

PHILCO
ALL-SPEED



AUTOMATIC RECORD CHANGER

MODEL M-24

This de luxe record changer is designed to play automatically, 78-, 45-, or 33 $\frac{1}{3}$ -r.p.m. records of 7-inch, 10-inch, or 12-inch size. The changer will play twelve 7-inch, twelve 10-inch, or ten 12-inch records at one loading. It operates from a 105-125-volt, 60-cycle, a-c supply. If operation is desired on a 50-cycle supply, the 50-60-cycle motor, Part No. 35-1462, must be used, with the springs supplied in Conversion Kit Part No. 40-7848.

INTRODUCTION

The time interval between the last note of one record and the first note of the next one is shortened by the use of a velocity trip. The possibility of damaging the changer by holding the tone arm during a change cycle is prevented by spring-loading all actuating levers.

The controls are conveniently grouped near the front of the changer, and the knobs are concentrically mounted in the front right-hand corner. The tone-arm head is immediately behind the control knobs, and the record shelf is in the front left-hand corner.

The tone-arm set-down indexing is simplified by eliminating feelers and establishing the set-down by means of the record-shelf position. The nodding spindle, rather than a complicated system of levers and blades, accomplishes the record dropping. Most of the working parts are mounted on a bridge subassembly, a feature which makes the parts easily accessible for servicing.

CORRECTION TO MANUAL

The motor assembly, Part No. 35-1455, shown in figure 12, is now obsolete. Any reference to figure 12 in this manual should be disregarded.

DESCRIPTION OF OPERATING CYCLE

At the completion of a record, the changer trips, and allows the dog latch to engage the spur of the turntable hub gear. This rotates the cam gear, allowing the teeth of the cam gear and hub gear to engage. As the cam rotates, it forces the lifter lever down, raising the tone arm from the record. As the tone arm reaches maximum height, the tone-arm actuator, motivated by the cam gear, contacts the trip-arm stud and swings the tone arm against the rest post. After the tone arm reaches the rest post, the push-off lever rotates, nodding the spindle and dropping the next record onto the turntable. After the record has dropped, the return lever contacts the stud of the trip arm, and starts the tone arm inward. The tone arm is now controlled by the actuator and return levers, in contact with the stud of the trip arm. The return lever continues swinging the tone arm inward until it is stopped by the set-down lever, whose position is dependent upon the setting of the record shelf. This stoppage of the inward travel of the tone arm by the established position of the return lever accomplishes the set-down indexing. The tone arm is thus held above the set-down point. The lifter lever now moves upward, slowly dropping the tone arm to the record surface. As the cam gear continues to rotate, the actuator lever is moved outward and away from the strip-arm stud. The tone-arm return lever

then moves away from the trip-arm stud, but the spring portion of the actuator momentarily remains in contact with the stud, preventing a sudden release of the tone arm, which could cause the needle to jump into the modulated groove. The trip-plate supporting finger now engages the dog latch, and the index lever locks the cam gear in a neutral position. The tone arm is now free to play the record.

As the tone arm advances toward the spindle, the friction-clutch trip finger engages the end of the trip plate. Through the applied pressure of the friction finger (approximately 2 grams) against the trip plate, the trip-plate finger supporting the dog latch begins to move, lessening the engagement of the trip-plate finger and dog latch, preparatory to releasing the latch. This engagement is slowly lessened while the needle is in the playing grooves, giving the reset cam an opportunity (once each revolution of the turntable) to reset the trip plate into full engagement and slip the friction finger into the friction clutch. As the needle rides in the lead-out or eccentric groove of the record, the velocity of the friction finger is increased. The speed of the disengagement of the trip-plate supporting finger and the dog latch is also increased sufficiently to allow complete disengagement of the dog latch before it has been restored by the reset cam.

ADJUSTMENTS

SPINDLE

The spindle should be checked for perpendicularity (use square on turntable surface) when the changer is out of cycle. To adjust, bend the ear on the push-off-lever assembly; bending the lever toward the spindle spring, throws the top of the spindle away from the record shelf. This is shown in figures 3 and 6.

RECORD SHELF

CAUTION: This adjustment must be made immediately after a change cycle is completed.

With the changer turned to the OFF position, place a record-shelf gauge, Part No. 45-6647, on the record shelf. The edge of the gauge should fit snugly against the edge of the raised portion of the shelf. Remove all play without flexing the spindle.

If the gauge does not fit properly, loosen the two saddle mounting screws which hold the record shelf to the base plate (figure 1), and adjust the position of the record shelf. Then tighten the screws.

TONE-ARM HEIGHT AND LIFT

With the changer out of cycle, and the tone arm over the base plate, the needle point should be $\frac{1}{8}$ inch $\pm \frac{1}{16}$ inch above the base plate. To adjust the clearance, bend the protruding ear of the swivel post, at the rear of the tone-arm heel. See figure 2. Bending the ear upward decreases the clearance, bending it downward increases the clearance. Raise the tone arm to its maximum height, and place it against the rest post. There should be approximately $\frac{3}{32}$ inch clearance between the lower edge of the tone arm and the

top of the rest-post hook. Bend the ear of the swivel to obtain the most satisfactory adjustment of both the rest-post clearance and the base-plate clearance.

VERTICAL TIMING

Adjust the vertical timing by bending the end of the lifter lever (shown in figure 2), which attaches to the pull-cord, so that there is approximately $\frac{1}{32}$ inch to

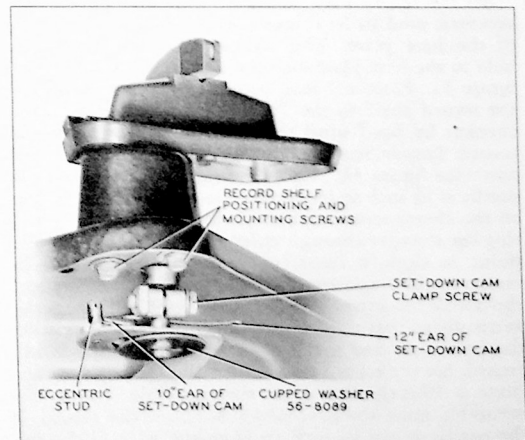
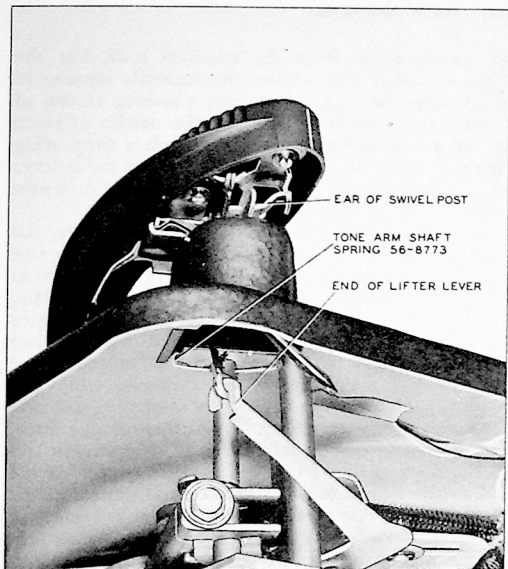


Figure 1. Record-Shelf Adjustment and 10-Inch, 12-Inch, and Fine Set-Down

TPO-1839



TPO-1831

Figure 2. Tone-Arm Height and Lift Adjustments and Vertical Timing Adjustments

$\frac{1}{16}$ inch slack in the pull-cord for all tone-arm positions between the tone-arm rest post and the spindle, when the changer is out of cycle. Check by cycling the changer and note that the lifter lever and pull-cord will raise the tone arm straight up to its maximum height, and then move horizontally to the tone-arm rest post after the slack adjustment has been made.

SET-DOWN

Set the record shelf to the 12-inch position. Set the eccentric stud to its center position toward the corner of the base plate. This stud is accessible through a hole in the base plate near the tone-arm stanchion (see figure 5). Place a 7-inch record on the turntable, set the record shelf to the 7-inch position, and cycle the changer by hand until the tone arm is just above the record. Loosen the hex-head clamp screw on the trip arm (see figure 3), and swing the tone arm until the needle is $\frac{1}{8}$ inch in from the edge of the record. Tighten the clamp screw, and check the adjustment by putting the changer through another cycle. If the set-down point is slightly incorrect, it may be corrected by means of the eccentric stud mentioned above. Recheck the needle set-down. The trip arm should be positioned vertically so that the friction finger is midway between the base plate and the lifter lever. Remove the 7-inch record. Set the record shelf to the 10-inch position, and place a 10-inch record on the turntable. Rotate the turntable until the needle is just above the record. If the needle is not $\frac{1}{8}$ inch in from the edge of the record, an adjustment may be made by bending the ear of the set-down cam which is in contact with the eccentric stud. See figure 1. Bending the ear outward moves the set-down point away from the spindle; bending the

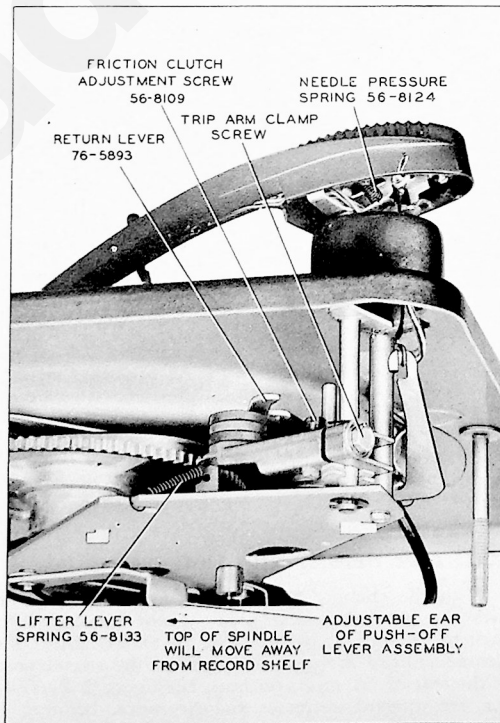
ear in toward the shelf shaft moves the set-down point toward the spindle. Recheck the needle set-down. Using a 12-inch record, with the shelf set to the 12-inch position, repeat the adjustment, bending the corresponding ear of the set-down cam (figure 1).

The eccentric stud mentioned above (shown in figures 1 and 5) provides a fine adjustment of the set-down position. This adjustment varies the set-down position of all size records over a total range of $\frac{3}{16}$ inch. Do not use this adjustment unless it is desired to change all three set-down positions by an equal amount.

TRIP

CAUTION: Do not adjust the friction clutch until the trip-plate engagement is properly set, as explained below.

The proper trip action is greatly dependent upon the proper engagement of the dog latch and the finger of the trip plate supporting it. The correct engagement is $\frac{3}{64}$ inch (or approximately one-half the width of the supporting finger of the trip plate) when the ear of the reset arm is contacting the peak point of the reset cam. This is shown in figure 4. The extent of this engagement is adjustable by bending the ear of the trip plate, shown in figure 6. Bending the ear inward decreases the amount of engagement, and bending the ear outward increases the amount of engagement. This



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Figure 3. Adjustment of Trip Arm for 7-inch Set-Down

adjustable ear is accessible through the large hole in the bridge, and should be bent by using long-nose pliers.

NOTE: Too much engagement will prevent tripping, while too little engagement will cause pre-tripping.

After the trip-latch engagement is set, check the changer for trip action. If the trip action is faulty, i.e., if the changer pre-trips or does not trip at all, recheck the trip-latch adjustment. If the changer still does not operate properly, check for tight tone-arm lead dress or excessive friction in the tone-arm-shaft bearing. If this does not clear the trouble, the friction clutch can be adjusted, although this should not be necessary. This is a screw adjustment and it is accessible from under the motorboard. (See figures 3 and 15.) Adjust the screw which is located on the trip arm by turning it counter-clockwise until it is snug, (not tight); then loosen one turn. Check the adjustment by playing several records. If the changer pre-trips, loosen the screw (turn clockwise) a bit more. This trip arm and clutch assembly is shown in figure 15.

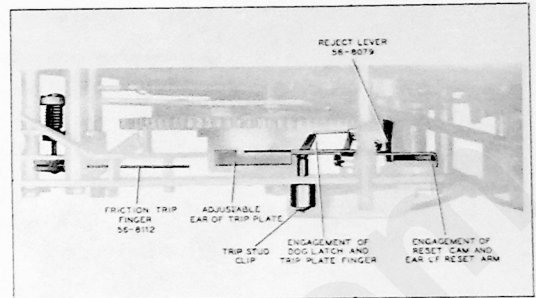


Figure 4. Trip Adjustment

UNEVEN TURNTABLE SPEED (WOWS)

Uneven turntable speed may be caused by any of the following conditions:

1. Dirt under and around the idler-wheel assembly.
2. Idler-wheel spring loose or missing.
3. Flat spot on idler-wheel tire or turntable.
4. Loose, worn, or distorted pulley belt.
5. Oil or grease on idler-wheel tire, pulley, pulley belt, or drive shaft.
6. Speed-control knob not in proper position.

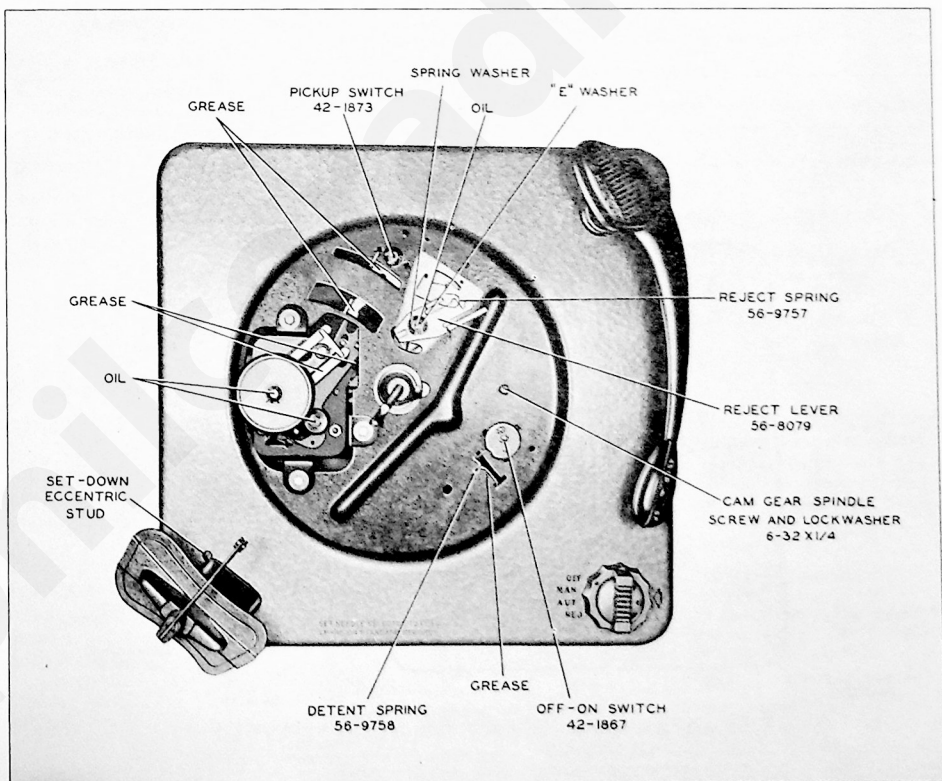


Figure 5. Top View, Showing Lubrication Points

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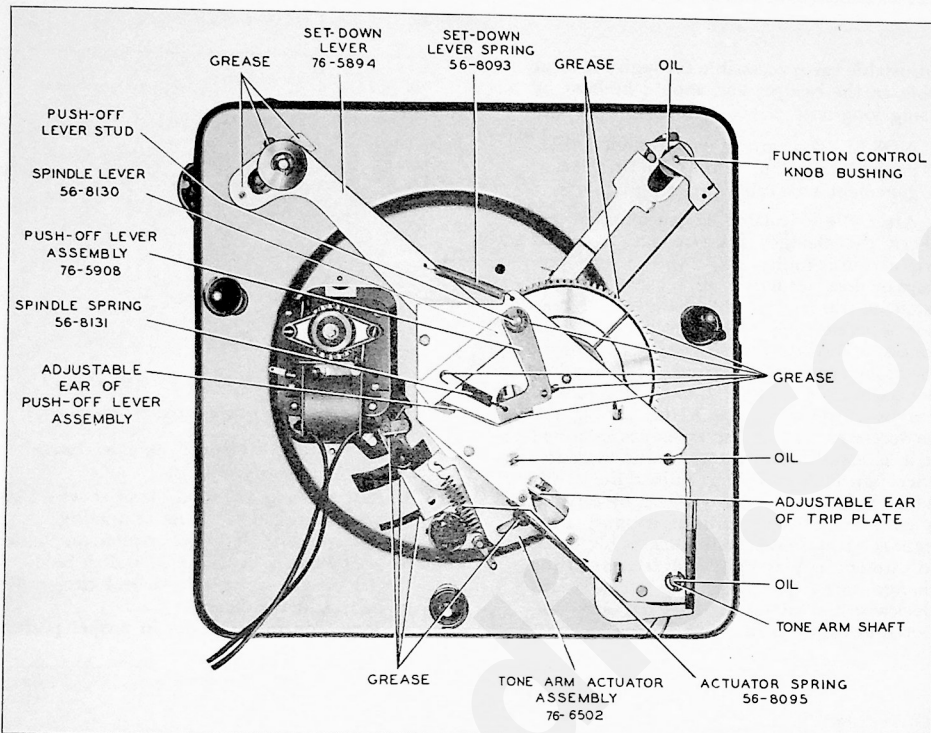


Figure 6. Bottom View, Showing Lubrication Points

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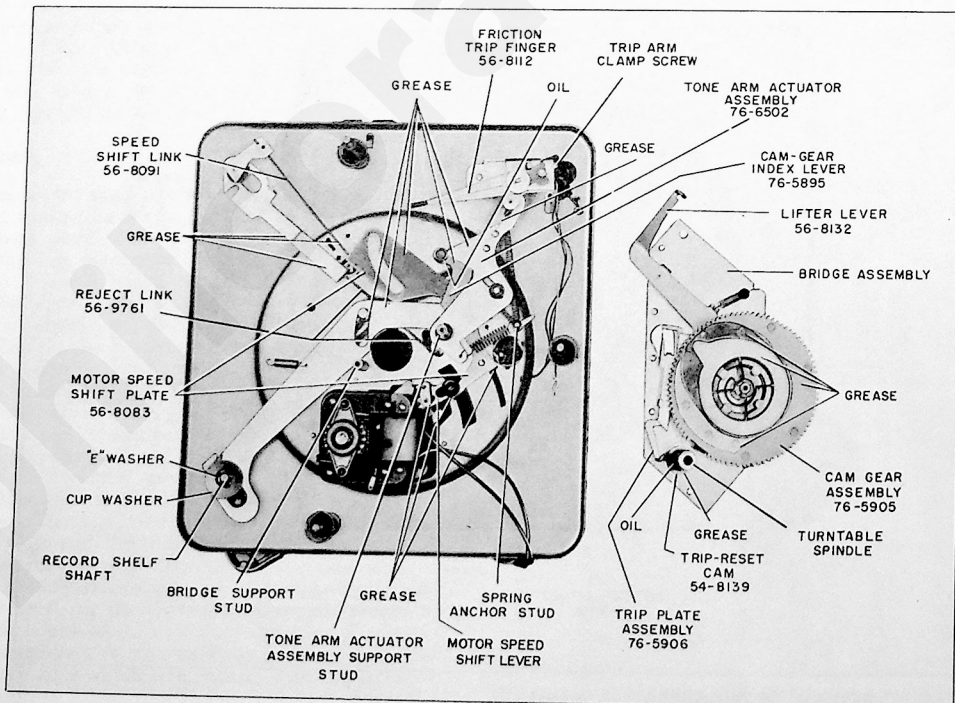


Figure 7. Bottom View, Bridge Removed, Showing Lubrication Points

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LUBRICATION

LUBRICANTS

1. Oil: S.A.E. 20.
2. Grease: Motor cup grease.
3. Contact lubricant: Dow Corning "DC-4."

PARTS NOT TO BE LUBRICATED

1. Motor drive shaft.
2. Motor pulley.
3. Drive belt.
4. Idler tire.
5. Dog latch (on cam gear).
6. Lifting lever (where dog rides).
7. Trip-plate assembly.
8. Friction washer and tone-arm stanchion.
9. Friction finger.
10. Friction washer.
11. Spindle latch (may be lubricated with powdered graphite or talcum powder).

PARTS TO BE GREASED

1. Actuator assembly.
 - Lifting lever, where lever contacts cam gear.
 - Tone-arm-actuator lever where it contacts stud of friction-clutch assembly.
2. Base Plate.
 - a. Switch lever, detent spring, and slot where switch-lever ear rides in base plate.
 - b. Actuating stud on the function knob, where it engages the switch lever.
 - c. Motor-speed-shift plate, where it rides in guide slots, and slot that rides on cam-gear spindle; control link where it rides on base plate.
3. Bridge assembly.
 - a. Push-off lever where end slides on bridge, where stud rides in slot of bridge, and at pivot pin.
 - b. Cam gear, all cam surfaces and gear teeth except dog latch.
 - c. Friction-clutch assembly.
 - d. Stud of friction-clutch assembly where return lever and tone-arm actuator ride.
4. Motor.

NOTE: When lubricating the motor, use grease or oil very sparingly. Excessive lubrication will cause erratic operation.

- a. Cam surfaces of idler-wheel lifter.
- b. Detent surfaces.
- c. Guide slots of shifter plate.
- d. Extension of idler shaft in contact with lower shifter plate.
- e. Retaining ear of speed-shift lever.
5. Record shelf.
 - a. Record-shelf-shaft bearing.
 - b. Detents for record shelf.
 - c. Hold-down pin and detents.
 - d. Hold-down shaft.
 - e. Set-down cam, where eccentric stud rides.

PARTS TO BE OILED

1. Cam-gear spindle.
2. Control-knob shafts.
3. Index-lever roller.
4. Motor.
 - a. Idler-assembly pivot shaft.
 - b. Idler-wheel shaft.
 - c. Slider bar, four points.
 - d. Two shift roller pins.
 - e. Pulley shaft (wipe dry and apply only *one* drop).
 - f. Under pivot bushing of shifter plate.
5. Reject-lever pivot.
6. Tone-arm shaft where it rotates in bridge and in base plate.
7. Tone-arm-pivot pin where it goes through swivel assembly.
8. Trip-plate-assembly pivot in bushing only.
9. Turntable bearings, top and bottom.
10. Actuator spindle.
11. Bearing surfaces between actuator lever, washer, set-down lever, index lever, washer, and return lever (grease end of return lever where it contacts stud of friction-clutch assembly).

CAUTION: When lubricating the motor, remove the rubber belt and idler wheel. When lubrication is completed, be sure the motor shaft and pulley are free from oil and grease. Failure to observe this precaution may result in slippage.

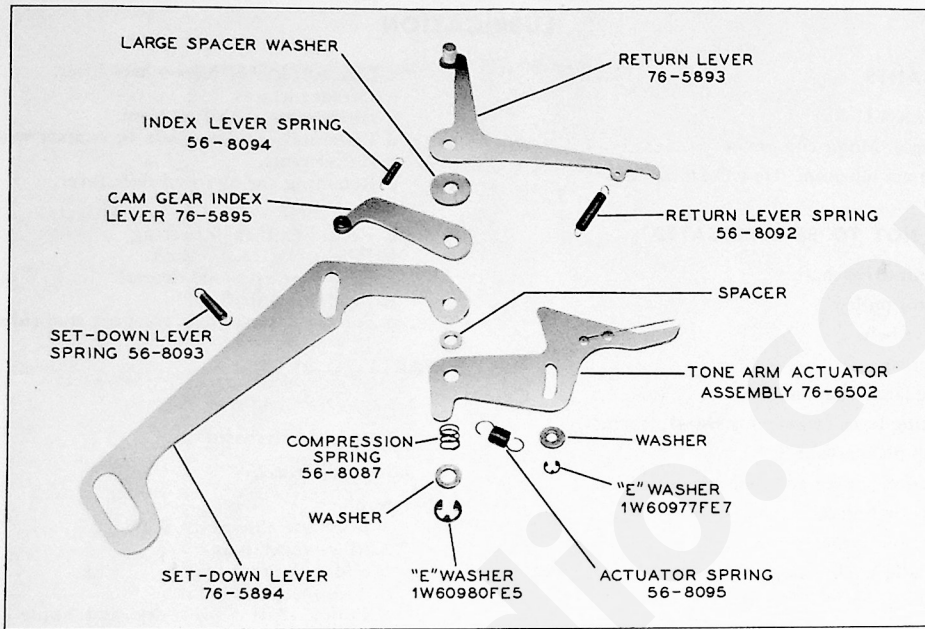
CONTACT LUBRICATION

Apply Dow Corning "DC-4" to the contacts of the cartridge contact plate, and to the dimple of the cartridge retaining spring. See figure 14.

REPLACEMENT OF PARTS AND ASSEMBLIES

The following procedures are recommended for the correct removal of parts and assemblies. The parts should be replaced by reversing the order of removal.

Adjustments should be made according to the directions given in the ADJUSTMENTS section of this manual.



TPO-1833-A

Figure 8. Actuator Assembly

1. Crystal Cartridge.

Grasp crystal cartridge with fingernails. With the other hand, hold tone arm and apply slight pressure on switch handle. Pull cartridge down and to the outside. Replace cartridge by holding contacts toward spindle, and pushing upward until firmly seated.
2. Needle.

Remove crystal cartridge (see paragraph 1). Lift needle out gently with prying motion, using fingernail or knife point. When replacing needle, align key of needle shaft with keyway in chuck of cartridge; then push needle into cartridge.
3. Turntable.

Remove spring retainer and washer located on the top of the turntable spindle bushing. Lift turntable off.

NOTE: When replacing turntable, position SPEED control knob midway between LP and 45 or 45 and SP. This holds the idler wheel in a retracted position. Then replace turntable. This method will prevent damage to the idler-wheel tire; then replace washer and retainer.
4. Spindle. See figure 6.

Disengage spindle spring. Remove spindle. Do not lose spring washer under spindle lever.
5. Bridge. See figure 9.
 - a. Remove set-down-lever spring. See figure 8.
 - b. Remove the three hex-head bridge mounting screws and the two plastic cable clamps.
 - c. Remove "E" washer from tone-arm spindle.
 - d. Remove hex-head drive screw from cam-gear spindle. This screw is located on the top of the motorboard under the turntable. See figure 5.
 - e. Remove pull-cord and disconnect tone-arm wires.
 - f. Carefully lift off bridge, cam gear, spindle bushing, trip-plate assembly, lifter lever, spindle lever, and push-off lever.
6. Cam Gear.
 - a. Remove bridge. See paragraph 5.
 - b. Remove "E" washer from cam-gear spindle.
 - c. Lift off cam gear.
7. Push-off-Lever Assembly and Spindle Lever.
 - a. Remove cam gear. See paragraph 6.
 - b. Remove "E" washer from push-off lever stud. See figure 6.
 - c. Rotate push-off lever so that stud is in large hole, and lift off both push-off lever and spindle lever.
8. Trip-Plate Assembly.
 - a. Remove cam gear. See paragraph 6.
 - b. Remove clip from trip stud, see figure 4, and lift assembly from bushing.
9. Trip Reset Cam, Neoprene Washer, and Ball Bearing.
 - a. Remove cam gear. See paragraph 6.
 - b. Remove spring retaining ring. See figure 9.
 - c. The trip reset cam, neoprene washer, ball cover, balls, and race may be removed in that order.
10. Trip-Arm Assembly. See figure 15.

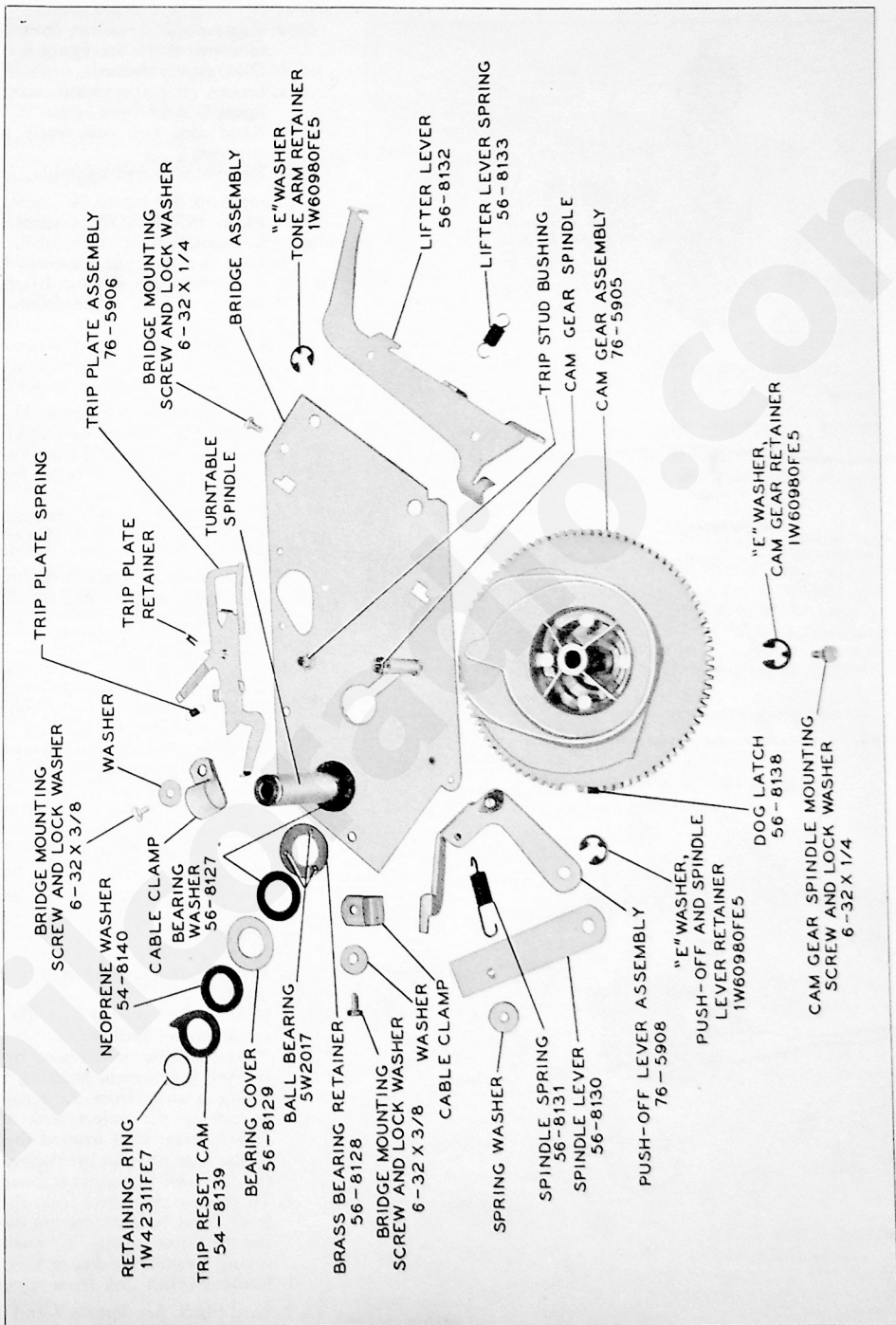


Figure 9. Bridge Assembly

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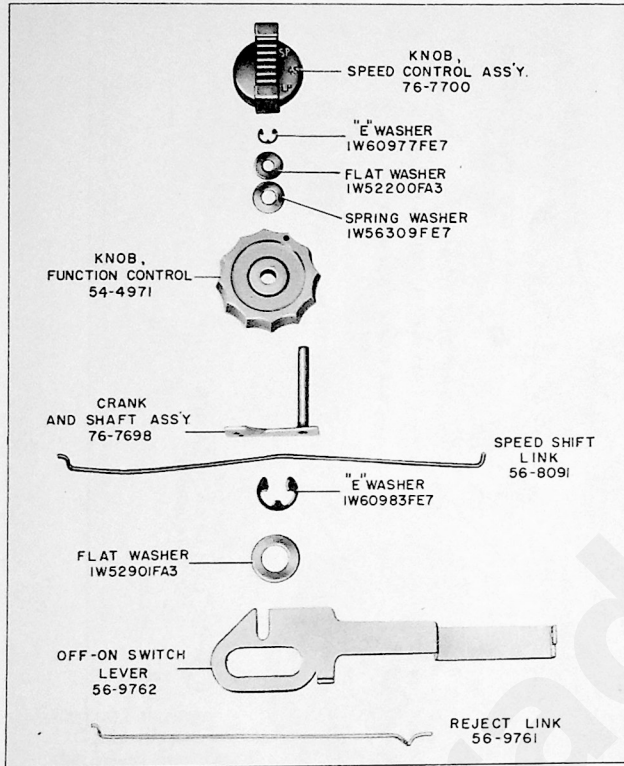


Figure 10. Control Assembly

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- a. Remove "E" washer from end of tone-arm shaft. See figure 6.
 - b. Disengage pull-cord.
 - c. Loosen trip-arm-clamp screw. See figure 7.
 - d. Raise tone arm sufficiently to clear trip arm.
 - e. Remove trip-arm assembly.
11. Tone Arm. See figure 14.
 - a. Place FUNCTION control in the OFF position.
 - b. Unsolder the four tone-arm leads.
 - c. Remove pull-cord from lifter lever.
 - d. Remove "E" washer from end of tone-arm shaft.
 - e. Loosen trip-arm-clamp screw.
 - f. Remove tone-arm-shaft spring.
 - g. Lift out tone arm.
 12. Motor Assembly. See figures 11 and 12.
 - a. Remove turntable. See paragraph 3.
 - b. Unsolder motor lead from switch on base plate, and free other lead from tape and spaghetti.
 - c. Remove the three hex-head drive screws, washers, and spacers from motor frame.
 - d. Slide jaws of speed-shift lever free of rubber grommet and ear of motor-speed-shift plate.
 - e. Lift motor out.
 13. Control Shaft and Links. Figure 10 shows the control assembly.
 - a. Place function control knob in the OFF position.
 - b. Remove turntable, and detent spring from motor board.
 - c. Pull off speed control knob.
 - d. Remove "E" washer, flat washer, and spring washer.
 - e. Pull off function control knob.
 - f. Push speed change shaft and crank assembly through the bushing in the base plate.
 - g. Disengage shaft and crank assembly from its link.
 - h. Remove the speed shift link. See figure 7.
 - i. Remove "E" washer and flat washer from control bushing.
 - j. Remove off-on switch lever by lifting it over the control bushing and rotating it away from the record shelf to release the reject link and the switch lever. Pull toward the corner of the base plate to lift the ear out of the "T" slot in the motorboard.
 - k. To remove the reject link, the reject lever must be removed by disengaging the reject spring, "E" washer, and spring washer. See figure 5.
 - l. Remove reject link from reject lever.
 14. Record Shelf. See figures 7 and 13.
 - a. Remove "E" washer from bottom of record-shelf shaft.
 - b. Remove cupped washer.

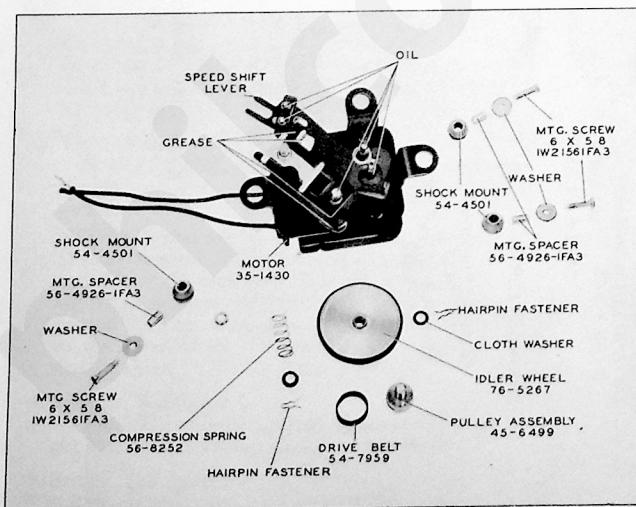


Figure 11. Motor Assembly—Part No. 35-1451

TPO-9-204

- c. Loosen set-down cam clamp screw. See figure 13.
 - d. Remove set-down cam, record-shelf spring, and spacer. See figure 13.
 - e. Lift record shelf from saddle.
15. Actuator Levers. See figure 8.
- a. Remove bridge. See Paragraph 5.
 - b. Remove spring from tone-arm return lever.
 - c. Remove "E" washer, washer, and compression spring from actuator support stud.
 - d. Remove "E" washer and washer from tone-arm-actuator support stud.
 - e. Remove tone-arm-actuator assembly.
 - f. Remove spacer washer from actuator support stud.
 - g. Remove set-down lever.
 - h. Remove cam-gear index lever.
 - i. Remove motor-speed-shift plate by pulling speed-shift lever toward center of changer, freeing grommet from jaws of lever, and returning lever to an outward position. Lift and turn free end of speed-shift plate toward tone arm; this will free ear in large slot. With free end, carefully twist plate down between return-lever support stud and spring-anchor stud. Ear in small slot will come free.
 - j. Remove large spacer washer from actuator stud.

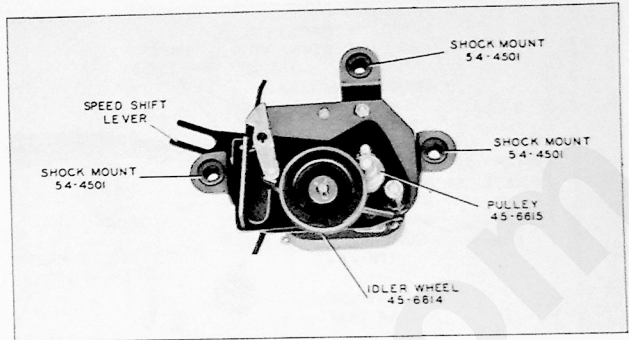


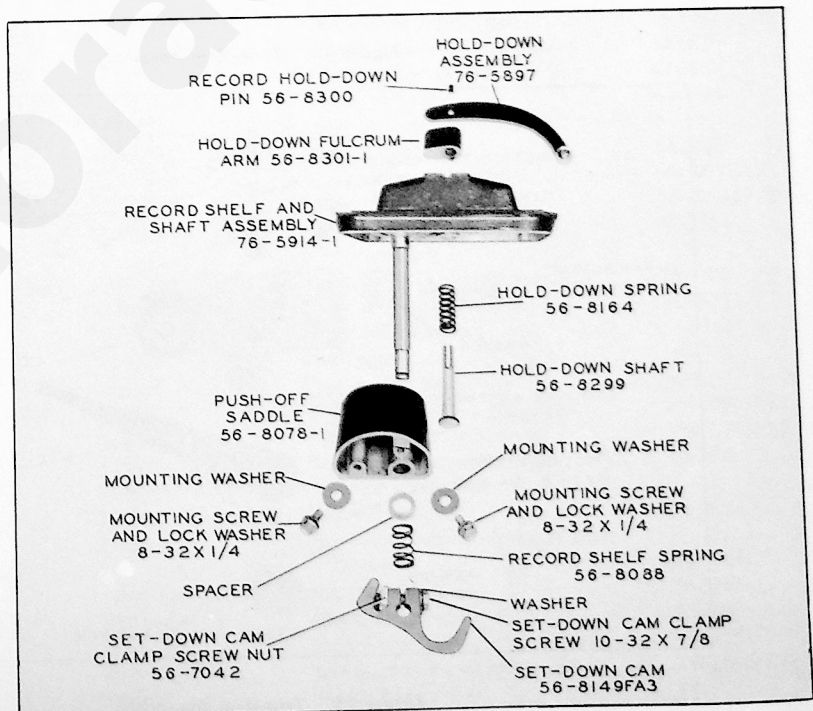
Figure 12. Motor Assembly

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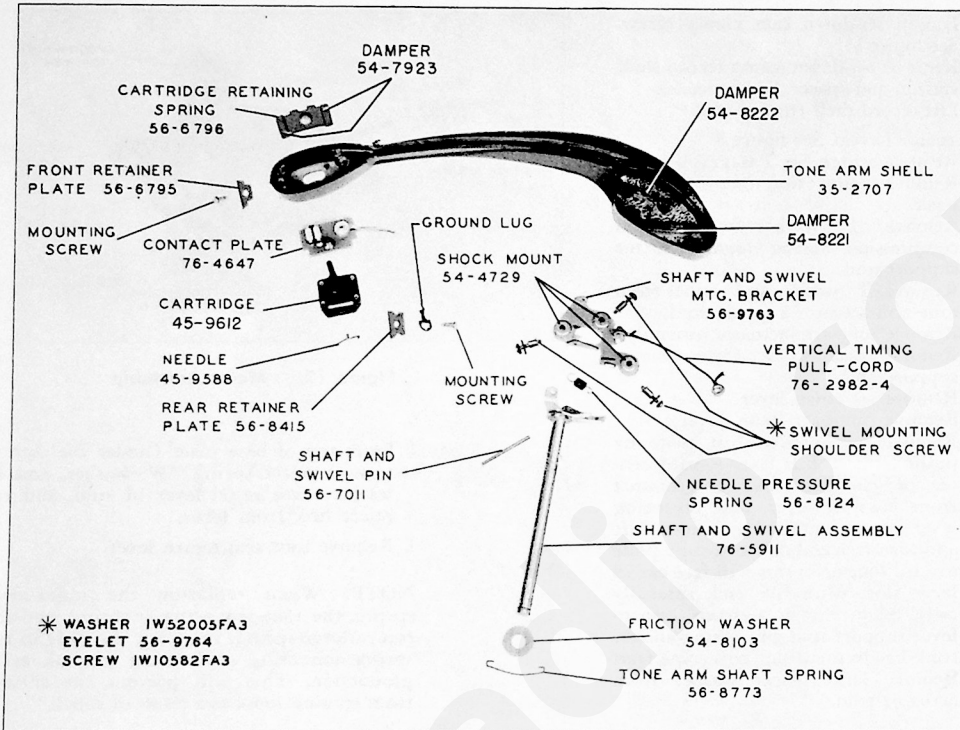
- k. From top of base plate (under the turntable), remove reject spring, "E" washer, and spring washer. Free reject lever of stud, and remove reject link from lever.
- l. Remove tone-arm-return lever.

NOTE: When replacing the index-lever spring, the tone-arm-actuator spring, and the return-lever spring, recement the ends to the spring mounting stud, using glyptal, as in production. This will prevent the springs from coming loose as a result of shock.

Figure 13. Record-Shelf Assembly

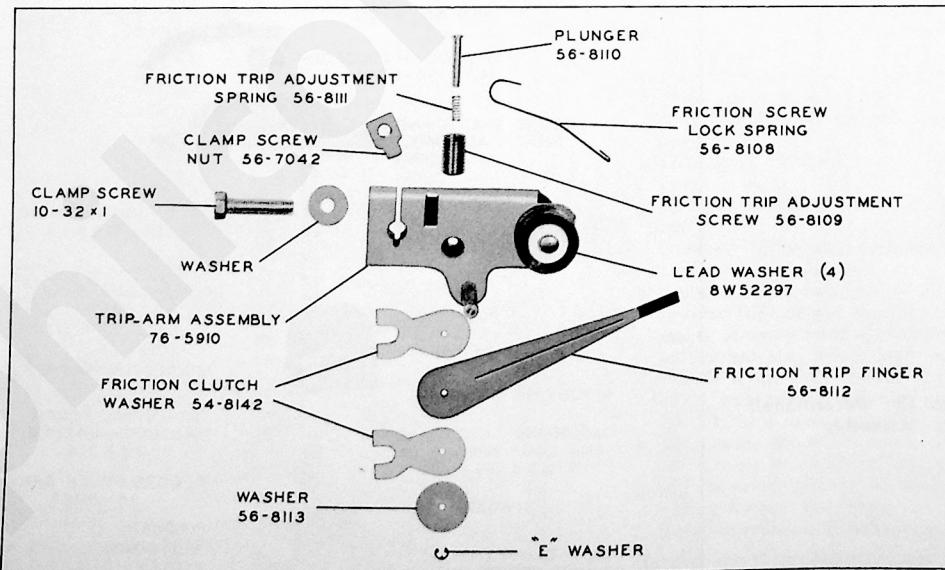


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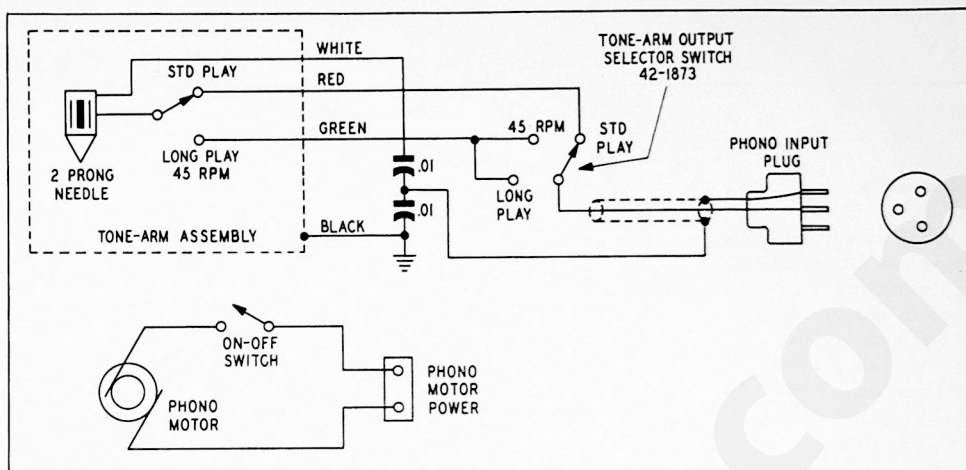
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Figure 14. Tone-Arm Assembly



TPO-1842

Figure 15. Trip-Arm Assembly



TPO-2313

Figure 16. Wiring Diagram for Model M-24

REPLACEMENT PARTS LIST

Description	Service Part No.	Description	Service Part No.
Actuator Assembly. (See figure 8.)		Changer Base Plate, Tone-Arm Rest, and	
Cam-gear index lever	76-5895	Tone-Arm Stanchion	76-5892
Spring, index lever	56-8094	Bumper, tone-arm rest, rubber	54-8136
Compression spring	56-8087	Switch, motor power	42-1867
Return lever	76-5893	Switch, pickup	42-1873
Spring, return lever	56-8092	Changer Mounting Hardware	
Set-down lever	76-5894	Sleeve, rubber (3)	54-7798
Spring, set-down lever	56-8093	Spring, heavy, top (3)	56-7059FA9
Tone-arm-actuator assembly	76-6502	Spring, light, bottom (3)	56-7059-IFCP
Spring, actuator	56-8095	Speed nut (3)	W-2554
Bridge Assembly. (See figure 9.)		Control Assembly	
Ball bearing, 1/8 inch dia. (3)	5W2017	Knob, SPEED control assembly	76-7700
Bearing cover	56-8129	Knob, FUNCTION control	54-4971
Bearing retainer, brass	56-8128	Lever, off-on switch	56-9762
Bearing washer (2)	56-8127	Link, reject	56-9761
Cam-gear assembly	76-5905	Link, speed shift	56-8091
Dog latch	56-8138	Washer, "E" shaft and crank	1W60983FE7
Pin, dog-latch mounting	56-8139	Washer, "E" switch lever	1W60980FE5
Lifter lever	56-8132	Crank-and-shaft assembly	76-7698
Spring, lifter lever	56-8133	Motor and Hardware	
Neoprene washer	54-8140	Drive belt	54-7959
Push-off-lever assembly	76-5908	Grommet, rubber, speed-selector	
Retaining ring, reset cam and		lever	54-4914
bearing	1W42311FE7	Idle wheel	76-5267
Spindle lever	56-8130	Plate, motor-speed shift	56-8083
Spring, spindle	56-8131	Pulley assembly	45-6499
Trip-plate assembly	76-5906	Screw, motor mounting (3)	1W21561FA3
Trip-reset cam	54-8139	Shock mount (3)	54-4501

RECORD CHANGER

Description	Service Part No.	Description	Service Part No.
Spacer, mounting (3)	56-4926	Needle, sapphire tips	45-9589
Spring, idler retractor	56-8252	Pin, shaft and swivel	56-7011
Idler wheel	45-6614	Pull-cord, vertical timing	76-2982-4
Pulley assembly	45-6615	Retainer plate, front	56-6795
Shock mount (3)	54-4501	Retainer plate, rear	56-8415
Motor, 117 volts, 50-60 cycles	35-1442	Eyelet, bracket mounting (3)	56-9764
Conversion kit, for 50-cycle operation	40-8680	Screw, bracket mounting (3)	1W10582FA2
Record-Shelf Assembly		Washer (3)	1W52005FA3
Hold-down assembly	76-5897	Shaft-and-swivel assembly	76-5911
Hold-down fulcrum arm	56-8301-1	Shock mount, bracket mounting (3)	54-4729
Hold-down pin	56-8300	Spring, cartridge retaining	56-6796
Hold-down shaft	56-8299	Damper	54-7923
Hold-down spring	56-8164	Spring, needle pressure	56-8124
Push-off saddle	56-8078-1	Spring, tone-arm shaft	56-8773
Record-shelf-and-shaft assembly	76-5914-1	Tone-arm shell	35-2707-1
Set-down cam	56-8149FA3	Washer, horizontal friction (plastic)	54-8103
Nut, cam locking	56-7042	Trip-Arm Assembly	76-5910
Spacer	56-8833	Finger, friction trip	56-8112
Spring, record shelf	56-8088	Nut, clamp screw	56-7042
Washer, cupped	56-8089	Plunger	56-8110
Reject lever	56-8079	Screw, friction-trip adjustment	56-8109
Spring, detent	56-9758	Spring, friction-screw lock	56-8108
Spring, reject	56-9757	Spring, friction-trip adjustment	56-8111
Spindle Record	76-5909	Washer, flat	56-8113
Tone-Arm Assembly (Complete)	35-2717	Washer, friction clutch (plastic) (2)	54-8142
Bracket, mounting for shaft and swivel	56-9763	Washer, "C"	56-8793
Damper	54-8221	Washer, lead (4)	8W52297
Damper	54-8222	Turntable	35-2711-3
Cartridge		Retainer, turntable	56-8097
Contact plate	76-4647-1	Washer, turntable	56-8096
Needle			

PARTS LIST CORRECTIONS

Description	Service Part No.
Cartridge	45-9785
Needle	45-9784

NOTE: The above changes should also be made to figure 14.

CORRECTION TO MANUAL

The motor assembly, Part No. 35-1455, shown in figure 12, is now obsolete. Any reference to figure 12 in this manual should be disregarded.