

PHILCO



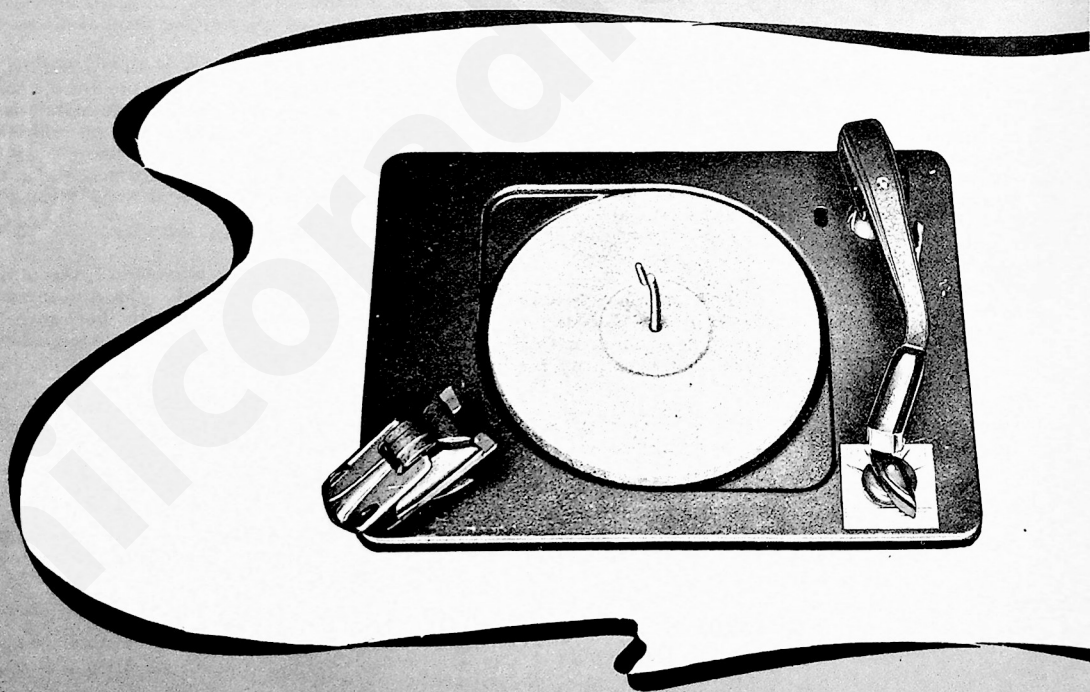
SERVICE

HOME RADIO

SERVICING . . . 1946

PHILCO AUTOMATIC RECORD CHANGER

Model M-4



SERVICE DIVISION

PHILCO RADIO AND TELEVISION CORPORATION

PHILADELPHIA, PENNA.

INTRODUCTION

PHILCO AUTOMATIC RECORD CHANGER

Model M-4

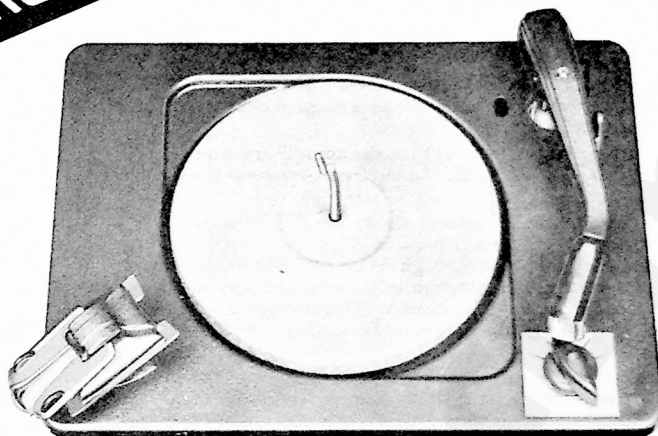


Figure 1—PHILCO AUTOMATIC RECORD CHANGER, MODEL M-4.

The Philco Automatic Record Changer, Model M-4, figure 1, is a record changer of the highest quality. Its design gives fast, smooth changing of records and the dynamic pickup unit used gives unexcelled reproduction.

The changer mechanism incorporates many new features, such as a retractable idler wheel and a tone-arm safety device. When the changer is not in use, the idler wheel is retracted from the turntable rim and motor shaft, thus greatly aiding in the prevention of flat spots on the idler-wheel tire. Should the tone arm be held by the user during a change

cycle, a safety feature prevents any damage to the mechanism.

The M-4 changer is used in several 1946 Philco Radio-Phonograph combinations.

The changer operates on 117 volts, 60 cycles, a.c., and will play, automatically, either ten 12" records or twelve 10" records. Provision is also made for manual operation.

The dynamic pickup unit of the M-4 changer is equipped with a semi-permanent jewel-point needle, affording long life of the needle and record. The needle is easily replaceable if necessary.

PREPARATION FOR USE

UNPACKING

Remove the wood screws and self-tapping screws from the wooden cleat holding the changer, at the rear of the cabinet, and remove the cleat. Remove the tape used to hold the cardboard packing and turntable, also the tape holding the tone arm to the tone-arm rest post. The spindle will be found attached to this rest post, or to the record shelf.

The changer is spring-mounted in the cabinet, and is shipped from the factory in operating condition. No attempt should be made to loosen or remove the four corner bolts except for leveling or servicing.

OPERATING CHECKS

The following is a logical series of checks to be performed before the instrument is delivered to the owner.

Should any of these checks reveal faulty operation, the correct adjustment will be found in the SERVICING section of this manual.

1. Place the spindle into the turntable and turn the spindle so that the offset is toward the record shelf. The spindle should drop all the way into its slot.

2. Place the tone arm on its rest post, turn the record shelf fully counterclockwise to the 10" position and lift the record hold-down over and toward the corner of the changer, as shown in figure 2.

3. Place a good 10" record over the spindle and onto the record shelf. Bring the hold-down over onto the record.

4. Turn the master control switch to REJ (reject) and release; it will spring back to AUT (automatic). The changer should go through its cycle. Observe the action of the push-off mechanism; the record should drop smoothly onto the turntable. The pickup jewel should lower onto the record approximately $\frac{1}{8}$ " in from the edge.

5. Allow the record to play through and, when the jewel travels the eccentric finishing groove, observe the tripping action; it should be smooth and positive.

6. Load the changer to capacity by placing eleven more 10" records over the spindle and onto the record shelf. See figure 3. Reject each record with the master control switch and observe the changer action. The tone arm, in its elevated position, should not strike the bottom of the remaining stack of records. After the full stack of records has dropped onto the turntable, the tone arm should lift high enough to clear the top record by approximately $\frac{1}{8}$ ".

NOTE

Should any record fail to drop onto the turntable, carefully examine the record before making any adjustments to the changer. An unusually thick record may not drop.

7. Turn the changer master control switch to OFF, place the tone arm on its rest post, and pull the spindle straight up and out; unload the records, and replace the spindle.

8. Turn the record shelf fully clockwise to the 12" position, as shown in figure 4.

9. Place a good 12" record over the spindle and onto the record shelf. Bring the hold-down over onto the record. Repeat steps 4, 5, and 6, using nine additional 12" records in step 6.

10. Place the master control switch at MAN (manual) and play one record through to determine that the tripping mechanism is electrically disconnected.

11. Unload the changer as outlined in step 7.

12. With the master control switch OFF, the idler wheel should automatically disengage from the turntable rim. Check by spinning the turntable manually; it should revolve freely.

NOTE

Should the tone arm be held during a change cycle, the safety device will permit the changer to cycle without damage to any parts or adjustments.

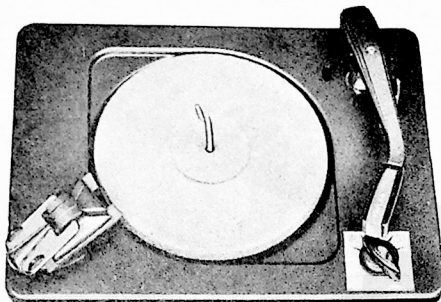


Figure 2—CHANGER, RECORD SHELF IN 10" POSITION.

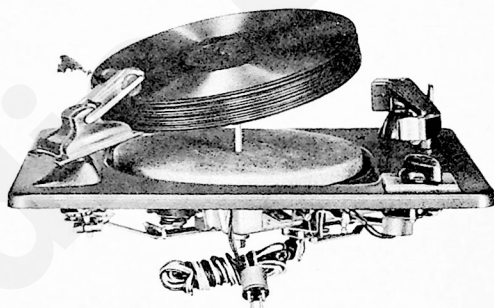


Figure 3—CHANGER, LOADED WITH TWELVE 10" RECORDS.

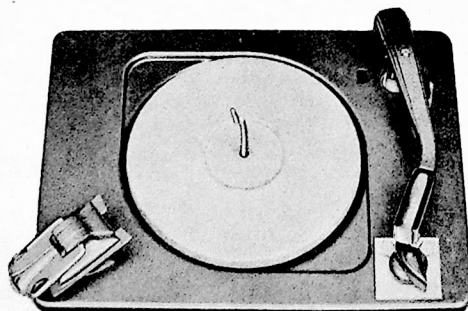


Figure 4—CHANGER, RECORD SHELF IN 12" POSITION.

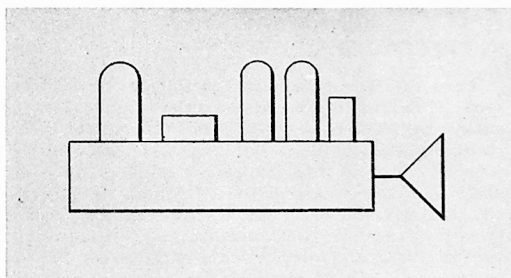
PHILCO RADIO-PHONOGRAPH TROUBLE-SHOOTING PROCEDURE

The following tests are given for quickly localizing trouble in a Philco radio-phonograph. Be sure to make each test, in the order given, *before* removing either the radio chassis or the record changer from the cabinet.

If the trouble is found to be in the audio amplifier, or pre-amplifier, refer to the radio service manual for the particular model under test. If the trouble is in some part of the record changer, or in the separately-mounted phono input transformer, refer to the **SERVICING** section of this record changer manual.

1. AUDIO-AMPLIFIER TESTS

The audio amplifier, with the exception of the pre-amplifier and separately-mounted phono input transformer, is common to both the radio and phonograph



sections of the combination. With a station tuned in, observe whether the speaker output is normal by listening to its tonal quality and volume, with the volume control set to the tap. To locate the tap, set the tuning control for background noise between stations, or slightly out of tune with a station; then slowly turn the volume control from its minimum volume position until a sharp increase in high-frequency response is noted. The tap is at this point. The volume should be approximately the same in radio and phonograph operation.

a. Pre-Amplifier

Check the pre-amplifier as follows:

Remove the cable plug connection between the phono input transformer and radio chassis. Adjust the volume control for normal radio volume (tap on volume control). With the radio-phonograph set for phonograph operation, touch a test prod to the receptacle contact on the radio chassis; a loud audible response should be heard from the speaker.

If no response is heard, there is trouble in the pre-amplifier circuit; test the pre-amplifier tube before removing the radio chassis from the cabinet. An audible

response merely indicates that the circuit is not completely inoperative, and does not conclusively indicate that the gain is normal.

b. Phono Input Transformer

Check the input transformer as directed on page 284 of this manual.

2. TONE-ARM TESTS

a. Pickup

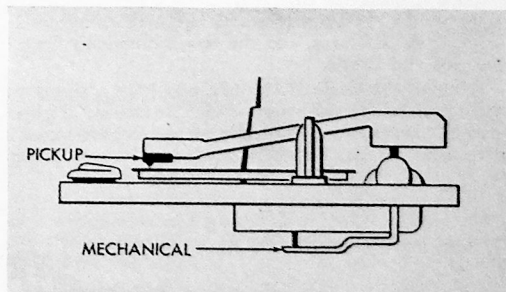
Play a familiar record on the radio-phonograph, and listen to the reproduction.

NOTE

It is advisable that a familiar record be included as a regular part of the serviceman's test equipment.

If the output is distorted, try a new needle. Distortion or low volume may indicate trouble in the pickup, phono input transformer, connecting leads, or pre-amplifier.

Further tests on the pickup are given on page 284 of this manual. If the pickup is found to be faulty, it will be necessary to remove the record changer from the cabinet.



b. Set-Down

Set the record shelf to the 10" position, and place the tone arm on its rest post. Place a good 10" record on

the turntable, then turn the master control switch to REJ, and release. Observe the action of the tone arm; it should rise and travel over to the record, the needle coming down approximately $\frac{1}{8}$ " in from the outside edge of the record. If the tone arm does not set down correctly, the necessary adjustment may be made, as directed on page 282 of this manual, without removing the record changer from the cabinet.

c. Lift

Set the record shelf for 10" operation and place a full stack of twelve 10" records on the changer. Start the changer by turning the master control switch to REJ and releasing. During the change cycle, the tone arm, in its elevated position, should not strike the bottom of the remaining stack of records.

Continue to reject each record until the full stack is on the turntable. Make sure that the tone arm clears the top record by $\frac{1}{8}$ " when the arm swings away from the spindle.

If either of these clearances is not correct, the lift adjustment may be made, as described on page 282 of this manual, without removing the record changer from the cabinet.

d. Tripping

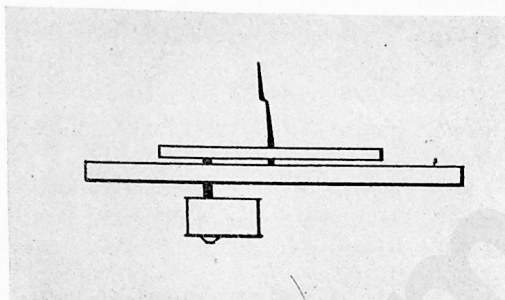
Play a record through, with the master control switch in AUT position. As the needle travels the eccentric finishing groove, tripping of the mechanism should be prompt and positive. The adjustments required are given on page 284 of this manual.

3. TURNTABLE and MOTOR TEST

Load the turntable with ten 12" records. Place a stroboscope disc, such as Philco Part No. 45-2900, on the top record. Illuminate the disc with an electric light, preferably a neon bulb. The circle of dots on the disc indicating the turntable speed will normally appear to remain stationary, or will drift slowly in one direction or the other. The speed of the turntable should be $78 \pm 3 - 1.4$ r.p.m. Erratic movement of the dots indicates unstable turntable speed.

If a stroboscope disc is not available, a small piece of paper may be inserted under the edge of a record to serve as an indicator, and the revolutions may then be counted and timed.

Remove the stack of records, and play a single record, preferably one containing sustained, high-frequency tones. Listen critically to the reproduction to determine if any "wow" (tone variation) is present.

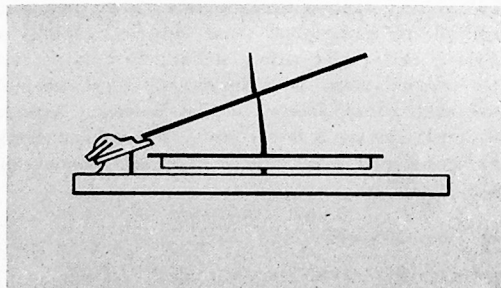


Wows are caused by unstable turntable speed. See page 285 of this manual.

Unsatisfactory operation in the above tests indicates trouble in the motor, idler-wheel assembly, or turntable bearings.

4. RECORD-SHELF TEST

Turn the record shelf to the 10" position. Place a stack of twelve 10" records over the spindle. Turn the master control switch to REJ, and observe the record-dropping action. The record should fall smoothly; the edge of the record should leave the lips of the record shelf *after* the center has started to fall. Run through the change cycle, using the complete stack of records. If one record fails to change, examine the record for defects. Unsatisfactory record changing may be due to improper adjustment of the record shelf, including the push-off slider cam. These adjustments, given on page 285 of this manual, require removal of the record changer from the cabinet.



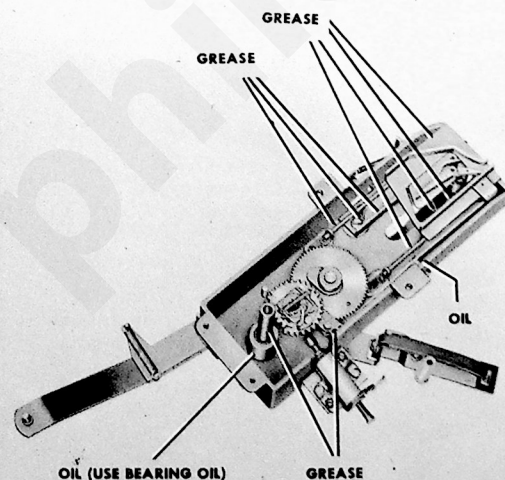
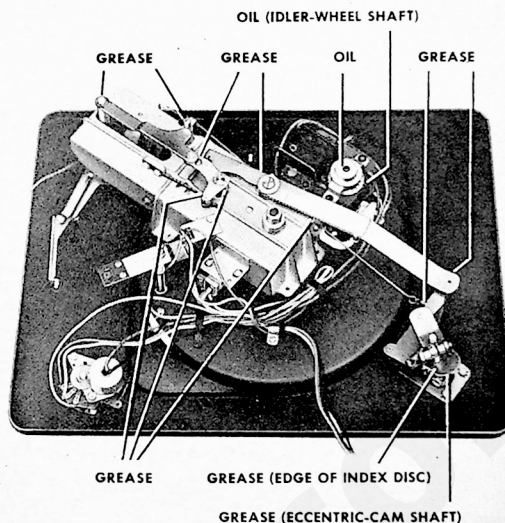
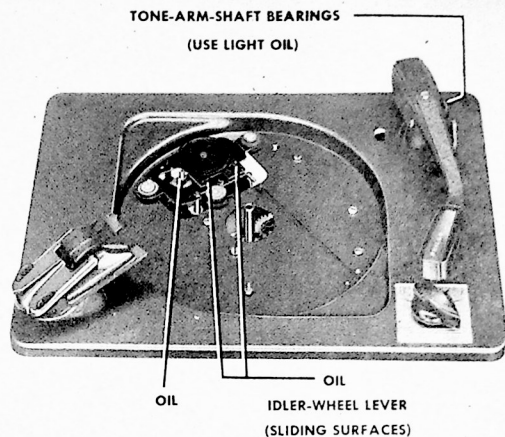
SERVICING

Description of Operating Cycle

Power for the motor is supplied from the power line through a master control switch having OFF, MAN, AUT, and REJ positions. The turntable is rim-driven

by a rubber-tired idler wheel between the motor and turntable rim.

The changer mechanism is driven, by the turntable gear, through an intermediate gear having a retractable



segment; when retracted, this segment is held by a latch, thus mechanically disconnecting the turntable from the remainder of the changer mechanism while a record is playing. When the needle travels the eccentric finishing groove of the record, the change cycle is started, electrically, by a trip pawl riding a trip switch. This switch energizes a solenoid, driving its plunger against the intermediate-gear latch, and releasing the movable segment. The segment meshes with the turntable-hub gear, causing the changer mechanism to be driven through a cycle. At the completion of the cycle, the gear segment is retracted by a cam lever and is again held by the latch.

During the change cycle, the tone arm is operated by a lift-rod and a sliding, main-cam assembly, while the next record is dropped by the operation of a push-off slider in the record-shelf assembly.

Record rejection is also started electrically by the control switch, which, in REJ position, shorts across the trip-switch circuit, energizing the solenoid.

Cleaning and Lubrication

After long periods of use, or when a major part or assembly is replaced, the record changer should be cleaned and lubricated. Carbon tetrachloride or other similar cleaning fluid may be used to remove dirt, old oil, or grease. Some parts and assemblies may have to be removed for proper lubrication. The correct procedure for the removal and reinstallation of these parts and assemblies will be found in the REPLACEMENT OF PARTS AND ASSEMBLIES section of this manual. Apply lubricants sparingly, using only enough to do the job. All lubrication points are shown in figure 5.

Parts Not to be Lubricated

The following parts should not be lubricated at any time:

- Segment, latch, or gear teeth, of segment gear.
- Turntable-hub gear teeth.
- Trip pawl.
- Solenoid plunger.

Guide arm and tracking pawl (part of main-cam assembly).

Parts to be Greased

Using a light grease of the vaseline type, or a general-purpose grease of about the same weight, lubricate the following parts:

- All studs with moving parts attached.
- Index disc and lever.
- Turntable shaft (apply grease around sleeve, then put turntable on).
- Main-cam and slider-cam slide rods (4).
- Positioning-cam slots.
- All shafts (except tone-arm shaft).
- Push-off-slider eccentric cam and shaft.
- Tone-arm pivots.
- Lift-arm bushing.

Figure 5—CHANGER, SHOWING ALL LUBRICATION POINTS.

Parts to be Oiled

Using very light oil, lubricate the following parts:
Motor bearings.
Idler-wheel bearing and idler-wheel lever assembly.
Turntable-shaft ball bearings.
Tone-arm-shaft bearings.

CAUTION

Do not get oil on rubber tire, motor pinion, or inside rim of turntable; if so, remove immediately with carbon tetrachloride.

ADJUSTMENTS AND TESTS

All adjustments to this changer made on the service bench require the use of a radio chassis designed for the changer; all adjustments except those made to the pickup may be made by the use of a suitable auxiliary power supply, to furnish operating voltage for the electric trip mechanism. Details of the auxiliary supply will be found on page 286 of this manual.

Tone-Arm Lift Adjustment

Set the record shelf for 10" operation. With the master control switch OFF, manually trip the changer by lightly pushing the solenoid plunger into the coil. Swing the tone arm in near the spindle. Revolve the turntable one turn by hand. Place a 10" record onto the record shelf and spindle. Position the tone arm so that the needle point is approximately $1\frac{1}{2}$ " from the center of the spindle. In this position, the tone arm is at maximum height and should clear the bottom of the record by $\frac{1}{16}$ " to $\frac{1}{8}$ ", and the needle point should clear the turntable by approximately $1\frac{1}{4}$ ". Adjust for correct clearance by turning the adjustment screw through a hole at the top and rear of the tone arm, as shown in figure 6. Turning the screw clockwise raises the arm; counterclockwise lowers it. Then determine whether the tone arm lowers sufficiently to play the first record by revolving the turntable through the



Figure 6—ADJUSTING TONE-ARM LIFT.

complete cycle. The tone arm should lower until the needle point is below the top surface of the turntable.

Tone-Arm Set-Down Adjustment

Set the changer for 10" operation. Place a 10" record in position and start a change cycle. Shut off the changer and stop the turntable when the jewel lowers to approximately $\frac{1}{4}$ " above the record. An eccentric screw, reached through a slot in the changer base plate near the tone-arm mounting, provides the adjustment. See figure 7. Adjust so that the jewel will lower onto the record $\frac{1}{8}$ " in from the edge.

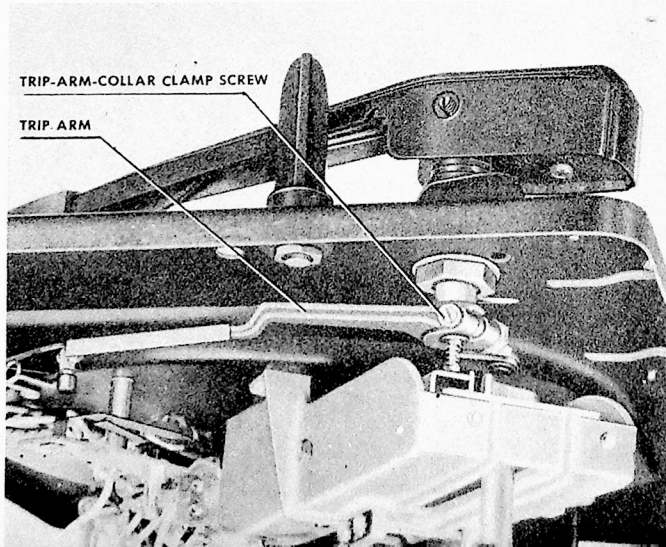
In the event that the range of the eccentric screw does not provide the correct adjustment, proceed as follows:

Turn the eccentric screw to the mid-position of its range. Loosen the clamp screw on the trip-arm collar attached to the tone-arm shaft. See figure 8. Hold the

Figure 7—ADJUSTING TONE-ARM SET-DOWN.



Figure 8—TRIP-ARM CLAMP, FOR EXTENDING RANGE OF SET-DOWN ADJUSTMENT.



TRIP-ARM-COLLAR CLAMP SCREW

TRIP-ARM

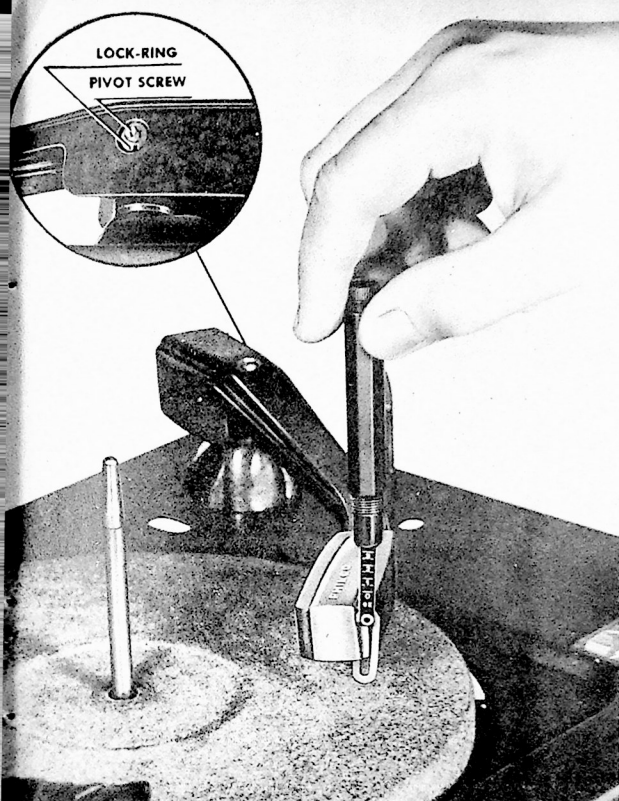


Figure 9—MEASURING TONE-ARM VERTICAL FRICTION.

trip arm firmly and move the tone arm to the approximate desired position and tighten the collar.

NOTE

A .003" to .005" vertical play in the tone-arm shaft must be maintained when making this adjustment.

If necessary, a vernier set-down adjustment may now be made with the eccentric screw, as previously described.

The 10" adjustment should be correct for 12" records. However, the tone-arm rest is adjusted so that the tone arm cannot set down off a 12" record.

Tone-Arm Needle Pressure and Vertical Friction

With a 2-oz., postal-type scale, similar to Philco Part No. 45-2958, hooked under the front edge of the tone arm, as shown in figure 9, lift up the arm with the scale, noting the reading. Lower the arm, again noting the reading; the difference in these two readings represents vertical friction and should not exceed 1/8 oz.

The reading midway between the two readings taken is the needle pressure. The needle pressure of the dynamic tone arm should be between 3/4 and 1 ounce. If the tone arm pivot screw is too tight, excessive friction will result. Loosen the locknut, adjust the pivot screw, and retighten the locknut. If the pivot screw is too



Figure 10—MEASURING TONE-ARM HORIZONTAL FRICTION.

loose, erratic set-down of the tone arm and trip failure on some records is likely.

Tone-Arm Horizontal Friction and Trip Sensitivity

With the changer out of cycle and the master control switch OFF, hook a pendulum scale, similar to Philco Part No. 45-2953, under the front edge of the tone arm, as shown in figure 10. Move the tone arm with scale slowly toward the spindle, and back to the outer edge of the record. The pendulum scale is calibrated in 1/16-ounce divisions, with 0 center. The average of both readings should not exceed 1/16 ounce.

With the trip pawl riding at 45° on the top member of the trip switch, the needle should be in the operating range for tripping, i.e., 1 1/2" to 3" from the center of the spindle. The trip contact should make with a reading of from 1/4 to 3/8 ounce. If these specifications are met, many records which may be considered to have defective trip grooves will play and trip satisfactorily.

Excessive friction may be caused by lack of vertical play in the tone-arm shaft or a defective shaft bearing. Correct assembly of shaft and bearing is given under REPLACEMENT OF PARTS AND ASSEMBLIES.

Tone-Arm Lead-In Test

Using a record which has no lead-in groove, see that the tone arm leads into the first record-playing groove. If it does not lead in properly, check to make

sure that the changer is level in the cabinet. If necessary, level the changer by adjusting the T-nuts and locknuts, as required.

Pickup and Phono Input Transformer Test

To test the pickup and phono input transformer, attach the pickup plug to the phono input transformer, Philco Part No. 32-8256, and attach the lead from the transformer to a radio chassis, designed for use with the dynamic pickup, and known to be in normal operating condition. If such a receiver is not available,

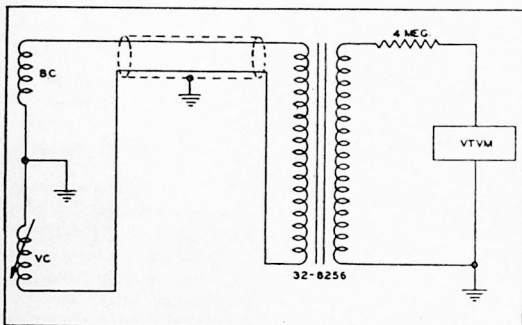


Figure 11—TESTING DYNAMIC PICKUP.

a comparable audio amplifier may be used. Play a record of good quality and listen to the reproduction.

If no reproduction is heard:

Check for a short or open in the shielded-wire pickup lead.

Check the pickup voice coil; this coil should have a resistance of approximately 3 to 4 ohms.

Check the primary and secondary of the transformer; normal resistance of the primary is approximately .1 ohm; secondary, 7000 ohms.

If output is distorted:

Try a new needle.

For a complete check of the dynamic pickup, a standard audio-tone record, or equivalent, and a vacuum-tube voltmeter with a range of 1 or 1½ volts, and with an input impedance of 1 megohm or more,

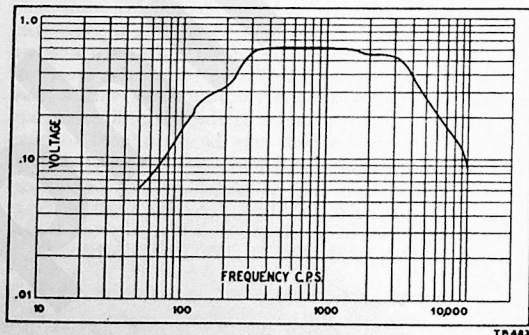


Figure 12—FREQUENCY-RESPONSE CURVE OF DYNAMIC PICKUP.

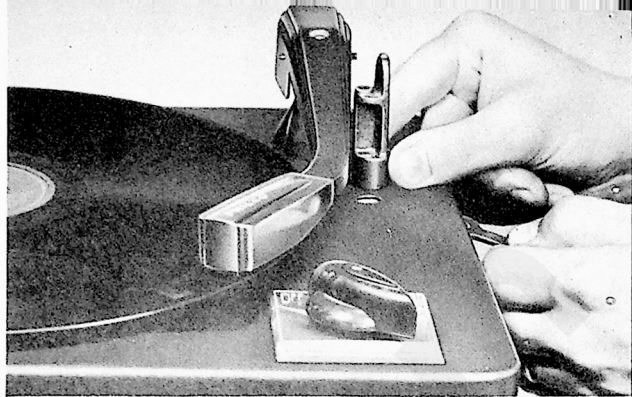


Figure 13—ADJUSTING TONE-ARM REST POST.

are required. An oscilloscope may be used in the place of the vacuum-tube voltmeter, if desired.

Before making the check, make sure that the needle pressure is between $\frac{3}{4}$ and 1 ounce, that the vertical friction does not exceed $\frac{1}{8}$ ounce, and that the horizontal friction does not exceed $\frac{1}{16}$ ounce.

With the vacuum-tube voltmeter (or oscilloscope) connected as shown in figure 11, the output voltage, when playing 1000 cycles on the audio-tone record, should be at least .6 volt. A complete frequency-response curve should closely approximate that of figure 12.

Tone-Arm Rest-Post Placement

The tone-arm rest is adjusted so that the tone arm cannot set down off a 12" record. See figure 13.

Tripping Adjustments

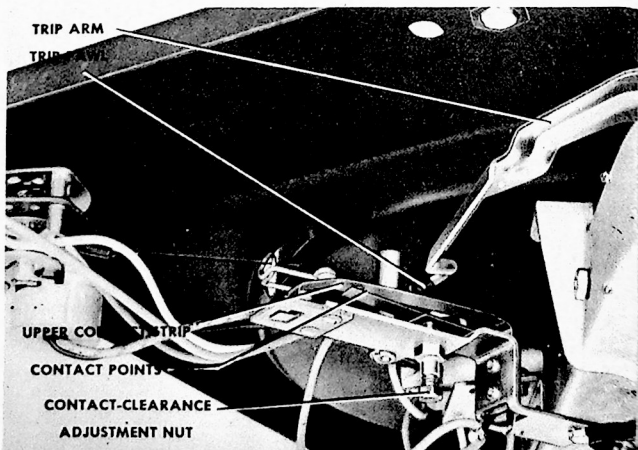
Before making any adjustments to the trip-switch assembly, make the following observations:

Be sure the two trip-switch-assembly mounting screws are tight. One point of mounting is on the changer-mechanism housing and the other screw is under the turntable.

Examine the upper contact strip and make sure it is reasonably flat along the center portion. The strip should have sufficient tension to hold the lip, located on the outer end, against the slotted insulated piece, with a pressure of from $\frac{1}{8}$ to $\frac{1}{4}$ oz.

With the master control switch OFF, swing the tone

Figure 14—TRIP-CONTACT ASSEMBLY, SHOWING CORRECT ANGLE OF TRIP PAWL.



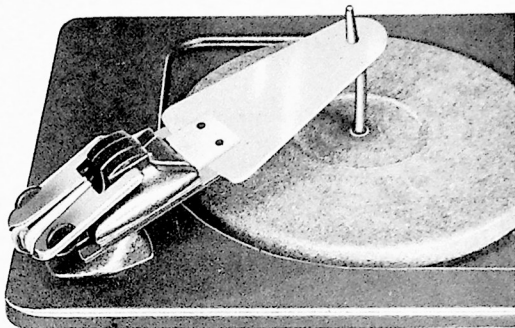


Figure 15—RECORD SHELF, SHOWING SPECIAL RECORD-SHELF GAUGE IN CORRECT POSITION.

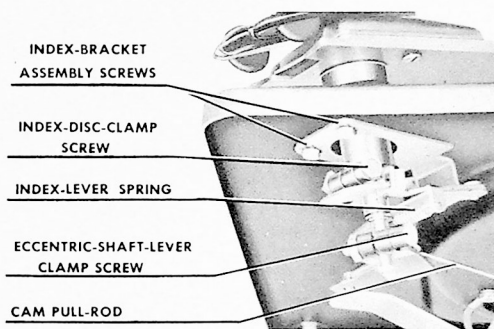


Figure 16—INDEX-BRACKET, INDEX-DISC, AND ECCENTRIC-SHAFT-LEVER ASSEMBLIES.

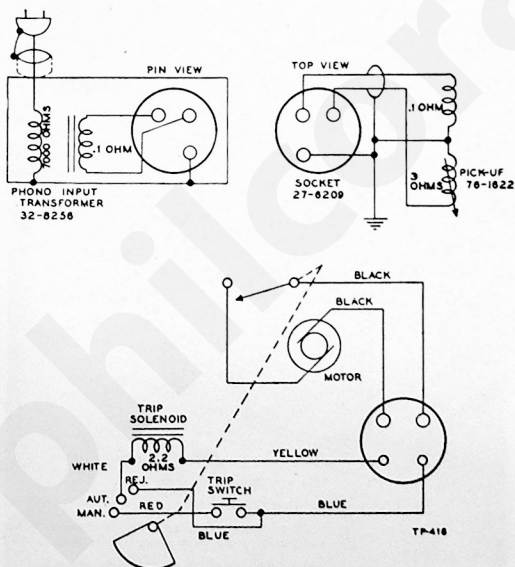


Figure 17—WIRING DIAGRAM OF CHANGER.

arm in so that the rubber-tipped trip pawl is approximately in the center of the flat portion of the upper contact strip. In this position, the trip pawl should be at an angle of approximately 45° with respect to the strip, as shown in figure 14. If necessary, shape the trip arm slightly up or down to give the correct angle.

The clearance between the contact points should be adjusted for a gap of $\frac{1}{32}$ ", by means of the adjusting nut on the lower strip. See figure 14. The tripping action can be checked by watching the trip pawl and the contacts while the jewel needle is travelling the eccentric finishing groove of a record.

The trip should operate by a slight backward movement of the tone arm (not less than $\frac{1}{16}$ ") while the arm is between $1\frac{1}{2}$ " and 3" from the center of the spindle. Check the action at several points within this range.

NOTE

The top surface of the upper contact strip is coated with a substance for positive action.

Record-Shelf Adjustments

To set the record shelf correctly, place the shelf in its 10" position. Place a special record-shelf gauge, Philco Part No. 45-1470, over the spindle and onto the record shelf, as shown in figure 15.

Loosen the two hex-head screws which hold the index-bracket assembly to the changer base plate. See figure 16. Also loosen the hex-head clamp screw on the index disc. Disconnect one end of the index-lever spring. Move the record-shelf assembly away from the spindle, allowing the center raised portion of the gauge to fit between the record shelf lips, and the wide part of the gauge to drop level with the shelf lips, as shown in figure 15. Push the entire assembly lightly against the edge of the gauge. Before tightening the index-bracket-assembly screws, turn this assembly so that the cam pull-rod is just taut without tensing the spring. Hold the assembly in this position and tighten the two index-bracket screws. Re-connect the index-lever spring; then tighten the clamp screw on the index disc. When the above adjustments have been made, both lips of the record shelf should be touching the edge of the gauge.

Record Push-Off Adjustment

With the changer out of cycle, set the record shelf to the 10" position. Loosen the hex-head clamp screw holding the eccentric-shaft lever to the push-off cam shaft. See figure 16. Rotate the push-off cam shaft *clockwise* until the end of the push-off slider nearest the turntable emerges from the slot in the record shelf and retracts to a point where the center portion of the slider end is just flush with the edges of the slot. Tighten the clamp.

Uneven Turntable Speed (Wows)

Uneven turntable speed (wows) may be caused by the following:

Dirt under and around turntable or idler-wheel assembly. Remove the turntable and clean out the dirt.

Flat or worn spots on rubber tire of idler wheel or defective turntable shaft and bearing assembly. Replace

defective parts as directed under **REPLACEMENT OF PARTS AND ASSEMBLIES**.

Lack of lubrication on turntable-bearing assembly or idler-wheel assembly. Follow directions under the *Cleaning and Lubrication* paragraph in this section of the manual.

Hole in record too large or too small. Try other records.

AUXILIARY POWER SUPPLY

A power adapter for the Model M-4 Philco Automatic Record Changer, providing proper voltages for the motor and solenoid through the connector on the changer, can be quickly assembled.

A small power transformer with one 6.3-volt filament winding, such as Philco Part No. 32-8190, will be satisfactory. The filament winding should have a rating of at least 2 amperes. The voltage for the motor is obtained by a direct connection to the power-transformer primary. The solenoid is energized by the 6.3-volt winding. The use of a socket, Philco Part No. 27-6182, will facilitate the connection of the auxiliary power supply to the changer.

The power supply may be assembled on any suitable chassis; the wiring diagram is shown in figure 18.

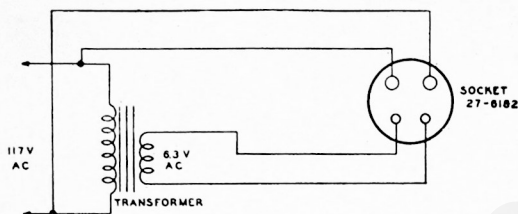


Figure 18—WIRING DIAGRAM OF AUXILIARY POWER SUPPLY.

SPECIAL TOOLS

Most of the adjustments and repairs to the Philco M-4 Changer may be made with the tools usually found in the serviceman's tool kit, and the two scales and special gauge illustrated in figure 19.

The pendulum scale, Philco Part No. 45-2953, may be used to measure the horizontal friction, or drag, of the tone arm.

The 2-oz. scale, Philco Part No. 45-2958, may be used to measure the vertical friction and needle pressure of the tone arm, and all spring tensions not in excess of 2 ounces.

The special record-shelf gauge, Philco Part No. 45-1470, must be used to make the record-shelf adjustments accurately.

A stroboscope disc, Philco Part No. 45-2900, will aid in detecting faulty turntable speed.

After the changer has been removed from the cabinet for repairs, a stand similar to the one shown in figure 20 may be used. This stand is constructed from easily obtainable parts, listed in the figure, and is a convenient addition to any repair shop which expects to service record changers.

If it is not convenient to construct a stand to support the changer, changer support posts, Philco Part No. 45-2894 (4 required), may be purchased.

Figure 20—DETAILS OF SUPPORTING STAND FOR CHANGER.

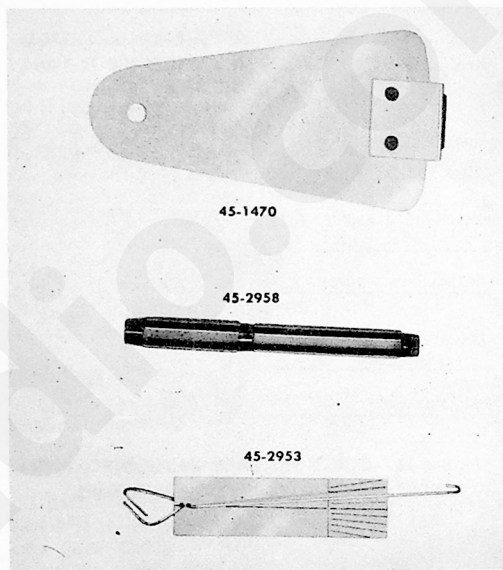
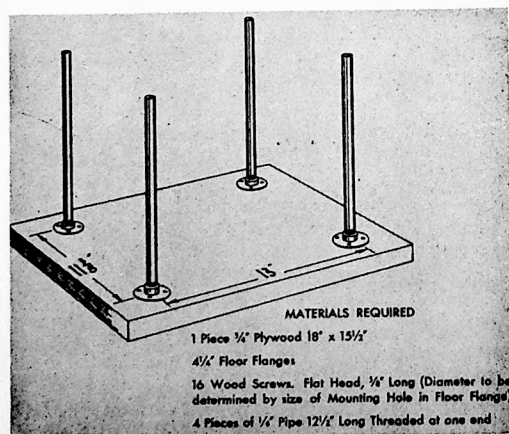


Figure 19—SCALES AND SPECIAL GAUGE.



REPLACEMENT OF PARTS AND ASSEMBLIES

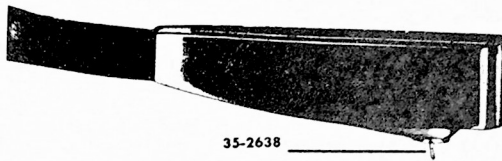


Figure 21—PICKUP HEAD, SHOWING CORRECT PLACEMENT OF NEEDLE.

Whenever a part or assembly is found to be defective, by test or visual inspection, or when it becomes necessary to remove parts for lubrication, the following procedures are recommended.

Parts should be replaced by reversing the order of removal, and adjusted and lubricated according to the directions given in the **SERVICING** section of this manual. A part should be replaced only when a defect is evident or when all adjustments fail to produce proper operation.

1. Needle (Part No. 35-2638)

The needle should be pulled straight out with the fingers. There are no setscrews or locking devices. When replacing the needle, make sure that it is placed so that its bend is in the direction of record rotation. See figure 21. Push the needle in place, using finger pressure only.

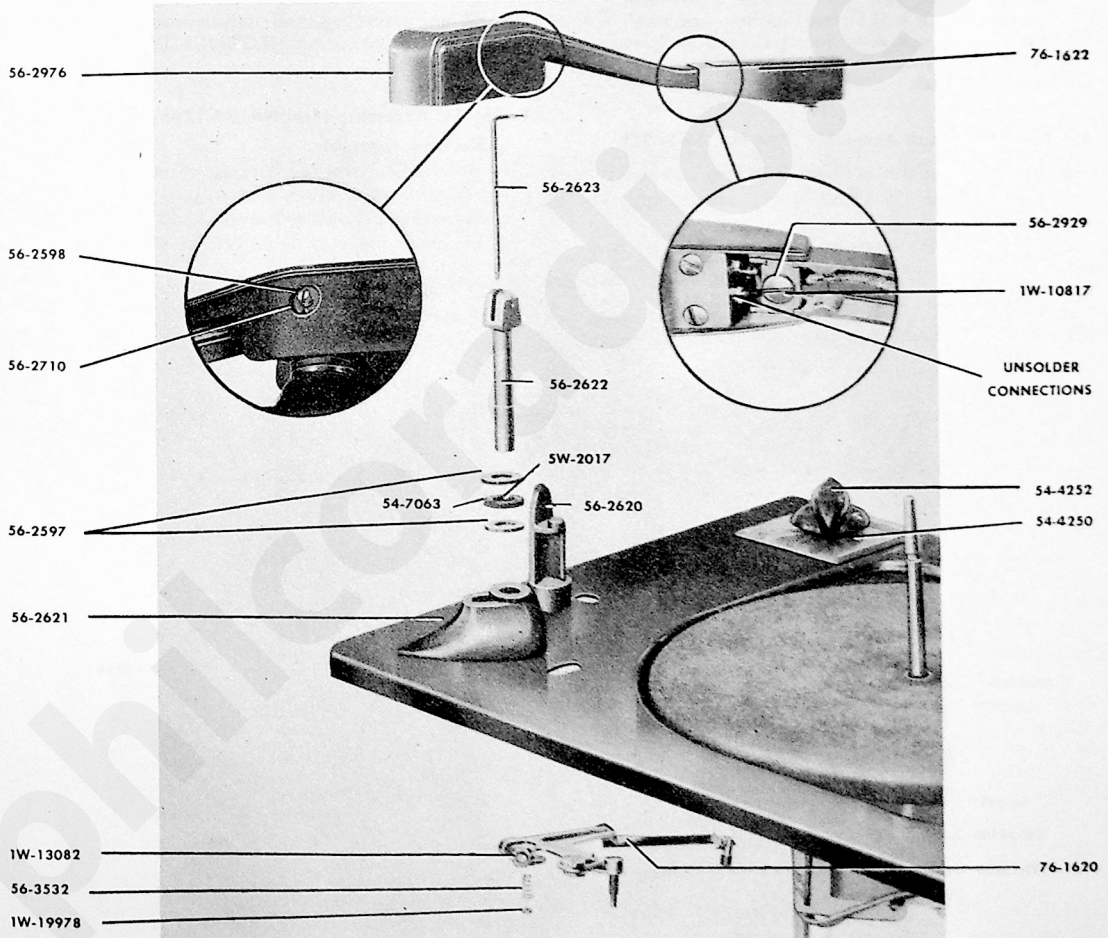


Figure 22—TONE-ARM-SHAFT AND TRIP-ARM ASSEMBLIES, EXPLODED VIEW.

2. Tone Arm (Part No. 56-2976)

- Unsolder plug from end of pickup cable.
- Loosen locknut 56-2710 and bearing screw 56-2598. See figure 22.
- Lift off tone arm.

3. Pickup-Head Assembly (Part No. 76-1622)

- Remove tone arm, as directed in steps 2b and 2c above. It is not necessary to unsolder plug from pickup cable, as there is generally enough slack to allow the tone arm to be turned over.
- Remove screw 1W-10817 and clamp plate 56-2929, figure 22.
- Unsolder wires at head.

CAUTION

Do not place head where it may attract iron filings or dirt. This head contains a powerful magnet which will attract and hold any small particles of magnetic material, and delicate mechanism which will be damaged by any foreign matter.

4. Tone-Arm-Shaft Assembly (Part No. 56-2622)

- Remove tone arm as directed in step 2 above.
- Loosen screw 1W-13082 in trip-arm assembly 76-1620, figure 22.
- Withdraw the tone-arm-shaft assembly. Be careful not to lose the three balls 5W-2017 shown in figure 22.
- Remove nut 1W-19978 and spring 56-3532 from lift rod 56-2623 and remove lift rod.

e. When replacing tone-arm shaft and lift-rod assembly, the lift-rod must point toward the pickup head.

f. When replacing the tone-arm shaft allow .003" to .005" clearance between the tone-arm-shaft bushing and trip arm.

5. Tone-Arm-Shaft Bushing (Part No. 56-2621)

- Remove tone-arm shaft as directed in step 4 above.
- Remove tone-arm shaft-bushing nut and lock-washer.

6. Trip-Arm Assembly (Part No. 76-1620)

Loosen screw 1W-13082 in trip-arm assembly and remove assembly.

7. Tone-Arm Rest Post (Part No. 56-2620)

- Remove nut and lift out tone-arm rest post.
- When replacing post, adjust according to the procedure given under ADJUSTMENTS AND TESTS in this manual.

8. Motor Assembly (Part No. 35-1298)

- Remove turntable.
- Bend cable dress lug holding wires to base plate, being careful not to break off the lug.
- Remove nut holding ground strap.
- Unsolder the two leads, one at switch and one from cable.
- Unhook pull-cord spring.
- Remove three screws, washers, spacers, and rubber mounting grommets. See figure 23.

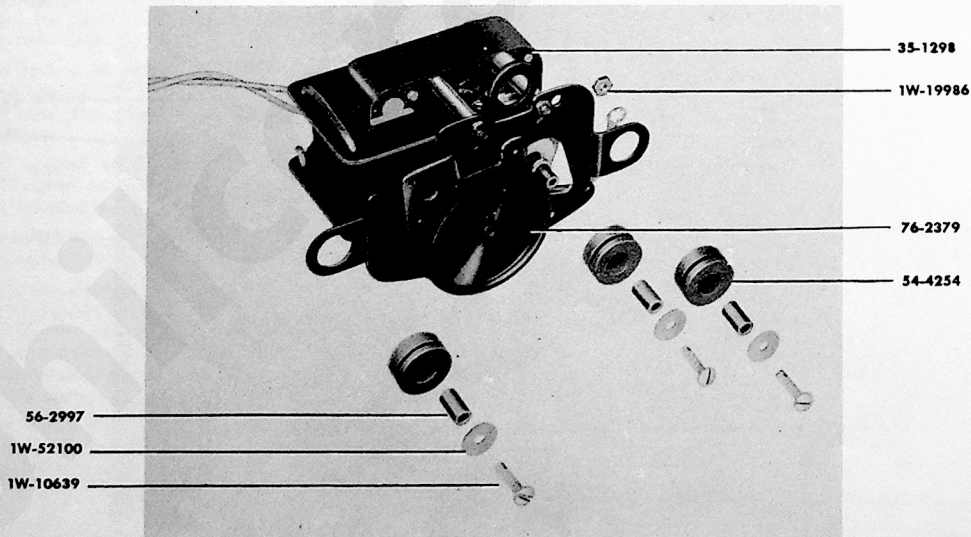


Figure 23—MOTOR AND IDLER-WHEEL ASSEMBLY,
WITH MOUNTING HARDWARE.

9. Idler Wheel (Part No. 76-2379)

- a. Remove spindle and turntable.
- b. Remove retaining spring and flat washer from idler-wheel shaft (underside of changer).
- c. Lift out idler wheel.

10. Master Control Switch (Part No. 42-1734)

- a. Unsolder five leads from switch.
- b. Lift off knob 54-4252, figure 22.
- c. Remove $\frac{3}{8}$ " nut under knob.
- d. Unhook pull-cord spring 56-2617, figure 24.

11. Record Hold-Down (Part No. 56-2653)

- a. Remove record-shelf cap cover 56-2915, by turning counterclockwise about $\frac{1}{8}$ turn and lifting out. See figure 25.
- b. Lift out retaining spring 56-2656.
- c. Unhook hold-down spring 56-2654 and lift off hold-down.

12. Eccentric-Shaft-Lever Assembly (Part No. 76-1618)

- a. Remove cross-link spring 56-2627 and cross-link 56-2626, figure 24.
- b. Loosen screw 1W-13082 and remove assembly, figure 25.
- c. When replacing assembly, make record push-off adjustment as directed under ADJUSTMENTS AND TESTS.

13. Index-Disc Assembly (Part No. 76-1904) and Index-Bracket Assembly (Part No. 76-1615)

- a. Remove eccentric-shaft-lever assembly as directed in step 12 above.
- b. Unhook one end of pull-rod spring 56-3591, figure 24.
- c. Loosen screw 1W-13083 holding index-disc assembly.
- d. Remove two screws, 1W-32694, holding index-bracket assembly and remove both assemblies.
- e. When replacing these assemblies, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

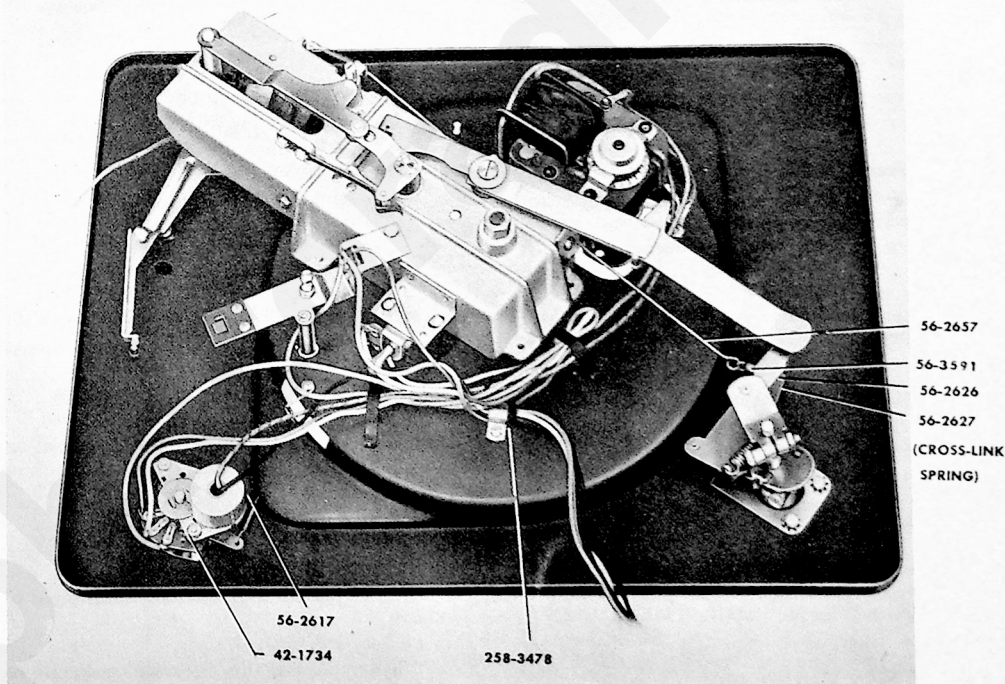


Figure 24—CHANGER, UNDERSIDE VIEW.

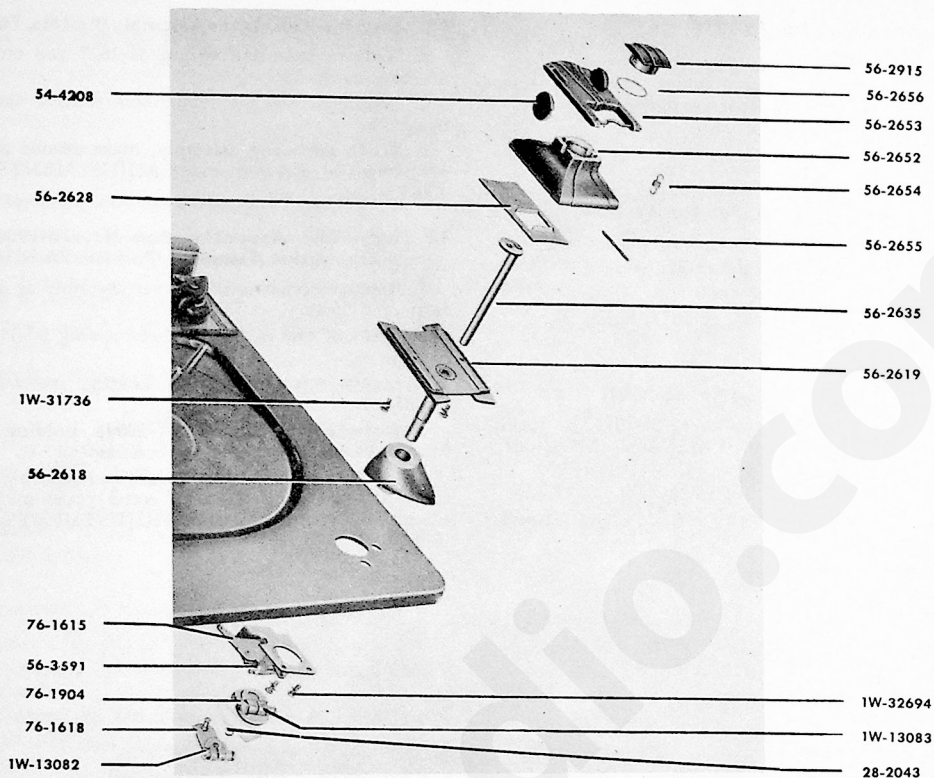


Figure 25—RECORD SHELF AND ASSOCIATED ASSEMBLIES, EXPLODED VIEW.

14. Record-Shelf Stanchion (Part No. 56-2618)

a. Remove index-disc assembly and index-bracket assembly as directed in step 13 above.

b. Lift out record-shelf and cap assembly and lift out stanchion.

c. When replacing this assembly, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

15. Record-Shelf-Cap Assembly (Part No. 56-2652)

a. Remove index-disc assembly and index-bracket assembly as directed in step 13 above.

b. Lift out record-shelf and cap assembly.

c. Remove two screws, 1W-31736, figure 25, from underside of record shelf and lift out record-shelf-cap assembly.

d. When replacing this assembly, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

16. Push-Off Slider (Part No. 56-2628)

a. Remove record-shelf-cap assembly as directed in step 15 above.

b. Lift out push-off slider.

c. When replacing this assembly, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

17. Push-Off-Cam Assembly (Part No. 56-2635)

a. Remove record-shelf-cap assembly as directed in step 15 above:

b. Remove locking ring 28-2043, figure 25.

c. Lift out push-off-cam assembly.

d. When replacing this assembly, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

18. Record Shelf (Part No. 56-2619)

a. Remove push-off-cam assembly as directed in step 17 above.

b. Lift out record shelf.

c. When replacing this assembly, make all record-shelf adjustments, including record push-off adjustment, as directed under ADJUSTMENTS AND TESTS.

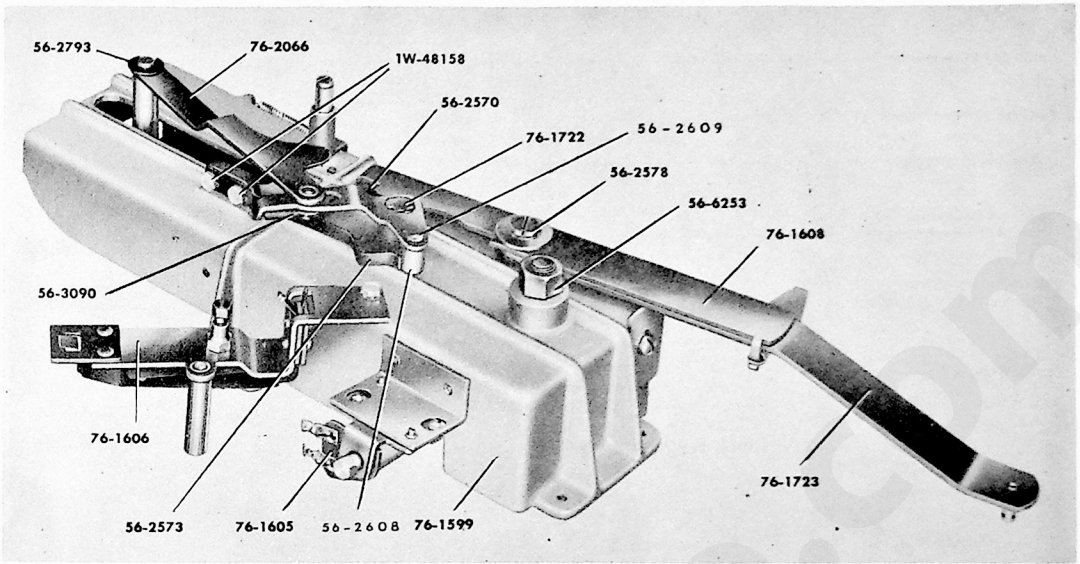


Figure 26—CHANGER MECHANISM ASSEMBLY, UNDERSIDE VIEW.

19. Trip-Contact Assembly (Part No. 76-1606)

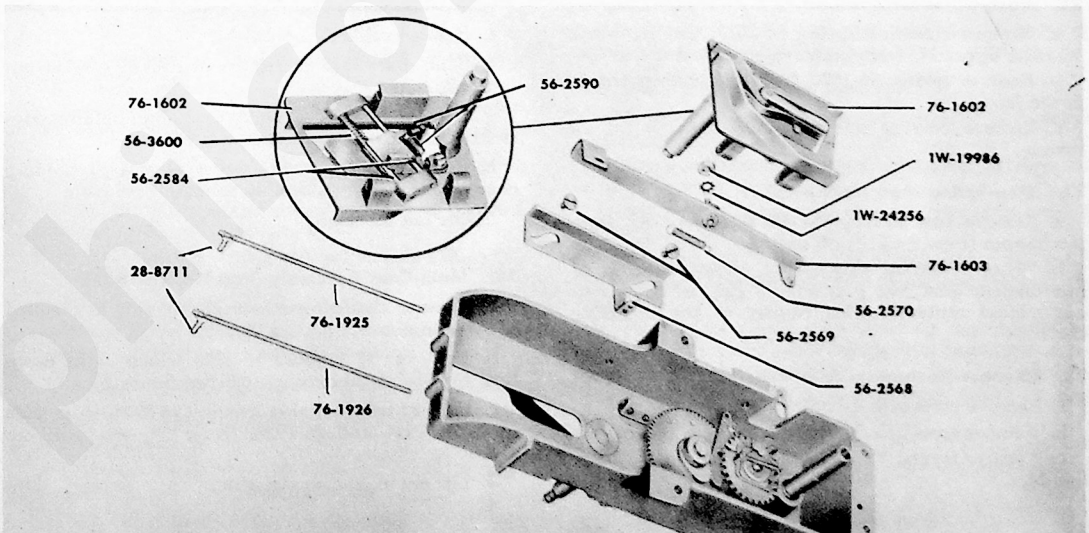
- a. Remove spindle and turntable.
- b. Unsolder the red and blue wires.
- c. Remove hex-head screw holding trip-contact assembly to changer-mechanism housing, figure 26.
- d. Remove slotted screw holding trip-contact assembly to base plate and lift off assembly.
- e. When replacing, adjust contact clearance as directed under ADJUSTMENTS AND TESTS.

ected under ADJUSTMENTS AND TESTS.

20. Push-Link Assembly (Part No. 76-2066)

- a. Remove "C" washers 56-2793 from main-cam and main gear-shaft assemblies, figure 26.
- b. Remove spring 56-3090 from main gear-shaft assembly.
- c. Lift out link.

Figure 27—CHANGER MECHANISM ASSEMBLY, SHOWING DISASSEMBLY OF MAIN CAM, LIFT ARM, AND POSITIONING CAM.



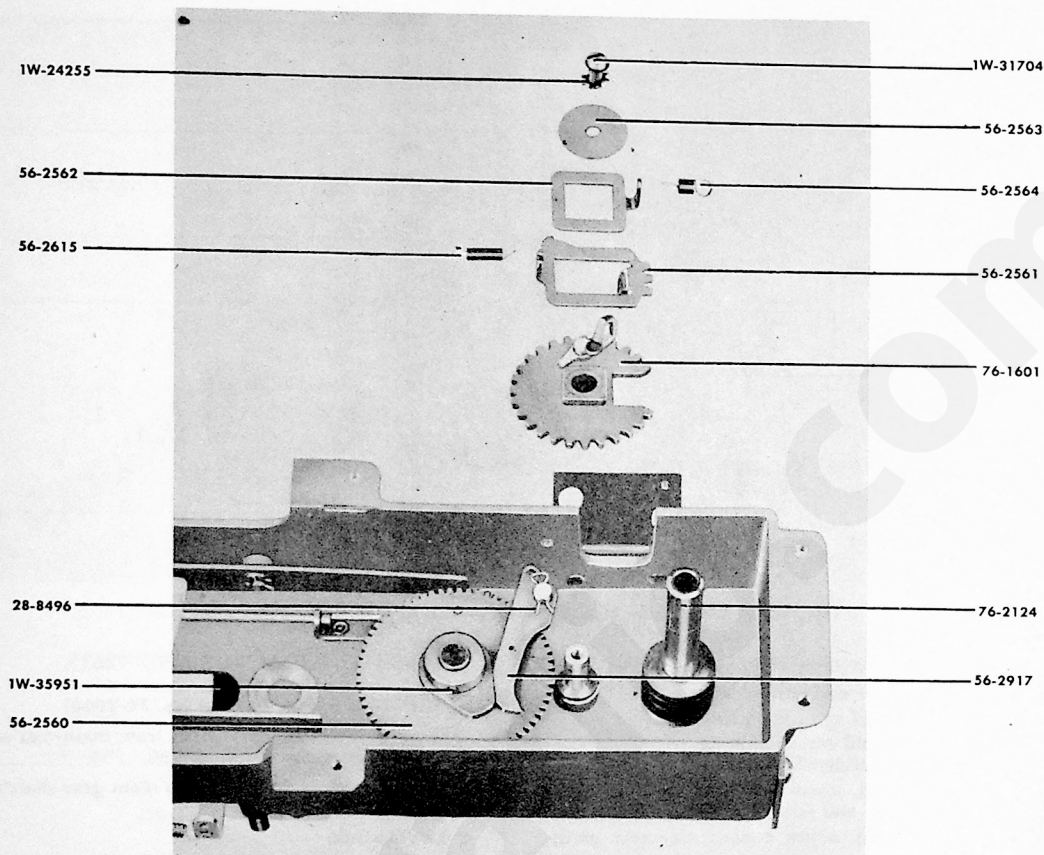


Figure 28—CHANGER MECHANISM, DISASSEMBLY OF INTERMEDIATE GEAR.

21. Push-Off-Lever Assembly (Part No. 76-1608)

- a. Remove cross-link spring 56-2627, and cross-link 56-2626, figure 24, from eccentric-shaft lever.
- b. Remove spring 56-2570 from mechanism frame, figure 26.
- c. Remove bearing screw 56-2578 and lift off assembly.

22. Stop-Spring (Part No. 56-2573)

- a. Remove two screws, 1W-48158, figure 26, from mechanism frame and lift off spring.
- b. When replacing this spring, adjust position of intermediate gear; the gear should stop with the cut-out section centered, with respect to the turntable shaft.

23. Changer-Mechanism Assembly (Part No. 76-1599)

- a. Remove cross-link spring 56-2627, figure 24.
- b. Remove cross-link 56-2626.
- c. Remove spring 56-3591 and pull-rod 56-2657, figure 24.

- d. Remove spindle and turntable.
- e. Remove cable clamp 258-3478.
- f. Bend dress lugs to remove wires; be careful not to break lugs.
- g. Remove one screw (under turntable) holding trip-switch assembly to main base plate.
- h. Remove four screws (under turntable) holding changer-mechanism assembly to main base plate.
- i. Lift out assembly.

24. Main-Cam Assembly (Part No. 76-1602)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove "C" washer 56-2793 which holds push-link 76-2066 to main-cam stud. See figure 26.
- c. Lift out two retaining springs, 28-8711, from slide shafts 76-1925 and 76-1926, figure 27, and pull out shafts.
- d. Lift out main-cam assembly.

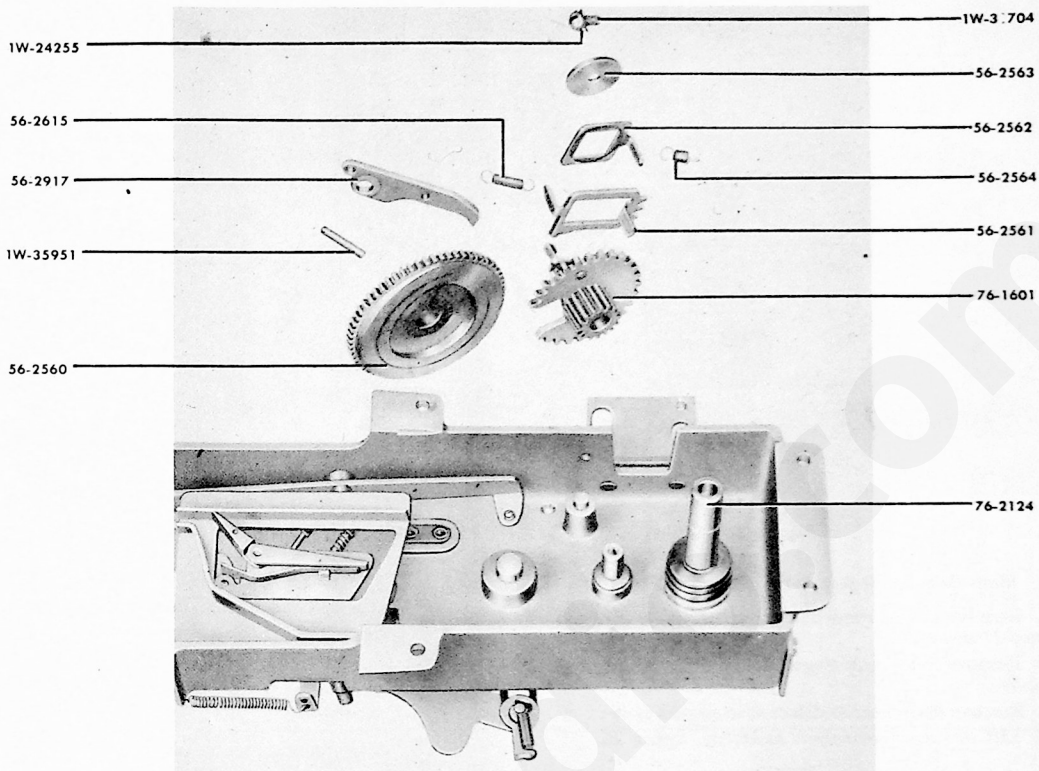


Figure 29—PARTS OF MAIN-GEAR AND INTERMEDIATE-GEAR ASSEMBLIES, UNDERSIDE VIEW.

25. Positioning Cam (Part No. 56-2568)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove main-cam assembly as directed in step 24 above.
- c. Remove pull-rod 56-2657, figure 24, and spring 56-2570, figure 26.
- d. Remove two shouldered screws, 56-2569, figure 27, and lift out cam.

26. Lift-Arm Assembly (Part No. 76-1603)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove nut 1W-19986 and lockwasher 1W-24256. See figure 27.
- c. Lift out assembly.
- d. When replacing this assembly, be sure to place ball-end on cam surface under main gear.

27. Intermediate-Gear Assembly (Part No. 76-1601)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove two springs, 56-2564 and 56-2615, from latch and segment gear. See figure 28.

- c. Remove screw 1W-31704, lockwasher 1W-24255, and retaining washer 56-2563.
- d. Lift out spring lug 56-2562 and gear segment 56-2561
- e. Lift out intermediate-gear assembly. Figure 29 shows the underside of the parts in the assembly.

28. Main Gear (Part No. 56-2560)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove intermediate-gear assembly as directed in step 27 above.
- c. Remove main-cam assembly as directed in step 24 above.
- d. Remove two screws, 1W-47664, figure 30, holding solenoid assembly 76-1605 to mechanism, and remove solenoid.
- e. Remove hex-head screw holding trip-contact assembly 76-1606 to changer-mechanism housing and remove trip-contact assembly.
- f. Remove retaining spring 28-8496, figure 28, and remove cam lever 56-2917.
- g. Drive out tapered pin 1W-35951 in main gear and lift out main gear. Figure 29 shows the underside of the main gear.

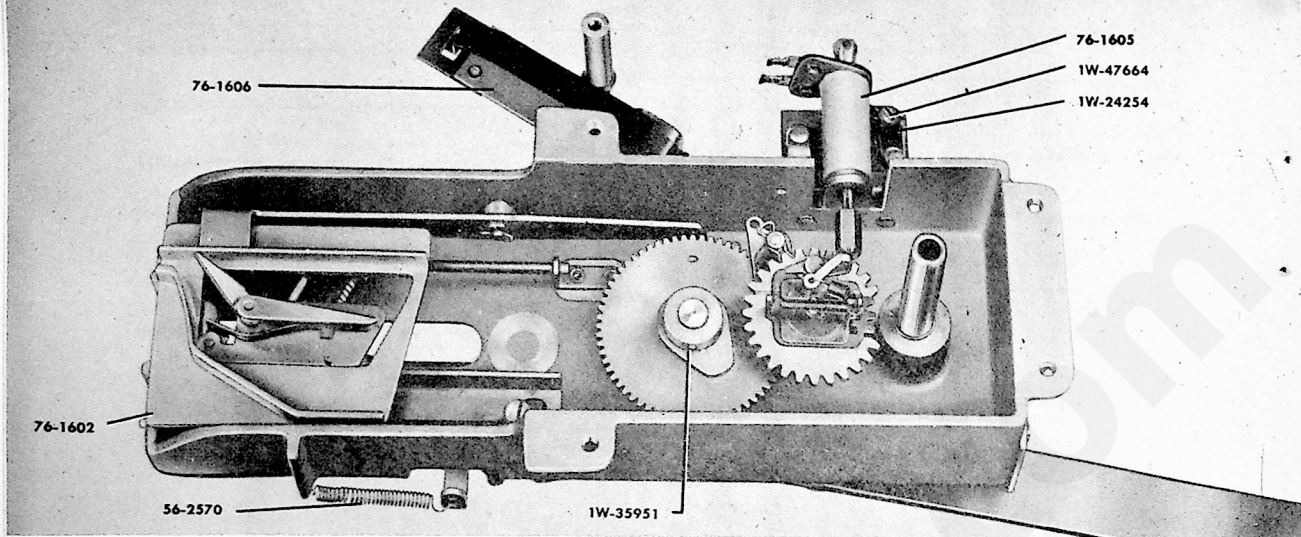


Figure 30—CHANGER MECHANISM ASSEMBLY, TOP VIEW.

29. Main-Gear-Shaft Assembly (Part No. 76-1722)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove push-link assembly as directed in step 20 above.
- c. Remove main gear as directed in step 28 above.
- d. Lift out main-gear-shaft assembly, figure 26.

30. Turntable-Shaft Assembly (Part No. 76-2124)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Loosen nut 56-6253, figure 26, a few turns and tap with a wooden mallet. Continue this process until shaft is free.

31. Turntable Bearings (Part No. 5W-2017)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Remove turntable-shaft assembly as directed in step 30 above.
- c. Remove spring ring 56-2599, steel washer 56-2596, neoprene washer 54-4220, ball race 56-2597, neoprene washer 54-7063, ball race 56-2597, neoprene washer 54-4220, and steel washer 56-2596, in order, as shown in figure 31.

32. Solenoid Assembly (Part No. 76-1605)

- a. Remove changer-mechanism assembly as directed in step 23 above.
- b. Unsolder the two wires from the lugs of the solenoid.
- c. Remove the two screws, 1W-47664, and lock-washer, 1W-24254, figure 30.
- d. When replacing this assembly, align the solenoid plunger so that its center strikes the latch and trips the segment gear, but does not over-push so as to bind the gear segment. The correct position is shown in figure 30.

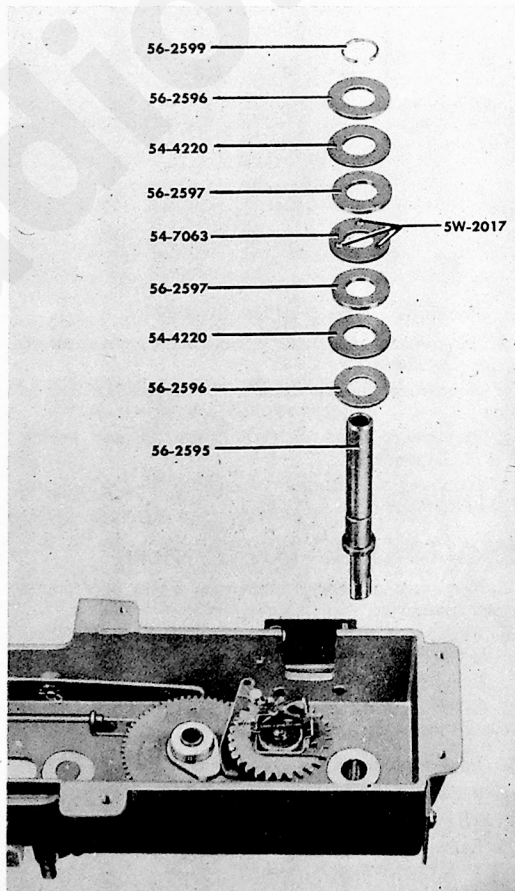


Figure 31—DISASSEMBLY OF TURNTABLE SHAFT AND BEARINGS.

REPLACEMENT PARTS LIST

SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION
27-6209	Socket (Pickup Cable)	56-2573	Spring, Stop (Push-Off Arm)	56-2919	Spindle (Turntable)	76-1925	Slide-Shaft Assembly (Short)
28-2043	Ring, Locking (Push-Off-Cam Shaft)	56-2578	Screw, Push-Off Lever	56-2920	Push-Off-Lever Guide	76-1926	Slide-Shaft Assembly (Long)
28-8496	Spring, Retaining (Lift Arm—Cam Lever)	56-2584	Slider Cam Rod, Cam Assembly	56-2927	Clamp Plate (Pickup Head)	76-2066	Push-Link
28-8711	Spring, Retaining (Main-Cam Slide Shaft)	56-2590	Spring (Slider Cam—Guide Arm)	56-2976	Tone Arm	76-2379	Idle Wheel Assembly
32-8256	Transformer (Phono Input)	56-2595	Spring Assembly, Turntable	56-2996	Bearing Pin (Tone Arm)	1W-10639	Screw, Motor Mounting, No. 6-32
35-1298	Motor	56-2596	Washer (Turntable Shaft)	56-2997	Brass Spacer (Motor Mounting)	1W-10817	Screw
35-2639	Turntable	56-2597	Race, Ball (Turntable Shaft—Tone Arm Shaft)	56-3090	Spring (Push-Off Arm)	1W-10941	Screw
41-3685	Cable Assembly (A-C)	56-2598	Screw, Tone-Arm Bearing	56-3091	Roller (Push-Link)	1W-13082	Screw, No. 10-32
41-3723	Cable (Tone Arm)	56-2599	Ring, Spring (Turntable Shaft)	56-3092	Stud, Roller (Push-Link)	1W-13083	Screw, No. 10-32
42-1734	Switch, Master Control	56-2608	Roller	56-3532	Spring (Lift-Rod)	1W-14318	Screw, Lift-Adjust
45-1552-1	Needle	56-2609	Roller Stud	56-3591	Spring (Pull-Rod—Bell-Crank)	1W-19978	Nut (Lift-Rod)
54-4142	Plug, Four-Prong (A-C)	56-2615	Spring, Segment (Seg-Gear Assm)	56-3600	Spring (Slider-Cam Rod)	1W-19986	Nut, No. 6-32
54-4181	Bumper, Rubber (Trip Pawl)	56-2617	Stanchion, Record-Shelf	56-6243	Nut, Tone-Arm Swivel-Bushing	1W-24254	Washer
54-4208	Bumper, Rubber (Record Hold-Down)	56-2618	Record Shelf	56-6253	Nut, Turntable-Shaft Mounting	1W-24255	Lockwasher, No. 5
54-4220	Washer, Cushion (Turntable Shaft)	56-2619	Record Shelf	76-1599	Changer-Mechanism Assembly	1W-24256	Lockwasher, No. 6
54-4250	Plate (Master Control Switch)	56-2620	Rest Post	76-1600	Base Assembly (Changer Mechanism)	1W-24257	Lockwasher, No. 8
54-4252	Knob (Master Control Switch)	56-2621	Bushing, Tone-Arm-Shaft	76-1601	Intermediate-Gear Assembly	1W-24264	Lockwasher, 3/8"
54-4254	Grommet (Motor Mounting)	56-2622	Shaft, Tone-Arm	76-1602	Main-Cam Assembly	1W-24520	Lockwasher, 3/8" (Rest Post)
54-7063	Retainer, Ball (Turntable Shaft—Tone-Arm Shaft)	56-2623	Rod, Lift (Tone Arm)	76-1603	Lift-Arm Assembly	1W-24524	Lockwasher, 3/8"
54-7124	Cord, Pull	56-2626	Gross Link	76-1604	Turntable-Shaft Assembly	1W-31704	Screw, No. 5-40
56-2071	Shell, Plug (A-C)	56-2627	Spring, Cross-Link	76-1605	Solenoid Assembly	1W-31736	Screw, No. 6-32
56-2448	Cover, Plug (Pickup Cable)	56-2628	Slider, Push-Off	76-1606	Trip-Contact Assembly	1W-32694	Screw
56-2560	Main Gear	56-2635	Shaft, Push-Off-Cam	76-1608	Push-Off-Lever Assembly	1W-35951	Pin
56-2561	Gear Segment	56-2652	Cap, Record-Shelf	76-1614	Plate and Lug Assembly	1W-36672	Rivet
56-2562	Lug, Spring (Segment-Gear Assembly)	56-2653	Hold-down, Record	76-1615	Index-Bracket Assembly	1W-36675	Rivet
56-2563	Washer, Retaining (Segment-Gear Assembly)	56-2654	Spring (Record Hold-Down)	76-1617	Push-Off-Cam Assembly	1W-44709	Nut, 3/8"-32
56-2564	Spring (Segment-Gear Assembly)	56-2655	Pin, Spring (Record Hold-Down)	76-1618	Eccentric-Shaft-Lever Assembly	1W-47664	Screw
56-2568	Cam, Positioning	56-2656	Spring, Retaining (Rec.-Shelf Cap)	76-1620	Trip-Arm Assembly	1W-48158	Screw, No. 6-32
56-2569	Stud (Positioning Cam)	56-2710	Locknut (Tone-Arm Pivot)	76-1622	Pickup-Head Assembly	1W-48188	Screw
56-2570	Spring (Positioning Cam—Push-Off Lever)	56-2713	Counterweight (Tone Arm)	76-1722	Shaft Assembly	1W-52100	Washer, Compression
		56-2714	Spring (Push-Off-Lever Extension)	76-1723	Push-Off Lever Extension Assembly	1W-56913	Nut, Speed
		56-2793	"C" Washer (Push-Link)			5W-2017	Ball Bearing
		56-2915	Cap Cover (Record Shelf)			W-1775	Locknut, Spring
		56-2917	Cam Lever				

GENERAL INFORMATION ON M-4 RECORD CHANGER

INTERMITTENT TRIP TROUBLE

Make the checks recommended, under *Tripping Adjustments*. Be especially critical in checking the angle of the trip pawl with respect to the upper contact strip; the angle should not be less than 45° , and 50° is preferable. To obtain proper trip action, it may be necessary to score the compound coating on the top of the upper contact strip. Use a knife blade for this purpose, making the score marks across the narrow dimension, about $\frac{1}{8}$ " apart.

STICKING SOLENOID

A sticking solenoid, of the type having no chamfer on the inside edges, may be corrected with a $\frac{1}{4}$ " socket wrench. Place the wrench over the hex-shaped end of the plunger, push the plunger in and rotate it while pressing it against the solenoid; this procedure removes the sharp corner from the solenoid tube.