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PS-1800



Specifications

- Turntable :** 12" 2lb diecast aluminum with automatic tone arm return system
Speed 33- $\frac{1}{3}$, 45 rpm servo system
- Tone Arm :** SONY PUA-230 static balanced type
- Cartridge :** SONY VM-11G
(CANADA and general export model only)
- Stylus :** SONY ND-115G 0.5 mil diamond
- Power Requirements :** 117V AC 50/60 Hz (USA & CANADA)
100, 117, 220, 240V, AC 50/60 Hz (General Export Model)
- Power Consumption :** 5W
- Dimensions :** 19- $\frac{5}{16}$ " (W) \times 17- $\frac{1}{16}$ " (H) \times 16- $\frac{1}{4}$ " (D)
(490 \times 180 \times 413 mm)
- Weight :** 20 lb 14 oz (9.5 kg)

SONY®
SERVICE MANUAL

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SECTION 1

THEORY OF OPERATION

GENERAL INFORMATION

The PS-1800 employs a slow-speed servo-controlled dc motor to drive the turntable and features a unique mechanism to return the tone arm to rest and shut down the system at the end of the record. The use of a slow speed motor eliminates much of the noise and rumble that originates in mechanical speed reducing systems.

This unique servo system effectively compares motor speed with a very stable frequency reference.

Any error in motor speed results in a correction in the current supplied to the motor. The speed reference is entirely independent of outside influence. Line frequency is used only to power the strobe light.

In addition, a fully electronic sensing mechanism using the SONY MAGNETO DIODE (SMD) makes a feather touch automatic tone arm return system possible without placing any mechanical load on the tone arm.

TECHNICAL SPECIFICATIONS

I) General

Speeds :	33- $\frac{1}{3}$ rpm and 45 rpm
Speed Control Range :	$\pm 4\%$
Start-up Time :	within 0.5 seconds
Flutter and Wow :	less than 0.08% rms
Signal-to-Noise Ratio :	greater than 60 dB (NAB Standard)
Turntable Vertical Motion :	within $\frac{1}{32}$ " (0.1mm)
Power Requirements :	117V AC 50/60 Hz (USA & CANADA Model) 100, 117, 220, 240V AC 50/60 Hz (General Export Model)

Power Consumption :	5W
Turntable :	12" (300mm), 2 lb (0.9kg) diecast aluminum
Weight :	20 lb 14 oz (9.5kg)
Dimensions :	19- $\frac{5}{16}$ " (W) \times 17- $\frac{1}{16}$ " (H) \times 16- $\frac{1}{4}$ " (D) (490 \times 180 \times 413mm)

II) Tone Arm

Pivot to stylus length :	9- $\frac{1}{16}$ " (230mm)
Overhang :	$\frac{9}{16}$ " (14mm)
Tracking Error :	1° 24'
Stylus Force Adjustment Range :	0 to 3 grams (with click-stop 0.5 gram increments)

Cartridge Weight Range :	4.5 to 11 grams
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III) Cartridge (CSA and General export model)

Output Voltage :	4 mV
Load Impedance :	50 kohms
Frequency Response :	10~20,000Hz
Channel Separation :	30 dB at 1,000Hz 25 dB at 10,000Hz
Compliance :	20×10^{-6} cm/dyne
Optimum Stylus Force :	2 grams
Stylus :	0.5 mil diamond (ND-115G)

CIRCUIT DESCRIPTION

Basic servo action is illustrated in the block diagram of Fig. 1-1. In this system the rotational speed of the turntable is measured by a tone generator, a mid-frequency ac generator that is coupled to the shaft of the drive motor. The frequency of the signal produced by this tone generator is proportional to speed.

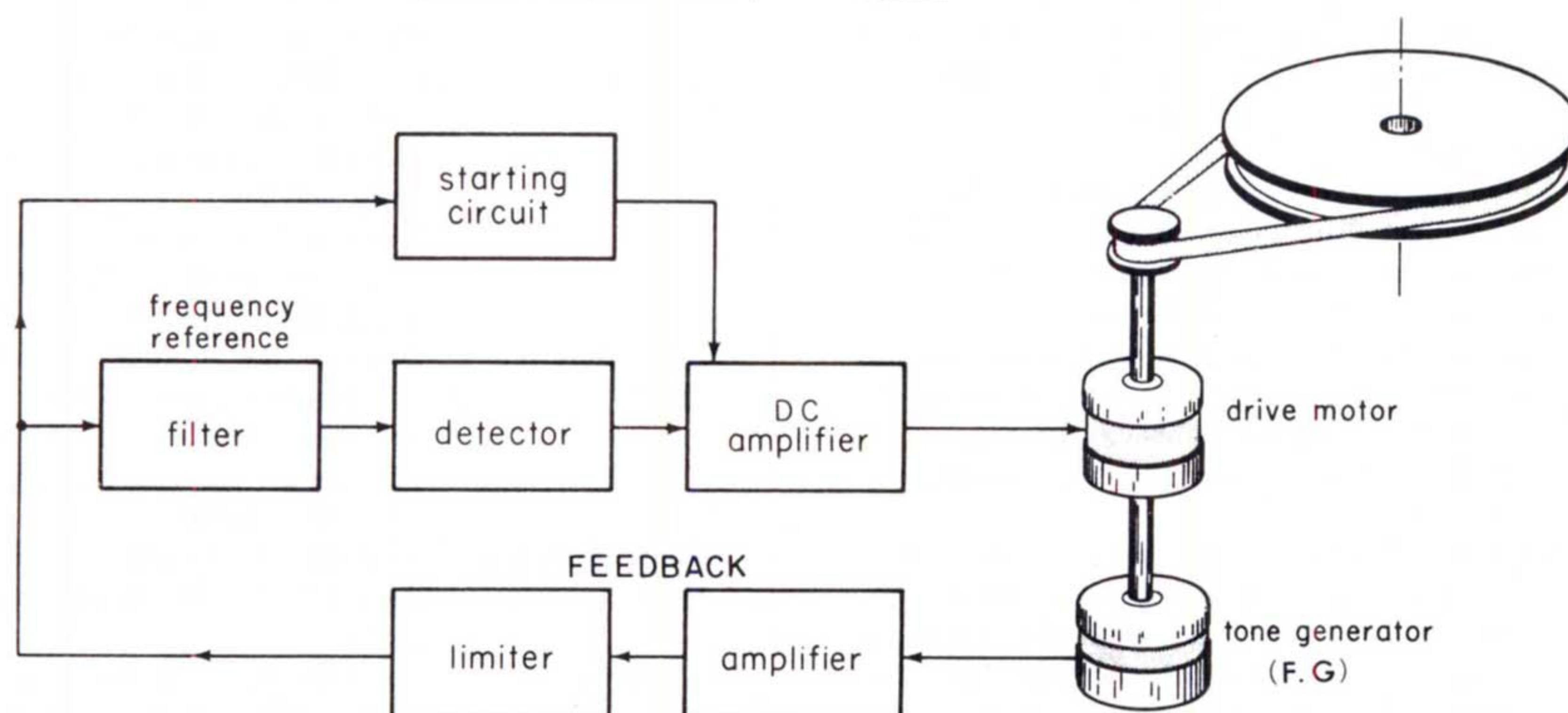


Fig. 1-1 Block Diagram of Servo System

The signal is amplified and limited to remove all amplitude variations. It is then passed through a passive RC filter which serves as the speed reference for the system. The output of this filter falls when speed exceeds the design figure and rises if speed falls below the design point.

Following the filter is a detector, which is simply a fullwave rectifier and ripple filter.

The output of the detector is a dc voltage that controls the conduction of a two-phase dc amplifier which, in turn, controls the current supplied to the motor. Operating characteristics of the servo system are shown on the graph of Fig. 1-2. The dashed line illustrates the frequency-versus-speed relationship for the tone generator. The solid graph is the response of the filter.

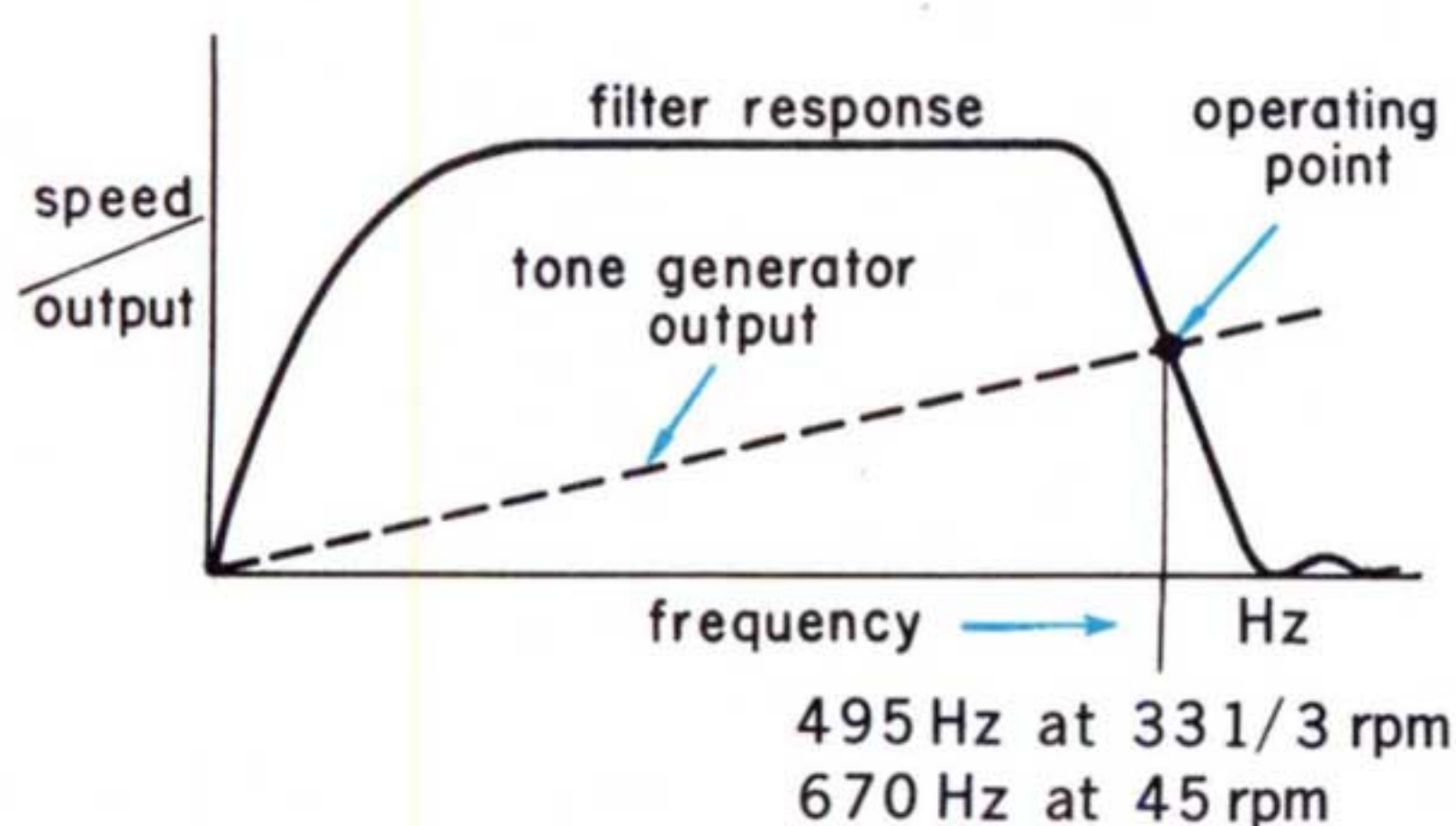


Fig. 1-2 Operating Characteristics

A stable operating point for the system occurs where the two graphs cross, and the system acts to maintain this operating point. For example, if the motor should turn faster (perhaps due to a decrease in mechanical load) the output frequency of the tone generator would rise.

This would cause a drop in the output of the filter and a subsequent drop in motor current and speed. Thus the system automatically corrects changes in rotational speed regardless of the cause.

A very tight control of speed is maintained because the slope of the filter response is very steep at the operating point (60 dB per octave or more).

Thus a slight change in speed results in a large correction current.

Following is a description of the functions of all stages and controls. The description follows the signal path. Stages are listed with the reference designations of their transistors, where applicable. For a better understanding of the description that follows refer to the block diagram on page 3 and the schematic diagram on page 16~17.

Stage/Control	Function
Tone Generator	The Tone (Frequency) generator (FG) is directly coupled to the shaft of the drive motor, thus allowing speed to be converted into frequency most effectively. The output of the tone generator is compared with a very stable frequency reference. This conventional common-emitter amplifier amplifies the small signal produced by the tone generator to the level required at the input of the filter circuit.
Ac Amplifier Q 101	
Limiter D101, 102	Removes all amplitude variations from the signal. Each diode making up this two diode limiter conducts when the signal across it exceeds the barrier potential (0.6V) in a forward biased condition. Thus, the output signal is limited to 1.2V peak-to-peak.
Low-pass Filter R104, 105 C103, 104	This two stage RC passive filter eliminates not only higher order harmonics but also unwanted noise to extract only the fundamental frequency component.
Twin-T Filter R106-R110 C105-C109 R111-R115 C108-C110	Makes use of phase shift cancellation to achieve very sharp cutoff at the desired frequency. The rate at which the filter response falls to cutoff is speeded up by negative feedback from voltage amplifier Q103. Two filters are employed to match the selected operating speed; 33 rpm or 45 rpm.
Emitter follower Q102	Accepts the output of either of the two twin-T filters and provides a high input impedance to prevent loading of the filter circuits.
Voltage Amplifier Q103	Amplifies the signal to the level required for the driver stage, Q104.
Fine Speed Adj. R121	Controls input signal level fed to the driver stage. Control is labeled "PITCH" on Stereo Player unit.

Stage/Control	Function
Driver Q104	This stage is basically a voltage amplifier that provides essentially flat response over its small operating range. It supplies the necessary interstage gain to drive the following rectifiers.
Voltage Doubler D104, 105	Rectifies the ac signal that appears at the output of driver Q104. The rectified signal is filtered by C117 and applied to the input of emitter follower Q105 in the form of a dc signal.
DC Amplifier Q105, 106	Following the voltage doubler is a two-stage power amplifier section in the Darlington configuration. This stage amplifies dc voltage and controls the current that is supplied to the drive motor. Q106 is a power transistor to meet the current demand of the motor.
Starting Circuit D102, 103	When power is applied to the Stereo Player by closing switch S3, a small current flows in transistor Q101, so that its collector voltage is close to B+. Since the collector of Q101 is coupled to the base of Q105 through D103, and D102, Q105 is quickly brought into conduction. As a result Q106 conducts heavily and a relatively large current is supplied to the drive motor to start it. As the combination motor and tone generator come up to their correct operating speed the tone generator's ac output increases and Q101 conducts more heavily than at first lowering its collector voltage to near zero. On the other hand dc voltage applied to the base of Q105 by the voltage doubler increases. This combined effect reverse biases D103 and effectively disconnects the base of Q105 from the components which cause heavy conduction when the Player is first turned on.

Stage/Control	Function
Automatic Return and Shutoff SMD D109 Q107, 108, 109	Automatically returns the tone arm to its rest position and shuts off power to the record player. The operation of these circuits are as follows:

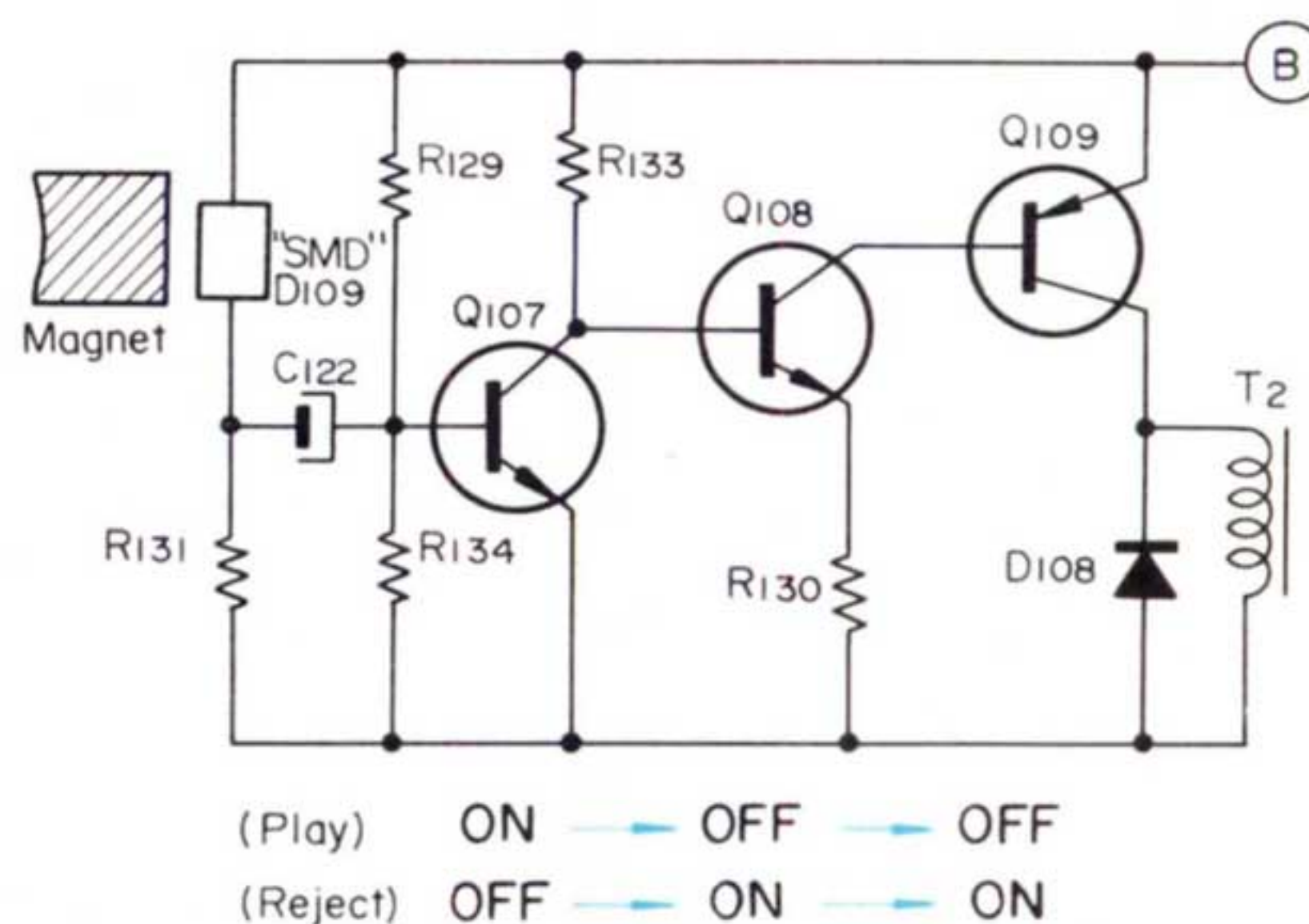


Fig. 1-3 Automatic Return and Shutoff Circuit

When the Stereo Player is in its normal playing mode, transistor Q107 is saturated by the voltage across R134. The zero or ground potential at the collector of Q107 is applied to the base of Q108 where it holds Q108 in a cut off condition. With Q108 cut off Q109 does not conduct and no current is supplied to solenoid T2.

When the Player's tone arm comes to the end of a record the tone arm is brought close to the center of the turntable.

This physically brings a permanent magnet into close proximity with an SMD (SONY Magneto Diode). The SMD is a newly developed device which is sensitive to a magnetic field. In this case the electrical resistance of the SMD increases when the magnet is brought close to it. This has the effect of increasing the voltage drop across the SMD, D109, and decreasing the voltage drop across R131. The decreasing positive

Stage/Control

Function

potential at the junction of D109 and R131 is coupled through C122 to the base of Q107 and considerably decreased conduction. The collector of Q107 consequently goes up to about + 4 volts. This positive-going voltage is applied to the base of Q108 where it causes this transistor to conduct and in turn causes Q109 to conduct heavily and supply current to solenoid T2.

T2 releases a latch that allows the silicone-oil damping mechanism to raise the Arm Lifter. Microswitch S3 is automatically opened and power is removed from the Stereo Player.

Strobe

The strobe unit, located at the front-center of the turntable well, provides a means of checking turntable speed against the local power-line frequency. Flashes from the neon lamp (100 or 120 flashes per second) are viewed through the small window attached to the motor-board. Speed is adjusted to make one of the chains of the display appear to stand still. Since the turntable operates from a d-c source, operation is entirely independent of the power line frequency. The power line frequency is used as a check of turntable speed.

Stage/Control

Function

Reject Button
S 2

This switch used to reject the tone arm anywhere on the record. When the switch is closed Q109 becomes deeply biased and energizes the solenoid. After this the operation is as mentioned earlier; the latch mechanism is released, the tone arm is brought back to its rest position, and switch S 3 is opened removing power from the Player.

Power Supply
D107,
C119, 120

A positive 12 volts for the system is provided by the half wave rectifier D107 and filter capacitors C119 and C120.

Voltage Selector
(General Export
Model only)

The voltage selector sets up the proper power transformer connections to suit local power line voltage conditions.

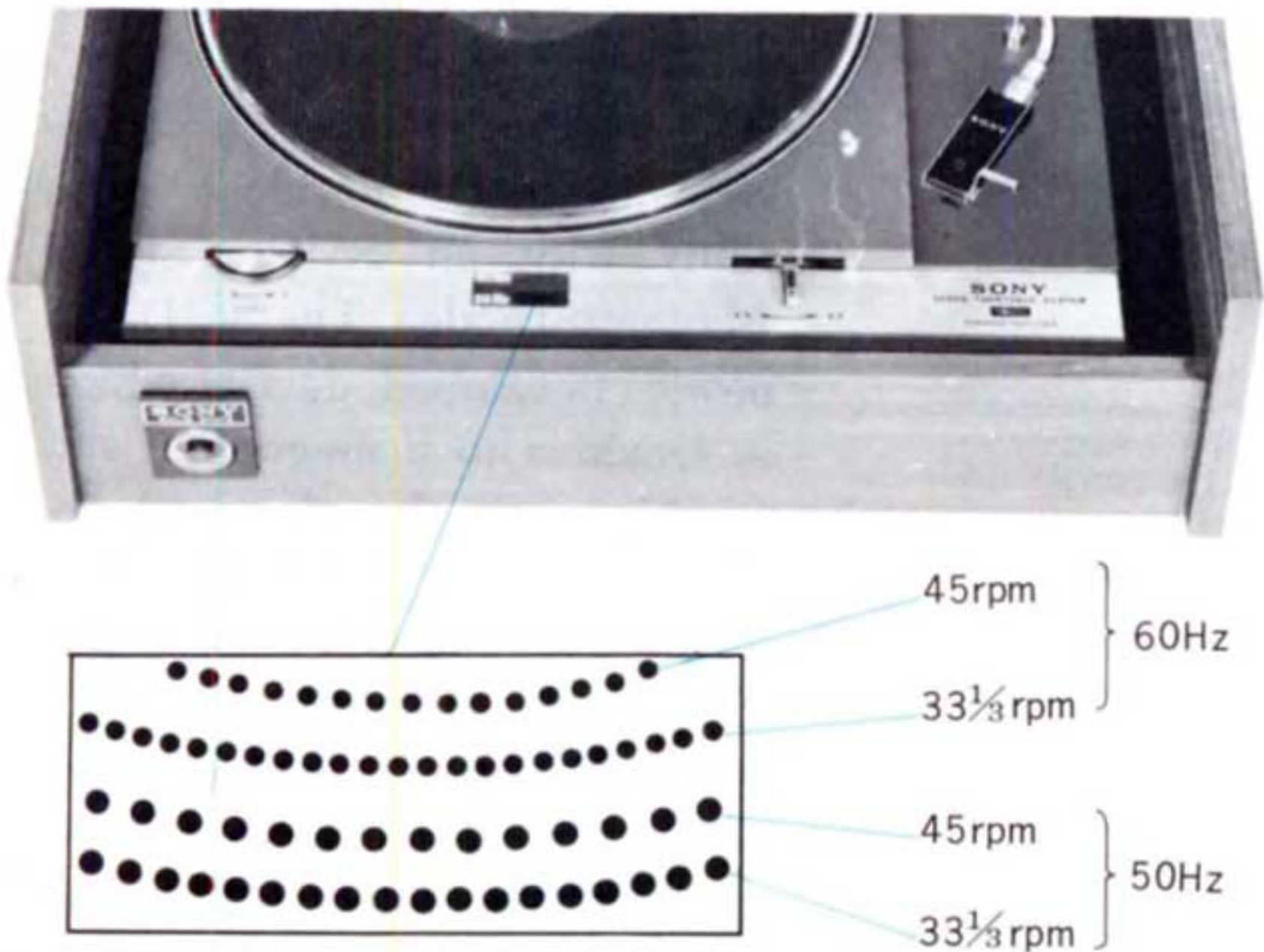
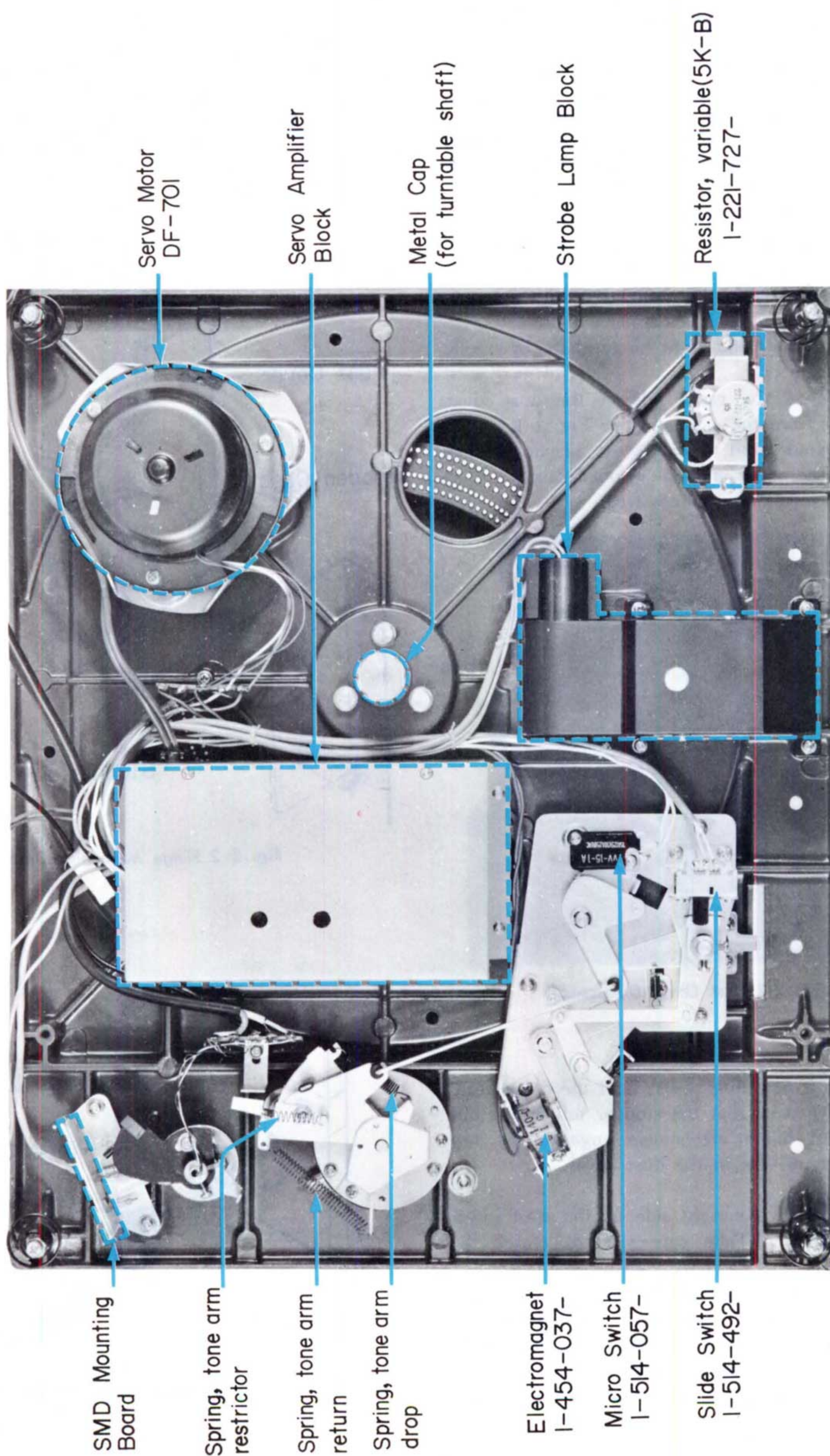


Fig. 1-4 Speed Indication on Strobe

TURNTABLE BASE LAYOUT

— Bottom Side —



SECTION 2 DISASSEMBLY AND REPLACEMENT OF PARTS

2-1 Dust Cover Replacement

1. Open the dust cover and pull off the plastic cap from the left hinge shaft.
Place a finger against the coil spring. With a screwdriver in your other hand, carefully unhook the spring from the notched hole in the side of the hinge mechanism.
2. Remove the two screws, that secure the hinge shafts, from the outsides of the wooden case.
Note: If necessary, prevent the right hinge shaft from rotating by holding it with a screwdriver.
3. Remove the left and right hinge shafts by simply pulling them off.
4. Slowly move the right side of the dust cover out away from the cabinet. See Fig. 2-1.
Position your hand to catch the plastic washer between the cover and the wooden case.
The dust cover now comes free.

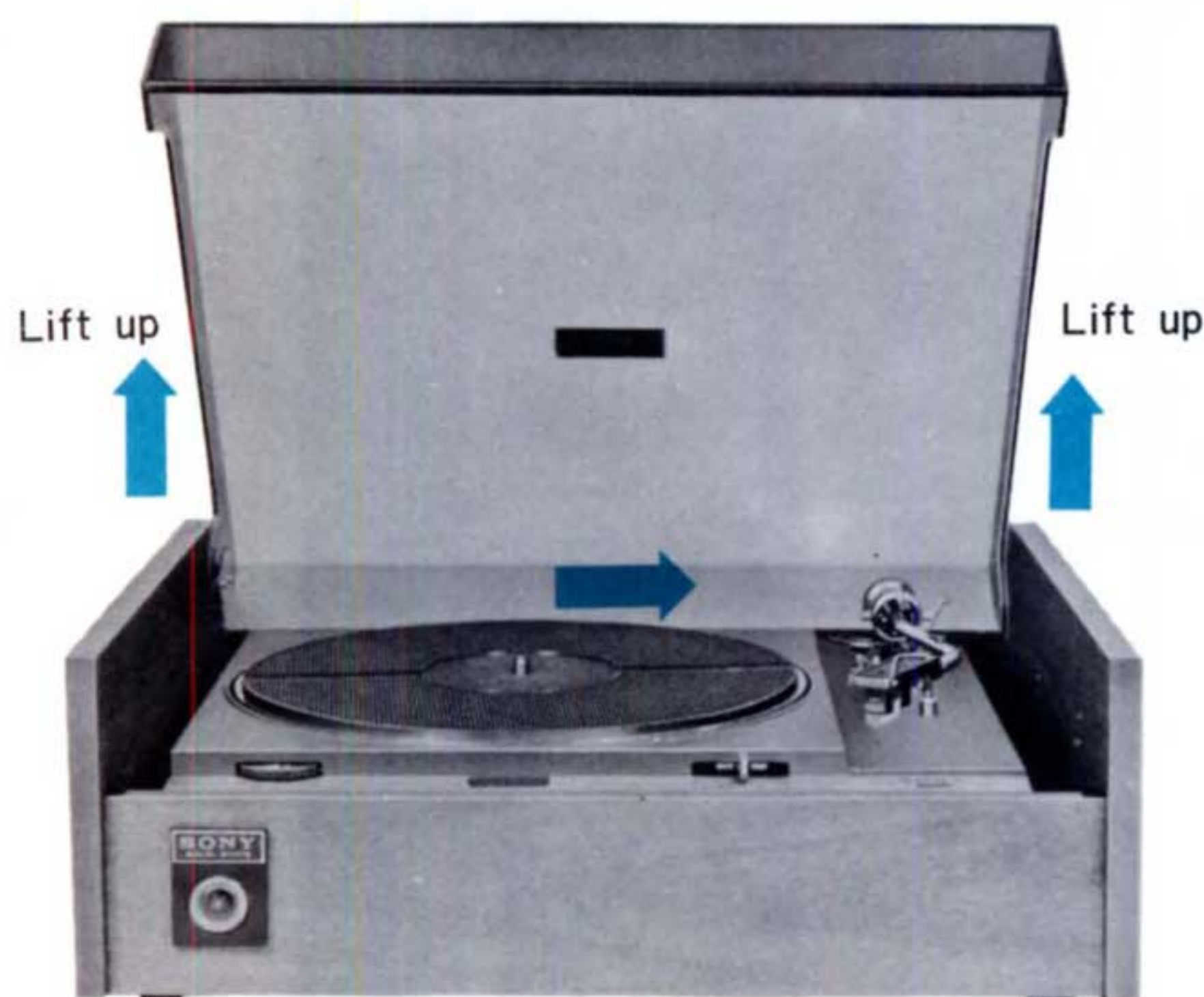


Fig. 2-1 Dust Cover Disassembly

5. To attach a new dust cover, hold the cover vertically. Move it so that the stopper tab jutting out of the left hinge mechanism engages the top portion of the slot in the dust cover. See Fig. 2-2.
Carefully move the right side of the dust cover into position. Take care not to scratch the cabinet.
6. Insert the left hinge shaft and position it correctly. Secure it with a screw and flatwasher.
7. Place the plastic washer between the dust cover and wooden case on the right side; then secure the right hinge shaft with a screw and flatwasher.

8. Fit the end of the coil spring into the slot of the left hinge shaft. Pull the other end toward you and hook it into the small square hole in the hinge mechanism. See Fig. 2-3.
Put the plastic cap back onto the hinge shaft.

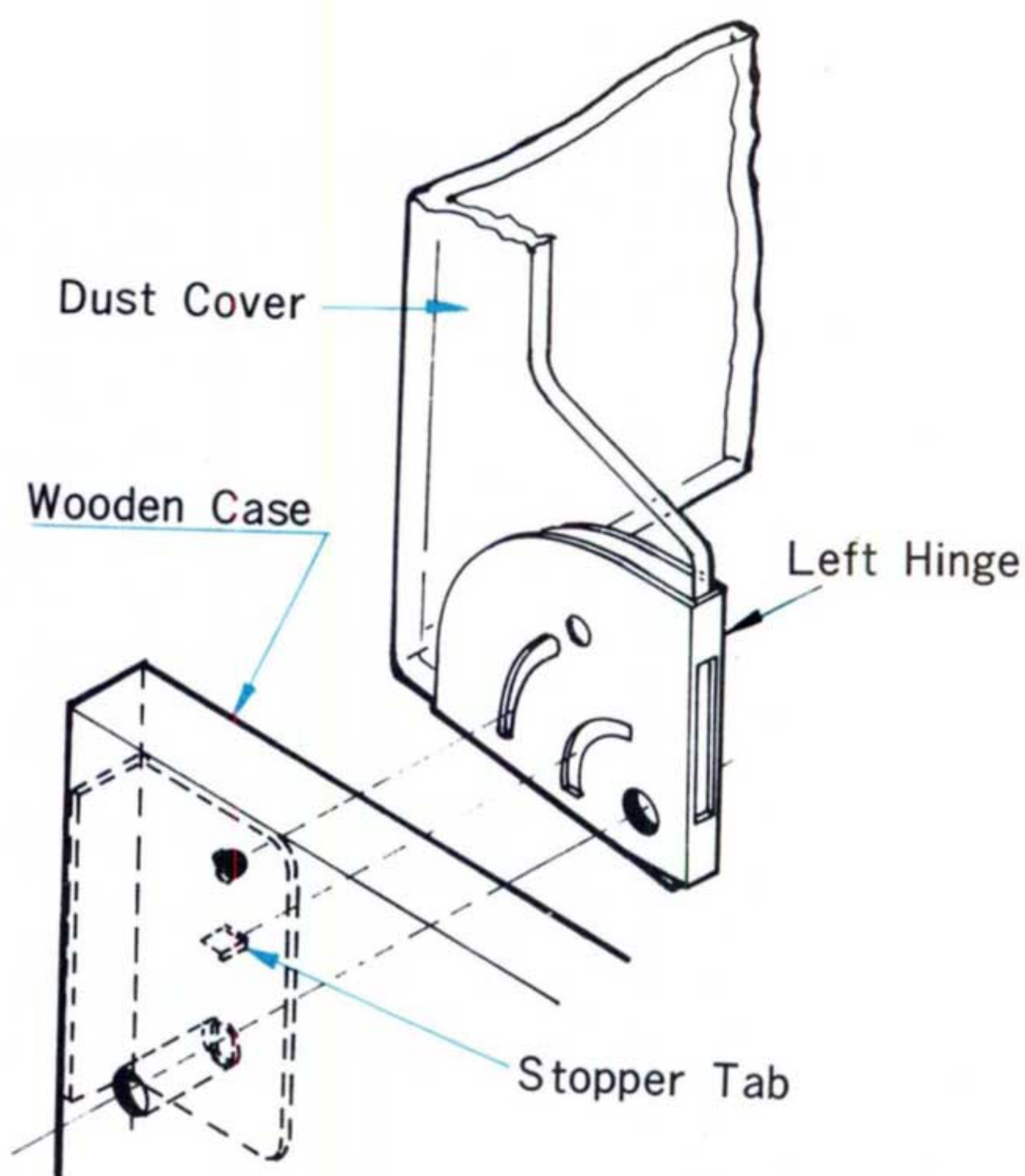


Fig. 2-2 Hinge Mechanism Details

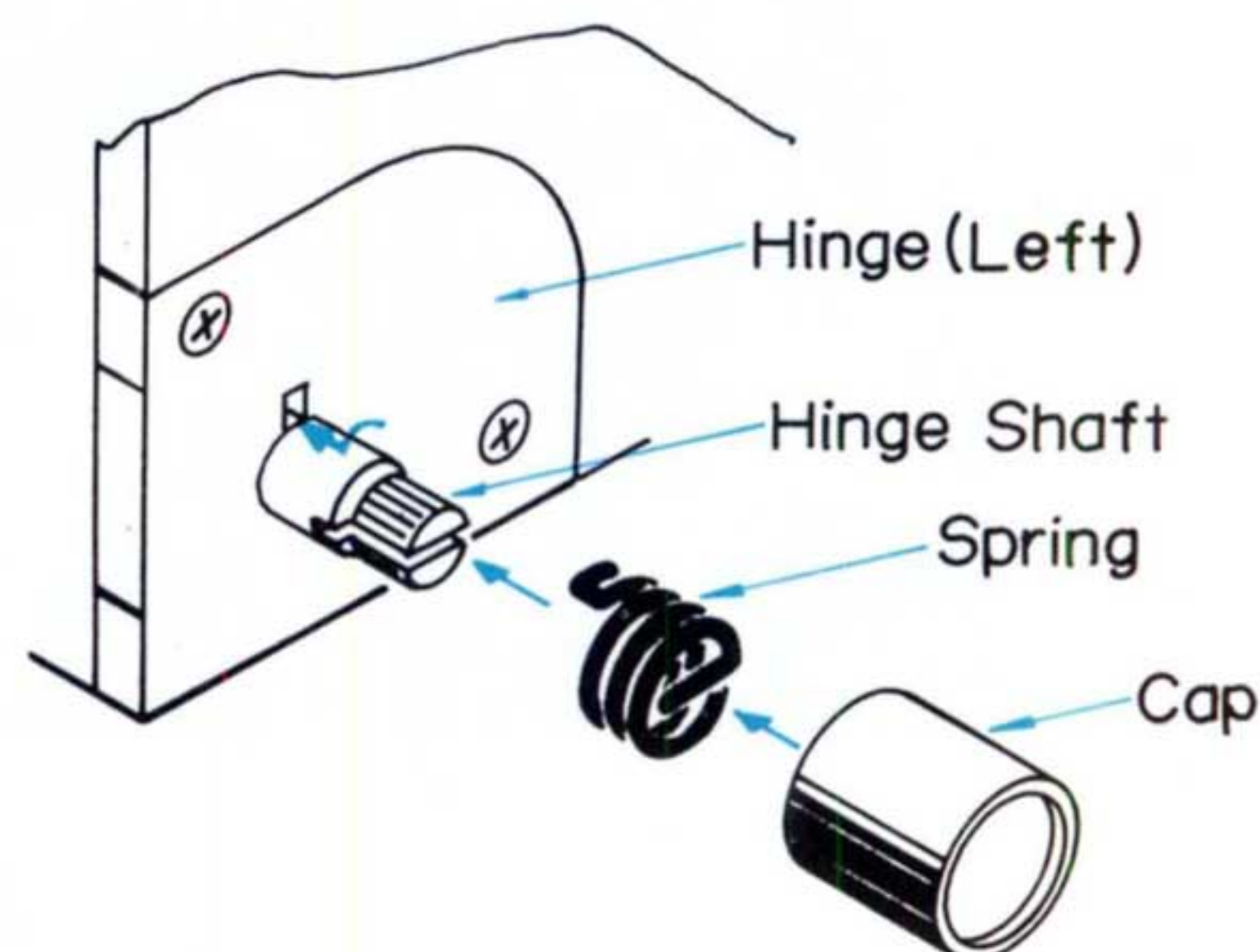


Fig. 2-3 Hinge Mechanism Details

2-2 Removal of Turntable

1. Remove the rubber mat from the turntable.
2. Insert both your fingers into the two holes of the turntable with one of the thumbs placed inside of the rubber belt to hook it off, as shown in Fig. 2-4.
3. Lift the turntable straight up and carefully place it on some protective pad with the shaft up.

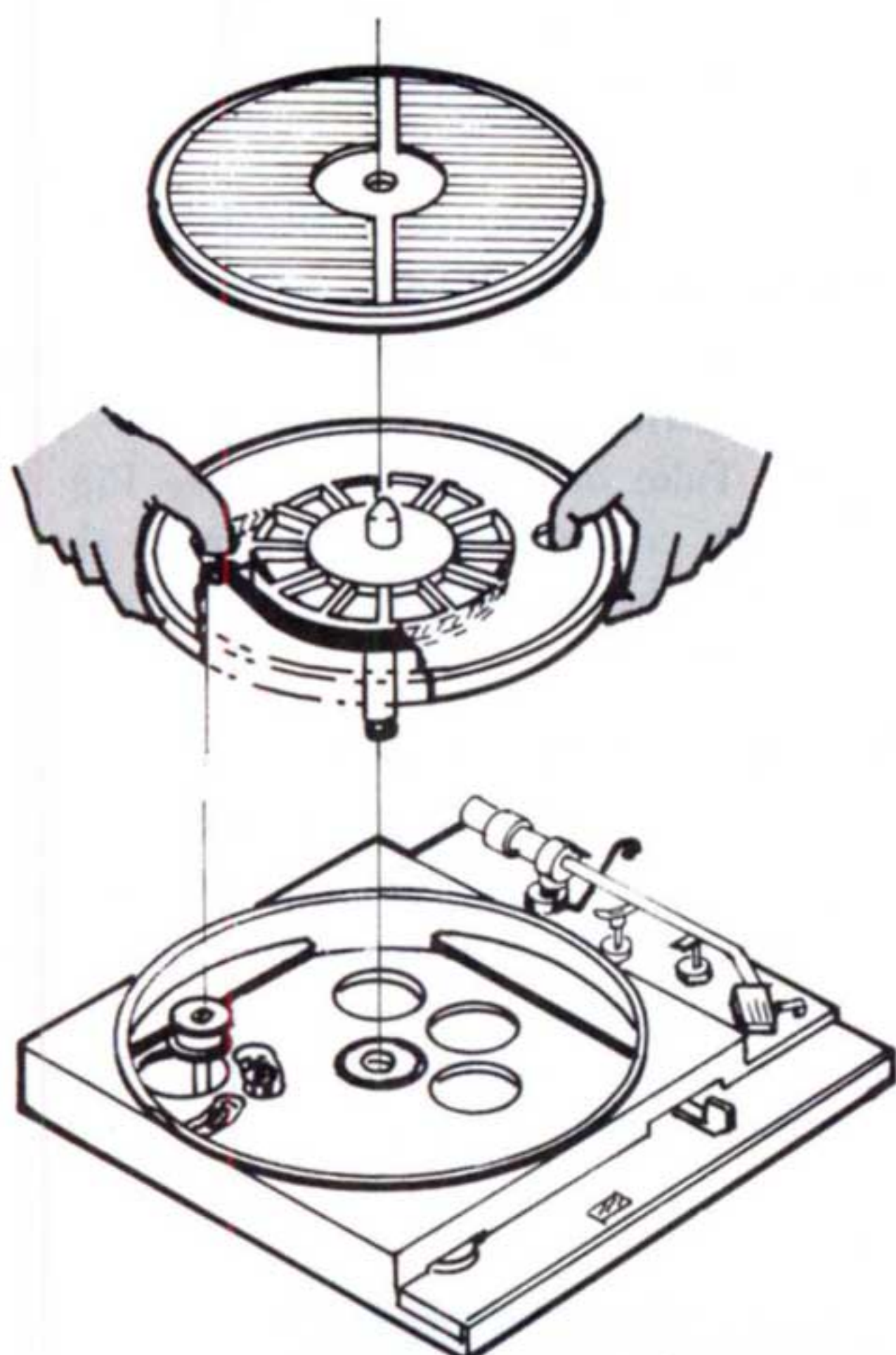


Fig. 2-4 Removal of Turntable

2-3 Removal of Turntable Base

1. Remove the turntable. See Section 2-2.
2. Remove the motor transit screw from the bottom of the wooden case as shown in Fig. 2-5 if it has not yet been removed.

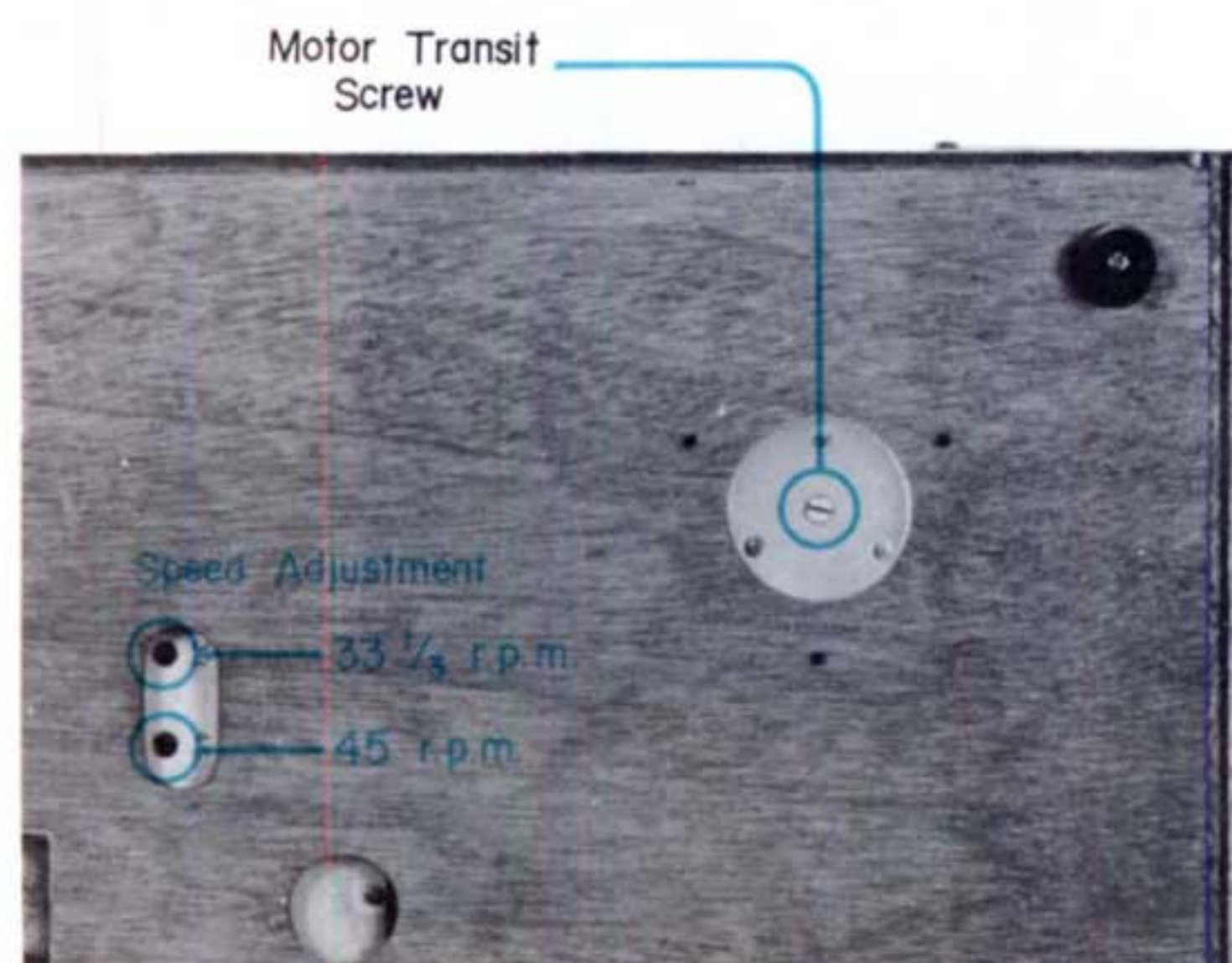


Fig. 2-5 Transit Screw for the Motor

3. Remove the four transit screws (+RF 4 ϕ \times 20) from the turntable base as shown in Fig. 2-6 if they have not yet been removed.
4. Carefully lift the turntable base while disconnecting the four lead wires from the 4-p terminal board and place it on a protective pad. See Fig. 2-7.

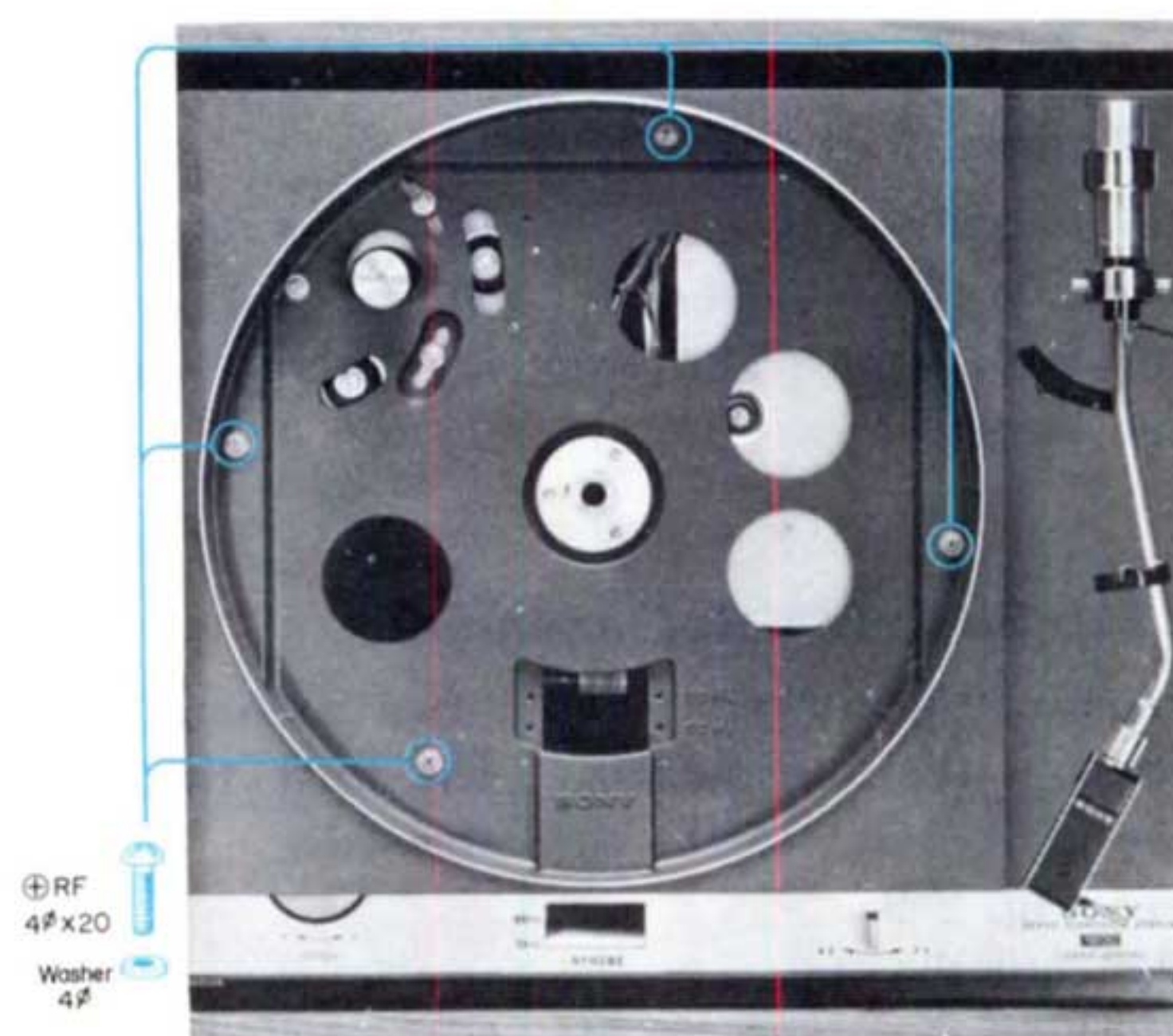


Fig. 2-6 Transit Screw for Turntable Base

CAUTION

Take note that the two removable blue wires are connected to the terminals on one side of the terminal board. This is the side that contains the two soldered-in blue wires. The two gray removable wires are connected to the other side of the terminal board. Make sure that when you reconnect the wires to this terminal board that you connect them as noted above.

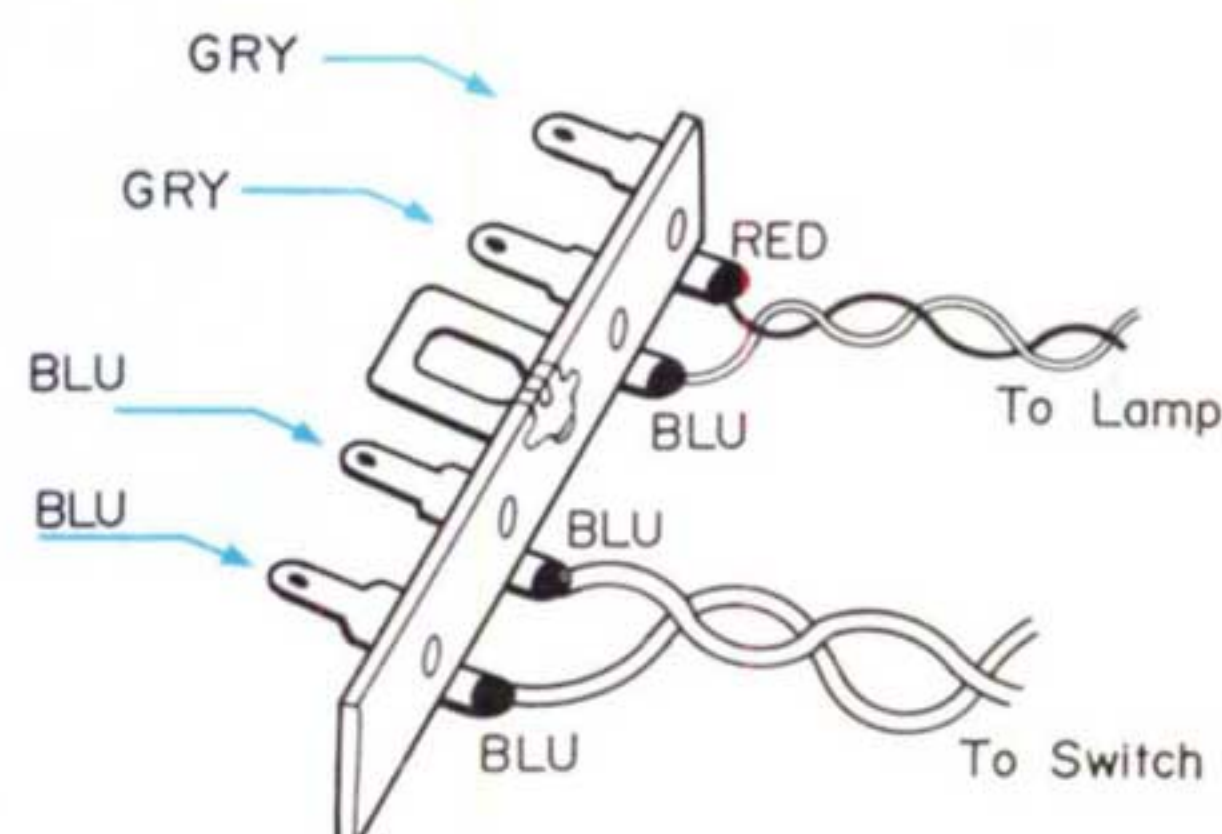


Fig. 2-7 4-P Terminal Wiring

2-4 Removal of Servo Amplifier Chassis

1. Remove the turntable base. See Section 2-2.
2. Remove the two self tapping screws from the servo amp chassis as shown in Fig. 2-9.
3. Turn the chassis in the direction of the arrow in Fig. 2-9. Now the entire servo amp unit can be removed for service.
4. To remove the printed circuit board twist the two hooks that secure the board to the chassis with a pair of pliers and slide the board off the brackets.

2-5 Removal of Sub Chassis

1. Remove the servo amp chassis. See Section 2-4.
2. Remove the four screws (+RF 3 ϕ \times 6) from the turntable base. This frees the sub chassis from the base.

2-6 Strobe Lamp Replacement

1. Remove the turntable base. See Section 2-3.
2. Remove the four screws (+RF 3 ϕ \times 8) that secure the strobe unit to the turntable base. See Fig. 2-9.
Pull out the unit.
3. Slide off the cover of the lamp socket and pry out the lamp. See Fig. 2-8.
4. Unsolder the lead wire and install the new lamp.

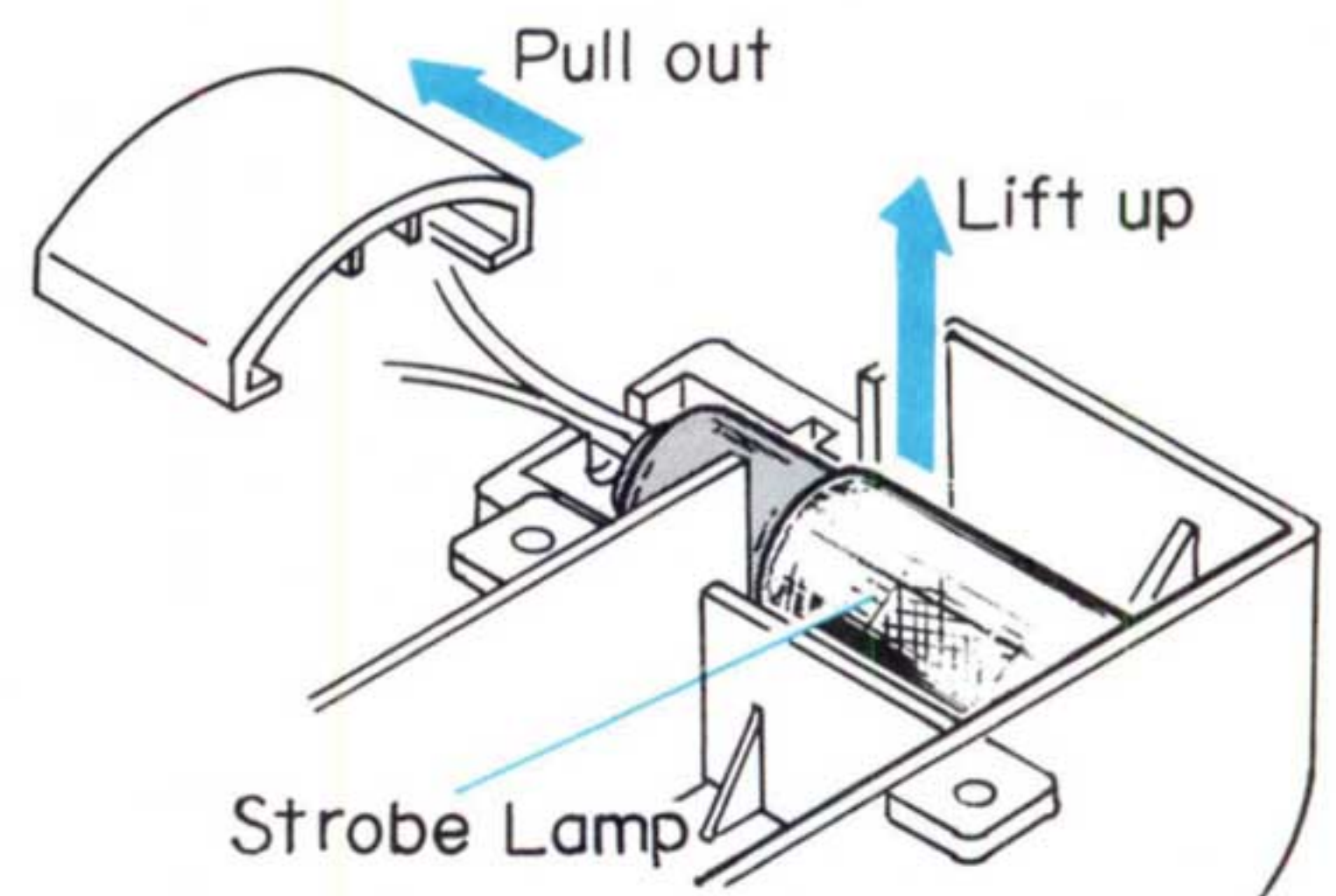


Fig. 2-8 Strobe Lamp Replacement

2-7 Fine Speed Adj. Replacement

1. Remove the turntable base. See Section 2-3.
2. Remove the two screws (+RF 3 ϕ \times 6) from the bracket. Take off the bracket. See Fig. 2-9.
3. Pull off the control knob and remove the hexnut that secures the control to the bracket. Install the replacement.

2-8 Tone Arm Replacement

1. Remove the turntable base. See Section 2-3.
2. Unsolder the five wires coming out of the tone arm shaft from the 5-p terminal board to which they are connected. Take note of the color of the wire connected to each terminal. See Fig. 2-10.

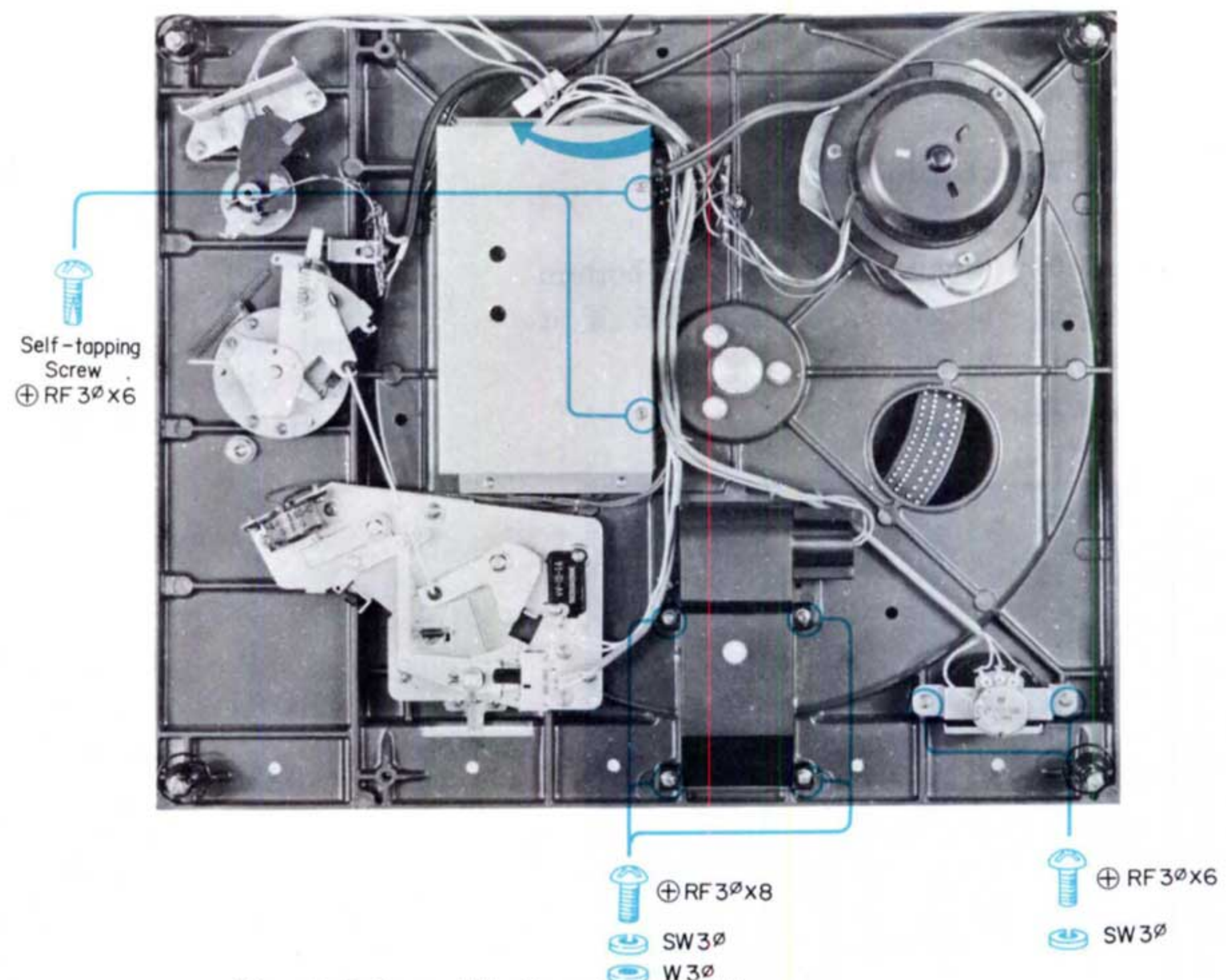


Fig. 2-9 Turntable Base Bottom View

3. Remove the permanent magnet mounting bracket assembly by loosening the two set screws (+RF3 ϕ ×8). To reinstall, see sensing mechanism height adjustment, Section 3-7 on page 13.
 4. Loosen the set screw that secures the tone arm shaft to the tone arm base. This set screw is found on the top side of the turntable base.
- Now remove the tone arm.
5. Install the replacement and perform the tone arm height adjustment.
- See Section 3-4 on page 12.

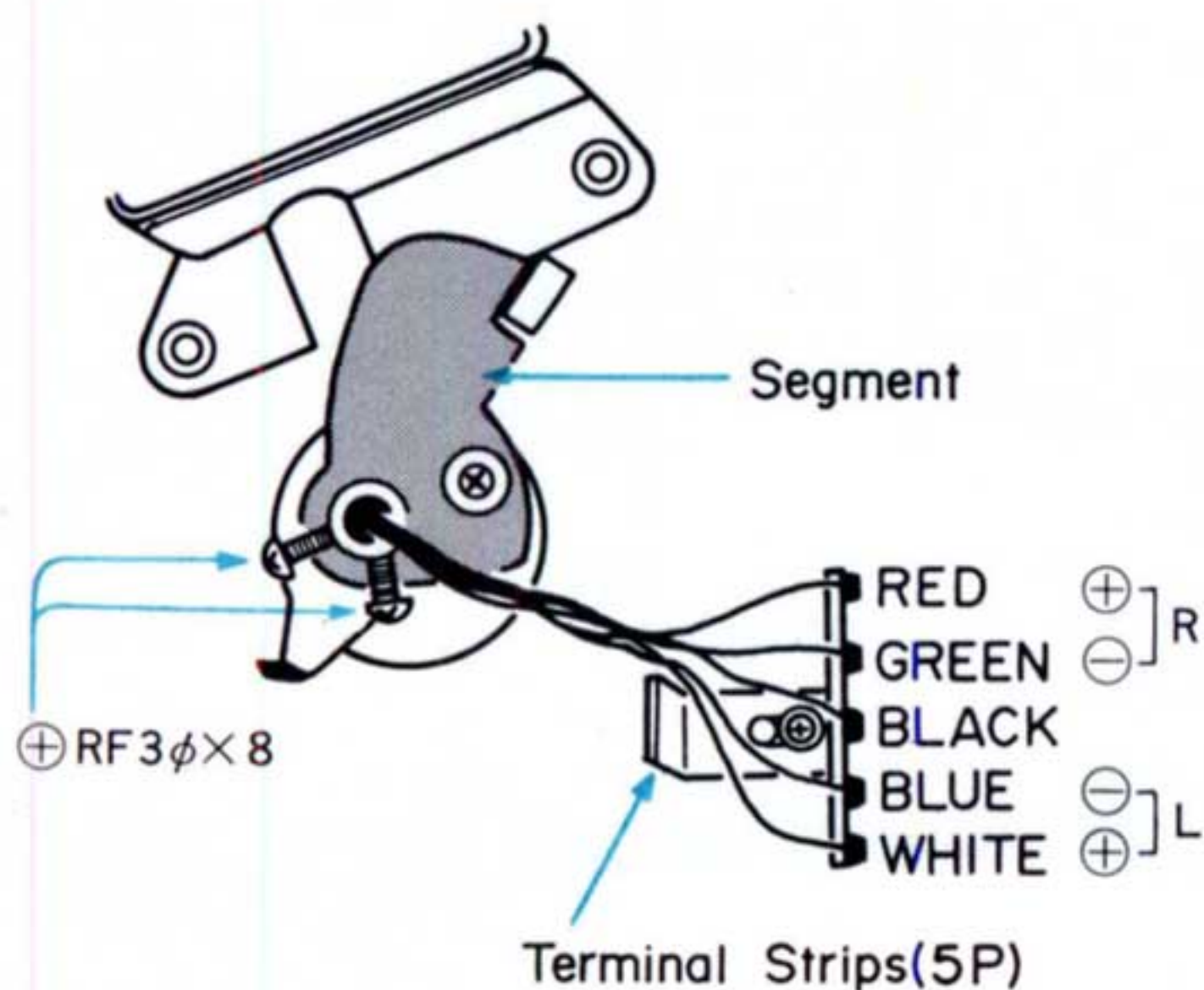


Fig. 2-10 Tone Arm Wiring

2-9 FG/DM Motor Replacement

1. Remove the turntable base. See Section 2-3.
 2. Unsolder four lead wires from 4-p terminal which mediate between motor and servo amplifier board.
 3. Remove the drive pulley from the motor shaft by loosening the two set screws as shown in Fig. 2-11.
- Pull off the pulley, to reinstall see pulley height adjustment. See section 3-8.

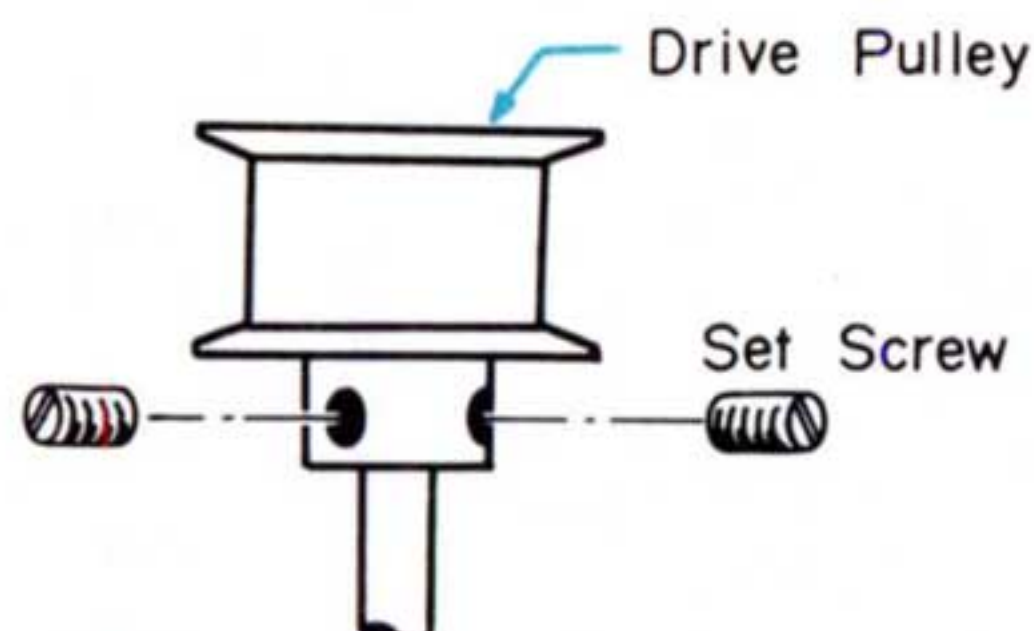


Fig. 2-11 Removal of Drive Pulley

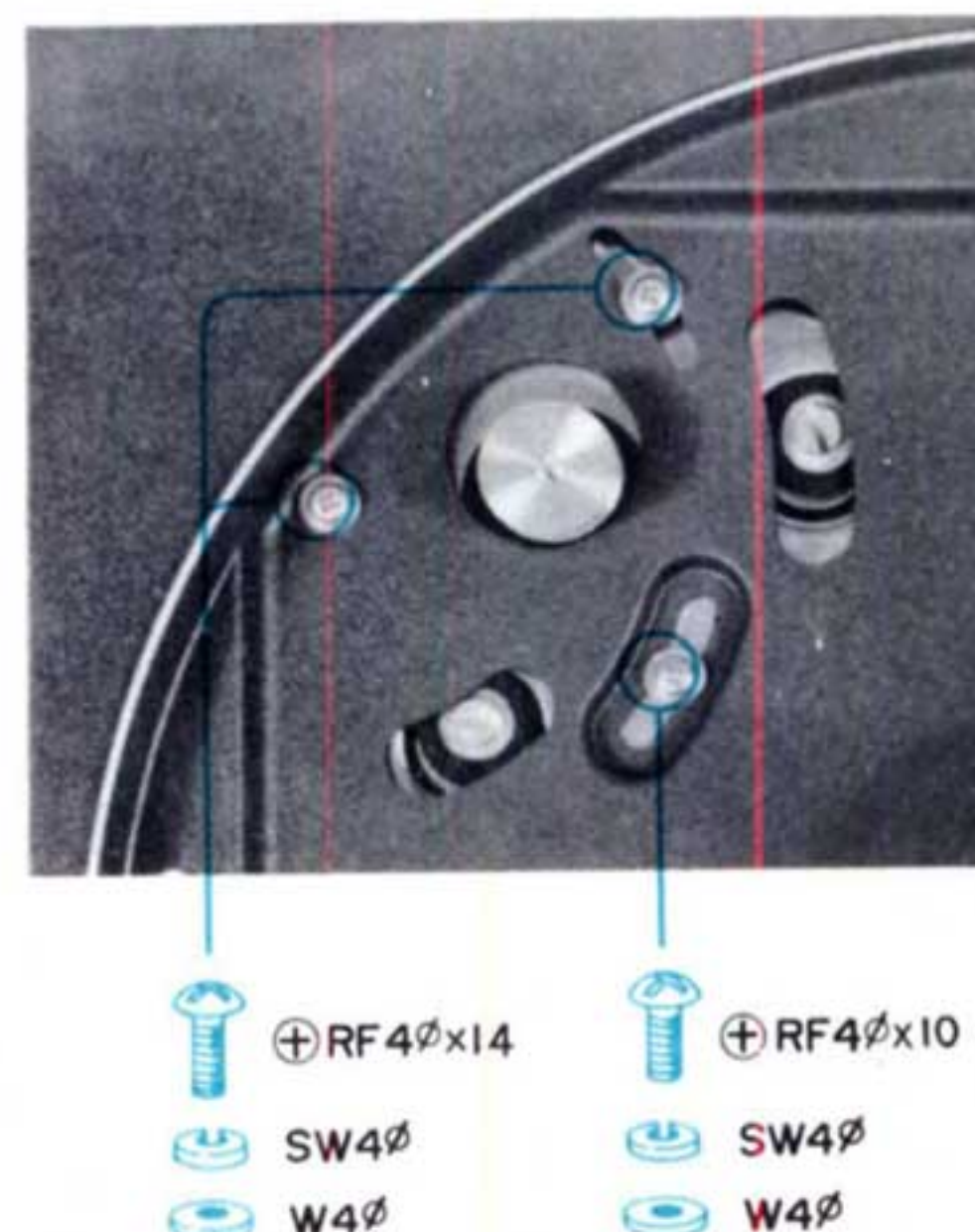


Fig. 2-12 Removal of Motor Bracket

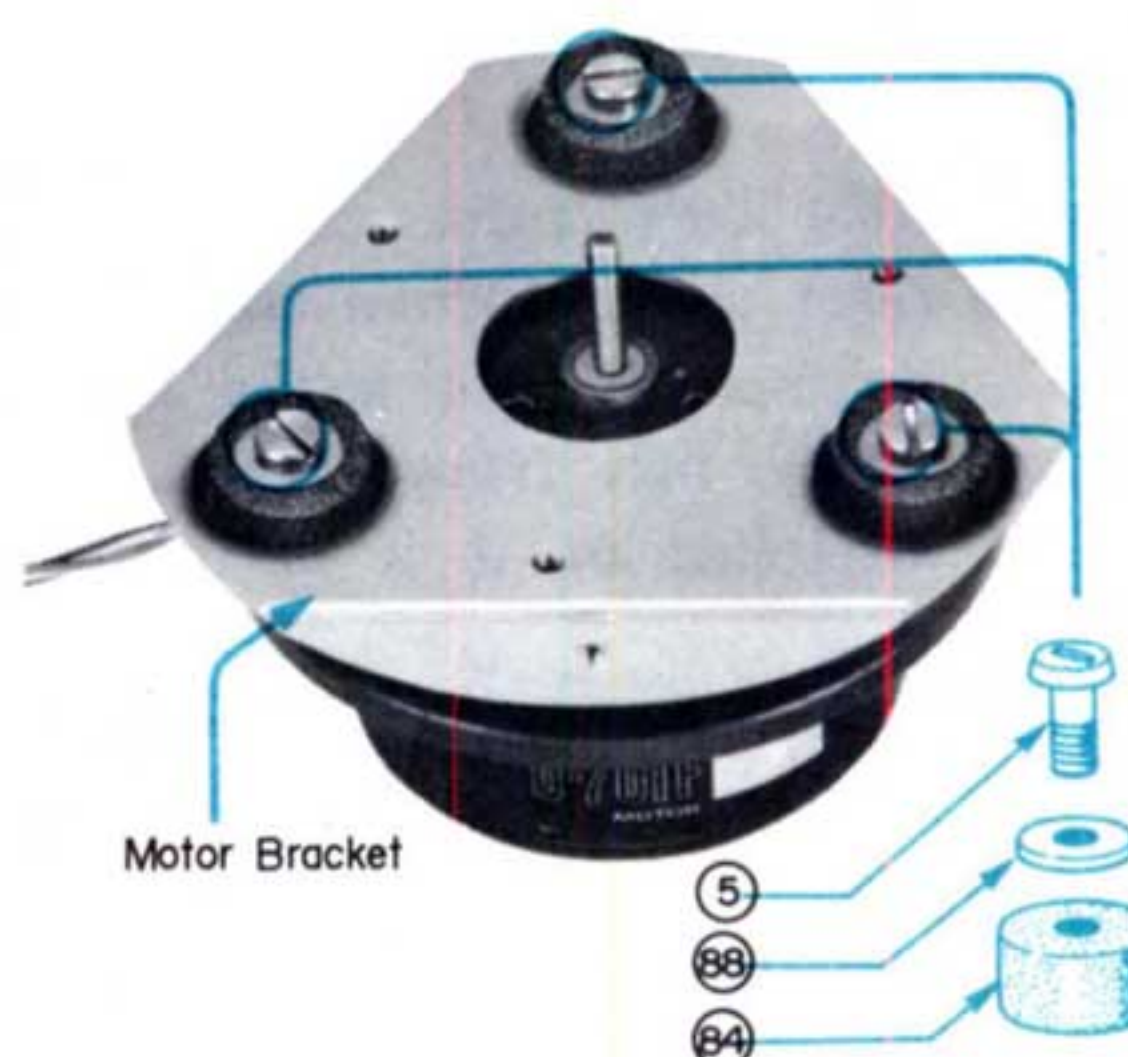


Fig. 2-13 Removal of the Motor

2-10 Reject Button Lamp and Switch Replacement

1. Remove the turntable base. See Section 2-3.
2. Unsolder the four lead wires from the 4-p terminal board.
3. Firmly but carefully push the back of the reject button assembly with a screwdriver. This frees the reject button assembly.
4. Pull out the lamp and install the replacement.
5. Remove the screw that secures the leaf switch with a screwdriver.
6. Place solvent around the base of the leaf switch and remove the switch. Install replacement.
7. Confirm that the contact points of the leaf switch do not touch each other when the REJ/OFF button is not pushed.

Note: When reconnecting lead wires, solder the two thicker blue wires (from the leaf switch) to one side of the 4-p terminal board. Solder the other two wires (from the lamp) to the other side of the terminal board.

4. Remove the three screws which secure the Motor supporting bracket to turntable. See. Fig 2-12.
5. Remove the three screws from the motor bracket. This frees motor. See Fig. 2-13.
6. Install the replacement.

SECTION 3 MAINTENANCE AND ADJUSTMENT

Caution: To avoid damage to the stylus while making these adjustments make sure that the stylus protecting cover is in place.

3-1 Lubrication

Every three months, remove the turntable base and apply 2 or 3 drops of SONY Oil OL-2K to the shaft of the turntable.

Note; Motor bearings are completely sealed and never need lubrication.

When lubricating the turntable shaft, inspect the drive belt and the surface of the motor pulley and turntable drive surface. Wipe dust from the belt with a dry cloth. Clean pulley and drive surfaces carefully with a soft cloth moistened with denatured alcohol.

3-2 Belt Tension

Drive belt tension has been preset at the factory and need not be reset under normal conditions.

If belt tension appears loose, check the length of the belt against a new belt from stock. Replace the belt if it has stretched or if it is cracked or worn.

If belt tension is insufficient with a normal belt, increase belt tension by loosening the three mounting screws for the motor. See Fig. 3-1.

Reset the position of the motor to move the motor pulley closer to the rim of the turntable well.

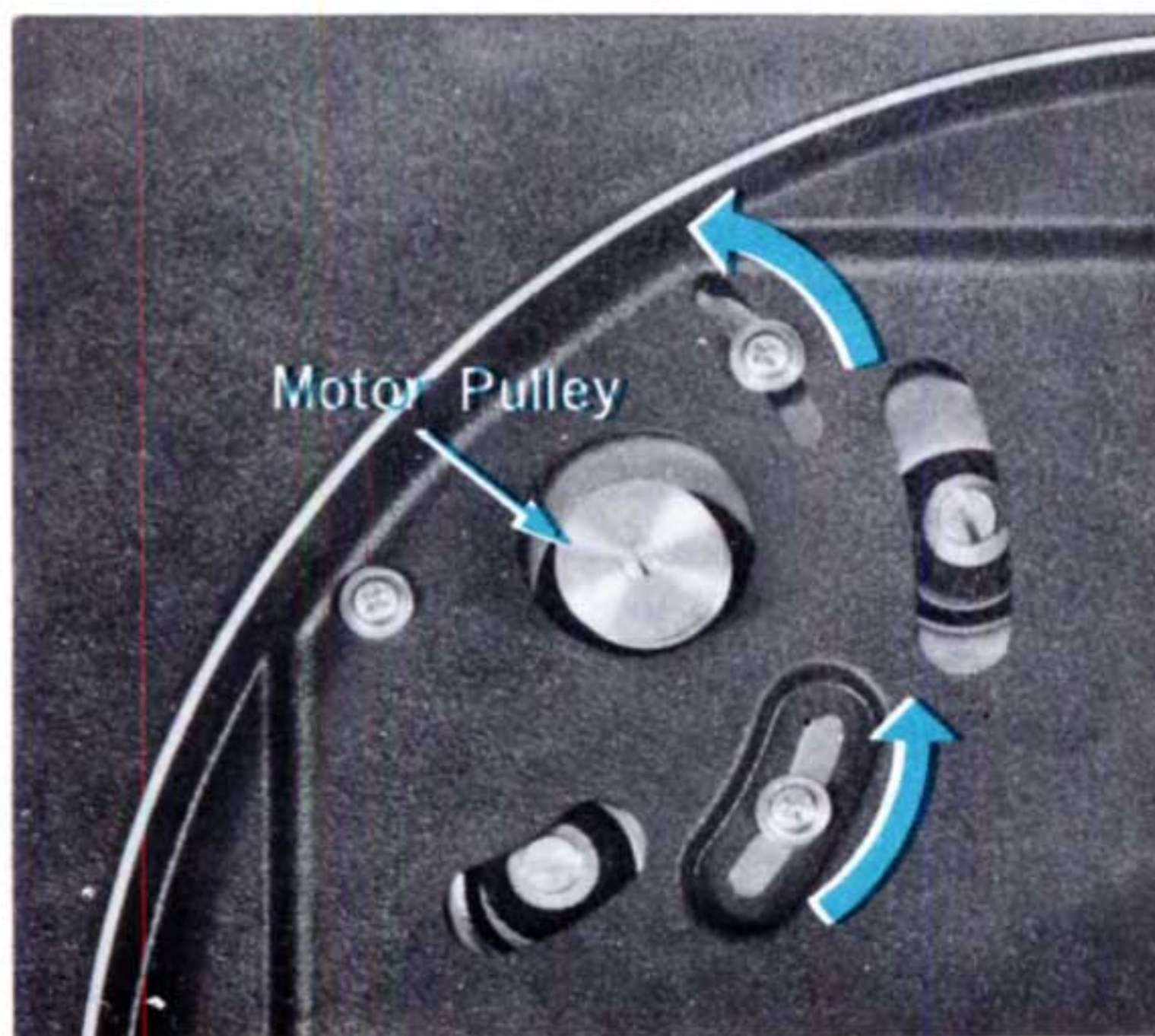


Fig. 3-1 Belt Tension Adj.

3-3 Fine Speed Control Adjustment

Correct operating speed should occur when the front panel speed control is at or near the midrange setting. If not, re-adjustment is needed.

1. Set the Speed Control to mid position.
2. Place the turntable in the horizontal position.
3. Set the 33-45 Control to the desired speed and turn the appropriate semifixed resistor until the strobe indicates the correct operating speed. See Fig. 3-2.

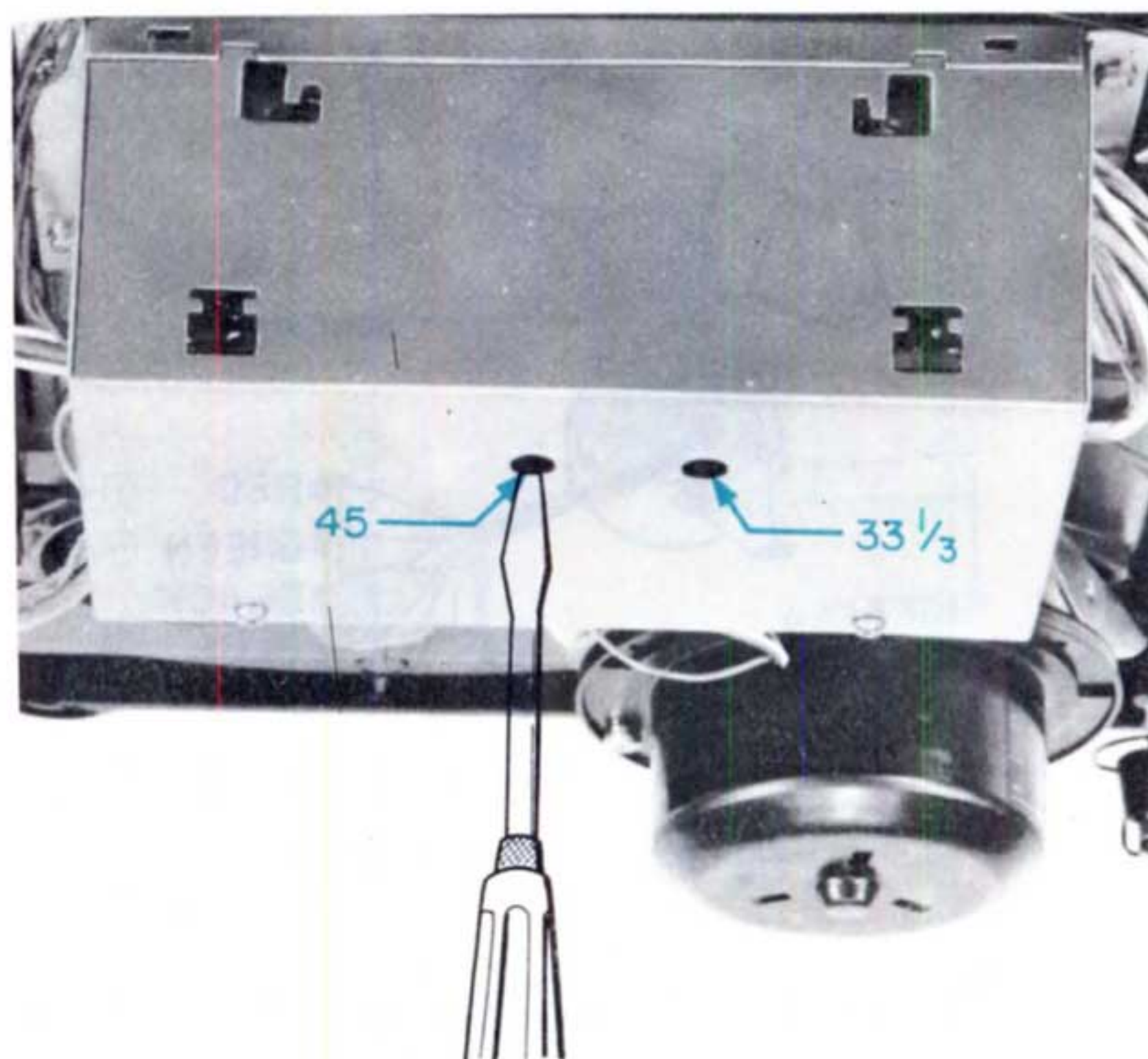


Fig. 3-2 Fine Speed Control Adj.

3-4 Tone Arm Height Adjustment

1. Loosen the set screw that secures the tone arm shaft to the tone arm base.
2. Adjust the height of the shaft so that the top ball bearings come in line with the surface of the tone arm base as shown in Fig. 3-3.

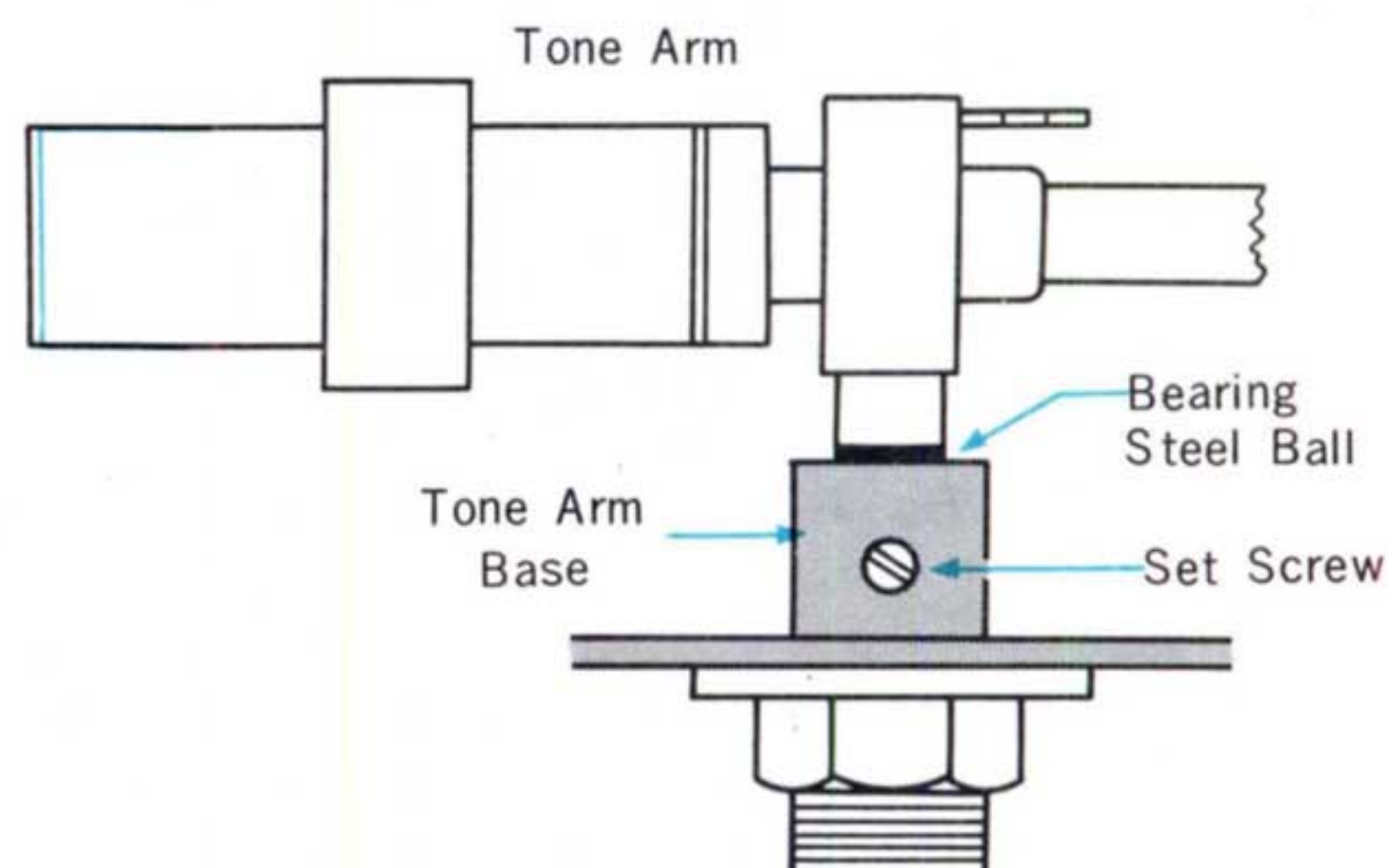


Fig. 3-3 Tone Arm Height Adj.

3-5 Arm Lifter Height Adjustment

1. Unplug the ac power cord.
2. Move the 33-45 lever to the 33 or 45 position as if to begin playing.
3. Adjust the tone arm lifter height by loosening the set screw that secures the lifter to its shaft while holding the shaft with a pair of tweezers, as shown in Fig. 3-4.

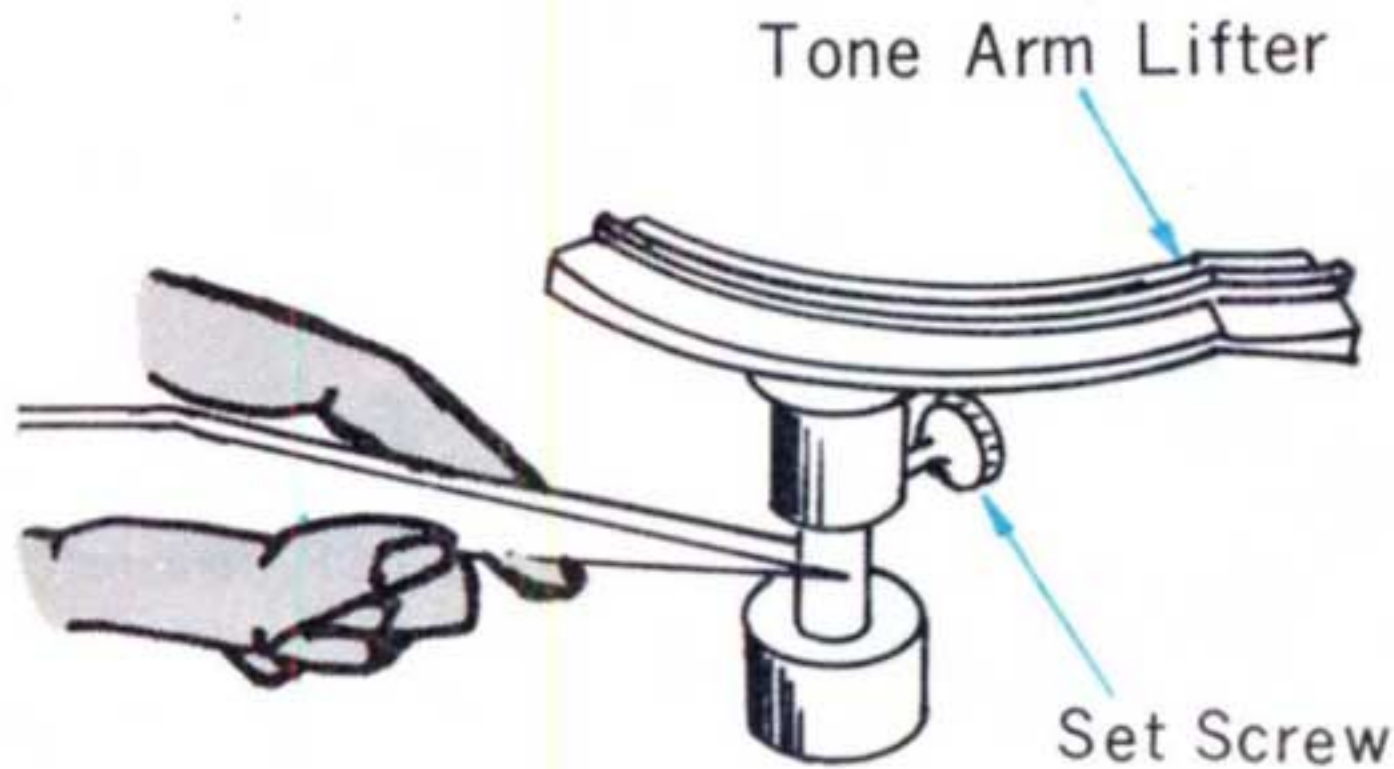


Fig. 3-4 Arm Lifter Height Adj.

The clearance between the stylus and the fringe of the turntable base should be between $1/16''$ and $1/8''$ (2-3 mm). See Fig. 3-5.

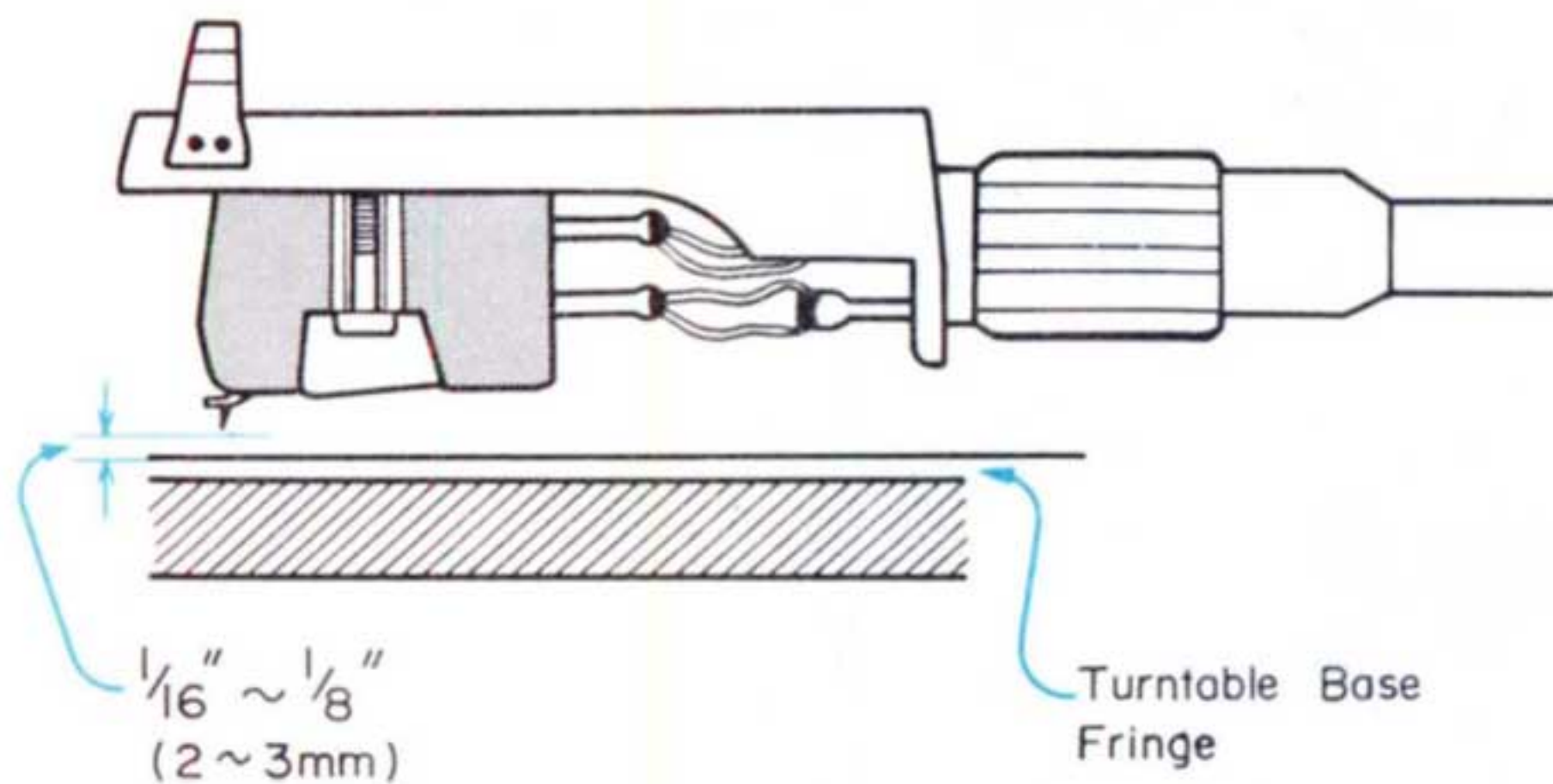


Fig. 3-5 Clearance between Stylus and Fringe of Turntable Base.

3-6 Arm Rest Height Adjustment

1. Place the arm rest in its raised position by applying ac to the Player and pressing the REJ/OFF button.
CAUTION: If turntable base is removed from cabinet while doing this, be extremely careful. Remove ac power after arm rest is raised.
2. Lock the tone arm to the arm rest and loosen the set screw that secures the arm rest to the arm rest base.
3. Adjust the height of the arm rest so that the clearance between the tone arm and arm lifter is less than $1/16''$ (1.0 mm) as shown in Fig. 3-6.

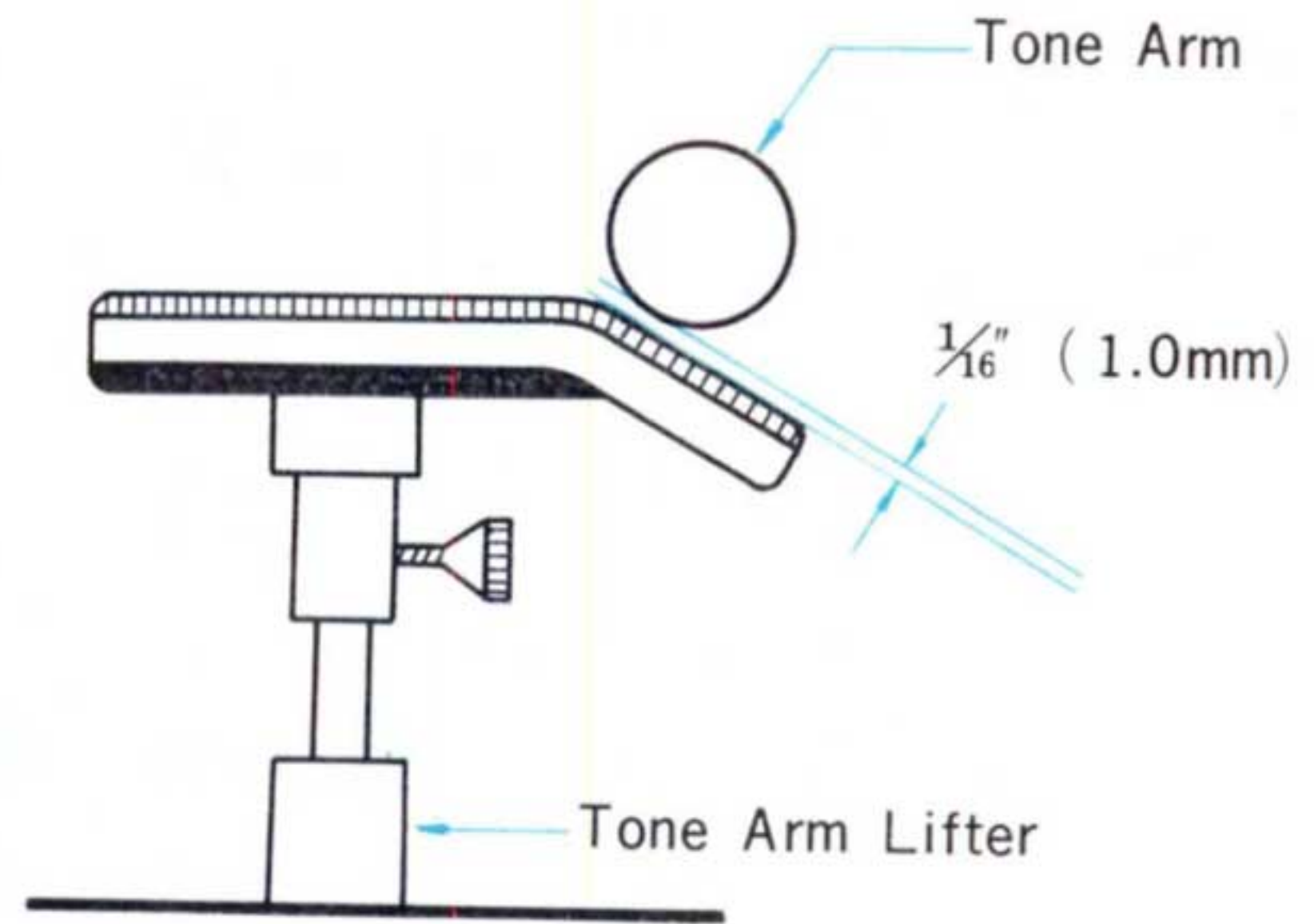


Fig. 3-6 Arm Rest Height Adj.

3-7 Sensing Mechanism Adjustment

To make this adjustment, first remove the turntable base as in Section 2-3. Then check the following:

- (a) For a Height Adjustment
 1. Loosen the two set screws (+RF3 ϕ ×8) that secure the permanent magnet mounting bracket assembly to the tone arm shaft.
 2. Set the end of the bracket assembly shaft $1/8''$ (3mm) from the end (bottom) of the tone arm shaft. See Fig. 3-7
- (b) For a Horizontal position adjustment
 1. Loosen the two screws (+RF3 ϕ ×8) that secure the permanent magnet mounting bracket assembly to the tone arm shaft.
 2. Place the turntable base in a horizontal position, right side up, and put the turntable back on its base.
 3. Put a conventional 12" record on the turntable.
 4. Adjust the horizontal position of the bracket assembly so that the permanent magnet aligns with the SMD when the stylus moves into the last groove of the record. See Fig. 3-7.

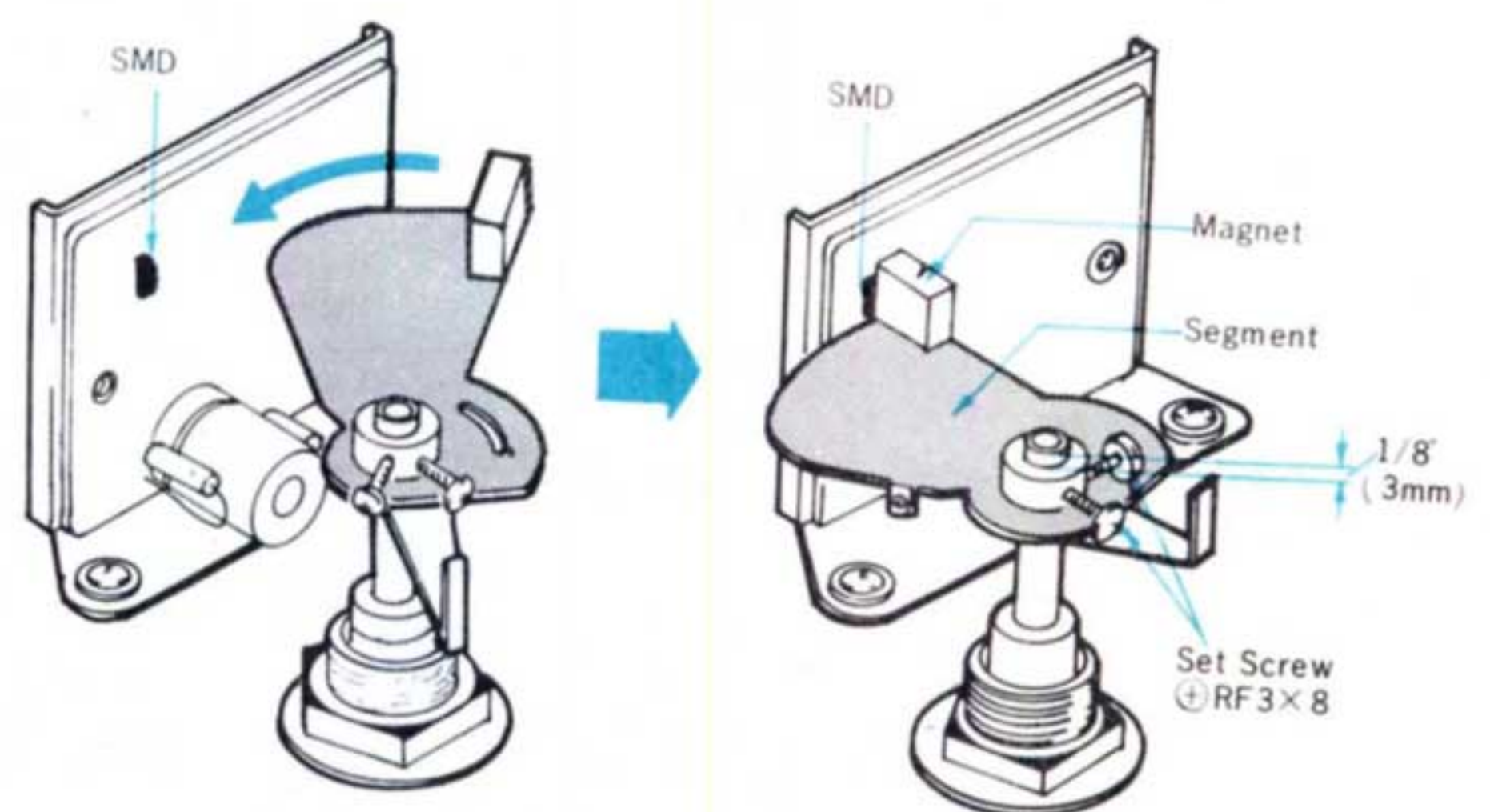


Fig. 3-7 Sensing Mechanism Adj.

3-8 Motor Pulley Height Adjustment

1. Remove the turntable. See Section 2-2.
2. Adjust the height of the pulley by loosening the two set screws that secure the pulley to the motor shaft. The height between the top of the pulley and the turntable base should be $5/8" \pm 1/16"$ ($16 \pm 1\text{mm}$).

3-9 Silicone-oil Damping Mechanism Adjustment

(a) Tone Arm Drop Speed Adjustment

1. Remove the turntable base. See Section 2-3.
2. Adjust the tension of the coil spring (1) in Fig. 3-8 by changing the holes to which one of its ends is attached with a pair of tweezers.
3. Drop Speed is increased as the tension of the coil is increased and vice versa.

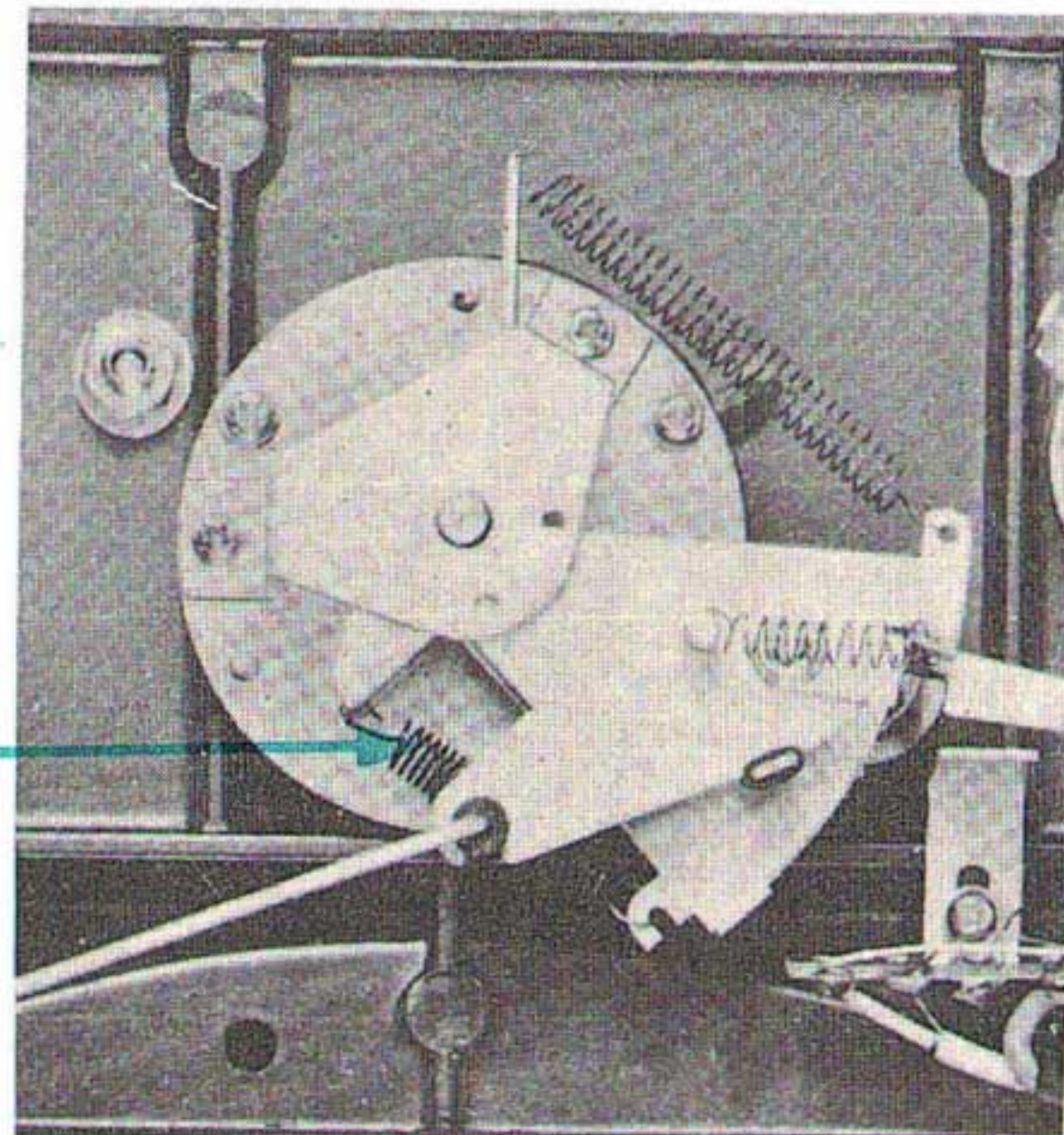
(b) Tone Arm Return Speed Adjustment

1. Remove the turntable base. See Section 2-3.
2. Adjust the tension of coil spring in Fig. 3-9 by changing the holes to which one of its ends is attached with a pair of tweezers.
3. Return speed is increased as the tension of the coil is increased and vice versa.

(c) Tone Arm Restrictor Adjustment

This adjustment is needed where the damping mechanism operates perfectly except for the tone arm return movement.

1. Remove the turntable base. See Section 2-3.
2. Increase the tension of coil spring in Fig. 3-9 with a pair of tweezers.



Tone Arm Drop Spring

Fig. 3-8 Tone Arm Drop Speed Adj.

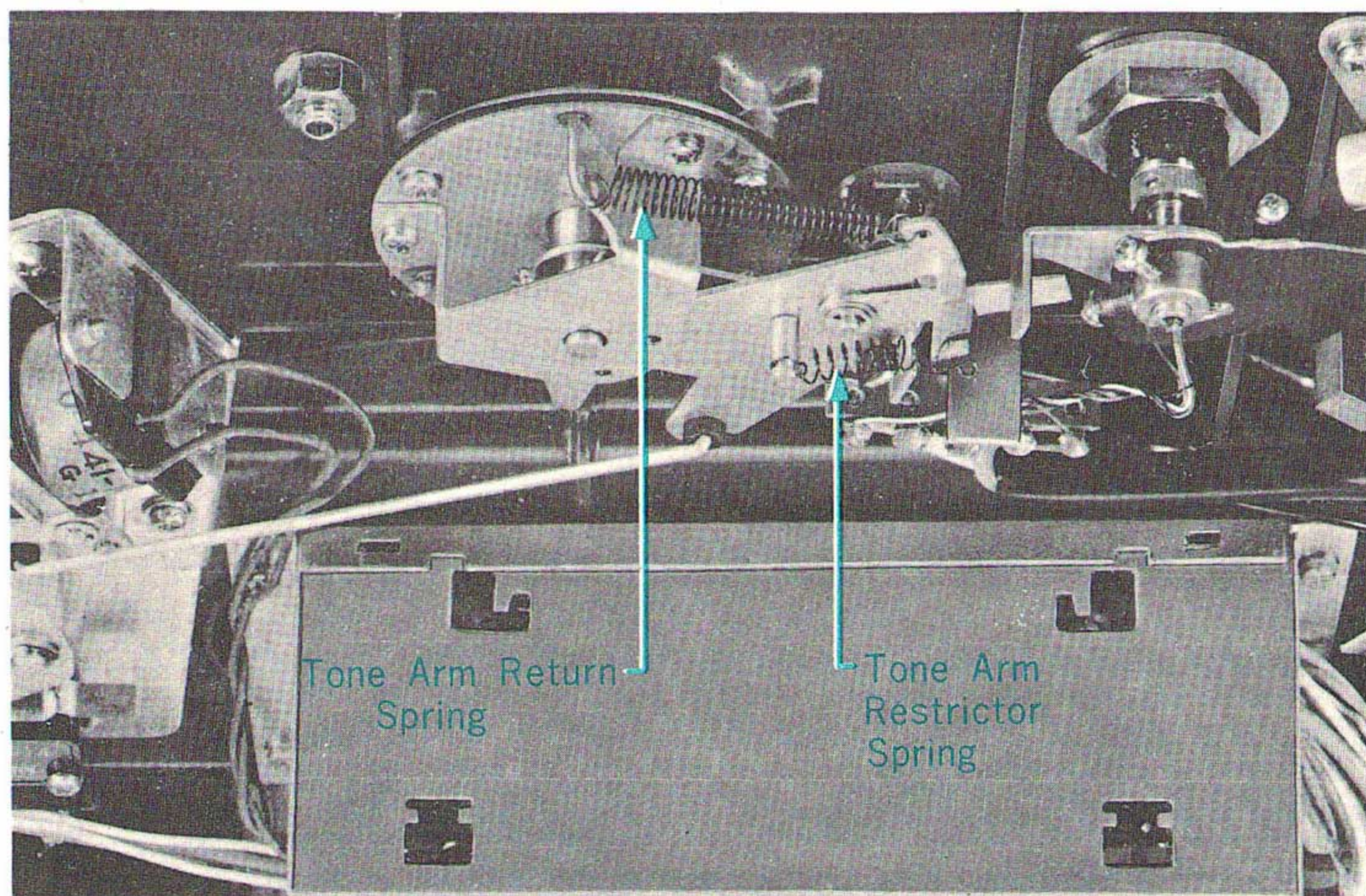
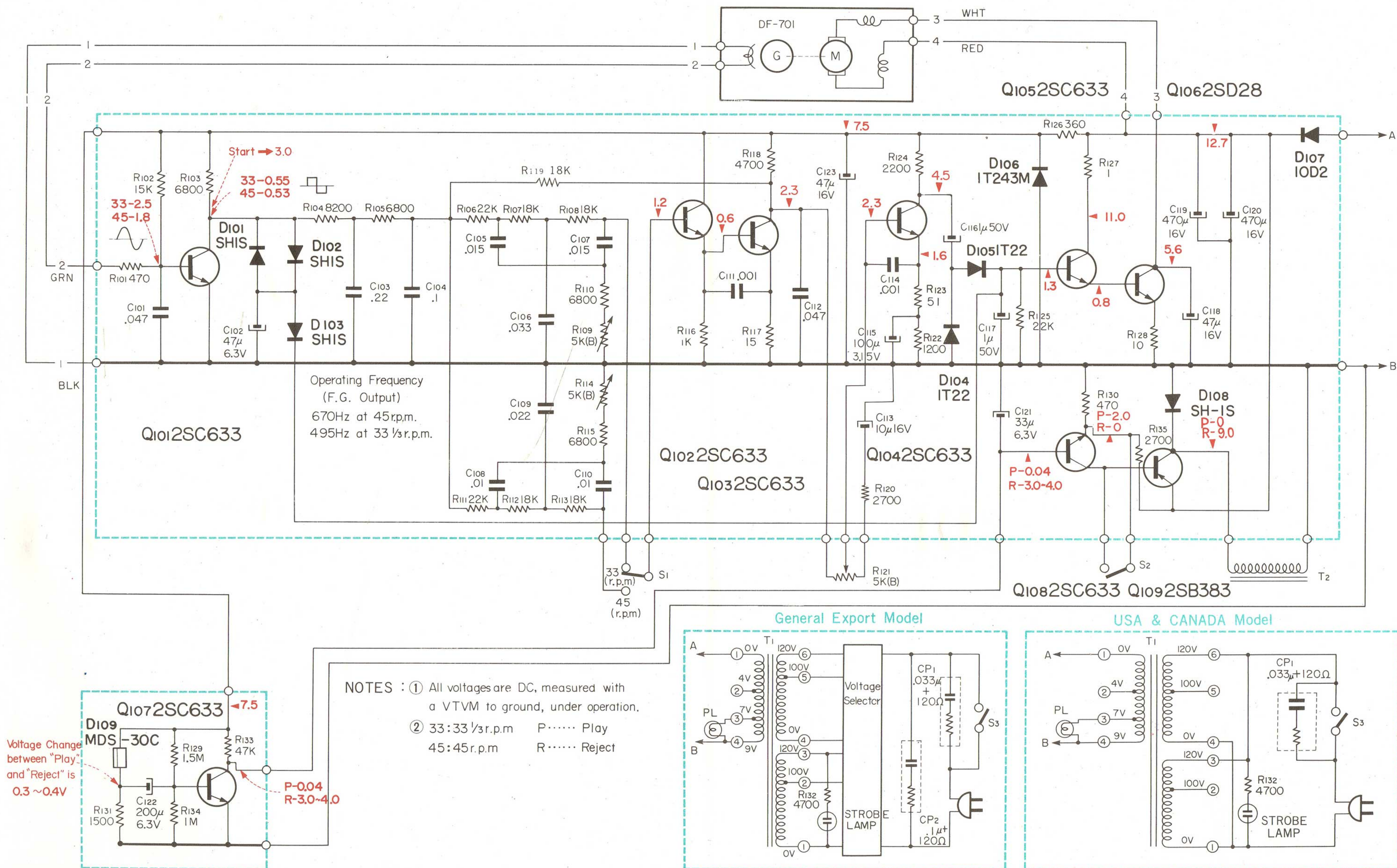


Fig. 3-9 Tone Arm Return and Restrictor Adj.

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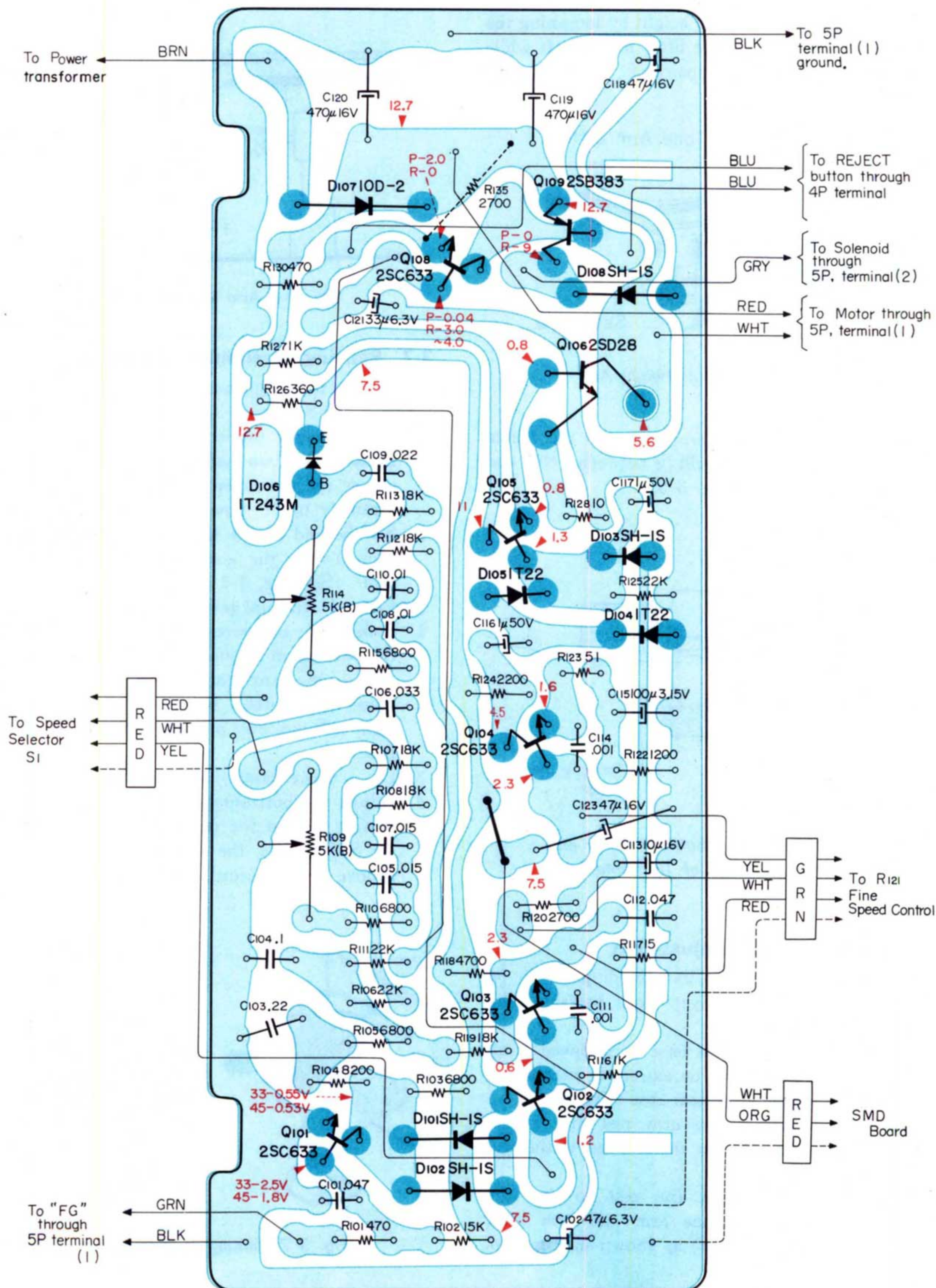
MEMO



MOUNTING DIAGRAM

Servo Amplifier Board

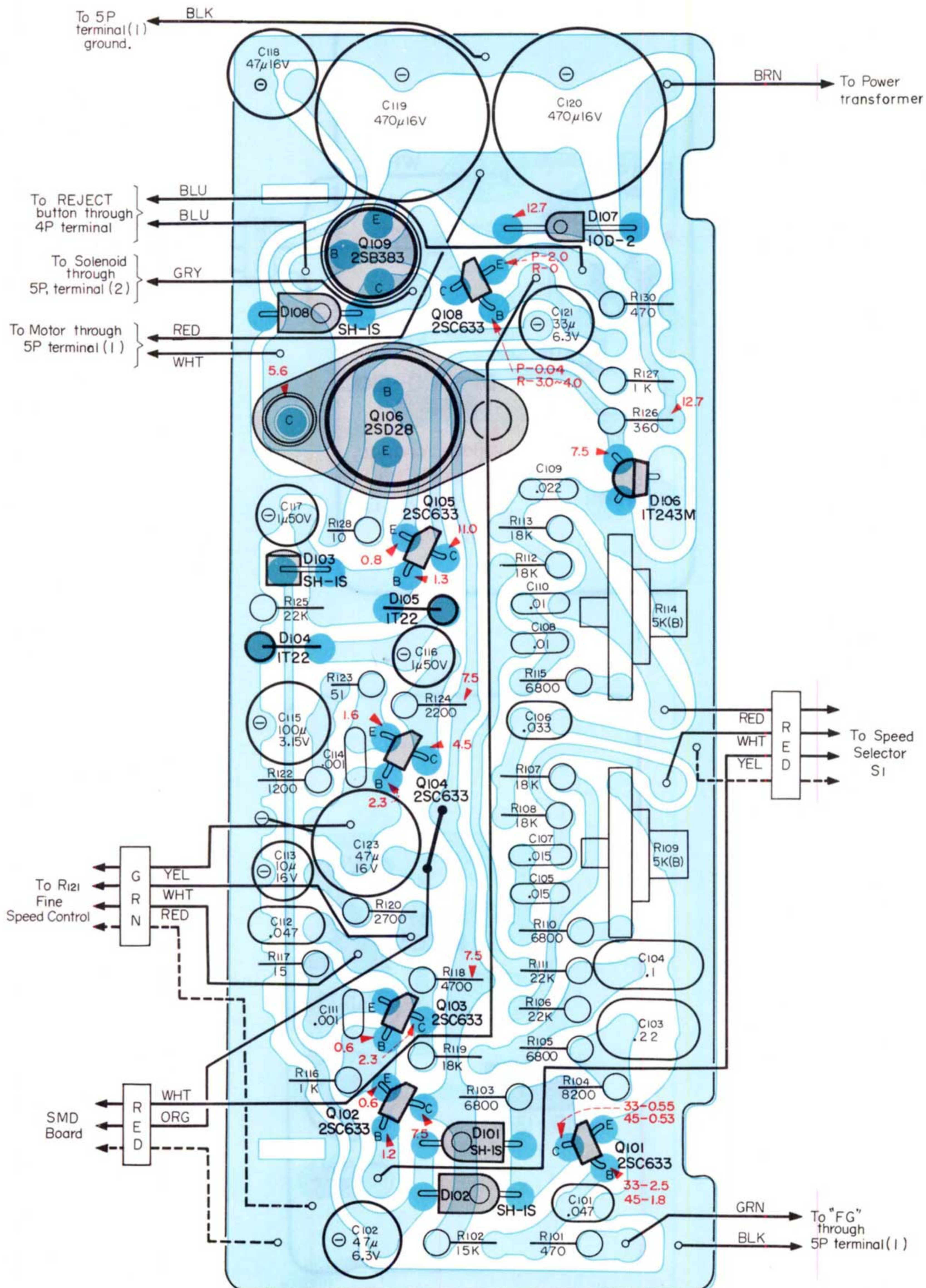
— Conductor Side —



MOUNTING DIAGRAM

Servo Amplifier Board

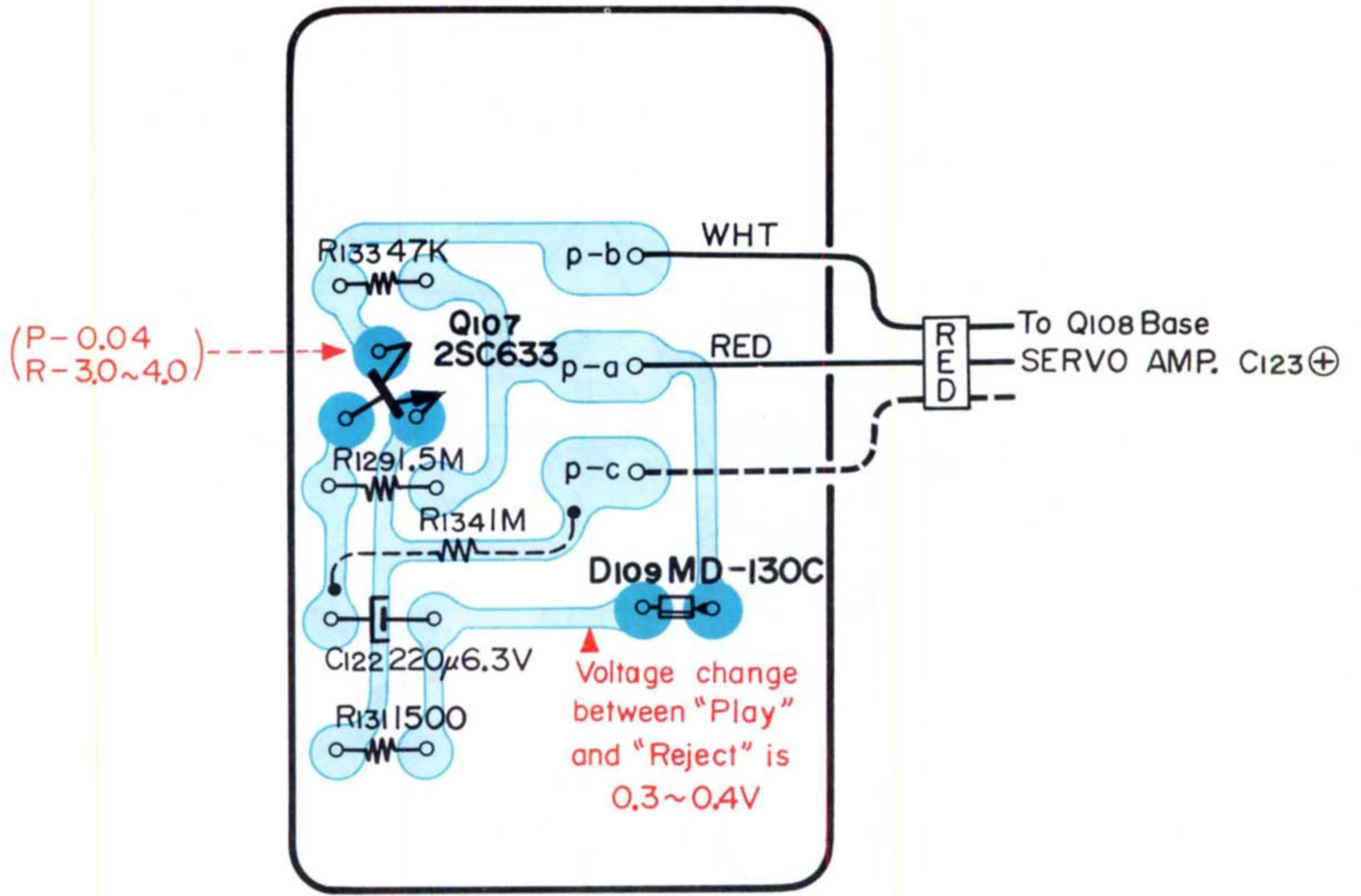
— Component Side —



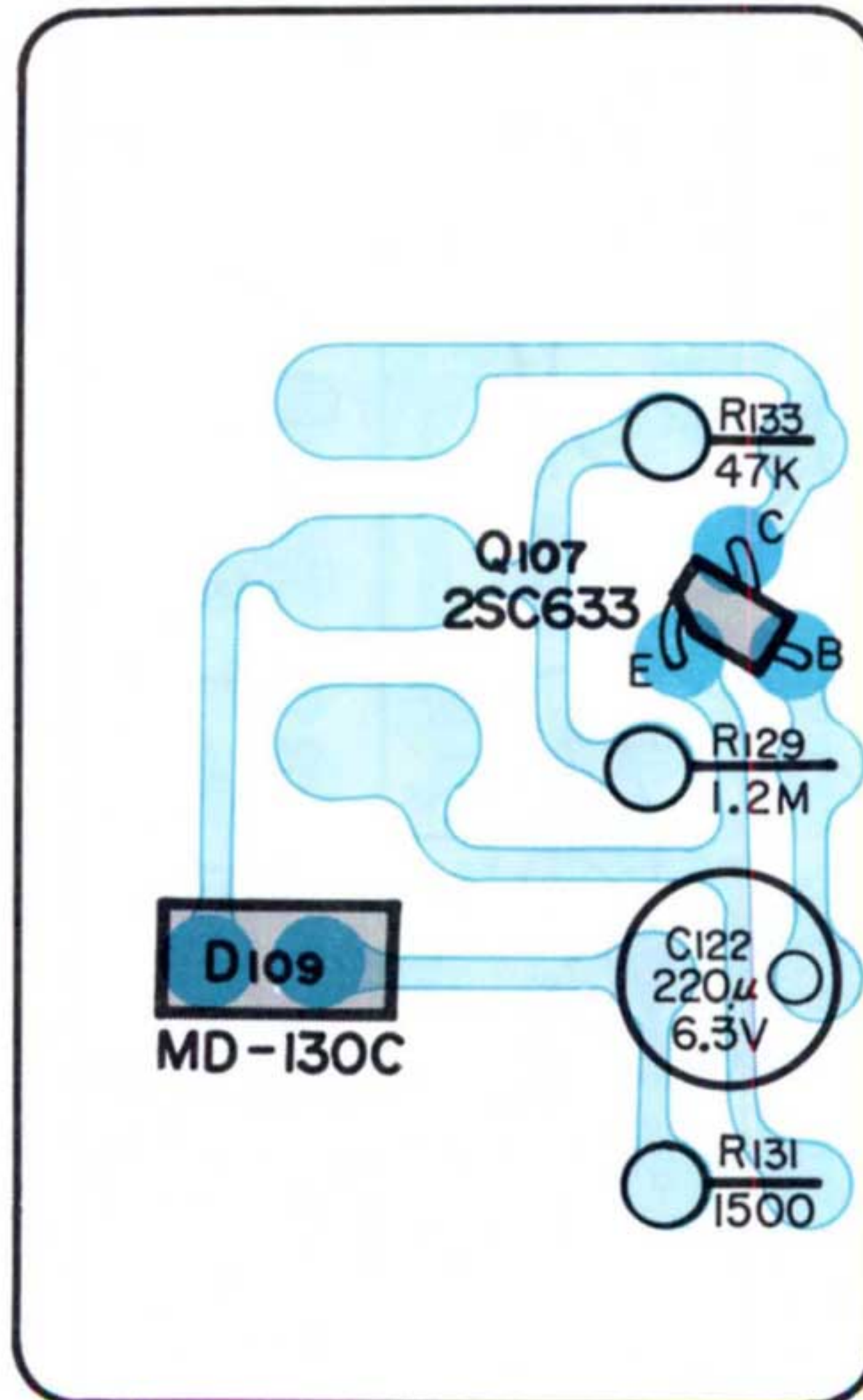
MOUNTING DIAGRAM

SMD Board

— Conductor Side —

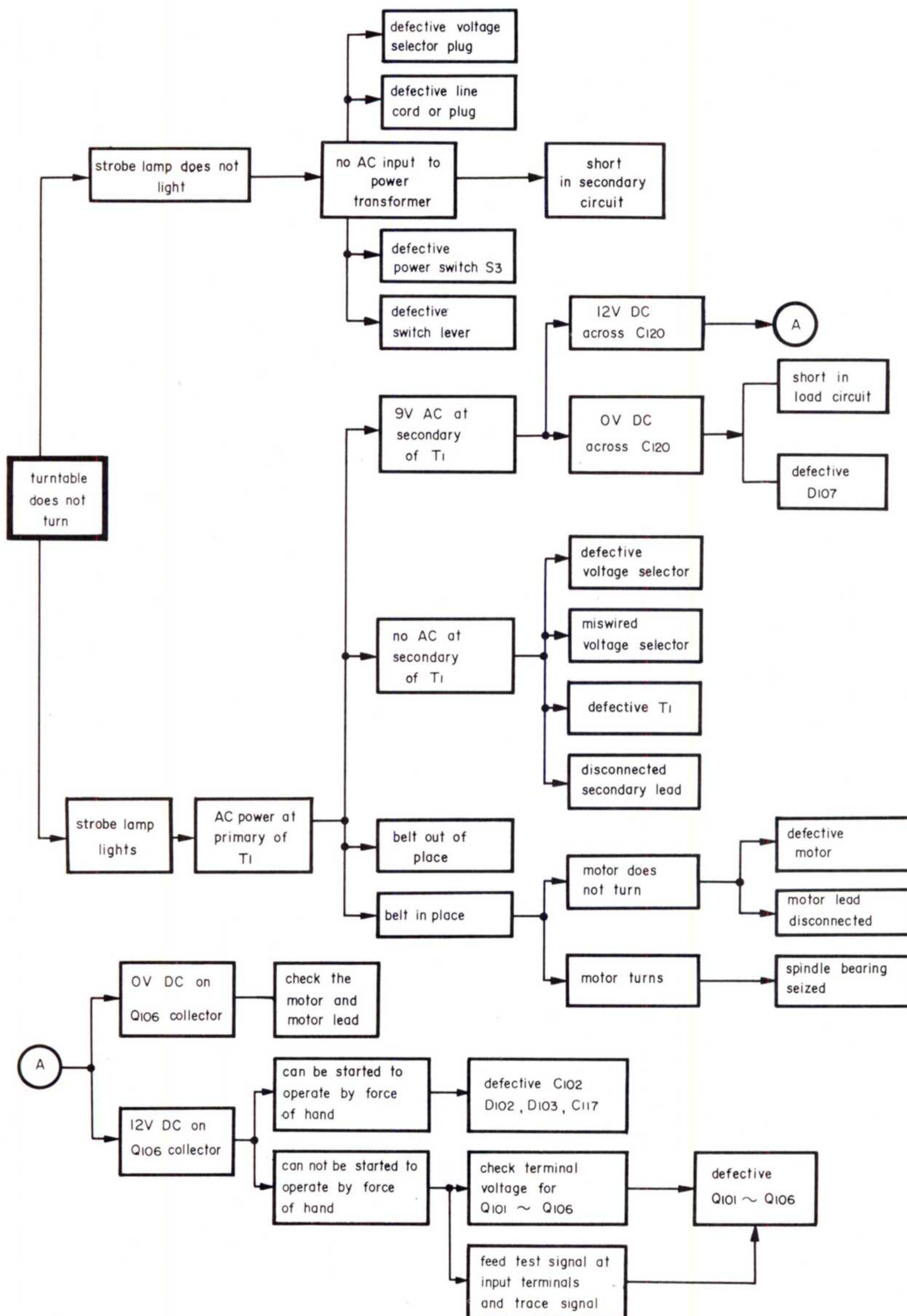


— Component Side —

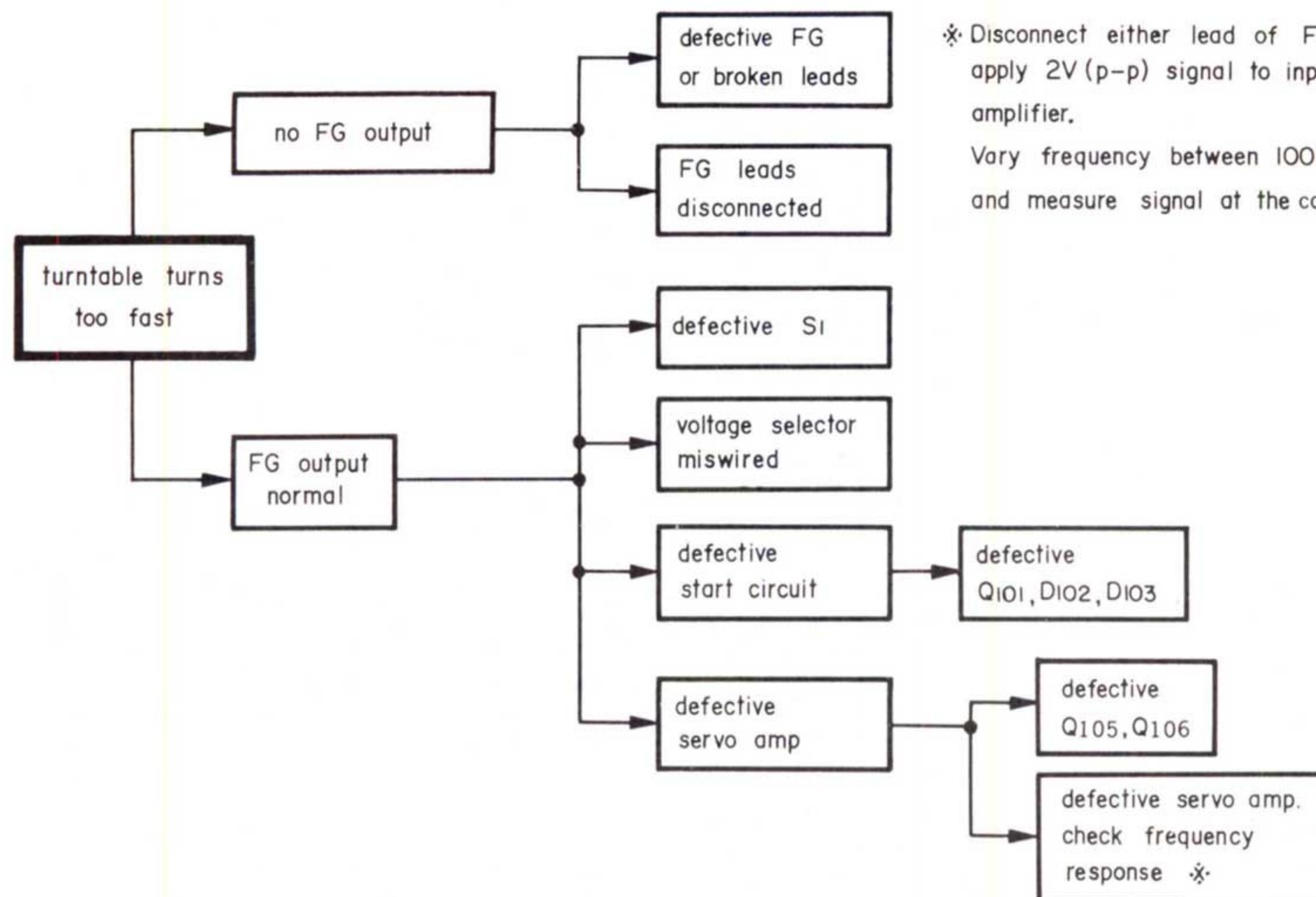


SECTION 4 TROUBLESHOOTING CHART

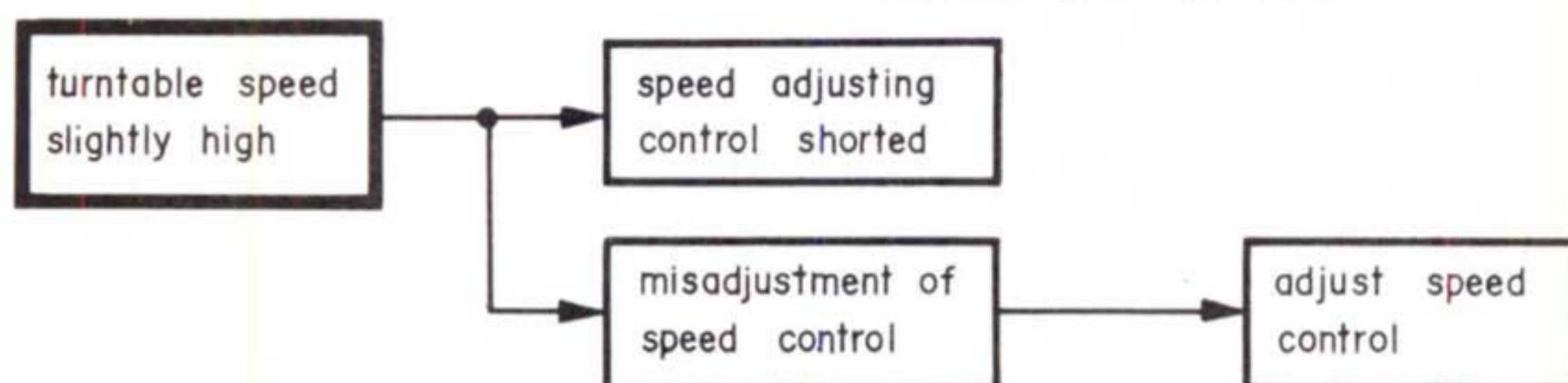
1. TURNTABLE DOES NOT TURN



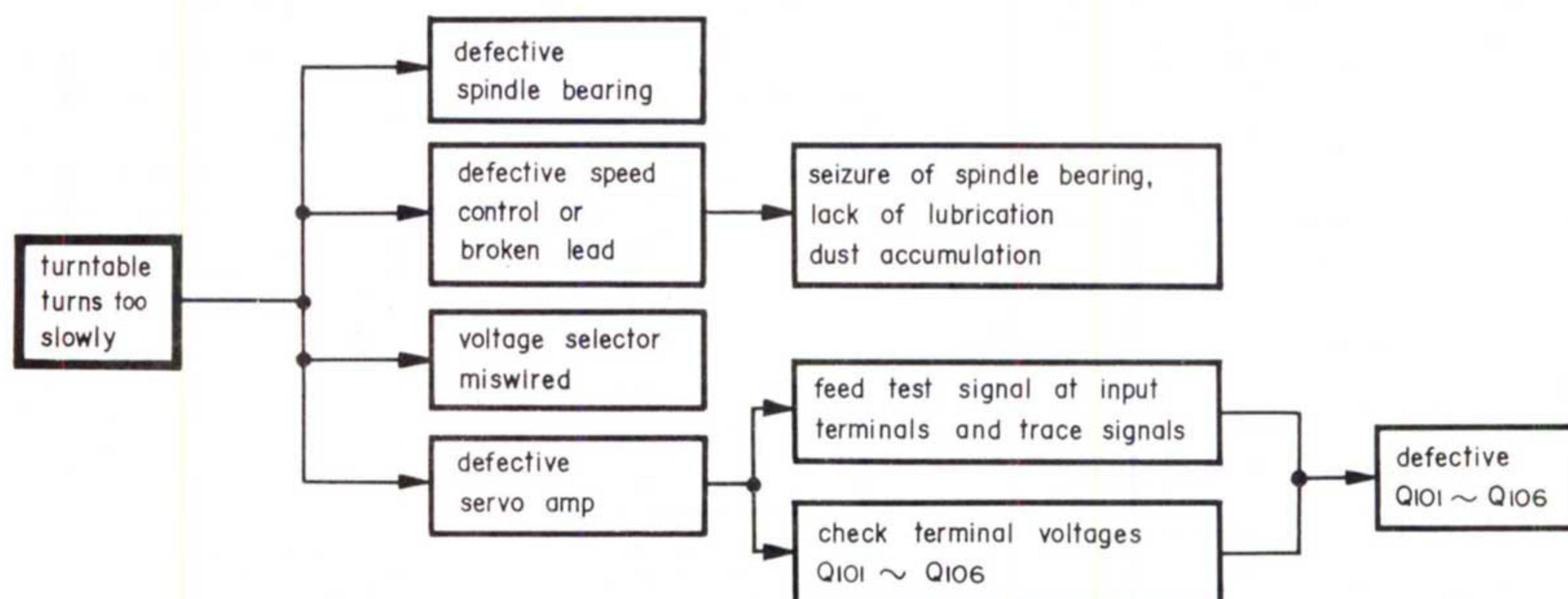
2. TURNTABLE TURNS TOO FAST



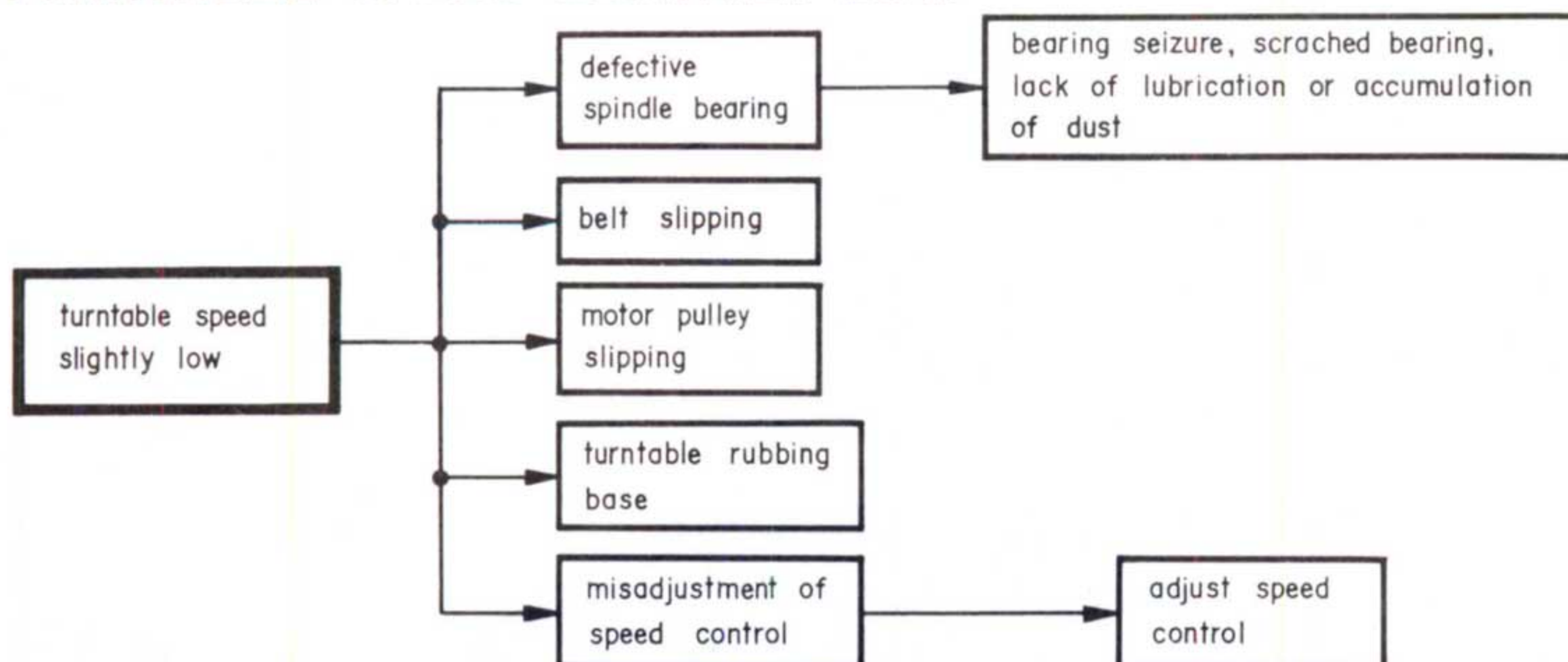
3. TURNTABLE SPEED SLIGHTLY HIGH



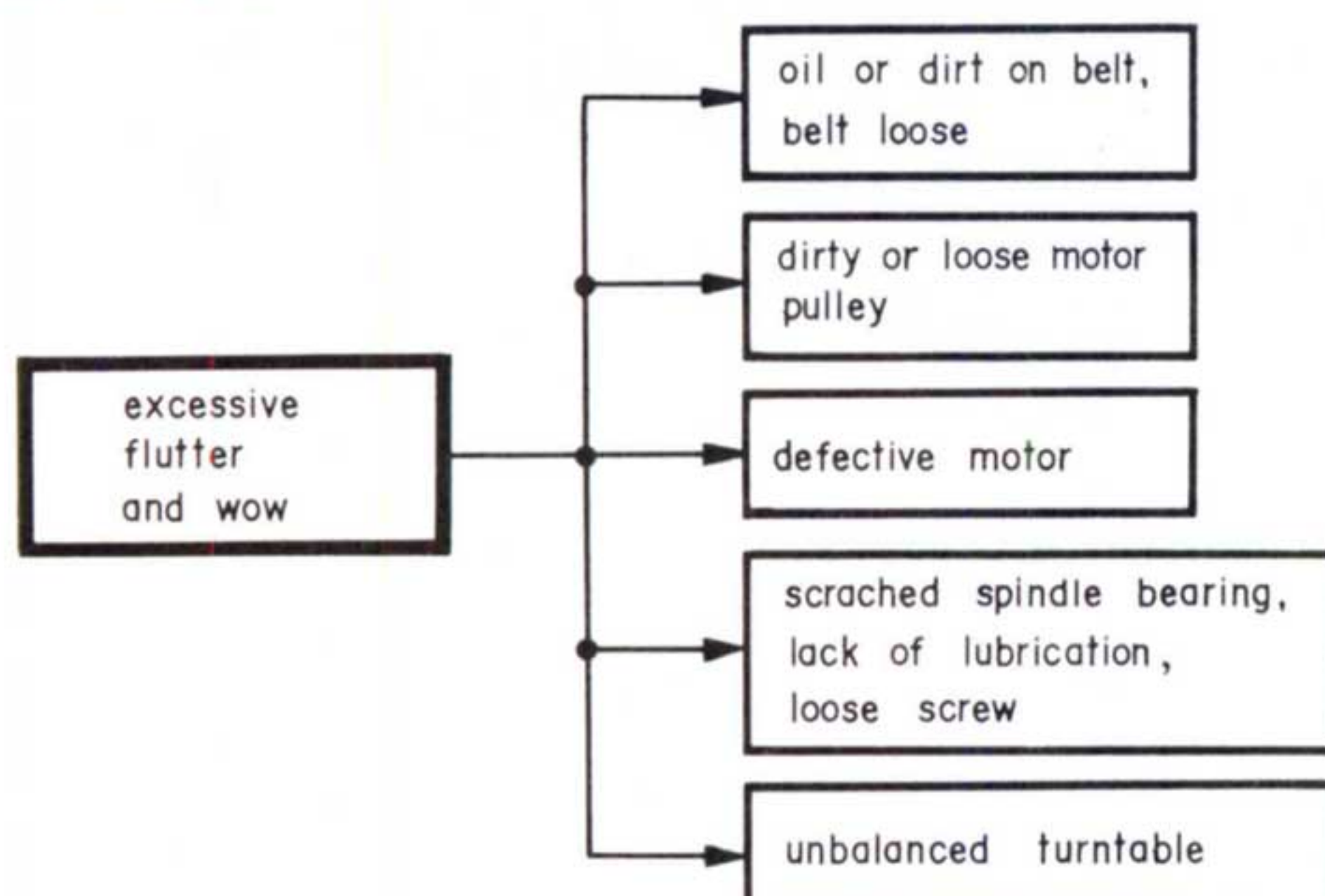
4. TURNTABLE TURNS TOO SLOWLY



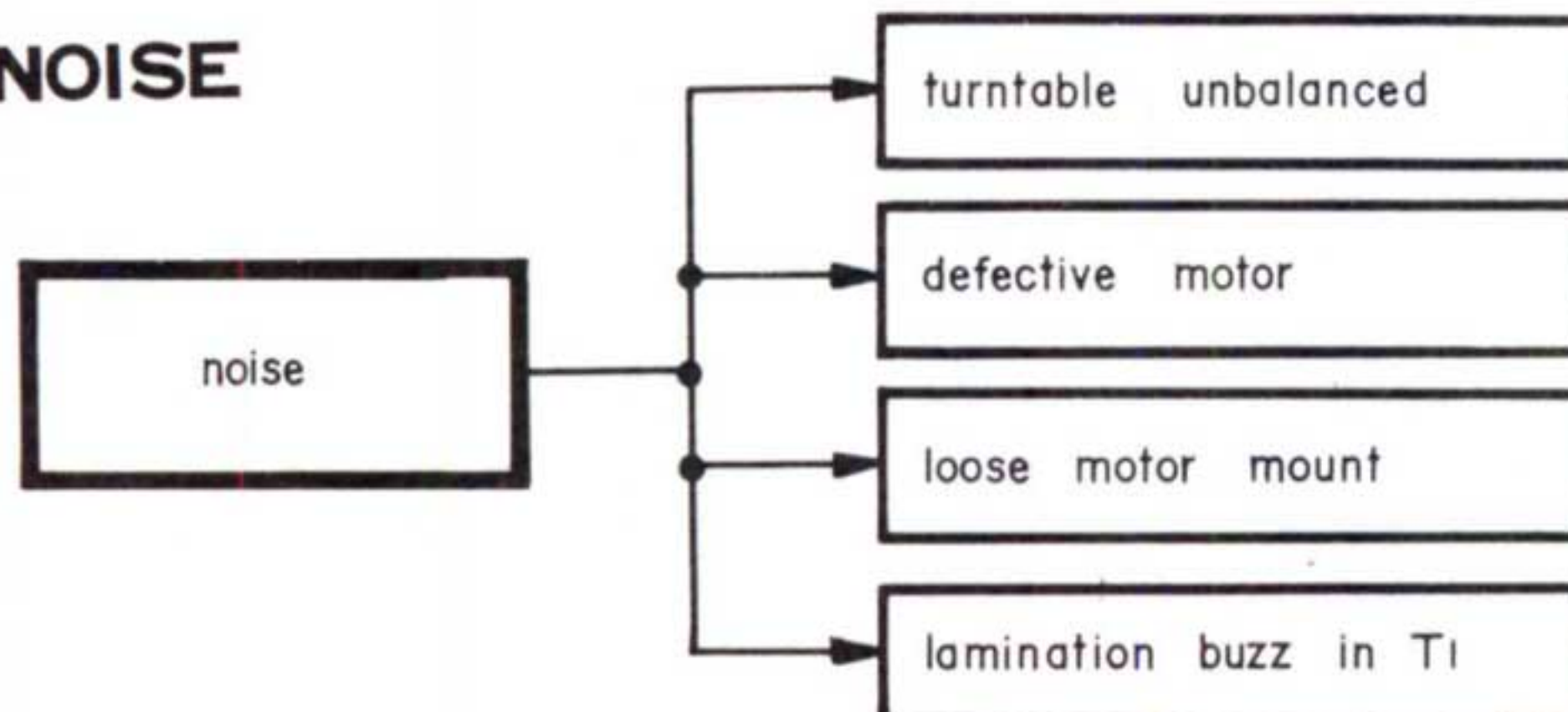
5. TURNTABLE SPEED SLIGHTLY LOW



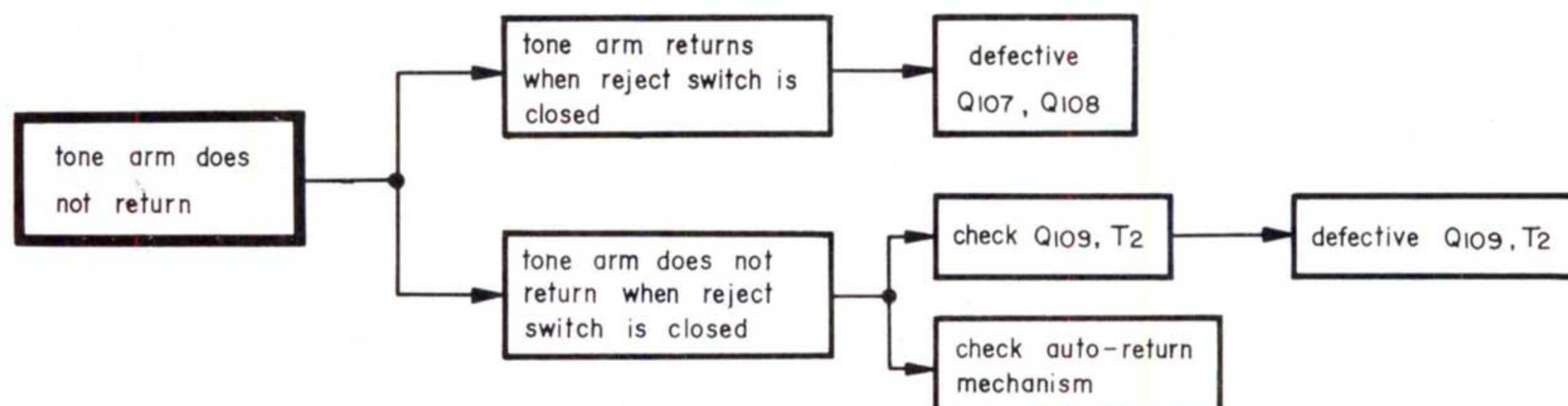
6. EXCESSIVE FLUTTER AND WOW



7. NOISE

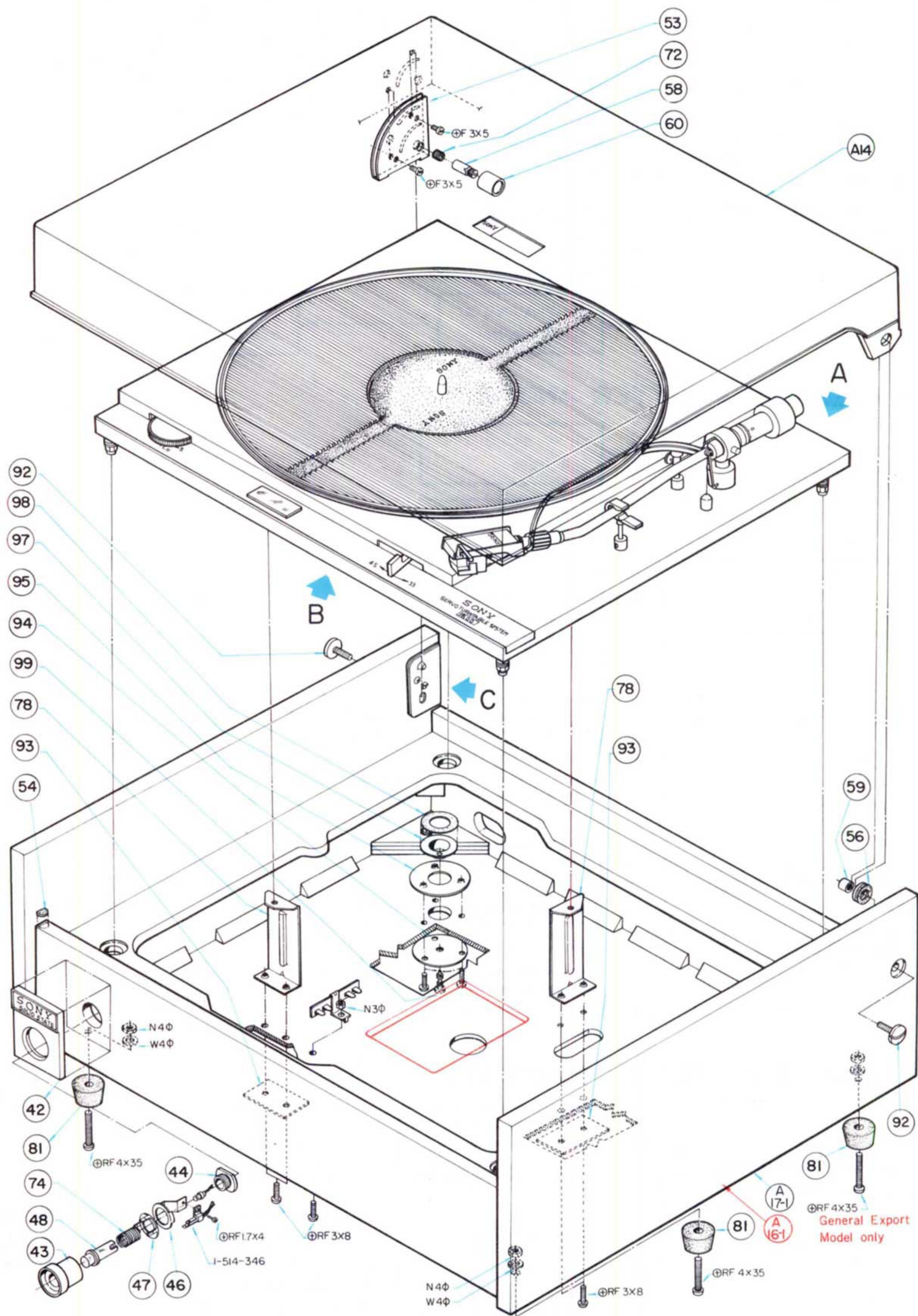


8. TONE ARM DOES NOT RETURN



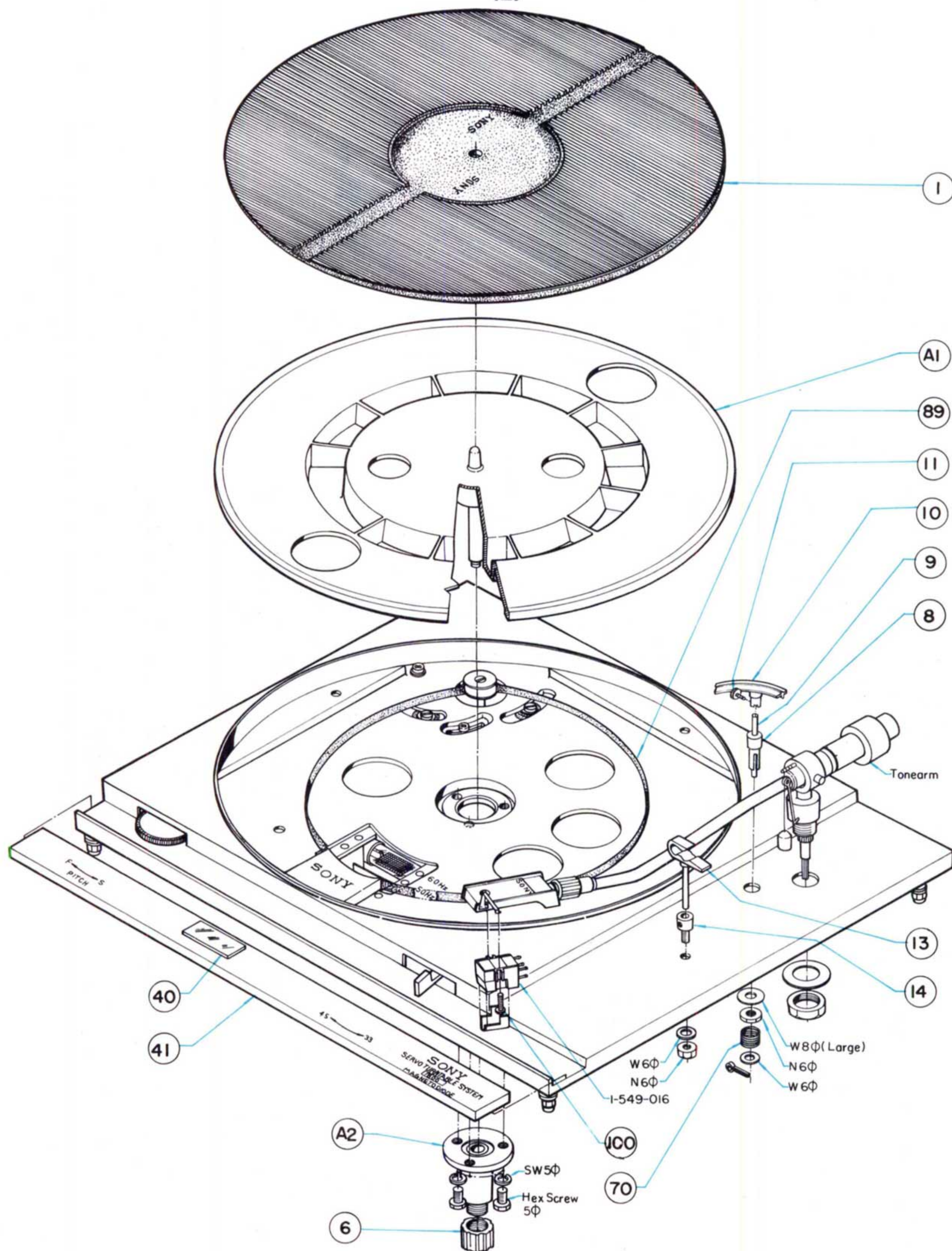
EXPLODED VIEW

(1)



EXPLODED VIEW

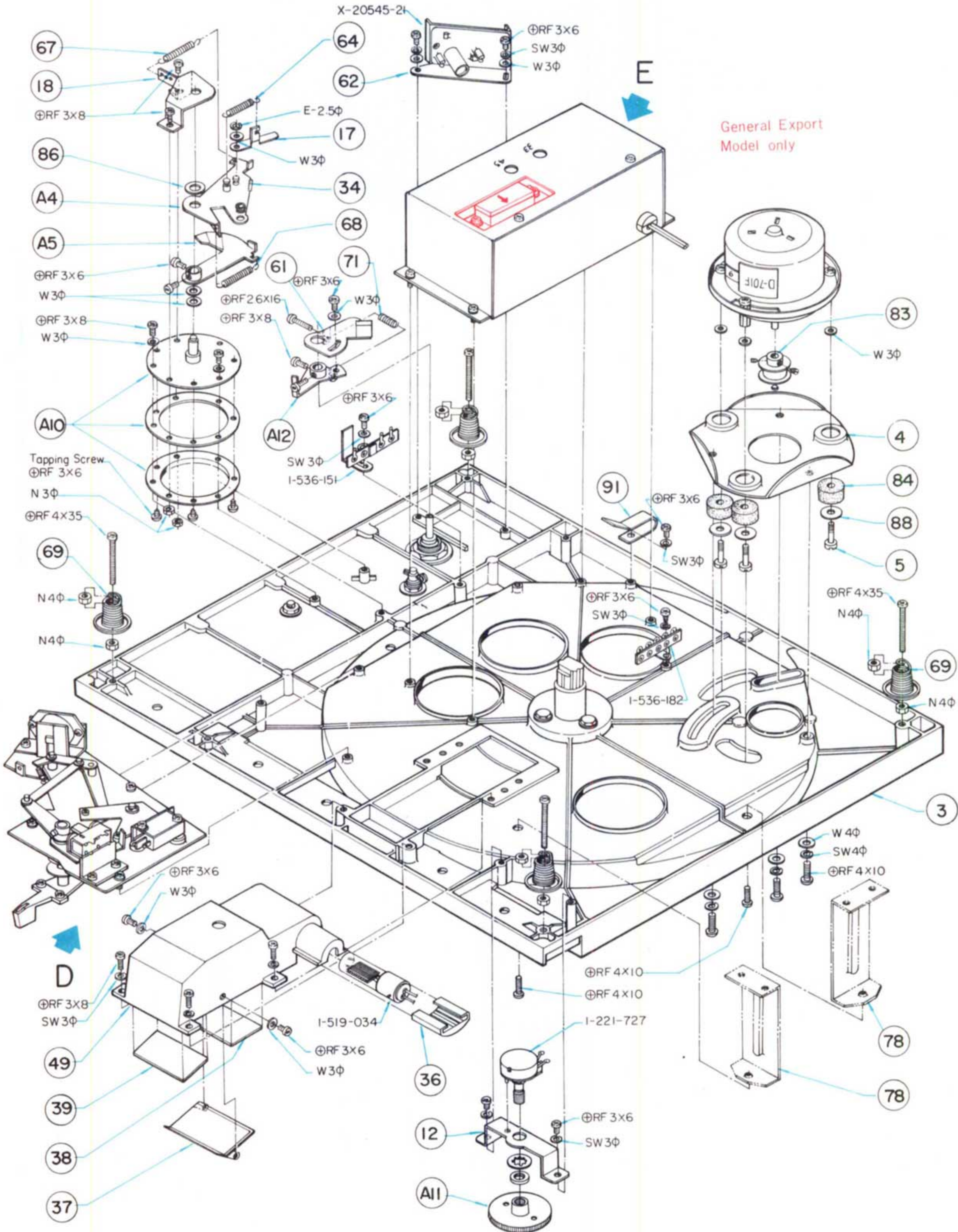
(2)



DETAIL "A"

EXPLODED VIEW

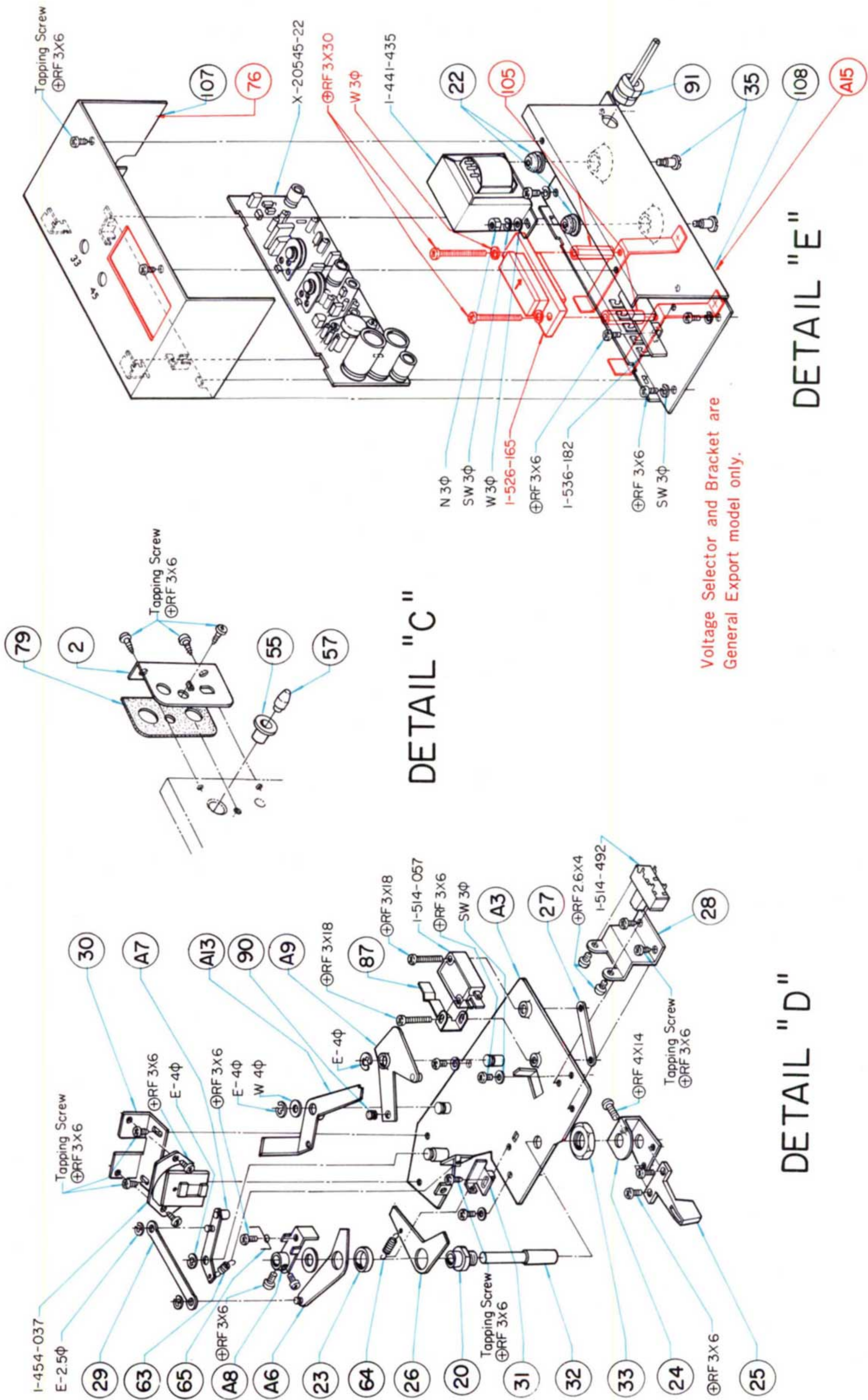
(3)



DETAIL "B"

EXPLODED VIEW

(4)



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