SERVICE MANUAL and PARTS LIST

for

V-M MODEL 950

TRI-O-MATIC RECORD CHANGER

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Manufactured in Canada under License
by

AUDIO TOOL AND ENGINEERING LTD.

TORONTO, CANADA

Form No. 2544-C

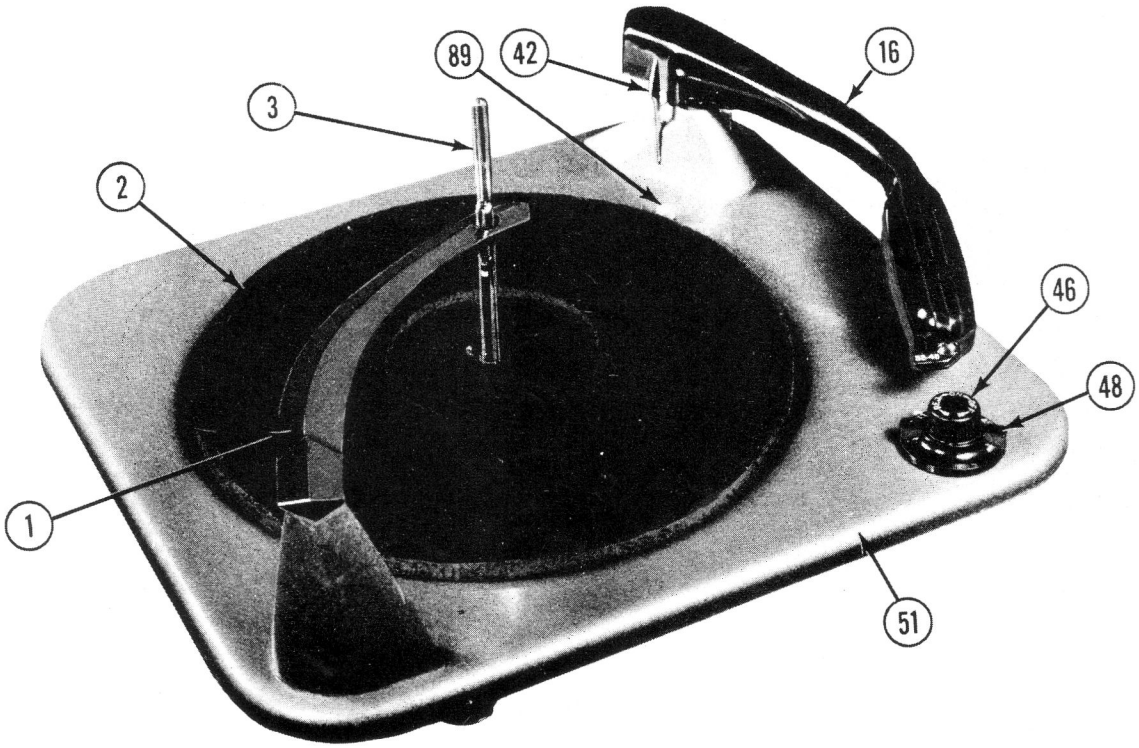


Figure 2

SPECIFICATIONS

The V-M 950 Tri-o-matic Record Changer Intermix Model is designed to play standard 78 RPM, fine-groove 45 RPM, or long-play 33-1/3 RPM records of standard commercial dimensions. Records up to 12 inches in diameter can be played manually.

Features of this changer include playing and automatically changing as many as ten - 12", twelve - 10", or any assortment of 10" and 12" of the same type (78 RPM or 33-1/3 RPM).

A full stack of twelve - 7", 33-1/3 RPM records or a full stack of twelve - 7", 45 RPM records (with the adapter inserted in the record) will also play on this changer.

The changer shuts off after the last record has been played.

Connect this changer only to an outlet supplying 117 volts, 60-cycle ac unless otherwise specified. Power consumption 25 watts.

PREPARING FOR OPERATION

SHIPPING BOLTS: Before placing in operation, the machine must be floated freely on the mounting springs. During shipment, the mechanism is secured by means of two shipping bolts. To float the changer, remove the turntable by lifting it straight up the spindle. Turn the two shipping bolts in a clockwise direction as far as they will go and replace the turntable. Before the turntable can be fully seated, the idler wheel must be gently pushed back out of the way to prevent damage to the rubber tire.

OPERATION

Loading -

1. Pull straight up on record support knob until record support clears spindle. Swing record support to the left until pin in shaft drops into locating groove.

2. Changer will automatically play ten - 12" either standard or long-play records, twelve - 10" either standard or long-play records, any assortment of ten - 12" and 10" records intermixed, or twelve - 7" long-play or fine-groove records.

NOTE: Standard, fine-groove, and long-play records cannot be intermixed. Motor speed control knob must be reset for each type of recording.

3. Place records on spindle and lower to offset shelf. Hold records level and replace record support over spindle.

To Play Standard Recordings -

1. Motor speed control knob must be in the "78" position.

2. To start, turn changer control knob to "Rej." and release. Changer will operate automatically until the last record has been played. Pickup arm returns to rest and the changer control knob to the "Off" position. Changer automatically stops.

LEVELING RECORD CHANGER: It is essential to have the record changer absolutely level. Use a torpedo or similar type level on the record changer baseplate. Use adequate shims to level the record changer pan or radio combination cabinet to achieve perfect level.

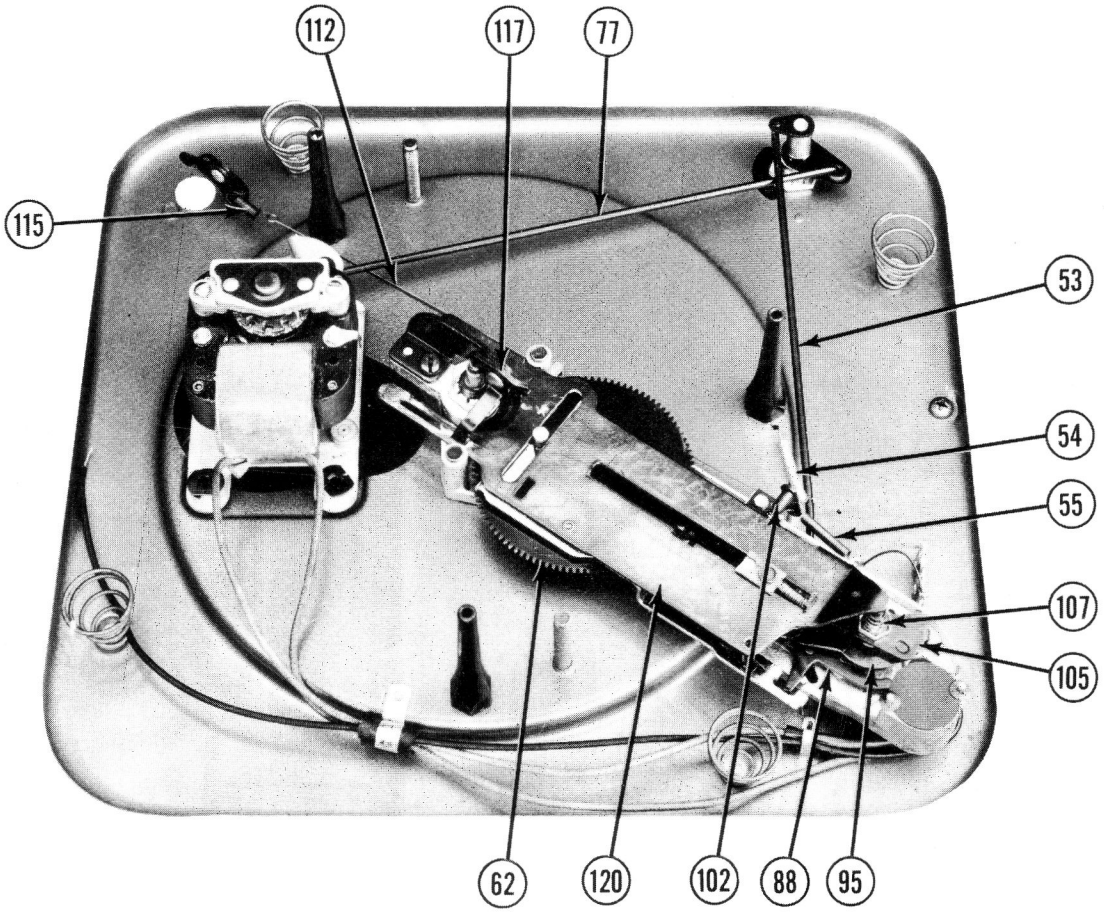


Figure 3

To Play Long-Play (33-1/3 RPM) Records -

1. Motor speed control knob must be in the "33" position.

To Play Fine-Groove (45 RPM) Records -

1. Motor speed control knob must be in the "45" position.

2. These records are manufactured with a 1-1/2" spindle hole. It is essential that a record adapter be inserted into each 45 RPM record to be played. This is necessary to reduce the spindle hole to conventional size.

REJECTING: To reject a record at any time while changer is operating, turn changer control knob to "Rej." and release.

STOPPING: To turn off changer before automatic shut-off, turn changer control knob to "Off." Lift pickup arm and place on rest.

UNLOADING: Lift the record support and swing to the left until pin on shaft drops into locating groove. Lift stack of records straight up and off spindle.

MANUAL OPERATION: To play single records or home recordings, allow the changer to go through its complete shut-off cycle. Lift the record support arm and move it to the left clear of the turntable. Place record on spindle and lower to spindle shelf. Tilt record down toward the rear of pickup arm and lower record to turntable. Turn changer control knob to "On" position only. Raise pickup arm and place in lead-in groove of record.

REPEATING OF 7", 10", OR 12" RECORDS: To repeat records, swing record support clear of spindle, place record on the turntable, and start changer. Record repeats until control is turned "Off." If a 12" record is repeated, wait for the changer to finish cycling and reposition the pickup arm manually to the 12" position.

SUGGESTIONS: When loading and unloading the changer, use care to prevent bending of the spindle. Records should not be left on the spindle except during operation of changer. Records will warp. When machine is not in use, it is suggested that the speed control knob be left in the "78" position. For best reproduction, keep needle and records clean. Store records flat, in folders or in albums. Do not lay record on record.

CHANGE CYCLE

This changer is provided with what is known as a velocity trip mechanism. The change cycle is started by the faster inward motion of the pickup arm when the needle enters the trip grooves at the end of the record. Only records having fast-finishing grooves before the eccentric cycling groove will operate this velocity trip.

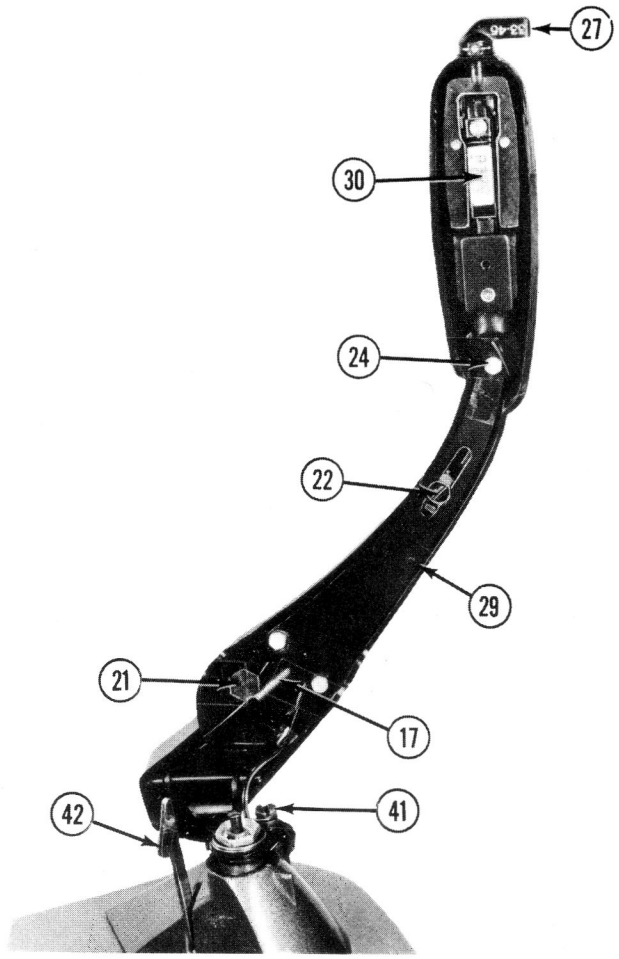


Figure 4

The pickup arm and hinge assembly and trip finger cam (105) are secured at opposite ends of the pickup arm shaft and sleeve (43) so that they move in unison. As the pickup arm nears the end of the record, the trip finger cam (105) pushes the trip link (110), which, in turn, engages the trip lever (68) rotating the pawl lever (65) to move the trip pawl (69) toward the hub on the turntable. While a record is playing, the small motions of the trip pawl (67) are not sufficient to cycle the mechanism because on each revolution of turntable the wiping contact by the hub projection moves the trip pawl (67) back to clear the projection.

In the first revolution of the turntable during which the pickup arm advances rapidly, the trip pawl (67) is moved far enough to definitely engage the projection on the turntable hub. The gear on the turntable hub will now engage the main gear (62) and start its rotation. This, in turn, starts the lateral motion of the slide and cam assembly (120). The slide and cam assembly (120) moves to the rear through the action of an eccentric pin (71) on the main gear (62) moving in the cross slot on the slide and cam assembly (120).

As the slide and cam assembly (120) begins to move, the cam surface at the rear pushes the lift pin (35) upward, raising the pickup arm clear of the record. At the same time, the tab on the rear of the slide and cam assembly (120) contacts the trip finger cam (105) swinging the pickup arm clear of the turntable.

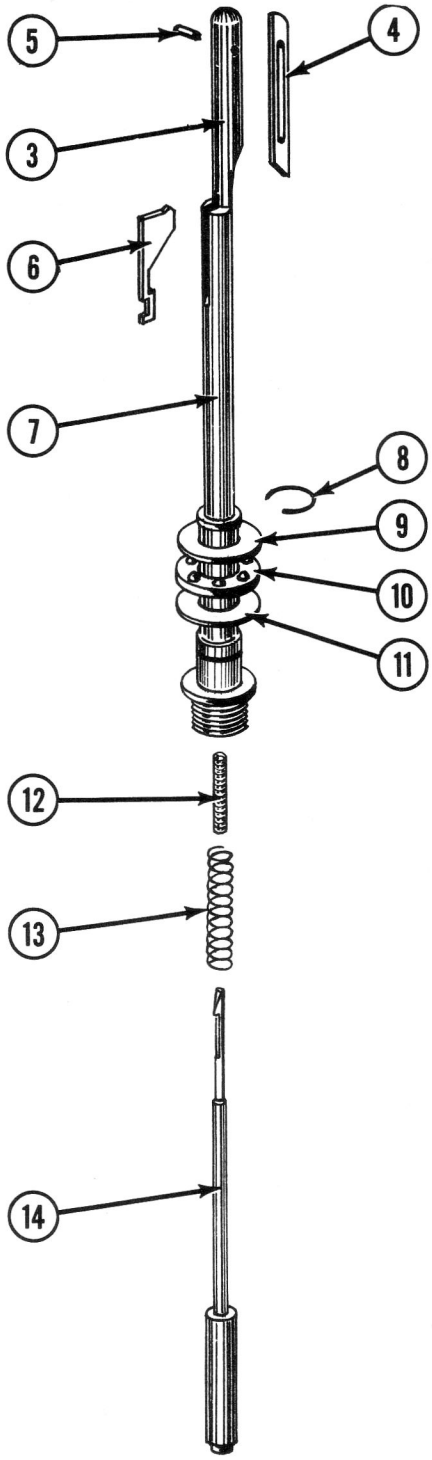


Figure 5

The front edge of the ejector link slot in the slide and cam assembly (120) then contacts the ejector link on the ejector link assembly (117). The ejector link moves the pusher shaft and housing assembly (14) upward actuating the spindle assembly (3), causing the record pusher (6) to move straight up so as to enter the center hole of the record, and then to be pivoted forward, dropping a record to the turntable. (See Figure 5 .)

The spindle guide (4) inside the spindle (3) prevents more than one record at a time from being ejected.

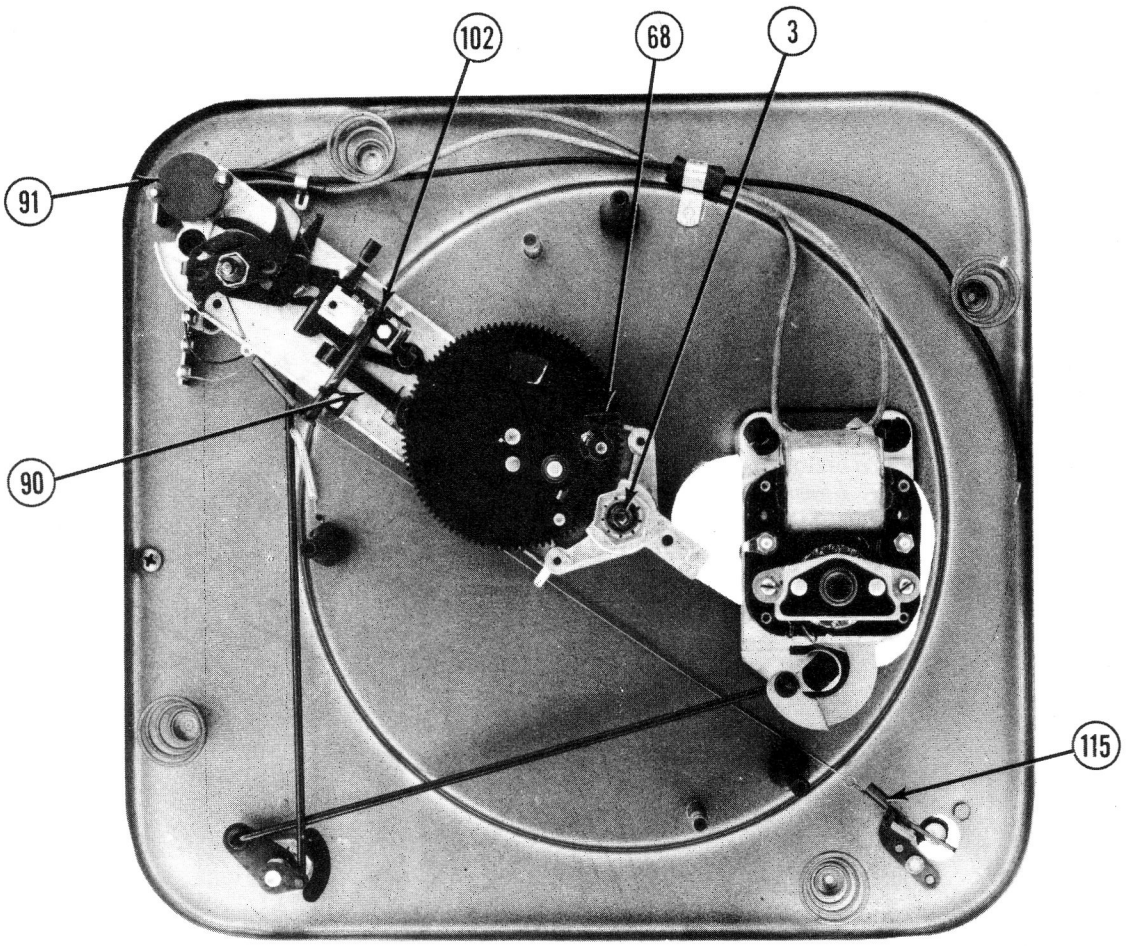


Figure 6

When records are removed from the turntable, the guide slides straight up allowing free movement up the spindle, then slides back into position by gravity.

Simultaneously, the tab on the rear of the slide and cam assembly (120) contacts the pickup arm return locator (95), moving it clear of the reset lever (81); at the same time, the pickup arm return locator (95) is locked in position with the trip finger cam (105) by means of matching holes in the pickup arm return locator (95) and detents in the trip finger cam (105). This is accomplished by the pressure of the compressed conical lift pin spring (107) overcoming the pressure of the lift pin compression spring washer (97).

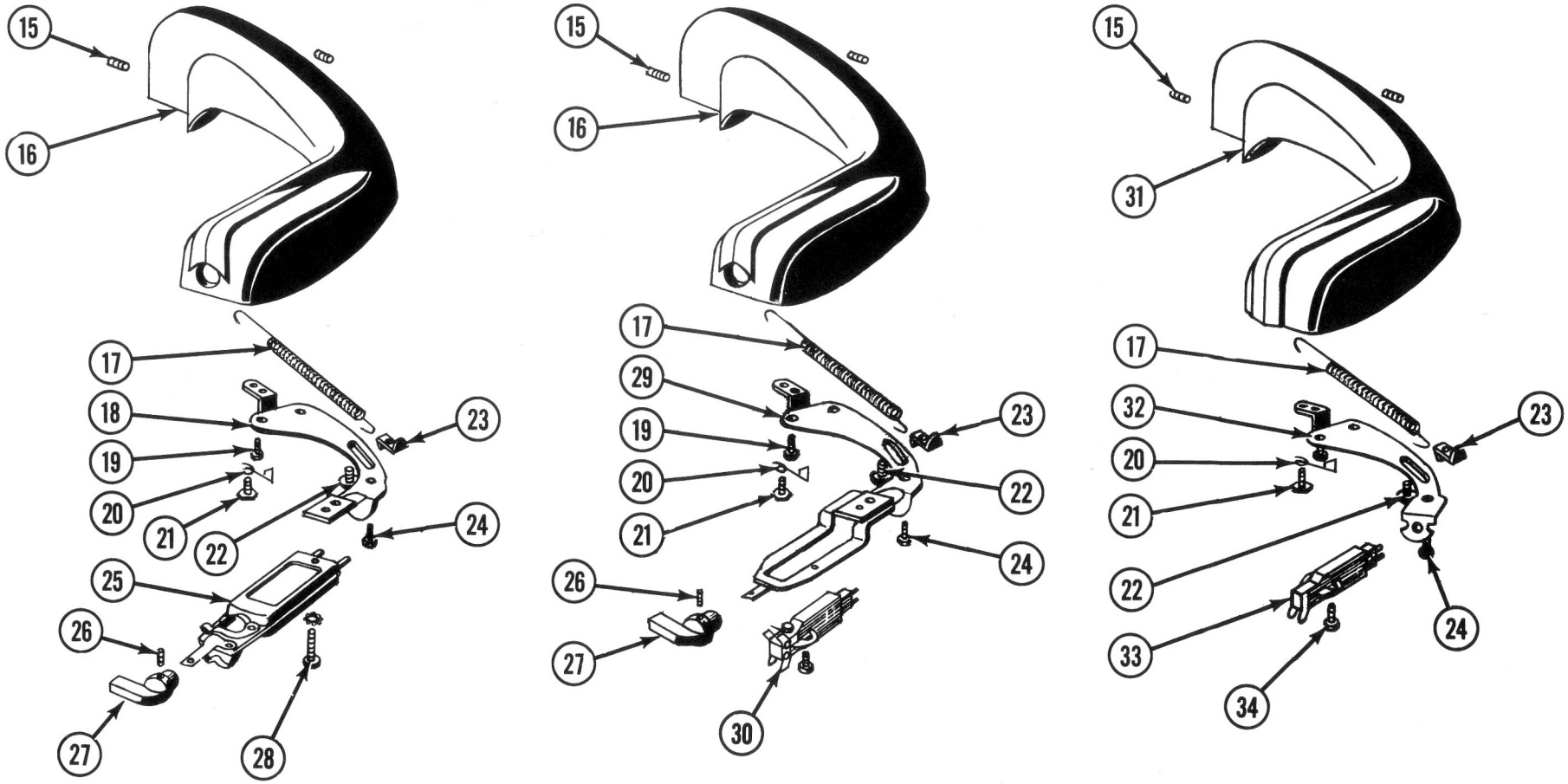
At the same time, the cam surface of the bracket on the main gear assembly (62) moves the reset lever (81) to mid-position (10" set-down) where it is held by the 12" record selector (42). The slide and cam assembly (120) continues to the rear and then starts forward. If 7" records are being changed, the rubber bumper (89) of the 7" set-down lever (90) is free to move upward permitting the other end to drop into the hole in the main gear (62) as this gear rotates. This action of the 7" set-down lever (90) raises the reset lever (81) to the upper position (7" set-down).

If 10" records are being changed, the 7" set-down lever (90) will not operate as the rubber bumper (89) will contact the edge of the record and the reset lever (81) will remain in the mid-position (10" set-down) as originally placed by the caming action of the bracket on the main gear (62).

If a 12" record is being changed, the edge of the record strikes the 12" record selector (42) releasing the reset lever (81) which drops to the bottom position (12" set-down).

As the slide and cam assembly (120) continues forward, the tab on the rear of the slide will move clear of the pickup arm return locator (95) and trip finger cam (105), which are still locked together. These rotate under the action of the pickup arm return spring (87) until one of the three set-down steps in the pickup arm return locator (95) strikes the reset lever (81), which has been positioned by the record being changed (see above). This stops the inward movement of the pickup arm return locator (95), trip finger cam (105) and pickup arm. The pickup arm is then lowered to the lead-in grooves of the record at this point as the lift pin (35) rides down the rear cam surface of the slide and cam assembly (120). As the pressure is released from the conical lift pin spring (107), the lift pin compression spring washer (97) separates the pickup arm return locator (95) and trip finger cam (105), permitting the pickup arm to ride freely across the record.

As soon as the last record has been dropped, the



EXPLODED VIEWS OF TONE ARMS

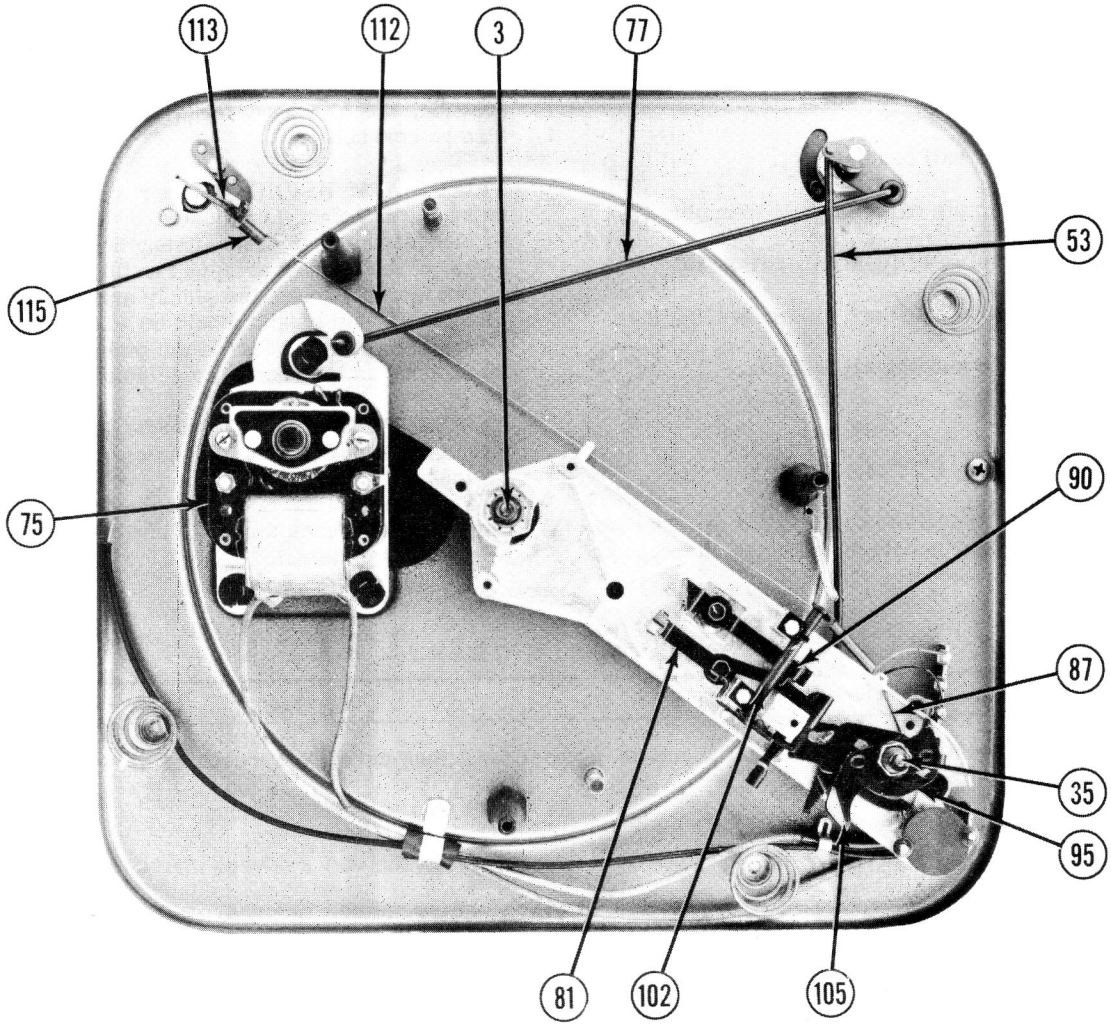


Figure 7

record support assembly (1) drops below the shelf on the spindle assembly (3) and the lower end of the record support post contacts the arm of the shut-off lever on the shut-off lever bracket assembly (117). This pulls the control link (112), which, in turn, rotates the crank of the lever assembly (102). This forces the tab on the lever assembly (102) against the slide and cam assembly (120). At the end of the change cycle, which drops the last record, this tab on the lever assembly (102) drops into the cut-out in the main slot on the slide and cam assembly (120), and the other end of the lever assembly (102) is pushed against the pickup arm return locator (95).

When the last record has been played, the change cycle starts again; however, this time, as the pickup arm return locator (95) is pivoted clear of the reset lever (81) by the tab on the slide and cam assembly (120), the lever assembly (102) rises to the shut-off position. A tab on the lever assembly (102) raises the trip link (110) to the upper position. As the pickup arm return locator (95) starts to return the pickup arm to the record, it is stopped by the lever assembly (102) with the pickup arm positioned over the pickup arm rest post (45). The main gear continues to rotate pulling the trip link (110) forward to reset it. A tab on the upper surface of the trip link (110) contacts a lever on the control shaft assembly (88) rotating the control shaft assembly to turn off the motor and return the control knob to the "Off" position.

As the slide and cam assembly (120) moves forward, the lift pin (35) rides down the rear cam surface lowering the pickup arm to the pickup arm rest post (45).

LUBRICATION

Additional lubrication should not be required for the life of the changer, but in cases of unusual use or high-operating temperature, the changer should be lubricated as follows: (Refer to the exploded view.)

Apply Andok "B" to:

1. Edges of all slots in slide and cam assembly (120).

2. Outer edges of tines on forked end of slide and cam assembly (120).

3. Lift pin cam surface on slide and cam assembly (120).

4. Lower surface of pickup arm return locator (95).

5. Inner surface of tab on rear of slide and cam assembly (120).

6. Turntable ball bearing (10).

7. Eccentric pin on main gear assembly (70).

Apply a small quantity of light mineral oil to:

1. Pickup arm shaft and sleeve bearing (43).

2. Turntable and spindle bearing.

ADJUSTMENTS

NEEDLE SET-DOWN (Refer to Figure 4); The set-down position of the needle is adjusted by means of the set-down adjustment screw (41) mounted on the hinge arm assembly (40). Turn this screw adjusting pickup arm for correct set-down on 10" record. When the correct set-down is obtained for the 10" position, the 12" and the 7" needle set-down will also be correct.

PICKUP ARM HEIGHT (Refer to Figure 4): The pickup arm height is adjusted by the lift screw (21) located at the rear of the strengthener. To raise the height of the pickup arm, turn this screw counter-clockwise. To lower the pickup arm, turn clockwise. The pickup arm height should be adjusted so that with a 1-1/8" stack of records the pickup arm lifts 1/4" straight up as the change cycle starts.

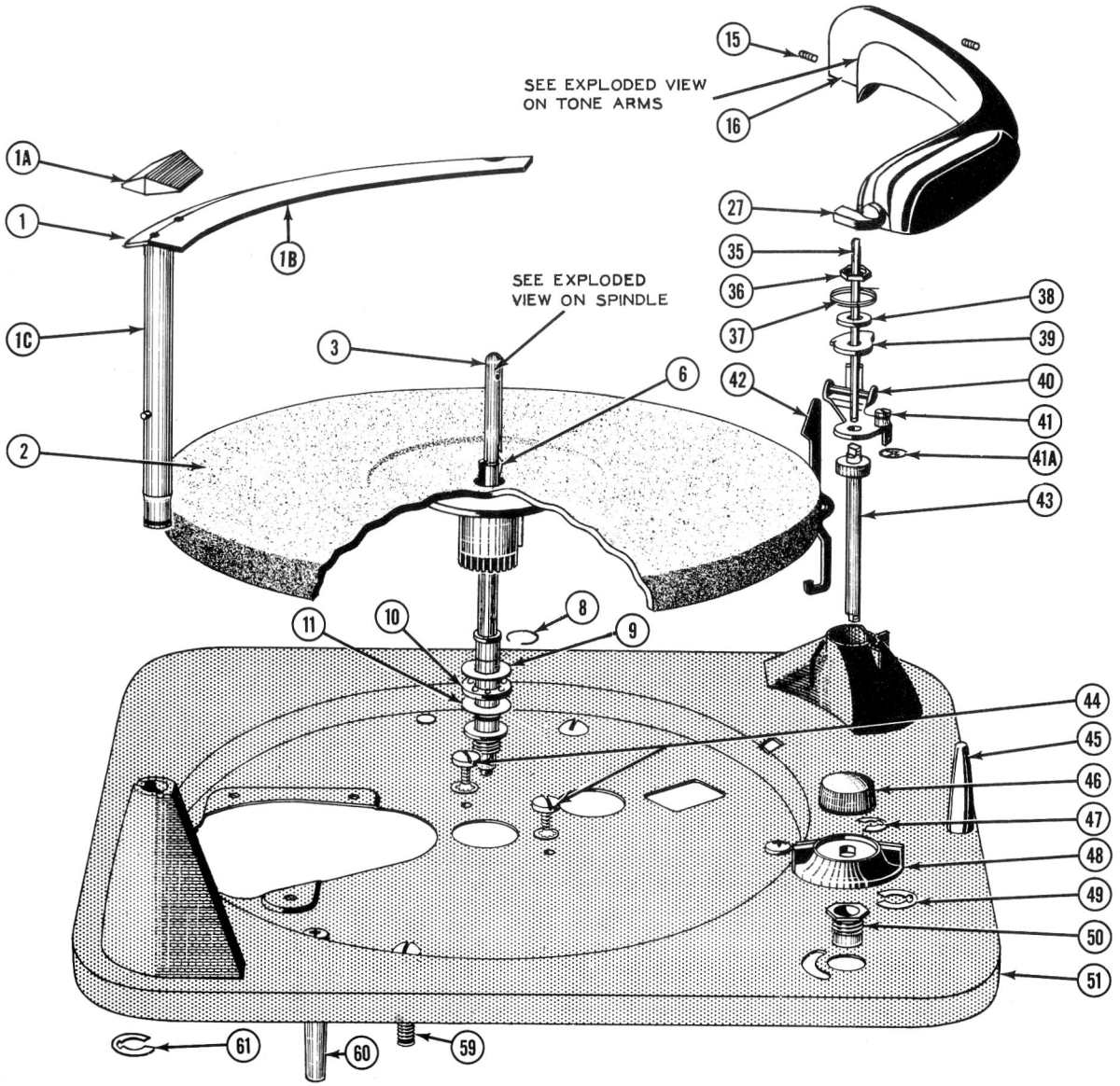
NEEDLE PRESSURE: The needle pressure should be between 10 and 12 grams. Adjustment may be made by loosening the screw (22) on the slide which moves in a slot in the tone arm strengthener (see Figure 4). Move the slide back and forth until the correct needle pressure is obtained.

TROUBLE CHART

SYMPTOM	CAUSE	REMEDY
Turntable does not revolve when control is turned to "On."	1. No current at motor.	(a) Check that current is reaching ac leads of changer. (b) Check that switch is closing. (c) Check wiring and soldered terminals in the changer.
	2. Motor defective.	(a) Remove turntable to allow motor to operate without load. If current is reaching motor and drive spindle does not rotate, the motor is defective. Repair or replace.
	3. Motor idler wheel (74) not engaging turntable rim.	If drive spindle is turning but turntable is not: (a) Check motor idler assembly to determine if it is free to contact the drive spindle and turntable rim. (b) Wipe off inside rim of the turntable (2) to remove flock, or if oily, clean the turntable rim and rubber tire of the idler wheel (74) with naphtha.
Changer does not cycle when the control knob is turned to the "Rej."	1. The manual reject not actuating the trip.	(a) Turn the control knob (46) to the reject position, hold and see that the control shaft assembly (88) has moved the trip link (110) to the rear. This should actuate the trip pawl (67) on the main gear (62), which will bring the spur on the trip pawl (67) in contact with the hub gear on the turntable hub. (b) Check for binding of the pawl lever (65), the trip lever assembly (68) and the trip pawl (67). If binding occurs, clean out all foreign matter and check for freedom.
Control knob cannot be turned to "On" position.	1. Machine shut off during cycle.	Turn the turntable clockwise, by hand, until the control knob (46) is free.
Pickup arm strikes records on spindle when it raises, or pick-up arm rest when it moves out.	1. Pickup arm height not adjusted properly.	(See instructions for adjusting pickup arm height under "Adjustments.")
Turntable speed too slow (refer to exploded view).	1. Binding in turntable bearing.	Check the turntable bearing for freedom. Hold the motor idler wheel (74) out of engagement with the turntable and spin the turntable, by hand, to see if it turns readily and

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
		coasts for a long time. If binding occurs, remove turntable, clean off foreign matter, and lubricate with light mineral oil.
	2. Motor pulley too small in diameter.	Replace the motor pulley with one having a greater diameter.
	3. Line voltage too low.	The line voltage should not be less than 105 volts or the turntable may be too slow.
	4. Operating temperature too low.	If the machine has been stored in a cold place or operated in surroundings at a temperature of less than 60° F., the turntable speed may be too slow.
Turntable speed too fast.	1. Motor pulley too large in diameter.	Replace the pulley with one having a smaller diameter, or grind one or two thousandths off the pulley.
Turntable stalls or slows down during cycle (refer to exploded view).	1. Motor idler not engaging turntable.	(See "Turntable Does Not Revolve When Control Knob Is Turned to 'On' Position.")
	2. Turntable bearing tight.	(See "Turntable Does Not Revolve When Control Knob Is Turned to 'On' Position.")
	3. Operating temperature too low.	The line voltage should not be less than 105 volts.
	4. Binding in drive mechanism.	Hold idler (74) away from turntable, or remove idler wheel. Cycle machine by turning turntable slowly by hand. The main gear should turn freely for the complete revolution without binding at any point: (a) If binding occurs, check for foreign matter in the gear teeth, a bent gear bearing, or bent spindle bushing. Straighten or replace. Clean and lubricate.
	5. Binding between pickup arm lift pin (35) and lift pin cam surface on slide and cam assembly (120).	Lift pin should ride freely on cam surface without binding.
	6. Spindle pusher spring compressing too far.	Cycle the changer and watch the relationship between the bottom of the pusher housing and the lower button of the pusher housing. Just before the slide and cam (120) has completed its backward motion, the pusher housing should stop its upward motion and the lower button should continue up .005 to .047" more, slightly compressing the pusher spring. If the spring compresses too much, the changer may stall on the shut-off cycle.
	7. Motor weak.	When everything checks all right, but the changer still stalls in cycle, the motor may be weak.
	8. Grease on idler wheel.	1. Wipe off idler wheel rubber tire; inner rim of turntable and rubber belts with naphtha.
	9. Idler wheel bent and not making positive engagement with drive pulley.	1. Straighten idler, or replace, as necessary.
	10. Turrets unseated from lock ring on turret shaft.	Remove turret and center lock ring. (If lock ring is distorted, replace with new lock ring.) Replace turret and press down to assure turret of being locked to the


SEE EXPLODED VIEW ON TONE ARMS
SEE EXPLODED VIEW ON SPINDLE
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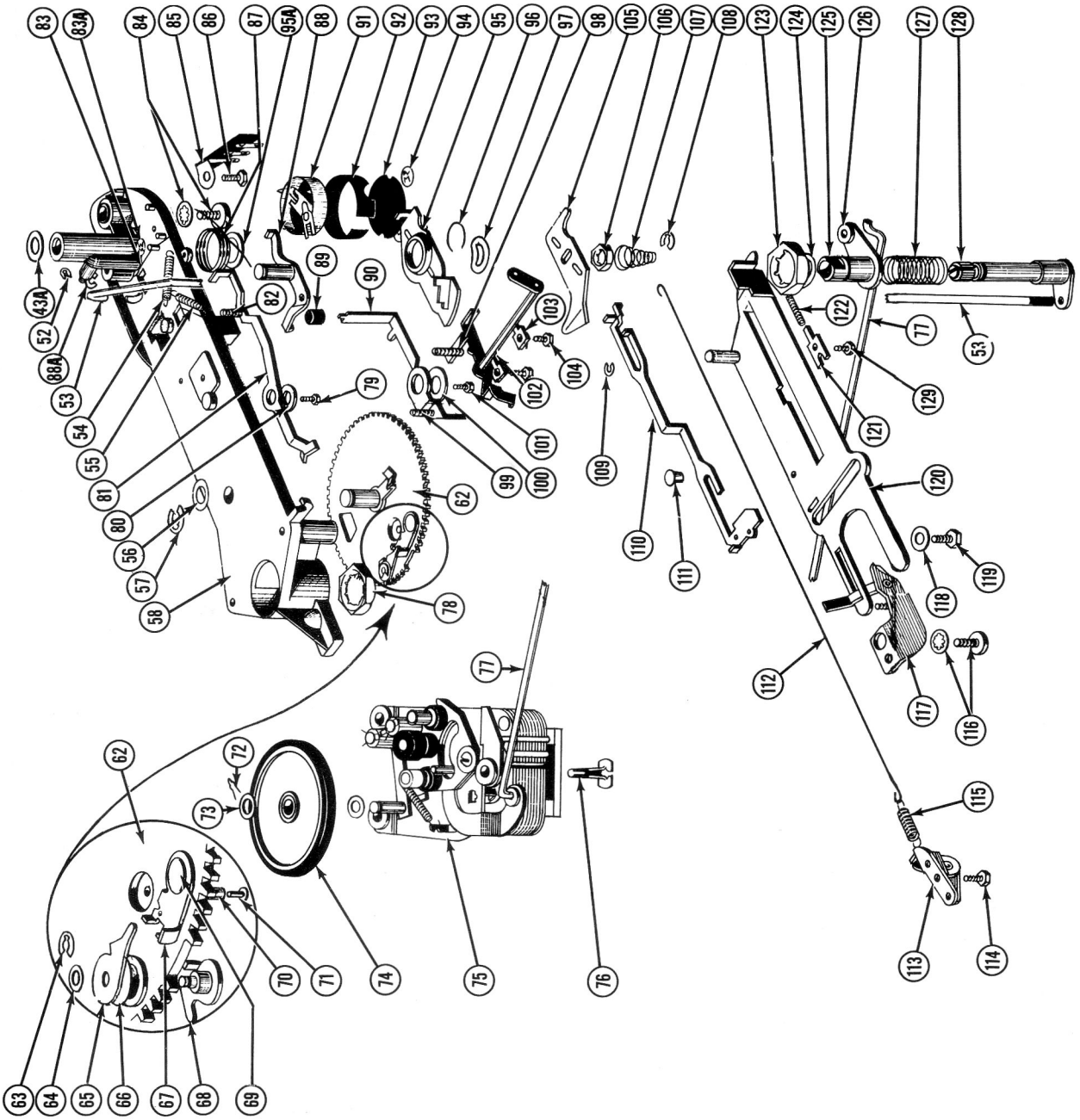
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TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
		turret shaft. (Turret will snap into position when properly locked.)
	11. Idler wheel tension spring weak.	Replace spring or bend motor tension spring anchor bracket to give desired tension.
Changer continues to cycle.	Reject mechanism binding.	(a) Make certain the trip link (110) is not frozen in the reject position. (b) Make certain the changer control lever (88) is not binding and that it actuates the trip link (110) when the changer control knob (46) is turned to reject. (c) Check for binding of trip pawl (67), trip lever (68) and pawl lever (65); these must be free to turn easily. (d) Check the changer control linkage (23), (53) and (88).
Noise during playing of record.	1. Motor rumble.	If a low-pitched rumbling sound comes from the loud speaker while a record is being played, check motor grommets to be sure the motor is freely suspended on them. The motor lead wires should have slack to allow the motor to float. Motor rumble may also come from an unbalanced motor rotor; in this case, replace the motor.
	2. Defective turntable bearings (10).	Defective turntable bearings can cause rumble. Check for foreign matter in the bearing, defective balls, binding between balls and ball retainer; rough surface on washers. Clean ball bearing, sleeve bearing, and washers; lubricate with Andok "B" and light mineral oil.
	3. Defective motor idler wheel.	A rapid thumping sound while the motor is running may indicate a flat spot on the motor idler wheel (74). If this condition does not clear up after ten minutes of running time, remove the turntable and check the rubber tire on the idler. If the surface of the rubber tire is not smooth and even, replace the idler. Should the bearing of the idler wheel show signs of excessive wear or be extremely wobbly, the idler wheel should be replaced.
	4. Defective record.	Worn or defective records cause needle scratch and distortion of the recorded sound. If the record is warped, it may slip on the other records causing "Wow" (a waver in the recorded sound). An enlarged hole in the record can also cause "Wow."
	5. Turntable scrapes.	If a scraping sound occurs as the turntable revolves, check: (a) Turntable warped, causing outer rim to rise and fall. (b) Motor idler or mounting plate bent.
	6. Squeaks.	Squeaking sound as changer operates indicates lack of oil. Lubricate points indicated under "Lubrication."
	7. Pulleys on motor not properly seated.	Check that pulleys are properly seated.
	8. 7" lever (81) loose.	Check 7" lever washer (100) and screw (101) to see if they are tight.
Distortion of Recorded Sound.	1. Defective record.	(See "Noise During Playing of Record.")
	2. Defective amplifier.	Check phonograph amplifier and speaker.
	3. Bad cartridge.	Replace. (See "Defective Cartridges.")

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
No Sound During Playing.	1. Defective cartridge.	Replace. (See "Defective Cartridges.")
	2. Defective wiring.	Check pickup leads for a shorted or open lead.
	3. Defective amplifier.	Check phonograph amplifier and speaker.
	4. Loose cartridge terminal clips.	Remove, squeeze together slightly, and replace.
Excessive Record Wear	1. Binding on pickup arm.	(See "Needle Does Not Track Across Record Properly."
Changer does not shut off after last record has been played (refer to exploded view).	1. Record support binding (1).	The record support must drop below the off-set shoulder of the spindle or the changer will not shut off. (See "Two Records Drop at Once." - 3)
	2. Lever assembly binding (100).	Clean out dirt and make sure this operates smoothly.
	3. Control link broken (112).	Replace.
	4. Spring (115) loose or broken.	Replace.
	5. Shut-off lever binding.	Check lever and if bent, straighten.
Rough pickup arm motion.	1. Horizontal defects.	(a) Check pickup arm return locator (95) for tightness. (b) Check that pickup arm return spring (87) is not weak and is hooked up properly. (c) Check that fiber washer (95A) is installed under pickup arm return locator.
	2. Vertical defects.	(a) Lift pin (35) binding; clean out dirt and lubricate. (b) Slide and cam (120) binds; check bearing points - - clean and lubricate. (c) Burrs in main slot in slide and cam (120) - - remove with fine file. (d) Ejector lever on ejector bracket assembly (117) binding in slide and cam slot: straighten, remove burrs, and lubricate. (e) Pickup arm shaft and sleeve binding: clean and lubricate.
Noise during change cycle.	1. Tines on the forked end of the slide and cam assembly (120) bent.	Replace.
	2. Control lever bent.	Straighten or replace. Check that "C" washer (95) holds.
	3. Lack of lubrication Grinding noise.	Lubricate ejector lever (117) where it contacts lower end of spindle (3).
Control knob does not detent on "33," "45," or "78" positions.	1. Bent parts.	(a) Insure that forked shaped stamping under idler is not catching in detent notch. Straighten or replace motor. (b) Insure that speed control arm (126) and speed control rod (77) are not bent.
Cartridge drags on record.	1. Needle bent.	Replace.

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
	2. Cartridge mounting screws loose.	Tighten.
Shuts off when last record drops.	1. Shut-off spring (115 and link (112) too short.	Check length of shut-off spring (115) and shut-off link (112) by comparing with another set - - may be too short. Replace.
	2. Shut-off bracket (113) bent.	Straighten or replace.
	3. Shut-off link (112) bent.	Straighten or replace.
	4. Shut-off lever assembly (102) binding.	(a) Check for burrs: remove with fine file. (b) Check for tight bearings: clean and lubricate.
Will not play manually.	1. Trip link (110) bent.	Straighten or replace.
	2. Trip finger cam (105) bent.	Straighten or replace.
Impossible to adjust set-down.	1. Pickup arm shaft and sleeve assembly (43) defective.	Shift the safety plate (39) toward the eccentric set-down adjusting screw (41), and tighten pickup arm shaft and sleeve nut (36). Hold pickup arm against rear stop and push on trip finger cam (105). The safety plate (39) should move away from the set-down adjusting screw (41) and snap back when the trip finger cam (105) is released: if it does not, replace the pickup arm shaft and sleeve assembly (43). Hinge pivot screws may be adjusted favoring one side or the other.
Record does not drop when changer cycles.	1. Spindle pusher shaft and housing assembly (14) broken.	If the pusher shaft (inside the spindle) is broken, the lower end (housing) will drop out of the spindle (7) (see Figure 5). Loosen spindle nut (78) and remove spindle (3). Replace with new spindle unit.
	2. Record pusher (6) in spindle not moving far enough forward to reject a record.	The record pusher should move up inside the spindle body (7), then move forward until it has reached a point flush with, or a maximum of, .010" beyond the spindle body(7). To insure that the record pusher (6) is all the way forward, the lower button on the shaft and housing assembly (14) should be raised high enough by the ejector lever to slightly compress the pusher spring inside the pusher shaft and housing assembly (14). (See "Turntable Stalls During Cycle.") If the spring is compressed and the record pusher (6) does not move far enough forward to eject a record, the spindle (3) should be replaced. If a record is not pushed completely off the ledge, it may hang on the spindle momentarily, then drop on the pickup arm when it moves in over the turntable.
	3. Record pusher (6) raises outside the spindle body (7).	When changer cycles, the record pusher (6) should rise up just inside the spindle body, then move forward inside the center hole in the record. If the record pusher (6) rises outside the spindle body (7), it will raise the record instead of pushing it off the spindle ledge. Remove the spindle (3) and replace with a complete new spindle assembly.
Two records drop at once (refer to exploded view and Figure 5).	1. Hole in record too large.	Check the diameter of the hole in the record. An oversize hole will cause two records to drop at once.
	2. Spindle guide (4) not fully down.	If the spindle guide is not all the way down, more than one record may be dropped at a time.

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
		(a) Check the guide to be sure it is free and does not bind at any point. Clean out foreign matter or straighten if necessary. Do not oil. (b) When records are placed on the spindle, be sure the guide is all the way down. The guide will normally raise as a record is being dropped, but it should return to place immediately, by gravity.
	3. Record support (1) binding on spindle, or bent out of square with shaft.	The record support (1) must be able to slide freely, by gravity, down the spindle. If the support does not follow the records down as they are being ejected, two or more records may be ejected at once. If binding occurs: (a) Check the spindle (3) to determine if it is straight. Bend carefully with the fingers, if necessary. (b) Straighten the record support (1) if it is not square with the record support shaft. (c) When the pin in the record support shaft has just entered the slot in the record support shaft post on the baseplate, the play in the record support (1), as it is swung from side to side, should be equal on both sides of the spindle. To correct bent condition, hold the support shaft and carefully force the record support into proper position. If the support is loose on the shaft, remove the knob and restake with hammer and punch.
	4. Record pusher (6) defective.	The record pusher (6) may be deformed, etc. This may cause two records to drop at once. Replace with new pusher or replace spindle assembly.
	5. Slide play in spindle (3).	Tighten spindle nut (78). If stripped, replace.
Record hits pickup arm (refer to exploded view).	1. Record pusher (6) not moving far enough forward to eject record.	(See "Record Does Not Drop When Changer Cycles" -2.)
	2. Record pusher (6) extending beyond outside diameter of spindle.	Cycle changer, by hand, until pusher shaft and housing assembly (14) is at the top of its travel. Using new record as a gauge, pass it over the spindle to see if it binds at any point. File off high points on record pusher (6), with a fine file, until record will pass freely over spindle.
	3. Pickup arm not adjusted properly.	(See "Adjustments")
Needle does not set down on 10" record in proper position (refer to exploded view).	1. Pickup arm not adjusted properly.	(See "Adjustments") (a) Loose nut (36) on pickup arm shaft and sleeve (43).
	2. Pickup arm shaft and sleeve (43) binding.	File off burrs and rough surfaces. Polish and lubricate shaft.
	3. 7" set-down lever (90) and 12" record selector (42) not operating properly.	Insure that the proper operation and reset of the 7" set-down lever (90) and 12" record selector (42) is not being interfered with.
	4. Needle bent.	Replace with new needle.
	5. Wire spring (83) broken.	12" record selector (42) does not cock: check for broken 12" record selector spring (83).

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
	6. Bent pickup arm return locator (95).	Straighten or replace.
	7. Bent trip finger cam (105).	Straighten or replace.
Needle does not set down on 12" record in proper position (refer to exploded view).	1. Diameter of 12" record undersize.	The set-down position of the needle for 12" records is determined by the edge of the record striking the 12" record selector (42). If a 12" record has a diameter of less than the standard size of 11-7/8". plus or minus 1/32", it may fail to depress the 12" record selector far enough.
	2. Enlarged center hole in record.	An enlarged center hole might fail to set the 12" record selector because it could produce the same effect as a small record.
	3. Pickup arm not adjusted properly	(See "Adjustments") (a) Loose nut (36) on the pickup arm shaft and sleeve (43). Tighten.
	4. Binding of pickup arm shaft and sleeve (43).	Clean and polish shaft (43), and lubricate with light oil.
	5. Reset lever spring (82) broken.	Replace spring (82).
	6. 12" record selector spring (83) broken.	Replace spring (83).
	7. 12" record selector (42) binding.	The 12" record selector must be free to operate smoothly. Clean out dirt and straighten if bent, or replace.
	8. Bent pickup arm return locator (95).	Straighten or replace.
	9. Bent trip finger cam (105).	Straighten or replace.
Needle does not set down on 7" record properly.	1. 7" set-down lever spring(99) broken or weak.	Replace.
	2. Pickup arm not adjusted properly.	(See "Adjustments") (a) Loose nut (36) on pickup arm shaft on sleeve: tighten.
	3. 7" set-down lever screw (101) loose.	Tighten.
	4. 7" set-down lever (90) hitting frame or baseplate when it goes through hole in frame.	Straighten, or replace.
	5. Reset lever (81) bent.	Replace.
	6. 7" set-down lever (90) does not fall into opening in main gear.	Replace.
	7. Bent pickup arm return locator (95).	Straighten, or replace.

TROUBLE CHART - Cont.

SYMPTOM	CAUSE	REMEDY
	8. Bent trip finger cam (105).	Straighten, or replace.
Changer does not cycle when record has been played.	1. No finishing trip groove on record.	Check record for eccentric trip groove in center of record. Some old records and home recordings do not have this eccentric trip groove.
	2. Needle jumps out of grooves in record.	(a) Check trip pressure: the lateral pressure should not exceed 3 grams. (If pressure is excessive, see "Changer Trips Before Needle Reaches End of Record.")
		(b) The record may be defective: the finishing groove is often too shallow. Check with a record that is known to be good.
		(c) The needle point may be damaged or affected by an excessive accumulation of dust, lint, etc.: check needle pressure as described under "Adjustments."
		(d) There may be binding in the pickup arm shaft and sleeve assembly (43) or between the pickup arm return locator (95) and the trip finger cam (105): see "Needle Does Not Track Properly Across Record.")
	3. Trip pawl (67) binding on gear face.	The trip pawl must be free to move forward and engage the boss on the turntable hub when the trip lever releases it. Check for burrs or foreign matter lodged between the trip pawl (67) and main gear (62). Do not oil as this might collect dirt and gum up the pawl.
	4. Trip finger cam (105) bent.	Straighten, or replace.
	5. Trip link (110) bent.	Straighten, or replace.
Changer trips before needle reaches end of record.	1. Hole in record too large.	If the hole in the record is too large, the groove may turn eccentric with the spindle and cause premature tripping.
	2. Binding of trip link (110).	With the trip link released, check the trip link for freedom of motion. It should be free to move without binding.
Needle does not track across record properly.	1. Needle may be clogged by accumulation of lint, dirt, etc., or worn.	(a) Clean foreign material from around needle (105).
		(b) Check needle to see if the tip is bent or broken. Replace, if necessary. (Refer to paragraph on "Damaged Needle.")
	2. Trip finger cam (105) does not disengage from the pickup arm return locator (95) when cycle is completed.	There should be a 1/32" gap between the trip finger cam (105) and the pickup arm return locator (95) when the machine is not in cycle. If the gap is small enough to allow the parts to touch and bind as the needle moves across the record, the compression spring washer (97) may be weak or broken. Replace.
	3. Check the bearing in the pickup arm post for binding.	(a) Check pickup arm return locator (76) and trip finger cam (80) for binding. (See 2 above.)
	4. Changer not level.	(See "Leveling Record Changer During Long Play" under "Preparation for Operation.")
	5. Pickup leads too tight.	Give the pickup leads enough slack to allow the tone arm to move freely across a record.

CARTRIDGES

1. Damaged Cartridge (Astatic LQD)

To remove the cartridge, proceed as follows:

(a) Rotate the cartridge so the cartridge mounting screw (28) is facing downward.

(b) Loosen the set screw (26) and remove the cartridge control knob (27).

(c) Carefully pull the cartridge lead up from the rear section of the arm until adequate slack is obtained.

(d) Remove the cartridge mounting screw (28).

(e) Disconnect the pickup leads and remove cartridge.

(f) Replace cartridge and connect pickup leads.

(g) Secure pickup cartridge to mounting bracket (18).

(h) Replace the cartridge control knob (27) and tighten set screw (26).

(i) Push excess pickup lead into rear section of pickup arm.

Damaged Needle (Astatic LQD)

(a) Rotate cartridge control knob to correspond with needle to be removed.

(b) The needle may now be removed by pulling it straight out of its mounting.

(c) In replacing the new needle, make sure that the colored needle is used on the side of the pickup cartridge having the corresponding color spot.

2. Damaged Cartridge (Shure P-81)

(a) Disconnect the pickup leads.

(b) Loosen the two cartridge mounting screws and remove cartridge.

(c) Replace cartridge and connect leads.

Damaged Needle (Shure P-81)

(a) Loosen knurled thumb nut that secures needle to the cartridge.

(b) Carefully remove needle and replace with a new needle of the same part number.

CAUTION: The replacement needle will have to be adjusted, before it is tightened in the pickup cartridge, to assure that the needle shank is securely held by the knurled thumb nut. Do not use pliers on knurled thumb nut. Tighten with fingers only.

3. Damaged Cartridge (Shure P-77)

(a) Rotate the cartridge so the cartridge mounting screws may be loosened.

(b) Remove the cartridge control knob (27).

(c) Carefully pull the cartridge lead up from the rear section of the arm until adequate slack is obtained.

(d) Disconnect the leads and remove the cartridge.

(e) Replace the cartridge and connect the pickup leads.

(f) Secure the cartridge to the mounting bracket (strengthener) (29).

(g) Push excess pickup lead into rear section of pickup arm and re-install plastic cartridge control lever.

Damaged Needle (Shure P-77)

(a) Rotate the cartridge control knob to the position corresponding to the type needle to be replaced.

(b) Loosen the knurled thumb nut that secures needle to the cartridge.

(c) Carefully remove needle and replace with a new needle of the same part number.

CAUTION: Make sure that the colored needle is used on the side of the pickup cartridge having the corresponding color spot. The replacement needle will have to be adjusted, before it is tightened in the pickup cartridge, to assure that the needle shank is securely held by the knurled thumb nut. Do not use pliers on knurled thumb nut. Tighten with fingers only.

ASTATIC CARTRIDGES

2753	Cartridge, Astatic LQD-1M complete	9.50
2754	Osmium one mil needle	2.50
2755	Osmium three mil needle	2.50
3137	Cartridge, Astatic LQD-1JM complete	10.50
2755	Osmium three mil needle	2.50
3135	Sapphire one mil needle	3.30
3168	Cartridge, Astatic LQD-1J complete	10.50
3135	Sapphire one mil needle	3.30
3136	Sapphire three mil needle	3.30
2816	Cartridge, Astatic LQD-1M not grounded complete	9.50
2754	Osmium one mil needle	2.50
2755	Osmium three mil needle	2.50
2876	Cartridge, Astatic CQ complete	8.25
3521	Sapphire one mil needle	3.30
2500	Cartridge, Astatic CQ ungrounded complete	8.25
3709	Sapphire one and one-half mil needle	3.30
3560	Cartridge, Astatic GCAG complete	7.75
3561	Osmium truncated needle	2.50
3547	Cartridge, Astatic GCAG complete	8.25
3559	Sapphire truncated needle	3.30

SHURE BROTHERS CARTRIDGES

2606	Cartridge, Shure Brothers, P-77 complete	13.45
2628	Osmium one mil needle	2.50
2629	Osmium three mil needle	2.50
3063	Cartridge, Shure Bros., 79-V complete	13.45
2629	Osmium three mil needle	2.50
3120	Sapphire one mil needle	3.75
3182	Cartridge, Shure Bros., P-76-A complete	14.70
3119	Sapphire three mil needle	3.75
3120	Sapphire one mil needle	3.75
3366	Cartridge, Shure Bros., P-71-A complete	10.95
3367	Sapphire Unipoint needle	3.75
3368	Cartridge, Shure Bros., P-37-C complete	9.40
3369	Osmium Unipoint Needle	2.25
3373	Cartridge, Shure Bros., P-81 complete	9.70
3374	Osmium Unipoint needle	2.25
3411	Cartridge, Shure Bros., P-81 complete	10.95
3412	Sapphire Unipoint needle	2.25
3415	Cartridge, Shure Bros., P-81-C complete	9.70
3369	Osmium two mil needle	2.50
3455	Cartridge, Shure Bros., P-76-AF complete	13.45
3120	Sapphire one mil needle	3.75
2629	Osmium three mil needle	2.50
3442	Cartridge, Shure Bros., P-72-V complete	13.45
2628	Osmium one mil needle	2.50
2629	Osmium three mil needle	2.50
3553	Cartridge, Shure Bros., P-37-D complete	9.40
3567	Osmium Unipoint needle	2.25
3579	Cartridge, Shure Bros., P-37-A complete	10.60
3412	Sapphire Unipoint needle	3.75
3691	Cartridge, Shure Bros., P-76-A complete	14.70
2628	Osmium one mil needle	2.50
2629	Osmium three mil needle	2.50
3719	Cartridge, Shure Bros., P-81-A complete	9.70
3720	Osmium 2.3 mil needle	2.25

WEBSTER CARTRIDGES

2197	Cartridge, Webster F-14-2 complete	8.50
2630	Duo Needle, Osmium tip	2.50
3239	Cartridge, Webster A-1 complete	10.50
3292	Sapphire one mil needle	3.30
3293	Sapphire three mil needle	3.30
3399	Cartridge, Webster A-1M complete	9.50
3400	Osmium one mil needle	2.50
3401	Osmium three mil needle	2.50
3555	Cartridge, Webster A-1M-Z complete	9.00
3292	Sapphire one mil needle	3.30
3401	Osmium three mil needle	2.50

PARTS LIST

Prices subject to change without notice.

Ref. No.	Part No.	Description	List Price
1	2908-A	Record support Assembly, consists of	1.08
1A		3286-P Plastic Button	.18
1B		2902-J Record Support Arm	.28
1C		2530 Record Support Rod	.61
2	2528-A	Turntable and Hub Assembly	3.31
3	2576	Spindle & Bearing Assembly consists of	9.84
		2536 Spindle Assembly less Ball Race and Washers	9.10
4		2128 Spindle Guide	.27
5		1535 Pin for Spindle Guide	.04
6		1529 Record Pusher	.69
7		2537 Spindle Body and Base Assembly	5.94
8		2078 Retaining Ring	.02
9		2639 Bearing Washer	.10
10		2624 Bearing (Ball Race)	.47
11		2639 Bearing Washer	.10
12		1527 Pusher Spring	.10
13		2552 Pusher Shaft Spring	.04
14		2539 Pusher Shaft & Housing Assembly	1.43
15	2310	Hinge Pivot Screw	.08
16	2503-B	Plastic Tone Arm	1.50
17	2508	Hinge Spring	.25
18	2945	Strengthener and Bracket Assembly	.55
19	2275	Strengthener Screw #4 x 1/4" Thread Cutting	.02
20	2255	Lock Spring	.07
21	2912	Lift Screw	.04
22	2449	Screw for Slide 6-32 x 1/8"	.02
23	2934	Adjusting Slide	.13
24	2275	Strengthener Screw #4 x 1/4" Thread Cutting	.05
25	2753	Cartridge, Astatic LQD (also see Cartridge Breakdown)	10.50
26	2370	Cartridge Control Knob Screw	.04
27	2860-G	Cartridge Control Knob	.39
28	2817	Lockwasher and Screw Cartridge Mounting	.03
29	2509	Strengthener & Bracket Assembly	.90
30	3691	Cartridge "Shure" P-76V (see also Cartridge Breakdown)	13.45
31	2542-B	Plastic Tone Arm Assembly Only	1.42
32	2917	Strengthener and Bracket Assembly	.55
33	3399	Cartridge, "Webster A1M (see also Cartridge Breakdown)	9.50
34	2904	Cartridge Mounting Screw	.02
35	2220	Lift Pin	.16
36	1975	Pal Nut	.04
37	2247	Safety Spring	.07
38	2937	Washer 1/4 I.D. x 1/2 O.D. x 1/16"	.02
39	2249	Safety Plate	.17
40	2294	Hinge Assembly	.43
	2933	Hinge Pin	.08
	2505	Hinge Bracket Only	.24
41	2269	Eccentric Set-Down Adjustment Screw (part of item 40)	.09
41-A	2926	Speed Nut	.02
42	2957	12" Record Selector	.39
43	2921	Tone Arm Shaft and Sleeve	.99
43-A	2952	Fibre Washer	.02
44	409	Screw 10-24 x 5/16" Casting Hold Down and Lockwasher	.08
45	2558-G	Tone Arm Rest Post	.13
46	2907	Reject Knob	.18
47	2975	"C" Washer-Switch Control	.02
48	2906-G	Speed Control Knob	.26
49	2594	"C" Washer-Switch Control	.02
50	2593	Control Shaft Bearing	.18
51	2523	Base Plate	2.21
52	1588	"C" Washer, 12" Record Selector	.02
53	2600	Shut-off Rod	.12
54	2442	Trip Spring-Control Link	.08
55	1721	Reject Spring-Shut-off rod	.10
56	2221	Fibre Washer, Main Gear Assembly	.02
57	1719	"C" Washer-Main Gear Assembly	.02
58	2525	Die Cast Frame	2.79
59	2077	Shipping Bolt	.06
60	2918	Plastic Support Leg	.10
61	2110	"C" Washer, Record Support Assembly	.02
62	2575	Main Gear Assembly Consists of	1.53
		2512 Gear Only	.30
63		1588 "C" Washer, Trip Lever Assembly	.02
64		2829 Fibre Washer, Trip Lever Assembly	.02
65		2940 Pawl Lever	.04
66		2516 Spring Washer, Trip Lever Assembly	.06
67		2939 Trip Pawl	.10
68		2569 Trip Lever Assembly	.18
69		2943 Rivet for Pawl Lever	.06
70		2977 Roller	.04
71		2227 Rivet for Roller	.03
		The following parts may also be used to service any Phono Motors motor	
72	4147	Hairpin Cotter - Idler	.05
73	4146	Fibre Washer-Idler	.03

PARTS LIST - Cont.

Ref. No.	Part No.	Description	List Price
74	4137	Idler Wheel	2.25
75	4201	Phonomotors Turret Motor, 115v. 60 cy.	19.10
	4234	Pulley, 78 r.p.m.	1.68
	4235	Pulley, 45 r.p.m.	1.40
	4236	Pulley, 33 1/3 r.p.m.	2.05
	4233	Felt Washer-Pulley	.04
		Note: The above parts may also be used to service:	
75	4202	Phonomotors Turret Motor, 115v. 25 cy.	22.40
75	4101	Phonomotors 2 Belt Motor, 115v. 60 cy.	19.10
	4128	Pulley, 45 r.p.m.	1.40
	4132	Pulley, 33 1/3 r.p.m.	1.50
	4136	Hairpin Cotter-Pulley	.04
	4164	Belt, 45 r.p.m.	.53
	4163	Belt, 33 1/3 r.p.m.	.49
75	4102	Phonomotors 2 Belt Motor, 115 v. 25 cy.	22.40
	4129	Pulley, 45 r.p.m.	1.40
	4133	Pulley, 33 1/3 r.p.m.	1.40
	4165	Belt, Universal	.53
	4136	Hairpin Cotter-Pulley	.04
	4142	Idler Arm and Pivot Assembly	.80
	4145	Idler Arm Link	.67
	4250	Idler Spring-Turret Motor	.17
	4148	Idler Spring, Belt Motor	.17
	4150	Mounting Grommet	.05
	4118	Lever Grommet	.05
76	1736	"C" Washers	.05
		The following parts are used for mounting motor at rotor end	
		4170 Evelet	.05
		4171 Flat Head Screw, 6/32 x $\frac{1}{2}$	.03
		4172 Nut, 6/32 x 5/16	.02
77	2942	Motor Speed Control Rod	.26
78	2208	Pal Nut for Spindle	.07
79	2087	Screw, 6/32 x 1/4" Reset Lever	.02
80	492	Washer, Flat Steel - Reset Lever	.02
81	2560	Reset Lever	.27
82	2925	Spring-Reset Lever	.02
83	2563	Spring - 12" Record Selector	.02
83A	1720	Speed Nut - Spring - 12" Record Selector	.02
84	409	Screw 1-/24 x 5/16 and Lockwasher	.08
85	2951	Terminal Strip	.09
86	2087	Screw 6/32 x 1/4	.02
87	2574	Return Spring -Pickup Arm	.03
88	2284	Control Shaft Assembly	.22
88A	1652	"C" Washer for Item 88	.02
89	2580	Rubber Bumper	.12
90	2581	7" Set Down Lever	.16
91	467	Switch	.71
92	2931	Fibre Insulating Strip	.02
93	2573	Switch Cover	.02
94	1720	Speed Nut - Switch Cover Hold Down	.02
95	2561	Locator Plate - Tone-Arm Return	.22
95A	2266	Fibre Washer	.02
96	2271	Retaining Ring - Locator Plate	.02
97	2953	Spring Washers	.02
98	2585	Spring Shut-Off Lever	.02
99	2579	Spring - 7" Set Down Lever	.04
100	492	Washer - Flat Steel 7" Set-Down Lever	.02
101	2087	Screw 6/32 x 1/4" - 7" Set-Down Lever	.02
102	2591	Lever Assembly - Shut-Off	.55
103	1587	Lever Assembly Bearing	.02
104	2932	Screw 4/40 Hex Head	.02
105	2520	Trip Finger Cam	.02
106	1975	Pal Nut	.02
107	2262	Lift Pin Spring	.04
108	1588	"C" Washer - Lift Pin Spring	.02
109	1588	"C" Washer - Slide Retainer	.02
110	2958	Trip Link	.36
111	2245	Rivet-Trip Link	.02
112	2935	Control Link	.04
113	2586	Shut-Off Bracket Assembly	.30
114	2053	Screw 6 x 5/16	.02
115	2978	Shut-Off Spring	.08
116	409	Screw 10/24 x 5/16 and Lockwasher	.08
117	2571	Ejector Link Assembly	.34
118	2274	Flat Washer	.02
119	2087	Screw 6/32 x 1/4 Slide and Cam Assembly	.02
120	2288	Slide and Cam Assembly	.46
121	2211	Slide Bearing	.08
122	2246	Spring - Slide Bearing	.02
123	2208	Pal Nut	.07
124	2909	Washer	.03
125	2597	Control Shaft Assembly - Motor	.35
126	2765	Rubber Grommet	.07
127	2910	Compression Spring	.07
128	2599	Switch Control Lever	.38
129	2087	Screw 6/32 x 1/2	.03
130	2546	Record Support Rod Spring	.04

STANDARD PRODUCT WARRANTY

The manufacturer warrants each of its products manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to us intact, for our examination, with all transportation charges prepaid to our factory within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

This Warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory nor to cases where the serial number thereof has been removed, defaced or changed.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by us without charge to the owner.

This Warranty is in lieu of all other Warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

AUDIO TOOL AND ENGINEERING LTD.

TORONTO, CANADA

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