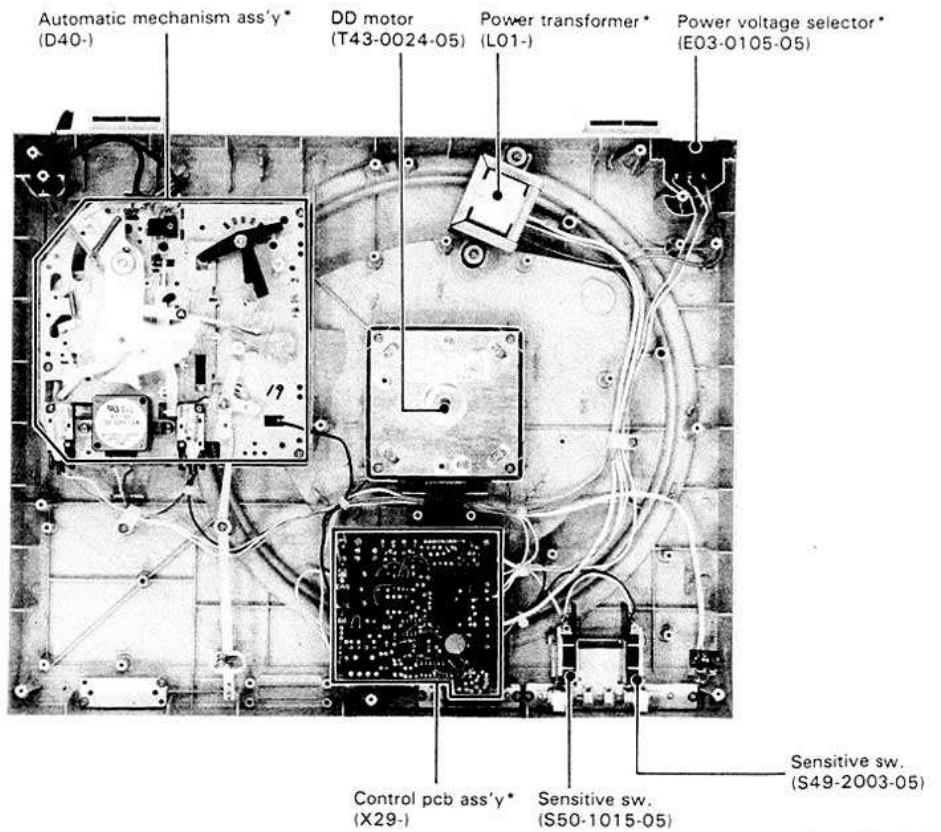
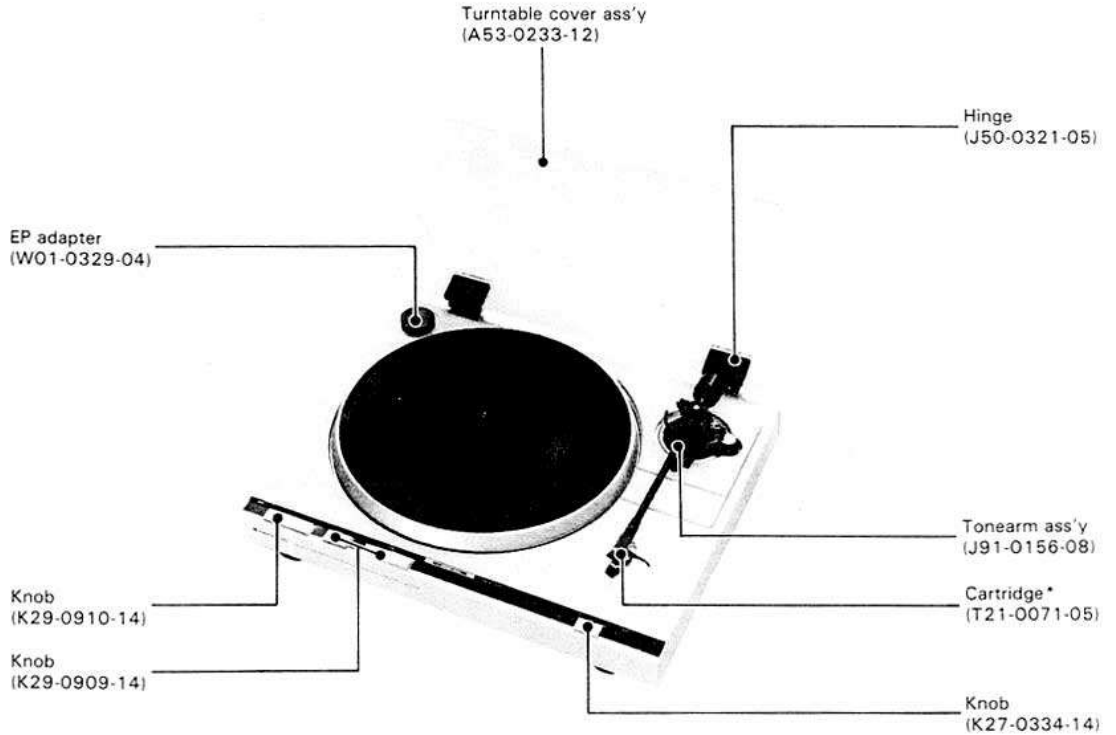


QUARTZ PLL DIRECT DRIVE FULL AUTOMATIC TURNTABLE

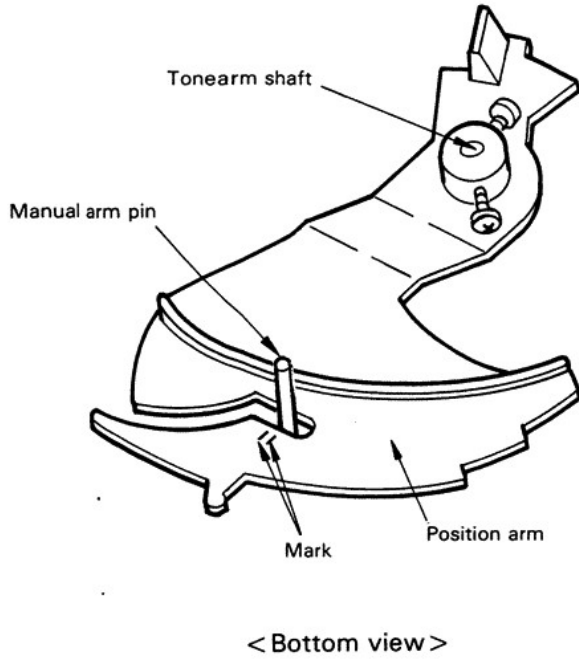


*Refer to Parts List (P16)

AUTOMATIC MECHANISM ASS'Y

How to mount position arm

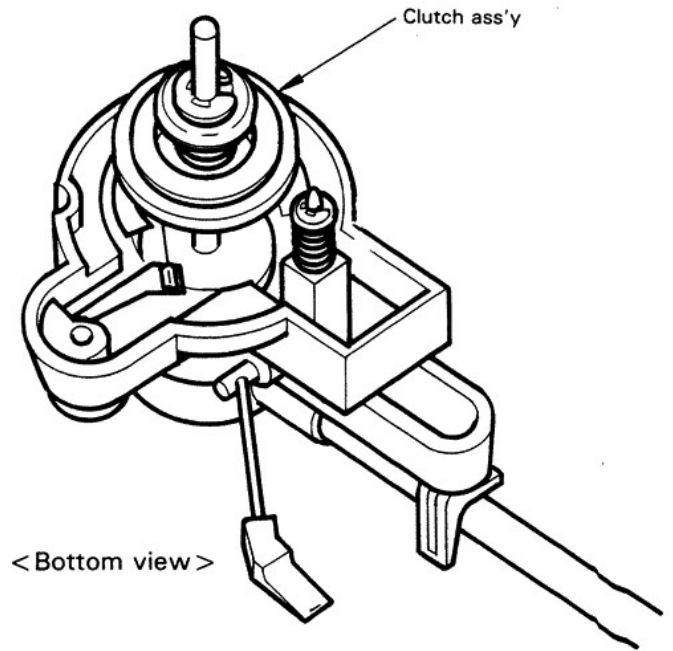
Fix the position arm so that the manual arm pin by screws is within the mark on the position arm.



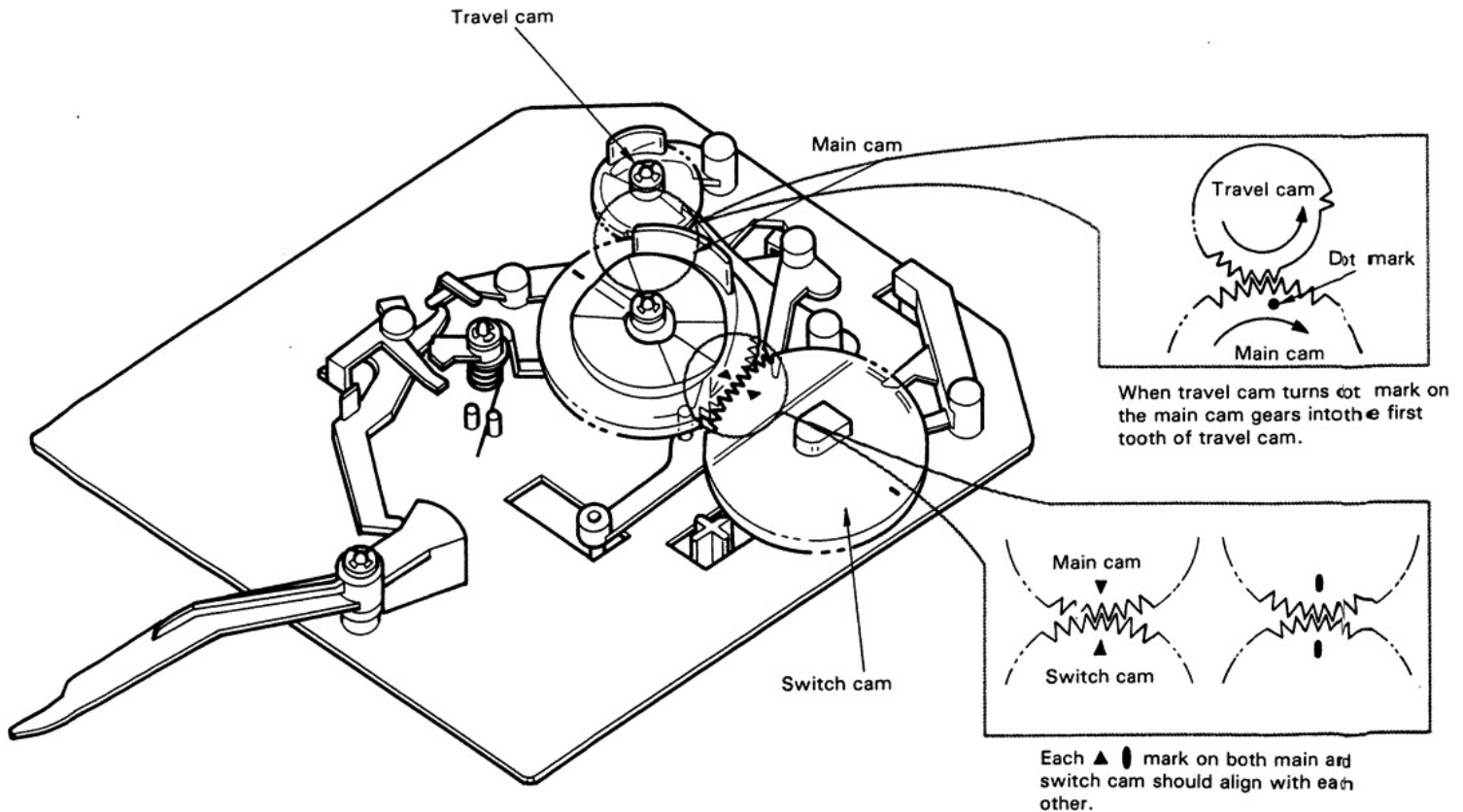
How to check clutch ass'y operation

Before check remove position arm. Confirm clutch ass'y function from bottom side.

- 1 Hold tonearm to tonearm rest.
- 2 Press PLAY/CUT button (AUTO-IN)
- 3 Confirm clutch ass'y turns from bottom side.
- 4 Also press PLAY/CUT button again (AUTO-RETURN)



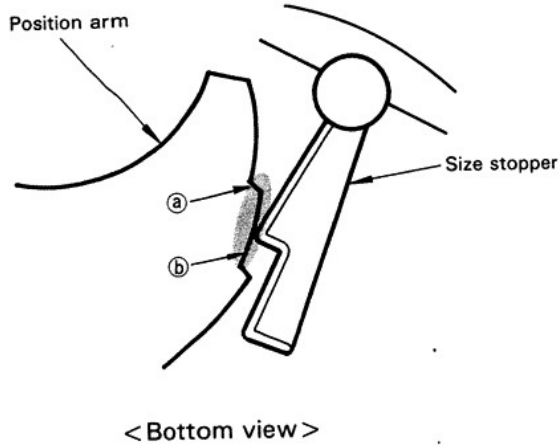
How to mount travel cam, main cam and switch cam.



ADJUSTMENT

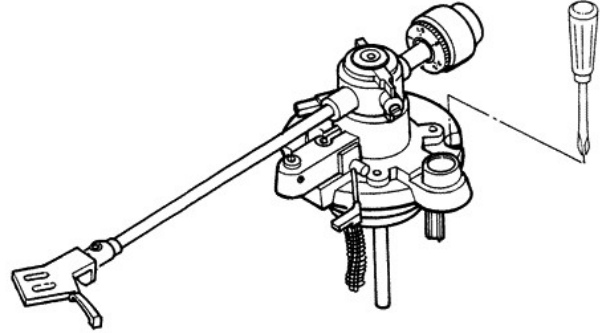
How to adjust size stopper

Confirm:
in AUTO-IN mode, size stopper contact with the black parts of position arm. If not, adjust the stopper of size stopper or slider. Refer to next page.



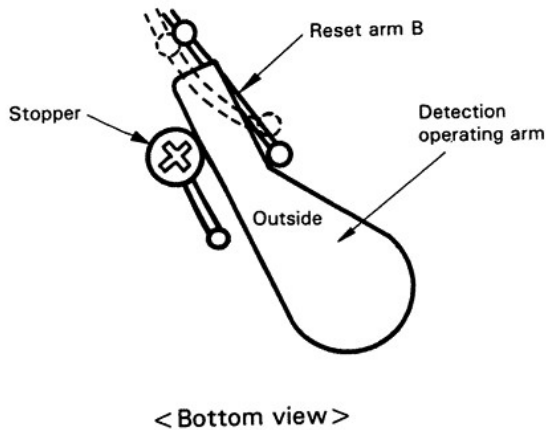
How to adjust the auto-in position

Adjust the auto-in in the 30 cm record auto-in mode. Put the turntable in the 30 cm record auto-in mode. Play back the test record (P-3027, Parts No. T99-0204-05). Adjust the auto-in adjusting screw through the tonearm base access hole so that the stylus drops at count 20 ± 15 on the test record.



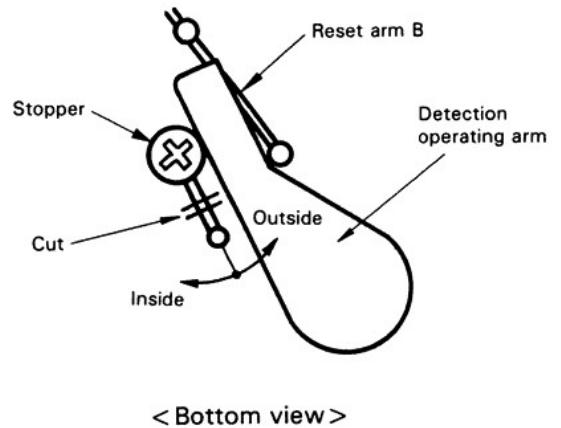
How to check reset arm B

Confirm:
from STOP to PLAY Mode, detecting operating arm is forced down by reset arm B.

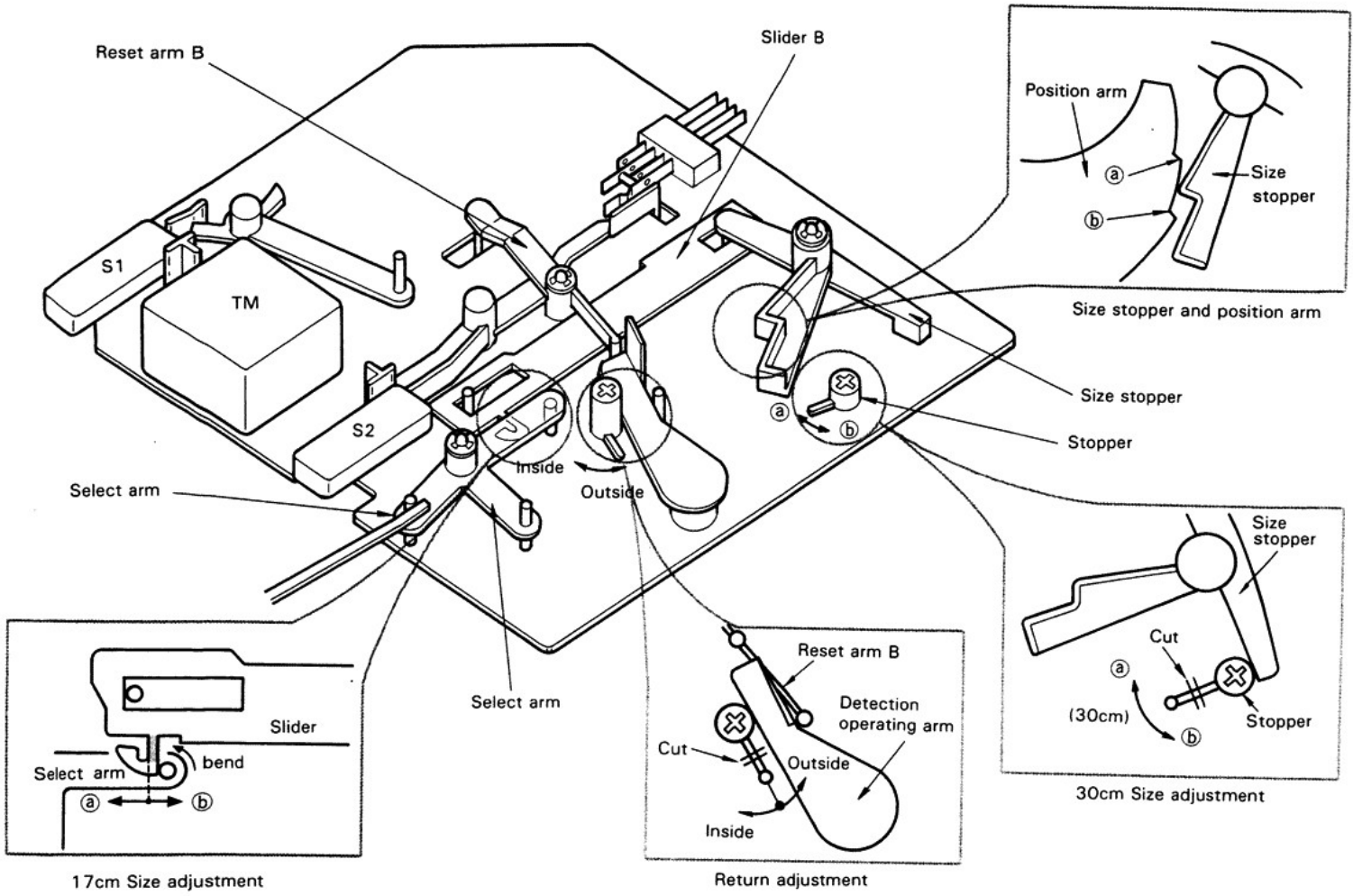


How to adjust the auto-return position

Use the test record (PRC—30041, Parts No. T99-0211-05) to adjust the auto-return position. Adjust the stopper for detection operating arm so that the auto-return action starts at the 20 count of the test record.



ADJUSTMENT

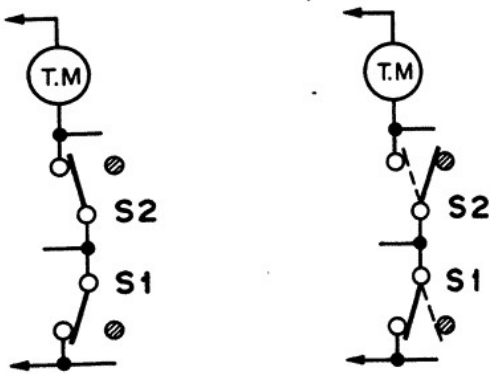
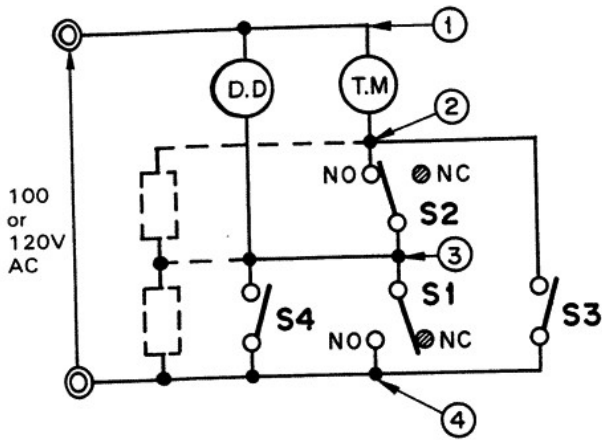


< Adjustment part of automatic mechanism >

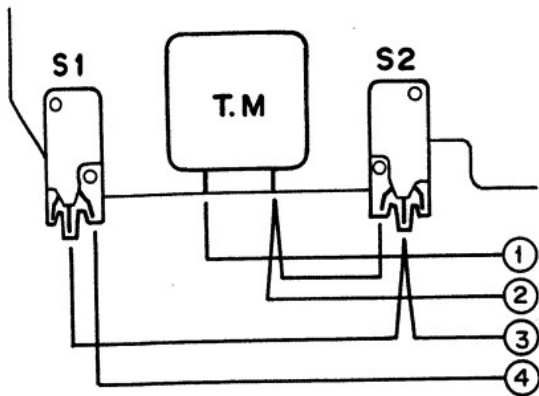
CIRCUIT DESCRIPTION

DD and Timing Motor Operation

The following figures illustrate the motor circuit and actual part configuration.



< During mechanism operation > < During PLAY >



< Bottom view >

- S₁: Mechanism, rest position timing (K1)
- S₂: Mechanism, play position timing (K2)
- S₃: PLAY/CUT switch
- S₄: REPEAT switch
- TM: Timing motor
- DD: Turntable motor

In the STOP condition, sensitive switch S₁ is OFF and sensitive switch S₂ is ON.

When the PLAY operation starts, either when the PLAY/CUT button is pressed for auto-in action or when manual operation (See "Mechanism operation") is performed, the timing gear rotates to turn ON S₁.

The S₁ ON condition is self-sustained by the mechanism until play is completed.

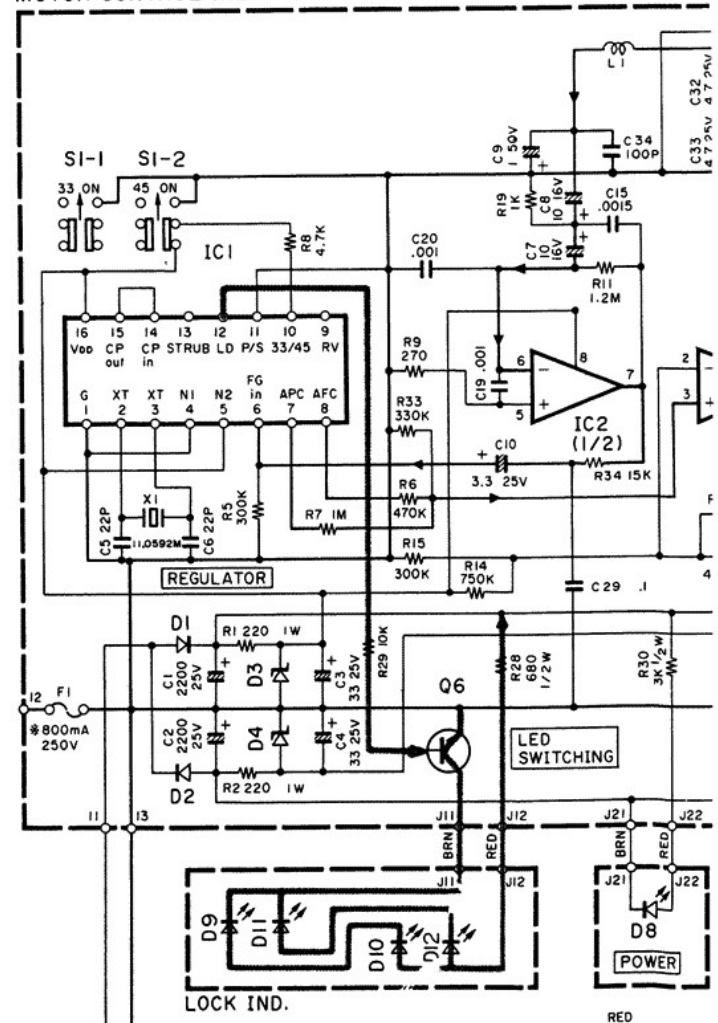
On the other hand, S₂ is ON only when the mechanism is in the Auto-in or Auto-return condition. During this period, S₂ is self-sustained by the mechanism, as is S₁. The self-sustained condition is maintained by the switch cam attached to the timing motor shaft and by switch arms A and B, which turn the sensitive switch ON and OFF.

Lock Indicator

When the rotation speed is steady, the No. 12 terminal of IC₁ is at the H level. This voltage is applied to the base of LED switching transistor Q6. With Q6 ON, the four lock indicator LEDs connected to the Q6 collector will light, indicating steady rotation.

When the power is applied, B+ current flows to light power indicator LED D8. (Refer to troubleshooting.)

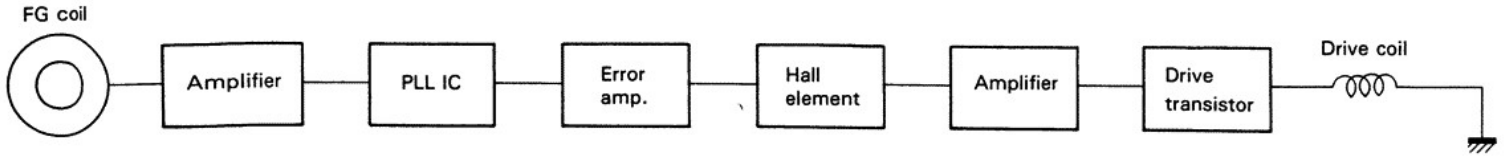
MOTOR CONTROL (X29-1250-11) (A/3)



CIRCUIT DESCRIPTION

Motor Drive Circuit

The following is a block diagram of the KD-50F.



< Block diagram of KD-50F >

As the motor starts rotating, an FG signal produced by the FG coil attached to the motor shaft is amplified and fed to PLL IC, which in turn compares the phase and speed of the FG signal and converts it into a voltage. This voltage is then coupled to the error amplifier, whose output is applied to the Hall element. The voltage produced at the Hall element is amplified before energizing the coil for motor rotation. The stator winding and Hall element are installed to provide clockwise rotation.

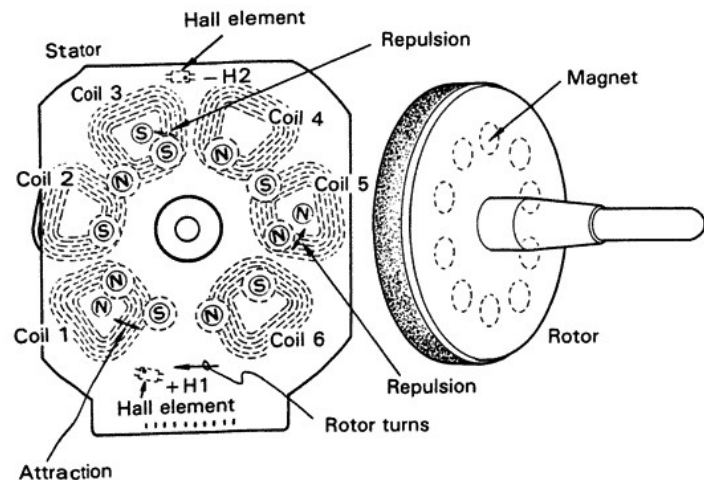
The motor consists of the stator and rotor sections as shown in figure.

The stator has a 2-phase winding and 6 coils. The rotor contains 10 imbedded magnets. Also, 2 Hall elements are used to detect magnet position. The Hall elements and coils are interconnected, changing the direction of the current flowing in the coil corresponding to the magnetic polarity detected by the Hall element.

Suppose that the rotor is superimposed on the stator as shown in figure.

The magnet installed in the rotor cannot change its own polarity, so current is fed to the stator winding to change its polarity and obtain rotational force.

Upon sensing the S pole, Hall element + H₁ produces a voltage which is insufficient to drive the motor, so the voltage is amplified by the OP amplifier to switch the drive transistor and feed current to each drive coil.



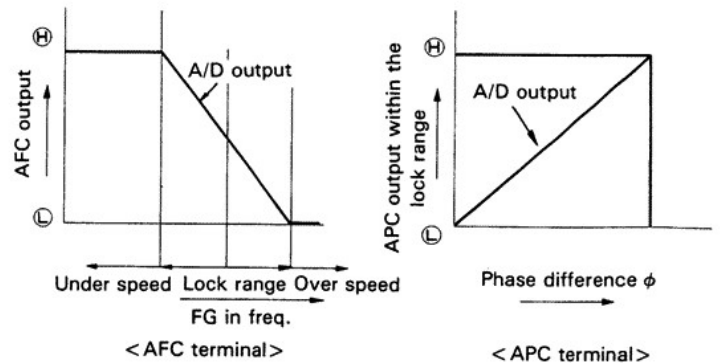
< Figure of rotor and stator >

There are 3 coils in one phase, each spaced at one coil intervals. These coils are wound in the reverse direction of the preceding coil, thereby changing pole orientation.

It can be seen that polarity of coil 1 must be N to produce clockwise rotation. Other coils cause the motor to rotate clockwise in a similar manner by repulsion or attraction.

As the S pole of the rotor passes through coil 1, the polarity of coils 1 is to repulse the rotor's S pole. As the rotor's N pole follows the S pole, the S pole of coil 1 and N pole of the rotor attract each other to cause further clockwise rotation. These successive operations keep the motor rotating in the clockwise direction. If one of the Hall elements is faulty, no fixed direction of rotation results and the platter keeps rotating in the direction which is turned by hand.

Understanding that the motor rotates by magnetic attraction or repulsion, consider how the circuit works in this respect. An FG signal fed to IC₁ by the motor rotation normally produces a voltage at terminal No.s 7 and 8 as shown in the following figure:



Terminal No.s 7 and 8 of IC₁ are designed so that they are at the L level during STOP and at high speeds, and at the H level at low speeds.

Assume that the speed is slow. In this case, a current proportional to the APC and AFC output voltages of IC₁ is fed to the Hall element by the DC amplifier (15 dB) consisting of IC₂ and Q₁.

The variations in the current are proportional to the output voltage of the Hall element.

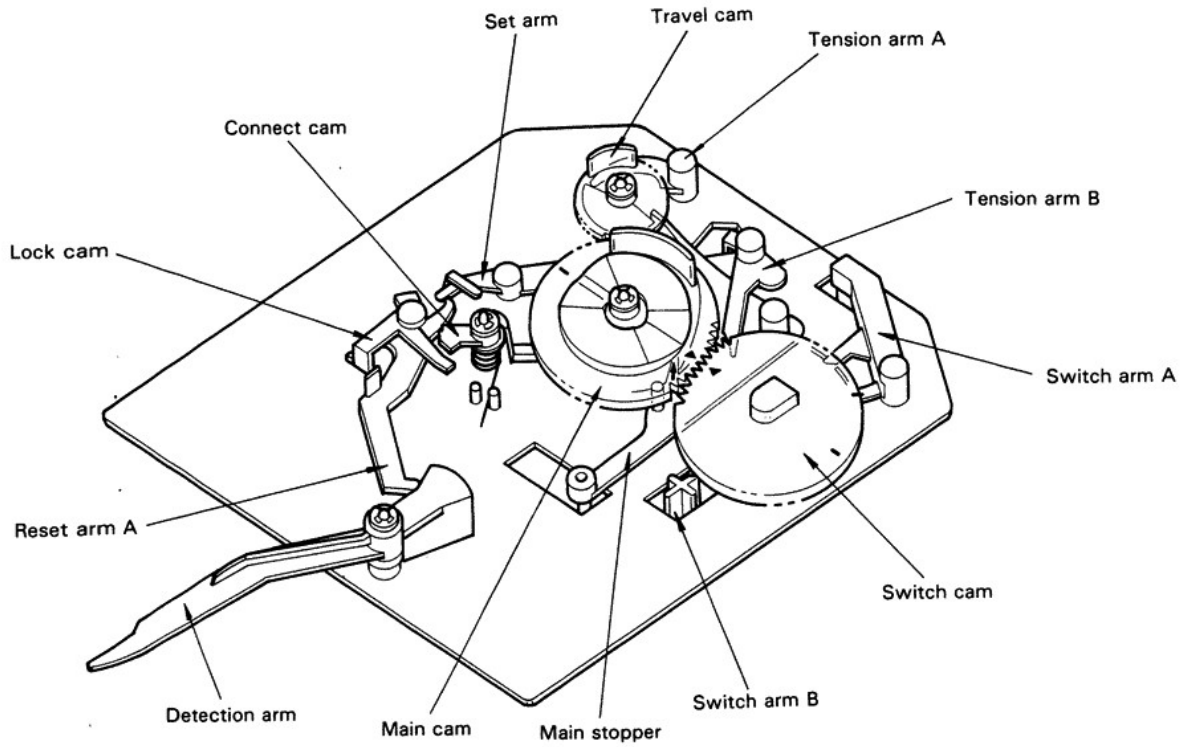
The output of the Hall element is further amplified and fed to the coil switching transistor. At high speeds, on the other hand, the output of the DC amplifier decreases, reducing the voltage generated by the Hall element and lowering its torque.

MECHANISM DESCRIPTION

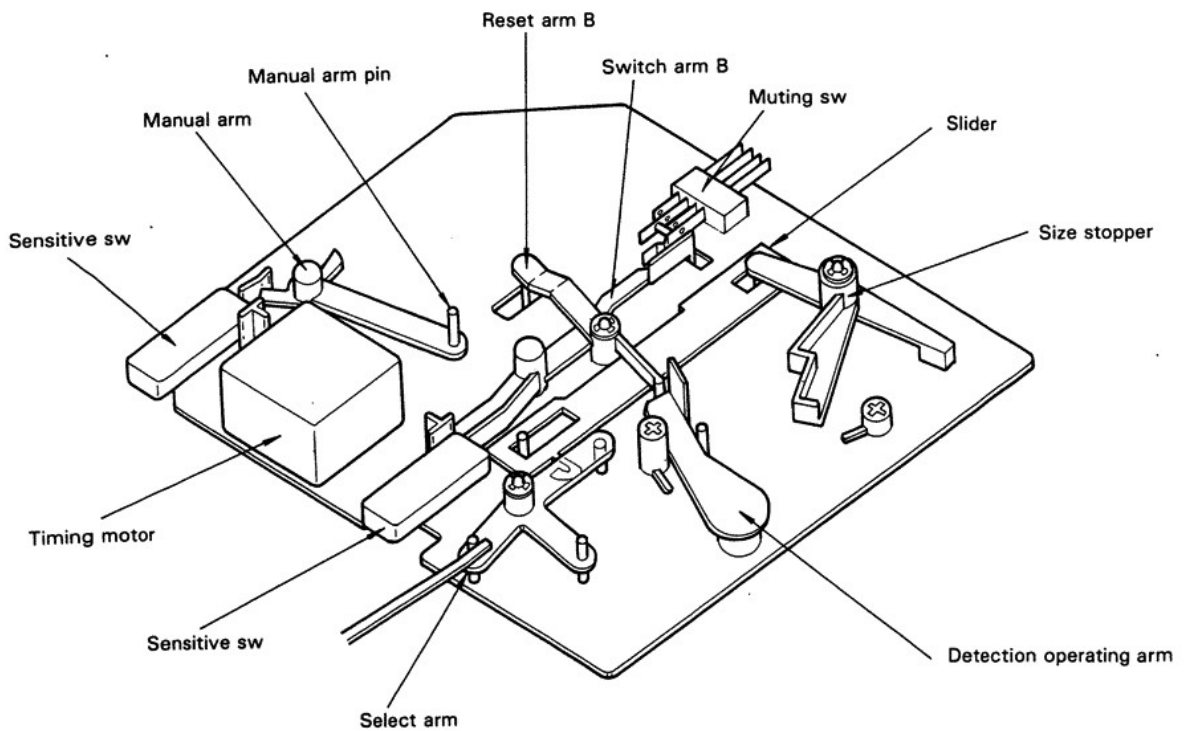
AUTOMATIC OPERATION

AUTO-IN

AUTO-IN operation starts when the PLAY/CUT switch is pressed while the main cam is at stop position and the tonearm on the rest.



< Parts name and location > Top view



< Parts name and location > Bottom view

MECHANISM DESCRIPTION

MANUAL

The tonearm is lifted and swung to the platter manually. The timing motor switch is turned on when the tonearm is moved inwards about $10 \sim 15^\circ$. Then, after about 5.6 seconds (60 Hz) or 6.7 seconds (50 Hz), the tonearm is automatically lowered.

REPEAT

REPEAT operation is enabled when the REPEAT switch (lock-in type) is ON. The REPEAT switch can be released when the CUT switch is operated.

RETURN

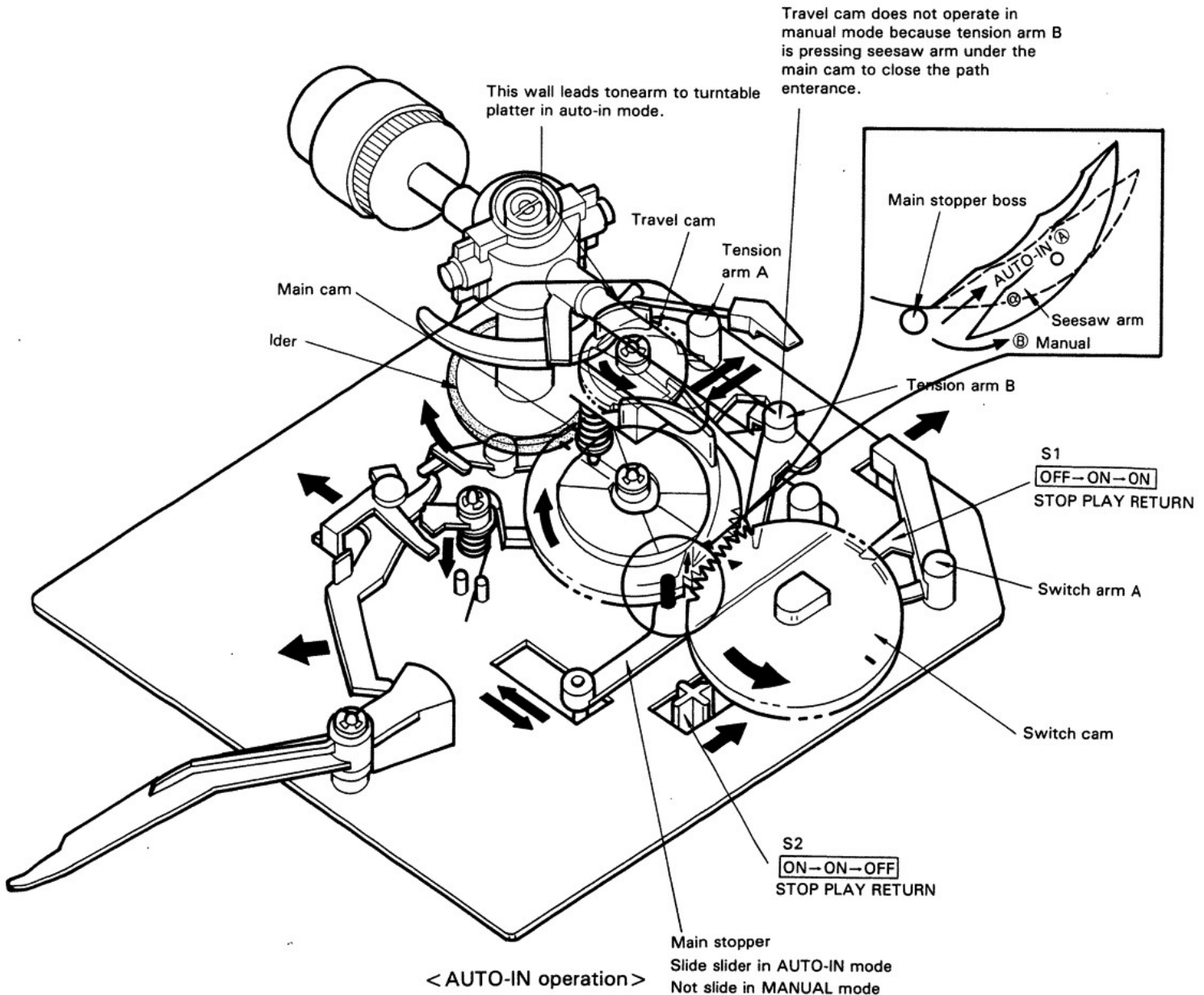
RETURN operation automatically starts when the end of a record is mechanically detected or when the CUT switch is operated. If the tonearm is stopped by hand during the RETURN operation, operation is switched into the MANUAL mode.

Automatic Mechanism Operation

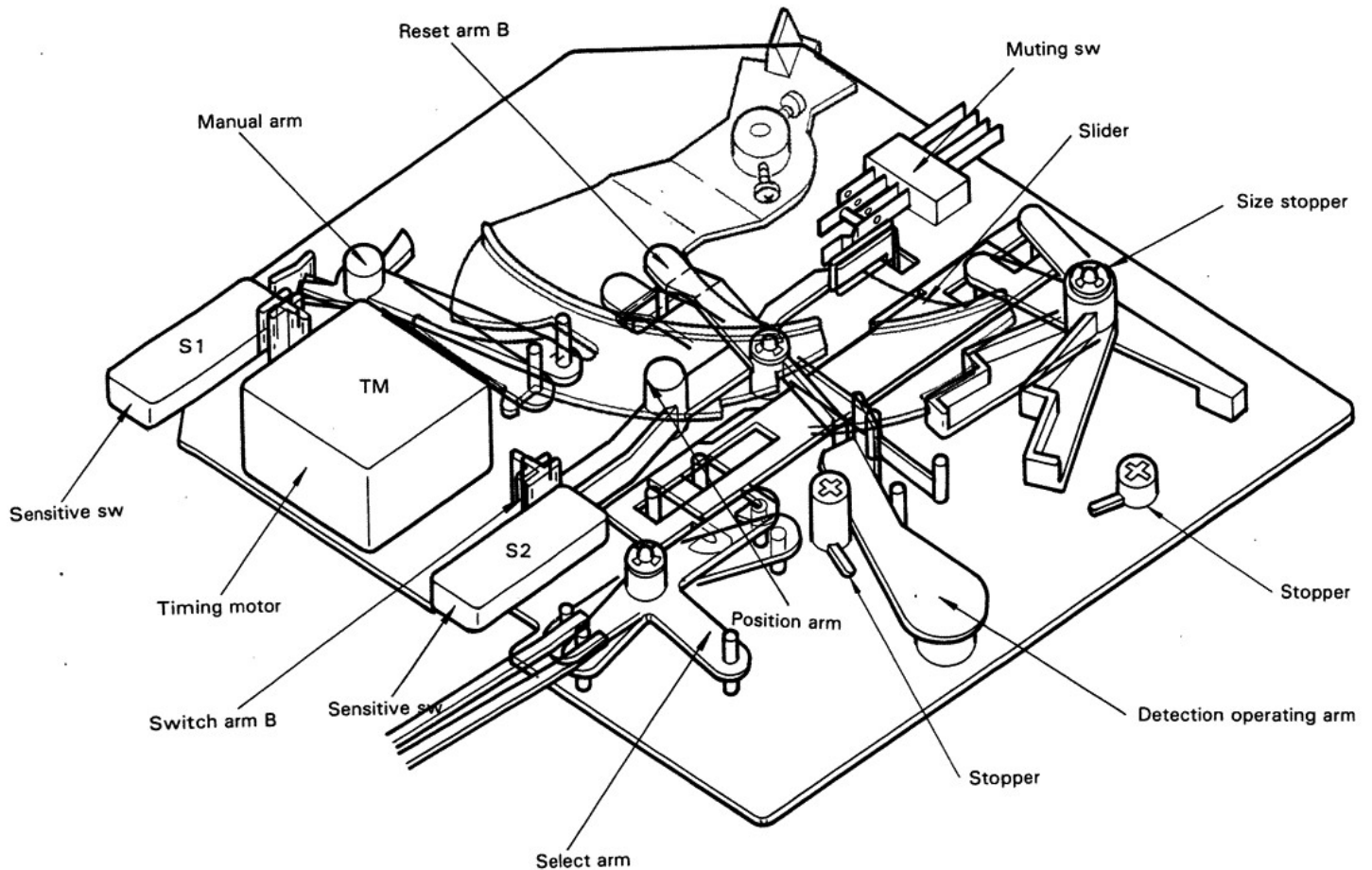
The switch cam rotates counterclockwise one turn for each clockwise revolution of the main cam. One AUTO-IN or RETURN operation cycle is completed by a half turn of the main cam. These cams are driven by the timing motor according to the ON-OFF states of sensitive switches S_1 and S_2 . (See "Basic Operation Circuit" on page 5 and the assembly diagram on page 5).

AUTO-IN

When the START/STOP switch is operated, timing motor starts rotating with switch cam. Switch cam pushes down switch arm A to turn sensitive switch S_1 (K_1) ON. Then, timing switch is kept ON mechanically so that the timing motor rotates continuously.



MECHANISM DESCRIPTION



< Slider operation >

Main cam rotates along with switch cam. When main cam starts rotating, seesaw arm ① is in the AUTO-IN position indicated by the solid outline in figure. If the tonearm is moved before main cam rotates to a certain position, seesaw arm ① is set in the MANUAL position indicated by the dotted outline in figure by tension arm B. (See "MANUAL START".) The tonearm must be in the rest position when AUTO-IN operation is to be started. Therefore, seesaw arm ① remains in the AUTO-IN position (solid line). The boss ($\phi 3$) on main stopper, which is coupled with main cam, is then allowed to move as shown by arrow A in figure, so that main stopper rotates clockwise. Travel cam, which has been stopped by tension arm, then moves to intermesh with the gear of main cam.

As travel cam rotates, it pushes the idler of clutch assembly to move the tonearm.

As main stopper rotates, the slider moves. When the record size is set to 17 cm, select arm is not rotated, but when the record size is set to 30 cm, select arm is rotated. The mechanism will not be damaged if the record size is switched while the tonearm is moving, but it is not certain where between the 17 cm and 30 cm positions the tonearm will be lowered. Slider stops at either size position according to the position of select arm. Size stopper is rotated to the selected size position by the movement of the slider. The above operations are completed before the tonearm is shifted. As the tonearm shifts, the position arm is swung until it is stopped by size stopper. Since the idler of clutch assembly is still in contact with travel cam, the clutch assembly slips at the felt part to absorb the rotational force of the travel cam. After the idler moves away from travel cam, size stopper is released. If connect cam is unlocked, the $\phi 3$ boss on main cam causes it to be returned to the lock position, where it is locked by lock cam.

Then, the boss on main cam pushes set arm to free detection arm, which is pushed against the eccentric sleeve, so that the end of the record can be detected.

After all the above operations have been completed, switch arm B is set to the OFF state and timing motor stops.