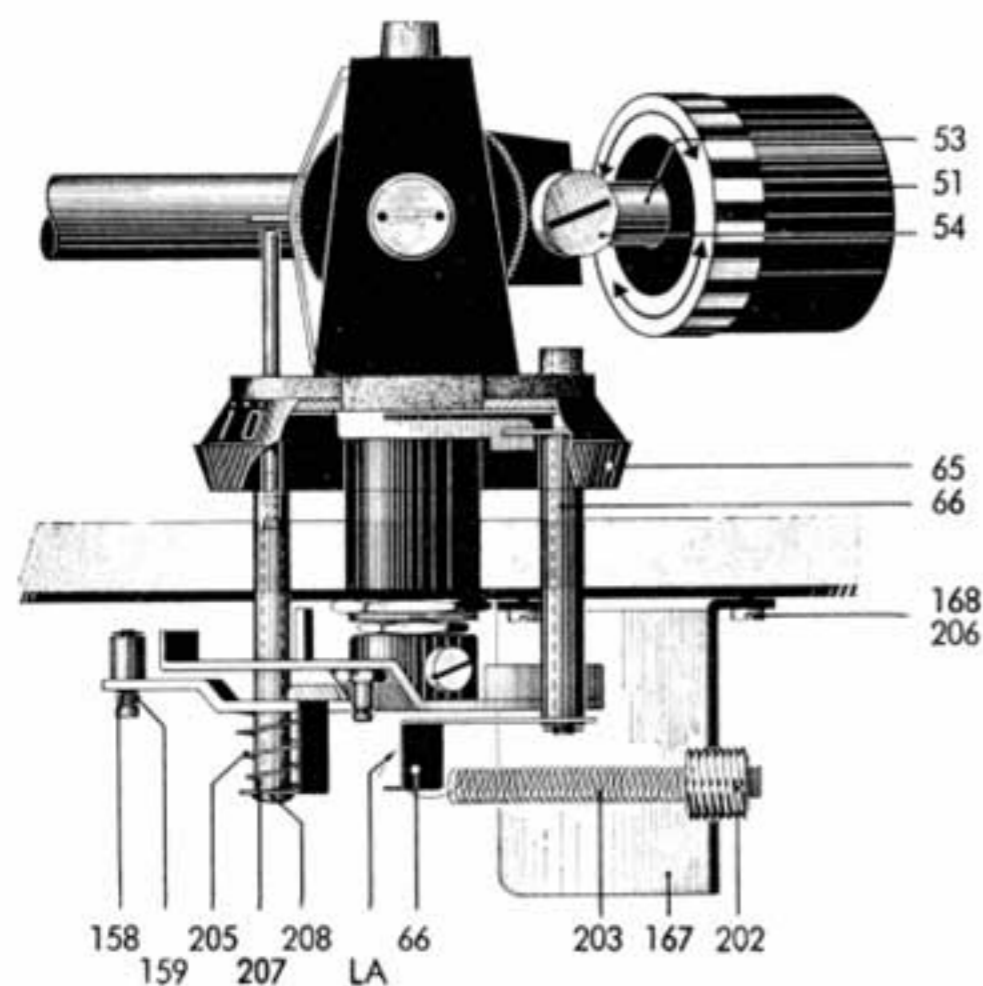
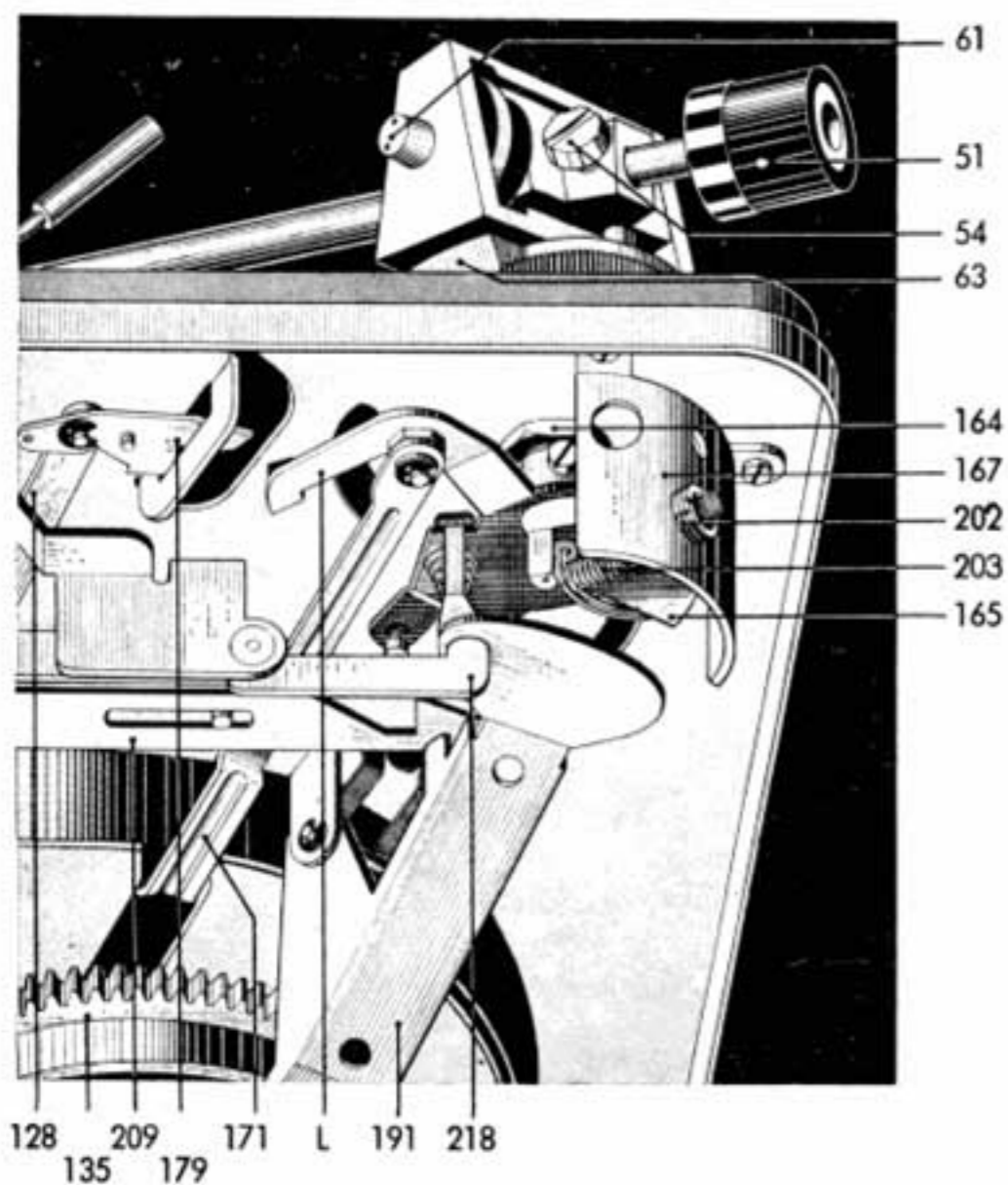


Fig. 7 Tonearm suspension (underneath view)



## Tonearm and its suspension

The tubular metal tonearm of the Dual 1019 employs precision ball bearings for both horizontal and vertical movements.

Vertical bearing friction is less than 0.05 gm.

Horizontal bearing friction is less than 0.05 gm.

Especially favorable conditions for pickup are thus provided.

Before setting the tracking pressure corresponding to the cartridge used, set the scale to zero and balance the arm. A rough balance is obtained by sliding the counterweight and spindle. The final setting is made by rotating the counterbalance weight (51).

The counterbalance weight is such that cartridges weighing from 1 to 16 gms. can be balanced.

In order to absorb shocks (sharp blows), the counterbalance weight is mounted on the threaded spindle (53) by means of an elastic coupling. Nylon braking prevents the counterbalance from turning during ordinary handling.

The cartridge head will accept all cartridges with the international  $\frac{1}{2}$ " standard mount. Tracking force is set by turning the spring housing (55) with its scale divisions and thus tightening or loosening the internal spiral spring. Adjustment range is continuously variable from 0—5 gms. with scale markings in  $\frac{1}{2}$  gram steps.

To replace the tonearm assembly and suspension, the following procedures are recommended:

1. Set tracking force scale to "0"
2. Unsolder the tonearm lead
3. Remove main lever (191) and connecting lever (218)
4. Remove "C" ring and washer of the shut-off slide from the arm segment (165)
5. Unhook tension spring (203) and loosen screws (162, 166)
6. Place adjusting ring (65) of the "Anti-Skating" mechanism in the "5.5" position
7. Lift off arm segment (165) and remove lift screw

To loosen the nut (164), hold the bearing housing (45), between the base plate (15) and adjusting ring (65), with a suitable tool (such as flat pliers). Carefully take out the tonearm, taking care not to bend the spring lever (166).

To re-install the tonearm, the reverse procedure is followed. Before tightening screws (162, 166), check the tonearm position over the arm rest, so that the tonearm lowers onto the rest without binding.

When installed, moving the tonearm in and out with the adjusting ring (65) in its "0" position, should not cause the tension spring (203) to move. If necessary, the setting can be corrected by means of the tabs (LA) of the spring lever (66).

Similarly, after re-installing the retaining spring for the tonearm leads, care must be taken that the arm segment (165) is not impeded by the tonearm leads.

## Tonearm Anti-Skating Mechanism

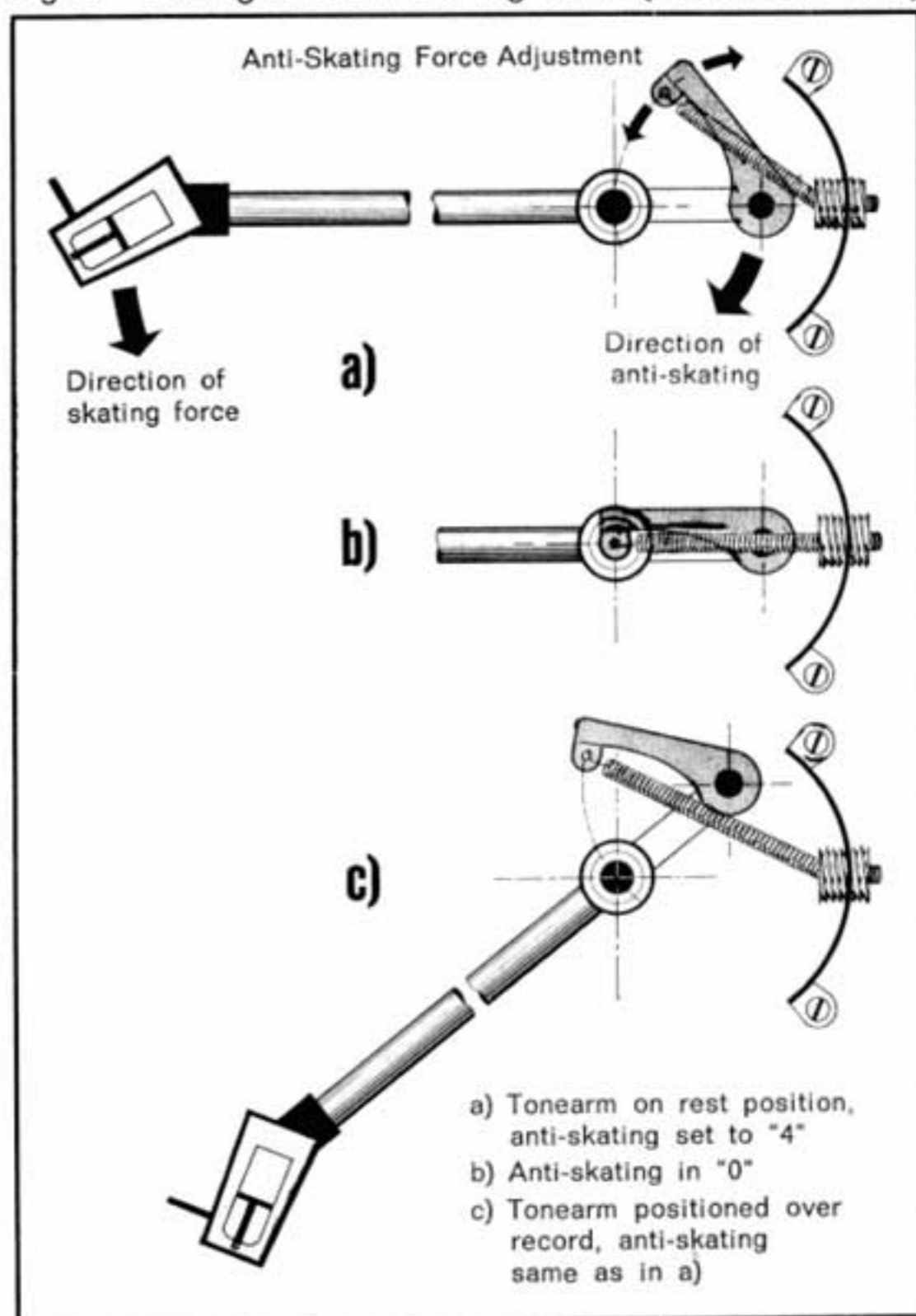
The tendency of a tonearm to slide across the record is caused by the tonearm geometry. In the Dual 1019, this is virtually eliminated by a precision anti-skating mechanism.

Skating force is a function of tonearm geometry, tracking force, and needle contour. The resulting skating effect pulls the tonearm towards the center of the record. This occurs not only on the eccentric shut-off grooves but also causes unequal contact with the groove sides.

Rotating the adjustment ring of the anti-skating mechanism moves the spring lever (66) by means of the curved track inside the adjustment ring, and the tension spring (203) transmits the counter-movement to the tonearm.

The optimum adjustment of the anti-skating mechanism is obtained with a needle curvature of  $0.7 \pm 0.1$  mil. The adjusting screw (threaded bushing) is sealed with glyptol after setting. The Dual Skate-O-Meter and standard record L 096 are required for readjustment, which should only be performed by an authorized service station. Separate Skate-O-Meter instructions available.

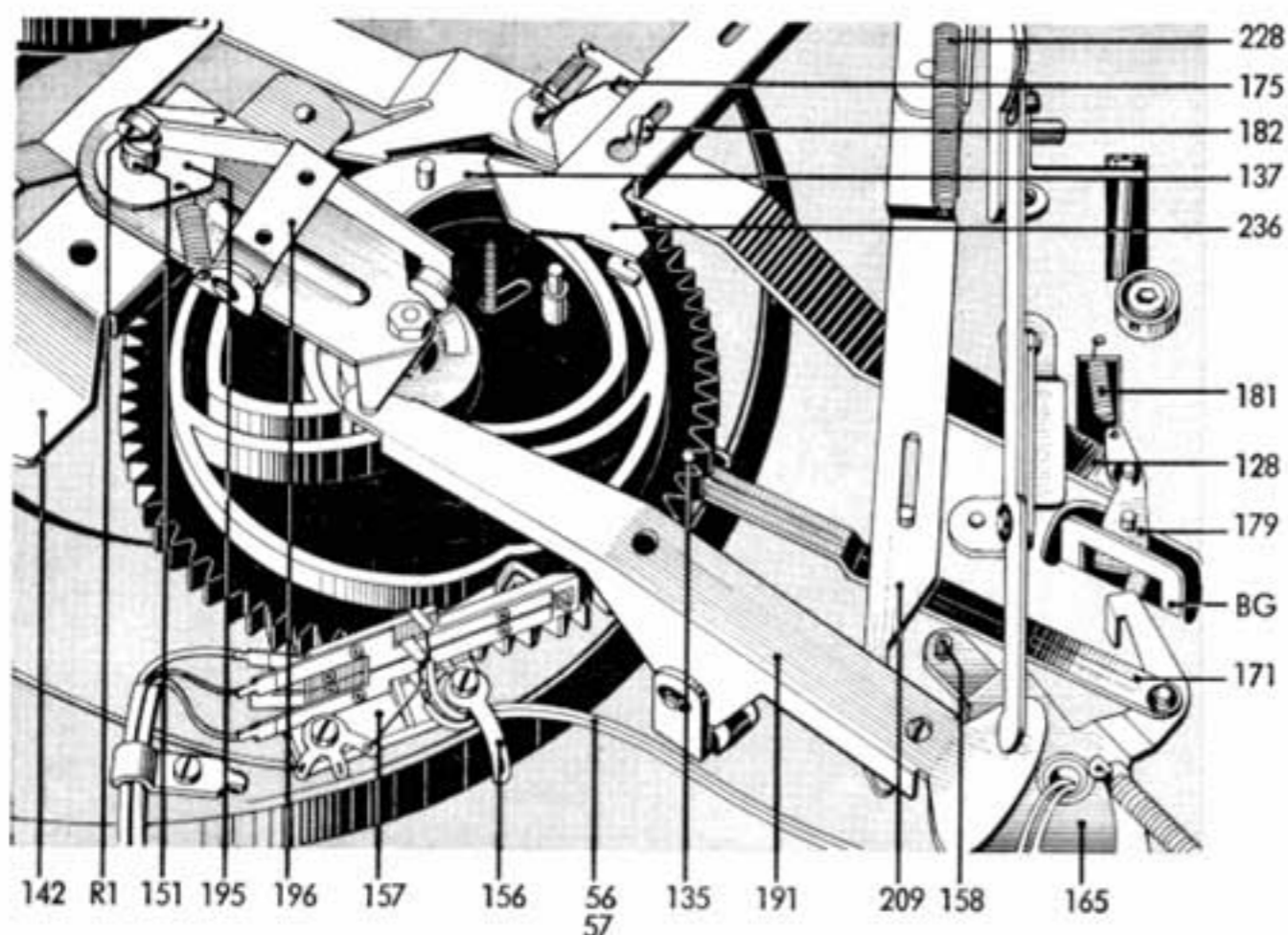
Fig. 8 Skating and anti-skating force (underneath view)



## Trouble shooting:

| Symptom   | Cause  | Remedy  |
|---|--|---|
| Tonearm bearing assembly  |  |   |
| Both bearings require a small, barely noticeable, amount of play. Only the left bearing screw (38) is to be used for adjustment of the horizontal bearings. The vertical bearing adjustment is made by means of the locknut (47). |  |   |
| Needle slides out of record groove  | <ul style="list-style-type: none"> <li>a) Tonearm not balanced</li> <li>b) Tonearm tracking force too light</li> <li>c) Needle defective</li> <li>d) Tonearm bearing friction too high</li> <li>e) Ball missing from shutoff rail (171)</li> </ul> | <ul style="list-style-type: none"> <li>a) See operating instructions</li> <li>b) Adjust with spring housing (barrel screw 55) to correct pressure for particular cartridge</li> <li>c) Replace needle</li> <li>d) Check tonearm bearing</li> <li>e) Install ball (23 or 173)</li> </ul>   |
| Tonearm lowers beside tonearm rest (75)   | <ul style="list-style-type: none"> <li>a) Arm segment assembly (165) out of position</li> <li>b) The latch (179) presses against the tabs (L) of the arm segment during the change cycle</li> </ul>  | <ul style="list-style-type: none"> <li>a) Loosen the machine screws (162, 166) and rotate the arm segment assembly. Then tighten screw (166) and re-check adjustment. Adjustment is correct when tonearm lowers onto arm rest (75) without binding. Finally, tighten screw (162).</li> <li>b) Loosen screw (175). Turn the short arm on the long switch arm piece to correct switch arm position. Turn the main cam by hand, and adjust so that when the tonearm lowers onto the arm rest, clearance of about <math>\frac{1}{64}</math>" is obtained between latch segment tabs.</li> </ul> |
| Horizontal bearing friction too high  | Tonearm is set too high on the arm lift. Main lever jams against the guide pin of the lift screw assembly  | Pickup needle should not be farther from the record than $\frac{1}{4}$ ". Adjust by turning screw (R 8, Fig. 12).   |
| Vertical movement of tonearm is impeded during set down cycle   | <ul style="list-style-type: none"> <li>a) Bearing friction too high</li> <li>b) Lift screw jams in guide sleeve of the arm segment (165)</li> </ul>  | <ul style="list-style-type: none"> <li>a) Check bearing screw (38) and arm balance</li> <li>b) Remove and clean lift screw</li> </ul>   |

Fig. 9 Tonearm guide mechanism



Tonearm raising and lowering, as well as horizontal movements, are controlled by main lever (191) and lift screw (207).

Setting the unit for playback of 7", 10", and 12" records is accomplished by means of the indexing switch (82a, Fig. 12). The set-down points of the tonearm are determined by the eccentric of the arm positioning slide (209) contacting the record size selector lever (230, Fig. 13).

Horizontal movement of the tonearm is limited by the arm segment (165) striking the arm positioning slide (209). During the change cycle, the main lever (191) raises the arm positioning slide, bringing it within reach of the spring stud (158). On completion of the change cycle (i. e., set-down of the tonearm on the record), the arm positioning slide is again released and returns to its normal position.

It thus moves out of reach of the spring stud (158) permitting the tonearm to move horizontally without hindrance, while playing a record.

## Tonearm movements

A guide groove located on the underside of the main cam (135) controls automatic lift-off and set-down of the tonearm as the main cam rotates 360°.

## Tonearm lift

The tonearm lift permits the tonearm to be safely set down at any desired position of the record (except in the shut-off area).

Pushing the lift handle towards the front, turns the drive washer (226). This, in turn, moves the connecting lever (218), main lever (191), and lift screw (207) to raise the tonearm.

After the tonearm is moved to the desired spot of the record, the lift handle is lightly tapped towards the rear, to release. Thus freed, connecting lever and the leaf spring (192) of the main lever (191) resume their normal positions and the tonearm lowers. The lowering of the tonearm is delayed by silicone grease on the drive washer.

Fig. 10 Tonearm lift (tonearm raised)

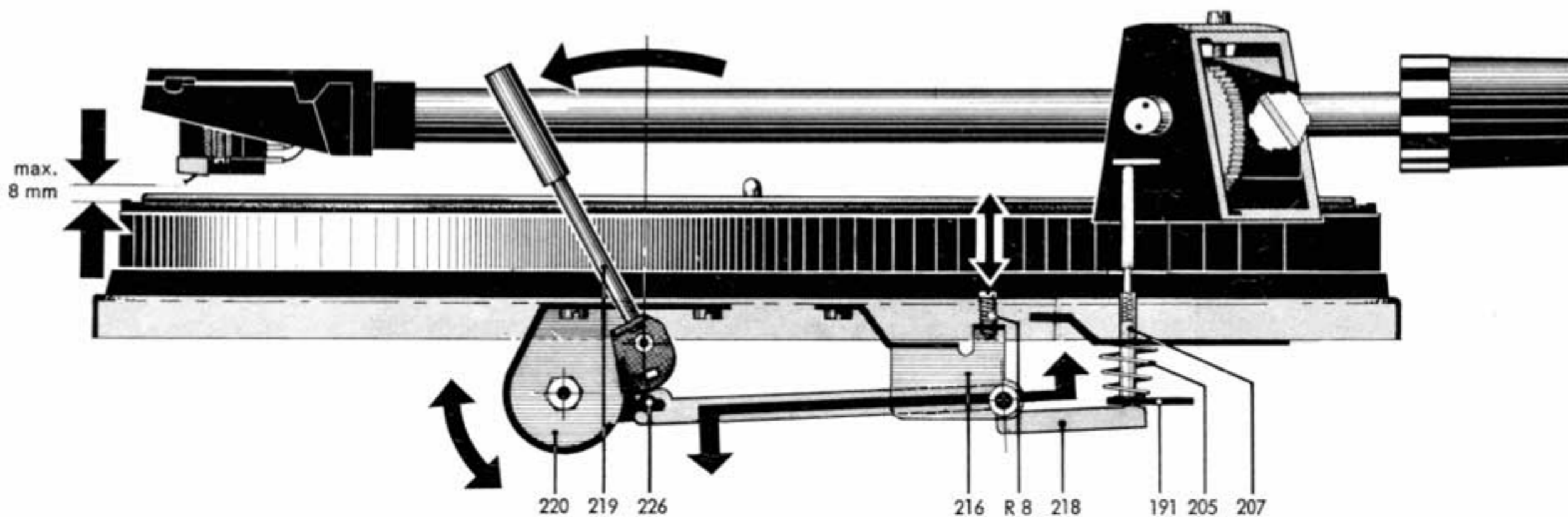
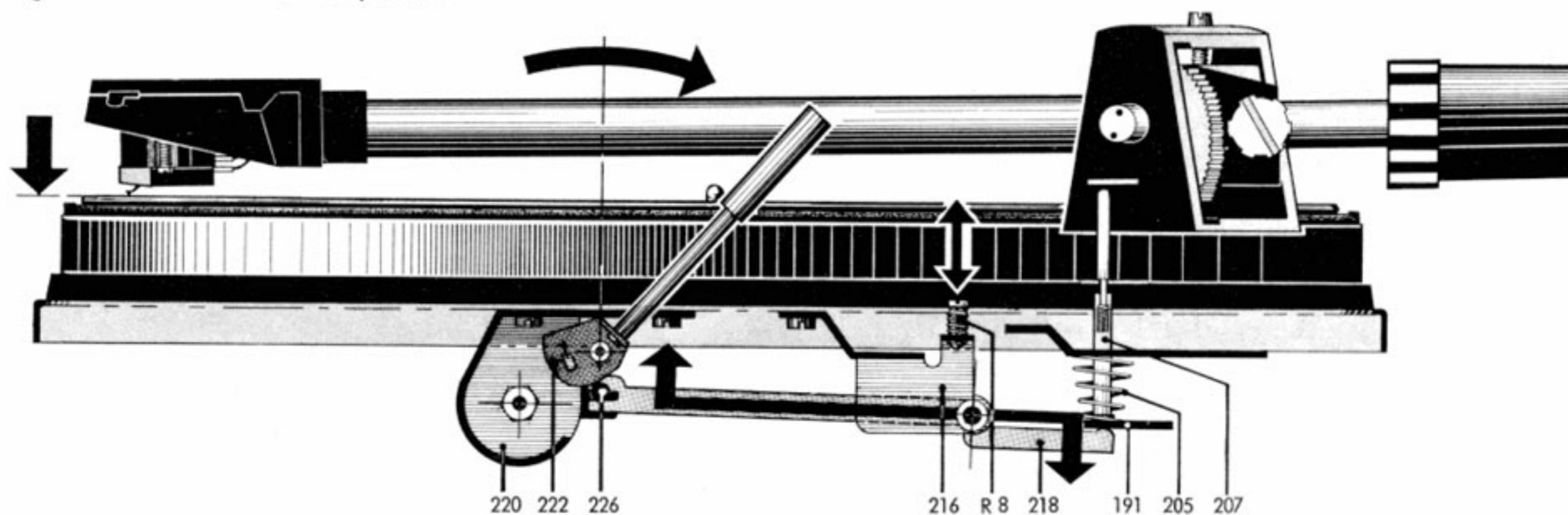




Fig. 11 Tonearm lift in rest position

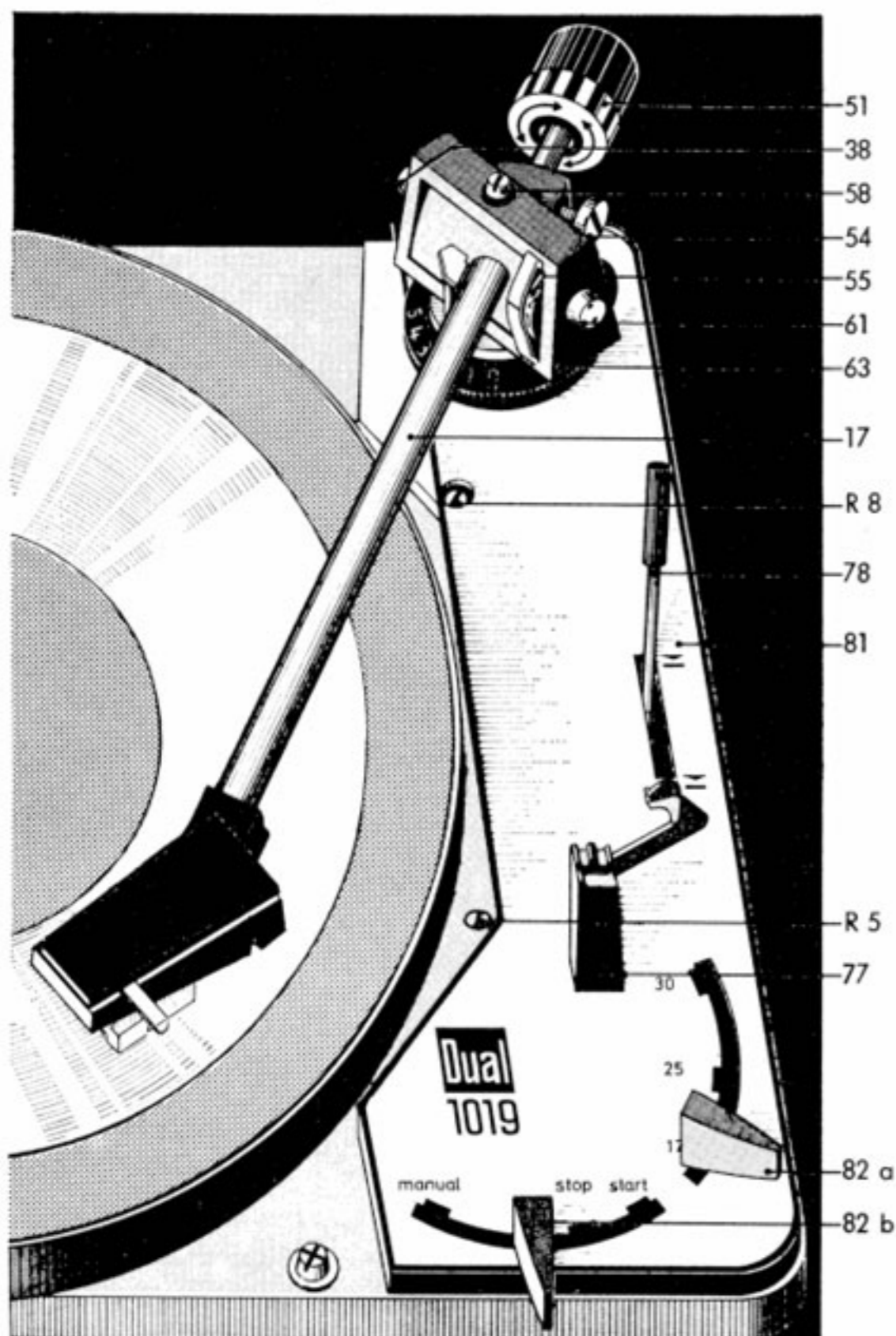


The set screw (R 8) permits needle height to be varied from 0 to  $\frac{1}{4}$ " above the record. Turning to the right increases, to the left decreases, this distance.

## Trouble shooting:

| Symptom  | Cause  | Remedy  |
|--|--|---|
| Tonearm does not move onto record when drop cycle actuated         | Damping too great.<br>Drive washer dirty   | Loosen nut (224). Remove cover washer (225) and drive washer (226). Clean thoroughly. Spread silicone grease evenly on both sides of the drive washer. Reassemble and wipe off excess grease.   |
| Tonearm lowers too quickly onto record when drop cycle is actuated | Too little damping   | Loosen nut (224). Remove cover washer (225) and drive washer (226). Clean thoroughly. Spread silicone grease evenly on both sides of the drive washer. Reassemble and wipe off excess grease.   |
| Tonearm misses edge of record                                      | a) Wrong record size selected<br>b) Set-down incorrectly adjusted<br>c) Record not of standard size<br>d) Tonearm clutch surfaces contaminated | a) Select correct record size with record indexing switch.<br>b) Adjust for 7" record by turning eccentric screw R 5, so that tonearm sets down about $\frac{1}{16}$ " from edge of record. (Adjustment is made only for 7" records; 10" and 12" adjustment being then automatically correct.<br>c) Use standard records.<br>d) Clean clutch surfaces |
| Tonearm strikes record during change cycle                         | Tonearm height incorrectly set   | Adjust arm height with height adjust screw (58). When correctly adjusted, the pickup needle is $\frac{1}{64}$ " above the dress-up plate (81) when removed from the arm rest.   |

Fig. 12 Operating elements



## Start cycle

Moving the operating switch (82b, Fig. 12) to "start" moves the switch lever (233) towards the main cam, initiating the following sequence:

- a) The set screw (184) of the switch lever assembly turns the switch arm (128) mounted on the grooved shaft (182). The rocker assembly (96, Fig. 2) moves the drive wheel (90, Fig. 2) into contact with the motor pulley and turntable, by means of a tension spring. At the same time, the switch slide (118, Fig. 15) actuates the line switch through the switch arm, and the turntable begins to turn.
- b) The switch angle (UW) mounted on the switch lever assembly (233) is brought within range of the cam follower lever (137) so that it is pushed into the change position after the rotation of the main cam (Fig. 14).

Moving the operating switch also releases the start lever (236) pulling it towards the main cam by means of the tension spring (234). This causes the coiled spring (177, Fig. 15) to bring the shut-off lever (131, Fig. 18) within range of the main cam dog. Thus the shut-off lever drives the main cam. To prevent mis-operation, the operating switch is locked during the start cycle (i. e. when the main cam is turning). Just before the main cam reaches its null position (at the end of the change cycle), the start lever is pushed clear of the main cam by means of the start pin (SB) of the main cam. This, in turn, restores the switch lever and operating switch to their original positions.

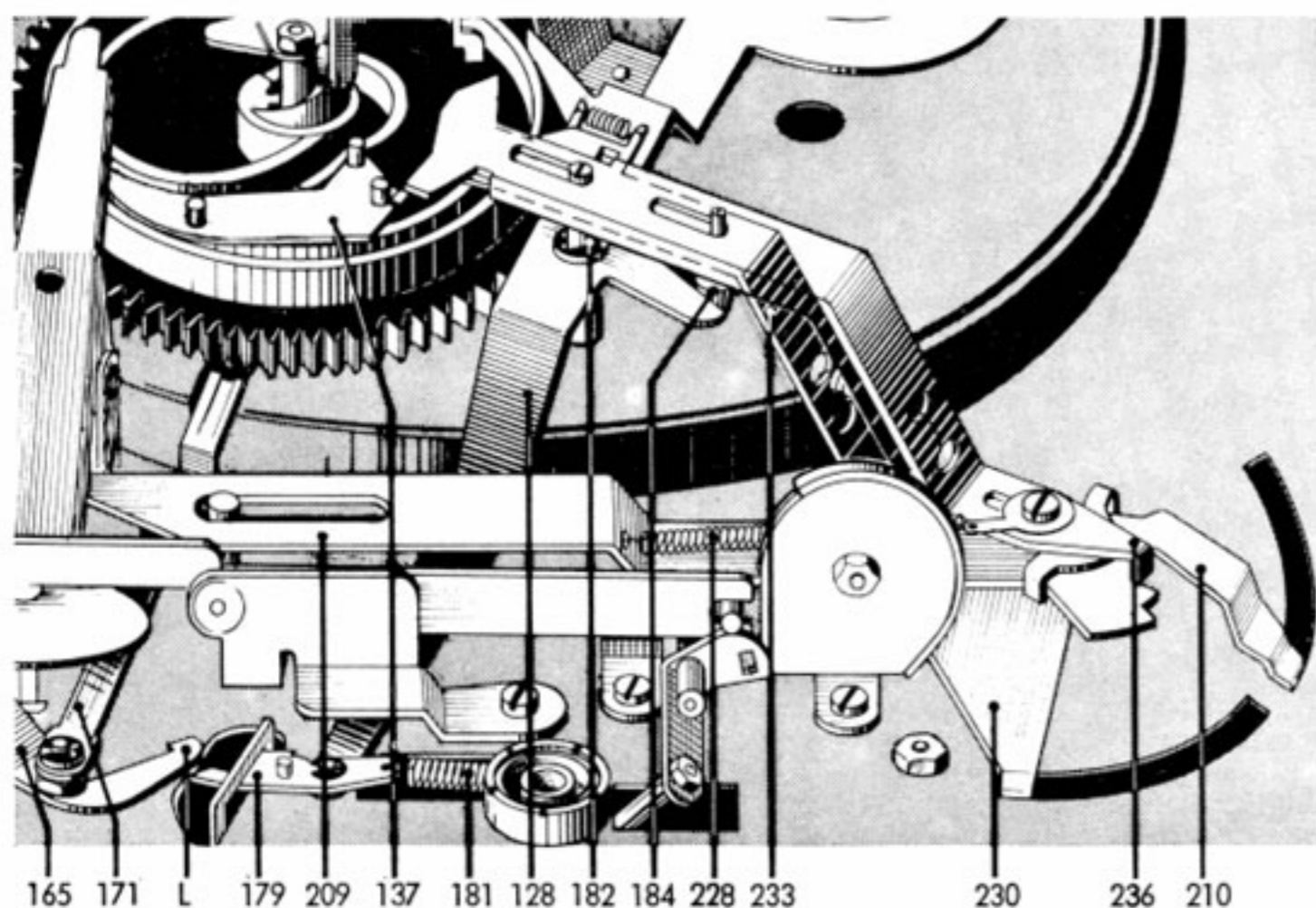
After installing and also after moving the record changer, the unit should be started with the tonearm locked. This will automatically re-adjust the shut-off lever which may have shifted out of position.

## Manual operation

Placing the operating switch in „Manual“ position initiates the start cycle. The switch lever assembly (233) is pushed towards the main cam and the following sequence is set up:

- a) Set screw (184) mounted on the switch lever (233) rotates the switch arm (128) which is mounted on the grooved shaft (182).
- b) The rocker assembly (96, Fig. 2) then moves the idler wheel (90, Fig. 2) into contact with the motor pulley and turntable by means of a tension spring.

Fig. 13 Start position



c) At the same time, the switch slide (118, Fig. 15) actuates the line switch and the turntable begins to rotate.

d) The switch arm latch (179) rests in the support (BG, Fig. 14) in the base plate, locking the switch arm in position to keep the idler wheel in contact with the turntable.

On reaching the shut-off groove, the tonearm automatically returns to its rest position and the unit shuts off (see shut-off mechanism). However, should the tonearm be lifted off manually and returned to the tonearm rest, the tabs of the arm segment (165) release the latch (179). The tension spring (181) then returns the switch arm (128) to its initial position, opening the line switch and disengaging the idler wheel.

Fig. 14 Stop action

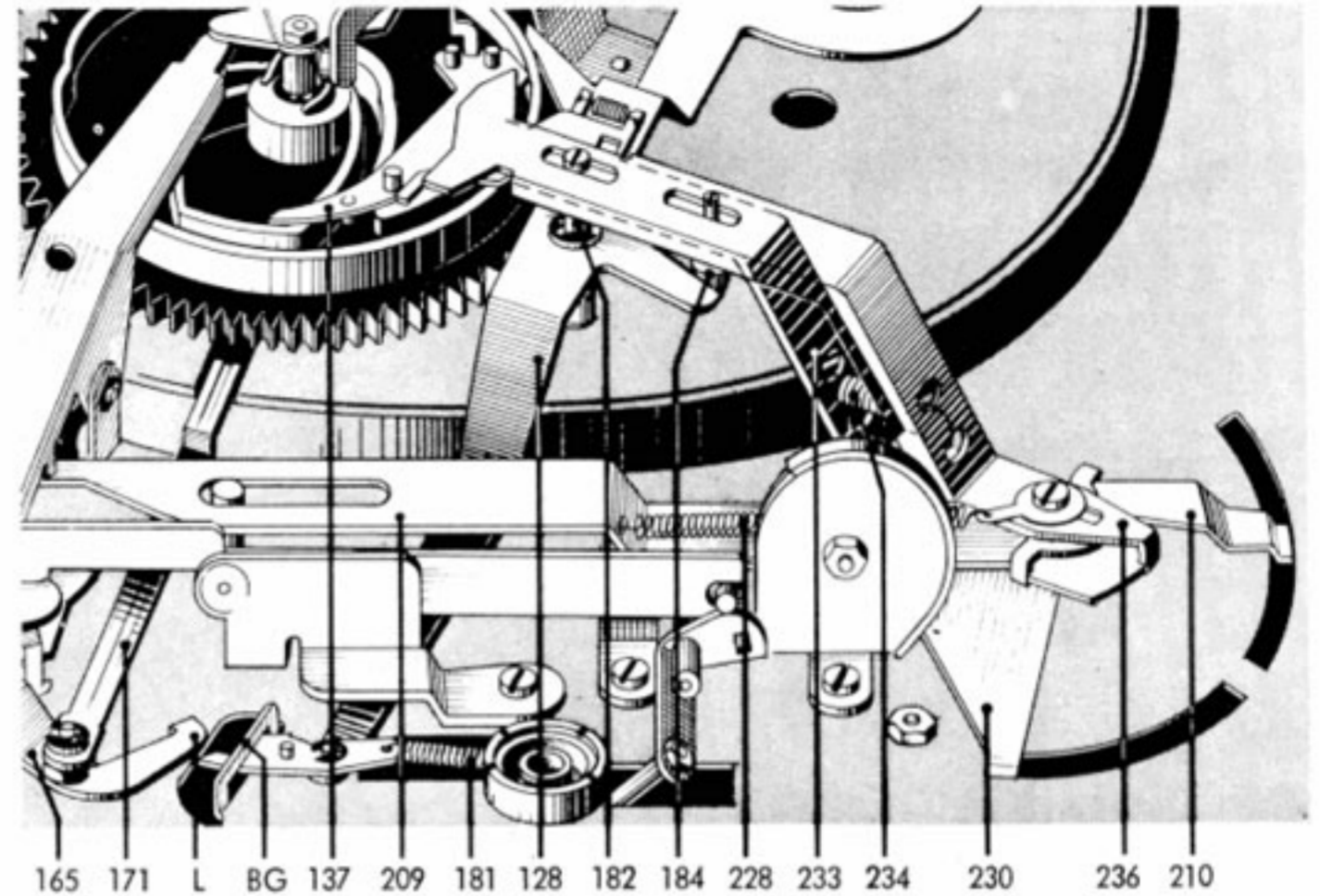
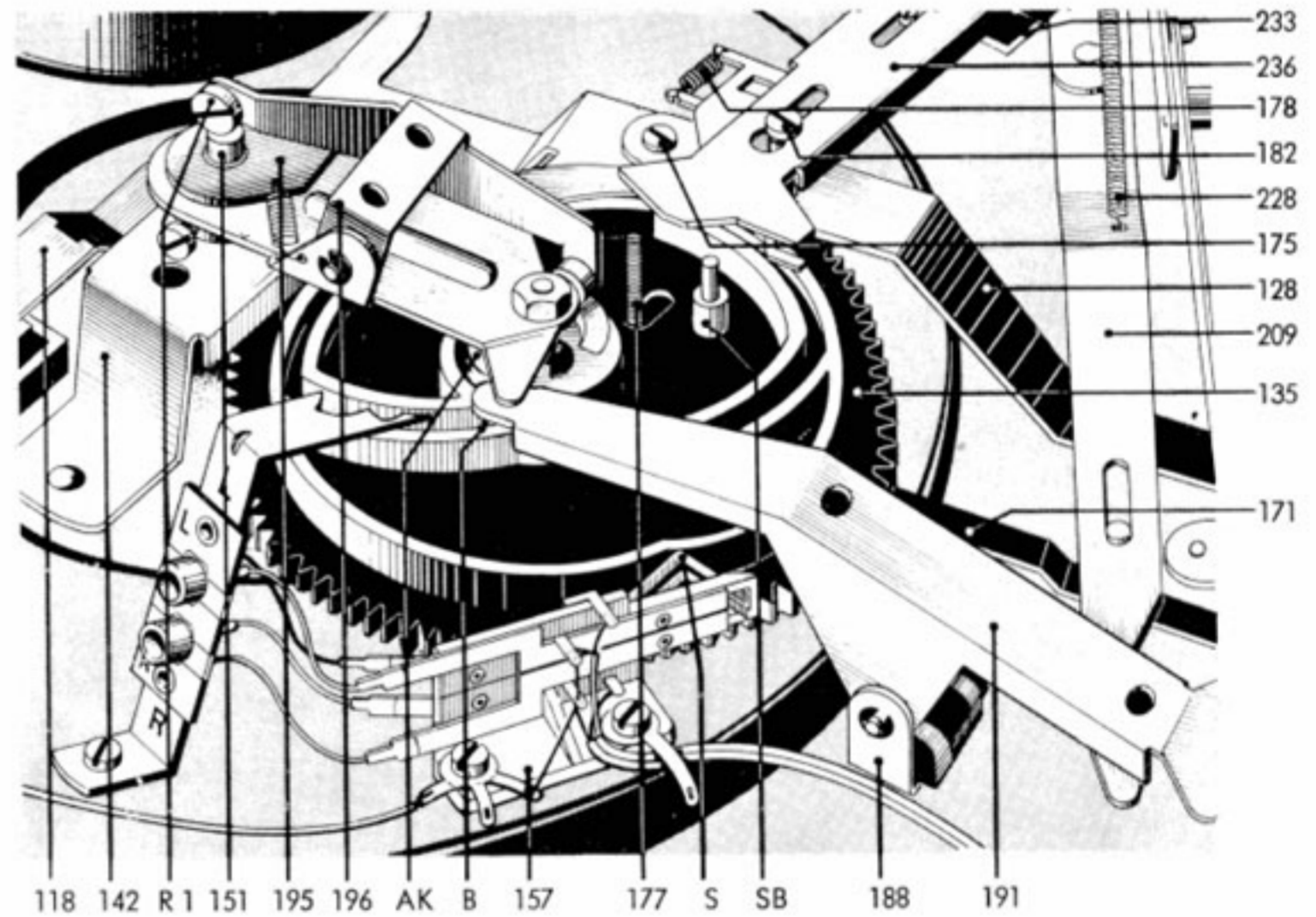


Fig. 15 Record drop



## Stop switching

Placing the operating switch in "Stop" position moves the switch lever (233) and switch angle (UW) towards the main cam, as in the start cycle, but only half as far. This causes the main cam to push the cam follower lever (137) to the side, into its stop position.

## Record drop

Records to be placed are stacked on the appropriate changer spindle — AW 2 for standard records, AS 9 for 45 r.p.m. records. Records are dropped by the rotation of the main cam (135) whose cam (AK) guides the cam rocker (196), pushing the change actuator stud (151) and releasing a record by means of the automatic spindle.

The design of the main cam is such that a record can only drop when the tonearm is above the tonearm rest — where it cannot interfere with the largest possible record (12" dia.). A muting switch (157) is provided to prevent change cycle noises from being picked up by the tonearm cartridge. The switch springs (S) for both channels are actuated by the main cam (135). In the rest position, the muting switch opens.

Fig. 16 Changing action

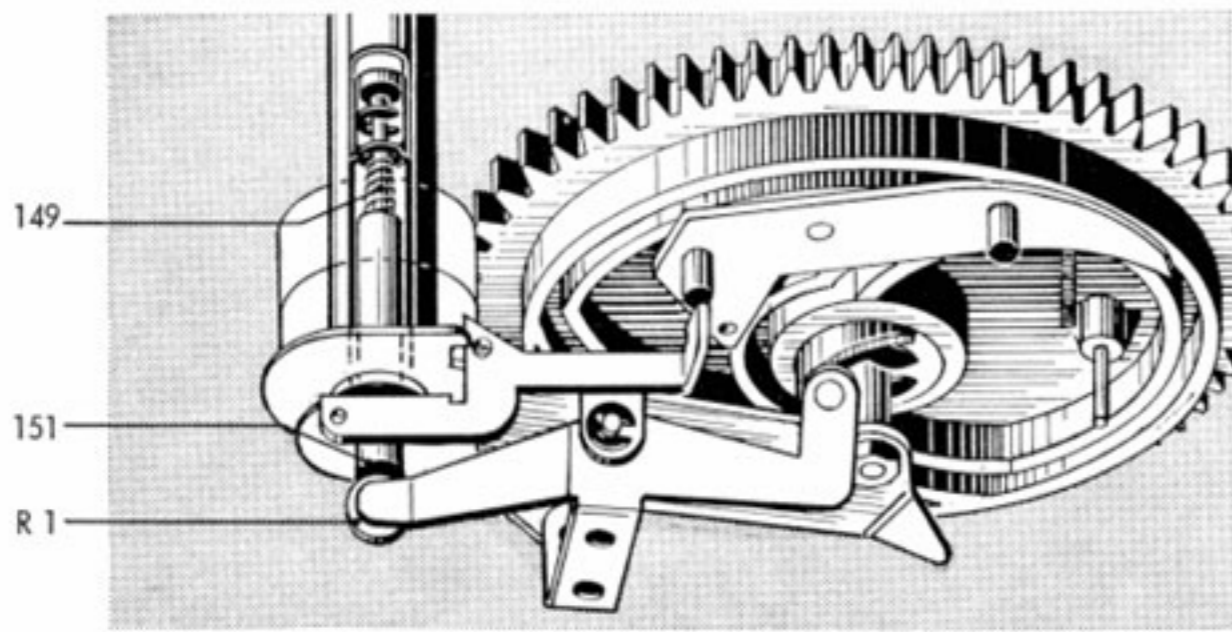


Fig. 17 Shut-off position

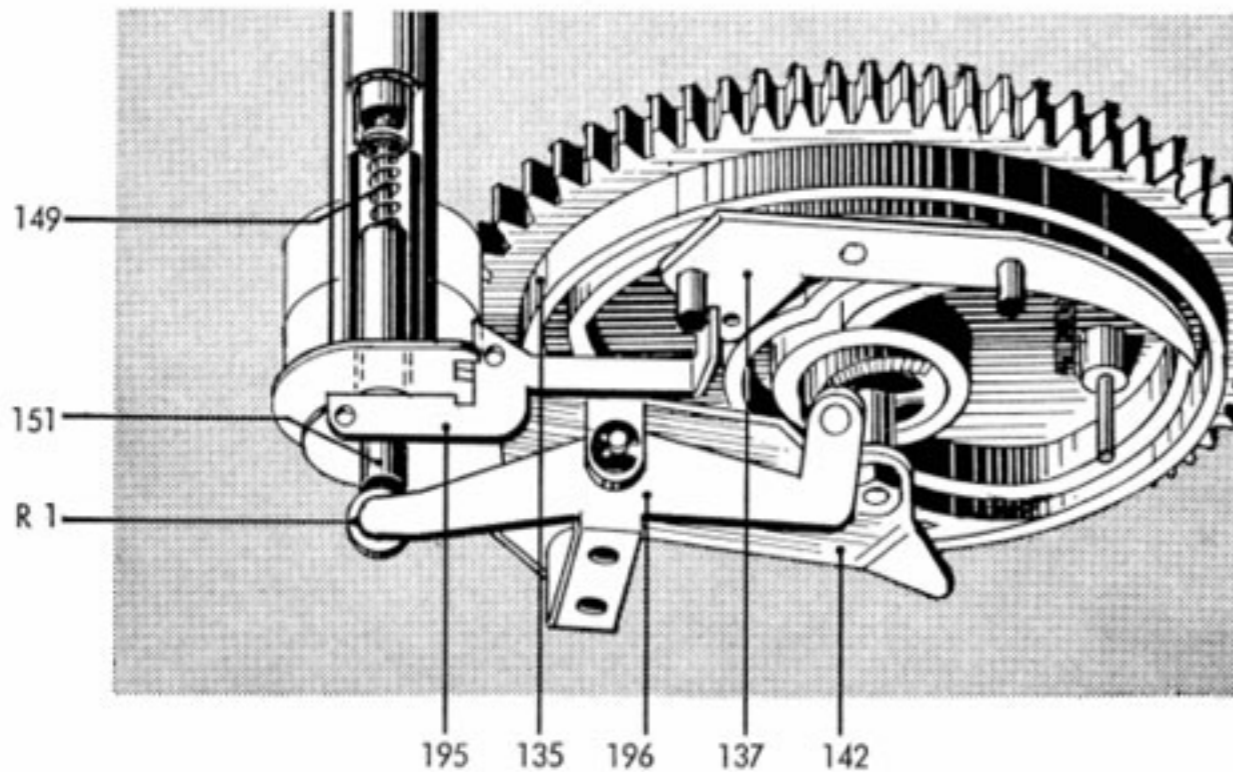
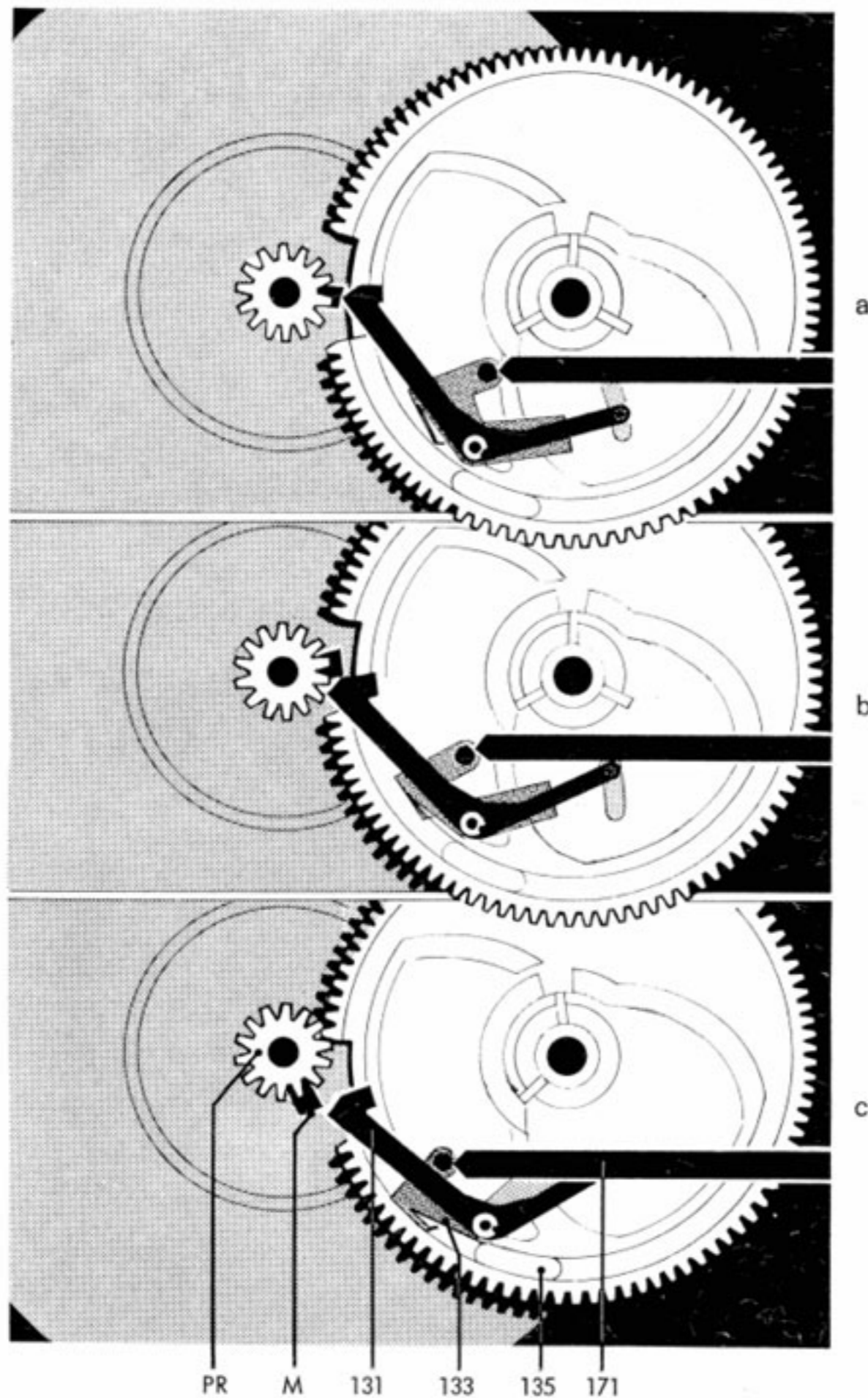


Fig. 18 First stage of change or shut-off action



## Shut-off

Shut-off and change functions are determined by the position of the cam follower lever (137, Fig. 17). After the last record of the stack drops, the change lever guides the cam follower lever (137).

To initiate shut-off, the cam follower lever is brought into position (longer end towards the center of the main cam) by the change lever. After the tonearm has swung over the tonearm rest, the guide post (B, fig. 15) of the main lever (191) contacts the outside of the main cam (135) whose vertical profile causes the tonearm to lower onto its support. The traversing of the tonearm releases the latch (179) from its support (BG). However, the main cam keeps the switch arm (128) in its "play" position until the end of the change cycle. When the main cam returns to its null position, the switch arm drops into the cut-out in the main cam, the line switch is operated and the drive wheel is disengaged.

## Shut-off and change cycle

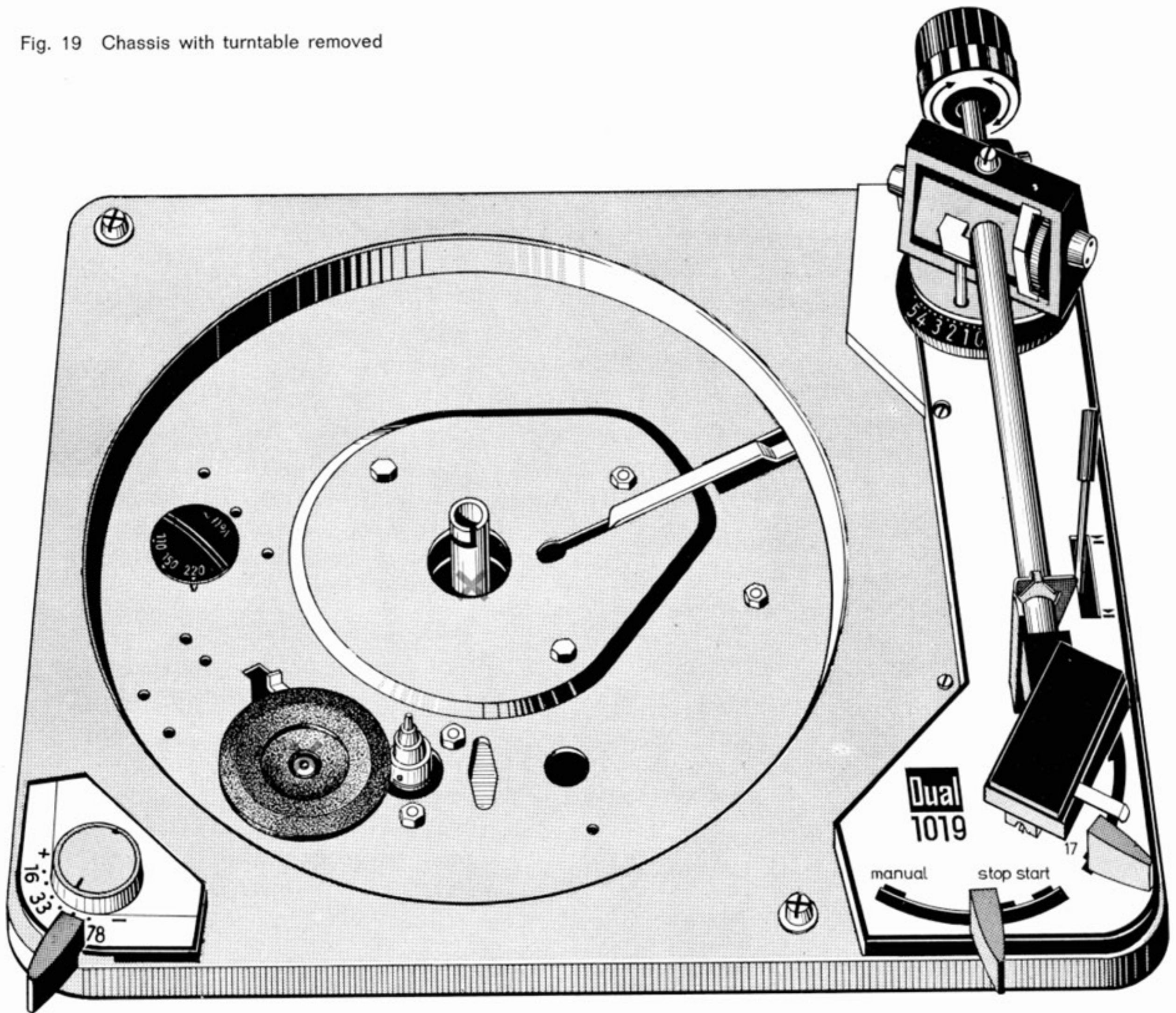
The dog (M) on the turntable gear (PR) and the shut-off lever (131) actuate both the change cycle at the end of the record as well as the shut-off after the last record of a stack.

As a record is played, the tonearm moves towards the center of the record, dependent on the pitch of the record groove. This motion carries the shut-off lever towards the dog by means of the shut-off slide (171). The eccentric dog pushes the shut-off lever back at each revolution, as long as the tonearm advance is only one record groove (Fig. 18a). The shut-off groove with its greater pitch brings the shut-off lever against the dog with greater force (Fig. 18b). The shut-off lever then engages and causes the main cam (135) to be driven by the turntable gear out of its null position (Fig. 18c).

## Trouble shooting

| Symptom  | Cause  | Remedy  |
|--|--|---|
| Tonearm returns to arm rest immediately, after being manually placed on record               | Shut-off mechanism shifted out of position during shipping   | Whenever unit is moved, before using, put unit through start cycle.   |
| Turntable stops after automatic set-down of the tonearm                                      | Switch arm (128) fails to engage latch (179)   | Loosen screw (175) and turn the short arm piece on the long switch-arm piece. Turn the main cam to its null position and adjust for about $\frac{1}{64}$ " play between the tabs (L) and the arm segment, when the tonearm drops onto the arm rest.   |
| Tonearm returns to its rest position after each record                                       | Excessive engagement between change lever (195) and cam follower   | Re-adjust change lever (195) so that with record on, and spindle locked, there is about $\frac{1}{64}$ " clearance between change lever and the guide post of the cam follower lever (137). With no record loaded, engagement should be about $\frac{1}{32}$ ", to obtain shut-off.   |
| Turntable does not turn when switch moved to "Manual" and tonearm off resting post           | Switch lever assembly out of adjustment  | Re-adjust with set screw (184) so that in manual position, the latch (179) overtravels the support (BG) about $\frac{1}{64}$ ". Secure adjustment with locknut.   |
| Last record keeps repeating  | Inadequate engagement between change lever (195) and cam follower (137)  | Re-adjust change lever (195) so that with record on and spindle locked, there is about $\frac{1}{64}$ " clearance between change lever and guide pin of the cam follower lever (137). With no record loaded, engagement should be about $\frac{1}{32}$ ", to obtain shut-off.   |
| Record drops after switch moved to "stop", another record drops when switch moved to "start" | Normal operation   |   |
| Records do not drop  | <ul style="list-style-type: none"> <li>a) Travel of cam rocker (196), too short</li> <li>b) Automatic spindle not locked in position</li> <li>c) Spindle is defective</li> </ul> | <ul style="list-style-type: none"> <li>a) Re-adjust eccentric R 1 so that when the three supports of the automatic spindle are completely retracted, further rotation of the main cam causes overtravel of about <math>\frac{1}{64}</math>" between the cam and the roller of the cam rocker.</li> <li>b) After inserting spindle, rotate to its stop.</li> <li>c) Replace spindle</li> </ul> |
| Turntable slows down as record drops   | Travel of cam rocker (196), too long   | Re-adjust eccentric R 1 so that when the three supports of the automatic spindle are completely retracted, further rotation of the main cam causes overtravel of about $\frac{1}{64}$ " between cam and roller of the cam rocker.   |
| Acoustic feedback  | <ul style="list-style-type: none"> <li>a) Parts of the chassis (e. g. connecting leads) touching the mounting board</li> <li>b) Connecting leads pulled too tight</li> </ul>     | <ul style="list-style-type: none"> <li>a) Correct cut-out according to installation instructions. Move leads.</li> <li>b) Loosen or lengthen leads.</li> </ul>  |

Fig. 19 Chassis with turntable removed



## Lubrication

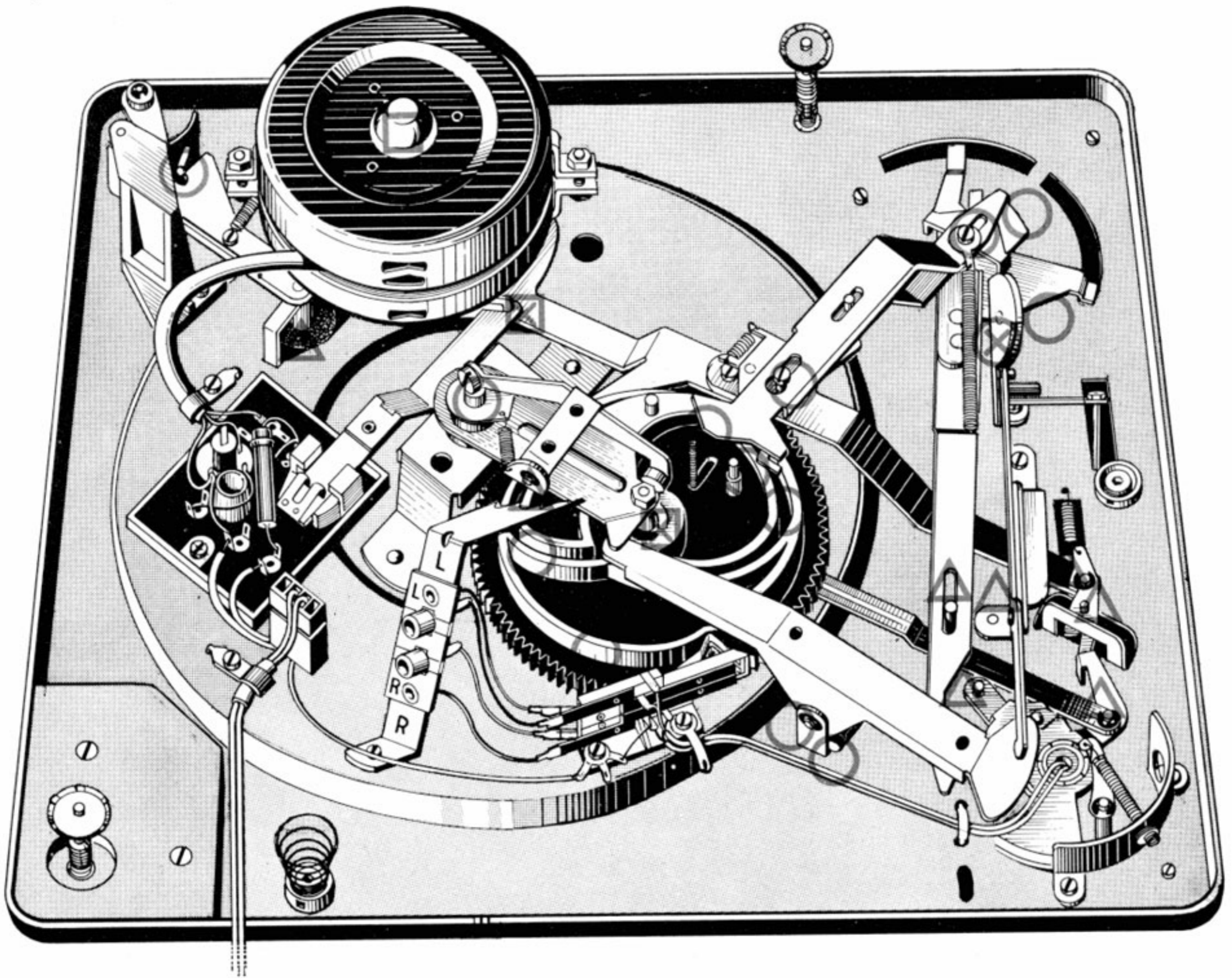
All bearings and sliding points have been properly lubricated during assembly. Re-lubrication is normally not necessary for about two years since all important bearings are provided with oil retainers and sintered bearings.

Lubrication should be applied sparingly. It is of primary importance that no oil or grease should get onto the friction surfaces of the idler wheel, motor pulley or turntable, to avoid slippage. For the same reason, avoid touching these parts.

Use the following lubricants:

- Fine bearing oil, Shell Clavus 17, for motor bearings and sintered bearings.
- Adhesive oil, Renotac, for turntable and drive wheel.
- Molycote paste G, where greater pressure or friction occur.
- Silicone rubber grease, for the drive washer of the tonearm lift.
- Silicone grease.
- Thicker, non-gumming oil, Calypsol WIK 700, for other sliding and bearing points.

Fig. 20 Chassis, viewed from below



## Replacement parts

| Ref. No. | Part No.       | Description   | Number per unit |
|----------|----------------|---|-----------------|
| 1        | 13 E - Ausf. A | 45 automatic spindle (accessory)  | 1               |
| 2        | 12 C - U 208   | Automatic spindle AW 2  | 1               |
| 3        | 12 K - 196     | Turntable washer  | 1               |
| 4        | 12 E - 214     | Retaining ring  | 1               |
| 5        | 12 K - U 329   | Turntable mat   | 1               |
|          | 12 K - 189     | Ring facing   | 1               |
| 6        | 12 K - U 315   | Turntable with mat  | 1               |
| 7        | 12 K - U 4     | Speed regulator knob  | 1               |
| 8        | 12 K - 20      | Speed change knob   | 1               |
| 9        | 12 K - U 301   | Switch plate assembly   | 1               |
| 10       | Z 3/5a         | Machine screw   | 6               |
| 11       | 4650/4         | "C" ring  | 3               |
| 12       | 5,1/10/1 St    | Washer  | 1               |
| 13       | 4680/5,2/10a   | Bowed lockwasher  | 2               |
| 14       | 12 F - U 4     | Speed change lever  | 1               |
| 15       | 12 K - U 2     | Base plate  | 1               |
| 16       | 12 F - U 186   | Shipping screw assembly   | 1               |
| 17       |                | Tonearm assembly with bearings<br>(available only less ref. nos. 37 and 63) |                 |
| 18       | 12 K - U 327   | Centering disc for 45 records   | 1               |

| Ref. No. | Part No.     | Description   | Number per unit |
|----------|--------------|---|-----------------|
| 19       | 12 K - 194   | Single play spindle . . . . .                         | 1               |
| 20       | Z 3/5a       | Machine screw . . . . .                               | 6               |
| 21       | M 4/2        | Hex nut . . . . .                                     | 6               |
| 22       | 6 K 4/4      | Hex nut . . . . .                                     | 2               |
| 23       | 4000/400     | Steel ball . . . . .                                  | 1               |
| 24       | M 4/2        | Hex nut . . . . .                                     | 6               |
| 25       | M 3/7a       | Hex nut . . . . .                                     | 2               |
| 26       | 12 F - U 136 | Suspension spring (3 pcs to a set) . . . . .          | 1               |
| 27       | 12 F - 303   | Rubber sleeve . . . . .                               | 3               |
| 28       | 12 F - 300   | Cup . . . . .   | 3               |
| 29       | 12 F - 314   | Compression spring . . . . .                          | 3               |
| 30       | 12 F - 298   | Threaded disc . . . . .                               | 3               |
| 31       | 4,2/7/0,3 St | Washer . . . . .                                      | 2               |
| 32       | 12 F - 291   | Compression spring . . . . .                          | 2               |
| 33       | 12 F - 249   | "C" ring . . . . .                                    | 2               |
| 34       | 12 F - 254   | Spring cup . . . . .                                  | 2               |
| 34a*     | M 4/2        | Hexnut . . . . .                                      | 4               |
| 35       | 12 F - 255   | Washer . . . . .                                      | 2               |
| 36       | 4650/4       | "C" washer . . . . .                                  | 3               |
| 37       | 12 K - U 305 | Tonearm assembly . . . . .                            | 1               |
| 38       | 12 K - 78    | Bearing screw, short . . . . .                        | 1               |
| 39       | 12 K - 36    | Switch lever assembly . . . . .                       | 1               |
| 40       | 4680/4,2/8d  | Tonearm handle . . . . .                              | 1               |
| 41       | 4,2/8/0,5 St | Washer . . . . .                                      | 1               |
| 42       | 4693/4       | Grip ring . . . . .                                   | 1               |
| 43       | 12 K - U 270 | Retainer . . . . .                                    | 1               |
| 44       | 12 K - 314   | Shield . . . . .                                      | 1               |
| 45       | 12 K - 68    | Bearing housing . . . . .                             | 1               |
| 46       | 12 F - U 60  | Ball bearing race . . . . .                           | 2               |
| 47       | 12 K - 71    | Stop nut . . . . .                                    | 1               |
| 48       | 12 K - 90    | Positioning screw . . . . .                           | 1               |
| 49       | 4680/5,2/10a | Bowed lockwasher . . . . .                            | 2               |
| 50       | Z 3/5a       | Machine screw . . . . .                               | 6               |
| 51       | 12 K - U 319 | Balance weight . . . . .                              | 1               |
| 52       | 12 K - U 317 | Balance weight with spindle . . . . .                 | 1               |
| 53       | 12 K - 199   | Spindle . . . . .                                     | 1               |
| 54       | 15 N - 54    | Clamping screw . . . . .                              | 1               |
| 55       | 12 K - U 311 | Spring barrel . . . . .                               | 1               |
| 56       | 12 K - 44    | Tone arm cable (right channel) . . . . .              | 1               |
| 57       | 12 K - 46    | Tone arm cable (left channel) . . . . .               | 1               |
| 58       | 12 K - 62    | Positioning screw . . . . .                           | 1               |
| 59       | 15 N - 74    | Damping ring . . . . .                                | 1               |
| 60       | 4650/3,2     | "C" ring . . . . .                                    | 2               |
| 61       | 12 K - 76    | Bearing screw, long . . . . .                         | 1               |
| 62       | 15 N - 9     | Marker . . . . .                                      | 1               |
| 63       | 12 K - U 310 | Bearing frame assembly . . . . .                      | 1               |
|          | 12 K - U 308 | Bearing frame assembly with bearing housing . . . . . | 1               |
| 64       | 12 K - U 40  | Guide ring . . . . .                                  | 1               |
| 65       | 12 K - 64    | Adjusting ring . . . . .                              | 1               |
| 66       | 12 K - U 46  | Spring lever . . . . .                                | 1               |
| 67       | 12 K - 66    | Ring . . . . .  | 1               |
| 68       | 4650/2,3     | "C" ring . . . . .                                    | 11              |
| 69       | 12 F - U 60  | Bearing race . . . . .                                | 2               |
| 70       | 12 K - 104   | Mounting screw . . . . .                              | 1               |
| 71       | 12 K - U 54  | Arm latch assembly . . . . .                          | 1               |
| 72       | 12 K - 102   | Tensioning block . . . . .                            | 1               |
| 73       | 12 K - U 52  | Bearing holder . . . . .                              | 1               |
| 74       | M 2,6/4b     | Hexnut . . . . .                                      | 1               |
| 75       | 12 K - 106   | Tonearm rest . . . . .                                | 1               |
| 76       | M 3/7a       | Hexnut . . . . .                                      | 2               |
| 77       | 12 K - U 50  | Arm latch assembly . . . . .                          | 1               |
| 78       | 12 K - U 78  | Arm lift lever . . . . .                              | 1               |
| 79       | M 2/4        | Hexnut . . . . .                                      | 1               |
| 80       | 12 K - 95    | Damping block . . . . .                               | 1               |
| 81       | 12 K - U 321 | Dress-up plate (metric markings) . . . . .            | 1               |
|          | 12 K - U 323 | Dress-up plate (inch markings) . . . . .              | 1               |
| 82       | 12 K - 108   | Switch button . . . . .                               | 2               |
| 83       | Z 3/5a       | Machine screw . . . . .                               | 6               |
| 84       | 12 F - 252   | Special screw (threaded) . . . . .                    | 2               |
|          | 12 F - 251   | Special screw (pierced) . . . . .                     | 2               |



Fig. 21 Exploded view, parts above chassis

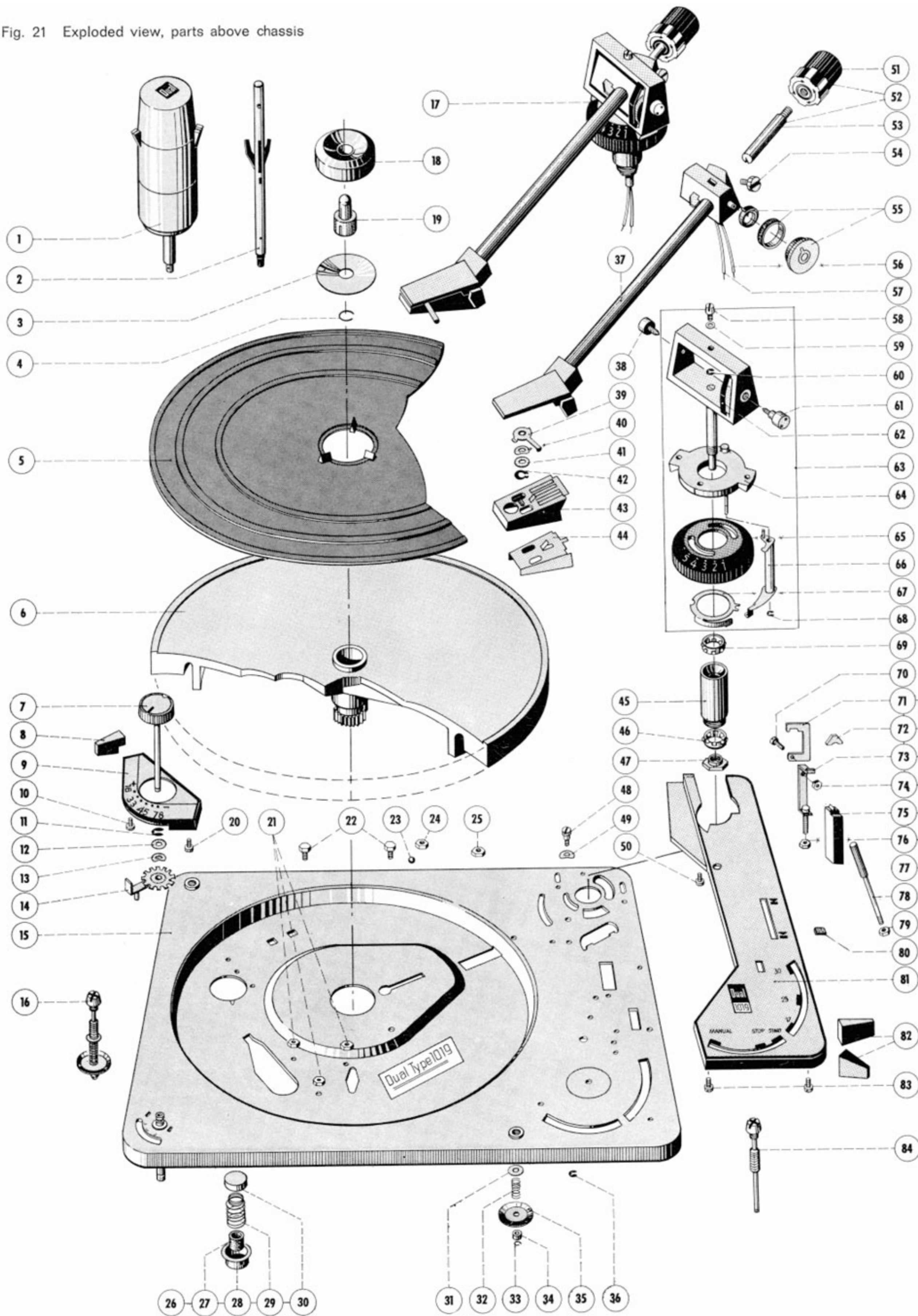
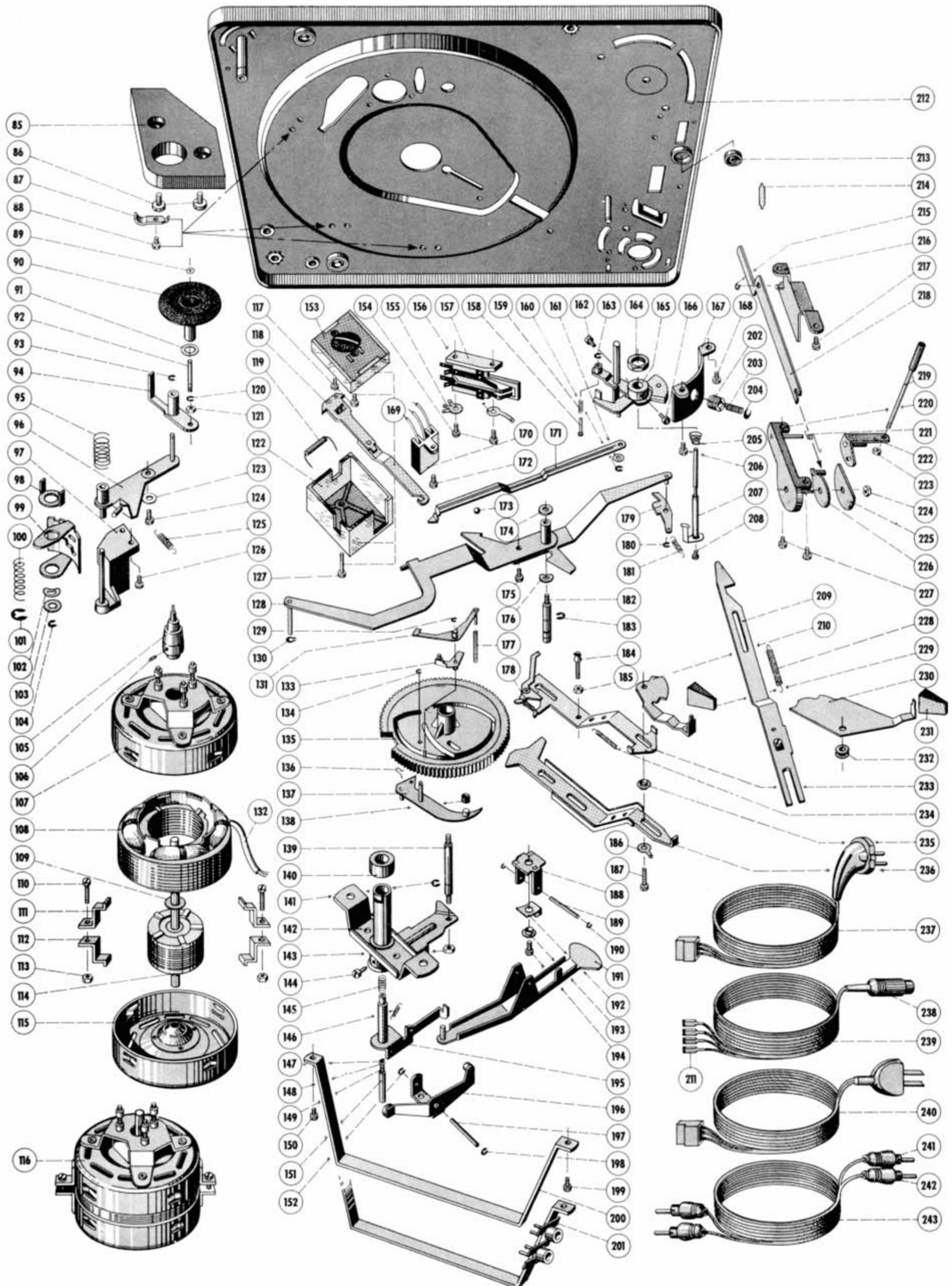


Fig. 22 Exploded view, parts below chassis



| Ref. No. | Part No.     | Description                                  | Number per unit |
|----------|--------------|--|-----------------|
| 85       | 12 F - 7     | Plate . . . . .                              | 1               |
| 86       | Z 4/5a       | Machine screw . . . . .                      | 2               |
| 87       | 12 A - 325   | Cable clamp . . . . .                        | 3               |
| 88       | Z 3/4d       | Machine screw . . . . .                      | 4               |
| 89       | 12 F - 45    | Lockwasher . . . . .                         | 1               |
| 90       | 12 F - U 13  | Idler wheel . . . . .                        | 1               |
| 91       | 11 C - 138   | Washer . . . . .                             | 1               |
| 92       | 12 F - 41    | Idler wheel shaft . . . . .                  | 1               |
| 93       | 4650/3,2     | "C" ring . . . . .                           | 2               |
| 94       | 12 F - U 9   | Lever and stud assembly . . . . .            | 1               |
| 95       | 12 F - 24    | Compression spring . . . . .                 | 1               |
| 96       | 12 F - U 7   | Rocker assembly . . . . .                    | 1               |
| 97       | 12 F - U 8   | Support assembly . . . . .                   | 1               |
| 98       | 12 F - 14    | Speed regulator detent . . . . .             | 1               |
| 99       | 12 F - 16    | Switch segment . . . . .                     | 1               |
| 100      | 12 F - 18    | Compression spring . . . . .                 | 1               |
| 101      | 4650/6       | "C" ring . . . . .                           | 2               |
| 102      | 4680/3,2/8c  | Bowed lockwasher . . . . .                   | 1               |
| 103      | 3,2/10/1 St  | Washer . . . . .                             | 1               |
| 104      | 4650/2,3     | "C" ring . . . . .                           | 11              |
| 105      | 31 N - U 20  | Motor pulley, 50-cycle . . . . .             | 1               |
|          | 31 N - U 28  | Motor pulley, 60-cycle . . . . .             | 1               |
| 106      | G 2,6/3,5    | Set screw . . . . .                          | 1               |
| 107      | 31 N - U 6   | Upper end-bell assembly . . . . .            | 1               |
| 108      | 31 N - U 1   | Stator assembly . . . . .                    | 1               |
| 109      | 5,3/10/2 F   | Washer . . . . .                             | 1               |
| 110      | Z 4/12a      | Machine screw . . . . .                      | 2               |
| 111      | 31 N - 40    | Retaining bracket . . . . .                  | 4               |
| 112      | 31 N - 40    | Retaining bracket . . . . .                  | 4               |
| 113      | M 4/7        | Hexnut . . . . .                             | 2               |
| 114      | 31 N - U 15  | Rotor assembly . . . . .                     | 1               |
| 115      | 31 N - U 5   | Lower end-bell assembly . . . . .            | 1               |
| 116      | 31 N - U 10  | Motor assembly, less motor pulley . . . . .  | 1               |
| 117      | Z 3/8a       | Machine screw . . . . .                      | 2               |
| 118      | 12 F - U 57  | Switch slide . . . . .                       | 1               |
| 119      | 4020/83      | Capacitor . . . . .                          | 1               |
| 120      | 4650/2,3     | "C" ring . . . . .                           | 11              |
| 121      | M 3/4        | Hexnut . . . . .                             | 2               |
| 122      | 12 F - 152   | Power switch cover . . . . .                 | 1               |
| 123      | 3,2/6/0,5 St | Washer . . . . .                             | 1               |
| 124      | Z 3/3c       | Machine screw . . . . .                      | 6               |
| 125      | 12 F - 112   | Idler wheel spring . . . . .                 | 1               |
| 126      | Z 3/5a       | Machine screw . . . . .                      | 6               |
| 127      | Z 3/30a      | Machine screw . . . . .                      | 1               |
| 128      | 12 F - U 43  | Switch arm . . . . .                         | 1               |
| 129      | 4650/1,5     | "C" washer . . . . .                         | 3               |
| 130      | 4693/3       | Grip ring . . . . .                          | 1               |
| 131      | 12 F - U 42  | Shut-off lever . . . . .                     | 1               |
| 132      | J 07 nf/150  | Insulating sleeve . . . . .                  | 1               |
| 133      | 12 F - U 40  | Friction plate assembly . . . . .            | 1               |
| 134      | 4650/2,3     | "C" washer . . . . .                         | 11              |
| 135      | 12 K - U 303 | Main cam . . . . .                           | 1               |
| 136      | 12 D - 57    | Snap ring . . . . .                          | 1               |
| 137      | 12 H - U 11  | Cam follower lever . . . . .                 | 1               |
| 138      | 12 F - 84    | Rubber bumper . . . . .                      | 1               |
| 139      | 12 D - 36    | Main cam bearing post . . . . .              | 1               |
| 140      | 12 F - U 28  | Ball bearing assembly . . . . .              | 1               |
| 141      | 4650/6       | "C" washer . . . . .                         | 2               |
| 142      | 12 F - U 22  | Turntable bearing support assembly . . . . . | 1               |
| 143      | M 4/2        | Hexnut . . . . .                             | 6               |
| 144      | 12 F - 63    | Machine screw . . . . .                      | 1               |
| 145      | 12 F - 64    | Compression spring . . . . .                 | 1               |
| 146      | 12 D - 96    | Change lever tension spring . . . . .        | 1               |
| 147      | 4650/1,5     | "C" washer . . . . .                         | 3               |
| 148      | 2,1/5/0,5 St | Washer . . . . .                             | 1               |
| 149      | 12 F - 68    | Compression spring . . . . .                 | 1               |
| 150      | Z 3/4d       | Machine screw . . . . .                      | 4               |
| 151      | 12 F - U 26  | Change actuator stud . . . . .               | 1               |
| 152      | 4650/2,3     | "C" washer . . . . .                         | 11              |
| 153      | 12 G - U 28  | Switch plate with voltage selector . . . . . | 1               |
|          | 12 F - U 54  | Switch plate less voltage selector . . . . . | 1               |
| 154      | Z 3/4,5a     | Machine screw . . . . .                      | 2               |
| 155      | 4103/29      | Solder lug . . . . .                         | 1               |
| 156      | 4103/27      | Solder lug . . . . .                         | 1               |
| 157      | 12 F - U 75  | Muting switch . . . . .                      | 1               |
| 158      | 12 F - 168   | Spring stud . . . . .                        | 1               |
| 159      | 12 K - 120   | Compression spring . . . . .                 | 1               |
| 160      | 4650/2,3     | "C" ring . . . . .                           | 1               |
| 161      | 12 K - 144   | Washer . . . . .                             | 1               |
| 162      | Z 3/6c       | Machine screw . . . . .                      | 1               |
| 163      | 4650/1,5     | "C" washer . . . . .                         | 3               |

| Ref. No. | Part No.     | Description                                      | Number per unit |
|----------|--------------|--|-----------------|
| 164      | 12 F - 156   | Hexnut . . . . .                                 | 1               |
| 165      | 12 K - U 313 | Arm segment assembly . . . . .                   | 1               |
| 166      | Z 3/6        | Machine screw . . . . .                          | 2               |
| 167      | 12 K - 130   | Spring post . . . . .                            | 1               |
| 168      | Z 3/3c       | Machine screw . . . . .                          | 6               |
| 169      | 12 G - U 77  | Power switch with voltage selector . . . . .     | 1               |
|          | 12 F - U 52  | Power switch with slide and cover . . . . .      | 1               |
| 170      | 12 F - U 163 | 4-pin connector w/breakaway power cord . . . . . | 1               |
| 171      | 12 F - 174   | Shut-off slide . . . . .                         | 1               |
| 172      | Z 3/6        | Machine screw . . . . .                          | 2               |
| 173      | 4000/400     | Steel ball . . . . .                             | 1               |
| 174      | 3,2/7/0,5 St | Washer . . . . .                                 | 1               |
| 175      | Z 3/3c       | Machine screw . . . . .                          | 6               |
| 176      | 4680/5,2/8   | Bowed lockwasher . . . . .                       | 1               |
| 177      | 12 F - 98    | Coiled spring . . . . .                          | 1               |
| 178      | 12 F - 137   | Tension spring . . . . .                         | 1               |
| 179      | 12 K - U 18  | Latch . . . . .                                  | 1               |
| 180      | 4650/2,3     | "C" washer . . . . .                             | 11              |
| 181      | 11 A - 10    | Tension spring . . . . .                         | 2               |
| 182      | 12 F - 100   | Grooved shaft . . . . .                          | 1               |
| 183      | 4650/4       | "C" washer . . . . .                             | 3               |
| 184      | 12 F - U 51  | Set screw . . . . .                              | 1               |
| 185      | M 3/4        | Hexnut . . . . .                                 | 2               |
| 186      | 4103/32      | Solder lug . . . . .                             | 1               |
| 187      | Z 3/12a      | Machine screw . . . . .                          | 1               |
| 188      | 12 K - 140   | Main lever bearing support . . . . .             | 1               |
| 189      | 12 D - 212   | Main lever shaft . . . . .                       | 1               |
| 190      | 4650/2,3     | "C" washer . . . . .                             | 11              |
| 191      | 12 K - U 325 | Main lever . . . . .                             | 1               |
| 192      | 12 K - 142   | Leaf spring . . . . .                            | 1               |
| 193      | 12 B - 50    | Spacer . . . . .                                 | 1               |
| 194      | Z 3/6b       | Machine screw . . . . .                          | 1               |
| 195      | 12 F - U 24  | Change lever . . . . .                           | 1               |
| 196      | 12 D - U 60  | Cam rocker . . . . .                             | 1               |
| 197      | 12 D - 102   | Cam rocker shaft . . . . .                       | 1               |
| 198      | 4650/2,3     | "C" washer . . . . .                             | 11              |
| 199      | Z 3/7a       | Machine screw . . . . .                          | 1               |
| 200      | 12 K - 180   | Stand . . . . .                                  | 1               |
| 201      | 12 K - U 100 | Stand with phono jacks . . . . .                 | 1               |
| 202      | 12 K - 132   | Threaded bushing . . . . .                       | 1               |
| 203      | 12 K - 134   | Tension spring . . . . .                         | 1               |
| 204      | 12 K - 136   | Positioning washer . . . . .                     | 1               |
| 205      | 12 K - 128   | Helical spring . . . . .                         | 1               |
| 206      | Z 3/3c       | Machine screw . . . . .                          | 6               |
| 207      | 12 K - U 60  | Lift screw . . . . .                             | 1               |
| 208      | 12 D - 209   | Guide pin . . . . .                              | 1               |
| 209      | 12 K - U 64  | Arm positioning slide . . . . .                  | 1               |
| 210      | 12 F - 123   | Manual/automatic selector . . . . .              | 1               |
| 211      | 4012/40      | Blade connector . . . . .                        | 4               |
| 212      | 12 K - U 2   | Base plate assembly . . . . .                    | 1               |
| 213      | 12 F - 298   | Threaded bushing . . . . .                       | 3               |
| 214      | 12 F - 172   | Audio cable, spring retainer . . . . .           | 1               |
| 215      | 4650/2,3     | "C" washer . . . . .                             | 11              |
| 216      | 12 K - U 80  | Bearing support, connecting lever . . . . .      | 1               |
| 217      | Z 3/7a       | Machine screw . . . . .                          | 1               |
| 218      | 12 K - 176   | Connecting lever . . . . .                       | 1               |
| 219      | 12 K - U 78  | Arm lift rod . . . . .                           | 1               |
| 220      | 12 K - U 70  | Support bracket with drive washer . . . . .      | 1               |
| 221      | 12 K - 162   | Torsion spring . . . . .                         | 1               |
| 222      | 12 K - U 76  | Drive cam assembly . . . . .                     | 1               |
| 223      | M 2/4        | Hexnut . . . . .                                 | 1               |
| 224      | M 4/2        | Hexnut . . . . .                                 | 6               |
| 225      | 12 K - 160   | Cover washer . . . . .                           | 1               |
| 226      | 12 K - U 74  | Drive washer . . . . .                           | 1               |
| 227      | Z 3/3c       | Machine screw . . . . .                          | 6               |
| 228      | 12 A - 452   | Tension spring . . . . .                         | 1               |
| 229      | 12 K - 108   | Selector knob . . . . .                          | 2               |
| 230      | 12 F - 118   | Record size selector lever . . . . .             | 1               |
| 231      | 12 K - 108   | Selector knob . . . . .                          | 2               |
| 232      | 12 F - 120   | Spacer, short . . . . .                          | 1               |
| 233      | 12 F - U 41  | Switch lever assembly . . . . .                  | 1               |
| 234      | 11 A - 10    | Tension spring . . . . .                         | 2               |
| 235      | 12 F - 132   | Spacer, long . . . . .                           | 1               |
| 236      | 12 F - 135   | Start lever . . . . .                            | 1               |
| 237      | 12 F - U 184 | Power cord, European . . . . .                   | 1               |
| 238      | 4012/21      | Miniature 5-pin plug . . . . .                   | 1               |
| 239      | 12 F - U 133 | Plug-in output cable . . . . .                   | 1               |
| 240      | 12 F - U 175 | Power cord, American . . . . .                   | 1               |
| 241      | 4012/22      | Phono plug (yellow) for output cable . . . . .   | 2               |
| 242      | 4012/23      | Phono plug (red) for output cable . . . . .      | 2               |
| 243      | 12 F - U 127 | Output cable, phono connector . . . . .          | 1               |

\* Part not shown

We reserve the right to make changes